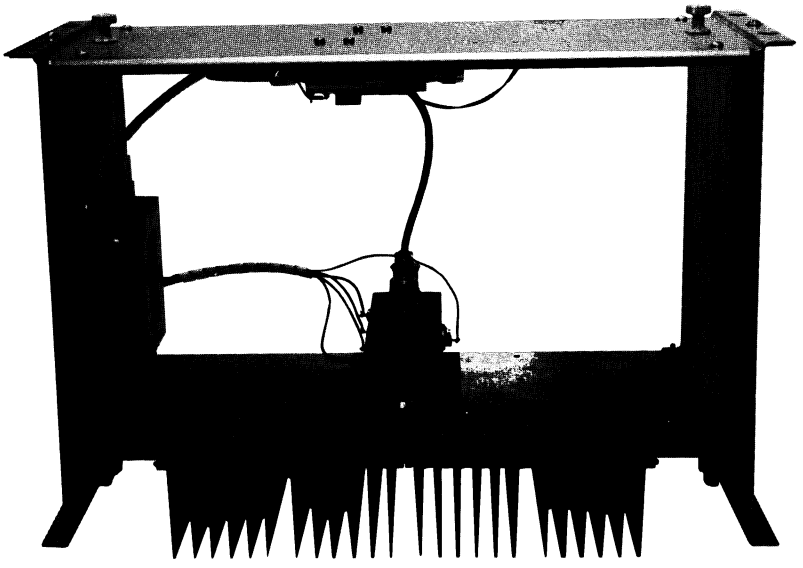
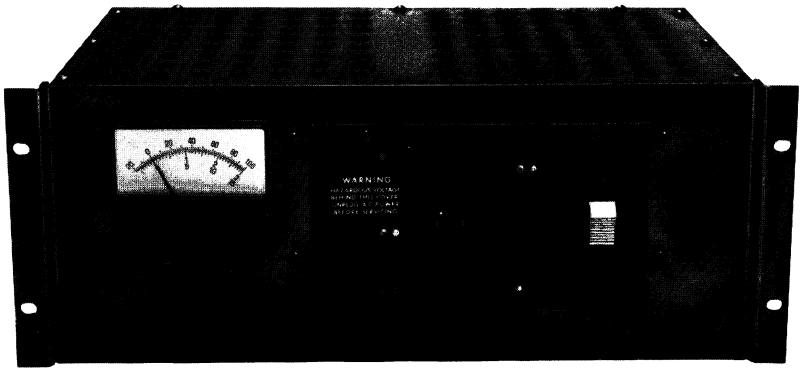
LBI30445A
(DF3174)

INSTRUCTIONS
FOR
GENERAL ELECTRIC
851—870 MHz POWER AMPLIFIER 19C307185P1
AND POWER SUPPLY 19C307186P1





MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

Printed in U.S.A.

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WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

SPECIFICATIONS

POWER AMPLIFIER 19C307185P1

Frequency	851-870 MHz
RF Power Output	90 Watts
RF Power Input	8 Watts
Cathode Current	430 milliamps*
Cathode Current (No drive)	15 milliamps*
Gain	11 dB*
Efficiency	44%*
Load Impedance	50 ohms

*Typical values

POWER SUPPLY 19C307186P1

AC Power Input	121/242 V ±20%, 60 Hz only Standby: 65 Watts Transmit: 475 Watts
Power Output	525 V DC @ 500 mA for PA plate 10.5 V AC @ 1.75A for Filament 140 V DC for Antenna Relay 8 V DC for Cathode Bias
Dimensions (H X W X D)	7" x 19" x 9-1/4"
Weight	65 lbs.

DESCRIPTION

POWER AMPLIFIER 19C307185P1

The 19C307185P1 is a microwave power amplifier module for operation in the 851-870 MHz frequency band by adjusting the RF input drive level the output power can be set from 30 to 90 Watts.

The power amplifier assembly consists of a cavity assembly containing a ceramic planar triode tube, a dual directional coupler and a low pass filter. Provisions for mounting an optional antenna relay have also been incorporated. The cavity assembly is mounted to a heat sink assembly for conduction of heat from the PA tube. Conduction and convection cooling are employed. The station power amplifier is designed to mount in a standard 19-inch relay rack.

WARNING

Beryllium oxide, a toxic substance is utilized within the PA CAVITY ASSEMBLY. Disassembly of the cavity or removal of the PA tube from the cavity should not be attempted. If the ceramic within the cavity assembly is crushed, broken or abraded, the dust may be hazardous if inhaled.

POWER SUPPLY 19C307186P1

The 19C307186P1 power supply provides all the necessary voltages to operate the RF Power Amplifier. The power supply is normally connected for 121 VAC operation but can be operated from a 242 VAC source with jumper changes located on the back of the front panel. The input voltage is stepped down to 10.5 Volts by a ferroresonant transformer which provides ±3% line regulation for a ±20% primary change. This 10.5 Volts is the filament supply for the RF Power Amplifier. The input voltage is also stepped up to 425 VAC by the plate transformer to provide the plate supply voltage for the RF Power Amplifier.

All important functions of the power amplifier can be monitored on the front panel meter. By selecting the desired switch position, the following functions can be monitored.

- Ep (use 0-100 scale as 0-1000 volts). This scale provides a measure of the plate voltage supplied to the tube in the power amplifier. It should be about 500 volts when loaded.
- Ik (use 0-100 scale as 0-1000mA). This scale provides a measure of the cathode current of the tube in the power amplifier. At maximum power output (100 watts) the cathode current should be about 500 mA. It should never exceed 700 mA under any condition.
- Ef (use 0-15 scale as 0-15 volts). This scale provides a measure of the filament voltage supplied to the tube in the power amplifier. It should read 10.5 volts.
- RF IN (use 0-15 scale as 0-15 watts). This scale provides a relative measure of the continuous power input to the power amplifier. Maximum power output (100 watts) requires a power input of about 10 watts and should never exceed 15 watts under any condition.
- RF OUT (use 0-15 scale as 0-150 watts). This scale provides a relative measure of the continuous power output. The amplifier should not be operated at a power level greater than 90 watts continuous. The heat sinking provided is sufficient for 90 watt operation at an ambient temperature up to 60°C.
- RF REFL. (use 0-15 scale as 0-15 watts). This scale provides a relative measure of the output power which is reflected from the load. This reading will be lowest when the load is properly matched to the amplifier.

OPERATION

To operate the C-2142, turn on the main AC switch and allow a one minute warmup. The green pilot light should come on immediately. With the keyed-ON switch OFF, check these readings on the front panel meter.

RF drive should be 0.
RF output should be 0.
Plate voltage should be approximately 600V.
Cathode current should be between 0-25 mA.
Filament voltage should be 10.5 volts ±0.2 Volts.

If all readings check, the push-to-talk switch can now be operated. With this switch in the ON position, RF drive is supplied to the power amplifier and full rated power output should be obtained. Check the readings on the front panel meter for RF drive, RF output, and cathode current. If these readings are in order the unit is ready for operation.

RF drive for the power amplifier can be varied by adjusting the power control potentiometer in the drive amplifier. This control is accessed from the front and is located at the back of the radio housing, with the door down and the Driver cover removed.

CIRCUIT ANALYSIS

POWER AMPLIFIER (Reference Drawing CA01145T)

The power amplifier utilizes a ceramic planar triode operating in the grounded-grid configuration. The tube is mounted as an integral part of the cavity assembly. Input tuning and output tuning and output coupling adjustments are provided. This amplifier operates as a linear amplifier, providing approximately 10 to 11 dB of gain while delivering up to 90 watts of RF output. Varying the amount of drive allows setting the power amplifier output to any value between 30 and 90 watts.

Excitation to the power amplifier is applied to the cavity input jack and then coupled through C-8 to the cathode of the ceramic planar triode tube (Y1763-3). A piston trimmer capacitor resonates the input circuit to match 50 ohms. The DC return lead of the cathode is held at approximately 6.2V above ground by means of a zener diode. Since the tube operates in a grounded-grid configuration and the grid is physically grounded to the cavity, this 6.2 volts serves as the protective bias when no drive is applied.

The plate circuit of the amplifier is a foreshortened 1/2 wave coaxial line. The plate of the tube is connected to one end of the line and a variable capacitor is located between the cavity and the other end of the line. RF energy is coupled from the cavity near the low impedance section of the plate line by means of an adjustable link. Heat is coupled from the plate of the tube and the plate line by means of a beryllia block mounted between the plate line and the cavity wall. The cavity is then mounted to a heat sink in order to dissipate the heat to the cabinet air by means of conduction and convection.

This amplifier operates with a plate potential of approximately 500 volts. The DC characteristics of the tube are such that the amplifier can be safely operated with the DC plate voltage applied continuously. Removal of RF drive causes the plate current to drop to only a few milliamps.

All DC leads into the cavity are filtered to prevent spurious radiation of RF.

A directional coupler is provided on the amplifier output to facilitate field adjustment of the PA controls. A low pass filter is provided for suppression of all harmonics in the transmitter output.

POWER SUPPLY

Supply and Control Circuits (Figure 1)

The high side of the 121 VAC input to the power supply is connected to TB1 terminal 1 and the neutral side is connected to TB1 terminal 3. The safety ground wire is connected to TB1 terminal 2.

Switch (SW1) is the main power on-off switch with fuse (f1, 8 amp.) in series with the line. Fuse (f2, 5 amp.) is in series with the plate transformer (T1).

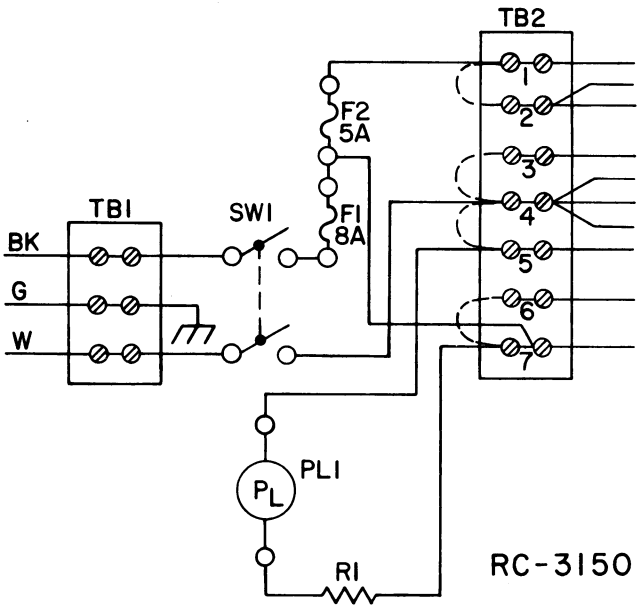


Figure 1 - Supply and Control Circuits

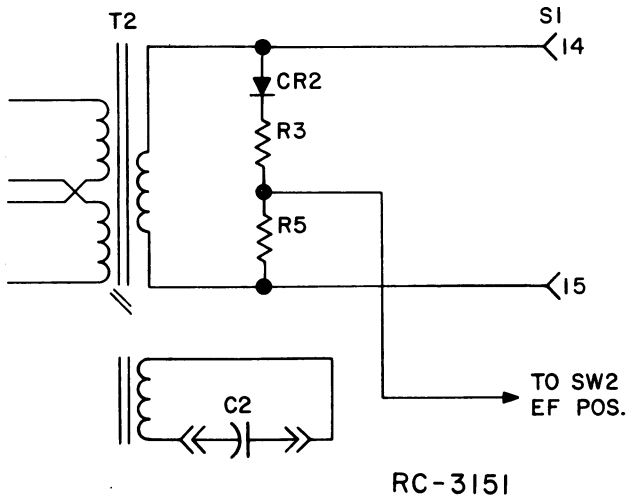


Figure 2 - Filament Supply

Filament Supply (Figure 2)

The filament power circuit supplies a regulated (±3%) 10.5 VAC to the C-2142 power amplifier tube. With switch (SW1) in the ON position, power is applied to the

primary of the ferroresonant filament voltage transformer (T2).

A rectified (CR2), and voltage divider comprising R3 and R5, provides a DC voltage which is connected to the Ef position of the metering switch (SW2) for the purpose of monitoring the filament voltage.

Plate Supply Voltage (Figure 3)

The high voltage supply provides 525 VDC for the PA tube plate circuit. The full-wave bridge rectifier circuit consists of four silicon rectifiers (CR3, 4, 5, 6). The bridge circuit is connected across the secondary of power transformer (T1). Provision is made for providing a lower plate voltage (275 VDC) by connecting the bridge rectifier to a tap on the secondary transformer (T1).

The rectifier output is filtered by capacitor (C3), choke (CH1), and capacitor (C4). Resistor (R8) is a bleeder across the high voltage supply and in conjunction with (R7) forms a voltage divider providing a voltage which is connected to the Ep metering position of switch (SW2). The plate voltage is on when main power switch (SW1) is in the ON position. Plate power can be disabled by removing fuse (F2).

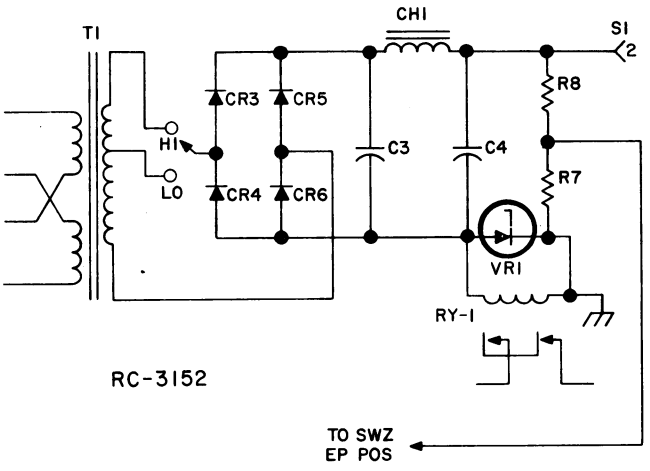


Figure 3 - Plate Supply Voltage

Antenna Relay Circuit (Figure 4)

140 VDC is derived from the 121 VAC across one of the primary windings of transformer (T1). A silicon rectifier (CR1) is used as a halfwave rectifier to supply the 140 VDC which is filtered by capacitor (C1). This voltage is connected via the normally open contacts of relay (RY1) and the interconnecting cable harness to the antenna relay which is located in the power amplifier unit. Relay (RY1) is operated by approximately 100 mA of cathode current of the power amplifier tube. Diode CR7 is a transient suppressor to protect the coil of the antenna relay.

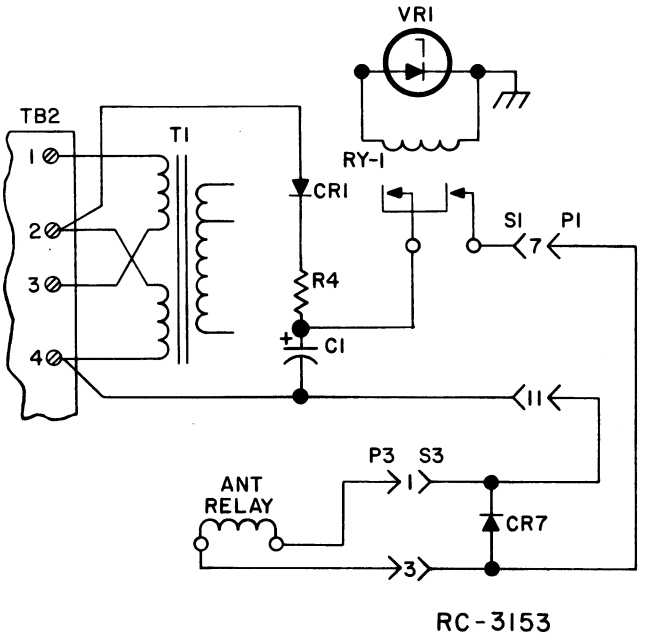


Figure 4 - Antenna Relay Circuit

Cathode Bias Circuit (Figure 5)

Cathode bias for the power amplifier tube is provided by zener diode (VR2) and the 3 ohm Ik monitor resistor (R6).

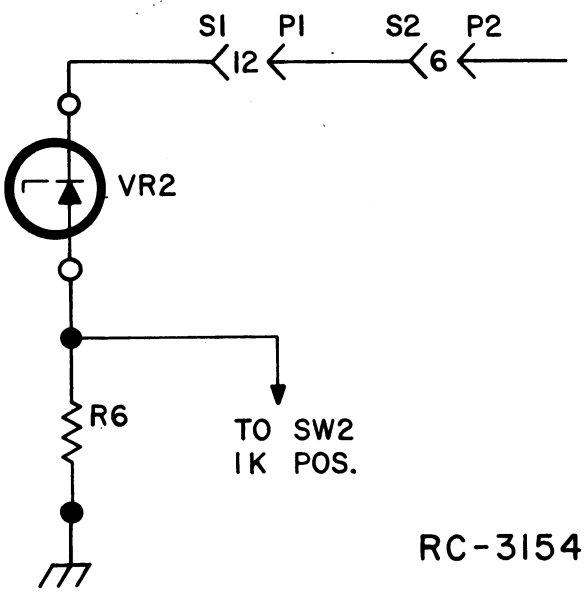


Figure 5 - Cathode Bias Circuit

Meter Circuit (Figure 6)

Metering of the power supply filament voltage (Ef), plate voltage (Ep), cathode current (Ik) as well as RF power input to the PA (RF IN), RF power output (RF OUT) and RF reflected power (RF REFL.) is accomplished through the use of a single meter and switching circuit (M1 and SW2). Referring to Figure 6, the filament voltage from transformer (T2), is connected to diode (CR1), and filter capacitor (C1) to convert the 10.5 VAC to DC for metering purposes. This DC voltage is divided down by R3 and R5 to obtain a value which will deflect meter (M1) to the 10.5 division of the 0-15 scale. It should be noted that the waveform of the secondary voltage of transformer (T2) is not sinusoidal and attempts to measure this voltage with VOM's and VTVMS which are not true R.M.S. reading instruments can give erroneous results.

The plate voltage measurement is accomplished by dividing the DC output of the filtered DC plate voltage by a voltage divider made up of R8 and R7. This divider is proportioned so that the 0-100 scale of M1 reads directly in plate voltage when multiplied by 10.

Cathode current is measured by means of a three ohm resistor in series with the cathode of tube in the power amplifier. Meter (M1) is a 3 volt DC voltmeter and the three ohm resistor will produce a three volt drop with 1000 mA current through it. Accordingly the meter is a 0-1000 mA current meter in the Ik position and is read on the 0-100 scale.

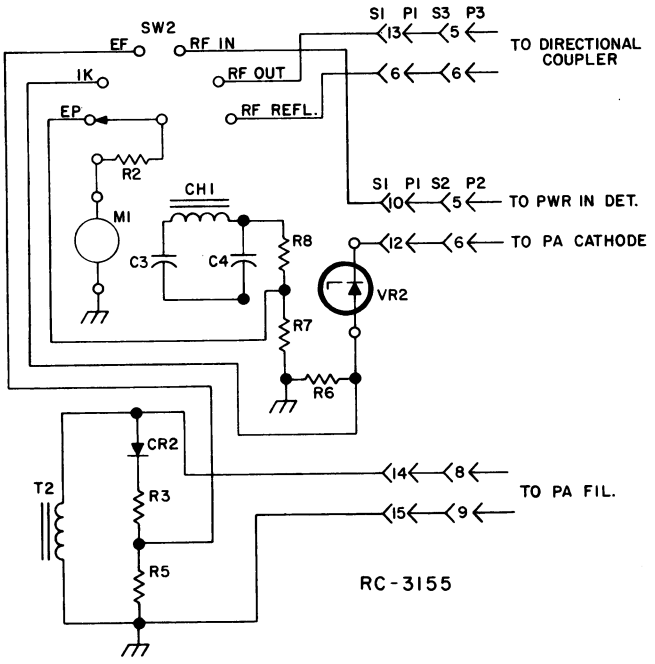


Figure 6 - Meter Circuit

Relative power input is indicated on the 0-15 scale of M1 and is a rough approximation of the actual input power in watts to the P.A.

Relative power output is indicated on the 0-15 scale.

Relative reflected power is also indicated on the 0-15 scale.

POWER SUPPLY MODIFICATIONS

The power supply is normally used on single phase 121 volt 60 Hz power sources. It may be modified for use on a 242 volt 60 Hz source by reconnecting the jumper on terminal board (TB2) as follows:

Remove the jumpers between terminals 1 & 2, 3 & 4, 4 & 5 and 6 & 7.

Replace jumpers between terminals 2 & 3 and 5 & 6.

Low power operation may be obtained by removing the red lead from the Hi terminal on A-102 and reconnecting it to the Lo terminal. This will give better plate effiency when operating at the 30 Watt level than is obtained by just reducing RF Drive.

ALIGNMENT

The following steps should be performed when initially tuning the Power Amplifier or when retuning for a new operating frequency.

1. Tune up exciter and driver into a dummy load.
2. Unkey transmitter, then connect driver to PA input.
3. Adjust power set control on driver for minimum output.
4. Connect PA output to dummy load.
5. Turn on PA power.
6. Key on transmitter.
7. Increase drive until 200 to 250 mA of PA cathode current flows.
8. Adjust cathode tuning for a maximum cathode current. Reduce drive if necessary to keep I_k in the 200 to 250 mA range.
9. Alternately adjust PA tuning and loading for a maximum indication of "forward power out".
10. Unkey transmitter and connect antenna or duplexer.

11. Key ON transmitter and adjust any tuning of load or duplexer that may be desired for a minimum of "reflected power output".

12. Repeat Step 9.

13. Increase drive to produce no more than 500 mA I_k.

14. If other than 90 watts output is required, calibrate "forward power output" reading against an in-line or terminating wattmeter,. then adjust drive to produce desired output power level.

MAINTENANCE

POWER AMPLIFIER

The C-2142 MCM is a microwave power amplifier module. It has been designed to provide smooth operation and long life.

The unit is guaranteed for 1000 hours of life in both keyed ON and push-to-talk modes of operation. Life is defined as a 1 dB degradation of output relative to the initial power output level for the tube. This is roughly a drop in power from 90 watts to 70 watts.

If for some reason the power amplifier fails to operate properly, the RF chassis can be pulled out for inspection. First remove the two screws in the front panel. The chassis should then slide out far enough for convenient maintenance.

A glowing red light inside the RF chassis means there is high voltage present. To remove this voltage take out the plate supply fuse located on the front panel, or turn off Power Switch on PA Power Supply.

Check to see if the MCM is plugged in to the power supply. A five wire cable with Molex plug connects the MCM to the power supply. Also check the RF cables and make good tight connections.

If the MCM still fails to operate satisfactorily, the entire unit should be replaced. No internal adjustment (such as tube replacement) can be made on the MCM. It is not field serviceable. If it becomes inoperable the entire unit should be replaced.

To replace the MCM, first make sure all voltages are turned off. The entire system should be unplugged if possible.

Follow these 3 steps to remove the MCM.

1. Unplug the five wire cable with Molex plug from the power supply.

2. Remove RF cables at the input and output ports of the MCM.

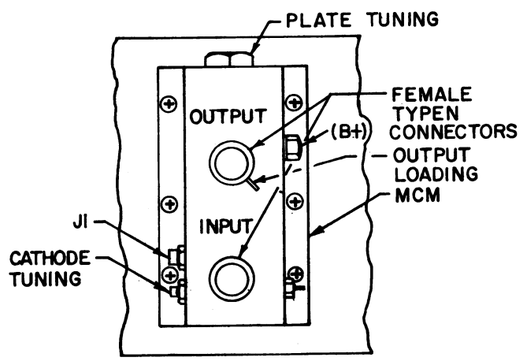
3. Remove the 6 mounting screws and take the MCM out.

When replacing a new MCM a thermal compound (such as Wakefield Engineering part no. 120-8, or Dow Corning 340) should be used to insure good thermal contact between the MCM and heat sink radiator. Smear a thin coat of the compound on the back of the MCM before mounting it to the back plate with the six screws. Replace the power supply cable and RF cables. A new unit must be properly aligned before it is ready for operation (see alignment instructions).

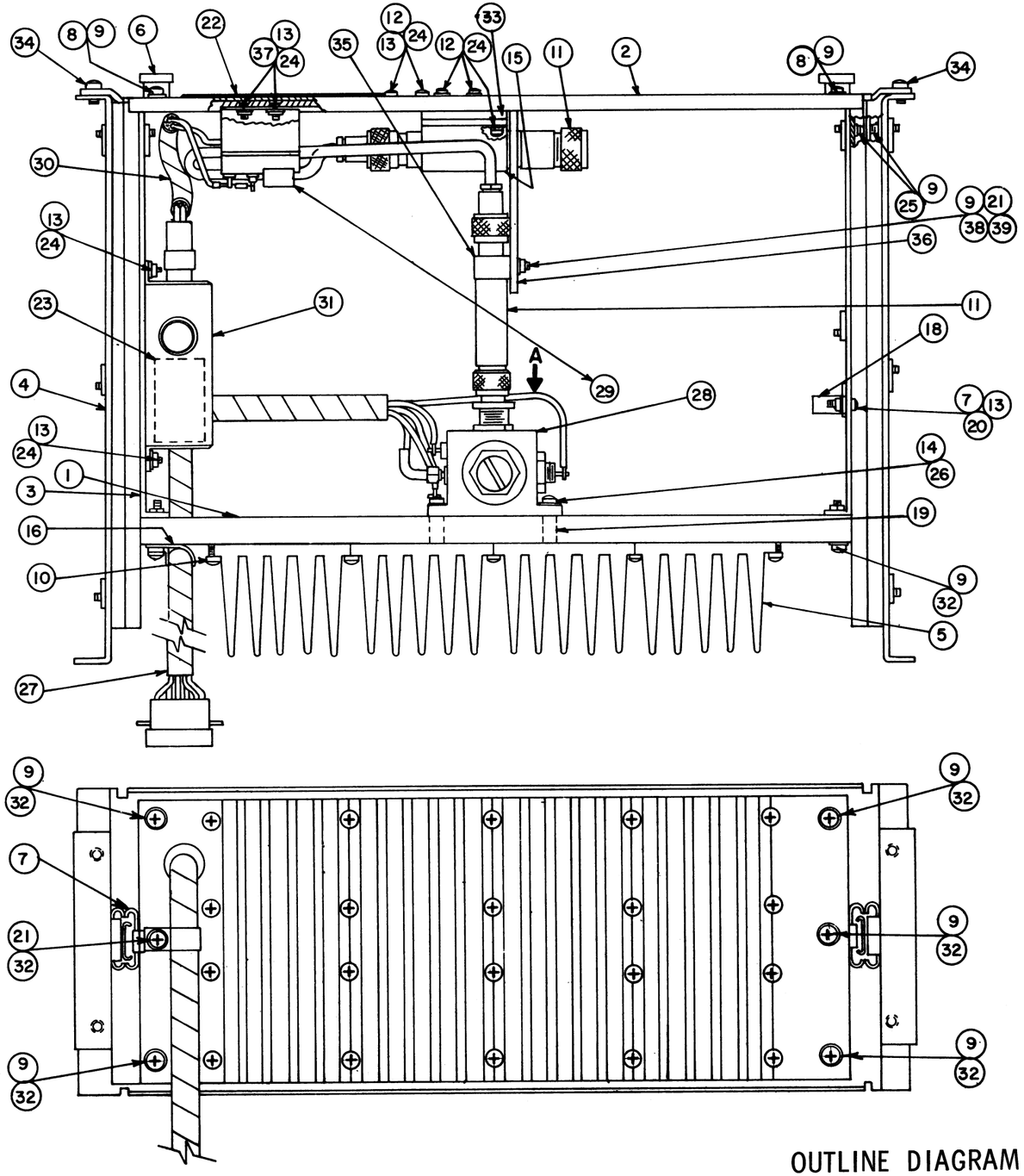
MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

NO	FUNCTIONAL NAME	DR OR MAT'L NO	Q/ASSLY
1	HEAT SINK (PLATE)	CP1193	1
2	FRONT PANEL	CP1195	1
3	SIDE RAIL	CP1196	2
4	SIDE SUPPORT	CP11000	2
5	HEAT SINK (FINNED)	CP11005	4
6	INSTRUMENTATION KNOB	CP50164	2
7	CHASIS SLIDE	CP75202	1 PR
8	8-32 X 3/8" PAN HD SCREW	CP75204	4
9	#8 INT STAR LOCKWASHER	CP75205	23
10	8-32 X 3/4" PAN HD SCREW	CP75206	20
11	FILTER	CP0503	2
12	6-32 X 3/8" PAN HD SCREW	CP75207	7
13	6-32 HEX NUT	CP75210	10
14	10-32 X 1/2" R.H.M.S.	CP75212	6
15	FILTER CLAMP	CP75213	1
16	ADJUSTABLE P-CLIP	CP75222	1
17	6-32 X 1/2" PAN HD SCREW	CP75225	2
18	ADJUSTABLE P-CLIP	CP75232	2
19	10-32 HELICAL 5/16"	CP75233	6
20	#6 FLAT WASHER	CP75270	2
21	#8 FLAT WASHER	CP75271	2
22	CAUTION LABEL (YELLOW)	CP0702	1
23	WARNING LABEL (RED)	CP0703	1
24	#6 INT STAR LOCKWASHER	CP7548	13
25	8-32 X 3/8" PAN HD SCREW (MAGNETIC)	CP75269	12
26	#10 INT STAR LOCKWASHER	CP7579	6
27	RF POWER SUPPLY CONN ASS'LY	CA0114RW	X
28	AMPLIFIER ASSEMBLY	CA0114CA	X
29	DIRECTIONAL COUPLER ASS'LY	CA0114DC	X
30	JUNCTION BOX CONN ASS'LY	CA0114SW	X
31	JUNCTION BOX ASSEMBLY	CA0114RG	X
32	8-32 X 1" PAN HD SCREW	CP75274	6
33	FILTER BASE PLATE	CP1174-B18H25B2	1
34	10-32 X 3/8" PAN HD SCREW	CP75275	2
35	CABLE CLAMP	CP50177	1
36	MOUNTING BRACKET	CP75276	1
37	6-32 X 3/8" FLAT HD SCREW	CP75286	2
38	8-32 X 1/2" PAN HD SCREW	CP75201	1
39	8-32 HEX NUT	CP75209	1



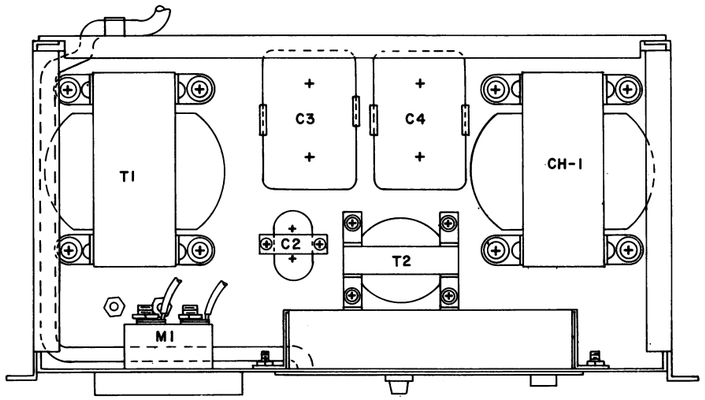
VIEW AT "A"

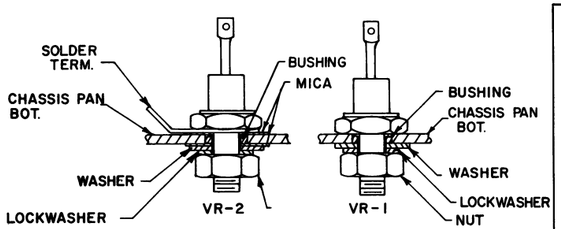


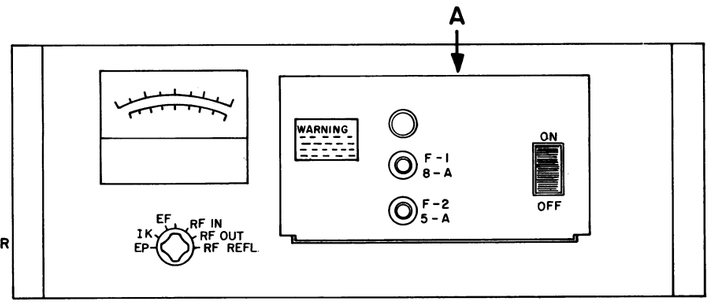
(CA0114RF, Rev. 1)

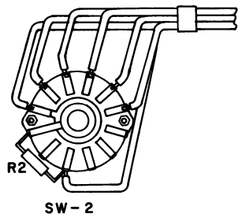
OUTLINE DIAGRAM

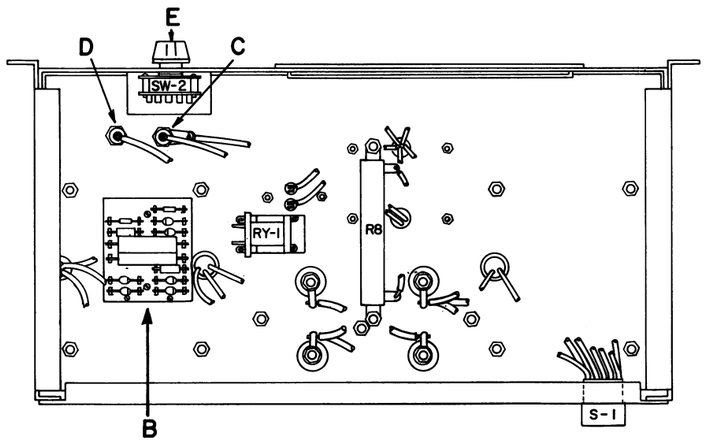
C2142 RF CHASSIS

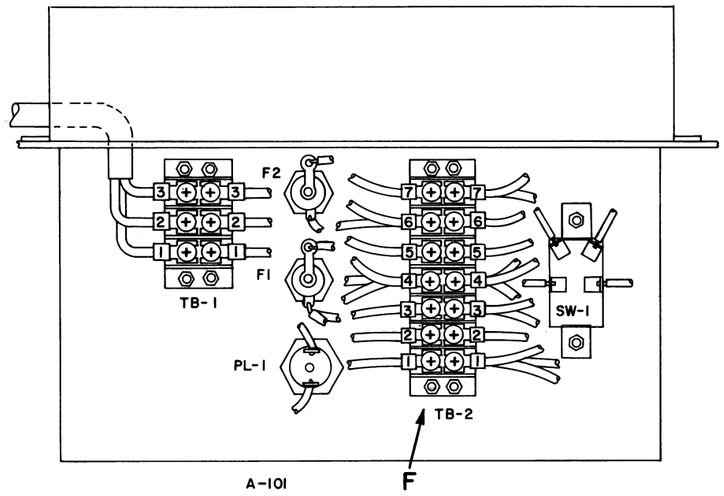


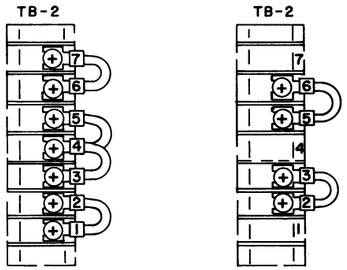


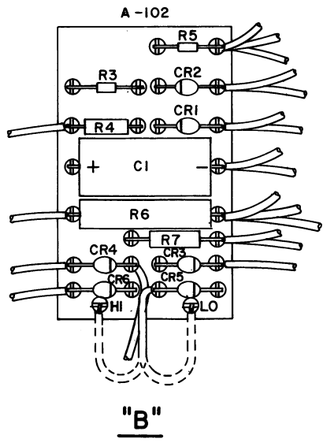








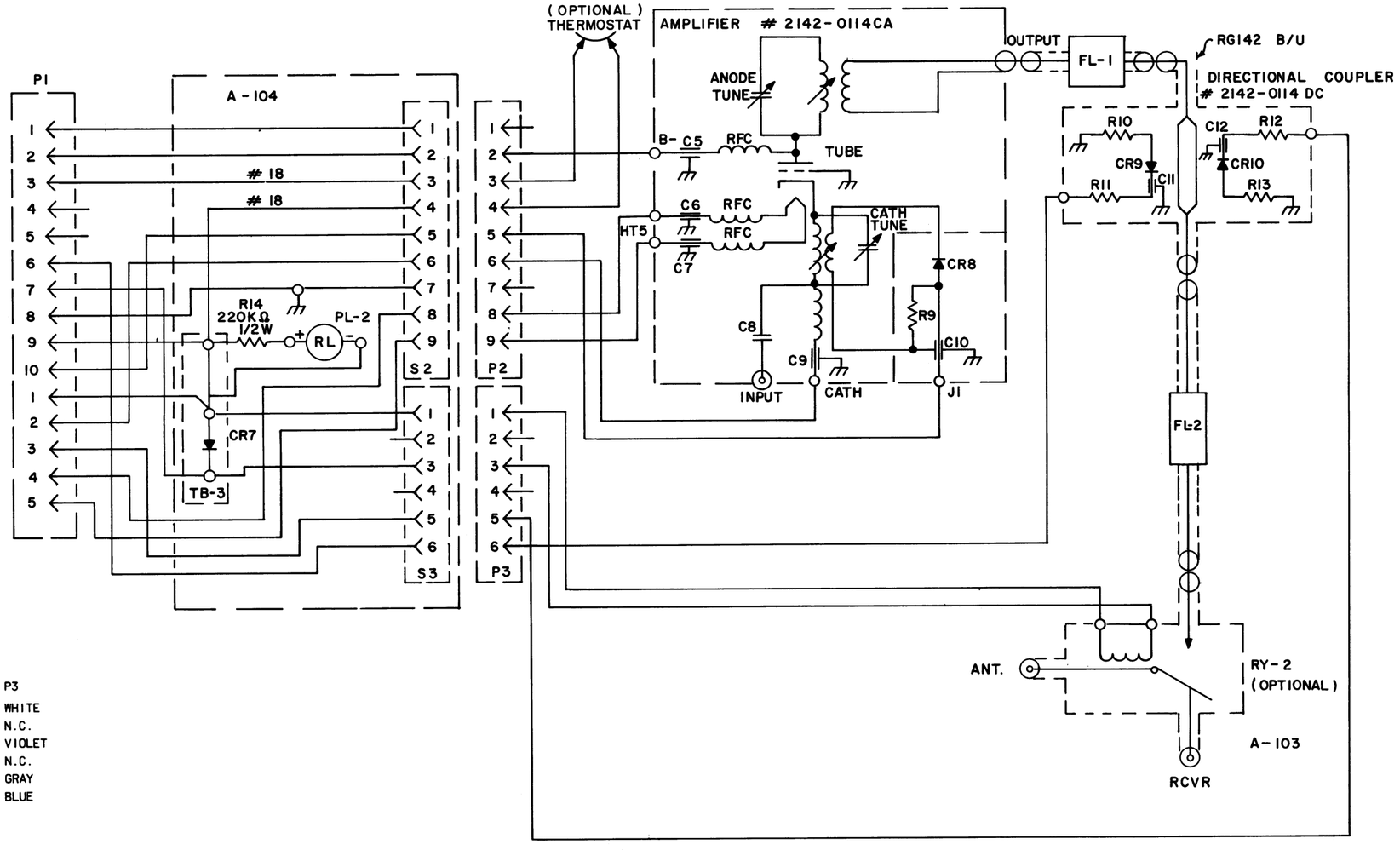




OUTLINE DIAGRAM

C2142 POWER SUPPLY CHASSIS

(CA0114PS, Rev. 1)



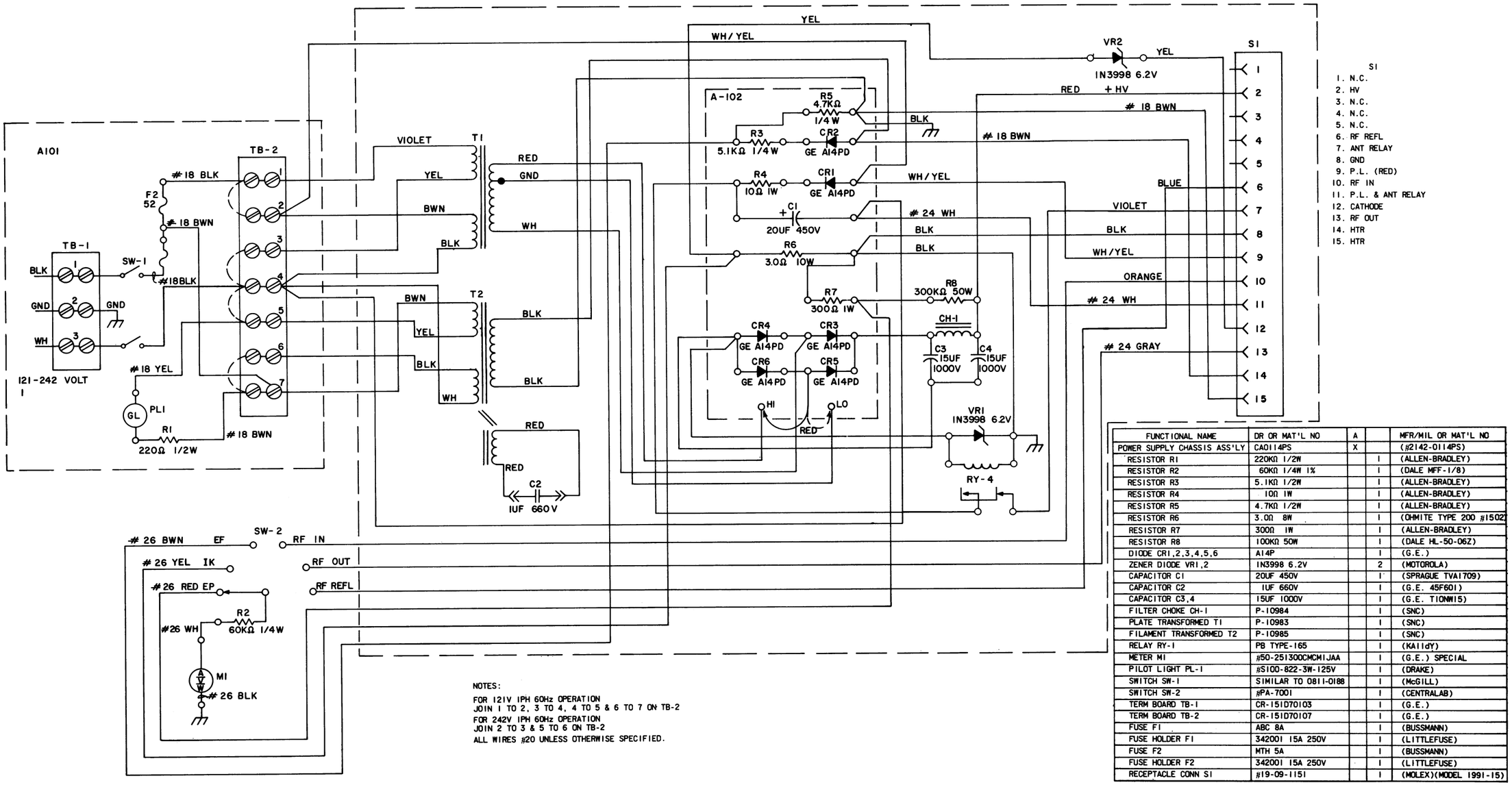
P1	S2	P2	S3	P3
1. N. C.	1. N.C.	1. N.C.	1. WHITE	1. WHITE
2. RED	2. RED	2. RED	2. N.C.	2. N.C.
3. WHITE	3. WHITE	3. N.C.	3. VIOLET	3. VIOLET
4. N.C.	4. WH/YEL	4. N.C.	4. N.C.	4. N.C.
5. N.C.	5. ORANGE	5. ORANGE	5. GRAY	5. GRAY
6. BLUE	6. YELLOW	6. YELLOW	6. BLUE	6. BLUE
7. VIOLET	7. N.C.	7. N.C.		
8. BLACK	8. BROWN	8. BROWN		
9. WH/YEL	9. BROWN	9. BROWN		
10. ORANGE				
11. WHITE				
12. YELLOW				
13. GRAY				
14. BROWN				
15. BROWN				

FL-1 & FL-2 = 900MHz LOW PASS FILTER

(CA0114ST, Sh. 2, Rev. 1)

SCHEMATIC DIAGRAM

C2142 RF CIRCUITRY



S1
1. N.C.
2. HV
3. N.C.
4. N.C.
5. N.C.
6. RF REFL
7. ANT RELAY
8. GND
9. P.L. (RED)
10. RF IN
11. P.L. & ANT RELAY
12. CATHODE
13. RF OUT
14. HTR
15. HTR

NOTES:

FOR 121V 1PH 60Hz OPERATION
JOIN 1 TO 2, 3 TO 4, 4 TO 5 & 6 TO 7 ON TB-2
FOR 242V 1PH 60Hz OPERATION
JOIN 2 TO 3 & 5 TO 6 ON TB-2
ALL WIRES #20 UNLESS OTHERWISE SPECIFIED.

FUNCTIONAL NAME	DR OR MAT'L NO	A		MFR/MIL OR MAT'L NO
POWER SUPPLY CHASSIS ASS'LY	CA0114PS	X		(#2142-0114PS)
RESISTOR R1	220KΩ 1/2W		1	(ALLEN-BRADLEY)
RESISTOR R2	60KΩ 1/4W 1%		1	(DALE MFF-1/8)
RESISTOR R3	5.1KΩ 1/2W		1	(ALLEN-BRADLEY)
RESISTOR R4	10Ω 1W		1	(ALLEN-BRADLEY)
RESISTOR R5	4.7KΩ 1/2W		1	(ALLEN-BRADLEY)
RESISTOR R6	3.0Ω 8W		1	(OHMITE TYPE 200 #1502)
RESISTOR R7	300Ω 1W		1	(ALLEN-BRADLEY)
RESISTOR R8	100KΩ 50W		1	(DALE HL-50-06Z)
DIODE CR1,2,3,4,5,6	A14P		1	(G.E.)
ZENER DIODE VR1,2	IN3998 6.2V		2	(MOTOROLA)
CAPACITOR C1	20UF 450V		1	(SPRAGUE TVA1709)
CAPACITOR C2	1UF 660V		1	(G.E. 45F601)
CAPACITOR C3,4	15UF 1000V		1	(G.E. TIONW15)
FILTER CHOKE CH-1	P-10984		1	(SNC)
PLATE TRANSFORMED T1	P-10983		1	(SNC)
FILAMENT TRANSFORMED T2	P-10985		1	(SNC)
RELAY RY-1	PB TYPE-165		1	(KAIdY)
METER M1	#50-251300CMM1JAA		1	(G.E.) SPECIAL
PILOT LIGHT PL-1	#S100-822-3W-125V		1	(DRAKE)
SWITCH SW-1	SIMILAR TO 0811-0188		1	(McGILL)
SWITCH SW-2	#PA-7001		1	(CENTRALAB)
TERM BOARD TB-1	CR-151D70103		1	(G.E.)
TERM BOARD TB-2	CR-151D70107		1	(G.E.)
FUSE F1	ABC 8A		1	(BUSSMANN)
FUSE HOLDER F1	342001 15A 250V		1	(LITTLEFUSE)
FUSE F2	MTH 5A		1	(BUSSMANN)
FUSE HOLDER F2	342001 15A 250V		1	(LITTLEFUSE)
RECEPTACLE CONN S1	#19-09-1151		1	(MOLEX)(MODEL 1991-15)

SCHEMATIC DIAGRAM

(CA0114ST, Sh. 1, Rev. 1)

C2142 POWER SUPPLY CIRCUITRY