

## Chapter 1 Introduction

This manual explains the installation, setup, alignment, and maintenance procedures for the Innovator LX Series UHF analog modular driver/transmitter. It is important that you read all of the instructions, especially the safety information in this chapter, before you begin to install or operate the unit.

### 1.1 Manual Overview

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, maintenance, return procedures, and warranties. The second chapter describes the driver/transmitter and includes discussions on system control and status indicators and remote control connections. Chapter 3 explains how to unpack, install, setup, and operate the driver/transmitter. Chapter 4 contains circuit-level descriptions for boards and board-level components in the driver/transmitter. Chapter 5, Detailed Alignment Procedures, provides information on adjusting the system assemblies for optimal operation. The appendices contain assembly and subassembly drawings and parts lists, and system specifications.

### 1.2 Assembly Designators

Axcera has assigned assembly numbers, such as Ax (x=1,2,3...), to all assemblies, modules, and boards that are referenced in the text of this manual and shown on the block diagrams and interconnect drawings provided in the appendices. These supporting documents are arranged in increasing numerical order in the appendices. Section titles in the text for assembly or module descriptions or alignment procedures contain the associated part number(s) and the

relevant appendix that contains the drawings for that item.

### 1.3 Safety

The UHF drivers and transmitters manufactured by Axcera are designed to be easy to use and repair while providing protection from electrical and mechanical hazards. Listed throughout the manual are notes, cautions, and warnings concerning possible safety hazards that may be encountered while operating or servicing the driver/transmitter. Please review these warnings and familiarize yourself with the operation and servicing procedures before working on the driver/transmitter.

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

**Retain Manuals** – The manuals for the driver/transmitter should be retained at the transmitter site for future reference. We provide 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 Instructions** – All of the operating and use instructions for the driver/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 cabinets 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 Maintenance

The Innovator LX Series Driver/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 top covers should be taken off and any accumulated foreign material should be removed. 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.

#### 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#).

An 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 exchange 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.

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, or bulbs.

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 ▶**

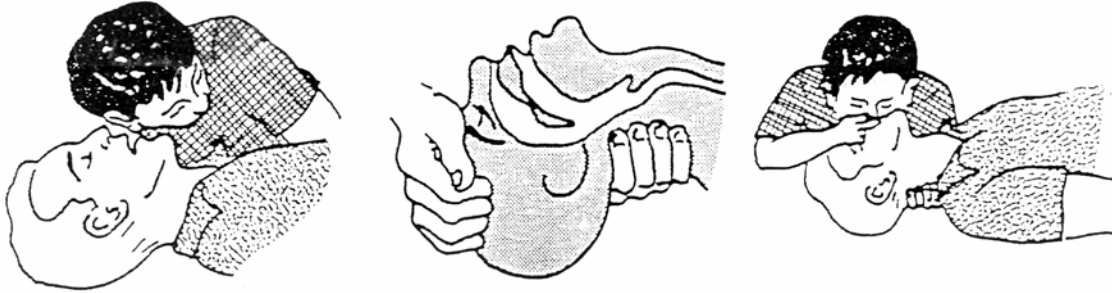
**DO NOT ATTEMPT TO REPAIR OR TROUBLESHOOT THIS EQUIPMENT UNLESS YOU ARE FAMILIAR WITH ITS OPERATION AND EXPERIENCED IN SERVICING HIGH VOLTAGE EQUIPMENT. LETHAL VOLTAGES ARE PRESENT WHEN POWER IS APPLIED TO THIS SYSTEM. IF POSSIBLE, TURN OFF POWER BEFORE MAKING ADJUSTMENTS TO THE SYSTEM.**

**★ RADIO FREQUENCY RADIATION HAZARD ★**

**MICROWAVE, RF AMPLIFIERS AND TUBES 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 RF AND MICROWAVE AMPLIFIERS. 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 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.

**Note: Because of possible FCC assigned offset, check for the assigned Carrier Frequency as written on License.**

UHF Channels NTSC Standard IF, 45.75 MHz							
Visual Carrier Frequency (MHz)				L.O. (MHz)	Crystal Frequency (MHz)		
Channel	Nominal	Minus	Plus	Nominal	Nominal	Minus	Plus
14	471.25	471.24	471.26	517.00	64.625	64.62375	64.62625
15	477.25	477.24	477.26	523.00	65.375	65.37375	65.37625
16	483.25	483.24	483.26	529.00	66.125	66.12375	66.12625
17	489.25	489.24	489.26	535.00	66.875	66.87375	66.87625
18	495.25	495.24	495.26	541.00	67.625	67.62375	67.62625
19	501.25	501.24	501.26	547.00	68.375	68.37375	68.37625
20	507.25	507.24	507.26	553.00	69.125	69.12375	69.12625
21	513.25	513.24	513.26	559.00	69.875	69.87375	69.87625
22	519.25	519.24	519.26	565.00	70.625	70.62375	70.62625
23	525.25	525.24	525.26	571.00	71.375	71.37375	71.37625
24	531.25	531.24	531.26	577.00	72.125	72.12375	72.12625
25	537.25	537.24	537.26	583.00	72.875	72.87375	72.87625
26	543.25	543.24	543.26	589.00	73.625	73.62375	73.62625
27	549.25	549.24	549.26	595.00	74.375	74.37375	74.37625
28	555.25	555.24	555.26	601.00	75.125	75.12375	75.12625
29	561.25	561.24	561.26	607.00	75.875	75.87375	75.87625
30	567.25	567.24	567.26	613.00	76.625	76.62375	76.62625
31	573.25	573.24	573.26	619.00	77.375	77.37375	77.37625
32	579.25	579.24	579.26	625.00	78.125	78.12375	78.12625
33	585.25	585.24	585.26	631.00	78.875	78.87375	78.87625
34	591.25	591.24	591.26	637.00	79.625	79.62375	79.62625
35	597.25	597.24	597.26	643.00	80.375	80.37375	80.37625
36	603.25	603.24	603.26	649.00	81.125	81.12375	81.12625
37	609.25	609.24	609.26	655.00	81.875	81.87375	81.87625
38	615.25	615.24	615.26	661.00	82.625	82.62375	82.62625
39	621.25	621.24	621.26	667.00	83.375	83.37375	83.37625
40	627.25	627.24	627.26	673.00	84.125	84.12375	84.12625
41	633.25	633.24	633.26	679.00	84.875	84.87375	84.87625
42	639.25	639.24	639.26	685.00	85.625	85.62375	85.62625
43	645.25	645.24	645.26	691.00	86.375	86.37375	86.37625

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<b>UHF Channels NTSC Standard IF, 45.75 MHz</b>							
<b>Visual Carrier Frequency (MHz)</b>				<b>L.O. (MHz)</b>	<b>Crystal Frequency (MHz)</b>		
Channel	Nominal	Minus	Plus		Nominal	Minus	Plus
44	651.25	651.24	651.26	697.00	87.125	87.12375	87.12625
45	657.25	657.24	657.26	703.00	87.875	87.87375	87.87625
46	663.25	663.24	663.26	709.00	88.625	88.62375	88.62625
47	669.25	669.24	669.26	715.00	89.375	89.37375	89.37625
48	675.25	675.24	675.26	721.00	90.125	90.12375	90.12625
49	681.25	681.24	681.26	727.00	90.875	90.87375	90.87625
50	687.25	687.24	687.26	733.00	91.625	91.62375	91.62625
51	693.25	693.24	693.26	739.00	92.375	92.37375	92.37625
52	699.25	699.24	699.26	745.00	93.125	93.12375	93.12625
53	705.25	705.24	705.26	751.00	93.875	93.87375	93.87625
54	711.25	711.24	711.26	757.00	94.625	94.62375	94.62625
55	717.25	717.24	717.26	763.00	95.375	95.37375	95.37625
56	723.25	723.24	723.26	769.00	96.125	96.12375	96.12625
57	729.25	729.24	729.26	775.00	96.875	96.87375	96.87625
58	735.25	735.24	735.26	781.00	97.625	97.62375	97.62625
59	741.25	741.24	741.26	787.00	98.375	98.37375	98.37625
60	747.25	747.24	747.26	793.00	99.125	99.12375	99.12625
61	753.25	753.24	753.26	799.00	99.875	99.87375	99.87625
62	759.25	759.24	759.26	805.00	100.625	100.62375	100.62625
63	765.25	765.24	765.26	811.00	101.375	101.37375	101.37625
64	771.25	771.24	771.26	817.00	102.125	102.12375	102.12625
65	777.25	777.24	777.26	823.00	102.875	102.87375	102.87625
66	783.25	783.24	783.26	829.00	103.625	103.62375	103.62625
67	789.25	789.24	789.26	835.00	104.375	104.37375	104.37625
68	795.25	795.24	795.26	841.00	105.125	105.12375	105.12625
69	801.25	801.24	801.26	847.00	105.875	105.87375	105.87625
70	807.25	807.24	807.26	853.00	106.625	106.62375	106.62625

**Note:** Because of possible FCC assigned offset, check for the assigned Carrier Frequency as written on License.

<b>UHF Frequency Assignments</b>				
<b>Channel Number</b>	<b>Bandwidth (MHz)</b>	<b>Video (MHz)</b>	<b>Color (MHz)</b>	<b>Audio (MHz)</b>
14	470-476	471.25	474.83	475.75
15	476-482	477.25	480.83	481.75
16	482-488	483.25	486.83	487.75
17	488-494	489.25	492.83	493.75
18	494-500	495.25	498.83	499.75
19	500-506	501.25	504.83	505.75
20	506-512	507.25	510.83	511.75
21	512-518	513.25	516.83	517.75
22	518-524	519.25	522.83	523.75
23	524-530	525.25	528.83	529.75
24	530-536	531.25	534.83	535.75
25	536-542	537.25	540.83	541.75
26	542-548	543.25	546.83	547.75
27	548-554	549.25	552.83	553.75
28	554-560	555.25	558.83	559.75
29	560-566	561.25	564.83	565.75
30	566-572	567.25	570.83	571.75
31	572-578	573.25	576.83	577.75
32	578-584	579.25	582.83	583.75
33	584-590	585.25	588.83	589.75
34	590-596	591.25	594.83	595.75
35	596-602	597.25	600.83	601.75
36	602-608	603.25	606.83	607.75
37	608-614	609.25	612.83	613.75
38	614-620	615.25	618.83	619.75
39	620-626	621.25	624.83	625.75
40	626-632	627.25	630.83	631.75
41	632-638	633.25	636.83	637.75
42	638-644	639.25	642.83	643.75
43	644-650	645.25	648.83	649.75



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<b>UHF Frequency Assignments</b>				
<b>Channel Number</b>	<b>Bandwidth (MHz)</b>	<b>Video (MHz)</b>	<b>Color (MHz)</b>	<b>Audio (MHz)</b>
44	650-656	651.25	654.83	655.75
45	656-662	657.25	660.83	661.75
46	662-668	663.25	666.83	667.75
47	668-674	669.25	672.83	673.75
48	674-680	675.25	678.83	679.75
49	680-686	681.25	684.83	685.75
50	686-692	687.25	690.83	691.75
51	692-698	693.25	696.83	697.75
52	698-704	699.25	702.83	703.75
53	704-710	705.25	708.83	709.75
54	710-716	711.25	714.83	715.75
55	716-722	717.25	720.83	721.75
56	722-728	723.25	726.83	727.75
57	728-734	729.25	732.83	733.75
58	734-740	735.25	738.83	739.75
59	740-746	741.25	744.83	745.75
60	746-752	747.25	750.83	751.75
61	752-758	753.25	756.83	757.75
62	758-764	759.25	762.83	763.75
63	764-770	765.25	768.83	769.75
64	770-776	771.25	774.83	775.75
65	776-782	777.25	780.83	781.75
66	782-788	783.25	786.83	787.75
67	788-794	789.25	792.83	793.75
68	794-800	795.25	798.83	799.75
69	800-806	801.25	804.83	805.75
70	806-812	807.25	810.83	811.75

## dBm, dBw, dBmV, dB $\mu$ V, & VOLTAGE EXPRESSED IN WATTS

### 50 Ohm System

WATTS	PREFIX	dBm	dBw	dBm V	dB $\mu$ V	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	1 HECTROWATT	+ 50	+ 20			
50		+ 47	+ 17			
20		+ 43	+ 13			
10	1 DECAWATT	+ 40	+ 10			
1	1 WATT	+ 30	0	+ 77	+137	7.07V
0.1	1 DECIWATT	+ 20	- 10	+ 67	+127	2.24V
0.01	1 CENTIWATT	+ 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

$$^{\circ}\text{F} = 32 + [(9/5) ^{\circ}\text{C}]$$

$$^{\circ}\text{C} = [(5/9) (^{\circ}\text{F} - 32)]$$

## **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)	liter	3.7854118
U.S. liquid (One U.S. gallon equals 0.8327 Canadian gallon)		
fluid ounce (fl oz)	milliliters (ml)	29.57353
British Thermal Unit	watt (W)	0.2930711
		per hour (Btu/hr)
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	1000 - 2000 MHz
S	2000 - 4000 MHz
C	4000 - 8000 MHz
X	8000 - 12000 MHz
Ku	12 - 18 GHz
K	18 - 27 GHz
Ka	27 - 40 GHz
V	40 - 75 GHz
W	75 - 110 GHz

**ABBREVIATIONS/ACRONYMS**

<b>AC</b>	Alternating Current	<b>PCB</b>	Printed circuit board
<b>AFC</b>	Automatic Frequency Control	<b>QAM</b>	Quadrature Amplitude Modulation
<b>ALC</b>	Automatic Level Control		
<b>AM</b>	Amplitude modulation		
<b>AGC</b>	Automatic Gain Control		
<b>AWG</b>	American wire gauge		
<b>BER</b>	Bit Error Rate		
<b>BW</b>	Bandwidth		
<b>DC</b>	Direct Current		
<b>D/A</b>	Digital to analog		
<b>dB</b>	Decibel		
<b>dBm</b>	Decibel referenced to 1 milliwatt		
<b>dBmV</b>	Decibel referenced to 1 millivolt		
<b>dBw</b>	Decibel referenced to 1 watt		
<b>FEC</b>	Forward Error Correction		
<b>FM</b>	Frequency modulation		
<b>Hz</b>	Hertz		
<b>ICPM</b>	Incidental Carrier Phase Modulation		
<b>I/P</b>	Input		
<b>IF</b>	Intermediate Frequency		
<b>LED</b>	Light emitting diode		
<b>LSB</b>	Lower Sideband		
<b>MPEG</b>	Motion Pictures Expert Group		
<b>O/P</b>	Output		
<b>PLL</b>	Phase Locked Loop		

## RETURN LOSS VS. VSWR

