INSTRUCTION MANUAL
(Preliminary)

INNOVATOR LX SERIES

1.67 GHz 400W DVB-H TRANSMITTER

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Chapter 1
Introduction

1.1 Manual Overview

This manual provides descriptions of the transmitter and associated equipment along with the set up and operating procedures. It is important that you read all of the instructions, especially the safety information in this chapter, before you begin operating the unit.

This instruction manual is divided into five chapters and supporting appendices. **Chapter 1**, Introduction, contains information on the assembly numbering system used in the manual, safety, contact information, return procedures, and warranties. **Chapter 2**, System Description, includes overview of entire transmitter system. **Chapter 3**, Circuit Descriptions, contains circuit level descriptions for boards and board level components in the transmitter. **Chapter 4**, Transmitter Tuning Procedure, provides information on adjusting the system for optimal operation. **Appendix A** contains system specifications. **Appendix B** contains Site Drawings. **Appendix C** contains a list of Modules and Site ID. **Appendix D** Site Acceptance Document.

1.2 Assembly Designators

Axcera has assigned assembly numbers, Ax designations such as A1, where x=1,2,3...etc, to all assemblies, modules, and boards in the system.

These designations are referenced in the text of this manual and shown on the drawings provided in the appendices.

The cables that connect between the boards within a tray or assembly and that connect between the trays, racks and cabinets are labeled using Brady markers.

Figure 1-1 is an example of a Brady marked cable. There may be as few as two or as many as four Markers on any one cable. These Brady markers are read starting furthest from the connector. If there are four Brady Markers, this marker is the transmitter number such as transmitter 1 or Transmitter 2. The next or the furthest Brady Marker is the rack or cabinet number on an interconnect cable or the board number within a tray. The next number on an interconnect cable is the Tray location or number. The Brady marker closest to the connector is the Jack or Connector number on an interconnect cable or the jack or connector number on the board within a tray.

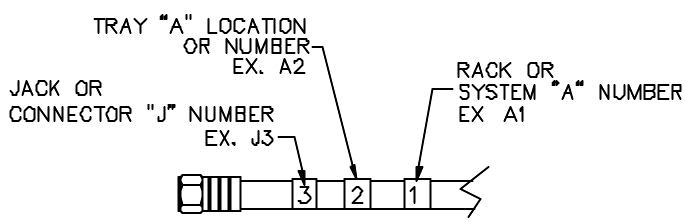


Figure 1-1 Brady Marker Identification Drawing

1.3 Safety

The 1.67 GHz transmitter systems manufactured by Axcera are designed to be easy to use and repair while providing protection from electrical and mechanical hazards. Please review the following warnings and familiarize yourself with the operation and servicing procedures before working on the transmitter system.

Read All safety Instructions – All of the safety instructions should be read and understood before operating this equipment.

Retain Manuals – The manuals for the transmitter should be retained at the transmitter site for future reference. Axcera provides two sets of manuals for this purpose; one set can be left at the office while one set can be kept at the site.

Heed all Notes, Warnings, and Cautions – All of the notes, warnings, and cautions listed in this safety section and throughout the manual must be followed.

Follow Operating Instructions – All of the operating and use instructions for the transmitter should be followed.

Cleaning – Unplug or otherwise disconnect all power from the equipment before cleaning. Do not use liquid or aerosol cleaners. Use a damp cloth for cleaning.

Ventilation – Openings in the cabinet and module front panels are provided for ventilation. To ensure the reliable operation of the driver/transmitter, and to protect the unit from overheating, these openings must not be blocked.

Servicing – Do not attempt to service this product yourself until becoming familiar with the equipment. If in doubt, refer all servicing questions to qualified Axcera service personnel.

Replacement Parts – When replacement parts are used, be sure that the parts have the same functional and performance characteristics as the original part. Unauthorized substitutions may result in fire, electric shock, or other hazards. Please contact the Axcera Technical Service Department if you have any questions regarding service or replacement parts.

1.4 Contact Information

The Axcera Field Service Department can be contacted by phone at **(724) 873-8100** or by fax at **(724) 873-8105**.

Before calling Axcera, please be prepared to supply the Axcera technician with answers to the following questions. This will save time and help ensure the most direct resolution to the problem.

1. What are the Customers' Name and call letters?
2. What are the model number and type of transmitter?
3. How long has the transmitter been on the air? (Approximately when was the transmitter installed.)
4. What are the symptoms being exhibited by the transmitter? Include the current control/power supply LCD readings and the status of LEDs on the front panels of the modules. If possible, include the control/power supply LCD readings before the problem occurred.

1.5 Material Return Procedure

To insure the efficient handling of equipment or components that have been returned for repair, Axcera requests that each returned item be accompanied by a Material Return Authorization Number (MRA#).

The MRA# can be obtained from any Axcera Field Service Engineer by contacting the Axcera Field Service Department at (724) 873-8100 or by fax at (724) 873-8105. This procedure applies to all items sent to the Field

Service Department regardless of whether the item was originally manufactured by Axcera.

When equipment is sent to the field on loan, an MRA# is included with the unit. The MRA# is intended to be used when the unit is returned to Axcera. In addition, all shipping material should be retained for the return of the unit to Axcera.

Replacement assemblies are also sent with an MRA# to allow for the proper routing of the exchanged hardware. Failure to close out this type of MRA# will normally result in the customer being invoiced for the value of the loaner item or the exchanged assembly.

When shipping an item to Axcera, please include the MRA# on the packing list and on the shipping container. The packing slip should also include contact information and a brief description of why the unit is being returned.

Please forward all MRA items to:

AXCERA, LLC
103 Freedom Drive
P.O. Box 525
Lawrence, PA 15055-0525 USA

For more information concerning this procedure, call the Axcera Field Service Department @ (724) 873-8100.
Axcera can also be contacted through e-mail at **info@axcera.com** and on the Web at **www.axcera.com.**

1.6 Limited One Year Warranty for Axcera Products

Axcera warrants each new product that it has manufactured and sold against defects in material and workmanship under normal use and service for a period of one (1) year from the date of shipment from Axcera's plant, when operated in accordance with Axcera's operating instructions. This warranty shall not apply to tubes, fuses, batteries, bulbs or LEDs.

Warranties are valid only when and if (a) Axcera receives prompt written notice of breach within the period of warranty, (b) the defective product is properly packed and returned by the buyer (transportation and insurance prepaid), and (c) Axcera determines, in its sole judgment, that the product is defective and not subject to any misuse, neglect, improper installation, negligence, accident, or (unless authorized in writing by Axcera) repair or alteration. Axcera's exclusive liability for any personal and/or property damage (including direct, consequential, or incidental) caused by the breach of any or all warranties, shall be limited to the following: (a) repairing or replacing (in Axcera's sole discretion) any defective parts free of charge (F.O.B. Axcera’s plant) and/or (b) crediting (in Axcera's sole discretion) all or a portion of the purchase price to the buyer.

Equipment furnished by Axcera, but not bearing its trade name, shall bear no warranties other than the special hours-of-use or other warranties extended by or enforceable against the manufacturer at the time of delivery to the buyer.

NO WARRANTIES, WHETHER STATUTORY, EXPRESSED, OR IMPLIED, AND NO WARRANTIES OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR FREEDOM FROM INFRINGEMENT, OR THE LIKE, OTHER THAN AS SPECIFIED IN PATENT LIABILITY ARTICLES, AND IN THIS ARTICLE, SHALL APPLY TO THE EQUIPMENT FURNISHED HEREUNDER.

☞ WARNING!!!

≺ HIGH VOLTAGE ≻

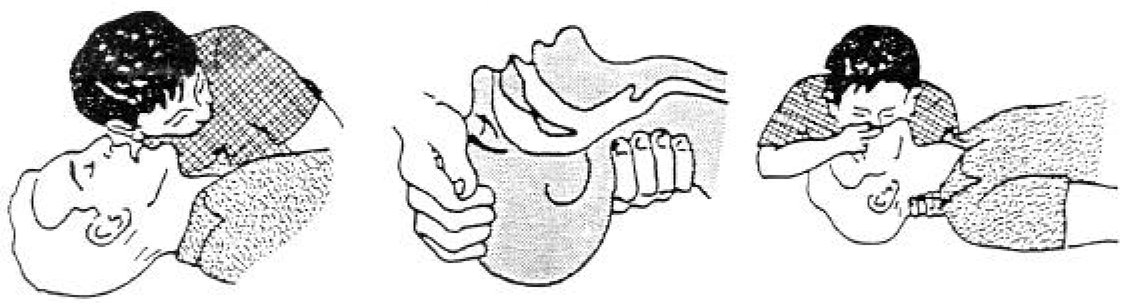
DO NOT ATTEMPT TO REPAIR OR TROUBLESHOOT THIS EQUIPMENT UNLESS YOU ARE FAMILIAR WITH ITS OPERATION AND EXPERIENCED IN SERVICING HIGH VOLTAGE EQUIPMENT. LETHAL VOLTAGES ARE PRESENT WHEN POWER IS APPLIED TO THIS SYSTEM. IF POSSIBLE, TURN OFF POWER BEFORE MAKING ADJUSTMENTS TO THE SYSTEM.

★ RADIO FREQUENCY RADIATION HAZARD ★

MICROWAVE TRANSMITTERS GENERATE HAZARDOUS RF RADIATION THAT CAN CAUSE SEVERE INJURY INCLUDING CATARACTS, WHICH CAN RESULT IN BLINDNESS. SOME CARDIAC PACEMAKERS MAY BE AFFECTED BY THE RF ENERGY EMITTED BY MICROWAVE TRANSMITTERS. NEVER OPERATE THE TRANSMITTER SYSTEM WITHOUT A PROPERLY MATCHED RF ENERGY ABSORBING LOAD ATTACHED. KEEP PERSONNEL AWAY FROM OPEN WAVEGUIDES AND ANTENNAS. NEVER LOOK INTO AN OPEN WAVEGUIDE OR ANTENNA. MONITOR ALL PARTS OF THE RF SYSTEM FOR RADIATION LEAKAGE AT REGULAR INTERVALS.

EMERGENCY FIRST AID INSTRUCTIONS

Personnel engaged in the installation, operation, or maintenance of this equipment are urged to become familiar with the following rules both in theory and practice. It is the duty of all operating personnel to be prepared to give adequate Emergency First Aid and thereby prevent avoidable loss of life.



RESCUE BREATHING

1. Find out if the person is breathing.

You must find out if the person has stopped breathing. If you think he is not breathing, place him flat on his back. Put your ear close to his mouth and look at his chest. If he is breathing you can feel the air on your cheek. You can see his chest move up and down. If you do not feel the air or see the chest move, he is not breathing.

2. If he is not breathing, open the airway by tilting his head backwards.

Lift up his neck with one hand and push down on his forehead with the other. This opens the airway. Sometimes doing this will let the person breathe again by himself.

3. If he is still not breathing, begin rescue breathing.

-Keep his head tilted backward. Pinch nose shut.
-Put your mouth tightly over his mouth.
-Blow into his mouth once every five seconds
-DO NOT STOP rescue breathing until help arrives.

LOOSEN CLOTHING - KEEP WARM

Do this when the victim is breathing by himself or help is available. Keep him as quiet as possible and from becoming chilled. Otherwise treat him for shock.

BURNS

SKIN REDDENED: Apply ice cold water to burned area to prevent burn from going deeper into skin tissue. Cover area with a clean sheet or cloth to keep away air. Consult a physician.

SKIN BLISTERED OR FLESH CHARRED: Apply ice cold water to burned area to prevent burn from going deeper into skin tissue.

Cover area with clean sheet or cloth to keep away air. Treat victim for shock and take to hospital.

EXTENSIVE BURN - SKIN BROKEN: Cover area with clean sheet or cloth to keep away air. Treat victim for shock and take to hospital.

dBm, dBw, dBmV, dBμV, & VOLTAGE EXPRESSED IN WATTS

50 Ohm System

WATTS	PREFIX	dBm	dBw	dBmV	dBμV	*VOLTAGE*
1,000,000,000,000	1 TERAWATT	+150	+120			
100,000,000,000	100 GIGAWATTS	+140	+110			
10,000,000,000	10 GIGAWATTS	+130	+100			
1,000,000,000	1 GIGAWATT	+120	+ 99			
100,000,000	100 MEGAWATTS	+110	+ 80			
10,000,000	10 MEGAWATTS	+100	+ 70			
1,000,000	1 MEGAWATT	+ 90	+ 60			
100,000	100 KILOWATTS	+ 80	+ 50			
10,000	10 KILOWATTS	+ 70	+ 40			
1,000	1 KILOWATT	+ 60	+ 30			
100	100 WATTS	+ 50	+ 20			
50	50 WATTS	+ 47	+ 17			
20	20 WATTS	+ 43	+ 13			
10	10 WATTS	+ 40	+ 10			
1	1 WATT	+ 30	0	+ 77	+137	7.07V
0.1	100 MILLIWATTS	+ 20	- 10	+ 67	+127	2.24V
0.01	10 MILLIWATTS	+ 10	- 20	+ 57	+117	0.707V
0.001	1 MILLIWATT	0	- 30	+ 47	+107	224mV
0.0001	100 MICROWATTS	- 10	- 40			
0.00001	10 MICROWATTS	- 20	- 50			
0.000001	1 MICROWATT	- 30	- 60			
0.0000001	100 NANOWATTS	- 40	- 70			
0.00000001	10 NANOWATTS	- 50	- 80			
0.000000001	1 NANOWATT	- 60	- 90			
0.0000000001	100 PICOWATTS	- 70	-100			
0.00000000001	10 PICOWATTS	- 80	-110			
0.000000000001	1 PICOWATT	- 90	-120			

TEMPERATURE CONVERSION

°F = 32 + [(9/5) °C]

°C = [(5/9) (°F - 32)]

USEFUL CONVERSION FACTORS

To Convert From	To	Multiply By
mile (US statute)	kilometer (km)	1.609347
inch (in)	millimeter (mm)	25.4
inch (in)	centimeter (cm)	2.54
inch (in)	meter (m)	0.0254
foot (ft)	meter (m)	0.3048
yard (yd)	meter (m)	0.9144
mile per hour (mph)	kilometer per hour(km/hr)	1.60934
mile per hour (mph)	meter per second (m/s)	0.44704
pound (lb)	kilogram (kg)	0.4535924
gallon (gal) U.S. liquid (One U.S. gallon equals 0.8327 Canadian gallon)	liter	3.7854118
fluid ounce (fl oz)	milliliters (ml)	29.57353
British Thermal Unit per hour (Btu/hr)	watt (W)	0.2930711
horsepower (hp)	watt (W)	746

NOMENCLATURE OF FREQUENCY BANDS

Frequency Range	Designation
3 to 30 kHz	VLF - Very Low Frequency
30 to 300 kHz	LF - Low Frequency
300 to 3000 kHz	MF - Medium Frequency
3 to 30 MHz	HF - High Frequency
30 to 300 MHz	VHF - Very High Frequency
300 to 3000 MHz	UHF - Ultrahigh Frequency
3 to 30 GHz	SHF - Superhigh Frequency
30 to 300 GHz	EHF - Extremely High Frequency

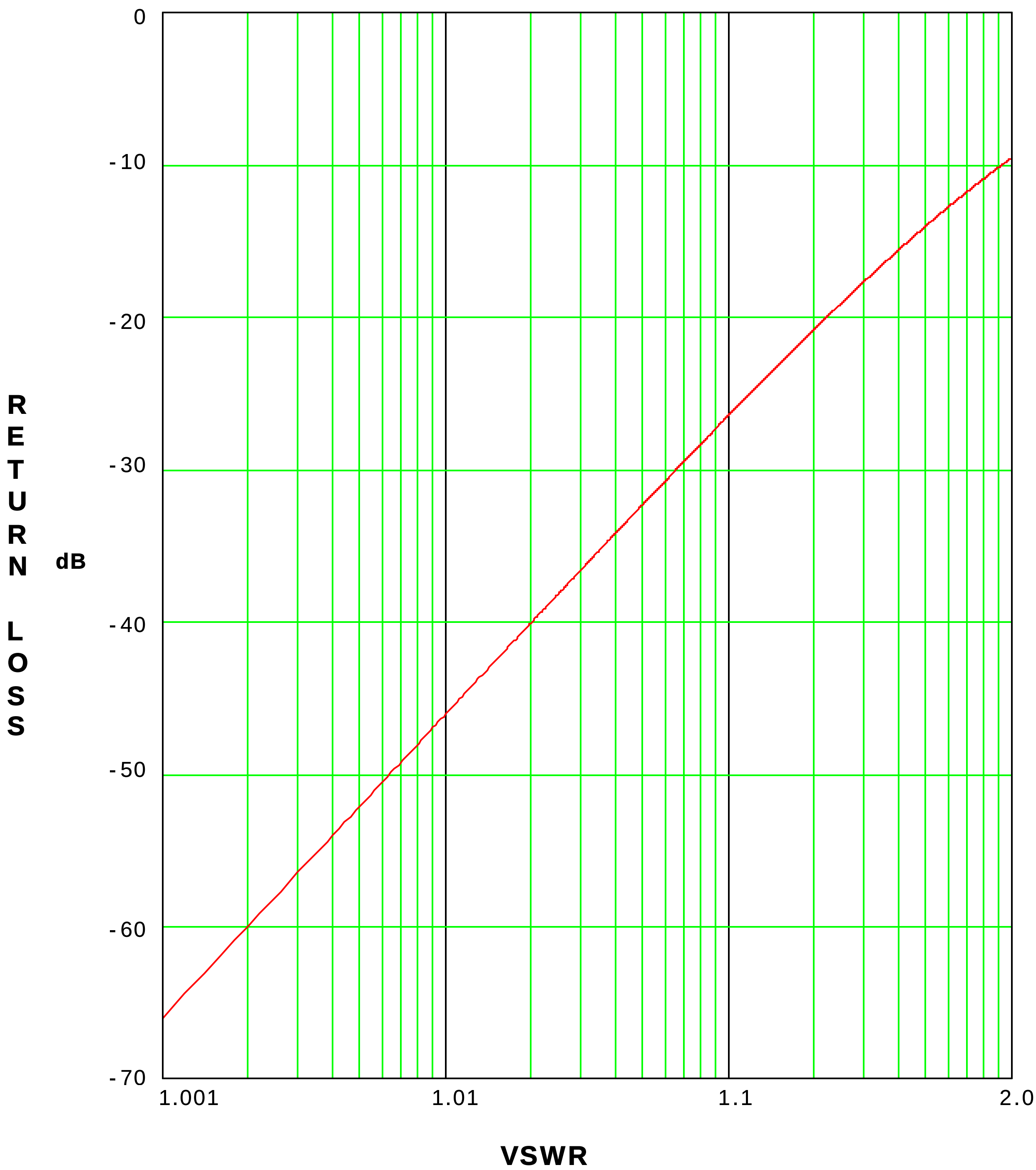
LETTER DESIGNATIONS FOR UPPER FREQUENCY BANDS

Letter	Freq. Band
L	1 – 2 GHz
S	2 - 4 GHz
C	4 - 8 GHz
X	8 - 12 GHz
Ku	12 - 18 GHz
K	18 - 27 GHz
Ka	27 - 40 GHz
MM	40 - 100 GHz

ABBREVIATIONS/ACRONYMS

AC	Alternating Current
AFC	Automatic Frequency Control
ALC	Automatic Level Control
AM	Amplitude Modulation
AGC	Automatic Gain Control
ASI	Asynchronous Serial Interface
AWG	American Wire Gauge
BER	Bit Error Rate
BW	Bandwidth
COFDM	Orthogonal Frequency Division Multiplexing
DC	Direct Current
D/A	Digital to Analog
dB	Decibel
dBm	Decibel referenced to 1 milliwatt
dBmV	Decibel referenced to 1 millivolt
dBw	Decibel referenced to 1 watt
FEC	Forward Error Correction
FM	Frequency Modulation
GSM	Global System for Mobile Communications
GPS	Global Positioning System
Hz	Hertz
ICPM	Incidental Carrier Phase Modulation
I/P	Input
IF	Intermediate Frequency
LED	Light Emitting Diode
LNB	Low Noise Block converter
LSB	Lower Sideband
MPEG	Motion Pictures Expert Group
O/P	Output
PLL	Phase Locked Loop
PCB	Printed Circuit Board
SFN	Single Frequency Network
QAM	Quadrature Amplitude Modulation

RETURN LOSS VS. VSWR



Chapter 2
System Description

System Overview

The LX Series Innovator digital transmitters are complete 1.67 GHz modular television transmitters that operate at a nominal output power of 50 to 400 watts digital. These systems can be either single output or dual output transmitters. The transmitter is divided into two major assemblies, the Exciter/Driver Chassis Assembly and the Power Amplifier Chassis Assembly as shown in Figure 2-1.

The LL400ATC transmitter operates at a nominal output power of 400 watts digital. Typically with a 36 MHz COFDM (orthogonal frequency division multiplexing) IF input the transmitter produces an RF on channel 1.67 MHz output.

The model number scheme for a Innovator LX Series digital transmitter is as follows (where ### = power in watts):

LL####ATC - Low power, L-Band, ### Single Output, A-Line, Transmitter, COFDM
(Example):
LL400ATC is a 400 Watt Single Output Digital 1.67 GHz Transmitter using the Orthogonal Frequency Division Multiplexing modulation scheme.

The modules and assemblies that make up the Exciter/driver chassis assembly are shown in Figure 2-2 and listed in Table 2-1.

Figure 2-1: LL400ATC Front View

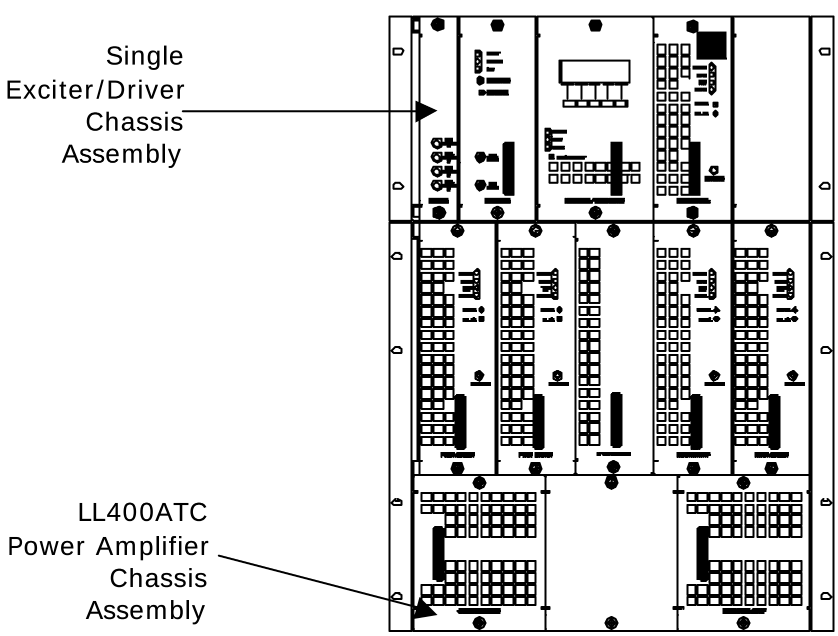
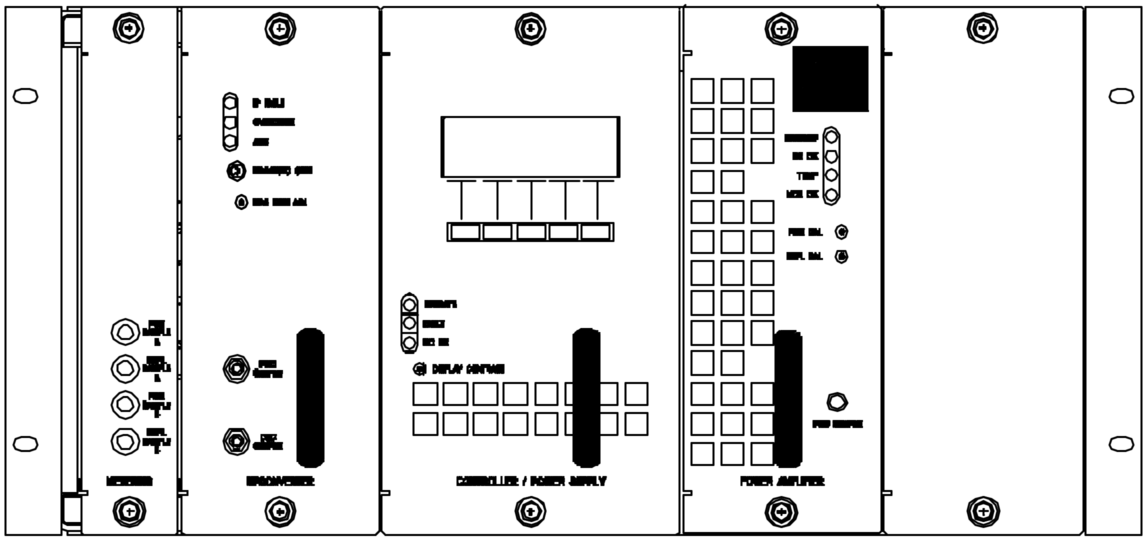


Figure 2-2: Exciter/Driver Chassis, Single, 1.67 GHz, Front View



A1 A2 A4 A6

Table 2-1: Exciter/Driver, 1.67 GHz, Modules and Assemblies

ASSEMBLY DESIGNATOR	TRAY / ASSEMBLY NAME	PART NUMBER
	Exciter Amplifier Chassis Assembly, Single, 1.67 GHz	1305021 (220 VAC)
A1	Metering Module	1304976
A2	Upconverter Module, Single	1305061
A4	Control/Power Supply Module	1305035 (220 VAC)
A6	5 Watt Driver Amplifier Module	1304844
A11	Backplane Board, 1.67 GHz	1304891

2.1 Exciter Amplifier Chassis Assembly, Single, 1.67 GHz, 220 VAC (1305021); Appendix B

The chassis assembly provides the area in which the Modules are mounted. The Metering and the Upconverter Modules slide into the assembly and plug directly into the backplane board. The driver power amplifier module and the power supply section of the Control & Monitoring/Power Supply Module also slide into the assembly but do not plug directly into the backplane board. The backplane board provides module to module interconnection as well as interconnection to remote command and control connectors. Refer to the chassis interconnect drawing (1305023) and the backplane board schematic drawing (1304893), located in Appendix B, for the exciter amplifier chassis assembly connections.

2.1.1 (A1) Metering Assembly, 1.67 GHz (1304976; Appendix B)

The (A1) Metering Assembly contains the Metering Board, 1.67 GHz (1304922).

This assembly has circuitry that is used to measure the average power of up to four RF inputs. Each RF input is split on the Metering Board, with some of the signal being applied to an average power detector, and the rest of the signal sent to the front panel sample to allow the operator to monitor the RF signal with his own test equipment. The output of each detector is sent to the transmitter's system control via the Backplane board into which the assembly plugs.

Table 2-2. Metering Assembly Front Panel Samples

SMA CONNECTOR	DESCRIPTION
FWD SAMPLE A	Sample of A Output Power
REFL SMAPLE A	Sample of A Reflected Power
FWD SAMPLE B	Sample of B Output Power
REFL SMAPLE B	Sample of B Reflected Power

2.1.2 (A2) Upconverter Module Assembly (1305061; Appendix B)

The Upconverter Module Assembly contains an Upconverter Control board (1304780), an LO Generator board (1304940) and either one or two Upconverter boards (1304929).

This assembly converts either one or two separate 36 MHz IF signals to either one or two RF outputs at a frequency of 1670-1675 MHz.

The description below is for one half of the upconverter assembly. The IF and upconverter paths can be duplicated to provide two outputs when needed. The second IF path is always present, but not used in single output upconverters. A second Upconverter board is added for dual output transmitters.

An IF Signal centered at 36 MHz at a level of 0 dBm average is applied to the Upconverter Control board. A sample is applied to a peak detector, which checks for the presence of an IF input. If the input is not present, an alarm is generated and displayed on the module's front panel, and is also noted by the microcontroller on the Upconverter control board. The IF signal is then applied to a pin diode attenuator, which is used to hold the output level of the transmitter constant.

The signal then is applied to the Upconverter board, and converted to RF via a double balanced mixer. The resulting RF output signal is filtered, then amplified, and is sent back to the Upconverter Control board, which routes it to the back of the tray. There is also a second output -20dB from the main output that is sent to the front panel as a sample.

The local oscillator consists of a Crystal oscillator running at 1/15 of the final LO frequency of 1708.5 MHz. The oscillator drives a X5 multiplier, is filtered, and then is sent to a final X3 multiplier circuit. A sample of the output signal is applied to a PLL circuit, which locks the LO signal to a 10 MHz reference generated by the Upconverter Control Board. An alarm is generated if the PLL unlocks that is sent to a microcontroller on the Upconverter Control Board. There are two outputs that are sent to the two upconverter control boards, and a third output used as a front panel LO sample.

The LO generator board also contains all the front panel alarms and controls. In addition to the Input Fault indicator mentioned above, there is also an indicator that shows the status of the Overdrive detection circuit, and another indicator that shows the status of the AGC circuit.

The AGC circuit is located on the upconverter control board, and attempts to adjust the gain of the IF pin attenuator to hold a constant output power. The circuit also looks at the output power of the driver, and will limit how far the pin attenuator can adjust if the output power of the driver gets to high. When it does so, the Overdrive indicator switches from green to Red. The status of the AGC circuit is controlled by a front panel switch, which can bypass the AGC and operate the pin attenuator with a fixed bias instead of with the AGC circuit. The indicator is normally green when the AGC circuit is enabled, and switches to Amber if the AGC switch is in manual.

Table 2-3. Upconverter Front Panel Switch

SWITCH	FUNCTION
MAN/AUTO AGC (Left Manual, Right AGC)	Controls AGC function. Switched to left bypasses AGC.

Table 2-4. Upconverter Front Panel Status Indicators

LED	FUNCTION
Input Fault (Red)	When lit it indicates that the input is missing or the level is below the preset value.
AGC Overdrive (Red)	When lit it indicates that the AGC is cutting back due to too much drive to the driver module.
AGC Fault (Red)	When lit it indicates that the AGC is out of range.

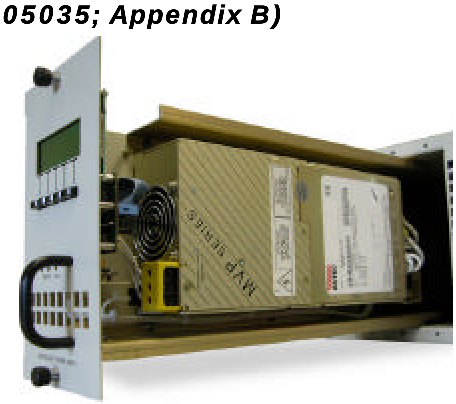
Table 2-5. Upconverter Front Panel Control Adjustments

POTENTIOMETERS	DESCRIPTION
MAN GAIN ADJ	Adjusts the gain of the upconverter and transmitter when in the Manual AGC position.

Table 2-6. Upconverter Front Panel Samples

SMA CONNECTOR	DESCRIPTION
FWD SAMPLE	Sample of the RF Output of the Upconverter
OSC SAMPLE	Sample of the LO signal in the Upconverter as generated on the LO Generator Board.

2.1.3 (A4) Control/Power Supply Module Assembly, 220 VAC (1305035; Appendix B)



The Control & Monitoring/Power Supply Assembly is made up of a Control Board (1302021), a Power Protection Board (1302837) and a Switch Board (1527-1406). The Assembly also contains a switching power supply that provides ±12 VDC to the rest of the modules in the chassis and +28 VDC to the Power Amplifier module.

The Assembly provides all transmitter control and monitoring functions. The Front panel LCD allows monitoring of system parameters, including forward and reflected power, transistor currents, module temperatures and power supply voltages.

Table 2-7. Controller/Power Supply Display

DISPLAY	FUNCTION
LCD	A 4 x 20 display providing a four-line readout of the internal functions, external inputs, and status.

Table 2-8. Controller/Power Supply Status Indicator

LED	FUNCTION
OPERATE (green)	When lit it indicates that the transmitter is in the Operate Mode. If transmitter is Muted the Operate LED will stay lit, the transmitter will remain in Operate, until the input signal is returned.
FAULT (red or green)	Red indicates that a problem has occurred in the transmitter. The transmitter will be Muted or placed in Standby until the problem is corrected.
DC OK (red or green)	Green indicates that the switchable fuse protected DC outputs that connect to the modules in the transmitter are OK.

Table 2-9. Controller/Power Supply Control Adjustments

POTENTIOMETERS	DESCRIPTION
DISPLAY CONTRAST	Adjusts the contrast of the display for desired viewing of screen.

2.1.4 (A6) 5 Watt Driver Power Amplifier Assembly (1304844; Appendix B)

The 5 Watt Driver PA assembly consists of an amplifier control board (1304774) and a two stage 40 Watt Driver board (1304865). The assembly amplifies the output from the upconverter assembly to a power level of 1 to 5W average power.

The amplifier has two stages of gain, both of them using LDMOS transistors operating from a +28V supply. The amplifier control board monitors the driver PA assemblies output and reflected power, temperature, and the current drawn from the two devices.

A sample of the output signal is routed to the front panel for monitoring purposes. There are also two controls on the front panel used to calibrate the metering of the forward and reflected power of the driver assembly.

Table 2-10. 5 Watt Driver Power Amplifier Status Indicators

LED	FUNCTION
ENABLED (Green)	When lit Green, it indicates that the PA is in the Operate Mode. If a Mute occurs, the PA will remain Enabled, until the input signal is returned.
DC OK (Green)	When lit Green, it indicates that the fuse protected DC inputs to the PA module are OK.
TEMP (Green)	When lit Green, it indicates that the temperature of the heatsink assembly in the module is below 78°C.
MOD OK (Green)	When lit Green, it indicates that the PA Module is operating and has no faults.

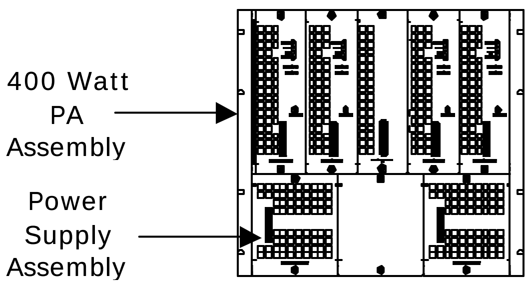
Table 2-11. 5 Watt Driver Power Amplifier Status Adjustments

POTENTIOMETERS	DESCRIPTION
FORWARD CAL	Adjusts the gain of the Forward Power monitoring circuit
RFL CAL	Adjusts the gain of the Reflected Power monitoring circuit

Table 2-12. 5 Watt Driver Power Amplifier Status Indicators

DISPLAY	FUNCTION
FWD SAMPLE	RF sample of the amplified signal being sent out the module on J25.

2.2 Power Amplifier Chassis Assembly, LL400ATC (1305863; Appendix B)



The power amplifier chassis assembly in the LX Series contains a modular television amplifier that slides into the assembly that produces approximately 400 Watts Digital output. There is also needed an external Power Supply Module Assembly, which also slides into the Power Amplifier Chassis Assembly, under the PA Module.

The RF output of the exciter/driver at the “N” connector J8 connects to the (A3) power amplifier chassis assembly at the “N” connector J201. Data and control information for the system is fed through the system serial cable. The system serial cable connects from J34 on the exciter/driver assembly to J232 on the Power Amplifier Assembly that connects to (A4) the External Amplifier Signal Board (1303344).

The RF input at J201 is connected to J111 on the power amplifier module. The output of the power amplifier at J112 connects to the RF output jack J203 of the power amplifier chassis assembly.

2.2.1 (A3) Power Amplifier Module Assembly, 100 Watt, 1/67 GHz (1304502; Appendix B)

The 100W amplifier assembly consists of an amplifier module control board (1304774), a single stage driver board (1304616), a phase/gain board (1305026) and a Quad Stage board (1304607). The assembly amplifies the output from the upconverter assembly to a power level of 1 to 5 Watts average power.

The amplifier has two stages of gain, both of them LDMOS transistors operating from a +28V supply. The output stage consists of four LDMOS devices operating in parallel, combined with quadrate hybrids. The amplifier control board monitors the assemblies’ output and reflected power, temperature, and the current drawn from the driver, and each pair of output devices.
A sample of the output signal is routed to the front panel for monitoring purposes.

There are also two controls on the front panel used to calibrate the metering of the forward and reflected power of the PA assembly.

Table 2-13. Power Amplifier Status Indicators

LED	FUNCTION
ENABLED (Green)	When lit Green, it indicates that the PA is in the Operate Mode. If a Mute occurs, the PA will remain Enabled, until the input signal is returned.
DC OK (Green)	When lit Green, it indicates that the fuse protected DC inputs to the PA module are OK.
TEMP (Green)	When lit Green, it indicates that the temperature of the heatsink assembly in the module is below 78°C.
MOD OK (Green)	When lit Green, it indicates that the PA Module is operating and has no faults.

Table 2-14. Power Amplifier Control Adjustments

POTENTIOMETERS	DESCRIPTION
RFL CAL	Adjusts the gain of the Reflected Power monitoring circuit
FORWARD CAL	Adjusts the gain of the Forward Power monitoring circuit

Table 2-15. Power Amplifier Sample

DISPLAY	FUNCTION
FWD SAMPLE	RF sample of the amplified signal being sent out the module on J25.

2.1.4 Power Supply Module Assembly, 1 kW (1305174; Appendix B)

The Power Supply Module Assembly is made up of a +28V/2000W Switching Power Supply and a ±12V/40W Switching Power Supply.

The power supply module provides the +28 VDC and the +12 VDC and -12 VDC to the power amplifier module assembly.

2.1.5 RF Output Assemblies

The 36 MHz COFDM Modulated IF from the PROTV modulator connects to the rear of the exciter/driver chassis assembly at J24, the RF input jack. The driver power amplifier RF output jack is at the “N” connector J25, PA RF Output. The RF output of the driver PA module is connected directly to the input of the power amplifier assembly. The PA assembly amplifies the RF signal to approximately 100W. The output is connected to a coupler assembly, which provides forward and reflected samples of the transmitters DTV output signal, before it is filtered for testing purposes. The output of the coupler is connected to a Myat 1.67 GHz 8 Section Bandpass Filter. The filter is tuned to a 5 MHz bandwidth around 1.6725 MHz center frequency.

The filtered signal is next connected to a low pass filter and output coupler assembly. The output coupler assembly provides a forward and a reflected power sample to the Metering Board, mounted in the exciter/driver assembly cabinet, for metering and test purposes. The RF output of the transmitter is at the “N” connector output jack of the low pass filter output coupler assembly.

2.2 Control and Status

The control and status readings of the exciter/driver chassis assembly are found by operating the front panel display screen on the front of the assembly.

2.2.1 Front Panel Display Screens

A 4 x 20 display located on the front of the Control & Monitoring/Power Supply Module is used in the LX Series transmitter for control of the operation and display of the operating parameters of the transmitter.

2.3 System Operation

When the transmitter is in operate, as set by the menu screen located on the Control & Monitoring Module, the following occurs. The +28 VDC stage of the Power Supply in the Control & Monitoring Module is enabled, the operate indicator on the front panel is lit and the DC OK on the front panel should also be green. The enable and DC OK indicators on the driver PA Module will also be green.

When the transmitter is in standby. The +28 VDC stage of the Power Supply in the Control & Monitoring Module is disabled, the operate indicator on the front panel will be extinguished and the DC OK on the front panel should remain green. The enable indicator on the driver PA Module is also extinguished.

If the transmitter does not switch to Operate when the operate menu is switched to Operate, check that all faults are cleared and that the remote control terminal block stand-by signal is not active.

2.3.1 Principles of Operation

Operating Modes

This transmitter is either operating or in standby mode. The sections below discuss the characteristics of each of these modes.

Operate Mode

Operate mode is the normal mode for the transmitter when it is providing RF power output. To provide RF power to the output, the transmitter will not be in mute. Mute is a special case of the operate mode where the +28 VDC section of the power supply is enabled but there is no RF output power from the transmitter.

Operate Mode with Mute Condition

The transmitter will remain in the operate mode but will be placed in mute when the following fault conditions exists in the transmitter.

- Upconverter is unlocked
- Upconverter module is not present

Entering Operate Mode

Entering the operate mode can be initiated a few different ways by the transmitter control board. A list of the actions that cause the operate mode to be entered is given below:

- A low on the Remote Transmitter Operate line.

- User selects "OPR" using switches and menus of the front panel.

- Receipt of an “Operate CMD” over the serial interface.

There are several fault or interlock conditions that may exist in the transmitter that will prevent the transmitter from entering the operate mode. These conditions are:

- Power Amplifier heat sink temperature greater than 78°C.

- Transmitter is Muted due to conditions listed above.

- Power Amplifier Interlock is high indicating that the amplifier is not installed.

Standby Mode

The standby mode in the transmitter indicates that the output amplifier of the transmitter is disabled.

Entering Standby Mode

Similar to the operate mode, the standby mode is entered using various means. These are:

- A low on the Remote Transmitter Stand-By line.
- Depressing the “STB” key on selected front panel menus.
- Receipt of a “Standby CMD” over the serial interface.

RF System Interlock

A RF System Interlock signal is provided through TB30-5. When this signal's circuit is completed to ground such as through a wire between TB30-5 and TB30-15, the transmitter is allowed to operate. If this circuit is opened, the transmitter switches to a Mute condition. This circuit may be completed through coax relay contacts and reject load contact closures to assure the RF output system is available to receive the transmitter's output RF signal.

2.4 Maintenance

The Innovator LX Series Transmitter is designed with components that require little or no periodic maintenance except for the routine cleaning of the fans and the front panels of the modules. The amount of time between cleanings depends on the conditions within the transmitter room. While the electronics have been designed to function even if covered with dust, a heavy buildup of dust, dirt, or insects will affect the cooling of the components. This could lead to a thermal shutdown or the premature failure of the affected module. When the front panels of the modules become dust covered, the module should be pulled out and any accumulated foreign material should be removed.

NOTE: To remove the driver/power amplifier module, mounted in the exciter/driver assembly, the input and output cables must be removed from the rear of the module and also a 6/32” x ½” Philips screw, mounted between the two connectors, needs to be removed before the module will pull out. After removal of the screw, which is used to hold the module in place during shipping, it does not need to be replaced.

A vacuum cleaner, utilizing a small, wand-type attachment, is an excellent way to suction out the dirt. Alcohol and other cleaning agents should not be used unless you are certain that the solvents will not damage components or the silk-screened markings on the modules and boards. Water-based cleaners can be used, but do not saturate the components. The fans and heatsinks should be cleaned of all dust or dirt to permit the free flow of air for cooling purposes.

It is recommended that the operating parameters of the driver/transmitter be recorded from the LEDs on the modules and the LCD system metering on the control/monitoring module at least once a month. It is suggested that this data be retained in a rugged folder or envelope.

2.5 Customer Remote Connections

The remote monitoring and operation of the transmitter is provided through jack TB30 located on the rear of the chassis assembly. If remote connections are made to the transmitter, they must be made through plug TB30 at positions noted on the transmitter interconnect drawing and in Table 2-16.

Figure 2-3. Exciter/Driver Chassis Assembly Rear View

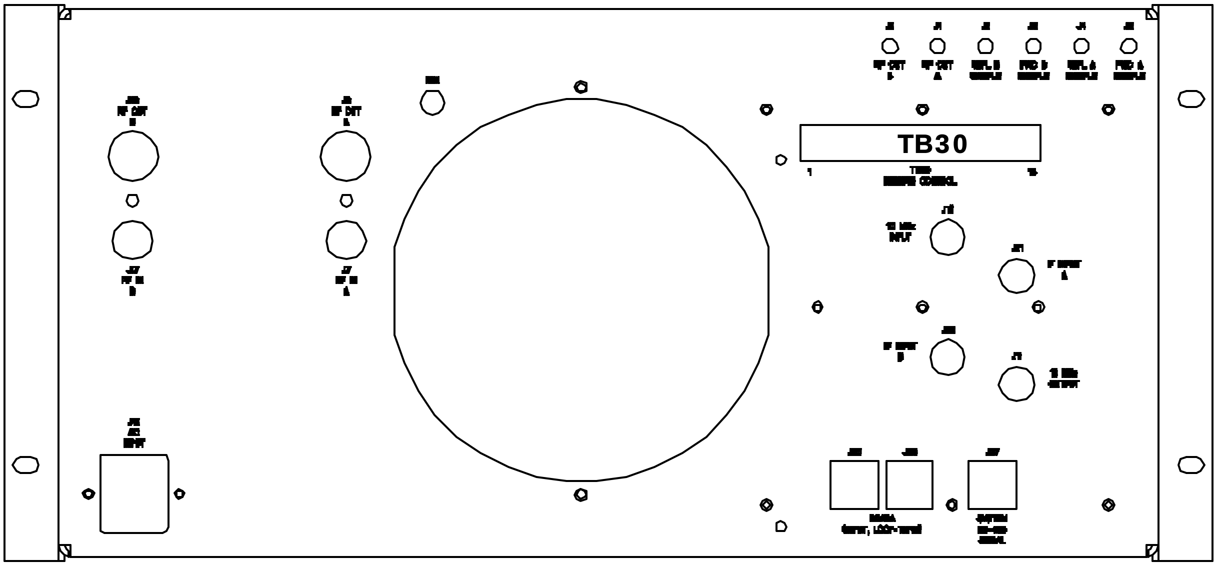


Table 2-16: LX Series Chassis Assembly Hard Wired Remote Interface Connections to TB30 an 18 pos. Terminal Block Located on the Rear of the Assembly

Signal Name	Pin Designations	Signal Type / Description
RMT Transmitter State	TB30-1	Discrete Open Collector Output - A low indicates that the transmitter is in the operate mode.
RMT Transmitter Interlock	TB30-2	Discrete Open Collector Output - A low indicated the transmitter is OK or completes a interlock daisy chain. When the transmitter is not faulted, the interlock circuit is completed.
RMT Transmitter Interlock Isolated Return	TB30-3	Ground - Configurable ground return which can be either jumpered directly to ground or it can be the “source” pin of an FET so that the transmitter interlock can be daisy chained with other transmitters. This signal does not directly interface to the microcontroller.
RMT AUX IO 1	TB30-4	Discrete Open Collector Inputs, Discrete Open Drain Outputs, or 0 - 5 VDC Analog Input - When used as an output, this line is pulled to +5 VDC with a 1.0 kO resistor for logic high and pulled to ground for a low. A diode allows this line to be pulled up to 12 VDC. When used as a digital input, this line considers all values over 2 Volts as high and those under 1 volt as low. As an analog input, this line is protected by a 5.1 zener diode.
RMT AUX IO 2	TB30-5	Same as RMT AUX IO 1.
RMT Transmitter Operate CMD	TB30-7	Discrete Open Collector Input - A pull down to ground on this line indicates that the transmitter is to be placed into the operate mode.
RMT Transmitter Stand-By CMD	TB30-9	Discrete Open Collector Input - A pull down to ground on this line indicates that the transmitter is to be placed into the standby mode.

Signal Name	Pin Designations	Signal Type / Description
RMT RF System Interlock A	TB30-11	When this signal's circuit is completed to ground such as through a wire between TB30-11 and TB30-12, the transmitter A is allowed to operate. If this circuit is opened, transmitter A switches to a Mute condition.
RMT RF System Interlock B (Used in dual systems only)	TB30-13	When this signal's circuit is completed to ground such as through a wire between TB30-13 and TB30-14, transmitter B is allowed to operate. If this circuit is opened, transmitter B switches to a Mute condition.
RMT Ground	TB30-6, 8, 10, 12, 14, 16, and 18	Ground pins available through Remote
RMT +12 VDC	TB30-15	+12 VDC available through Remote w/ 2 Amp re-settable fuse
RMT -12 VDC	TB30-17	-12 VDC available through Remote w/ 2 Amp re-settable fuse

Chapter 3
Circuit Descriptions

3.1 (A1) Metering Module Assembly (1304976; Appendix B)

This assembly has circuitry that is used to measure the average power of up to four RF inputs. Each RF input is split on the Metering Board, with some of the signal being applied to an average power detector, and the rest of the signal sent to the front panel sample to allow the operator to monitor the RF signal with his own test equipment. The output of each detector is sent to the transmitter's system control via the Backplane board into which the assembly plugs.

The Metering Assembly contains the Metering Board, 1.67 GHz (1304922).

3.1.1 Metering Board (1304922; Appendix B)

This board has circuitry that is used to measure the average power of up to four RF inputs that come in to the board at the mixed signal connector J1. Each RF input is split with some of the signal being applied to one of the average power detector ICs on the board (U2, U4, U5, and U7), and the rest of the signal is sent to the front panel as a sample to allow the operator to monitor the RF signal with his own test equipment. The output of each detector is sent to the transmitter's system control via J1 to the Backplane that the assembly plugs into. Each section has a calibration pot that is factory set (R5, R15, R25, R35).

3.2 (A2) Upconverter Module Assembly, Single Output (1305061; Appendix B)

This assembly converts the 36 MHz IF input signal to the RF output at a frequency of 1670-1675 MHz.

The Upconverter Module Assembly contains an Upconverter Control board (1304780), an LO Generator board (1304940) and the Upconverter board (1304929).

3.2.1 (A1) Upconverter Control Board (1304780; Appendix B)

An IF Signal centered at 36 MHz at a level of 0 dBm average is applied to J1-11B of the Upconverter Control board. A sample is connected to a peak detector, which checks for the presence of the IF input. If the input is not present, an alarm is generated and displayed on the module's front panel, and is also noted by microcontroller U20 on the Upconverter control board. The IF signal is then applied to a pin diode attenuator, which is used to hold the output level of the transmitter constant.

The AGC circuit is located on the upconverter control board, and attempts to adjust the gain of the IF pin attenuator to hold a constant output power. The circuit also looks at the output power of the driver, and will limit how far the pin attenuator can adjust if the output power of the driver reaches too high a level. When it does so, the Overdrive indicator switches from Green to Red. The status of the AGC circuit is controlled by a front panel switch, which can bypass the AGC, and operate the pin attenuator with a fixed bias instead of with the AGC circuit. The indicator is normally Green when the AGC circuit is enabled, and switches to Amber if the AGC switch is in manual. This information is fed back to the Upconverter control board and used to control the AGC.

There is a second IF and AGC path for the B side of the transmitter if it is present. Its operation is identical to side A just described.

The board also controls what 10 MHz reference is used by the PLL circuitry of the Upconverter. In normal operation the board uses an external 10 MHz reference, which enters the board at J1-5B. Its presence is detected with a peak detector that controls a relay. If the external reference is not present, the board switches over to its internal reference U2. This reference is not suitable for use in a transmitter with an SFN network as the transmitter will no longer be locked to the GPS, but it does allow the transmitter to be tested without requiring a GPS reference.

Microcontroller U20 performs all the data collection and reporting functions for the Upconverter. It communicates via an RS-485 link to the transmitter's system controller.

3.2.2 (A1) Upconverter Board, 1.67 GHz (1304929; Appendix B)

This board converts a 36 MHz IF input to a 1672.5 MHz RF output.

The IF input at J2 passes through a frequency response correction circuit, consisting of adjustments C8, C9, R6 and R7, which are factory set to compensate for any response variation in the upconverter assembly. The signal is then converted to the final frequency by a double balanced mixer U4.
The RF output of the mixer amplified by U5 and filtered by the band pass filter U7 and amplified by U8 before it is connected to J7 on the board. A coaxial cable jumper connects J7 to J4 on the board. The RF is filtered by a second band pass filter U13 and amplified by U9 and U10. The output is then sent to the directional coupler U11 and exits the board at the RF output jack J5

The coupled output from U11 leaves the board at the SMA J6, which is accessed through the front panel of the Upconverter Assembly, for monitoring purposes.

3.2.3 (A4) LO Generator Board, Single Output (1305829; Appendix B)

The local oscillator consists of a Crystal oscillator consisting of Y1, Q2 and their associated components running at 1/15 of the final LO frequency of 1708.5 MHz.
The oscillator drives a X5 multiplier consisting of CR1, L3, and L6-L8. The output is filtered and then is sent to a final X3 multiplier circuit consisting of CR2, C22 and C23. The output is filtered by the band pass filter U5 and then split by the splitter U7. A sample of the output signal is applied to the PLL circuit U11, which locks the LO signal to a 10 MHz reference generated by the Upconverter Control Board. An alarm is generated if the PLL unlocks that is applied to a microcontroller on the Upconverter Control Board. In a dual system, there are two outputs that are sent to the two upconverter control boards, and a third output used as a front panel LO sample. There is only one upconverter board in a single system

The LO generator board also contains all of the front panel alarms and controls. There are LED indicators that show, the status of the IF input, the status of the Overdrive detection circuit, and another indicator that shows the status of the AGC circuit.

The external AGC circuit is located on the upconverter control board, and attempts to adjust the gain of the IF pin attenuator to hold a constant output power. The circuit also looks at the output power of the driver, and will limit how far the pin attenuator can adjust if the output power of the driver increases too much. When it gets too high, the Overdrive indicator switches from Green to Red. The status of the AGC circuit is controlled by a front panel switch, which can bypass the AGC. When bypassed the pin attenuator is controlled by a fixed bias instead of with the AGC circuit. The indicator is normally Green when the AGC circuit is enabled, and switches to Amber when the AGC switch is in manual.

3.3 (A4) Control Monitoring/Power Supply Module, 220 VAC (1305035;Appendix B)

The Control Monitoring/Power Supply Module Assembly contains (A1) a Power Protection Board (1302837), (A2) a 600 Watt Switching Power Supply, (A3) a Control Board (1302021), (A4) a Switch Board (1527-1406) and (A5) a LCD Display.

AC Input to Exciter/Driver Chassis Assembly

The AC input to the Exciter/Driver Chassis Assembly is connected from J12, part of a fused entry module, located on the rear of the chassis assembly to J50 on the Control Monitoring/Power Supply Module. J50-10 is line #1 input, J50-8 is earth ground and J50-9 is neutral input. The input AC connects to J1 on the Power Protection Board where it is fuse protected and connected back to J50, at J50-11 AC Line #1 and J50-12 AC Line #2, for distribution to the cooling Fan.

3.3.1 (A1) Power Protection Board (1302837; Appendix B)

The input AC connects through J1 to two 10 Amp AC fuses F1 and F2. The AC line #1 input connects from J1-1 to the F1 fuse. The AC line #1 input after the F1 fuse is split with one line connected back to Jack J1 Pin 4, which becomes the AC Line #1 to the Fan. The other line of the split connects to J4. The AC line #2 input connects from J1-3 to the F2 fuse. The AC line #2 input after the F2 fuse is split with one line connected back to Jack J1 at Pin 5, which becomes the AC Line #2 to the Fan. The other line of the split connects to J2. J1-2 is the earth ground input for the AC and connects to J3.

Three 150 VAC, for 115 VAC input, or three 275 VAC, for 230 VAC input, MOVs are connected to the input AC for protection. One connects from each AC line to ground and one connects across the two lines. VR1 connects from J4 to J2, VR2 connects from J4 to J3 and VR3 connects from J2 to J3.

3.3.1.1 +12 VDC Circuits

+12 VDC from the Switching Power Supply Assembly connects to J6 on the board. The +12 VDC is divided into four separate circuits each with a 3 amp self resetting fuse, PS3, PS4, PS5 and PS6.

The polyswitch resettable fuses may open on a current as low as 2.43 Amps at 50°C, 3 Amps at 25°C or 3.3 Amps at 0°C. They definitely will open when the current is 4.86 Amps at 50°C, 6 Amps at 25°C or 6.6 Amps at 0°C.

PS3 protects the +12 VDC 2 Amp circuits for the System Controller, the Amplifier Controller and the Spare Slot through J62 pins 7, 8, 9 and 10. If this circuit is operational, the Green LED DS3, mounted on the board, will be lit.

PS4 protects the +12 VDC 2 Amp circuits for the Modulator and the IF Processor through J62 pins 13, 14, 15 and 16. If this circuit is operational, the Green LED DS4, mounted on the board, will be lit

PS5 protects the +12 VDC 2 Amp circuits for the Upconverter through J62 pins 17, 18, 19 and 20. If this circuit is operational, the Green LED DS5, mounted on the board, will be lit

PS6 protects the +12 VDC 2 Amp circuits for the Remote through J63 pins 17, 18, 19 and 20. If this circuit is operational, the Green LED DS6, mounted on the board, will be lit

3.3.1.2 -12 VDC Circuits

-12 VDC from the Switching Power Supply Assembly connects to J5 on the board. The -12 VDC is divided into two separate circuits each with a 3 amp self-resetting fuse, PS1 and PS2.

PS1 protects the -12 VDC 2 Amp circuits for the System through J63 pins 1, 2, 3 and 4. If this circuit is operational, the Green LED DS1, mounted on the board, will be lit

PS2 protects the -12 VDC 2 Amp circuits for the Remote through J62 pins 1, 2, 3 and 4. If this circuit is operational, the Green LED DS2, mounted on the board, will be lit

The connections from J62 and J63 of the Power Protection Board are wired to J62 and J63 on the Control Board.

3.3.2 (A3) Control Board (1302021; Appendix B)

In this transmitter, control monitoring functions and front panel operator interfaces are found on the Control Board. Front panel operator interfaces are brought to the control board using a 26-position conductor ribbon cable that plugs into J60. The control board controls and monitors the Power Supply and Power Amplifier module through a 16 position connector J61 and two 20 position connectors J62 & J63.

3.3.2.1 Schematic Page 1

U1 is an 8 bit RISC microcontroller that is in circuit programmed or programmed using the serial programming port J4 on the board. When the microcontroller, U1, is held in reset, low on pin 20, by either the programming port or the external watchdog IC (U2), a FET Q1 inverts the reset signal to a high that connects to the control lines of U5, an analog switch. The closed contacts of U5 connects the serial programming lines from J4 to U1. LED DS10 will be lit when programming port J4 is used.

U2 is a watchdog IC used to hold the microcontroller in reset, if the supply voltage is less the 4.21 VDC; (1.25 VDC < Pin 4 (IN) < Pin 2 (Vcc). The watchdog momentarily resets the microcontroller, if Pin 6 (ST) is not clocked every second. A manual reset switch S1 is provided but should not be needed.

Diodes DS1 through DS8 are used for display of auto test results. A test board is used to execute self-test routines. When the test board is installed, Auto_Test_1 is held low and Auto_Test_2 is allowed to float at 5 VDC. This is the signal to start the auto test routines.

U3 and U4 are used to selectively enable various input and output ICs found on pages 2 & 3 of the schematic.

U1 has two serial ports available. In this application, one port is used to communicate with transmitter system components where U1 is the master of a RS-485 serial bus. The other serial port is used to provide serial data I/O where U1 is not the master of the data port. A dual RS-232 port driver IC and a RS-485 Port driver are also in the second serial data I/O system. The serial ports are wired such that serial data input can come through one of the three serial port channels. Data output is sent out through each of the three serial port channels.

Switch SW1, transmitter operation select, is used to select either transmitter operation or exciter/driver operation. When the contacts of SW1 are closed, transmitter operation is selected and the power monitoring lines of the transmitter's power amplifier are routed to the system power monitoring lines.

3.3.2.2 Schematic Page 2

U9 is a non-inverting transceiver IC that provides 2 way asynchronous communication between data busses. The IC is used as an input buffer to allow the microcontroller to monitor various digital input values.

Digital output latch circuits are used to control system devices. Remote output circuits are implemented using open drain FETs, Q13, Q14, Q16, and Q17, with greater than 60 Volt drain to source voltage ratings.

Remote digital inputs are diode protected, using CR6, CR7, CR8 and CR9 with a 1 kO pull-up resistor, to +5 VDC. If the remote input voltage is greater than about 2 Volts or floating, the FET is turned on and a logic low is applied to the digital input buffer, U9. If the remote input voltage is less than the turn on threshold of the FET (about 2 VDC), a logic high is applied to the digital input buffer, U9.

Four of the circuits on page two of the schematic, which include Q2, Q9, Q19 and Q21, are auxiliary I/O connections wired for future use. They are wired similar to the remote digital inputs but include a FET, Q5, Q12, Q20 and Q22, for digital output operations. To operate these signals as inputs, the associated output FET must be turned off. The FETs are controlled by U10 and U12, analog input multiplexer ICs.

3.3.2.3 Schematic Page 3

U13, U14, U15, U16, U17 and U18 are 3 state non-inverting transceiver ICs that provide 2 way asynchronous communication between data busses. The ICs are used as input buffers to allow the microcontroller to monitor various digital input values. The digital inputs to the ICs utilize a 10 kO pull-up resistor. The buffer IC, U18, used for data transfer to the display is wired for read and write control.

3.3.2.4 Schematic Page 4

U19 and U20 are digitally controlled analog switches that provide samples back to the microprocessor. Each analog input is expected to be between 0 and 5 VDC. If a signal exceeds 5.1 VDC, a 5.1 Volt zener diode clamps the signals voltage, to prevent damage to the IC. Most signals are calibrated at their source, however two dual serial potentiometers ICs are used to calibrate four signals, System Visual/Average Power, System Aural Power, System Reflected Power and the Spare AIN 1. For these four circuits, the input value is divided in half before it is applied to an op-amp. The serial potentiometer is used to adjust the output signal level to between 80 and 120% of the input signal level. Serial data, serial clock and serial pot enables are supplied by the microprocessor to the dual serial potentiometer ICs. J62 and J63 are two 20-position connectors that provide the +12 VDC and –12 VDC power through the Power Protection Board. The ±12 VDC generated by the switching power supply connects to J62 and J63 after being fuse protected on the Power Protection Board.

3.3.2.5 Schematic Page 5

There are three dual element, red/green, common cathode LED indicators mounted on the front panel of the sled assembly; DC OK, Operate and Fault.

There are three, the fourth is a spare, identical circuits that drive the front panel mounted LED indicators. The levels on the 1, 2, 3 and 4 LED Control Lines, for both the red and green LEDs, are generated by the IC U11 as controlled by the DATABUS from the microprocessor U1.

Each LED controller circuit consists of an N-Channel MOSFET w/internal diode that controls the base of an N-P-N transistor in an emitter follower configuration. The emitter of the transistor connects the LED.

With the LED control line LOW, the MOSFET is Off, which causes the base of the transistor to increase towards +12 VDC, forward biasing the transistor. With the transistor forward biased, current will flow from ground through the LED, the transistor and the current limiting resistors in the collector to the +12 VDC source. The effected LED will light.

With the LED control line HIGH, the MOSFET is On, which causes the base of the transistor go toward ground potential, reverse biasing the transistor. With the transistor reverse biased, no current through the transistor and LED, therefore the effected LED will not light.

A third color, amber, can also be generated by having both transistors conducting, both control lines LOW. The amber color is produced because the current applied to the green element is slightly greater than the red element. This occurs because the current limiting resistors have a smaller value in the green circuit.

There are four voltage regulators, three for +5 VDC and one for +7 VDC, which are used to power the Control Board. +12 VDC is applied to U25 the +7 VDC regulator that produces the +7 VDC, which is applied to the LEDs mounted on the board. The +7V is also connected to the input of U26 a precision +5.0 Volt regulator. The +5.0 VDC regulator output is used to power the analog circuits and as the microcontroller analog reference voltage. Another two +5 Volt regulator circuits U27, +5V, and U8, +5 Vserial, are used for most other board circuits.

3.3.3 (A4) Switch Board (1527-1406; Appendix B)

The switch board provides five front-panel momentary contact switches for user control and interface with the front-panel LCD menu selections. The switches, SW1 to SW5, complete the circuit through connector J1 to connector J2 that connects to J1 on (A5) the 20 Character by 4 line LCD Display. J1 on the switch board is also cabled to the Control Board. When a switch is closed, it connects a logic low to the control board that supplies the information from the selected source to the display. By pushing the button again, a different source is selected. This occurs for each push button. Refer to Chapter 3 Section 3.5.3, for more information on the Display Menu Screens.

3.3.4 (A2) Switching Power Supply Assembly

The power supply module contains a switching power supply, an eight position terminal block for distributing the DC voltages, a three position terminal block to which the AC Input connects. Jack J1 connects to the Control Board and supplies DC OK, at J1-4 & 3, and AC OK, at J1-2 & 1, status to the control board. A Power Supply enable connects from the control board to the power supply at V1-6 & 7. The power supply is configured for three output voltages +12V, -12V, at the 8 position terminal block, and a main output power of +28 VDC at J50 pin A (+) and J50 pin B (Rtn). The power supply is power factor corrected to .98 for optimum efficiency and a decrease in energy consumption. For safety purposes all outputs are over voltage and over current protected. This supply accepts input voltages from 85 to 264 volts AC, but the power entry module, for the exciter/amplifier chassis, must be switched to the proper input voltage setting, for the transmitter to operate.

3.4 (A6) 5 Watt Driver Power Amplifier Module Assembly (1304844; Appendix B)

The RF from the Upconverter Module Assembly connects from the Upconverter RF Output BNC Jack J23, through a cable, to the PA RF Input BNC Jack J24, located on the rear of the exciter/amplifier chassis assembly.

The 5 Watt Driver PA assembly consists of (A1) a two stage 40 Watt amplifier board (1304865) and (A5) an amplifier control board (1304774). The assembly amplifies the output from the upconverter assembly

3.4.1 (A1) Two Stage 40 Watt Amplifier Assembly (1304865; Appendix B)

The RF from J24 is connected to the RF input jack J15 of (A1) the two stage 40 Watt amplifier assembly.

This board has two stages of gain and is used to amplify the output of the upconverter module to a point where it can drive up to four 130W amplifier modules.

The driver stage Q2 is a single-ended LDMOS transistor, operating Class A. Its' bias is generated by U4, R64 and their associated components. CR3 provides temperature compensation for the bias. The output of Q2 is applied to the input of the push-pull LDMOS transistor Q1, which is operating Class A. Its' bias is generated by the 5V regulator Q3, R7 and their associated components. The bias of Q1 is temperature compensated by CR1 and CR2.

The output of Q1 is connected to a directional coupler used for metering. The main output is J9 and the coupled output is J10. The board also generates the reflected power metering sample for the module. R62 attenuates the signal from the reject port of an external circulator. The reflected sample is at J12.

3.4.2 (A3) Circulator

The circulator is connected to the output of the two stage 40W amplifier and provides protection of the amplifier devices in the case of problems in the external circuits. A reflected power sample at 3 on the circulator is fed back to the two stage 40W amplifier at J11. The level is fed through R62 a 20dB attenuator to J12 on the board that is cabled to J5 on the amplifier control board.

3.4.3 (A5) Amplifier Control Board (1304774; Appendix B)

The amplifier control board provides LED fault and enable indications on the front panel of the module and also performs the following functions: overdrive cutback, when the drive level reaches the amount needed to attain 110% output power; and overtemperature, VSWR, and overdrive faults. The board provides connections to the LCD Display in the control/power supply assembly for monitoring the % Reflected Power, % Output Power, and the power supply voltage.

If the Module OK LED, located on the front panel, is Red and blinking, a fault is present. The meaning of the blinking LED is as follows.

1 Blink: Indicates Amplifier Current Fault.
2 Blinks: Indicate Temperature Fault.
3 Blinks: Indicate +28V Power Supply Over Voltage Fault.
4 Blinks: Indicate +28V Power Supply Under Voltage Fault.
5 Blinks: Indicate Reflected Power Fault.
6 Blinks: Indicate +12V or –12V Power Supply Fault

3.4.3.1 Schematic Page 1

U4, located upper center of page, is an in circuit microcontroller. The controller is operated at the frequency of 3.6864 MHz using crystal Y1. Programming of this device is performed through the serial programming port J2. U4 selects the desired analog channel of U1 through the settings of PA0-PA2. The outputs of Port A must be set and not changed during an analog input read of channels PA5-PA7. PA3 of U4 is a processor operating LED that monitors the ±12 VDC. PA4 is not used in this configuration. PA5 is the selected channel of analog switch U1. PA6 is used to monitor the +5V digital supply to the board. PA7 is connected to an amp current fault.

U2 is a serial to RS-485 driver IC. U5 is a watchdog IC used to hold the microprocessor in reset, if the supply voltage is less than 4.21 VDC. U5 momentarily resets the microcontroller if Pin 6 ($\overline{ST}$) is not clocked every second. A manual reset switch is provided but should not be needed.

In the upper left of Page one, U1 is used to determine where the amplifier control board is located. The four inputs come from the main amp connector and are used to set the SCADA address of the controller. Pull-up resistors, R1-R4 set a default condition of logic high.

U6 below and left of U3 is used to control four board mounted status LEDs, ENABLED, DC OK, TEMP and MOD OK all located on the front panel. A FET is turned On to shunt current away from the LED to turn it Off.

U8 below U6 is not used in this configuration.

3.4.3.2 Schematic Page 2

In the lower right corner are voltage regulator circuits. U17 should allow for 0.14 amps of power at +7 VDC using its 92 C/W rating if Ta = 60°C max and Tj = 125°C max 0.26 amps can be obtained from U17 if the mounting pad is 0.5 square inches. The controller will not need this much current. U18 and U19 are low drop out +5 VDC, voltage regulators with a tolerance greater than or equal to 1%. 100mA of current is available from each device but again the controller will not need this much current.

In the upper left section are circuits with U9 and U11. U11 is used to generate a regulated voltage that is about 5 volts less than the +32 VDC supply, approximately +26.25 VDC. When the +32 VDC supply is enabled, the circuitry around U9A is used to provide gate voltage to Q14 that is 5 volts greater than the source pin of this FET. The gate of Q14 can be turned Off by any one of a few different circuits. These circuits are wired through Q12 and Q13. These transistors are not present at this time, but may be installed to increase the shut-down time on a detected fault. Without Q12 and Q13 installed, Q14 is only turned off by the microcontroller through Q16.

U10A is used to detect high current in amplifier #1. At 0.886 VDC the current to amplifier #1 should be greater than 5 Amps.

U10B and U12A are used to detect a high current condition in amplifier stages #2 and #3. With a 2.26 VDC reference, high current shut down should be about 13.1 Amps.

U12B is used to detect high power supply voltage. U13A is used to indicate that the power supply voltage is less than 26 VDC.

U25B on Page 3 is used to detect high reflected power. U13B determines if the power supply temperature gets too hot.

3.4.3.3 Current monitoring sections of the board.

The ICs U14, U15 and U16 along with associated components set up the current monitoring sections of the board. R67, R68 and R69 are 0.01O/5W 1% through hole resistors used for monitoring the current through several sections of the amplifier. The voltage developed across these resistors are amplified for current monitoring by U14, U15 or U16. These LT1787HVCS8 precision high side current sense IC amplifiers accept a maximum voltage of 60 VDC. The 43.2 kO resistor from pin 5 to ground sets the gain of the amplifier to about 17.28. This value is not set with much accuracy since the manufacturer internally matches the resistors of this part but their actual resistance value is not closely defined. A trimming resistor is suggested to give a temperature stability of –200 ppm/C, but instead the microcontroller will determine the exact gain of the circuit and use a correction factor for measurements. Circuit loading components are located in the lower portion of each current monitoring circuit. These components allow for short duration high current loading of the supply.

A6 is an external temperature sensor thermistor, mounted on the amplifier module's heat sink, which is used to monitor the temperature of the heatsink. It connects to J6 pins 1 & 2 on the board and is wired to the comparator IC U13B. If the temperature in amplifier #1 increases above 75°C the output of U13B will go Low that is used as a temperature fault output, which generates a Temperature Fault alert that disables Amplifier #1

3.4.3.4 Schematic Page 3, Forward and Reflected power detector sections of the board.

A Forward Power Sample enters the board at SMA Jack J3 and is split. One part connects to J4 on the board, the SMA Forward Power Sample Jack, located on the front panel of the assembly. The other part of the split forward power sample is detected by U26 and the DC level amplified by U22A and U22B. R201 is a front panel Average Calibration adjustment pot. The output of U22B at pin 7 is split with one part connected to the Average Power sample remote. The other split output connects through jumper W3 on J12 to U27B that is part of the Forward Average Power circuit. The output of U27B is detected by CR29 and the output Average Forward power level connects to U4 Pin 56, shown on page 1 of the schematic, on the board.

A Reflected Power Sample enters the board at SMA Jack J5 and is detected by CR31 and the DC level amplified by U21B. The output of U21B at pin 7 is connected through the Reflected Calibration adjustment pot R203 to U25A. The output is split with one part connected to U3 Pin 5, shown on page 1 of the schematic. The other part of the split from U25A connects to the comparator IC U25B that has a reference level connected to the other input. If the reflected level increases above the reference level a low output is produced and connected to the Reflected Power Shutdown circuit at CR14 and CR15, shown on page 2 of the schematic. The Reflected Power Fault V connects to Pin 29 of U4, shown on page 1 of the schematic. A Fault Alert, Low, connects to pin 25 of U4, shown on page 1 of the schematic.

This completes the description of the 5 watt driver power amplifier module assemblies.

3.5 Power Amplifier Module Assembly, 100W (1304502; Appendix B)

(**NOTE:** There are four of these assemblies in a LL400ATC)

The Power Amplifier Module Assembly contains (A1) a Phase/Gain Board (1305026), (A2) a Single Stage Amplifier Pallet, 1.67 GHz (1304616), (A3) a Quad Stage Amplifier Pallet (1304607) and (A6) an Amplifier Module Control Board (1304774) and (A7) a Temperature Sensor IC.

3.5.1 (A1) Phase/Gain Board (1305026; Appendix B)

The RF input from the OSP JACK J1 on the rear of the PA assembly connects to J1 on the Phase/Gain Board. The phase/gain board provides the circuits that are used to normalize the gain and phase of each amplifier module so that they are all identical in systems with multiple power amplifiers.

U1, U2, CR1, CR2 and their associated components form two pin diode attenuators isolated between quadrature hybrids. The diodes provide the gain normalization, and the hybrids allow this gain variation to occur without inducing a poor return loss to the amplifier.

Q3, C9 and C10 form a phase shifter circuit that normalizes the phase shift through the entire module.

+12 VDC from an external switching power supply is applied to J3 on the board and is used as the reference that is applied to the phase-control pot. The gain and phase controlled output connects to the RF output jack J2 on the board.

3.5.2 (A2) Single Stage Pallet Assembly, 1.67 GHz (1304616; Appendix B)

The output of the Phase/Gain Board is connected to the input J3 of (A2) the single stage amplifier assembly.

This board has contains a single push-pull LDMOS RF transistor Q1, which is operating Class AB. The bias for Q1 is generated by the 5V regulator Q3, R7 and their associated components. Q1's bias is temperature compensated by CR1 and CR2.

This stage amplifies the signal from the driver to a level high enough to drive the quad stage amplifier board that follows in the signal path.

3.5.3 (A3) Quad Stage Amplifier Pallet (1304607; Appendix B)

This board consists of four push-pull LDMOS transistors (Q1-Q4) operating in parallel to generate a total average power of 130W COFDM.

Each transistor stage is identical. The following description uses Q1 as an example and can be applied to the other three transistors. The bias is generated from the 5V regulator U3, which makes the idle current independent of any supply voltage variations. Two temperature sensing diodes CR1 and CR2 are used to temperature compensate the bias voltage. As Q1 heats up, the required bias voltage to maintain a constant idle voltage drops. As Q1 heats up, CR1 and CR2 heat up as well, causing the bias voltage to drop. R7 adjusts the bias voltage to the transistor. R38 is a current monitoring resistor used to measure Q1's Drain current while the module is being tested.

Each transistor stage is connected to the other transistors and splitters by quadrature hybrids. These hybrids provide isolation between the transistors. There is an Output coupler on the board's final RF output used for metering of the module's output power. This RF output sample leaves the board at J34. The reflected power metering sample is also generated on this board. The 20dB attenuator R32 provides a termination for an external circulator, and generates a sample used for reflected power metering by an external control board.

3.5.4 (A6) Amplifier Control Board 1304774; Appendix B)

The amplifier control board provides LED fault and enable indications on the front panel of the module and also performs the following functions: overdrive cutback, when the drive level reaches the amount needed to attain 110% output power; and overtemperature, VSWR, and overdrive faults. The board provides connections to the LCD Display in the control/power supply assembly for monitoring the % Reflected Power, % Output Power, and the power supply voltage.

If the Module OK LED, located on the front panel, is Red and blinking, a fault is present. The meaning of the blinking LED is as follows.

1 Blink: Indicates Amplifier Current Fault.
2 Blinks: Indicate Temperature Fault.
3 Blinks: Indicate +28V Power Supply Over Voltage Fault.
4 Blinks: Indicate +28V Power Supply Under Voltage Fault.
5 Blinks: Indicate Reflected Power Fault.
6 Blinks: Indicate +12V or –12V Power Supply Fault

3.5.4.1 Schematic Page 1

U4, located upper center of page, is an in circuit microcontroller. The controller is operated at the frequency of 3.6864 MHz using crystal Y1. Programming of this device is performed through the serial programming port J2. U4 selects the desired analog channel of U1 through the settings of PA0-PA2. The outputs of Port A must be set and not changed during an analog input read of channels PA5-PA7. PA3 of U4 is a processor operating LED that monitors the ±12 VDC. PA4 is not used in this configuration. PA5 is the selected channel of analog switch U1. PA6 is used to monitor the +5V digital supply to the board. PA7 is connected to an amp current fault.

U2 is a serial to RS-485 driver IC. U5 is a watchdog IC used to hold the microprocessor in reset, if the supply voltage is less than 4.21 VDC. U5 momentarily resets the microcontroller if Pin 6 ($\overline{ST}$) is not clocked every second. A manual reset switch is provided but should not be needed.

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U6 below and left of U3 is used to control four board mounted status LEDs, ENABLED, DC OK, TEMP and MOD OK all located on the front panel. A FET is turned On to shunt current away from the LED to turn it Off.

U8 below U6 is not used in this configuration.

3.5.4.2 Schematic Page 2

In the lower right corner are voltage regulator circuits. U17 should allow for 0.14 amps of power at +7 VDC using its 92 C/W rating if Ta = 60°C max and Tj = 125°C max 0.26 amps can be obtained from U17 if the mounting pad is 0.5 square inches. The controller will not need this much current. U18 and U19 are low drop out +5 VDC, voltage regulators with a tolerance greater than or equal to 1%. 100mA of current is available from each device but again the controller will not need this much current.

In the upper left section are circuits with U9 and U11. U11 is used to generate a regulated voltage that is about 5 volts less than the +32 VDC supply, approximately +26.25 VDC. When the +32 VDC supply is enabled, the circuitry around U9A is used to provide gate voltage to Q14 that is 5 volts greater than the source pin of this FET. The gate of Q14 can be turned Off by any one of a few different circuits. These circuits are wired through Q12 and Q13. These transistors are not present at this time, but may be installed to increase the shut-down time on a detected fault. Without Q12 and Q13 installed, Q14 is only turned off by the microcontroller through Q16.

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U12B is used to detect high power supply voltage. U13A is used to indicate that the power supply voltage is less than 26 VDC.

U25B on Page 3 is used to detect high reflected power. U13B determines if the power supply temperature gets too hot.

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A6 is an external temperature sensor thermistor, mounted on the amplifier module's heat sink, which is used to monitor the temperature of the heatsink. It connects to J6 pins 1 & 2 on the board and is wired to the comparator IC U13B. If the temperature in amplifier #1 increases above 75°C the output of U13B will go Low that is used as a temperature fault output, which generates a Temperature Fault alert that disables Amplifier #1.

3.5.4.4 Schematic Page 3, Forward and Reflected power detector sections of the board.

A Forward Power Sample enters the board at SMA Jack J3 and is split. One part connects to J4 on the board, the SMA Forward Power Sample Jack, located on the front panel of the assembly. The other part of the split forward power sample is detected by U26 and the DC level amplified by U22A and U22B. R201 is a front panel Average Calibration adjustment pot. The output of U22B at pin 7 is split with one part connected to the Average Power sample remote. The other split output connects through jumper W3 on J12 to U27B that is part of the Forward Average Power circuit. The output of U27B is detected by CR29 and the output Average Forward power level connects to U4 Pin 56, shown on page 1 of the schematic, on the board.

A Reflected Power Sample enters the board at SMA Jack J5 and is detected by CR31 and the DC level amplified by U21B. The output of U21B at pin 7 is connected through the Reflected Calibration adjustment pot R203 to U25A. The output is split with one part connected to U3 Pin 5, shown on page 1 of the schematic. The other part of the split from U25A connects to the comparator IC U25B that has a reference level connected to the other input. If the reflected level increases above the reference level a low output is produced and connected to the Reflected Power Shutdown circuit at CR14 and CR15, shown on page 2 of the schematic. The Reflected Power Fault V connects to Pin 29 of U4, shown on page 1 of the schematic. A Fault Alert, Low, connects to pin 25 of U4, shown on page 1 of the schematic.

3.6 Power Supply Assembly (1302863; Appendix B)

(**NOTE:** There are two of these assemblies in a LL400DATC)

The Power Supply Assembly contains (A1) a +28V/2000W switching power supply (1301504) and (A2) a ±12V/40W switching power supply (1303242). The +28VDC connects through J1 (+28VDC) and J2 (RTN) to the rest of the amplifier assembly. The ±12VDC outputs, the +28VDC control lines and the 220VAC connect to the assembly through Jack J3.

Each Power Supply Assembly supplies voltages to two of the power amplifier assemblies.

This completes the description of the Power Amplifier Chassis Assembly, the Power Amplifier Module Assembly and the Power Supply Assembly.

3.7 Bandpass and Low Pass Filters

NOTE: There are two identical output paths of the transmitter system. These filters are tuned at the factory for optimum performance and should not be adjusted.

Each of the bandpass filters, manufactured by Myat, is a 1.67 GHz 10 Section Bandpass Filter. The filters are tuned to a 5 MHz bandwidth around 1.6725 MHz.

The Bandpass Filter Assemblies are tuned to reject unwanted distortion products generated when the signals are diplexed and also during the amplification process. The RF Outputs of the coupler assemblies are connected to the Bandpass Filters and then to the low pass filter and coupler assemblies. Both sets of filters are tuned to reject unwanted distortion products generated when the signals are diplexed and also during the amplification process. The filtered RF Outputs at the “N” connector jacks of the low pass filter/coupler assemblies are cabled to the Antennas for your System.

This completes the description of the LL400ATC 1.67 GHz Transmitter.

Chapter 4
Transmitter Tuning Procedure

The following connections are made to the transmitter

Table 4-1: Interface Connections, Exciter/Driver Assembly

Port	Type	Function	Ohm
J12	IEC	AC Input	N/A
J1	SMA	RF Output A (from Upconverter)	50
J2	SMA	RF Output B (from Upconverter) – N/A	50
J3	SMA	Forward A Sample	50
J4	SMA	Reflected A Sample	50
J5	SMA	Forward B Sample – N/A	50
J6	SMA	Reflected B Sample – N/A	50
J7	BNC	RF Input A (to Power Amplifier A)	50
J8	N	RF Output A (from Power Amplifier A)	50
J10	BNC	10 MHz Reference Input	50
J11	BNC	10 MHz Reference Output	50
J17	BNC	RF Input B (to Power Amplifier B) – N/A	50
J18	BNC	RF Output B (from Power Amplifier B) – N/A	50
J21	BNC	IF Input A	75
J22	BNC	IF Input B – N/A	75
TB30	Termination	Remote Control & Monitoring	
J35	RJ-45	SCADA (Input / Loop-Thru)	CAT5
J36	RJ-45	SCADA (Input / Loop-Thru)	CAT5
J37	RJ-45	System RS-485 Serial	CAT5

Table 4-2: Interface Connections, External Power Amplifier Assembly

Port	Type	Function	Ohm
J220	Circular-3	AC Input #1	N/A
J221	Circular-3	AC Input #2	N/A
J201	N	Power Amplifier RF Input A	50
J203	7-16	Power Amplifier RF Output A – N/A	50
J205	7-16	System RF Output	50
J200	N	Power Amplifier RF Input B – N/A	50
J202	7-16	Power Amplifier RF Output B – N/A	50
J232	RJ-45	System RS-485 Serial Input	CAT5
J233	RJ-45	System RS-485 Serial Output	CAT5

4.1 Tuning Procedure

4.1.1 Setting up Manual Gain

Turn the Manual Gain Pot on the front panel of the Upconverter full CCW. Switch the Auto/Manual Gain Switch to the left (Manual)

Gradually turn the manual gain pot clockwise while monitoring the output power on a power meter connected to the output of the transmitter is 100%.

4.1.2 Power Calibration

Connect a Power meter to the output sample of the transmitter. Note the Insertion loss from the output to the sample port. Enter that offset into the Power meter's Offset Rel function, and set the reference frequency to 1670 MHz.

Navigate to the **Transmitter Setup** Menu on the System Controller and enter that menu. Scroll down until the **A Output Power Adjust** screen is reached. Use the Up/down Arrows to adjust power to desired output power.

Scroll down to the **A Output Power Cal** screen. Adjust Power Calibration until meter reads 100%.

4.1.3 Setting up AGC

Step 1: Navigate to the **Transmitter Setup** Menu on the System Controller and enter that menu. Scroll down until the **A Output Power Adjust** screen is reached. Use the Up/down Arrows to adjust power to 100%. (Power Calibration must have been done first)

Step 2: Scroll down further to **Inner Loop A Gain** menu is reached. Increase the Inner Loop Gain while watching the output power. Keep increasing until the output power begins to drop. Note the setting on Inner Loop gain, and reduce the setting by 10%. **Example:** The Inner Loop Gain setting where power begins to move is 210. Reduce the setting by 21 to 189.

NOTE: If adjusting the Inner Loop gain causes the power to rise immediately, then the AGC has been running on Inner Loop Gain, not Outer Loop Gain. Go back to step 1, reduce the power to 50%, then go to step 2 and reduce **the Inner Loop A Gain** until the power stops rising or you have reached 110%, whichever comes first. If you reach 110%, go to step 1 and reduce power to 50% again. Repeat as many times as you need to until the Inner Loop does not affect power. Once the power stops rising when Inner Loop Gain Continue to lower the Inner Loop gain further by 20%, then go back to step 1 a final time. Bring the power back up to 100% and go to step 2 one final time.

4.1.4 Overdrive

Go to the **Transmitter Setup Menu**, and scroll down to the **A Output Power Adjust** screen. Turn the Output power up to 10%. Then scroll down to the **A**

Overdrive screen and lower the Overdrive setting until power just starts to drop. Go back to the **A Output Power Adjust** screen and reduce the power to 100%.

4.1.5 Reflected Power Calibration

Connect a Power meter to the Reflected sample of the transmitter. Note the Insertion loss from the output to the sample port. Enter that offset into the Power meter's Offset Rel function, and set the reference frequency to 1670 MHz.
Navigate to the **Transmitter Setup** Menu on the System Controller and enter that menu. Scroll down until the **A Output Power Adjust** screen is reached. Use the Up/down Arrows to adjust power to 20% of the desired output power.

Swap the forward and reflected power cables on the transmitter's output coupler.

Scroll down to the **A Output Power Cal** screen. Adjust Power Calibration until meter reads 20%.

Return cables to their correct position. Go back to the **A Output Power Adjust** screen and return Output power to 100%.

4.1.6 Bandpass Filter Assembly

The Bandpass Filter Assembly is 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 Axcera Field Support Department before beginning the adjustment.

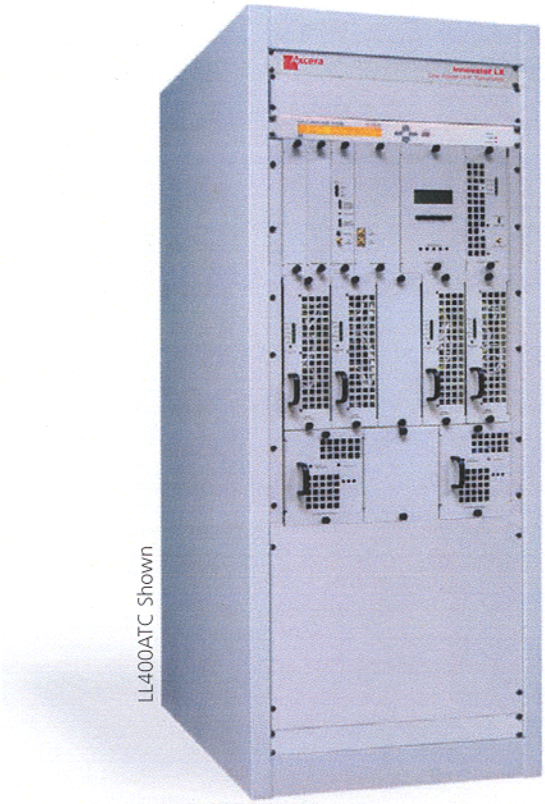
Linear and Non-linear Pre-correction set-up

Refer to the Pro-Television manual for this procedure.

APPENDIX A

INNOVATOR LX SERIES SPECIFICATIONS

Low Power 1.6 GHz DVB-H Transmitter 50W-400W



LL400ATC Shown

Designed to provide operators with a product that will meet their needs like no other solution on the market, this new low power transmitter line uses the latest LDMOS devices for operation at 1670 to 1675 MHz. All modules are factory phase and gain matched, easing service and support and allowing users to minimize spare parts stock.

The very compact and completely modular design uses a chassis/backplane configuration with higher power versions providing parallel amplifier and power supply modules which can be removed and replaced while the transmitter is on the air.

Configurations are available in power levels from 50 watts to 3 kilowatts DVB-H, and all are manufactured by Axcera - *The RF Experts*.

Axcera.

Low Power 1.6 GHz DVB-H Transmitter 50W-400W

Performance

Frequency Range[1]	1670 MHz to 1675 MHz
Standard	DVB-H
Modulation	QPSK, 16 QAM and 64 QAM
IFFT Length	2K, 4K, 8K
Protection Interval	1/4, 1/8, 1/16 & 1/32
Code Rate	1/2, 2/3, 3/4, 5/6, & 7/8
Output Impedance	50 Ω
Frequency Stability	1×10^{-6}
w/Precise Frequency Option	1×10^{-10}
Regulation of RF Output Power	3%
Shoulder Attenuation	-35 dB or better
Phase Noise	< -85 dBc/Hz @ 100 Hz
Inputs	Serial data inputs (ASI), 75Ω Parallel Data Input (SPI), High Priority, LVDS

Options

Dual Exciter with Automatic Switcher
AC Surge Protector
Spare Parts Kit
GPS-receiver
SFN Adapter
Hierarchical Modulation
Channel Filter

[1] Other Frequencies - Consult Factory
[2] Based on Standard Indoor Rack - Other Configurations, Consult Factory
[3] Above 8,500 feet - Consult Factory

General

Model Number	LL50ATC	LL100DATC	LL100ATC	LL200DATC	LL200ATC	LL300ATC	LL400DATC	LL400ATC
Power Output *(Average)*	50 W	50+50 W	100 W	100+100 W	200 W	300 W	200+200 W	400 W
Output Connector	7/8" EIA	Dual 7/8" EIA	7/8" EIA	Dual 7/8" EIA	7/8" EIA	7/8" EIA	Dual 7/8" EIA	7/8" EIA
Power Consumption	800 W	1575 W	1300 W	2575 W	2250 W	3200 W	4500 W	4250 W
Input Power								
Line Voltage	220 V +10%/-15% (all models)							
Power Requirements	Single Phase, 50 or 60 Hz (all models)							
Size *(H x W x D Centimeters/Inches)*[2]	140 x 56 x 86/ 55"x22"x34" (all models)							
Weight[2]	300 lbs 136 kg	410 lbs 186 kg	390 lbs 177 kg	430 lbs 195 kg	410 lbs 186 kg	430 lbs 195 kg	480 lbs 218 kg	450 lbs 204 kg
Operational Temperature Range	-5°C to +50°C, derate 2°C/1000 ft. (all models)							
Maximum Altitude[3]	8500 feet (2600m) AMSL (all models)							
Operational Humidity Range	0% to 98% non-condensing (all models)							
RF Load Impedance	50 Ω (all models)							

103 Freedom Drive, PO Box 525, Lawrence, PA 15055 t: 724-873-8100 f:724-873-8105 www.axcera.com

APPENDIX B

DRAWINGS AND PARTS LISTS

Innovator LX Series 1.67 GHz Digital Transmitter System