

E&I 550L

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 one year from the date of original delivery, each unit to be free of defects in materials and workmanship. For the period of 12 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

The 550L is a broadband solid state amplifier covering the frequency spectrum from 1.5 to 400 MHz. It is rated at 50 watts of RF power with low harmonic and intermodulation distortion. Over 60 watts of saturated power can be produced with increased distortion products. A highly linear Class A design, the 550L will amplify inputs of AM, FM, SSB, pulse and any complex modulation signals. The amplifier has 50 dB gain, it is unconditionally stable and will not oscillate even with combinations of mismatched source and load impedance. It is protected against failure due to output load mismatch and/or overdrive.

1.2 INSTRUMENTATION 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 quoted to identify specific unit.

1.3 SPECIFICATIONS

Physical and electrical specifications are listed in Table 1-1 below

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Table 1-1. SPECIFICATIONS

FREQUENCY COVERAGE:	1.5 to 400 MHz
GAIN:	50 dB min, ± 2.5 variation.
CLASS A LINEAR OUTPUT:	Nominal 50 watts.
HARMONIC DISTORTION:	> -25 dBc at 40 watts output.
SATURATED RF POWER OUTPUT:	150W Min. from 1.5- 50 MHz; 60W Min. from 50 – 300 MHz;
INPUT IMPEDANCE	50 ohms, VSWR, 1.5:1 Maximum.
OUTPUT IMPEDANCE:	50 ohms, VSWR, 2.5:1 Maximum
STABILITY:	Continuous operation into any load or source impedance.
PROTECTION:	Unit will withstand a + 13dBm input signal (1.0 Volts RMS) for all output load conditions, without damage.
POWER REQUIREMENTS:	100 – 240 VAC 47-63 Hz.
SIZE:	8 3/4 X 17 X 19.8inches 22.2 X 43.2 x 202.7 cm.
WEIGHT:	40 pounds 18.2 kg
CONNECTORS:	N
OPERATING TEMPERATURE:	0 – 40 C
RACK MOUNTING:	

Chapter 2 Operation

2.1 INTRODUCTION

The 550L RF amplifier is used to amplify the RF level of signal sources in the 1.5 to 400 MHz range. No tuning or any other form of adjustment is required.

The 550L produces power output at its output connector, regardless of load impedance. Any power reflected due to output load mismatch is absorbed in the amplifier. Therefore, although the output impedance is 50 ohms (maximum VSWR: 2.5:1), the amplifier will work into any load impedance at reduced power.

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2.2 RACK INSTALLATION

This unit is 5U high, 17" width. With the handles removed it will fit into a standard rack.

2.2.1 Mains Voltage

The unit accommodates AC line voltages from 100 TO 240 VAC 47 – 63 Hz

2.3 OPERATION

A line cord is supplied to form a connection between the mains supply and the rear of the unit. Plug this into the AC input at the rear of the unit and the AC mains outlet.

2.3.1 Proceed as follows:

- (i) Ensure that there is at least 3" or 7.5 cm clearance at the rear of the 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 N plug to the load.
- (iv) Connect the input signal via a 50 ohm coaxial lead and N plug to the input connector.

Chapter 3 Technical Description

3.1 GENERAL DESCRIPTION

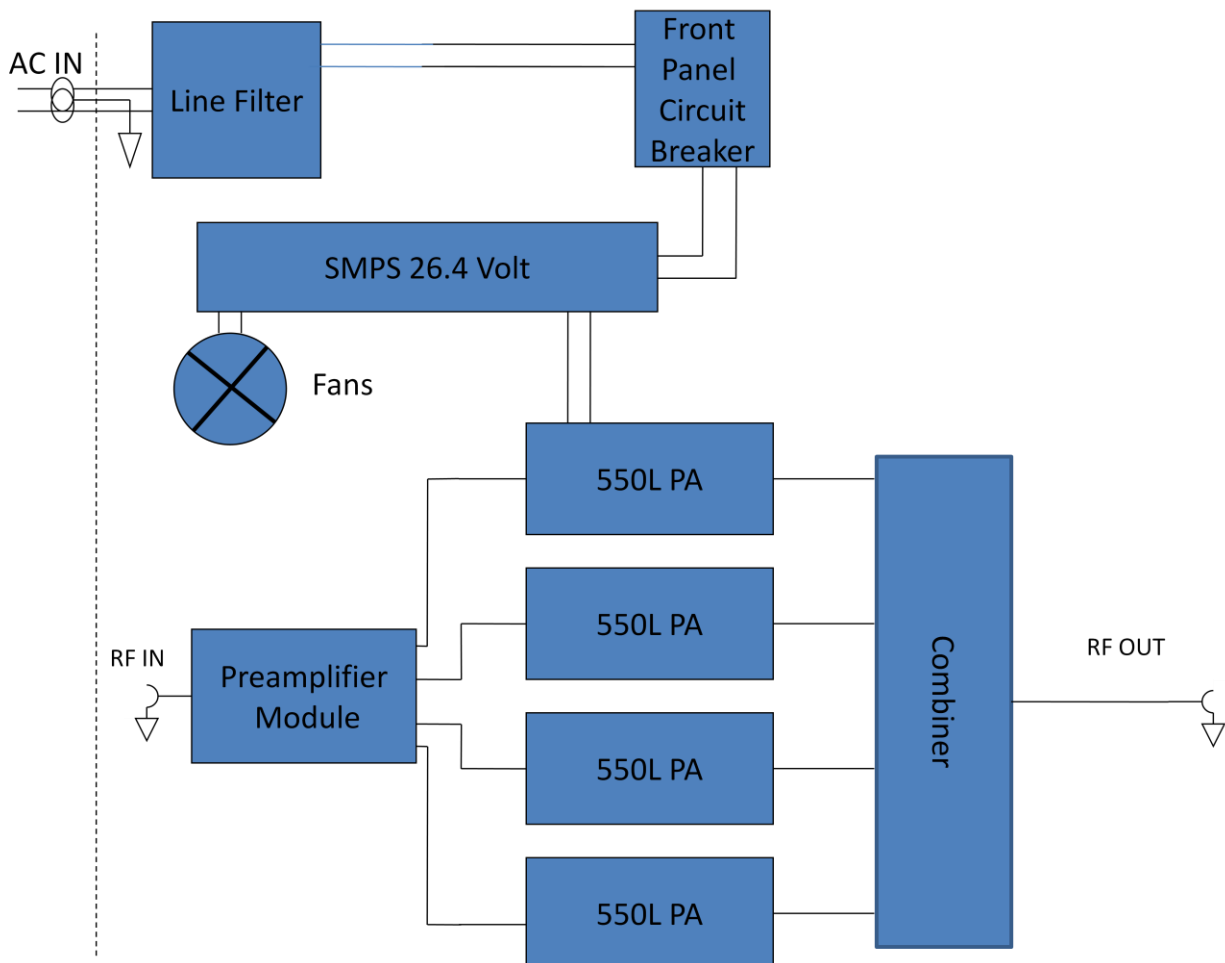
The 550L is designed to amplify signals by 50 dB in the frequency band of 1.5 to 400 MHz. The signal from the front panel N connector is fed via a length of 50 ohm coaxial cable into the input of the preamplifier amplifier module. The signal from the input of the preamplifier is fed to a pi network attenuator. The output of the attenuator is fed to the base of transistor Q1. The gain flatness of this low noise stage is adjusted by variable capacitor C4. The output of Q1 is fed via capacitor C5 to the input of Q2, which is adjusted for gain flatness by capacitor C8. Q3 and Q4 provide the additional gain. The output of Q4 is coupled to the base of Q5 via T1. The power output of the driver

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transistor is split four ways and fed to four coaxial connectors mounted at the side of the preamplifier module.

The four outputs of the splitter are each fed via 50 ohm cables to the input of the 550L power amplifier modules. The input signal to each power amplifier module is attenuated and matched with transformer T1. Capacitors match the reactive impedance of Q1 the output of which is split into four components and fed to the base of Q2, Q3, Q4 and Q5 respectively. These signals are matched to the impedance of the devices. Negative feedback is provided and then the outputs are matched and combined through hybrid transformers to provide a single output. The output of each power amplifier module is fed via a 50 ohm cable to the output combiner module. The output of the combiner module is fed directly to the N connector on the front panel.

There is a switch mode power supply units that provide the 26.4 VDC ampere source.



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Chapter 4 Maintenance

4.1 INTRODUCTION

The E&I 550L RF amplifier requires no periodic maintenance. The instrument is unconditionally stable and is fail-safe under all load conditions. Damage can only be externally caused by the incorrect selection of the AC supply voltage or by an input signal in excess of the specified 1 volt rms equivalent to a power level of 13dBm.

This chapter therefore, deals only with certain fundamental procedures for fault location.

Performance limits quoted are for guidance only and should not be taken for guaranteed performance specifications unless they are also quoted in the Specification Section 1.2.

4.2 PERFORMANCE CHECKS

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

4.2.1 Initial Check

The following check can be made after repair and adjustments or whenever the condition of the unit is in question.

- a. Connect AC power supply. Switch on power and observe that the display initializes.
- b. Connect a sweep generator (Wavetek 2001 or similar) capable of sweeping the frequency range 1.5 to 400 MHz, to the input connector.
- c. Adjust the output level of the sweep generator so that a 50 ohm video detector connected at the output of the unit will not be damaged by excessive power output. (Reference section 4.4.1 for set up.)
- d. Observe the gain versus frequency ripple on an oscilloscope calibrated in decibels. The gain variation must be not more than +/- 2.5 dB over the frequency range.
- e. Connect a calorimetric power meter (HP435B or equivalent) through a 20 dB 100 watt attenuator to the output connector. Adjust the input CW signal to any frequency between 1.5 MHz and 400 MHz for 40 watts output.
- f. Observe the harmonic distortion of the output, properly attenuated, on a spectrum analyzer. The harmonic components contributed by the amplifier

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should be better than 25 dB down from the fundamental.

- (a) If the above items are found to be outside of the specification, check the spectral content of the input signal. If this is a pure signal then the unit needs to be returned to the factory for service.

4.3.1 Measurement of Gain

1. Equipment Required (or equivalent):

- a) Oscilloscope - Tektronix T921
- b) Sweep/Generator - Wavetek 2001
- c) Signal Generator - Exact Model 7060
- d) 50 ohm Detector - Wavetek D151
- e) Attenuator, 20 dB, 100 Watts Bird

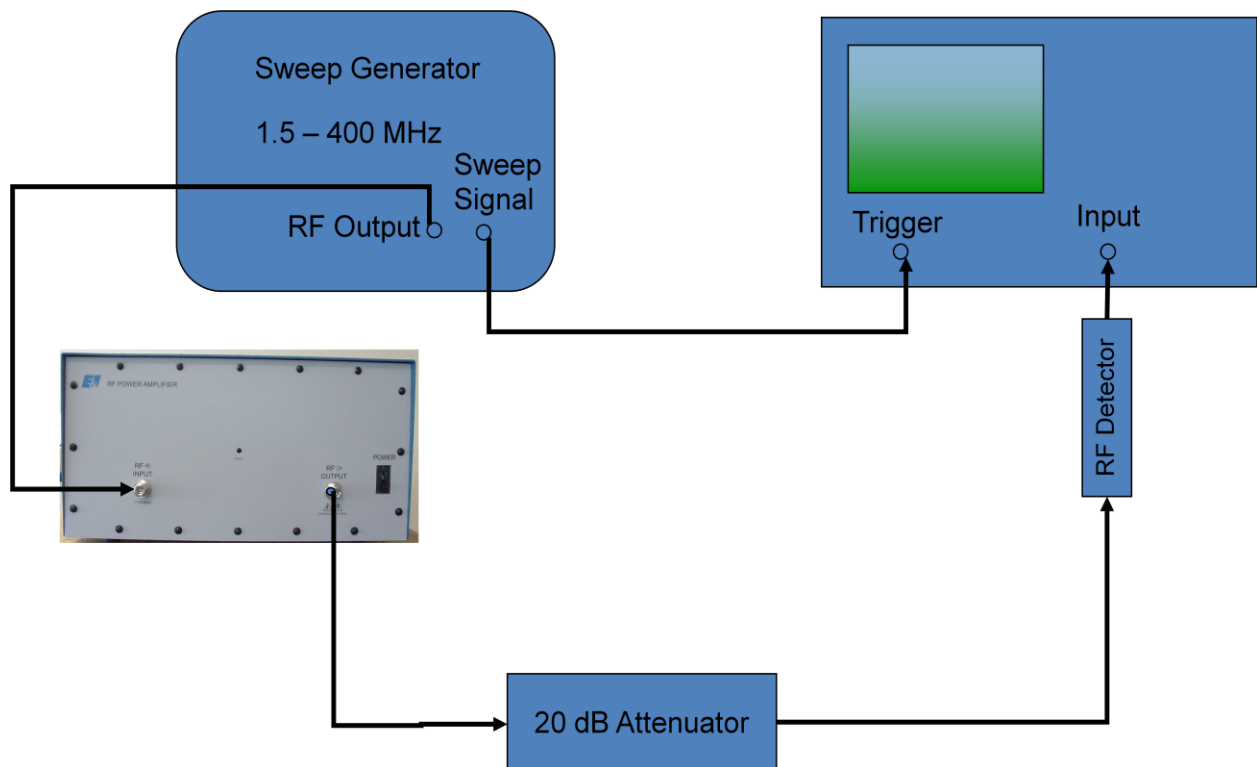


Figure 4-1. Gain Measurement

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2. Connect the equipment as shown in Figure 4-1, then proceed as follows:

- a) Set the oscilloscope to DC, Time/cm to Ext. X, and gain to 10mv/cm.
- b) Set the sweep generator to the video sweep mode with the start frequency at 1.5 MHz and the sweep width to 400 MHz.
- c) Disconnect the 550L from the set-up and connect the sweep/generator RF output directly to the 20 dB attenuator.
- d) Adjust the output level of the sweep/generator for full vertical deflection on the oscilloscope face.
- e) Calibrate the scope face to show 5 dB in 1 dB steps by attenuating the sweep/generator in 1 dB.
- f) Return sweep/generator output level to full deflection. Rotate the step attenuator (CCW) so that the output is reduced by 50 dB.
- g) Reconnect the A150 into the test set-up of Figure 4-1.
- h) Place the 550L power switch to the "ON" position.
- i) Observe the gain versus frequency sweep on the oscilloscope.
 - The average gain should be greater 50 dB
 - The gain variation should be within the 5 dB as shown on the oscilloscope.

4.4.2 Measurement of Harmonics

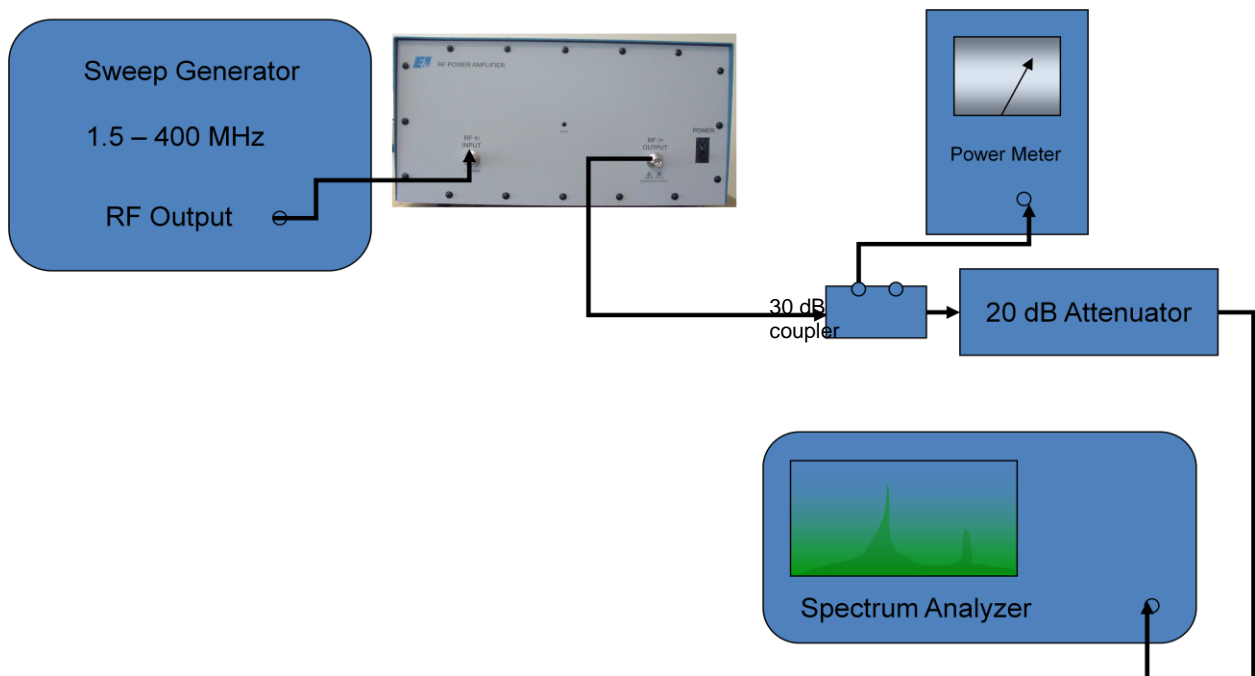


Figure 4-2

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1.) Equipment Required:

- a) Sweep/Signal Generator
- b) Calorimetric Power Meter HP435B
- c) Spectrum Analyzer.
- d) Attenuator (30dB)
- e) Coupler (30 dB)

2.) Connect the Equipment as shown in Figure 4-2, then proceed as follows:

- a) Adjust the signal generator to a CW center frequency of 1.5 MHz, for an indicated output of 40 watts on the power meter.
- b) Using the spectrum analyzer, check that the level of the carrier harmonics is less than -25 dB with respect to the carrier while manually scanning the frequency band of 1.5 400 MHz. An indicated power output of 40W should be maintained during this operation.

4.5 PACKAGING FOR RESHIPMENT

In the event of the equipment being returned for servicing it should be packed 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.

Chapter 5 Safety:

Do not attempt to operate this unit with the cover removed. High AC and DC voltages are present. The cover protects 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 driver board 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.

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