

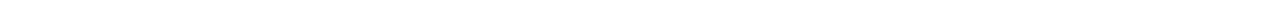


**Antenna Extender  
US 5 Band**

FCCID: 2AXALAE5BUS00

# **User Manual**

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# Instrument Care and Safety Information

Please read the whole of this section before using your Optical Zonu product. It contains important safety information and will enable you to get the most out of your equipment.



## Electrical Safety

The Optical Zonu Antenna and Equipment Units are Safety Class 1 products (having a metal case that is directly connected to earth via the power supply cable).

When operating the equipment note the following:

Hazardous voltages exist within the equipment. There are no user serviceable parts inside, and the covers should only be removed by suitably qualified personnel.

The equipment does not have an isolating switch on the mains inlets. Equipment must be installed within easy reach of a clearly labeled dual pole main isolation switch.

Make sure that only fuses of the required rate current, and of the specified type (anti-surge, quick blow, etc.) are used for replacement.

***Please read this manual fully for information on installing your Optical Zonu equipment before commissioning your fiber optic link.***

***Changes or modifications not expressly approved by Optical Zonu Corp. void the user's authority to operate the equipment.***

## Product Description

Optical Zonu's Antenna Extender is an RF-Over-Fiber connection between the donor antenna and a Bi-directional Amplifier (BDA) or RF Booster. The transport is band-specific. There are versions that pass the five US cellular wireless bands 700 MHz (Bands 12, 13), 850 MHz (Band 5), PCS (Band 25), AWS 1 (Band 4) and WCS (Band 30), the US 700MHz and 800MHz Public Safety Wireless Bands and five EU bands (Bands 1, 3, 7, 8, 20).

The units install easily and there are no adjustments in the fiber connection. The BDA gain must be set for optimal drive levels without overdriving the fiber transport.

The Antenna Extender RF Gain is fixed and is specified for a 1 m length of fiber. For typical single mode fiber with a loss of 0.35 dB/km, the specification is good up to approximately 3,000 ft.

# System Overview

## Check Package Contents

Before attempting to use this product, please verify the condition of the packaging and it includes all components:

- Packing list
- Antenna Unit (quantity according to PO)
- Equipment Unit (quantity according to PO)
- Hybrid Fiber/Power Cable Assembly
- 48 VDC Antenna Unit Power Supply
- +12 VDC Equipment Unit Power Supply
- User Manual

Note: If any items are missing or configuration is not as specified, please contact Optical Zonu immediately. Please have the Model Number, Serial Number and Invoice Number available for reference when you call.

## User-Supplied Components

The user must supply the following:

- Bi-Directional Amplifier or RF Booster
- Donor antenna and mounting
- Coaxial cable from donor antenna and Antenna Extender Antenna Unit – N(M) termination to connect to Antenna Unit
- Coaxial cable from Equipment Unit to BDA – N(M) termination to connect to Equipment Unit

# Warning and Safety Requirements

**Warning.** This is **NOT** a **CONSUMER** device. It is designed for installation by **FCC Licensees** and **QUALIFIED INSTALLERS**. You **MUST** have an **FCC LICENSE** or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

## FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference.

## ESD Precautions

Precautions for handling electro-static sensitive devices should be observed when handling all OZC modules. Technicians should ensure that they use effective personal grounding (e.g. ESD wrist strap etc.) when servicing the equipment.

Any equipment or tools used should be grounded to prevent static charge buildup. Best practices should be observed at all times. For reference see the relevant standards, including EN 61340-5-1, "Protection of Electronic Devices from Electrostatic Phenomena– General Requirements".

## Environmental Conditions

Do not install in corrosive atmosphere or in critical environmental conditions such as hazardous classified areas.

## Installation Site Features

This equipment is suitable for installation at customer's premises sites and network telecommunication facilities.

A trained technician should carry out the installation of the system. The chassis should be installed in a suitable location where:

- There is no risk of explosion
- The environment is not classified as a high-risk one in case of fire
- Suspended particles are not to be found in great concentration
- There is no risk of traffic which could cause collision damages
- The site is properly located with respect to the ergonomic positioning of the working environments
- The system is protected against any possible violation
- The site must be accessible by maintenance personnel
- The site must guarantee proper space for cables and natural ventilation for the system

## Safety and Precautions during Installation or Maintenance

During installation, the following tools and equipment will be needed.

### *Typical electrician tools*

Cross-point screwdriver, scissors, pliers, nippers, drill and bits, screws for installing each unit.



**CAUTION:** Do not paint or otherwise coat the equipment.

### *Power Supply Connection*

Power connection must be carried out following all necessary precautions:

- It must be properly made according to the due diligence rules (ex.: EN rules, IEC rules, etc.)
- In accordance with the rules for safety against direct or indirect contacts
- In accordance with the rules for safety against over current (short circuit, overloading)
- In accordance with the rules for safety against over voltage
- Connection is to be carried out by appropriate and competent staff



**CAUTION:** In North America, this equipment is to be installed in accordance with the National Electric Code (NEC) ANSI/NFPA 70 and the Canadian Electric Code (CEC) Part 1, C22.1.



**CAUTION:** Do not connect the AC power until you have verified that the line voltage is correct.

### *Safety and Precautions for Lasers*

The optical transmitter used in the GPS Fiber Transport Link contains a laser which has a power level that is not dangerous for health. However, it is classified as class 1 equipment (in accordance with EN60825).

It is nevertheless prudent, during the installation phase, to observe the following rules:

- Never look directly inside the optic connector exit of the transmitter when it is switched on.

The wavelength of the laser is not visible to the human eye, which means that long-term damage will not be immediately known.

- When working with the optical connectors, check at each end that the transmitting laser(s) are switched off.

## Warning Labels



**Class 1 Laser Product.**



**GROUND** - Use this terminal for a safety ground connection for the equipment.

# System Installation

The basic system interconnection is shown in the figure below.

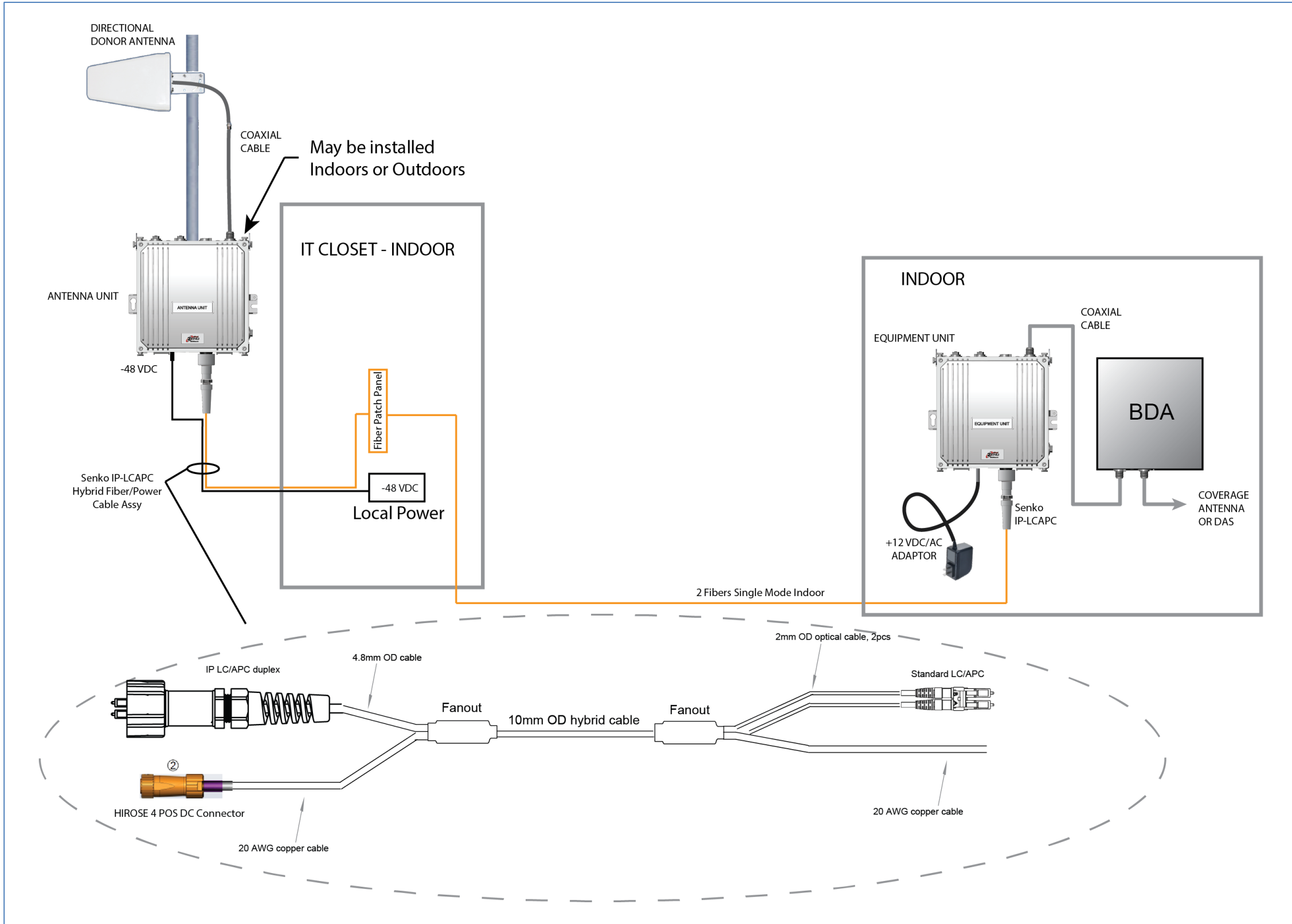


Figure 1. Antenna Extender connections – Antenna Unit Local Power. The Antenna Unit fiber connector is an IP-68 dual LC/APC optical connector. The hybrid cable includes a breakout to the IP-68 rated, Hirose DC connector for the -48VDC. Select the hybrid cable terminated with standard indoor-rated dual LC/APC fiber connectors to connect to 2 riser-rated single mode fibers. The DC conductors are connected to the -48VDC/AC power supply. If the Antenna is also mounted indoors, a standard dual LC/APC optical connection can be used and the power supply can be connected directly to the unit.



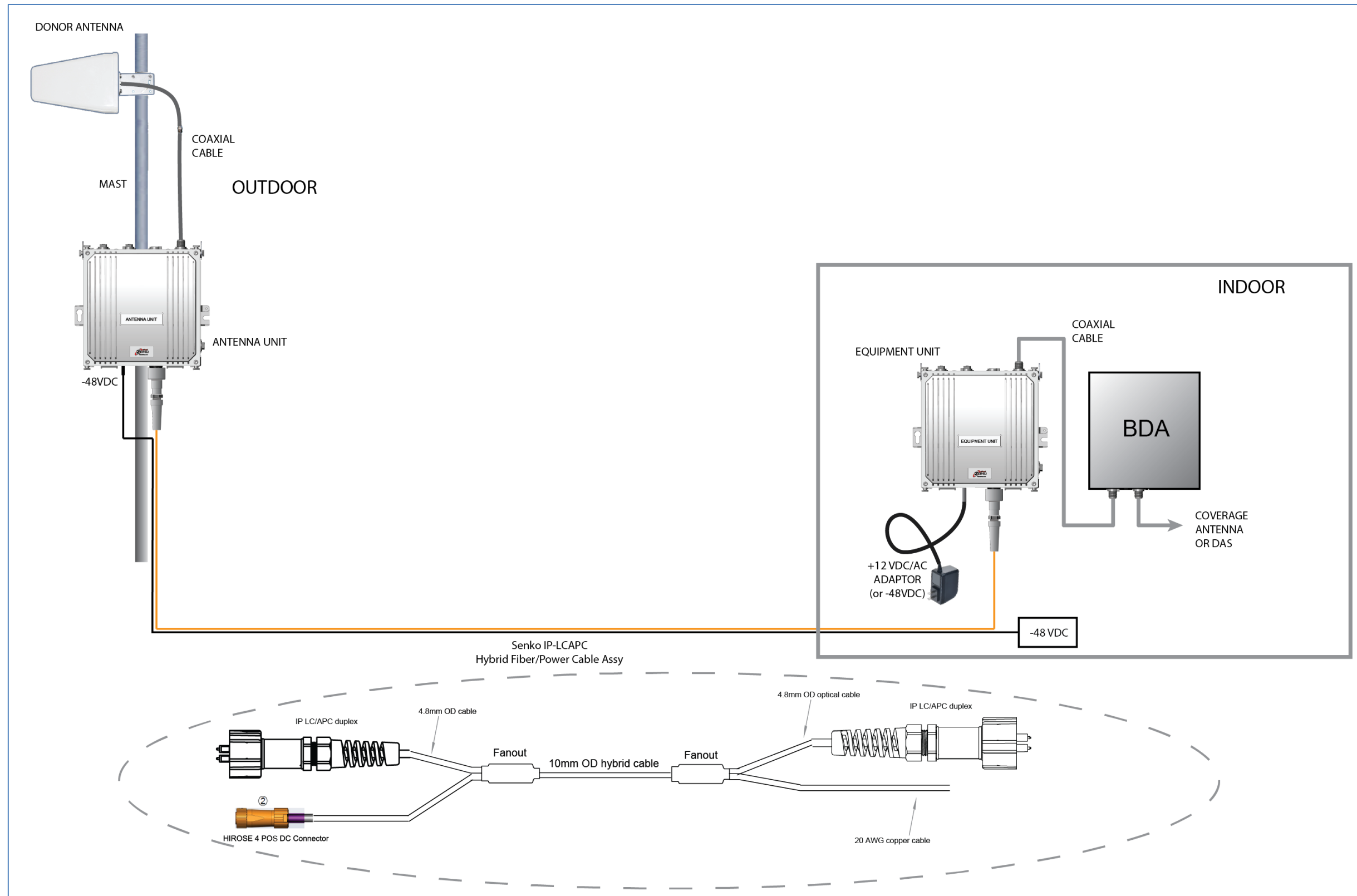


Figure 2. Antenna Extender connections - Antenna Unit Remote Power. Select the hybrid cable assembly that makes a home run connection to the Equipment Unit. The -48 VDC power supply for the Antenna Unit is installed here. The -48 VDC Antenna Unit can handle a voltage drop up to 12 VDC. Since the Equipment Unit is installed indoors, a standard indoor dual LC/APC optical cable termination can be used. Using the Senko IP-LCAPC provides additional protection.

# Installation Planning

The proposed installation must first be analyzed to ensure it will provide the needed coverage.

1. Select a repeater or RF booster that covers the needed frequency band(s) and has a limited maximum RF uplink power. Use a model that has an uplink RF power no more than 24 or 27 dBm. A 10 dB attenuator can be installed in between the repeater and the Antenna Extender Equipment Unit to limit the uplink power to +17 dBm. Using a high power repeater will require installing high attenuation which may degrade the downlink sensitivity.
2. Locate the nearest donor site that supports the desired services. Always use a directional donor antenna. This ensures the strongest signal and minimizes interference to and from other donor sites. Design programs such as IBWave can be used to test the system performance with different repeaters and donor antennas.

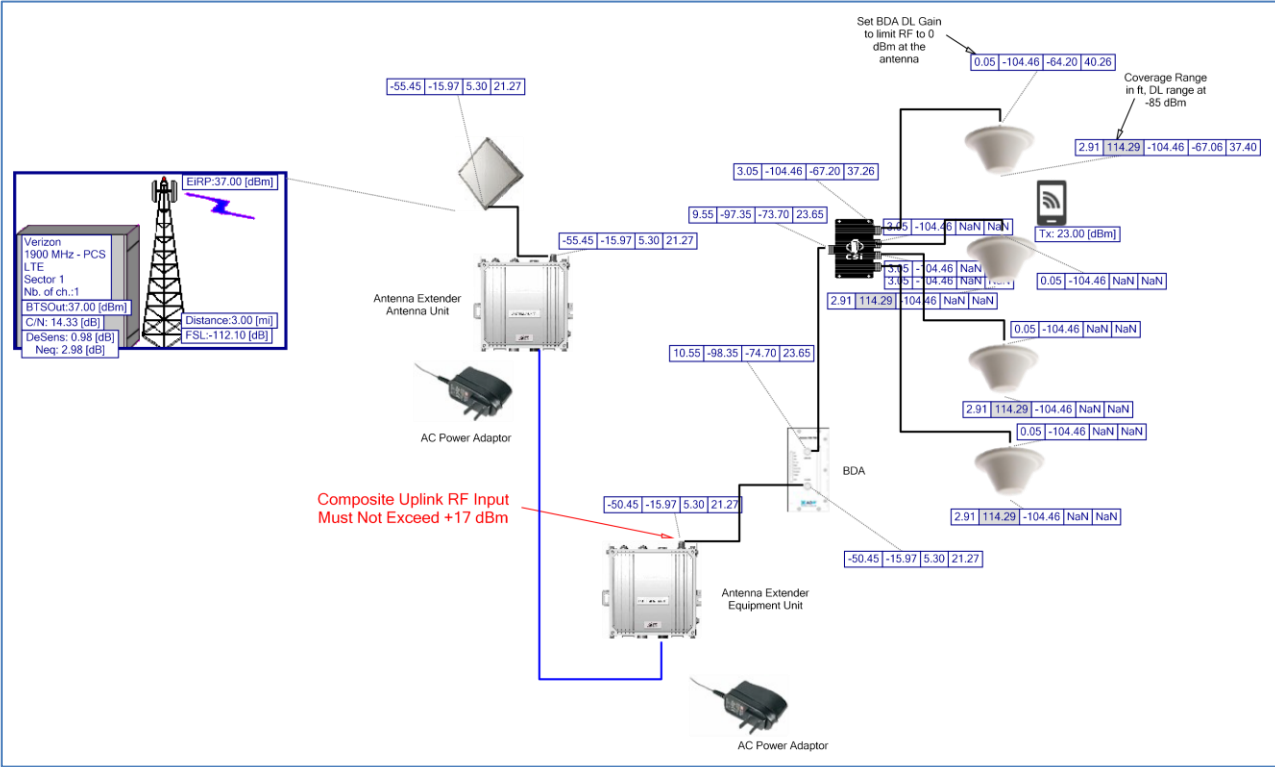


Figure 3. IBWave can be used to analyze the performance of the proposed site with different, antennas, repeaters and cables.

Optical Zonu recommends using a trained engineering services firm to select the donor site, the optimum donor antenna and donor antenna location. These firms also guarantee installations that are rugged and meet all necessary codes.

Contact your Optical Zonu representative for a recommendation.

**Optical Zonu Corporation, 818-780-9701; [support@opticalzonu.com](mailto:support@opticalzonu.com).**

## Installing the Units

The dimensions for Antenna and Equipment Units is shown in the Figure.

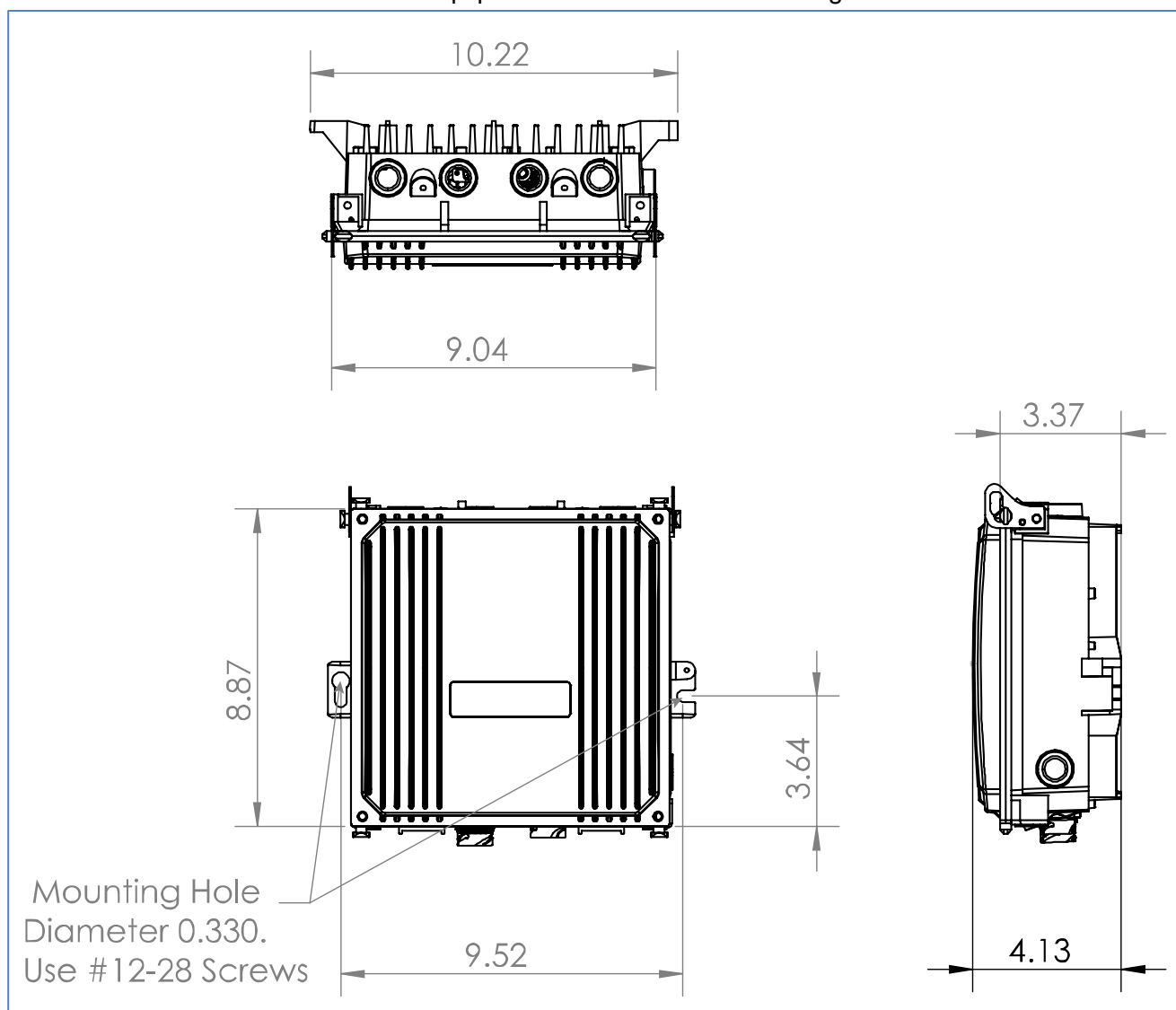


Figure 4. Antenna and Equipment Unit dimensions in inches.

To ensure the maximum downlink sensitivity and maximum uplink transmit RF power, the Antenna Unit should be mounted as close as possible to the donor antenna.

Use #12-28 screws (or bolts) with washers to secure the units to a wall or to a strut clamped onto a mast. If the Antenna Unit is to be installed outdoors, it is preferable to mount the unit with the RF connector up and the fiber optic and DC connector on the bottom.

**IMPORTANT: do not connect the Equipment Unit to the BDA until all other connections have been made. Then, only connect the BDA to the Equipment Unit when it is verified that the BDA gains have been set properly. This will help prevent overdriving the Equipment Unit and causing possible damage.**

## Fiber Optic Connections and DC Power

The units have no power switch. The unit comes on when DC power is plugged into the unit. The earth ground connections may be connected to either an isolated or common bonding network.

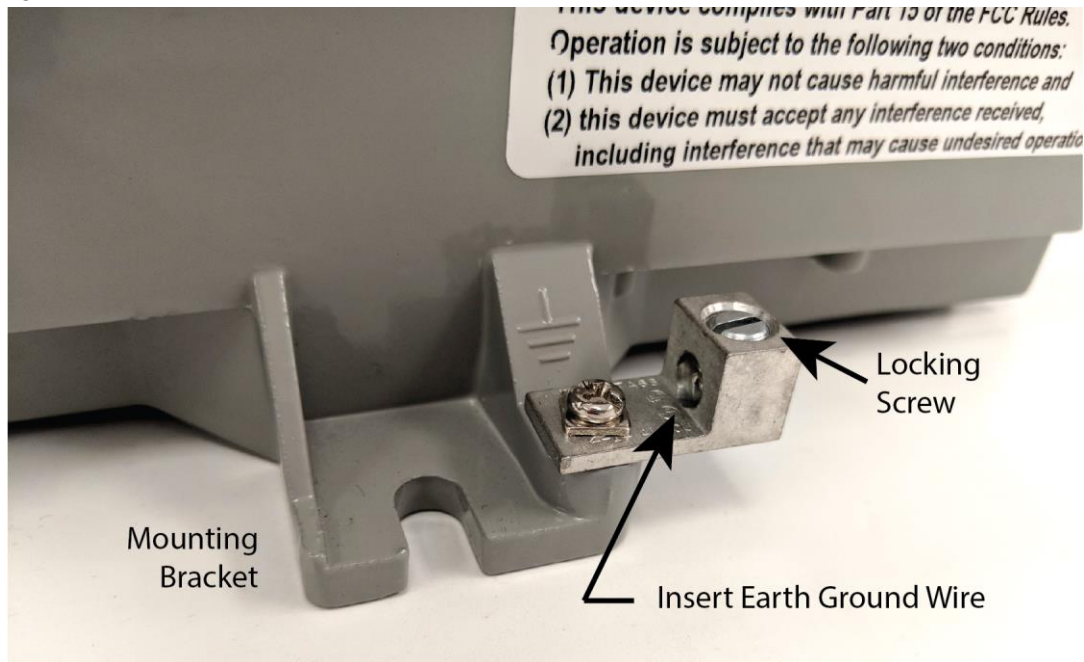


Figure 5. Earth Ground Connection.

The equipment shall be provided with a suitably listed DC breaker or Fuse in the building installation supply wiring. *The DC connections should always be with an isolated DC return.* Connect a protective earthing wire to the Aluminum grounding lug shown in Figure 3. Slide the grounding wire through the hole in the lug and tighten the locking screw. The grounding wire should be between 20AWG and 14AWG and should have a green and yellow insulator.

The DC power connection for the Antenna Unit is the Hirose 4 Position LF Series.



Figure 6. The Hirose DC connector.

If the power for the Antenna Unit is to be supplied locally at AC power in a NEMA enclosure, use the hybrid cable that is terminated with the indoor dual LC/APC fiber connectors that can be connected to the pre-installed cable run via a splice tray or patch panel in the NEMA enclosure. The Antenna Unit can also be powered remotely over the hybrid cable run the entire distance to the Equipment Unit. In this case, the hybrid cable terminated in the non-hybrid Senko IP-LCAPC is preferred with the DC breakout for power. The 48VDC power supply must be with an isolated return.

The Equipment Unit is powered locally with the +12 VDC/AC Power Adaptor. The standard AC adaptor used is lightweight (<0.25 kg) devices. Select AC outlets that are in physical locations that minimize the danger of accidental disconnection.

### Short turn bayonet lock

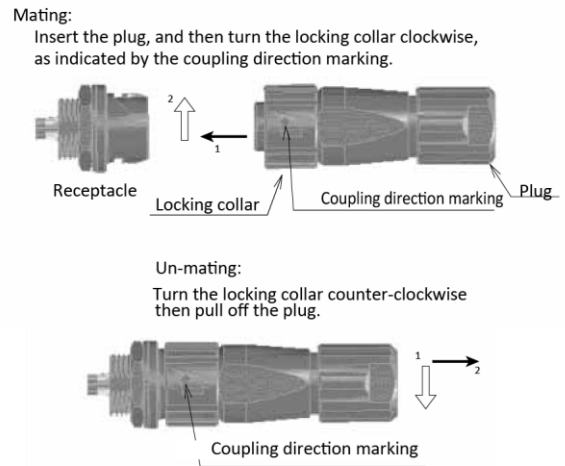


Figure 7. DC Connections

For the standard single mode fiber versions, both the Antenna and Equipment Units each have two fibers with a dual LC/APC connector. Single mode fiber with an angle cut dual LC connector (LC/APC) must be used. The connector will be green indicating it is an angle-polished connector. Flat-polished single mode connectors have a blue or beige boot.

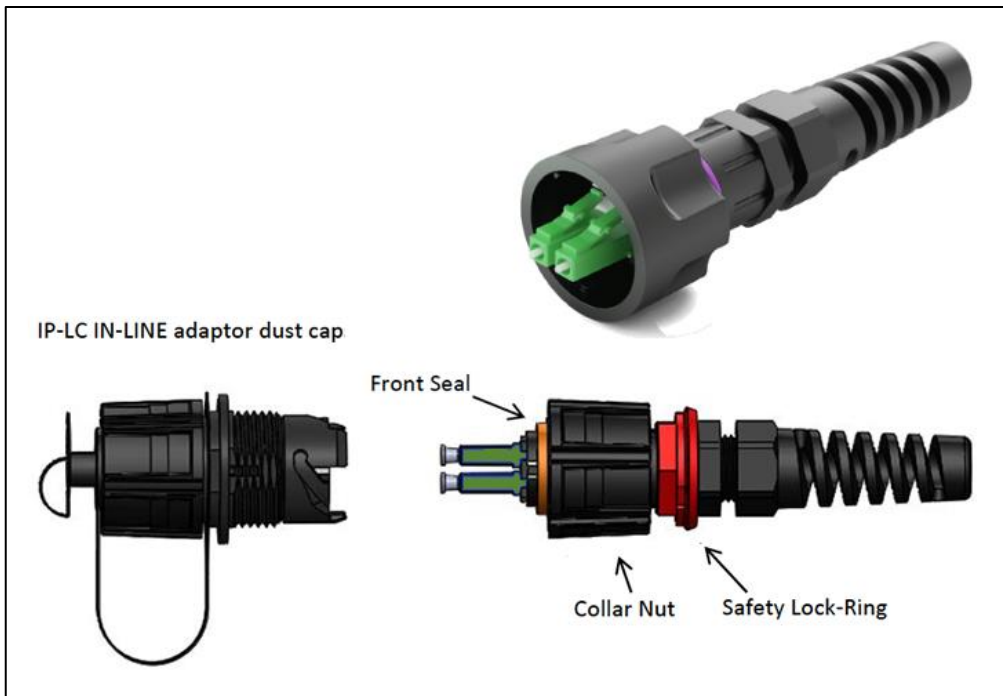


Figure 8. The connector and mating cable plug for the Antenna Unit fiber connection.



**CAUTION:** Use of optical cables with connectors other than as specified will damage the optical connectors on the unit.

Always clean the fiber optic cable connectors using standard fiber connector cleaning tools (for example, see <https://www.fiberinstrumentsales.com/consumables.html?cat=88>)



Figure 9. Equipment Unit DC and Fiber Optic Connections. The fiber connector is shown capped.

## Connecting RF

To ensure the maximum downlink sensitivity and maximum uplink transmit RF power, the Antenna Unit should be mounted as close as possible to the donor antenna.

Connect the donor antenna to the Antenna Unit RF port with an outdoor-rated coaxial cable. The Antenna Unit RF connector is N(F) so the cable must have an N(M) termination. The connector at the other end will depend on the donor antenna.

The Antenna Extender has a nominal 2 dB gain in the Uplink path and -5 dB in the downlink path (base station-to-mobile).

For the uplink (mobile-to-base station), the Antenna Extender has a maximum RF input +15 dBm. The maximum uplink composite uplink transmit RF output power is +17 dBm. **DO NOT EXCEED THE +17 dBm UPLINK RF INPUT LEVEL.**

**IMPORTANT:** For the uplink, it is important to cap the maximum BDA output power to +15 dBm so as to not overdrive the Antenna Extender. This is *total* RF power. For example, if the BDA supports two bands on the same RF port, each band must be limited to +12 dBm (2 equal RF signals result in a total RF level 3 dB higher than the power per band).

Once you have verified the BDA uplink gain settings and maximum power are set correctly, connect the Equipment Unit RF port to the BDA donor antenna port with coaxial cable.

# Specifications

## RF Parameters

		Base to Mobile (Downlink)	Mobile to Base (Uplink)
Gain (Typical)	500m Fiber Cable Max	-5 dB	0 dB
Passband Ripple		< 1.5 dB per Band	
Maximum Input Power		-30dBm (-65 to -50dBm Typical)	+17 dBm
Output Power		-	+17 dBm Max Composite
Noise Figure		< 20 dB	< 52 dB
Impedance		50 $\Omega$	
VSWR		< 1.5 : 1	

## Mechanical Parameters

Dimensions	Each Unit	9.5"W x 8.9"H x 4.1"D	
	Optical/Power (Antenna Unit)	IP1-LC/APC (Senko IP-68 Dual LC/APC + two 16AWG Conductors)	
Connectors	Optical (Equipment Unit)	IP-LC/APC (Senko IP-68 Dual LC/APC)	
	RF	N(F)	
	Power (Eqpmt Unit)	Hirose LF Series, Bayonet Lock, 4 Contacts	

## Electrical Parameters

Power	Each Unit	Antenna Unit: 48VDC; 0.23A Max Equipment Unit: +12VDC; 0.4A Max
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## Environmental Parameters

Operating Temperature	Antenna Unit	-20 to +50°C
	Equipment Unit	0 to +40°C
Storage Temperature	Each Unit	-20 to +85°C
Maximum Altitude		2,000 m

# Alarms

Each unit has a single, multi-color LED with these alarm indications:

1. GREEN - Unit OK
2. RED - Unit Fail
3. SLOW BLINKING RED - Received Optical Power Low / High
4. SOLID YELLOW - Equipment Unit Uplink RF Input low
5. FAST BLINKING YELLOW - Equipment Unit Uplink RF Input High
6. FAST BLINKING RED – Tx Optical Power Out Low / High

There are no user accessible electrical alarm connections.

## Handling Fiber Optic Cable & Connectors

This product is supplied with angle-polished connectors (APC) and these must not be confused with standard flat, spherical or "super" polished connectors. These connector types are not interchangeable and mating one with the other will damage both the cable and the equipment. The specification of the optical connector is critical to the performance of the complete fiber optic link.

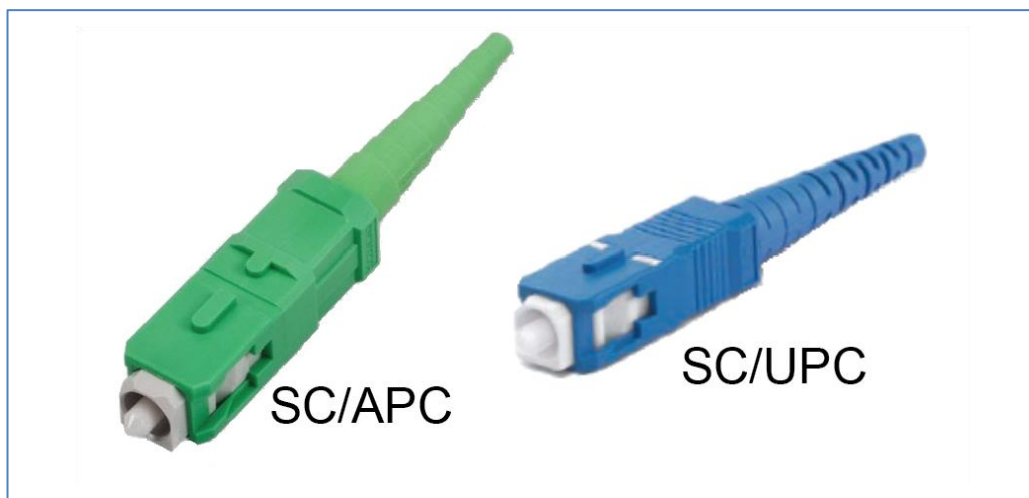


Figure 10. Optical Zonu products use APC (angle polished connectors). These are always single mode and are indicated by a green boot. Do not try to connect UPC (ultra-polish connectors – indicated by a blue boot). These are flat polished connectors that will damage the mating APC connector.

Note that a yellow jumper indicates single mode fiber, but the connector end must be green indicating an angle cut connector (APC).

Ensure that all mating connectors are matched types. All Optical Zonu equipment uses APC connectors.



The Minimum Bend Radius of a simplex patch cable is typically 30 mm. Avoid over-bending the cable as this will result in a high optical loss.

Connect SC/APC cable to SC/APC modules and FC/APC cable to FC/APC modules only. To connect SC/APC, locate the connector key. Align key and keyway then gently push the plug into the adapter until a click is heard and the connector locks. To disconnect SC/APC just pull back the “square” collar. Replace the dust caps on both the receptacle and the cable plug.

To connect FC/APC optical connectors, remove the dust caps and align the white ceramic center ferrule on the cable connector with the mating receptacle. There is a key (lug) on the side of the ferrule, which must match the keyway (gap) in the receptacle shroud. When they are aligned, gently push the plug home and finger tighten the knurled collet nut onto the threaded receptacle. To disconnect, unscrew the knurled collet on the plug and gently withdraw the plug. Replace the dust caps on both the receptacle and the cable plug. (keep in mind the Minimum Bend Radius of Fiber Optic Cables is 50mm.)

## Cleaning Optical Connectors

Optical connectors MUST be cleaned before use. Most performance issues are due to dirty fibers. For more details please read the cleaning instruction which accompanies the connector cleaning kit you use (see <https://www.fiberinstrumentsales.com/>).

When cleaning and connecting the fiber optic cables, never look directly into the end of the fiber.

Power off both the Head End and the Remote units while connecting and cleaning. Remember light is also coming from the unit at the other end of the fiber.

Always cap the connector with the plastic cover when not in use.

Never touch the fiber tip with your finger.

Optical Zonu RF over Fiber transceivers use a variety of angle cut optical connectors: SC/APC, FC/APC and LC/APC. They must mate with their corresponding connectors and adaptors. The plastic boot color on cable side of the connector is GREEN indicating the connector is angle cut APC.

Always clean both sides of the mating surfaces. For bulkhead connectors use a pen tool.

Dry cleaning, no special solutions or cleaner, is the preferred method. Solvents might attack epoxy and some optical cleaners for lenses may leave residues. If a cleaner is used, only reagent-grade 99% isopropyl alcohol should be used. Never use cotton swabs or cloth it will leave threads behind. As a



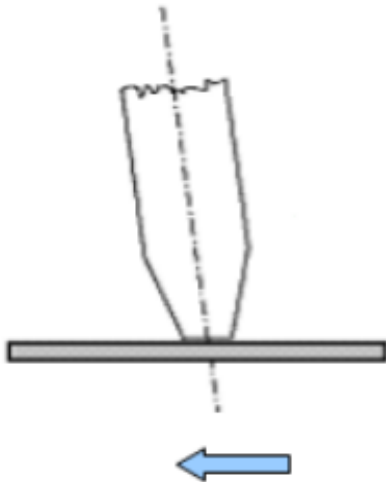
Figure 11. Bulkhead optical connector cleaning tool.

last step clean and dry the end of the ferrule with a dry lint free wipe or surface before insertion.

If possible, use a Figure 8 motion and ensure that the tip of the ferrule is always parallel to the cleaning pad.

The connectors are all angle-cut. The angle of the angle cut connector is very slight. They have a slope of only about 8 degrees

If a dispenser like Cletop is used, push the lever down to expose the cleaning surface. Begin by twisting back and forth and then with the key facing left pull down.



Key is facing into this diagram

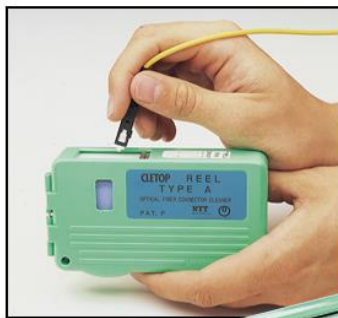


Figure 12. Cletop fiber connector cleaner cassette.

# Product Warranty

Optical Zonu Corporation guarantees its products and will maintain them for a period of one year from the date of shipment at no cost to the customer. Extended warranty options are available at the time of purchase.

Please note that, if a product must be returned to the factory, the customer is responsible for shipping costs.

The Company or its agents will maintain its products in full working order and make all necessary adjustments and parts replacements during Company normal working hours provided that the Customer will pay at the rates currently charged by the Company for any replacements made necessary by accident, misuse, neglect, willful act or default or any cause other than normal use.

Claims must be made promptly, and during the guarantee period.

## **IMPORTANT**

Please contact both your selling agent and OZC prior to returning any goods for Warranty or Non-Warranty repairs. Goods will not be accepted without a valid Return Material Authorization (RMA).

# Troubleshooting

## *No RF Output*

1. Verify the correct units are installed at each location
  - a. Donor Antenna Connection – Antenna Unit
  - b. BDA Connection – Equipment Unit
2. Verify Units are properly powered
3. Verify LED Status indicators are GREEN at both units

## *Low RF Output*

1. Is the Status LED Blinking RED slowly? – Low received optical power.
  - a. Is the other unit status LED RED or blinking RED fast?
    - i. If yes, that unit has failed. Contact factory for RMA repair.
    - ii. If no, problem is in fiber path
  - b. Fiber Path potential problems
    - i. Incorrect fiber connectors – The Antenna Extender uses dual LC/APC for the 2 fiber versions and SC/APC for the single fiber versions. Connecting a flat polished connector will result in high optical loss a possible damage to the APC (angle polished) connector. APC connectors are green, flat polished are blue.
    - ii. Dirty connectors – singlemode fiber has a core diameter of just 9 microns. The slightest dirt or finger oils will seriously degrade optical and rf performance. Be sure to have the proper fiber connector cleaning tools available (see Cleaning Optical Connectors section above).
    - iii. Incorrect fiber – unless otherwise specified, the standard Antenna Extender uses singlemode fiber. Multimode fiber will result in seriously degraded performance.
2. Verify that the UL RF input power at the Equipment Unit is within that specified range. If RF input from the BDA is too low, the uplink output power will drop below the specified output. If too high, as indicated by a slow blinking RED LED status indicator, the RF performance will degrade. A very high uplink RF input can damage the Equipment Unit front end.