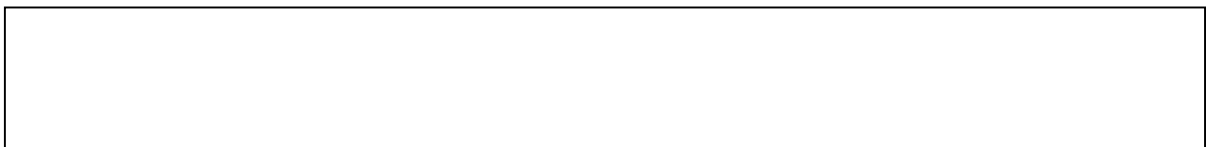




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INSTALLATION AND OPERATING INSTRUCTIONS FOR HIGH POWER PCS REPEATER

MODEL: MW-BDA-PCS-F-50W90





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Applicable documents

Repeater Management Application Software User Manual



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1. Repeater overview

Dekolink's repeater assembly provides an exceptional capability to extend the coverage area of radio communications into building areas and RF shielded environments.

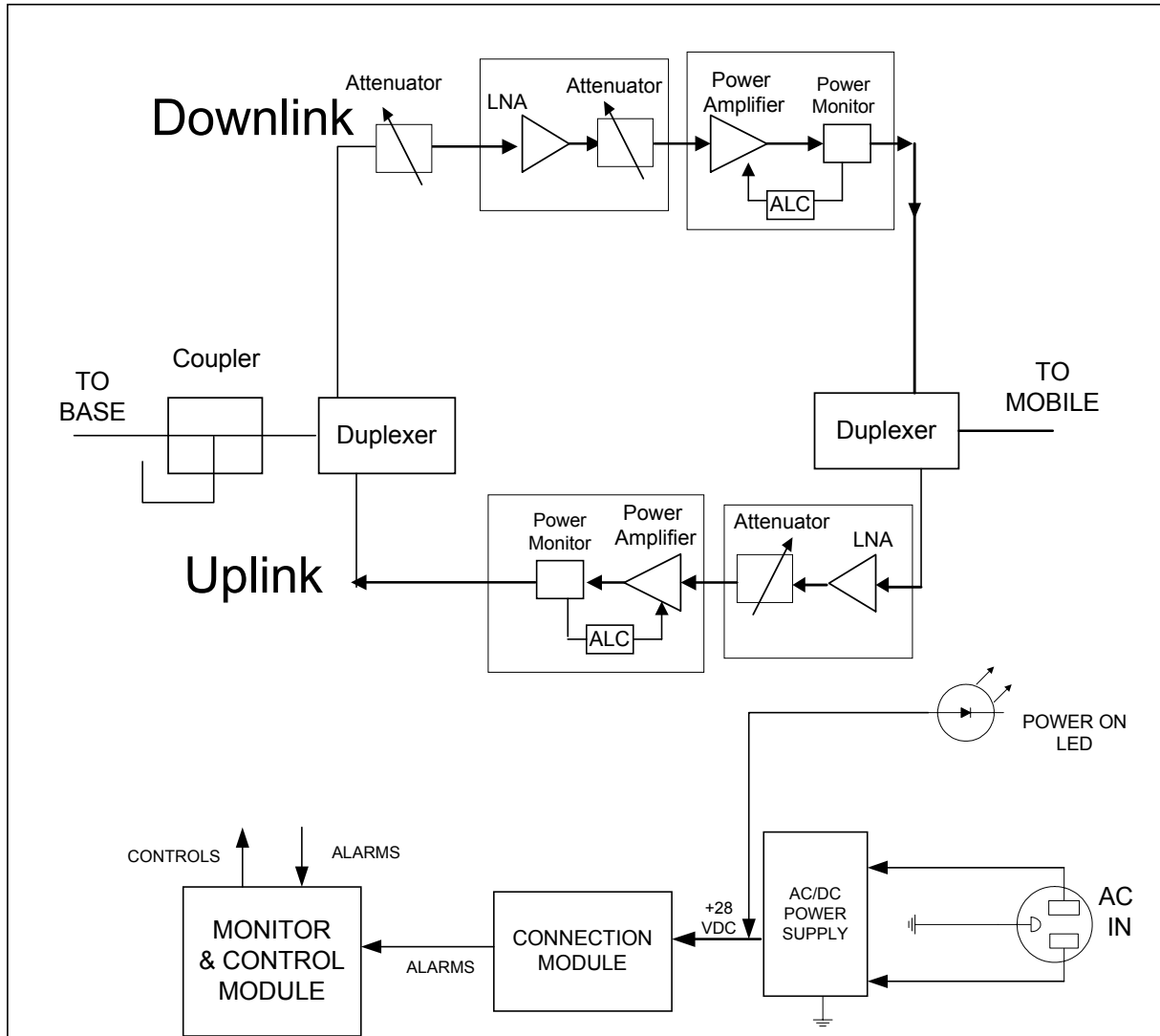
The unit's integrated high linearity power amplifiers contribute to the overall improved system performance while avoiding non-linear related phenomena. The unit is based on a duplexed path configuration, having sharp out of band attenuation for improved isolation between the receiving and transmitting paths.

2. Block diagram description

Within the repeater, the downlink path receives RF signals from base station (donor side) amplifies them and re-transmits them to the subscribers (service area). The repeater uplink path receives RF signals from the service side, amplifies them and retransmits them towards the donating base station. On both the repeaters' ends, cavity tuned duplexers separate the Tx and Rx signals (frequency separation) and diverts them to the amplifying path while providing the required signal isolation.

Two amplifiers are used to perform the required amplification for each of the paths; a Low Noise Amplifier (LNA) and a high power amplifier. Each of the LNAs includes an internal step attenuator that allows adjusting the gain of the relevant path to the required level depending on the specific field situation.

Figure 1 - Repeater RF block diagram





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2.1. Step attenuator and RF gain setting

For proper operation and in order to avoid oscillations, Dekolink's suggestion is to have an isolation value between the base station antenna (donor side) and the mobile antenna (service side) that exceeds the repeaters' set gain by 12dB.

A step attenuator integrated in the LNA can be adjusted to change the repeaters' gain in 1dB steps, within a range of 31dB. Adjustment is done via SW.

2.2. Automatic Level (gain) Control (ALC) functionality

In order to prevent saturation of the power amplifiers, the repeater is equipped with ALC circuits on both its paths. When a high signal is received, the ALC detects its amplitude and sends a feedback signal to a voltage variable attenuator, which attenuates the signal level so that the output power of the amplifier does not exceed a preset limit.

The uplink ALC is always on.

The ALC function on the downlink path can be enabled/disabled via SW. If the ALC on the downlink path is disabled then the amplifier gives maximum gain.

2.3. Power supply unit

The repeater includes a high efficiency power supply unit able to supply the required power needed to run it.

This module converts the supplied mains voltage, to +28VDC.

2.4. Power control unit

The power from the +28VDC power supply unit is connected to this module.

This connection unit contains:

Power On/Off switch (28VDC)

DC fuse

2.5. Repeater connection module

The connection module supplies and monitors the DC power to all the active components of the repeater.

The repeater values are sampled here and, if needed, the relevant alarms are sent to the remote monitoring and control. Module

2.6. Remote monitoring and control module

The remote monitoring and control module is based on a dedicated microcontroller. The interface to this controller is via a serial RS-232C port.

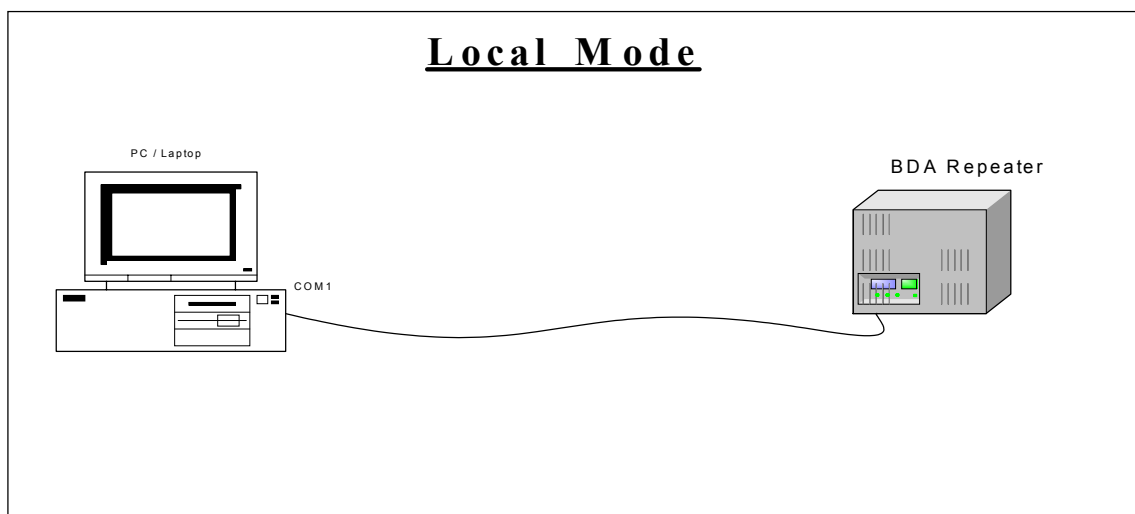
There are two ways for monitoring and control of the repeater as follows:

Local Mode: Through a local serial computer connection

The host computer has dedicated software, for analysis, control and display of the status of the repeater using a friendly Graphics User Interface (GUI).

For repeater control software installation see "Repeater Management Application Software User Manual".

Figure 2 - Repeater Monitoring and Control setup





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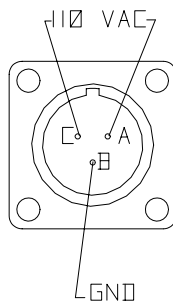
3. Repeater operation

The repeater AC power is supplied through a 3-wire male plug connector. A switch on the power control unit turns on the repeater.

The RF connection is made via 2 type “N” connectors. The repeater connector labeled “BASE” must be connected to the roof antenna pointing to the base station (donor side).

The repeater connector labeled “MOBILE” must be connected to the antenna/s pointing to the area covered by the repeater (service side).

Figure 3 – AC connector pin assignment



The repeater can be remotely controlled and monitored via a modem connected to the repeaters' remote monitoring and control module. The modem uses a directional coupler to transmit and receive RF signals through the repeater base side antenna.

The repeater can be controlled locally through RS232 connector housed on the remote monitoring and control unit. This is a D9 male connector; pin 2 is Tx; pin 3 is Rx and pin 5 is Gnd.

The power on/off switch is housed on the power control unit.



4. Repeater monitoring and control

4.1. Controls

- 4.1.1. PAMP On: Turns on/off the downlink power amplifier (✓ indicates amplifier is on)
- 4.1.2. Max Power: This window is blank when the downlink ALC is turned off (✓ indicates DL ALC is on)
- 4.1.3. Max Gain: The repeater gain is selected from a choice list
- 4.1.4. FWD Threshold: This value sets the lower limit for a downlink power alarm declaration. For example if the value shows 33dBm and the repeater transmits less than 33dBm (downlink), the FWD Measure alarm (that appears in the Link Alarm Status) will turn red. The actual transmitted power is also shown.

4.2. Link alarm status (downlink & uplink)

- 4.2.1. Power Amplifier: Turns red when the Power Amplifier (PA) current is above or below its specified limits
- 4.2.2. Main Voltage: Turns red when the internal power supply voltage is below or above its limits
- 4.2.3. Pre Amplifier: Turns red when the Low Noise Amplifier (LNA) current is above or below its specified limits
- 4.2.4. VSWR: Turns red when the return loss of the downlink antenna or cable connection exceeds 10dB (=VSWR 2:1)
- 4.2.5. FWD Measure: see FWD Threshold above

4.3. General alarm status

- 4.3.1. Temperature: Turns red when the chassis temperature exceeds 80°C
- 4.3.2. Door Open: Turns red when the repeater's door is opened
- 4.3.3. FAN Failure: Turns red when the internal FAN current is above or below its specified limits



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Figure 4 – Repeater monitoring and control screen

The screenshot displays the 'Dekolink Repeater Management Application' window. The interface is divided into several sections:

- Header:** Repeater Name: Temp Unit, Last Update: 5:07, 2003.26.11101718, Repeater PN: MW-BDA-PCS-F-50W90
- Left Panel:** A sidebar with 'Global' and 'Temp Unit' icons.
- CB Management Tab:**
 - Control Section:**
 - Downlink:** PAmp On: ☒; Max Power: ☒ 40 dBm; Max Gain: 90 dB; FWD TreshHold: 30 dBm.
 - Uplink:** Max Gain: 90 dB.
 - Smart ALC Section:** Smart ALC: ☐; SALC Power: 39 dBm; Auto Gain Downlink: 90 dB; Auto Gain Uplink: 90 dB.
 - Link Alarm Status Section:**
 - Downlink:** Power Amplifier: ☒; Main Voltage: ☒; Pre Amplifier: ☒; VSWR: ☒; FWD Measure: ☒ < 29 dBm.
 - Uplink:** Power Amplifier: ☒; Main Voltage: ☒; Pre Amplifier: ☒; VSWR: ☒; FWD Measure: ☒.
 - General Alarm Status Section:** Temperature: ☒; Door Open: ☒; Fan Failure: ☒.
- Bottom Section:** Status: Please Connect to Unit; Request Parameters; Send Parameters; A 'Connect' button is located on the left.



5. Repeater installation

Install the repeater in a shielded, ventilated and easy to reach area. Use low loss cables to connect antennas to the repeater. Install the repeater close to the service area to improve output power and noise figure.

The repeater's "BASE" connector port is connected to donor antenna (usually a Yagi antenna), while the repeater's "MOBILE" connector port is connected to a mobile antenna or Distributed Antenna System – DAS (outdoor or indoor).

5.1. Donor side antenna installation

Typically this is a directional antenna such as a Yagi or Dish antenna of 10 to 15dB gain. This antenna points to the base station in order to get maximum input power. It should be installed in "line of sight" with the base site. If no line of sight is achieved it is recommended to raise the antenna higher until the line of sight is reached. The signals received from the base station that are to be retransmitted should be the dominant (at least 6dB higher than other received signals in the vicinity).

Attention to the minimal antenna isolation needed should be carefully considered. Choose the antenna site to get the maximum isolation from the remote (mobile serving) antenna.

5.2. Service side antenna Installation

For outdoor applications the remote antenna is a directional antenna depending on the coverage requirements.

For indoor applications covering a large building, the RF signals are usually split using power dividers and distributed antenna systems, each covering a floor or a smaller area.

5.3. Antenna isolation

For proper operation the isolation between the donor side and service side antennas must be at least 12dB higher than the repeater's gain. Lower isolation leads to high in-band ripple and noise. Oscillations appear when the isolation is lower than repeater set gain.

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.



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5.4. Installation steps

- 5.4.1. Install all antennas. Measure the isolation between the two antennas. The isolation limits the maximum gain for the repeater. For a 90dB gain; an isolation of over 102 dB is required. Lower isolation will increase noise. Isolation lower than or equal to repeater gain would start oscillations within the repeater.
- 5.4.2. Measure the channel power reaching the base input of the repeater. This sets the recommended repeater gain. For example; 4 signals are received at –49dBm each (total power of –43dBm). Since the maximum composite power of the repeater is +40dBm, the gain setting should be over $40+43 = 83\text{dB}$ in order to get maximum power from the repeater. In this case isolation of over 95dB is necessary for proper operation.
- 5.4.3. Connect the antenna cables to the repeater ports.
- 5.4.4. Turn on the downlink ALC (the ALC is always on at the uplink preamplifier). This ALC limits the output power of the repeater. The ALC at the downlink path guarantees constant downlink power when and if the donor power changes.
- 5.4.5. Set repeater gain to the calculated value (as in par. 2 above) using the SW package. Turn on the RF power amplifier.
- 5.4.6. Set the uplink channel gain as required (usually the same gain as in the downlink path is used).
- 5.4.7. Note the measured FWD Power indicating proper functionality of the repeater.

WARNING: Do not set the repeater RF gain higher than 12 dB below the measured antenna isolation.

WARNING: Check that the LED on the uplink power amplifier indicating uplink composite power does not lit permanently. This LED would light permanently if the isolation between antennas is low (indicating oscillation) or the repeater is faulty. During normal operation this LED may flicker if a nearby mobile is in use.



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6. Specifications

6.1. Electrical specifications

Parameter	Specification	
	Downlink	Uplink
Frequency Range [MHz]	1970-1975	1890-1895
Gain [dB]	90±4	
Passband ripple	<3dB p-p	
Attenuation range (via SW)	0 to 31dB in 1dB steps	
Noise figure	≤ 5dB	
Output power @ 1dB compression	50W	8W
3 rd order intercept point	62 dBm min	47 dBm typ.
Composite power output	+40dBm	+27dBm
Downlink IMD @ two tone 37dBm each	50dBc	-----
Uplink IMD @ two tone 24dBm each	-----	44dBc
ALC factory set level (nom.)	40dBm	27dBm
ALC range	15dB	20dB
Impedance	50Ω	
VSWR	<1.5:1	
Rx/Tx isolation	> 100dB	
Power supply	AC 110/220V/50Hz Range: 176~264V, 45~65	

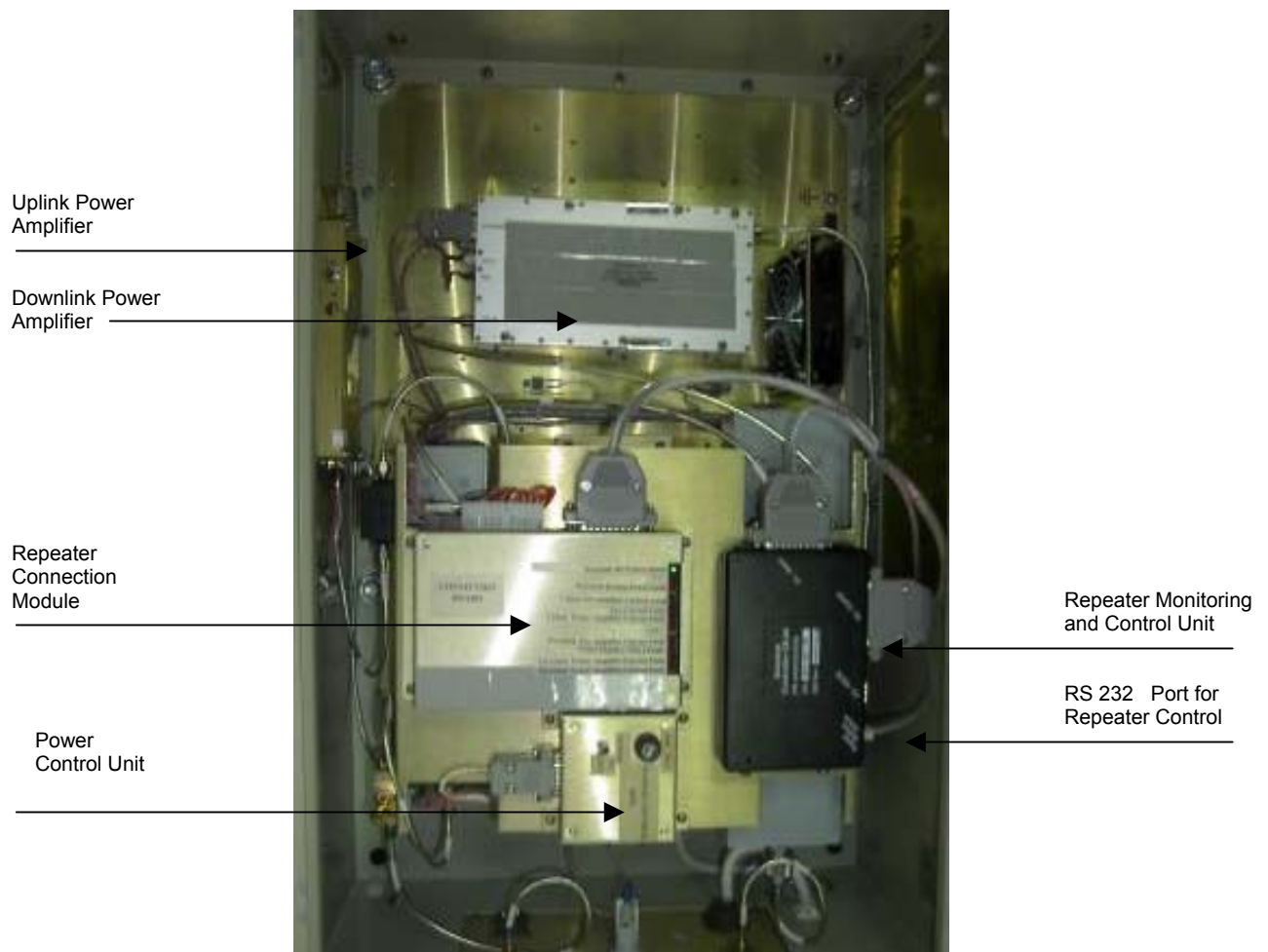
6.2. Mechanical specifications

Size [mm]	600X400X300 (approx.)
RF connectors	N-type Female
Weight [Kg]	40 (approx.)
Enclosure Type	Weatherproof enclosure for wall-mounted installation

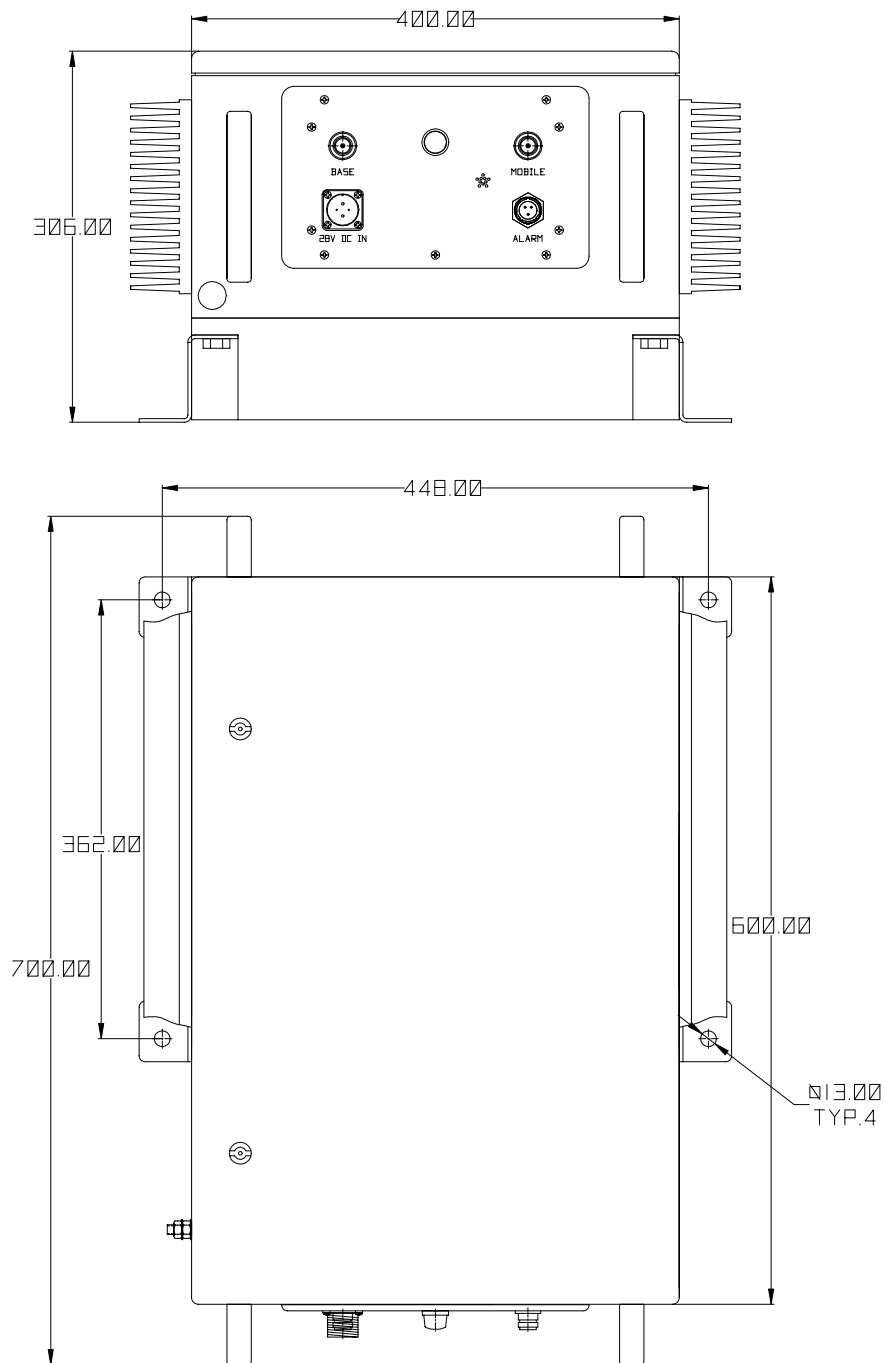
6.3. Environmental conditions

Operating temperature	-30°C to +50°C
Humidity	≤ 95%
Weatherproof conditions	Protected to IP65

Mechanical layout



Mechanical outline





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7. RF exposure warning

In order to satisfy the FCC RF exposure requirements, you must ensure that the installation complies with the following:

One antenna is connected via cable that has typical 1~10 dB attenuation (depends on the length of the cable) to the BDA base port. This antenna is installed outdoor and has very sharp beam (Yagi type or similar) pointed to the donor (BTS). This type of antenna has about 10 dBi gain. Typical specifications: gain: 8 dBd (=10.1 dBi), VSWR: better than 1.5:1 , Impedance: 50 ohm. The outdoor antenna must be installed to provide a minimum separation distance of 1 m (100 cm) from persons within the area.

The second antenna is connected to the BDA MOBILE port. There are two applications: Outdoor and Indoor.

In the case of Outdoor the type of antenna is omnidirectional (isotropic) with 0 to 2 dBi typical gain, or wide beam with up to 8 dBi gain, and is installed on a mast to cover shadowed, outdoor, area. This antenna must be installed to provide a minimum separation distance of 2 m (200 cm) from persons within the area

In the case of Indoor coverage the power is split to several, omnidirectional (isotropic) antenna with 0 to 2 dBi typical gain, and distributes to different indoor areas (in building floors, tunnels, basements, parking lots, shopping centers etc.). Typical specifications: gain: 2 dBi, VSWR: better than 2:1 , Impedance: 50 ohm. At least 5 such antenna must be connected to the BDA using cables and splitters. In this case the max. EIRP from each antenna will not exceed 3W so that the minimum required separation distance from persons within the area is 20cm.

Less separation is needed if the power is divided into more than 5 antenna covering many floors or areas.



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8. 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's 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's 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.