Iridium Fiber Optic Repeater System

Operations Manual

© 2020, Global Foxcom. All rights reserved. Other trademarks referenced are the property of their respective owners.
This document contains proprietary information belonging to Global Foxcom
All specifications are subject to change without prior notice. Rev A1/ May 2020

Israel Corporate HQ, 16 Hataasia Street, Har Tov A Ind. Zone, Beit Shemesh 99052. Tel: +972-2-589-9888 Fax: +972-2-589-9898
US Sales Office, 1315 Outlet Center Drive, Smithfield, North Carolina 27577. Tel: 609-228-8104/9 Fax: 201-289-7093
www.foxcom.com | sales@foxcom.com

Table of Contents

List of Figures

1 Important Information

This is the Operation Manual for the Iridium Fiber Optic Repeater system.

1.1 Warranty and Repair

Global Foxcom performs testing and inspection to verify the quality and reliability of our products. Global Foxcom uses every reasonable precaution to ensure that each unit meets specifications before shipment. Customers are asked to advise their incoming inspection, assembly, and test personnel as to the precautions required in handling and testing our products. Many of these precautions are to be found in this manual.

The products are covered by the following warranties:

1.1.1 General Warranty

Global Foxcom warrants to the original purchaser all standard products sold by Global Foxcom to be free of defects in material and workmanship for 24 months from date of shipment from Global Foxcom. During the warranty period, Global Foxcom will repair or replace any product that Global Foxcom proves to be defective. This warranty does not apply to any product which has been subject to alteration, abuse, improper installation or application, accident, electrical or environmental over-stress, negligence in use, storage, transportation or handling.

1.1.2 Specific Product Warranty Instructions

All Global Foxcom products are warranted against defects in workmanship, materials and construction, and to no further extent. Any claim for repair or replacement of units found to be defective on incoming inspection by a customer must be made within 30 days of receipt of shipment, or within 30 days of discovery of a defect within the warranty period.

This warranty is the only warranty made by Global Foxcom and is in lieu of all other warranties, expressed or implied. Global Foxcom sales agents or representatives are not authorized to make commitments on warranty returns.

1.1.3 Returns

In the event that it is necessary to return any product against above warranty, the following procedure shall be followed:

1. Return authorization is to be received from Global Foxcom prior to returning any unit. Advise Global Foxcom of the model, serial number, and discrepancy. The unit may then be forwarded to Global Foxcom, transportation prepaid. Devices returned collect or without authorization may not be accepted.

2. Prior to repair, Global Foxcom will advise the customer of our test results and any charges for repairing customer-caused problems or out-of-warranty conditions, etc.

3. Repaired products are warranted for the balance of the original warranty period, or at least 90 days from date of shipment.

1.1.4 Limitations of Liabilities

Global Foxcom's liability on any claim, of any kind, including negligence for any loss or damage arising from, connected with, or resulting from the purchase order, contract, quotation, or from the performance or breach thereof, or from the design, manufacture, sale, delivery, installation, inspection, operation or use of any equipment covered by or furnished under this contact, shall in no case exceed the purchase price of the device which gives rise to the claim.

EXCEPT AS EXPRESSLY PROVIDED HEREIN, GLOBAL FOXCOM MAKES NO WARRANTY, EXPRESSED OR IMPLIED, WITH RESPECT TO ANY GOODS, PARTS AND SERVICES PROVIDED IN CONNECTION WITH THIS AGREEMENT INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. GLOBAL FOXCOM SHALL NOT BE LIABLE FOR ANY OTHER DAMAGE INCLUDING, BUT NOT LIMITED TO, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH FURNISHING OF GOODS, PARTS AND SERVICE HEREUNDER, OR THE PERFORMANCE, USE OF, OR INABILITY TO USE THE GOODS, PARTS AND SERVICE.

The Company's exclusive warranty and the remedy provided for breach there of shall not apply to:

1. Any Product used or operated other than pursuant to the Company's written instructions,
2. Damage or deficiencies resulting from accident, alteration, modification, misuse, tampering, negligence, improper maintenance, installation or abuse,
3. Use of any Product other than at the Installation Site,
4. Use of any Product that is defective or damaged due to misuse, accident, or neglect, or due to external electrical stress, lightning or other acts of nature,
5. Use of any Product by a person who is not any authorized employee of the Customer, or
6. Used other than as explicitly authorized in writing by the Company.

1.1.5 Reporting Defects

The units were inspected before shipment and found to be free of mechanical and electrical defects.

Examine the units for any damage which may have been caused in transit. If damage is discovered, file a claim with the freight carrier immediately. Notify Global Foxcom as soon as possible.

Note: Keep all packing material until you have completed the inspection.

1.1.6 Precautions

1.1.6.1 PERSONAL SAFETY

Applying power to the transmitter unit will create a laser energy source operating in Class 1M as defined by IEC 825-1. Use either an infrared viewer, optical power meter or fluorescent screen for optical output verification.

1.1.6.2 AC POWER HAZARD

The rackmount power supply line is EMI filtered. The chassis is connected to earth ground in compliance with safety requirements. Always use the 3-prong AC plug with earth ground to avoid possibility of electrical shock hazard to personnel.

1.1.6.3 GROUNDING

See **section 2.3.2 for instructions on how to connect** of the ODU's main grounding point. Do not attempt to install the ODU before grounding the unit at this point.

The unit should be installed according to NEC/CEC.

1.1.6.4 EQUIPMENT SAFETY

To avoid damaging your product, please observe the following:

1. The transmitter input and receiver output are DC coupled and can withstand external DC. Do not exceed 25V DC bias.

2. The input of the outdoor unit transmitter (L-Band uplink) and may have an optional built-in bias for inserting DC power up the coax to the LNB. Make certain any equipment or test equipment connected to the transmitter input can withstand this bias.

3. Do not allow any dirt or foreign material to get into the optical connector bulkheads. This may cause damage to the polished optical connector end faces.

4. The optical fiber jumper cable bend radius is 3 cm. smaller radii can cause excessive optical loss and/or fiber breakage.

5. If multiple chassis are installed in a Rack allow sufficient room for adequate ventilation; otherwise the units may overheat causing possible safety hazard or equipment damage.

6. Make sure the unit is grounded!

2 Introduction to the Iridium Optic Repeater System

The Iridium satellite constellation is a large group of satellites providing voice and data coverage to satellite phones, pagers and integrated transceivers over the Earth's entire surface.
Iridium communication uses TDMA & FDMA together with DE-QPSK/DE-BPSK modulation to cover the frequency range of 1616-1626.5MHz.
Iridium terminals need open line-of-sight to the open sky to function. Units will not work consistently indoors, or under forest cover.
Iridium has a very powerful paging channel that can ring the phone indoors, but the customer may have to walk outdoors to take the call. [Wikipedia]

Global Foxcom's Optical repeater is a fiber-based Bi-Directional repeater transport system that can be used for Iridium satellite signals.
Global Foxcom's Iridium system helps create virtual Iridium satellite coverage inside a building, a bunker or an enclosed facility.

With the optional supplied inline RX amplifier, outdoor antennas can be mounted up to a distance of 25meters from the ODU unit (using an LMR400 cable).

Global Foxcom offers a full SATELLITE repeater solution, which includes a separate or integrated GPS system as well as Inmarsat. For more information, contact Global Foxcom sales.

2.1 System Components

The Iridium optical repeater consists of the following components (images below):

2.1.1 Indoor Unit

- Indoor compact unit is equipped with Iridium optical transceiver (supplied with power adapter).
- Dual ceiling mount distribution antennas [PN: 4700012].
- Dual 10M low-loss coax cable [PN: 4201831].

2.1.2 Outdoor Unit

- AC Powered ODU enclosure equipped with Iridium optical transceiver, high-power amplifier, filters and pole mounting kit.
- Dual Iridium antennas with pole-mount kit [PN: 4700012].
- Dual 5M low-loss coax cable [PN: 4201835].
- Inline RX amplifier [selected versions only]

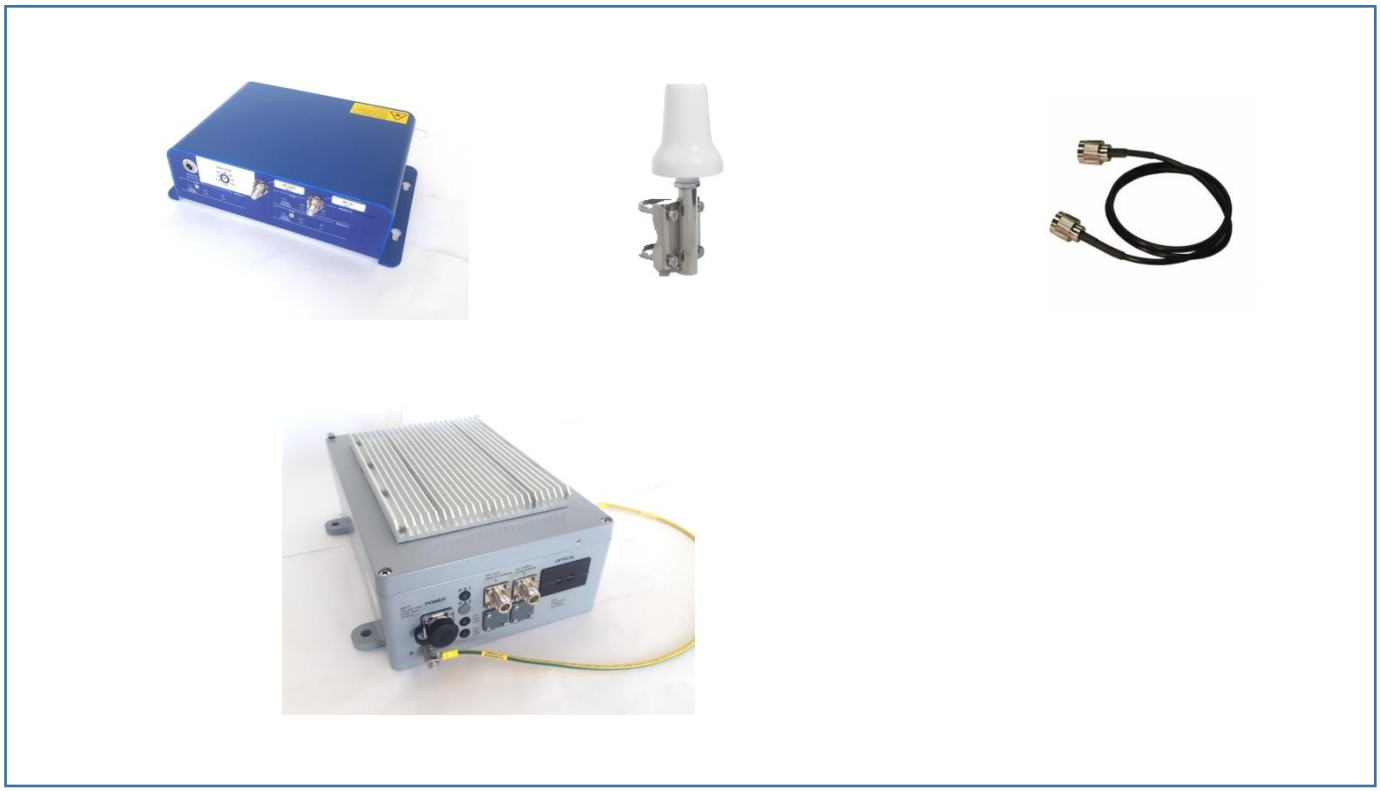


Figure 1: System Components

2.2 Product Drawing

2.2.1 Compact Indoor Unit

Figure 2: Compact Enclosure Front View

Figure 3: Compact Enclosure Rear View

2.2.2 Outdoor Unit

Figure 4: ODU Front View

Figure 5: ODU Connector Panel (Single Zone)

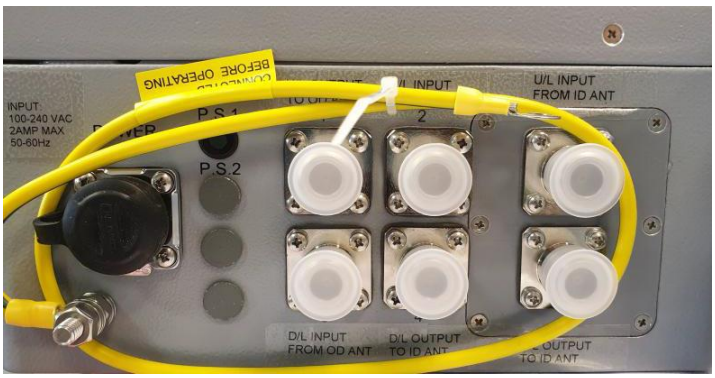


Figure 6: ODU Connector Panel (Dual Zone)

2.2.3 External ODU LED Description

LED Name	LED Function
P.S 1	Indicates Internal PS Is “ON”
UP	Optical Uplink Receiver - Indicates sufficient light coming into the ODU Unit
DW	Optical Downlink Transmitter - Indicates Laser OK and sufficient light is coming out.

2.2.4 ODU Internal Module Identification

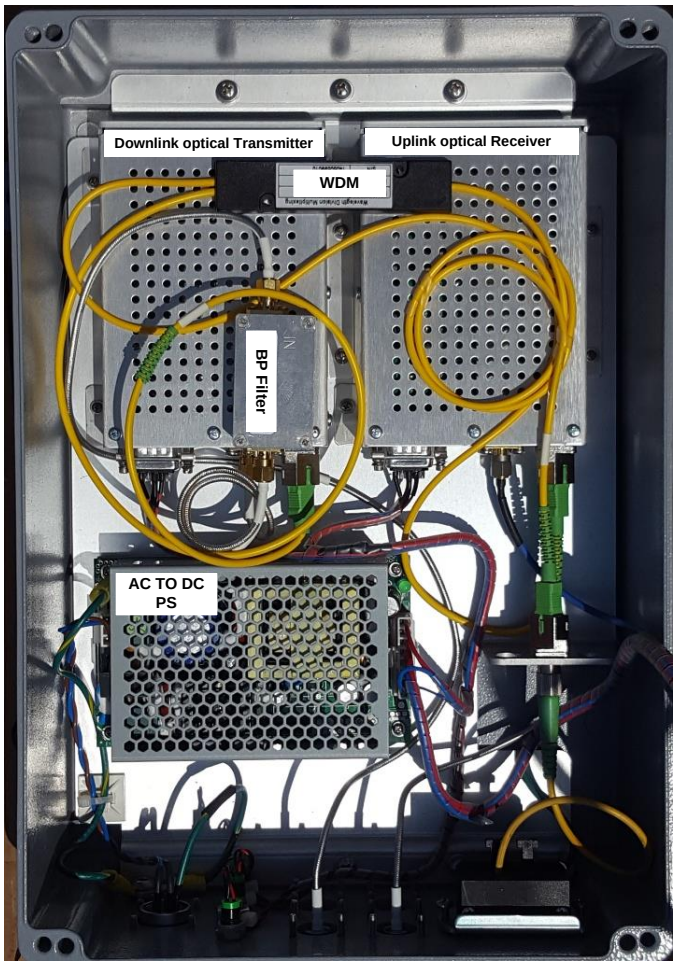


Figure 7: ODU Internal Module

Note: The newer configuration in the ODU is slightly different from this image. The D/L and U/L units are standing up in an OD5 configuration. Technically there is no change. Will replace this image as soon as we can.

2.3 Connection Diagram

2.3.1 System Diagram Compact Version

The following diagram shows a compact version with one set of indoor antenna.

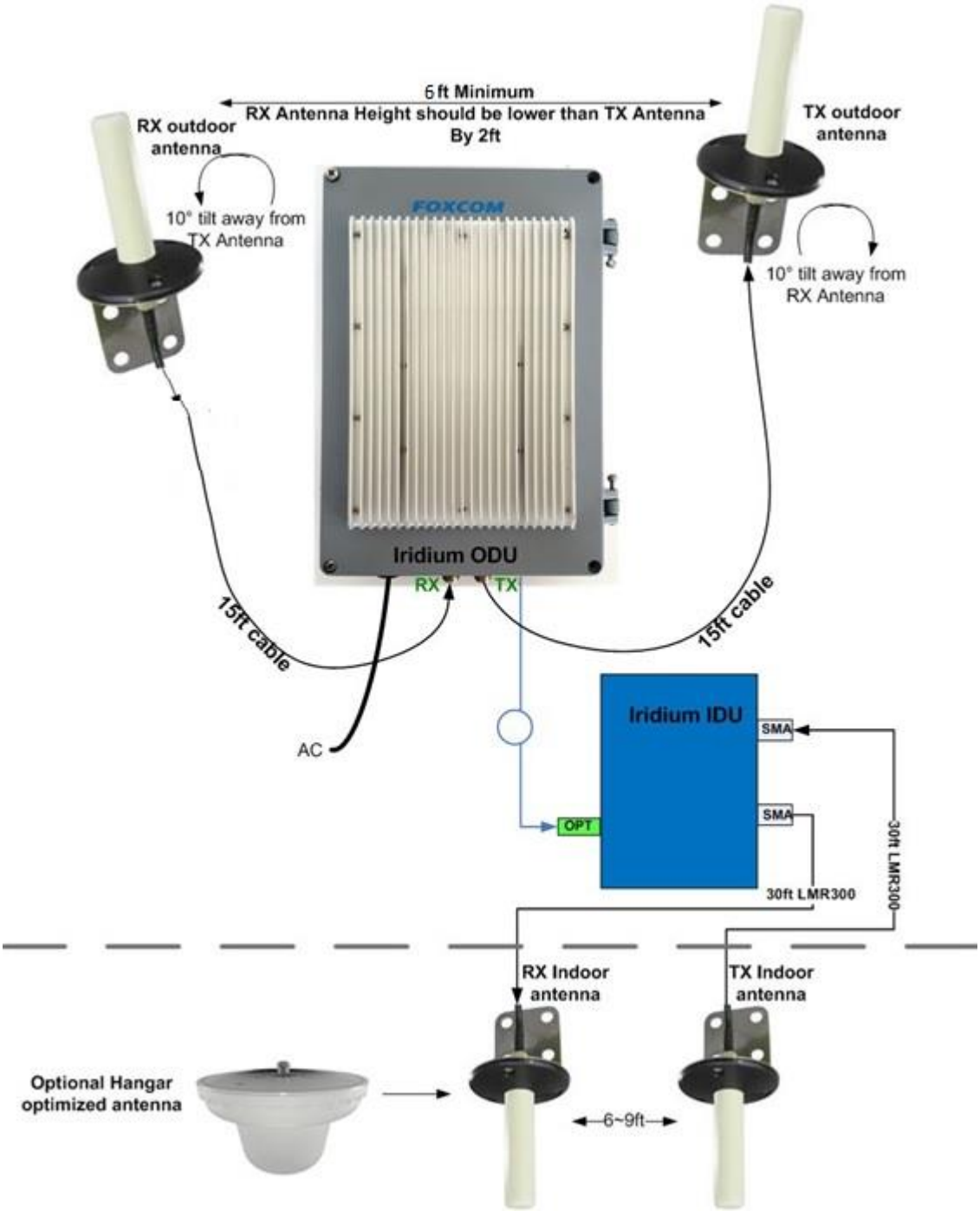


Figure 8: System Diagram Single Zone Version

2.3.2 System Diagram Dual Zone Version

The following diagram shows a compact version with two sets of indoor antennas. Installation and operation of the dual zone version is similar to the single zone system.

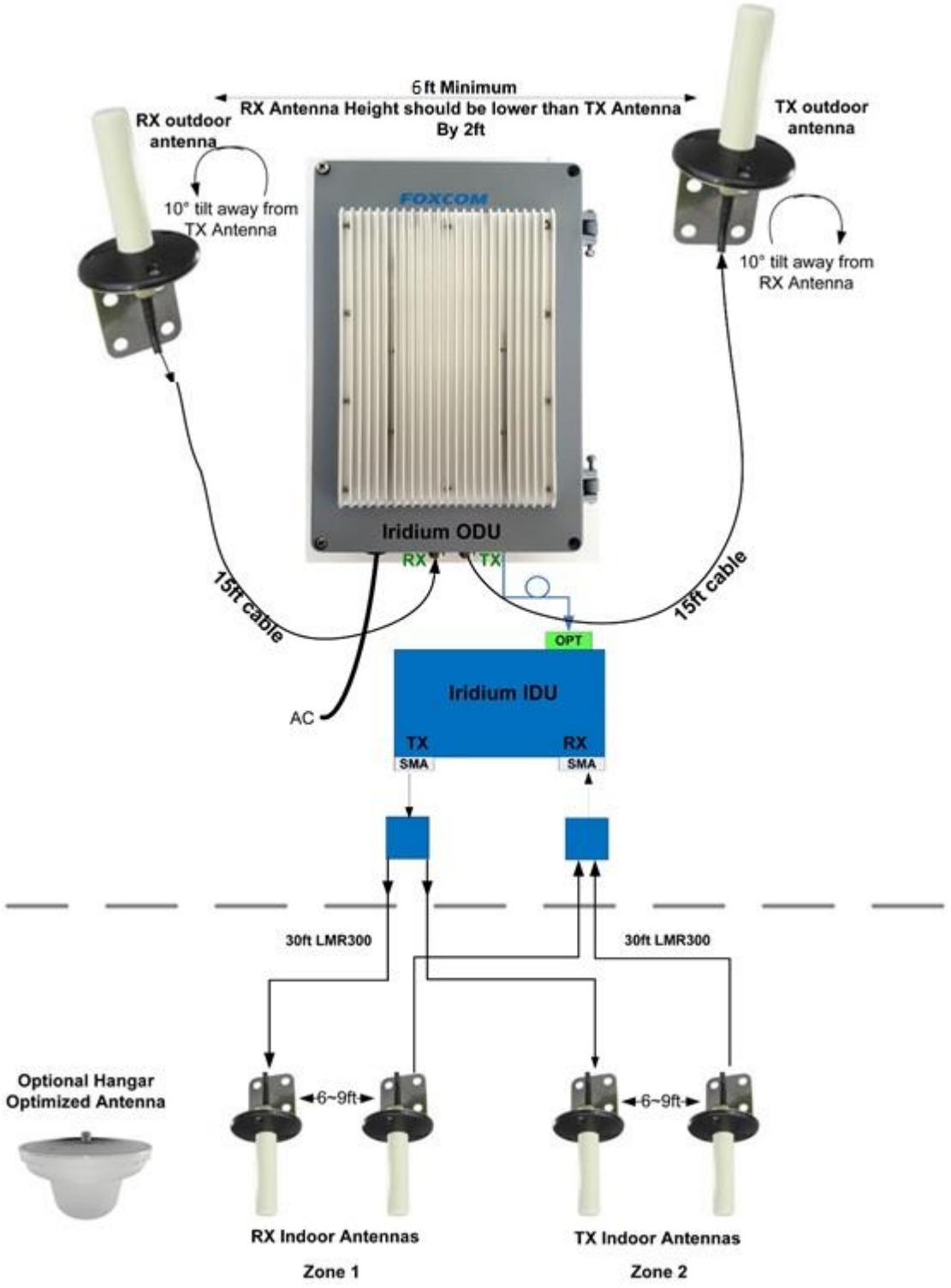


Figure 9: System Diagram Dual Zone Version

3 Installation

3.1 Connecting the Fiber Optic Cables

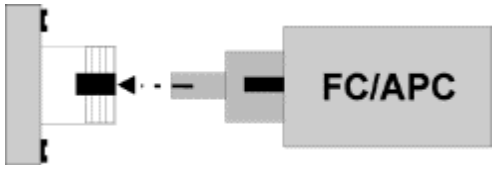
Before connecting the cables:

- The fiber cable must be either fusion spliced or connected via FC/APC connectors
- Wipe the connector with a lint-free cotton cloth.
- Note the polarity key of the optical connector before inserting

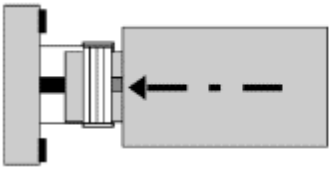
Compact Indoor Unit Fiber Connection

To connect the fiber optic cable of the compact indoor unit line up the polarity key:

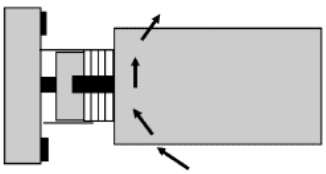
1.



2. Insert the connector



3. Tighten the connector



ODU Fiber Connection

The ODU is equipped with water-tight Fiber passage. The Fiber pass sub- assembly must be removed, installed on the fiber, and then placed back into the ODU.

1. To remove the fiber pass sub-assembly, open the two crossed screws holding it to the ODU body and pull the locker.
2. Once the locker is removed, you will be able to pull the black fiber pass assembly out.
3. To open the fiber pass sub-assembly, open the two crossed screws connected to it.
4. Once the fiber is placed inside, work your away backward and assemble the fiber pass back inside.

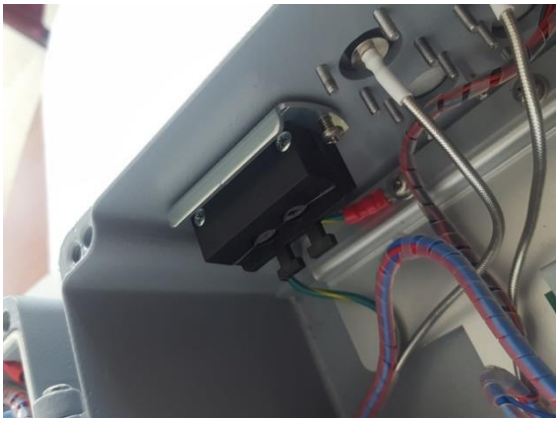


Figure 10: ODU Fiber Connection 1

Figure 11: ODU Fiber Connection 2

3.2 Setting Up the Indoor Unit

To power up the compact indoor enclosure, apply 12VDC via the DC Jack using the supplied wall mount power supply.

Compact indoor unit can be placed on a shelf or installed on a wall.

3.2.1 Powering the Indoor Iridium Unit

1. Apply AC power to the Chassis
2. On the front panel OPT1 LED should be “ON”.
3. Using an optical power meter (if available), verify outgoing optical power of +1 to +4dBm
4. Connect fiber optic cables to the unit.
5. Connect RF cable from ceiling mount antenna to the Indoor Iridium chassis.

3.2.2 Installing the Indoor Antenna

Indoor antennas must be installed on the ceiling in the center of the room facing down with a distance between them of at least 2 meters.

Single Zone kits are supplied with two ceiling mount antennas. Connect the antennas to the IDU using the two supplied 10M (30 feet) LMR 300 cables.

Dual Zones kits are supplied with four ceiling mount antennas that support coverage zones. These should be hung on the ceiling in the center of the room in each zone. Connect the antennas to the IDU using the four supplied 10M (30 feet) LMR 300 cables.

Note: Customer can request another kind of cable than LMR 300, such as LMR 400 or 600.

3.3 Setting Up the Outdoor Unit

The unit's built in PS requires STABLE 100-240VAC 50-60Hz.

3.3.1 Installing the Outdoor Unit

3.3.2 Hanging the Outdoor Unit on a Pole

- The ODU is normally installed on a wall but can also be installed on a pole using the supplied pole mounting kit. The pole diameter must be between 2" to 6" (51–150mm).
- Depending on your box, connect the two brackets at the edge of the box or 1.5" from the edge of the box with bolts and a large washer. See Figure 12: Hanging the Outdoor Unit on a Pole and Figure 13.
- Using a Philips screwdriver, screw each bracket to the ODU.
- Open the round bracket with a Philips screwdriver. Thread the round bracket through the bracket already attached to the ODU.
- Close the round bracket around the pole with the screw provided.

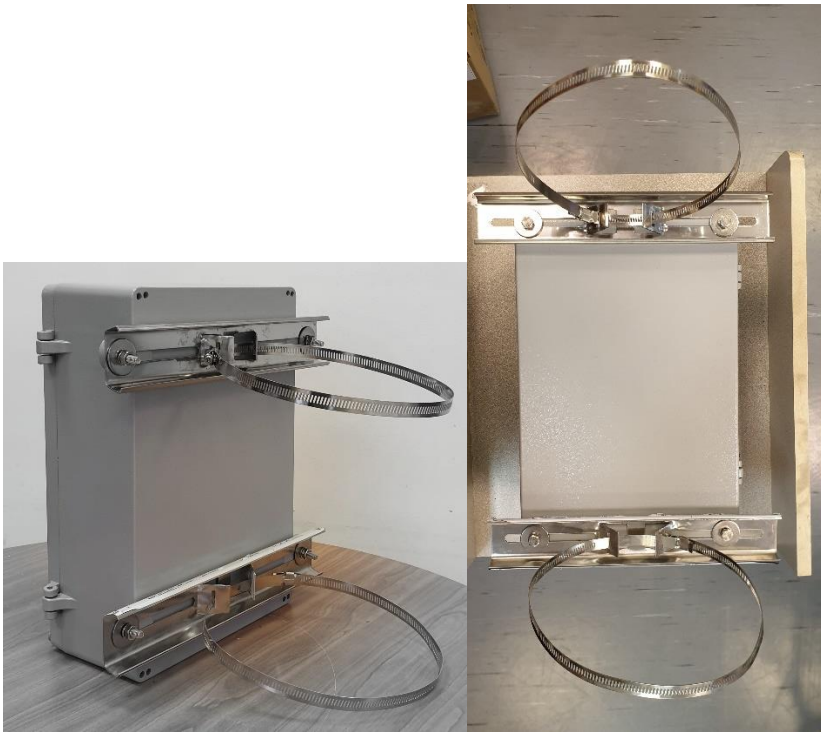


Figure 12: Hanging the Outdoor Unit on a Pole

Figure 13: Close-up of washer on pole mount

3.3.3 Hanging the Outdoor Unit on a Wall

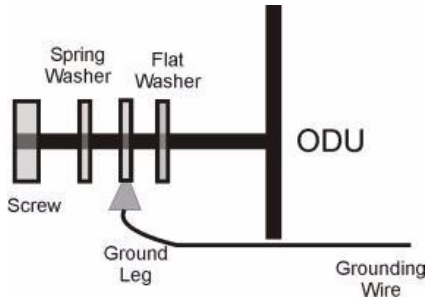
CAUTION: The ODU is heavy! Make sure that the wall can support its weight (5 kg.) Suitable bolts must be used. Global Foxcom recommends that the ODU be installed on a concrete wall.

1. Verify the holes on the provided drill sheet match the wall ears on your box.
2. Using the drill sheet, drill four holes (5/16”) through the markings indicated on the paper.
3. Using the drilled holes as a guide, place the ODU on the wall.
4. Using four screws, secure the ODU to the wall.

3.3.4 Connecting the Input/Output/Power Cables

WARNING: UNIT MUST BE GROUNDED BEFORE APPLYING POWER

1. To ground the unit, assemble the ground assembly.



2. Connect optical fibers and cover them using the supplied weather cover protection

3.3.5 Mounting the Outdoor Antennas

WARNING: ANTENNA MUST BE CONNECTED BEFORE APPLYING POWER

- Using one supplied 5Meter RF COAX cable, connect the receiver (Downlink) antenna to Downlink input RF port (RF2).
- Using a second supplied 5Meter RF coax cable connect the transmitting (Uplink) antenna to the Uplink Output RF port (RF1).

Note1: Antenna must be installed with a minimum of 6 meters from one another. A recommended installation distance is 8 meters.

Note2: It is recommended to place the Outdoor transmitting antenna 2 feet higher than the height of the Outdoor receiving antenna.

Note3: Both TX and RX Antenna MUST be tilted from each other by 10 degrees.

Note4: Make sure that outdoor unit is installed in an area that does not include any radiating antennas.
A radiating antenna placed nearby (below 10 meter) can affect system performance.

3.3.6 Powering the Outdoor Iridium Unit

1. Apply AC power
2. On the front panel OPT3 LED should be “ON”
3. Using an optical power meter (If available) verify outgoing optical power of +1 to +4dBm
4. Connect fiber optic cables to the outdoor unit [see section 2.1 for more information]
5. Once the fibers are connected, verify that the front panel OPT4 LED is “ON”

3.4 Connecting Iridium Repeater with Manual Adjustment

1. Connect the outdoor and indoor units.
   Make sure that the fiber cables are cleaned and that the connection to the FC/APC Bulkhead is inserted all the way inside.
2. Check that the indentation and key are lined up and then screw in tightly.
   THIS IS VERY IMPORTANT. The Outdoor unit and the bulkheads on this unit are for outdoor use and require more care to ensure they are connected correctly.
3. The optical power travelling on the fiber from the transmitter on the roof to the indoor unit: _____dBm (should be >2dBm).
4. The optical power travelling on the fiber from the transmitter from the Indoor unit to the Roof: _____dBm (should be >2dBm).

The new Indoor Unit will have two gain adjustment knobs. The one on the right is for the uplink signal (U/L), which is what the indoor phone is sending to the Iridium Satellite. The one on the left is the downlink (D/L), which is the signal from the Iridium Satellite coming into the building.

The knobs have several settings allowing modification to system gain. When the knob is in the 5 O'clock position the system is at its default factory optimized position for both U/L (45.4) and D/L (49.4).

Figure 14: Manual Gain Adjustment

- The units are pre-set from the factory for maximum gain and performance. Because ceiling height and size of room are all different, the manual gain adjustment will make it easy to set up and get the best out of the units for your room.
- First try the units without changing the settings.
- Second, whenever aligning a system, ALWAYS start with the downlink path. After that adjust the Uplink, where the goal is to achieve the best possible Up:Down ratio.

3.4.1 Setting Up the Downlink at 3 Meters from the Indoor Antenna

1. Stand about 3 meters (approximately 9–10 feet) from the Indoor Antenna.
2. Check the signal quality on your Iridium phone.
3. Wait 30–60 seconds to verify levels.
   How many Bars do you have_____? You should be seeing 4–5 bars. If the signal is lower, change the "DOWNLINK" knob one position Clockwise.
   For example, if the knob was at "0" move it to "+2".
4. Check the signal quality on your Iridium phone. Wait 30–60 seconds to verify levels. Do this until you get 5 bars.

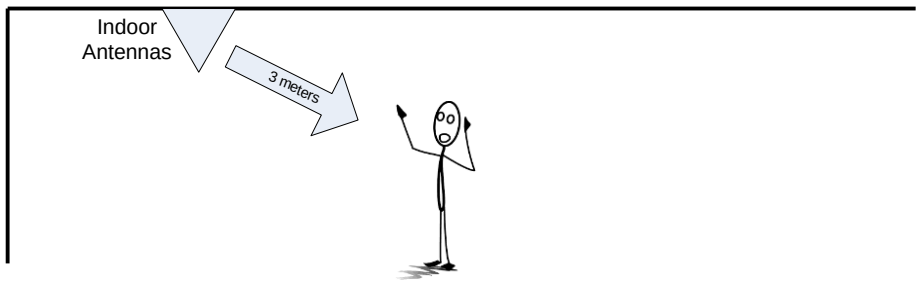


Figure 15: Setting Up the Downlink at 3M

3.4.2 Setting Up the Downlink at 5 Meters from the Indoor Antenna

1. Stand about 5 meters (approximately 15–16 feet) from the Indoor Antenna.
2. Check the signal quality on your Iridium phone.
3. Wait 30–60 second to verify levels.
   How many Bars do you have_____? You should be seeing 4–5 bars. If the signal is lower, change the "DOWNLINK" knob one position Clockwise.
   For example, if the knob was at "0" move it to "+2".
4. Check the signal quality on your Iridium phone. Wait 30–60 second to verify levels. Do this until you get 5 bars.

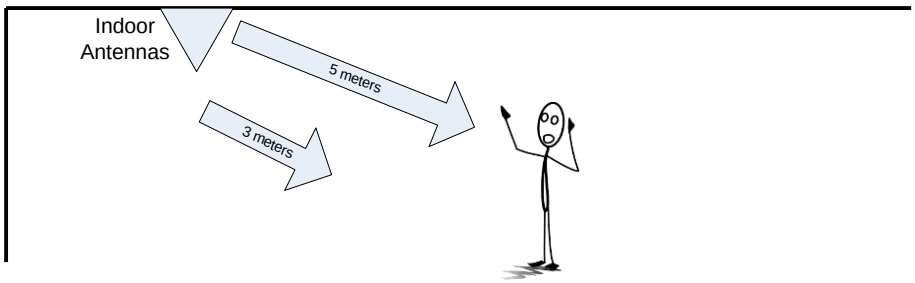


Figure 16: Setting Up the Downlink at 5M

3.4.3 Setting Up the Downlink at 10 meters from the Indoor Antenna

1. Stand about 10 meters (approximately 30 feet) from the Indoor Antenna.
2. Check the signal quality on your Iridium phone.
3. Wait 30–60 second to verify levels. How many Bars do you have_____? By this point we should see 3–4 bars.
   You should NOT adjust the gain level for the downlink at this point.

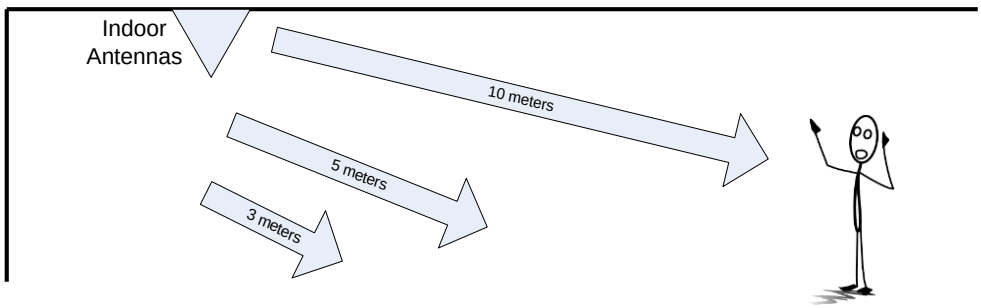


Figure 17: Setting Up the Downlink at 10M

3.4.4 Setting Up the Uplink at 5 meters from the Indoor Antenna

1. Go back to the 5 meter mark.
2. Check the signal quality on your Iridium phone.
3. Wait 30–60 second to verify levels. You should see 4–5 bars.
4. Make a call while looking at the phone.
   Do the bars drop drastically? If so, we need to **decrease** power on the Uplink.
5. Change the knob one position Counter-Clockwise.
   For example, if the knob was at "0" move it to "-2".
6. Check the signal quality on your Iridium phone.
   Wait 30–60 second to verify levels. Do this until you get 5 bars.

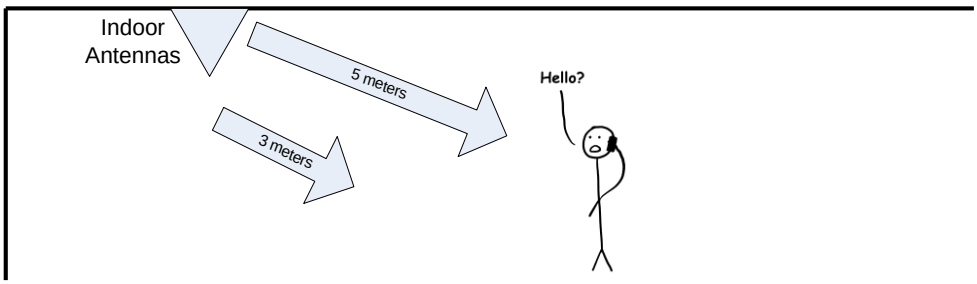


Figure 18: Setting Up the Uplink at 5M

At this point all levels should be adjusted and you will be able to use the phones at least 10 meters from the Indoor Antenna.

4 Product Technical Description

4.1 System Specifications

Iridium Optical Repeater Specifications		
Downlink		
Frequency range	1616-1626.5MHz	
ODU input/IDU output VSWR	1:1.6	
ODU RF input signal range [total power]	up to -20dBm	
Noise Figure	<5dB	
Uplink		
Frequency range	1616-1626.5MHz	
IDU input/ODU output VSWR	1:1.6	
IDU RF input signal range [total power]	up to +30dBm	
Noise Figure	<5dB	
Optical Specifications		
Required fiber type	Dual SMF-28 or equivalent [single mode]	
Optical wavelength	1550 ±10nm	
IDU/ODU optical power output	-3dBm / 0.5mW (Min)	
Optical connector	FC-APC	
Fiber length	3Km max (2dB).	
Physical Specifications	**Indoor**	**Outdoor**
RF Connectors	Dual SMA Female	Dual N-Type Female
Dimensions	19" Wide 1U Chassis	14" x 6" x 3" *
Operating temperature	-20 to +55° C	-30 to +55° C
Operating voltage	100-240VAC 50/60Hz	100-240VAC 50/60Hz *

ODU unit is supplied with external IP65-rated AC/DC Power Supply measuring 7"x 3.5" x 2".

4.2 Model Dimensions

4.2.1 Outdoor Unit

ODU Front Panel Dimensions: 29cmW x 13.5cmH

Installation: Pole 2” to 3”

ODU Box Dimensions: 36Lx29Wx13.5Hcm

Figure 19: Model Dimensions for Outdoor Unit

4.2.2 Indoor Unit

Compact IDU Dimensions: 20.8cm L x 13.2cm W x 6cm H

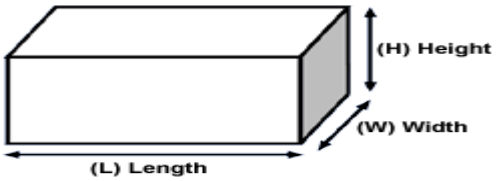


Figure 20: Model Dimensions for Indoor Unit

4.3 ODU AC Connector Assembly

Pin	Function
A	110 to 220VAC ~
B	0 (Neutral)
C	Ground

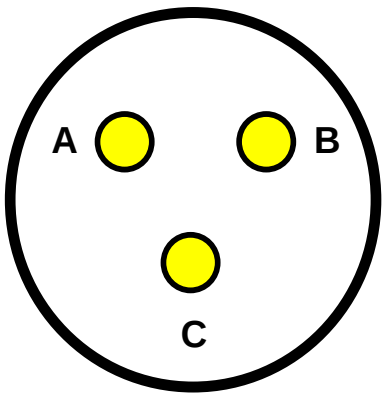


Figure 21: ODU AC Connector Assembly

5. Troubleshooting and Optical Connector Cleaning

5.1. Troubleshooting the IDU

Problem	Possible Cause
Laser LED not ON (TX)	1. No DC power to the unit. Possible power supply problem. Check the power supply fuse. 2. If an optical power meter is available, verify the optical light output. The power should be a minimum 0dBm [0.5mW]. If any or all the above are not within the guidelines, the laser or laser circuits are defective.
OPT LED not ON (RX)	1. Not enough light or no light arrives to the receiver input. If an optical power meter is available make sure that a minimum of -3dBm arrives to the unit. If lower optical power arrives, refer to the section: Cleaning Fiber Optic Connections.

5.2. Troubleshooting the Iridium Repeater

Problem	Possible Cause
Laser LED not ON (TX)	1. No DC power to the unit. Possible power supply problem. Verify AC connector is assembled correctly. 2. If optical power meter is available, verify the optical light output. The power should be minimum 0dBm [0.5mW]. If any or all the above are not within the guidelines, the laser or lasers circuit are defective.
OPT LED not ON (RX)	1. Not enough light or no light at all arrives to the receiver input. If optical power meter is available make sure that minimum of -3dBm arrives to the unit. If lower optical power arrives, refer to the section: Cleaning Fiber Optic Connections.

5.3. Troubleshooting the Iridium Repeater

Problem	Possible Cause
Unable to put out a call with a good signal bar (Phone resets itself when trying to dial)	1. Transmit fiber is disconnected or there is high loss on transmit fiber. 2. If optical power meter is available, verify the optical light output. The power should be minimum 0dBm [1mW].
Signal bar shows low signal level	1. Signal interferes with Iridium satellite signal. Make sure a cellular transmitting antenna is NOT mounted in close proximity to the Iridium system (<10Meter). Make sure transmitting and receiving outdoor antennas are mounted at least 4 meters from each other.

5.4. Cleaning Fiber Optic Connections

The unit has an FC/APC angle polished optical connector for very high optical return loss performance. The units are specified into single mode fiber i.e. 9/125 micron core diameter. Full performance is specified only for low return loss optical plant – meaning the fiber must be fusion-spliced and all connections or splices must have a return loss greater than -60 dB. With these guidelines in mind, link lengths beyond 20 kilometers (DFB-based products) can be achieved with high performance. Specific performance and/or design assistance is available by request from Global Foxcom.

If there is low/no signal or noisy signal at a Global Foxcom module, the connector should be cleaned. Dirt on the inside connector tip can impair the flow of light causing problems in signal transmission. Global Foxcom modules are sealed but dirt can occasionally enter during installation and alignment.

The input and output optical ports of all Global Foxcom equipment are known in the fiber optic world as bulkhead ports. Global Foxcom uses FC/APC connectors.

The following materials are representative of the types of cleaning materials that should be used for cleaning the fiber optic ports and connectors. They are available from several suppliers.

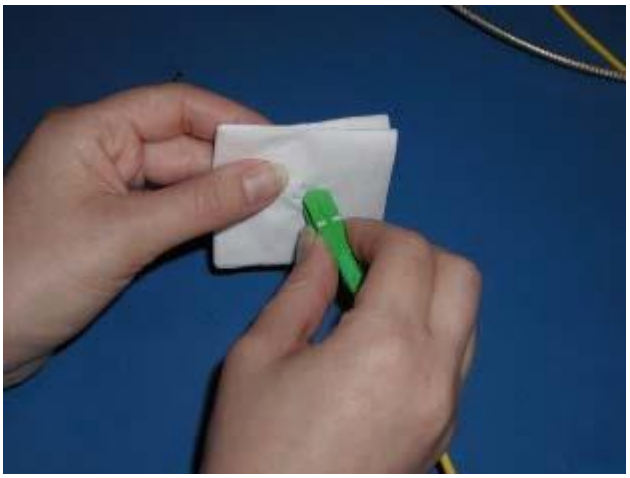
Cleaning Material

Description	Manufacturer
Kim Wipes	Kimberly Clark
Cletop Automatic Connector cleaner	Cletop
Fiber optic Swab	Cletop or FIS

Wiping clothes should be made of lint-free, alcohol-free nonabrasive materials. Swabs should have a tightly wrapped tip and be talcum-free. For removing dust from receptacles, a canned compressed gas is recommended. Do not use commercial compressed air because of risk of contamination.

5.4.1. Cleaning Procedure for FC-APC Connectors

Use a Kim Wipe to gently wipe the end face surface of the connector. Alternatively, a Cletop automatic connector cleaner can be used.



5.4.2. Cleaning Procedure for FC-APC Connectors

Caution: Clean the transmitter and receiver optical ports **only** when there is evidence of contamination or reduced performance. Regular maintenance is not needed.

Using a clean fiber optic cleaning swab, gently wipe out the optical port. Discard the swab after use.