



# INSTALLATION AND OPERATING MANUAL

FOR

**BDA-XXX-1/1W-60-A**

**BI-DIRECTIONAL AMPLIFIER**



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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.

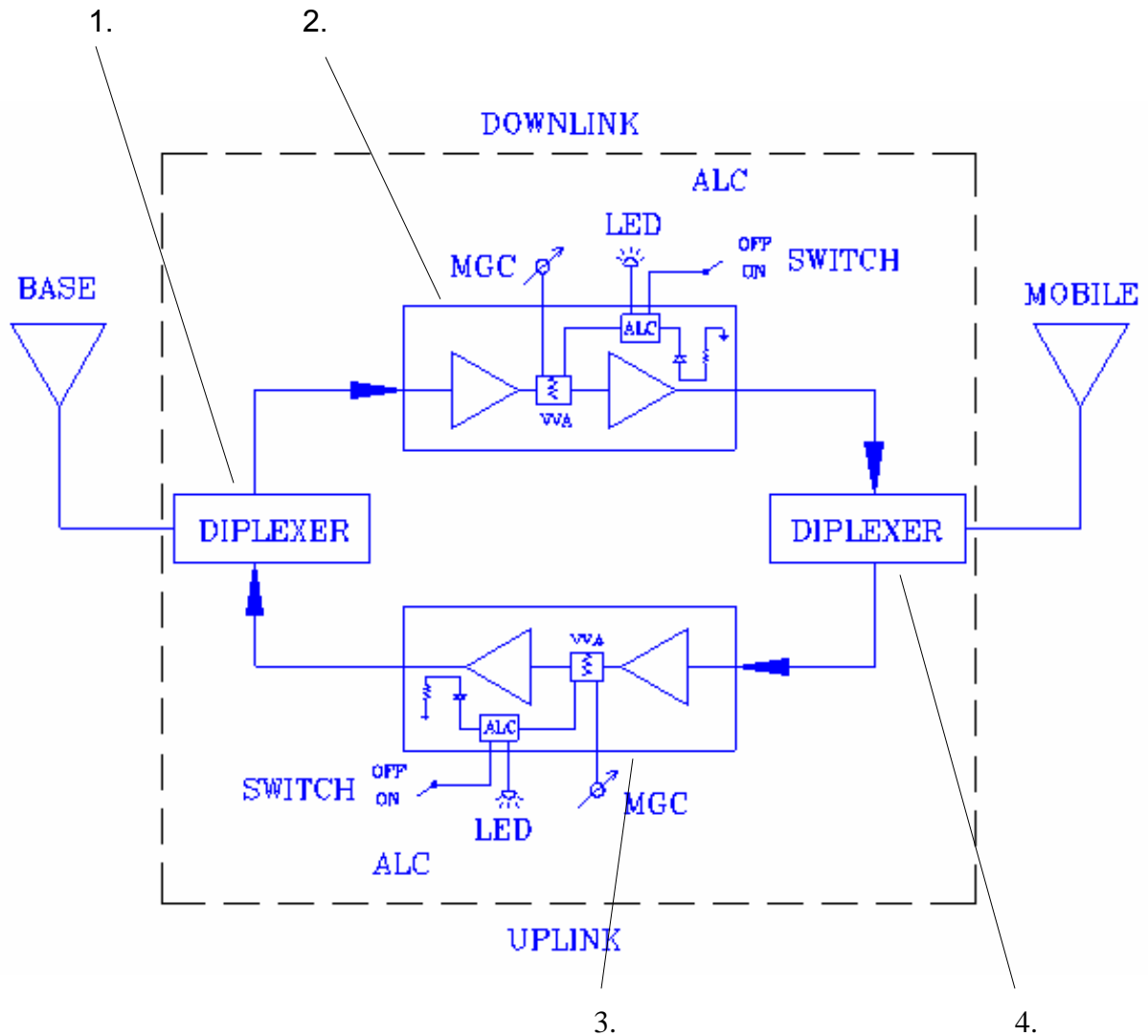
## **BDA BLOCK DIAGRAM DESCRIPTION:**

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 SMR frequency bands are as follows: *806-821 MHz for the Uplink and 851-866 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 Manual Gain Control (MGC) provides continuous control of amplifier gain. The use of these controls is covered in the "OPERATION" section, later in this document.

**Figure 1**



**BDA BLOCK DIAGRAM  
BDA-XXX-1/1W-60-A**

1. Up-Link Diplexer - has low bandpass insertion loss and high selectivity
2. Down-Link amp - is a low noise amplifier with an ALC circuit which offers 45dB Gain
3. Up-Link amp - is a low noise amplifier with an ALC circuit which offers 45dB Gain
4. Down-Link Diplexer - has low bandpass insertion loss and high selectivity

## ELECTRICAL SPECIFICATIONS:

Frequency Range	: See Table 1
Pass band Gain @ min attenuation	: 60 dB minimum
Manual Gain Control Range (continuous)	: 15 dB minimum
Pass band Ripple	: ±1.5 dB (typ)
Noise Figure @+25°C at max gain	: 5.0 dB max
3rd Order Intercept point <i>Uplink</i>	: +45 dBm (typ)
<i>Downlink</i>	: +45 dBm (typ)
*Output Power @ 1dB Compression <i>Uplink</i>	: +32 dBm (typ)
<i>Downlink</i>	: +32 dBm (typ)
*ALC Factory Set Point <i>Uplink</i>	: +25 dBm
<i>Downlink</i>	: +25 dBm
Isolation between Up/Down Link	: 80 dB min
Input/ Output Impedance	: 50 Ohms
VSWR (Input/Output)	: 1.5: 1 max
Power Supply	: 110VAC/0.80Amp : 240VAC/0.40 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 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.*

**Table 1**

<b>Frequency Band</b>	<b>Downlink Frequency Ranges</b>	<b>Uplink Frequency Ranges</b>
SMR	851-866 MHz	806-821 MHz
CELL A	869-880 MHz	824-835 MHz
CELL B	880-894 MHz	835-849 MHz
CELL AB	869-894 MHz	824-849 MHz
GSM F	935-960 MHz	890-915 MHz
GSM H	947-960 MHz	902-915 MHz
GSM L	935-947 MHz	890-902 MHz
NPS PAC	866-869 MHz	821-824 MHz
2PG	929-942 MHz	898-904 MHz
2PGN	929-942 MHz	900-903 MHz
PS8	851-869 MHz	806-824 MHz
PS9	935-941 MHz	896-902 MHz

## **MECHANICAL SPECIFICATIONS:**

Size	: 11.2 x 9.7 x 6.0 inch : (284.5 x 246.4 x 152.4 mm)
RF Connectors	: N-type Female
Weight	: 13.5 Lbs. (6.2kg.) approx.

## **ENVIRONMENTAL CONDITIONS:**

The unit is designed for indoor 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 standard 3-wire male plug (IEC-320) 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.

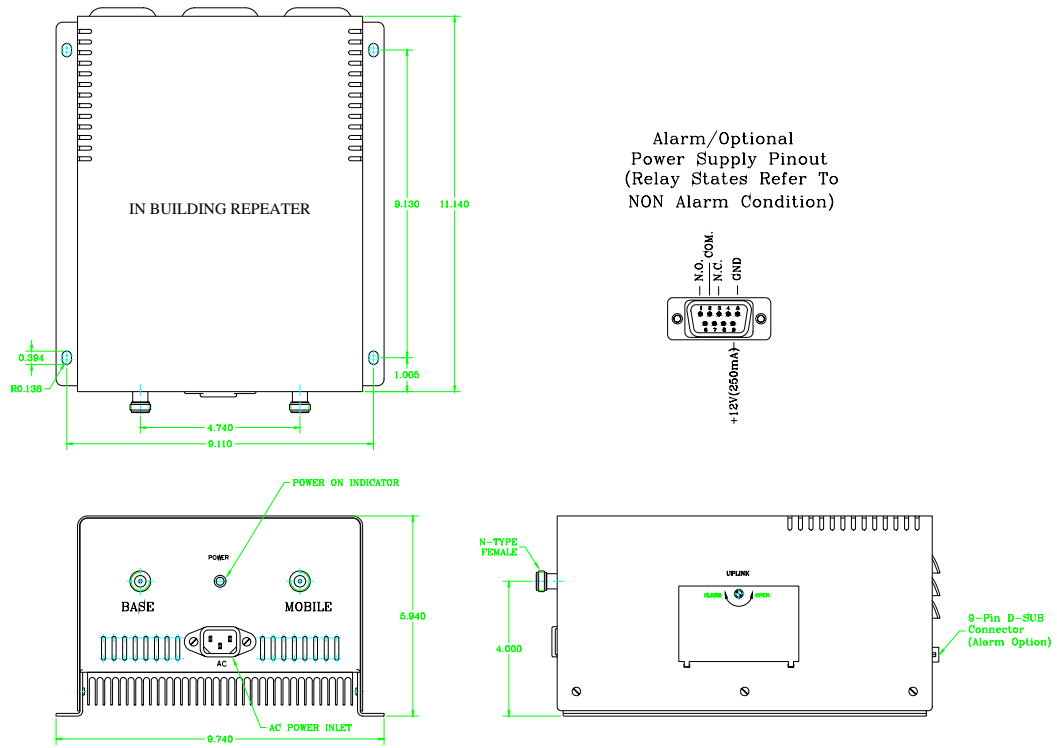
A 9-pin D-Sub connector provides failure alarm output contacts (see diagram next page) as well as an optional 12 VDC (250mA) auxiliary output.

The RF connections are made via 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



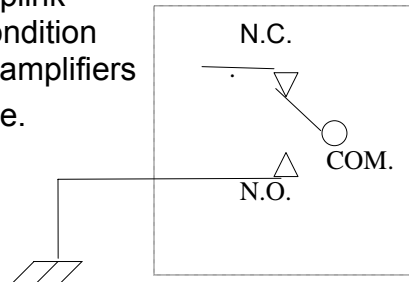
## BDA Mechanical Outline

# Figure 2a

### Optional Alarm Conditions

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.

(Relay Shown in Non-Alarm Condition)





## **RF EXPOSURE WARNING**

In order to satisfy the FCC RF exposure requirements, the BDA/antenna installation must comply with the following:

The outdoor antenna (Yagi type or similar directional antenna) must be installed so as to provide a minimum separation distance of 0.3 meters (30 cm) between the antenna and persons within the area. (This assumes a typical antenna with gain of [10.1 dBi, VSWR  $\leq$  1.5:1,  $Z_0=$  50 ohms, and a cable attenuation of between 1-10 dB).

The indoor antenna (omni directional) must be installed so as to provide a minimum separation distance of 0.2 meters (20 cm) between the antenna and persons within the area. (This assumes a typical wide-beam type antenna with gain of 0-2 dBi, VSWR  $\leq$  2:1,  $Z_0=$  50 ohms, and a cable attenuation of between 1-10 dB).

## **BDA INSTALLATION**

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

1. Mount the BDA on the wall with the RF connectors pointing DOWN. Using appropriate screws and anchors, attach the BDA to the wall at the four 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 adjustment access panels on the sides of the BDA and verify that both of the ALC switches are in their factory preset "ON" positions. Close the panels.
5. Connect the AC power cord to the BDA and then to the power source. Verify that the "Power ON" lamp is illuminated.

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

## **BDA OPERATION**

Refer to figure 3 for adjustment access location and label.

### **ALC (Automatic Level Control)**

To minimize intermodulation products, each amplifier in the BDA contains an ALC feedback loop. The ALC circuit senses the output power and limits it to the factory preset level of +25 dBm.

ALC function is selected with an on/off toggle switch located on each amplifier and accessible via the adjustment access panels located on the sides of the BDA enclosure (Left, or “BASE” side is Downlink, right, or “MOBILE” side is Uplink). A red indicator lamp located on each amplifier illuminates when output power exceeds the ALC set point. The indicator is functional regardless of the position of the ALC switch.

Units are shipped with the ALC switch in the “ON” position.

### **MGC (Manual Gain Control)**

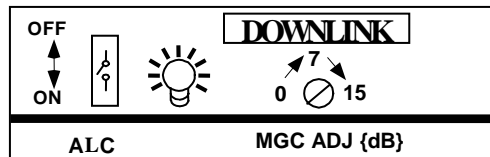
BDA gain can be reduced by approximately 15 dB with screwdriver-adjustable potentiometers located on each amplifier. The potentiometers accept a 3/32” slotted screwdriver (provided), and are accessible via the adjustment access panels located on the sides of the BDA enclosure (Left, or “BASE” side is for Downlink, right, or “MOBILE” side is for Uplink).

When ALC operation is selected, the MGC remains the “master” gain control. **MGC cannot raise ALC set point above its factory preset level.**

If operation below the 25 dBm ALC set point is desired, BDA gain can be reduced by turning the MGC potentiometer clockwise until the light goes off.

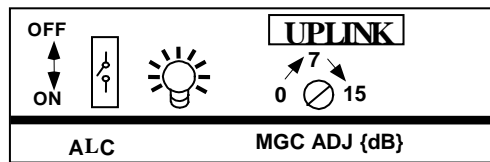
**Operation of BDA-XXX-1/1W-60-A at maximum gain with greater than -25 dBm average power incident on either BASE or MOBILE port can cause damage to the BDA.**

**Figure 3**



**Downlink's Adjustment Access Panel and Label**

**Figure 4**



**Uplink's Adjustment Access Panel and Label**

## **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:

$$\text{Isolation} = 92.5 + 20 \text{ Log } (F \times D) - G_t - G_r$$

Where:

F = frequency (GHz)

D = separation (Km)

G<sub>t</sub> = transmit antenna gain (in the direction of the receive antenna).

G<sub>r</sub> = receive antenna gain (in the direction of the transmit antenna).

For example, at the SMR 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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