136-174 MHz, 110 WATT POWER AMPLIFIER
19D902797G1

TABLE OF CONTENTS

DESCRIPTION

The VHF Power Amplifier Assembly is a wide band RF power amplifier operating over the entire 136 to 174 MHz range without tuning or band splitting. Its main function is to amplify the 10 mW FM signal from the Transmitter Synthesizer to the rated RF output of 110 watts at the antenna port. The output of the Power Amplifier Assembly is adjustable from 65 to 135 watts at the PA output J104. This corresponds to a rated RF output of 55 to 110 watts at the antenna.

The assembly consists of a printed wiring board (A1) and associated components, including a power module and three RF power transistors, mounted to the heat sink assembly. The printed wiring board (A1) contains both the power amplifier circuitry (100 series components) and the power control circuitry (200 series components).

Unfiltered supply voltage, A+, for the power amplifier circuits enters the assembly via feedthrough capacitor, C1. Power cable W4 routes the A+ from CI to J103 on the PWB. Filtered A+ voltage for the power control circuit enters the assembly via control cable W13 which connects to the PWB at J201.

The Power Control circuitry sets the output power level by adjusting the PA Power Set level. It keeps the output power constant despite variations in input power, power amplifier gain, or temperature through the use of a feedback control loop in the PA assembly.

M/A-COM Wireless Systems
3315 Old Forest Road
Lynchburg, Virginia 24501
(Outside USA, 434-385-2400) Toll Free 800-528-7711
www.macom-wireless.com

Printed in U.S.A.

TABLE 1 - GENERAL SPECIFICATIONS	
ITEM	**SPECIFICATION**
FREQUENCY	136 MHz - 174 MHz
OUTPUT POWER	65 watts - 135 watts (into Low Pass Filter)
INPUT POWER (RF)	10 mW min. into 2:1 VSWR
TEMPERATURE RANGE	30°C TO + 60°C (Ambient air)
SUPPLY VOLTAGE	13.4 Vdc
CURRENT	29 Amps max. (25 A typical @ 135W, 13.4V)
DUTY CYCLE	Continous
STABILITY	Stable into 3:1 VSWR; all temp. ,voltage, freq. 65 watts - 135 watts
RUGGEDNESS AT HIGH VSWR	No damage into open or short load.

CIRCUIT ANALYSIS

POWER AMPLIFIER

The power amplifier section of the PA Board consists of an Exciter, a Low Level Amplifier, a Driver, and the Power Amplifier Finals. All these gain stages have an input and output impedance of 50 ohms. Figure 1 is a block diagram showing the signal flow within the Power Amplifier Assembly.

Exciter (UIOI)

The Exciter stage uses a broadband silicon monolithic microwave integrated circuit (MMIC) amplifier. The signal from transmitter synthesizer, typically 10 dBm (10 mW), is input to the Exciter through a 10 dB resistive pad (R100 & R102). The Exciter amplifies the resulting 0 dBm (1 mW) signal to 20 dBm (100 mW). Following the Exciter is a 3 dB resistive pad (R104 & R106). This attenuator reduces the MMIC output power to 17 dBm (50 mW).

The MMIC requires a 5 volt supply source. The 8 volt regulator (U100) provides the 5 volts to the MMIC via a dropping resistor R103.

Low Level Amplifier (U1O2)

The Low Level Amplifier (LLA) stage uses a 50 ohm thick film RF Power Module to amplify and control of the output power. Internally, the module is a two stage amplifier. The power control circuitry controls the gain of the first stage by varying the collector voltage of Q203. The second stage gain remains constant with A + providing the DC supply voltage.

The signal from the Exciter stage, typically 17 dBm (50 mW), is input into the LLA. Under maximum Power Set conditions, the LLA amplifies the signal to a typical output level of 40 dBm (10 W).

Driver (Q101)

The driver is a 6 dB RF amplifier. A network consisting of C114, C117 and C139 and L103 and L105 provides interstage impedance matching between U102 and Q101. The signal from the LLA, typically 40 dBm (10 W), is amplified to 46 dBm (40 W). Impedance matching between the driver output and the input to U103 is provided by C145, C148, C152, C153, and L108. The splitter, U103, is a quadrature 90° hybrid coupler. It divides the signal and applies equal power to the two Power Amplifier Finals, Q102 and Q103.

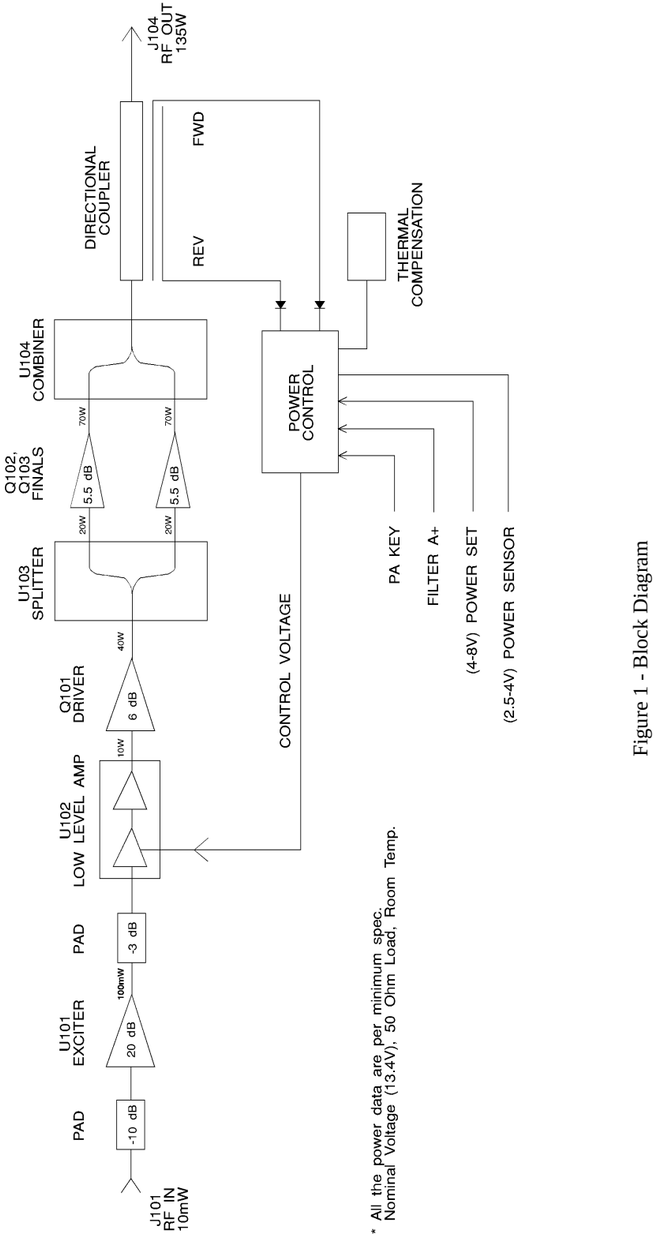


Figure 1 - Block Diagram

Power Amplifier Finals (Q102, Q103)

Each of the Power Amplifier Final devices is capable of producing 5.5 dB of gain. The output signal from the Splitter is impedance matched to each of the finals. Under optimum conditions each final amplifies the 43 dBm (20 W) power input signal to 48.45 dBm (70 W) output power. The outputs are then impedance matched to the input of the Combiner, U104. The Combiner is a quadrature 90° hybrid coupler which combines (sums) the output power of the finals. This produces an output power of approximately 51.3 dBm (135 W) which is coupled through C 140 to the directional coupler (part of A1 PWB) and on to the antenna circuits. In addition, the directional coupler samples both forward and reverse power and sends this sample to the Power Control circuitry.

POWER CONTROL

The Power Control circuitry performs three basic functions. It keys and unkeys the PA, sets the PA output power, and protects the PA against adverse conditions.

Keying and Unkeying the PA

To key the PA, the digital controller places 5 volts on the PA key line, J201-2. Zero volts on the PA key line causes the PA to unkey. If the control cable (W13) is disconnected, with nothing actively driving the PA key line, the PA will remain unkeyed.

PA Output Power Set

PA output power is set according to the level of the Power Set line. Four (4) volts on this line will produce minimum power. As the voltage increases toward eight (8) volts, the power will increase to its maximum rated output. The PA output power is initially set for an output of 135 watts at J104. This is done by adjusting R217 while injecting a 10 mW signal at J1 and applying 8 volts to J201-3. After setting the maximum power level, changing the output power is done by varying the voltage applied on the Power Set line.

PA Protection

The power control also protects the PA against over temperature and high VSWR conditions.

An over temperature condition exists when the flange temperature of the final output transistor reaches 80°C. At this point the output power will drop below its set level. The output power will continue to drop such that when the flange temperature reaches 125°C the PA output drops at least 10 dB below its set level.

Reflected power is limited to 25% of the set power. If the output VSWR degrades to worse than 3:1 the forward power will be reduced to limit the reflected power to 25% of the set power. The Power Sensor line indicates when the PA is operating in a cutback condition. If the PA is keyed and the power control is cutting back, the Power Sensor line will drop to zero (0) volts and the PA alarm light on the station will turn on.

Theory of Operation

Power control of the MASTR III Power Amplifier is accomplished with a feedback control loop. The three possible feedback signals are: representation of forward power, temperature sensitive scaled representation of forward power, or representation of reflected power. These three signals are input to a diode summing junction which selects the largest of the three for use as the feedback.

The stripline directional coupler samples the output power and produces a voltage, Vf, proportional to the forward output power. The power control compares the forward voltage, Vf, to a reference voltage at U201D. The output of U201D controls the current flow thru Q202 and the output of Q203. The collector output of Q203 adjusts the control voltage, Vct1. This control voltage is capable of adjusting the total PA output power since it provides the first stage DC supply to the Low Level Amplifier, U102.

During over temperature operation, a scaled representation of the forward power is maintained constant by varying the control voltage line. Thermal resistor R209 sensing an increase in temperature causes the output of U201A to increase. If the output of U201A becomes larger than the other feedback lines, the output of U201D will begin to decrease. This in turn will cause the output of Q203 to decrease reducing the supply voltage to U102. Since the scaling is a function of temperature the power is reduced as the temperature increases.

Under VSWR cutback operation the reverse voltage, Vr, representative of the reflected output power is held below a threshold by reducing the control voltage as necessary. If Vr increases at U201B beyond the preset threshold an increase at U201D will result. This causes a subsequent reduction in the control voltage to U102. Thus the power control circuit reduces the output power in order to limit the reflected power to 25% of the set power.

Signal Interface

The signal interface to the MASTR III Power Amplifier is supported by a six position feedthrough connector, J201, with the following pinout:

1 - POWER SENSE
2 - PA Key
3 - POWER SET
4 - NC
5 - Ground
6 - 13.8 VF

Power Sense

This line indicates when the PA is experiencing adverse conditions. Under normal operation, while the PA is keyed, this line will be proportional to forward power. Minimum power (zero watts) corresponds to 2.5 volts while maximum power corresponds to 4.5 volts. This voltage is not temperature compensated and no effort is made to calibrate this signal to an absolute power level. It is intended to provide a relative indication of forward power and to discriminate between normal and cutback operation.

Zero volts on this line, when the PA is keyed, indicates the forward power is cutback. This power cutback may be due to high reflected power (VSWR) or may be due to high PA temperatures. This fault condition may indicate a problem with the PA or may indicate a system problem external to the Power Amplifier. High VSWR may be due to a poor antenna and high temperature may be due to a blocked cabinet vent. Zero volts on this line, when the PA is keyed, does not indicate zero forward power. Zero volts indicates the PA is protecting itself due to adverse conditions. If the adverse condition, either high VSWR or high temperature is eliminated, the power will return to normal and the PWR SENSOR voltage will rise above 2.5 volts.

PA Key (Interface Connector pin 2)

This line is used to key and unkey the PA. UNKEY = 0 volt and KEY = 5 volts. The driver of this line must be capable of supplying 5 volts at 1.0 mA. The appropriate key sequence requires RF from the transmit synthesizer be input to the PA before the KEY line is energized.

Power Set (Interface Connector pin 3)

This line is used to set the RF Power Output of the PA. Minimum power output equals 4 volts and maximum power output equals 8 volts. The driver of this line must be capable of supplying 8 volts at 1.0 mA.

13.8 VF (Interface Connector pin 6)

This line provides the filtered supply voltage for the Power Control. The driver of this line must be capable of supplying 13.8 volts ±20% at 100 mA.

TROUBLESHOOTING GUIDE

SYMPTOM	AREAS TO CHECK	INDICATIONS
1. No Power or low Power at Antenna Port	1. Measure the transmitter output power before the duplexer or antenna switch (for simplex mode).	The presence of power at this port is an indication of a defective duplexer, switch, or cables.
	2. Measuer the transmitter output power before the low pass filter.	The presence of power at this port is an indication of a defective filter or cables.
	3. Measure the transmitter output power before the optional isolator at the PA output port.	The presence of power at this port is an indication of a defective isolator or cables.
2. No power at PA output port and PA ALARM is OFF	1. Station is in receive mode.	
3. No power at PA output port and PA ALARM is ON.	1. No RF input to PA. Check connection between PA and TX Synthesizer.	TX Synthesizer should deliver a minimum of 10 mW (10 dBm) to the PA.
	2. Check the logic or DC inputs to the PA from the Interface Board through J201.	
	a. J201-2 PA KEY	5 volts during transmit
	b. J201-3 POWER SET	4 volts to 8 volts (4 volts represents zero RF power)
	c. J201-6 13.8 VF	13.8 Vdc ±20%
	3. Defective PA	Replace PA
4. Low power at PA output port and PA ALARM is OFF	1. Low RF input to PA from TX Synthesizer.	Power should be a minimum of 10 mW (10 dBM).
	2. Check the voltage on J201-3 (POWER SET).	For nominal output power, this voltage should be above 6 volts.
	3. Check the power supply voltage on the collector of Q101, Q102 and Q103.	Voltage should be nominal 13.4 Vdc.
	4. One of the two final PA transistors (Q102 or Q103 is defective.	Replace the defective transistor.
5. Low power at PA output port and PA ALARM is ON.	1. Check for over temperature and/or a high VSWR condition due to a mis-match at the output port.	The power control circuit protects the PA by cutting back the power. In case of a mismatch, refer to symptom 1.

VHF POWER AMPLIFIER VOLTAGE CHART

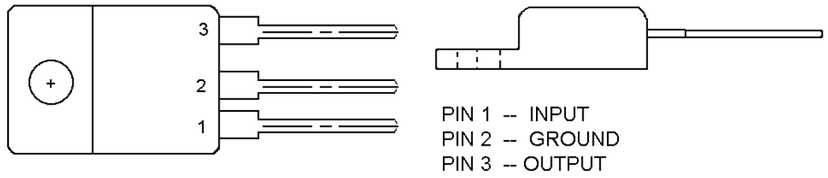
PARAMETER (50 OHM, -30° TO +60° C)	REFERENCE SYMBOL	READINGS (volts DC)
SUPPLY VOLTAGE	A+	13.4 V ±20%
CONTROL VOLTAGE	Vct 1	0 - 12 V
FORWARD VOLTAGE	Vf	3 - 7 V
REVERSE VOLTAGE	Vr	2 - 6 V
POWER SENSE	J201-1	2.5 - 4 V
PA KEY	J201-2	5 V
POWER SET	J201-3	4 - 8 V
13.8 VF	J201-6	13.8 V ±20%

VHF POWER AMPLIFIER TYPICAL VOLTAGE READINGS
(50 ohm, room temperature, 13.4 Vdc supply voltage, and 110 watt output)

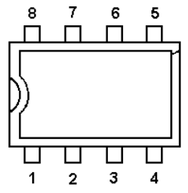
REFERENCE SYMBOL	@ 136 MHz (volts DC)	@ 150 MHz (volts DC)	@ 162 MHz (volts DC)	@ 174 MHz (volts DC)
Vct1	7 - 10 V	6 - 8 V	4 - 6 V	4 - 6 V
Vf	5 - 7 V	5 - 7 V	5 - 7 V	5 - 7 V
Vr	2 - 3 V	2 - 3 V	2 - 3 V	2 - 3 V
J201-1	2.5 - 4 V	2.5 - 4 V	2.5 - 4 V	2.5 - 4 V
J201-3	6 - 8 V	6 - 8 V	6 - 8 V	6 - 8 V
J201-6	13.4 V	13.4 V	13.4 V	13.4 V

RATED POWER FOR MASTR III VHF BASE STATION

STANDARD	WITH DUPLEXER	WITH ISOLATOR	WITH DUPLEXER AND ISOLATOR
110W	75W	95W	70W

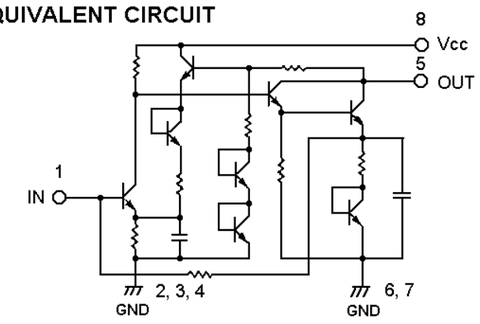


U100
19A705532P2
VOLTAGE REGULATOR

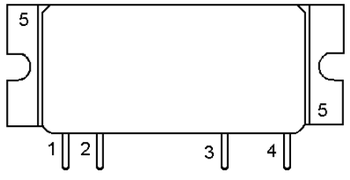


PIN CONNECTIONS
1. Input
2. GND
3. GND
4. GND
5. Output
6. GND
7. GND
8. Vcc

EQUIVALENT CIRCUIT



U101
344A3221P1
MMIC AMPLIFIER



1. P in
2. Vcc ı - 1ST STAGE
3. Vcc FINAL
4. P out
5. FIN - GROUND

U102
19A70532P1
PA AMPLIFIER MODULE

110 WATT POWER AMPLIFIER
19D902797G1
ISSUE 5

SYMBOL	PART NO.	DESCRIPTION
		---------- ASSEMBLIES ----------
A1		POWER AMPLIFIER BOARD 19D902794G1
		---------- CAPACITORS ----------
C100 and C101	19A702052P5	Ceramic: 1000 pF ± 10%, 50 VDCW.
C103	19A702052P5	Ceramic: 1000 pF ± 10%, 50 VDCW.
C104 and C105	19A705108P120	Mica chip: 1000 pF, ±5%, 100 VDCW.
C106	19A705205P7	Tantalum: 10 uF, 25 VDCW; sim to Sprague 293D.
C109	19A705205P7	Tantalum: 10 uF, 25 VDCW; sim to Sprague 293D.
C110	19A705108P120	Mica chip: 1000 pF, ±5%, 100 VDCW.
C111 and C112	19A705205P7	Tantalum: 10 uF, 25 VDCW; sim to Sprague 293D.
C114	19A705108P25	Mica chip: 33PF ±5%, 500 VDCW, temp coef. ±50.
C115	19A705108P40	Mica chip: 91 pF, ±5%.
C116 and C117	19A705108P95	Capacitor, Mica Chip: 200 pF, + 5%, 100 VDCW, temp coef 0 ± 50 PPM.
C118	19A705108P21	Mica chip: 22pF ±5%, 500 VDCW, temp. coef. ±50.
C119	19A705108P22	Mica: 24 pF, ±5%, 500 VDCW.
C123	19A705108P22	Mica: 24 pF, ±5%, 500 VDCW.
C124	19A705108P30	Mica: 51 pF, ±5%, 500 VDCW.
C125	19A705108P35	Mica: 82 pF, ±5%, 500 VDCW, temp coef 0 ± 50 PPM/°C.
C126	19A705108P30	Mica: 51 pF, ±5%, 500 VDCW.
C128 thru C130	19A705108P35	Mica: 82 pF, ±5%, 500 VDCW, temp coef 0 ± 50 PPM/°C.
C131 and C132	19A700006P38	Mica chip: 150pF, 100 VDCW.
C133 and C134	19A705108P120	Mica chip: 1000 pF, ±5%, 100 VDCW.
C135 and C136	19A700006P38	Mica chip: 150pF, 100 VDCW.
C137 and C138	19A705108P120	Mica chip: 1000 pF, ±5%, 100 VDCW.
C139	19A705108P33	Mica chip: 68 pF, ±5%, 100 VDCW.
C140	19A705108P120	Mica chip: 1000 pF, ±5%, 100 VDCW.
C141	19A705108P97	Mica chip: 240pF ±5%, 500 VDCW, temp. coef. ±50.
C145	19A705108P25	Mica chip: 33 pF, ±5%, 500 VDCW, temp coef 0 ± 50 PPM/°C.
C147	19A705108P120	Mica chip: 1000 pF, ±5%, 100 VDCW.
C148	19A705108P36	Capacitor, Mica Chip: 91 pF, + 5%, 500 VDCW, temp coef 0 ± 50 PPM.
C152 and C153	19A705108P35	Mica: 82 pF, ±5%, 500 VDCW, temp coef 0 ± 50 PPM/°C.
C160 and C161	19A705108P30	Mica: 51 pF, ±5%, 500 VDCW, temp coef 0 ± 50 PPM/°C.
C164 and C165	19A705108P22	Mica: 24 pF, ±5%, 500 VDCW, temp coef 0 ± 50 PPM/°C.
C166 and C167	19A705108P27	Mica: 39 pF, ±5%, 500 VDCW, temp coef 0 ± 50 PPM/°C.
C168 and C169	19A705108P120	Mica chip: 1000 pF, ±5%, 100 VDCW.
C170 and C171	19A705205P7	Tantalum: 10 uF, 25 VDCW; sim to Sprague 293D.
C201	19A702061P41	Ceramic: 39 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C202 and C203	19A702052P26	Ceramic: 0.1 uF ± 10%, 50 VDCW.
C204	19A702061P41	Ceramic: 39 pF ± 5%, 50 VDCW, temp coef 0 ± 30 PPM.
C205 thru C207	19A702052P5	Ceramic: 1000 pF + 10%, 50 VDCW.
C208	19A702052P26	Ceramic: 0.1 uF ± 10%, 50 VDCW.
C209	19A702052P5	Ceramic: 1000 pF + 10%, 50 VDCW.
C213	19A702052P26	Ceramic: 0.1 uF ± 10%, 50 VDCW.
C225	19A702052P24	Ceramic: 0.068 uF ± 10%, 50 VDCW.
C263	19A702052P5	Ceramic: 1000 pF + 10%, 50 VDCW.
C266	19A702052P5	Ceramic: 1000 pF + 10%, 50 VDCW.
C270	19A702052P5	Ceramic: 1000 pF + 10%, 50 VDCW.
C272 and C273	19A702052P5	Ceramic: 1000 pF + 10%, 50 VDCW.
C301 and C302	19A705108P34	Mica chip: 75pF ±5%, 500 VDCW, temp. coef. ±50.
C303 and C304	344A3126P62	Porcelain: 1000pF ±5%, 50 VDCW.
		---------- DIODES ----------
D201 and D202	19A700047P3	19A702250P113.
D203	19A700053P3	Silicon: 2 Diodes in Series, Common Cathode; sim to MBAV70L.
D205 and D206	19A700053P3	Silicon: 2 Diodes in Series, Common Cathode; sim to MBAV70L.
D209	19A700047P3	19A702250P113.
D210	19A700083P102	Silicon: 5.1 Volt Zener; sim to SZSX84-C5V1.
D211	19A700025P6	Zener: 4.8 - 5.4 V.
		---------- JACKS ----------
J101	19A705512P1	Connector, RF SMB Series: sim to Amp No. 221111-1. Printed wire, two part: 6 contacts, sim to Molex 22-29-2061.
J103	19A702778P464	Threaded metalic spacer, swage type.
J201	19A704852P32	Printed wire, two part: 6 contacts, sim to Molex 22-29-2061.
		---------- INDUCTORS ----------
L100	19A701091G1	Coil.
L101	19A701091G1	Coil.
L102	19A129569P1	Coil.
L103	19A701418P1	Coil.
L104	19A701420P5	Coil.
L105	19A701091G1	Coil.
L106	19A136533P1	Coil.
L108	19A701418P1	Coil.
L115	19A701418P1	Coil.
L116	19A701420P5	Coil.
L117	19A701418P1	Coil.
L118	19A701420P5	Coil.
L119 and L120	19C320617P17	Coil: 17nH.
L121 and L122	19A701420P5	Coil.
L123 and L124	19A701418P1	Coil.
L125 and L126	19A129360P4	Coil.
L160 and L161	344A3301P1	Coil.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	PART NO.	DESCRIPTION
L203 thru L205	19A700024P37	Coil, RF: 100 uH ± 10%.
L301 thru L304	REG70420/2	Ferrite Bead.
		---------- TRANSISTORS ----------
Q201 and Q202	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
		---------- RESISTORS ----------
R100	19B800607P270	Metal film: 27 ohms ±5%, 1/8 w.
R101	19B800607P330	Metal film: 33 ohms ±5%, 1/8 w.
R102	19B800607P270	Metal film: 27 ohms ±5%, 1/8 w.
R103	19A700113P27	Composition: 33 ohms ±5%, 1/2 w.
R104	19B800607P331	Metal film: 330 ohms ±5%, 1/8 w.
R105	19B800607P100	Metal film: 10 ohms ±5%, 1/8 w.
R106	19B800607P331	Metal film: 330 ohms ±5%, 1/8 w.
R107	19A700113P5	Composition: 3.9 ohms ±5%, 1/2 w.
R108	19A700113P15	Composition: 10 Ohms ±5%, 1/2 w.
R109	19A700112P15	Composition: 10 ohms ±5%, 1 w.
R110	19A700112P13	Composition: 8.2 ohms ±5%, 1 w.
R112	19A700112P13	Composition: 8.2 ohms ±5%, 1 w.
R201 and R202	19B801486P101	Metal film: 100 ohms ±5%, 1/2 w.
R203	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R204	19B800607P183	Metal film: 18K ohms ±5%, 1/8 w.
R205	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w.
R206	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R207 and R208	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R209	19A705813P2	Thermistor: sim to AL03006-58.2K-97-G100.
R210 and R211	19B800607P472	Metal film: 4.7K ohms ±5%, 1/8 w.
R212 and R213	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R214	19B800607P473	Metal Film: 47k Ohms ±5%, 1/8 w.
R215	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R216	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R217	19A700109P5	Variable, cermet: 10K ohms ±20%, 1/4 w.
R218 and R219	19B801486P101	Metal film: 100 ohms ±5%, 1/2 w.
R220	19A702931P333	Metal film: 21.5K ohms ±1%, 200 VDCW, 1/8 w.
R221	19A702931P293	Metal film: 9090 ohms ±1%, 200 VDCW, 1/8 w.
R223	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R224	19B800607P223	Metal film: 22K ohms ±5%, 1/8 w.
R226 and R227	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R228	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R229 and R230	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R233	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R235	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R301 and R302	19A700113P15	Composition: 10 Ohms ±5%, 1/2 w.
		---------- INTEGRATED CIRCUITS ----------
U101	344A3221P1	Linear: MMIC Amplifier; sim to NEC UPC1677C.
U201	19A701789P4	Linear: Quad Op Amp; sim to LM224D.
		---------- CAPACITORS ----------
C1	19A116708P2	Feedthru.

NOTE: COMPONENTS ARE ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

SYMBOL	PART NO.	DESCRIPTION
		---------- JACKS ----------
J1		Part of W1.
J104	7777145P5	Receptacle: sim to Amphenol 82 - 97.
		---------- TRANSISTORS ----------
Q101	19A134340P4	Silicon, NPN, VHF Amplifier: 45 w.
Q102 and Q103	19A149632P1	Silicon, NPN, VHF Amplifier: 68 w., 12.5 volts.
Q203	19A700055P1	Silicon, PNP: Darlington; sim to TIP - 125.
		---------- RESISTORS ----------
R108	19A143832P4	Power: 50 ohms ±5%, 150 w.
R111	19A143832P4	Power: 50 ohms ±5%, 150 w.
		---------- INTEGRATED CIRCUITS ----------
U100	19A705532P2	Integrated Circuit, Linear (Positive Voltage Regulator): sim to M57719.
U102	19A705326P1	Power Amplifer Module: 145 to 175 MHz., sim to Mitsubishi M57719.
U103 and U104	344A3219P1	Coupler, hybrid: 130 to 180 MHz, amplitude balance ±0.25 dB; sim to Anaren No. 10262 - 3.
		---------- CABLES ----------
W1	19B801529G4	RF Input Cable. Includes the following:
	19B800560P2	RF Cable.
	19A705512P3	Connector, RF SMB Series: sim to AMP 228213 - 1.
	19A115938P1	Connector, coaxial: (BNC Series); sim to Amphenol 31 - 318.
W4	19B801695G11	Power Cable. Includes the following:
	19B209268P115	Solderless terminal.
	19B209260P11	Solderless terminal.
	19A115959P2	Wire, stranded.
	19A701503P2	Cable: battery, red.
	19A701503P10	Cable: battery, black.
	19B209268P116	Solderless terminal.
W10	19B801695G3	Power Cable: W12 - R.
W11	19B801695G4	Power Cable: W12 - BK.
W13	19B801739P1	Power Control cable.
		---------- MISCELLANEOUS ----------
2	19D902420P6	Heat sink assembly.
5	19A702381P510	Screw, thread forming: TORX DRIVE No. M3.5 - 0.6 x 10.
6	7139898P3	Nut, hex, brass: No. 1/4 - 28.
11	19A702364P310	Machine screw, TORX Drive: No. M3 - 0.5 x 10.
15	7147306P2	Insulator.
16	19A700136P7	Insulated sleeving.
21	19A701863P27	Clip, loop.
22	19A701312P5	Flatwasher: M3.5.
28	19A702364P316	Machine screw: Pan Head, Steel.
29	19A700034P4	Nut, hex: No. M3 x 0.5 MM.
30	19A700033P5	Lock washer, external tooth: No. 3.
35	19A705469P1	Insulator Plate, TO - 220.
36	19A700068P1	Insulator, bushing.
37	19A134455P3	Flatwasher.
38	19B801659G3	Cover (see separate parts list below).
41	19A700033P6	Lock washer, external tooth, M3.5.
45	N405P5B6	Lock washer.
46	19A701312P4	Flatwasher: 3.2 ID.
50	19A702381P408	Tap screw, TORX Drive, M3 - 0.5 x 8.
51	19A705106P1	Resistor Spacer.

SYMBOL	PART NO.	DESCRIPTION
		COVER 19B801659G3
2	19D902421P1	Power Amplifier Cover.
4	19A702381P522	Screw, thread forming:
5	19A701365P4	Washer.
11	19A149969P3	Shield.
13	5493477P9	Axial fan.
14	5493477P10	Grille.
15	N80P13028B6	Machine screw.
16	N210P21B6	Machine nut.
17	19A701312P5	Flatwasher: M3.5.
18	19A701863P10	Clip, loop.
20	19A702364P410	Machine screw.
21	19A700041P28	Shell.
22	19A700041P26	Contact: sim to Molex 08 - 50 - 0113.
24	N405P37B6	Lock washer.
25	L401P23B6	Split washer.

PRODUCTION CHANGES

Changes in the equipment to improve or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - POWER AMPLIFIER 19D902797G1

To improve reliability. Replace C131, C132, C135 & C136 with 19A700006P37. Printed circuit board also changed.

REV. B - POWER AMPLIFIER 19D902797G1

To meet ETSI specs for adjacent channel transient power. Changed R224 from 10K ohms (19B800607P103) to 22K ohms (19B800607P223). Added D211 (19A700025P6) between Q201-C (cathode) and Q201-E (anode).

REV. A - POWER AMPLIFIER MODULE, 19D902797G1
REV. A - POWER AMPLIFIER BOARD 19D902794G1

To improve reliability.

Changed capacitors C131, C132, & C136.

REV. B - POWER AMPLIFIER BOARD 19D902794G1

To meet ETSI specs for adjacent channel transient power.

Changed resistor R224. Resistor R224 was 19B800607P103, 10k ohms.

Added Zener diode D211 between transistor Q201-C (cathode) and Q201-E (anode).

REV. B - POWER AMPLIFIER MODULE 19D902797G1
REV. C - POWER AMPLIFIER BOARD 19D902794G1

To replace transistor Q101, no longer manufactured by vendor and to improve final PA stability.

Added capacitors C118 and C301-C304.

Added ferrite beads L301-L304.

Deleted resistors R104 and R106. Resistors R104 and R106 were 19B800607P331, 330 ohms.

Changed capacitor C114. Capacitor C114 was 19A705108P19, 18pF.

Changed capacitors C132 and C135. Capacitors C132 and C135 were 19A700006P37, 130pF.

Changed capacitor C141. Capacitor C141 was 19A705108P120, 1000pF.

Changed inductor L106. Inductor L106 was 19A701418P1.

Changed inductors L119 and L120. Inductors L119 and L120 were 19A129569P1.

Changed resistors R105 and R214. Resistor R105 was 19B800607P100, 10 ohms. Resistor 214 was 19B800607P103, 10k ohms.

Moved diodes D203, D205, D206, D209 and D210.

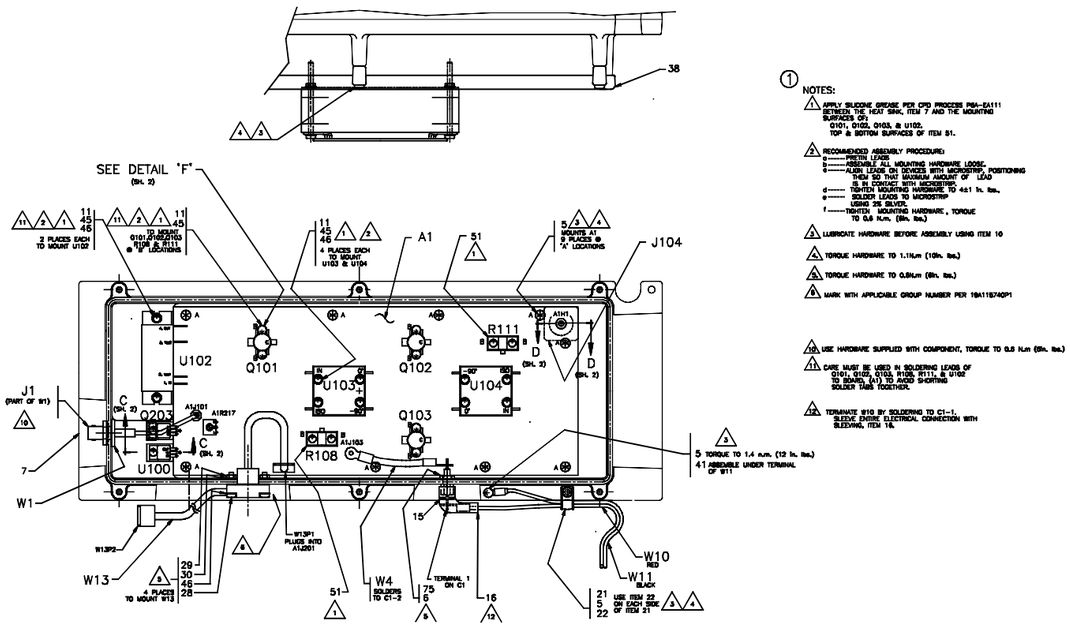
Moved connectors J101, J103 and J201.

Changed Printed Wire Board (PWB) from 19D902793P1R5 to 19D902793P1R6.

LOW PASS FILTER MODULE
19D902856G1
ISSUE 1

SYMBOL	PART NO.	DESCRIPTION
		---------- JACKS ----------
J1 and J2	7777145P5	Receptacle: sim to Amphenol 82 - 97.
		---------- MISCELLANEOUS ----------
2	19D903063P1	Casting.
3	19D903064P1	Casting.
4	19D902853G1	High Band Filter Board. See separate parts list.
5	19A702381P513	Screw, thread forming: TORX, No. M3.5 - 0.6 x 13.
6	19A702364P210	Machine screw, metric: M2.5 - .45 x 10.
7	19A134455P3	Flatwasher.
8	19A700032P3	Lockwasher, tooth, steel, metric: 2.5.
10	19B235310P1	Nameplate.
		HIGH BAND FILTER BOARD 19D902853G1
		---------- CAPACITORS ----------
C301	19A116679P6R2D	6.2 pF.
C302	19A116679P24G	24 pF.
C303	19A116795P33G	33 pF.
C304	19A116679P3R9D	3.9 pF.
C305	19A116679P68J	68 pF.
		---------- INDUCTORS ----------
L301	19A129569P1	Coil.
L302	19A701418P1	Coil.
L303	19A129569P1	Coil.
L304	19A701420P5	Coil.
L305	19A129569P1	Coil.
L306	19A701418P1	Coil.

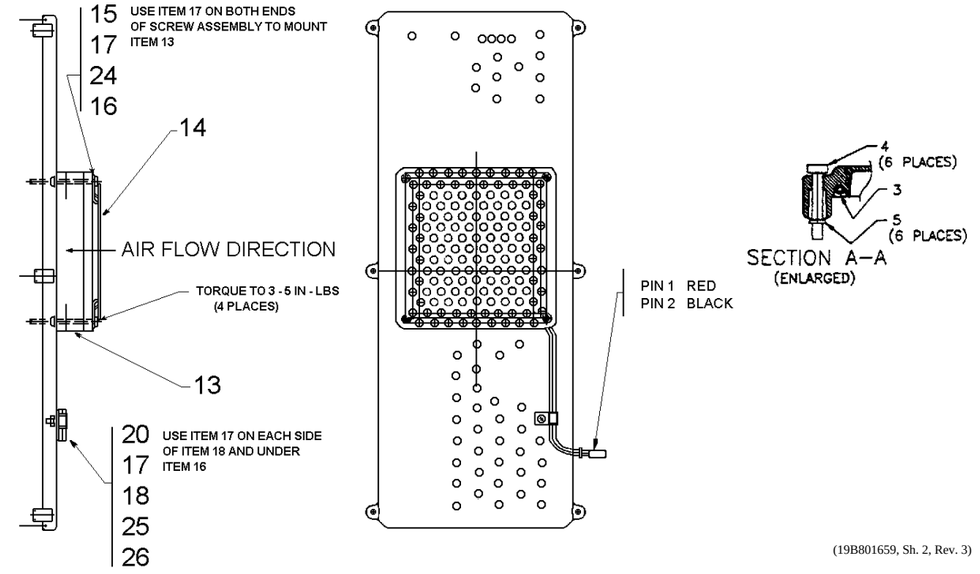
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



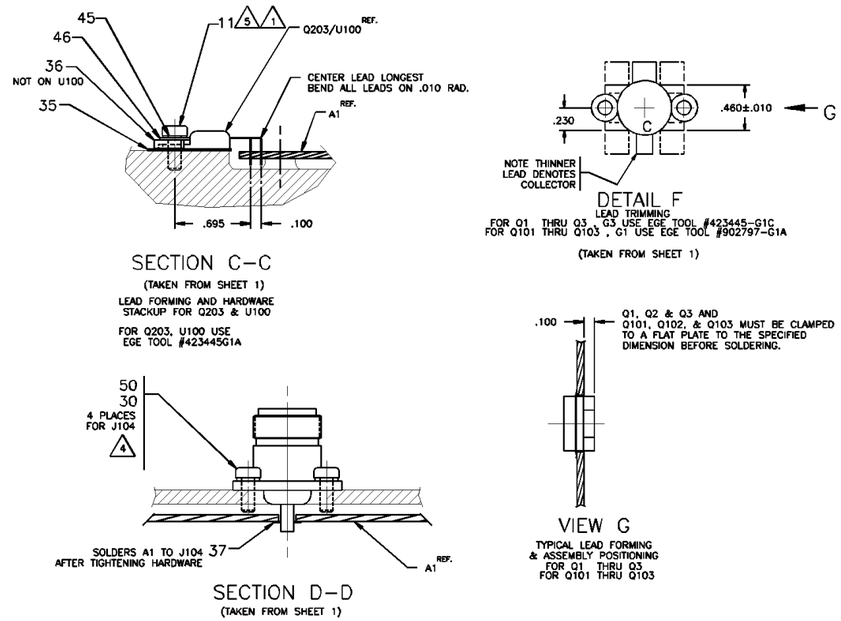
① NOTES:

1. APPLY SILICONE GREASE PER CPD PROCESS P9A-EA111 BETWEEN THE HEAT SINK, ITEM 7 AND THE MOUNTING SURFACES OF: Q101, Q102, Q103, & U102. TOP & BOTTOM SURFACES OF ITEM 51.
2. RECOMMENDED ASSEMBLY PROCEDURE:
   - a ——— PRETIN LEADS.
   - b ——— ASSEMBLE ALL MOUNTING HARDWARE LOOSE.
   - c ——— ALIGN LEADS ON DEVICES WITH MICROSTRIP POSITIONING THEM SO THAT MAXIMUM AMOUNT OF LEAD LENGTH IS IN CONTACT WITH MICROSTRIP.
   - d ——— TIGHTEN MOUNTING HARDWARE TO 4±1 in. lbs.
   - e ——— SOLDER LEADS TO MICROSTRIP USING 3% SILVER.
   - f ——— TIGHTEN MOUNTING HARDWARE, TORQUE TO 0.6 N.m. (5in. lbs.)
3. LUBRICATE HARDWARE BEFORE ASSEMBLY USING ITEM 10
4. TORQUE HARDWARE TO 1.1N.m (10in. lbs.)
5. TORQUE HARDWARE TO 0.5N.m (5in. lbs.)
6. MARK WITH APPLICABLE GROUP NUMBER PER 19A11B740P1
10. USE HARDWARE SUPPLIED WITH COMPONENT, TORQUE TO 0.5 N.m (5in. lbs.)
11. CARE MUST BE USED IN SOLDERING LEADS OF Q101, Q102, Q103, R108, R111, & U102 TO BOARD, (A1) TO AVOID SHORTING SOLDER TABS TOGETHER.
12. TERMINATE E10 BY SOLDERING TO C1-1. SLEEVE ENSURE ELECTRICAL CONNECTION WITH SLEEVING, ITEM 16.

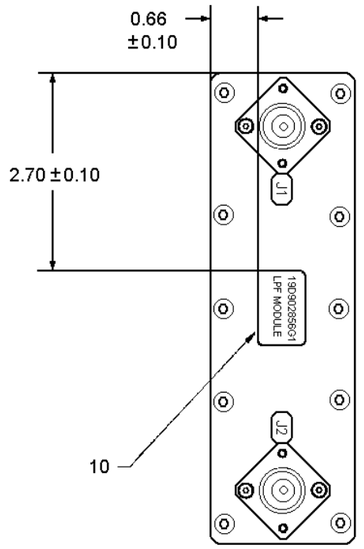
POWER AMPLIFIER ASSEMBLY
19D902797G1
(19D902797, Sh. 1, Rev. 14)

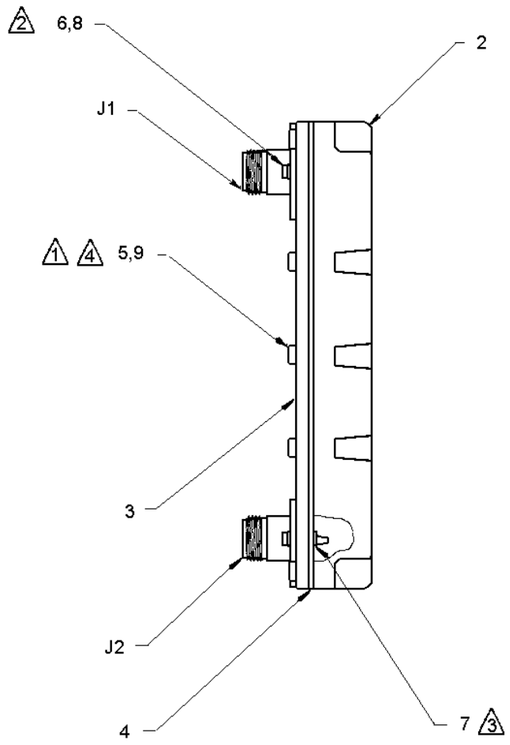


(19B801659, Sh. 2, Rev. 3)



POWER AMPLIFIER ASSEMBLY
19D902797G1
(19D902797, Sh. 2, Rev. 14)

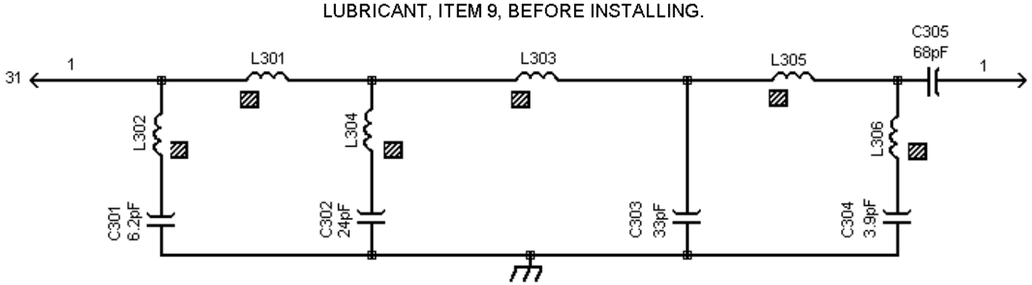




1

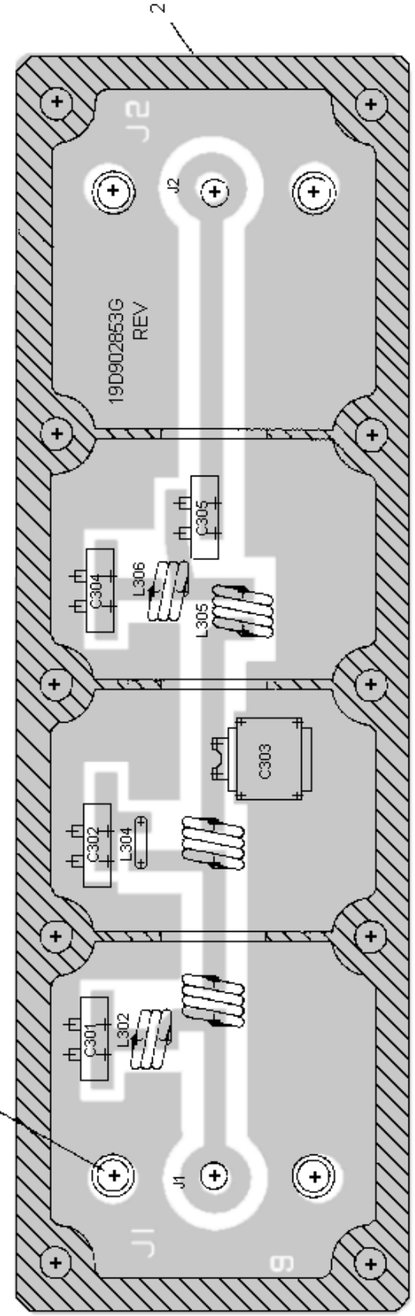
NOTES:

1. TORQUE SCREW, ITEM 5, TO 15.5 1.3 IN - LB.
2. TORQUE SCREW, ITEM 7, TO 7 IN - LBS.
3. SOLDER CONNECTORS J1 AND J2 AND ITEM 7 TO ITEM 4.
4. COAT THREADS OF SCREW, ITEM 5, WITH LUBRICANT, ITEM 9, BEFORE INSTALLING.



LOW PASS FILTER MODULE
19D902856G1

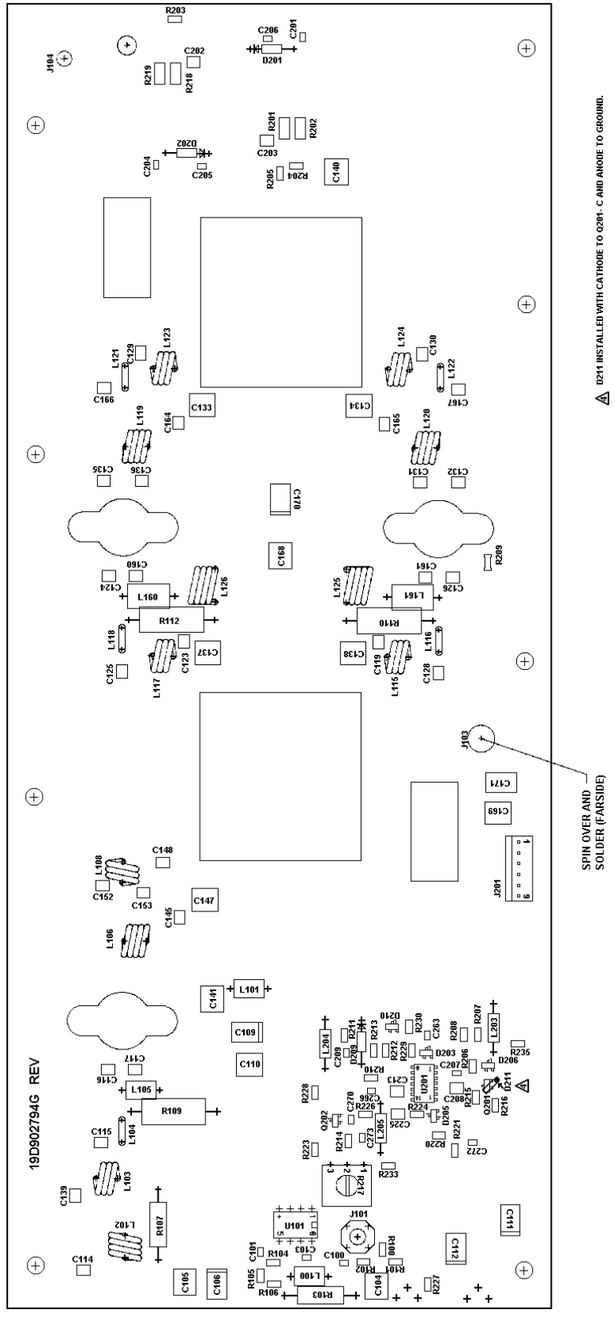
(19D902856 Sh. 1, Rev. 1)



CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

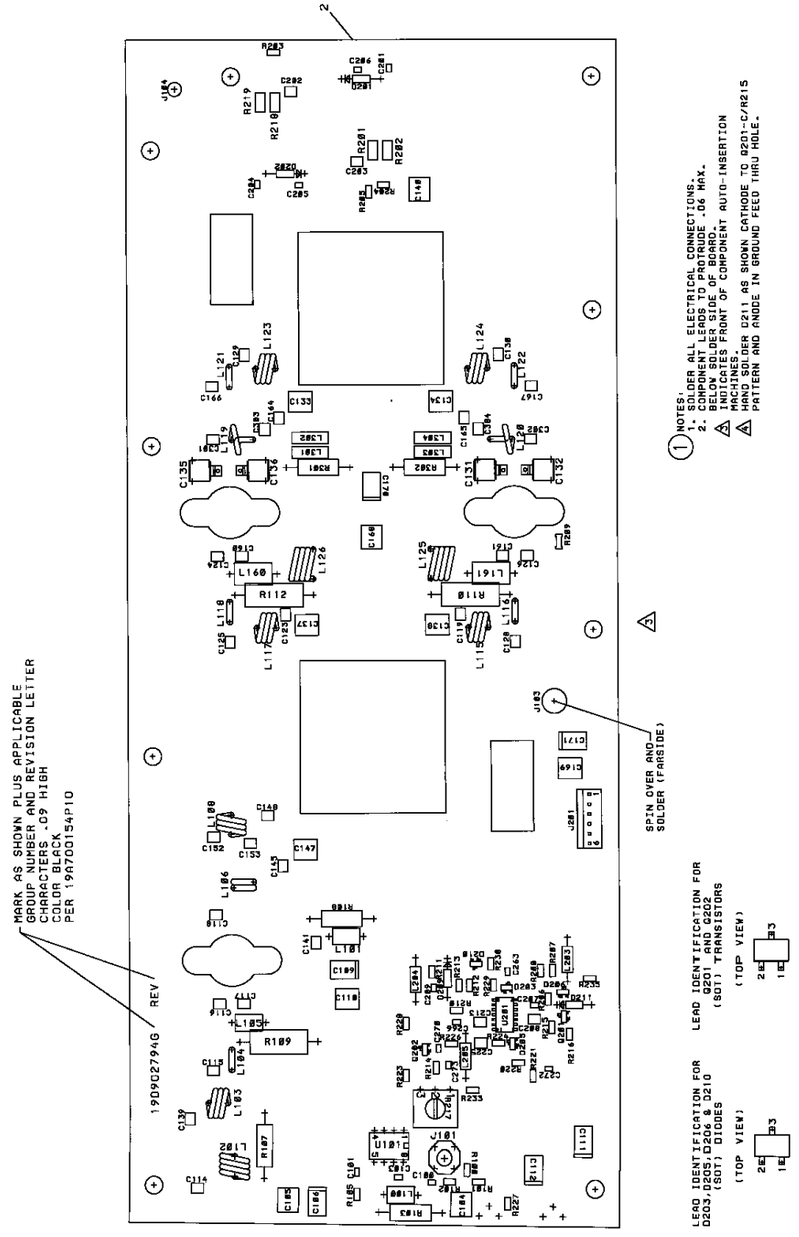
LOW PASS FILTER MODULE
19D902856G1

(19D902853, Sh.1, Rev. 2)
(19D902854, Comp. Side, Rev. 9A)



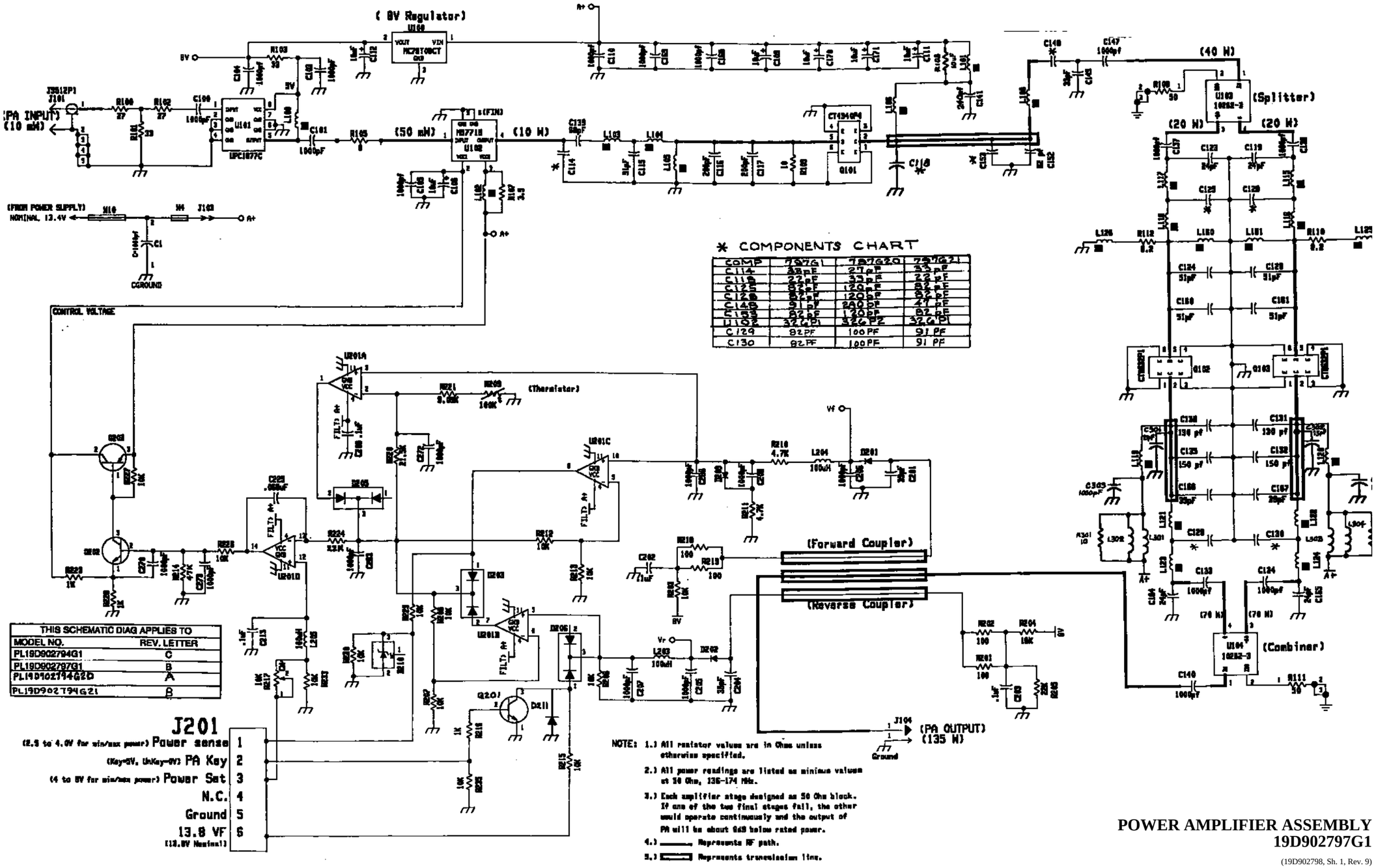
POWER AMPLIFIER BOARD A1
19D902794G1 REV. B AND EARLIER

(19D902794, Sh 1, Rev 15)



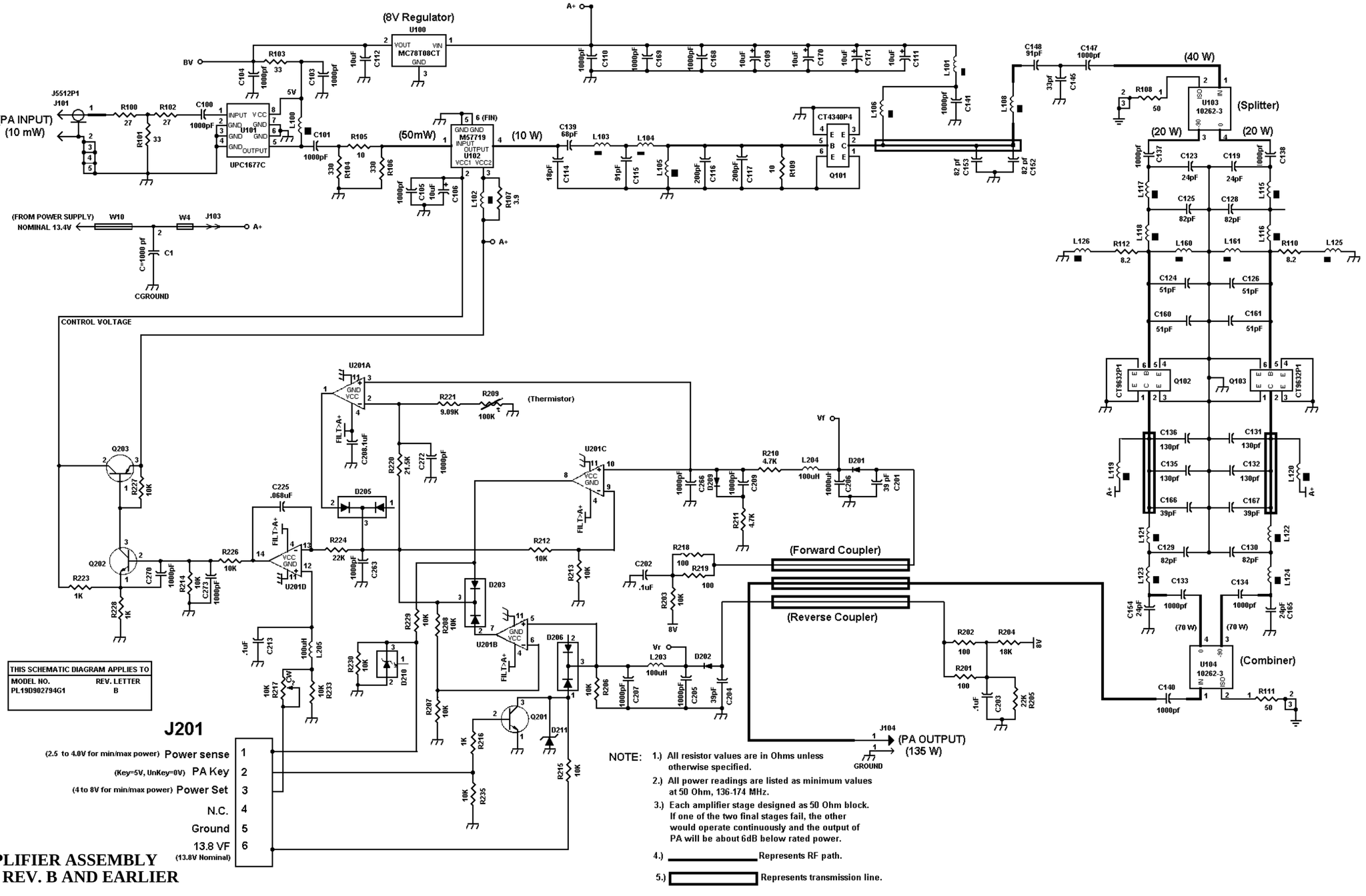
POWER AMPLIFIER BOARD A1
19D902794G1 REV. C AND LATER

(19D902794, Sh.1, Rev. 18)

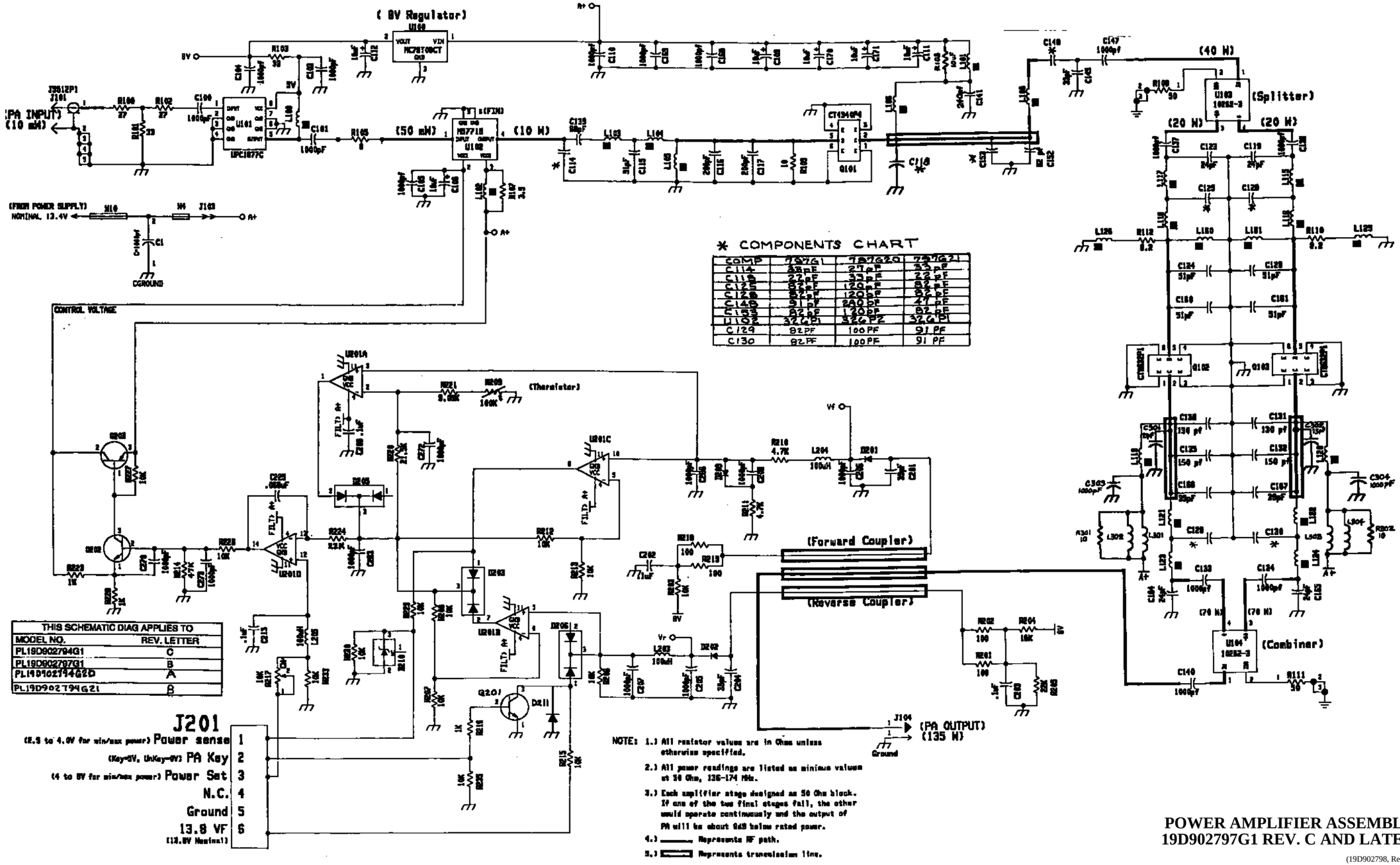


POWER AMPLIFIER ASSEMBLY
19D902797G1

(19D902798, Sh. 1, Rev. 9)



POWER AMPLIFIER ASSEMBLY
19D902797G1 REV. B AND EARLIER
(19D902798, Rev. 4)



POWER AMPLIFIER ASSEMBLY
19D902797G1 REV. C AND LATER

(19D902798, Rev. 9)