Redefining Wireless Technology

INSTALLATION
AND
OPERATING MANUAL

FOR

RBDA-PCS-1/25W-90-A

INDOOR REPEATER

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BDA OVERVIEW:

The BDA assembly extends 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.

BDA CIRCUIT DESCRIPTION:

Refer to figure 1 for the following discussion.

The BDA Downlink path receives RF signals from the base station and amplifies and transmits them to the subscriber. The BDA Uplink path receives RF signals from the subscriber and amplifies and transmits them to the base station. The Uplink and Downlink occupy two distinct frequency bands. For example, the PCS/A frequency bands are as follows: *1850-1865 MHz for the Uplink and 1930-1945 MHz for the Downlink.* Two diplexers isolate the paths and route each signal to the proper amplifying channel.

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. The use of these controls is covered in the "OPERATION" section, later in this document.

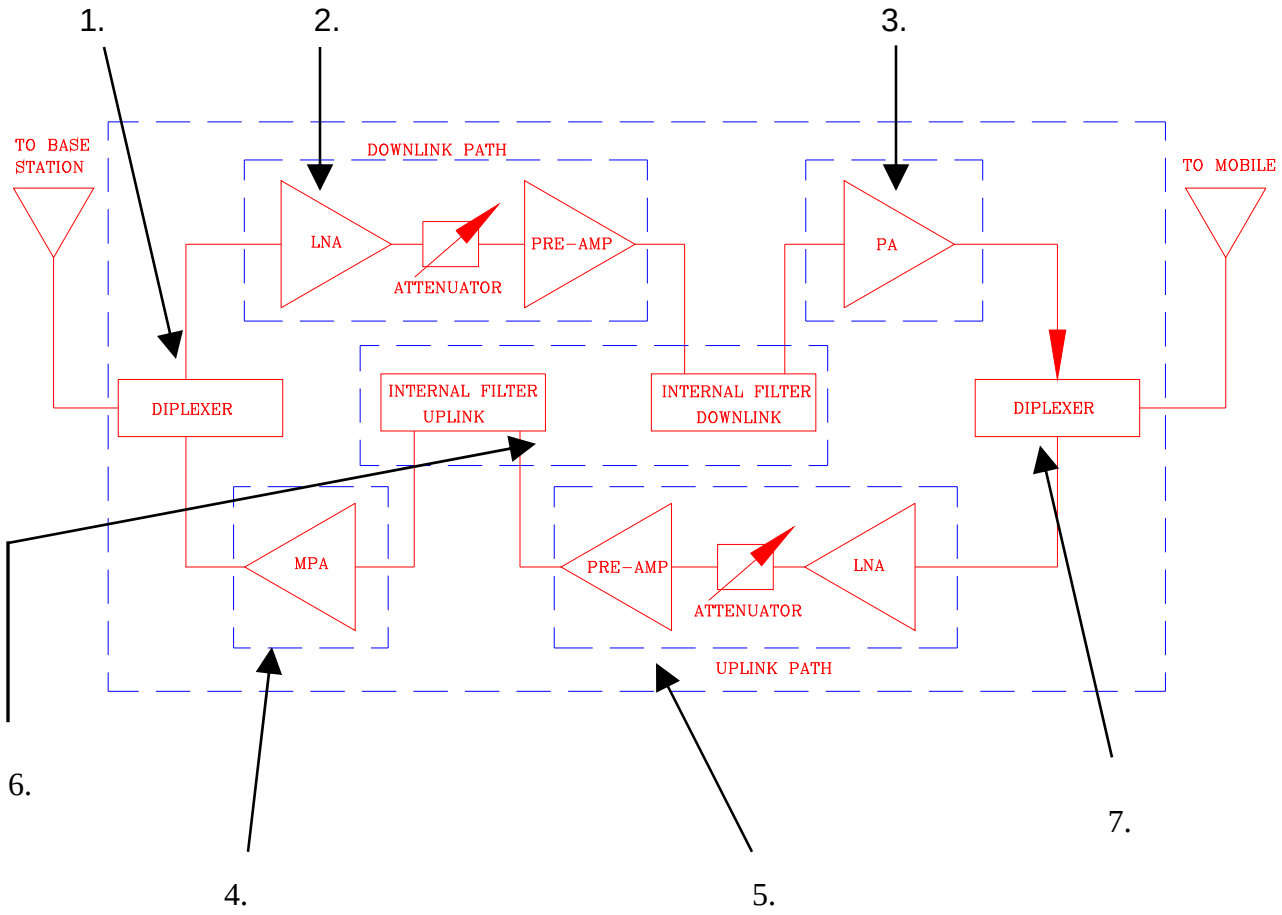
FCC INFORMATION for USER:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by G-Wave, Inc. could void the user's authority to operate this equipment

Figure 1



BDA Block Diagram

1. Uplink Diplexer - has low bandpass insertion loss and high selectivity

2. Downlink Pre-amp - is a low noise amplifier that drives the Downlink PA and offers 46dB Gain

3. Downlink PA – is a power amplifier with an ALC circuit which offers 43dB Gain

4. Uplink MPA – is a medium power amplifier with an ALC circuit which offers 43dB Gain

5. Uplink Pre-amp - is a low noise amplifier that drives the Uplink MPA and offers 46dB Gain

6. Filters used on High-Gain Repeaters (90dB) to provide better isolation between Tx & Rx frequencies and to aid the diplexer rejection.

7. Downlink Tx filter is enhanced for High Power applications, preventing arching when the power amplifier approaches the 1dB compression point.

ELECTRICAL SPECIFICATIONS:

Frequency Range		: See Table
Pass Band Gain @ min attenuation		: 90 dB (typ.)
Variable Step Attenuator Range (2-dB steps)		: 0-30 dB
Pass band Ripple		: ±1.5 dB (typ)
Noise Figure @+25°C at max gain		: 5.0 dB max.
3rd Order Intercept point		
Uplink		: +45 dBm (typ)
Downlink		: +55 dBm (typ)
*Output Power @ 1dB Compression		
Uplink		: +33 dBm (typ)
Downlink		: +44 dBm (typ)
*Maximum Output power per Carrier		
Uplink	Single Carrier	: +25.0 dBm
	Two Carriers	: +20.25 dBm
	Three Carriers	: +18.25 dBm
Downlink	Single Carrier	: +37.0 dBm
	Two Carriers	: +33.25 dBm
	Three Carriers	: +30.25 dBm
Maximum Input power per Carrier @ Max Gain		
Uplink	Single Carrier	: -55 dBm
	Two Carriers	: -60 dBm
	Three Carriers	: -62 dBm
Downlink	Single Carrier	: -43 dBm
	Two Carriers	: -47 dBm
	Three Carriers	: -50 dBm
Isolation between Up/Down Link		: 105 dB min.
Input/ Output Impedance		: 50 Ohms
VSWR (Input/Output)		: 1.5: 1 max.
Power Supply		: 110VAC/1.3 Amp : 240VAC/0.60 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 3.75 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)*

Table 1

Frequency Band	Downlink Frequency Ranges	Uplink Frequency Ranges
PCS A	1930-1945 MHz	1850-1865 MHz
PCS B	1950-1965 MHz	1870-1885 MHz
PCS C	1975-1990 MHz	1895-1910 MHz
PCS D	1945-1950 MHz	1865-1870 MHz
PCS E	1965-1970 MHz	1885-1890 MHz
PCS F	1970-1975 MHz	1890-1895 MHz

** Other contiguous or non contiguous blocks are available upon request (Example: PCS AD, PCS EF…, AC, BE etc)*

MECHANICAL SPECIFICATIONS:

Size	: 19.0 x 13.0 x 5.25 inch (483 x 330 x 133 mm)
Weight	: 30 Lbs. (13.6kg.) approx.

ENVIRONMENTAL CONDITIONS:

The unit is designed for outdoor applications:

Operating temperature: - 20°C to + 50°C

Storage temperature: - 50°C to + 90°C

BDA CONNECTIONS

The BDA AC power is accepted through a 3-wire male plug with phase, neutral and ground leads. The AC power is wired to a high efficiency DC switching power supply which is CE and UL approved. The power supply runs the amplifiers and the Power-On lamp. The metal enclosure of the BDA is connected to ground.

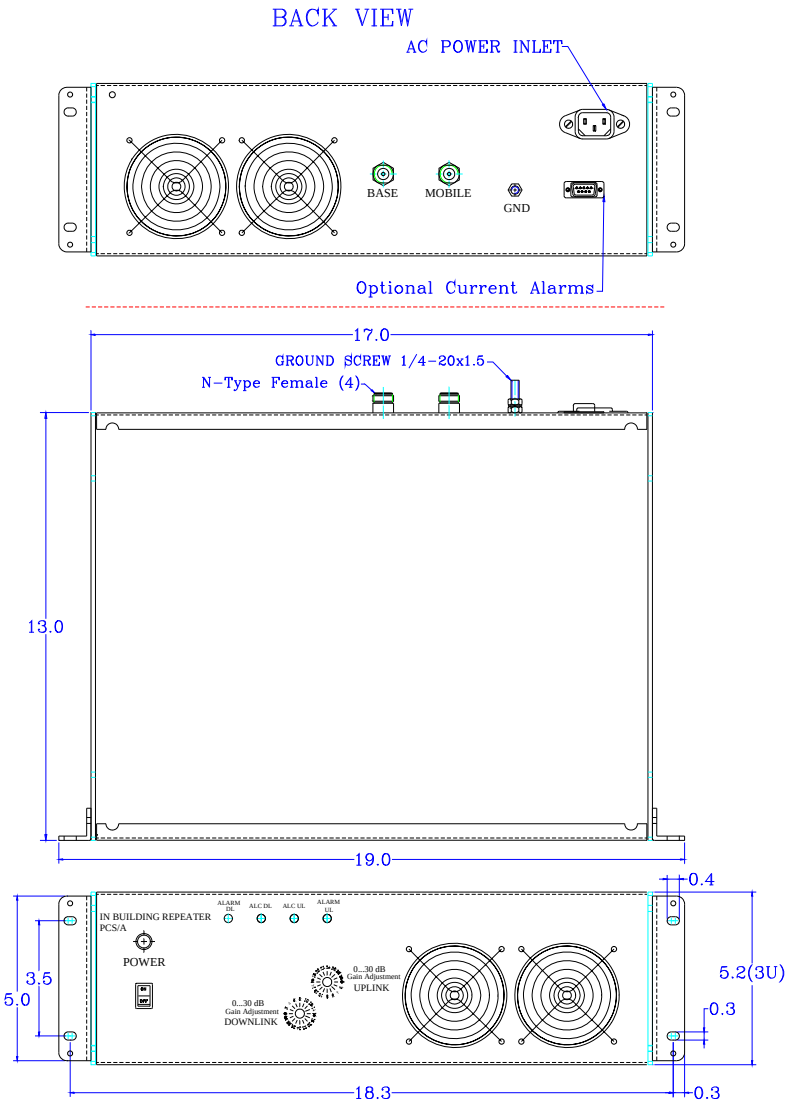
An optional 7-pin circular connector provides failure alarm output contacts as well as a 12 VDC (250mA) auxiliary output.

The RF connections are made via two type “N” female connectors. The RF connector labeled “BASE” must be connected to the antenna pointing towards the base station. The RF connection labeled “MOBILE” must be connected to the antenna facing the area to be covered by the BDA.

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 BDA gain. Isolation less than this value can cause gain ripple across the band. Isolation equal to or less than the BDA gain will give rise to oscillations which will saturate the amplifiers and possibly cause damage to the BDA.

Figure 2



BDA Mechanical Outline

OUTDOOR BDA INSTALLATION PROCEDURE

IMPORTANT: DO NOT APPLY A.C. OR DC POWER TO THE BDA UNTIL CABLES ARE CONNECTED TO BOTH PORTS OF THE BDA AND THE ANTENNAS.

1. Mount the BDA on the structure with the RF connectors pointing DOWN. Using appropriate screws and anchors, attach the BDA to the structure using the six mounting holes on the side flanges.

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

3. Connect the cable from the donor antenna to the BDA connector labeled “BASE” and the cable from the service antennas to the BDA connector labeled “MOBILE”.

4. Open the access door on the BDA and verify that the Uplink and Downlink ALC switches are in their factory preset “ON” positions and attenuation is positioned to its maximum setting.

5. Connect the AC power cord to the BDA and then to the power source. Turn the power switch to its “ON” position. Verify that the “Power On” indicator is lit. Close the access door.

Installation of the BDA is now complete. To adjust the gain controls to suit the specific signal environment, refer to “Outdoor BDA Operation”.

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.

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 antenna) must be installed so as to provide a minimum separation distance of 0.36 meters (36 cm) between the antenna and persons within the area. (This is calculated with an antenna that has a maximum gain of [5 dBi, 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 0.29 meters (29 cm) between the antenna and persons within the area. (This is calculated with an antenna that has a maximum gain of [15 dBi, VSWR >?> 1.5:1, Zo= 50 ohms, and a cable attenuation of between 2-10 dB).

BDA OPERATION

Variable Step Attenuator

BDA gain can be reduced by up to 30 dB in 2 dB steps using the variable step attenuator (Figure 3). Gain adjustment is made with rotary switches accessible via the access door on the BDA enclosure. Arrows on the shafts of these switches point to the value of attenuation selected. BDA gain can be determined by subtracting the attenuation value from the gain reported on the BDA 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, the Uplink amplifier and the Downlink amplifier in the BDA contain an ALC feedback loop (Figure 5). The ALC circuit senses the output power and limits it to the factory preset level of +25 dBm on the Uplink and +37 dBm on the Downlink.

The ALC function has a red indicator lamp located on Panel adjustment (See Figure 5), the LED's illuminate when output power meets or exceeds the ALC set point.

To establish proper operating gain on the Uplink and Downlink sides, start with the Downlink. Observe the red indicator lamp on the Downlink 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. Repeat the process for the Uplink. The level indicator is accurate to +/- 0.4 dB of the ALC set point. **Note**: ***Operation of the BDA in the alarm condition will void the warranty, and output power should be immediately reduced using the variable step attenuator.***

Operation of RBDA-PCS-1/25W-90-A at maximum gain with greater than -50 dBm average power incident on the MOBILE port or greater than -40 dBm average power incident on the BASE port can cause damage to the BDA.

Figure 3
Variable Gain Adjustment Access

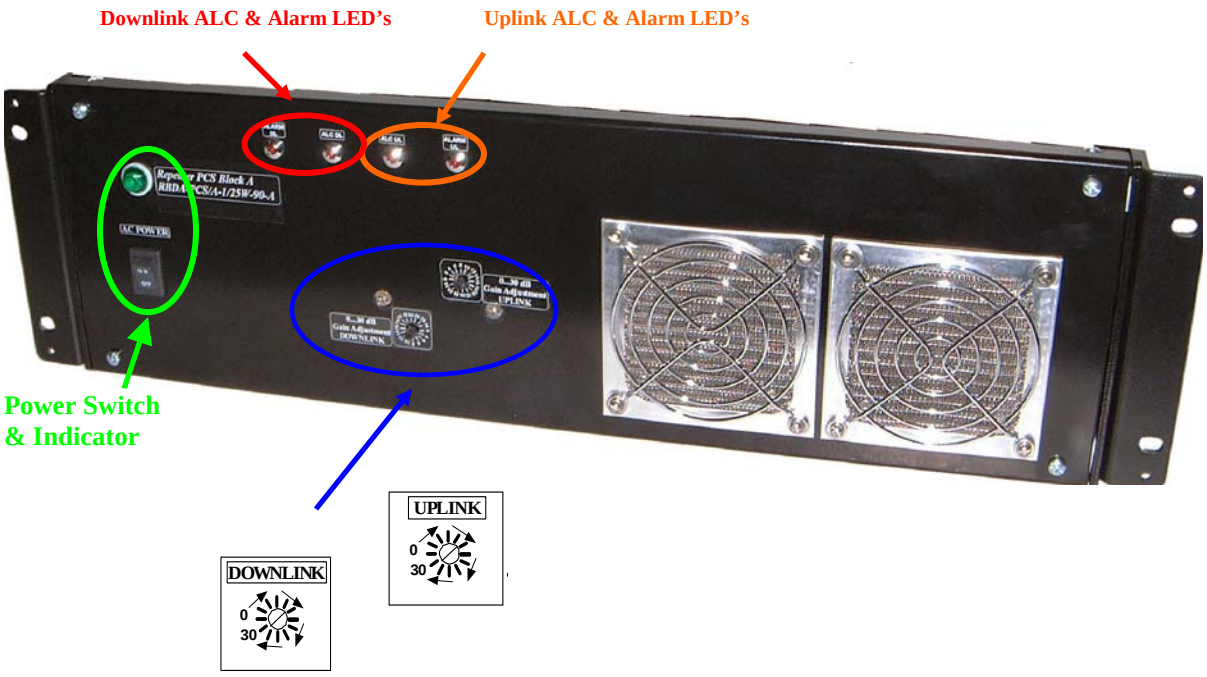


Figure 4
Back Panel

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 or 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)
D = separation (Km)
Gt = transmit antenna gain (in the direction of the receive antenna).
Gr = receive antenna gain (in the direction of the transmit antenna).

For example, at the PCS frequencies, the antenna isolation at 100 m separation is about 78 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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