

# 411LA

## Broadband Power Amplifier



HIGH RF VOLTAGES MAY BE PRESENT AT THE OUTPUT OF THIS UNIT. All operating personnel should use extreme caution in handling these voltages and be thoroughly familiar with this manual.

Do not attempt to operate this unit prior to reading this manual.

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## Warranty

Electronics & Innovation Ltd., (hereafter E&I) warrants for the period of three years from the date of original delivery, each unit to be free of defects in materials and workmanship. For the period of 36 months E&I will, at its option, repair or replace defective parts so as to render the unit fully operational such that it performs according to the original specifications; free of charge to the original purchaser.

Should warranty service be required, the unit must be returned to E&I, freight cost to be borne by the owner. If, in our opinion, the unit has been damaged by use outside the limits prescribed in this manual or by accident, then the warranty shall not be honored. In such a case E&I will provide an estimate for repair, assuming repair is possible and provide a quote at standard service rates.

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## Chapter 1 Introduction

### 1.1 Introduction

The E&I Model 411LA is an all solid state amplifier which has a flat frequency response from 150 kHz to 300 MHz. It provides up to 10W of linear power with low harmonic and intermodulation distortion. Gain is 40 dB nominal, with variation of less than +/-2.5 dB over the entire frequency range. Input and output impedances are 50Ω and the unit may

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be driven to full power output by most RF synthesizers, signal generators and swept signal sources.

The E&I Model 411LA will provide its rated forward power output into any load impedance, regardless of match. It will absorb the power reflected from a mismatched load without causing failure or oscillation.

The Model 411LA is packaged for bench mounting and can be supplied with rack mounting adapters. It has an integral power supply which operates from 100 – 240 VAC 47 - 63 Hz main supply.

The Model 411LA will raise the power level of signal sources and generators without requiring tuning or band-switching. The Class A linear circuitry will amplify signals of AM, FM, SSB, TV and complex modulations, limited only by their peak input and bandwidth, with minimum distortion.

## **1.2 Specifications**

Physical and electrical specifications are listed in Figure 1.

## **1.3 Instrument Identification**

Each amplifier is identified by a serial number tag on the back panel of the unit. Both the model number and the serial number should be given in any correspondence with the company.

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# **Chapter 2 Operation**

## **2.1 Introduction**

The E&I 411LA RF amplifier is used to increase the RF output level of signal sources in the 0.15 to 300 MHz range. No tuning or any other form of adjustment is required.

## **2.2 Mains Voltage Setting**

The unit automatically adjusts to accommodate the available AC line voltage.

## **2.3 Mains Fuse Rating**

The Mains Fuse FI is located on the rear panel. The replacement part number is F981-ND

## **2.4 Rack Installation**

In order to install the Model 411LA in a standard 19 inch relay rack, the mounting brackets must be attached to the cover as follows:

a. Remove the four feet on the underside of the amplifier if the minimum vertical usage of the relay rack is necessary.

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- b. Remove the two M4-10 screws located on each side of the cover nearest the front panel.
- c. Attach the rack mounting brackets to the sides of the unit using the screws removed in step (b).

## **2.5 Mains Lead Connection**

The unit comes supplied with a 6 foot mains cord.

## **2.6 Cooling**

When the 411LA is enclosed by an external cabinet, provisions must be made to ensure an adequate flow of cooling air to the unit. Ambient temperature of the air must not exceed 40° C.

### **2.7 Proceed as follows:**

- (i) Ensure that there is at least 3" / 7.5 cm clearance at the rear of unit for air flow.
- (ii) Ensure RF input voltage is not excessive
  - a. The 1 V rms indicated maximum input voltage is 5 times the level of the input signal required to achieve maximum output. Input voltages in excess of 2 volts peak may permanently damage the instrument.
- (iii) Connect the output via a 50 ohm coaxial lead and BNC plug to the load.
- (iv) Connect the input signal via a 50 ohm coaxial lead and BNC plug to the input connector.

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## **Chapter 3 Technical Description**

### **3.1 GENERAL DESCRIPTION**

The E&I Model 411LA is a linear Class A amplifier capable of increasing the output of any signal generator, frequency synthesizer, sweep generator or laboratory signal source from 150 kHz to 300 MHz. The Model 411LA is completely protected against damage due to load mismatch provided that the input RF level does not exceed 1 VRMS or 1.4V peak. If the attached signal source is capable of generating substantially more than this input voltage, please use caution in adjusting it. The Model 411LA will saturate well before the maximum input voltage and there will be no increase in output power at that point. The 411LA is unconditionally stable. Any impedance can be connected to the input and output of the amplifier, without causing oscillation. The 411LA will deliver its rated power to any load impedance regardless of match. Load mismatch will cause RF power to reflect back to the amplifier. The unit is designed to withstand 100% reflected power (a pure

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reactance open or short circuit load will cause 100% reflected power) continuously without damage.

### 3.2 Control, Indicators and Connectors

The power switch is located on the front panel.

The BNC connectors are marked with the universal symbol for input and output.

**See Figure 2 for Front and Rear panel**

### 3.3 Operating Procedure

Refer to the following procedure as a guide to operating the Model 411LA.

- a. The input and output are connected via the front panel BNC connectors to the signal source and load respectively.
- b. The input signal should be increased gradually while observing the output voltage on the output RF voltmeter.

### 3.4 Precautions

- a. The input and output of the Model 411LA should not be connected together. This will cause oscillation and may damage the input preamplifier.
- b. When the input signal voltage of the signal source is unknown, insert an attenuator between it and the Model 411LA input.

### 3.5 Performance Checks

To determine the amplifier's performance carry out the following procedure.

#### 3.5.1 Initial Check

The following check can be made whenever the condition of the unit is in question.

- (i) Connect power supply. Switch on power and observe that the switch illuminates.
- (ii) Connect the output of the 411LA amplifier to 20 dB attenuator.
- (iii) Connect a calorimetric power meter (HP434 or equivalent) to the output of the attenuator.
- (iv) Connect a sweep generator (Wavetek 2001 or similar) capable of sweeping the frequency range 1 to 300MHz to the input connector, *ensure that the output power of the generator is initially set to minimum.*
- (v) Adjust the output level of the sweep generator to -10dBm.

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(vi) Adjust the input CW signal to any frequency between 1 and 300MHz for 10W output.

If you can not attain RF power, verify that:

- (a) The mains fuse is correctly selected and not blown
- (b) The switch is illuminated.

If the mains fuse is not blown but you are still unable to get any RF power, either return the unit to E&I for repair or proceed to chapter 4.

### 3.2 Measurement of Gain

Equipment required:

- (a) Two power meters; HP 434 or equivalent
- (b) Sweep/Signal Generator
- (c) 20 dB Coupler
- (d) Attenuator, 20 dB

Connect the equipment as shown in Figure 2, then proceed as follows:

- (a) Increase power from the signal generator to attain an output power measurement of 3 watts as indicated on the output power meter.
- (b) Measure input power and calculate gain. Gain should be a nominal 40 dB
- (c) Vary the frequency of the sweep generator across the band from 150 KHz to 300 MHz. Note that the variation of gain is within +/- 2.5 dB

### 3.3 Measurement of Harmonics

Equipment required:

- (a) Sweep/Signal generator
- (b) Attenuator, 20 dB
- (c) Power Meter - HP434A
- (d) Spectrum Analyzer

Connect the equipment as shown in Figure 3 then proceed as follows:

- (d) Adjust the sweep/Signal generator at a CW center frequency of 300 MHz for an indicated output of 10W on the power meter.

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- (e) Using the spectrum analyzer, check that the level of harmonics are less than -25 dB with respect to the carrier.
- (f) Vary the frequency of the generator from 150 KHz to 300 MHz, the harmonics should remain at -22dBc or below.

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## **Chapter 4 Maintenance**

### **4.1 Introduction**

The E&I 411LA RF amplifier requires no periodic maintenance. The instrument is unconditionally stable and is fail safe under all load conditions. Damages can only be externally caused by an input signal in excess of the specified IV RMS maximum.

This chapter therefore, deals only with certain fundamental procedures for fault location and with the subsequent re-alignment procedures.

Performance limits quoted are for guidance only and should not be taken for guaranteed performance specifications unless they are also quoted in Figure 1.

### **4.2 Packing for Reshipment**

In the event of the equipment being returned for servicing it should be packaged in the original shipping carton and packing material. If this is not available wrap the instrument in heavy paper or plastic and place in a rigid outer box of wood, fiberboard or very strong corrugated cardboard. Use ample soft packing to prevent movement. Provide additional support for projecting parts to relieve these of unnecessary shock. Close the carton securely and seal with durable tape. Mark the shipping container FRAGILE to ensure careful handling.

### **4.3 Access and Layout**

#### ***NB: Removal of the cover voids the warranty!***

The E&I Model 411LA amplifier is housed in an aluminum chassis. A block diagram schematic is illustrated in figure 4. The cover can be removed by releasing the 6 M3 screws on the side of the unit.

The rear panel supports the mains fuse holder, AC line cord and the cooling fan.

### **4.4 Power supply**

The power supply is mounted vertically on the right hand side of the amplifier. It is a wholly self contained unit controlled by the control board.

### **4.5 The Amplifier Module**

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The power amplifier module is mounted on the RF heat sink. To remove this module, the RF heat sink must be demounted from the chassis. The RF drive unit sits underneath the PA section

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## **Chapter 5 Safety:**

Do not attempt to operate this unit with the cover removed. High AC, RF and DC voltages are present. The cover prevents against electrical shock due to AC line voltages, high DC and RF fields. Further the cover provides part of the cooling system design. Components, specifically on the RF boards are prone to over-heat and eventual failure if the unit is operated without the cover in place.

Ensure that the load is connected to the output prior to connecting the RF input to the unit. This will prevent high voltages being present and exposed at the output connector.

Only use the AC cord provided or equivalent.

Ensure that the mains outlet is properly grounded.

## **Appendix:**

### Figures

Figure 1	411LA Specifications
Figure 2	Front and Rear View
Figure 3	Gain Test Set-Up
Figure 4	Harmonic Test Set-Up
Figure 5	Block Diagram



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**Figure 1:****411LA Specification:**

Frequency Coverage:	150 kHz to 300 MHz
Gain:	40 dB
Gain Variation:	±2.5 dB
Maximum Class A Linear Output:	10W
Harmonic Distortion:	All harmonics more than 22 dB below main signal at 10W output; lower at reduced power output.
Drive Source Requirements	Any signal generator, function generator, or oscillator capable of 1 mW of output into 50 Ω
Input/Output Impedance: Input VSWR: Output VSWR:	50Ω 1.5:1 Maximum 2:1 Maximum
Power Requirements:	115VAC ±10%, 50-60Hz, 3.5A; 230VAC ±10%, 50-60Hz, 1.7A
Noise Figure:	10 dB Maximum
Typical 3rd Order Intercept Point:	+50dBm
Stability:	Continuous operation into any load or source impedance.
Protection:	Unit will withstand a +13dBm input signal (IV RMS) for all output load conditions, including short and open circuit loads.
Front Panel Controls:	AC Power On/Off
Front Panel Connections:	RF Input RF Output
Operating Temperature:	0° to 45° C
Cooling System	Forced air
Size:	7.5" H x 9.5" W x 12.5" D 19.05 x 23.13 x 31.75 cm.
Weight:	25 lbs; 11.3kg.
Input Connector:	Type BNC
Output Connector:	Type BNC
Rack Mounting:	19 inch adaptors optional

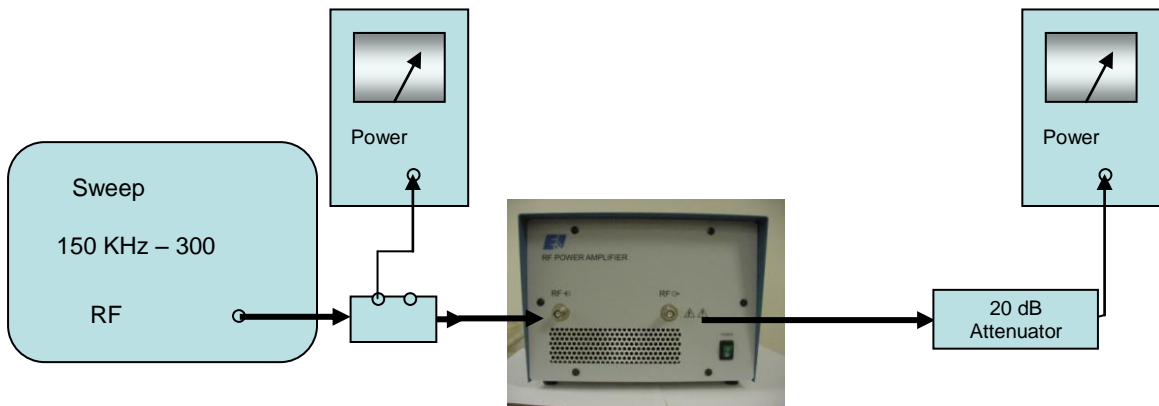
**Figure 2**

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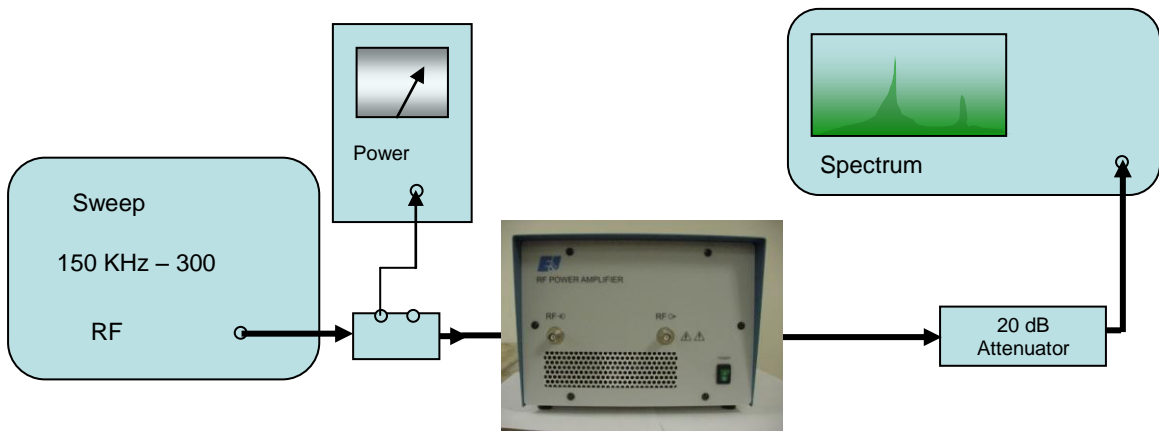


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**Figure 5**

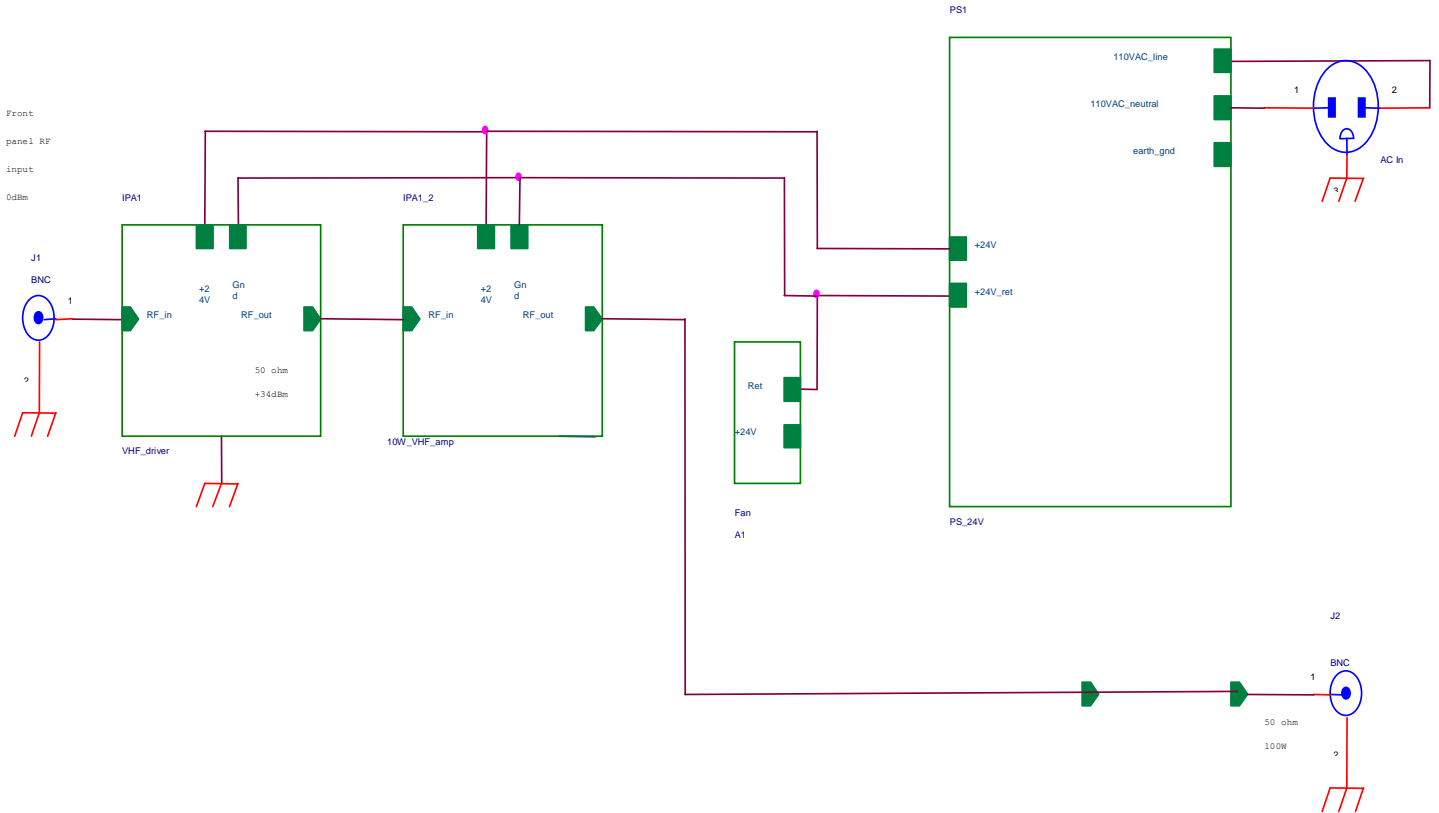


**Figure 4**



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**Figure 5**



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