Redefining Wireless Technology

INSTALLATION
AND
OPERATING MANUAL

FOR

BDA-UHF-4/4W-70-A

BI-DIRECTIONAL AMPLIFIER

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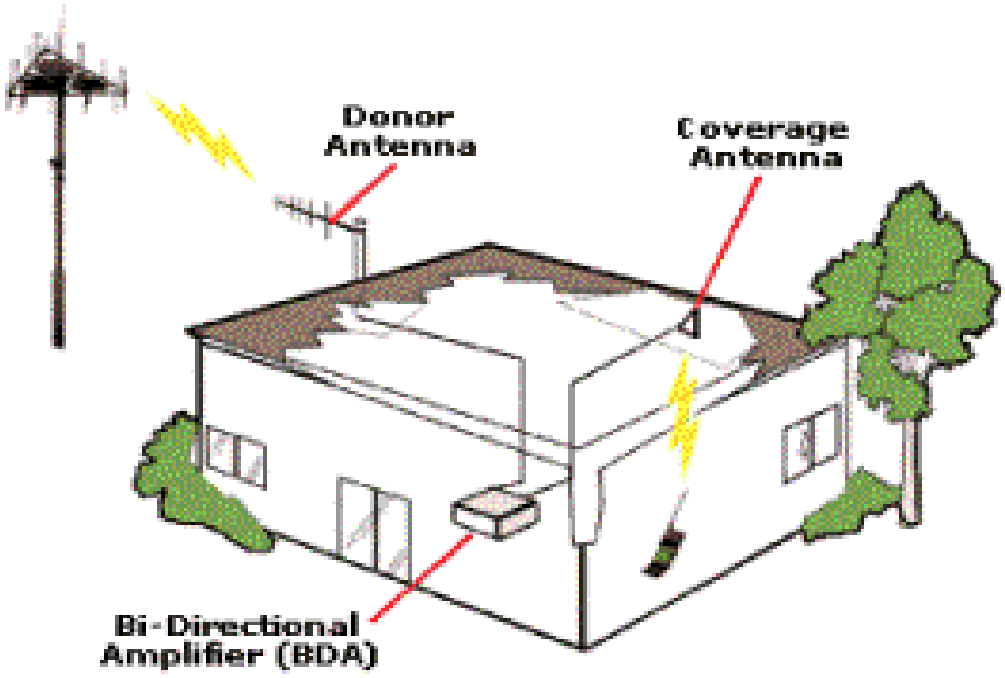
BDA OVERVIEW:

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.

Refer to figure 1 for the following discussion.

The illustration is a typical scenario of In-Building Signal Enhancement. On the top of the structure, the directional antenna points to closest Base Station (Uplink), the Indoor repeater is inside the building and internal antennas send and receive signals from a Mobile telephone.

Figure 1



BDA BLOCK DIAGRAM DESCRIPTION:

Refer to figure 2 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, a sample frequency band in UHF is as follows: *468.0-470.0 MHz for the Uplink and 463.0-465.0 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.

OPTIONAL EQUIPMENT OVERVIEW:

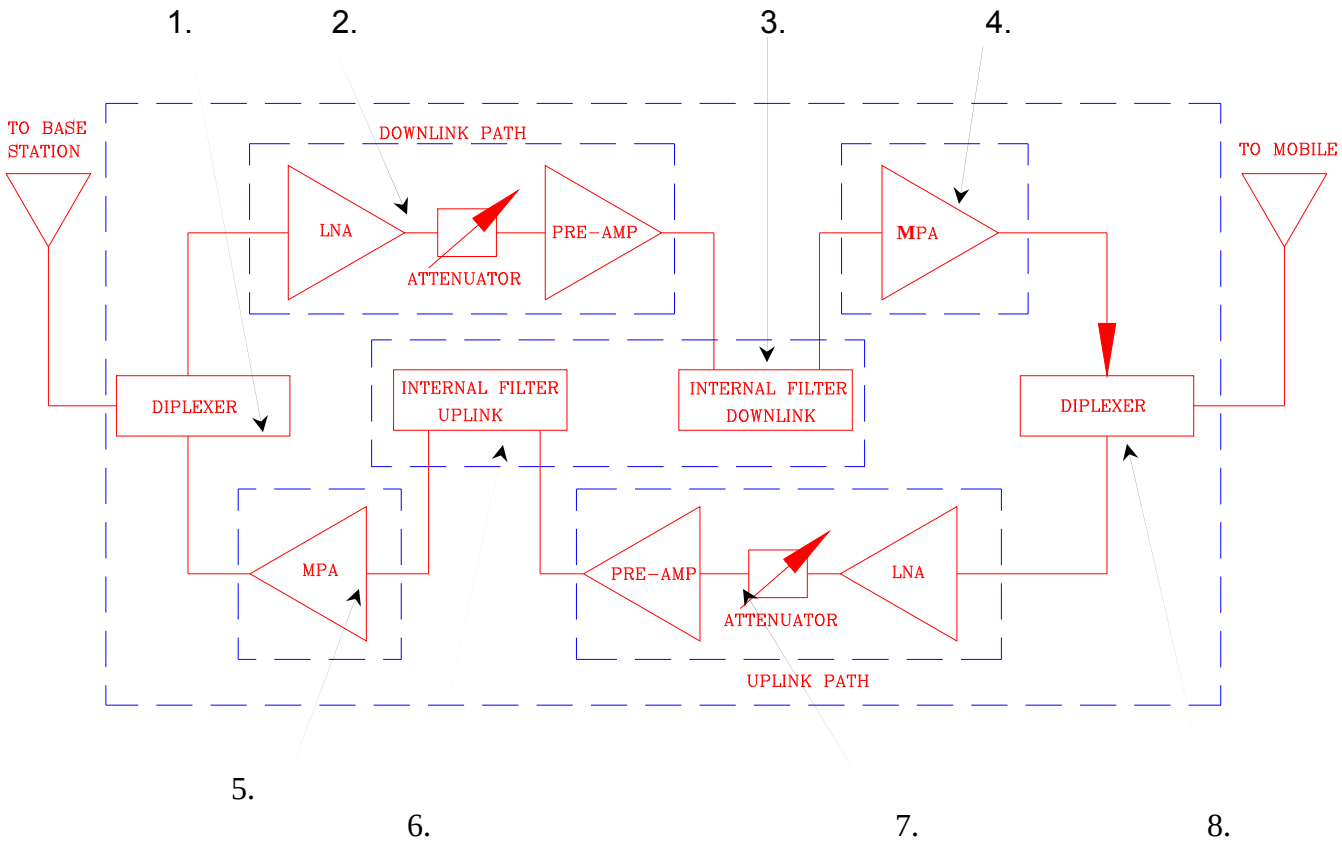
a.) DC Input Power Option (S1)

The BDA is equipped with both AC and DC voltage inputs for power operation. This gives the flexibility of powering the BDA with either an AC or DC source. If both sources are connected, the BDA will automatically select the stronger source for power.

b.) Uninterruptible Power System (UPS)

An optional UPS is offered for systems that need emergency back-up power. The system can easily be connected to a battery for uninterruptible operation. Not only does the power supply power the load, but it also charges the battery. If the AC power fails, the battery will uphold the load.

Figure 2



BDA BLOCK DIAGRAM
BDA-UHF-4/4W-70-A

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

2. Downlink Pre-amp - is a low noise amplifier that drives the Downlink MPA and offers 32dB Gain.

3. Internal Filter Downlink - This highly selective filter gives additional rejection for increased isolation.

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

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

6. Internal Filter Uplink - This highly selective filter gives additional rejection for increased isolation.

7. Uplink Pre-amp - is a low noise amplifier that drives the Uplink MPA and offers 32dB Gain.

8. Downlink Diplexer - has low bandpass insertion loss and high selectivity.

ELECTRICAL SPECIFICATIONS:

BDA-UHF-4/4W-70-A (SAMPLE)

Specifications	Typical
Frequency Range Uplink & Downlink	 406.1-454 MHz 456-462.5375 MHz 462.7375-467.5375 MHz 467.7375-512 MHz
3dB Bandwidth	2 MHz
Minimum passband separation	5 MHz
Pass band Gain @ min attenuation	70 dB minimum
Variable Step Attenuator Range (2-dB steps)	0-30 dB
Pass band Ripple	±1.5 dB typ.
20 dB Bandwidth Uplink Downlink	 3.25 MHz typ. 3.25 MHz typ.
Noise Figure @+25□C at max gain	5.0 dB maximum 4.5 dB typical
3rd Order Intercept point Uplink Downlink	 +51 dBm typ. +51 dBm typ.
*Output Power @ 1dB Compression Uplink Downlink	 +39 dBm typ. +39 dBm typ.
*Composite Output Power Uplink Downlink	 +31 dBm typ. (conductive power) +31 dBm typ. (conductive power)
*Output Power ALC Set Uplink Downlink	 +31 dBm typ. (conductive power) +31 dBm typ. (conductive power)
Input/ Output Impedance	50 Ohms
VSWR (Input/Output)	1.5: 1 max
Power Supply	110VAC/1.40Amp 240VAC/0.64Amp 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.*

MECHANICAL SPECIFICATIONS:

Size	: 16.0 x 16.0 x 11.2 inch : (406 x 406 x 285 mm)
RF Connectors	: N-type Female
Weight	: 48.0 Lbs. (21.6kg.) 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.

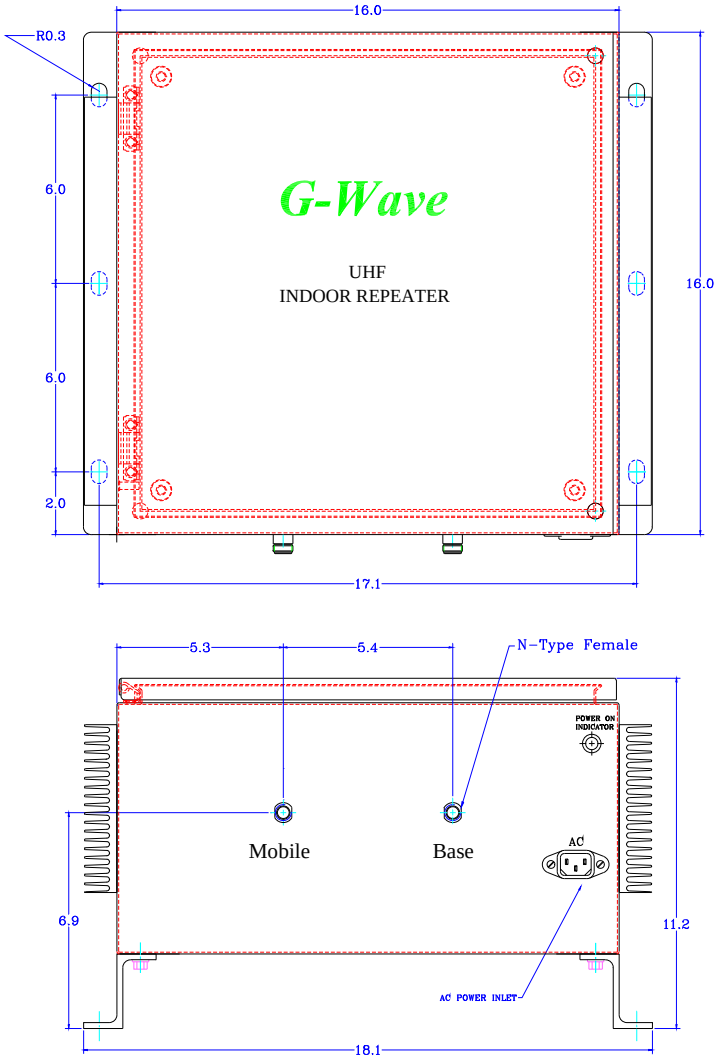
A optional 9-pin D-Sub connector provides failure alarm output contacts (see diagram next page) as well as an optional 12 VDC (250mA) auxiliary output.

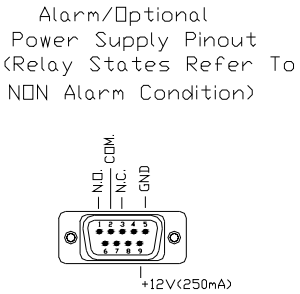
The RF connections are made via two type “N” female connectors. The RF connector labeled “BASE” must be connected to the antenna pointing towards the base station. The RF connection labeled “MOBILE” must be connected to the antenna facing the area to be covered by the BDA.

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 3





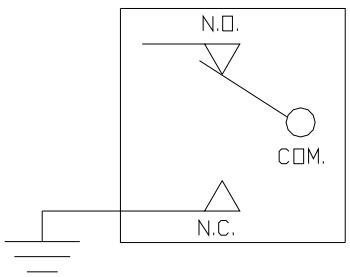
BDA Mechanical Outline

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)



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 Uplink and Downlink attenuation is set to 30 dB. 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 attenuation is positioned to its maximum setting (30 dB). After verification attenuation, follow the above steps starting with step 1.

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 0.5 meters (50 cm) between the antenna and persons within the area. (This assumes a typical antenna with gain of [8 dBi, VSWR ≤ 1.5:1, Zo= 50 ohms, and a cable attenuation of between 2-10 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 2-10 dB).

BDA OPERATION

Refer to figure 3 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 (Figure 4). 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 +31 dBm.

The ALC function is integrated in each amplifier. A red indicator lamp located on each amplifier illuminates when output power exceeds the ALC set point.

To establish proper operating gain on the Uplink and Downlink sides, start with the Downlink. Verify that the attenuation is set for 30 dB. Observe the red indicator lamp on the Downlink amplifier. Units are shipping with maximum attenuation. Decrease attenuation one step at a time until the lamp is lit. Then, 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.

Operation of BDA-UHF-4/4W-70-A at minimum attenuation with greater than -25 dBm average power incident on either BASE or MOBILE port can cause damage to the BDA.

Figure 4
Variable Gain Adjustment Access

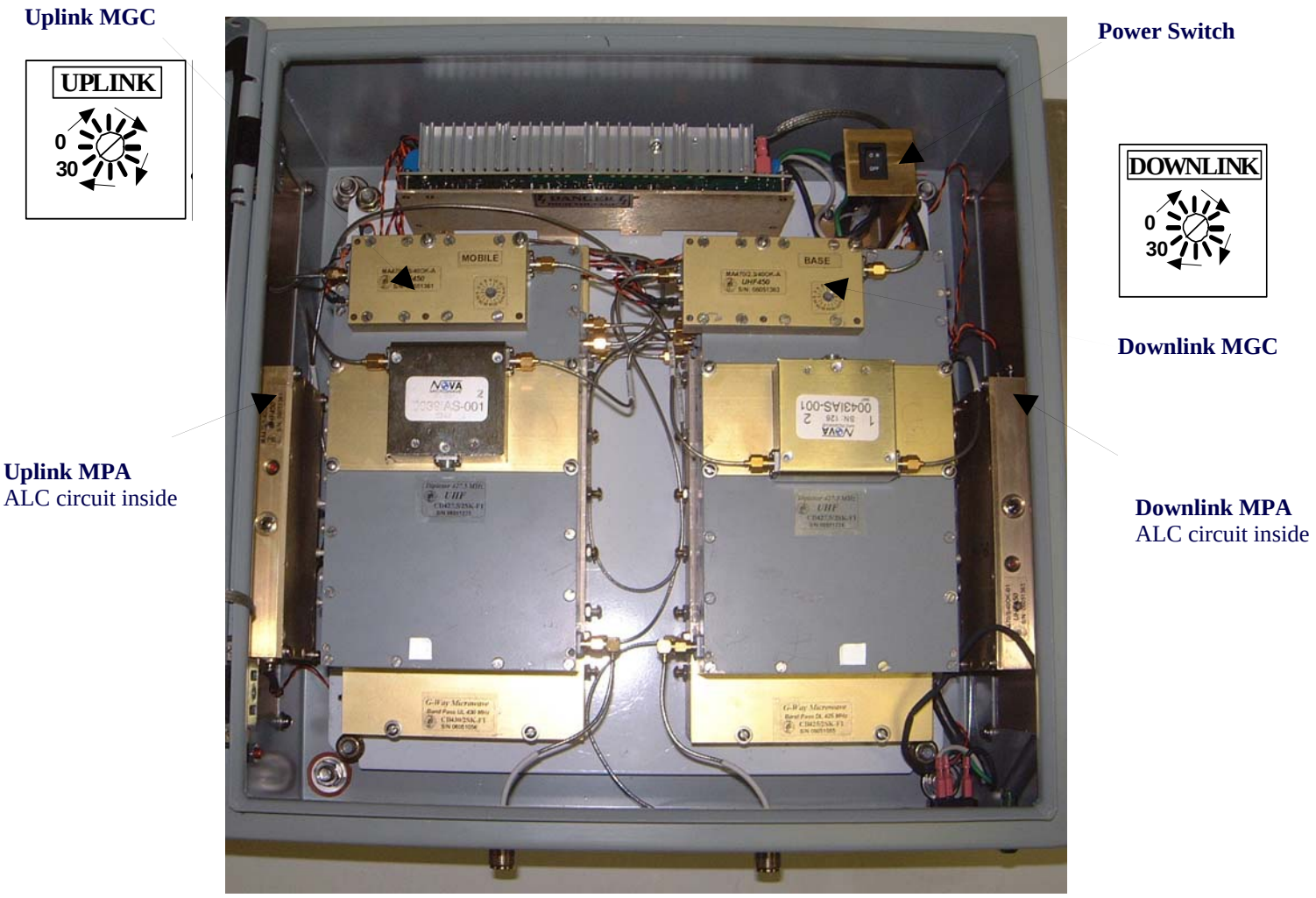
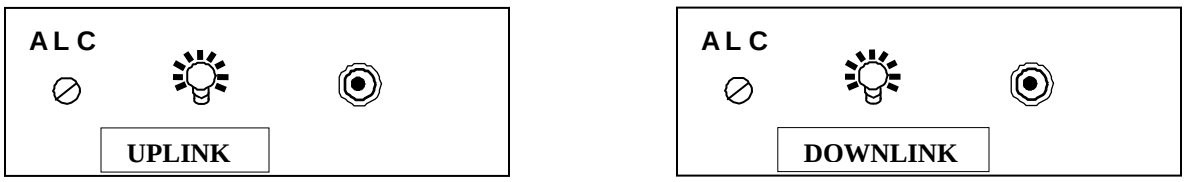


Figure 5
ALC Indication



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 UHF 450 frequencies, the antenna isolation at 100 m separation is about 65.5 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.

GWave
Redefining Wireless Technology
38 Leuning Street
South Hackensack, NJ 07606
Tel. 201-343-3140 Fax 201-343-6390
sales@gwaverf.com
www.gwaverf.com