



TEST & ALIGNMENT SPECIFICATION
FOR BDA 800 MHz 1W Booster

DCT000000003

Revision 1, May 18, 1999

TITLE	SIGNATURE	DATE
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- **REVISION RECORD**

Revisions are tracked here as ...

1 May 18, 1999 Updated from SMA Documents

Alan Aslett

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- **INTRODUCTION:**

This document provides a step by step procedure for final assembly and test of a Kaval dual cellular booster. This procedure presupposes availability of a complete mechanical parts kit and PCBs with all SMD parts installed. Major activities are installation of PCBs into housing, installation of remaining parts and test. Because of the nature of the interface connector, it is easier to test PCBs once installed. There are no parts on the underside of the PCB, so all repairs can be done without removing PCBs from housing. This procedure is specific to the production of cellular band boosters intended for installation into Cellcom BDA systems. Some adjustment parameters may differ for other customers and applications. It is recommended that debug and repair not be done by personnel that do test. Unit should be taken to an offline repair station. Test operator should apply a tag or sticker to defective unit coded with paragraph number of test step at which unit failed. It is recommended that a test checklist be produced to accompany this document which is used to record test results for each unit. Checklist should refer to paragraph numbers of tests. This can have plots attached and should be filed by serial number for future reference.

- **EQUIPMENT**

The following tools or instruments are required for final assembly:

- Multimeter
- Booster test interface (custom made)
- 24V DC Power supply with current limiting at 1A
- Scalar Network Analyzer capable of 900 MHz operation
- 1W minimum 10 or 20 dB attenuator, type N.
- Type N test cables
- N- Female to N-Female adapter.
- 1 Ohm 1W Resistor with test leads. (One banana, the other, a pointed probe such as used with multimeters)
- Insulated Tuning Screwdriver
- #0 Philips Screwdriver
- #1 Philips Screwdriver (preferably motorized)
- Nutdriver for D-sub jack screws.
- Wire Stripper
- Flush Cutter
- Static Protected Soldering Station
- Hobby Knife
- Moderate Viscosity Cyanoacrylate Glue
- Coarse File or Dremel Tool

- **MATERIALS**

Each Dual Booster requires the following materials. Refer to BOM for details.

- 2 Booster PCB Assemblies
- 1 Housing Kit.
- Approx. 13.5" #24 AWG insulated hookup wire, assorted colours.
- Heatsink Grease
- Parts listed on BOMs

- **DOCUMENTATION**

Referenced documentation is listed below:

- DCA000000001: Assembly Drawing, 1W Dual Booster
- SCH000000004: Schematic Diagram: 800MHz 1W Booster

- **PROCESS**

- **Inspection and Preparation**

- ***Housing Kit.***

Inspect housing parts for hazardous burrs, loose metal chips and clean and deburr as required. If machining oil residue exists, clean with Varsol.

Install Top Cover to Wall Extrusion using 16 #2-56 flat head machine screws.

- ***PCB***

Inspect PCB for missing or improperly installed SMD parts.

Using a file or Dremel tool, chamfer two corners of PCB closest to RF connectors approximately 0.100" to eliminate interference with weld fillets in housing.

- ***Divider Wall Subassembly***

Install two divider walls to center divider wall using 4 #2-56 x 3/8" thread cutting screws. Be mindful of correct orientation of grooves and notched in walls to ensure they conform to PCB ground locations and allow clearance for components.

Install EMI gasket material to grooves in underside of divider wall assembly. Cut gasket to length so that it is only installed where divider wall meets exposed ground on top of PCB or where divider walls contact metal housing. Be careful that stray embedded wires do not possibly contact any active traces on PCB. Gasket bits should be tack-glued to divider assembly with sparing use of cyanoacrylate glue. (Loctite type 401 recommended).

- ***Hookup Wire.***

Cut hookup wire to 1.5" length. Use different colour wires for each connection (resistor color coding corresponding to pin number on D connector is recommended)

Strip one end (PCB) to a length of 0.080", other end (D-connector) to 0.150".

- ***Regulator Leads***

Trim voltage regulator leads to a length of 0.200"

- **Installation of Leaded Components**

Install fuse clips into PCB. It may be helpful to install a fuse into the clips before clip insertion into PCB to assure correct alignment.

Install hookup wires to location P1. Refer to Interconnect Diagram for connection details.

Using flush cutters, trim fuse clip and wire leads flush with PCB. Length of protrusion below PCB cannot exceed 0.030" or short circuits may occur.

- **Installation of PCB into Housing**

Install PCB assemblies into housing. 8 pcs #4-40 x 5/16" thread forming screws are used to fasten down each booster PCB. Screws go through top plate and into heatsink. Note that one screw hole in PCB is not used. This is normal.

Be sure that one PCB of each band split is installed. One should have an 881 MHz dielectric filter (F1), the other must be an 836 MHz part.

- **Installation of Bolted Components**

Apply heatsink grease (a.k.a. Synthetic Gorilla Snot) to regulator and power module tabs.

Note: Be sure to stir compound thoroughly before using. Apply a minimal amount. Excess compound actually reduces thermal conductivity. Objective is to eliminate air voids between device tab and heatsink. Avoid getting this material on clothing. There is no known way of removing it from fabrics.

Install voltage regulators and RF power modules to heatsink using 6 pcs. #6-32 x 5/16 thread forming screws.

Solder all connections of installed parts just installed.

Install filtered 9 pin D connector from outside of housing. Fasten it down using two hex jack screws with single lockwashers (252900-00). Note: Jack screw kits will have excess parts that are unused.

Solder interconnect wires to D connector in accordance with sketch.

- **Installation of Divider Wall Assembly**

Install divider wall assembly into housing and fasten with 8 pcs #2-56 x 3/8 thread cutting screws. It is helpful to clamp divider assembly down with a clamp or toggle press to ensure gaskets are compressed and holes line up.

Inspect divider wall areas of PCB to ensure no components short to wall. Realign components as needed.

NOTE: This step can be done after bias test if divider walls are not available, but these steps must be repeated after wall installation in such case.

- **BIAS TEST**

This test is performed for each booster PCB. A multimeter is used for all voltage measurements. All measurements are with respect to chassis ground, so connect multimeter negative lead to any convenient point on metallic housing using an alligator clip.

Plug test adapter module into 9 pin connector.

Set a laboratory power supply to 24 VDC +/- 0.1 VDC and current limit it to 0.75A.

Connect PSU to banana jacks on test adapter.

Set AGC switch to off position and coarse gain to on position.

Apply power. Verify PSU does not current limit. Verify supply current draw is 600 mA +/- 50 mA

Verify voltage at TP 10 is +24 VDC +/- 0.1V

Verify voltage at TP 14 is +23.85 VDC +/- 0.1V.

Verify voltage at TP18 is 23.5 VDC +/- 0.15 V

Verify voltage at pin 3 of U9 is 12 VDC +/- 0.25 V

Verify Voltage at TP12 is 8 VDC +/- 0.25 V

Verify voltage at TP1 is 4.4 VDC +/- 0.2 V

Verify voltage at TP2 is 5.0 VDC +/- 0.25 V

Verify voltage at TP4 is 5.0 VDC +/- 0.25 V

Verify voltage at TP5 is 2.8 VDC +/- 0.25 V

Verify voltage at TP9 is < 0.3 VDC

Verify voltage at TP15 is < 0.3 VDC

Switch Coarse Gain off.

Verify voltage at TP4 is < 0.3 VDC

Verify voltage at TP5 is < 0.3 VDC

Verify voltage at TP9 is 3.8 VDC +/- 0.25 VDC

Verify voltage at TP8 is 5.5 VDC +/- 0.25 VDC

Verify voltage at TP11 is 8.0 VDC +/- 0.25 V

Verify voltage at TP17 is 5.0 VDC +/- 0.25 VDC

- **ALIGNMENT OF FAULT DETECT**

Connect a 1W 1 Ohm resistor between TP14 and TP18. This simulates a reduction of power module current by 50%.

Adjust R40 so that fault light on test adapter turns off.

Carefully adjust R40 so that fault light barely turns on.

Remove 1W resistor. Verify fault light goes out.

- **RF TEST**

- **Swept Response**

- **Overall Gain**

Connect unit to scalar network analyzer or spectrum analyzer with tracking generator. Set input level to -50 dBm. Sweep center frequency +/- 100 MHz. Set AGC off, coarse gain off fine gain to maximum. Verify midband gain is 54 dB +/- 2 dB. See Fig. 1 for sample plot. Note: Plot shows booster at full gain. Shape should be the same at lower gains.

- **Passband**

Verify gain within operating passband does not vary from reading in 6.8.2 by more than +/- 1 dB.

Verify rejection at offsets of +/- 100 MHz is at least 35 dB.

- **Input Return Loss**

Set coarse gain to on. Verify input return loss over operating passband is greater than 10 dB. See Fig. 2 for sample plot.

- **Single Tone Tests**

- **Saturated Power**

Apply a single tone at input at a level of -30 dBm at the center of the application operating band. Verify output power is at least +30 dBm.

- **Coarse Gain Adjustment**

Set coarse gain off. With input signal at a level of -50 dBm, measure output level. Set coarse gain on.

Adjust R21 to obtain an output level of 16 dB +/- 0.25 dB higher than reading obtained with coarse gain off.

- **Maximum Gain**

Calculate difference between output level and - 50 dBm. This is the maximum gain. Verify this to be +70 dB +/- 2 dB.

- **AGC Alignment**

With an input signal level of – 30 dBm, with coarse gain on, fine gain at max and AGC on, adjust R12 to obtain an output level in accordance with the table below. Settings are derived using FCC recommended procedure for determining channel loading of multichannel amplifiers.

APPLICATION	AGC Single Carrier Target Level
Standalone Booster	+20 dBm
Booster used with SMA 20W Amplifier	+15 dBm
Booster used with TRL 35W Amp with +51dBm IP3	+10.5
Booster used with TRL 35W amp that conforms to +55.5 dBm IP3	+15 dBm

- **Verification of Fine Gain Control**

With a single carrier input level of –50 dBm, AGC off and all gains set to max, observe the output level while decreasing fine gain step by step. Verify that steps are monotonic and that with fine gain set to minimum, overall gain is less than maximum gain by 16 dB +/- 0.7 dB. (Monotonic means that the steps are in the right order, that when you reduce gain by any 1 dB step, the gain change is in the right direction. Some attenuator faults may result in steps getting out of order when you cross a high bit boundary.)

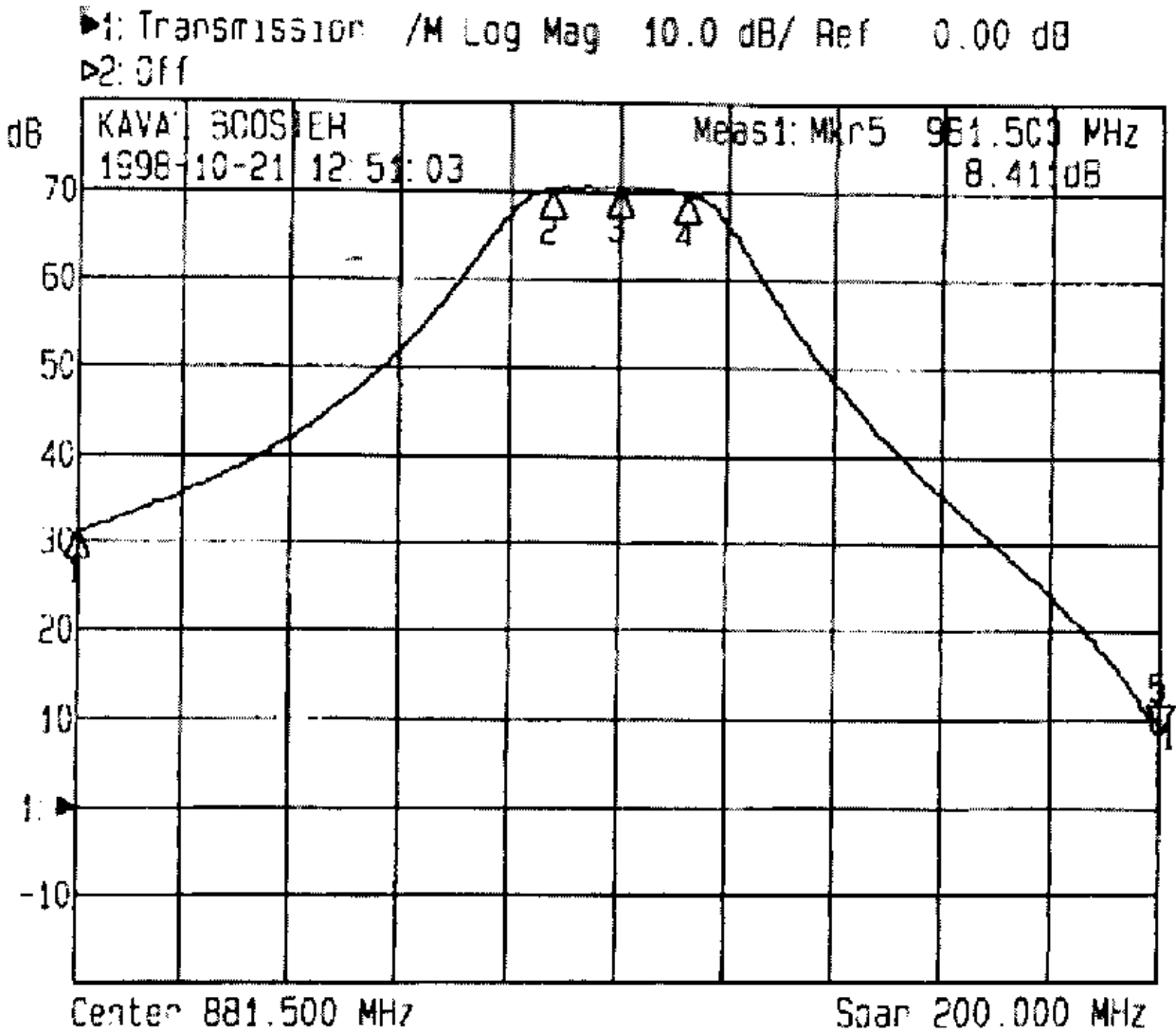
- **INSTALLATION OF BOTTOM COVER**

Install labels (uplink/downlink) near 9 pin connectors. Ensure labels go with correct PCB boards.
Install bottom cover (to assembly using 16 #2-56 flat head screws.

- **FINAL TEST AND INSPECTION**

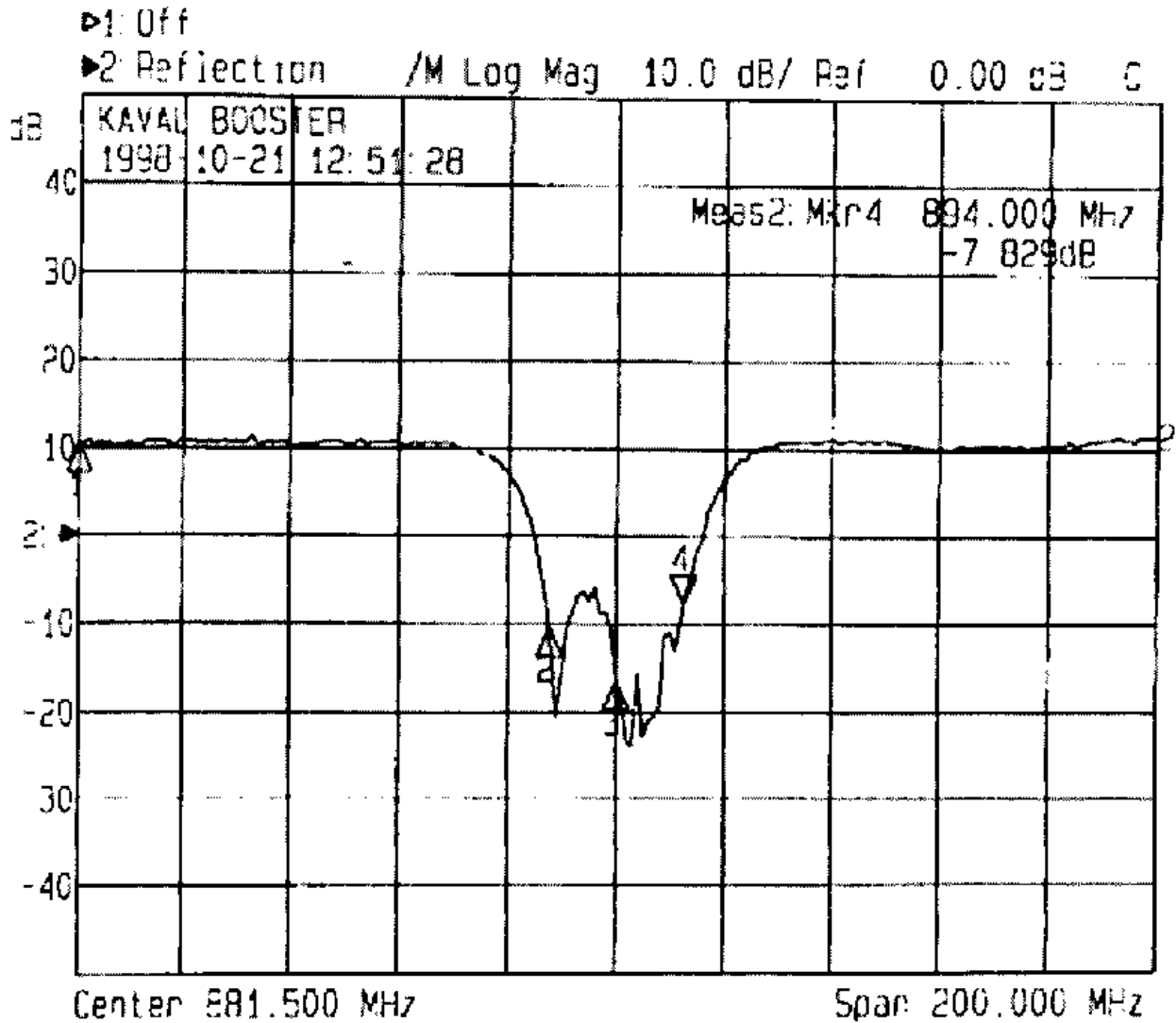
If required by customer contract, repeat swept measurement at full gain to produce a final plot for shipment to customer or for file. This also verifies that cover installation did not disrupt the circuitry as gaskets were compressed.
Inspect housing for missing screws.
Affix nameplate with serial number.
Pack unit for shipment if applicable.

• **FIGURE #1: TYPICAL BOOSTER RESPONSE WITH LID REMOVED**



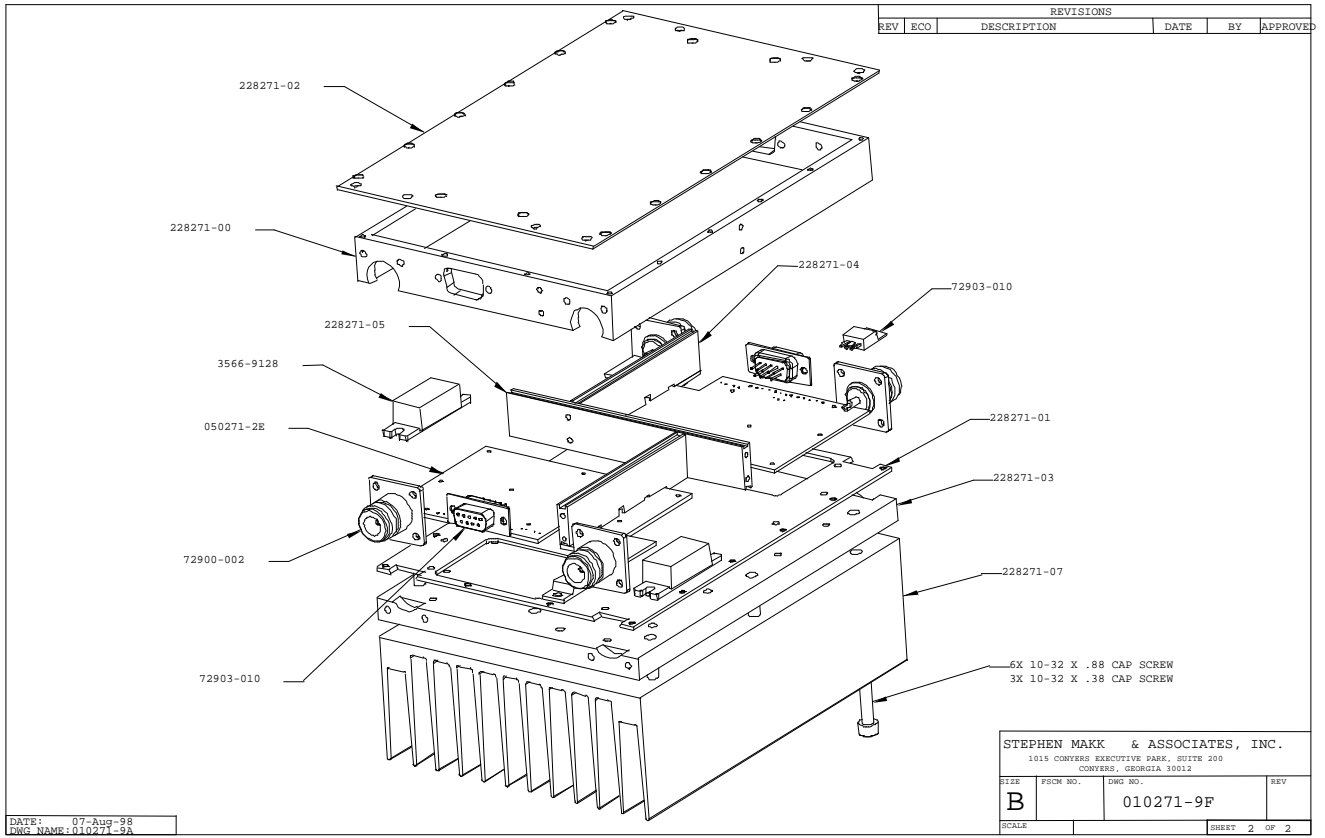
1: Mkr (MHz)	dB	2: Mkr (MHz)	dB
1: 781.5000	31.345		
2: 869.0000	70.290		
3: 881.5000	70.440		
4: 894.0000	69.755		
5: 981.5000	8.411		

• **FIGURE #2: TYPICAL BOOSTER INPUT RETURN LOSS**

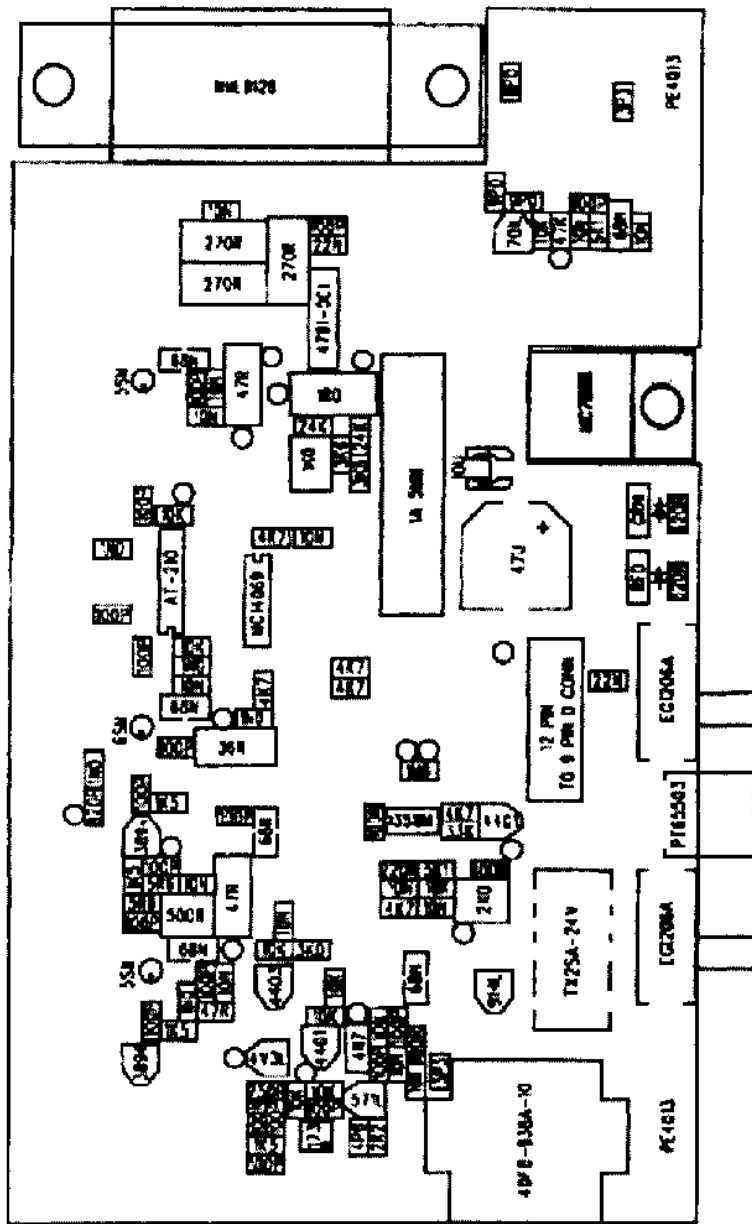


1: Msc (MHz)	dB	2: Msc (MHz)	dB
		1 781.5000	10.457
		2 869.0000	-10.600
		3 881.5000	15.544
		4 894.0000	-7.829

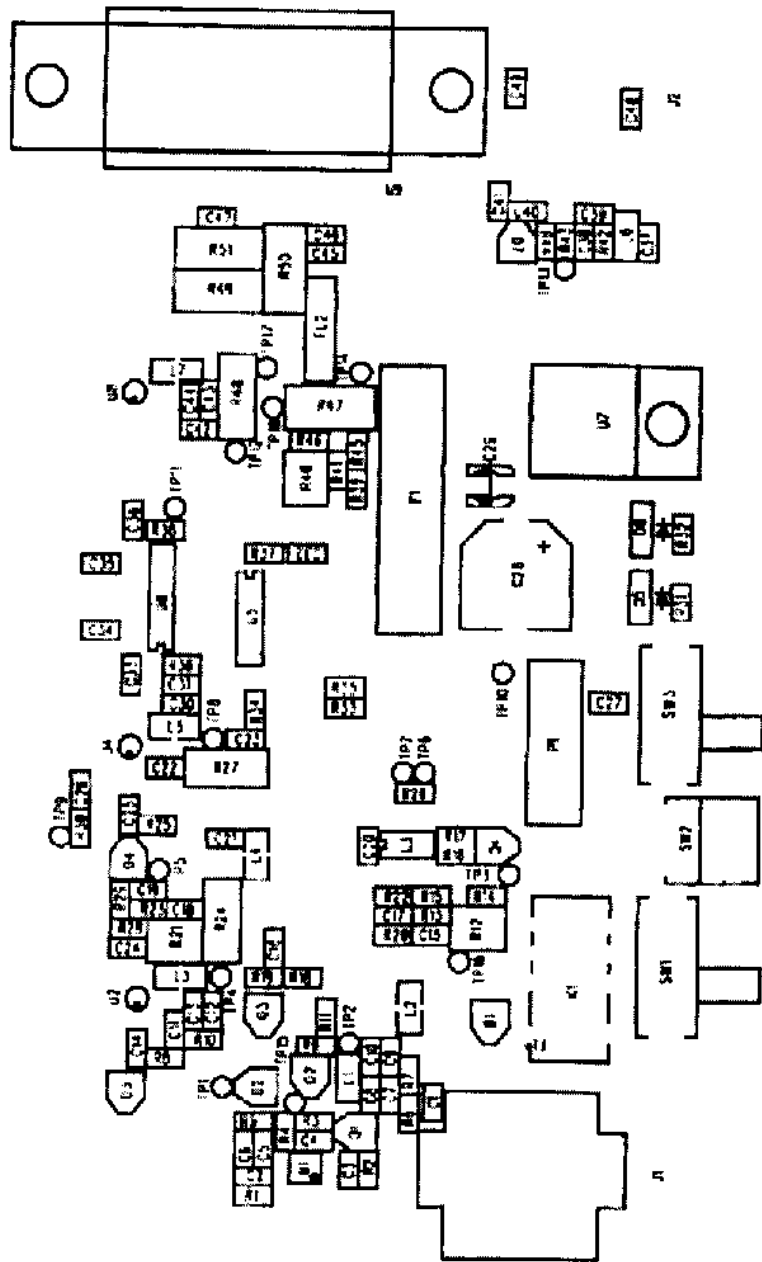
● **FIGURE #3: ASSEMBLY DRAWING**



• **FIGURE #4: BOARD OUTLINE #1**



• **FIGURE #5: BOARD OUTLINE #2**



- **FIGURE #6: BOOSTER TO DB-9 WIRING**

BOOSTER TO DB-9 WIRING

