# SECTION V

## FAULT ISOLATION/MAINTENANCE AND REPAIR

## 5.1 GENERAL

This section provides the procedures for fault isolation and maintenance and repair to the Lowest Repairable Unit (LRU) level.

## 5.2 DISASSEMBLY

Disassembly should be only to the extent necessary to accomplish the repair or replacement of the defective LRU. Procedures for the disassembly of major modules and assemblies are given in the following paragraphs.

### 5.2.1 TOP OR BOTTOM TRANSCEIVER COVER REMOVAL

Refer to Figure 5.2.1.1.

a) Remove the three (3) screws at the rear of the cover.
b) Release cover latches.
c) Pull cover up and back from the front panel (1A1).

## 5.3 TEST SET-UP

### 5.3.1 PRELIMINARY

Connect RT-9000 and test equipment as shown in Figure 5.3.1.1.

WARNING: For personal safety and to prevent damage to voltage sensitive components in the Transceiver, always turn 'OFF' the RT-9000 whenever reseating printed circuit cards (PC), LRU's, and when replacing fuses.

## 5.4 BITE

### 5.4.1 PRELIMINARY

The BITE of the RT-9000 Transceiver provides immediate LRU faults. The Surveillance BITE is controlled by the microprocessor on CPU Assembly 1A2A1. It checks the operational status of the LRU's with the exception of the DC to DC Power Supply 1A5A1, AC Power Supply 1A5A2, and the Select/Distribution Reference Amplifier 1A2A6. These LRU's have self-surveillance BITE non-dependent upon CPU Assembly 1A2A1.

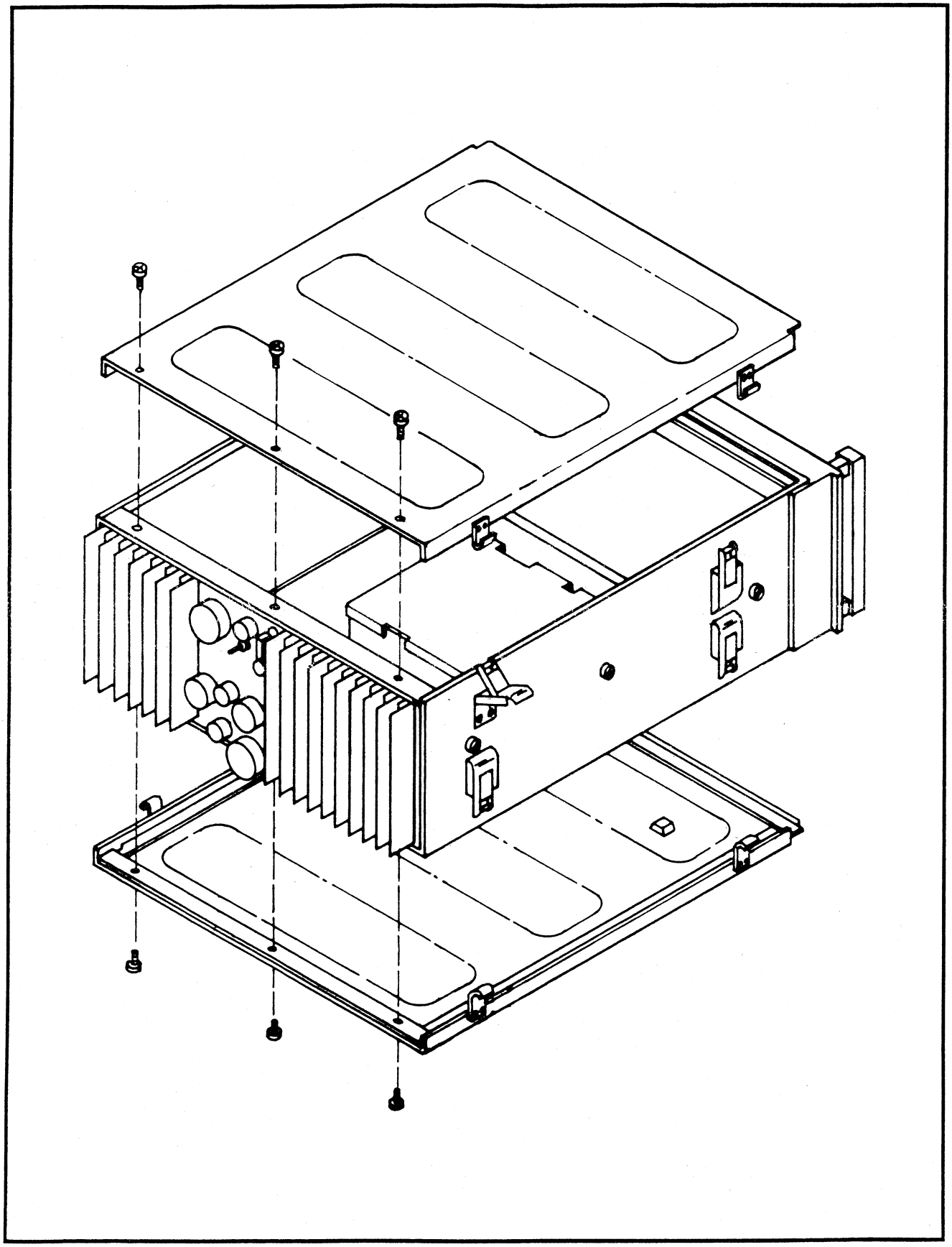


Figure 5.2.1.1 Top or Bottom Transceiver Cover Removal.

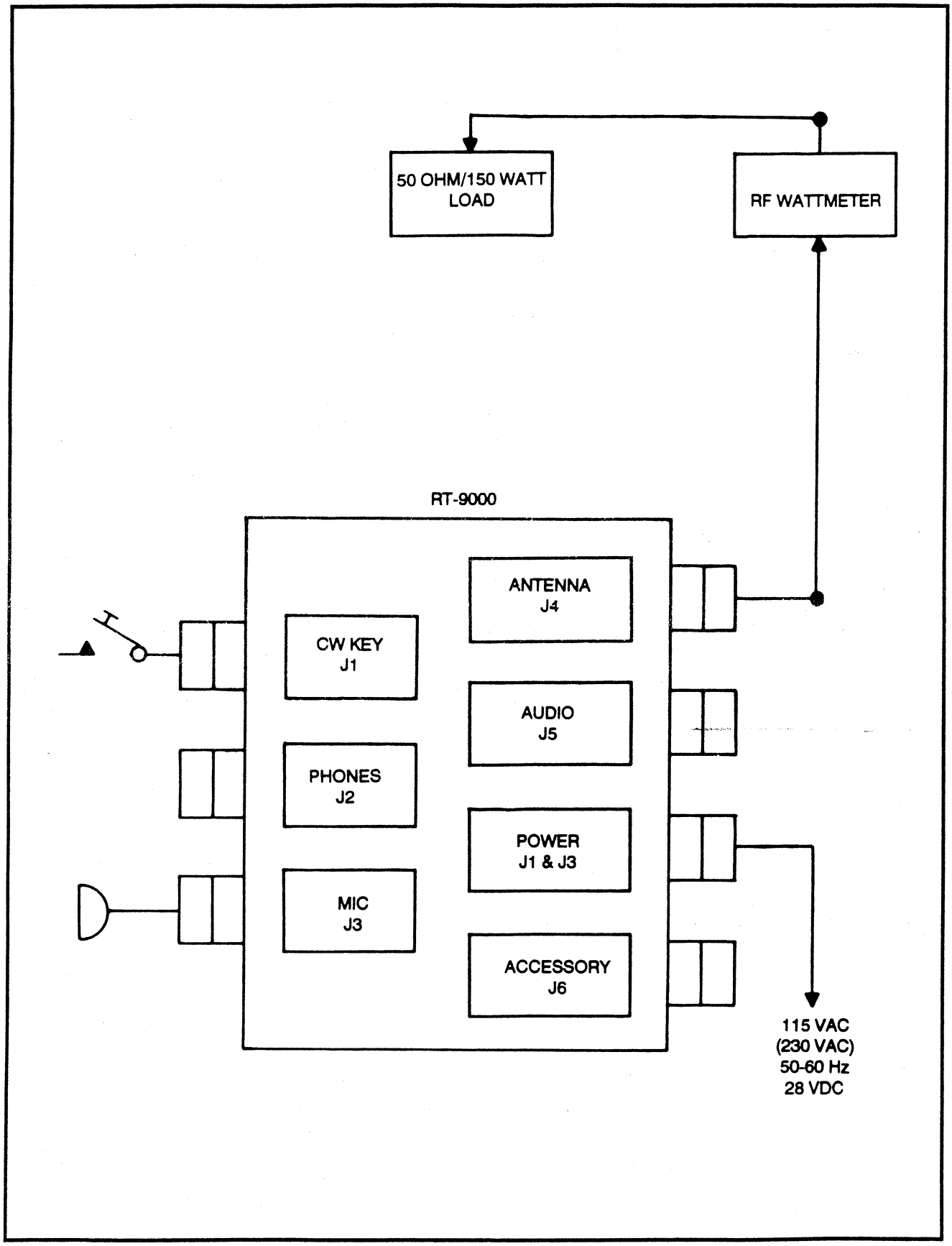



Figure 5.3.1.1 Transmitter BITE Test Set-Up.

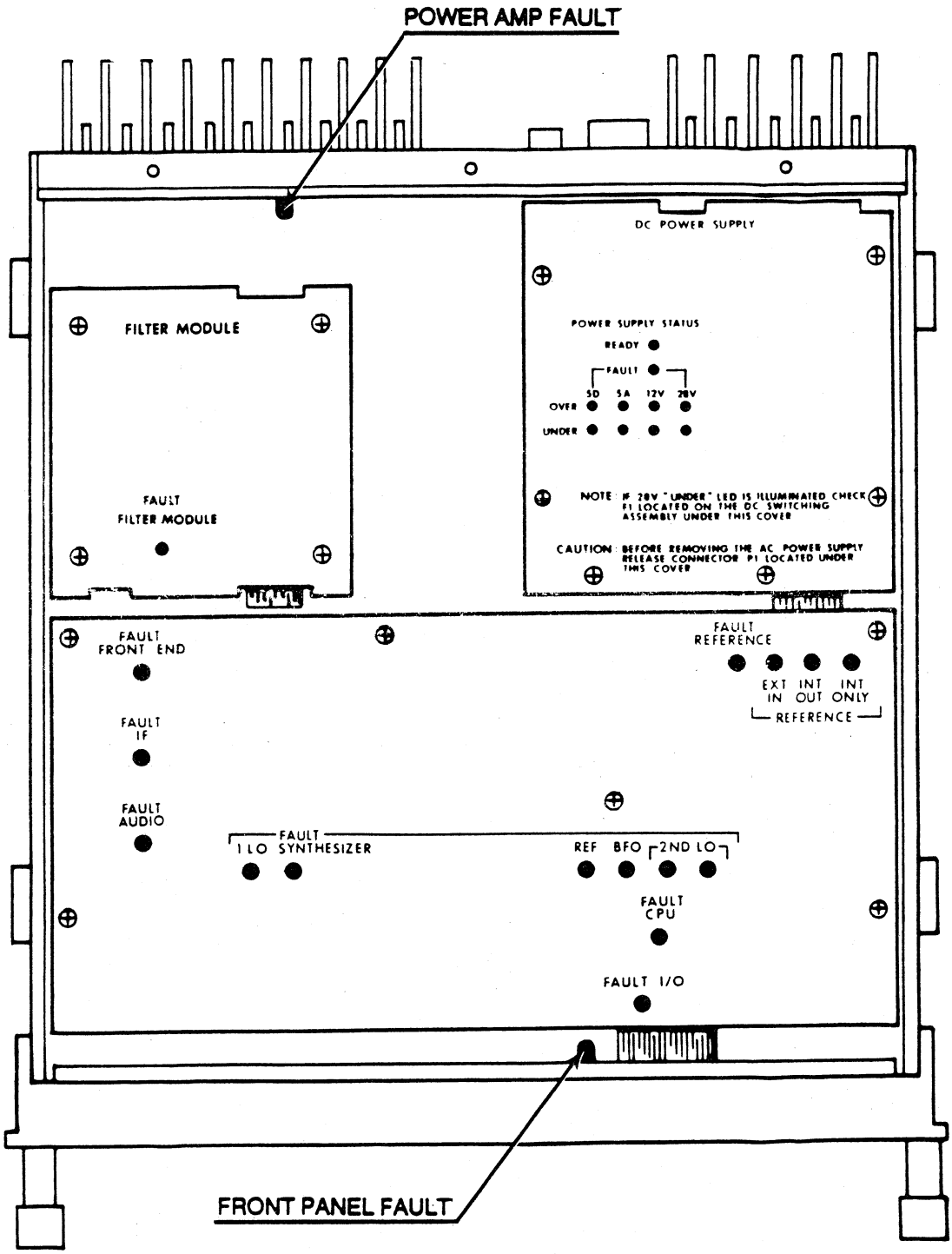



Figure 5.4.1.1 Top View of RT-9000 LRU 'Fault Indicators'.

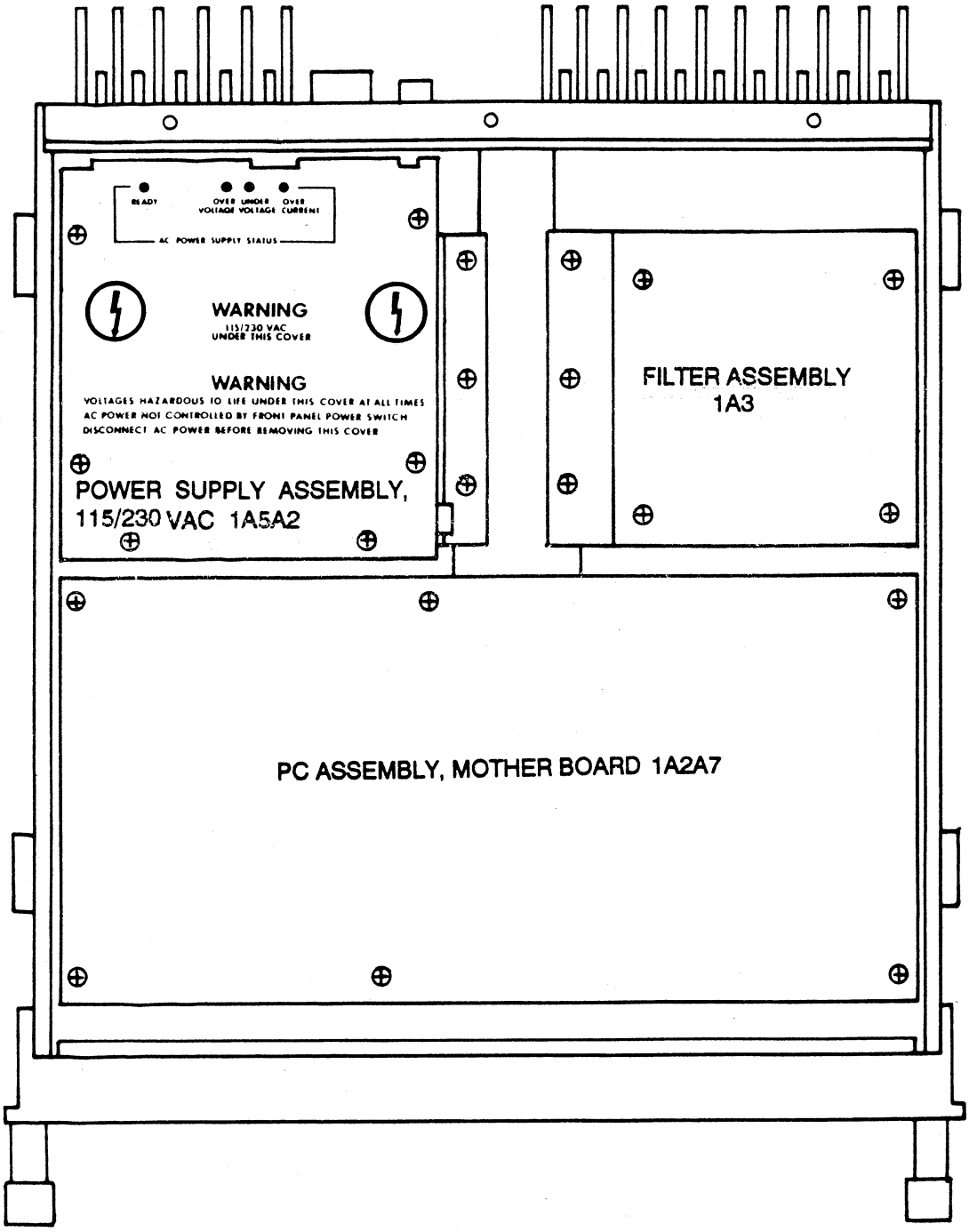



Figure 5.4.1.2 Bottom View of RT-9000 AC Power LRU 'Fault Indicators' Location.

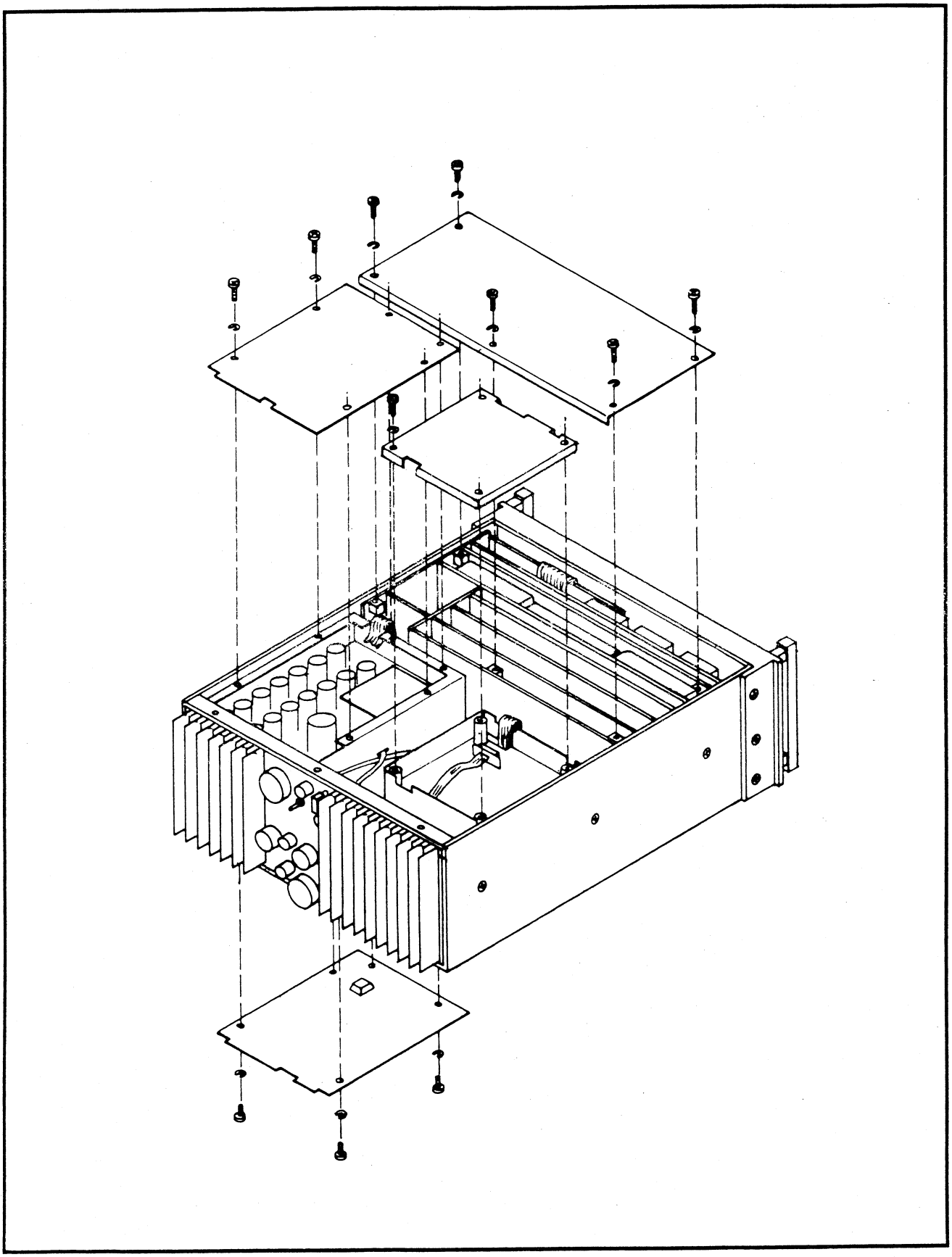


Figure 5.4.1.3 Module Cover Removal.

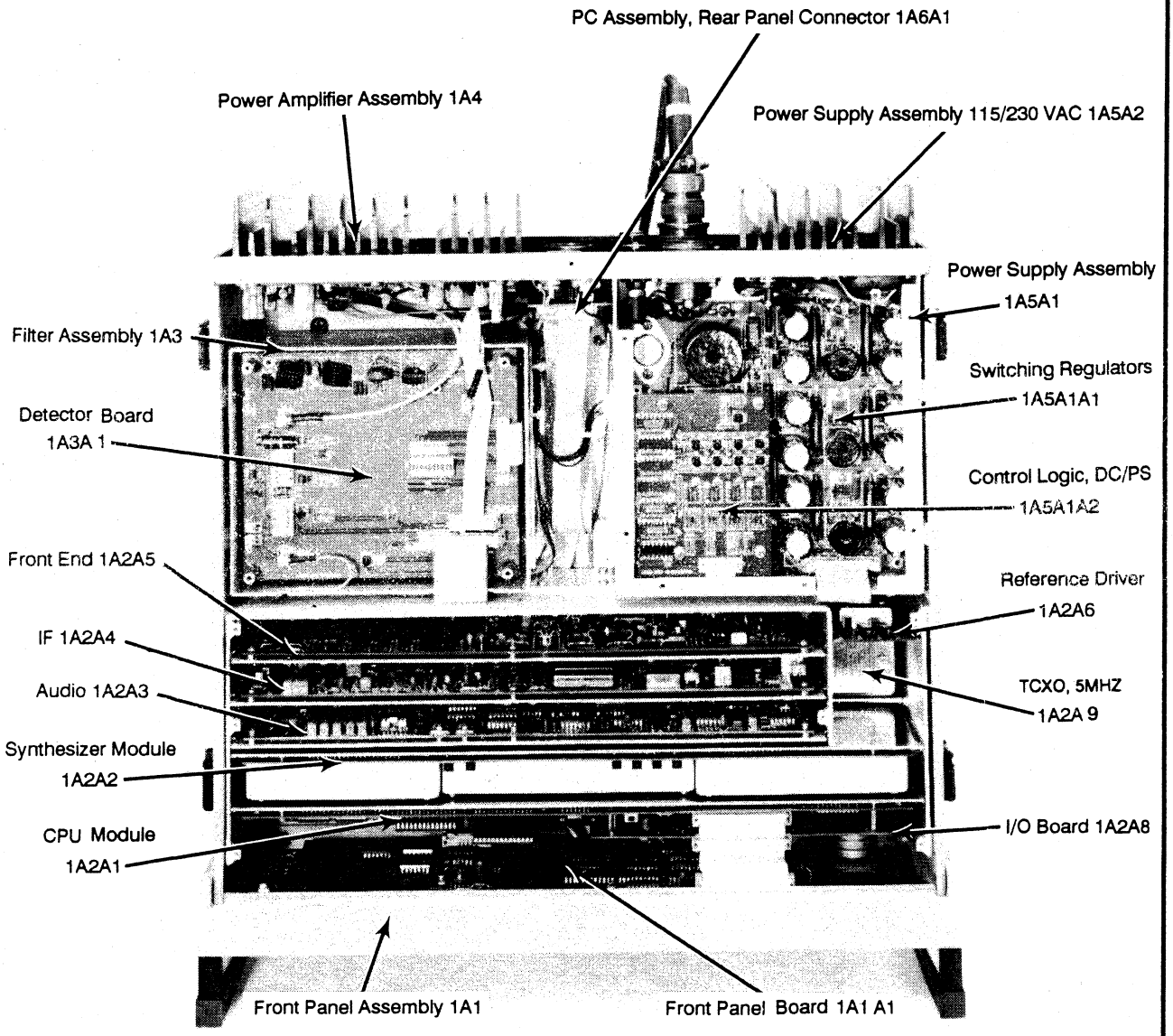



Figure 5.4.1.4 Major Assembly Locations.

The front panel 'LCD' will display a plain language 'FAULT MESSAGE', the 'FAULT' Red LED will illuminate on the Front Panel Figure 5.4.1.5 and on the faulty LRU. (See Figures 5.4.1.1 and 5.4.1.2).

With RT-9000 Transceiver connected as in Figure 5.3.1.1. Turn 'ON' Transceiver and perform the following:

Depress the feature menu select key (1) successively until the feature menu shown in Figure 5.4.1.5 is indicated on the 'Feature' display (2).

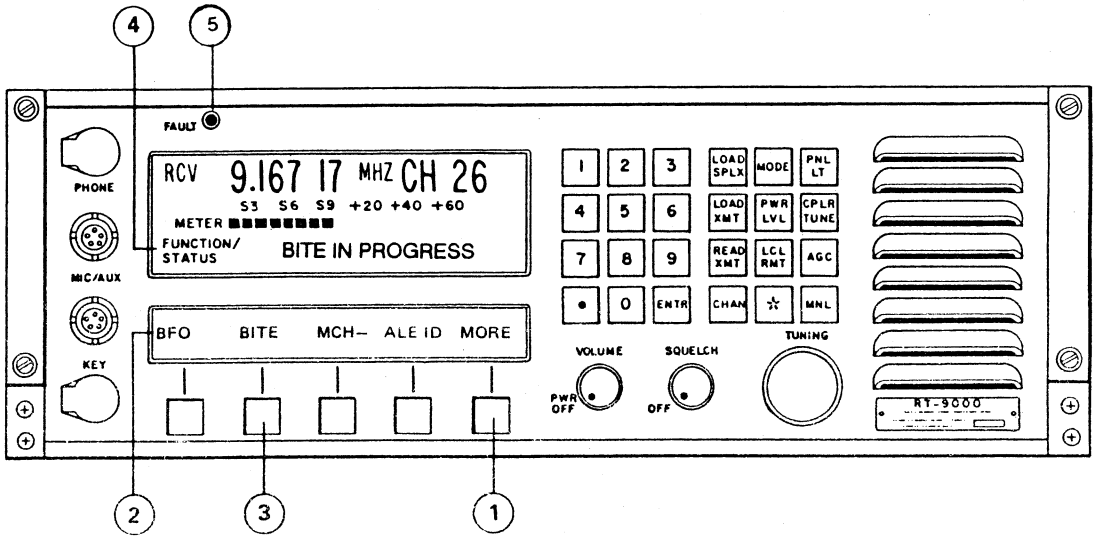



**Figure 5.4.1.5** The RT-9000's 'Operational' Display Screen.

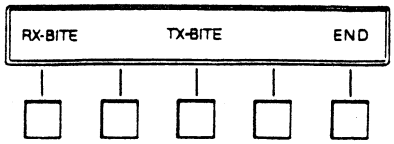
Depress the 'BITE' key (3). The equipment will initiate a self test routine and will display the results in the function/status screen (4) of the 'Operational' display. The initial message will be:

'BITE IN PROGRESS'.

As each module is tested, a corresponding message will appear briefly on the display in the following order:

| | | | |
|---|---|---|---|
| | 'FRONT PANEL O.K.' | or | 'FRONT PANEL FAULT' |
| | 'CPU O.K.' | or | 'CPU FAULT'" |
| | 'SYNTHESIZER O.K.' | or | 'SYNTHESIZER FAULT' |
| | 'POWER SUPPLY O.K.' | or | 'POWER SUPPLY FAULT' |
| NOTE: | 'I/O O.K.' | or | 'I/O FAULT' (Displayed ONLY when I/O is selected.) |
| | 'SELECT RX' | or | 'TX BITE' |

The Feature Menu will display:




Depress the feature key 'RX--BITE'. The equipment will initiate Receive self-test routine. You will momentarily hear 1000 Hz tone from speaker and 'Operational' display will read:

'RX BITE IN PROGRESS'

As each module is tested, a corresponding message will appear briefly on the display in the following order:

| | | |
|---|---|---|
| 'AUDIO O.K.' | or | 'AUDIO FAULT' |
| 'IF O.K.' | or | 'IF FAULT' |
| 'FRONT END O.K.' | or | 'FRONT END FAULT' |

If all modules check O.K., the 'Operational' display will read:

'TEST COMPLETE'.

Depress the feature key 'TX--BITE'. 'Operational' display will read:

'CONNECT ANTENNA LOAD'.

Depress the feature key TX--BITE once more. The equipment will initiate Transmit self-test routine. Frequency on 'Operational' display will change to 1.75000 MHz.

As each module is tested, a corresponding message will appear briefly in the following order:

| | | |
|---|---|---|
| 'AUDIO O.K.' | or | 'AUDIO FAULT' |
| 'IF O.K.' | or | 'IF FAULT' |
| 'FRONT END O.K.' | or | 'FRONT END FAULT' |
| 'POWER AMP O.K.' | or | 'POWER AMP FAULT' |

After the Power Amplifier check, the Filter Module is checked at 1.75000 MHz and then stepped through and checked in each of its bands with a test frequency of 2.75000 MHz, 3.75000 MHz, 4.75000 MHz, 5.75000 MHz, 7.75000 MHz, 10.75000 MHz, 16.75000 MHz, and 25.75000 MHz. As this is being accomplished, the frequency being displayed will change accordingly, and RF output power should be indicated by a varing 90 to 110 Watt output on RF Wattmeter. At the end of the test it will briefly display:

'FILTER MOD O.K.' or 'FILTER MOD FAULT'.

At the conclusion of the 'TX BITE TEST', if all modules check O.K., the message:

'TEST COMPLETED'

will appear on the display and by depressing the 'END' features key 3 , the RT-9000 will revert to operational status.

NOTE: In any of the above tests, if a 'FAULT' 5 is detected, the test will stop at that particular fault. By depressing the appropriate features key, you are able to re-run that particular test again to double-check the fault.

## 5.4.2 COMMON MODULES

NOTE: Refer to Figures 5.4.1.3 and 5.4.1.4 for module cover removal and assembly locations.

### 5.4.2.1 FRONT PANEL FAULT

This is an indication of a failure on the Front Panel P.C. Board Assembly 1A1A1.

a) Turn Transceiver 'OFF' and remove Front Panel Module 1A1. See Figure 5.4.2.1.1 on the following page.

b) Remove and replace Front Panel P.C. Board Assembly 1A1A1. See Figure 5.4.2.1.1.

c) Reinstall Front Panel Module 1A1. Turn Transceiver 'ON'.

d) Repeat 'BITE TEST'. Upon completion of successful test, return Transceiver to operational status and return failed 1A1A1 P.C. Assembly to factory for repair.

e) If in step d) above, test fails the Front Panel test again, turn 'OFF' Transceiver and remove 1A1 Module; replace with original 1A1A1 P.C. Assembly. Return the failed 1A1 Module to factory for repair.

#### 5.4.2.2 CPU FAULT

This is an indication of a failure on the P.C. Assembly CPU 1A2A1.

a) Turn the Transceiver 'OFF' and remove and replace P.C. Assembly 1A2A1. See Figures 5.4.1.3, 5.4.1.4, and 5.4.2.2.1 through 5.4.2.2.2.

b) Turn 'ON' Transceiver and repeat 'BITE TEST'. Upon completion of a successful test, return Transceiver to operational status.

c) Return failed P.C. Assembly 1A2A1 to factory for repair.

#### 5.4.2.3 I/O FAULT

This is an indication of a failure on P.C. Assembly I/O 1A2A8.

a) Turn the Transceiver 'OFF' and remove and replace P.C. Assembly 1A2A8. See Figures 5.4.1.3, 5.4.1.4, and 5.4.2.2.1 through 5.4.2.2.2.

b) Turn 'ON' Transceiver and repeat 'BITE TEST'. Upon completion of a successful test return Transceiver to operational status.

c) Return failed P.C. Assembly 1A2A8 to factory for repair.

#### 5.4.2.4 SYNTHESIZER FAULT

This is an indication of a failure on the Synthesizer Module 1A2A2.

a) Turn the Transceiver 'OFF' and remove and replace Module. See Figure 5.4.1.3 and 5.4.1.4.

b) Turn 'ON' Transceiver and repeat 'BITE TEST'. upon completion of a successful test, return Transceiver to operational status.

c) Return failed Module 1A2A2 to factory for repair.

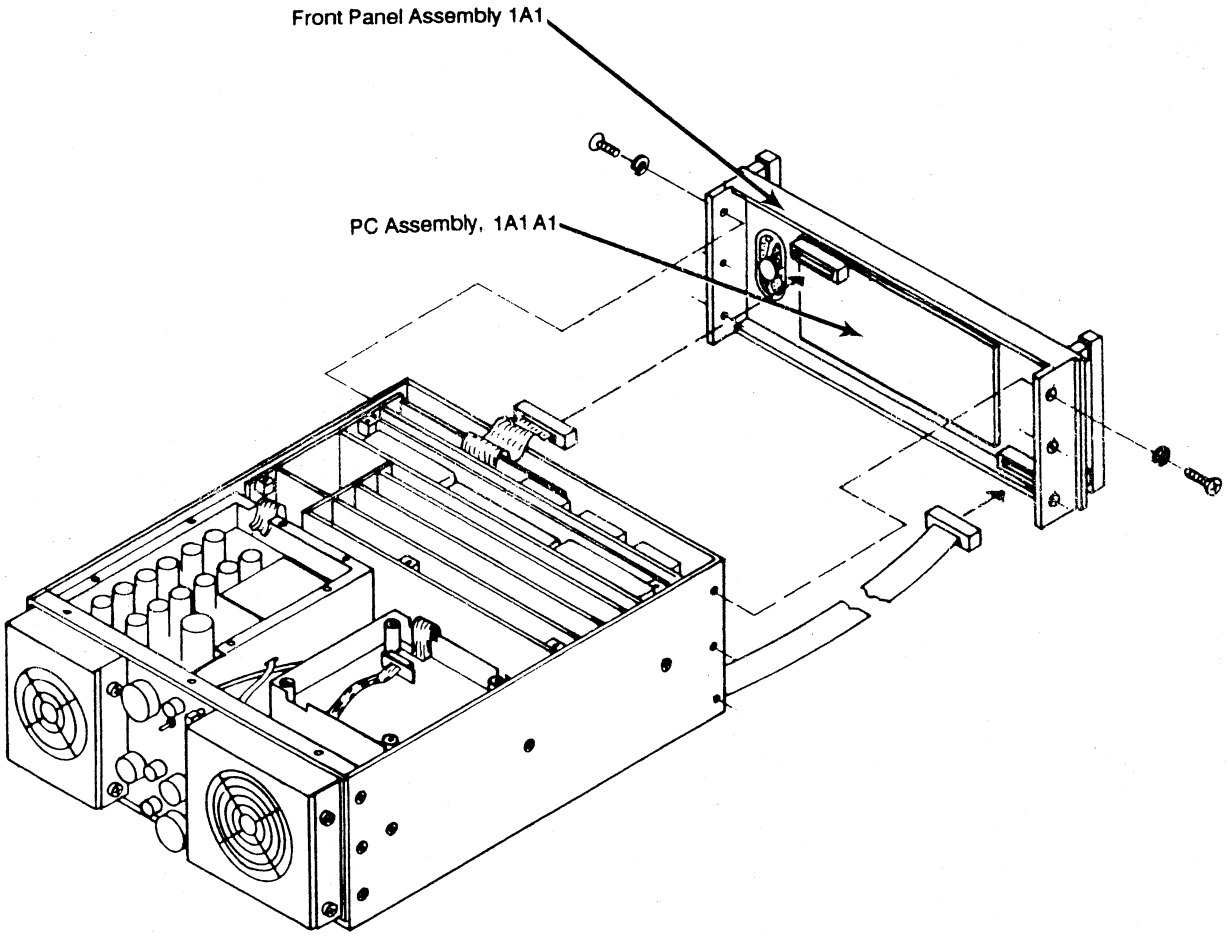



Figure 5.4.2.1.1 Front Panel (1A1) Removal.

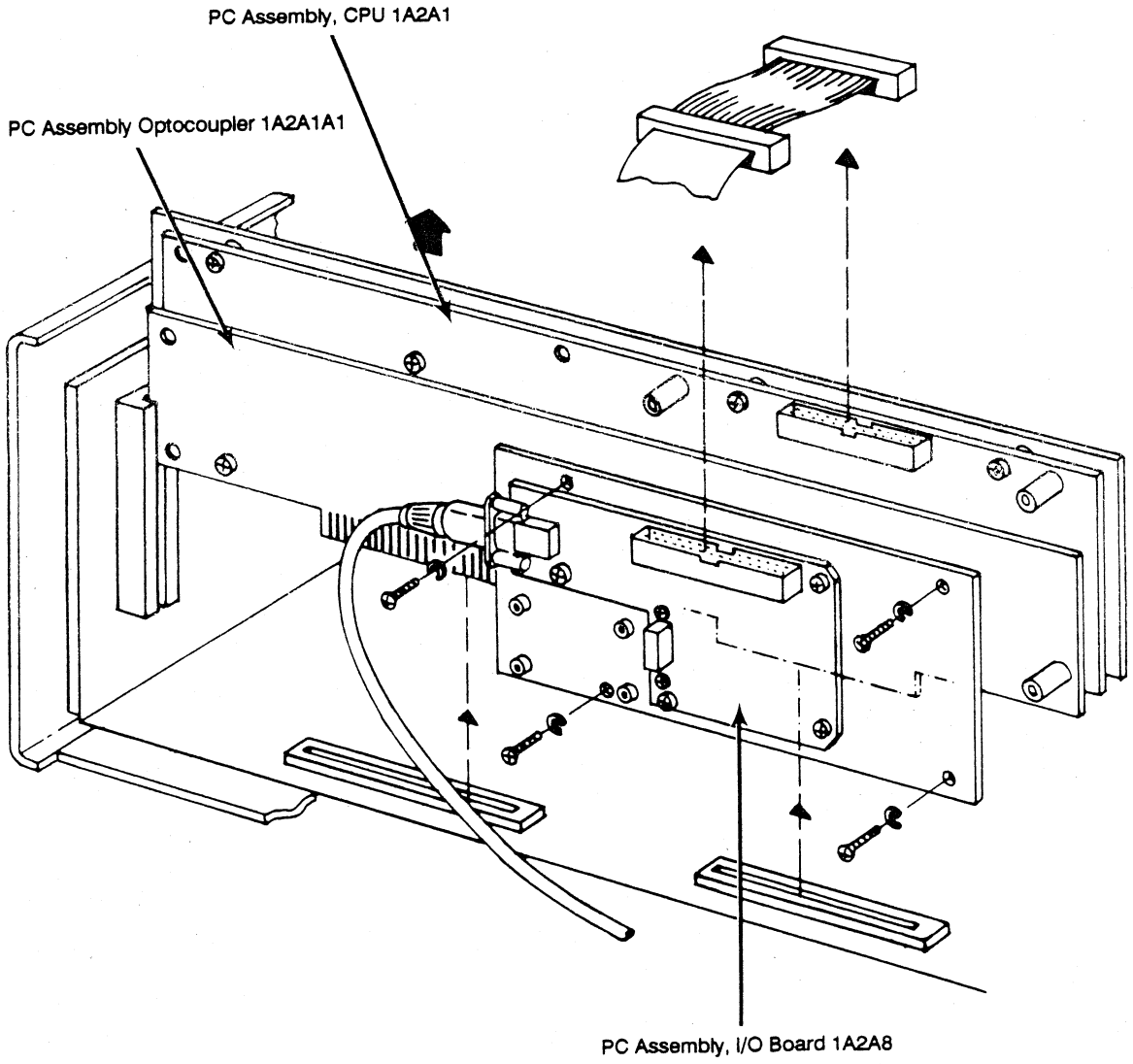



Figure 5.4.2.2.1 Removal/Replacement of CPU 1A2A1 and I/O 1A2A8.

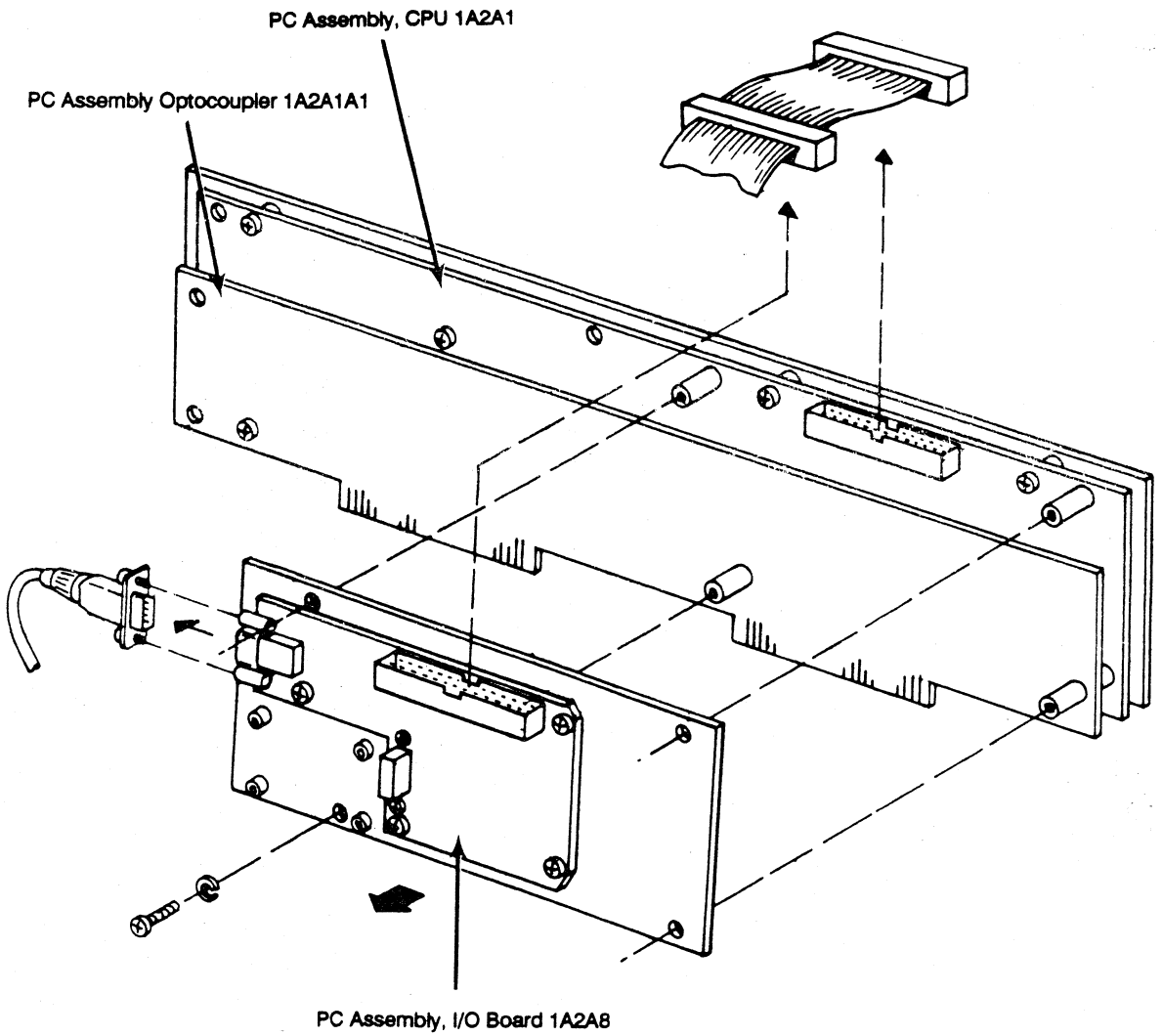



Figure 5.4.2.2.2 Removal/Replacement of I/O 1A2A8 Only.

### 5.4.2.5 POWER SUPPLY FAULT

This indicates a failure of the 1A5A1 +5 VDC analog circuit. The failures are:

a) +5 VDC analog 'OVER' voltage.
b) +5 VDC analog 'UNDER' voltage.

a) +5 VDC Analog 'OVER' Voltage.

1) Turn 'OFF' Transceiver and remove and replace P.C. Assembly 1A5A1A1 (switching regulator board). See Figures 5.4.1.3, 5.4.1.4, and 5.4.2.4.1 thru 5.4.2.4.4.

2) Turn 'ON' Transceiver; observe Power Supply Fault LED's (should be 'OFF'); run 'BITE TEST'. Upon completion of successful test, return Transceiver to operational status. Return P.C. Assembly 1A5A1A1 to factory for repair. If above power supply LED's are 'ON', turn 'OFF' Transceiver and remove and replace P.C. Assembly 1A5A1A2 (Control Logic Board). See Figure 5.4.2.4.3.

3) Turn 'ON' Transceiver; observe Power Supply Fault LED's (should be 'OFF'); run 'BITE TEST'. Upon completion of successful test, return Transceiver to operational status. Return P.C. Assembly 1A5A1A2 to factory for repair.

b) +5 VDC Analog 'UNDER' Voltage.

1) Turn 'OFF' Transceiver and remove ribbon connector to Filter Module 1A3J4.

2) Turn 'ON' Transceiver and observe Power Supply Fault LED's. If LED's are 'OFF', a short is indicated in the 1A3 Filter Module assembly on the +5 VDC analog line. Remove and replace 1A3 Module. See Figure 5.4.2.4.4. If LED's are 'ON', trouble is indicated in other circuitry. Turn 'OFF' Transceiver and reinstall connector to 1A3J4. Go on to step 3.

3) Remove Front End P.C. Assembly 1A2A5. Turn 'ON' Transceiver and observe Power Supply Fault LED's. If LED's are 'OFF', a short is indicated in the 1A2A5 +5 VDC analog circuitry; replace 1A2A5. If LED's are 'ON', trouble is indicated in other circuitry. Turn 'OFF' Transceiver and reinstall 1A2A5. Go on to step 4.

4) Remove IF P.C. Board Assembly 1A2A4. Turn 'ON' Transceiver and observe Power Supply Fault LED's. If LED's are 'OFF', a short is indicated in the 1A2A4 +5 VDC analog circuitry; replace 1A2A4. If LED's are 'ON', trouble is indicated in other circuitry. Turn 'OFF' Transceiver and reinstall 1A2A4. Go on to step 5.

5) Remove Audio P.C. Board Assembly 1A2A3. Turn 'ON' Transceiver and observe Power Supply Fault LED's. If LED's are 'OFF', a short is indicated in the 1A2A3 +5 VDC analog circuitry; replace 1A2A3. If LED's are 'ON', trouble is indicated in other circuitry. Turn 'OFF' Transceiver and reinstall 1A2A3. Go on to step 6.

6) Remove and replace D.C. Power Supply Switching Regulator Board 1A5A1A1. Turn 'ON' Transceiver and observe Power Supply Fault LED's. If LED's are 'OFF', 1A5A1A1 should be sent to factory for repair. If LED's are 'ON', trouble is indicated in other circuitry. Turn 'OFF' Transceiver and go to step 7.

7) Remove and replace Control Logic P.C. Board Assembly 1A5A1A2. Turn 'ON' Transceiver and observe Power Supply Fault LED's. If LED's are 'OFF', 1A5A1A2 should be set to factory for repair. If LED's are 'ON', it indicates trouble could be on Mother Board 1A2A7 or in the interconnecting ribbon cables. Turn Transceiver 'OFF' and use normal troubleshooting procedures to locate the short on the +5 VDC line throughout the Transceiver.

Other Power Supply Fault LED's are discussed in section 5.5.

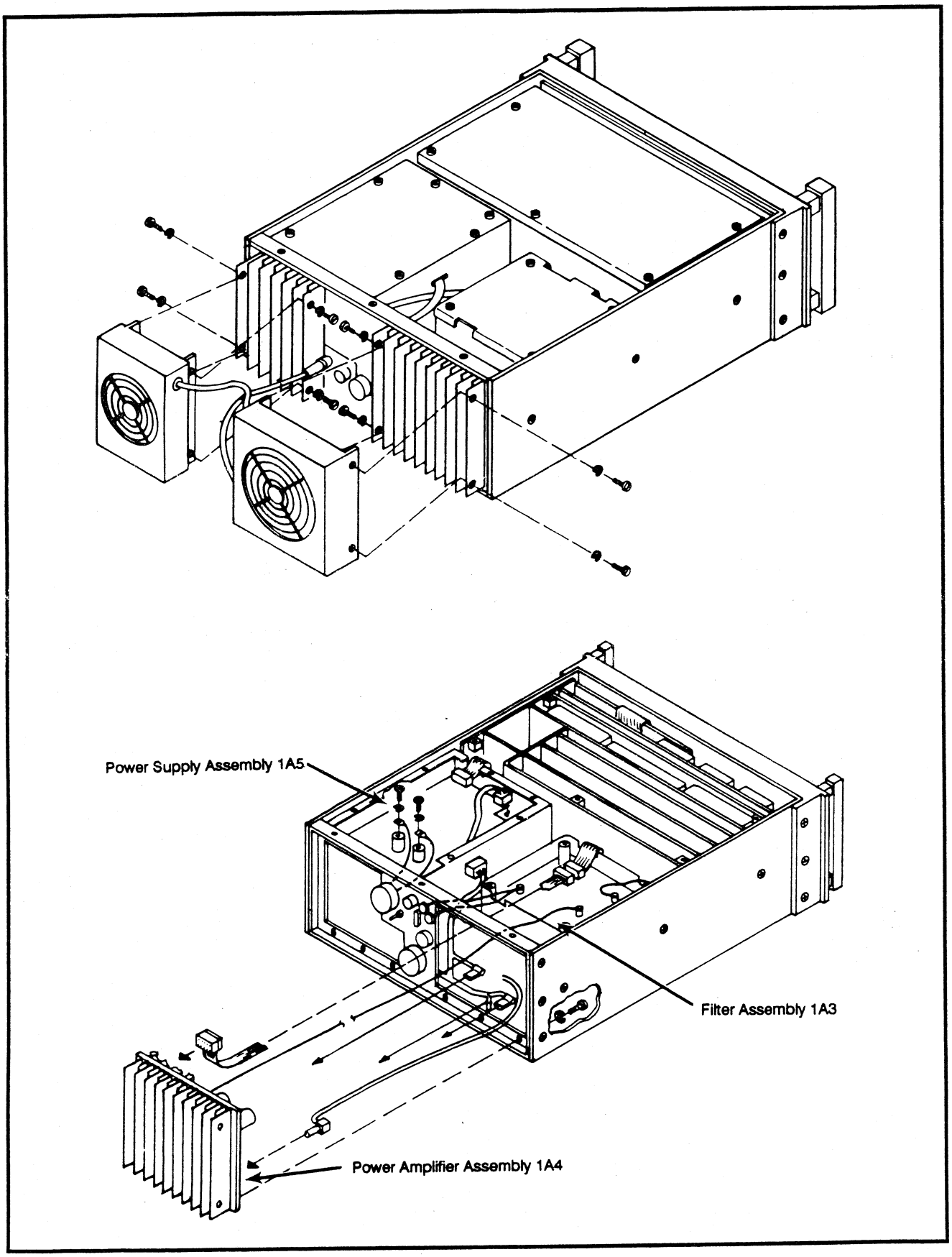



Figure 5.4.2.4.1 Removal/Installation of Modules 1A4, 1A5, and Optional Fans.

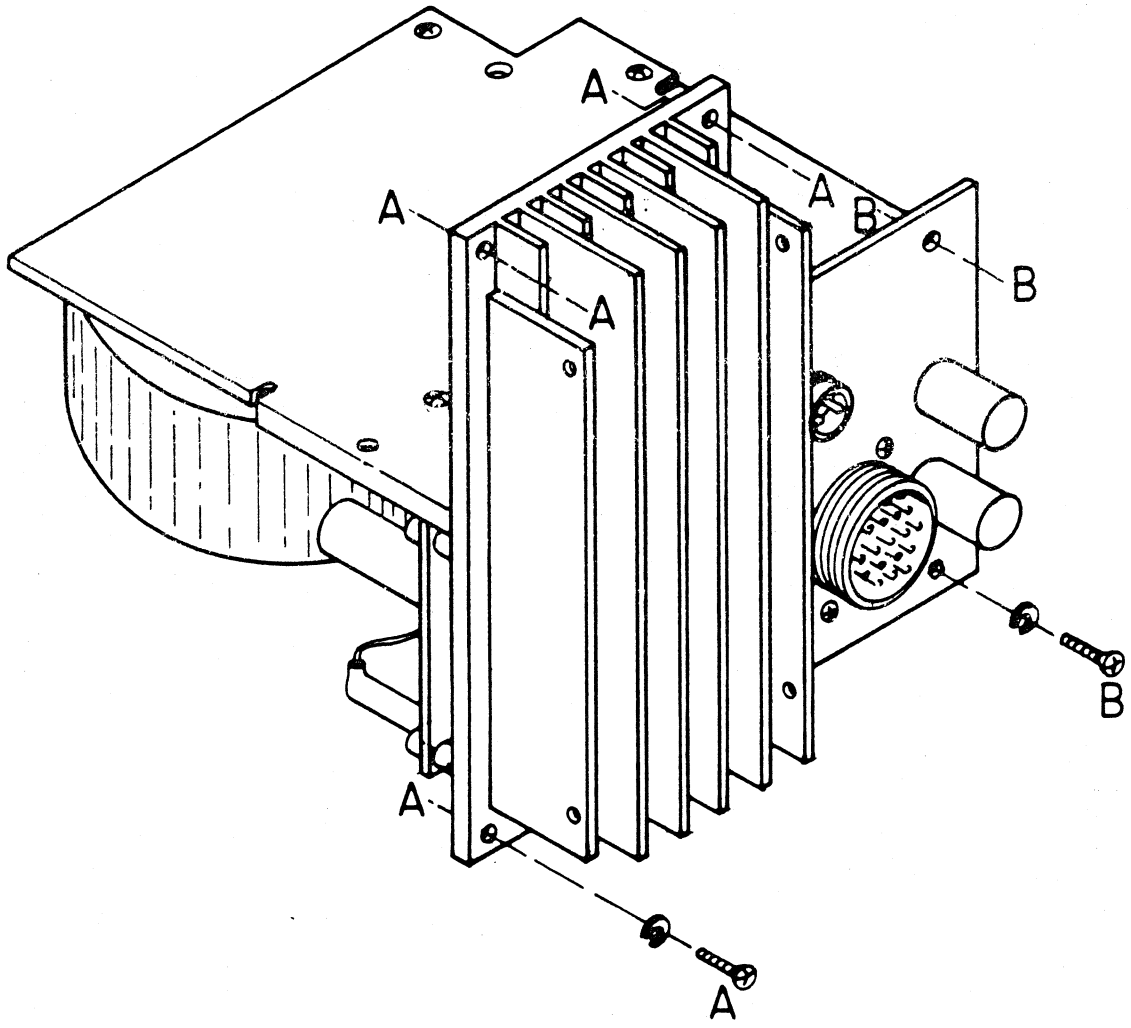



Figure 5.4.2.4.2 Removal/Installation of AC Power Supply Module 1A5A2.

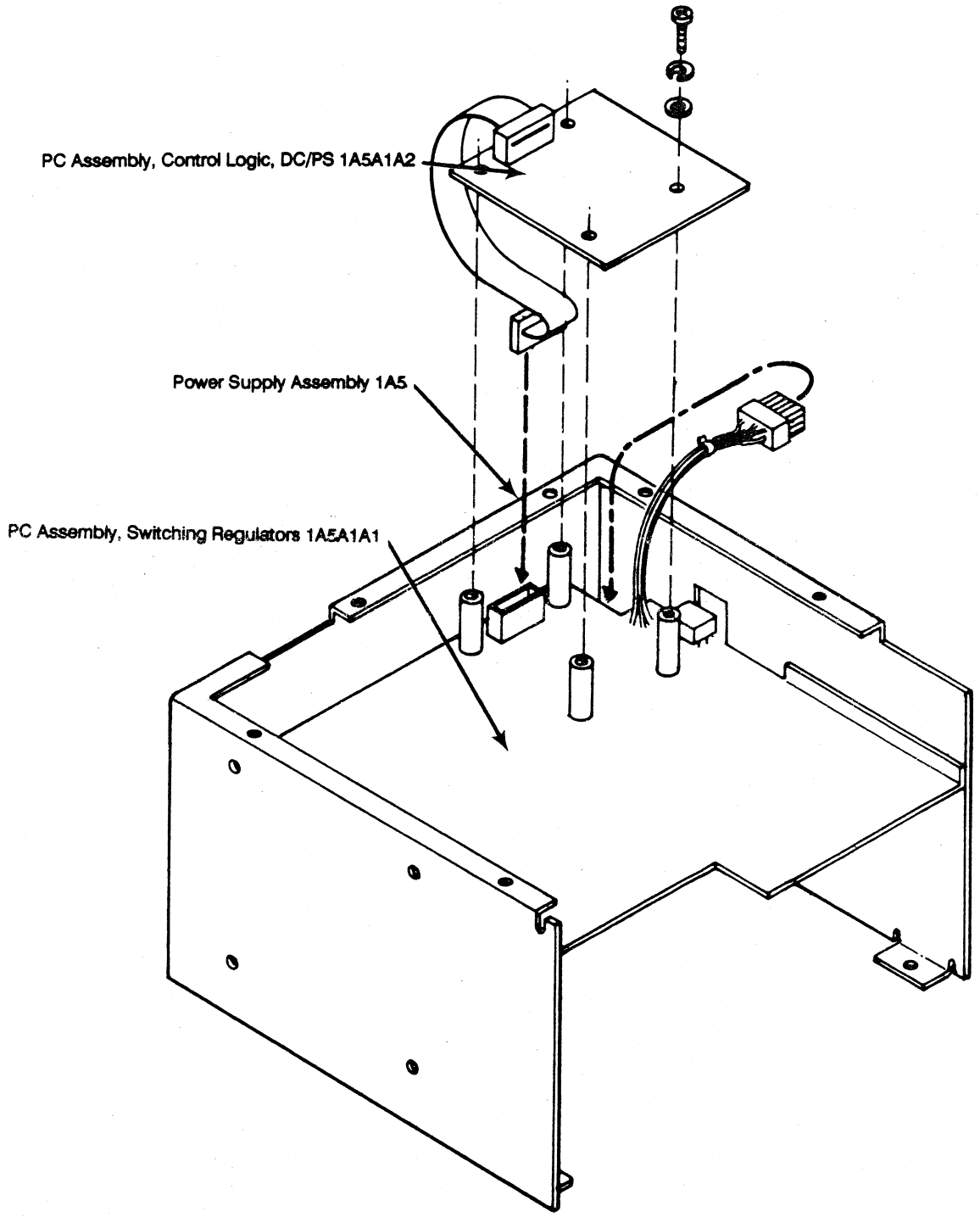



Figure 5.4.2.4.3 Removal/Installation of DC Power Supply PC Board 1A5A1A2.

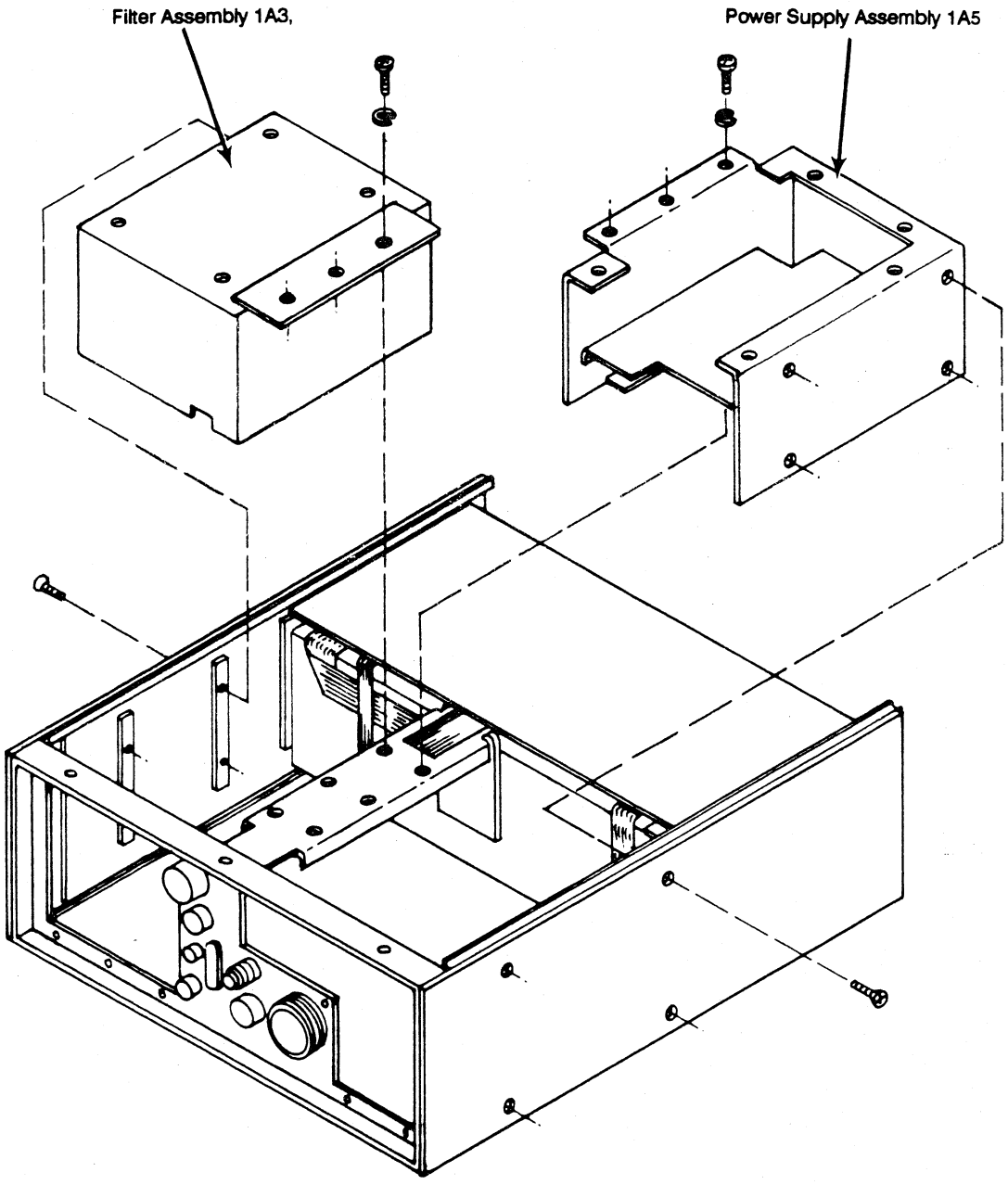



Figure 5.4.2.4.4 Removal/Installation of Module 1A3 and 1A5.

## 5.4.3 RECEIVER MODULES

### 5.4.3.1 AUDIO FAULT

This is an indication of a failure on the Audio P.C. Board Assembly 1A2A3.

a) Turn Transceiver 'OFF' and remove and replace 1A2A3. See Figures 5.4.1.3 and 5.4.1.4.

b) Turn Transceiver 'ON'. Repeat 'BITE TEST'. Upon completion of successful test, return Transceiver to operational status. Return failed 1A2A3 to factory for repair.

### 5.4.3.2 IF FAULT

This is an indication of a failure on the IF P.C. Board Assembly 1A2A4.

a) Turn Transceiver 'OFF' and remove and replace 1A2A4. See Figures 5.4.1.3 and 5.4.1.4.

b) Turn Transceiver 'ON'. Repeat 'BITE TEST'. Upon completion of successful test, return Transceiver to operational status. Return failed 1A2A4 to factory for repair.

### 5.4.3.3 FRONT END FAULT

This is an indication of a failure on the Front End P.C. Assembly 1A2A5.

a) Turn Transceiver 'OFF' and remove and replace 1A2A5. See Figures 5.4.1.3 and 5.4.1.4.

b) Turn Transceiver 'ON'. Repeat 'BITE TEST'. Upon completion of successful test, return Transceiver to operational status. Return failed 1A2A5 to factory for repair.

## 5.4.4 TRANSMITTER MODULES

### 5.4.4.1 AUDIO FAULT

This indicates a failure on the Audio P.C. Assembly 1A2A3.

a) Turn Transceiver 'OFF' and remove and replace 1A2A3. See Figures 5.4.1.3 and 5.4.1.4.

b) Turn Transceiver 'ON'. Repeat 'BITE TEST'. Upon completion of successful test, return Transceiver to operational status. Return failed 1A2A3 to factory for repair.

### 5.4.4.2 IF FAULT

This indicates a failure on the IF P.C. Assembly 1A2A4.

a) Turn Transceiver 'OFF' and remove and replace 1A2A4. See Figures 5.4.1.3 and 5.4.1.4.

b) Turn Transceiver 'ON'. Repeat 'BITE TEST'. Upon completion of successful test, return Transceiver to operational status. Return failed 1A2A4 to factory for repair.

#### 5.4.4.3 FRONT END FAULT

This indicates a failure on the Front End P.C. Assembly 1A2A5.

a) Turn Transceiver 'OFF' and remove and replace 1A2A5. See Figures 5.4.1.3 and 5.4.1.4.

b) Turn Transceiver 'ON'. Repeat 'BITE TEST'. Upon completion of successful test, return Transceiver to operational status. Return failed 1A2A5 to factory for repair.

#### 5.4.4.4 POWER AMP FAULT

This indicates a failure on the Power Amplifier Module 1A4.

a) Turn Transceiver 'OFF' and remove and replace 1A4. See Figures 5.4.1.3, 5.4.1.4 and 5.4.2.4.1.

b) Turn Transceiver 'ON'. Repeat 'BITE TEST'. Upon completion of successful test, return Transceiver to operational status. Return failed 1A4 to factory for repair.

#### 5.4.4.5 FILTER MODULE FAULT

This indicates a failure on the Filter Module Assembly 1A3.

a) Turn Transceiver 'OFF' and remove and replace 1A3. See Figures 5.4.1.3, 5.4.1.4, 5.4.2.4.1, and 5.4.2.4.4.

b) Turn Transceiver 'ON'. Repeat 'BITE TEST'. Upon completion of successful test, return Transceiver to operational status. Return failed 1A3 to factory for repair.

## 5.5 TROUBLE SHOOTING WITH SELF-SURVEILLANCE BITE

### 5.5.1 DC TO DC POWER SUPPLY 1A5A1 / 1A5A1A1 / 1A5A1A2

Reference Table 5.5.1.

### 5.5.2 AC POWER SUPPLY 1A5A2 / 1A5A2A1 / 1A5A2A2

Reference Table 5.5.1

### 5.5.3 SELECT/DISTRIBUTION REFERENCE AMPLIFIER 1A2A6

Reference Table 5.5.2

THIS PAGE INTENTIONALLY LEFT BLANK.

| | DC TO DC POWER SUPPLY 1A5A1 | | | | | | | | | | AC POWER SUPPLY | | | | POSSIBLE TROUBLE | CORRECTIVE ACTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LED's X=ON BLANK=OFF | READY | FAULT | 5D | | 5A | | 12 V | | 28 V | | READY | OVER VOLTAGE | UNDER VOLTAGE | OVER CURRENT | | |
| | | | OVER | UNDER | OVER | UNDER | OVER | UNDER | OVER | UNDER | | | | | | |
| 1 | X | | | | | | | | | | X | | | | No Trouble | No Action Required |
| 2 | | X | | | | | | | | X | X | | | | 1. 1A5A1A1 F1 Open.<br>2. Short in the Transceiver on +28 V line. | Replace fuse as required. If fuse opens again, use normal trouble shooting procedures and locate and repair short. |
| 3 | | | | | | | | | | | | | | | 1. No AC power.<br>2. Open AC Fuses 1A5A2 F1 and F2.<br>3. Open 1A5A2 F3. | 1. Check for AC input.<br>2. Replace F1 and F2. If fuses open again, remove and replace 1A5A2 power supply.<br>3. Replace F3. If it opens again, replace power supply. |
| 4 | | | | | | | | | | | No AC power supply installed or using only DC to DC supply. | | | | 1. No DC power.<br>2. 1A6 F1 open. | 1. Check for +28 VDC input.<br>2. Replace F1. If it opens again, remove and replace 1A5A1 power supply. |
| 5 | | | | | | | | | | | | X | | | 1A5A2 AC power supply. | Replace 1A5A2 assembly. |
| 6 | | | | | | | | | | | | | X | | 1A5A2 AC power supply. | Replace 1A5A2 assembly. |
| 7 | | | | | | | | | | | | | | X | 1. 1A5A2 AC power supply.<br>2. Short on +28 V line in DC power supply or Radio. | 1. Remove 1A5A1 F1 and P3 to radio and check. Use normal trouble shooting procedures to locate and repair short.<br>2. Replace 1A5A2 assembly. |
| 8 | | X | | X | X | | | X | | | X | | | | U5 and associated circuitry in 1A5A1. | Replace 1A5A1 assembly. |
| 9 | | X | X | | | X | | X | | | X | | | | U2 and associated circuitry in 1A5A1. | Replace 1A5A1 assembly. |
| 10 | | X | | X | | X | X | | | | X | | | | U1 and associated circuitry in 1A5A1. | Replace 1A5A1 assembly. |
| 11 | | X | | | | | | X | | X | No AC power supply installed or using only DC to DC supply. | | | | DC power input low. | Correct DC input voltage. |
| 12 | | X | | | | | | | X | | No AC power supply installed or using only DC to DC supply. | | | | DC power input high. | Correct DC input voltage. |
| 13 | | X | | | | X | | | | | X | | | | 1. U5 and associated circuitry in 1A5A1.<br>2. Short on +5 V analog line in Transceiver. | 1. Replace 1A5A1 assembly.<br>2. Use normal trouble shooting procedures, locate and repair short. |
| 14 | | X | | X | | | | | | | X | | | | 1. U2 and associated circuitry in 1A5A1.<br>2. Short on +5 V digital line in Transceiver. | 1. Replace 1A5A2 assembly.<br>2. Use normal trouble shooting procedures to locate and repair short. |
| 15 | | X | | | | | | X | | | X | | | | 1. U1 and associated circuitry in 1A5A1.<br>2. Short on +12 V line in Transceiver. | 1. Replace 1A5A2 assembly.<br>2. Use normal trouble shooting procedures to locate and repair short. |

Table 5.5.1 DC to DC and AC Power Supply Troubleshooting.

## SELECT/DISTRIBUTION REFERENCE AMPLIFIER
## 1A2A6

NOTE: S1A, S1B, and S1C are accomplished by a jumper plug. Normal factory setting is INTERNAL ONLY. However, this value can be changed by the user to INTERNAL OUT or EXTERNAL IN.

| LED's X=ON BLANK=OFF | INT ONLY | INT OUT | EXT IN | FAULT | POSSIBLE TROUBLE | CORRECTIVE ACTION |
|---|---|---|---|---|---|---|
| 1 | X | | | | Normal indication for factory setting. | No action required. |
| 2 | X | | | X | 1. No input to 1A2A6.<br>2. No output from 1A2A6. | 1. Use oscilloscope and check input and output on 1A2A7 Mother board J11 pins 5 and 2. Replace as required 1A2A9 or 1A2A6. |
| 3 | | X | | | Normal indication for this setting. | No action required. |
| 4 | | X | | X | 1. No input to 1A2A6.<br>2. No output from 1A2A6. | 1. Use oscilloscope and check input and output on 1A2A7 Mother board J11 pins 5, 4, and 2. Replace as required 1A2A9 or 1A2A6. |
| 5 | | | X | | Normal indication for this setting. Input is from an external frequency standard. | No action required. |
| 6 | | | X | X | 1. No input from external frequency standard.<br>2. No output from 1A2A6. | 1. Use oscilloscope and check input from External Standard at J11 pin 4 and check output at J11 pin 2. Replace as required External Standard or 1A2A6. |

Table 5.5.2 Select/Distribution Reference Amplifier Troubleshooting.

## 5.6 TEST EQUIPMENT REQUIRED OR EQUIVALENT

| | |
|---|---|
| Multimeter | Simpson 260 |
| Wattmeter, thruline with 250 Watt, 2-30 MHz element | Bird Model 43 |
| Power Supply (optional for DC only), 0-40 Volt @ 30 Amp | HP-6269 |
| Oscilloscope, 100 MHz bandwidth | Tektronix Model 2235 |
| RF Signal Generator | Wavetek 3000 |
| Coaxial Resistor, 50 ohm, 150 Watt (3 each) | Bird Model 8135 |
| Audio Generator | Leader Model LAG-120B |
| Audio Voltmeter | Leader Model LMV-181A |
| Frequency Counter | Systron-Donner Model 6050 with option 12 |
| RF Voltmeter | Boonton 92EA |
| 100/1 Voltage Divider | Boonton 91-7 |
| Tee Adapter | Boonton 91-14A |
| Digital Multimeter | Leader LDM-853A |
| Microphone | P/N 8076000602 |
| CW Key | P/N 5024000994 |
| Coaxial Cable (4 each) | RG-58/U with BNC Connectors |
| Adaptor, N to BNC (3 each) | UG-201/U |
| Adaptor, UHF to BNC (2 each) | UG-273/U |
| 'T' Connector BNC (2 each) | UG-274/U |
| Audio Interface Cable | P/N 8076004594 |
| Remote Key Switch | Any model one (1) pole toggle switch |
| Headset | P/N 0840200005 |