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MICROWAVE COMPONENTS AND SUBSYSTEMS

0DU48

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Linear High Power Amplifier

COMPONENT MAINTENANCE MANUAL
WITH
ILLUSTRATED PARTS LIST

ITS Electronics Part Number	Rockwell Collins Part Number
PA-1A6-6048-8M	822−2577−XXX

XX-XX-XX

RECORD OF REVISIONS

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SERVICE BULLETIN LIST

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TABLE OF CONTENTS

1 Introduction

This manual provides instructions to perform fault isolation, test and maintenance on the HPA−901B, ITS product P/N: PA-1A6-6048-8M, Rockwell Collins Part Number (RCPN) 822−2577−XXX, linear High Power Amplifier (HPA).

1.1 Abbreviations

AMSS	Aeronautical Mobile Satellite Services
ARINC	Aeronautical Radio, Inc.
ATP	Acceptance Test Procedures
BIT	Built-in Test
DUT	Device under Test
HPA	High Power Amplifier
Hz	Hertz
ITS	ITS Electronics, Inc.
LED	Light Emitting Diode
LRU	Line Replaceable Unit
MCU	Modular Concept Unit
MHz	Megahertz
PC	Personal Computer
PSMCPT	Power Supply, Monitoring, Control and Pilot Tone
RAM	Random-access Memory
RF	Radio Frequency
RMS	Root Mean Square
ROM	Read-Only Memory
SDI	Source Destination Identifier
SRU	Shop Replaceable Unit
VA	Volt-Ampere
VAC	Volt Alternating Current
VSWR	Voltage Standing Wave Ratio
W	Watt

2 Description and Operation

2.1 General

The HPA is an 8-MCU 60 watt (W) L-Band linear high power amplifier. It is intended for use as part of a system that provides the Aeronautical Mobile Satellite Services (AMSS).

2.2 Electrical Description

The HPA will operate from an aircraft supplied power of 115 volt alternating current (VAC) root mean square (RMS), single phase, 400 hertz (Hz) nominal,

600 volts−amperes (VA) maximum, 500 VA nominal. Its operation frequency range is 1626.5 to 1660.5 megahertz (MHz).

The HPA is a forced-air cooled in accordance with ARINC 600. The architecture, internal layout, front and rear views are shown in Figure 2.1, Figure 2.2 and Figure 2.3. Its front and rear panel connector details are shown in Figure 2.4 and Figure 2.5.

Upon application of power, and at other times when the test mode is commanded via the ARINC 429 serial input bus, the HPA will perform microprocessor RAM and ROM tests. Continuous monitoring of the following functions is performed:

- Power Supply
- Control Bus Input
- RF Power Input
- VSWR
- Temperature

Four front−panel LED indicators are identified as follows:

- OVER TEMP: Illuminated when an overtemperature condition exists (thermal limiting)
- POWER SUPPLY FAULT: Illuminated when an internal power supply fault is detected
- RF FAULT: Illuminated when an internal RF fault is detected
- CONTROLLER FAULT: Illuminated when an internal control function fault is detected.

The HPA has two external electrical connectors:

- Front Panel Connector
- Rear Panel Connector

The Front Panel Connector is MS3102 type circular connector. It is not wired or used on the aircraft. This connector is for the HPA testing at the manufacturer or another shop facility. This connector pin-out is indicated as in Figure 2.4.

The Rear Panel Connector is of the “low insertion force, shell size 2” type, as defined in ARINC Specification 600. This connector is wired on the aircraft. It provides main interface with ARINC 429 buses, discrete Mute control and SDI. This connector pin-out is indicated as in Figure 2.5.

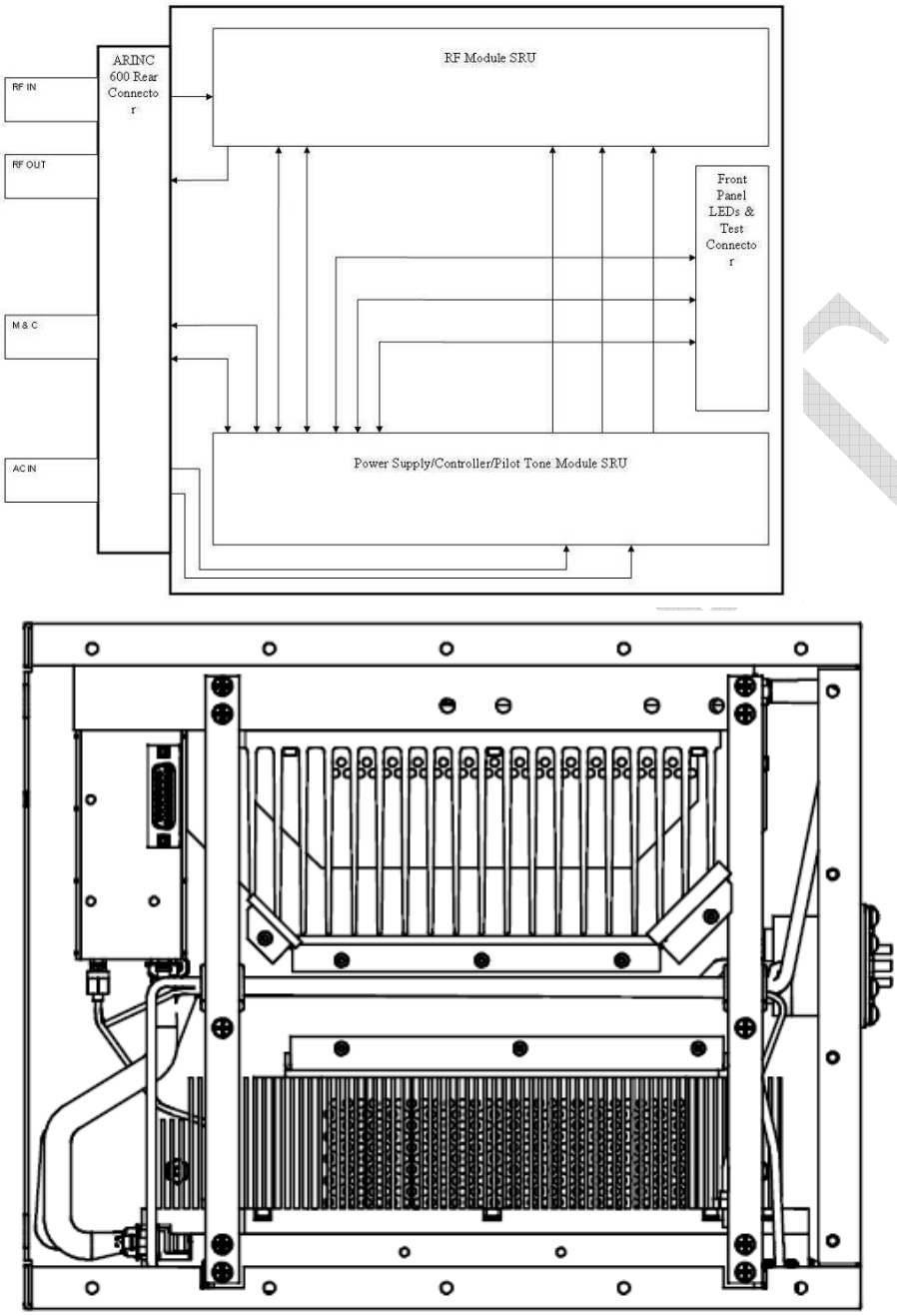


Figure 2.1 HPA Architecture and Internal Layout

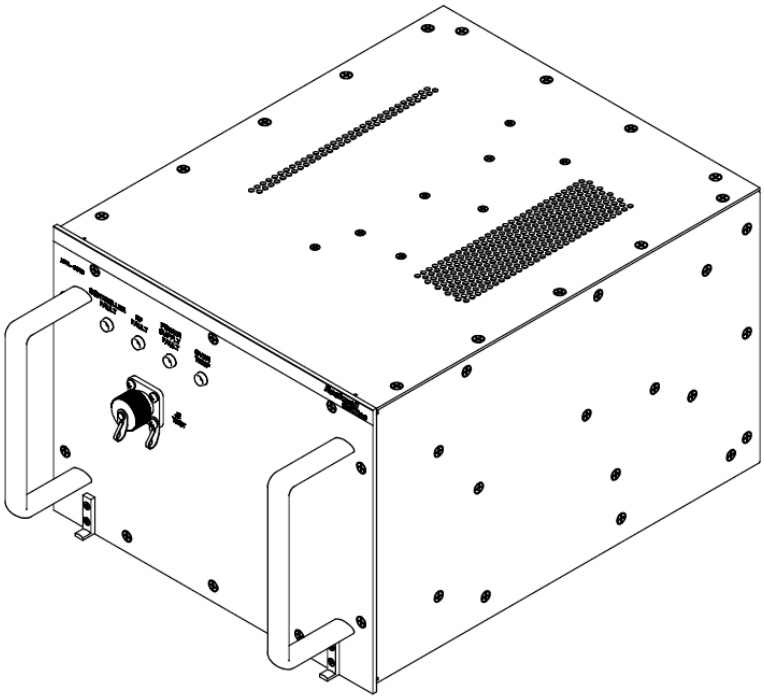


Figure 2.2 HPA Front View

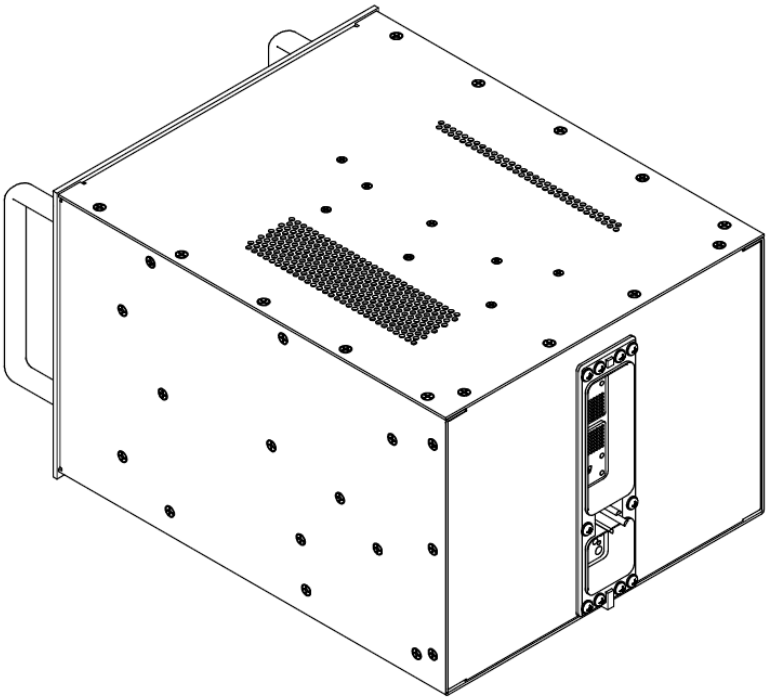


Figure 2.3 HPA Rear View

Pin	Function	Internal Connection
A	RS-232 Transmit	To Controller
B	RS-232 Receive	To Controller
C	RS-232 Ground	To Controller

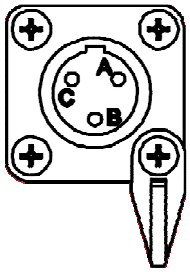


Figure 2.4 HPA Front Panel and Test Connector Details

Pin	Function	Internal Connection
TP1A	ARINC 429 Input A	To Controller
TP1B	ARINC 429 Input B	To Controller
TP1C	ARINC 429 Output A	To Controller
TP1D	ARINC 429 Output B	To Controller
TP3A	HPA Mute Top/Port A	To Controller
TP3B	HPA Mute Top/Port B	To Controller
TP3C	HPA Mute Starboard A	To Controller
TP3D	HPA Mute Starboard B	To Controller
TP5A	SDI #1	To Controller
TP5B	SDI #2	To Controller
TP5D	SDI Common	To Controller
TPC1	RF Input	To RF Module
MPC1	RF Output	To RF Module
BP1	115 VAC Input (Hot)	To Power Supply
BP7	115 VAC Input (Cold)	To Power Supply
BP8	Chassis Ground	To Power Supply

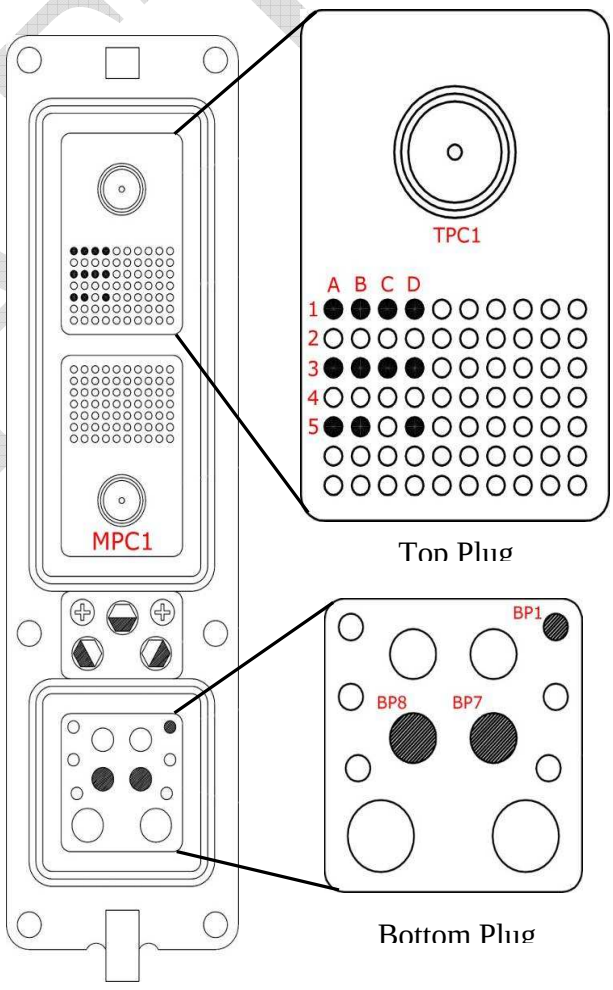


Figure 2.5 HPA Rear Connector Details

2.3 Mechanical Description

The HPA mechanical outline details are described in Figure 2.6 (Drawing Number is ODH4800000).

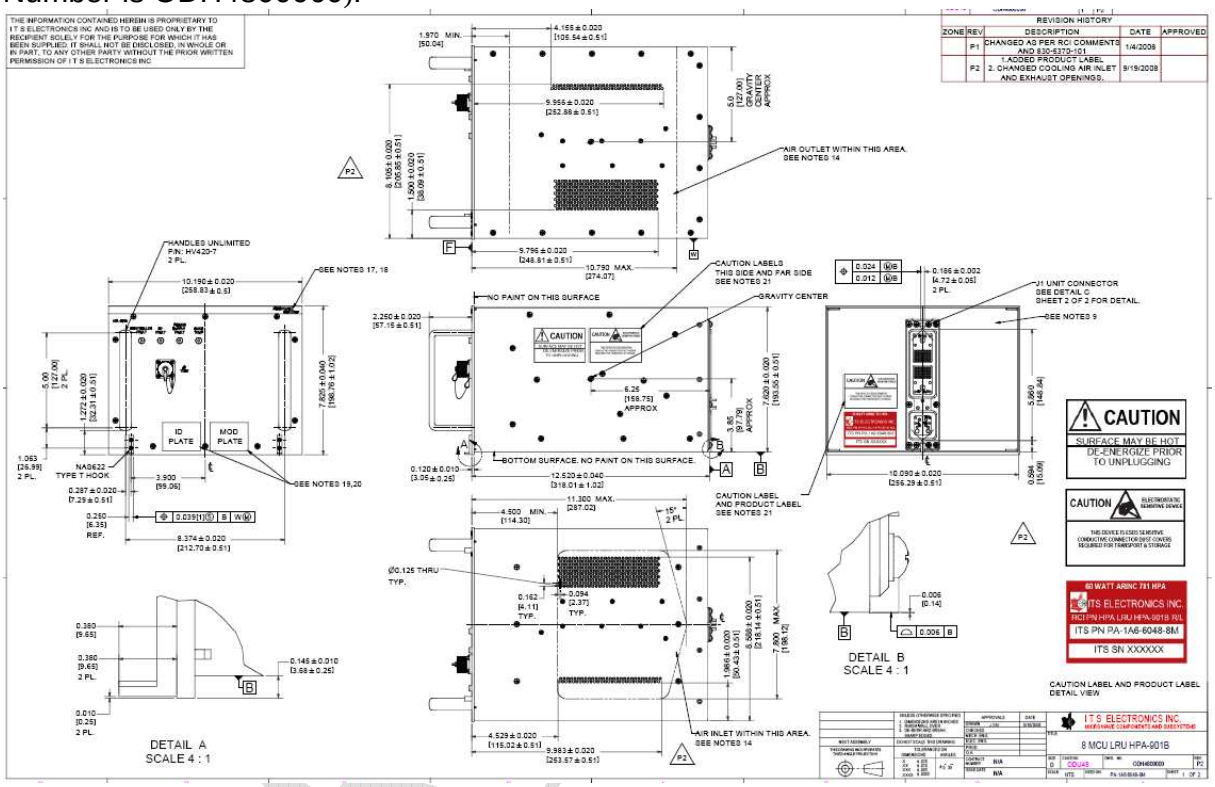


Figure 2.6 HPA Mechanical Outline

The HPA mechanical construction is illustrated in Figure 2.1.

The HPA is intended for installations on the aircraft in the Equipment Racks that are compliant to the requirements of ARINC Specification 600. Therefore, the HPA Enclosure is designed to conform to the ARINC Specification 600. The Enclosure size is 8 Modular Concept Units (8-MCU).

The Enclosure assembly is comprised of:

- bottom, left and right side panel/chassis
- front panel
- rear panel
- top panel
- two handles
- two hold-down hooks
- associated hardware

All Enclosure parts are metallic. The panels' material is aluminum alloy. Interior and bottom surface finish is chemical conversion coating. Exterior (except bottom) surface finish is paint.

The HPA cooling medium is forced air moving through the HPA in the upward or downward direction. To provide the interface between the HPA and the aircraft cooling system, the Enclosure top and bottom panels have air inlet/outlet apertures (sets of multiple individual openings).

The two Shop Replaceable Units are mounted to the sides of the Enclosure.

A low insertion force, shell size 2 Connector, as defined in ARINC Specification 600, is mounted to the rear panel.

An MS3201 type Connector is mounted to the front panel.

The four LEDs are mounted to the front panel.

The two handles and two hold-down hooks are mounted to the front panel.

The forced air enters either from the inlet of the top lid or from the bottom lid and goes through the heat sinks of the two SRUs to cool the internal components. The hot air exits from the outlet of the opposite lid.

2.4 The HPA Family Tree and Block Diagram

The HPA consists of the following SRUs:

- Power Supply, Monitoring, Control and Pilot Tone (PSMCPT) Module (Part No. H4800200)
- RF Module (Part No. H4800900)

3 LRU on-line Fault Diagnosis

HPA has BIT to provide seven-byte information for fault diagnosis purpose. The details of the BIT information are in Table 3.1. Each state has its own hex-value "mask" when turned on. The masks of the turned on states aggregate to the hex value of a byte. For example, if "Low Input Power" (mask "02") and "Input Power Overdrive" (mask "04") are turned on, the hex value of the first byte will be "06" (i.e. "02"+"04").

In Table 3.1, only the states marked in the "Fault" column turned on will represent LRU failure.

Flag	Byte No.	Mask	Description	Effect		
				Mute	+32V Shutdown	Fault
Pwr	1	01	Return Loss			
		02	Low Input Power			
		04	Input Power Overdrive			
		08	Output Power Too High	X		
		10	N/A			
		20	N/A			
		40	N/A			
		80	N/A			
t1	2	01	HPA 1 Over-Temp Warning			
		02	HPA 1 Over-Temp Mute	X		
		04	HPA 1 Over-Temp Shutdown	X	X	
		08	HPA 1 Under-Temp			
		10	HPA 2 Over-Temp Warning			
		20	HPA 2 Over-Temp Mute	X		
		40	HPA 2 Over-Temp Shutdown	X	X	
		80	HPA 2 Under-Temp			
t2	3	01	MCU Over-Temp Warning			
		02	MCU Over-Temp Mute	X		
		04	MCU Over-Temp Shutdown	X	X	
		08	MCU Under-Temp			
		10	N/A			
		20	N/A			
		40	N/A			
		80	N/A			
Ov	4	01	9V Over-Voltage			x
		02	32V Over-Voltage			x
		04	Spare Over-Voltage			
		08	N/A			
		10	32V Over-Current Measured	X	X	x
		20	32V Over-Current Low Cutoff	X		x
		40	32V Over-Current High Cutoff	X	X	x
		80	N/A			
Uv	5	01	9V Under-Voltage			x
		02	32V Under-Voltage			x
		04	Spare Under-Voltage			
		08	N/A			
		10	32V Under-Current Measured			x
		20	N/A			

		40	N/A			
		80	N/A			
Mem	6	01	Application ROM CRC	X		x
		02	EEPROM CRC	X		x
		04	RAM Array Fault	X		x
		08	RAM Data Line Fault	X		x
		10	RAM Addr Line Fault	X		x
		20	N/A			
		40	N/A			
		80	N/A			
Msc	7	01	Pilot Tone Tx Lock	X		x
		02	Pilot Tone Rx Lock	X		x
		04	ARINC Rx Timeout			
		08	ARINC HW Failure			x
		10	N/A			
		20	N/A			
		40	N/A			
		80	N/A			

Table 3.1 Seven-byte BIT information matrix

3.1 LRU Remove/Replace/Back-to-Normal-Status Verification Procedures

Once the LRU BIT test shows “FAULT” state, follow the below described procedures to remove the faulty LRU from the aircraft and install a replacement LRU. Send the faulty LRU back to the original manufacturer for repair.

3.2 Tool list

No tools are needed.

3.3 LRU Removal Procedures

WARNING:

THE HPA LRU WEIGHS 30 LBS

REMOVE IT WITH CARE TO PREVENT PERSONAL INJURY

Step 1: Release the two hold-down hooks and pull out the LRU from the rack

3.4 LRU Installation Procedures

WARNING:

THE HPA LRU WEIGHS 30 LBS

INSTALL IT WITH CARE TO PREVENT PERSONAL INJURY

Step 1: Push the LRU into the rack and fix the two hold-down hooks

3.5 LRU Repair Verification Procedures

After installing the LRU properly by the above procedures, check if the BIT result shows no error.

4 LRU Shop Testing, Fault Isolation and Procedures

4.1 LRU Test Environment Setup Procedures

Test Conditions

Unless specified otherwise, the tests shall be performed at the following conditions:
Ambient Temperature: +25℃ ±5℃
Altitude: 0 to 6,000 feet mean sea level
Vibration and Shock: None
Relative Humidity: 20% to 85%, non-condensing
Power Source: 115.0 ±2.3 VAC at 400 ±8 Hertz
Forced Air Cooling (minimum air flow rate): 34 Kg/hr

Suggested Test Equipment

Arbitrary Waveform Generator -	Agilent PSG-D Series E8267C
ARINC Bus Box -	Ballard Model BB1020
Signal Generators 1 and 2 -	Hewlett-Packard 8648C
Splitter -	Mini-Circuits ZFSC-2-2500
Power Meter -	Hewlett-Packard E4419B
Power Sensors -	Hewlett-Packard 9300A
Spectrum Analyzer -	Hewlett-Packard E4407B
High Power RF Cable -	500 W, N-male to N-male
Directional Coupler -	10 dB, A.M.Electronics SMC4030-10
40 dB Attenuator -	100 W, Weinschel 48-40-XX
10 dB Attenuator -	Mini-Circuits BW-S10W2
Personal Computer -	with standard serial port and USB port
Power Supply -	Hewlett-Packard 6813A

Note

The test equipment models listed here are for reference only. Available equivalents may be used.

Note

The Arbitrary Waveform Generator may be substituted with the Signal Generator 1 for single-tone measurements, and with the Signal Generators 1 and 2 and the Splitter for two-tone measurements.

4.2 PC Test Environment Setup Procedures

1. Use mouse to click “Start”, then choose “Programs”, then click “Accessories”, then “Communications” and then choose “Hyperterminal”
2. A setup window, as in Figure 4.1, will show up. Enter a name that you want to give to the connection, choose an icon for the connection and click “OK”

Figure 4.1 Hyperterminal setup (1)

3. A connection setup window, as in Figure 4.2, will show up. Choose the appropriate connection port and click “OK”

Figure 4.2 Hyperterminal setup (2)

4. A port property setup window, as in Figure 4.3, will show up. Choose the values as shown in Figure 4.3 and click “OK”

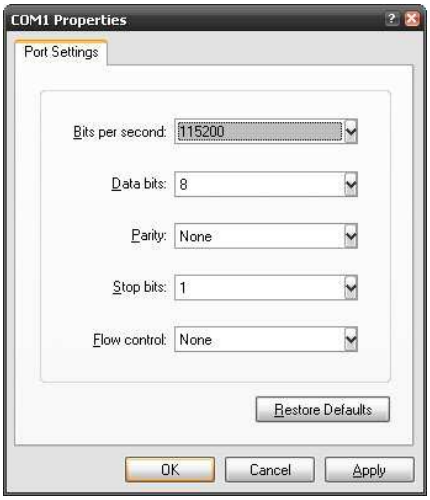


Figure 4.3 Hyperterminal setup (3)

5. A text-based Hyperterminal window will show up as in Figure 4.4.

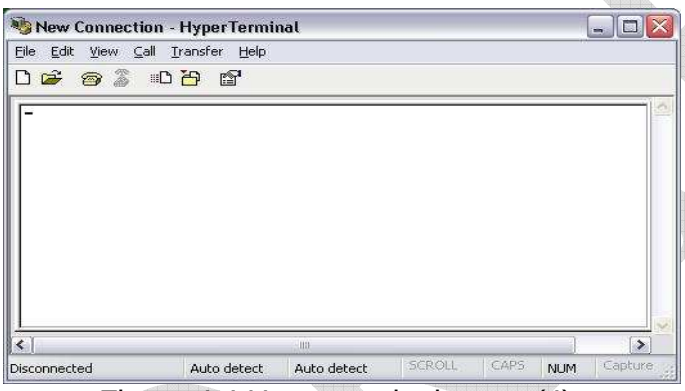


Figure 4.4 Hyperterminal setup (4)

6. After few seconds, a welcome message and command prompt will show up as in Figure 4.5. If nothing shows up, check the connection cable and setup. If connection is correct, then it means the LRU has failed.

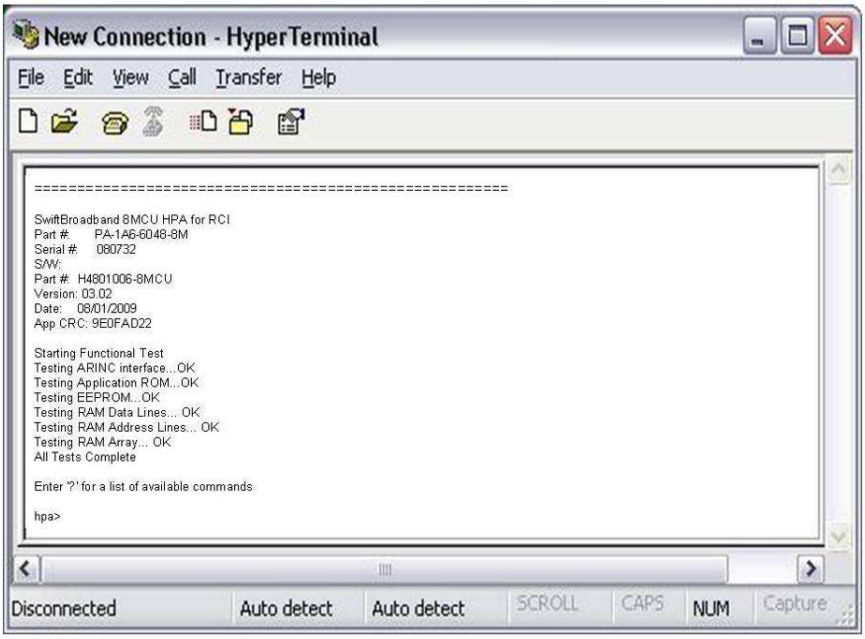


Figure 4.5 Hyperterminal setup (5)

4.3 LRU Hardware Fault Verification Procedures

Fault Verification by BIT

Step 1: After connecting the LRU to PC and test equipments and setting up the Hyperterminal in PC properly, if nothing shows up, then it means the LRU failed.

Step 2: Type the command “d1” (note: it is the numerical digit “one”, not the alphabet “l”) and press “enter”. The diagnostic information will be shown in Figure 4.6 as an example.

The seven hex-value numbers, titled as “diag”, in Figure 4.6 represent the seven bytes of BIT results.

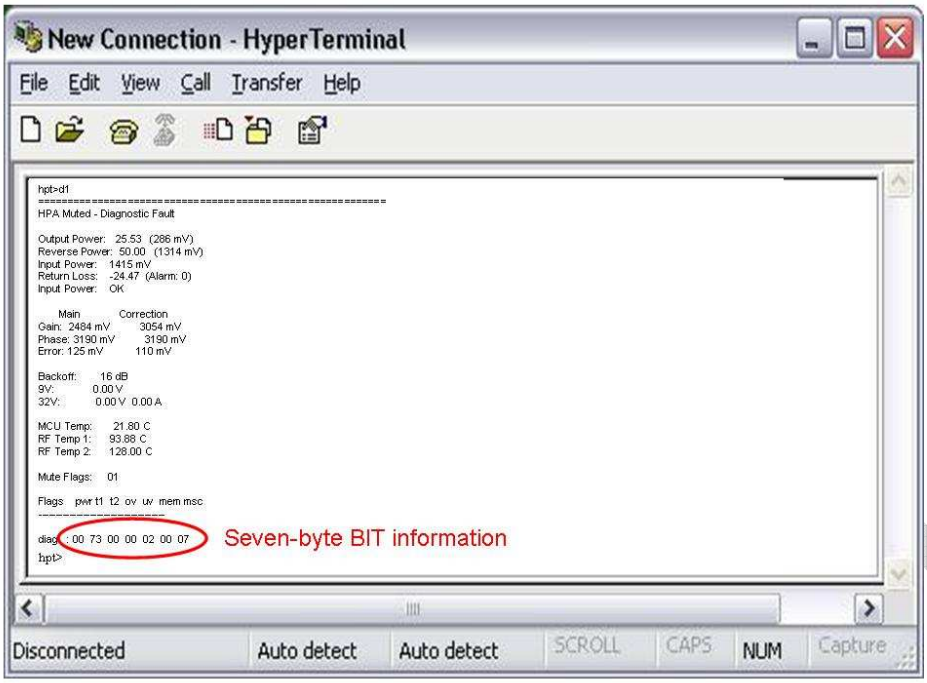


Figure 4.6 BIT diagnostic information

Step 3: Type the command “df” and press “enter”, the explanatory BIT diagnostic information will be displayed as in Figure 4.7.

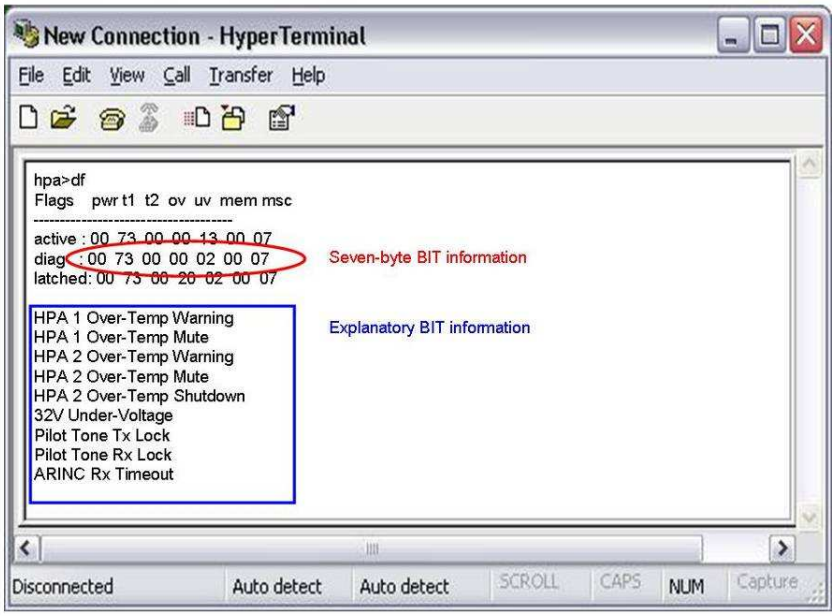


Figure 4.7 Explanatory BIT diagnostic information

For example, in Figure 4.6 and Figure 4.7, the second BIT byte is “73” in hex value. By Table 3.1, this is equivalent to “01”+“02”+”10”+”20”+”40”, which

means “HPA 1 Over-Temp Warning”, “HPA 1 Over-Temp Mute”, “HPA 2 Over-Temp Warning”, “HPA 2 Over-Temp Mute” and “HPA 2 Over-Temp Shutdown” as in the first five lines of the explanatory message in Figure 4.7. The fifth BIT byte is “02”, which means “32V Under-Voltage” as in the sixth line of the explanatory message in Figure 4.7. The seventh BIT byte is “07” (ie. “01”+”02”+”04”), which means “Pilot Tone Tx Lock”, “Pilot Tone Rx Lock” and “ARINC Rx Timeout” according to Table 3.1, as in the last three lines of the explanatory message in Figure 4.7.

Since “32V Under-Voltage” is turned on here and marked as a “FAULT State” in Table 3.1, we can conclude that the LRU is faulty.

Fault Verification by Acceptance Test Procedures (ATP)

If BIT test shows no fault, test the “Intermodulation, Power Dissipation” per ATP by the following procedures.

Run the ARINC 429 user interface software (filename “RCI HPA-901B ARINC429 M&C.exe”) on the PC.

Step 1: Connect the Arbitrary Waveform Generator to the RF IN of the DUT as shown in Figure 4.8.

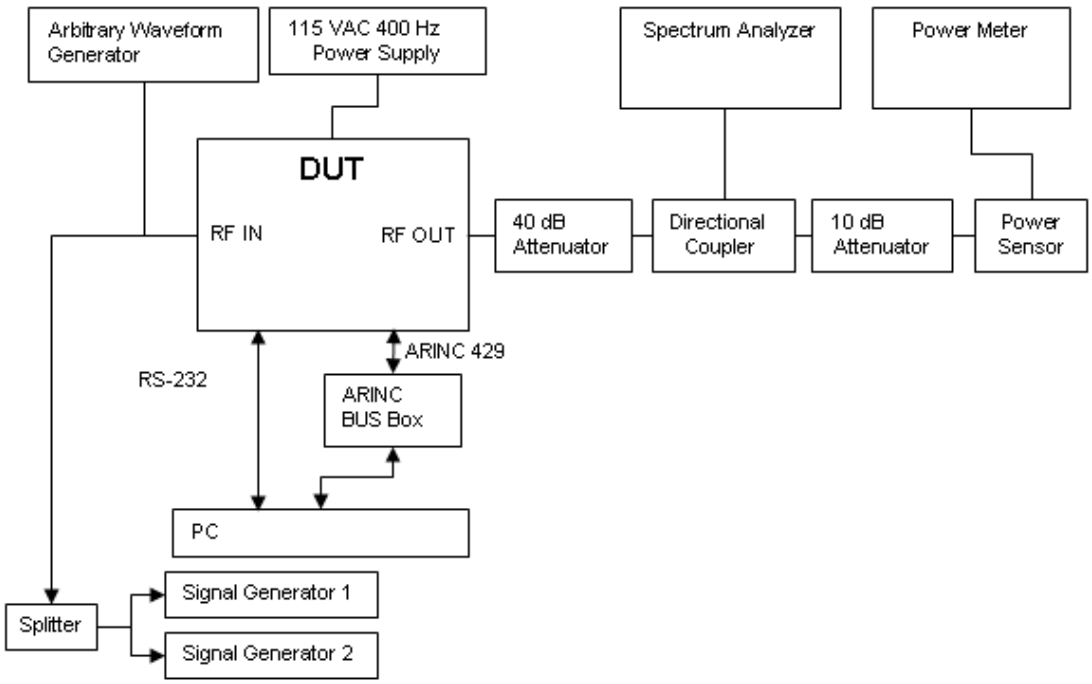


Figure 4.8 ATP setup

Step 2: Set the output power of the Arbitrary Waveform Generator to two tone mode, –14 dBm total power. Or, if using two separate signal generators, set the output power of each tone to -17 dBm.

Step 3: Set the tone frequencies to 1626.5 and 1660.5 MHz (band middle, 34 MHz spacing).

Step 4: Apply power to the DUT as required.

Step 5: Set the DUT gain to the 0 dB back-off.

Step 6: Adjust output power of the Arbitrary Waveform Generator so that the output of the DUT is 47.8 dBm (60W).

Step 7: Measure the intermodulation product level and AC power consumption.

Step 8: Calculate power dissipation by subtracting 60 Watt from the measured AC power consumption.

Step 9: Reduce the output power of the DUT to 47 dBm (50W).

Step 10: Measure the intermodulation product level.

Step 11: If the results are beyond the threshold limits as stated in Table 4.1, the LRU has failed the test.

4.4 SRU Hardware Fault Isolation Procedures

From the results of the test procedures described above, the faulty SRU can be isolated according to Table 4.1.

Test	Threshold limits beyond which represent LRU failure status	Shop Diagnostic Results	
		Most likely faulty SRU	2nd most likely faulty SRU
BIT	9V Over Voltage	PSCPT	-
BIT	32V Over Voltage	PSCPT	-
BIT	32V Over-Current Measured	RF Module	PSMCPT Module
BIT	32V Over-Current Low Cutoff	RF Module	PSMCPT Module
BIT	32V Over-Current High Cutoff	RF Module	PSMCPT Module
BIT	9V Under-Voltage	PSMCPT Module	-
BIT	32V Under-Voltage	PSMCPT Module	-
BIT	32V Under-Current Measured	RF Module	PSMCPT Module
BIT	Application ROM CRC	PSMCPT Module	-
BIT	EEPROM CRC	PSMCPT Module	-
BIT	RAM Array Fault	PSMCPT Module	-
BIT	RAM Data Line Fault	PSMCPT Module	-
BIT	RAM Addr Line Fault	PSMCPT Module	-
BIT	Pilot Tone Tx Lock	PSMCPT Module	-
BIT	Pilot Tone Rx Lock	PSMCPT Module	-
BIT	ARINC HW Failure	PSMCPT Module	-
ATP Paragraph 7.1.5	Intermodulation product level at 60W should be −31.5 dBc or lower	RF Module	PSMCPT Module
	Intermodulation product level at 50W should be −42.5 dBc or lower	RF Module	PSMCPT Module
	The power consumption shall not exceed 300 W	RF Module	PSMCPT Module

Table 4.1 SRU Fault Isolation Criteria

5 Disassembly Instruction of the HPA−901B

5.1 **General**: this section describes how to disassemble the High Power Amplifier HPA-901B

5.2 **Materials**: Refer to Table A1 in Appendix A for the parts necessary to assemble the unit

5.3 Disassembly Procedure

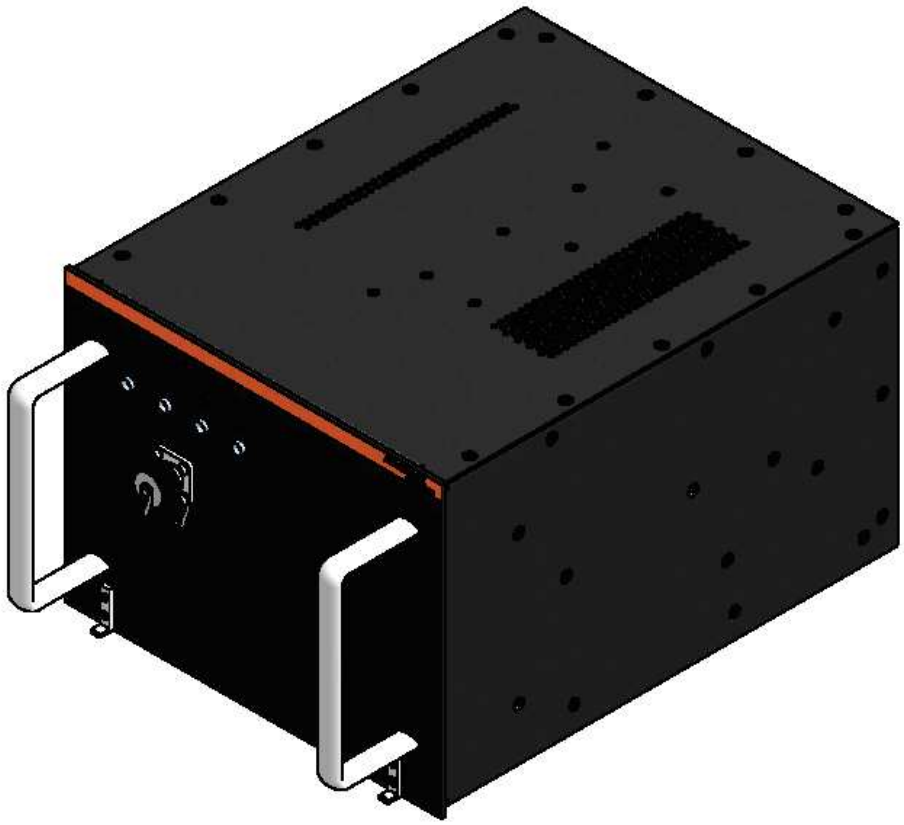
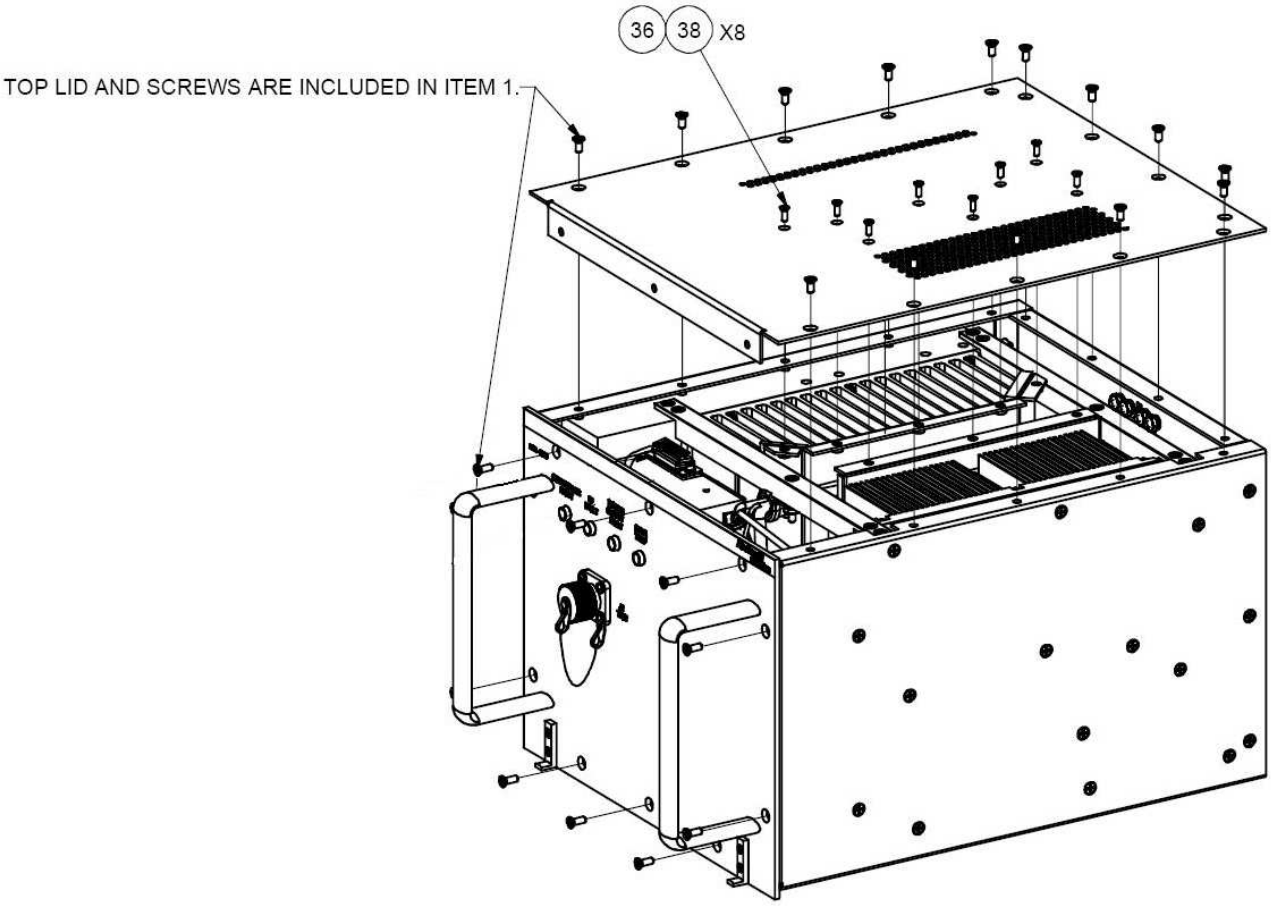


Figure 5.1 Fully Assembled HPA−901B



5.4 Top Lid and Front Panel Disassembly

- Remove eight #4-40 x 5/16" Flat Head Philips Screws (38) that secure the HPA Lid Assembly to the Housing (Figure 5.1).
- Remove the rest of the Flat Head Philips Screws from the top lid. All screws have been assembled with Loctite locking compound, so higher initial torque force must be applied to unlock the screws
- Remove top three screws from the front panel as shown on the Figure 5.2.
- Remove Top Panel

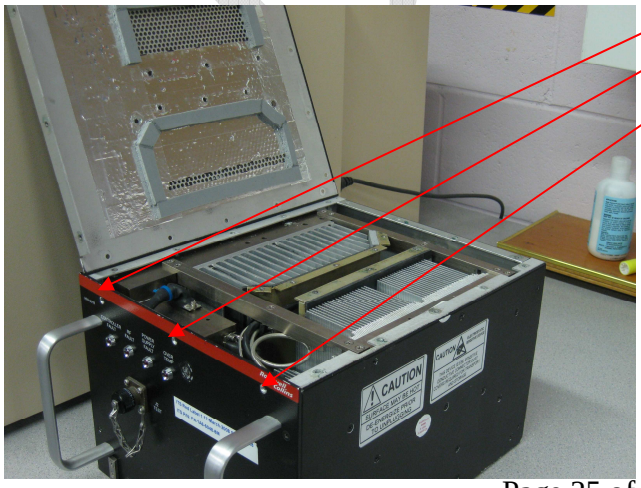


Figure 5.2 HPA with Removed Lid

5.5 Front Panel Disassembly

- Remove two #4x40 3/8” Screws to uninstall D-Sub Connector (2) from the housing (see Figure 5.3)
- Remove the rest of the screws from the front panel
- Remove front panel

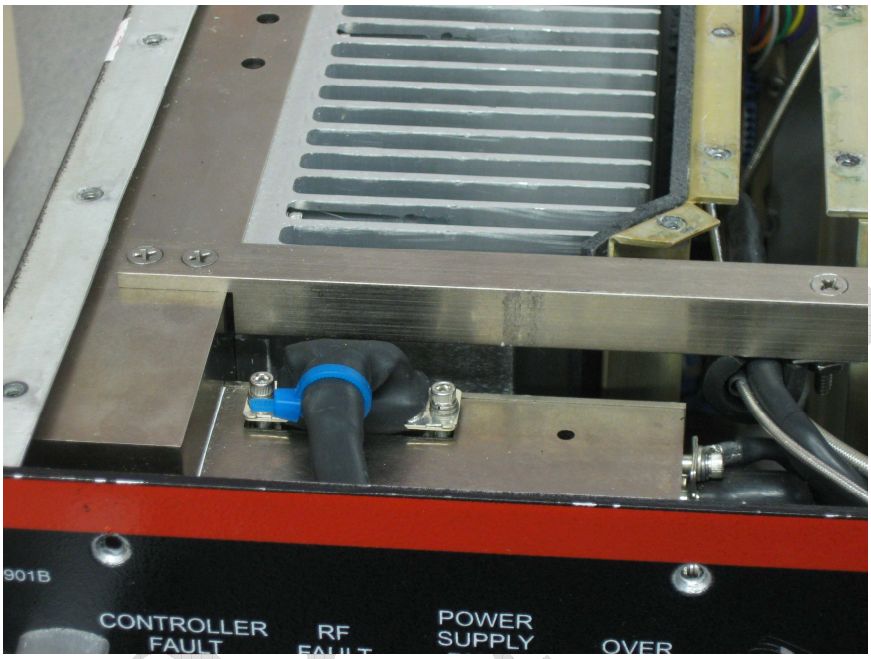
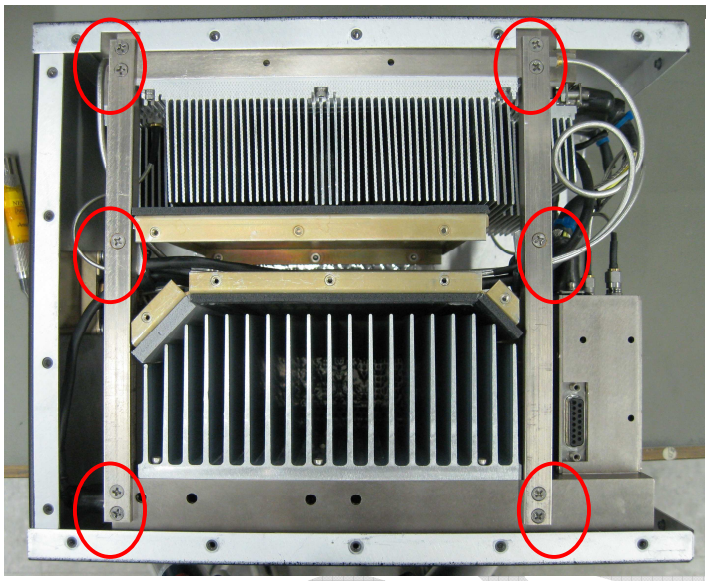


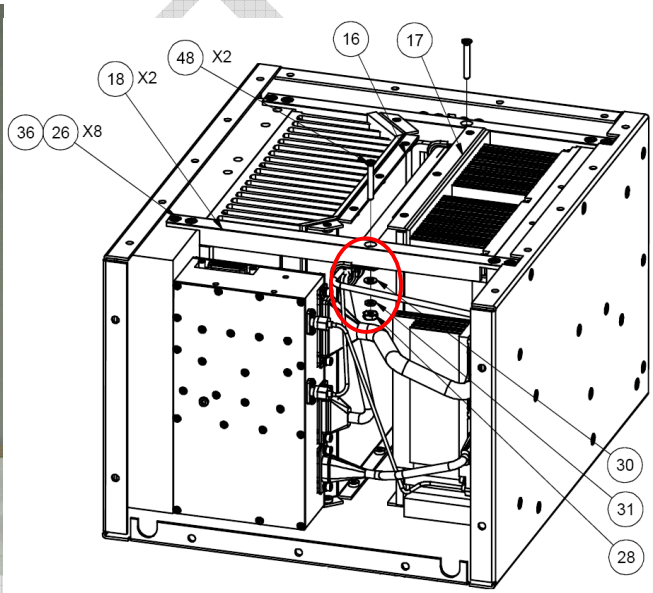
Figure 5.3

5.6 Top Bracket Removal

- Remove #4-40 x 5/16" Flat Head Philips Screws (36) holding two top brackets (18).
- Remove two middle screws item (48) securing two steel plated clamps item (47). Please note – middle screws have hardware on the back side of the bracket. See Figure 5.3 a) and b) below
- Remove the clamps item (47) holding cables and harnesses together. See Figure 5.5



a)



b)

Figure 5.4

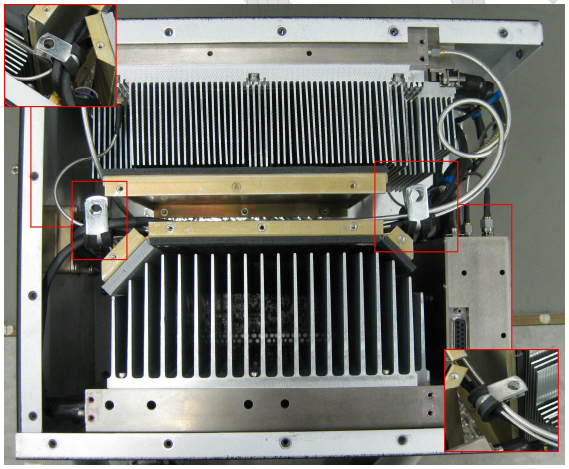


Figure 5.5 Top view after brackets removed

5.7 RF and DC Heat-sink Gasket Cover Assemblies Removal

– Remove 8 screws item (38) located on the bottom cover Figure 5.6 a) and b) in order to uninstall RF and DC Heat-sink Gasket Cover Assemblies items (16) and (17). Please note, all the screws are locked with Loctite 290 compound, so higher initial torque force must be applied

a)

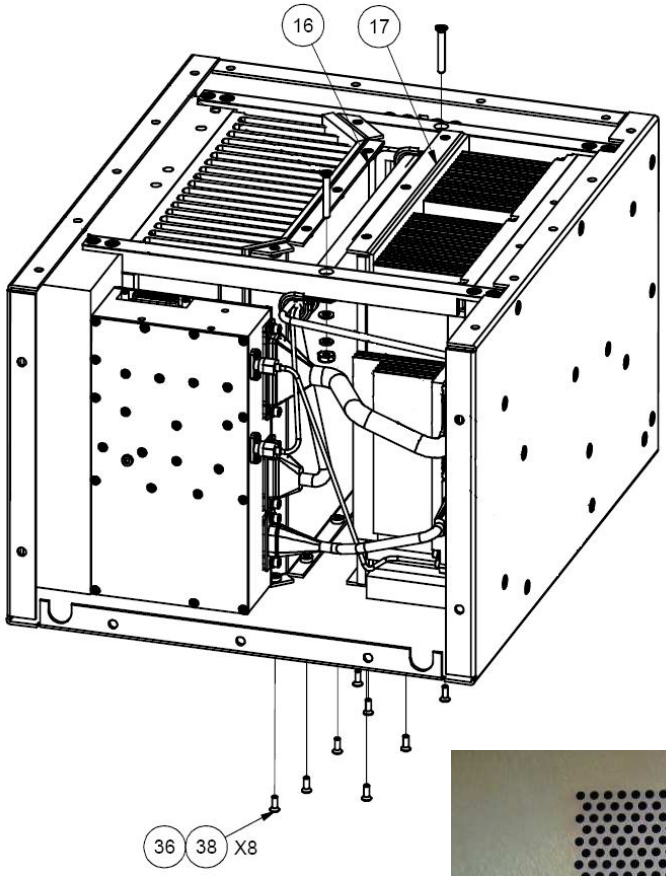
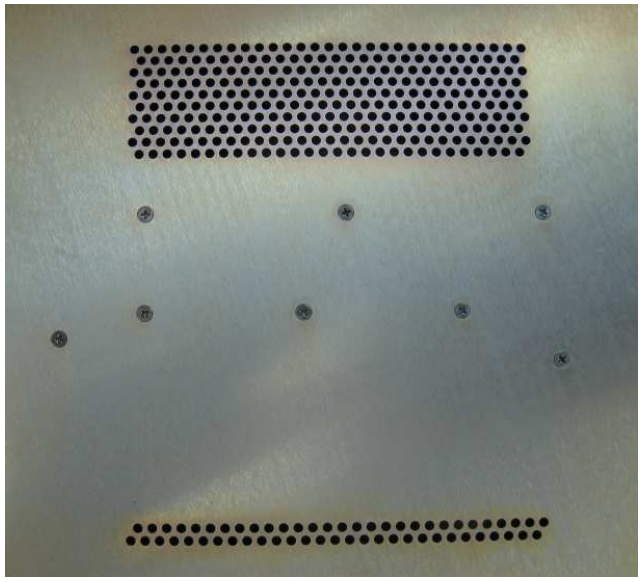
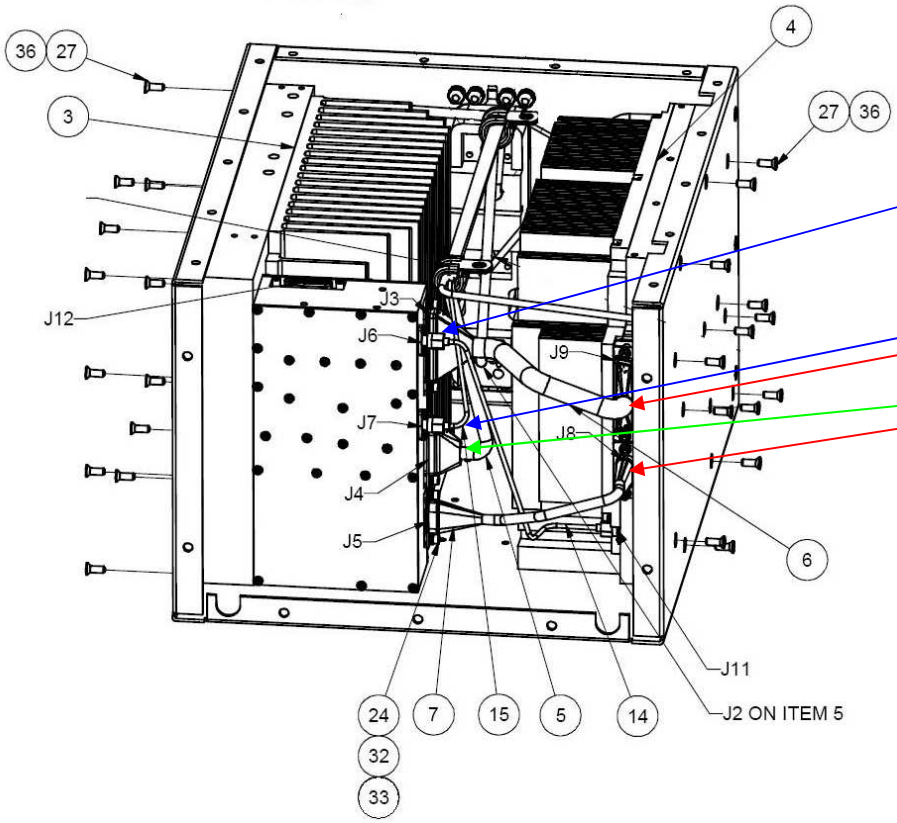


Figure 5.6 b)

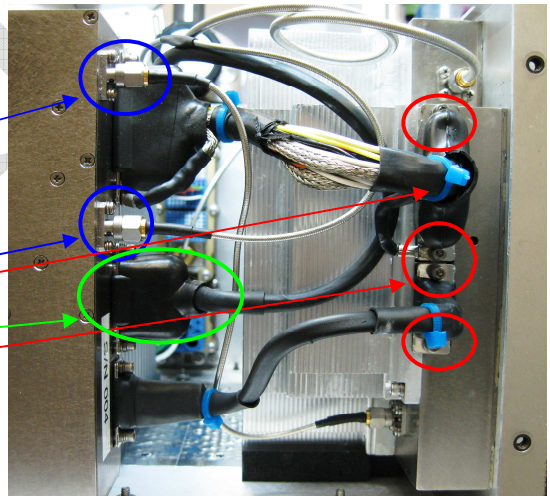


5.8 Power Supply Removal

- Remove four screws from J8 and J9 of RF module as shown on the picture Figure 5.7 a) and b) (shown with red arrows) then disconnect Pilot Tone Cables 1 and 2. items (14) and (15)
- Disconnect J6 and J7 Semi-rigid cable connectors of the Power Supply Module (shown with blue arrows)
- Remove screws item (27) from the left side cover of the drawing Figure 5.7 to uninstall Power Supply sub-assembly
- In order to remove Power Supply assembly first shift it for approximately 3'' to gain the access to the rest of the cables and then remove two connectors (J4 and J15 shown on the drawings Figure 5.7 a) and b) and on Figure 5.8 a) and b) with green color)
- Remove Power Supply from the housing

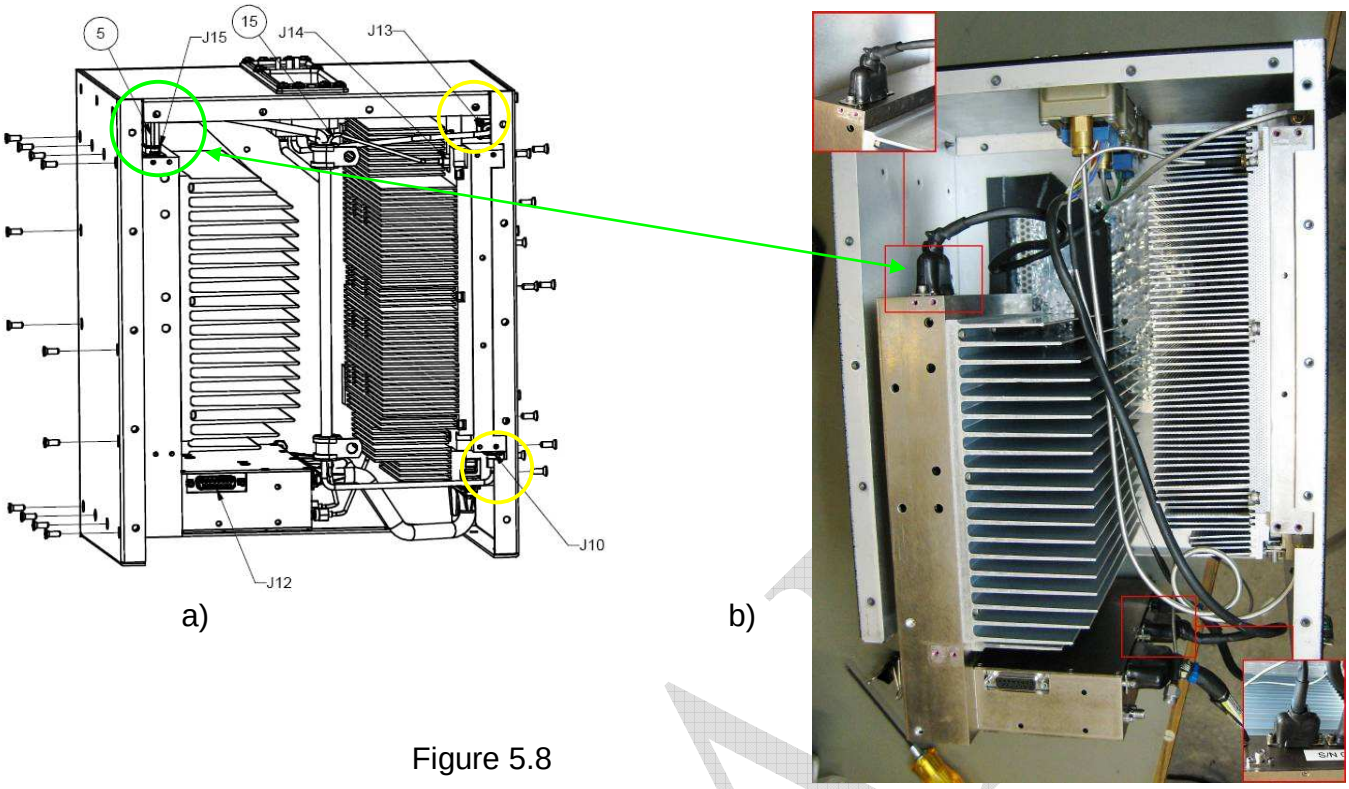


a)



b)

Figure 5.7



a) b)

Figure 5.8

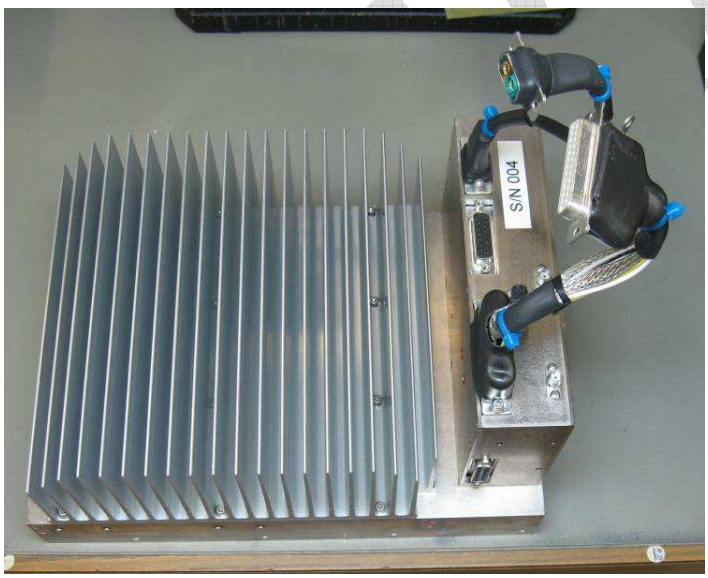


Figure 5.9 Power Supply Assembly

5.9 RF Module Removal:

- Remove all the screws item (27) holding RF Module from the right side on the Figure 5.7 a). Please note all screws are locked with Loctite 290 compound, so higher initial torque force must be applied
- Shift RF Module off the side panel for approx. 2" distance
- Disconnect two Semi-rigid Cables J10 and J13 at locations shown on Figure 5.8 a) with yellow circles and on the Figure 5.10 below
- Remove RF Module from the housing

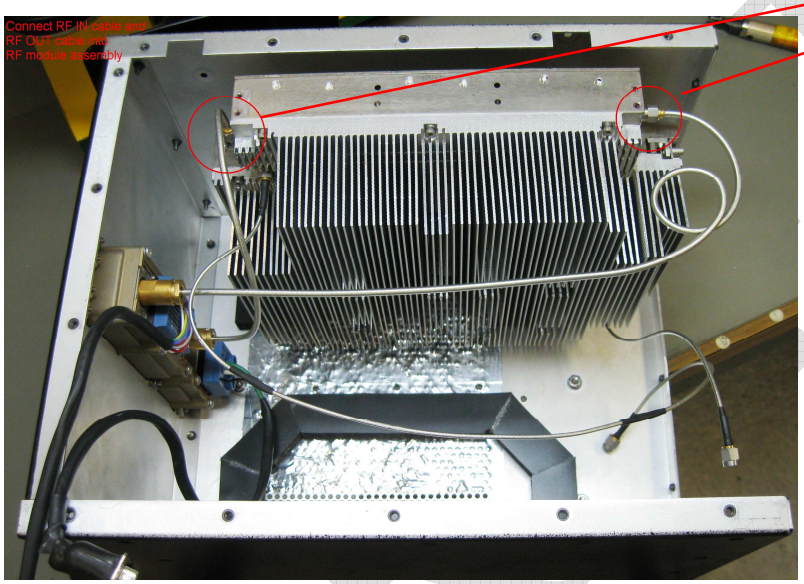


Figure 5.10

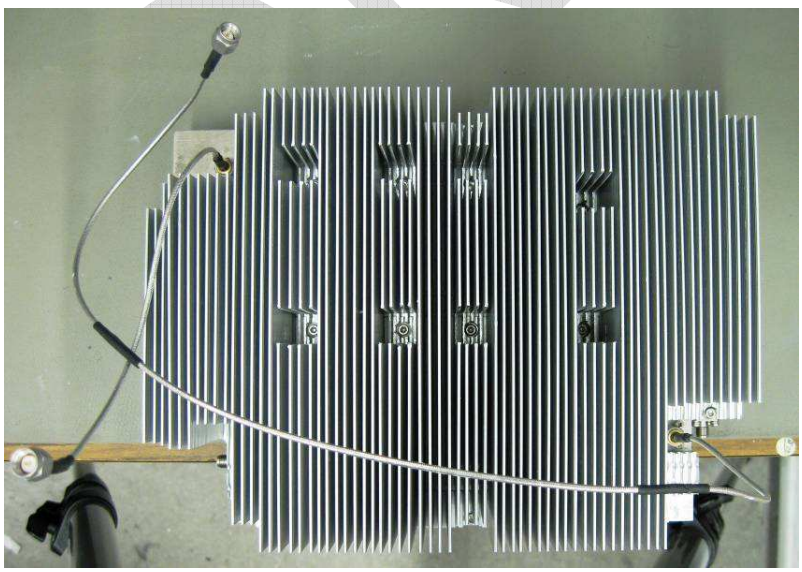


Figure 5.11 RF Module Sub-assembly

6 Cleaning

– No cleaning operation for HPA901B is required

7 Check

– Checking is limited to visual inspection of the following

- Ensure that the air channels are not obstructed.
- Ensure that all connectors are secure.
- Ensure that the HPA is mounted securely.

8 Repair

– Because of the complexity of the HPA901B, field servicing is not practical. Should a fault be identified within a unit, the unit should be returned to the factory, in its original packing material if possible, for repair or replacement.

– Refurbished replacement units will be functionally tested prior to being shipped to the customer. Based on the type of fault, ITS Electronics Inc. will determine the types of tests required to verify the integrity and serviceability of the unit. These tests will be listed on the functional test sheet that accompanies the unit.

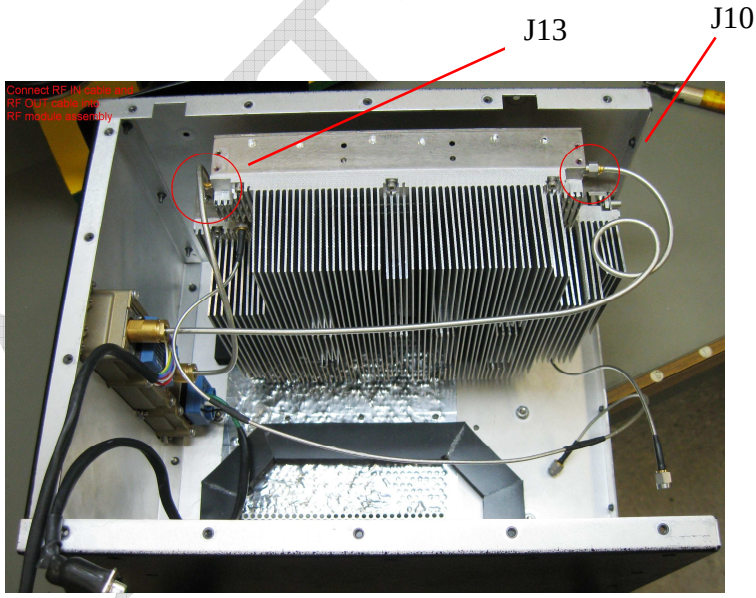
9 Assembly

9.1 RF Module Installation

- Place RF Module into the housing Figure 8.1 a)
- Connect Semi-rigid Cables to J10 and J13 as shown on Figure 8.1 b)
- Install 13 screws item (27) securing RF module to the housing.

All screws must be assembled with Loctite 290 locking compound

a)



b)

Figure 8.1

9.2 Power Supply Installation

- Place Power Supply onto the housing away from the back cover to more easily plug connectors and cables as shown on the Figure 8.2 a)
- Install two connectors J4 and J15 as shown on the drawings Figure 8.2 a) and b)
- Install Pilot Tone Cables 1 and 2 item (14) and (15) – J6 and J7 of the Power Supply Module and J8 and J9 of RF module as shown on the picture Figure 8.2 b)
- Align Power Supply Module mounting holes with side cover
- Install 12 screws item (27) as shown on the drawing Figure 5.7 to secure Power Supply sub-assembly in place

All screws must be assembled with Loctite 290 locking compound

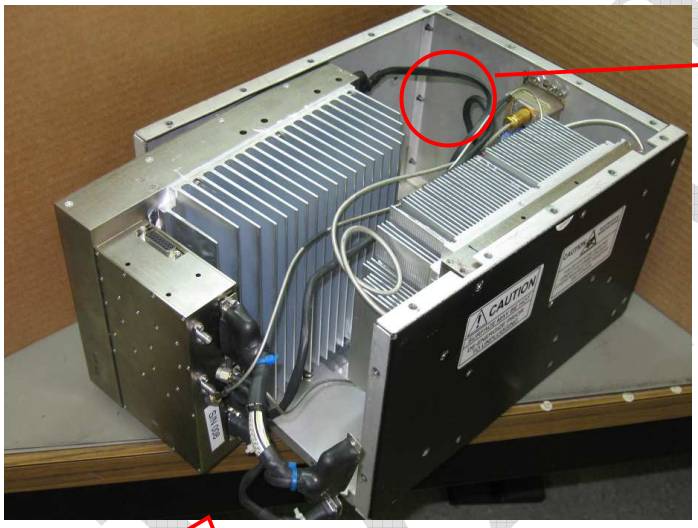
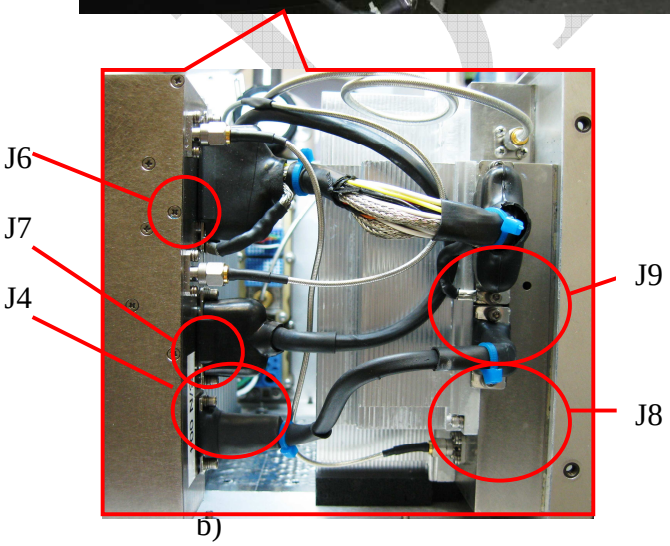


Figure 8.2

a)



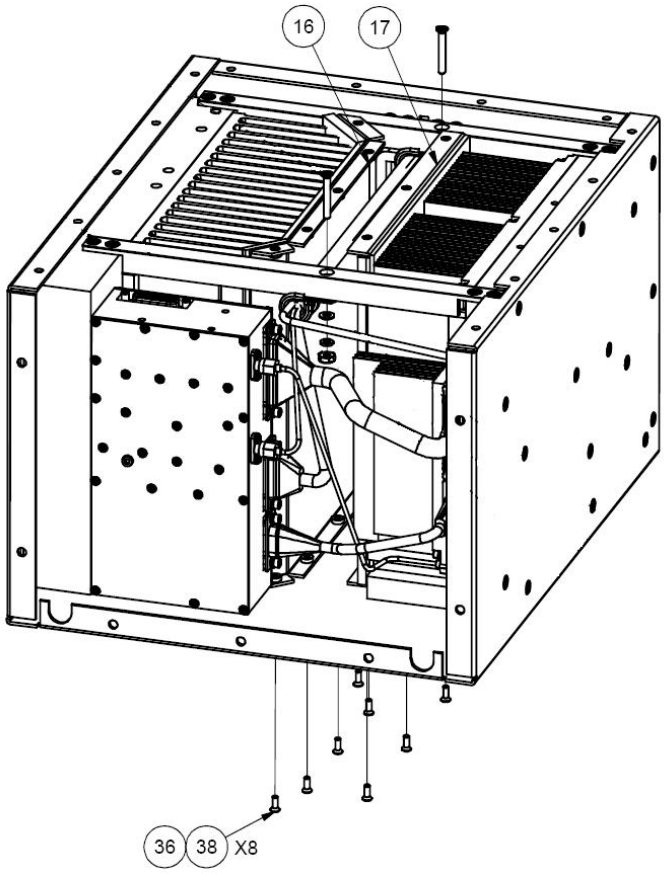
b)

Installed RF and Power Supply

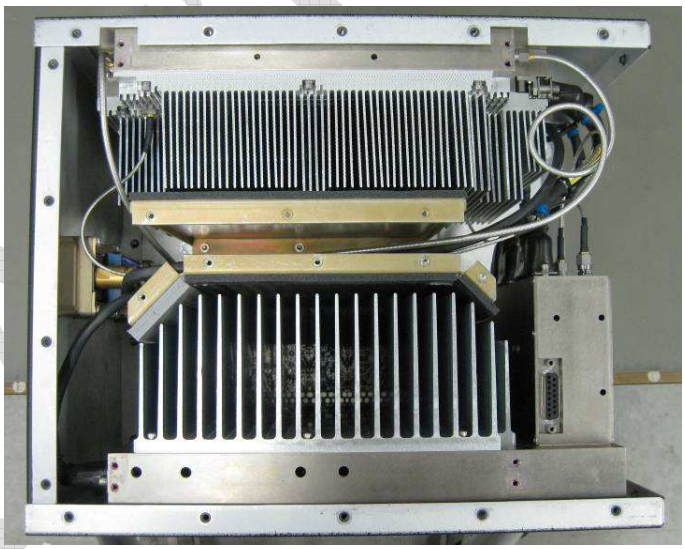
9.3 RF and DC Heat-sink Gasket Cover Assemblies Installation

- Place items(16) and (17) - RF and DC Heat-sink Gasket Cover Assemblies into the housing as shown on the Figure 8.3 a) and b)
- Install 8 screws item (38) to the bottom cover Figure 8.3 a) and c) in order to secure RF and DC Heat-sink Gasket Cover Assemblies.

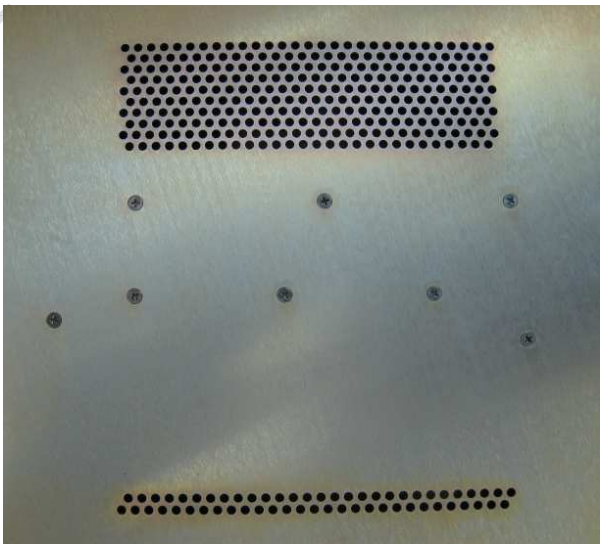
All screws must be assembled with Loctite 290 locking compound



a)



b)



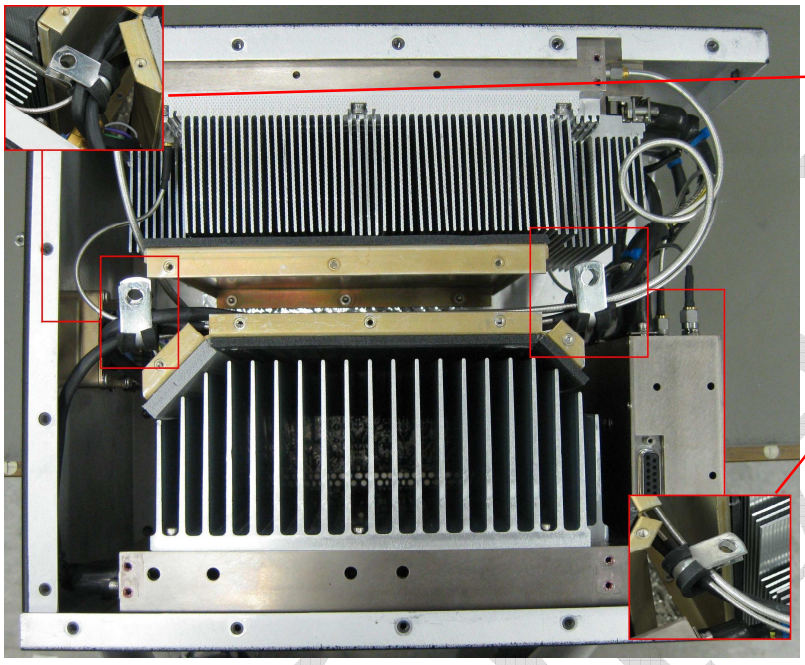
c)

Figure 8.3

9.4 Top Bracket Installation

- Install 2 steel plated clamps item (47) to the cables and harnesses per Figure 8.4 a)
- Place Top bracket item (18) onto the housing
- Install two middle screws item (48) with nut, flat and lock washers items (28), (30) and (31) holding clamps item (47), see Figure 8.4 b) and c)
- Install #4-40 x 5/16" Flat Head Philips Screws item (36) holding the brackets.

All screws without lock washers must be assembled with Loctite 290 locking compound

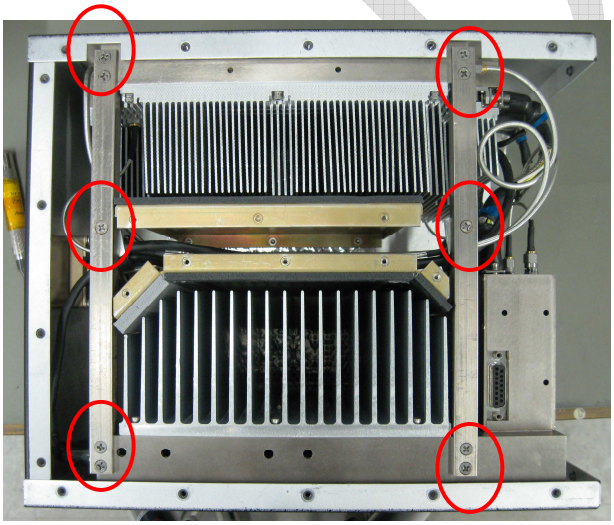


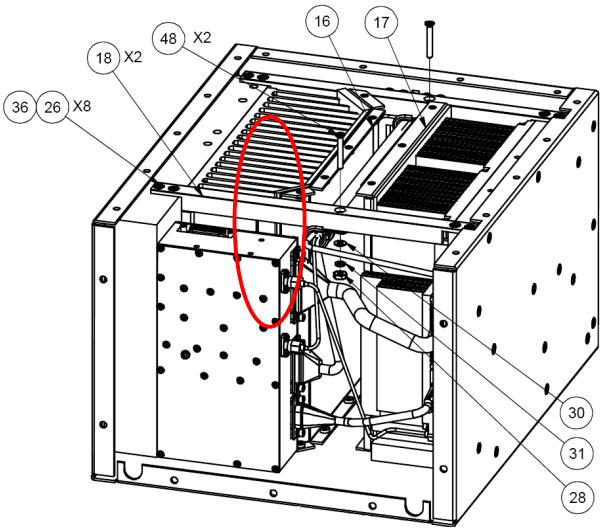
a)

b)

c)

Figure 8.4

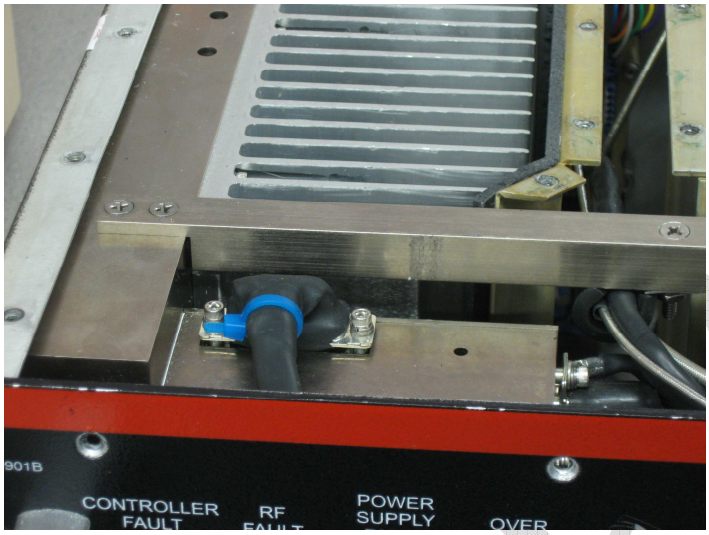


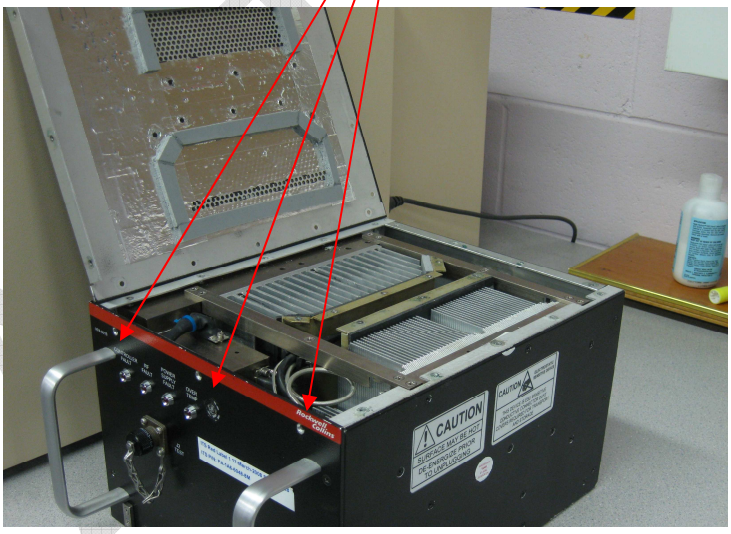


9.5 Front Panel Assembly

- Place the front panel onto the housing
- Plug D-Sub Connector item (2) on the J12 on the Power Supply module as shown on Figure 8.5 a) and secure with two #4x40 3/8" screws
- Install the front panel screws except top three as shown on the picture 8.5 b)

All screws must be assembled with Loctite 290 locking compound





a) Figure 8.5 b)

9.6 Top Lid and Front Panel Assembly

- Place top lid onto the housing as shown on the Figure 8.6
- Align RF and DC Heat-sink Gasket Covers with the top lid holes
- Install eight #4-40 x 5/16" Flat Head Philips Screws (38) that secure the top lid to the RF and DC Heat-sink Gasket Covers items (16) and (17) as shown on Figure 5.1 with red circle.
- Install top three screws from the front panel as shown on the Figure 8.5 b)
- Install the rest of Flat Head Philips Screws on the top lid.

All screws must be assembled with Loctite 290 locking compound

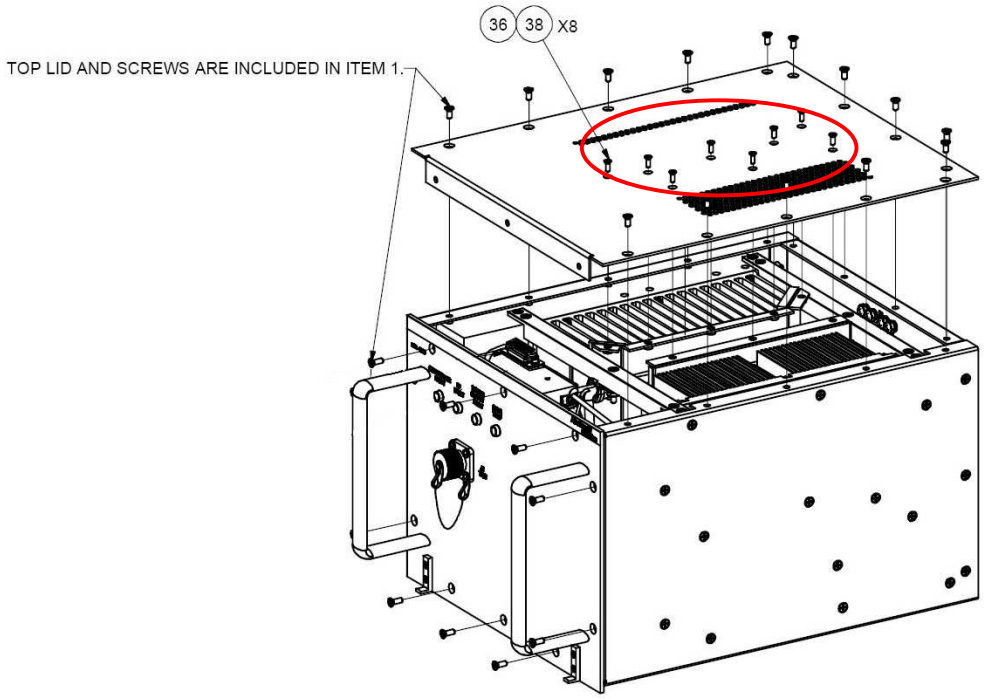


Figure 8.6

Appendix A. ILLUSTRATED PARTS LIST

A.1 General

- The Illustrated Parts List (IPL) includes a list, as in Table A1 and illustration drawings, Figure A1 ~ Figure A7.
- A Numerical Index is included in this section.
- Supplier (vendor) information includes the name, address, and CAGE code for each supplier.

A.2 Explanation and Usage

- Each SRU or part has its unique cross reference index, the “ITEM NO.”, specified in Table A1 as well as in the drawings.
- The number of a specific SRU or part in a HPA is shown in the “QTY” column.
- The measurement unit of a specific SRU or part in a HPA is shown in the “UM” column. “EA” means that SRU or part is counted individually as one piece. “IN” means that material is counted in length (inches) while “CC” means that material measured in volume (cubic centimeters).
- Each SRU or part has its own unique identification as in the “PART NUMBER” column
- The characteristics of a specific SRU or part is describe in the “PART DESCRIPTION” column
- The “MANUFACTURER” column shows the manufacturer of that SRU or part. For the general parts, such as washer, screw, no manufacturer is specified.

ITEM	QTY	UM	PART NUMBER	PART DESCRIPTION	MANUFACTURER
1	1	EA	H4800400	8MCU Enclosure	Churchill
2	1	EA	16-500324	15 pos male , D-sub connector, shell nickel plated, solder cup 50 micro inch gold plated	CONEC
3	1	EA	H4800200	Power Supply Module Assembly	ITS
4	1	EA	H4800900	RF Module Assembly	ITS
5	1	EA	H4802700	ARINC Harness Assembly	ITS
6	1	EA	H4802800	DC to RF Control DB25 Wiring Harness	ITS
7	1	EA	H4802900	DC to RF 32V Power 2W2 Wiring Harness	ITS
8			NOT IN USE		
9	4	EA	CR1-3008-0000-I	LED, CR series T1 3/4, high effic. red, no res., IP66, #24 MIL-W-22759/33 wires	WILBRECHT
10	A/R	EA	05805A500BK	HT-805(A)-. 500 Black, Black Medium Grade Cellular Silicone	Rogers Co.
11	A/R	EA	05805A250GY	HT-805(A)-. 250 Gray, Gray, Medium Grade Cellular Silicone	Rogers Co.
12			NOT IN USE		
13	1	EA	H4804300	Service Connector Wiring Harness	ITS
14	1	EA	H4800700	Pilot Tone Cable 1	ITS
15	1	EA	H4800800	Pilot Tone Cable 2	ITS
16	1	EA	H4804500	DC HEATSINK GASKET COVER ASSEMBLY	ITS
17	1	EA	H4804600	RF HEATSINK GASKET COVER ASSEMBLY	ITS
18	2	EA	H4800021	TOP BRACKET	ITS
19	1	EA	MS25043-10DA	Dust Cap with sash chain. (BLACK)	ITT Cannon
20	4	EA	5805-23-P	WAVE SHAPE SPRING WASHER, STNLS 301-304, PASSIVATED, ID=0.350"" OD=0.492"" THK=0.007"	Seastrom
21	4	EA	909-0059	#10 FLAT WASHER N TYPE B, OD. 0.406 x 0.040	not specified
22	4	EA	909-0060	#10 HELICAL SPRING LOCK WASHER, 0.334" MAX. OD, 0.047"THK.	not specified
23	4	EA	909-0055	#4-40 x 1/2" PAN HEAD PHILLIPS SCREW	not specified
24	14	EA	909-0073	#4-40 x 3/8" SCKT. HEAD SCREW	not specified
25	4	EA	909-0069	#4-40 HEX. NUT, 3/16" HEX. x 3/32"	not specified
26	8	EA	909-0119	#6-32 x 1/4" FLAT HEAD PHILLIPS SCREW	not specified
27	25	EA	909-0621	BLACK PAINTED HEAD #6-32 x 3/8"L 100 deg flat head phillips machine screw	Churchill
28	12	EA	909-0063	#6-32 HEX NUT, 5/16" HEX.x 0.108	not specified
29	10	EA	909-0067	#6-32 x 1/2" PAN HEAD PHILLIPS SCREW	not specified
30	22	EA	909-0022	#6 FLAT WASHER OD: 0.312 x 0.032, TYPE B, N	not specified
31	12	EA	909-0579	#6 SPRING LOCK WASHER OD: 0.266 x 0.040	not specified
32	18	EA	909-0003	#4 Helical Spring Lock Washer, 0.031 THK.	not specified
33	22	EA	909-0106	#4 FLAT WASHER 0.209 O.D. x 0.032 THK. (NAS620-C4)	not specified
34	4	EA	909-0244	#10-32 x 1/2" SOCKET HEAD SCREW	not specified
35	2	EA	HV420-7	#HV420-7 Oval-Internal Thread Handle. 5" x2.25"	HANDLE UNLIMITED
36	2	CC	290	LOCTITE 290	LOCTITE
37	10	IN	LC136-1-500	LACING TAPE	ALPHA
38	16	EA	909-0174	#4-40 x 5/16" FLAT HEAD PHILLIPS SCREW	not specified
39	13.5	IN	FIT-221V3/32	HEAT SHRINK TUBING (0.094" ID)	ALPHA WIRE
40	2	IN	FIT-221V5/16	HEAT SHRINK TUBING (0.312" ID)	ALPHA WIRE
41	1.5	IN	FIT-221V1/4	HEAT SHRINK TUBING (0.250" ID)	ALPHA WIRE
42	1.5	IN	PLF100-3/4-BLK-4	HEAT SHRINK TUBING (0.75" ID)	PLASTRONIC
43	1.5	IN	PLF100-1-BLK-4	HEAT SHRINK TUBING (1" ID)	PLASTRONIC
44	1	EA	PLT1M-M76	TEFZEL 4" BLUE CABLE TIE	PANDUIT
45	1	EA	ABMM-AT-CO	4 way adhesive backed mount, Black, 0.75"x0.75", Material: ABS	PANDUIT
46	1	IN	Sn63Pb37	SOLDER WIRE Sn63Pb37	KESTER
47	2	EA	SPN-6	STEEL PLATED SANTOPRENE CLAMP, 3/8" ID	RICHCO
48	2	EA	909-0247	#6-32 x 1" FLAT HEAD PHILLIPS SCREW	not specified

Table A1 - HPA Part List

A.3 Vendors (Suppliers)

VODU48 ITS Electronics Inc.
200 Edgeley Blvd., Unit #24-27
Concord, Ontario, CANADA L4K 3Y8

VCAGE ALPHA
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE ALPHAWIRE
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE Churchill
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE CONEC
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE HANDLE UNLIMITED
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE ITT Cannon
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE KESTER
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE Loctite
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE PANDUIT
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE PLASTRONIC
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE RICHCO
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE Rogers Co.
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE Seastrom
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS

VCAGE WILBRECHT
Address and CAGE code to be supplied by ITS
Address and CAGE code to be supplied by ITS