Figure 4.0 - 3a:
Color Photograph showing the exterior of the CB - 15AMP Bi-directional Amplifier Unit in Rear View:

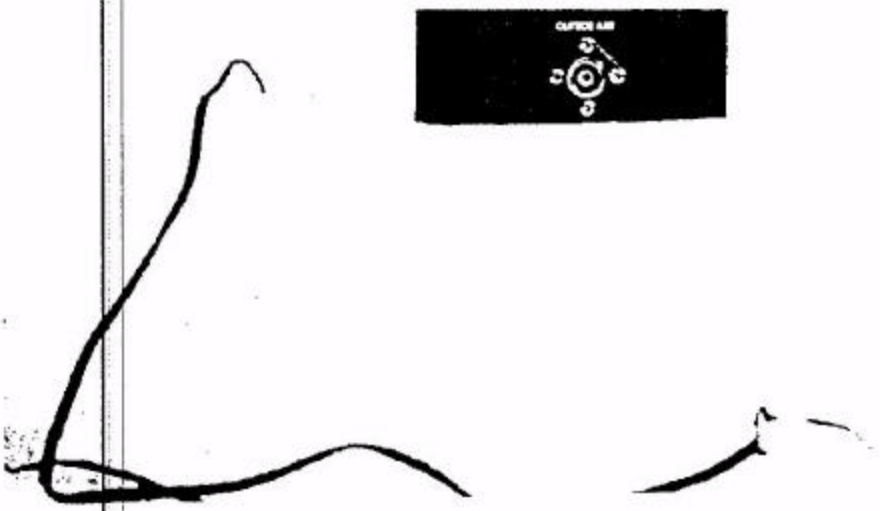

**Table 4.0 - 1: Manufacturer's Stated Nominal Characteristics For The ORA Electronics Model "CB-15AMP" Bi-directional Amplifier Unit:**

| | |
|---|---|
| Model #: | CB-15AMP |
| Main Amplifier Output Power: | 1.6 Watts |
| Duplexer Output Power: | 1 Watt |
| Uplink Frequency Band: | 824 - 849 MHz |
| Downlink Frequency Band: | 869 - 894 MHz |
| Uplink (Transmit-side) Gain: | 5 dB (typical) |
| Downlink (receive-side) Gain: | 13 dB (typical) |
| Passband Ripple: | +/- 1.5 dB |
| 1 dB Gain Compression Point: | |
| Uplink | +30 dBm |
| Downlink | +13 dBm |
| Downlink Noise Figure: | 6 dB (typical) |
| VSWR (at RF Connectors): | 2:1 |
| Electrical Power Requirements: | 12 V DC (nominal) @ 550 mA |

Although there are no user-serviceable parts within the Unit, and although there are no user-performable adjustments or alignments that can be made on the unit, access may be gained to the to interior by removing the ten flat-head screws which hold the base coverplate onto the remainder of the Unit (i.e. onto the housing). Once the base coverplate is removed, the Unit's circuit board is exposed to view. The layout of the interior of the unit is shown in two color photographs (Figures 4.0 - 4a and b) which provide the two viewing angles needed to clearly illustrate the layout of the circuit board of the Unit. (This board is permanently mounted to the housing by means of a potting adhesive on the threads of the internal hold-down screws; thus, it could not be removed for purposes of photography).

Figure 4.0 - 5 shows the Block Diagram of the CB - 15AMP Bi-directional Amplifier Unit. The Schematic (Circuit Diagram) of the Unit is shown in Figure 4.0 - 6. The Unit's Circuit Board Layout and its Parts List are presented in Figure 4.0 - 7, and Table 4.0 - 1, respectively.

Due to the simplicity of the Unit, there is no "Users Manual" or "Instruction Sheet" provided by the manufacturer. (Hence, these items are omitted from this Report).

**Figure 4.0 - 4a:**
**Color Photograph showing the interior (including the base coverplate, and base coverplate hold-down screws) of the CB - 15AMP Bi-directional Amplifier Unit in 3/4 Bottom Front View:**

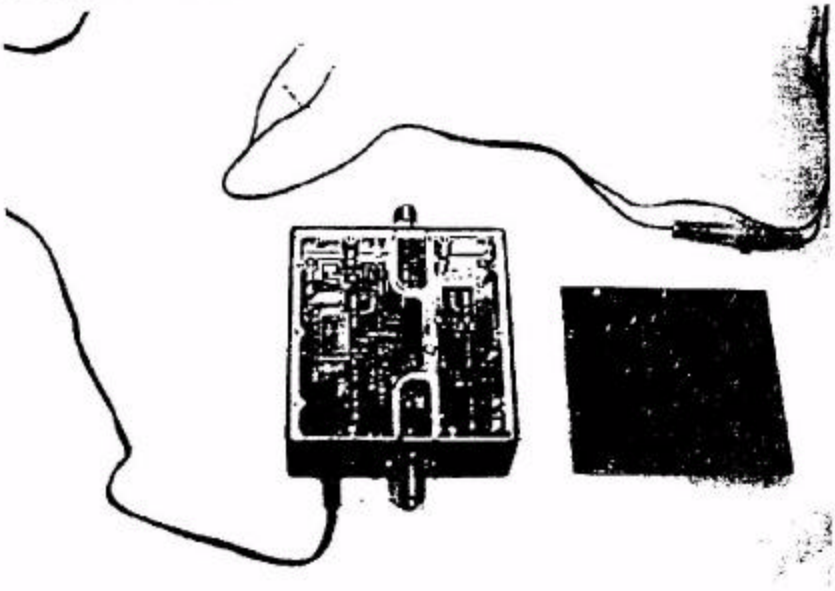

**Figure 4.0 - 4b:**
**Color Photograph showing the interior (including the base coverplate, and base coverplate hold-down screws) of the CB - 15AMP Bi-directional Amplifier Unit in 3/4 Bottom Left View:**

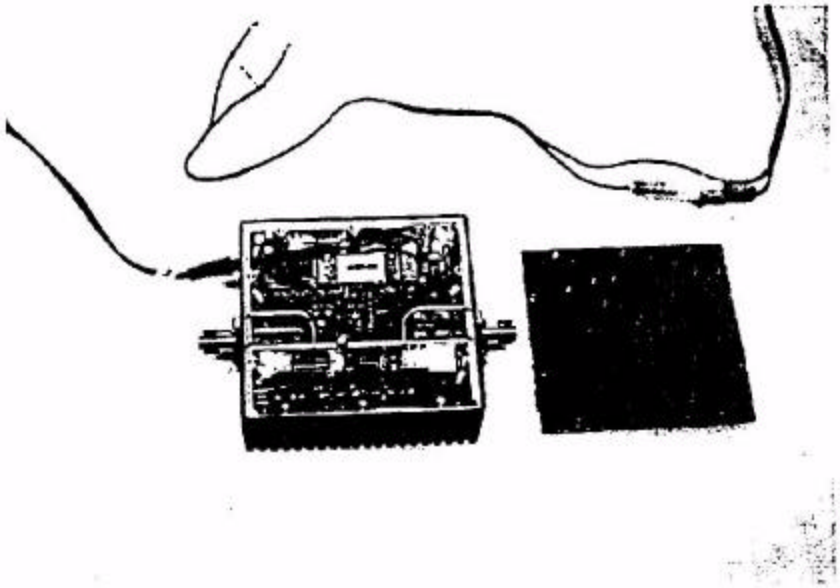

Figure 4.0 - 4a:
Color Photograph showing the interior (including the base coverplate, and base coverplate hold-down screws) of the CB - 15AMP Bi-directional Amplifier Unit in 3/4 Bottom Front View:

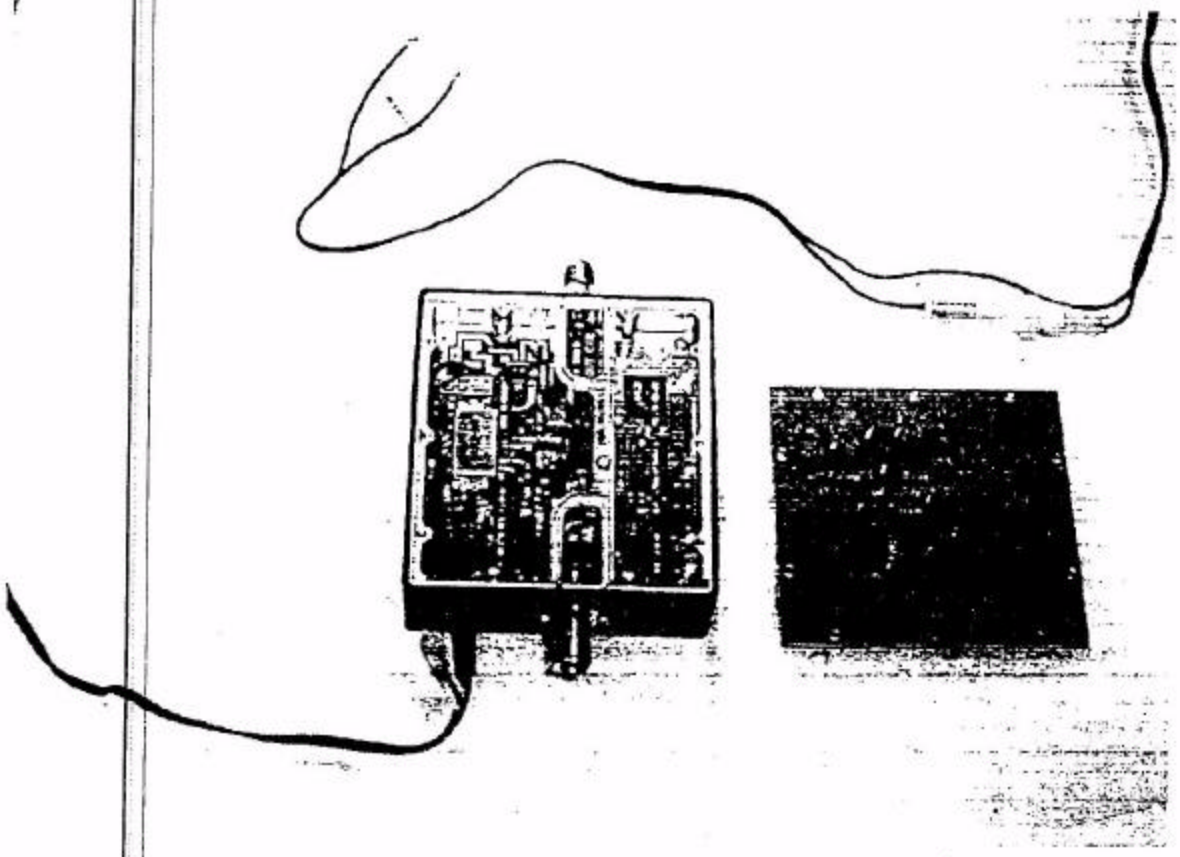

Figure 4.0 - 4b:
Color Photograph showing the interior (including the base coverplate, and base coverplate hold-down screws) of the CB - 15AMP Bi-directional Amplifier Unit in 3/4 Bottom Left View:

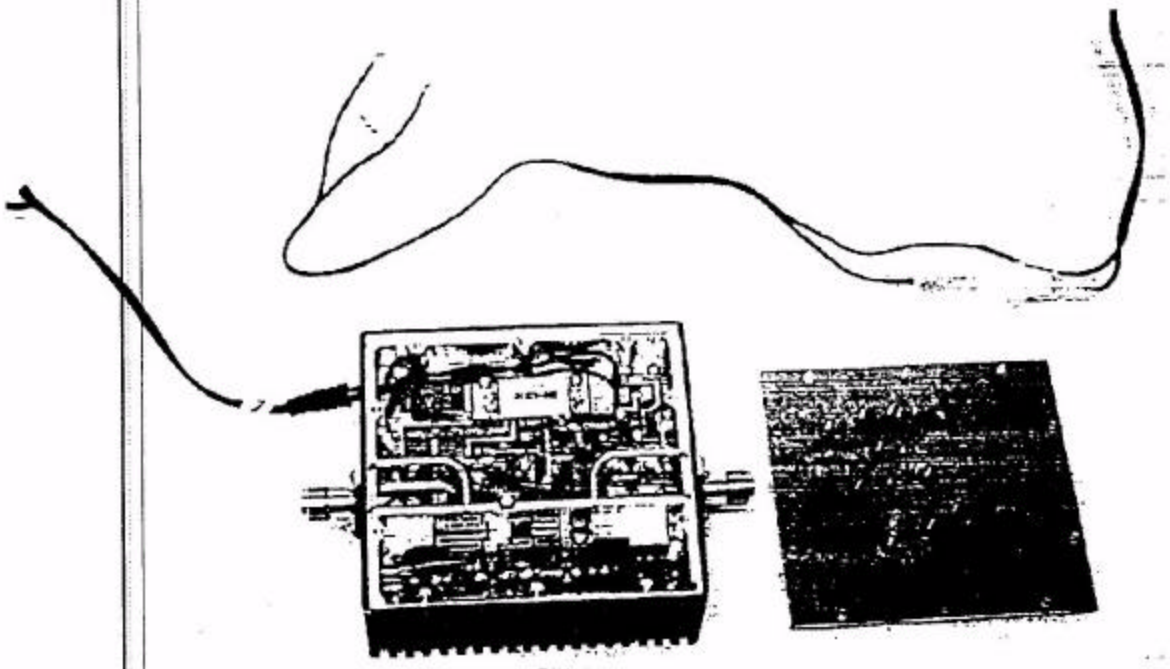

**FIGURE 4.0 - 5:**
**Block Diagram of the CB - 15AMP Bi-directional Amplifier Unit.**

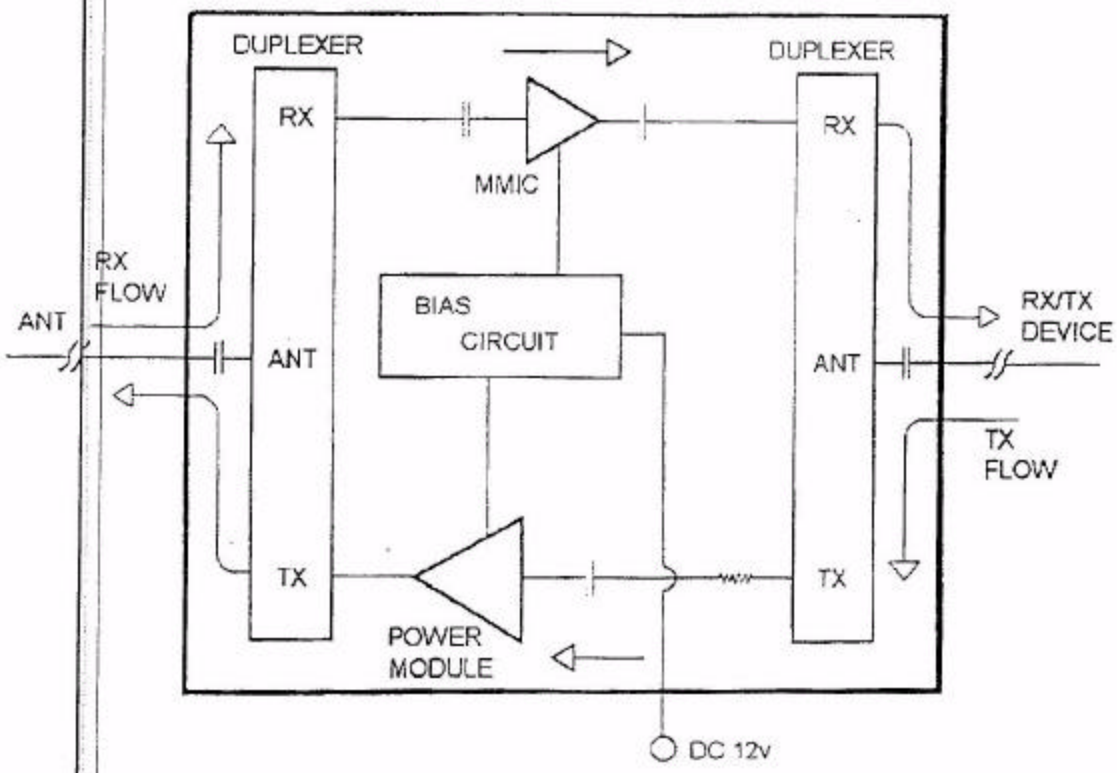

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**FIGURE 4.0 - 6:**
**Schematic (Circuit) Diagram of the CB - 15AMP Bi-directional Amplifier Unit.**

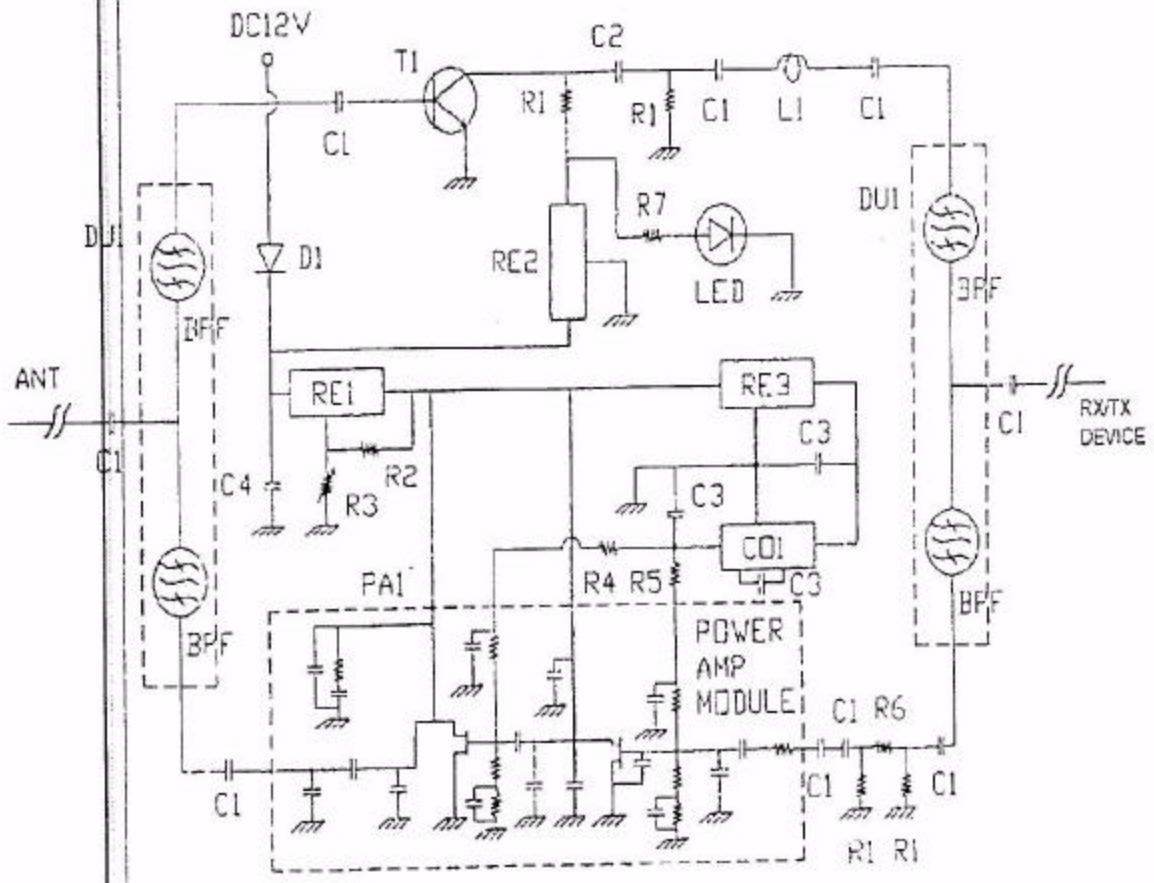

**FIGURE 4.0 - 7:**
**Circuit Board Layout of the CB - 15AMP Bi-directional Amplifier Unit.**

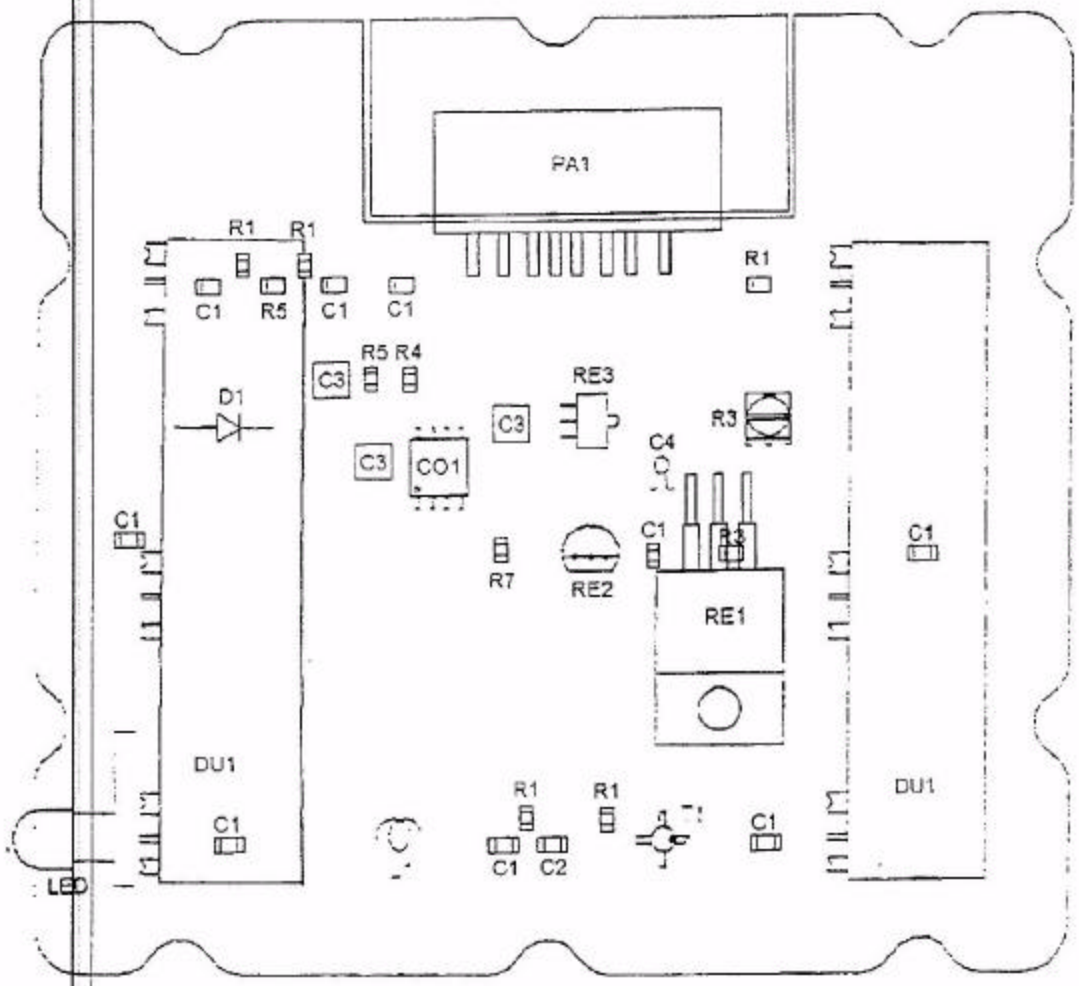

**Table 4.0 - 1: Parts List of the CB - 15AMP Bi-directional Amplifier Unit.**

| Symbol | Name | Quantity | Symbol | Name | Quantity |
|---|---|---|---|---|---|
| C1 | Chip Capacitor | 10 | R7 | Chip Resistor | 1 |
| C2 | Chip Capacitor | 1 | D1 | Diode | 1 |
| C3 | Tantal Capacitor | 3 | T1 | MMIC | 1 |
| C4 | Tantal Capacitor | 1 | PA1 | Power Module | 1 |
| R1 | Chip Resistor | 2 | L1 | Inductor | 1 |
| R2 | Chip Resistor | 1 | RE1 | Var. Regulator | 1 |
| R3 | Var. Resistor | 1 | RE2 | Regulator | 1 |
| R4 | Chip Resistor | 1 | RE3 | Regulator | 1 |
| R5 | Chip Resistor | 1 | CO1 | Converter | 1 |
| R6 | Chip Resistor | 1 | L.E.D. | Light Emitting Diode | 1 |
| DU1 | Duplexer | 2 | | | |

## 5.2 TEST PROCEDURES AND TEST RESULTS

### 5.2.1 "Bench Test" Measurements of EUT Output Power and Emission Bandwidth

The first "bench test" was intended to measure the RF output Power and Emission Bandwidth of the EUT, as viewed from the "OUTSIDE ANTENNA" port. This test employed an HP 8660C Frequency Synthesizer to provide a swept (750 MHz to 950 MHz) 0 dBm signal that was input to the "INSIDE ANTENNA" port of the EUT *via* a coaxial cable. An HP 8566B Spectrum Analyzer equipped with an HP 85685A Preselector was used as the Detection System. A coaxial cable was used to connect the "OUTSIDE ANTENNA" port of the EUT to the input port of the Preselector. In order to protect the Preselector's Front End, a 30 dB Fixed Pad was placed directly on the input port connector of the Preselector.

The results of this test are plotted in Figure 5.2.1 - 1. An examination of this figure discloses that the passband of the "power amplifier" (i.e. transmit-side) portion of the EUT is from approximately 804 MHz to 865 MHz. There are no measurable outputs above 920 MHz or below 800 MHz. The amplifier gain varies from + 27 db to +31 dB over the -6 dB points of the passband. Figure 5.2.1 - 2 shows a plot, with a 50 kHz span, of the measured power gain at an $f_o$ = 850.0 MHz . A maximum of +27.5 dBm output power was measured for this nominal case. Note also that the "close in" spurious emissions within the passband of operation were measured at better than -62 dB with respect to the power level of the carrier at $f_o$ . Figure 5.2.1 - 3 is a similar plot spanning 300 MHz to 1500 MHz, again with an $f_o$ of 850 MHz. It is noteworthy that there are no out-of-passband spurious emissions.

The second "bench test" was intended to measure the RF Output Power and Emission Bandwidth of the EUT, as viewed from the "INSIDE ANTENNA" port. This test was performed in a manner similar to the first, except that the frequency synthesizer output was injected into the "OUTSIDE ANTENNA" port of the EUT, and that the EUT outputs were monitored at the "INSIDE ANTENNA" port. Also, an input power level of -10 dBm was used to keep the "preamplifier" section of the EUT within its linear range. The results of this test are plotted in Figure 5.2.1 - 4. This plot shows that the receive-side passband of the EUT is from about 857 MHz to 910 MHz, with no measurable outputs beyond these limits. It also shows that the "preamplifier" section of the EUT exhibits a usable dynamic range of as much as 45 dB (within its passband).

The purpose of third "bench test" was to check for parasitic oscillations in the EUT that could result in spurious signals being emitted from the "OUTSIDE ANTENNA" port. This test was performed by terminating the "INSIDE ANTENNA" port in a 50 ohm dummy load, and monitoring the EUT's RF power outputs over the frequency range 100 MHz to 2500 MHz using the Spectrum Analyzer and Preselector (and a 30 dB Fixed Pad to

# 5.0 TESTS PERFORMED ON THE EUT

## 5.1 INTRODUCTION

As stated in Section 4.0 of this Report, the equipment under test (EUT) was an ORA Electronics "CB - 15AMP" Bi-directional Amplifier intended for use in land mobile cellular telephone communications applications. The objective of the testing program was to assess the EUT's compliance with the *relevant* requirements of 47 CFR Part 22, Subpart K (for Domestic Public Cellular Telecommunications devices). Because the EUT was not designed to generate a Carrier Frequency Signal, and because the EUT was not designed to modulate the Carrier Frequency Signal of the Cellular Telephone to which it is attached, most of the testing requirements of 47 CFR Part 22, Subpart K and of EIA/TIA IS-90 (Recommended Minimum Standards for 800 MHz Dual-Mode Narrowband Analog Cellular Subscriber Units) are irrelevant. Guidance on what tests ought to be performed was therefore sought from Mr. George Tannahill of the FCC's Evaluation and Certification Branch. Based upon his guidance, a variety of relevant tests were performed on the EUT during the period 26 May through August 1, 1994. These tests included:

- a series of "bench tests" to measure EUT output power and emission bandwidth (as seen from both the "INSIDE ANTENNA" and the "OUTSIDE ANTENNA" ports);
- ANSI C63.4 (3 meter range) radiated emissions tests of the EUT (with the "OUTSIDE ANTENNA" port terminated in a dummy load, and, with the "OUTSIDE ANTENNA" port connected to an antenna);
- a radiated test (using an actual cellular telephone as a signal source) to measure the emission bandwidth and emission spectrum properties of the EUT.

The procedures used during these tests, and the results of these tests are detailed in the following Subsections of this report.