INNOVATIVE COMMUNICATION SOLUTIONS

INSTALLATION
AND
OPERATING MANUAL

FOR

RHBDA-PS8-0.1/25W-55-A (R)

RACK BI-DIRECTIONAL AMPLIFIER

TABLE OF CONTENTS

RHBDA OVERVIEW:

The RHBDA assembly enhances the coverage area of radio communications in buildings and RF shielded environments. The unit features low noise figure and wide dynamic range. It is based on a duplexed path configuration with sharp out of band attenuation allowing improved isolation between the receiving and transmitting paths.

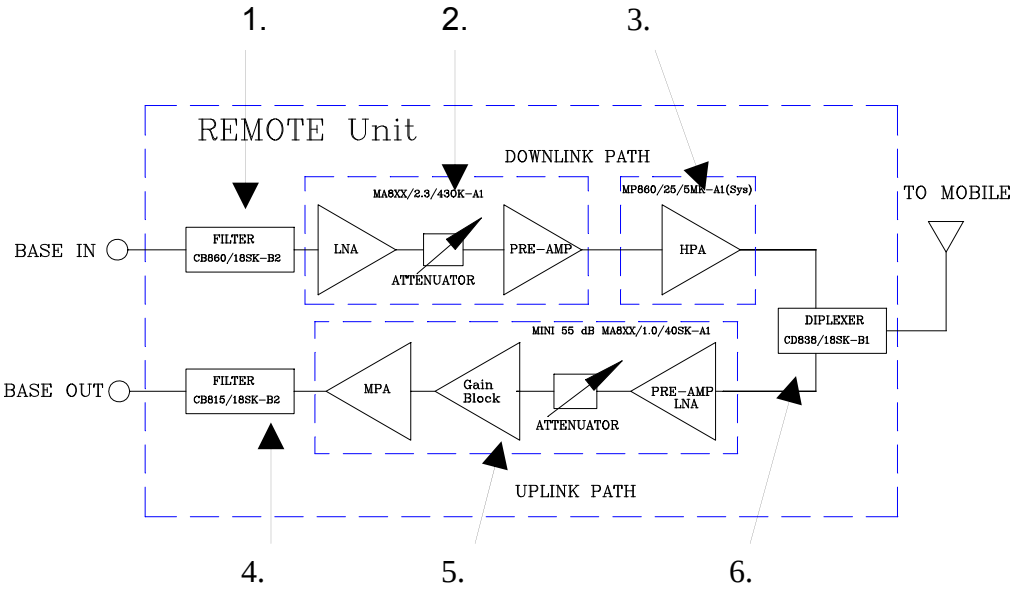
RHBDA BLOCK DIAGRAM DESCRIPTION:

Refer to Figure 1 for the following discussion.

The RHBDA Downlink path receives RF signals from a Source, amplifies the RF signal, and transmits the signal to the subscriber. The RHBDA Uplink path receives RF signals from the subscriber then amplifies the RF Signal, and sends it to the Base. The Uplink and Downlink occupy two distinct frequency bands. The frequency bands are as follows: *806-824 MHz for the Uplink and 851-869 MHz for the Downlink.* Two Filters and one diplexer isolate the Uplink and Downlink paths.

A selectable Automatic Level Control (ALC) allows for output power limiting. A variable step attenuator gives 0 – 30 dB of attenuation in 2 dB steps on the Rack Uplink and Rack Downlink paths. The use of these controls is covered in the "OPERATION" section, later in this document.

Figure 2



RHBDA BLOCK DIAGRAM

1. Downlink Filter - has a narrow bandpass and high selectivity.
2. Downlink LNA & Attenuator – 0-30 dB in 2-dB steps of attenuation on the Downlink input signal with a pre-amplifier that has 20 dB gain.
3. Downlink HPA – is a High power amplifier with an ALC circuit which offers 40dB Gain.
4. Uplink Filter - has a narrow bandpass and high selectivity.
5. Uplink LPA – is a Low power amplifier consisting of two modules, with an ALC circuit which offers 60dB Gain.
6. Mobile Diplexer - has low bandpass insertion loss and high selectivity.

ELECTRICAL SPECIFICATIONS:

Frequency Range	Uplink	: 806-824 MHz
	Downlink	: 851-869 MHz
System Pass band Gain @ min attenuation		
Downlink		: 60 dB (Typ.)
Uplink		: 60 dB (Typ.)
Variable Step Attenuator Range (2-dB steps)		
Uplink		: 0-30 dB
Downlink		: 0-30 dB
Pass band Ripple		: ±1.5 dB (Typ.)
Noise Figure @+25°C at max gain		
Uplink		: 5.0 dB (Max.)
3rd Order Intercept point		
Downlink		: +55 dBm (Typ.)
*Output Power @ 1dB Compression		
Downlink		: +44 dBm (Typ.)
*Output power per Carrier		
Uplink	Single Carrier	: +5.0 dBm
Downlink	Single Carrier	: +36.0 dBm
Input/ Output Impedance		: 50 Ohms
VSWR (Input/Output)		: 1.5: 1 (Max.)
Power Supply		: 110VAC/1.5 Amp : 220VAC/0.75 Amp : 50 to 60 Hz

**The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by minimum of 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device. (See above table for multiple carrier signal output power ratings)*

MECHANICAL SPECIFICATIONS:

Size	: 19.0 x 13.0 x 5.25 inch : (482.2 x 330.2 x 133 mm)
RF Connectors	: N-Type Female
Weight	: 23.0 Lbs. (10.45 kg.) approx.

ENVIRONMENTAL CONDITIONS:

The unit is designed for indoor applications:

Operating temperature: - 20°C to + 55°C

Storage temperature: - 50°C to + 90°C

RHBDA CONNECTIONS

The RHBDA Rack AC power is accepted through a standard 3-wire male plug (IEC-320) with phase, neutral and ground leads (See Figure 3). The AC power is wired to a high efficiency DC switching power supply which is CE and UL approved. The Rack power supply runs the amplifiers, the Power ON lamp, and Fiber Optic Transceiver. The metal enclosure of the RHBDA is connected to ground.

An optional 9-pin D-Sub connector provides failure alarm output contacts (see diagram next page) as well as an optional 12 VDC (250mA) auxiliary output.

The RF connections are made via three type “N” female connector on the back panel (See Figure 3). The RF connection on the Rack Unit labeled “MOBILE” must be connected to the antenna facing the area to be covered by the RHBDA. The RF connector labeled “UL OUT” must be connected to the RF Source Signal going to the Base. The RF connection labeled “MOBILE DL” must be connected to the RF Source Signal from the Base.

The RF connections must be made through cables with characteristic impedance of 50 ohms.

The isolation between the base station antenna and the mobile antenna should be at least 12 dB higher than the RHBDA gain. Isolation less than this value can cause gain ripple across the band. Isolation equal to or less than the RHBDA gain will give rise to oscillations which will saturate the amplifiers and possibly cause damage to the RHBDA.

Figure 3
RHBDA Mechanical Outline

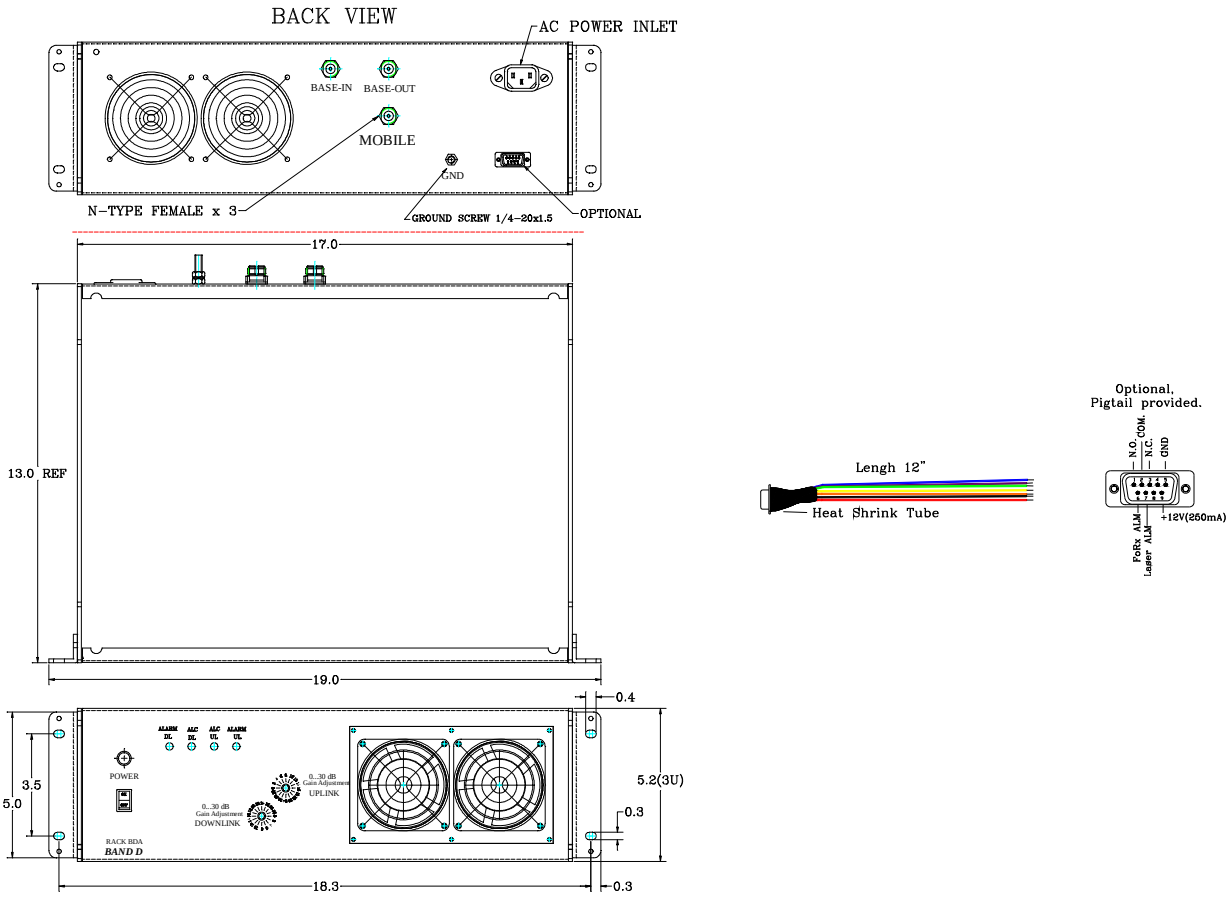
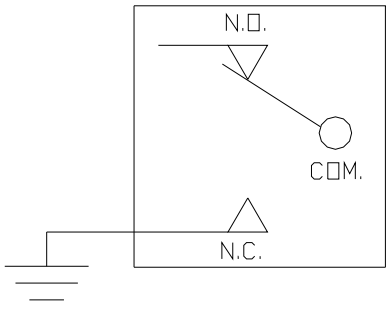


Figure 3a

Conditions for Optional Alarm

The alarm monitors current of both uplink and downlink amplifiers. An alarm condition will occur if either uplink or downlink amplifiers are over or under its current tolerance or if there is no DC power present.

(Relay Shown in Non-Alarm Condition)



RHBDA INSTALLATION

DO NOT APPLY A.C. POWER TO THE RHBDA UNTIL CABLES ARE CONNECTED TO BOTH PORTS OF THE RHBDA AND THE ANTENNAS.

1. Side the RHBDA into the 19" accessible rack. Mount the RHBDA to the rack. Using appropriate screws, attach the RHBDA to the rack at the four mounting holes on the Front panel.

2. Ensure that the isolation between the donor antenna and the service antenna is at least 12 dB greater than the RHBDA gain. **(Use the higher of the Uplink and Downlink gains reported on the RHBDA test data sheet).**

3. Connect the cable from the service antennas to the RHBDA connector labeled "MOBILE" and connect the cable going to the Base RF Signal Source to the RHBDA connector labeled "UL OUT", and the cable coming from the Base RF Signal Source to the RHBDA connector labeled "DL IN".

4. Verify that all attenuation settings are positioned at 30 dB.

5. Connect the AC power cord to the Rack Unit. Turn the power switch to the "ON" position. Verify that each **Green** "Power ON" lamp, Laser alarms LED's are illuminated.

Installation of the Rack RHBDA's is now complete. To adjust the gain controls to suit the specific signal environment, refer to the next section of the manual.

Note: For repeat installations of existing equipment, make sure the attenuation is positioned to its maximum setting (30 dB). After verification of the attenuation, follow the above steps starting with step 1.

RHBDA OPERATION

Refer to figure 3 for adjustment access location and label.

Variable Step Attenuator

The RHBDA's gain can be reduced on the Rack Unit by up to 30 dB on the Uplink and Downlink, in 2 dB steps using the variable step attenuators. Gain adjustment is made with rotary switches accessible via the Front panel on the RHBDA enclosure. Arrows on the shafts of these switches point to the value of attenuation selected. RHBDA gain can be determined by subtracting the attenuation value from the gain reported on the RHBDA Test Data Sheet for that side of the unit. The attenuators are labeled for Uplink and Downlink.

ALC (Automatic Level Control)

To minimize intermodulation products, each amplifier in the RHBDA contains an ALC feedback loop. The ALC circuit senses the output power and limits it to the factory preset level of +5 dBm for the Uplink and +36 dBm for the Downlink. Two red indicator lamps are located on the Front panel which illuminate when the output power exceeds the ALC set point.

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To establish proper operating gain on the Rack Unit, start with the Downlink. Observe the red indicator lamp on the front panel. Units are shipping with maximum attenuation. Decrease attenuation one step at a time until the lamp is lit. Then, using the Downlink step attenuator, increase the attenuation until the lamp goes off. The Uplink ALC function is to avoid overloading the fiber optic transceiver. Setting the attenuation of the Uplink will depend on minimum and maximum distance from the mobile to sever antennas. The level indicator is accurate to +/- 0.4 dB of the ALC set point.

Operation of the RHBDA-PS8-0.1/25W-55-A at maximum gain (Minimum Attenuation) with greater than -10 dBm average power incident on the MOBILE port may cause damage to the RHBDA.

Figure 4
Rack Front Panel Adjustment

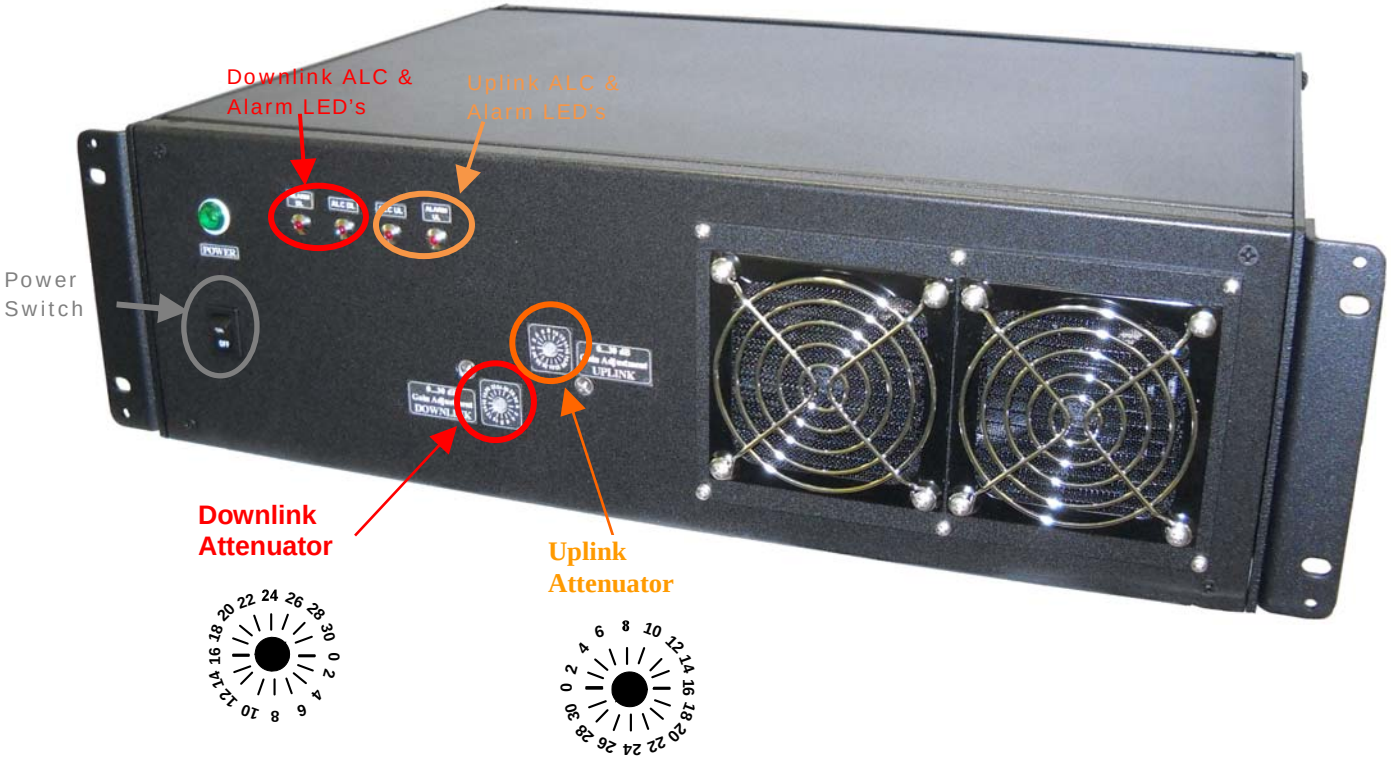
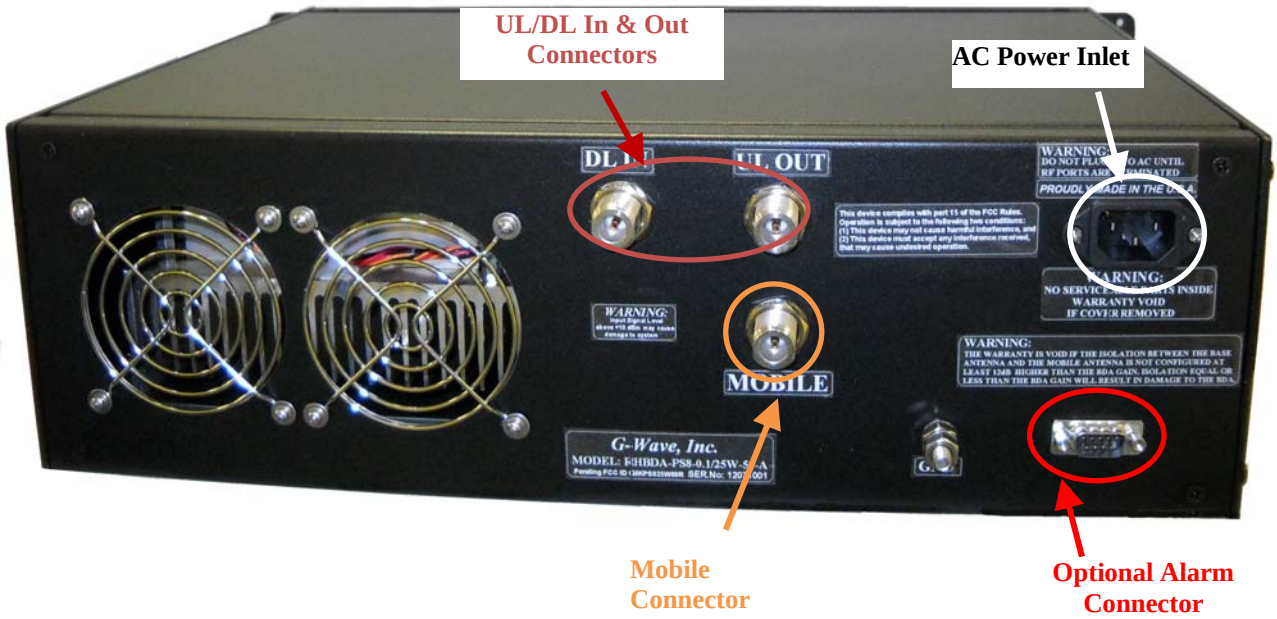


Figure 4a
Rack Back Panel Connections



RF EXPOSURE WARNING

The antenna used for this transmitter must be fixed-mounted on outdoor permanent structures. In order to satisfy the FCC RF exposure requirements, the BDA/antenna installation must comply with the following:

The downlink indoor antenna (Omni type or similar directional antenna) must be installed so as to provide a minimum separation distance of 0.35 meters (35 cm) between the antenna and persons within the area. (This assumes a typical antenna with Unity gain (VSWR ≤ 1.5:1, Zo= 50 ohms, and a cable attenuation of between 2-10 dB)

The uplink outdoor antenna (Yagi type or similar directional antenna) must be installed so as to provide a minimum separation distance of 0.35 meters (35 cm) between the antenna and persons within the area. (This assumes a typical antenna with maximum gain of [10 dBi, VSWR ≤ 1.5:1, Zo= 50 ohms, and a cable attenuation of between 2-10 dB).

DIAGNOSTICS GUIDE

The BDA provides long term, care-free operation and requires no periodic maintenance. There are no user-serviceable components inside the BDA. This section covers possible problems that may be related to the installation or operating environment.

a. Gain Reduction

Possible causes: Bad RF cables and RF connections to antennas, damaged antennas.

b. Excessive Intermodulation or Spurious

Possible causes:
Amplifier oscillation caused by insufficient isolation. The isolation between two antennas is given by the equation:
Isolation = 92.5 + 20 Log (F x D) – Gt – Gr
Where:
F = frequency (GHz) Gt = transmit antenna gain (in the direction of the receive antenna)
D = separation (Km) Gr = receive antenna gain (in the direction of the transmit antenna)

For example, at the PS8 frequencies, the antenna isolation at 100 m separation is about 71 dB for Omni-directional antennas (0 dB gain). To increase isolation, the antennas should have higher directivity and must be pointed away from each other.

c. Occasional Drop-out of some Channels

Possible causes: One channel with very strong power dominates the RF output of the amplifier.

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