INSTALLATION
AND
OPERATING MANUAL

FOR

BDA-1XXX-.X/.XW-XX-AX

MINI-BI-Directional Amplifier

TABLE OF CONTENTS

PARAGRAPH	PAGE NO
Mini-BDA OVERVIEW	3
Mini-BDA BLOCK DIAGRAM DESCRIPTION	3
Mini-BDA OPTIONS	3
Mini-BDA BLOCK DIAGRAM DRAWING (Figure 1)	4
ELECTRICAL SPECIFICATIONS	5
FREQUENCY RANGES (Table 1)	6
SYSTEM SPECIFICATIONS (Table 2)	6
MECHANICAL CONNECTIONS	7
ENVIRONMENTAL CONDITIONS	7
Mini-BDA CONNECTIONS	7
MECHANICAL OUTLINE DRAWING (Figure 3 & 3a)	8
RF EXPOSURE WARNING	9
Mini-BDA INSTALLATION	10
Mini-BDA OPERATION	11
MECHANICAL OUTLINE- ADJUSTMENT (Figure 4)	12
DIAGNOSTICS GUIDE	13

Mini-BDA OVERVIEW:

The Mini-BDA assembly extends the coverage area of radio communications in buildings and RF shielded environments. The Mini-BDA has dual RF paths to extend coverage in two distinct frequency bands.
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.

Mini-BDA BLOCK DIAGRAM DESCRIPTION:

Refer to Figure 1 for the following discussion.

The Mini-BDA Downlink path receives RF signals from the base station and amplifies and transmits them to the subscriber. The Mini-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.

An 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.

Mini-BDA Options:

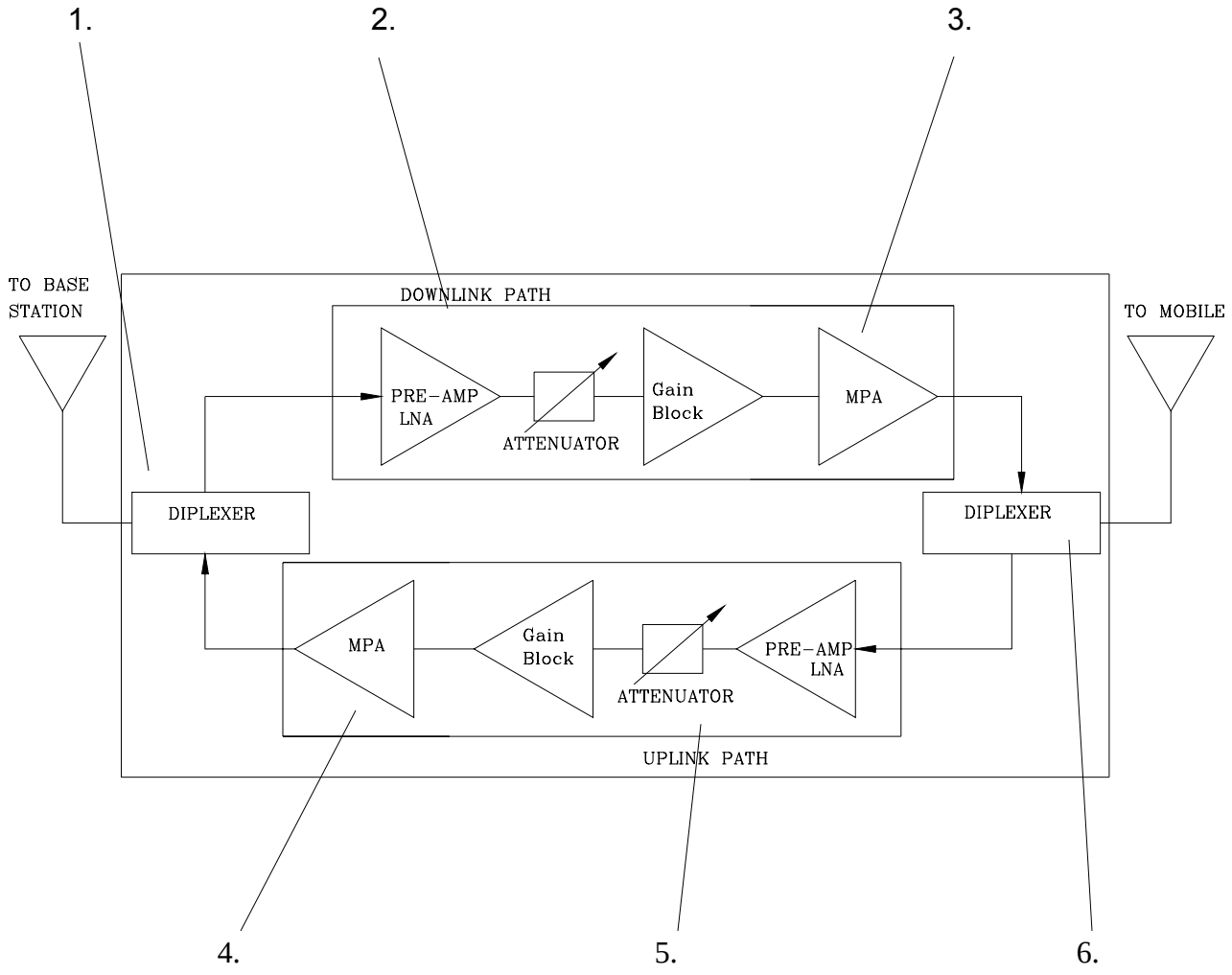
The Mini-BDA can be used as a line amplifier. With an optional external bias-tee, the Mini-BDA will function with power coming from the In-building antenna.

Optional External Bias-Tees

(For .1/.1 Watt Models only)

An optional 9 pin D-sub connector is available for external alarm monitoring (See Figures 3 & 3a).

Figure 1



Mini-BDA BLOCK DIAGRAM

1. Up-Link Diplexer - has low pass band insertion loss and high selectivity

2. Down-Link Pre-amp - is a low noise amplifier that drives the Down-Link MPA and offers 38dB Gain

3. Down-Link MPA – is a medium power amplifier with an ALC circuit which offers 40dB Gain. (High power amplifier with an ALC circuit which offers 40dB Gain for 1 & 2 Watt models)

4. Up-Link MPA – is a medium power amplifier with an ALC circuit which offers 40dB Gain

5. Up-Link Pre-amp - is a low noise amplifier that drives the Up-Link MPA and offers 38dB Gain

6. Down-Link Diplexer - has low pass band insertion loss and high selectivity

ELECTRICAL SPECIFICATIONS:

Frequency Range	: See Table 1
Pass band Gain @ min attenuation	: See Table 2
Nominal Channel Bandwidth	: 25.3 MHz typical
Variable Step Attenuator Range (2-dB steps)	: 0-30 dB
Pass band Ripple	: ±1.5 dB typical
Noise Figure @+25°C at max gain	: 3.0 dB max.
3rd Order Intercept point	: See Table 2
Output Power @ 1dB Compression	: See Table 2
Isolation between Up/Down Link	: 80 dB min., 90 typical
Input/ Output Impedance	: 50 Ohms
VSWR (Input/Output)	: 1.5: 1 max
Power Supply (Local)	: 15VDC/1.67 Amp : *(24VDC/1.88 Amp for 1 Watt Model)* : *(24VDC/3 Amp for 2 Watt Model)*

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

Table 2

System	Pass band Gain (dB) Typ.		3rd Order Intercept Point (dBm) Typ.		Output Power @ 1dB Compression (dBm) Typ.		ALC Factory Set Point (dBm)	
	Uplink	Downlink	Uplink	Downlink	Uplink	Downlink	Uplink	Downlink
.1/.1 Watt 70 dB Gain	72	72	33	33	19	19	10	10
.1/.5 Watt 70 dB Gain	72	72	33	39	19	26	10	18
.5/.5 Watt 70 dB Gain	72	72	39	39	27	26	18	18
.5 / 1 Watt 70 dB Gain	72	72	39	44	27	31	18	22
.5 / 2 Watt 70 dB Gain	72	72	39	46	27	36	18	27
.1/.1 Watt 60 dB Gain	61	61	34	34	20	20	11	11
.1/.5 Watt 60 dB Gain	61	61	34	40	20	27	11	18
.5/.5 Watt 60 dB Gain	61	61	40	40	27	27	18	18
.5 / 1 Watt 60 dB Gain	61	61	39	44	27	31	18	22
.5 / 2 Watt 60 dB Gain	61	61	39	46	27	36	18	27

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.

MECHANICAL SPECIFICATIONS:

Size	: 8.75 x 6.20 x 3.0 inch : (222.3 x 157.5 x 76.2 mm)
RF Connectors	: N-type Female
Weight	: 2.0 Lbs. (4.4 kg.) approx.

ENVIRONMENTAL CONDITIONS:

The unit is designed for indoor applications:

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

Storage temperature: - 50°C to + 90°C

Mini-BDA CONNECTIONS

The Mini-BDA is powered by a +15 VDC/1.67 Amp Wall Plug-In AC adapter with a 2.5 mm output connector (+24 VDC/1.88 Amp Desk Top AC adapter for 1 Watt models and (+24 VDC/3.0 Amp Desk Top AC adapter for 2 Watt models). The Wall Plug-In and Desk Top power adapters are highly reliable and compact, designed for use in telecommunications. The power adapters are CE & UL approved. The metal enclosure of the Mini-BDA is connected to ground.

A 9-pin D-Sub connector provides failure alarm output contacts.

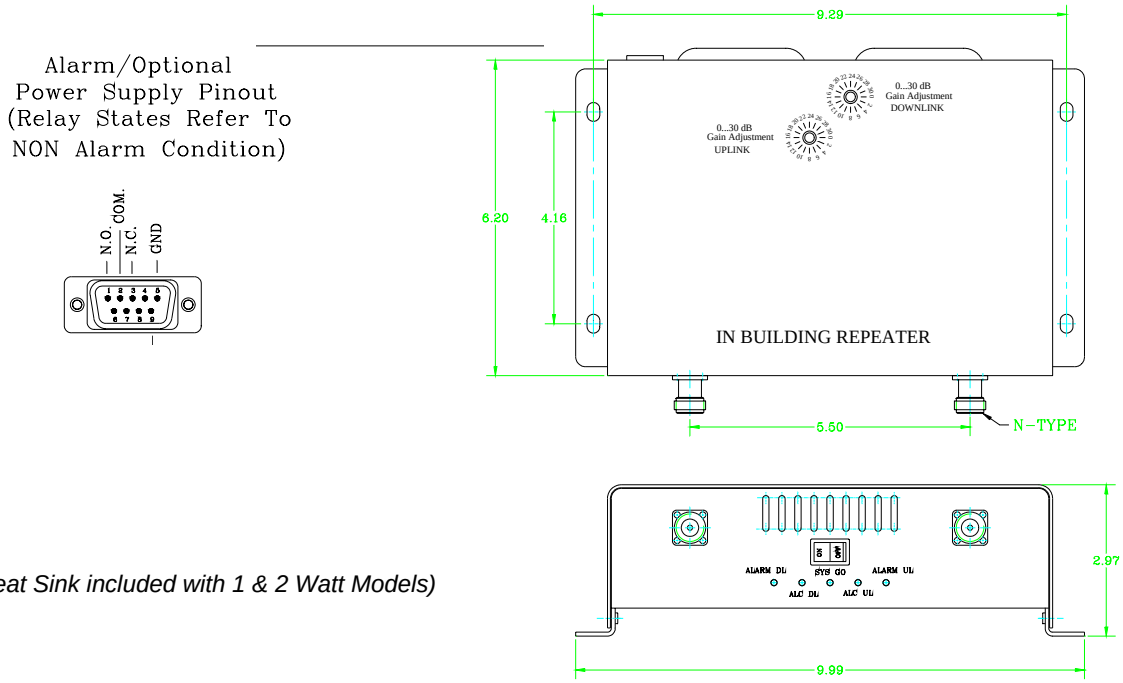
The RF connections are made via two type “N” female connectors. The RF connector labeled “BASE” must be connected to the antenna pointing towards the base station. The RF connection labeled “MOBILE” must be connected to the antenna facing the area to be covered by the Mini-BDA.

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

Figure 3

Mini-BDA Mechanical Outline



(Heat Sink included with 1 & 2 Watt Models)

Downlink Alarm

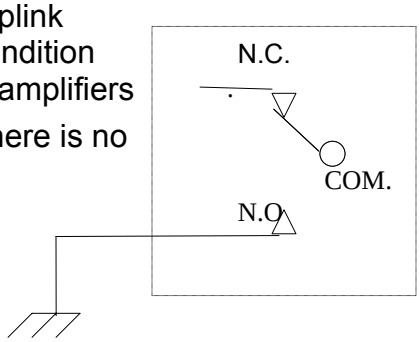
Uplink Alarm

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 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 Mini-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).

Mini-BDA INSTALLATION

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

1. Mount the Mini-BDA on the wall with the RF connectors pointing DOWN. Using appropriate screws and anchors, attach the Mini-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 Mini-BDA gain. (Use the higher of the Uplink and Downlink gains reported on the Mini-BDA test data sheet).

3. Connect the cable from the donor antenna to the Mini-BDA connector labeled “BASE” and the cable from the service antennas to the Mini-BDA connector labeled “MOBILE”.(Note: If used as a line amplifier, connect the external bias-tee between the service antenna cable and the Mini-BDA connector labeled “MOBILE”, with the RF+DC side of the bias-tee connected towards the service antenna cable.)

4. Connect the 2.5mm connector of the Wall Plug-In power adapter to the Mini-BDA and then to the AC power source. Turn the Power switch to the “ON” position and verify that the “System GO” lamp is illuminated.

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

Mini-BDA OPERATION

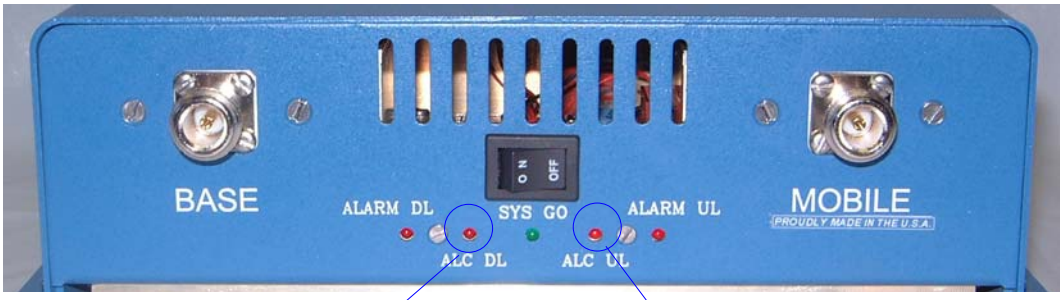
Refer to figure 3 and 4 for adjustment access location and label.

Variable Step Attenuator

Mini-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 from the top of the Mini-BDA enclosure (See Figure 4). Arrows on the shafts of these switches point to the value of attenuation selected. The Mini-BDA gain can be determined by subtracting the attenuation value from the gain reported on the Mini-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 Mini-BDA contains an ALC feedback loop. The ALC circuit senses the output power and limits it to the factory preset level (See Table 2). A red indicator lamp is located on the front panel of the Mini-BDA and illuminates when the output power exceeds the ALC set point (See below).

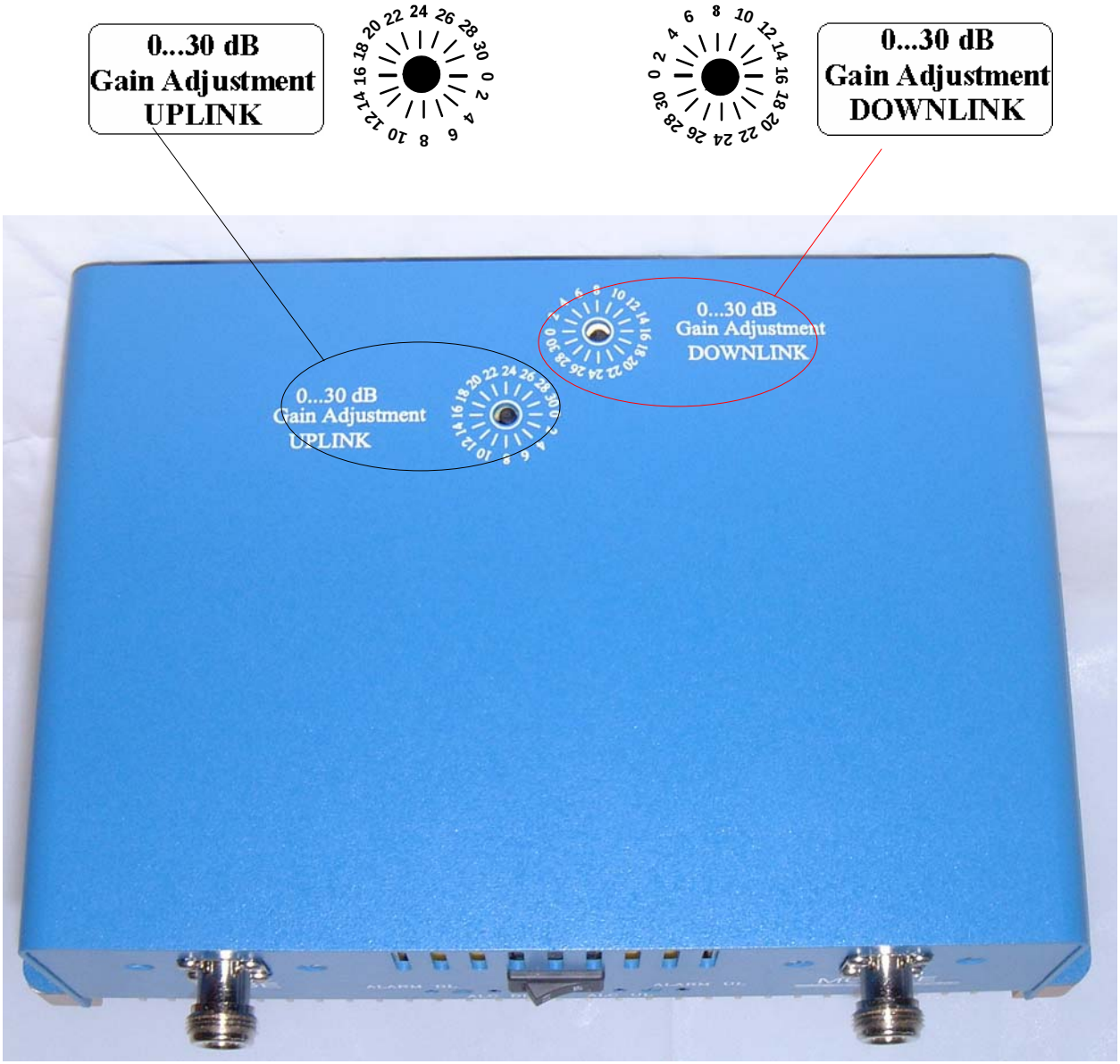


Downlink ALC Uplink ALC

To establish proper operating gain on the Uplink and Downlink sides, start with the Uplink. Observe the red indicator lamp on the Uplink amplifier. If the lamp is lit, using the Uplink step attenuator, reduce the gain 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-1XXX-.X/.XW-XX-AX at maximum gain with greater than -35 dBm average power incident (for 60 dB gain .1 watt units), -30 dBm average power incident (for 60 dB gain .5 watt units), -27 dBm average power incident (for 60 dB gain 1 watt units), -23 dBm average power incident (for 60 dB gain 2 watt units), -45 dBm average power incident (for 70 dB gain .1 watt units), -40 dBm average power incident (for 70 dB gain .5 watt units), -37 dBm average power incident (for 70 dB gain 1 watt units), and -33 dBm average power incident (for 70 dB gain 2 watt units) on either BASE or MOBILE ports can cause damage to the Mini-BDA.

Figure 4



Adjustment Access and Label

DIAGNOSTICS GUIDE

The Mini-BDA provides long term, care-free operation and requires no periodic maintenance. There are no user-serviceable components inside the Mini-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 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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