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Dual Band 700/800 Bi-Directional Amplifier

Product Manual

Deko3178B

MW-CBDA-SMR-700-800-16W80

Rev. 1.55

ABOUT THIS MANUAL

This Product Manual describes the Deko3178B Dual Band BDA and provides information on how to setup, configuration of the Dual Band BDA and troubleshooting procedures.

TO WHOM IT IS INTENDED:

This Product Manual is intended for experienced technicians and engineers. It is assumed that the customers installing, operating, and maintaining Dekolink Dual Band BDA's are familiar with the basic functionality of Dual Band BDA's.

NOTICE

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Publication No.: 300TC80031 Rev. 1.55

SAFETY WARNINGS

Throughout this manual, important safety warnings are included to warn of possible hazards to persons or equipment. A safety warning identifies a possible hazard and then describes what may happen if the hazard is not avoided. The safety warnings – in the form of Dangers, Warnings and Cautions must be followed at all times. These warnings are flagged by the use of a warning icon, usually the triangular alert icon seen below. The exclamation point within the triangular alert icon is intended to warn the operator or service personnel of operation and maintenance from factors related to the product and its operating environment, which could pose a safety hazard.

GENERAL SAFETY WARNINGS CONCERNING USE OF THIS SYSTEM

Always observe standard safety precautions during installation, operation and maintenance of this product. Only a qualified and authorized personnel should carry out adjustment, maintenance or repairs to the components of this equipment.

DANGER: ELECTRICAL SHOCK

This equipment is intended to be installed indoor. Wet conditions increase the potential for receiving an electric shock when installing or using electrically powered equipment. To prevent electrical shock when installing or modifying the system power wiring, disconnect the wiring at the power source before working with un-insulated wires or terminals.

CAUTION: RF EXPOSURE

To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 35 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.

WARNING: EQUIPMENT MODIFICATIONS

Changes or modifications not expressly approved by Dekolink Wireless Ltd. could void the user's authority to operate the equipment

REVISION HISTORY

The revision history for this document is shown in Table 1.

Table 1: Revision history

P/N	Revision	Date	Description
300TC80031	1.0	26-FEB-2008	Initial Version
300TC80031	1.3	13-May-2008	Frequency change, minor edits
300TC80031	1.4	27-May-2008	Minor edits from lab
300TC80031	1.5	28-May-2008	Minor edits – power per carrier
300TC80031	1.55	29-May-2008	Minor edits – Warning, Canada freq

CONTENTS

1 INTRODUCTION

Deko3178B is a dual-band 700/800 MHz band selective mid-power amplifier in a single compact unit.
Specially designed for public safety in-door networks, the Deko3178B small foot-print and flexible installation options minimize interference with operations on the floor on which it is installed.
It can be installed in a rack, mounted on a wall or on the ceiling. It's relatively low weight which allows mounting and maintenance by a single person, in addition to the simple commissioning procedure that does not require a high level technician, provides significant savings on labor costs.
The Deko3178B can be remotely monitored via an external wireless modem connected to dry-contacts on the unit. It can be remotely accessed through a secure website or through a third-party NMS via SNMP traps.

Figure 1-1: Deko3178B Dual Band BDA

1.1 FEATURES

- Band selective, mid-power amplifier for public safety in-building network
- Dual-band SMR 700/800 MHz in a single unit
- Composite power (See Appendix A)
- 80 dB RF gain
- Small footprint and light weight for easy maintenance
- RF SAW filtering
- Gain matching uplink and downlink
- Alarm indication by LED and Dry contact
- Manual Gain Control
- High linear amplification
- Ideal for in-building and out-door coverage solutions
- Relative small size and light weight
- Cost effective solution
- Wall mounted easy Installation
- Reliable operation, maintenance free

1.2 DEKO3178B BLOCK DIAGRAM DESCRIPTION

The CBDA Downlink path receives the RF signal from the base station, amplifies it and transmits it to the subscriber. The BDA Uplink path receives the RF signal from the subscriber amplifies it and transmits it to the base station. Two triplexers at the Dual Band BDA's input and output separate the uplink and downlink frequency bands, creating high isolation between them and enabling the appropriate amplification of the signals in each path.

Each path contains two amplifiers and an RF SAW Filter that provides signal filtration and amplification. In addition, the Dual Band BDA power amplifiers have an ALC option switch. When switched on, the ALC circuit limits the amplifier output power. The ALC circuit senses the output power and introduces more attenuation, when the output power exceeds the preset level. This way the gain of the amplifier is reduced, its output power is limited and the intermediations products are kept below the desired level.

Warning: The AGC switch must be always ON in order to limit the spurious signals.

The gain of each path can be set manually. The separation of the gain setting architecture enables setting the actual gain for each path.

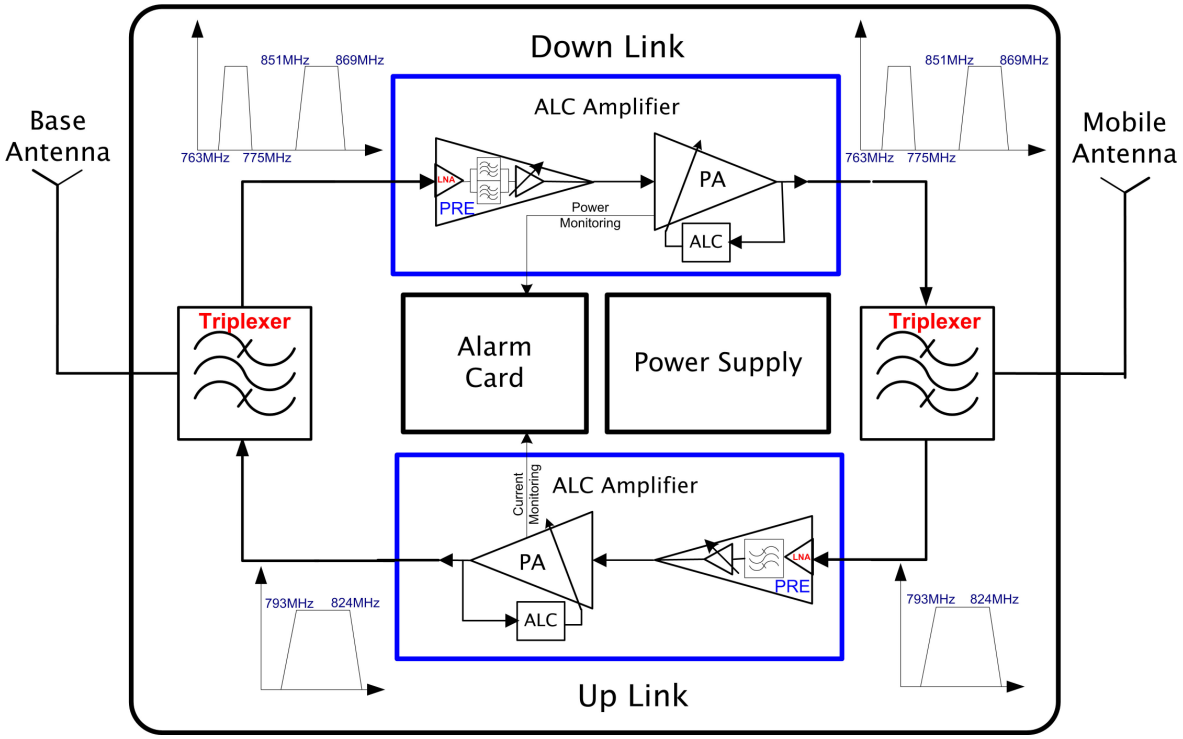


Figure 2. Deko3178B Functional Block Diagram

1.3 DEKO3178B INTERFACES

The Deko3178B interfaces are located on the dual band BDA top and front panel.

1.3.1 Front Panel Ports

The front panel includes the dual band antenna and power connections as shown below.

There are two types of antenna connectors: Base (Donor) and Mobile (Service) connections.

Figure 1-3. Deko3178B Front Panel

The following table provides a description of the front panel ports and connections.

Group	Connectors
BASE	Donor antenna connections.
MOBILE	Service antenna connections.
EXT. Alarm	Dry contact alarm port for external alert devices
AC	Connection to AC power supply (100 to 240 VAC)

1.3.2 Front Panel Indicators

The front panel includes one Power indicator that shows green upon power up of the unit.

1.3.3 Internal Power Selector

Deko3178B includes two internal power level selectors used for manual UL and DL gain control adjustment. See following figure.

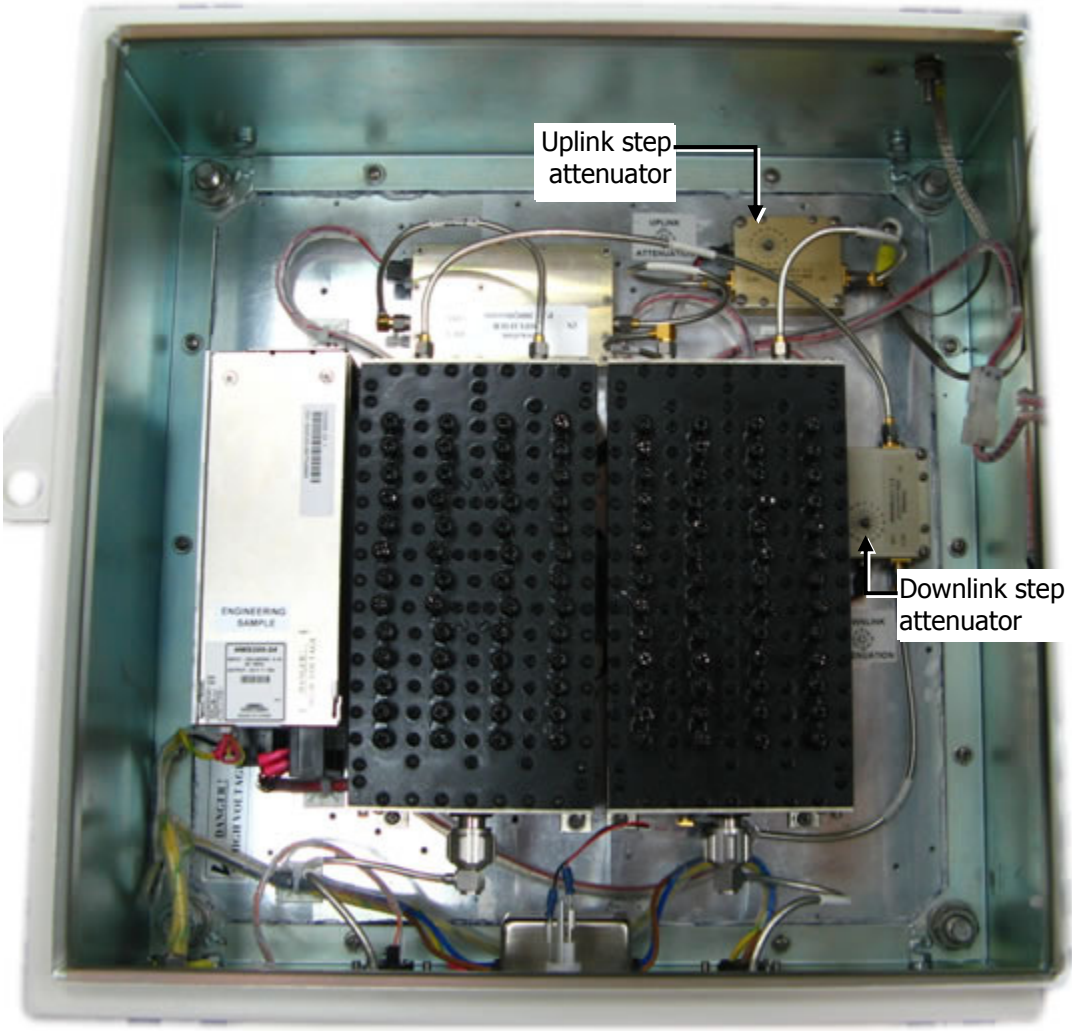


Figure 4. Internal View of Deko3178B UL/DL Step Attenuators

1.3.3.1 UL Step Attenuator

The manual gain setting function for the UL path is performed with the use of a rotary knob. The attenuation can be adjusted in 2 dB steps. See following figure.

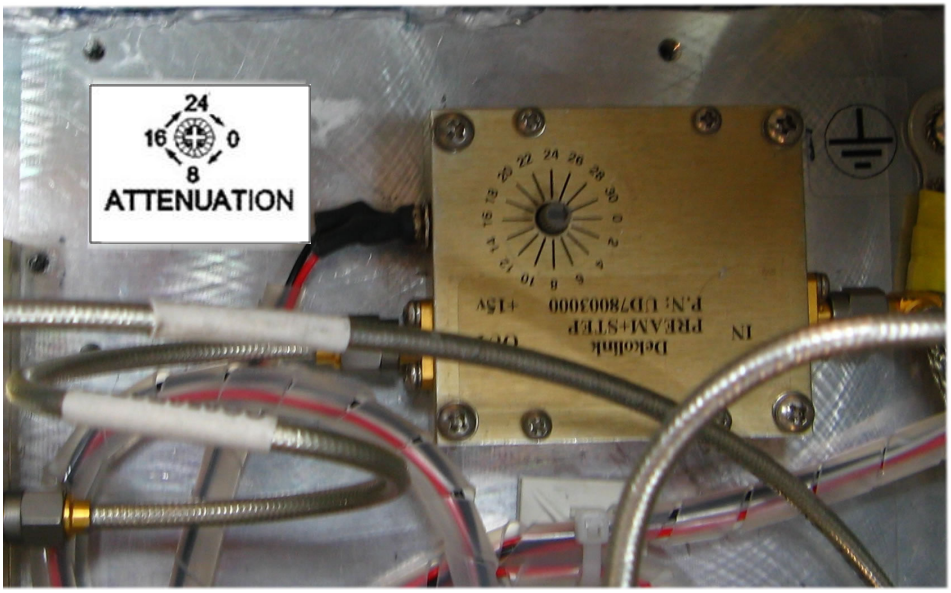


Figure 5. UL Step Attenuator

1.3.3.2 DL Step Attenuator

The manual gain setting function for the DL path is performed with the use of a rotary knob. The attenuation can be adjusted in 2 dB steps. See following figure.

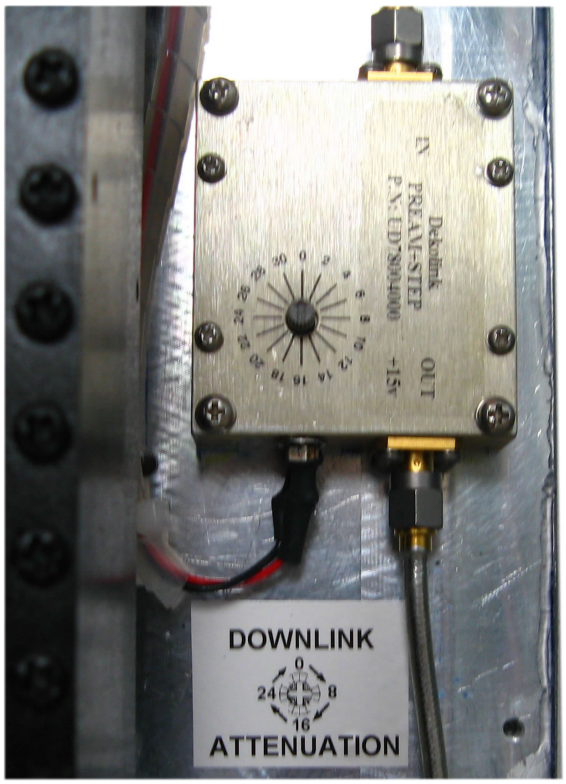


Figure 6. DL Step Attenuator

2 SITE AND INSTALLATION REQUIREMENTS

This section describes the power, antenna and site requirements for the Dual Band BDA installation.

2.1 GROUNDING WIRES REQUIREMENTS

Requirements for grounding wires

- Protective grounding conductor - should be aluminum with cross-section 10AWG.
- Lug of the protective grounding conductor - should be aluminum
- Washers and screw - should be high Cr stainless steel, or 12% Cr stainless steel, or Cr on, Ni on steel, tin on steel

2.2 ANTENNA REQUIREMENTS

2.2.1 Base (Donor) Antenna

The Base (Donor) antenna is usually installed outdoors and is either a directional antenna such as a Yagi or a Panel antenna.

Donor Antenna specifications:

- Yagi type or similar – 10 to 15 dBi gain, very sharp beam pointed to the BTS.
- Cable and jumper loss is at least 2dB.
- The required Base signals should be the dominant signals; at least 6 dB higher power than other signals.
- Example of antenna's typical specifications:

Gain:	8 dBd (=10 dBi)
VSWR:	< 1:5:1
Impedance:	50 ohm

2.2.2 Mobile (Service) Antenna

The Mobile antenna is installed indoors.

Note: Before installing the Mobile antenna, see FCC regulations for information regarding recommended distances between the antennas and populated areas.

The following describes the requirements for an omni-directional mobile used for indoor applications.

Specifications:

- Omni directional antenna with a 0 to 2 dBi typical gain, or wide beam with up to 3dBi gain.
- Example of omni-directional antenna specifications:

Gain:	0 to 2 dBi
VSWR:	< 2:1
Impedance:	50 ohm

2.3 PRE-INSTALLATION SAFETY INSTRUCTIONS

Before installing the Dual Band BDA, review the following safety information:

- Follow all local safety regulations when installing the Dual Band BDA.
- Only qualified personnel are authorized to install and maintain the Dual Band BDA.
- During normal operation, the Dual Band BDA door should be closed.
- Some maintenance tasks may require the Dual Band BDA door to be opened while the power is on. In such cases, perform the required tasks carefully and remember to close the Dual Band BDA cover/door when finished.
- Ground the CBDA with the grounding bolt located on the external lower side of the cabinet (see 3.4).
- Do not use the grounding bolt to connect external devices.
- Follow Electro-Static Discharge (ESD) precautions.
- Before closing the CBDA cover, make sure no wires are in the way.
- Use low loss cables to connect the antennas to the Dual Band BDA.

2.4 INSTALLATION LOCATION, ENVIRONMENT AND CABLES

WARNING

THE DUAL BAND BDA MUST ALWAYS BE INSTALLED VERTICALLY AND TOP-DOWN, TO ALLOW FREE-FLOW OF COOLING AIR. HORIZONTAL INSTALLATION ON A BENCH FOR LONG TIME MAY CAUSE DAMAGE TO THE DUAL BAND BDA DUE TO OVER-HEATING.

- Use a suitable mounting surface, such as a rigid wall.
- Follow Electro-Static Discharge (ESD) precautions.
- Install the Dual Band BDA close to the service area to monitor the output power and noise figure.
- Use low loss cables to connect the antennas to the Dual Band BDA.
- Install the Dual Band BDA in a shielded, ventilated, and easy-to-reach area – preferably at eye level.

3 INSTALLING THE DUAL BAND BDA

3.1 UNPACKING

Upon receiving the Deko3178B unit, perform the following:

1. Examine the shipping container for damage before unpacking the unit.
2. Perform a visual inspection to reveal any physical damage to the equipment.
3. Verify that all of the equipment (listed below) is included. Otherwise contact Dekolink Wireless Ltd.

The Deko3178B Dual Band BDA is shipped with the following equipment:

- Deko3178B Dual Band BDA - Model: MW-CBDA-SMR700-800-16W80
- Key (used to lock the Dual Band BDA case)
- AC supply cable [6 ft.]
- User Manual (CD)
- Packaging box

3.2 REQUIRED TOOLS AND MATERIALS

A standard professional tool box is required in order to mount the Deko3178B Dual Band BDA Mounting the Deko3178B

To mount the Dual Band BDA on the wall

1. Choose the location of the Dual Band BDA on the wall according to the following criteria:
   - The location should be at normal eye level height, above ground.
   - Make sure that there is enough room to allow the door to swing completely open, and to enable easy access to the Dual Band BDA for maintenance and on-site inspection.
2. Mark the drilling holes on the wall surface based on the Dual Band BDA four mounting holes. See following figure.

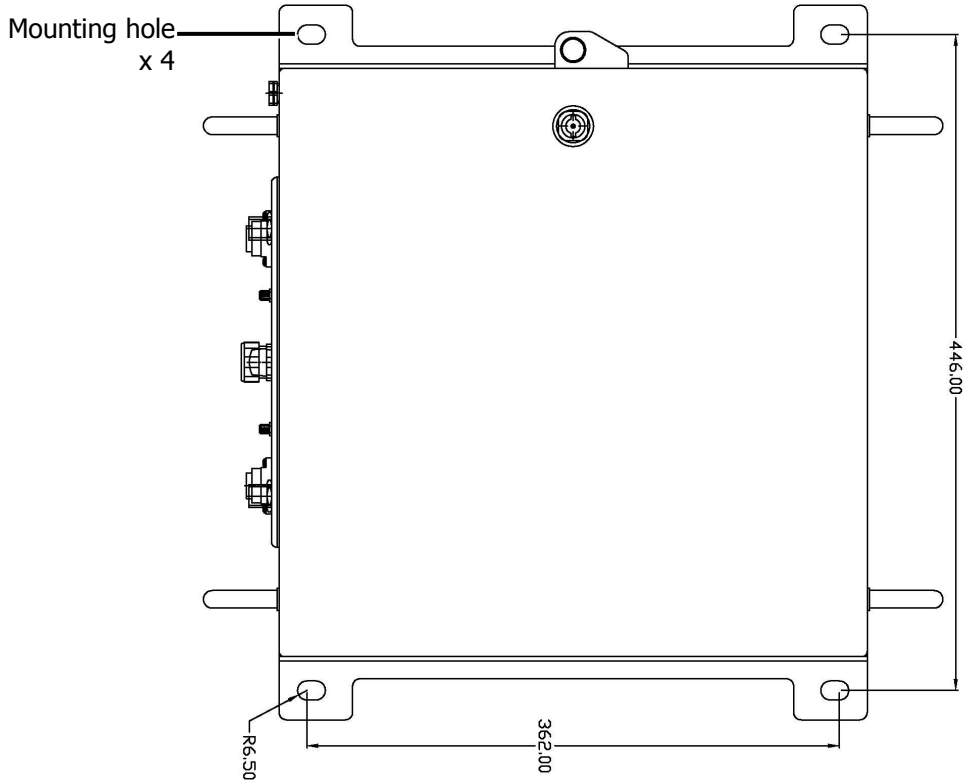


Figure 7. Deko3178B Mounting Holes

3. Drill the four holes in the wall.
4. Align the chassis so that the mounting brackets fit into the holes drilled in the wall.
5. Use tire bolts, hex-head bolts, and M8 washers to secure the enclosure firmly to the wall.

Note: Bolts and Washers are not supplied with the Dual Band BDA.

3.3 DRY CONTACT ALARM CONNECTIONS

The front panel **Alarm** port (see 1.3.1) is an optional dry contact alarm port that supports two alarm connections from external sources (incoming outputs). The use of relay alarms (open or short wire-pair circuit) is recommended for the external alarms port.

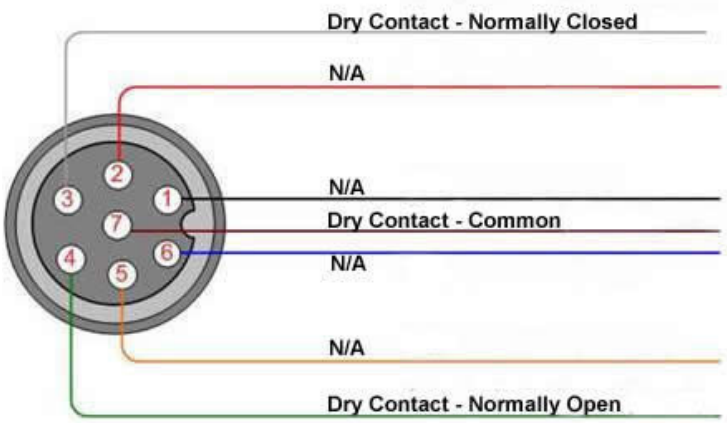


Figure 8. Alarm Connector Pinout

The following table provides a description of the Alarm connector pinout and the corresponding cable wire color-match pin.

No.	Pin	Signal Name
1	A	Not Connected
2	B	Not Connected
3	C	Dry Contact – Normally Closed
4	D	Dry Contact - Normally Open
5	E	Not Connected
6	F	Not Connected
7	G	Dry Contact - Common

- The relay alarms are *Normally Open*, however they close upon power up. Upon detecting a fault or when the power is cut off from the CBDA the relay alarms open.
- The relay alarms are connected to pins 3 and 4 of the front panel Alarms connector used for remote sensing of faults.

3.4 GROUNDING

Once the Dual Band BDA is installed, you are required to ground it. The Dual Band BDA case includes a grounding lug, where a grounding conductor cable should be attached. The Dual Band BDA grounding conductor is found at the right-hand side of the bottom panel.

The protective grounding conductor should be copper with cross-section of 10AWG. The lug of the protective conductor should also be aluminum. Washers and screw should be high CR stainless steel, or 12% stainless steel, or 12% Cr stainless steel, or Cr on steel, Ni on steel, tin on steel.

3.5 POWER UP

To power-up

The Dual Band BDA operates from a 100/240 VAC Mains. The maximum consumption power is 105W.

Connect the AC power cable to the Dual Band BDA front panel **AC IN** (100-240VAC) connector.

Figure 9.Power Up Connection

4 ANTENNAS INSTALLATION AND CONNECTION

4.1 RF GAIN SETTING CRITERIA

In order for the CBDA Dual Band BDA to operate effectively the isolation between the base station and the mobile antenna must be *at least 15 db higher than the CBDA gain*.

The step attenuator on the low noise amplifier can reduce the CBDA gain. The CBDA gain can be reduced by the amount indicated on the step attenuator.

Note: A higher CBDA gain than the isolation between the antennas would cause oscillation which would saturate the amplifier. On the other hand, if the isolation were only a few db higher than the CBDA gain, it would not be enough to cause oscillation however it would cause gain ripple in the band.

4.2 ANTENNA INSTALLATION

4.2.1 Base (Donor) Antenna

NOTE: Verify that the antennas meet requirements described in section 2.2.1.

Installation requirements:

- The antenna should point to the direction of the base station for maximum input power
- Verify that the antenna is in the base stations line of sight (raise the antenna if necessary)
- Install the donor antenna at a higher level (i.e. floor) than the mobile antenna
- Must be installed at a minimum distance of 1 meter from any personnel within the area.

4.2.2 Mobile (Service) Antenna

NOTE: Verify that the antennas meet requirements described in section 2.2.2.

Installation requirements:

- Install the service antenna on the ceiling or on the wall so it would shadow the required coverage area within the in building environment.
- Installation of this antenna must provide a minimum separation distance of 0.5 m from any personnel within the area.
- Cable and jumper loss is at least 2dB.

4.3 ANTENNA CONNECTIONS

Note 1: Do not operate the Dual Band BDA without terminating the antenna connections with actual antennas or proper dummy loads.
Note 2: If the coaxial cables are NOT weather-resistant type, wrap the exterior coaxial cables with insulation and holding tape (Type 3M Rubber splicing tape) for environmental protection and to ensure longer lifetime.

To connect the antennas to the Dual Band BDA

- Connect the Donor antenna to the Dual Band BDA BASE port.
- Connect the Service antenna to the Dual Band BDA MOBILE port.

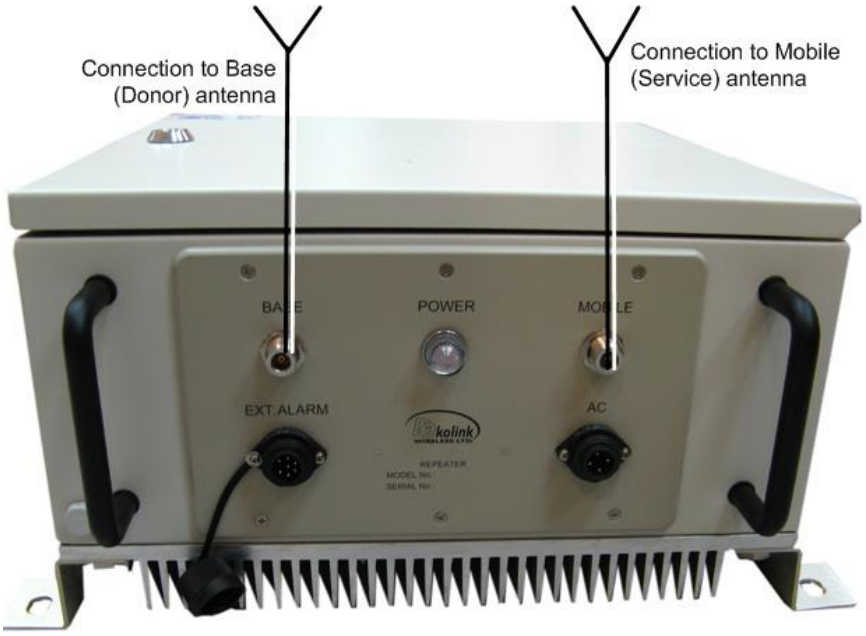


Figure 4-1.Deko3178B – Antenna Connections

4.4 VERIFYING ISOLATION BETWEEN DONOR AND MOBILE ANTENNAS

The isolation between the Base/Donor and Mobile/Service antennas is critical especially for high gain, outdoor applications.

For proper operation of the Deko3178B Dual Band BDA, it is recommended that the isolation between the Donor and Service antennas be at least 15 dB higher than the Dual Band BDA set gain.

The isolation between the antennas is critical for high gain outdoor Dual Band BDA.

To measure the isolation; inject a known signal into one antenna and measure the power at the other antenna. This should be done across the frequency range of both uplink and downlink bands.

NOTE: Lower isolation can lead to high in-band ripple, oscillations and low signal quality.

To measure the isolation, proceed as follows:

1. Inject a known signal from a signal generator into one antenna (preferably the Donor antenna).

2. Measure the coupled output from the Service antenna, using the Spectrum analyzer and LNA if applicable.
3. Perform this procedure across the frequency range of both the Uplink and Downlink bands.
4. Register the lower result for system operation.

NOTE: The SALC feature overcomes this procedure.

4.5 VERIFYING THE LINK BETWEEN THE BTS AND THE DUAL BAND BDA

This test checks the signal strength from the BTS antenna to the CBDA Dual Band BDA.

Proceed as follows:

1. Using a Spectrum analyzer, measure the received signal from BTS at the Donor antenna port near the Dual Band BDA.
2. Adjust the Donor antenna direction to receive the maximum signal strength.
3. Compare the received signal strength with the calculated signal strength from the design phase.

   In case of discrepancy, check for one of the following:

   - Antenna out of direction
   - Antenna tuned to side lobe instead of main lobe
   - Antenna connector or antenna cable faulty
   - Line of sight problem (obstruction), etc.
   - Register the signal strength of the downlink channel for the system operation phase.

5 MONITORING AND ALARMS

5.1 DEKO3178B ALARMS

The Deko3178B Dual Band BDA has two main active elements: DL Power Amplifier and UL power amplifier. A monitor circuit monitors these elements and initiates an alarm upon detecting a deviation from the normal operation. The summarized alarm output of the monitoring card is sent to the corresponding front panel Alarm connector.

The monitor circuit performs the following functions:

- Monitors the current of uplink power amplifier - If the current is either below or above the specified limits an automatic alarm function is provided through a lit LED and a dry contacts relay.
- Monitors the downlink RF output power - If the output power is lower than +20dBm an alarm function is provided by a lit LED and a dry contacts relay.

Indication	Cause	Action
Downlink LED is ON	Indicates low RF power at downlink path <20 dBm)	Check base antenna connection Check antenna alignment to base. Use higher gain BDA
Downlink LED is ON	BDA fault	Replace BDA
Uplink Amp LED is ON	Uplink amplifier over current or undercurrent fault	Replace BDA

APPENDICES:

APPENDIX A: SPECIFICATIONS (@+25°C)

This paragraph provides the electrical, mechanical and environmental specifications of the Deko3178B Dual Band BDA.

Parameters		DL	UL
Frequency Range	USA	769 - 775 MHz 851 – 869 MHz	799 - 805 MHz 806 - 824 MHz
	Canada	759-780 MHz 847-872 MHz	790-828 MHz
Passband Gain		80 dB	
Passband Ripple		± 1.5 dB	
Gain Attenuation Range (in 2 dB steps)		0 to 30 dB	
Max output power Per carrier	Single carrier	31.8 dBm	23.3 dBm
	Multiple carriers	26 dBm	20 dBm
Output IP3 (typical)		+ 50 dBm	+ 43 dBm
Noise Figure@ Maximum Gain (typical)		5 dB	
Propagation Delay		< 5 µsec	
Max RF Input Power (no damage)		10 dBm	
Max RF Input Power Per carrier @ Max Gain	Single carrier	-49dBm	-57dBm
	Multiple carriers	-56dBm	-60dBm

Electrical

Parameter	Value
Power Supply	100/240 VAC, 105 W
Impedance Level	50 Ω
RF Connector	N-type, female
Diplexer's Connectors	SMA-type, female
VSWR (typical)	1.5 : 1

Mechanical Specifications

Parameter	Value
Size L x W x H	400 x 400 x 220 mm (approx.) [15.76 x 15.76 x 8.66 inch]
Weight	14 kg (approx.) (30.8 lbs)
Weatherproof	IP-65, NEMA 4

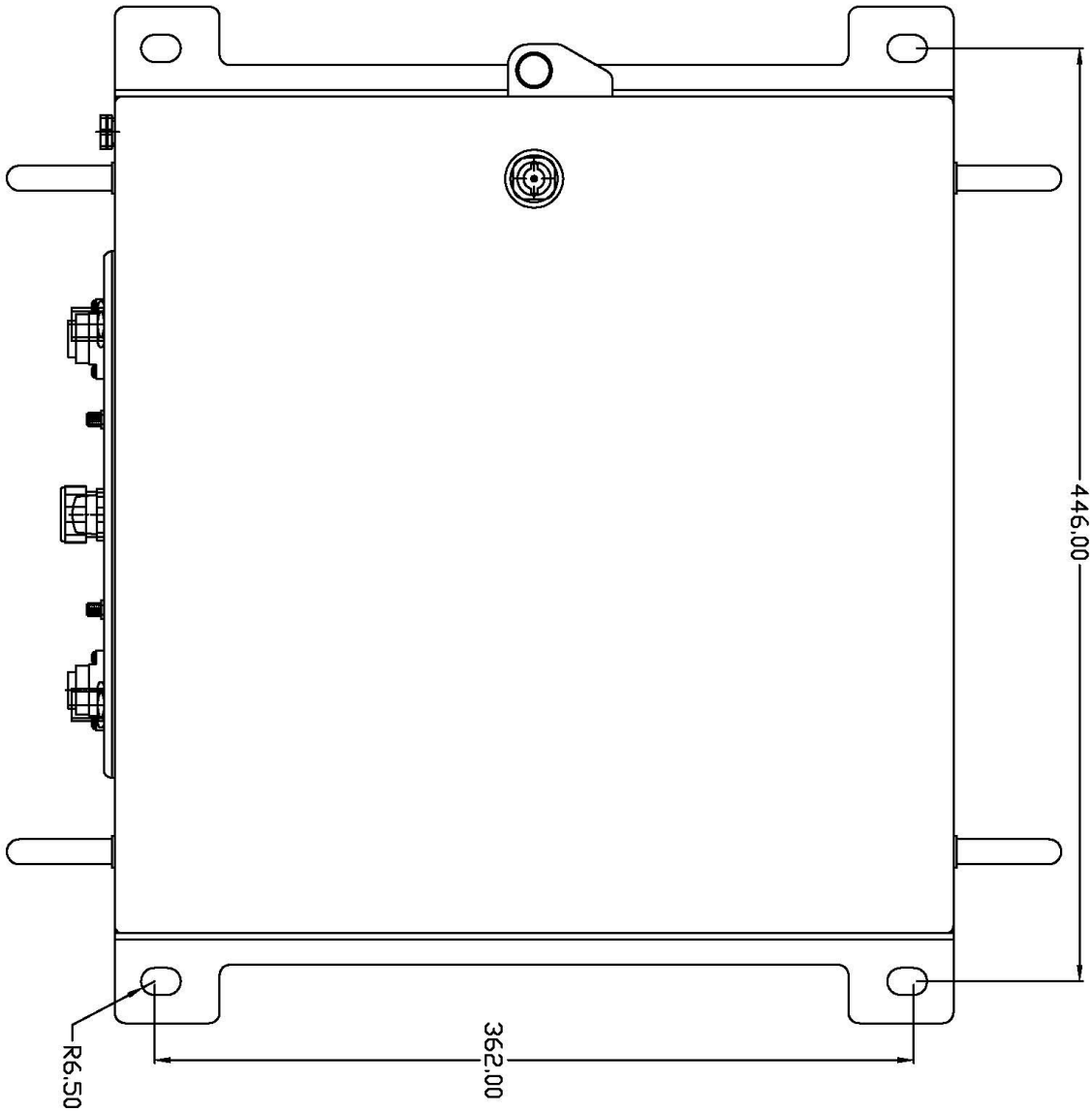
Environmental Specifications

Deko3178B is designed to operate properly under the following environmental conditions.

Condition	Value
Operating temperature	-10 °C to +50 °C (14 to 122° F)
Storage temperature	-40 °C to +80 °C (-40 to 176° F)

APPENDIX B: MECHANICAL DRAWING

The following mechanical drawing shows the Deko3178B dimensions.



APPENDIX C: DEKOLINK WIRELESS LIMITED WARRANTY

Dekolink Wireless [Ltd.] ("Dekolink"), manufacturer of this product (the "Product") warrants to the original purchaser ("Purchaser") that the Product is free from defects in materials and workmanship for a term that ends on the earlier of twelve (12) months from the date of activation of the Product or fifteen (15) months from the date of shipment of the Product by Dekolink. The obligations of Dekolink under this warranty shall be limited solely to the repair or exchange or giving credit for, at the option of Dekolink, any Product that may prove defective in accordance with evidence satisfactory to Dekolink. Any repair or replacement of the Product by Dekolink shall not extend the original warranty period. This warranty is exclusive to the original Purchaser and is not assignable.

This warranty applies only upon the condition that the Product has been installed, maintained and operated under conditions of normal use. The provisions of this warranty shall not apply if, in Dekolink judgment, the Product has been subject to misuse or neglect, damaged in an accident or by act of vandalism, or repaired or altered in any way that adversely affects its performance or reliability.

To obtain warranty service, Purchaser may, upon the prior written authorization of Dekolink or its authorized service representative, return the defective Product to Dekolink authorized service center. All shipping and insurance charges are the sole responsibility of Purchaser and are not included in this warranty.

Dekolink expressly excludes and disclaims all other warranties, including but not limited to any warranties of merchantability or fitness for a particular purpose.

Dekolink shall in no event be liable for any special, indirect, incidental, consequential or punitive damages or for loss, damage, or expense, including loss of use, profits, revenue, or goodwill, directly or indirectly arising from purchaser's use or inability to use the merchandise, or for loss or destruction of other property or from any other cause, even if Dekolink has been advised of the possibility of such damage. Some states do not allow the exclusion or limitation of incidental or consequential damages so these limitations may not apply under certain circumstances.

The liability of Dekolink shall in no event exceed an amount equivalent to the purchase price paid by the purchaser for the defective product.

This warranty shall not be extended, altered or varied except by a written instrument duly signed by Dekolink.