

## **6 MAINTENANCE**

### **6.1 GENERAL**

This section addresses repeater faults, fault identification, fault troubleshooting, removal and replacement of faulty item(s), and final system testing.

### **6.2 MAINTENANCE PHILOSOPHY**

Repeater maintenance is limited to removal and replacement of least replaceable units (SPU, HPA, RF Coupler, RF Detector(s) and fixed hardware components such as air filter, fans, and cables) and modification of GUI screen parameters. The user is not authorized to attempt repair of any LRU. Repair or replacement of any other components, such as the PDU, Band Pass Filter, or internal heater requires replacement of the entire repeater assembly. Prior to shipping a repeater back to Alcatel-Lucent, contact the Customer Technical Assistance Center (CTAC) to discuss the problem. See CTAC contact instructions in the Front Matter section of this manual.

### **6.3 TEST EQUIPMENT**

The only test equipment required is a PC.

### **6.4 SPECIAL TOOLS**

Two special wrenches are required to perform maintenance on the HPA and the RF Coupler.

- **HPA RF CONNECTOR WRENCH:**  
1 1/4-inch open-end, overall length not to exceed four inches. Maximum thickness 1/2 inch.
- **RF COUPLER WRENCH:**  
1 1/8-inch open-end, overall length not to exceed five inches. Maximum thickness 1/8 inch.

### **6.5 PREVENTIVE MAINTENANCE**

The only required scheduled preventive maintenance is for the rear door air filter assembly. As a general rule, it is recommended replacing the air filter every 6 months under normal conditions or every 3 months in dusty environments. Under extremely dusty conditions or in a windy environment near open areas with loose blowing sand/dirt, it is recommended that filters be inspected more frequently and adjusting replacement intervals as deemed necessary.

### **6.6 TROUBLESHOOTING OVERVIEW**

Troubleshooting can be performed remotely and locally as described in the following paragraphs.

#### **6.6.1 Remote Troubleshooting Overview**

Remote troubleshooting is performed at the NMC by an operator using the GUI screens. When the cause of the fault is identified, the user determines if the fault can be corrected from the NMC. If not, a maintenance technician is dispatched to the repeater site.

## 6.6.2 Local Troubleshooting Overview

Local troubleshooting is performed at the repeater site by a dispatched technician using a PC, GUI screens (or CLI), and external test equipment. When the fault is corrected, the technician follows on with a system test. When satisfied that the repeater is operating correctly, coordination between the technician and the NMC operator returns the repeater back to the remote operating condition and broadcast mode.

## 6.7 REPEATER ALARM INDICATORS

Alarms are indicated on GUI Status screens, GUI Alarms screens, and front panel LEDs. **Refer to Appendix D, Alarm Descriptions, Causes, and Corrections.**

## 6.8 TROUBLESHOOTING PROCEDURES

### 6.8.1 Remote Troubleshooting/Repair Procedures

- Upon receipt of an alert via the repeater site TELCO line, NMC personnel will evaluate the indicated problem(s). Refer to the Operations section for instructions on use of the GUI.
- Access the GUI
- View the Alarms screens for indicated problem identification.
- View the Status screens for additional information.
- If it is determined that the problem(s) can be corrected remotely, access the necessary GUI screens and correct as required.
- If it is determined that the problem(s) cannot be corrected from the NMC, take the necessary steps to dispatch a technician to the repeater site to perform local maintenance.

### 6.8.2 Local Troubleshooting/Repair Procedures

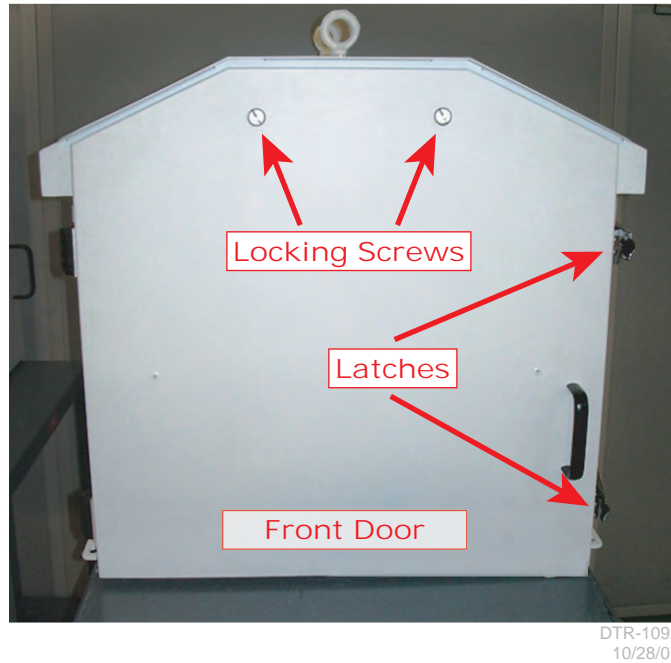
When indicated cautionary statements are adhered to by the technician during maintenance, the equipment is unlikely to present a hazard to the technician or the structure.



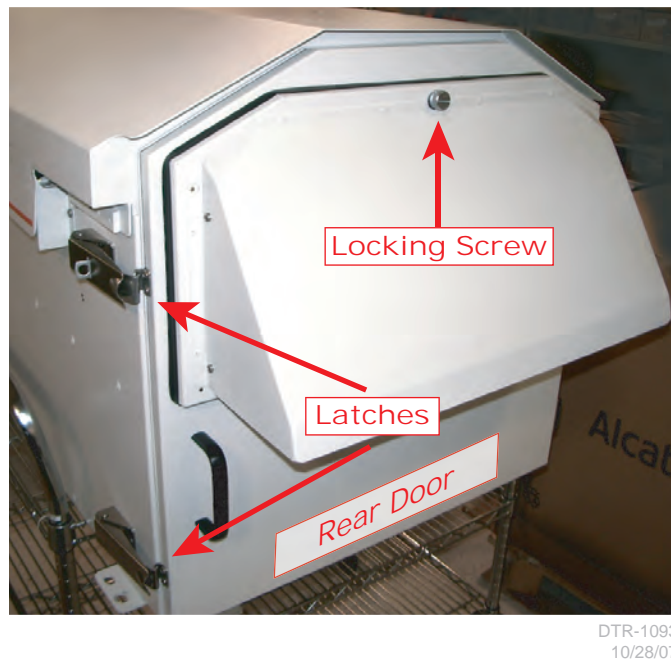
***The front and rear doors of the repeater cabinet are secured by draw latches and captive locking screws. There are two latches and two locking screws on the cabinet front door and two latches and one locking screw on the cabinet rear door (see figure 6-1). It is imperative that opening and/or closing of these doors be done in the provided sequence. Failure to follow the sequence could result in door warping or bending and render the cabinet water protection system invalid.***

***Opening the Door – first release the captive locking screw(s) then undo the draw latches.***

***Closing the Door – first secure the draw latches then tighten the captive locking screw(s).***



**Figure 6-1 Locking Screws and Latches (Sheet 1 of 2)**



**Figure 6-1 Locking Screws and Latches (Sheet 2 of 2)**



***NMC coordination must be accomplished prior to repeater being switched to Local operating condition. This will prevent conflicting actions between the NMC and on-site operator(s) and preclude possible personal injury and/or equipment damage.***

- Switch the repeater to the Local operating condition.
- Connect the PC to a repeater Ethernet (LAN) connector on the back panel of the Controller (or to the SPU front panel RS-232 connector for CLI if an active LAN connector is not available).
- View the SPU front panel indicators.
- Access GUI (or CLI screens).
- Use the Alarms and Status GUI in conjunction with the SPU front panel indications to help identify problem(s).
- Refer to Appendix D, “Alarm Descriptions, Causes, and Suggested Responses”, for procedures to correct problems.
- Access the GUI screens and enter changes as required.
- Remove and replace components if required.
- Major unit replacement requires parameter updating.
- Run repeater test on completion of troubleshooting/repair.
- Coordinate with the NMC and return repeater to the Remote operating condition.



***When working in the vicinity of fans (under repeater roof or replacing air filter on repeater back door), power to fans must be removed.***



***POSSIBILITY OF EQUIPMENT AND/OR STRUCTURE DAMAGE DUE TO FIRE. Any fuse replacement must be with an exact fuse value (size, rating, capacity) as the fuse being replaced.***

## 6.9 REMOVAL AND REPLACEMENT (R/R) PROCEDURES

**Table 6-1 Remove/Replace Matrix**

UNIT	PROCEDURE
Signal Processing Unit (SPU)	Refer to <a href="#">Chart 1</a>
High Power Amplifier (HPA)	Refer to <a href="#">Chart 2</a>
RF Detectors	Refer to <a href="#">Chart 3</a>
RF Coupler	Refer to <a href="#">Chart 4</a>
Rear Door Intake Fans 1 & 2	Refer to <a href="#">Chart 5</a>
Under Roof Exhaust Fans 3 & 4	Refer to <a href="#">Chart 6</a>
Fan Relays R1/R2	Refer to <a href="#">Chart 7</a>
Rear Door Air Filter	Refer to <a href="#">Chart 8</a>
PDU Front Access Circuit Breakers	Refer to <a href="#">Chart 9</a>
Power Distribution Unit (PDU)	Replace Repeater
Band Pass Filter	Replace Repeater
Internal Heater	Replace Repeater



## Chart 1 Remove and Replace signal Processing Unit (SPU)



*Main power to repeater must be off.*

STEP	PROCEDURE
	<b>REMOVAL</b>
1	Open front and rear doors <b>a To open front door</b> Release two locking screws then release two door latches. <b>b To open rear door</b> Release one locking screw then release two door latches
2	Coordinate with NMC and switch repeater to local operating condition.
3	Switch all repeater PDU circuit breakers to OFF switching main breaker last
4	Switch OFF commercial power source breaker supplying power to repeater.
5	Hang “ <b>DANGER – DO NOT TURN ON – PERSONNEL WORKING</b> ” sign at commercial power source breaker.
6	See <a href="#">Figure 6-2</a> for SPU rear cable connector panels (VSAT rcvr, modulator, controller, and up-converter) and disconnect all cables. Be sure to mark cables for ease in reconnecting.
7	Remove SPU via front of cabinet.





Figure 6-2 SPU Rear Connector Panels

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**STEP**

**PROCEDURE CONT.**

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**REPLACEMENT**

- 8 Insert new SPU into cabinet.
- 9 Reconnect all cables.
- 10 Switch ON commercial power source breaker and remove danger sign.
- 11 Switch ON main PDU circuit breaker.
- 12 Switch ON remaining PDU circuit breaker.
- 13 Perform parameter changes.  
When the SPU is replaced, various parameters must be changed. The following steps identify the required parameter changes. The steps are described using the GUI screens but the changes can also be made using the CLI screens.

**a CONFIG**

- CONFIG>Modulator>Repeater ID
- CONFIG>Coupler  
(enter the Forward and Reflected Port Offset values. These values are on labels affixed to the RF Detectors).
- CONFIG>PPP Parameters (Dial-in, Dial-out, Misc.).  
(these values are obtained from the SIRIUS Network Manager).
- CONFIG>Site  
(this information is furnished by the SIRIUS network Manager).



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STEP	PROCEDURE CONT.
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**b ALARMS**

- ALARMS>Alarm Properties  
(set SIRIUS specified alarm traps ON or OFF for NMS alerting).

**c NMS USERS**

- NMS USERS>User Properties  
Auth Type = SHA  
Priv Type = DES.

**d SYSTEM PARAMETERS**

- SYSTEM PARAMETERS>Network Parameters  
(reset per SIRIUS network manager information).
- SYSTEM PARAMETERS>SNMP Parameters  
(set SNMP Traps to ON and enter SNMP server IP address).
- SYSTEM PARAMETERS>Heartbeat Time  
(set time for minimum NMC interference; Heartbeat will display on Alarms Log).
- SYSTEM PARAMETERS>System Reset

At completion of System Parameters changes, perform System Reset to allow changes to take effect.

**e CONFIG**

- CONFIG>Repeater Operating Mode  
(set operating mode to Broadcast).

**14** Perform repeater operational test as described in the Turn-Up section of this manual.

**15** Coordinate with NMC and return repeater to remote operating condition.

**a To Close Front Door**

Secure two door latches then tighten two locking screws.

**b To Close Rear Door**

Secure two door latches then tighten one locking screw.



## Chart 2 Remove and Replace High Power Amplifier (HPA)



*Main power to repeater must be off.*

### Note

*This procedure requires a 1 1/4" open end wrench with an overall length of no more than 4 inches to disconnect and reconnect the RF OUT cable.*

STEP	PROCEDURE
	<b>REMOVAL</b>
1	Open front and rear doors.  <b>a To open front door</b> Release two locking screws then release two door latches.  <b>b To open rear door</b> Release one locking screw then release two door latches.
2	Coordinate with NMC and switch repeater to local operating condition.
3	Switch all repeater PDU circuit breakers to OFF, switching main breaker last.
4	Switch OFF commercial power source breaker supplying power to repeater.
5	Hang " <b>DANGER – DO NOT TURN ON – PERSONNEL WORKING</b> " sign at commercial power source breaker.
6	See <a href="#">Figure 6-3</a> for HPA rear panel cable connectors and disconnect HPA cables (AC IN, RF OOUT, CONTROL I/F, RF IN). Be sure to mark cables for proper reconnecting.
7	Remove HPA via front of cabinet.



Figure 6-3 HPA Rear Panel Connectors

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STEP	PROCEDURE CONT.
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**REPLACEMENT**

- 8 Insert new HPA into cabinet.



***RF Connector must be installed properly to prevent RF leakage and/or arcing.***

- 9 Reconnect all cables (use 1 1/4" open-end wrench on RF OUT cable connector).
- 10 Switch ON commercial power source breaker and remove danger sign.
- 11 Switch ON main PDU circuit breaker.
- 12 Switch ON remaining PDU circuit breakers.
- 13 Access GUI Global Status screen and check all values.
- 14 set repeater operating mode to Broadcast.
- 15 Coordinate with NMC and return repeater to Remote operating condition.
- 16 Close front and rear doors.
- a **To close front door**  
Secure two door latches then tighten two locking screws.
  - b **To close rear door**  
Secure two door latches then tighten one locking screw.

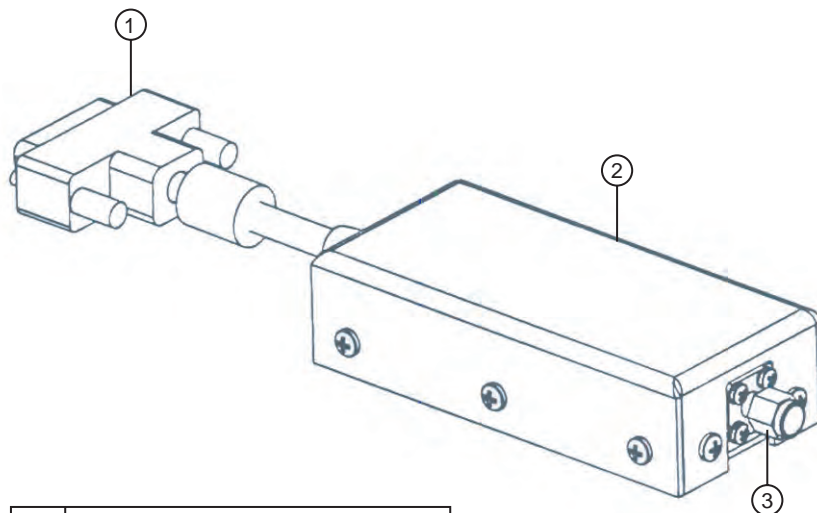
### Chart 3 Remove and Replace RF Detector(s)



***Main power to repeater must be off.***

#### Note

*Prior to removal of detector(s), tag each to identify which is the forward RF detector and which is the reflected RF detector. Failure to install detectors correctly will cause the wrong feedback signals to be transmitted to the main controller. This in turn will cause HPA power problems and inaccurate power readings.*



1	DB-9 Connector to SPU Controller
2	RF Detector
3	SMA Connector to RF Coupler

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**Figure 6-4 RF Detector**

STEP	PROCEDURE
<b>REMOVAL</b>	
1	Open front and rear doors.  <b>a To Open Front Door</b> Release two locking screws then release two door latches  <b>b To Open Rear Door</b> Release one locking screw then release two door latches.
2	Coordinate with NMC and switch repeater to Local operating condition.
3	Switch OFF all repeater PDU circuit breakers, switching repeater main breaker last.
4	Switch OFF commercial power source breaker supplying power to repeater.
5	Hang “ <b>DANGER – DO NOT TURN ON – PERSONNEL WORKING</b> ” sign at commercial power source breaker.
<b>Note</b>	
<i>Before removing RF detectors, tag each as FWD or REFL. The vertical detector is the FWD and the horizontal detector is the REFL. If the detectors are not connected properly during reinstallation, the RF power feedback signals to the main controller will be incorrect.</i>	
6	Loosen SMA connector(s) on detector(s) and remove detector(s) from RF coupler.
7	Disconnect detector cable connector(s) from SPU controller rear panel (FWD RF DETECTOR, REF RF DETECTOR).
8	Remove detector(s) from repeater.

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<b>STEP</b>	<b>PROCEDURE CONT.</b>
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**REPLACEMENT**

- |           |   |
|-----------|---|
| <b>9</b>  | Connect detector cable(s) to SPU controller rear panel (FWD RF DETECTOR, REF RF DETECTOR) ensuring correct detector connects to correct connector. Refer to NOTE preceding step 5.  |
| <b>10</b> | Connect RF detector(s) to RF coupler and tighten SMA connector(s). Ensure that proper detector is connected to the proper connector on the RF coupler. Refer to NOTE preceding step 5 above.                              |
| <b>11</b> | Close commercial power source breaker and remove danger sign.   |
| <b>12</b> | Close repeater main PDU circuit breaker.  |
| <b>13</b> | Close remaining repeater PDU circuit breakers.  |
| <b>14</b> | Access GUI Global Status screen and check RF Power Out values.  |
| <b>15</b> | Set operating mode to Broadcast.  |
| <b>16</b> | Coordinate with NMC and return repeater to remote operating condition.  |
| <b>17</b> | Close front and rear doors.<br><br><b>a To Close Front Door</b><br>Secure two door latches then tighten two locking screws.<br><br><b>b To Close Rear Door</b><br>Secure two door latches then tighten one locking screw. |





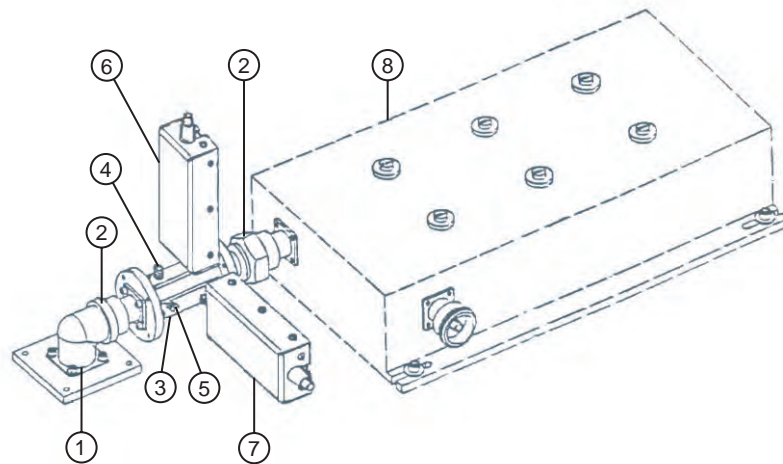
### Chart 4 Remove and Replace RF Coupler



**Main power to repeater must be off.**

**Note**

*This procedure requires a 1 1/8" open end wrench with an overall length of no more than 5 inches and a maximum thickness of 1/8" to disconnect and reconnect the RF Coupler securing nuts.*



1	Adapter Plate Securing Hardware
2	RF Coupler Connecting Nuts
3	RF Coupler
4	RF Monitor Cable Connector (FWD)
5	RF Monitor Cable Connector (REF)
6	RF Detector (FWD)
7	RF Detector (REF)
8	Band Pass Filter

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**Figure 6-5 RF Coupler and Detectors**

STEP	PROCEDURE
	<b>REMOVAL</b>
1	Open front and rear doors. <b>a To Open Front Door</b> Release two locking screws then release two door latches. <b>b To Open Rear Door</b> Release one locking screw and then release two door latches.
2	Coordinate with NMC and switch repeater to Local operating condition.
3	Switch OFF all repeater PDU circuit breakers switching repeater main breaker last.
4	Switch OFF commercial power source breaker supplying power to repeater.
5	Hang “ <b>DANGER – DO NOT TURN ON – PERSONNEL WORKING</b> ” sign at commercial power source breaker.
	<b>Note</b>
	<i>Before removing RF detectors, tag each as FWD or REFL. The vertical detector is the FWD and the horizontal detector is the REFL. Also do the same with the RF power monitor cables connected to the RF coupler. If the detectors and the monitor cables are not connected properly during reinstallation, the RF power feedback signals to the main controller and to the junction box monitor jacks will be incorrect.</i>
6	Loosen SMA connectors on both detectors and remove detectors from RF coupler.
7	Remove monitor cables from RF coupler.
8	Loosen RF coupler elbow adapter screws to allow movement of adapter.
9	Loosen RF coupler connecting nuts and remove coupler/detector assembly.

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STEP	PROCEDURE CONT.
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**REPLACEMENT**

- 10 Install coupler and tighten connecting nuts and elbow adapter screws.
- 11 Connect RF detectors to new coupler ensuring that proper detector is connected to the proper connector. Refer to NOTE preceding step 6 above.
- 12 Connect RF monitor cables to the RF coupler ensuring that proper cable is connected to proper connector. Refer to NOTE preceding step 6 above.
- 13 Switch ON commercial power source breaker and remove danger sign.
- 14 Switch ON repeater main PDU circuit breaker.
- 15 Switch ON remaining repeater PDU circuit breakers.
- 16 Access GUI Global Status screen and check RF Power Out values.
- 17 Set operating mode to Broadcast.
- 18 Coordinate with NMC and return repeater to Remote operating condition.
- 19 Close front and rear doors.
  - a **To Close Front Door**  
Secure two door latches then tighten two locking screws.
  - b **To Close Rear Door**  
Secure two door latches then tighten one locking screw.



### Chart 5 Remove and Replace Rear Door Intake Fan(s)



*Main power to repeater must be off.*



Figure 6-6 Rear Door Intake Fans

STEP	PROCEDURE
	<b>REMOVAL</b>
1	Open front and rear doors <ol style="list-style-type: none"><li>a <b>To Open Front Door</b> Release two locking screws then release two door latches.</li><li>b <b>To Open Rear Door</b> Release one locking screw then release two door latches.</li></ol>
2	Coordinate with NMC and switch repeater to Local operating condition.
3	Switch OFF all repeater PDU circuit breakers switching main breaker last.
4	Switch OFF commercial power source breaker supplying power to repeater.
5	Hang “ <b>DANGER – DO NOT TURN ON – PERSONNEL WORKING</b> ” sign at commercial power source breaker.
6	Disconnect and remove power wires from fan terminal block (see Figure 6-7).
7	Remove retaining hardware from fan mounting studs.
8	Remove fan from mounting studs.

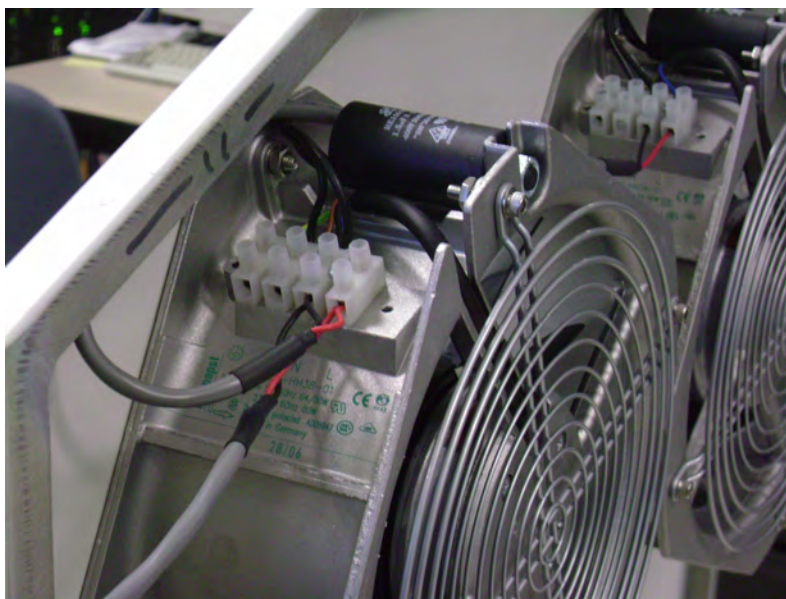


Figure 6-7 Fan Terminal Block



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<b>STEP</b>	<b>PROCEDURE CONT.</b>
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**REPLACEMENT**

- 9** Install new fan on mounting studs.
- 10** Replace and tighten fan securing hardware.
- 11** Reconnect power wires to fan terminal block.
- 12** Switch ON commercial power source breaker and remove danger sign.
- 13** Switch ON main PDU circuit breaker.
- 14** Switch ON remaining PDU circuit breakers.
- 15** Set operating mode to Broadcast.
- 16** Coordinate with NMC and return repeater to Remote operating condition.
- 17** Close front and rear doors.
  - a To Close Front Door**  
Secure two door latches then tighten two locking screws.
  - b To Close Rear Door**  
Secure two door latches then tighten one locking screw.



## Chart 6 Remove and Replace Under Roof Exhaust Fan(s)



*Main power to repeater must be off.*

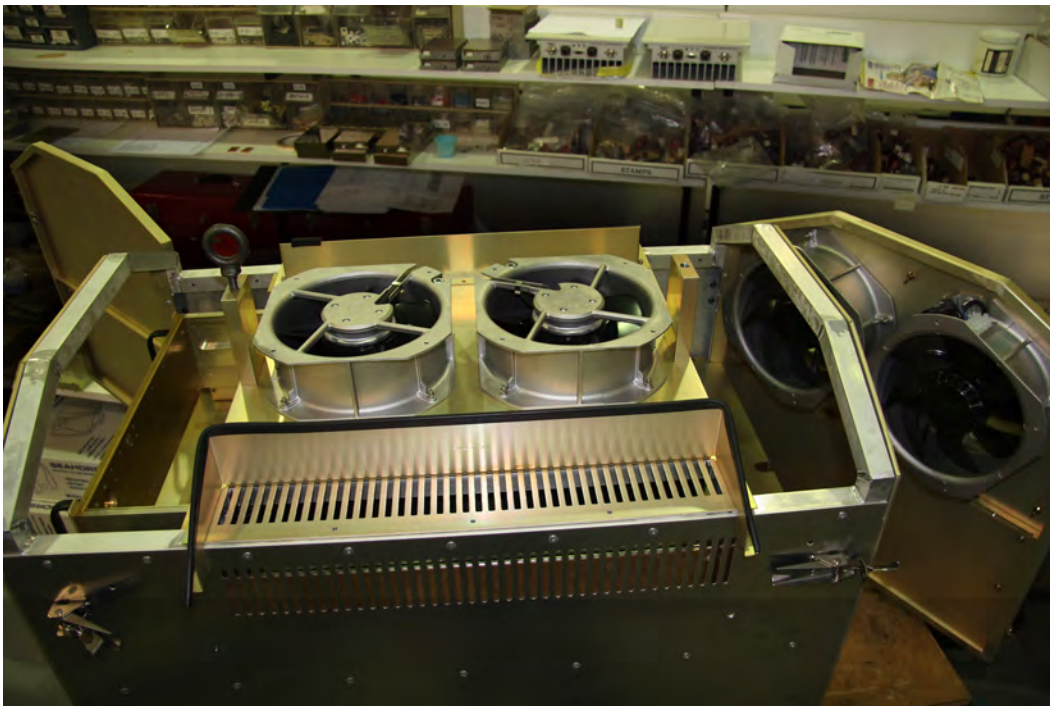
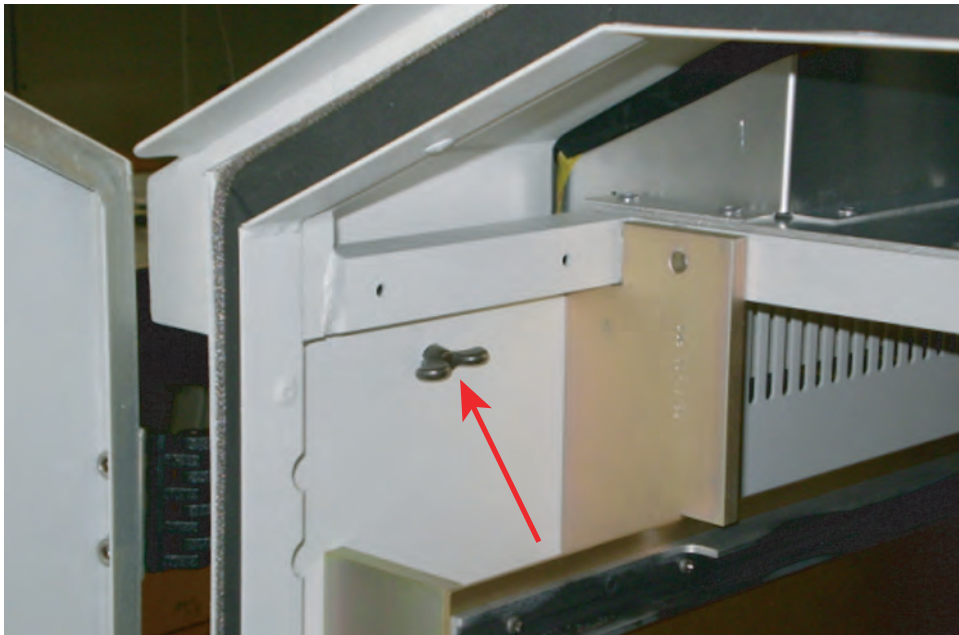


Figure 6-8 Under Roof Exhaust Fans

STEP	PROCEDURE
	<b>REMOVAL</b>
1	Open front and rear doors.
	<b>a To Open Front Door</b>
	Release two locking screws then release two door latches.
	<b>a To Open Rear Door</b>
	Release one locking screw then release two door latches.
2	Coordinate with NMC to switch repeater to Local operating condition.
3	Switch all repeater PDU circuit breakers to OFF, switching main breaker last.
4	Switch OFF the commercial power source main breaker which supplies power to repeater.
5	Hang “ <b>DANGER – DO NOT TURN ON – PERSONNEL WORKING</b> ” sign at commercial power source breaker.
6	Remove cabinet roof by removing four wing screws from interior of cabinet (Figure 6-9) and two eye bolts and their plastic spacers from exterior of roof (Figure 6-10).
7	Disconnect and remove power wires from fan terminal blocks (Figure 6-11).
8	Remove retaining hardware from fan mounting studs.
9	Remove fan(s) from mounting studs.



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**Figure 6-9 Internal Wing Screws (4)**



**Figure 6-10 External Eye Bolts and Spacers (2)**

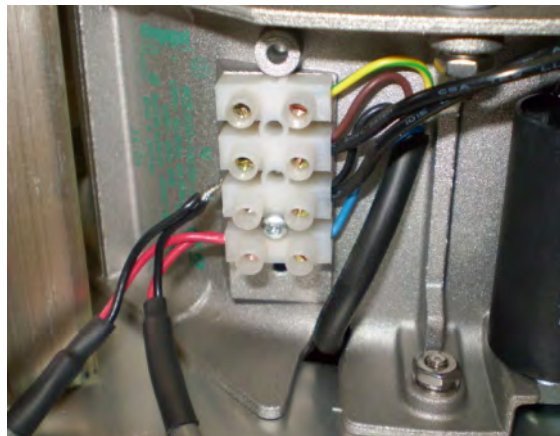


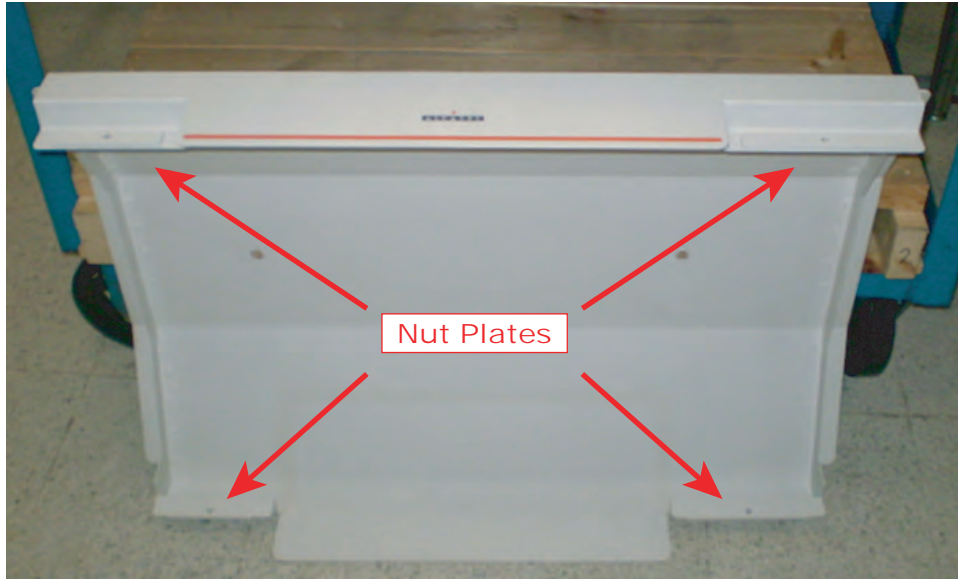
Figure 6-11 Fan Terminal Block

STEP	PROCEDURE CONT.
	<b>REPLACEMENT</b>
10	Install new fan(s) on mounting studs.
11	Replace and tighten fan securing hardware.
12	Reconnect power wires to fan terminal block.
13	Reinstall cabinet roof (Figure 6-12) and roof securing hardware (Figure 6-13).

**Note**

*When reinstalling the roof, the side with the larger nut plate goes to the front of the cabinet.*





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**Figure 6-12 Roof Showing Nut Plates**



**Figure 6-13 Roof Securing Hardware**



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<b>STEP</b>	<b>PROCEDURE CONT.</b>
<b>14</b>	Switch on commercial power source main breaker and remove danger sign.
<b>15</b>	Switch on main PDU circuit breaker.
<b>16</b>	Switch on remaining PDU circuit breakers.
<b>17</b>	Set operating mode to Broadcast.
<b>18</b>	Coordinate with NMC and return repeater to Remote operating condition.
<b>19</b>	Close front and rear doors.  <b>a To Close Front Door</b> Secure two door latches then tighten two locking screws.  <b>b To Close Rear Door</b> Secure two door latches then tighten one locking screw.

## Chart 7 Remove and Replace Fan Relay R1 and/or R2



*Main power to repeater must be off.*

### Note

*Relay R1 controls the roof fans; relay R2 controls the rear door fans.*

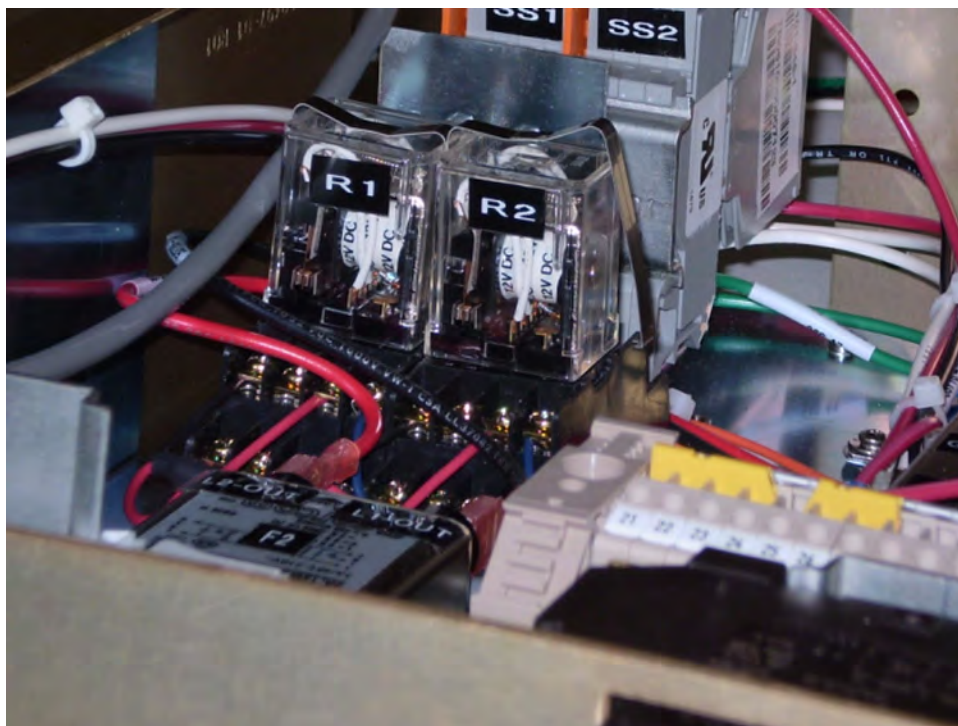


Figure 6-14 Fan Relays

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STEP	PROCEDURE
<b>REMOVAL</b>	
1	Open front and rear doors. <b>a To Open Front Door</b> Release two locking screws then release two door latches. <b>b To Open Rear Door</b> Release one locking screw then release two door latches.
2	Coordinate with NMC to switch repeater to local operating condition.
3	Switch OFF all repeater PDU circuit breakers switching main breaker last.
4	Switch OFF commercial power source breaker supplying power to repeater.
5	Hang “ <b>DANGER – DO NOT TURN ON – PERSONNEL WORKING</b> ” sign at commercial power source breaker.
6	SPU – <b>a</b> Disconnect all cables from rear of SPU. <b>b</b> Remove rack screws from front panel of SPU. <b>c</b> Slide SPU out of cabinet.
7	PDU – <b>a</b> Disengage the metal strap securing the relay. Use a flat object (e.g., screwdriver) along side the relay bottom to pry the band loose. <b>b</b> Unplug the relay from its socket.

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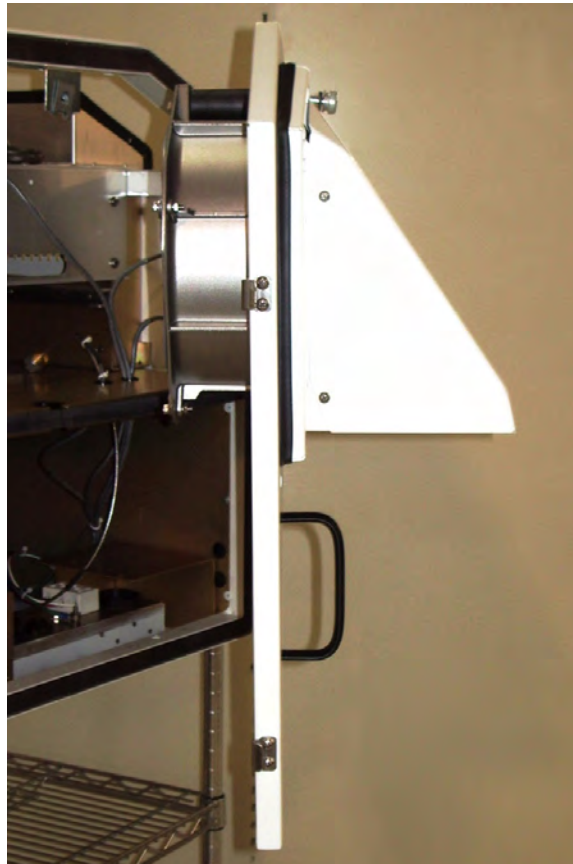
<b>STEP</b>	<b>PROCEDURE CONT.</b>
	<b>REPLACEMENT</b>
<b>8</b>	Insert the new relay into its socket.
<b>9</b>	Replace metal securing strap on relay.
<b>10</b>	Insert SPU into cabinet.
<b>11</b>	Secure SPU by replacing mounting screws through front panel.
<b>12</b>	Reinstall all connecting cables to rear connectors of SPU.
<b>13</b>	Close rear cabinet door by securing two draw latches and then tightening door locking screw.
<b>14</b>	Switch ON commercial power source breaker and remove danger sign.
<b>15</b>	Switch ON PDU main circuit breaker.
<b>16</b>	Switch ON PDU remaining circuit breakers.
<b>17</b>	Confirm that all fans are operational.
<b>18</b>	Set operating mode to Broadcast.
<b>19</b>	Coordinate with NMC and return repeater to Remote operating condition.
<b>20</b>	Close front cabinet door by securing two draw latches and tightening two door locking screws.



## Chart 8 Remove and Replace Rear Door Air Filter



*Main power to repeater must be off.*



**Figure 6-15 Rear Door and Filter Assembly**

STEP	PROCEDURE
	<b>REMOVAL</b>
1	Open front and rear doors. <b>a To Open Front Door</b> Release two locking screws then release two door latches. <b>b To Open Rear Door</b> Release one locking screw then release two door latches.
2	Coordinate with NMC and switch repeater to Local operating condition.
3	Switch OFF all repeater PDU circuit breakers switching main breaker last.
4	Switch OFF commercial power source main breaker supplying power to repeater.
5	Hang " <b>DANGER – DO NOT TURN ON – PERSONNEL WORKING</b> " sign at commercial power source breaker.
6	Remove five filter assembly retaining screws from inside of rear door (Figure 6-16).
7	Remove air filter assembly (Filter and Louver Plate/Storm Hood) from rear door (see <a href="#">Figure 6-17</a> and <a href="#">Figure 6-18</a> ).

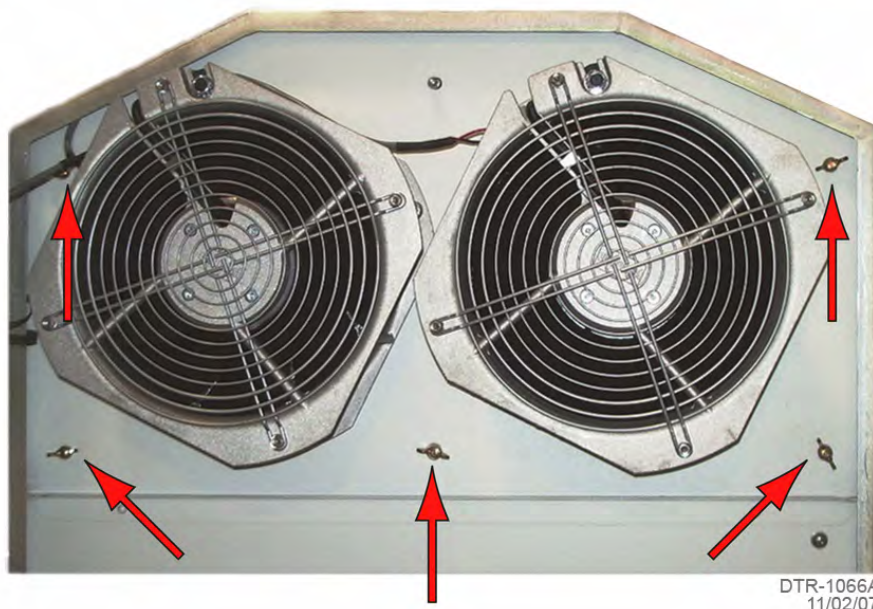


Figure 6-16 Filter Assembly Retaining Screws (Inside of Rear Door)





**Figure 6-17 Air Filter Assembly**



**Figure 6-18 Air Filter Assembly (Filter and Louver Plate)**

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<b>STEP</b>	<b>PROCEDURE CONT.</b>
	<b>REPLACEMENT</b>
<b>8</b>	Install new filter onto louver plate.
<b>9</b>	Using five retaining screws, re-attach filter assembly to cabinet rear door.
<b>10</b>	Switch ON commercial power source main breaker and remove danger sign.
<b>11</b>	Switch ON main PDU circuit breaker.
<b>12</b>	Switch ON remaining PDU circuit breakers.
<b>13</b>	Set operating mode to Broadcast.
<b>14</b>	Coordinate with NMC and return repeater to Remote operating condition.
<b>15</b>	Close front and rear doors.  <b>a To Close Front Door</b> Secure two door latches then tighten two locking screws.  <b>b To Close Rear Door</b> Secure two door latches then tighten one locking screw.

## Chart 9 Remove and Replace PDU Front Access Circuit Breakers



*Main power to repeater must be off.*



Figure 6-19 PDU Front Panel

STEP	PROCEDURE
	<b>REMOVAL</b>
1	Open front door. <b>a To Open Front Door</b> Release two locking screws then release two door latches.
2	Coordinate with NMC and switch repeater to Local operating condition.
3	Switch OFF all repeater PDU circuit breakers switching main breaker last.

---

STEP	PROCEDURE CONT.
4	Switch OFF commercial power source breaker supplying power to repeater.
5	Hang “ <b>DANGER – DO NOT TURN ON – PERSONNEL WORKING</b> ” sign at commercial power source breaker.
6	From front of cabinet remove PDU securing screws.
7	Carefully pull the PDU away from the rack.

**Note**

*The PDU can only be pulled out approximately six inches.*

- |    |  |
|----|--|
| 8  | Remove the PDU face plate screws.                                      |
| 9  | For the circuit breaker in question note and label the breaker wiring. |
| 10 | Disconnect the wiring for the specific breaker.                        |
| 11 | Remove the breaker securing screws.                                    |
| 12 | Remove the breaker.  |

---

<b>STEP</b>	<b>PROCEDURE CONT.</b>
	<b>REPLACEMENT</b>
<b>13</b>	Insert new breaker; install and tighten breaker securing screws.
<b>14</b>	Connect and secure breaker wires.
<b>15</b>	Reposition face plate and secure with face plate screws.
<b>16</b>	Set PDU back into the cabinet and secure with mounting screws.
<b>17</b>	Switch ON commercial power source breaker and remove danger sign.
<b>18</b>	Switch ON PDU main circuit breaker.
<b>19</b>	Switch ON PDU remaining circuit breakers.
<b>20</b>	Set operating mode to Broadcast.
<b>21</b>	Coordinate with NMC and return repeater to Remote operating condition.
<b>22</b>	Close front cabinet door by securing two draw latches and tightening two door locking screws.

### **6.10 CABLE REPLACEMENT**

For cable replacement refer to Repeater Cable Drawings and part number listing in Appendix C.

### **6.11 FINAL SYSTEM TESTING**

Refer to Turn-Up and Testing, Section 4, for Repeater System Test procedure.



## **A REPEATER DIAGRAMS**

### **A.1 GENERAL**

This section contains repeater support information and drawings.

### **A.2 LIST OF DRAWINGS**

<b>Title</b>	<b>Drawing No.</b>
System Document Mapping.....	3EM 04000 0000 ADZZA
System Application Rules .....	3EM 04000 0000 BGZZA (Sheet 1 of 3)
Transmit Antenna Configurations. ....	3EM 04000 0000 BGZZA (Sheets 2 and 3 of 3)
Equipping Option Drawing.....	3EM 04000 0000 BJZZA (3 of 3)
Signal Flow Drawing.....	3EM 04000 0000 EBZZA (Sheet 1 of 5)
Simplified Functional Block Diagram .....	3EM 04000 0000 EBZZA (Sheet 2 of 5)
HPA RF Block Diagram .....	3EM 04000 0000 EBZZA (Sheet 3 of 5)
SPU Block Diagram .....	3EM 04000 0000 EBZZA (Sheet 4 of 5)
PDU Block Diagram.....	3EM 04000 0000 EBZZA (Sheet 5 of 5)





## B ALCATEL-LUCENT PART NUMBERS

### B.1 LRU PART NUMBERS

See Table B-1 for Alcatel-Lucent LRU part numbers.

**Table B-1 Repeater LRU Part Numbers**

Item	Alcatel-Lucent Part Number
Repeater Assembly	3EM04000AA
SPU	3EM04001AA
HPA	3EM04002AA
RF Coupler Assembly	3EM21627AA
RF Detector	3EM20401AA
Cabinet Fans	1AB 35914 0001
Fan Relay	1AB 37003 0001
Main Circuit Breaker CB0	1AB 36981 0001
SPU Circuit Breaker CB1	1AB 37239 0002
HPA Circuit Breaker CB2	1AB 37239 0004
Fans Circuit Breaker CB3	1AB 37239 0002
External Heater Circuit Breaker CB4	1AB 37239 0001
Aux Power Circuit Breaker CB5	1AB 37239 0003
Internal Heater Circuit Breaker CB6	1AB 37239 0002

### B.2 CABLE PART NUMBERS

See Table B-2 for module connecting cables part numbers and descriptions.

**Table B-2 Intermodule Connecting Cables**

ALU P/N	Connects To	Connector Type	Connects To	Connector Type
3EM21705AA	VSAT RCVR (ASI OUT 2)	BNC Straight Plug	SPU Controller (ASI B)	BNC Straight Plug

23EM21705AA  
BNC Connectors on both ends

23EM21705AA  
06/30/07

**Table B-2 Intermodule Connecting Cables (Continued)**

ALU P/N	Connects To	Connector Type	Connects To	Connector Type
3EM21711AA	SPU Modulator (Ethernet)	RJ-45	SPU Controller (Ethernet)	RJ-45
<p style="text-align: center;">3EM21711AA RJ-45 Connectors on both ends</p> <p style="text-align: right;">3EM21711AA 06/30/07</p>				
3EM21713AA	Junction Box (CPL FWD)	N-Type Connector	RF Coupler (FWD)	SMA Straight Connector
<p style="text-align: center;">3EM21713AA</p> <p style="text-align: right;">3EM21713AA-FWD 06/30/07</p>				
3EM21713AA	Junction Box (CPL REF)	N-Type Connector	RF Detector (REF)	SMA Straight Connector
<p style="text-align: center;">3EM21713AA</p> <p style="text-align: right;">3EM21713AA-REF 06/30/07</p>				

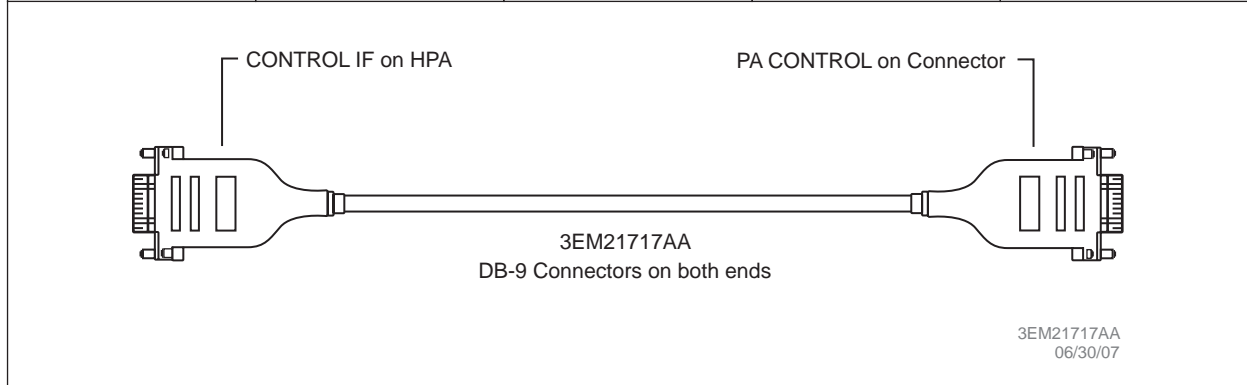
**Table B-2 Intermodule Connecting Cables (Continued)**

ALU P/N	Connects To	Connector Type	Connects To	Connector Type
3EM21714AA	BP Filter (RF IN)	7/16 DIN Male Right Angle	HPA (RF OUT)	7/16 DIN Male
<p>RF IN on Band Pass Filter</p> <p>RF OUT on HPA</p> <p>3EM21714AA SMA Connectors on both sides</p> <p>3EM21714AA 06/30/07</p>				
3EM21715AA	Junction Box (VSAT IN)	T&B Snap-N-Seal Connector	VSAT RCVR (VSAT ANT)	T&B Snap-N-Seal Connector
<p>VSAT Connector on Junction Box</p> <p>VSAT ANTENNA on VSAT RX</p> <p>3EM21715AA T&amp;B Snap-N-Seal Connectors on both sides</p> <p>3EM21715AA 06/30/07</p>				
3EM21716AA	Junction Box (GPS IN)	N-Type Straight Cable Plug	SPU Controller (GPS ANT)	SMA Straight Cable Plug
<p>Heat Shrink Tubing</p> <p>Heat Shrink Tubing</p> <p>N-Type Plug at junction box side</p> <p>SMA at Controller side</p> <p>3EM21716AA 06/30/07</p>				

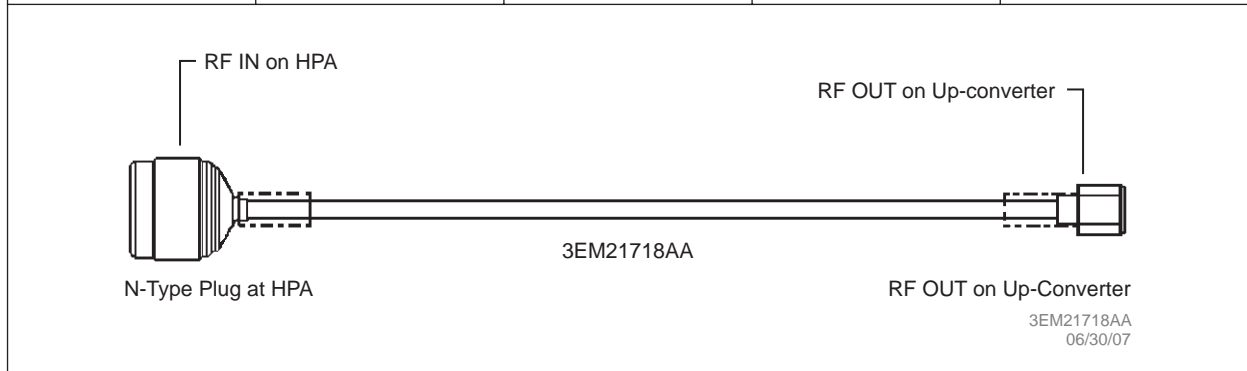
**Table B-2 Intermodule Connecting Cables (Continued)**

ALU P/N	Connects To	Connector Type	Connects To	Connector Type
---------	-------------	----------------	-------------	----------------

3EM21717AA	HPA (IF-RS485)	DB-9, Male	SPU Controller (PA CONTROL)	DB-9, Female
------------	----------------	------------	-----------------------------	--------------



3EM21718AA	HPA (RF IN)	N-Type Straight Cable Plug	Up-Converter (RF OUT)	SMA Straight Cable Plug
------------	-------------	----------------------------	-----------------------	-------------------------



**B.3 INTAKE AIR FILTER**

PN 3EM22381 AAAA HCZZA

## C ALARM DESCRIPTION, LIKELY CAUSE, AND SUGGESTED RESPONSE

**Note**

*Alarms are listed alphabetically by alarm names as they appear on the GUI Alarm screen*

**Note**

*Deviating above a positive or below a negative temperature threshold will cause an alarm as indicated in Table C-1. Following are the temperature thresholds for the repeater:*

### C.1 HPA DEFAULT TEMPERATURE THRESHOLD

- HPA Warning Low Temperature . . . . . -18°C
- HPA Warning High Temperature . . . . . +78°C
- HPA Critical Low Temperature. . . . . -30°C
- HPA Critical High Temperature . . . . . +82°C

### C.2 HPA COLD START OPERATING TEMPERATURE THRESHOLD

**Note**

*This value is in the HPA Controller firmware and cannot be changed by the operator. When the repeater is cold started below -18°C in Broadcast or Test mode, HPA DC power will be on but RF will be off until temperature is equal to or higher than -18°C.*

- HPA Cold Start Operating Temperature: . . . . . -18°C

### C.3 SPU OPERATING TEMPERATURE THRESHOLD

**Note**

*This value is set on the GUI screen under Config > Temperature*

- SPU Operating Temperature Threshold: +75°C

#### C.4 ALARM TABLE

See Table C-1 for alarm names, causes, and corrective responses.

**Table C-1 Alarms, Possible Causes, and Suggested Response**

Alarm	Description	Possible Cause	Operator Response
3.3V Voltage too high	SPU 3.3V Voltage is too high >3.6V	SPU Power Supply Fault	Replace the SPU
5.0V Voltage too high	SPU 5.0V Voltage too high >5.5V	SPU Power Supply Fault	Replace the SPU
12.0V Voltage too high	SPU 12V Voltage is too high >13.2V	SPU Power Supply Fault	Replace the SPU
3.3V Voltage too low	SPU 3.3V Voltage is too low <2.8V	SPU Power Supply Fault	Replace the SPU
5.0V Voltage too low	SPU 5.0V Voltage too low <4.3V	SPU Power Supply Fault	Replace the SPU
12.0V Voltage too low	SPU 12V Voltage is too low <10.2V	SPU Power Supply Fault	Replace the SPU
AC Interruption Occurred	12VDC toggles more than 10 $\mu$ s	AC power supply voltage interruption	Check AC Power
AC Power Lost	UPS 12V, 10V	No AC Power	Check AC Power
Cabinet Front Door Open	Door Open	Door Open	Close cabinet front door
Cabinet Rear Door Open	Door Open	Door Open	Close cabinet rear door
DSP Error	DSP is not responding	Possibly there is a hardware problem or software issue.	If reset doesn't clear the problem – Replace SPU (fault in Modulator).
Ethernet Connection Failure	No communication via Main Controller Ethernet switch port	Communication Error	Check Ethernet cable
Forward Power Detector Comm Error	Communication timeout	Error communicating to the Forward power detector on the output coupler	Replace Detector and/or SPU (Main Controller and/or Detector fault).
GPS Comm Error	Problem communicating with GPS receiver	Problem communicating with GPS receiver	Replace SPU (Main Controller fault)
GPS Holdover Duration Exceeded	Holdover process is too long	Check "Max GPS Holdover Time" parameter and make sure it is set properly.	Refer to Section 5, Figure 5-17. Adjust "Max GPS Holdover Time" parameter.
GPS Quality Low	GPS Signal Quality is low	Antenna disconnected	Check Antenna connection to the GPS

**Table C-1 Alarms, Possible Causes, and Suggested Response (Continued)**

<b>Alarm</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Operator Response</b>
GPS Surveillance Error	Problem detected on GPS receiver	Problem detected on GPS receiver	Replace SPU (Main Controller fault)
Heartbeat	Alarm notifies NMS that repeater is alive	Transmission interval defined by "Heartbeat Pace"	No action required
HPA Comm Error	No communication between HPA and Main Controller	No communication between HPA and Main Controller	Check Comm cable between HPA and Main Controller
HPA Driver/Pre-driver/Module Faults	Possibly over-current situation due to signal conditions	Possibly over-current situation due to signal conditions	If HPA is in Broadcast mode and reset doesn't resolve the problem – replace the HPA.
HPA Forward Power Fault	Forward power exceeded hard limit Warning $\geq 56$ dBm Critical $\geq 56.5$ dBm At critical condition, HPA turns off	Problem with HPA output circuit, Output Filter, Detector, output connector, or antenna cable.	Investigate Output Filter, Detector, output connector, or antenna cable. If no fault found, replace HPA
HPA Hardware Fault	Fault with RF modules, PS, or Controllers	Fault with RF modules, PS, or Controllers	Replace the HPA
HPA Input Power Fault	Input power exceeded hard limit Warning $\geq 3$ dBm Critical $\geq 5$ dBm At critical condition, HPA turns off	Input power from SPU too high	Replace SPU
HPA Operation Alarm	HPA Output power is close to operating thresholds.	HPA Output power is close to operating thresholds.	Check the output power of the HPA with a power meter. If the power is too close to the threshold check the loss on cables between the HPA and output filter.
HPA PS Alarms	Power supply failure	Power supply failure	Replace the HPA
HPA Reflected Power Fault	Reflected power exceeded hard limit Warning $\geq 45$ dBm Critical $\geq 47$ dBm At critical condition, HPA turns off	Problem with HPA output circuit, Output Filter, Detector, output connector, or antenna cable.	Investigate Output Filter, Detector, output connector, or antenna cable. If no fault found, replace HPA.
HPA Shutdown	HPA inoperative	Shutdown caused by any critical condition	Replace HPA

**Table C-1 Alarms, Possible Causes, and Suggested Response (Continued)**

<b>Alarm</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Operator Response</b>
HPA Temperature Fault	HPA turns off	HPA Temperature is above the Critical High Temperature level, +82°C.	Check input, output ventilation vents. Verify fans are operational. If no fault found, replace HPA.
HPA Temperature Fault Low	HPA turns off	HPA Temperature is below the Critical Low Temperature level, -30°C	Replace HPA
HPA Temperature Warning	HPA Temperature is above the Warning High Temperature level, +78°C	HPA Temperature is above the Warning High Temperature level, +78°C	Check input, output ventilation vents. Verify fans are operational. If no fault found, replace HPA.
HPA Temperature Warning Low	HPA Temperature is below the Warning Low Temperature level, -18°C	HPA Temperature is below the Warning Low Temperature level, -18°C	Replace HPA
Local Control Engaged	Triggered when repeater is switched to Local or Remote condition	Condition changes when Local/Remote switch is pressed	No action required
Module 0 HPA PS Voltage Fault	AC voltage on PS module 0 is off	AC voltage on PS module 0 is off	Replace HPA
Module 1 HPA PS Voltage Fault	DC voltage on PS Module 0 >32 V or <10 V	DC voltage on PS Module 0 >32 V or <10 V	Replace HPA
Module 2 HPA PS Voltage Fault	AC voltage on PS module 1 is off	AC voltage on PS module 1 is off	Replace HPA
Module 3 HPA PS Voltage Fault	DC voltage on PS Module 1 >32 V or <10 V	DC voltage on PS Module 1 >32 V or <10 V	Replace HPA
Module 4 HPA PS Voltage Fault	AC voltage on PS module 2 is off	AC voltage on PS module 2 is off	Replace HPA
Module 5 HPA PS Voltage Fault	DC voltage on PS Module 2 >32 V or <10 V	DC voltage on PS Module 2 >32 V or <10 V	Replace HPA
Module 6 HPA PS Voltage Fault	AC voltage on PS module 3 is off	AC voltage on PS module 3 is off	Replace HPA
Module 7 HPA PS Voltage Fault	DC voltage on PS Module 3 >32 V or <10 V	DC voltage on PS Module 3 >32 V or <10 V	Replace HPA
PA Module 0, 1, 2, 4, 5 or Driver Module TR1 Voltage Fault	This alarm is triggered when the voltage on transistor 1 exceeds 32 volts or goes below 26 volts	Wrong voltage on transistor 1	Replace HPA



**Table C-1 Alarms, Possible Causes, and Suggested Response (Continued)**

<b>Alarm</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Operator Response</b>
PA Module 0, 1, 2, 4, 5 or Driver Module TR2 Voltage Fault	This alarm is triggered when the voltage on transistor 2 exceeds 32 volts or goes below 26 volts	Wrong voltage on transistor 2	Replace HPA
PA Module 0, 1, 2, 4, 5, or Driver Module TRI Current Fault	This alarm is triggered when the current on transistor 1 exceeds 7 ampere or goes below 0.7 ampere	Wrong current on transistor 1	Replace HPA
PA Module 0, 1, 2, 4, 5 or Driver Module TR2 Current Fault	This alarm is triggered when the current on transistor 2 exceeds 7 ampere or goes below 0.7 ampere	Wrong current on transistor 2	Replace HPA
PA Module 0, 1, 2, 4, 5 or Driver Module Bias Voltage Fault	This alarm is triggered when the BIAS voltage exceeds 12 volts or goes below 7 volts	Wrong BIAS voltage on module	Replace HPA
Modulator Comm Error	Communication error with the modulator	IP Address of the modulator is not set on the Main Controller	Check the IP address of the modulator on the main controller – it should correspond to the IP address of the modulator verified through the CLI. Also check if the MAC address of the modulator is correct. If everything is correct – replace the SPU (modulator fault)
Modulator Restarted	Modulator fault	Modulator internal fault	Replace the SPU
No Lock to Input Stream	Either bad connection between the VSAT and Modulator or VSAT is unlocked	Check Satellite signal – in this case this alarm will come together with VSAT alarm.	If there is no VSAT alarm – check the cable connection between the modulator and the VSAT. In case the VSAT alarm is there – check the VSAT cable. If it fails, replace SPU (fault in modulator and/or VSAT).
No Lock to OIM Block	Normal if input stream is of Legacy type. Error decoding the incoming stream of Overlay type.	Hardware problem with the modulator or the modulator is in the synchronization stage	If this alarm appears without VSAT/SFN alarms – Replace SPU (fault in Modulator).

**Table C-1 Alarms, Possible Causes, and Suggested Response (Continued)**

<b>Alarm</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Operator Response</b>
Over Temperature Fault	Ambient temperature is above the user defined threshold	Roof exhaust fan(s) or rear door intake fan(s) inoperative.	Check fans operation. Replace fan(s) where necessary.
Pre-Driver LDMOS Voltage Fault	This alarm is triggered when the voltage on LDMOS transistor exceeds 32 volts or goes below 26 volts	Wrong voltage on Pre-Driver LDMOS device	Replace HPA
Pre-Driver LDMOS Current Fault	This alarm is triggered when the current on LDMOS transistor exceeds 2 ampere or goes below 0.4 ampere	Wrong current on Pre-Driver LDMOS device	Replace HPA
Pre-Driver Bias Voltage Fault	This alarm is triggered when the BIAS voltage exceeds 12 volts or goes below 7 volts	Wrong BIAS voltage on Pre-Driver	Replace HPA
Pre-Driver GaAs Current Fault	This alarm is triggered when the current on GASFET transistor exceeds 0.6 ampere or goes below 0.1 ampere	Wrong current on Pre-Driver GASFET device	Replace HPA
Pre-Driver GaAs Voltage Fault	This alarm is triggered when the voltage on GASFET exceeds 13 volts or goes below 9 volts	Wrong voltage on Pre-Driver GASFET device	Replace HPA
Reflected Power Alarm	Difference between HPA Forward power and HPA Reflected power exceeds the Return Loss Threshold	Return Loss Threshold is not set up right, the reflected power on the coupler is too high, or the actual return loss is bad.	Check the Return Loss Threshold as well as the reflected power reported by the detector. If the power is reported incorrectly – replace the detector.
Reflected Power Detector Comm Error	Communication timeout	Error communicating to the reflected power detector on the output coupler	Replace Detector and/or SPU (Main Controller and/or Detector fault).
Satellite Receiver Unlocked	VSAT Receiver problem	No VSAT input signal	Check VSAT input signal level. If good VSAT signal is present, replace SPU

**Table C-1 Alarms, Possible Causes, and Suggested Response (Continued)**

Alarm	Description	Possible Cause	Operator Response
Satellite Receiver Comm Error	VSAT Receiver problem	No VSAT input signal	Check VSAT input signal level. If good VSAT signal is present, replace SPU
SFN Timing Error	Synchronization problem	This alarm is typically raised in the beginning of the synchronization stage and shall disappear within 16 sec.	Refer to Section 5, Figure 5-12. If the alarm is raised persistently and accompanied with re synchronization – check the delays preset in the system. The target delay should be more than 1 second, but less than 6 seconds.
SPU Over Temperature Fault	SPU temperature above the threshold	SPU temperature is too high, or Operating Temperature Threshold is not set	Refer to Section 5, Figure 5-18. Check for valid Operating Temperature Threshold.
Supervisor Controller Comm Error	I <sup>2</sup> C communication error	No communication with Supervisor Processor in Main Controller	Replace SPU
Sync 1PPS Fault	1PPS signal is not detected by the modulator	Intermittent connection on the backplane, Main Controller, Modulator	Replace the SPU
Sync 10MHz Fault	10MHz signal is not detected by the modulator	Intermittent connection on the backplane, Main Controller, Modulator	Replace the SPU
Sync Lost	GPS signal lost, or problem with Modulator or Main Controller modules	GPS signal lost, or problem with Modulator or Main Controller modules	Check GPS input. If GPS is present, replace SPU.
Up-converter Fault	Up-converter PLL unlocked	Up-converter PLL unlocked	
Up-converter Comm Error	Communication error with up-converter in SPU	Communication error with up-converter in SPU	Replace SPU
VCXO Unlocked	10 MHz not locked to 1PPS	10 MHz not locked to 1PPS	Replace SPU
VSAT Comm Error	Error communicating with VSAT Receiver located in the SPU	Possible SPU backplane or VSAT Receiver fault	Replace SPU
VSAT LNB Power Fault	LNB Power block hardware failure	Power block hardware failure	Check voltage to LNB. If good, replace LNB.

**Table C-1 Alarms, Possible Causes, and Suggested Response (Continued)**

<b>Alarm</b>	<b>Description</b>	<b>Possible Cause</b>	<b>Operator Response</b>
VSAT LNB Over Current	Antenna shorted	Antenna shorted	Investigate antenna & antenna cable.
VSAT Receiver Internal Fault	Typically comes along with Satellite Receiver Unlocked	Any alarm on the satellite receiver	If the receiver is locked but there is an internal fault, replace the SPU
VSAT Unlocked	VSAT signal lost	VSAT unlocked to input signal	Check VSAT input signal
Wrong Input Stream Type	The incoming stream doesn't match the set parameters in "Input Stream Type"	"Input Stream Type" is set to Legacy while the incoming stream is Overlay	Refer to Section 5, Figure 5-10. Switch the "Input Stream Type" to Overlay or Legacy to match the incoming stream. Set this parameter to Auto to avoid further problems.

If no alarms are received from the modulator during the power-up – check the "Main Controller Address" parameter on the modulator.

# SIRIUS REPEATER SYSTEM DOCUMENT MAPPING

PRELIMINARY

**NOTES:**

- SYSTEM APPLICATION RULES  
3EM 04000 0000 BGZZA
- EQUIPPING OPTION DRAWING  
3EM 04000 0000 BJZZA
- INTERGRAL LM  
3EM 04000 0000 UDZZA (REPEATER)  
3EM 04001 0000 UDZZA (SPU)  
3EM 04002 0000 UDZZA (HPA)  
3EM 04025 0000 UDZZA (CABINET)
- MANUFACTURING  
3EM 04000 0000 RJZZA (TBD)
- SIGNAL FLOW DRAWING  
3DH 04000 0000 EBZZA
- ALARM DRAWING  
3DH 04000 0000 PJZZA (TBD)
- CABINET/INSTALLATION  
3EM 04000 0001 RJZZA
- INTERCONNECT DRAWING  
3EM 04000 0000 EJZZA
- SYSTEM SPECIFICATION  
UBS SUPPLIED (TBD)
- MECHANICAL DRAWINGS  
TOP LEVEL ASSEMBLIES:  
SPU ASSEMBLY           3EM 04001 AAAA  
HPA ASSEMBLY           3EM 04002 AAAA  
CABINET ASSY           3EM 04025 AAAA
- PUB INSTRUCTION BOOK  
CD-ROM INSTRUCTION BOOK (3EM21522AAAA)
- PRODUCT RELEASE NUMBER (TBA)

**DEFINITIONS**

SYSTEM APPLICATION RULES WILL INCLUDE GUIDELINES AND CONSTRAINTS NECESSARY FOR ENGINEERING THE PRODUCT IN VARIOUS CONFIGURATIONS.

EQUIPPING OPTION DRAWING INCLUDES PIC LIST ITEMS, AND TABLES OF REQUIRED AND OPTIONAL ITEMS USED IN CONJUNCTION WITH TOP LEVEL KITS.

INTEGRAL LM WITH KITS WILL DISPLAY A LINE BREAKDOWN OF MODULES AND COMPONENTS IN KIT FORM AS GROUPED TOGETHER WITH A TOP LEVEL PRICE STRUCTURE.

THE MANUFACTURING DRAWING WILL OFFER SPECIFIC DETAIL NECESSARY FOR FACTORY PRODUCTION OF THE EQUIPMENT. (INTERNAL/EXTERNAL)

SIGNAL FLOW DRAWINGS INCLUDE SIMPLIFIED BLOCK DIAGRAMS OF THE RF PATH THROUGH THE SYSTEM AT THE SPU, HPA, AND CABINET LEVEL.

ALARM DRAWINGS WILL INCLUDE ALARM INFORMATION FOR THE SIRIUS REPEATER.

CABINET/INSTALLATION COVERS ALL ASPECTS OF EXTERNAL MOUNTING OF THE DOGHOUSE WITH FIBERGRATE PLATFORM, AND RELATED INSTALLATION.

INTERCONNECT/POWER DISTRIBUTION DRAWINGS WILL COVER POWER DISTRIBUTION AND CUSTOMER INTERCONNECTIVITY, I.E., ANTENNA HOOK-UP, ETC.

SYSTEM SPECIFICATION INCLUDES ALL TECHNICAL INFORMATION REGARDING THE SIRIUS TERRESTRIAL REPEATER PRODUCT.

MECHANICAL DRAWINGS LIST THE VARIOUS PIECES REQUIRED FOR THE MECHANICAL FABRICATION PROCESS. (TOP LEVEL ASSEMBLIES).

PUBLICATIONS OR THE INSTRUCTION BOOK COVERS THEORY TO INSTALLATION PROCESSES FOR THE SIRIUS REPEATER.

SYSTEM DOCUMENT MAPPING

MAT		FIN		GEN TOL	
ED DATE	01   1/26/07				
CHANGE NOTE	EMR23070				
APPRO AUTHO	D. Mortensen				
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8BD 00057 0000 (930315) D

NOTES:

DIGITAL TERRESTRIAL REPEATER  
DTR-0200-SA-SIRIUS  
SYSTEM APPLICATION RULES

PRELIMINARY

DTR-0200-SA-SIRIUS TERRESTRIAL REPEATER OPERATION

101. THE REPEATER (SPU) RECEIVES A COMPLEX DIGITAL DATA STREAM (CCDS) FROM THE VSAT SATELLITE FEED, MODULATES THE SIGNAL INTO OFDM WAVEFORM, UP-CONVERTS THE OFDM WAVEFORM TO THE ASSIGNED S-BAND FREQUENCY. IT THEN AMPLIFIES AND TRANSMITS THE RF (TERRESTRIAL SIGNAL).

TERRESTRIAL REPEATER NAMING CONVENTION

DTR-0200-SA-SIRIUS

DTR DIGITAL TERRESTRIAL REPEATER  
0200 200 WATTS RF OUTPUT  
S BAND  
A AIR COOLED  
SIRIUS PROPRIETARY SIGNAL

TERRESTRIAL REPEATER ENGINEERING CONSIDERATIONS

102. THE TERRESTRIAL REPEATER IS A MODULAR SOLID STATE SYSTEM DESIGNED FOR SATELLITE DIGITAL RADIO SERVICE. THE REPEATER INCLUDES 5 FUNCTIONAL BLOCKS IN A SINGLE OUTDOOR ENCLOSURE.

THE FUNCTIONAL BLOCKS IN A REPEATER CABINET ASSY ARE:

- 1. SIGNAL PROCESSING UNIT (SPU)
- 2. HIGH POWER AMPLIFIER (HPA)
- 3. POWER DISTRIBUTION UNIT (PDU)
- 4. OUTPUT BANDPASS FILTER
- 5. OUTPUT COUPLER

103. THE MODULES ARE ORGANIZED INTO 3 MAIN COMPARTMENTS IN ACCORDANCE WITH THEIR FUNCTION:

SPU COMPARTMENT

- RECEIVER MODULE
- MODULATOR MODULE
- MAIN CONTROLLER MODULE
- UP CONVERTER MODULE

HPA COMPARTMENT

- POWER AMP MODULES
- PRE-DRIVER
- SPLITTER
- COMBINER
- POWER SUPPLY
- HPA CONTROLLER

UTILITY COMPARTMENT

- POWER DISTRIBUTION UNIT
- OUTPUT COUPLER
- BAND PASS FILTER

REPEATER PHYSICAL DESCRIPTION

104. THE REPEATER ENCLOSURE PROVIDES 2 HINGED LOCKABLE DOORS, (FRONT AND REAR) FOR MAINTENANCE ACCESS. CARE MUST BE TAKEN DURING INSTALLATION TO ALLOW ROOM TO OPEN THE DOORS FOR GENERAL MAINTENANCE AND EQUIPMENT REMOVAL. THE CABINET IS VENTILATED TO ALLOW FOR UP TO 3.5 KILOWATTS OF POWER DISSIPATION AT AMBIENT TEMPERATURE. A FULLY EQUIPPED REPEATER ENCLOSURE WEIGHS 266 Lbs AND INCLUDES TOP MOUNTED EYE-BOLTS FOR STRAP LIFTING. DIMENSIONS ARE: 40.39in LONG X 26.64in TALL X 26.8in WIDE.

105. POWER REQUIREMENTS ARE: 188-250VAC WITH 208VAC NOMINAL POWER CONSUMPTION IS: 2 KILOWATTS TYPICAL

106. SIRIUS SATELLITE RADIO FREQUENCY PLAN OCCUPIES 12.5 MHz OF S-BAND SPECTRUM (2320-2332.5), DIVIDED INTO 3 BLOCKS. THE UPPER AND LOWER BLOCKS ARE FOR SATELLITE OPERATION, AND THE MIDDLE BLOCK IS RESERVED FOR REPEATER OPERATION.

SATELLITE 1 2322.255 (4.510 MHz BANDWIDTH)  
REPEATER 2326.250 (4.012 MHz BANDWIDTH)  
SATELLITE 2 2330.245 (4.510 MHz BANDWIDTH)

107. SIGNAL INPUT FROM VSAT LNB  
INPUT FREQUENCY RANGE 950 TO 1450 MHz  
INPUT LEVEL RANGE -65 TO -25 dBm  
ANTENNA CONNECTOR F TYPE FEMALE (75 Ohms)

108. SIGNAL INPUT FROM GPS  
CHANNEL FREQUENCY 1575.42 MHz  
ANTENNA CONNECTOR N TYPE FEMALE (50 Ohms)

109. REPEATER RF OUTPUT  
OUTPUT CENTER FREQUENCY 2326.25 MHz  
BANDWIDTH 4.012 MHz  
OUTPUT POWER LEVEL 200 WATTS (+53 dBm)  
ANTENNA CONNECTOR 7/16 DIN FEMALE (50 Ohms)

TRANSMIT RF ANTENNA CONFIGURATIONS

110. THE RF OUTPUT OF THE REPEATER MAY INCORPORATE DIFFERENT TRANSMIT ANTENNA CONFIGURATIONS TO ACCOMMODATE REPEATER LOCATION, SIGNAL STRENGTH, AND RADIATION PATTERN. THE FOLLOWING TRANSMIT ANTENNA CONFIGURATIONS MAY BE USED:

- SINGLE SECTOR
- TWO SECTOR
- THREE SECTOR
- TRANSMIT DIVERSITY-NOT AVAILABLE
- OMNI TRANSMIT

THE SINGLE, TWO OR THREE SECTOR ANTENNA CONFIGURATIONS ARE DIRECTIONAL AND DEFINED BY SELECTED AZIMUTH BEAMWIDTH FOR REQUIRED COVERAGE. TYPICAL BEAMWIDTH SELECTIONS (BUT NOT LIMITED TO) COULD BE 60 DEGREE, 90 DEGREE, AND 120 DEGREE. A SINGLE SECTOR CONFIGURATION INCLUDES A SINGLE CABLE RUN FROM THE REPEATER TO THE ANTENNA. A TWO SECTOR CONFIGURATION INCLUDES A 3 dB SPLITTER TO SPLIT THE SIGNAL EQUALLY TO 2 ANTENNA, AND A THREE SECTOR CONFIGURATION INCLUDES A 3-WAY SPLITTER (4.7dB LOSS) FOR 3 EQUAL ANTENNA SIGNALS.

TRANSMIT DIVERSITY IS NOT AVAILABLE WITH THE SIRIUS REPEATER.

THE OMNI TRANSMIT ANTENNA IS NOT DIRECTIONAL AND TRANSMITS IN FULL 360 DEGREES.

SEE SHEET 2 FOR TRANSMIT ANTENNA CONFIGURATION DRAWINGS.

CONTROL AND COMMUNICATION

111. ACCESS FOR CONTROL AND COMMUNICATION TO THE REPEATER IS PROVIDED BY THREE INTERFACE PORTS. THEY ARE:

- 1. RS-232 SERIAL PORT (dB-9) IS FOR LOCAL CONTROL AND STATUS INFORMATION. ACCESS IS BY LAPTOP PC.
- 2. V90 MODEM PORT (RJ-11) IS FOR REMOTE CONTROL AND STATUS. THE SUPPORTED PROTOCOLS ARE SNMP, WEB INTERFACE, AND TELNET. ACCESS IS BY LAPTOP OR FULL SIZE PC.
- 3. ETHERNET PORT (RJ-45) IS FOR LOCAL CONTROL AND LAN ACCESS. LOCAL ACCESS FOR SUPPORTED PROTOCOLS, SNMP, WEB INTERFACE, AND TELNET.

FOR DETAILED INFORMATION USING THE GUI SCREENS, SEE THE OPERATION SECTION OF THE USER MANUAL.

EQUIPMENT FAILURE AND REPLACEMENT

112. PDU FAILURE OR RF FILTER FAILURE RESULTS IN REPLACING THE ENTIRE REPEATER ASSEMBLY. THE RF FILTER IS MOUNTED IN A POSITION WITH LIMITED ACCESSIBILITY. THE FOLLOWING LIST OF FAILED MODULES MAY BE REPLACED ON SITE FOR THE REPEATER ASSEMBLY:

- SPU
- HPA
- RF COUPLER
- RF DETECTORS
- FANS (TOP AND REAR DOOR)
- FAN RELAYS
- REAR DOOR FAN FILTER

SEE THE USER MANUAL FOR REPLACEMENT PROCEDURE.

REPLACEMENTS OTHER THAN LISTED HERE MUST BE AUTHORIZED BY CTAC, OR THE ENTIRE REPEATER MUST BE REPLACED.

SYSTEM APPLICATION RULES

MAT	FIN	GEN TOL	
ED DATE	01 4/15/07		
CHANGE NOTE	F		
APPRO AUTHO	D. Mortensen		
ORIGINATOR	Mal Grogan		
ALCATEL NETWORK SYSTEMS		Sirius Satellite Receiver Signal Flow Drawing	
		3EM 04000 0000 BGZZA	1 of

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# SIRIUS REPEATER TRANSMIT ANTENNA CONFIGURATIONS

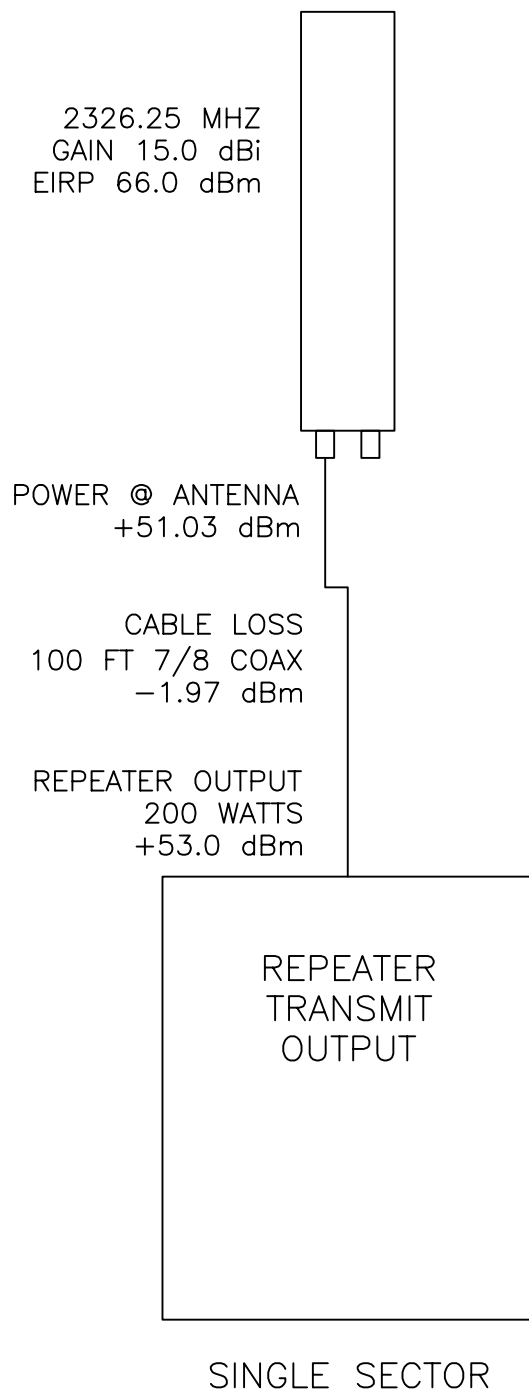
PRELIMINARY

### TRANSMIT CHAIN LOSS CALCULATIONS

201. POWER IS NORMALLY GIVEN IN WATTS. FOR DEVICE LOSSES, WE CONVERT TO dBm (DECIBELS IN MILLIWATTS). ANTENNA GAIN IS RELATIVE TO A THEORETICAL OR, ISOTROPIC ARIEL (dBi) OR RELATIVE TO A HALF WAVE DIPOLE (dBd).
202. THE REPEATER OUTPUT IS 200 WATTS. CONVERT WATTS TO dBm USING THE FOLLOWING FORMULA:  

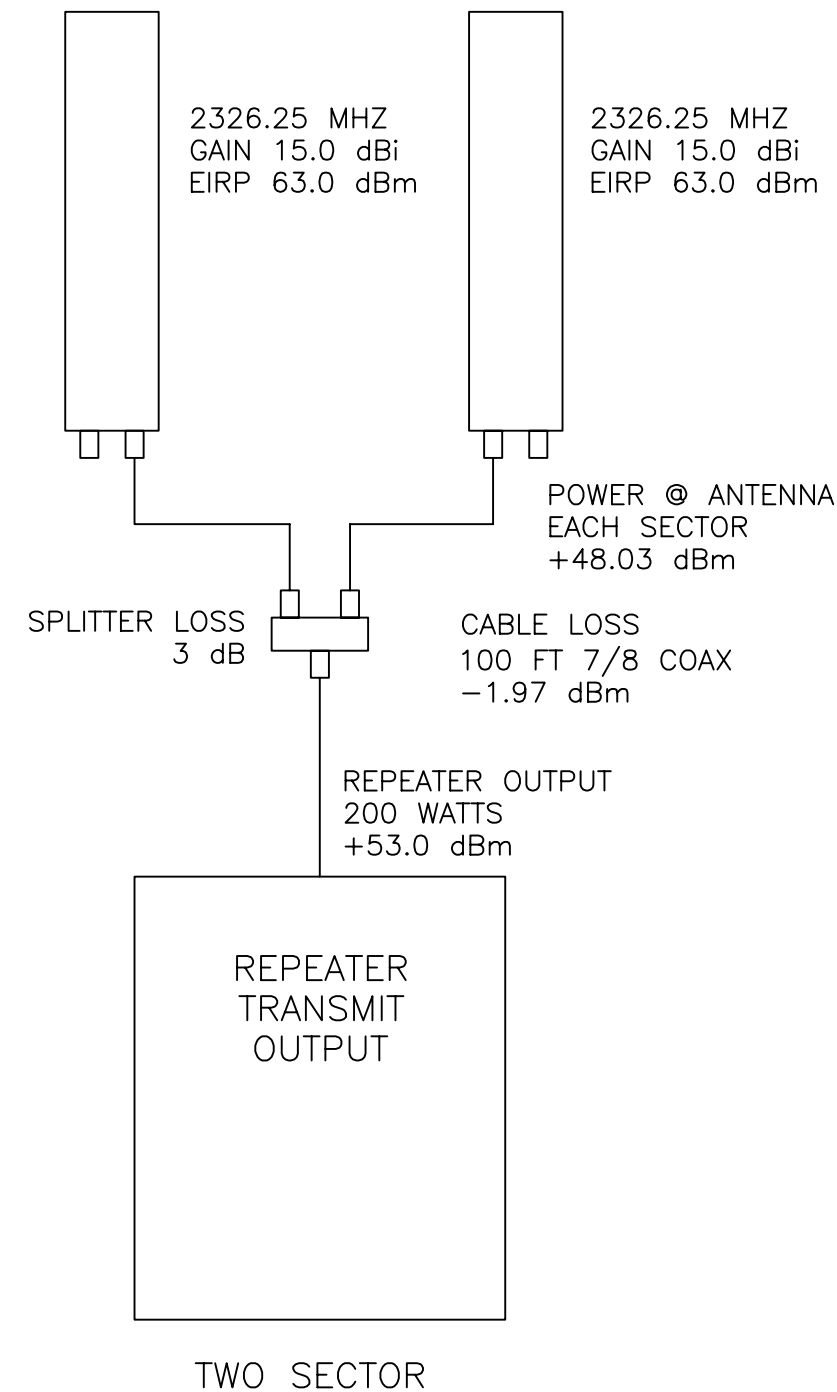
$$PWR (dBm) = 10 \text{ LOG } PWR (WATTS) + 30$$
 200 WATTS = 53.01 dBm
203. SUBTRACT CABLE LOSS TO GET POWER @ ANTENNA INPUT, I.E., 100 FT OF 7/8 INCH COAX IS ~ 1.97 dB OF LOSS, SO.....  
 53 dBm - 1.97 dB = 51.03 dBm @ ANTENNA INPUT.
204. NOTE: CABLE LOSS IS BASED OFF OF COAX SIZE AND TYPE. FOR THIS EXAMPLE, ONE SIZE OF FOAM FILLED COAX IS USED. THE TYPICAL INSTALLATION MAY HAVE TWO OR THREE SIZES IN THE TRANSMIT CHAIN THAT MUST BE ADDED TOGETHER. SEE THE 3 COAX EXAMPLES BELOW.
205. FOR 2 SECTOR ANTENNA, WHEN A 3 dB SPLITTER IS USED, SUBTRACT THE CABLE LOSS TO THE SPLITTER, SUBTRACT THE SPLITTER LOSS, AND SUBTRACT THE CABLE LOSS TO THE ANTENNA INPUT, I.E., 50 FT CABLE TO SPLITTER, SPLITTER LOSS, AND 50 FT CABLE FROM SPLITTER TO EACH ANTENNA = .985 dB CABLE LOSS + 3 dB SPLITTER LOSS + .985 dB CABLE LOSS = 4.97 dB LOSS.....  
 53 dBm REPEATER OUT - 4.97 dB = 48.03 dBm POWER @ EACH ANTENNA SECTOR.
206. ADD THE ANTENNA GAIN TO GET EIRP IN dBm. TYPICAL GAIN FOR THIS EXAMPLE WILL BE 15.0 dBi. 48.03 dBm + 15.0 dBi = 63.03 dBm.
207. CONVERT THE EIRP IN dBm TO EIRP IN WATTS USING FORMULA,  

$$POWER (WATTS) = \text{ANTILOG} ((POWER (dBm) - 30) / 10)$$
 2009 WATTS OF TRANSMIT POWER
208. NOTE: FCC LIMITS FOR RADIATED POWER WILL DETERMINE AMOUNT OF ATTENUATION NEEDED IN THE TRANSMIT CHAIN.



### CABLE EXAMPLES

- 50 Ohm foam filled coax  
LDF4-50A 1/2 inch  
3.43 dB loss per 100'
- 50 Ohm foam filled coax  
LDF5-50A 7/8 inch  
1.97 dB loss per 100'
- 50 Ohm foam filled coax  
LDF6-50 1,1/4 inch  
1.43 dB loss per 100'



SYSTEM APPLICATION RULES

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# SIRIUS REPEATER TRANSMIT ANTENNA CONFIGURATIONS

PRELIMINARY

## TRANSMIT CHAIN LOSS CALCULATIONS

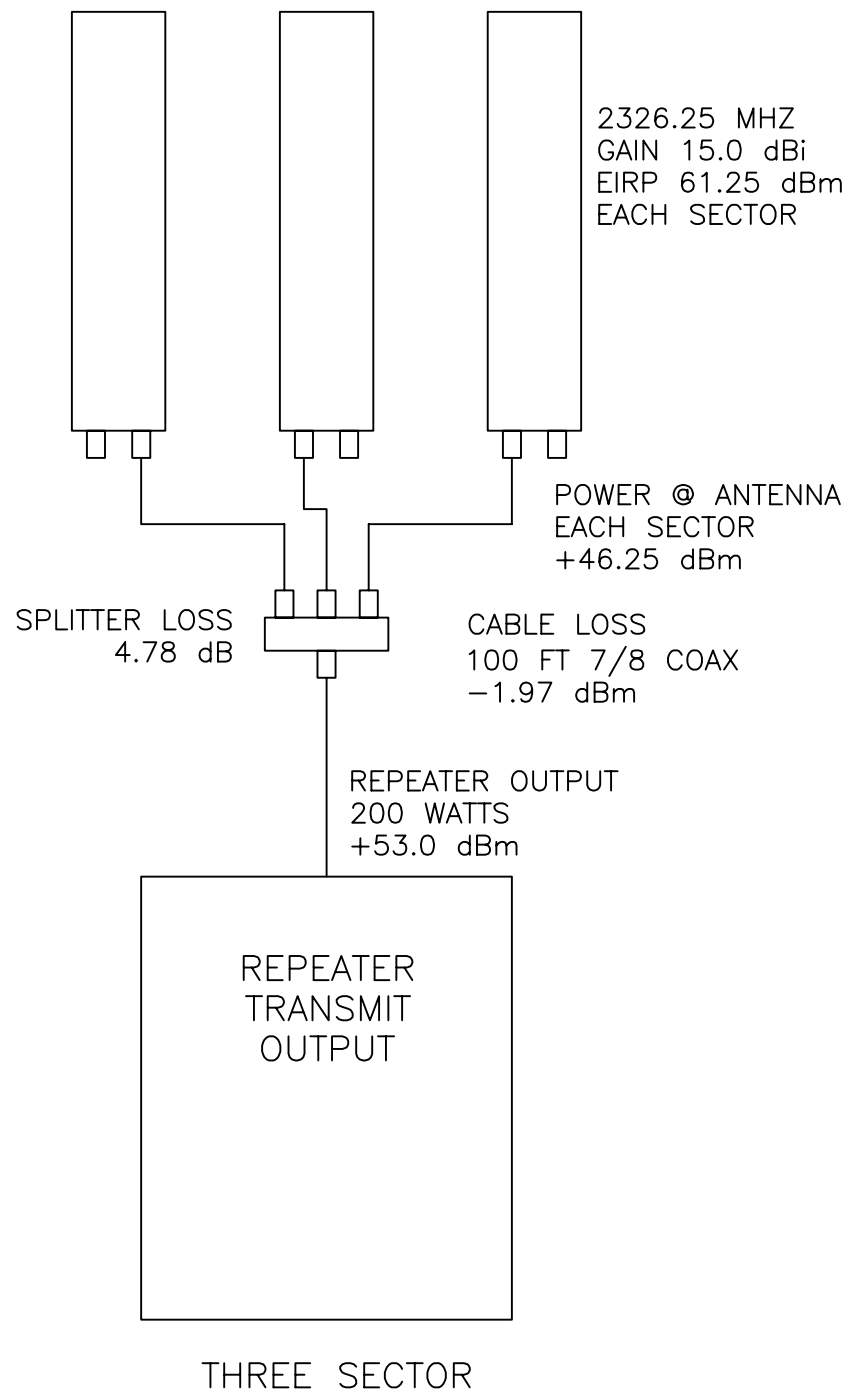
- 301. POWER IS NORMALLY GIVEN IN WATTS. FOR DEVICE LOSSES, WE CONVERT TO dBm (DECIBELS IN MILLIWATTS). ANTENNA GAIN IS RELATIVE TO A THEORETICAL OR, ISOTROPIC ARIEL (dBi) OR RELATIVE TO A HALF WAVE DIPOLE (dBd).
- 302. THE REPEATER OUTPUT IS 200 WATTS. CONVERT WATTS TO dBm USING THE FOLLOWING FORMULA:  

$$PWR (dBm) = 10 \text{ LOG } PWR (WATTS) + 30$$
 200 WATTS = 53.01 dBm
- 303. SUBTRACT CABLE LOSS TO GET POWER @ ANTENNA INPUT, I.E., 100 FT OF 7/8 INCH COAX IS ~ 1.97 dB OF LOSS, SO.....  
 53 dBm - 1.97 dB = 51.03 dBm @ ANTENNA INPUT.
- 304. NOTE: CABLE LOSS IS BASED OFF OF COAX SIZE AND TYPE. FOR THIS EXAMPLE, ONE SIZE OF FOAM FILLED COAX IS USED. THE TYPICAL INSTALLATION MAY HAVE TWO OR THREE SIZES IN THE TRANSMIT CHAIN THAT MUST BE ADDED TOGETHER. SEE THE 3 COAX EXAMPLES BELOW.
- 305. FOR 3 SECTOR ANTENNA, WHEN A 3-WAY SPLITTER (4.78 dB) IS USED, SUBTRACT THE CABLE LOSS TO THE SPLITTER, SUBTRACT THE SPLITTER LOSS, AND SUBTRACT THE CABLE LOSS TO THE ANTENNA INPUT, I.E.,  
 50 FT CABLE TO SPLITTER, SPLITTER LOSS, AND 50 FT CABLE FROM SPLITTER TO EACH ANTENNA = .985 dB CABLE LOSS + 4.78 dB SPLITTER LOSS + .985 dB CABLE LOSS = 6.67 dB LOSS.....  
 53 dBm REPEATER OUT - 6.75 dB = 46.25 dBm POWER @ EACH ANTENNA SECTOR.
- 306. ADD THE ANTENNA GAIN TO GET EIRP IN dBm. TYPICAL GAIN FOR THIS EXAMPLE WILL BE 15.0 dBi. 46.25 dBm + 15.0 dBi = 61.25 dBm.
- 307. CONVERT THE EIRP IN dBm TO EIRP IN WATTS USING FORMULA,  

$$POWER (WATTS) = \text{ANTILOG} ((POWER (dBm) - 30) / 10)$$
 1333 WATTS OF TRANSMIT POWER
- 308. NOTE: FCC LIMITS FOR RADIATED POWER WILL DETERMINE AMOUNT OF ATTENUATION NEEDED IN THE TRANSMIT CHAIN.

## CABLE EXAMPLES

- 50 Ohm foam filled coax  
LDF4-50A 1/2 inch  
3.43 dB loss per 100'
- 50 Ohm foam filled coax  
LDF5-50A 7/8 inch  
1.97 dB loss per 100'
- 50 Ohm foam filled coax  
LDF6-50 1,1/4 inch  
1.43 dB loss per 100'



SYSTEM APPLICATION RULES

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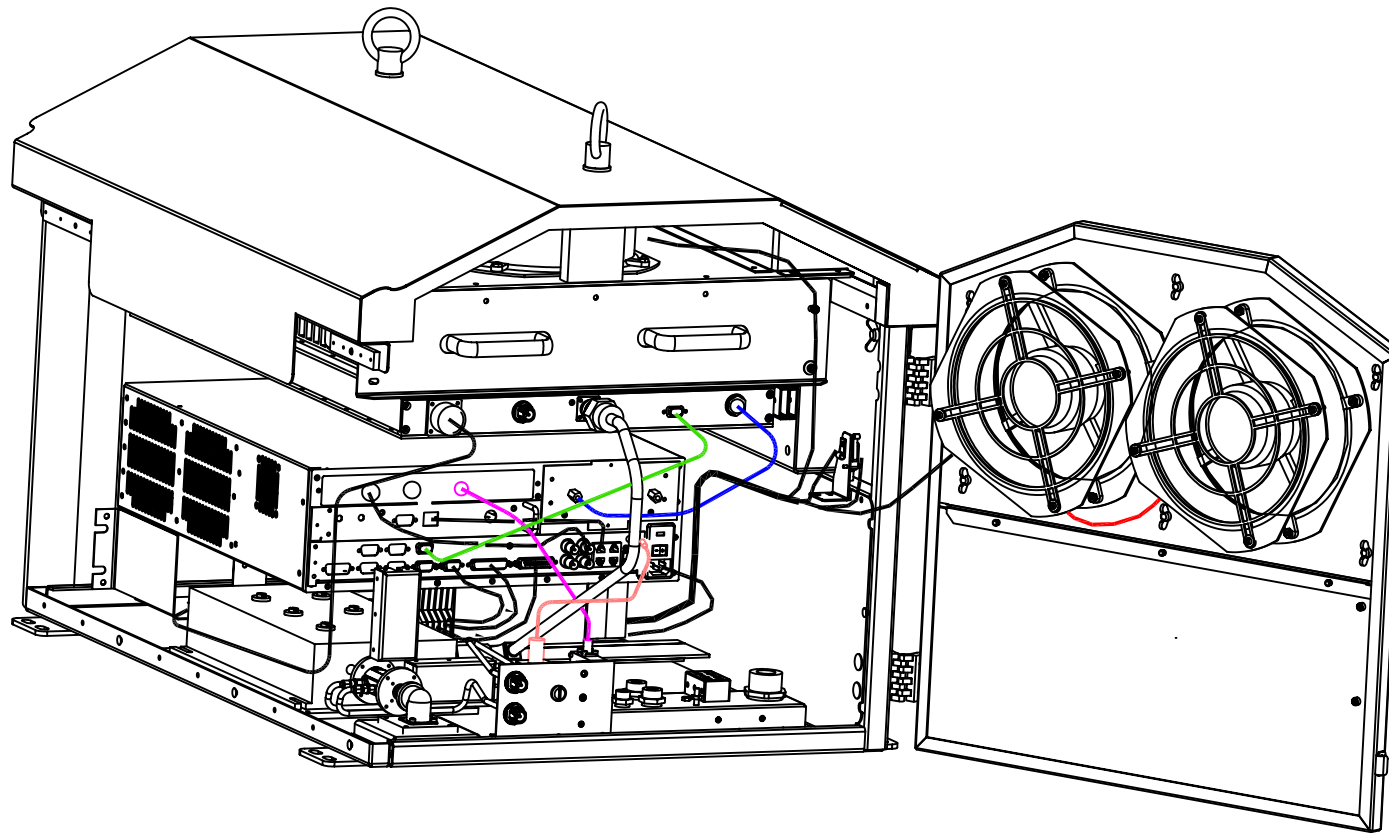
DIGITAL TERRESTRIAL REPEATER  
 DTR-0200-SA-SIRIUS  
 EQUIPPING OPTION DRAWING

PRELIMINARY

NOTES:

TERRESTRIAL REPEATER PRODUCT FEATURES AND ORDERING

- 101. THE TERRESTRIAL REPEATER IS AN ALL INCLUSIVE OUTDOOR ASSEMBLY THAT IS ORDERED BY A SINGLE TOP LEVEL ALCATEL-LUCENT P/N, (3EM04000AA).
- 102. THE FUNCTIONAL BLOCKS INCLUDED IN A REPEATER CABINET ASSY ARE:  
 SIGNAL PROCESSING UNIT (SPU)  
 HIGH POWER AMPLIFIER (HPA)  
 POWER DISTRIBUTION UNIT (PDU)  
 OUTPUT BANDPASS FILTER  
 OUTPUT COUPLER
- 103. CUSTOMER AND NETWORK ENGINEERING SUPPLIED ITEMS NOT INCLUDED FROM THIS PIC LIST ARE: GPS RECEIVE ANTENNA, V-SAT RECEIVE ANTENNA WITH LNB, RF TRANSMIT ANTENNA, POTS LINE (RJ-11), ETHERNET CONNECTION (RJ-45), AND 208 VAC SUPPLIED FOR THE PDU. SEE SHEET 3 FOR RECOMMENDED CABLE LIST TABLE D.
- 104. SEE SYSTEM APPLICATION RULES DRAWING 3EM04000000BGZZA FOR DETAILED ANTENNA DESCRIPTIONS.
- 105. ALCATEL-LUCENT RECOMMENDS USING FIBERGRATE MATERIAL FOR MOUNTING AND INSTALLATION OF THE OUTDOOR CABINET. SELECT THE FIBERGRATE OPTIONS FROM TABLE B ON SHEET 2. SEE THE INSTALLATION DRAWING 3EM04000001RJZZA FOR DETAIL.
- 106. USE THIS DRAWING TO ORDER THE REPEATER CABINET FOR NEW INSTALLATION FROM TABLE A ON SHEET 2. SELECT THE INSTALLATION OPTIONS FROM TABLE B ON SHEET 2. THE FIELD REPLACEABLE ITEMS ARE LISTED IN TABLE C ON SHEET 2. CTAC SHOULD BE CONSULTED PRIOR TO ORDERING REPLACEMENT ITEMS TO CONFIRM PROPER PROCEDURE.



REAR CUT-AWAY VIEW

EQUIPPING OPTION DRAWING

MAT	FIN	GEN TOL	
ED DATE	01 3/14/07		
CHANGE NOTE	F		
APPRO AUTHO	D. Mortensen		
ORIGINATOR	Mal Grogan		
ALCATEL NETWORK SYSTEMS	Sirius Satellite Receiver Equipping Option Drawing		
		3EM 04000 0000 BJZZA	1 of 3

TERRESTRIAL REPEATER  
EQUIPPING OPTIONS

PRELIMINARY

TABLE A (BASIC REPEATER)

ITEM NO.	ALCATEL PART NUMBER	NAME	DESCRIPTION	QTY	NOTES
1	3EM04000AA	TERRESTRIAL REPEATER	DTR-0200-SA-SIRIUS	1	201
2					

TABLE B (MOUNTING)

ITEM NO.	ALCATEL PART NUMBER	NAME	DESCRIPTION	QTY	NOTES
3	3EM22409AA	FIBERGRATE	4X4 FRP PANEL	1	202
4	3EM22409AB	EXTENDED BASE	LARGE FOOTPRINT	1	203
5	3EM22409AC	EXTENDED BASE	SMALL FOOTPRINT		
6	3EM22409AD	HARDWARE KIT	RIGID LEG BASE	1	204
7	3EM22409AE	GRATING LEG KIT	FLUSH CLIP MOUNTING		

TABLE C (REPLACEMENT ITEMS)

ITEM NO.	ALCATEL PART NUMBER	NAME	DESCRIPTION	QTY	NOTES
8	3EM04001AA	SPU	SIGNAL PROCESSING UNIT	1	205
9	3EM04002AA	HPA	HIGH POWER AMP	1	206
10	1AB359140001	FAN ASSY	ROOF OR REAR DOOR FANS	1	207
11	TBA	FAN RELAY	PDU FAN RELAY R1/R2	1	208
12	3EM22381AA	FAN AIR FILTER	REAR DOOR FILTER	1	209
13	3EM21627AA	RF COUPLER	RF FILTER COUPLER	1	210
14	3EM20401AA	RF DETECTOR	COUPLER DETECTOR	1	211

- 201. ORDER QTY 1 SIRIUS TERRESTRIAL REPEATER PER INSTALLATION SITE.
- 202. ALCATEL-LUCENT RECOMMENDS A FIBERGRATE PANEL FOR MOUNTING THE TERRESTRIAL REPEATER. ONE 4X4 PANEL IS REQUIRED PER REPEATER. THE FIBERGRATE PANEL MAY BE RE-SIZED IN THE FIELD FOR CUSTOM INSTALLATIONS USING STANDARD CUTTING TOOLS. FOUR J-BOLTS ARE INCLUDED TO ATTACH THE REPEATER CABINET TO THE THE FIBERGRATE.
- 203. WHEN EXTENDED BASES ARE REQUIRED TO SUPPORT THE FIBERGRATE PANEL, SELECT BASES WITH EITHER 5 INCH OR 18 INCH PLATFORM FEET. 5 INCH PLATFORM FEET WILL WORK FOR MOST INSTALLATIONS, BUT 18 INCH PLATFORM FEET MAY BE REQUIRED FOR A GRAVEL BASE OR OTHER ROUGH TERRAIN SUBSTRATE. EACH KIT INCLUDES 4 (FEET) EXTENDED BASES.
- 204. EXTENDED BASES MAY BE ATTACHED TO THE FIBER PANEL BY 2 DIFFERENT METHODS: NUT/WASHER HARDWARE, OR METAL CLIP WITH ADJUSTIBLE HEAD. THE NUT/WASHER SOLUTION IS RIGID, AND SHOULD BE USED IF THE EXTENDED BASES ARE "FREE FLOATING". IF THE BASES ARE BOLTED TO THE SUBSTRATE, THE METAL CLIP WITH ADJUSTIBLE HEAD PROVIDES THE BEST SOLUTION. CHOOSE QTY 1 HARDWARE KIT PER REPEATER. SEE THE SIRIUS REPEATER CABINET INSTALLATION DRAWING 3EM04000001RJZZA FOR MOUNTING DETAILS.  
  
THE FOLLOWING ITEMS ARE FIELD REPLACEABLE ITEMS.
- 205. ORDER QTY 1 OF THE SIGNAL PROCESSING UNIT (SPU) PER REPEATER WHEN REQUIRED.
- 206. ORDER QTY 1 OF THE HIGH POWER AMPLIFIER (HPA) PER REPEATER WHEN REQUIRED.
- 207. THERE ARE 4 FANS USED WITH EACH REPEATER CABINET. TWO FANS ARE ROOF MOUNTED, AND 2 FANS MOUNT TO THE REAR DOOR. ORDER REQUIRED QTY FOR REPLACEMENT.
- 208. THERE ARE 2 FAN RELAYS MOUNTED IN THE PDU. RELAY R1 PROVIDES POWER TO THE ROOF MOUNTED FANS, AND R2 PROVIDES POWER TO THE REAR DOOR FANS. ORDER QTY REQUIRED FOR REPLACEMENT.
- 209. THE REAR DOOR AIR FILTER COVERS THE FAN AREA. REPLACE THE FILTER AS OFTEN AS NEEDED. QTY 1 PER REPEATER.
- 210. THE RF COUPLER ON THE RF TRANSMIT FILTER OUTPUT MAY BE FIELD REPLACED IF NECESSARY. QTY 1 PER REPEATER.
- 211. THERE ARE TWO RF DETECTORS ON THE RF COUPLER OUTPUT. REPLACE AS NECESSARY.

EQUIPPING OPTION DRAWING

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ALCATEL NETWORK SYSTEMS	Equipping Option Drawing		3EM 04000 0000 BJJZZA	2

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TERRESTRIAL REPEATER  
EQUIPPING OPTIONS

PRELIMINARY

TABLE D (INSTALLATION CABLES)

ITEM NO.	ALCATEL PART NUMBER	NAME	DESCRIPTION	NOTES
15	INSTALLATION	TYPE F FEMALE	VSAT ANTENNA	301
16	INSTALLATION	TYPE N FEMALE	GPS ANTENNA	302
17	INSTALLATION	7/16 DIN FEMALE	RF ANTENNA (OUTPUT COUPLER)	303
18	INSTALLATION	CAT 5 MINIMUM	RJ-45 ETHERNET CABLES	304
19	INSTALLATION	RJ-11 CABLE	RJ-11 PHONE CABLES	
20	INSTALLATION	10-3 W/GRD	208 VAC WIRING	305

TABLE E (SPARES CABLE LIST-SPU)

ITEM NO.	ALCATEL PART NUMBER	NAME	DESCRIPTION	NOTES
1	3EM21705AA	SPU BNC CABLE	VSAT RCV TO CONTROLLER	306
2	3EM21711AA	ETHERNET CABLE	SPU CAT5E CABLE	
3	3EM21715AA	VSAT ANTENNA	SPU TO VSAT INPUT	
4	3EM21716AA	GPS ANTENNA	SPU TO GPS INPUT	
5	3EM21723AA	PDU-SPU CONTRL	PDU-SPU TEMP SENSOR	
6	3EM21722AA	STATUS INPUT	PDU TO SPU CONTROLLER-2	
7	3EM21721AA	RELAY CONTROL	PDU TO SPU CONTROLLER-1	
8	3EM21725AA	POWER CORD	PDU TO SPU AC POWER	

TABLE F (SPARES CABLE LIST-HPA)

ITEM NO.	ALCATEL PART NUMBER	NAME	DESCRIPTION	NOTES
9	3EM21724AA	AC INPUT CABLE	VAC FROM PDU	307
10	3EM21718AA	UPCON RF OUTPUT	SPU TO HPA RF INPUT	
11	3EM21714AA	RF OUTPUT CABLE	RF OUTPUT TO FILTER	
12	3EM21717AA	RS-485 CABLE	PA CONTROL FROM SPU	

TABLE G (SPARES CABLE LIST-PDU)

ITEM NO.	ALCATEL PART NUMBER	NAME	DESCRIPTION	NOTES
13	3EM21726AA	GROUND CABLE	PDU TO JUNCTION BOX	308
14	3EM21713AA	MONITOR CABLE	JUNCTION BOX TO RF COUPLER	
15	3EM21737AA	HEATER CABLE	PDU TO EXTERNAL HEATER	
16	3EM21741AA	HEATER CABLE	PDU TO INTERNAL HEATER	
17	3EM21735AA	SENSOR CABLE	PDU TO TEMP SENSOR	
18	3EM21736AA	SWITCH CABLE	PDU TO FRONT DOOR SWITCH	
19	3EM21736AB	SWITCH CABLE	PDU TO REAR DOOR SWITCH	

THE FOLLOWING CABLE LIST IS PROVIDED BY INSTALLATION. USE THIS TABLE AND NOTES FOR REFERENCE.

- 301. THE VSAT ANTENNA INPUT CABLE INTERFACES A SURGE SUPPRESSOR WITH F FEMALE CONNECTIONS ON BOTH PROTECTED SIDE AND SURGE SIDE. THE SURGE SUPPRESSOR IS LOCATED INSIDE THE JUNCTION BOX.
- 302. THE GPS ANTENNA INPUT CABLE INTERFACES A SURGE SUPPRESSOR WITH FEMALE TYPE N CONNECTIONS ON BOTH PROTECTED SIDE AND SURGE SIDE. THE SURGE SUPPRESSOR IS LOCATED INSIDE THE JUNCTION BOX.
- 303. THE RF ANTENNA OUTPUT CABLE INTERFACES A FEMALE 7/16 DIN CONNECTOR AT THE THE RF OUTPUT IN THE BOTTOM OF THE REPEATER. THIS IS THE HIGH POWER CONNECTION FOR THE REPEATER.
- 304. THE RJ-45 ETHERNET CABLE FEEDS THRU THE JUNCTION BOX VIA A CABLE GROMMET AND PLUGS INTO THE SPU. THE RJ-11 POTS LINE CABLE FEEDS THRU THE JUNCTION BOX VIA A CABLE GROMMET AND PLUGS INTO THE SPU. SINCE THERE IS NO INTERFACE POINT FOR THESE CABLES AT THE JUNCTION BOX, EXTRA CABLE LENGTH IS REQUIRED TO FEED INSIDE THE REPEATER CABINET.
- 305. 10-3 W/GRD ROMEX IS RECOMMENDED TO PROVIDE AC POWER VIA THE JUNCTION BOX. CONDUIT INSTALLATION FOR THE VAC LINE IS RECOMMENDED.

SPARE CABLE ASSEMBLY LIST

NOTE: SOME CABLES MAY BE REPLACED IN THE FIELD WITHOUT REPLACING THE TERRESTRIAL REPEATER. CABLE REPLACEMENT SHOULD BE DETERMINED BY CTAC PRIOR TO ORDERING CABLE ASSEMBLIES.

THIS IS A FULL LISTING OF TERRESTRIAL REPEATER CABLE ASSEMBLIES INCLUDED INTERNALLY WITH EACH REPEATER CABINET.

- 306. SPU SPARES CABLE ASSEMBLY LIST.
- 307. HPA SPARES CABLE ASSEMBLY LIST.
- 308. PDU SPARES CABLE ASSEMBLY LIST.

EQUIPPING OPTION DRAWING

ED	01	5/14/07		
ALCATEL NETWORK SYSTEMS	Equipping Option Drawing		3EM 04000 0000 BUZZA	3

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# DIGITAL TERRESTRIAL REPEATER DTR-0200-SA-SIRIUS SIGNAL FLOW DRAWING

PRELIMINARY

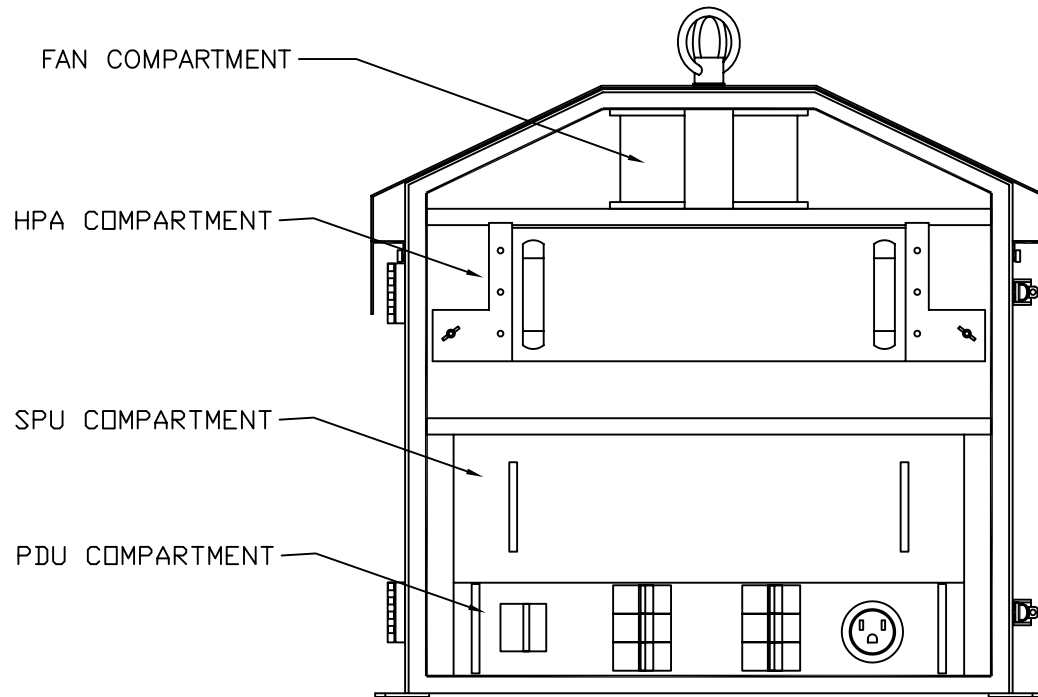
**NOTES:**

101. THIS DRAWING FOR THE TERRESTRIAL REPEATER, (DTR-0200-SA-SIRIUS), PROVIDES BLOCK DIAGRAMS AND CABINET COMPARTMENT LOCATOR.

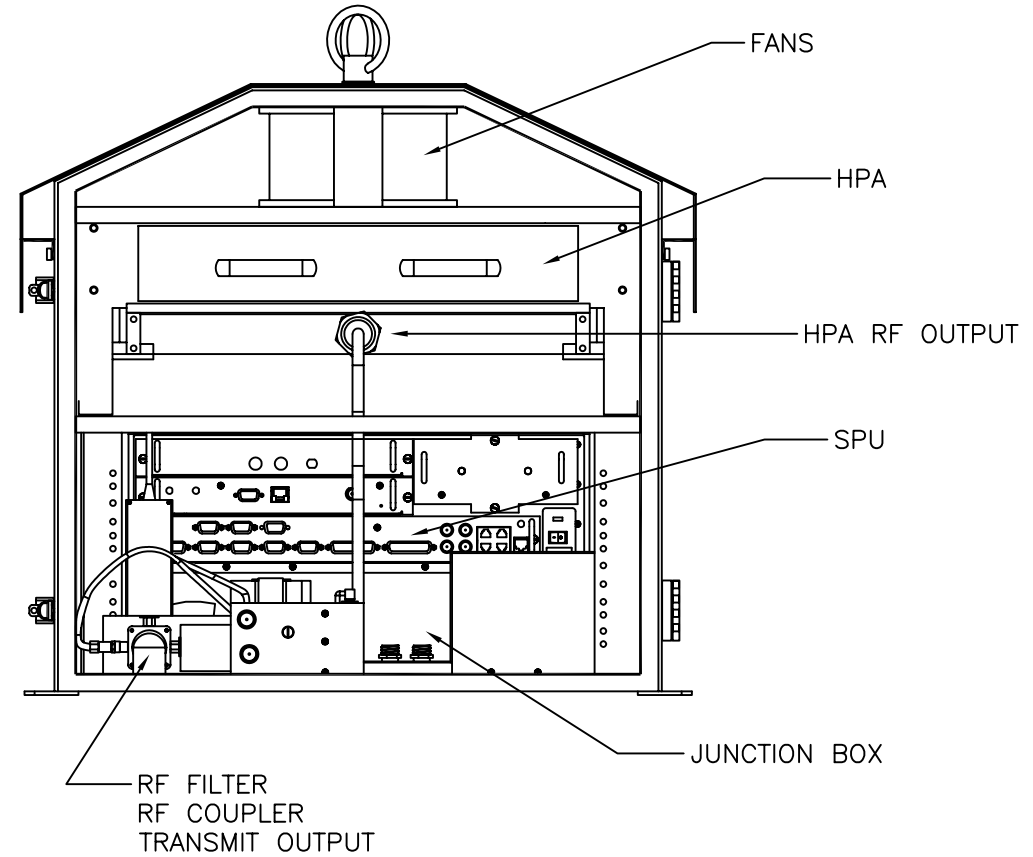
**INDEX**

SHEET 1	COMPARTMENT LOCATOR
SHEET 2	BLOCK AND SIGNAL
SHEET 3	HPA BLOCK DIAGRAM
SHEET 4	SPU BLOCK DIAGRAM
SHEET 5	PDU BLOCK DIAGRAM

FRONT VIEW



REAR VIEW



SIGNAL FLOW

MAT	FIN	GEN TOL	
ED DATE	01 3/14/07		
CHANGE NOTE	F		
APPRO AUTHO	D. Mortensen		
ORIGINATOR	Mal Grogan		
ALCATEL NETWORK SYSTEMS	Sirius Satellite Receiver Signal Flow Drawing		
		3EM 04000 0000 EBZZA	1 of 5

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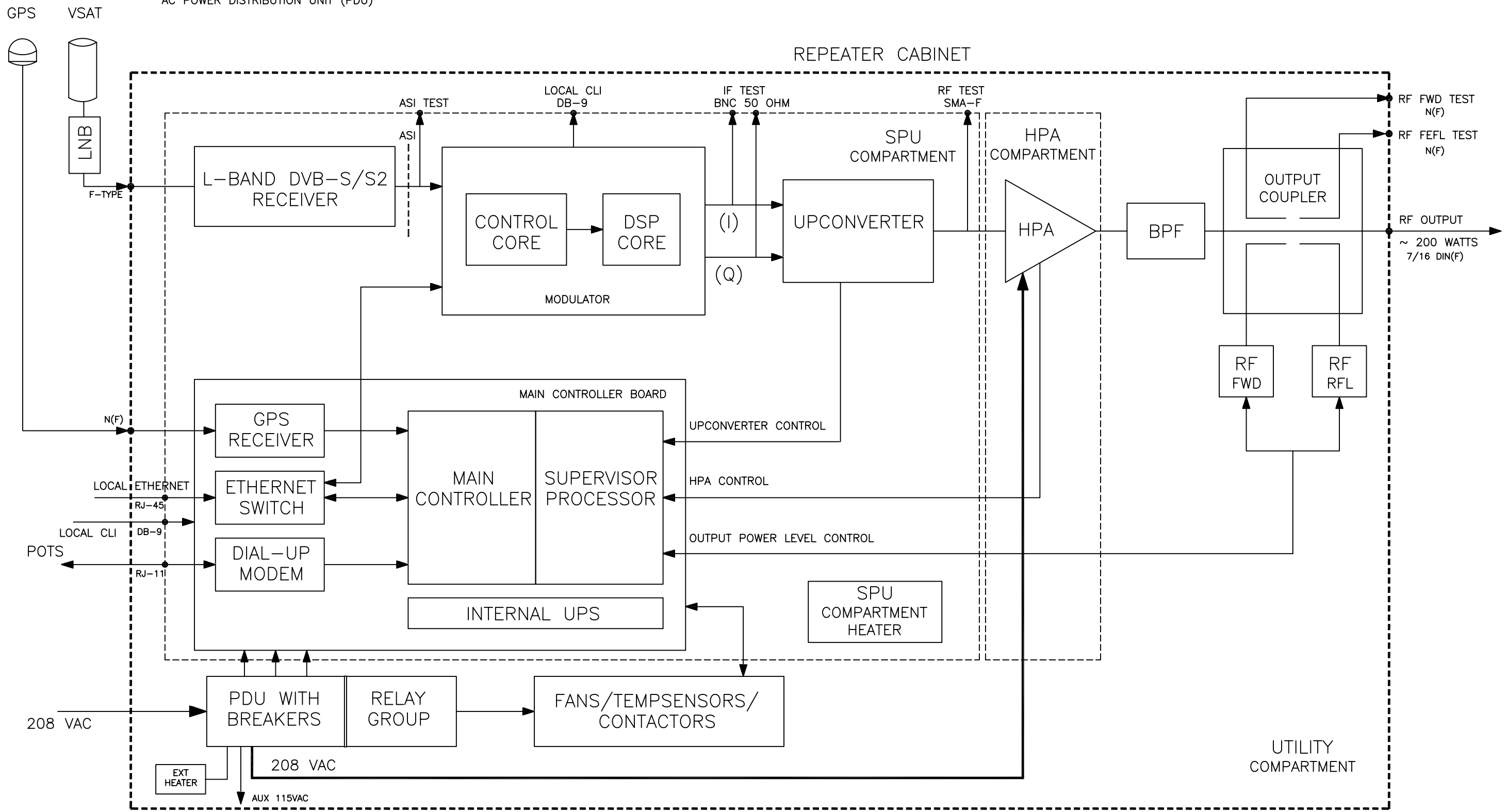
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# TERRESTRIAL REPEATER SIMPLIFIED FUNCTIONAL BLOCK DIAGRAM

PRELIMINARY

- NOTES:
- 201. THE TERRESTRIAL REPEATER BUILDING BLOCKS ARE:
  - SIGNAL PROCESSING UNIT (SPU)
  - HIGH POWER AMPLIFIER (HPA)
  - OUTPUT BAND PASS FILTER (BPF)
  - OUTPUT COUPLER
  - AC POWER DISTRIBUTION UNIT (PDU)

## REPEATER CABINET



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SIGNAL FLOW

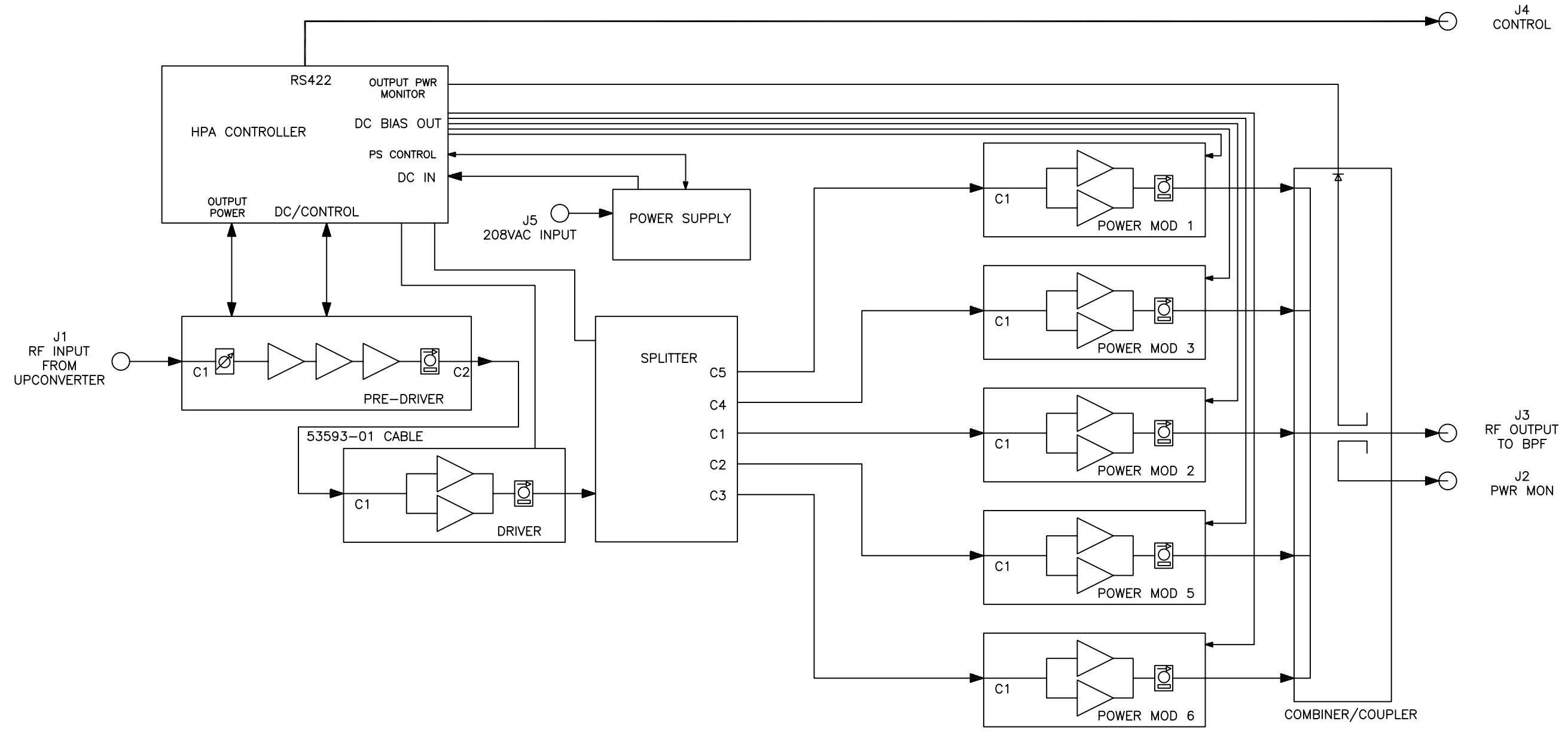
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ALCATEL NETWORK SYSTEMS	Signal Flow Drawing		3EM 04000 0000 EBZZA 2

# TERRESTRIAL REPEATER HPA RF BLOCK DIAGRAM

PRELIMINARY

NOTES:

- 301. THE HPA IS A FIELD REPLACEABLE LRU COMPONENT THAT INCLUDES AN INTEGRATED AC/DC POWER SUPPLY. THE HPA IS INSTALLED ON SLIDING RAILS IN THE HPA COMPARTMENT OF THE REPEATER ENCLOSURE. THE HPA AMPLIFIES THE SIRIUS S-BAND TERRESTRIAL SIGNAL FROM THE SPU UP TO AN OUTPUT LEVEL OF 200 WATTS AFTER THE OUTPUT SECTION AND FILTER
- 302. LOSSES ARE TAKEN IN TO ACCOUNT.



SIGNAL FLOW

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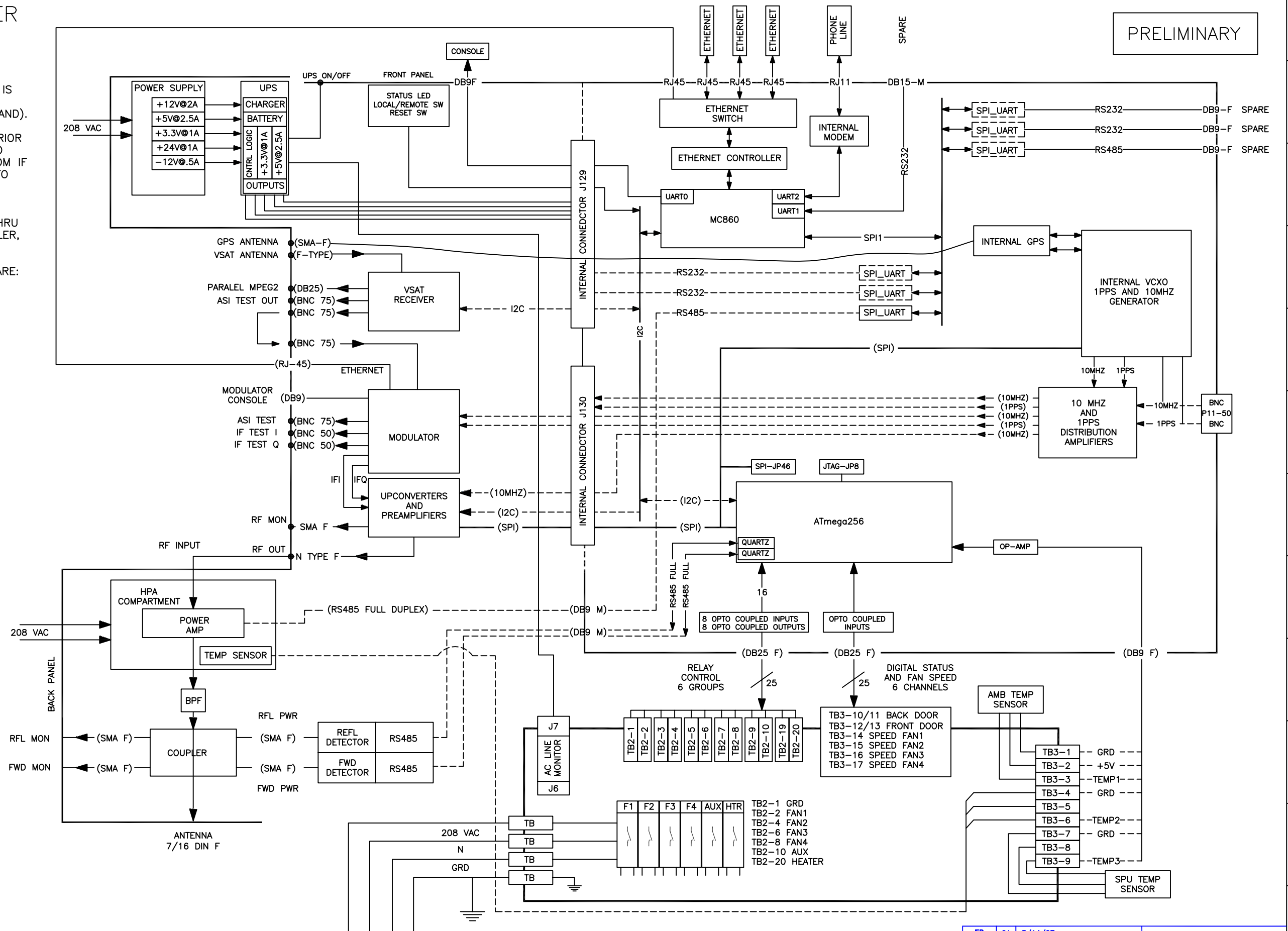
# TERRESTRIAL REPEATER SPU BLOCK DIAGRAM

PRELIMINARY

### NOTES:

401. THE PRIMARY FUNCTION OF THE SPU IS TO RECEIVE THE SIRIUS DIGITAL DATA STREAM FROM VSAT SATELLITE, (Ku BAND). THE LNB ON THE VSAT ANTENNA CONVERTS THE SIGNAL TO L-BAND PRIOR TO REPEATER ENTRANCE. THE L-BAND SIGNAL IS THEN MODULATED INTO OFDM IF WAVEFORM, WHICH IS UP CONVERTED TO THE ASSIGNED S-BAND FREQUENCY PLAN. THE SPU OUTPUT IS THEN AMPLIFIED VIA THE HPA, AND SENT THRU THE BANDPASS FILTER AND RF COUPLER, FOR THE FINAL RF OUTPUT.

402. THE SPU MAIN FUNCTIONAL BLOCKS ARE:  
 L-BAND RECEIVER  
 MODULATOR  
 UP CONVERTER  
 MAIN CONTROLLER BOARD  
 SPU COMPARTMENT HEATER



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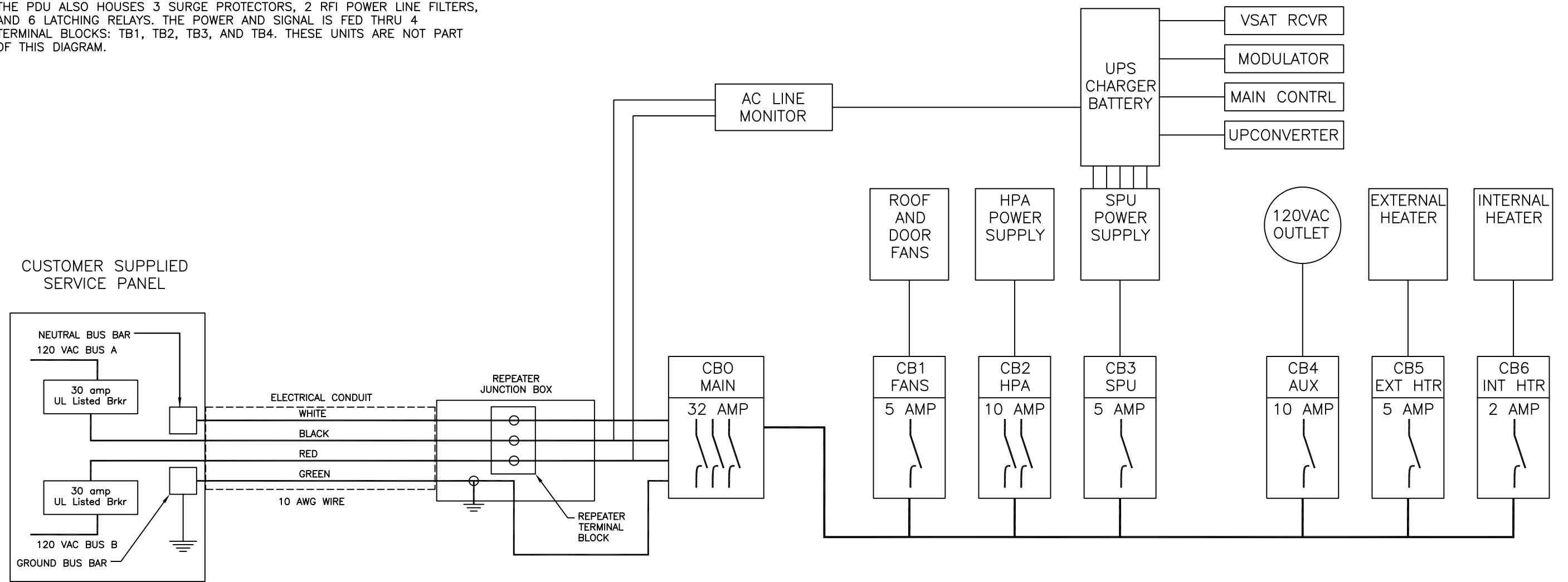
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# TERRESTRIAL REPEATER PDU BLOCK DIAGRAM

PRELIMINARY

### NOTES:

- 501. THE POWER DISTRIBUTION UNIT FOR THE REPEATER MOUNTS AT THE BOTTOM OF THE CABINET. THE PRIMARY POWER IS 208 VAC AND COMES IN THRU THE JUNCTION BOX VIA A CUSTOMER SUPPLIED SERVICE PANEL. SEE DRAWING BELOW.
- 502. 208 VAC FEEDS THE MAIN POWER BREAKER ON THE PDU (32A, 3-POLE CIRCUIT).
- 503. THE MAIN BREAKER PROVIDES POWER TO THE OTHER BREAKERS:  
 FANS-5A, 250 VAC  
 HPA-10A, 250 VAC  
 SPU-5A, 250 VAC  
 AUX POWER-10A, 250 VAC, TO AUX OUTLET-5A, 120 VAC  
 EXTERNAL HEATER-5A, 250 VAC  
 INTERNAL HEATER-2A, 250 VAC
- 504. THE SPU ALSO HOUSES A UNINTERRUPTIBLE POWER SUPPLY (UPS) THAT MONITORS AC LINE STATUS. IT DETECTS AC LINE VOLTAGE DROPS AND PROVIDES 5 TO 10 MINUTES OF PROTECTION FOR CPU BACKUP IN CASE OF FAILURE.
- 505. THE PDU ALSO HOUSES 3 SURGE PROTECTORS, 2 RFI POWER LINE FILTERS, AND 6 LATCHING RELAYS. THE POWER AND SIGNAL IS FED THRU 4 TERMINAL BLOCKS: TB1, TB2, TB3, AND TB4. THESE UNITS ARE NOT PART OF THIS DIAGRAM.



SIGNAL FLOW

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