Unique Broadband Systems Ltd.

Operation and Maintenance Manual

DRU-2KW
SiriusXM® Dual Repeater

2kW Dual Repeater Unit (DRU)

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Document: SX03-30000-01-M01
Revision: 01
Date: August 2015

UBS
Sirius XM DRU
Dual
Terrestrial Repeater

Model No: DRU-2KW
Product Number: SX03-30000-02
FCC ID: 2ACLT-DRU2KW

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Sirius XM DRU
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Model No: DRU-2KW
Product Number: SX03-30000-03
FCC ID: 2ACLT-DRU2KW

This device complies with part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Caution:
Changes or modifications not expressly approved by Unique Broadband Systems could void the user's authority to operate this equipment.

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REPEATER DRAWINGS AND DIAGRAMS A

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Chapter 1

Safety Instructions

Contents

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1 Safety Instructions

1.1 Manual Overview

This manual contains a description of UBS' SiriusXM Digital Terrestrial Repeater DRU-2KW (Combined and Independent configurations), as well as descriptions of the components which make up the repeater.

The manual also describes the steps required to install the repeater (and its components), put it into operation, operate/maintain it and service it. Where applicable, the repeater manual refers to the individual product manuals for several major components. The Appendix includes repeater mechanical, functional and wiring drawings/diagrams.

1.2 On-Site Safety

It is important that service technicians understand the hazards involved with working on broadcasting sites, are able to identify potential hazards and take appropriate action to minimize such hazards. This manual is intended as a general guide for trained and qualified personnel.

The installation, operation, maintenance and service of this equipment involves risks to both personnel and equipment, and must be performed only by qualified personnel exercising due care. Unique Broadband Systems Ltd. shall not be responsible for injury or damage resulting from improper procedures or from the use by improperly trained or inexperienced personnel performing such tasks.

During the installation and operation of this equipment, local building and electrical codes as well as fire protection standards must be observed. Always follow the relevant local or national safety rules and regulations.

1.3 Safe Work Practices

1. Workers shall not work in conditions that are unsanitary, hazardous or dangerous to their health or safety.
2. Workers shall wear appropriate personal protective equipment for the specific job or task.
3. Workers shall take all reasonable and necessary precautions to ensure their safety, the safety of their fellow workers and any person likely to be affected by their acts.
4. First aid kits and supplies shall be readily available on site at all times.
5. There shall be transportation readily available for an injured worker.
6. Any flammable material shall be handled and stored in a proper manner.
7. Workers in areas where there is a possible danger of head injury from the impact of falling objects, or from electrical shocks or burns shall wear proper head protection such as a hard hat.
8. Hard hats shall be worn at all times while an overhead hazard exists.
9. When machines or operations present a possible eye injury, proper eye protection shall be worn.
10. Safety toe work boots shall be worn where there is a danger of foot injury.
11. Signs and signals shall be used to alert people of potential dangers.

1.4 Safety Notes

Please review the following notes and familiarize yourself with the operation and servicing procedures before working on the repeater.

Read All Safety Instructions – All of the safety instructions should be read and understood before operating the repeater.

Heed all Notes, Warnings, and Cautions – All of the notes, warnings, and cautions listed in this safety section and throughout the manual must be followed.

Follow Installation and Operating Instructions – All of the installation and operating instructions for the repeater should be followed.

Retain Manuals – The manuals for the repeater should be retained at the site for future reference.

Repeater Ratings - The repeater ratings are provided in the text of this manual along with voltage and current values for the equipment.

Hazardous Accessibility – UBS has made attempts to provide appropriate connectors, wiring and shields to minimize hazardous accessibility.

Protective Earthing Terminal – A main protective earthing terminal is provided for equipment required to have protective earthing.

Single Point Breaker or Disconnect - The customer should provide a single point breaker or disconnect at the breaker box for the main AC input connection to the repeater.

Circuit Breakers and Wiring – All circuit breakers and wire are UL and CE certified and are rated for maximum operating conditions.

Ventilation – Openings in the cabinet are provided for ventilation. To ensure the reliable operation of the repeater and to protect the unit from overheating, these openings must not be blocked.

Servicing – Do not attempt to service the repeater yourself until becoming familiar with the equipment. If in doubt, refer all servicing questions to qualified UBS service personnel.

Cleaning – Unplug or otherwise disconnect all power from the equipment before cleaning. Do not use liquid or aerosol cleaners. Use only a damp cloth for cleaning.

Replacement Parts – When replacement parts are used, be sure that the parts have the same functional and performance characteristics as the original part. Unauthorized substitutions may result in fire, electric shock, or other hazards. Please contact UBS if you have any questions regarding service or replacement parts.

1.5 Graphic Symbols

Specific warning and caution statements, where applicable, are found throughout this manual.

Symbol	Meaning	Explanation
	High Voltage	Danger - High voltage and/or risk of electric shock.
	Warning	Warning - To prevent damage to equipment or personal injury, the operator must refer to all operating instructions in the manual.
	Electrostatic Discharges	Caution - Improper handling of equipment may result in damage to equipment from electrostatic discharges (ESD).
	Non-ionizing Radiation	Caution - Exposure to radio frequencies may result in person injury.
	Tipping Hazard	Caution - Over tipping the repeater may cause it to fall over, resulting in personal injury or loss of life.
	Lifting Hazard	Caution - Lifting heavy objects may result in personal injury.
	Hot Surface Hazard	Caution - Touching hot surfaces may result in burns. Allow surface to cool before servicing equipment.

1.6 Electrical Safety

1.6.1 Connection to the AC Power Supply

Electrical connections between the repeater and the building/site electrical service panel must comply with the following conditions:

- A properly rated circuit breaker must be installed in the building/site electrical service panel.
- A properly rated power cable must be used to connect the repeater to the building/site electrical service panel.
- A readily accessible disconnect device shall be installed between the repeater PDU and building/site electrical service panel.
- The repeater can be secured against unintentional power-on.

1.6.2 Installation

- Ensure that all repeater PDU circuit breakers and component power switches are switched off during the installation.
- Ensure that the main AC power cable to the repeater PDU is the last cable connected to the repeater when installing repeater cables.

1.6.3 Commissioning and Maintenance

	Never work on live parts unless specifically required and only if special safety precautions are followed.

Carefully observe the specific procedures for commissioning and maintenance where AC or DC power is present and observe the following rules.

- Remove rings, watches, and any other metallic jewelry. Short circuits in low-voltage, low-impedance DC circuits can cause severe arcing, which may result in burns or eye injury. Exercise caution to avoid shorting power input terminals.
- Ensure that the repeater's main breaker (or disconnect device) is turned off and a "**DANGER-DO NOT TURN ON - Personnel Working**" sign is hung on the breaker prior to working on the repeater's internal parts.
- Secure the repeater against unintentional power-on.
- Verify that the repeater is isolated from any power.
- Ensure that all repeater PDU circuit breakers are switched off prior to working on internal parts.

1.6.4 Battery Replacement

	Caution: Risk of explosion of battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.

1.7 RF Safety

1.7.1 Non-ionizing Radiation

	The American National Standards Institute (ANSI) has determined that it may be harmful for the human body to be exposed to Radio Frequencies in the range of 3KHz to 300GHz. In that range, people are not allowed to be exposed to RF power levels greater than 1mW/cm2 for longer than 5 minutes.

1.7.2 Rules for Operating the Repeater

	Opening RF lines during operation may cause electric arcs that can cause burns and eye injuries.

- Ensure that the repeater RF output ports are connected to properly rated antennas or test (dummy) loads before the repeater is powered on.
- Never turn on RF power if an RF line is open.
- Never undo RF lines during repeater operation.
- Never open modules during repeater operation.

1.8 Physical Safety

	Over tipping the repeater may cause it to fall over, resulting in personal injury or loss of life.

- The repeater will be secured to the building/pad before operation.
- Installation crew members must wear hard hats and steel toe boots/shoes during the installation.
- A minimum of two technicians is required for any lifting and/or positioning of the repeater cabinet.

1.9 Static Electricity

	This product contains ESD (Electrostatic Discharge) sensitive devices. Careless handling during repair can weaken, damage or destroy the devices.

Items such as clothing, paper/cardboard and plastics are the most common sources of electrostatic discharge. Please ensure that cellophane, plastics, masking tapes and white foam do not come into contact with ESD sensitive modules or their packaging.

1.9.1 Rules for Handling ESD Sensitive Modules

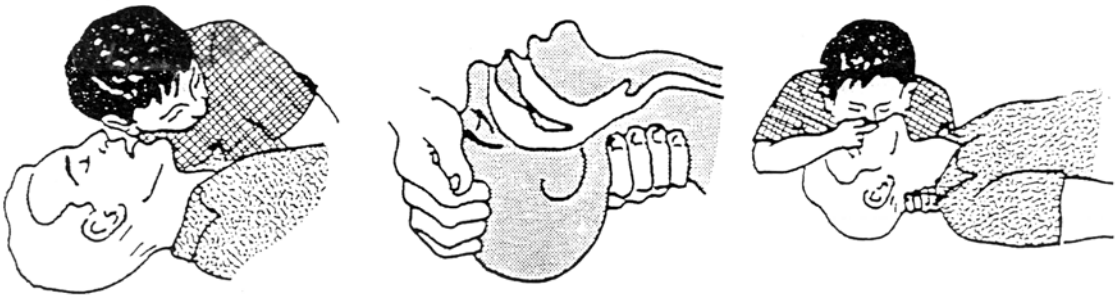
When repairing a module, proper ESD procedures should be followed to minimize the risk of damaging the module.

- All modules should be handled as ESD sensitive devices.
- Failed modules should be handled with the same care as good modules.
- Modules should be stored, packed, or shipped in antistatic bags or containers.
- Do not handle modules by touching the electronic components and/or PCB.
- Either wrist or heel ground straps should be worn prior to and during handling of modules containing ESD sensitive devices.
- Heel straps are only effective while standing on conductive or static dissipative surfaces.
- Surfaces (with resistance to ground in excess of 100 Meg-ohms), such as ordinary tile, should be covered with properly grounded static dissipative runners or waxed with a static dissipative wax.
- Use only ESD rated cleaning devices to clean modules.

1.10 First Aid

	Personnel engaged in the installation, operation, or maintenance of the repeater are urged to become familiar with the following rules both in theory and practice. It is the duty of all operating personnel to be prepared to give adequate Emergency First Aid and thereby prevent avoidable loss of life.

1.10.1 Rescue Breathing



1. Find out if the person is breathing. You must find out if the person has stopped breathing. If you think he is not breathing, place him flat on his back. Put your ear close to his mouth and look at his chest. If he is breathing you can feel the air on your cheek. You can see his chest move up and down. If you do not feel the air or see the chest move, he is not breathing.	2. If he is not breathing, open the airway by tilting his head backwards. Lift up his neck with one hand and push down on his forehead with the other. This opens the airway. Sometimes doing this will let the person breathe again by himself.	3. If he is still not breathing, begin rescue breathing. • Keep his head tilted backward. Pinch nose shut. • Put your mouth tightly over his mouth. • Blow into his mouth once every five seconds • **DO NOT STOP** rescue breathing until help arrives. LOOSEN CLOTHING - KEEP WARM Do this when the victim is breathing by himself or help is available. Keep him as quiet as possible and from becoming chilled. Otherwise treat him for shock.

1.10.2 Burns

Skin Reddened: Apply ice cold water to the burned area to prevent the burn from going deeper into skin tissue. Cover the area with a clean sheet or cloth to keep away air. Consult a physician.

Skin Blistered or Flesh Charred: Apply ice cold water to the burned area to prevent the burn from going deeper into skin tissue.

Extensive Burn – Skin Broken: Cover the area with a clean sheet or cloth to keep away air. Treat the victim for shock and take to hospital.

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Chapter 2

System Description

Contents

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2 System Description

2.1 Introduction

This section provides a functional description of the DRU-2KW as well as the DRU-2KW technical specifications.

2.2 Product Overview

The DRU-2KW is a terrestrial repeater system, which integrates Sirius (low band) and XM (high band) sub-systems in multiple, self-contained indoor cabinets. The DRU-2KW is capable of satellite signal reception, trans-coding and re-transmission of Sirius (low band) and XM (high band) legacy terrestrial repeater signals with a maximum power level of 1.74 kW each.

The DRU-2KW is available in two (2) configurations:

- Combined: HB and LB signals combined on a single output, LBD separate
- Independent: HB and LBD signals combined on a single output, LB separate

Figure 2-1 DRU-2KW SDARS 1 Repeater

2.3 Product Architecture

2.3.1 Cabinets

The DRU-2KW repeater is divided into four (4) indoor enclosures:

1) Low Band HPA Cabinet
2) Control Cabinet
3) Output Filter Network Cabinet (not seen)
4) High Band HPA Cabinet

Figure 2-2 DRU-2KW – Cabinets

Figure 2-3 DRU-2KW – Front View

PICTURE TBD

1) Fan/Blower
2) Removable Panel
3) Front Door

Figure 2-4 DRU-2KW – Rear View

PICTURE TBD

1) Fan/Blower
2) Removable Panel

Figure 2-5 DRU-2KW – Front View (Combined DRU)

PICTURE TBD

Figure 2-6 DRU-2KW – Rear View (Combined DRU)

PICTURE TBD

Figure 2-7 DRU-2KW – Front View (Independent DRU)

PICTURE TBD

Figure 2-8 DRU-2KW – Rear View (Independent DRU)

PICTURE TBD

2.3.2 Control Cabinet

In each DRU-2KW system, the control cabinet is located in front of the OFN cabinet, between the HB and LB HPA cabinets.

The control cabinet is accessible through hinged, locking, front and rear doors. Once the DRU-2KW system is fully assembled, the rear of the control cabinet is no longer accessible as it is located immediately in front of the OFN cabinet.

The control cabinet is cooled by the ambient air. A fan, mounted on the top panel, aids the cooling process by exhausting air out of the cabinet. The operating temperature for the cabinet is 32°F to +131°F (0°C to +55°C).

Two (2) temperature sensors are mounted in the control cabinet, allowing the system to monitory the temperature inside the cabinet. One temperature sensor is mounted on the bottom left side of the cabinet, while the other is mounted on the top panel next to the fan.

The following components are housed within the control cabinet:

- Power Distribution Unit (PDU)
- Battery Management System/Charger (BMS)
- 12V Battery
- High Band Dual Band Pass Filter (DBPF)
- High Band Low Noise Amplifier (LNA)
- High Band Exciter (HBE)
- Low Band Exciter (LBE)
- Terrestrial Repeater Monitoring System (TRMS)
- Dial-up Modem (customer furnished equipment, where applicable)
- Break-Out-Board
- Bulkhead/Cable Entrance with Surge Protectors and Fan

The HBE and LBE are mounted on retractable shelves, allowing each component to be pulled out of the cabinet. This permits the user to access (the rear panel) or replace each component with relative ease.

The top panel includes a number of bulkhead connectors used to interconnect components in the control cabinet with components in the other cabinets.

Figure 2-9 Control Cabinet – Front Door Open

1) Bulkhead/Cable Entrance with Surge Protectors and Fan
2) High Band Low Noise Amplifier (LNA)
3) High Band Dual Band Pass Filter (DBPF)
4) Terrestrial Repeater Monitoring System (TRMS)
5) Low Band Exciter (LBE)
6) High Band Exciter (HBE)
7) Battery Management System/Charger (BMS)
8) Power Distribution Unit (PDU)
9) 12V Battery

Figure 2-10 Control Cabinet – Rear Door Open

PICTURE TBD

1) Bulkhead/Cable Entrance with Surge Protectors and Fan
2) High Band Low Noise Amplifier (LNA)
3) High Band Dual Band Pass Filter (DBPF)
4) Terrestrial Repeater Monitoring System (TRMS)
5) Low Band Exciter (LBE)
6) High Band Exciter (HBE)
7) Battery Management System/Charger (BMS)
8) Power Distribution Unit (PDU)
9) 12V Battery

2.3.3 HPA Cabinet

In each DRU-2KW system, the HB and LB HPA cabinets are located on either side of the control cabinet. Each cabinet is accessible through removable front and rear panels.

The HPA cabinet is cooled using a single fan/blower and air intakes located on the top and rear (bottom) panels. The operating temperature for the HPA cabinet is 32°F to +131°F (0°C to +55°C).

Two (2) temperature sensors are mounted in the HPA cabinet: One is mounted below the bottom HPA compartment frame, allowing the system to monitor the temperature of the air being drawn into the cabinet, while the other is mounted below the fan/blower, allowing the system to monitor the temperature of the air being exhausted from the cabinet.

The following components are housed within the HPA cabinet and are accessible through the front door only:

- 4x High Power Amplifier Power Supply Units (HPA PSU's), with 8x Rectifier Modules
- 8x High Band High Power Amplifiers (HPA's)
- 2x Power Distribution Units (PDU's)

The following components are housed within the HPA cabinet and are accessible through the rear door only:

- Transmission Sub-system Controllers (TSC)
- 2-way Splitter
- 2x 4-way Splitters
- 2x 4-Way Hybrid Combiners w/Loads
- 3x HPA/TSC Transmit Output Coupler/RF Detectors
- Magic Tee w/Load

The inside rear panel includes a number of bulkhead connectors used to interconnect components in the HPA cabinet with components in the other cabinets.

NOTE: The list of components housed within the HB HPA cabinet and LB HPA cabinet is identical.

Figure 2-11 HPA Cabinet – Front Panel Removed

1) HPA
2) HPA PS (30 VDC Rectifier Module)
3) PDU

Figure 2-12 HB HPA Cabinet – Rear Panel Removed

PICTURE TBD

1) Transmission Sub-system Controller (TSC)
2) 4-way Splitter
3) 2-way Splitter
4) 4-Way Hybrid Combiner
5) 500W Termination with Heat Sink
6) 1000W Termination with Heat Sink
7) WR340 Rigid Waveguide
8) HPA/TSC Transmit Output Coupler/RF Detector
9) Magic Tee

Figure 2-13 LB HPA Cabinet – Rear Panel Removed

PICTURE TBD

1) Transmission Sub-system Controller (TSC)
2) 4-way Splitter
3) 2-way Splitter
4) 4-Way Hybrid Combiner
5) 500W Termination with Heat Sink
6) 1000W Termination with Heat Sink
7) WR340 Rigid Waveguide
8) HPA/TSC Transmit Output Coupler/RF Detector
9) Magic Tee

2.3.4 Control Cabinet Bulkhead Panel

The control cabinet bulkhead panel, which is located on the top of the control cabinet, includes surge protectors for the S-band receiver, VSAT receiver, GPS receiver, test device and dial-up modem. These surge protectors act as external interfaces for the DRU-2KW.

The bulkhead/cable entrance also includes a number of bulkhead connectors for interconnecting components in the control cabinet with components in the other cabinets.

Figure 2-14 Control Cabinet Bulkhead Panel (Combined DRU)

PICTURE TBD

Figure 2-15 Control Cabinet Bulkhead Panel (Independent DRU)

PICTURE TBD

2.3.5 Control Cabinet Power Distribution Unit (PDU)

The PDU, which is mounted in the control cabinet above the 12V battery, receives 208 - 240 VAC from the building/site electrical service panel or AC disconnect device and distributes the required power to a number of cabinet components – see Table 2-1.

The PDU is comprised of four (4) circuit breakers and four (4) surge protectors. Four (4) sets of terminal blocks allow for input and output AC power conductors to be connected to the PDU.

The PDU front panel provides access to the circuit breakers, surge protectors and power outlet, while the rear panel provides access to the AC input and output terminal blocks.

Figure 2-16 Control Cabinet PDU

Table 2-1 Control Cabinet PDU Circuit Breakers

Name	Rating	Circuit Breaker For
L1 L2 (MAIN AC)	15A, 2-pole	AC input from building/site electrical service panel or AC disconnect device
CB1 (TRMS)	5A, Single-pole	TRMS
CB2 (BMS)	10A, 2-pole	BMS
CB3 (AC SERVICE)	5A, 2-pole	Provides 120 VAC to GFI outlet

2.3.6 Battery Management System (BMS)

The BMS, which is mounted in the control cabinet above the PDU, is a high performance, modular power supply system and battery charger, which provides the HBE, LBE, HB TSC and LB TSC with the necessary voltage and current for normal operation.

The DRU-2KW employs a single mounting shelf containing a controller and two (2) identical rectifier modules. The BMS also includes a 12V pure lead-tin VRLA AGM back-up battery, which allows the BMS to provide power to the connected components for up to 60 minutes during a power outage.

The rectifier modules are high efficiency (85 - 90%) air cooled units with a typical power factor of 0.99. The modules are fed from the same two-pole, 10A circuit breaker in the PDU via the BMS mounting shelf.

The rectifier modules' DC outputs are bussed together by the BMS mounting shelf. With the use of five (5) front panel circuit breakers and ten (10) rear panel load terminals, the BMS is able to proved five (5) individual 12 VDC outputs – see Table 2-2.

Two (2) temperature probes are connected to the BMS, allowing for a temperature compensated rectifier output. One probe is mounted to the BMS battery, while the other is mounted to the back of the control cabinet copper ground bar.

Form-C alarm relay contacts on the BMS mounting shelf rear panel allow the exciters to indicate when an AC failure or BMS failure has occurred on the BMS.

Figure 2-17 BMS and Rectifier Module

Table 2-2 BMS Circuit Breakers

Name	Rating	Circuit Breaker For
BAT CB	100A	Battery (rear panel)
SPARE	2.5A	Spare
TSC-H	5A	HB TSC and HB HPA Controllers
TSC-L	5A	LB TSC and LB HPA Controllers
HBE	10A	HBE
LBE	25A	LBE

2.3.7 High Band Dual Band Pass Filter (DBPF)

The DBPF receives signals from the S-Band antenna and provides filtering before the signals reach the LNA and finally the HBE.

The DBPF allows the HB SAT1 A and SAT1 B ensembles to pass, while providing rejection in the 2305-2320 MHz and 2345-2360MHz WCS frequency bands as well as the Low and High SiriusXM terrestrial bands. The attenuation is to comply with TRS-DRU System-SPEC-01-00-000, Rev 1.3, DRU System Level Specification.

Figure 2-18 DBPF

2.3.8 High Band Low Noise Amplifier (LNA)

The LNA is a wide-band device which amplifies the HB SAT 1 A and SAT 1 B ensembles it receives from the S-Band antenna (via the DBPF). It is a high dynamic range device, which allows it to amplify input signals with relatively high power levels without producing excessive levels of distortions on the output.

To ensure stable and reliable operation under the most extreme source VSWR conditions, an isolator is incorporated into the LNA (front end). The isolator also suppresses spurious signals and LO leakage to the receive antenna.

The LNA design is based on low noise, high dynamic range transistor. The combination of a low noise figure and high output IP3 provides the best compromise between linearity and sensitivity of the LNA.

Figure 2-19 LNA

2.3.9 High Band Exciter (HBE)

The HBE functions as both an exciter and controller in the High Band sub-system.

The HBE receives the HB SAT 1 A and SAT 1 B ensembles from the S-Band antenna (via the DBPF and LNA) and trans-codes the received ensembles into two terrestrial band COFDM ensembles (waveforms). The terrestrial band ensembles (waveforms) are then up-converted to the assigned HB terrestrial S-Band frequencies, creating a single RF output used to drive the HB HPA.

The HBE also performs monitoring and control for a number of HB sub-system components as well as alarm monitoring for several common DRU cabinet components.

Please refer to the HBE Operating Manual for a more detailed description of the HBE.

Figure 2-20 HBE

2.3.10 Low Band Exciter (LBE)

The LBE functions as both an exciter and controller in the Low Band sub-system.

The LBE receives the downconverted LB satellite signal from the Ku-Band VSAT antenna and trans-codes the received signal into a terrestrial band COFDM waveform. The terrestrial band waveform is then up-converted to the assigned LB terrestrial S-Band frequency, creating a main RF output used to drive the LB HPA. In addition to the main RF output, the LBE also provides an independent, configurable, diversity RF output.

The LBE also performs monitoring and control for a number of LB sub-system components as well as alarm, RF signal level and status monitoring for several common DRU cabinet components.

Please refer to the LBE Operating Manual for a more detailed description of the LBE.

Figure 2-21 LBE

2.3.11 Terrestrial Repeater Monitoring System (TRMS)

The TRMS serves as a monitoring receiver capable of performing signal quality measurements for either the terrestrial broadcast or the satellite broadcast of the Sirius Satellite Radio and XM Satellite Radio commercial radio services.

Please refer to the TRMS Operating Manual for a more detailed description of the TRMS.

Figure 2-22 TRMS

2.3.12 HB HPA Cabinet Bulkhead Panel

The HB HPA cabinet bulkhead panel, which is located on the top-left side of the cabinet, includes a number of bulkhead connectors for interconnecting components in the HB HPA cabinet with components in the other cabinets.

Figure 2-23 HB HPA Cabinet Bulkhead Panel

PICTURE TBD

2.3.13 LB HPA Cabinet Bulkhead Panel

The LB HPA cabinet bulkhead panel, which is located on the top-right side of the cabinet, includes a number of bulkhead connectors for interconnecting components in the LB HPA cabinet with components in the other cabinets.

Figure 2-24 LB HPA Cabinet Bulkhead Panel

PICTURE TBD

2.3.14 DRU-2KW HPA Sub-system

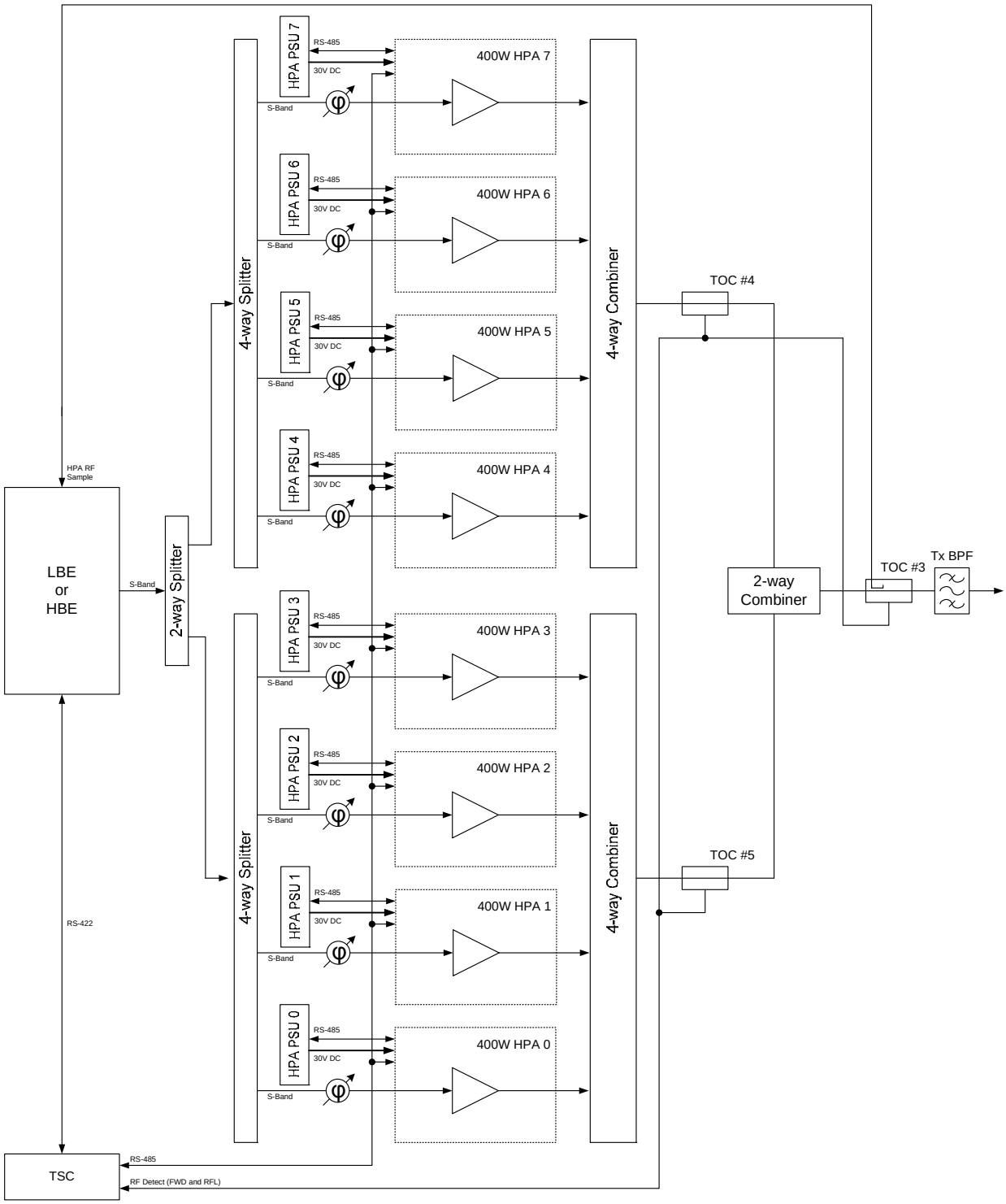
The DRU-2KW HPA sub-system consists of two (2) sets of HPA's, with each set containing four (4) 400W HPA's. In each set, the four (4) HPA's are combined to produce an output power level of 1.4 kW (61.4 dB). The HPA sets are then combined, using a magic tee, to produce an output power level of 1.74 kW (62.4 dBm) post filter.

The HPA sub-system includes a transmission sub-system controller (TSC), which uses RS-485 serial interfaces to communicate with the HPA's and HPA/TSC transmit output coupler/RF detector within the HPA sub-system. The HBE or LBE are connected directly to the TSC via a RS-422 serial interface.

The HPA sub-system includes:

- Power Distribution Unit (PDU)
- Transmission Sub-system Controller (TSC)
- 4-way Power Splitter
- 4-way Power Splitter
- 4x High Power Amplifier Power Supply Units (HPA PSU's), with 8x Rectifier Modules
- 8x 400W HPA's
- 2x 4-Way Hybrid Combiners w/Loads
- 3x HPA/TSC Transmit Output Coupler/RF Detectors
- Magic Tee

Figure 2-25 HPA Sub-system Block Diagram



2.3.15 HPA Cabinet Power Distribution Unit (PDU)

The PDU, which is mounted at the bottom of the HPA cabinet, receives 208 - 240 VAC from the building/site electrical service panel or AC disconnect device and distributes the required power to a number of cabinet components – see Table 2-3.

The PDU is comprised of eleven (11) circuit breakers, six (6) surge protectors with two (2) LED indicators and two (2) contactors. Eleven (11) sets of terminal blocks allow for input and output AC power conductors to be connected to the PDU.

The PDU front panel provides access to the circuit breakers and AC LED indicators, while the rear panel provides access to surge protectors, AC input and output terminal blocks, as well as the contactor's terminal blocks.

The PDU also includes two (2) contactors, which disable AC power to each set of four (4) HPA PSU's when there is no air flow in the HPA cabinet.

Figure 2-26 HPA Cabinet PDU

PICTURE TBD

Table 2-3 HPA Cabinet PDU Circuit Breakers

Name	Rating	Circuit Breaker For
L1 L2 L3 (MAIN1 AC)	40A, 3-pole	AC input from building/site electrical service panel or AC disconnect device
L1 L2 L3 (MAIN2 AC)	40A, 3-pole	AC input from building/site electrical service panel or AC disconnect device
CB0 (PS 0)	15A, 2-pole	HPA PS 0
CB2 (PS 1)	15A, 2-pole	HPA PS 1
CB2 (PS 2)	15A, 2-pole	HPA PS 2
CB3 (PS 3)	15A, 2-pole	HPA PS 3
CB4 (FAN)	8A, 3-pole	Fan/blower
CB5 (PS 4)	15A, 2-pole	HPA PS 4
CB6 (PS 5)	15A, 2-pole	HPA PS 5
CB7 (PS 6)	15A, 2-pole	HPA PS 6
CB8 (PS 7)	15A, 2-pole	HPA PS 7

2.3.15.1 Transmission Sub-system Controller (TSC)

The Transmission Subsystem Controller (TSC) serves as an agent for the exciter to communicate with and manage the HPA sub-system. The TSC accepts commands from the exciter to enable or disable the RF output and set the output power target.

The HPA sub-system is a variable gain HPA assembly, which is controlled via the TSC's ALC algorithm. The ALC algorithm monitors the forward power level at each of the HPA/TSC transmit output couplers and equally adjusts the output power level of the individual 400W HPA's to reach the targeted value.

The TSC monitors and controls the HPA's (and their slave power supplies) over a RS-485 serial bus and reports the HPA's statuses and alarms back to the exciter via a RS-422 serial interface.

The TSC is also connected to temperature sensors, which are mounted on the 4-way hybrid combiner and magic tee termination loads. This allows the TSC to monitor the temperature of the termination loads and prevent them from overheating.

Figure 2-27 TSC

2.3.15.2 2-Way Power Splitter

The 2-way, 0 deg., splitter is used to divide the exciter's RF output signal, in order to drive each set of four (4) HPA's in the HPA sub-system.

Figure 2-28 2-Way Splitter

2.3.15.3 4-Way Power Splitter

The 4-way, 0 deg., splitter is used to further divide the exciter's RF output signal, in order to drive the four (4) HPA's in each HPA sub-system HPA set.

Coaxial cables connected to the output of the splitter are cut to a pre-determined length in order emulate a phased splitter.

Phase adjusters are connected to the splitter's output legs in order to fine tune the phase offset of each splitter leg / cable combination.

Figure 2-29 4-Way Splitter

2.3.15.4 High Power Amplifier Power Supply Unit (HPA PSU)

The HPA PSU is a high performance, modular power supply system, which provides the HPA's with the necessary voltage and current to operate at the required output power level.

The HPA sub-system employs four (4) power supply mounting shelves, each containing two (2) identical rectifier modules. The rectifiers operate independent of each other; each rectifier module is dedicated to power a specific HPA.

The rectifier modules are high efficiency (better than 90%) air cooled units with a typical power factor of 0.98. The modules are fed from separate two-pole, 15A circuit breakers in the PDU via the mounting shelf. The modules are connected to the corresponding HB or LB HPA via the mounting shelf to provide the HPA with necessary 30 VDC (with a maximum current of 60 A).

Each rectifier module is connected to the corresponding HPA via a RS-485 serial interface on the mounting shelf, allowing the rectifier module to communicate with the HPA controller using the built in Galaxy protocol. The HPA controller is able to monitor the status of the rectifier module as well as enable or disable the rectifier module's DC output.

Figure 2-30 HPA PSU with Rectifier

2.3.15.5 High Power Amplifier (HPA)

The HPA operates as the final amplification stage for the terrestrial repeater. It utilizes highly efficient, LDMOS transistor technology to amplify the S-band terrestrial signal from the exciter to a power level of 400W (56 dBm). This solid-state design operates in a Doherty configuration over a frequency range of 2320 MHz to 2345 MHz.

The HPA sub-system employs eight (8), air-cooled HPA's, which are power/phase combined to provide an sub-system output power level of 1.74 kW (62.4 dBm) post filter. Each HPA is powered by an individual 30 VDC rectifier module, which is external to the HPA.

The HPA contains a pre-driver, a driver, a 4-way splitter, four individual power amplifier modules, a 4-way combiner/coupler with RF detector and an HPA controller. The four power modules operate in a parallel configuration, allowing the HPA to operate in soft fail mode. Under normal conditions, the HPA can operate with a maximum output power level of 56 dBm (400W). In the event of a single power module failure, the HPA is capable of operating at a reduced output power level of 53 dBm (200W). With the failure of a second power module, the HPA is capable of operating at a reduced output power level of 50 dBm (100W).

The HPA incorporates an internal ALC loop to maintain a constant output power level. Forward power detection is performed at the output of the HPA's internal 4-way combiner/coupler by RF detector circuitry. The HPA also includes an adaptive pre-corrector, which effectively pre-distorts the input drive signal to minimize amplifier distortion and reduce spectral regrowth.

The HPA is fully protected against input overdrive, output load VSWR and temperature faults. The protection circuits are all self-correcting, allowing restoration of the HPA to its normal operational state upon removal of the fault condition.

The HPA controller is used for monitoring and control of all HPA parameters and provides protection against abnormal operating conditions. In a DRU-2KW, each HPA is connected to the TSC via a RS-485 serial bus. The TSC is connected directly to the exciter via a RS-422 serial interface for monitoring and control of the eight (8) HPA's.

Figure 2-31 HPA

2.3.15.6 4-way Hybrid Combiner with Reject Loads

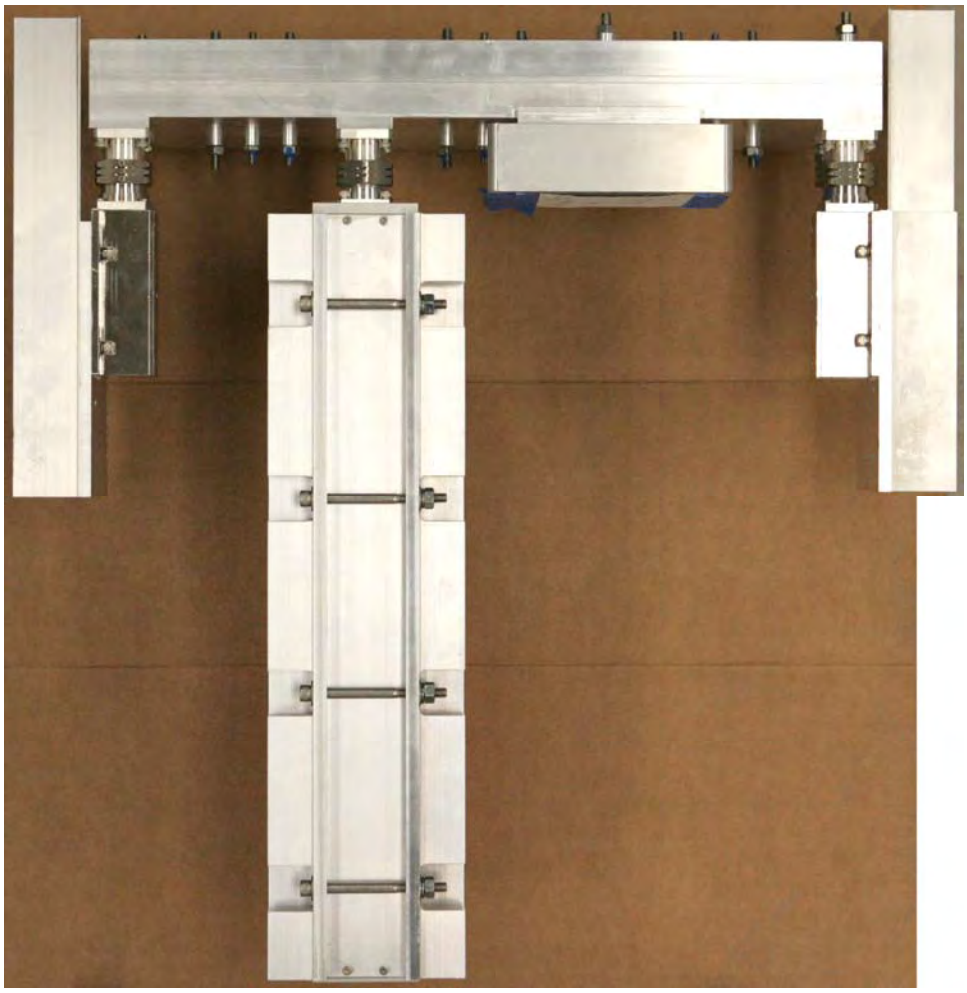
The 4-way, 90 deg., balanced (hybrid) combiner is used to combine the output of the four (4) HPA's in each HPA sub-system HPA set. The 4-way hybrid combiner is connected to each HPA RF output using 7/8" blind mate connectors.

Two (2) low power reject loads (with heat sinks) are used to terminate unwanted signals after the first combining stage.

A high power reject load (with heat sink) is used to terminate unwanted signals after the final combining stage.

Temperature sensors are mounted to the reject load heat sinks, allowing the TSC to monitor the temperature of each reject load and prevent overheating.

Figure 2-32 4-Way Hybrid Combiner with Reject Loads



2.3.15.7 HPA/TSC Transmit Output Coupler/RF Detector

The WG WR340 HPA/TSC transmission output coupler with RF detector is the final component in the HPA sub-system's transmission path. The HPA/TSC transmit output coupler is connected to the magic tee's output interface for forward and reflected power level measurements.

The HPA/TSC transmit output coupler with RF detector includes two (2) coupled forward ports, one (1) coupled reflected port and an RF detector board (which is located inside a weatherproof housing).

The RF detector performs forward and reflected power monitoring/detection using forward and reflected power detection circuits, which are connected to a coupled forward port and a coupled reflected port respectively. The detected power levels are reported to the TSC via a RS-485 interface.

The remaining coupled forward port is used to provide a forward power sample to the exciter.

An HPA/TSC transmit output coupler is also connected to each of the magic tee input interfaces, for forward and reflected power level measurements on each HPA set.

Figure 2-33 HPA/TSC Transmit Output Coupler/RF Detector

2.3.16 Fan/Blower and HPA Cabinet Cooling

The DRU-2KW employs a fan/blower, which is located at the top of the HPA cabinet. The fan/blower is horizontally mounted to pull ambient air through the cabinet via air intakes located on the top and rear (bottom) panels.

The cabinet is designed to divert the ambient air across the HPA heat sinks only, providing a means of cooling for the HPA's. All other components in the cabinet are cooled via natural convection.

The AC-powered fan/blower has a centrifugal configuration and exhausts air through openings on the side of the enclosure. An air flow sensor, installed below the fan/blower, is used to monitor the air flow in the HPA cabinet. Contactors, located in the HPA cabinet PDU, disable AC power to the HPA PSU's when a loss of air flow occurs.

Figure 2-34 Fan/Blower

PICTURE TBD

2.3.17 Output Filter Network (OFN) Cabinet

The output filter network (OFN) cabinet is an indoor/outdoor enclosure, located behind the control cabinet, between the HB and LB HPA cabinets.

The OFN cabinet is used to house the transmit output filters, which are accessible through removable front and rear panels. Once the DRU-2KW system is fully assembled, the front of the OFN cabinet is no longer accessible as it is located immediately behind the control cabinet.

The OFN cabinet is cooled through natural convection as louvers located on the front and rear panels allow for air circulation in the cabinet.

The following components are housed within the Combined DRU OFN cabinet:

- HB Transmit Output Filter (WG)
- LB Transmit Output Filter (WG)
- LBD Transmit Output Filter (DR)
- Diplexer
- DRU Transmit Output Coupler/RF Detector

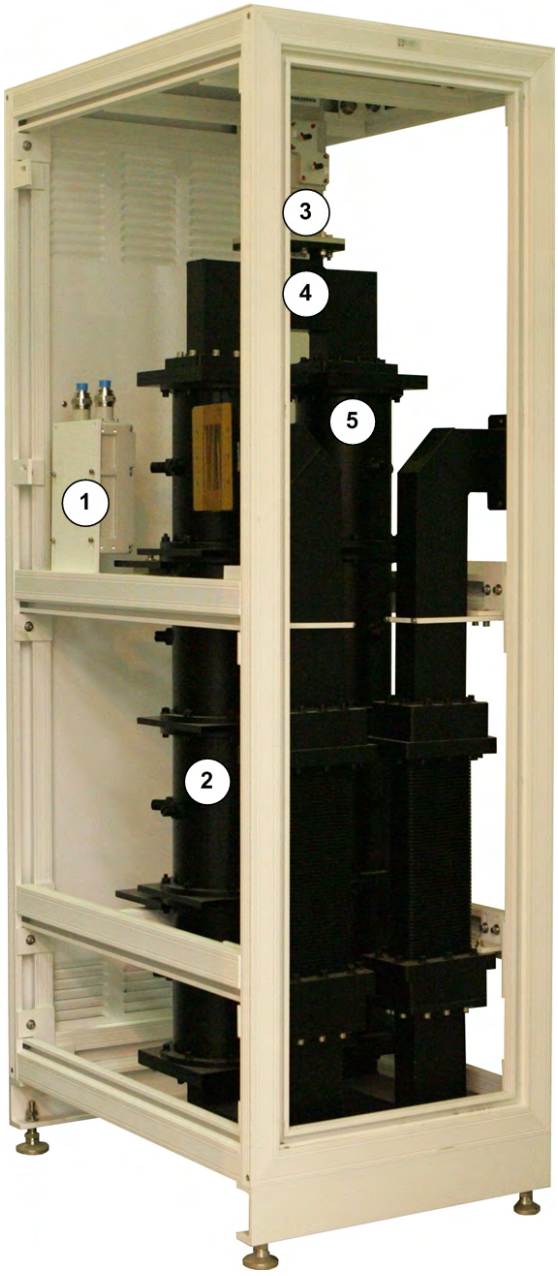
The following components are housed within the Independent DRU OFN cabinet:

- HB Transmit Output Filter (WG)
- LB Transmit Output Filter (WG)
- LBD Transmit Output Filter (WG)
- Diplexer
- 2x DRU Transmit Output Coupler/RF Detector's

In a Combined DRU, the diplexer combines the LB and HB transmit signals on a single output interface. In this configuration, the LBD transmit signal has an independent output interface.

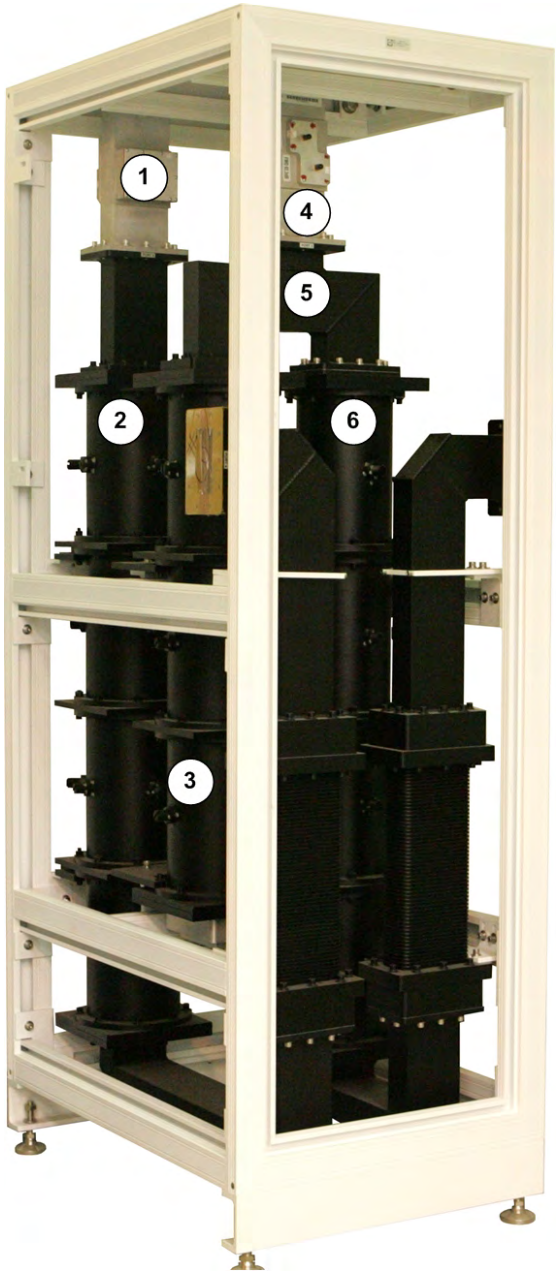
In an Independent DRU, the diplexer combines the HB and LBD transmit signals on a single output interface. In this configuration, the LB transmit signal has an independent output interface.

Figure 2-35 OFN Cabinet (Combined DRU)



1) LBD Transmit Output Filter
2) LB Transmit Output Filter
3) DRU Transmit Output Coupler/RF Detector
4) Diplexer
5) HB Transmit Output Filter

Figure 2-36 OFN Cabinet (Independent DRU)



1) DRU Transmit Output Coupler/RF Detector #2
2) LB Transmit Output Filter
3) LBD Transmit Output Filter
4) DRU Transmit Output Coupler/RF Detector #1
5) Diplexer
6) HB Transmit Output Filter

2.3.17.1 RF Output Interface Configuration

The RF output interface configuration will depend on the DRU configuration – see Table 2-4.

Table 2-4 RF Output Interface Configuration

Port	Combined DRU	Independent DRU
Output 1	WG WR340	WG WR340
Output 2	7/8" EIA Flange	WG WR340

Figure 2-37 RF Output Interfacte Configuration (Combined DRU)

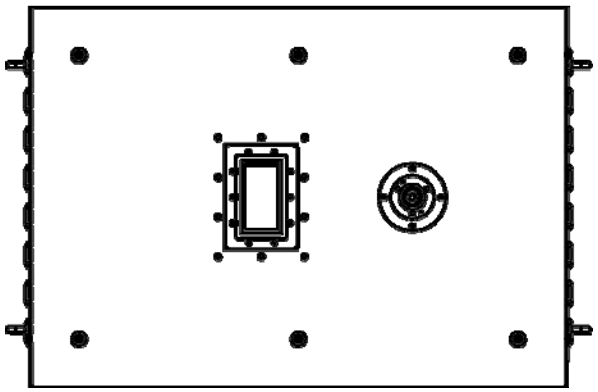
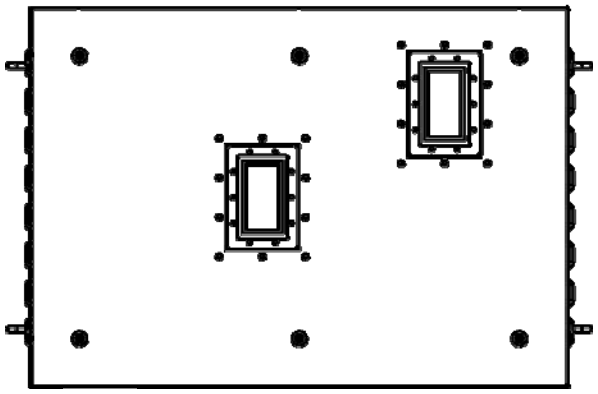


Figure 2-38 RF Output Interfacte Configuration (Independent DRU)



2.3.17.2 High Band Transmit Output Filter (Waveguide)

The HB transmit output filter is a waveguide, dual mode band pass filter which provides attenuation of the out-of-band emissions generated by the HB HPA. The attenuation is to comply with TRS-DRU System-SPEC-00-10-200, Rev 1.2, DRU System RF Output Filter Network Specification.

2.3.17.3 Low Band Transmit Output Filter (Waveguide)

The LB transmit output filter is a waveguide, dual mode band pass filter, which provides attenuation of the out-of-band emissions generated by the LB HPA. The attenuation is to comply with TRS-DRU System-SPEC-00-10-200, Rev 1.2, DRU System RF Output Filter Network Specification.

2.3.17.4 Low Band Diversity Transmit Output Filter (Waveguide)

In an Independent DRU, the LBD transmit output filter is a waveguide, dual mode band pass filter, which provides attenuation of the out-of-band emissions generated by the LBE LBD output. The attenuation is to comply with TRS-DRU System-SPEC-00-10-200, Rev 1.2, DRU System RF Output Filter Network Specification.

2.3.17.5 Low Band Diversity Transmit Output Filter (Dielectric Resonator)

In a Combined DRU, the LBD transmit output filter is a dielectric resonator band pass filter, which provides attenuation of the out-of-band emissions generated by the LBE LBD output. The attenuation is to comply with TRS-DRU System-SPEC-00-10-200, Rev 1.2, DRU System RF Output Filter Network Specification.

Figure 2-39 LBD Transmit Output Filter (Dielectric Resonator)

2.3.17.6 DRU Transmit Output Coupler/RF Detector

The WG WR340 DRU transmit output coupler with RF detector is the final component in the repeater's transmission path. The DRU transmit output coupler is connected to the OFN's output interface(s) for forward and reflected power level measurements.

The DRU transmit output coupler with RF detector includes three (3) coupled forward ports, one (1) coupled reflected port and an RF detector board (which is located inside a weatherproof housing).

The RF detector performs forward and reflected power monitoring/detection using forward and reflected power detection circuits, which are connected to a coupled forward port and a coupled reflected port respectively. The detected power levels are reported to the LBE via a RS-422 interface.

One of the two remaining coupled forward ports is used to provide a forward power sample to the TRMS. The other can be used for monitoring purposes.

Figure 2-40 DRU Transmit Output Coupler/RF Detector

2.4 Repeater Technical Specifications

2.4.1 External Input Signal Interfaces

S-Band Antenna	
Connector Name	S-BAND
Connector Type	N (female)
Connector Impedance	50 Ω

Ku-Band Antenna	
Connector Name	VSAT
Connector Type	F (female)
Connector Impedance	75 Ω

GPS Antenna	
Connector Name	GPS
Connector Type	N (female)
Connector Impedance	50 Ω

Test Antenna	
Connector Name	ANT
Connector Type	SMA (female)
Connector Impedance	50 Ω

PSTN Phone Line	
Cable Gland Name	TEL
Connector Type	Screw down terminals
Dial-up Modem Manufacturer	Multitech Systems
Model Number	MT5634IND
ACTA Registration Number	AU7USA-25814-M5-E
Ringer Equivalence Number	0.3B

2.4.2 External Output Signal Interfaces

Combined RF Output Port	
Connector Name	Output 1
Connector Type	WR340 Waveguide
Connector Impedance	50 Ω

Independent RF Output Port	
Connector Name	Output 2
Connector Type	Combined DRU: 7/8” EIA Flange Independent DRU: WR340 Waveguide
Connector Impedance	50 Ω

2.4.3 High Band RF Output

High Band RF Output	
Standard	XM Satellite Radio
Output Connector	Output 1
Output VSWR	< 1.3:1
Centre Frequency	2338.755 MHz
Bandwidth	5.060 MHz
Output Power Level	52.4 dBm to 62.4 dBm (174 W to 1.74 kW)
Output Power Level Stability (with ALC engaged)	± 0.2 dB
Spectral Re-growth	> 24 dBc
In-band Carrier to Interference	> 21 dBc
Peak-to-Average Ratio (@ 0.1% CCDF)	> 7.0, < 13.0
Gain Flatness	≤ +0.75 dB
In-band/Out-of-Channel Emissions	> 30 dBc: @ 2335.255 MHz, @ 2342.255 MHz > 46 dBc: @ 2333.515 MHz, @ 2343.995 MHz
Out-of-Band Emissions	< -90 dB Watts/MHz (< 2320.0 MHz, > 2345.0 MHz) < -80 dB Watts/MHz (2332.5 - 2345.0 MHz)

2.4.4 Low Band Main RF Output

Low Band RF Output	
Standard	Sirius Satellite Radio
Output Connector	Combined DRU: Output 1 Independent DRU: Output 2
Output VSWR	< 1.3:1
Centre Frequency	2326.250 MHz
Bandwidth	4.012 MHz
Output Power Level	52.4 dBm to 62.4 dBm (174 W to 1.74 kW)
Output Power Level Stability (with ALC engaged)	± 0.2 dB
Spectral Re-growth	> 27 dBc
In-band Carrier to Interference	> 24 dBc
Peak-to-Average Ratio (@ 0.1% CCDF)	> 7.0, < 13.0
Gain Flatness	≤ +0.75 dB
In-band/Out-of-Channel Emissions	> 35 dBc: @ 2322.138 MHz > 35 dBc: @ 2330.362 MHz
Out-of-Band Emissions	< -90 dB Watts/MHz (< 2320.0 MHz, > 2345.0 MHz) < -80 dB Watts/MHz (2332.5 - 2345.0 MHz)

2.4.5 Low Band Diversity RF Output

Low Band Diversity RF Output	
Standard	Sirius Satellite Radio
Output Connector	Combined DRU: Output 2 Independent DRU: Output 1
Output VSWR	< 1.3:1
Centre Frequency	2326.256040 MHz
Bandwidth	20 kHz
Output Power Level	24.4 dBm to 34.4 dBm (275 mW to 2.75 W)
Output Power Level Stability (with ALC engaged)	N/A
Spectral Re-growth	> 30 dBc
In-band Carrier to Interference	N/A
Peak-to-Average Ratio (@ 0.1% CCDF)	> 3.0, < 5.0
Gain Flatness	N/A
In-band/Out-of-Channel Emissions	> 45 dBc @ 2322.138 MHz > 45 dBc @ 2330.362 MHz
Out-of-Band Emissions	< -97 dB Watts/MHz (< 2320.0 MHz, > 2345.0 MHz) < -87 dB Watts/MHz (2332.5 - 2345.0 MHz)

2.4.6 Power Supply

Power Supply	
Control Cabinet Voltage	208 – 240 VAC, Single Phase, 4 wire (L1, L2, N, G)
HPA Cabinet Voltage	208 – 240 VAC, 3-Phase, 4 wire Delta or Y (L1, L2, L3, N, G)
Frequency	47 to 63 Hz
Power Consumption	Overall: max. 36 kVA Control Cabinet: 2 kVA HB HPA Cabinet: 17 kVA LB HPA Cabinet: 17 kVA

2.4.7 Environmental

Environmental	
Ambient Operating Temperature	32°F to +131°F (0°C to +55°C)
Ambient Storage Temperature	-22°F to +167°F (-30ºC to +75ºC)
Operating Humidity	5% to 95%, non-condensing
Storage Humidity	5% to 99%, non-condensing
Altitude	max. 5500 ft. (1676 m)
Control Cabinet Cooling	Forced air
HPA Cabinet Cooling	Forced air, 3100 CFM
Total DRU Heat Dissipation	97,000 BTU (Exhausted + Radiated) Note: Radiated heat (into room) is equal to 15% of dissipated heat.

2.4.8 Mechanical

Mechanical (Overall)	
Width	77.0 in. (195.58 cm)
Depth	59.0 in. (149.86 cm)
Height	102.4 in. (260.10 cm)
Weight (fully populated)	Combined DRU: 3300 lbs. (1497 kg) Independent DRU: 3400 lbs. (1542 kg)

Mechanical (Control Cabinet)	
Width	21.88 in. (55.58 cm)
Depth	28.50 in. (72.39 cm)
Height	72.10 in. (183.13 cm)
Weight (unpacked)	lbs. (kg)
Weight (in transport package)	lbs. (kg)

Mechanical (HB HPA Cabinet)	
Width	27.40 in. (69.60 cm)
Depth	50.92 in. (129.34 cm)
Height	102.40 in. (260.10 cm)
Weight (fully populated)	lbs. (kg)
Weight (partially populated)	lbs. (kg)
Weight (in transport package)	lbs. (kg)

Mechanical (LB HPA Cabinet)	
Width	27.40 in. (69.60 cm)
Depth	50.92 in. (129.34 cm)
Height	102.40 in. (260.10 cm)
Weight (fully populated)	lbs. (kg)
Weight (partially populated)	lbs. (kg)
Weight (in transport package)	lbs. (kg)

Mechanical (OFN Cabinet)	
Width	19.75 in. (50.17 cm)
Depth	30.44 in. (77.31 cm)
Height	Combined DRU: 65.91 in. (167.41 cm) Independent DRU: 64.61 in. (164.11 cm)
Weight (unpacked)	lbs. (kg)
Weight (in transport package)	lbs. (kg)

Unique Broadband Systems Ltd.

Chapter 3

Installation

Contents

3 Installation

3.1 Introduction

This section describes the installation procedures for the DRU-2W, which is to be installed in a restricted access location.

3.2 Components Installed at the Factory

The following components are installed in the Combined DRU cabinets prior to shipping.

Table 3-1 Combined DRU Components Installed at the Factory

Control Cabinet	**Part Number**	**Quantity**
PDU	SX03-33300-01	1
Dual Band Pass Filter (DBPF)	SX03-50100-01	1
Low Noise Amplifier (LNA)	SX03-50200-01	1
BMS Mounting Shelf w/Controller	SX03-50300-01	1
Break-Out-Board	SX03-92020-01	1
HPA Cabinet	**Part Number**	**Quantity**
4-Way Splitter	000087234R	4 (2 per cabinet)
2-Way Splitter	000087315R	2 (1 per cabinet)
4-Way Hybrid Combiner w/Loads	SX03-21825-01	4 (2 per cabinet)
PDU	SX03-31300-01	2 (1 per cabinet)
Fan/Blower	SX03-31600-01	2 (1 per cabinet)
Transmission Sub-system Controller (TSC)	SX03-50700-02	2 (1 per cabinet)
HPA PSU Mounting Shelf	SX03-51710-01	8 (4 per cabinet)
Magic Tee	SX03-52100-01	2 (1 per cabinet)
HPA/TSC Transmit Output Coupler/RF Detector	SX03-52350-01	6 (3 per cabinet)
Output Filter Network (OFN) Cabinet	**Part Number**	**Quantity**
Combined OFN, WG	SX03-24100-02	1
LBD DR Filter	SX03-51100-01	1
DRU Transmit Output Coupler/RF Detector	SX03-51600-01	1

The following components are installed in the Independent DRU cabinets prior to shipping.

Table 3-2 Independent DRU Components Installed at the Factory

Control Cabinet	**Part Number**	**Quantity**
PDU	SX03-33300-01	1
Dual Band Pass Filter (DBPF)	SX03-50100-01	1
Low Noise Amplifier (LNA)	SX03-50200-01	1
BMS Mounting Shelf w/Controller	SX03-50300-01	1
Break-Out-Board	SX03-92020-01	1
HPA Cabinet	**Part Number**	**Quantity**
4-Way Splitter	000087234R	4 (2 per cabinet)
2-Way Splitter	000087315R	2 (1 per cabinet)
4-Way Hybrid Combiner w/Loads	SX03-21825-01	4 (2 per cabinet)
PDU	SX03-31300-01	2 (1 per cabinet)
Fan/Blower	SX03-31600-01	2 (1 per cabinet)
Transmission Sub-system Controller (TSC)	SX03-50700-02	2 (1 per cabinet)
HPA PSU Mounting Shelf	SX03-51710-01	8 (4 per cabinet)
Magic Tee	SX03-52100-01	2 (1 per cabinet)
HPA/TSC Transmit Output Coupler/RF Detector	SX03-52350-01	6 (3 per cabinet)
Output Filter Network (OFN) Cabinet	**Part Number**	**Quantity**
Independent OFN, WG	SX03-24100-03	1
DRU Transmit Output Coupler/RF Detector	SX03-51600-01	2
WR340 to N-Type (F) End Launch Adapter	SX03-52400-01	1

NOTE: A number of other components, which were installed in the cabinet prior to shipping, are not listed in Table 3-1 or Table 3-2. They include:

- Surge suppressors
- Connectors, adapters and flanges
- Mounting brackets and panels
- Ground, AC, DC and communications wires
- RF cables

3.3 Components Installed On-Site

The following components must be installed in a Combined DRU on-site, after delivery.

Table 3-3 Combined DRU Components Installed On-site

Control Cabinet	Part Number	Quantity
BMS 12 VDC Rectifier Module	SX03-50320-01	2
12V Battery	SX03-50330-01	1
HBE	N/A	1
LBE	N/A	1
TRMS	N/A	1
Dial-up Modem	N/A	1
HPA Cabinet	**Part Number**	**Quantity**
High Power Amplifier (HPA)	SX03-40000-01	16 (8 per cabinet)
HPA PSU 30 VDC Rectifier Module	SX03-51720-01	16 (8 per cabinet)

The following components must be installed in an Independent DRU on-site, after delivery.

Table 3-4 Independent DRU Components Installed On-site

Control Cabinet	Part Number	Quantity
BMS 12 VDC Rectifier Module	SX03-50320-01	2
12V Battery	SX03-50330-01	1
HBE	N/A	1
LBE	N/A	1
TRMS	N/A	1
Dial-up Modem	N/A	1
HPA Cabinet	**Part Number**	**Quantity**
High Power Amplifier (HPA)	SX03-40000-01	16 (8 per cabinet)
HPA PSU 30 VDC Rectifier Module	SX03-51720-01	16 (8 per cabinet)

3.4 Required Tools

The following tools will be needed to install the repeater:

Table 3-5 Required Tools

Tool	Type	Size
Screwdriver	Phillips	#3
Screwdriver	Phillips	#2
Screwdriver	Slotted	1/4”
Screwdriver	Slotted	3/32”
Hex Driver		9/64”
Open End Wrench		1/2”
Open End Wrench		7/16”
Open End Wrench		11/32”
Open End Wrench		5/16”
Torque Wrench		5/16”
Wire Stripper		
Step Ladder		

3.5 Installation Overview

The repeater can be installed by following the basic sequence below:

- Repeater set-up
  - Check the installation surface structure, flatness and suitability.
  - Unpack the cabinets and components.
  - Position the cabinets according to the site drawing(s).
  - Fasten the cabinets together according to the DRU mechanical drawing(s).
- Control cabinet
  - Components
    - Mount the 12V battery in the control cabinet.
    - Install the BMS 12 VDC rectifier module in the BMS mounting shelf.
    - Mount the HBE in the control cabinet.
    - Mount the LBE in the control cabinet.
    - Mount the TRMS in the control cabinet.
    - Mount the dial-up modem in the control cabinet (where applicable).
  - Internal wire/cable connections
    - Connect the positive, negative and temperature sensor wires to the battery.
    - Connect the ground, communications, RF and power wires/cables to the HBE.
    - Connect the ground, communications, RF and power wires/cables to the LBE.
    - Connect the ground, communications, RF and power wire/cables to the TRMS.
  - Inter-cabinet cable connections
    - Connect the communications, RF and power wires/cables between the control cabinet and HB HPA cabinet bulkhead panels.
    - Connect the communications, RF and power wires/cables between the control cabinet and LB HPA cabinet bulkhead panels.
    - Connect the communications and RF and wires/cables between the control cabinet and OFN cabinet.
  - External input signal interfaces
    - Connect a cable from the S-Band antenna to the S-BAND surge protector.
    - Connect a cable from the Ku-Band VSAT antenna to the VSAT surge protector.
    - Connect a cable from the GPS antenna to the GPS surge protector.
  - Communications interface
    - Connect a PSTN phone line to the Telco surge protector (where applicable).
  - Shelter/room alarm connections
    - Connect any shelter/room alarm contacts/sensors (where applicable) to the break-out-board.
- HB HPA cabinet components
    - Install the HPA's in the HB HPA cabinet.
    - Install the HPA 30 VDC rectifier modules in the HB HPA cabinet.

- LB HPA cabinet components
  - o Install the HPA's in the LB HPA cabinet.
  - o Install the HPA 30 VDC rectifier modules in the LB HPA cabinet.
- OFN cabinet RF output interfaces
  - Connect a broadcast antenna to Output 1 (where applicable).
  - Connect a broadcast antenna to Output 2 (where applicable).
- Repeater AC power
  - o Connect an external ground conductor to the control cabinet.
  - o Connect an external ground conductor to the HB HPA cabinet.
  - o Connect an external ground conductor to the LB HPA cabinet.
  - o Connect a main AC power cable to the control cabinet.
  - o Connect a main AC power cable to the HB HPA cabinet.
  - o Connect a main AC power cable to the LB HPA cabinet.

NOTE: Detailed repeater installation information can be found in the subsequent sections of this manual.

3.6 Repeater Setup

The DRU-2KW repeater may only be installed indoors (typically on the top floor of a building nearest to roof, or in a shelter at the base of a transmission tower) in a restricted access location.

3.6.1 Moving the Repeater Cabinets

For shipping purposes, the repeater cabinets are attached to pallets. Some options for moving the repeater cabinets are:

- Using a pallet tuck
- Using a four wheeled furniture dolly
- Placing casters under the pallet

If the repeater cabinets are moved from the delivery location to the installation location while still attached to their pallets, a pallet truck or casters are viable options. However, if the repeater cabinets must be removed from their pallets, a narrower furniture dolly is a viable option for moving the repeater cabinets.

3.6.2 Removing HPA Cabinet Parts

If, for some reason, the HPA cabinet is unable to fit through a door/opening, the following exterior parts can be removed from the cabinet:

- Fan/blower
- Top hood
- Front panel

NOTE: Please refer Section 3.6.3 of the manual for unpacking instructions and Section 6 of the manual for detailed instructions on removing parts.

Figure 3-1 Control Cabinet Top Down View

PICTURE TBD

Figure 3-2 HPA Cabinet Top Down View

PICTURE TBD

Figure 3-3 OFN Cabinet Top Down View (Combined DRU)

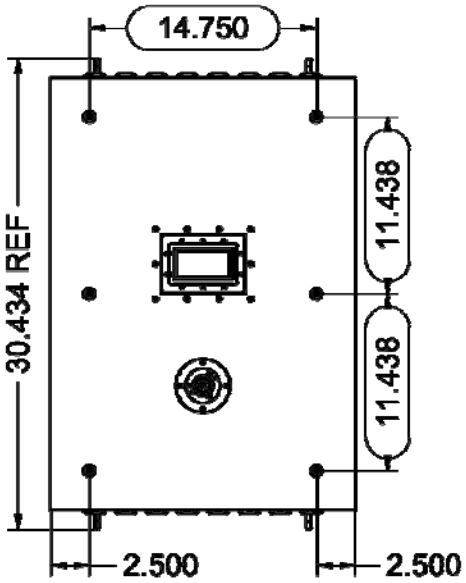
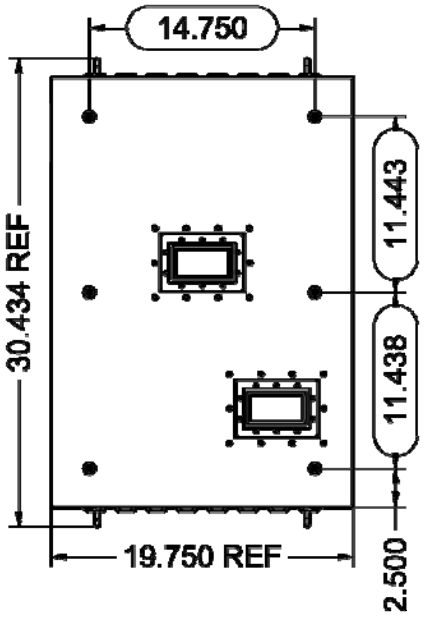


Figure 3-4 OFN Cabinet Top Down View (Independent DRU)



3.6.3 Unpacking

Inspect all crates, cabinets and boxes for exterior damage and make note of any dents, broken seals, or other indications of improper handling. In the event any in transit damage is discovered, report it to UBS.

The control and HPA cabinets will be wrapped in shrink-wrap with cardboard corner protection and will be secured to a pallet with four (4) bolts. Remove the shrink-wrap and cardboard corner protectors; do not discard the cardboard corner protectors.

Open/remove the front and rear doors/panels on the cabinets and inspect the interiors for packing material and carefully remove any material that is found. Do not remove any labeling or tags from the cabinets, drawers/modules, wires/cables or connectors; these are identification markers that make assembly of the repeater system much easier.

The OFN cabinet will be wrapped in shrink-wrap with cardboard corner protection and will be secured to a pallet with eight (8) bolts. Remove the shrink-wrap and cardboard corner protectors; do not discard the cardboard corner protectors.

Three (3) other pallets will include the components which need to be installed in the repeater cabinets on-site. The components have been sorted by cabinet prior to shipping. Remove the components from their pallet and boxes. Verify that all materials are enclosed as listed on the packing slip and report any shortages to UBS.

NOTE: The HPA's will be sorted on the pallets and each HPA will be marked, indicating which HPA compartment slot (0, 1, 2, 3, 4, 5, 6 or 7) it should be installed in.

3.6.4 Installation Surface

The load bearing strength of the roof or floor where the repeater cabinets will be placed should be taken into consideration. The repeater cabinets weigh approximately 3300 lbs. combined, and rest on an area of 31.55 square feet of roof or floor space.

Before installing the repeater cabinets, check the installation surface structure, flatness and suitability.

3.6.5 Repeater Cabinet Positioning

	Over tipping the repeater may cause it to fall over, resulting in personal injury or loss of life.

- The methods described in Section 3.6.1 can be used to move the repeater cabinets and components to the required installation location.
- The cabinets should be positioned to allow for adequate ventilation.
- Sufficient space must be made available in front of the cabinets so that the front doors/panels can be opened/removed, allowing the installer to access the 12V battery, PDU(s), BMS, LBE, HBE, TRMS, LNA, DBPF, dial-up modem, HPA PSU's and HPA's.
- Sufficient space must be made available behind the cabinets so that the rear panels can be removed, allowing the installer to access the TSC's, 4-way hybrid combiners (with reject loads), HPA/TSC transmit output coupler/RF detectors, magic tees (with reject load) and component rear panel interfaces (connectors).
- Sufficient space must be made available above the cabinets, allowing for cable connections to surge protectors as well as routing ground, AC, communications and alarm wires/cables into the cabinets. The fans/blowers are also accessed from the top of the cabinets.
- Unbolt the cabinet from the pallet before attempting to remove it from the pallet.

Figure 3-5 Repeater Bottom Up View

PICTURE TBD

3.6.6 Repeater Cabinet Mechanical Assembly

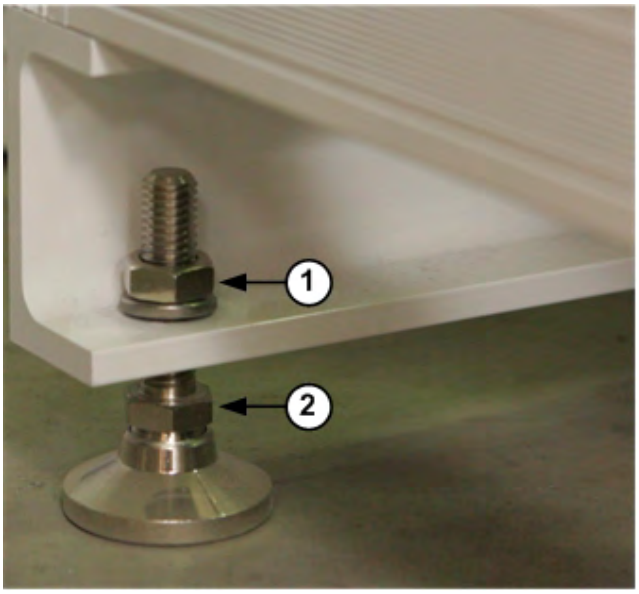
The control cabinet, LB HPA cabinet, HB HPA cabinet and OFN cabinet should be positioned according to site diagrams and fastened together according to the DRU-2KW mechanical drawing(s).

The DRU-2KW cabinets should be positioned and fastened together in the following sequence:

1. Position the LB HPA cabinet according to site drawings.
2. Using a spirit level, ensure that the LB cabinet is level from front to back and side to side. Shims can be used to level the cabinet.
3. Position the OFN cabinet according to site drawings and the DRU-2KW mechanical drawings SX03-30000-02-D01 or SX03-30000-03-D01.
4. The OFN cabinet height must be adjusted so that the WR340 waveguide flange on the side of the OFN cabinet is lined up with the WR340 flange on the side of the LB HPA cabinet.
5. The OFN cabinet feet can be adjusted to level the cabinet – see Figure 3-6.
   a. Loosen the top 1/2" nut.
   b. Turn the bottom 1/2" nut clockwise or counterclockwise to raise or lower the cabinet foot.
   c. Tighten the top 1/2" nut once the cabinet is level.
6. Using a spirit level, ensure that the OFN cabinet is level from front to back and side to side. Adjust the feet where necessary – refer to step 7.
7. Position the HB HPA cabinet according to site drawings and the DRU-2KW mechanical drawings SX03-30000-02-D01 or SX03-30000-03-D01.
8. Using a spirit level, ensure that the HB cabinet is level from front to back and side to side. Shims can be used to level the cabinet.
9. The OFN cabinet height may need to be adjusted slightly so that the WR340 flange on the side of the HB cabinet is lined up with the WR340 waveguide flange on the side of the OFN cabinet – refer to step 4.
10. Place a WR340 half gasket (UBS p/n SX03-24101-02) into the WR340 flange groove, located on the side of the LB HPA cabinet.
11. Secure the OFN cabinet WR340 waveguide to the LB HPA cabinet WR340 flange by installing a 1/4-20x1-1/8" socket head cap screw with #12 flat washer and 1/4" lock washer in each of the threaded holes (10 total) – see Figure 3-7. **NOTE:** Do not fully tighten the screws until the cabinets have been fully aligned.
12. Place a WR340 half gasket (UBS p/n SX03-24101-02) into the WR340 flange groove, located on the side of the HB HPA cabinet.
13. Secure the OFN cabinet WR340 waveguide to the HB HPA cabinet WR340 flange by installing a 1/4-20x1-1/8" socket head cap screw with #12 flat washer and 1/4" lock washer in each of the threaded holes (10 total) – see Figure 3-8. **NOTE:** Do not fully tighten the screws until the cabinets have been fully aligned.

14. Once all of the 1/4-20x1-1/8" socket head cap screw are lined up, proceed to tighten them fully, starting with the WR340 flange connections. A torque rating of 45 Inch Lbs. must be used to tighten the screws.
15. Position the control cabinet according to site drawings and the DRU-2KW mechanical drawings SX03-30000-02-D01 or SX03-30000-03-D01.

Figure 3-6 OFN Cabinet Foot

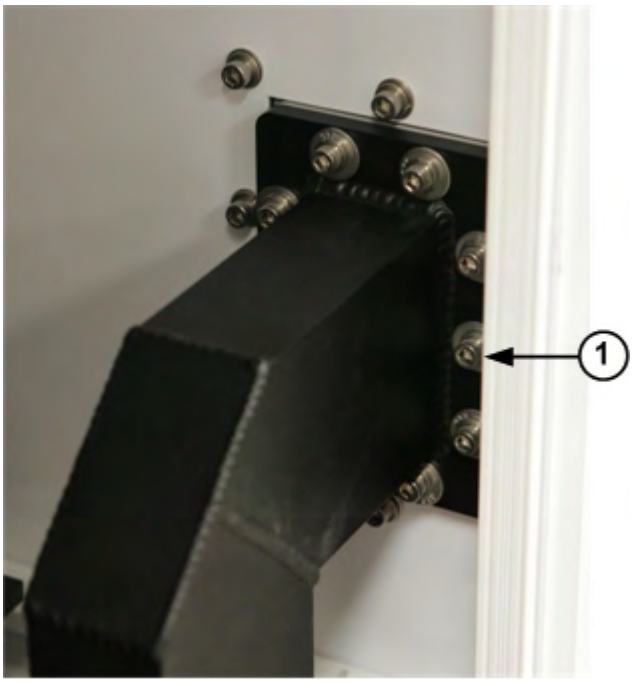


1) Top Nut
2) Bottom Nut

Figure 3-7 LB HPA Cabinet WR340 Flange Connection

1) 1/4-20x1-1/8” Socket Head Cap Screw with #12 Flat Washer and 1/4” Lock Washer

Figure 3-8 HB HPA Cabinet WR340 Flange Connection



1) 1/4-20x1-1/8” Socket Head Cap Screw with #12 Flat Washer and 1/4” Lock Washer

3.7 Control Cabinet Components

	Always ensure that the circuit breaker in the building/site electrical service panel or AC disconnect device is in the OFF position prior to beginning any installation work in the repeater cabinet. This will prevent injury caused by electric shock and prevent damage to equipment.

Several components must be installed in the control cabinet:

- 12V Battery
- Battery Management System (BMS) 12 VDC Rectifiers
- High Band Exciter (HBE)
- Low Band Exciter (LBE)
- Terrestrial Repeater Monitoring System (TRMS)
- Dial-up Modem (site dependent)

Figure 3-9 Un-populated Control Cabinet

PICTURE TBD

1) Shelf for 12V Battery
2) Empty Slot for BMS 12 VDC Rectifier Module
3) Shelf for HBE
4) Shelf for LBE
5) Open space for TRMS
6) Shelf for Dial-up Modem

Figure 3-10 Populated Control Cabinet

1) 12V Battery
2) BMS 12 VDC Rectifier Module
3) HBE
4) LBE
5) TRMS
6) Shelf for Dial-up Modem

3.7.1 12V Battery

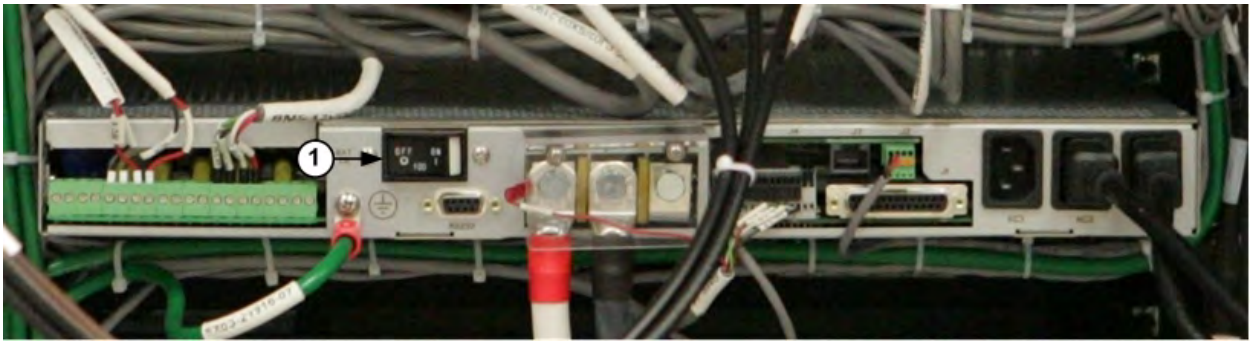
The control cabinet includes and shelf with custom brackets for mounting the battery. Please refer to Figure 3-9, Figure 3-10 or drawings SX03-33000-01-D01 for the mounting position of the battery.

During the installation procedure, several wires/conductors must be connected to the 12V battery. Please refer to drawings SX03-30900-02-D06 or SX03-30900-03-D06.

The 12V battery should be installed in the following sequence:

1. Ensure that the battery breaker (BAT CB) is in the OFF position – see Figure 3-11.
2. Remove the two (2) bolts from the battery terminals and set them aside.
3. Place the battery in the bottom shelf between the brackets. The terminals should face the left side of the cabinet – see Figure 3-13.
4. Connect the temperature probe and black 1AWG wire (SX03-33905-02) to the negative (-) terminal on the battery – see Figure 3-14. A torque rating of 60 Inch Lbs. maximum should be used to tighten the bolt.
5. Connect the white 1AWG wire (SX03-33905-01) to the positive (+) terminal on the battery – see Figure 3-14. A torque rating of 60 Inch Lbs. maximum should be used to tighten the bolt.
6. Side the sleeve over the battery's positive and negative terminals – see Figure 3-15.

Figure 3-11 BMS Rear Panel



1) BMS Battery Breaker BAT CB

Figure 3-12 Empty Shelf

PICTURE TBD

1) Bracket

Figure 3-13 Battery on Shelf

PICTURE TBD

1) Positive (+) Terminal
2) Negative (-) Terminal

Figure 3-14 Wires Connected to Battery Terminals

PICTURE TBD

1) Positive (+) Wire
2) Negative (-) Wire
3) Temperature Probe

Figure 3-15 Battery Installation Completed

PICTURE TBD

3.7.2 BMS 12 VDC Rectifier Module

The BMS mounting shelf includes two (2) empty slots for the 12 VDC rectifier modules. Please refer to Figure 3-9, Figure 3-10 or drawings SX03-33000-01-D01 for the mounting position of the rectifiers.

The BMS 12 VDC rectifier modules should be installed in the following sequence:

1. Slide the first rectifier module into the left-most slot until it stops – see Figure 3-18.
2. Secure the rectifier module to the shelf by tightening the 1/4-20x5/8" Phillips pan head screw until it stops. As the screw is tightened, the rectifier module will slide all the way into the slot.
3. Slide the second rectifier module into the middle slot until it stops and repeat step 2.

Figure 3-16 12 VDC Rectifier Module Front and Rear Panel

Figure 3-17 BMS Mounting Shelf with Controller

Figure 3-18 BMS Mounting Shelf with 1 Rectifier Module Installed

1) 12 VDC Rectifier Module
2) 1/4-20x5/6" Phillips Pan Head Screw (supplied with rectifier module)
3) Empty Slot for Second 12 VDC Rectifier Module

3.7.3 High Band Exciter (HBE)

The control cabinet includes a retractable shelf with mounting brackets for the HBE. Please refer to Figure 3-9, Figure 3-10 or drawing SX03-33000-01-D01 for the mounting position of the HBE.

The HBE should be should be installed in the following sequence:

1. Place the HBE on the shelf located above the BMS.
2. Secure the HBE to the shelf by installing two (2) 12-24x3/4" socket head cap screws and #12 flat washers (1 located on either side of the HBE) – see Figure 3-20.

Figure 3-19 HBE Shelf

PICTURE TBD

Figure 3-20 HBE Shelf with HBE

PICTURE TBD

1) HBE Mounting Bracket
2) Mounting Screw Hole
3) HBE
4) 12-24x3/4" Socket Head Cap Screw and "12 Flat Washer

3.7.4 Low Band Exciter (LBE)

The control cabinet includes a retractable shelf with mounting brackets for the LBE. Please refer to Figure 3-9, Figure 3-10 or drawings SX03-33000-01-D01 for the mounting position of the LBE.

The LBE should be installed in the following sequence:

1. Place the LBE on the shelf located above the HBE.
2. Secure the LBE to the shelf by installing four (4) 12-24x3/4" socket head cap screws and #12 flat washers (2 located on either side of the LBE) – see Figure 3-22.

Figure 3-21 LBE Shelf

PICTURE TBD

Figure 3-22 LBE Shelf with LBE

PICTURE TBD

1) LBE Mounting Bracket
2) Mounting Screw Hole
3) LBE
4) 12-24x3/4" Socket Head Cap Screw and "12 Flat Washer

3.7.5 Terrestrial Repeater Monitoring System (TRMS)

The control cabinet mounting rails includes an open slot for the TRMS. Please refer to Figure 3-9, Figure 3-10 or drawings SX03-33000-01-D01 for the mounting position of the TRMS.

The TRMS should be installed in the following sequence:

1. Slide the TRMS into the open slot located above the LBE.
2. Secure the TRMS to the rails by installing four (4) 12-24x3/4" Phillips pan head screws and #12 flat washers (2 located on either side of the TRMS) – see Figure 3-23.

Figure 3-23 TRMS in Rack

1) 12-24x3/4" Phillips Pan Head Screw and "12 Flat Washer
2) TRMS

3.8 HPA Cabinet Components

	Always ensure that the circuit breaker in the building/site electrical service panel or AC disconnect device is in the OFF position prior to beginning any installation work in repeater cabinet. This will prevent injury caused by electric shock and prevent damage to equipment.

During the installation procedure, several components must be installed in the HPA cabinets:

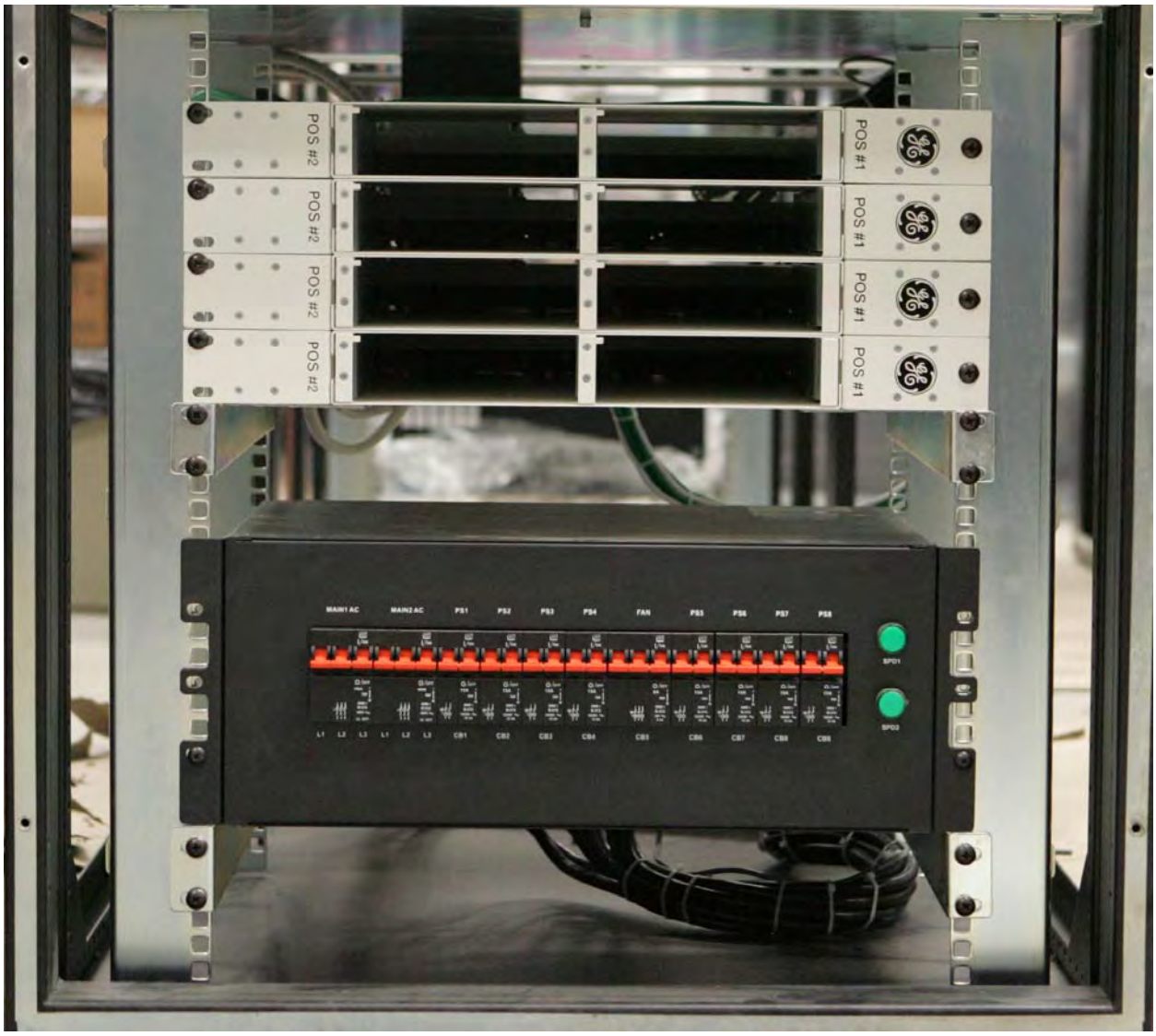
- HPA's
- HPA PSU's (30 VDC Rectifiers)

NOTE: The components installed in the HB HPA cabinet and LB HPA cabinet is identical.

Figure 3-24 Un-populated HPA Cabinet (Upper)

1) Empty Slot for HPA 0
2) Empty Slot for HPA 1
3) Empty Slot for HPA 2
4) Empty Slot for HPA 3
5) Empty Slot for HPA 4
6) Empty Slot for HPA 5
7) Empty Slot for HPA 6
8) Empty Slot for HPA 7

Figure 3-25 Un-populated HPA Cabinet (Lower)

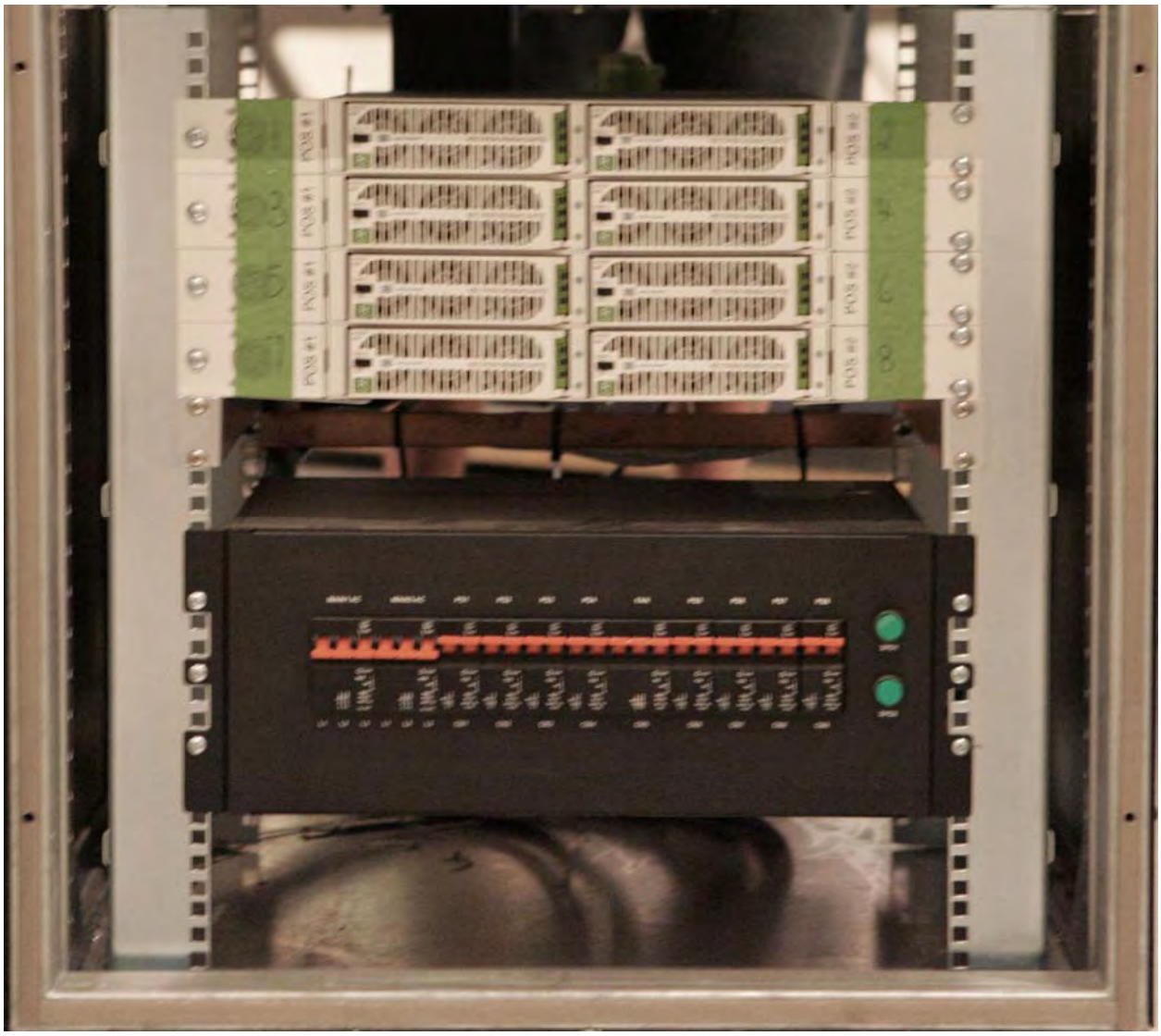


1) Empty Slot for HPA PS 0 (30 VDC Rectifier Module)
2) Empty Slot for HPA PS 1 (30 VDC Rectifier Module)
3) Empty Slot for HPA PS 2 (30 VDC Rectifier Module)
4) Empty Slot for HPA PS 3 (30 VDC Rectifier Module)
5) Empty Slot for HPA PS 4 (30 VDC Rectifier Module)
6) Empty Slot for HPA PS 5 (30 VDC Rectifier Module)
7) Empty Slot for HPA PS 6 (30 VDC Rectifier Module)
8) Empty Slot for HPA PS 7 (30 VDC Rectifier Module)

Figure 3-26 Populated HPA Cabinet (Upper)

1) HPA 0
2) HPA 1
3) HPA 2
4) HPA 3
5) HPA 4
6) HPA 5
7) HPA 6
8) HPA 7

Figure 3-27 Populated HPA Cabinet (Lower)



1) HPA PS 0 (30 VDC Rectifier Module)
2) HPA PS 1 (30 VDC Rectifier Module)
3) HPA PS 2 (30 VDC Rectifier Module)
4) HPA PS 3 (30 VDC Rectifier Module)
5) HPA PS 4 (30 VDC Rectifier Module)
6) HPA PS 5 (30 VDC Rectifier Module)
7) HPA PS 6 (30 VDC Rectifier Module)
8) HPA PS 7 (30 VDC Rectifier Module)

3.8.1 HPA Compartment Frame Pre-installation

	Several components mounted on the HPA compartment frame backplane must be loosened prior to installing the HPA's. Not doing so could damage a number of blind mate connectors.

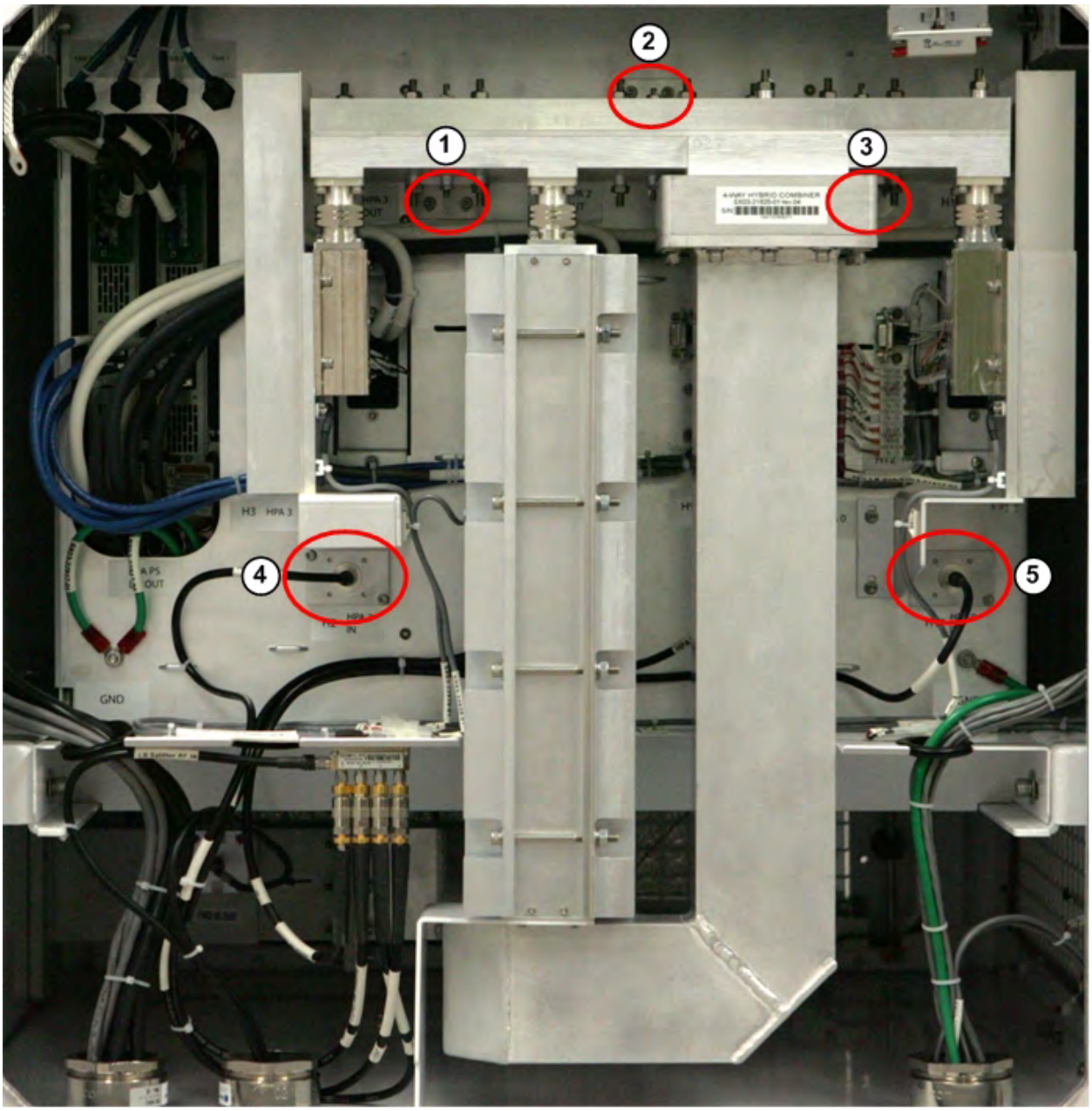
During product shipment, shear forces may cause some components mounted to the HPA compartment frame backplane to become slightly misaligned. It is important that these components are loosened prior to installing the HPA's. Loosening these components allows the HPA's to slide into the HPA compartment frame with fewer restrictions.

Please refer to Figure 3-28 for the locations of the components that should be loosened.

1. Ensure that the backplane components are installed properly and are free from physical damage.
2. Loosen the four (4) 8-32 socket head cap screws which secure the top 4-way combiner to the backplane (Figure 3-28, item 1, item 2 and item 3).
3. Loosen the two (2) 8-32 socket head cap screws which secure the HPA 3 input adapter to the backplane (Figure 3-28, item 4).
4. Loosen the two (2) 8-32 socket head cap screws which secure the HPA 2 input adapter to the backplane (Figure 3-28, item not visible).
5. Loosen the two (2) 8-32 socket head cap screws which secure the HPA 1 input adapter to the backplane (Figure 3-28, item not visible).
6. Loosen the two (2) 8-32 socket head cap screws which secure the HPA 0 input adapter to the backplane (Figure 3-28, item 5).
7. Loosen the four (4) 8-32 socket head cap screws which secure the bottom 4-way combiner to the backplane (Figure 3-28, item 6, item 7 and item 8).
8. Loosen the two (2) 8-32 socket head cap screws which secure the HPA 7 input adapter to the backplane (Figure 3-28, item 9).
9. Loosen the two (2) 8-32 socket head cap screws which secure the HPA 6 input adapter to the backplane (Figure 3-28, item not visible).
10. Loosen the two (2) 8-32 socket head cap screws which secure the HPA 5 input adapter to the backplane (Figure 3-28, item not visible).
11. Loosen the two (2) 8-32 socket head cap screws which secure the HPA 4 input adapter to the backplane (Figure 3-28, item 10).

Once the HPA compartment frame backplane components have been loosened, the installer can proceed to install the HPA's.

Figure 3-28 HPA Compartment Frame Backplane



3.8.2 High Power Amplifier (HPA)

	Always install the high power amplifiers with the aid of a second handler. The high power amplifier weighs approximately 55 lbs.

The HPA compartment frame includes eight (8) slots for the HPA's. Please refer to Figure 3-24, Figure 3-26 or drawings SX03-31000-02-D01 or SX03-32000-02-D01 for the mounting position of the HPA's.

The HPA's should be installed in the following sequence:

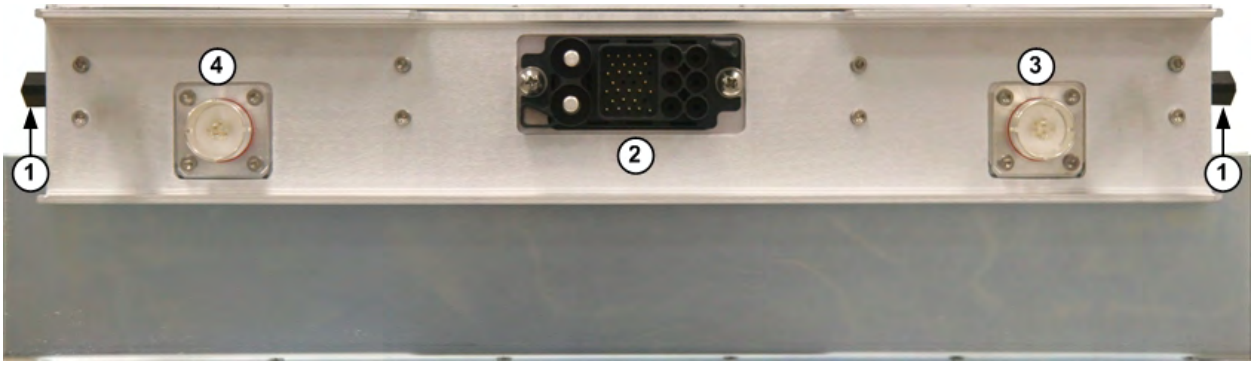
1. Remove the eight (8) magnetic plates from the HPA compartment frame by loosening the 10-32 slotted screw used to secure each plate in place.
2. Using two handlers, one located on each side of the HPA, lift the HPA and position it level to the top-left most open space in the HPA compartment frame.
3. Carefully line up the HPA sliders (1 located on the top and 1 located on the bottom of the HPA) with the slide rails mounted in the HPA compartment frame – see Figure 3-31.
4. Slowly push the HPA into the HPA compartment frame until it stops.
5. There are three (3) blind mate connectors located on the HPA rear panel which are aligned with corresponding connectors on the HPA compartment frame backplane – see Figure 3-30.
6. Ensure that the connectors are aligned properly and slowly push the HPA into the backplane until it stops. At this point, the back side of the HPA front panel should be flush with the HPA compartment frame.
7. Secure the HPA in place by tightening the 10-32 Slotted captive screw (located at the top of the HPA front panel) with a torque rating of 15.5 Inch Lbs. – see Figure 3-31.
8. Place the magnetic plate at the bottom of the HPA front panel and tighten the 10-32 Slotted captive screw with a torque rating of 15.5 Inch Lbs. Note: The magnetic plate must be installed in order for the HPA to power up later on.
9. Repeat steps 2 through 8 for the remaining seven (7) HPA's.

NOTE: Each HPA will be marked indicating which HPA compartment slot (0, 1, 2, 3, 4, 5, 6, or 7) it should be installed in. Ensure that the HPA is installed in the correct slot.

Figure 3-29 HPA Front Panel

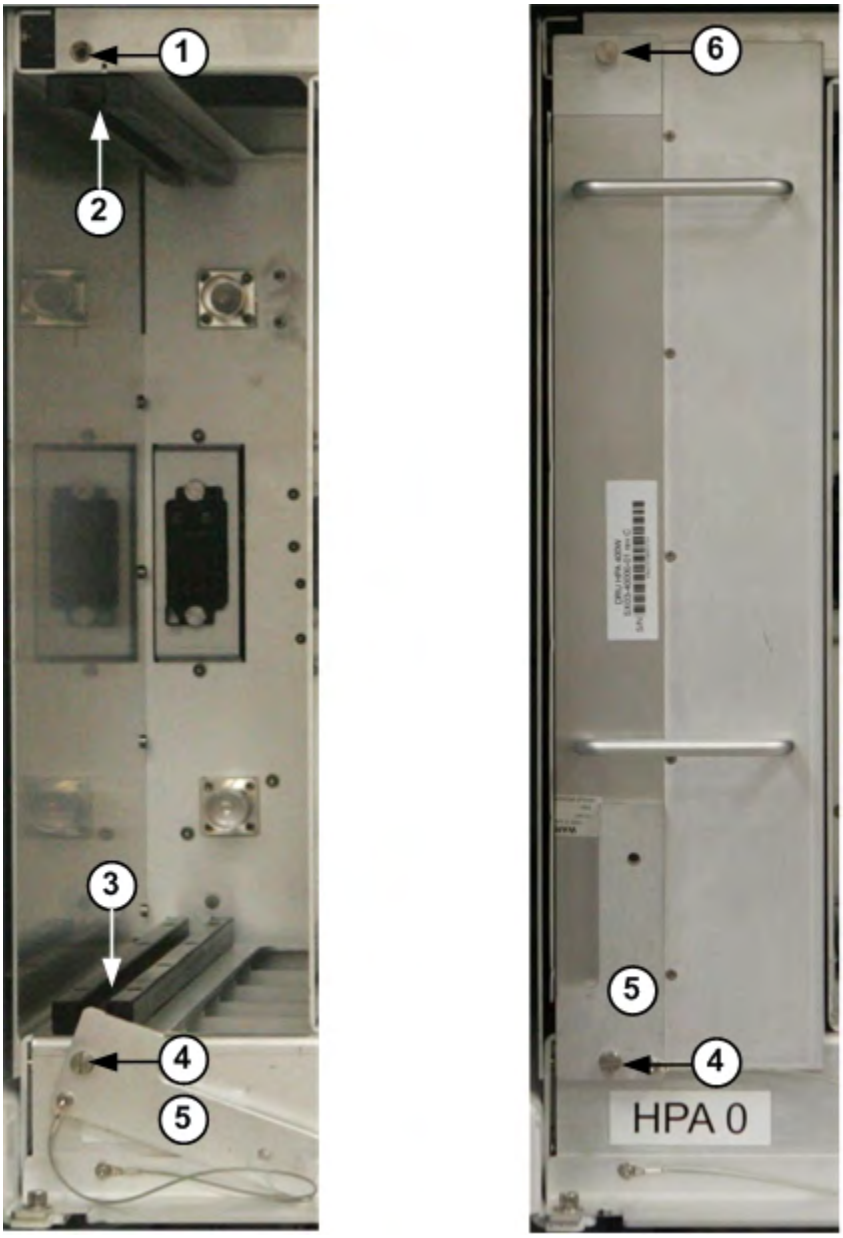
1) Handle
2) Slotted Captive Screw

Figure 3-30 HPA Rear Panel



1) Slider
2) DC and Control Connector
3) 7/8” Blind Mate RF Input Connector
4) 7/8” Blind Mate RF Output Connector

Figure 3-31 HPA Compartment (before and after)



1) Mounting Screw Hole
2) Top Slide Rail
3) Bottom Slide Rail
4) Magnetic Plate 10-32 Slotted Captive Screw
5) Magnetic Plate
6) 10-32 Slotted Captive Screw

3.8.3 Finalize HPA Installation

	Open or loose RF connections during operation may cause electric arcs that can cause burns and eye injuries, as well as damage equipment. Always ensure that all HPA compartment frame backplane components are tightened once the HPA's are installed.

Once the installation of the HPA's is complete, the components which are mounted to the HPA compartment frame backplane must be secured in place. A torque rating of 13.5 Inch Lbs. must be used to tighten the 8-32 socket head cap screws which secure these components to the HPA compartment frame backplane.

3.8.4 HPA PSU 30 VDC Rectifier Module

The four (4) HPA PSU mounting shelves each include two (2) empty slots for the HPA PSU 30 VDC rectifier modules. Please refer to Figure 3-25, Figure 3-27 or drawings SX03-31000-02-D01 or SX03-32000-02-D01 for the mounting position of the rectifier modules.

The HPA PSU 30 VDC rectifier modules should be installed in the following sequence:

1. Slide the black release button on the rectifier module front grill/cover cover to the right to release the grill/cover from the front of the rectifier module.
2. Position the rectifier module so that the open grill cover is facing down.
3. Slide the rectifier module into either of the empty slots on the left most HPA PSU mounting shelf until it stops – see Figure 3-33.
4. To secure the rectifier module in place, lift the grill cover up and push it towards the rectifier module until it clicks in place. As the grill cover is pushed in place, the rectifier module will slide all the way into the slot.
5. Repeat steps 1 through 4 for the seven (7) remaining rectifier modules.

Figure 3-32 HPA PSU 30 VDC Rectifier Module

1) Front Grill/Cover
2) Front Grill/Cover Release Button
3) Rear Panel

Figure 3-33 HPA PSU Shelf (before and after)

PICTURE TBD

1) Open Slot for Rectifier Module
2) Disengaged Rectifier Module with Open Grill Cover
3) Open Grill Cover
4) Fully Secured Rectifier Module with Closed Grill Cover

3.9 Control Cabinet Internal Wire/Cable Connections

Once the 12V batter, HBE, LBE TRMS and dial-up modem (where applicable) are mounted in the control cabinet, a number of wires/cables must be connected to these components.

NOTE: The cables will be bundled together using cable ties. Cut only the orange cable ties; do not cut the white cable ties unless instructed.

	Any RF cable, which is terminated with a SMA connector, should be tightened with a 5/16" torque wrench (set to 7-8 Inch Lbs.) to avoid over tightening and damaging the cable connector or mating connector.

3.9.1 Ground and AC Connections

All control cabinet internal ground wires are pre-wired to the cabinet ground bar. During the installation procedure, several components must be connected to the ground bar via the pre-wired ground wires. Please see the subsequent sections of this manual.

All control cabinet internal AC components are pre-wired to the cabinet PDU. Only the cabinet PDU needs to be connected to building/site electrical service panel (or AC disconnect device).

3.9.2 High Band Exciter (HBE)

During the installation procedure, a number of wires/cables must be connected to the HBE rear panel. Please refer to Table 3-6 or drawings SX03-30900-02-D06 or SX03-30900-03-D06.

The cables should be connected in the order that they appear in Table 3-6.

Figure 3-34 HBE Rear Panel

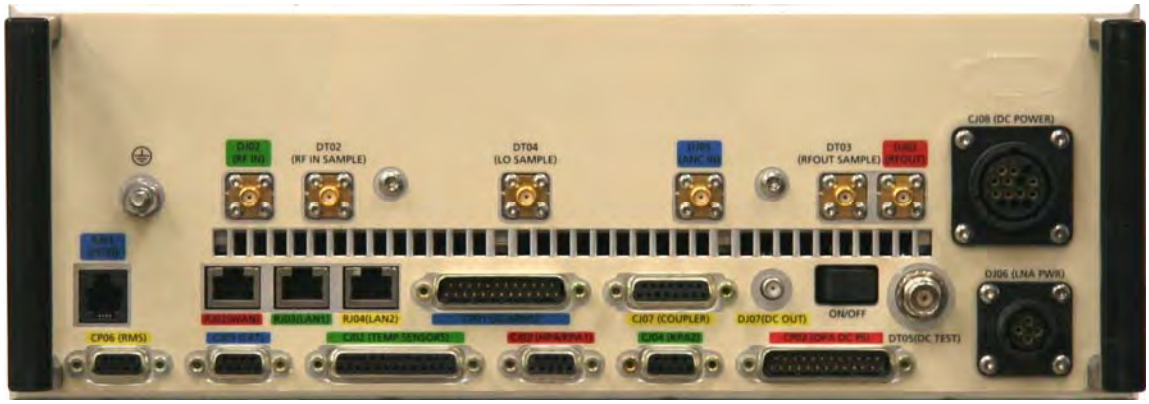


Table 3-6 HBE Rear Panel Connections

HBE Port	Name	Type	Cable Number
N/A	N/A	Ground Post	SX03-33937-03
CJ02	TEMP SENSORS	DB-25 (F)	SX03-33917-01
CJ03	HPA/KPA1	DB-9 (F)	SX03-33919-01
CP02	OPA DC PS	DB-25 (M)	SX03-33911-01
RJ02	WAN	RJ-45	SX03-33901-03
RJ03	LAN	RJ-45	SX03-33901-02
DJ06	LNA PWR	4-pos CPC	SX03-33906-01
CJ08	DC POWER	14-pos CPC	SX03-33908-01
DJ02	RF IN	SMA (F), 50 ohm	SX03-33941-01
DJ05	ANC IN	SMA (F), 50 ohm	SX03-33920-01
DJ03	RF OUT	SMA (F), 50 ohm	SX03-33924-01

3.9.3 Low Band Exciter (LBE)

During the installation procedure, a number of wires/cables must be connected to the LBE rear panel.

For a Combined DRU, please refer to Table 3-7 or drawing SX03-30900-02-D06. The cables should be connected in the order that they appear in Table 3-7.

For an Independent DRU, please refer to Table 3-8 or drawing SX03-30900-03-D06. The cables should be connected in the order that they appear in Table 3-8.

Figure 3-35 LBE Rear Panel

Table 3-7 LBE Rear Panel Connections – Combined DRU

LBE Port	Name	Type	Cable Number
N/A	N/A	Ground Post	SX03-33937-04
CJ02	OC1	DB-15 (F)	SX03-33929-01
CJ06	TEMP SENSORS	DB-25 (F)	SX03-33916-01
CJ01	HPA M&C	DB-9 (F)	SX03-33904-01
CP04	OPA-FAN-PS	DB-15 (M)	SX03-33909-01
RJ01	Modem	DB-9 (M)	N/A
RJ03	LAN	RJ-45	SX03-33901-03
RJ04	LAN	RJ-45	SX03-33901-01
CP07	ALARMS	DB-25 (M)	SX03-33910-01
DJ07	SW DC OUT	2.5 mm Locking DC Power Jack	SX03-33915-01
DJ06	DC POWER IN	Combination Sub-D	SX03-33907-01
DJ01	VSAT IN	F (F), 75 ohm	SX03-33938-01
DJ02	GPS IN	SMA (F), 50 ohm	SX03-33942-01
DJ05	DIV RF2 OUT	N (F), 50 ohm	SX03-33940-01
DJ04	RF HPA FB IN	SMA (F), 50 ohm	SX03-33923-01
DJ03	RF1 OUT	SMA (F), 50 ohm	SX03-33922-01

Table 3-8 LBE Rear Panel Connections – Independent DRU

LBE Port	Name	Type	Cable Number
N/A	N/A	Ground Post	SX03-33937-04
CJ02	OC1	DB-15 (F)	SX03-33929-01
CJ06	TEMP SENSORS	DB-25 (F)	SX03-33916-01
CJ01	HPA M&C	DB-9 (F)	SX03-33904-01
CP04	OPA-FAN-PS	DB-15 (M)	SX03-33909-01
CJ05	OC2	DB-15 (F)	SX03-33903-01
RJ01	Modem	DB-9 (M)	N/A
RJ03	LAN	RJ-45	SX03-33901-03
RJ04	LAN	RJ-45	SX03-33901-01
CP07	ALARMS	DB-25 (M)	SX03-33910-01
DJ07	SW DC OUT	2.5 mm Locking DC Power Jack	SX03-33915-01
DJ06	DC POWER IN	Combination Sub-D	SX03-33907-01
DJ01	VSAT IN	F (F), 75 ohm	SX03-33938-01
DJ02	GPS IN	SMA (F), 50 ohm	SX03-33942-01
DJ05	DIV RF2 OUT	N (F), 50 ohm	SX03-33940-01
DJ04	RF HPA FB IN	SMA (F), 50 ohm	SX03-33923-01
DJ03	RF1 OUT	SMA (F), 50 ohm	SX03-33922-01

3.9.4 Terrestrial Repeater Monitoring System (TRMS)

During the installation procedure, a number of wires/cables must be connected to the TRMS rear panel.

For a Combined DRU, please refer to Table 3-9 or drawing SX03-30900-02-D06. The cables should be connected in the order that they appear in Table 3-9.

For an Independent DRU, please refer to Table 3-10 or drawing SX03-30900-03-D06. The cables should be connected in the order that they appear in Table 3-10.

Figure 3-36 TRMS Rear Panel

Table 3-9 TRMS Rear Panel Connections – Combined DRU

TRMS Port	Name	Type	Cable Number
N/A	N/A	Ground Post	SX03-33937-05
Y2B	RF IN	SMA (F), 50 ohm	SX03-33912-01
Y9B	LAN	RJ-45	SX03-33901-02
Y10A	WAN	RJ-45	SX03-33901-01
Y12	N/A (AC Input)	NEMA Socket Polarized Type IEC 603	SX03-33932-01

Table 3-10 TRMS Rear Panel Connections – Independent DRU

TRMS Port	Name	Type	Cable Number
N/A	N/A	Ground Post	SX03-33937-05
Y1B	RF-IN	SMA (F), 50 ohm	SX03-33928-01
Y2B	RF IN	SMA (F), 50 ohm	SX03-33912-01
Y9B	LAN	RJ-45	SX03-33901-02
Y10A	WAN	RJ-45	SX03-33901-01
Y12	N/A (AC Input)	NEMA Socket Polarized Type IEC 603	SX03-33932-01

3.10 Inter-Cabinet Wire/Cable Connections

	Any RF cable, which is terminated with a SMA connector, should be tightened with a 5/16" torque wrench (set to 7-8 Inch Lbs.) to avoid over tightening and damaging the cable connector or mating connector.

3.10.1 Control Cabinet Bulkhead Panel

During the installation procedure, a number of cables must be connected between the control cabinet bulkhead panel and the other cabinets.

Figure 3-37 Control Cabinet Bulkhead Panel (Combined DRU)

PICTURE TBD

Figure 3-38 Control Cabinet Bulkhead Panel (Independent DRU)

PICTURE TBD

3.10.2 Control Cabinet to HB HPA Cabinet

During the installation procedure, a number of cables must be connected between the control cabinet bulkhead panel and HB HPA cabinet bulkhead panel. Please refer to Table 3-11 or drawings SX03-30900-02-D06 or SX03-30900-03-D06.

Figure 3-39 HB HPA Cabinet Bulkhead

PICTURE TBD

Table 3-11 Control Cabinet to HB HPA Cabinet Cable Connections

Control Cabinet Port/Type	HB HPA Cabinet Port/Type	Cable Number
BC26: 3-pos Circular (F)	BH7: 3-pos Circular (M)	SX03-33925-01
BC22: DB-9 (F)	BH6: DB-9 (M)	SX03-33936-01
BC6: SMA (F), 50 ohm	BH1: SMA (F), 50 ohm	SX03-33921-01
BC7: SMA (F), 50 ohm	BH2: SMA (F), 50 ohm	SX03-33921-01
BC8: DB-9 (F)	BH3: DB-9 (M)	SX03-33918-01
BC9: 3-pos Circular (F)	BH4: 3-pos Circular (M)	SX03-33925-01
BC10: 3-pos Circular (F)	BH5: 3-pos Circular (M)	SX03-33925-01

3.10.3 Control Cabinet to LB HPA Cabinet

During the installation procedure, a number of cables must be connected between the control cabinet bulkhead panel and LB HPA cabinet bulkhead panel. Please refer to Table 3-12 or drawings SX03-30900-02-D06 or SX03-30900-03-D06.

Figure 3-40 LB HPA Cabinet Bulkhead

PICTURE TBD

Table 3-12 Control Cabinet to LB HPA Cabinet Cable Connections

Control Cabinet Port/Type	HB HPA Cabinet Port/Type	Cable Number
BC25: 3-pos Circular (F)	BL7: 3-pos Circular (M)	SX03-33925-01
BC20: DB-9 (F)	BL6: DB-9 (M)	SX03-33936-01
BC1: SMA (F), 50 ohm	BL1: SMA (F), 50 ohm	SX03-33921-01
BC2: SMA (F), 50 ohm	BL2: SMA (F), 50 ohm	SX03-33921-01
BC3: DB-9 (F)	BL3: DB-9 (M)	SX03-33918-01
BC4: 3-pos Circular (F)	BL4: 3-pos Circular (M)	SX03-33925-01
BC5: 3-pos Circular (F)	BL5: 3-pos Circular (M)	SX03-33925-01

3.10.4 Control Cabinet to OFN Cabinet

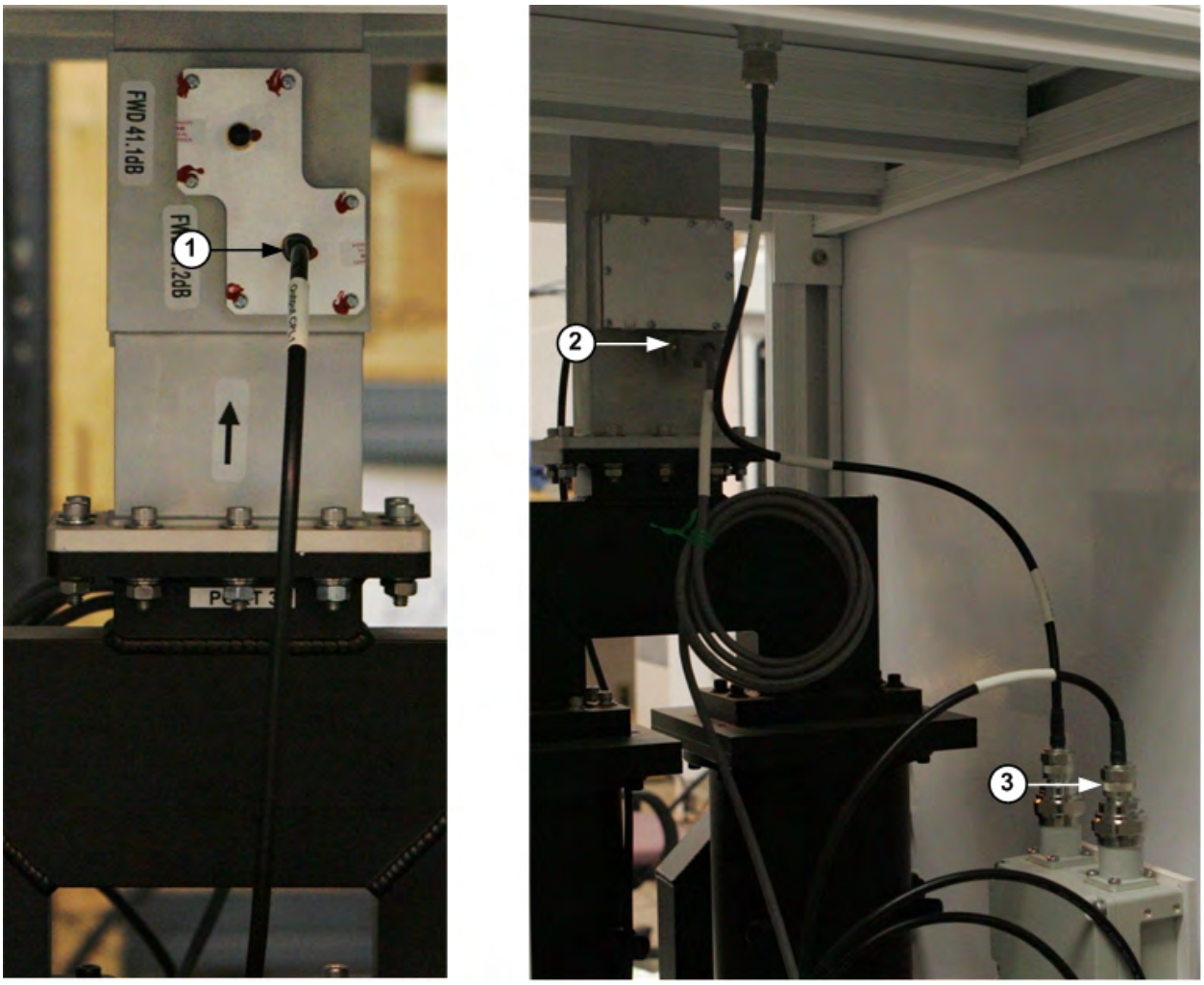
	Any RF cable, which is terminated with a SMA connector, should be tightened with a 5/16" torque wrench (set to 7-8 Inch Lbs.) to avoid over tightening and damaging the cable connector or mating connector.

3.10.4.1 Combined DRU

During the installation procedure, a number of cables must be connected between the control cabinet bulkhead panel and components located in the OFN cabinet.

1. Cable SX03-33912-02 must be connected between BC14 and the DRU transmit output coupler "FWD 61dB" sample port – see Figure 3-41.
2. Cable SX03-33929-02 must be connected between BC16 and the DRU transmit output coupler DB-9 serial port – see Figure 3-41.
3. Cable SX03-33940-02 must be connected between BC27 and the LBD DR transmit output filter RF input – see Figure 3-41.

Figure 3-41 Combined DRU OFN Cabinet Cable Connections



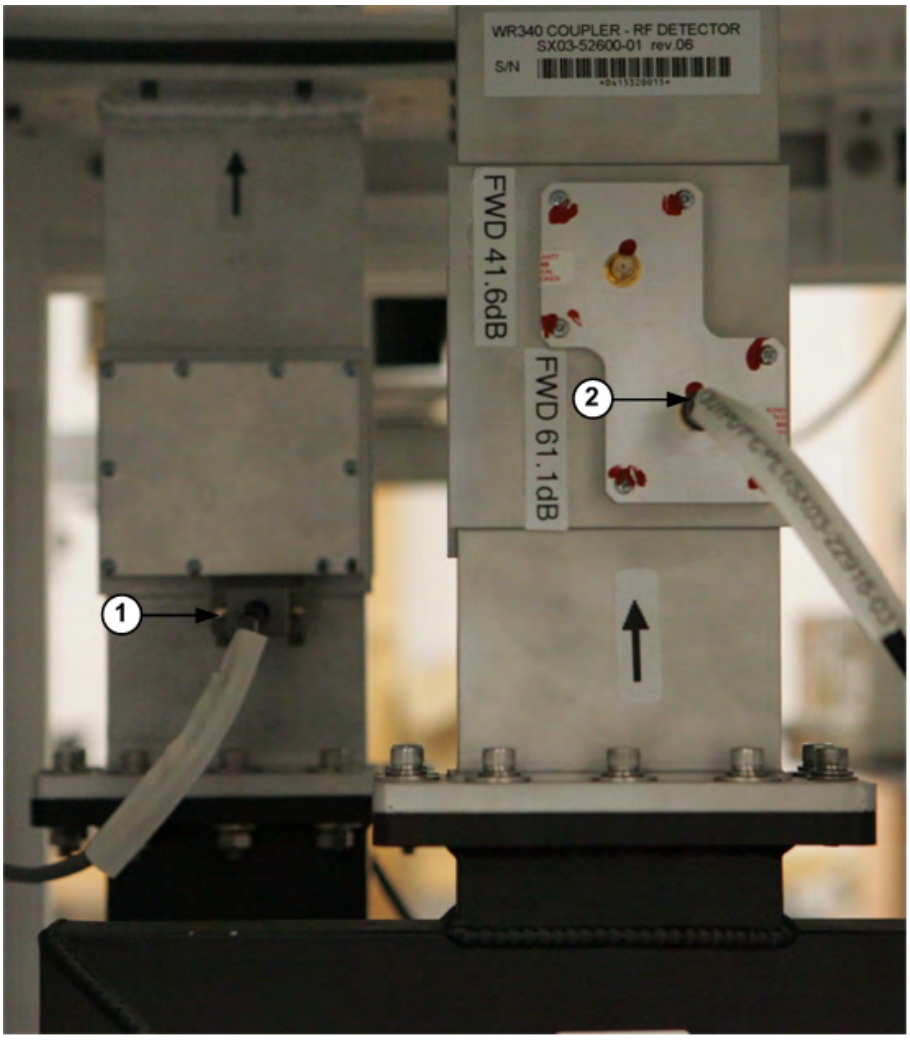
1) DRU Transmit Output Coupler FWD Sample Port with Cable SX03-33912-02
2) DRU Transmit Output Coupler DB-9 Serial Port with Cable SX03-33929-02
3) LBD DR Transmit Output Filter RF Input with Cable SX03-33940-02

3.10.4.2 Independent DRU

During the installation procedure, a number of cables must be connected between the control cabinet bulkhead panel and components located in the OFN cabinet.

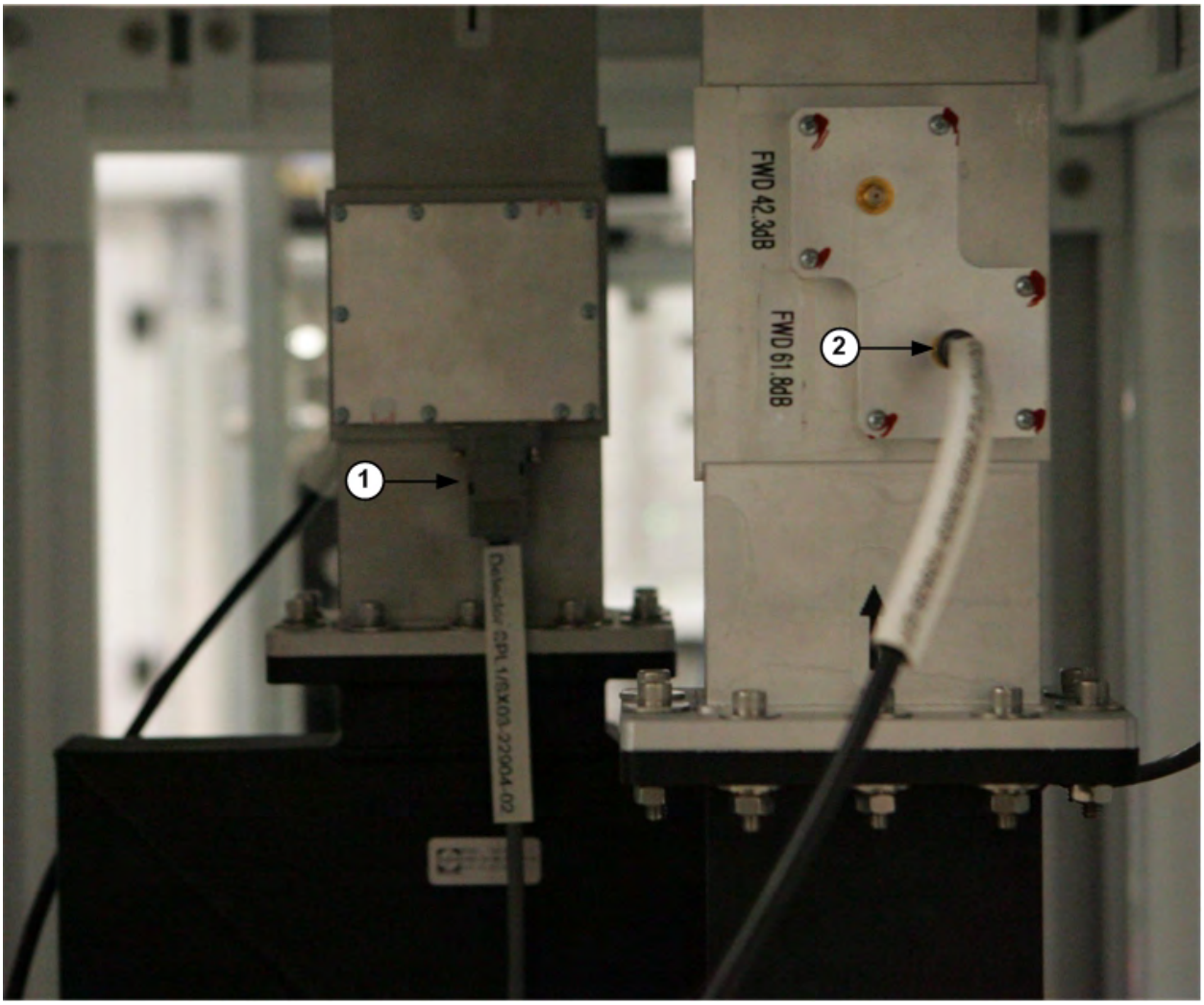
1. Cable SX03-33912-02 must be connected between BC14 and the DRU transmit output coupler #1 “FWD 61dB” sample port – see Figure 3-42.
2. Cable SX03-33928-02 must be connected between BC15 and the DRU transmit output coupler #2 “FWD 61dB” sample port – see Figure 3-43.
3. Cable SX03-33903-02 must be connected between BC13 and the DRU transmit output coupler #2 DB-9 serial port – see Figure 3-42.
4. Cable SX03-33929-02 must be connected between BC16 and the DRU transmit output coupler #1 DB-9 serial port – see Figure 3-43.
5. Cable SX03-33940-02 must be connected between BC27 the LBD WG transmit output filter RF input – see Figure 3-44.

Figure 3-42 Independent DRU OFN Cabinet Coupler Cable Connections (Front)



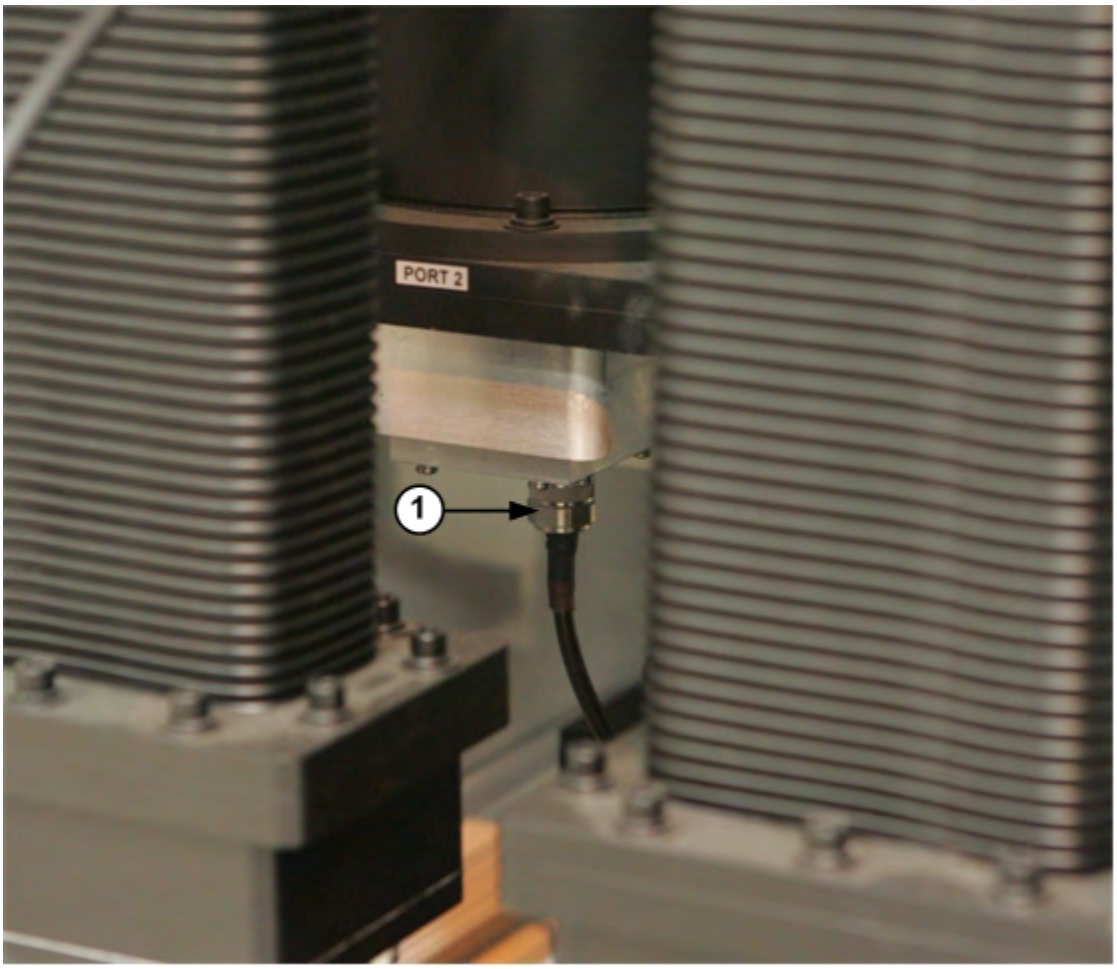
1) DRU Transmit Output Coupler #2 DB-9 Serial Port with Cable SX03-33903-02
2) DRU Transmit Output Coupler #1 FWD Sample Port with Cable SX03-33912-02

Figure 3-43 Independent DRU OFN Cabinet Coupler Cable Connections (Rear)



1) DRU Transmit Output Coupler #1 DB-9 Serial Port with Cable SX03-33929-02
2) DRU Transmit Output Coupler #2 FWD Sample Port with Cable SX03-33928-02

Figure 3-44 LBD WG Transmit Output Filter Input Cable Connection



1) LBD WG Transmit Output Filter RF Input with Cable SX03-33940-02

3.11 External Input Signal Interfaces

The source data for the DRU transmission is received via satellite antennas. These antennas are installed separately from the DRU and connected to the DRU via a cable run

	When connecting satellite antenna cables to the DRU the integrity of the protective earth must be ensured.

During the installation procedure, several external input signal connection must be made to the control cabinet:

- S-Band Antenna (BC23)
- Ku-Band VSAT Antenna (BC12)
- GPS Antenna (BC24)

Figure 3-45 Control Cabinet Bulkhead Panel

PICTURE TBD

3.11.1.1 S-Band Antenna

The following steps should be performed to connect the S-Band antenna (HBE RF input) to the DRU:

1. Run a cable from the S-Band antenna to the DRU.
2. If the cable does not already have a male N connector on it, install a male N connector on the end of the cable.
3. Attach and securely tighten the connector to BC23 – see Figure 3-45.

3.11.1.2 Ku-Band Antenna

The following steps should be performed to connect the Ku-Band VSAT antenna (LBE RF input) to the DRU:

1. Run a cable from the Ku-Band VSAT antenna to the DRU.
2. If the cable does not already have a male F connector on it, install a male F connector on the end of the cable.
3. Attach and securely tighten the connector to BC12 – see Figure 3-45.

3.11.1.3 GPS Antenna

The following steps should be performed to connect the GPS antenna (LBE GPS input) to the DRU:

1. Run a cable from the GPS antenna to the DRU.
2. If the cable does not already have a male N-type connector on it, install a male N-type connector on the end of the cable.
3. Attach and securely tighten the connector to BC24 – see Figure 3-45.

3.12 Communications Interfaces

3.12.1 PSTN Phone Line

	To reduce the risk of fire, use only #26 AWG or larger (I.e. #24 AWG) UL listed phone line cord.

The following steps should be performed to connect the PSTN phone line to the surge protector in the control cabinet (where applicable):

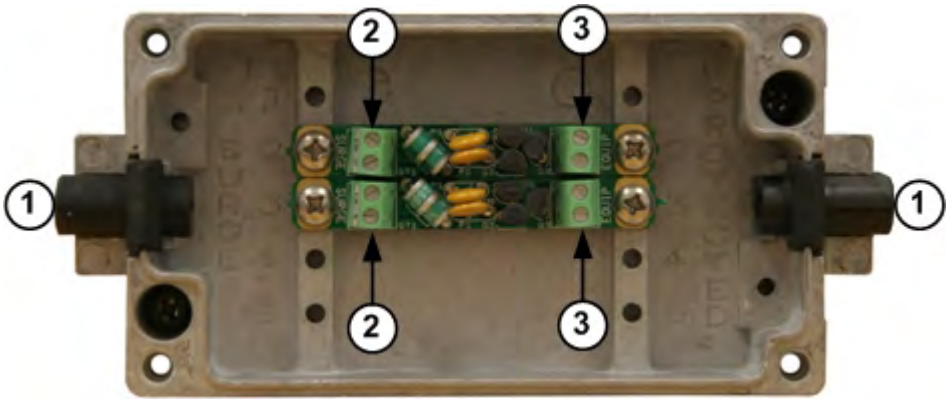
1. Run a #26 AWG or larger phone line cord (with RJ-11 connector) from the building/site PSTN termination point to the DRU.
2. Connect the phone line cord RJ-11 connector to BC11– see Figure 3-45.
3. Remove the lid screws from the Telco surge protector.
4. Install the cable grommets on the Telco surge protector:
   - Use the small grommet for cord with a 0.114 to 0.225 inch diameter
   - Use the large grommet for cord with a 0.250 to 0,350 inch diameter
5. Connect another #26 AWG or larger phone line cord (with RJ-11 connector) to BC11 on the inside of the control cabinet bulkhead panel.
6. Run the cable to the Telco surge protector.
7. Cut the cable to the proper length and remove approximately 1 inch of the outer insulation to expose the individual wires.
8. Remove 0.25 inches of insulation from each wire to expose the copper conductor.
9. Insert the copper conductor into the “SURGE” screw terminals on the surge protection modules and tighten the screws.
10. Replace the Telco surge protector lid.

Figure 3-46 Telco Surge Protector

PICTURE TBD

1) Telco Surge Protector

Figure 3-47 Telco Surge Protector (open cover)



1) Cable Grommet
2) Screw Terminal (Surge Side)
3) Screw Terminal (Protected Side)

3.13 Shelter/Room Alarm Connections

During the installation procedure, several shelter/room alarm contacts/sensors (where applicable) can be connected to the control cabinet break-out-board.

The following steps should be performed to connect an external alarm to the DRU:

1. Run a cable from the alarm contact/sensor to the DRU.
2. Remove the knock-out, located on the control cabinet top-rear frame – see Figure 3-48.
3. Feed approximately 36 inches of cable into the DRU.
4. Run the cable along the back rail to the break-out-board – see Figure 3-49.
5. Remove 4 inches of the outer insulation to expose the individual wires.
6. Remove 0.2 inches of insulation from the wires to expose the copper conductors.
7. Remove the appropriate jumper cable(s) from the break-out-board pluggable terminal block(s).
8. Insert the wires into the appropriate pluggable terminal block contacts and tighten the clamping screws – see Table 3-13 for a list of contacts.

Figure 3-48 Control Cabinet Rear Panel Knock-out

Figure 3-49 Control Cabinet Break-Out-Board

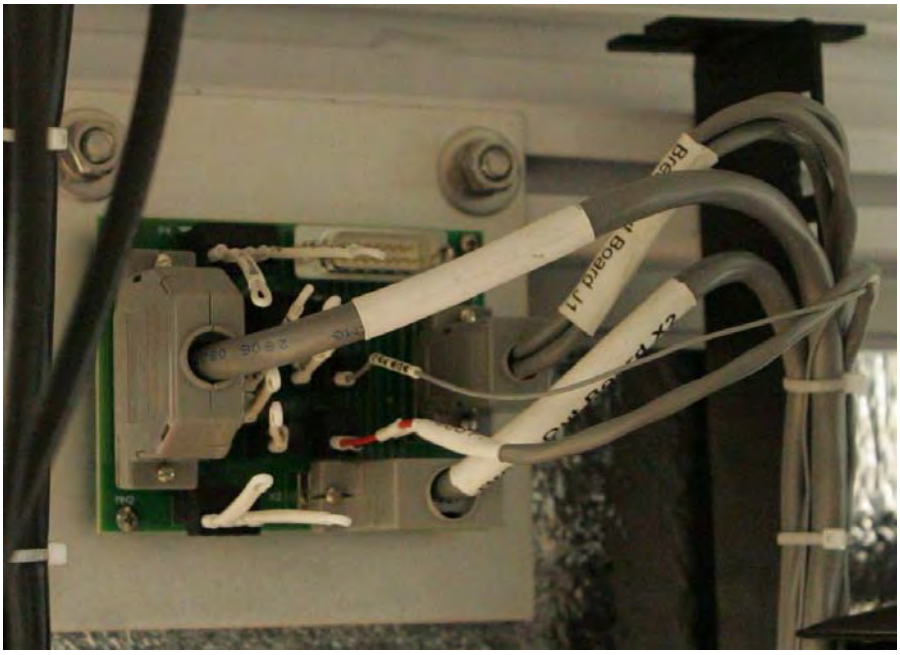


Figure 3-50 Break Out Board

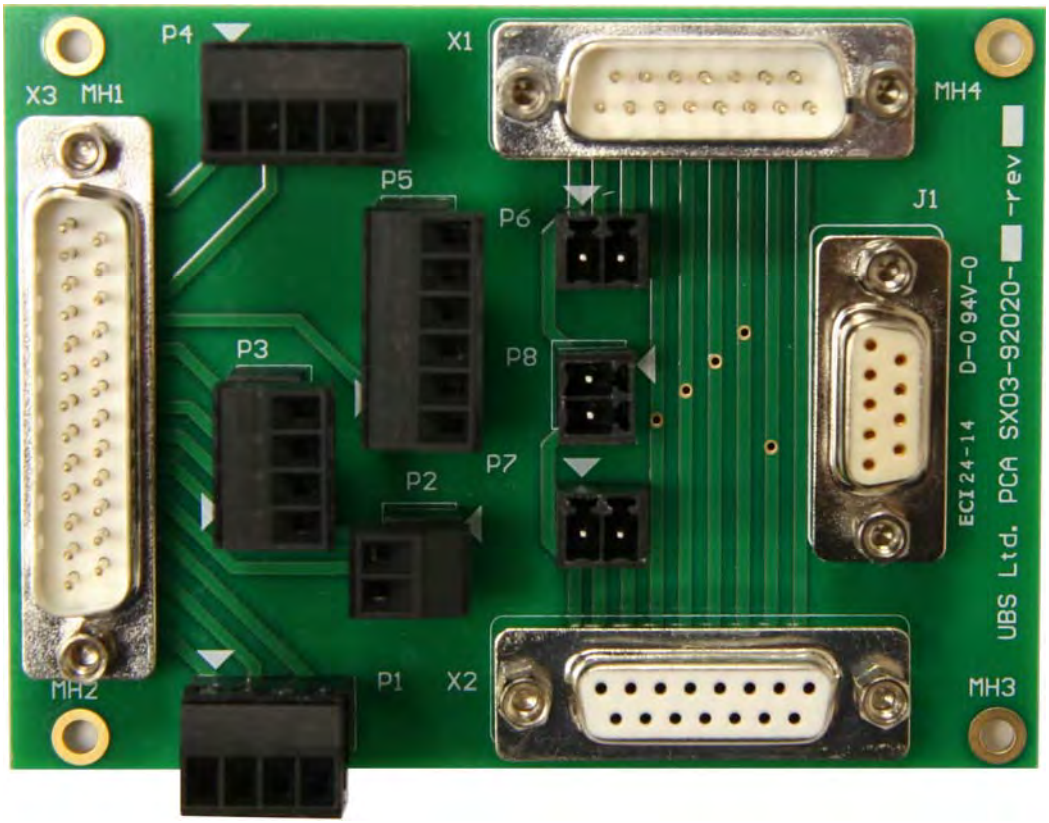


Table 3-13 Break Out Board External Alarm Contacts

Alarm	Positive (+) Contact	Negative (-) Contact
High Temp	P1 - 2	P1 - 1 and 3
Low Temp	P1 - 4	P1 - 1 and 3
Smoke	P2 - 2	P2 - 1
HVAC1	P3 - 2	P3 - 1 and 3
HVAC2	P3 - 4	P3 - 1 and 3
Blower	P4 - 2	P4 - 1 and 3
Dehydrator	P4 - 4	P4 - 1 and 3
Shelter Door	P5 - 2	P5 - 1 and 3
Spare	P5 - 4	P5 - 1 and 3

Note: P4 pin 5 and P5 pin 6 are ground pins.

3.14 RF Output Interfaces

	Opening RF lines during operation may cause electric arcs that can cause burns and eye injuries. RF output ports 1 and 2 must be terminated into a broadcast antenna or test load.

The DRU-2KW includes two (2) RF output ports, which are located on the OFN cabinet top panel.

During the installation procedure, these outputs must be terminated into a broadcast antenna or test load.

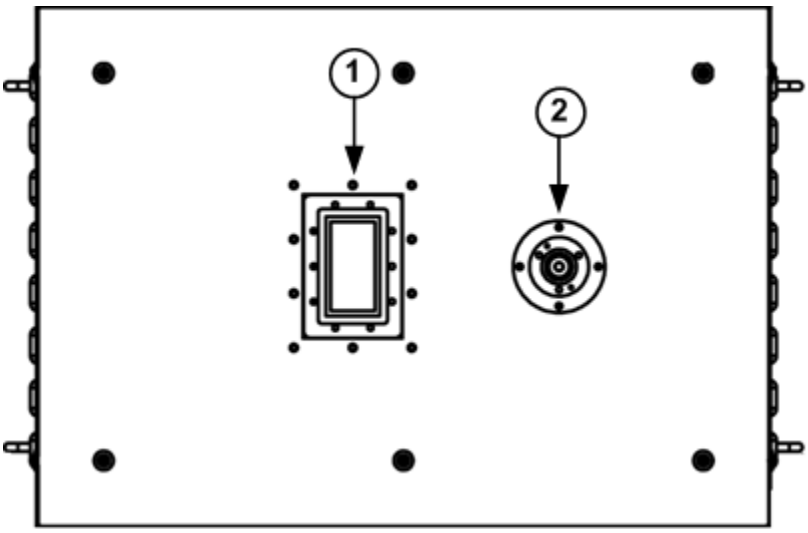
3.14.1 Configuration

The HB, LB and LBD transmit signal mapping depends on the DRU configuration – see Table 3-14.

Table 3-14 RF Output Mapping

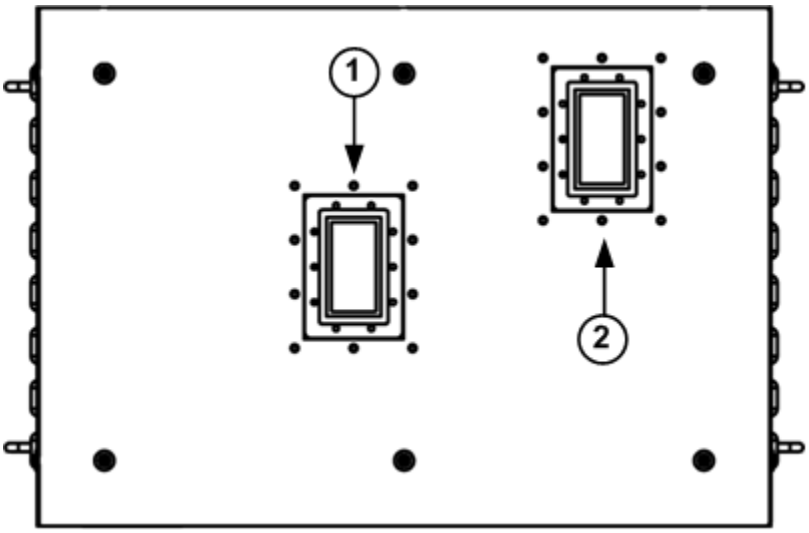
Port	Combined DRU	Independent DRU
Output 1	HB and LB	HB and LBD
Output 2	LBD	LB

Figure 3-51 Combined DRU RF Output Ports



1) Output 1 (Combined RF Output Port) – WR340 Flange
2) Output 2 (Independent RF Output Port) – 7/8" EIA Flange

Figure 3-52 Indepentent DRU RF Output Ports



1) Output 1 (Combined RF Output Port) – WR340 Flange
2) Output 2 (Independent RF Output Port) – WR340 Flange

3.14.2 Terminating a WR3 40 Flange Output

The following steps should be performed to terminate a WR340 flange output:

1. Place a WR340 half gasket (UBS p/n SX03-24101-02) into the WR340 flange groove – see Figure 3-53.
2. Connect the transmission line to the WR340 flange according to site drawings.
3. Secure the transmission line in place by installing a 1/4-20x7/8" socket head cap screw with #12 flat washer and 1/4" lock washer in each of the threaded holes (10 total) – see Figure 3-53. A torque rating of 45 Inch Lbs. must be used to tighten the 1/4-20 socket head cap screws.

Figure 3-53 WR340 Flange Connection (before and after)

Picture TBD

1) WR340 Half Gasket
2) 1/4-20x7/8” Socket Head Cap Screw with #12 Flat Washer and 1/4” Lock Washer

3.14.3 Terminating a 7/8" EIA Flange Output

The following steps should be performed to terminate a 7/8" EIA flange output:

1. Insert an inner connector into the 7/8" EIA flange – see Figure 3-54.
2. Place a rubber ring in the 7/8" EIA flange groove – see Figure 3-54.
3. Connect the transmission line to the 7/8" EIA flange according to site drawings.
4. Secure the transmission line in place by installing a 1/4-20x1" hex head bolt with 1/4" flat washer and 1/4" lock washer in each of the threaded holes (3 total) – see Figure 3-53. A torque rating of 45 In. Lbs. should be used to tighten the bolt.

Figure 3-54 7/8" EIA Flange Connection (before and after)

Picture TBD

1) Inner Connector
2) Rubber Ring
3) 1/4-20x1" Hex Head Bolt with 1/4" Flat Washer and 1/4" Lock Washer

3.15 AC Power

3.15.1 General Requirements

A certified Electrician should connect the repeater to the building/site electrical service panel to meet all local and national electrical codes, and according to the repeater electrical drawing(s).

- AC Supply Voltage
  - Control Cabinet: 208-240 VAC nominal, Single Phase, 4 wire (L1, L2, N, G)
  - HB HPA Cabinet: 208-240 VAC nominal, 3-Phase, 5 wire Delta or Y (L1, L2, L3, N, G)
  - LB HPA Cabinet: 208-240 VAC nominal, 3-Phase, 5 wire Delta or Y (L1, L2, L3, N, G)
- Frequency: 60 Hz
- Branch Protection
  - The control cabinet is to be installed with a branch protection of 15 A max
  - The HB HPA cabinet is to be installed with a branch protection of 70 A max
  - The LB HPA cabinet is to be installed with a branch protection of 70 A max
- Power Consumption:
  - Control Cabinet Current: 10A (Power Consumption: 2.0 kVA max)
  - HB Cabinet Current: 47A (Power Consumption: 17 kVA max)
  - LB Cabinet Current: 47A (Power Consumption: 17 kVA max)
  - Overall: 104A (Power Consumption: 36.0 kVA max
- Minimum AC mains wire requirements for the control cabinet:
  - Ground Conductor: #8 AWG
  - Power Cable (L1, L2, N, G): #12 AWG
  - Temperature rating: 75°C
- Minimum AC mains wire requirements for each HPA cabinet:
  - Ground Conductor: #8 AWG
  - Power Cable (L1, L2, L3, G): #4 AWG
  - Temperature rating: 75°C

	Verify that the AC supply voltage is within the specified range and check all power cables for damage.

3.15.2 Repeater Cabinet Ground Connection

	The repeater cabinets must be connected to the building/site's main ground terminal.

An external ground conductor can be secured to the ground stud located on the floor of the control cabinet, near the back right corner – see Figure 3-55. A torque rating of 45 – 50 In. Lbs. should be used to tighten the nut.

An external ground conductor can be secured to the ground stud located on the floor of the HB HPA cabinet, near the back right corner – see Figure 3-56. A torque rating of 45 – 50 In. Lbs. should be used to tighten the nut.

An external ground conductor can be secured to the ground stud located on the floor of the LB HPA cabinet, near the back left corner – see Figure 3-57. A torque rating of 45 – 50 In. Lbs. should be used to tighten the nut.

Figure 3-55 Control Cabinet Ground Stud

Picture TBD

Figure 3-56 HB HPA Cabinet Ground Stud

Picture TBD

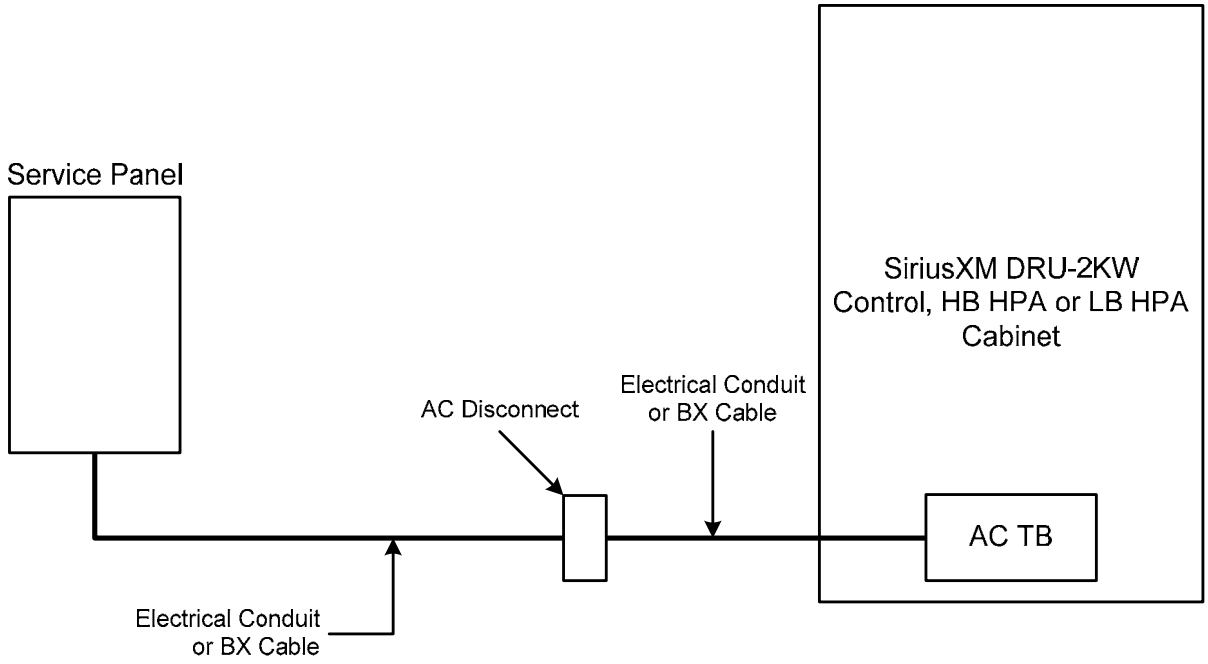
Figure 3-57 LB HPA Cabinet Ground Stud

Picture TBD

3.15.3 Repeater Cabinet AC Power Connection

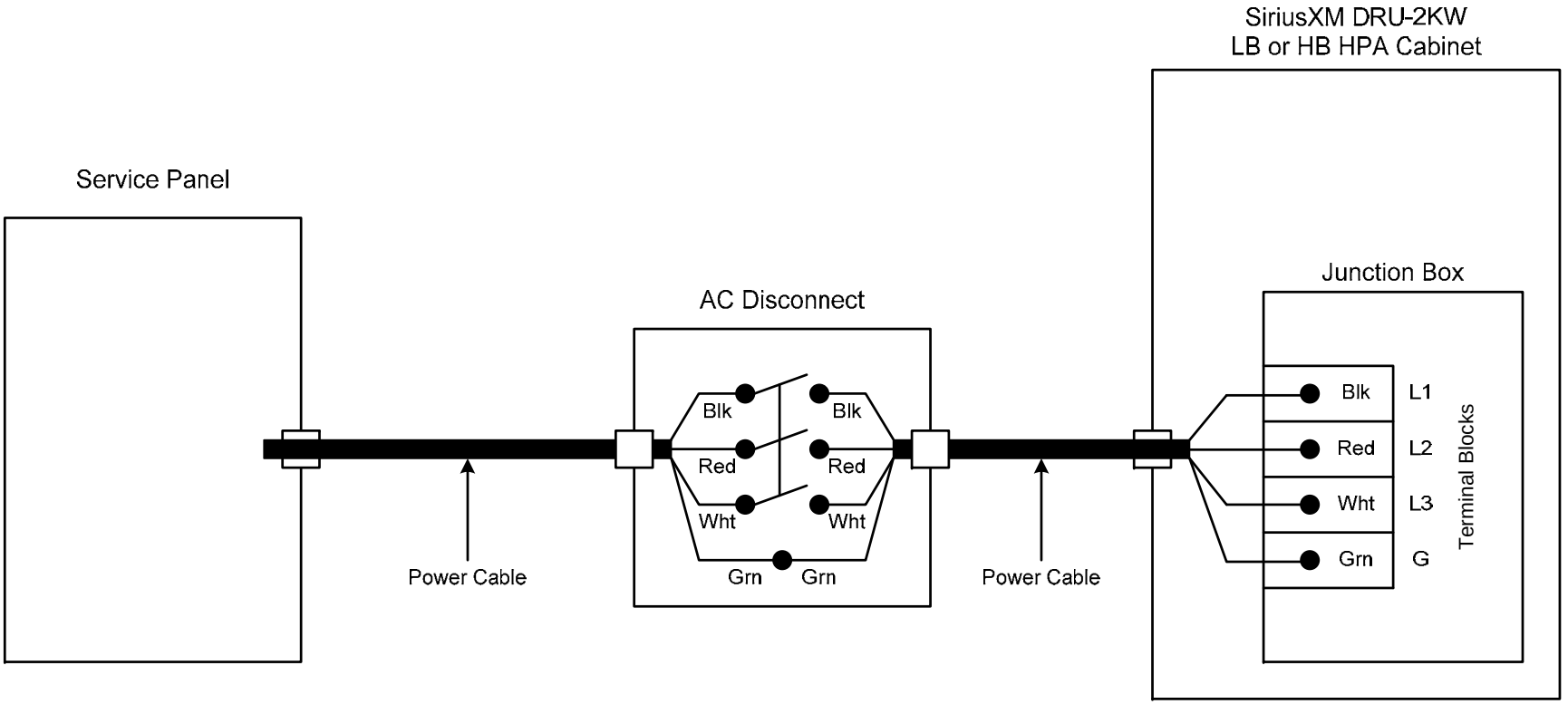
Figure 3-58 depicts the recommended repeater AC power connection.

Figure 3-58 AC Power Cable Routing



- Arrange for the installation of three (3) AC disconnect device in close proximity to the repeater cabinets. The AC disconnect devices must be connected to the building/site electrical service panel according to all local and national electrical codes.
- Three (3) AC power cables should be run to meet all local and national electrical codes, and according to the repeater electrical drawing(s). This may require the cables to be run inside electrical conduit between the building/site electrical service panel and the repeater cabinets.

Figure 3-59 HPA Cabinet AC Power Cable Schematic



3.15.3.1 Control Cabinet AC Power Connection

The following steps should be performed to make the electrical connection to the control cabinet once the power cable has been routed into the cabinet and prepped by a certified electrician:

	Place the circuit breaker in the building/site electrical service panel in the OFF position and place a "**DANGER-DO NOT TURN ON - Personnel Working**" sign on the circuit breaker.

1. Attach the cable to a Hubbell twist lock connector model HBL2413 or equivalent.
2. Insert the green wire into the terminal marked "G" and tighten the clamping screw.
3. Insert the white wire into the terminal marked "W" and tighten the clamping screw.
4. Insert the red wire into the terminal marked "Y" and tighten the clamping screw.
5. Insert the black wire into the terminal marked "X" and tighten the clamping screw.
6. Connect the incoming power cable to the PDU power cable (UBS p/n SX03-33943-01).
7. Verify that the circuit breaker in the building/site electrical service panel is still in the OFF position and that the AC disconnect device is in the OFF position (where applicable).
8. Place the circuit breaker in the building/site electrical service panel in the ON position and remove the sign.
9. Place the AC disconnect device in the ON position (where applicable).

3.15.3.2 HPA Cabinet AC Power Connection

The following steps should be performed to make the electrical connection to the HPA cabinets once the power cable has been routed into the cabinets and prepped by a certified electrician:

	Place the circuit breaker in the building/site electrical service panel in the OFF position and place a "**DANGER-DO NOT TURN ON - Personnel Working**" sign on the circuit breaker.

1. Remove the access panel from the junction box by removing the two (2) Phillips head screws – see Figure 3-60.
2. Loosen the cable gland, located on the rear of the junction box, and insert the multi conductor cable into the junction box.
3. Insert the green wire into the terminal block marked "GND" and tighten the clamping screw – see Figure 3-61.
4. Insert the white wire into the terminal block marked "L3" and tighten the clamping screw – see Figure 3-61.
5. Insert the red wire into the terminal block marked "L2" and tighten the clamping screw – see Figure 3-61.
6. Insert the black wire into the terminal block marked "L1" and tighten the clamping screw – see Figure 3-61.
7. Tighten the cable gland and replace the junction box access panel.
8. Verify that all PDU breakers are in the OFF position.
9. Verify that the circuit breaker in the building/site electrical service panel is still in the OFF position and that the AC disconnect device is in the OFF position (where applicable).
10. Place the circuit breaker in the building/site electrical service panel in the ON position and remove the sign.
11. Place the AC disconnect device in the ON position (where applicable).

Figure 3-60 Junction Box (with access cover installed)

Picture TBD

1) Junction Box Access Panel
2) Access Panel Mounting Screws

Figure 3-61 Junction Box (with power cable conductors connected)

1) Line 1 Terminal Block
2) Line 2 Terminal Block
3) Line 3 Terminal Block
4) Ground Terminal Block

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Chapter 4

Commissioning

Contents

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4 Commissioning

4.1 Introduction

This section describes the power-on, configuration and RF test procedures for the DRU-2KW.

4.2 Test Equipment

Please refer to Table 4-1 for a list of required test equipment. Operating instructions for test equipment are not included in this manual. Only precautionary notes or special test equipment settings required for measurement accuracy are included.

Table 4-1 Test Equipment

Type
PC/Laptop

4.3 Installation Verification

Please check the following before turning on the DRU-2KW:

- Verify that no equipment was damaged during the installation.
- Verify that there are no sign of water or debris in the cabinets.
- Verify that the ground conductors have been connected to the repeater LB cabinet and HB cabinet ground studs.
- Verify that the main AC power cables have been connected to the repeater LB cabinet and HB cabinet PDU's correctly.
- Verify that the electronics compartment components, which were packaged separately, have been installed correctly.
  - Verify that the components are in the correct locations (in the correct cabinet).
  - Verify that the ground, communications, RF and power wires/cables have been connected correctly.
- Verify that all HPA compartment components, which were packaged separately, have been installed correctly.
- Verify that all external input signals have been connected to the correct interfaces.
- Verify that the PTSN phone line cord has been connected to the surge protector correctly (where applicable).
- Verify that any external alarm contacts/sensors have been connected to the external alarm terminal block correctly (where applicable).
- Verify that the broadcast antenna(s) and transmission line(s) have been swept and connected to the correct RF output port.

4.4 Commissioning Procedure

During the commissioning (initial turn-on) procedure, the operator will be required to perform the following tasks:

1. Power-on the repeater
2. Configure the repeater
3. Place the repeater in broadcast mode

4.4.1 Repeater AC/DC Power-on

NOTE: The repeater is divided into separate LB and HB cabinets. However, there are several components which are shared by both cabinets, but are physically located in only one of the cabinets. In this case, the user will be required to move back and forth between cabinets when powering on the DRU-2KW.

The DRU-2KW AC/DC power should be turned on in the following sequence:

1. Ensure that the BMS front panel DC breakers are switched OFF.
2. Ensure that the BMS rear panel battery breaker BAT CB is switched OFF.
3. Ensure that the control cabinet PDU AC circuit breakers are switched OFF.
4. Ensure that the HB HPA cabinet PDU AC circuit breakers are switched OFF.
5. Ensure that the LB HPA cabinet PDU AC circuit breakers are switched OFF.
6. Switch ON the HBE rear panel DC breaker.
7. Switch ON the LBE rear panel DC breaker.
8. Switch ON the TRMS rear panel AC breaker.
9. Switch ON the Main AC repeater circuit breaker(s), located in the building/site electrical service panel.
10. Switch ON the AC disconnect device(s), located on or near the repeater (where applicable).
11. Switch ON the control cabinet PDU MAIN AC (L1 L2) circuit breaker.
12. Switch ON the HB HPA cabinet PDU MAIN1 AC (L1 L2 L3) circuit breaker.
13. Switch ON the HB HPA cabinet PDU MAIN2 AC (L1 L2 L3) circuit breaker.
14. Switch ON the LB HPA cabinet PDU MAIN1 AC (L1 L2 L3) circuit breaker.
15. Switch ON the LB HPA cabinet PDU MAIN2 AC (L1 L2 L3) circuit breaker.
16. Switch ON the 12V battery circuit breaker (BAT CB), located on the BMS rear panel.
17. Switch ON the AC SERVICE circuit breaker (CB3), located on the control cabinet PDU.
18. Switch ON the BMS circuit breaker (CB2), located on the control cabinet PDU.
    - o Ensure that the 12 VDC rectifier LEDs are illuminated green and that the internal fans are rotating continuously.
    - o Ensure that the BMS mounting shelf CTR LED is illuminated green.

19. Switch ON the TRMS circuit breaker (CB1), located on the control cabinet PDU.
    - Ensure that the TRMS Power LED is illuminated green.
20. Switch ON the FAN (CB4) circuit breaker, located on the HB HPA cabinet PDU.
    - Ensure that the HB HPA cabinet fan/blower is rotating continuously (fan/blower can be heard).
21. Switch ON the FAN (CB4) circuit breaker, located on the LB HPA cabinet PDU.
    - Ensure that the LB HPA cabinet fan/blower is rotating continuously (fan/blower can be heard).
22. Switch ON the HPA 0 PSU circuit breaker (CB0), located on the HB HPA cabinet PDU.
    - Ensure that the HB HPA 1 PSU (PS 0) Norm LED is blinking green.
    - Ensure that the HB HPA 1 PDU (PS 0) Alarm LED is blinking red.
23. Switch ON the HPA 1 PSU circuit breaker (CB1), located on the HB HPA cabinet PDU.
    - Ensure that the HB HPA 2 PSU (PS 1) Norm LED is blinking green.
    - Ensure that the HB HPA 2 PDU (PS 1) Alarm LED is blinking red.
24. Switch ON the HPA 2 PSU circuit breaker (CB2), located on the HB HPA cabinet PDU.
    - Ensure that the HB HPA 3 PSU (PS 2) Norm LED is blinking green.
    - Ensure that the HB HPA 3 PDU (PS 2) Alarm LED is blinking red.
25. Switch ON the HPA 3 PSU circuit breaker (CB3), located on the HB HPA cabinet PDU.
    - Ensure that the HB HPA 4 PSU (PS 3) Norm LED is blinking green.
    - Ensure that the HB HPA 4 PDU (PS 3) Alarm LED is blinking red.
26. Switch ON the HPA 4 PSU circuit breaker (CB4), located on the HB HPA cabinet PDU.
    - Ensure that the HB HPA 5 PSU (PS 4) Norm LED is blinking green.
    - Ensure that the HB HPA 5 PDU (PS 4) Alarm LED is blinking red.
27. Switch ON the HPA 5 PSU circuit breaker (CB5), located on the HB HPA cabinet PDU.
    - Ensure that the HB HPA 6 PSU (PS 5) Norm LED is blinking green.
    - Ensure that the HB HPA 6 PDU (PS 5) Alarm LED is blinking red.
28. Switch ON the HPA 6 PSU circuit breaker (CB6), located on the HB HPA cabinet PDU.
    - Ensure that the HB HPA 7 PSU (PS 6) Norm LED is blinking green.
    - Ensure that the HB HPA 7 PDU (PS 6) Alarm LED is blinking red.
29. Switch ON the HPA 7 PSU circuit breaker (CB7), located on the HB HPA cabinet PDU.
    - Ensure that the HB HPA 8 PSU (PS 7) Norm LED is blinking green.
    - Ensure that the HB HPA 8 PDU (PS 7) Alarm LED is blinking red.
30. Switch ON the HPA 0 PSU circuit breaker (CB0), located on the LB HPA cabinet PDU.
    - Ensure that the LB HPA 1 PSU (PS 0) Norm LED is blinking green.
    - Ensure that the LB HPA 1 PDU (PS 0) Alarm LED is blinking red.
31. Switch ON the HPA 1 PSU circuit breaker (CB1), located on the LB HPA cabinet PDU.
    - Ensure that the LB HPA 2 PSU (PS 1) Norm LED is blinking green.
    - Ensure that the LB HPA 2 PDU (PS 1) Alarm LED is blinking red.

32. Switch ON the HPA 2 PSU circuit breaker (CB2), located on the LB HPA cabinet PDU.
    - o Ensure that the LB HPA 3 PSU (PS 2) Norm LED is blinking green.
    - o Ensure that the LB HPA 3 PDU (PS 2) Alarm LED is blinking red.
33. Switch ON the HPA 3 PSU circuit breaker (CB3), located on the LB HPA cabinet PDU.
    - o Ensure that the LB HPA 4 PSU (PS 3) Norm LED is blinking green.
    - o Ensure that the LB HPA 4 PDU (PS 3) Alarm LED is blinking red.
34. Switch ON the HPA 4 PSU circuit breaker (CB4), located on the LB HPA cabinet PDU.
    - o Ensure that the LB HPA 5 PSU (PS 4) Norm LED is blinking green.
    - o Ensure that the LB HPA 5 PDU (PS 4) Alarm LED is blinking red.
35. Switch ON the HPA 5 PSU circuit breaker (CB5), located on the LB HPA cabinet PDU.
    - o Ensure that the LB HPA 6 PSU (PS 5) Norm LED is blinking green.
    - o Ensure that the LB HPA 6 PDU (PS 5) Alarm LED is blinking red.
36. Switch ON the HPA 6 PSU circuit breaker (CB6), located on the LB HPA cabinet PDU.
    - o Ensure that the LB HPA 7 PSU (PS 6) Norm LED is blinking green.
    - o Ensure that the LB HPA 7 PDU (PS 6) Alarm LED is blinking red.
37. Switch ON the HPA 7 PSU circuit breaker (CB7), located on the LB HPA cabinet PDU.
    - o Ensure that the LB HPA 8 PSU (PS 7) Norm LED is blinking green.
    - o Ensure that the LB HPA 8 PDU (PS 7) Alarm LED is blinking red.
38. Switch ON the HBE 10A circuit breaker, located on the BMS front panel.
    - o Ensure that the HBE Power LED is illuminated green and that the internal fan is rotating continuously.
39. Switch ON the LBE 25A circuit breaker, located on the BMS front panel.
    - o Ensure that the LBE Power LED is illuminated green and that the internal fan is rotating continuously. Note: Fan operation will be halted momentarily during the boot-up process, but will continue to operate continuously.
40. Switch ON the TSC-H 5A circuit breaker, located on the BMS front panel.
41. Switch ON the TSC-L 5A circuit breaker, located on the BMS front panel.
42. Switch ON the SPARE 2.5A circuit breaker, located on the BMS front panel.
    - o Ensure that the BMS alarm LEDs are no longer illuminated red; only the CTR LED should be illuminated green.

4.4.2 Repeater Configuration

Repeater configuration involves verifying, changing, and/or setting parameter values that allow the repeater to operate from its assigned location. The operator will be required to configure the following:

- Low Band Exciter (LBE)
- High Band Exciter (HBE)
- Terrestrial Repeater Monitoring System (TRMS)

4.4.2.1 Low Band Exciter (LBE) Configuration

Please refer to SiriusXM instructions as well as the LBE Operating Manual to configure the exciter with specific settings for its assigned location.

4.4.2.2 High Band Exciter (HBE) Configuration

Please refer to SiriusXM instructions as well as the HBE Operating Manual to configure the exciter with specific settings for its assigned location.

4.4.2.3 Terrestrial Repeater Monitoring System (TRMS) Configuration

Please refer to SiriusXM instructions as well as the TRMS Operating Manual to configure the TRMS with specific settings for its assigned location.

4.4.3 Placing a Combined DRU in Broadcast Mode

As the repeater is divided into LB and HB sub-systems, each sub-system must be placed in broadcast mode, independent of the other. It is recommended that the LB sub-system is placed in broadcast mode before the HB sub-system is placed in broadcast mode.

4.4.3.1 Low Band Sub-system

Once the LBE is powered up and all LBE alarms have cleared, the operator can place the LB sub-system in broadcast mode using the LBE GUI as follows:

1. Configure "SysExciterPwrSetp" so that the HPA input power level is -5.0 dBm, ± 0.5 dB – see Figure 4-1.
   - Navigate to the "HPA Overview" page to verify the "HpaInputPower" level – see Figure 4-2.
2. Set "SysPowerSetp" to the site specific power level (max. 62.4 dBm) – see Figure 4-1.
3. Set the Low Band Diversity power level according to SXM instructions.
4. Ensure that "SysOfnLoss" is set to the value listed in the DRU-2KW test report – see Figure 4-1.
5. Ensure that "SysLbdOfnLoss" is set to the value listed in the DRU-2KW test report – see Figure 4-1.
6. Set "SysOperatingMode" to "broadcast" – see Figure 4-1.
   - The LED's on the LB HPA's will flash green and blue alternately as the HPA's ramp up to the "SysPowerSetp" target.
   - Once the "SysPowerSetp" target is reached, the HPA LED's will be illuminated green. It should take approximately 10 minutes for the LB sub-system to ramp up to full power.
7. Ensure that the "SysPowerSetp" target is reached by viewing "Cpl1ForwardPwr" – see Figure 4-1, status window line 11.
8. Ensure that the TRMS LB Status LED is illuminated green.
   - The TRMS should scan through the channels at a slow rate of approximately 20 seconds per channel.

Figure 4-1 LBE GUI Sys Page

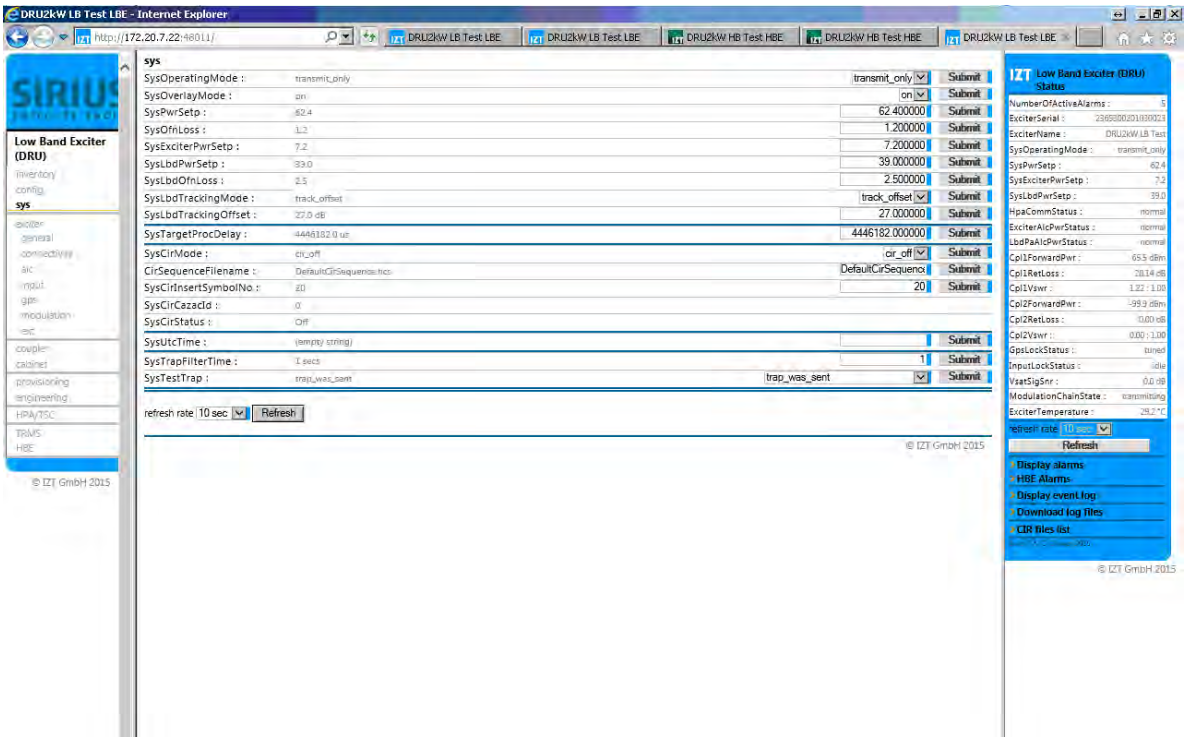
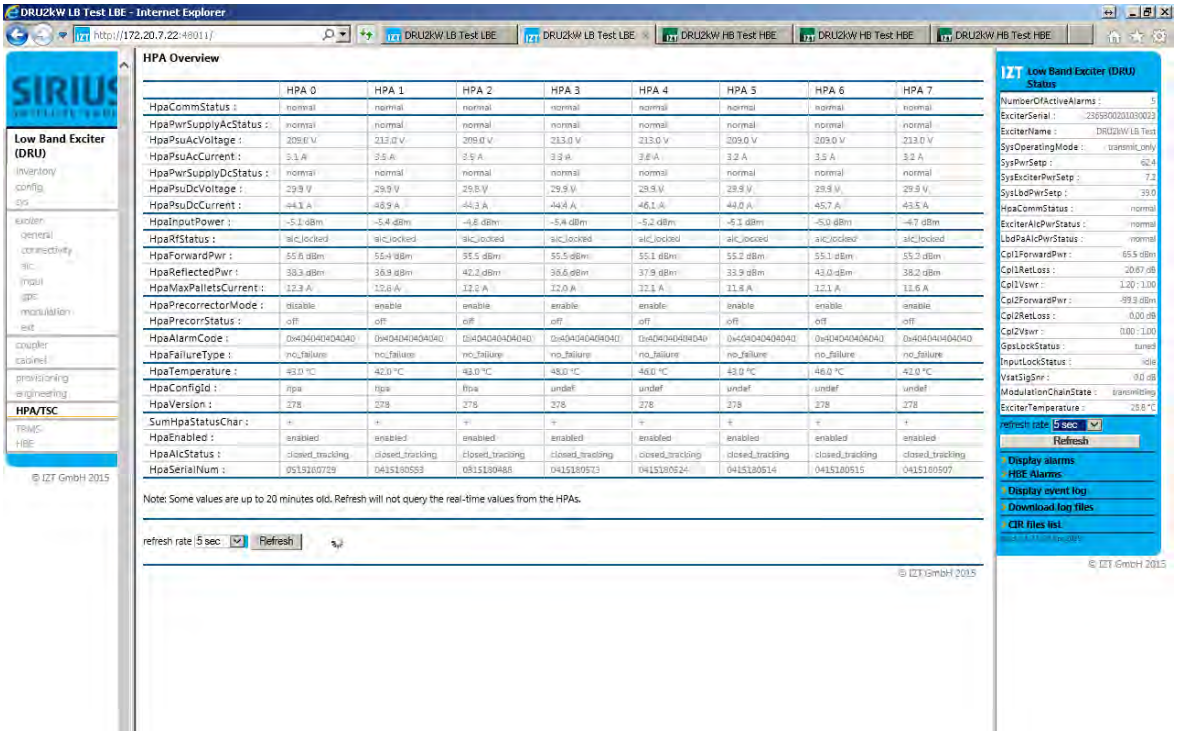


Figure 4-2 LBE GUI HPA Overview Page



4.4.3.2 High Band Sub-system

Once the HBE is powered up and all alarms have cleared, the operator can place the HB repeater in broadcast mode as follows:

1. Configure “SysExciterPwrSetp” so that the HPA input power level is -5.0 dBm, ± 0.5 dB – see Figure 4-3.
   - Navigate to the “HPA Overview” page to verify the “HpaInputPower” level – see Figure 4-4.
2. Set “SysPowerSetp” to the site specific power level (max. 62.4 dBm) – see Figure 4-3.
3. Set “SysOfnLoss” to 1.3 dB – see Figure 4-3.
4. Set “SysOperatingMode” to broadcast – see Figure 4-3.
   - Ensure that the LNA LED is illuminated green.
   - The LED’s on the HB HPA’s will flash green and blue alternately as the HPA’s ramp up to the “SysPowerSetp” target.
   - Once the “SysPowerSetp” target is reached, the HPA LED’s will be illuminated green. It should take approximately 10 minutes for the HB sub-system to ramp up to full power.
5. Ensure that the “SysPowerSetp” target is reached by viewing “Cpl1ForwardPwr” – see Figure 4-1, status window line 11.
   - Note: The HBE GUI does not provide any coupler measurements. The coupler measurements are provided by the LBE GUI.
   - The “Cpl1ForwardPwr” value should be 3 dB higher than the “SysPowerSetp” value as the LB and HB signals are combined on DRU transmit output coupler 1.
6. Ensure that the TRMS HB Status LED is illuminated green.
   - The TRMS should scan through the channels at a fast rate of approximately 2 seconds per channel.

Figure 4-3 HBE GUI Sys Page

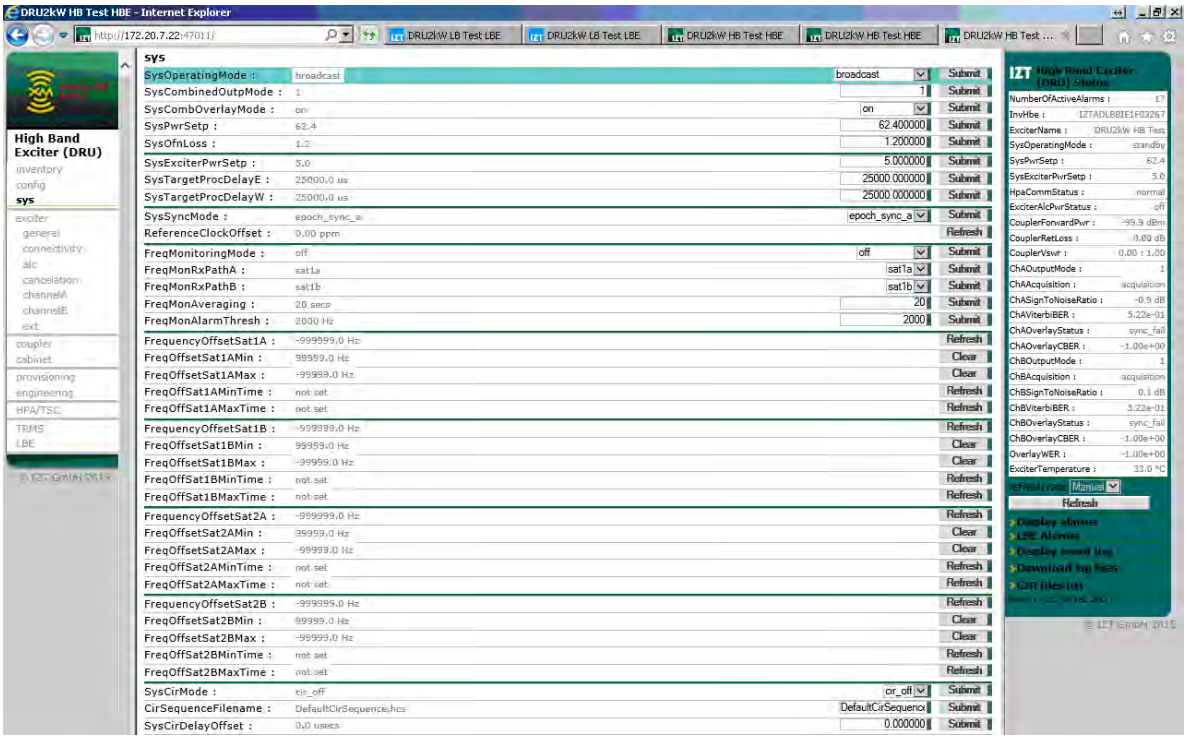
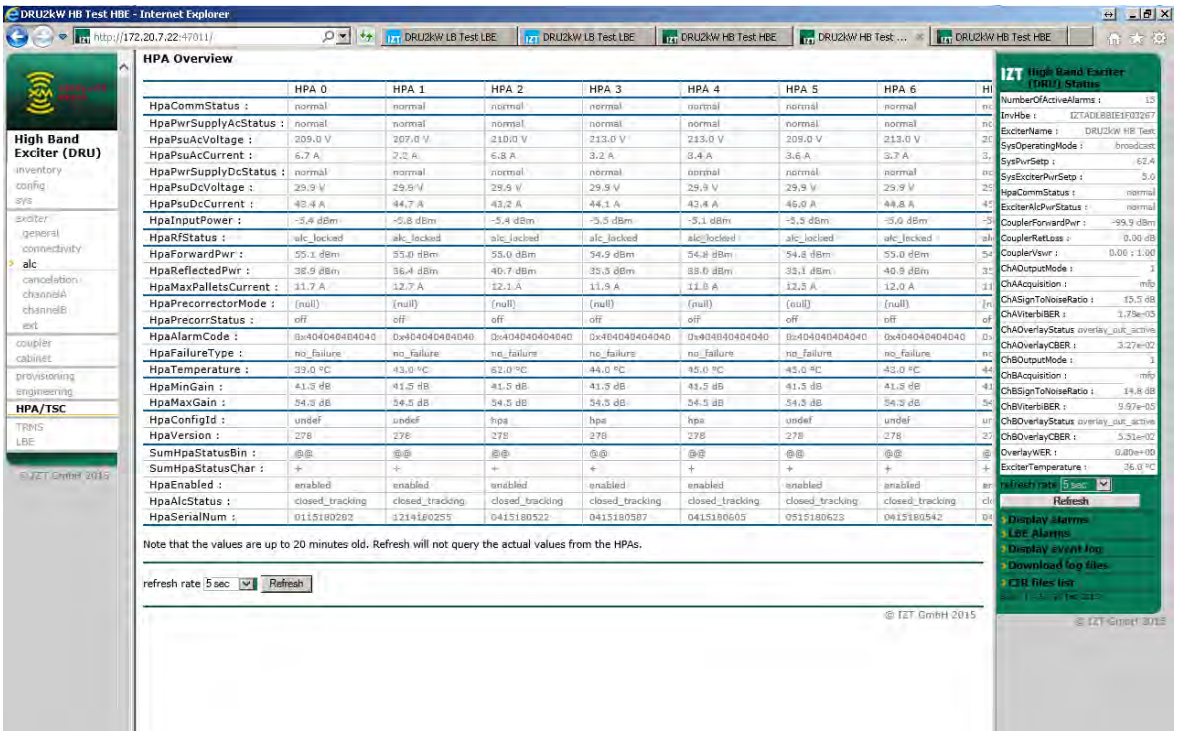


Figure 4-4 HBE GUI HPA Overview Page



4.4.4 Placing an Independent DRU in Broadcast Mode

As the repeater is divided into LB and HB sub-systems, each sub-system must be placed in broadcast mode, independent of the other. It is recommended that the LB sub-system is placed in broadcast mode before the HB sub-system is placed in broadcast mode.

4.4.4.1 Low Band Sub-system

Once the LBE is powered up and all LBE alarms have cleared, the operator can place the LB sub-system in broadcast mode using the LBE GUI as follows:

1. Configure "SysExciterPwrSetp" so that the HPA input power level is -5.0 dBm, ± 0.5 dB – see Figure 4-5.
   - Navigate to the "HPA Overview" page to verify the "HpaInputPower" level – see Figure 4-6.
2. Set "SysPowerSetp" to the site specific power level (max. 62.4 dBm) – see Figure 4-5.
3. Set the Low Band Diversity power level according to SXM instructions.
4. Ensure that "SysOfnLoss" is set to the value listed in the DRU-2KW test report – see Figure 4-5.
5. Ensure that "SysLbdOfnLoss" is set to the value listed in the DRU-2KW test report – see Figure 4-5.
6. Set "SysOperatingMode" to "broadcast" – see Figure 4-5.
   - The LED's on the LB HPA's will flash green and blue alternately as the HPA's ramp up to the "SysPowerSetp" target.
   - Once the "SysPowerSetp" target is reached, the HPA LED's will be illuminated green. It should take approximately 10 minutes for the LB sub-system to ramp up to full power.
7. Ensure that the "SysPowerSetp" target is reached by viewing "Cpl2ForwardPwr" – see Figure 4-5, status window line 14.
8. Ensure that the TRMS LB Status LED is illuminated green.
   - The TRMS should scan through the channels at a slow rate of approximately 20 seconds per channel.

Figure 4-5 LBE GUI Sys Page

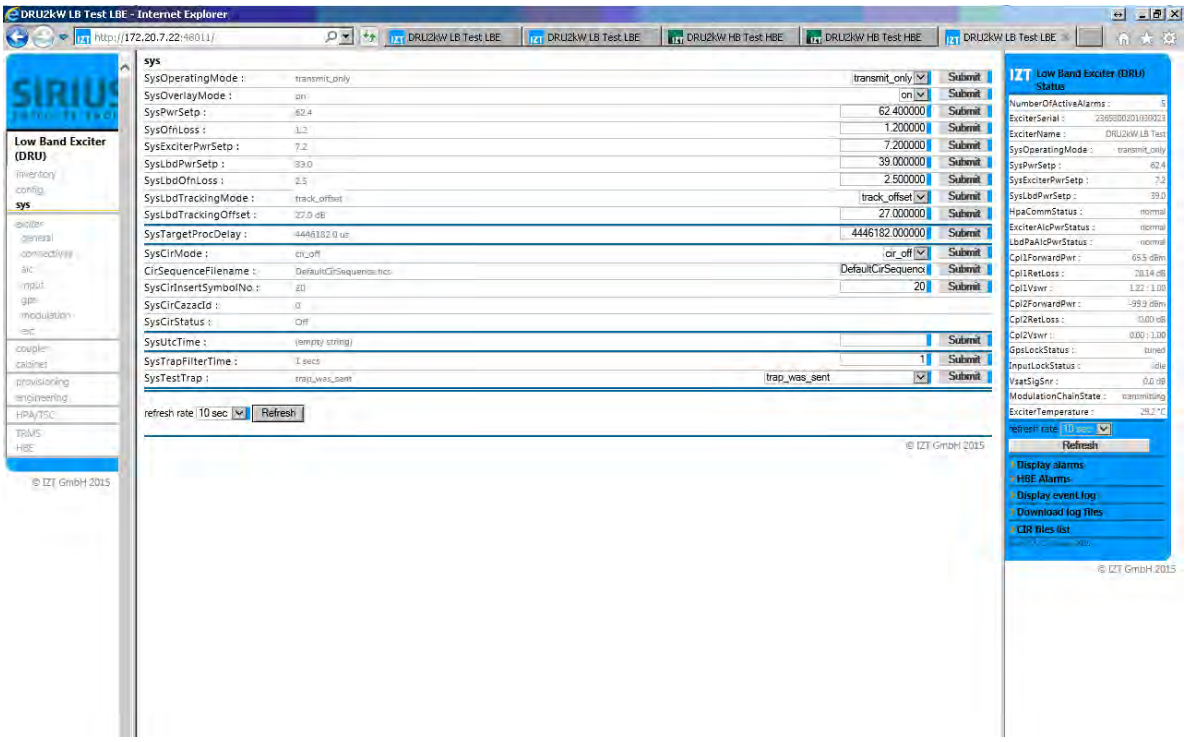
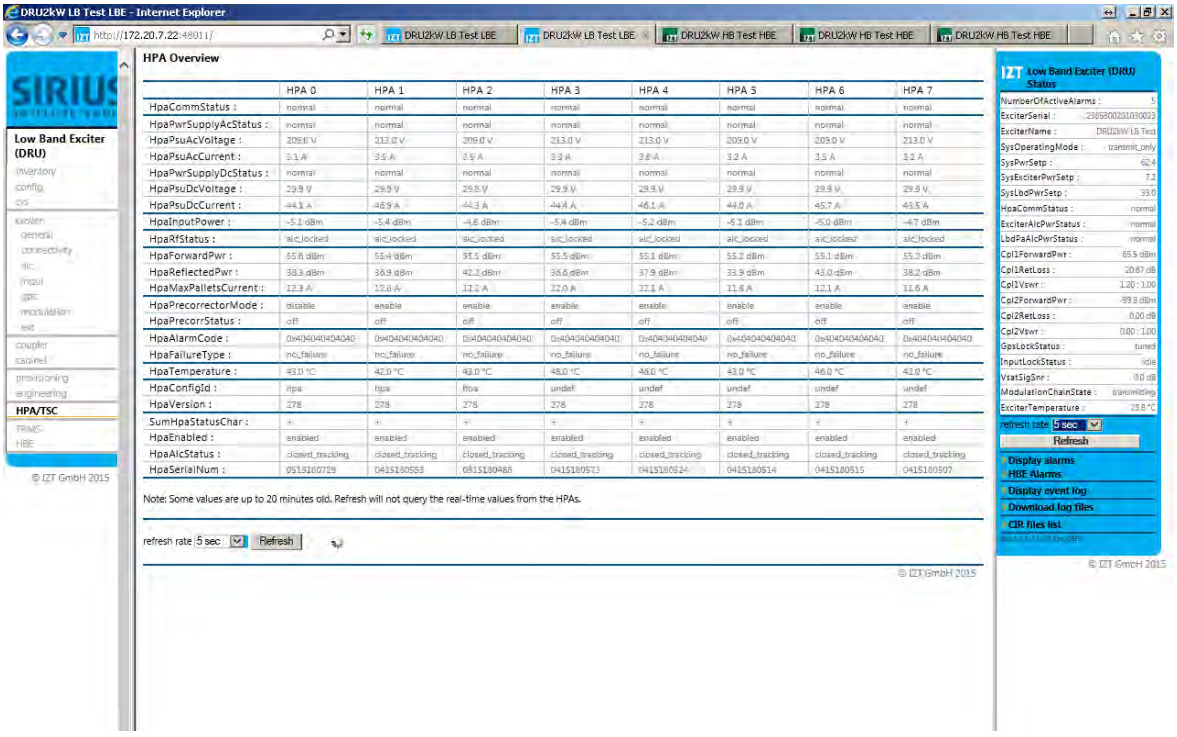


Figure 4-6 LBE GUI HPA Overview Page



4.4.4.2 High Band Sub-system

Once the HBE is powered up and all alarms have cleared, the operator can place the HB repeater in broadcast mode as follows:

1. Configure “SysExciterPwrSetp” so that the HPA input power level is -5.0 dBm, ± 0.5 dB – see Figure 4-7.
   - Navigate to the “HPA Overview” page to verify the “HpaInputPower” level – see Figure 4-8.
2. Set “SysPowerSetp” to the site specific power level (max. 62.4 dBm) – see Figure 4-7.
3. Set “SysOfnLoss” to 1.2 dB – see Figure 4-7.
4. Set “SysOperatingMode” to broadcast – see Figure 4-7.
   - Ensure that the LNA LED is illuminated green.
   - The LED’s on the HB HPA’s will flash green and blue alternately as the HPA’s ramp up to the “SysPowerSetp” target.
   - Once the “SysPowerSetp” target is reached, the HPA LED’s will be illuminated green. It should take approximately 10 minutes for the HB sub-system to ramp up to full power.
5. Ensure that the “SysPowerSetp” target is reached by viewing “Cpl1ForwardPwr” – see Figure 4-5, status window line 11.
   - Note: The HBE GUI does not provide any coupler measurements. The coupler measurements are provided by the LBE GUI.
6. Ensure that the TRMS HB Status LED is illuminated green.
   - The TRMS should scan through the channels at a fast rate of approximately 2 seconds per channel.

Figure 4-7 HBE GUI Sys Page

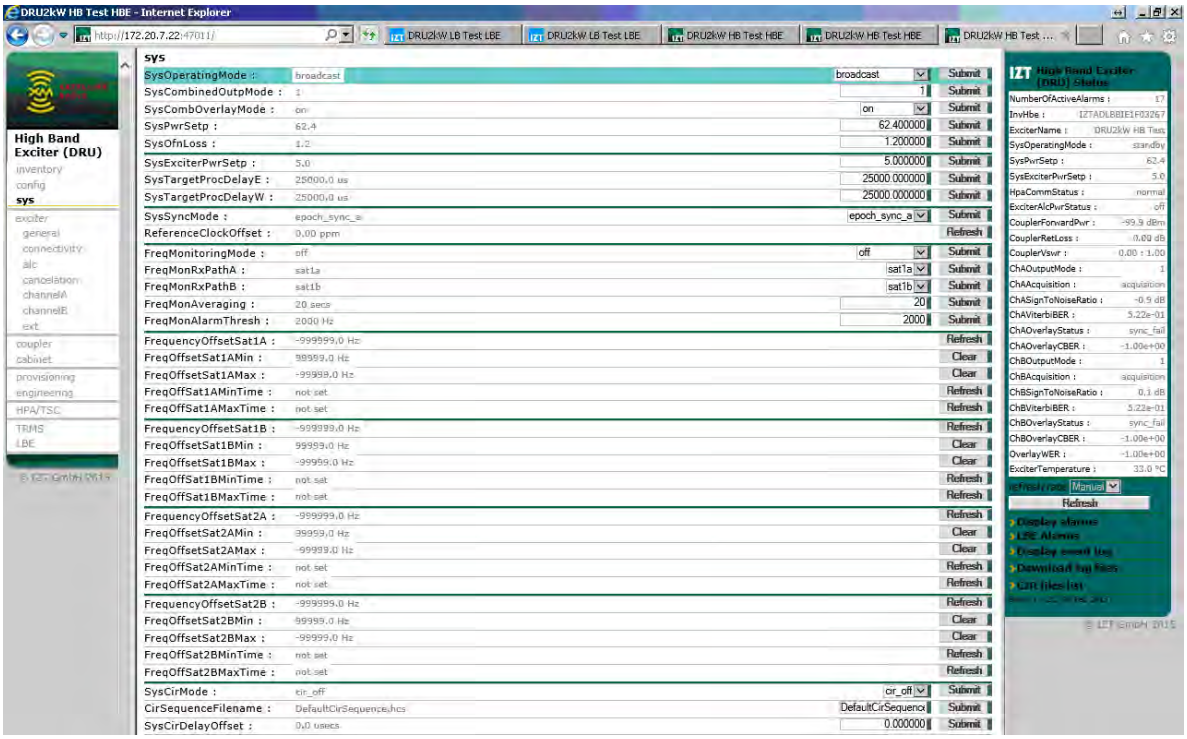
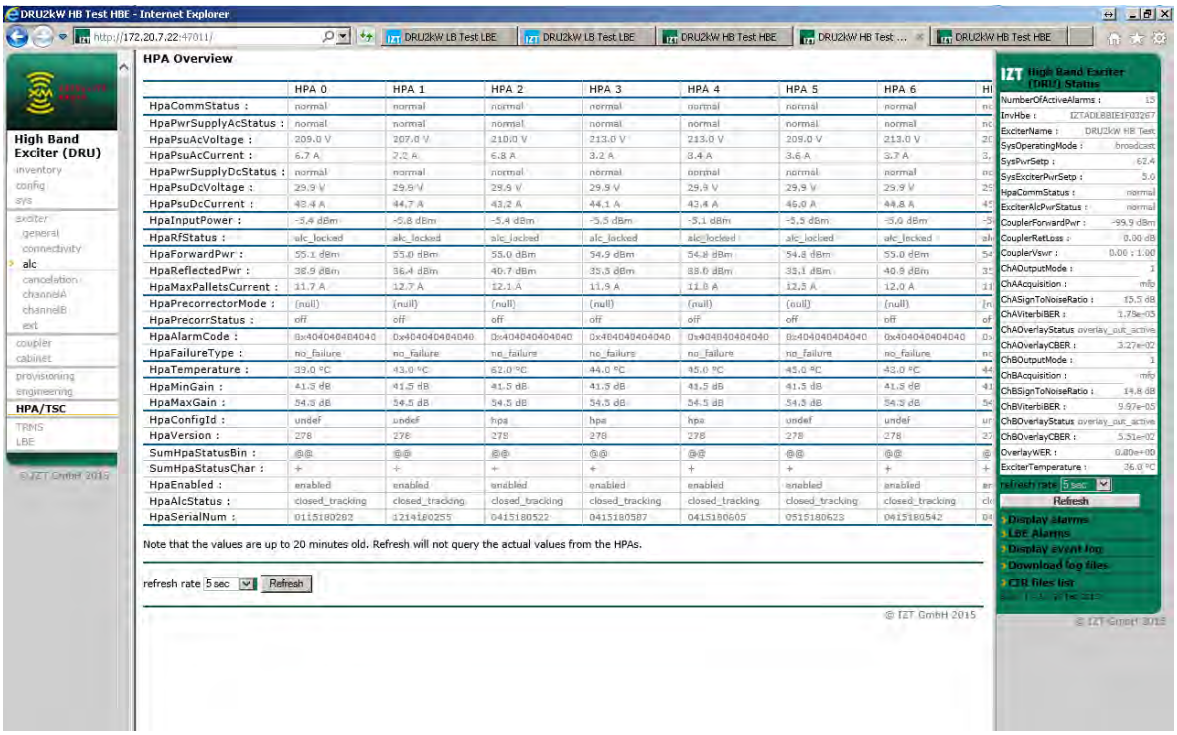


Figure 4-8 HBE GUI HPA Overview Page



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Chapter 5

Operation

Contents

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5 Operation

5.1 Introduction

This section addresses the control and operation of the DRU-2KW and provides descriptions of indicators and controls.

5.2 Control and Communication

The DRU-2KW can be controlled locally (on-site) or remotely from a Network Management System (NMS).

5.2.1 Control and Communication Interfaces

There is one (1) “cabinet” interface port provided for control and communication:

- TEL (Screw Terminal) – used for remote control of the HBE, LBE and TRMS via dial-up modem and LBE.

The HBE and LBE also include a front panel RJ-45 Ethernet port for local control of the corresponding exciter.

Please refer to the corresponding Operating Manual for detailed information on configuring the HBE, LBE and TRMS interface ports for local or remote control.

5.2.2 User Interfaces

The HBE, LBE and TRMS include their own user interface(s), permitting an operator to control the device locally or remotely. Please refer to the corresponding Operating Manual for detailed information on the HBE, LBE and TRMS user interfaces.

5.3 Modes of Operation

5.3.1 High Band Sub-system

Please refer to the HBE Operating Manual for detailed information on the HB sub-system operating modes.

5.3.2 Low Band Sub-system

Please refer to the LBE Operating Manual for detailed information on the LB sub-system operating modes.

5.3.3 Terrestrial Repeater Monitoring System (TRMS)

Please refer to the TRMS Operating Manual for detailed information on the TRMS operating modes.

5.4 Indicators and Controls

The DRU-2KW main components have individual indicators and controls used in normal operation.

5.4.1 High Band Exciter (HBE)

Please refer to the HBE Operating Manual for detailed information on the HBE indicators and controls.

5.4.2 Low Band Exciter (LBE)

Please refer to the LBE Operating Manual for detailed information on the LBE indicators and controls.

5.4.3 Terrestrial Repeater Monitoring System (TRMS)

Please refer to the TRMS Operating Manual for detailed information on the TRMS indicators and controls.

5.4.4 Dial-up Modem

Please refer to the Dial-up Modem Operating Manual for detailed information on the Dial-up Modem indicators and controls.

5.4.5 Control Cabinet Power Distribution Unit (PDU)

The control cabinet PDU front panel includes four (4) circuit breakers to turn on/off the cabinet AC power.

Figure 5-1 Control Cabinet PDU

Table 5-1 Control Cabinet PDU Circuit Breakers

Name	Rating	Circuit Breaker For
MAIN AC	15A, 2-pole	AC input from building/site electrical service panel or AC disconnect device
CB1	5A, Single-pole	TRMS
CB2	10A, 2-pole	BMS
CB3	5A, 2-pole	Provides 120 VAC to GFI outlet

5.4.6 Battery Management System (BMS)

The BMS rectifier front panel includes an LED to indicate that the rectifier has been powered on. The BMS mounting shelf front panel controller includes seven (7) status LEDs to indicate BMS operation and alarm conditions. The BMS mounting shelf front panel also includes five (5) circuit breakers to turn on/off the BMS 12 VDC output.

Figure 5-2 BMS

1) Rectifier Power LED Indicator
2) BMS Controller Status LED Indicators

Table 5-2 Rectifier LED Indicator

LED	Color	Description
	Green	Rectifier is powered on.
	OFF	Rectifier is powered off.

Table 5-3 BMS Controller Status LED Indicators

LED	Color	Description
CTR	Green	BMS is powered on and is operating under normal, no fault conditions.
	OFF	BMS is powered off.
MAJA	Red	“Major” (immediate response) alarm is present.
	OFF	Normal, no fault operation (when CTR LED is Green).
MINA	Red	“Minor” (scheduled response) alarm is present.
	OFF	Normal, no fault operation (when CTR LED is Green).
ACFA	Red	AC supply failure.
	OFF	Normal, no fault operation (when CTR LED is Green).
OTA	Red	One or more of the monitored temperatures is too high.
	OFF	Normal, no fault operation (when CTR LED is Green).
RFA	Red	Rectifier failure.
	OFF	Normal, no fault operation (when CTR LED is Green).
OVA	Red	System BUS Voltage is too high.
	OFF	Normal, no fault operation (when CTR LED is Green).

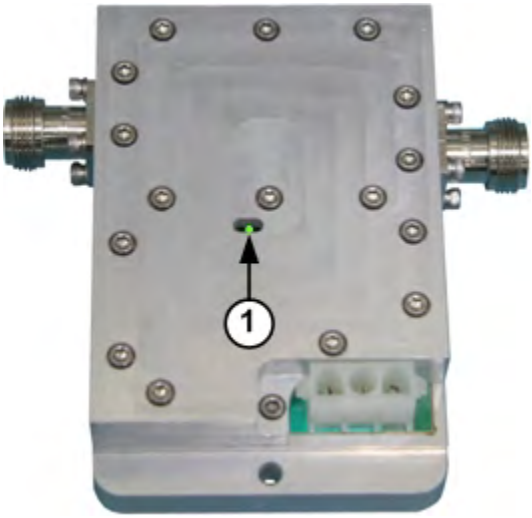
Table 5-4 BMS Circuit Breakers

Name	Rating	Circuit Breaker For
BAT CB	100A	Battery (rear panel)
SPARE	2.5A	Spare
TSC-H	5A	HB TSC and HB HPA Controllers
TSC-L	5A	LB TSC and LB HPA Controllers
HBE	10A	HBE
LBE	25A	LBE

5.4.7 High Band Low Noise Amplifier (LNA)

The LNA includes an LED, which is visible through the top cover, to indicate that the LNA has been powered on.

Figure 5-3 LNA



1) LNA Power LED Indicator

Table 5-5 LNA Power LED Indicator

LED	Color	Description
	Green	LNA is powered on.
	OFF	LNA is powered off.

5.4.8 HPA Cabinet Power Distribution Unit (HPA PDU)

The HPA cabinet PDU front panel includes two (2) LEDs, to indicate that the AC power is on. The PDU front panel also includes eleven (11) circuit breakers to turn on/off the cabinet AC power.

Figure 5-4 HPA Cabinet PDU

PICTURE TBD

1) AC Power LED Indicators

Table 5-6 HPA Cabinet PDU AC Power Status LED Indicator

LED	Color	Description
SPD1	Green	MAIN1 AC power on.
	OFF	MAIN1 AC power off.
SPD2	Green	MAIN2 AC power on.
	OFF	MAIN2 AC power off.

Table 5-7 HPA Cabinet PDU Circuit Breakers

Name	Rating	Circuit Breaker For
MAIN1 AC	40A, 3-pole	AC input from building/site electrical service panel or AC disconnect device
MAIN2 AC	40A, 3-pole	AC input from building/site electrical service panel or AC disconnect device
CB0	15A, 2-pole	HPA PS 0
CB1	15A, 2-pole	HPA PS 1
CB2	15A, 2-pole	HPA PS 2
CB3	15A, 2-pole	HPA PS 3
CB4	8A, 3-pole	Fan/blower
CB5	15A, 2-pole	HPA PS 4
CB6	15A, 2-pole	HPA PS 5
CB7	15A, 2-pole	HPA PS 6
CB8	15A, 2-pole	HPA PS 7

5.4.9 High Power Amplifier Power Supply Unit (HPA PSU)

The HPA PSU rectifier front panel includes three (3) status LEDs to indicate rectifier operation and alarm conditions.

Figure 5-5 HPA PSU Rectifier

1) HPA PSU Rectifier Status LED Indicators

Table 5-8 HPA PSU Rectifier Status LED Indicators

LED	Color	Description
Norm	Green	Rectifier is powered on and is operating under normal conditions. Note: Comm Fault is possible.
	Green Blink	Rectifier output is inhibited, preparing to deliver power, ramping up or in standby.
	Amber	Rectifier output is limited to less than fully rated output power.
	OFF	Rectifier is powered off. ACF or Fail alarm is active.
ACF	Amber	AC input is out of range and the rectifier output is powered off.
	OFF	Normal, no fault operation (when Norm LED is Green).
Fail	Red	Rectifier failure or shutdown.
	Red Blink	Communication failure with controller.
	Red Wink	Fan failure.
	OFF	Normal, no fault operation (when Norm LED is Green).

- Blink Timing shall be approximately 0.5 seconds ON and 0.5 seconds OFF.
- Wink Timing shall be approximately 0.2 seconds ON and 2 seconds OFF.

5.4.10 High Power Amplifier (HPA)

The HPA front panel includes one (1) status LED to indicate HPA operation and alarm conditions.

Figure 5-6 HPA

1) HPA Status LED Indicator

Table 5-9 HPA Status LED Indicator

LED	Color	Description
	Green	HPA is in broadcast mode and the output target has been reached.
	Green/Blue Blink	HPA is in broadcast mode and is ramping up to full power.
	Blue	HPA is in standby mode with the 30 VDC source enabled.
	Green/Red Blink	HPA is in standby mode with the 30 VDC source disabled.
	Red	HPA is in broadcast mode and alarm is present.
	OFF	HPA controller is powered off.

5.4.11 Transmission Sub-system Controller (TSC)

The TSC front panel includes one (1) status LED to indicate TSC operation and alarm conditions.

Figure 5-7 TSC

1) TSC Status LED Indicator

Table 5-10 TSC Status LED Indicator

LED	Color	Description
	Blue Blink	TSC is operational (alive).

Chapter 6

Maintenance

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6 Maintenance

6.1 Introduction

Under Construction.

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Unique Broadband Systems Ltd.

Chapter 7

Contact Information

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7 Contact Information

7.1 Limited 3 Year Warranty

UBS' standard warranty is three (3) years from the project completion date, provided that the warranty labels have not been broken. Opening any the components without the expressed, written consent of UBS will automatically void the warranty for said component.

UBS' liability for a warranty failure applies only to the equipment provided by UBS and excludes all other remedies, including, without limitation, incidental consequential damages. UBS is not responsible for any lost data, revenue, or any other consequential damages associated with a warranty or non-warranty failure.

In the event of a defect in/or failure of the UBS product, the customer shall contact UBS regarding the warranty claim. UBS is warranted to rework or repair the product at the UBS facility in Vaughan, Ontario once it has been properly returned by the customer.

To process a warranty claim or to obtain technical support, please contact UBS' Customer Service by either of the following methods:

Phone: 1-855-723-7094

Email: techsupport@uniquesys.com

7.2 Liability

The statements, specifications and instructions in this publication are believed to be correct to the best knowledge of Unique Broadband Systems Ltd. and its employees at the time of printing this manual. Unique Broadband Systems Ltd. will reserve the right to make changes to the content in this publication that reflects changes in equipment specifications and design. No liability is assumed for statements, results, or lack thereof from the use of information in this publication and for any direct or consequential damages, personal loss or injury and that all statements made herein are strictly to be used or relied on at the user's risk.

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