Redefining Wireless Technology

INSTALLATION
AND
OPERATING MANUAL

FOR

BDA-XXX-1/10W-X0-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.

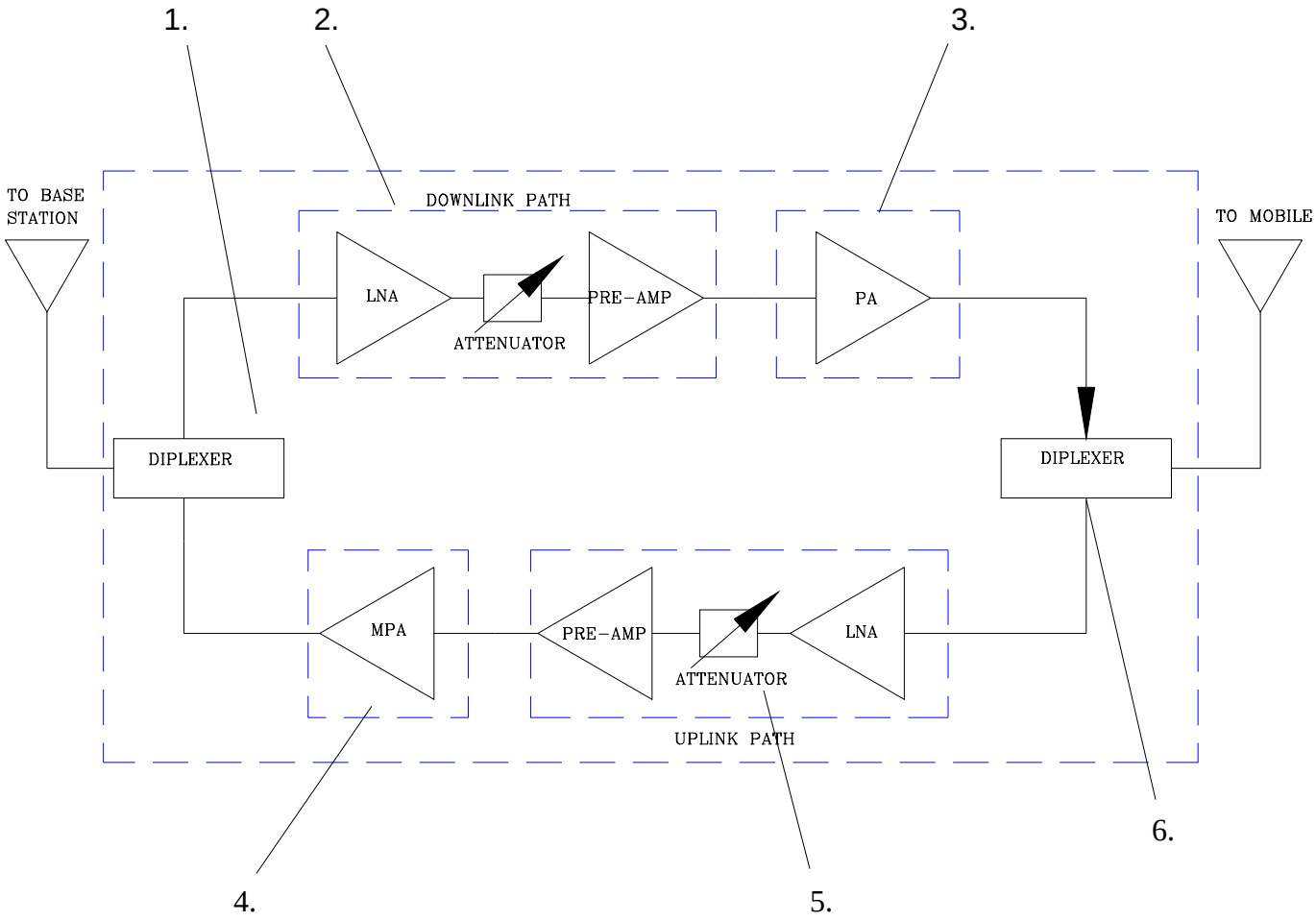
BDA BLOCK DIAGRAM DESCRIPTION:

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 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.

Figure 1



BDA BLOCK DIAGRAM
BDA-XXX-1/10W-X0-A

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

2. Downlink Pre-amp - is a low noise amplifier that drives the Downlink HPA and offers 45dB Gain, 50 dB gain for -90 models.

3. Downlink PA – is a high power amplifier with an ALC circuit which offers 43dB Gain, 48 dB gain for -90 models.

4. Uplink MPA – is a medium power amplifier with an ALC circuit which offers 43dB Gain, 48 dB gain for -90 models.

5. Uplink Pre-amp - is a low noise amplifier that drives the Uplink MPA and offers 45dB Gain, 50 dB gain for -90 models.

6. 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 1
Pass band Gain @ min attenuation	: 80 dB min, 90 dB min for -90 Models
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
20 dB Bandwidth	
Uplink	: 8 MHz
Downlink	: 20 MHz
3rd Order Intercept point	
Uplink	: +45 dBm (typ)
Downlink	: +50 dBm (typ)
*Output Power @ 1dB Compression	
Uplink	: +32 dBm (typ)
Downlink	: +40 dBm (typ)
*ALC Factory Set Point	
Uplink	: +25 dBm
Downlink	: +32 dBm
Isolation between Up/Down Link	: 100 dB min
Input/ Output Impedance	: 50 Ohms
VSWR (Input/Output)	: 1.5: 1 max
Power Supply	: 110VAC/1.20Amp : 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 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

Frequency Band	Downlink Frequency Ranges	Uplink Frequency Ranges
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	: 13.5 x 12.5 x 5.6 inch : (343 x 317.5 x 142.3 mm)
RF Connectors	: N-type Female
Weight	: 20.9 Lbs. (9.5kg.) 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.

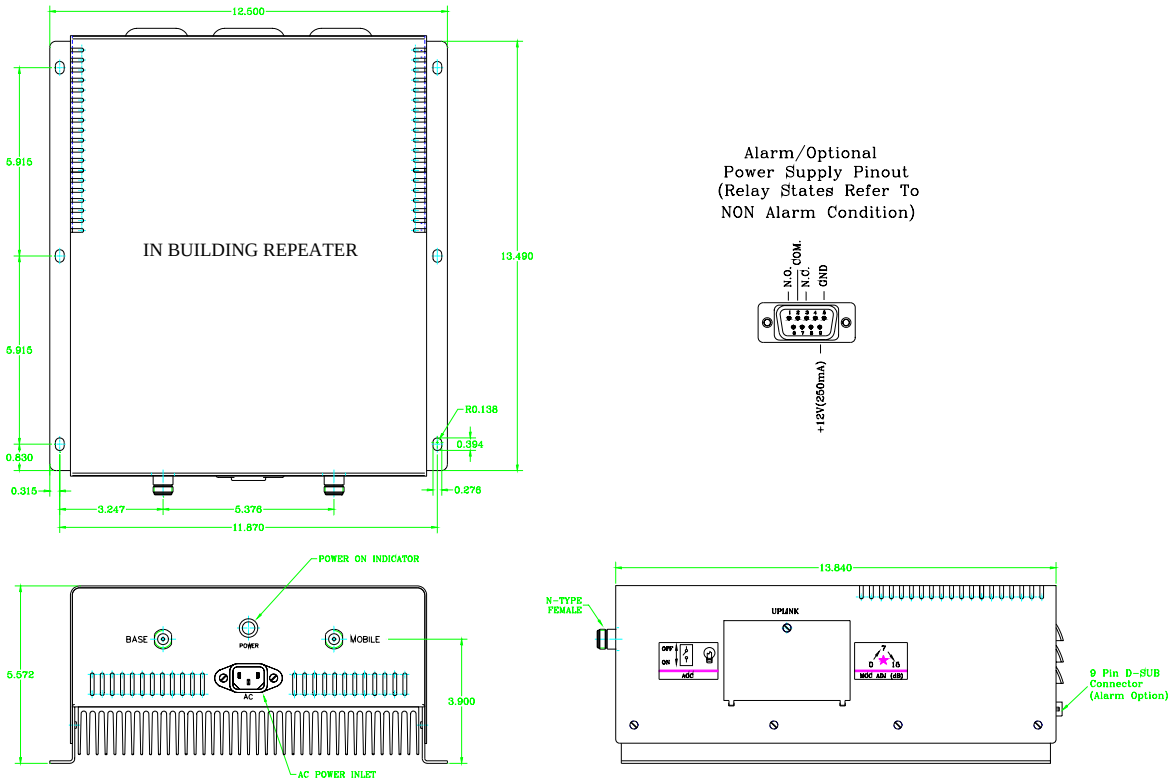
A 9-pin D-Sub connector provides failure alarm output contacts (see diagram next page) as well as an optional 12 VDC (250mA) auxiliary output.

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



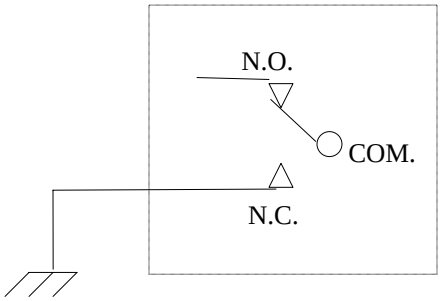
BDA Mechanical Outline

Figure 2a

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 or if there is no DC power present.

(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 ≤ 1.5:1, Zo= 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 ≤ 2:1, Zo= 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.

Note: For repeat installations of existing equipment, make sure the ALC switches are in the “ON” position and attenuation is positioned to its maximum setting (30 dB). After verification of ALC switches and attenuation, follow the above steps starting with step 1.

BDA OPERATION

Refer to Figure 3 & 4 for adjustment access location and label.

Variable Step Attenuator

BDA gain can be reduced by up to 30 dB in 2 dB steps using the variable step attenuator. 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, 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 on the Uplink and +32 dBm on the Downlink.

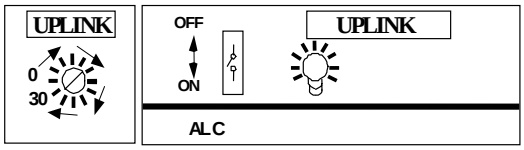
ALC function is selected with on/off toggle switches located on each amplifier and accessible via the access door on the BDA enclosure. A red indicator lamp located on each amplifier illuminates when output power meets or exceeds the ALC set point. The indicator is functional regardless of the position of the ALC switch.

Units are shipped with both ALC switches in the “ON” position. To ensure distortion-free operation limited to the set point, keep the ALC’s turned ON.

To establish proper operating gain on the Uplink and Downlink sides, start with the Uplink. Verify that the ALC switch is in the “ON” position. Observe the red indicator lamp on the Uplink amplifier. Units are shipping with maximum attenuation. Decrease attenuation one step at a time until the lamp is lit. Then, using the Uplink step attenuator, increase the attenuation until the lamp goes off. Repeat the process for the Downlink. The level indicator is accurate to +/- 0.4 dB of the ALC set point.

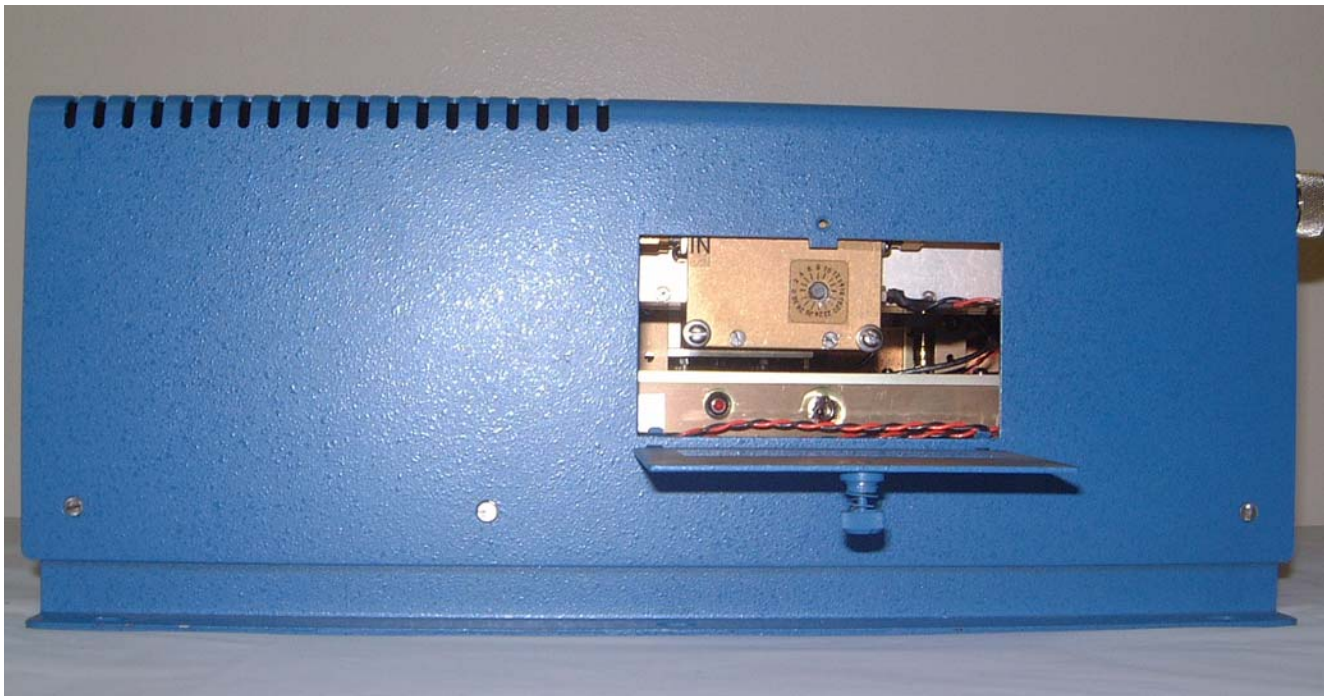
Operation of BDA-XXX-1/10W-X0-A at maximum gain with greater than -43 dBm average power incident for -80 Models and -53 dBm average power incident for -90 models on the MOBILE port or -38 dBm average power incident for -80 Models and -48 dBm average power incident for -90 models on the BASE port can cause damage to the BDA.

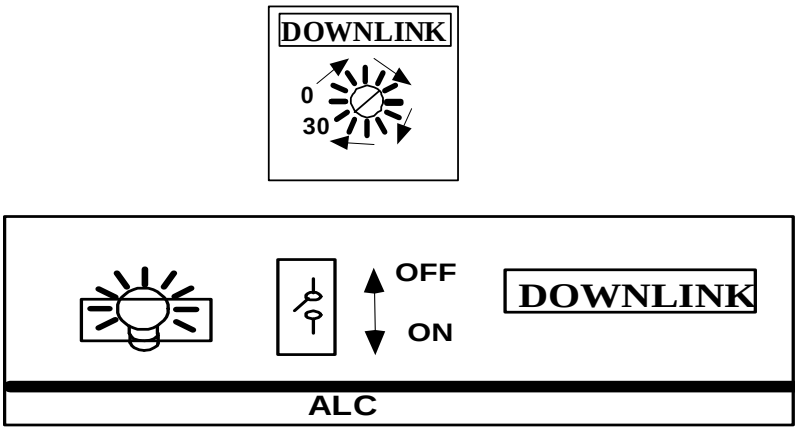
Figure 3



Adjustment Access Panel and Label

Figure 4





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:
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 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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