Iridium **Pilot**®

Land Station
Installation Guide
TPIM1301

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Land Station
Installation Guide

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> ⚠️ **Prior to Installing Iridium Pilot Land Station, read and understand this Installation Guide and the User Manual, including the safety warnings and information. Failure to do so could result in serious injury or death.**

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Contents

Section I – INTRODUCTION

1. Introduction

Thank you for purchasing Iridium Pilot Land Station, the NEXT generation solution for broadband voice and data communications. Leveraging the world's furthest reaching and only truly global communications network, Iridium Pilot Land Station delivers exceptional performance, reliability and durability anywhere on the planet. Powered by the Iridium OpenPort® service, and backed by an industry-leading warranty, you can count on a secure, real-time connection — whenever and wherever you need it.

About This Guide

This is the Installation Guide for the Iridium Pilot Land Station platform. The readers of this manual include anyone who intends to install this system. Specific skills are required to install the Iridium Pilot Land Station platform and therefore, it is important that you observe all safety requirements listed in the beginning of this manual, and operate the system according to this guide's guidelines.

This guide provides you with complete information on the installation and testing of the Iridium Pilot Land Station Terminal. This includes the following:

- System installation
- System start-up and test
- PC & network configuration
- System Administration
- Troubleshooting

Terms to Know

- ODU   Outdoor Unit (the radiating unit)
- IDU   Indoor Unit (the user interface unit)
- IBSU   Iridium Broadband Subscriber Unit (the ODU and IDU together)
- POTS: Plain Old Telephony System
- SIM: Subscriber Identity Module
- PSU: Power Supply Unit
- Provisioned: A term used to indicate the SIM card is activated for voice and data connection.
                         This can only be done by the Service Provider.

2. Safety Summary

The ODU and the IDU should be installed by a qualified professional technician trained in the installation of electronics and antennas. Failure to comply with these precautions or with specific warnings on the equipment, in the User Manual or in this guide violates the safety standards of the design, manufacture and intended use of this equipment.

⚠️ **WARNING**
⚠️ Prior to Installing Iridium Pilot Land Station, read and understand this Installation Guide and the User Manual, including the safety warnings and information. Failure to do so could result in serious injury or death.

If you do not have the Iridium Pilot Land Station User Manual, it can be found at www.iridium.com, or call 1-866-947-4348 (or +1-480-752-5155 for outside U.S.) and request that a User Manual be sent to you.

Follow all safety precautions carefully. Improper installation may result in injury or inability of the equipment to function properly. Only a qualified professional technician trained in the installation of electronics and antennas should remove the installation cover on the IDU.

Iridium Satellite LLC disclaims all liability for failure to comply with these requirements and improper installation.

Shock Hazard

⚠️ **WARNING**
⚡ The Indoor Unit (IDU) contains low voltage that may cause serious injury if opened. Do not, under any conditions, open or dismantle the IDU. Failure to follow these instructions could result in serious injury or death.

Radiation Hazard
The Federal Communications Commission has adopted a safety standard for human exposure to RF (Radio Frequency) energy, which is below the OSHA (Occupational Safety and Health Act) limits.

⚠️ **WARNING**
📡 The Outdoor Unit (ODU) transmits radio frequency energy (RF) that may cause thermal injuries including tissue damage from increased heating and body temperature. When the system power is ON keep all personnel a minimum of 1.0 m (3.3 ft.) from the antenna (see Radiation Hazard). Failure to do so could result in serious injury or death.

Figure 1.

RF Warning Label on ODU

Radiation Hazard
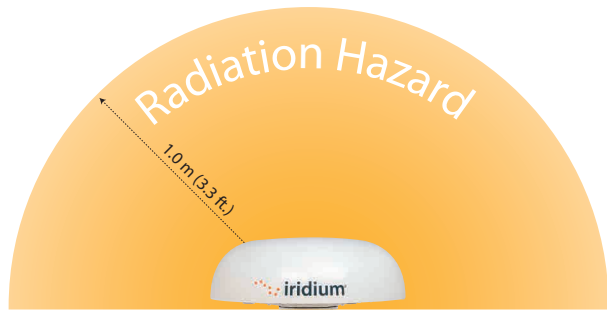
1.0 m (3.3 ft.)

Description	Minimum Distance from Antenna
within 0˚- 180˚ of the antenna elevation range	1.0 m (3.3 ft.)

Antenna mounting and substitution

The antenna supplied by the manufacturer or radio dealer must not be mounted at a location such that during radio transmission, any person or persons can come closer than the indicated minimum safe distance to the antenna: 1.0 m (3.3ft).

To comply with current FCC RF Exposure limits, the antenna must be installed at or exceeding the minimum safe distance shown above, and in accordance with the requirements of the antenna manufacturer or supplier.

Base Station Installation: The antenna should be fixed-mounted on an outdoor permanent structure. RF Exposure compliance must be addressed at the time of installation.

You may contact your radio dealer or the manufacturer for further instructions. You, as the qualified end-user of this radio device must control the exposure conditions of bystanders to ensure the minimum separation distance (above) is maintained between the antenna and nearby persons for satisfying RF Exposure compliance. The operation of this transmitter must satisfy the requirements of Occupational/Controlled Exposure Environment, for work-related use. Transmit only when person(s) are at least the minimum distance from the properly installed, externally mounted antenna.

If you have any concerns about the adequacy of the mounting or support for the Iridium Pilot Land Station device, seek advice from a structural engineer or other qualified individual.

⚠️ WARNING

⚠️ Exposure to radio frequency energy (RF) from the antenna may cause thermal injuries including tissue damage from increased heating and body temperature. Keep everyone at a safe distance from the antenna when the system power is ON. Personnel must maintain a minimum separation distance of 1.0 m (3.3ft) from the unit and installers must place ODU transmitter in a manner to maintain minimum spacing requirement. Failure to do so could result in exposure to radio frequency energy (RF) transmitted from the ODU that could result in serious injury or death.

> ## ⚠ WARNING
>
> Exposure to radio frequency energy (RF) from the antenna may cause thermal injuries including tissue damage from increased heating and body temperature. Do not substitute any antenna for the one supplied or recommended by the manufacturer or radio dealer. Substitution of antennas could cause exposure to excess radio frequency radiation which could result in serious injury or death.

> ## ⚠ WARNING
>
> ODU must be properly mounted and secured to location. Failure to do so could result in detachment of the unit, causing disruption in operation of the unit, or danger from a falling unit, which could result in serious injury or death.

> ## ⚠ WARNING
>
> Damage to the paint coating may allow rust to the ODU which could result in failure of the ODU. This in turn could cause disruption in operation of the Iridium Pilot Land Station device or danger from a falling unit. Avoid damaging the paint coating. If damage occurs, re-apply appropriate anti-corrosion paint. Failure to do so could result in serious injury or death.

Blasting Areas

> ## ⚠ WARNING
>
> To avoid interfering with blasting operations, do not use device in "blasting area" or in areas posted: "Turn off two-way radio." Obey all signs and instructions. Failure to do so could result in serious injury or death.

3. Overview of Operation

Iridium's constellation consists of 66 low-earth orbiting (LEO), cross-linked satellites operating as a fully meshed network and supported by multiple in-orbit spares. Iridium has gateways in Arizona and additional telemetry, tracking and control facilities in Canada and Norway. It is the largest commercial satellite constellation in the world.

Figure 2.

An Iridium Pilot Land Station voice or data call is received by the closest satellite to the device's current location, anywhere on the Globe. The traffic is routed through the meshed satellite network and lands at the Alaska Ground Station, and, is then routed over terrestrial networks to the Gateway in Arizona. At the gateway, traffic is converted back to internet protocol (IP) and voice, depending on call type and delivered to the IP cloud or the public switched telephone network (PSTN).

Figure 3.
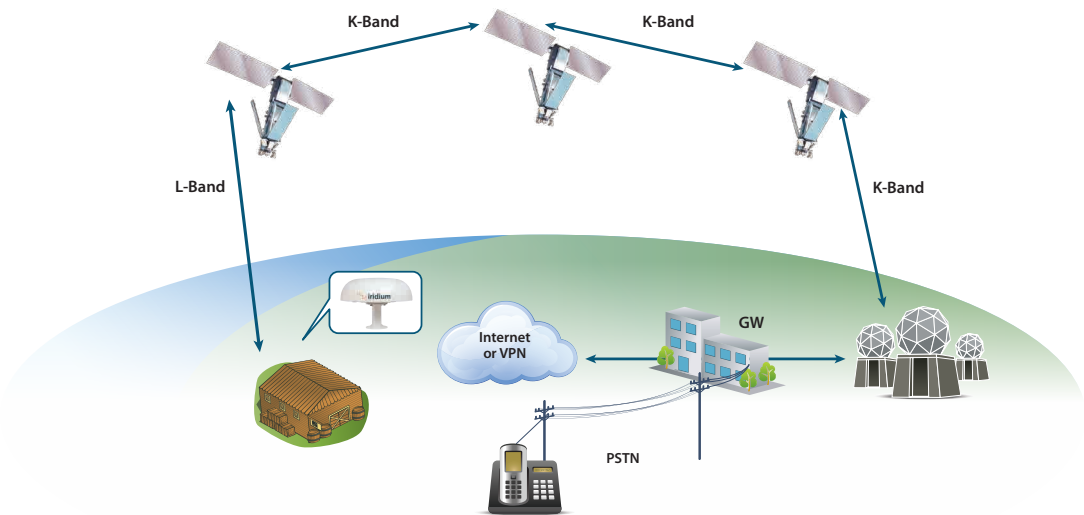
Section II – INSTALLATION

4. Broadband Subscriber Unit Components

1. Outdoor Unit (ODU): The ODU provides the communication connection between the IDU and Iridium's satellites. The ODU will automatically locate and track Iridium satellites overhead using a solid state antenna array.

Figure 4.

Mounting Bracket (not shown): The Mounting Bracket is the recommended installation method for both flat surface or pole mount installations of the ODU. Other installation approaches may require an adapter plate (user sourced).

2. Indoor Unit: The Indoor Unit (IDU) is the appliance to which you connect your telephones and computers. It is capable of handling three POTS/RJ11 telephone handsets and one Ethernet data connection.

3. ODU/IDU Cable (10 m and 30 m cable available): The cable connects the ODU to the IDU. It is shielded and has a waterproof connection for the ODU. Consult your Iridium service provider for availability. To maintain the waterproofing and shielding integrity of the cable, take care when altering the cable in any way. The pin-out of the interface cable can be found in Appendix C.

4. IDU Power Supply Unit: The AC Power Supply Unit (PSU) provides DC power to the IDU. Note that direct DC power supply is also supported for vehicle or other DC power locations.

5. SIM: The SIM card validates the system at start-up, allows connection to the Iridium network and provisions the appropriate phone and data lines.

6. ODU Ground Cable (3m standard and 8m available): The ground cable connects the ODU to a grounded source at the point of installation. Comes with an adapter kit to facilitate alternative installations.

7. IDU Ground (2.5m standard): Ground cable to ground the IDU at the installation location.

Figure 5.

SIM card, reset button and on/off switch are located behind panel
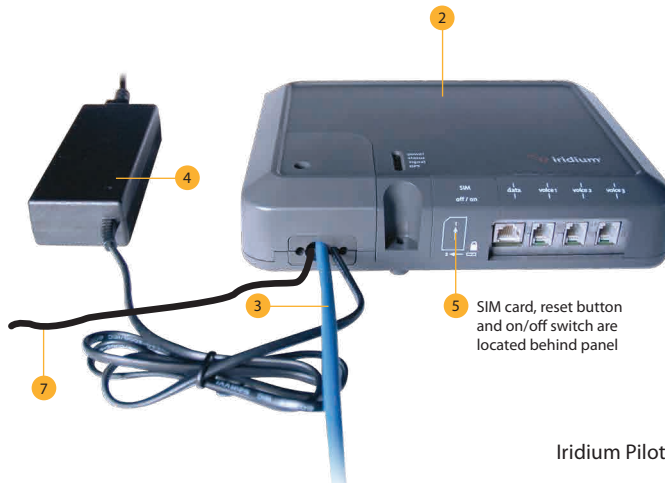
Installer/Customer Furnished Equipment

- **Mounting Pole/Location:** Used to establish vertical position of ODU. Must have additional support if exposed to high winds.
- **Ethernet Cable:** Use if data connection to a computer is provisioned. The total maximum length from the ODU to the computer cannot exceed 100 meters.
- **Fasteners:** User must supply fasteners necessary to mount the ODU mounting bracket as well as the IDU at their specific installation locations.
- **Strap wire with electrical clips:** To be used for grounding the ODU/IDU cable prior to installation. Prevents static discharge that may have built up on the cable during installation process.
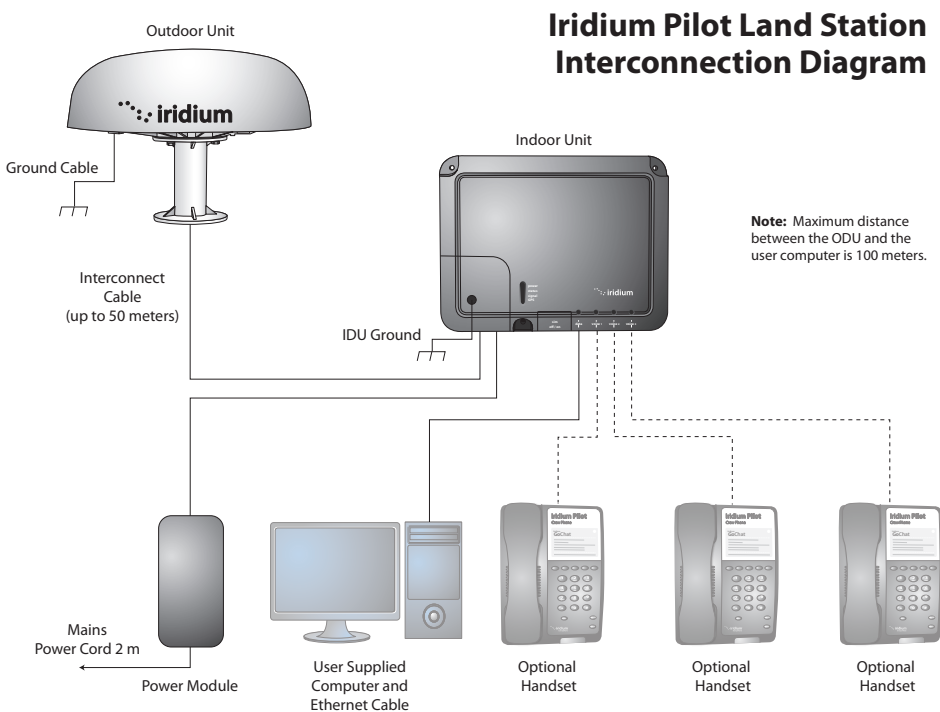
Recommended Practices/Supplies

Iridium recommends that a surge suppressor or universal power supply (UPS) unit is installed along with the Iridium Pilot Land Station product.

5. Interconnection Diagram

Figure 6.

Iridium Pilot Land Station Interconnection Diagram

Outdoor Unit

Ground Cable

Indoor Unit

Note: Maximum distance between the ODU and the user computer is 100 meters.

Interconnect Cable (up to 50 meters)

IDU Ground

Mains Power Cord 2 m

Power Module

User Supplied Computer and Ethernet Cable

Optional Handset

Optional Handset

Optional Handset

Understanding the Interface Between ODU and IDU

The IDU provides isolated 48 volts to operate the transceiver and digital base-band processor in the ODU. There is an E1 interface that carries voice information from the IDU to the ODU. The E1 also provides communications for housekeeping between the two devices, for SIM interfacing and "reset to factory defaults" commands. Lastly there is an Ethernet connection thru the IDU connecting directly to the ODU base-band processor.

6. Installation Considerations and Overview

Considerations

The single most important consideration of the Iridium Pilot Land Station installation is location of the ODU. It must be located to minimize obstructions that block transmission to and from the satellites and be far enough away from potential radio interferers that will degrade or jam reception of the Iridium downlink. The ODU should also be located where anyone does not accidently violate the 1 meter RF Radiation hazard zone. Mounting location is important to ensure a fully functional unit.

Overview of the Installation Process

1. Conduct a visual survey to identify locations for installation of the product. Place emphasis on avoiding potential interference (see section 8) and a clear view of the sky, and place ODU transmitter in a manner to maintain minimum spacing requirement of 1.0 from the antenna to a person.

2. Analyze and rank each of the potential sites.

3. Review User Manual and Installation Guide Warnings.

4. Temporary connection of equipment may be necessary to test and validate the potential ODU location(s). These tests should be run with all nearby RF generating systems operational.

5. Run the "Site Survey Tool" supplied on the accessory CD with your product. This will help to identify and quantify interferers with the ODU.

6. Installation of the ODU and IDU

- Install the mast or mounting bracket for the ODU

- Route the ODU/IDU cable and ground metal RJ-45 housing using strap wire/electrical clips

- Connect ODU/IDU cable to ODU

- Mount the ODU

- Connect the ground cable from the ODU to the ground connection

- Mount the IDU

- Remove electrical clips, route ODU/IDU cable to IDU and connect

- Connect the ground cable to the IDU and then connect other end to local ground connection

- Connect power supply to IDU

- Connect phones

- Test the system

Installation Parts and Tools

- Iridium Pilot Land Station unit – ODU, IDU, power module, interconnect cable, ground cable, optional mounting bracket and mounting hardware.

- User supplied pole (for pole mount) or other mounting location

- Windows compatible computer

- Iridium Pilot Land Station accessory CD

- Ethernet cable

- User supplied RJ11 phones

- Slotted and Phillips screw drivers

- Hammer and center punch

- Power drill and associated bits
- Wire cutters
- Wire strippers and terminal lug crimper
- RJ-45 Crimp tool
- Electrical tape
- Strap wire/electrical clips for temporary grounding the ODU/IDU cable (alligator clips)
- Ground connection points for ODU and IDU

6.1 Choosing a Location for the ODU

Proper location is critical to ensure proper communications between the Iridium Broadband Subscriber Unit (IBSU) and the Iridium satellite network.

ODU Installation Considerations

As previously stated, Iridium is a constellation of LEO satellites covering every location on the surface of the Earth, at any moment in time. This means the satellite communicating with the Iridium Pilot Land Station unit can be located anywhere within the local hemisphere, making a horizon-to-horizon unobstructed view of the sky important for uninterrupted communications. The solid state antenna array takes care of tracking the satellite to maintain acceptable link margin. No moving parts are used in the ODU for antenna tracking

Finding an unobstructed view of the sky may be challenging in your location. Pole mounting the ODU may provide better results.

Figure 7.

Unobstructed view of sky all direction

8.0 m (26.2 ft.)   8.0 m (26.2 ft.)

iridium

Minimize obstructions

Unrestricted area for obstructions

Minimize obstructions

2.0 m (6.6 ft.)

No metallic or concrete obstructions in grey shaded area
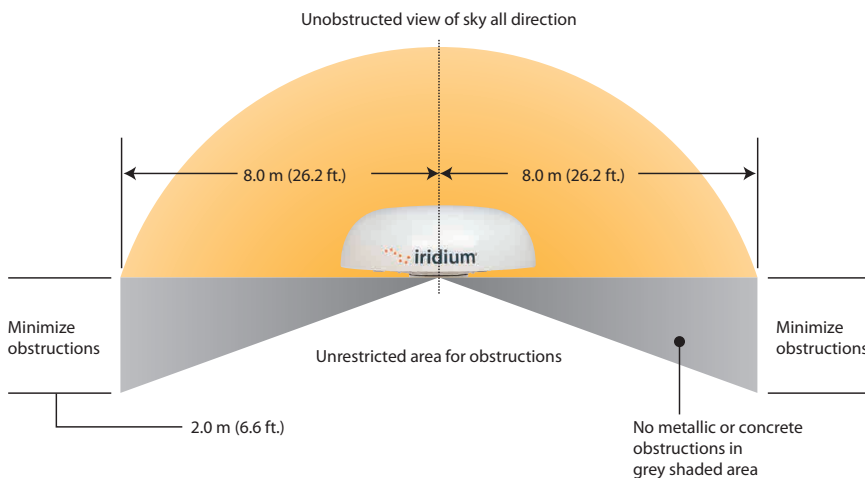
Obstructions Around the ODU

The satellite signals received by the antenna are less then 45° above the local horizon 90% of the time. Therefore, obstructions that impact signal reception must be considered prior to installation.

To ensure the best possible connection with the Iridium satellite network the ODU needs clear exposure, in all directions, to the sky. Two types of obstructions that should be considered when deciding the placement of the ODU include: metallic and building/fixed obstructions.

The loss of signal (dB) will increase the closer the obstruction is to the ODU. The table below shows the correlation between the size of the obstruction and the distance of the obstruction from the ODU and the amount of signal loss.

Obstruction Signal Loss Table – Signal interference around the ODU

Diameter of Obstruction	Obstruction Distance	Signal Loss
.2 m (.7 ft.)	< 2 m (6.5 ft.)	2 dB
	< 4 m (13.1 ft.)	1 dB
.4 m (1.3 ft.)	< 9 m (29.5 ft.)	2 dB
	< 31 m (101.8 ft.)	1 dB
.6 m (2 ft.)	< 22 m (72.2 ft.)	2 dB
	< 75 m (246 ft.)	1 dB
.8 m (2.6 ft.)	< 40 m (131.2 ft.)	2 db
		1 dB
1.0 m (3.3 ft.)	< 65 m (213.2 ft.)	2 dB
		1 dB

RADAR systems or high power transmitters may cause signal interference.

To avoid possible damage to the ODU and degradation of the ODU performance the unit must be mounted as far away as practical from these units. In addition it should also be kept clear of other sources of interference such as other Iridium or Inmarsat terminals.

The diagrams and tables below are only guidelines as the minimum distances will be dependent on the exact transmitter characteristics as well as reflections from surfaces or other items in the vicinity of the ODU. The tables for X and S-band radar distances are minimum distances to avoid damage to the ODU and do not necessarily guarantee a good communication link.

Minimum Distance from S-band & X-band RADARs

S-band (- 10 cm / 3 GHz) radars		
Radar Power	Min distance at 15˚ vertical separation	Min distance at 60˚ vertical separation
0 – 10kW	0.4 m (1.3 ft.)	0.4 m (1.3 ft.)
30kW	1.0 m (3.3 ft.)	0.5 m (1.6 ft.)
50kW	2.0 m (6.6 ft.)	1.0 m (3.3 ft.)

X-band (~ 3 cm / 10 GHz) and C-band (4-8GHz) radars		
Radar Power	Min distance at 15˚ vertical separation	Min distance at 60˚ vertical separation
0 – 10kW	0.8 m (2.6 ft.)	0.4 m (1.3 ft.)
30kW	2.4 m (7.9 ft.)	1.2 m (3.9 ft.)
50kW	4.0 m (13.1 ft.)	2.0 m (6.6 ft.)

Important

A vertical separation of at least 15° is required from any RADAR to ensure the ODU is out of the main transmit beam. If this is violated there is the potential the RADAR pulse will damage the sensitive RF receivers in the ODU or at a minimum disrupt communications each time the RADAR sweeps past the ODU.

Important! A vertical separation of 15˚ is always required from any radar.

Offset Distances from other Communications & Navigation Equipment ODU Location Priorities

This next step will use the Iridium Pilot Land Station equipment to measure the RF environment at the potential ODU mounting locations prior to permanent installation. This is an important step that will eliminate the possibility of needing to move the equipment later. It is imperative all RADARs, communications and navigation systems are ON and operating during this test to ensure all potential interferes are detected.

1. Locate the RADARs. They are usually the highest mounted items near the desired location of the ODU. Look for locations that are at least 15° below the RADARs and honor the separation distances.

2. Locate Inmarsat radomes and honor the 10 meter separation distances. The Inmarsat and Iridium operating frequencies are close together and interference is likely if the equipment is too close to each other. If one system is designated a "backup" then there may be some latitude to violate the offset distance.

3. Locate the GPS antenna. GPS and Iridium frequencies are close together and transmission from the ODU can affect navigation if the offset distances are not honored.

4. Note metal (RF reflective) surfaces just below the potential ODU location (Figure 7). Any metal in this area has the potential to reflect RF energy and cause multipath fading.

5. Look at possible locations and the remaining antennae in the immediate area and select the locations with the fewest potential interferers.

6. Finally look at the obstructions and determine if the site will provide a reasonably unobstructed view of the sky. Try not to allow any single obstruction to attenuate signal path more than 2 dB.

System	Minimum Separation
VHF	5.0 m (16.4 ft.)
HF (ssb)	5.0 m (16.4 ft.)
Inmarsat	10.0 m (32.8 ft.) minimum. Inmarsat may interfere with Iridium at distances up to 60.0 m (196.8 ft.) depending on the relative position of the satellites.
Other Iridium antennas (unity gain)	2.0 m (6.6 ft.)
Another Iridium Pilot Land Station Terminal	6.0 m (19.7 ft.)
GPS	10.0 m (32.8 ft.) if it is in the same horizontal plane as the ODU
Compass	1.0 m (3.3 ft.) estimate

6.2 Choosing a Location for the IDU

An ideal location for the IDU should be:

1. Within distance of the IDU/ODU cable (10m or 30m)

2. In a dry location.

3. Within close proximity to the digital and analog interface.

4. Close to AC/DC power.

5. Close to ground location.

Shock Hazard

<table>
<tr><td colspan="2">⚠️ **WARNING**</td></tr>
<tr><td>⚡</td><td>The Indoor Unit (IDU) contains low voltage that may cause serious injury if opened. Do not, under any conditions, open or dismantle the IDU. Failure to follow these instructions could result in serious injury or death.</td></tr>
</table>

System Connections for Temporary Setup

7. How to Connect the System

1. Prior to connecting the ODU/IDU cable, the metal RJ-45 connector must be grounded before connecting to the ODU or IDU. Use the strap wire/electrical clips (alligator clips) to connect the metal RJ-45 to ground connection (not an existing electrical system ground). This is to prevent any static discharge that may have built up in the line prior to installation. Be careful not to damage the RJ-45 connector.

2. Connect the 9-pin circular connector on the interface cable to the ODU receptacle on the bottom of the ODU.

Note: you can use the ODU shipping container as a temporary platform to support the ODU and to provide clearance for the connector and cable by cutting a small hole on the cardboard box. Elevate the ODU to the approximate intended install height and use a temporary platform to hold the unit. The orientation of the ground lug is important as the testing software will use this direction as "aft". For your install location, orient the ODU so that the ground lug points to your "aft" or "rear" of your facility or location.

3. Connect the supplied ground cable from the ODU to the ground connection (see. Figure 12). Torque bolt on ODU to 10-12ft-lbs.

4. Route the ODU/IDU cable to a location where Mains power is available. Tape the cable to reduce any trip hazard during the temporary operation of the system.

5. Remove the "installation cover" on the IDU. Remove the electrical clips from the RJ-45 connector and connect the interface cable and the green connector from the power module. You can leave the cover off at this time.

6. Remove the SIM cover and install the SIM noting the correct orientation as indicated on the unit. Close the SIM latch and make sure the power switch is in the off position. Leave the SIM cover off during the test.

7. Connect the mains cable to the power module and connect the other end to a Mains power outlet. The LED on the power module should light and the Power LED on the IDU should light.

8. Connect a cable from the IDU "Data" port to the RJ-45 connector on the lap top computer.

9. Connect the RJ-11 cable from "Voice 1" on the IDU to a phone handset (user supplied).

7.1 Initial Power-up and Site Survey Test

1. On the IDU move the power switch to the ON position. After the units boots and the GPS initializes (< 2 minutes) the status LEDs on the IDU should be as follows:

    a. Power = Green

    b. Status = Amber (Status can be Green with software version A012001)

    c. Signal=Green

    d. GPS=Green

2. Turn on the laptop computer and install the Iridium Pilot Land Station Accessory CD.

3. The PC should display the CD directory. Select the Site Survey Tool (SST) and double click to start the tool. (note the tool assumes the default IP address if the address has been changed select the settings menu from the Task bar and input the alternate IP address).

4. At this time make sure the any navigation and communication systems are on and active.

5. Click on the "Start" button on the SST application to begin the test. The tool scans ~ 2.6 channels per second requiring 97 seconds to complete a single scan. Several scans are useful in assessing the local noise environment and to detect down link information from the Iridium constellation. Note the screen will be updating to provide feedback the program is executing normally.

6. This test validates that you have placed the Iridium equipment in a good location. See Appendix G for more information on the SST.

8. Installing the System

Now that a suitable location for the ODU has been verified the equipment can be permanently installed for operation. The permanent installation is comprised of 7 steps.

1. Route the ODU/IDU interface cable.

2. Connect and mount the ODU and note that the ground lug orientation will be used in software as "Aft" or rear orientation.

3. Connect the ground cable from the ODU to a ground connection

4. Mount the IDU.

5. Connect the ground to the IDU, then the ODU/IDU interface cable and then the power connector

6. Connect the telephones and computer network to the IDU.

7. Test and verify the installation.

Routing the ODU/IDU Interface Cable

The interface cable has a waterproof circular connector that connects to the ODU and a shielded RJ-45 connector that connects to the IDU. Since the IDU side is much smaller it makes sense to pull the cable from the ODU towards the IDU. Once the ODU site is known, an IDU location must be selected that is within the distance of the ODU/IDU cable, accounting for the path thru the cable chase. Drill any required access holes in order to route the cable to the interior of the location. The cable should be pulled by the RJ-45 connector. Use care and install a pull string that attaches to the cable jacket and does not place stress on the connector. Use electrical tape to protect the RJ-45 during the pull operation. Leave just enough service loop at the ODU and store any excess cable in the cable chase or near the IDU.

Note: The ODU/IDU cable must be grounded prior to installing on the ODU or the IDU. Connect a wire strap/electrical clip from the metal RJ-45 housing to a ground connection (not an existing electrical system ground). Connect the cable to the ODU first. After the ground cable has been installed on the ODU you may then remove the electrical clips.

ODU Mounting Considerations

⚠️ WARNING

> ⚠️ ODU must be properly mounted and secured. Failure to do so could result in detachment of the unit, causing disruption in operation of the unit, or danger from a falling unit, which could result in serious injury or death.

A suitable mounting bracket or pole may need to be procured or fabricated to support the ODU. Factors to consider in selecting a mounting method include:

- The weight of the unit (13kg ,28 lbs) - weight includes provided mounting bracket
- The physical size of the unit (406mm high by 585mm in diameter) - height includes provided mounting bracket
- Mechanical resonance of the system excited by:
    - Mechanical vibrations induced by nearby operating machinery
    - Wind induced vibration

These factors will be discussed in the following paragraphs. The mounting bracket and pole must be capable of supporting the weight of the unit. Consideration should also be given to accessibility for installation and service work, and the task of lifting and supporting the size and weight of the equipment safely whilst all the connections are being made. The mounting bracket and pole must be capable of supporting the lateral loads caused by the wind. For example at 60 mph the lateral force on the ODU alone (ie. excluding the pole) will be approximately 3.5-4.5 kgf. This load will generate shearing and bending forces in the mounting bracket and pole which must be distributed safely into the mounting structure. Since this loading will vary continuously with time, the structure must not only withstand the static loading but also the fatigue loading over the lifetime of installation.

When selecting a suitable mounting pole it is important to consider resonance as well as strength. The ODU will be subject to vibrations caused by oscillating aerodynamic forces due to vortex shedding from the ODU itself (in the range 0 – 10 Hz for wind speeds up to 60 mph, or storm force 10), and any upstream objects even if they are outside the zone shown in Figure 7.

The ODU will also be subject to vibrations transmitted through the mounting structure (from engines, motorized equipment, cable stays or guy ropes). Careful consideration must therefore be given to minimize the potential for vibration causing damage to the ODU, by careful choice of the mounting position, pole diameter, pole length, and any necessary supporting structure. If necessary modify the design of the mounting pole to move its natural frequency (with ODU fitted) away from the frequency of the source of vibration. For example, increasing the stiffness of the mounting pole will increase its natural frequency – this might be achieved by using a shorter or thicker pole, but note that adding mass will have the contrary effect of reducing the natural frequency. If the pole cannot be shortened, then consider adding rigid support struts or tensioned guy ropes to reduce the effective length. The following guidelines are recommended:

- Minimum pole diameter: D = 60.3 mm (2.38 in.)
- Minimum wall thickness: t = 3.2 mm (.125 in.)
- Maximum unsupported pole length, L = 2.0 m (6.6 ft)

For 100 mph winds (hurricane force 12) the unsupported length should be reduced to 1.0 m (3.3 ft.). Longer poles are possible if additional support is provided such as guy ropes. More sophisticated mounting designs may be necessary to deal with vibrations in some installations. The design of vibration reducing or absorbent mountings is critically dependent on many installation specific factors that are well outside the scope of this manual. Hence for any such an installation, consult specialist suppliers of antenna mountings, to obtain professional advice.

Figure 8.
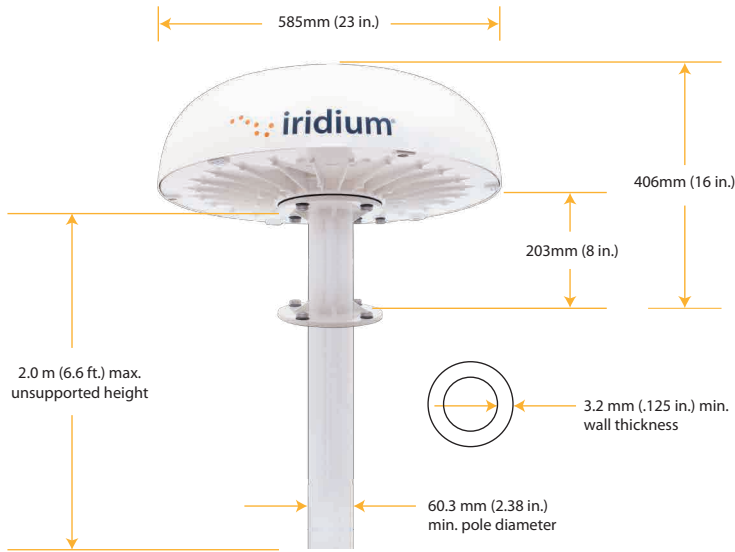
The ODU is supplied with an aluminum mounting bracket used to couple the ODU to a mast. The bracket provides an access hole to allow the circular ODU/IDU cable connector to pass thru the bracket and connect to the ODU. A detail of the mounting bracket is included herein to allow a custom mount to be fabricated with a matching bolt pattern. See Appendix E.

Galvanic Corrosion Protection

Note that the ODU base-plate and the mounting adaptor bracket are constructed out of aluminum. Care must be taken when mounting the unit to a steel structure. This transition area of dissimilar metals provides for the potential of galvanic corrosion. The dissimilar metals in the presence of an electrolyte create a very low voltage battery with the steel acting as the cathode and the aluminum acting as the anode. The battery action causes an ionic transfer of material from the anode to the cathode. This will cause the aluminum to corrode and dissolve at an accelerated rate. There are two actions the installer can use to prevent this corrosion. **See Appendix E for an assembly drawing detailing the installation of the ODU with recommended galvanic isolation.**

1. Create an electrical isolation barrier between the ODU base plates and mounting bracket or mast. Take caution not to damage this barrier during installation. A coating of sealant such as 3-M brand 5200 marine adhesive between the flanges should be used. Stainless steel isolation washers should be used to keep bolt head and lock washer from damaging the painted surface.

⚠ WARNING

⚠ Damage to the paint coating may allow rust to the ODU which could result in failure of the ODU. This in turn could cause disruption in operation of the Iridium Pilot Land Station device. Avoid damaging the paint coating. If damage occurs, re-apply appropriate anti-corrosion primer and paint. Failure to do so could result in serious injury or death.

2. Provide a water barrier to prevent an electrolyte from reaching the area between the dissimilar metals. Again 3-M brand 5200 adhesive, or equivalent, can be used for this purpose to cover all the fasteners and areas between the flanges.

These two steps should significantly reduce the possibility of galvanic corrosion and structural failure of the adaptor mounting bracket.
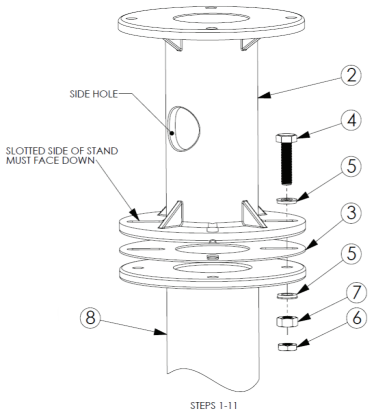
ODU Mounting

There is more than one approach that can be taken to install the ODU. The installation of the ODU is dependent on the mounting location. Follow these generic steps to install the ODU using the recommended mounting adaptor bracket:

Note: Apply a sealant such as 3-M brand 5200 adhesive, or equivalent, to cover all the fasteners and areas between the flanges to assist in galvanic corrosion protection.

1. Fasten mounting bracket to a mounting pole (user supplied) per "Recommended Stand Mounting" instructions below and in Appendix E. If you need to make an adaptor plate, use the bolt holes in the mounting bracket as a template.

Figure 9.

INSTALLATION INSTRUCTIONS:

- **RECOMMENDED STAND MOUNTING**
  NOTE: LOCATION MOUNT MAY DIFFER FROM THE EXAMPLE SHOWN. NEOPRENE BONDED STAINLESS STEEL WASHERS ARE INCLUDED TO PROTECT THE ANTI-CORROSION COATING ON THE STAND AND TO PREVENT GALVANIC CORROSION OF THE ASSEMBLY. 316 STAINLESS STEEL INSTALLATION HARDWARE IS REQUIRED FOR INSTALLATION.
1. TAKE CARE WHEN TRANSPORTING THE RADOME (1) AND MOUNTING BRACKET (2) SO AS NOT TO DAMAGE THE CORROSION RESISTANT COATINGS
2. PLACE THE PROVIDED ISOLATION GASKET (3) ONTO THE FABRICATED MOUNT (8)
3. PLACE THE MOUNTING BRACKET (2), WITH THE SLOTTED SIDE FACING DOWN, ONTO THE GASKET (3)
4. SLIDE A NEOPRENE BONDED ISOLATION WASHER (5) ONTO AN M10 HEX HEAD BOLT (4), WITH ITS METAL SIDE FACING THE BOLT HEX HEAD.
5. SLIDE THIS BOLT ASSEMBLY THROUGH THE SLOT IN THE MOUNTING BRACKET(2) THEN THROUGH THE HOLE IN THE INSTALL LOCATION MOUNTING PLATE (8).
6. SLIDE ON ANOTHER ISOLATION WASHER ON THE BOLT WITH THE RUBBER SIDE FACING THE MOUNTING PLATE AND THAT THE METAL SIDE WILL CONTACT THE NUT.
7. THREAD ON A HEX NUT (7) FINGER TIGHT.
8. REPEAT STEPS 4-7 FOR THE REMAINING THREE BOLTS.
9. TIGHTEN THE HEX NUTS (7) USING AN INTERMEDIATE TORQUE OF 5-6 FT-LBS AND THEN A FINAL TORQUE OF 10-12 FT-LBS, BOTH IN AN 'X' PATTERN (NUT 1 AND 3, THEN 2 AND 4).
10. THREAD ON A JAM NUT (6) TO ALL BOLTS.
11. FOR ALL FOUR BOLTS: IN ORDER TO PREVENT THE JAM NUT AND BOLT FROM TURNING, IMMOBILIZE / RESTRAIN THE HEX NUT (7) USING AN APPROPRIATE WRENCH AND THEN TIGHTEN THE JAM NUT (6) ON THE TOP OF IT, UNTIL THEY LOCK. TIGHTEN THE JAM NUT (6) USING 8-10 FT-LBS.

2. Fasten ODU radome to mounting bracket per "Radome Mounting" steps below and in Appendix E.

Note: The ODU/IDU cable must be grounded by electrical clips on the RJ-45 metal housing prior to connecting the cable to the ODU. The clips can be removed once the ground cable has been installed from the ODU to the ground connection (non-electrical system ground).
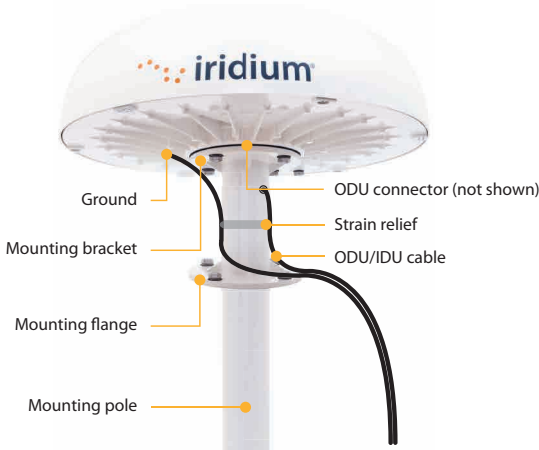
Figure 10.
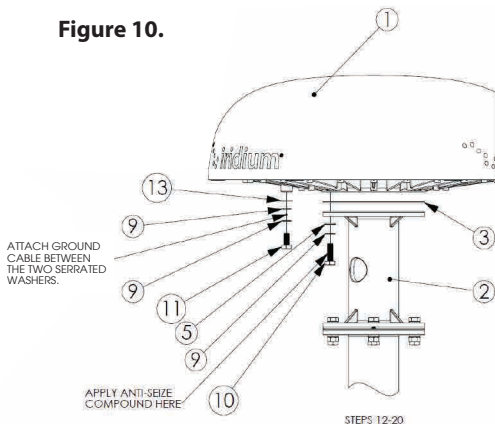
RADOME MOUNTING
NOTE: GROUNDING LUG ON RADOME BASE MUST BE FACING AFT OR "REAR" OF INSTALL LOCATION. ORIENTATION OF THIS GROUNDING LUG IS USED IN DIAGNOSTIC SOFTWARE AS THE "AFT" ORIENTATION.
12. MAKING SURE NOT TO DAMAGE THE METAL RJ-45 SHIELD ON THE POWER / DATA CABLE (NOT SHOWN), GROUND THE CABLE TO A GROUND CONNECTION USING STRAP WIRE / CLIPS (NOT SHOWN).
13. PLACE AN ISOLATION GASKET (3) ON TOP OF THE MOUNTING BRACKET (2).
14. ROUTE THE POWER/DATA CABLE (NOT PICTURED) THROUGH THE BOTTOM OR SIDE HOLE ON THE MOUNTING BRACKET, AND CONNECT TO THE RADOME. PLUG THE CABLE INTO AND LOCK THE CONNECTOR ON THE BOTTOM OF THE RADOME BY TIGHTENING THE PLASTIC FERRULE, TAKING CARE NOT TO OVERTIGHTEN.
15. PLACE THE RADOME ONTO THE MOUNTING BRACKET, WITH THE GROUNDING LUG ORIENTED TO "REAR" OF LOCATION AND ARROW ON THE RADOME BASE WILL POINT TOWARDS FRONT OF LOCATION.
16. SLIDE A LOCK WASHER (9) THEN AN ISOLATION WASHER (5) ONTO AN M10x30mm HEX HEAD BOLT (10). THE METAL SIDE OF THE ISOLATION WASHER SHOULD FACE THE LOCK WASHER. APPLY ANTI-SEIZE COMPOUND ON BOLT.
17. SLIDE THE PREPARED BOLT UP THROUGH THE MOUNTING BRACKET, AND FINGER TIGHTEN INTO THE RADOME BASE.
18. REPEAT STEPS 16 AND 17 FOR THE REMAINING THREE BOLTS.
19. TIGHTEN THE FOUR BOLTS USING AN INTERMEDIATE TORQUE OF 5-6 FT-LBS AND THEN A FINAL TORQUE OF 10-12 FT-LBS, BOTH IN AN 'X' PATTERN (BOLT 1 AND 3, THEN 2 AND 4).
20. ATTACH GROUND CABLE LUG (NOT SHOWN) BETWEEN TWO LOCK WASHERS (9) ON THE 20mm M10 BOLT (11). PLACE FLAT WASHER(13) BETWEEN THE RADOME BASE AND LOCK WASHER AND TIGHTEN INTO GROUND POST ON THE RADOME. TORQUE BOLT TO 10-12 FT-LBS. ATTACH THE TERMINATING END OF THE GROUND CABLE TO GROUND CONNECTION (NOT AN EXISTING ELECTRICAL SYSTEM GROUND) AT THE LOCATION USING A SUITABLE ,NONCORROSIVE CLAMP OR TERMINAL. USE THE GROUND CABLE ADAPTER KIT TO ALTER THE CABLE IF NEEDED.

2: INSTALLATION

Note: The mounting configuration may vary depending on the factors discussed (e.g.: location, pole selection).

When mounting the bracket ensure:

- The M10 bolts have 15 – 20 mm thread engagement into the ODU.
- ODU / IDU cable can be connected to the connector in the center of the ODU.
- The ground cable is long enough to connect to the ground connection.

Figure 11.   **Figure 12.**

Ground
Mounting bracket
Mounting flange
Mounting pole
ODU connector (not shown)
Strain relief
ODU/IDU cable

ADE BASE LATE
M10 FLAT WASHER
2 x M10 SERRATED LOCK WASHER
M10 x 20mm HEX HEAD BOLT
M10 L
RO D CABE
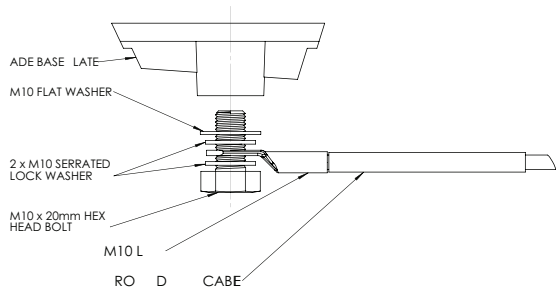
3. Ensure the ground cable is installed to the ground source at the installation location.

NOTICE: Install ground cables for both the ODU and IDU before using Pilot Land Station. Instructions on how to install the ground cables are provided in Section 8 and Appendix E of this Installation Guide. Failure to properly ground the ODU and the IDU could result in property damage in the case of a lightning strike or other excessive static build-up.

Install the ground cable using the components in the ground cable adapter kit. Silicone grease or joint compound should be applied between all contact surfaces, and an impervious coating should then be applied over the whole joint to exclude moisture from all metal surfaces, e.g. using self-amalgamating tape or a shrink-fit rubber boot (user supplied). Install the M10 Serrated Lock Washer onto the ground bolt, followed by the ground cable terminal end, then the other M10 Serrated Lock Washer and then complete with the M10 Flat Washer (See Figure 12). Torque the bolt to 10-12 ft/lbs.

4. Install cable ties for strain relief for the ODU/IDU cable and ground cable (earth strap).

8.1 IDU Mounting Considerations

The Indoor Unit (IDU) must be located within distance of the length of the ODU/IDU cable supplied (10m or 30m). Alternative cable length of up top 50m is available. The IDU should be mounted with the cable connectors pointing downwards on a flat vertical surface (wall) which is sheltered from the elements (e.g: water). The wall must be able to support the weight (1.35 kg, 3 lbs) and have adequate space for the unit that is 250 mm (9.8 in.) x 190 mm (7.5 in.) x 55 mm (2.16 in.). Space must be provided for the following cables:

- Power cable
- ODU/IDU cable (Details in Appendix C)
- Ground Cable (details in Appendix D)
- Handset (3 max – not supplied)
- Ground cable for the IDU

The cables connected internally to the IDU (e.g.: power, ground, cable from the ODU) should be attached to the IDU housing with strain reliefs. It is also advisable to protect the cable connection with external strain relief. The cables that connect to the data and handset ports must have external strain relief.

Connecting External Cables to the IDU

Figure 13.

Mounting hole

power
status
signal
GPS

iridium

SIM
off / on

data   voice 1   voice 2   voice 3

Installation
cover

Power LED   SIM cover

IDU Power Supply Options

Power to the IDU must be 11 to 32 volts DC. The Iridium supplied power supply unit (PSU) can be used to convert AC mains power to 24 VDC to run the Iridium Pilot Land Station platform. The PSU is able to connect 110 to 240VAC at 50 or 60Hz and is capable of supplying 50W continuous and 80W for .25 seconds at switch-on.

If appropriate, use the provided cable when connecting the AC PSU to the AC power source. Otherwise, the installer should provide a standard IEC cable with the appropriate country plug. The 2-way connector should be connected to the "power in + and –" terminals within the installation section of the IDU.

When using DC power the installer will need to provide a suitable 2 wire + earth cable capable of providing 12/24VDC nominal (11V min, 32V max) and 50W continuous / 80W for .25 seconds at switch-on at the IDU. The positive and negative wires must be terminated using the connector from the AC PSU (provided). The 2-way connector should be connected to the "power in + and –" terminals within the installation section of the IDU. The earth should be connected to the earth tag inside the installation area (See Figure 14).

Shock Hazard

<div style="border:1px solid orange;">

⚠ WARNING

⚡ The Indoor Unit (IDU) contains low voltage that may cause serious injury if opened. Do not, under any conditions, open or dismantle the IDU. Failure to follow these instructions could result in serious injury or death.

</div>

Mounting the IDU

After a suitable location has been chosen, mount the IDU:

1. Layout the locations for the mounting screws, 3 total (see template in Appendix E). The IDU is mounted with the connector edge facing down. Use the included template as a guide for drilling the mounting holes.

2. Drill and tap holes for M4 flange style mounting screws

    a. Note: Alternative screws or screw / washer combination may be used.
       Screw must fit into a 4.5 mm (.18 in.) hole.

3. Hold and screw the IDU against the wall.

Connecting Internal Connections to the IDU

Figure 14.
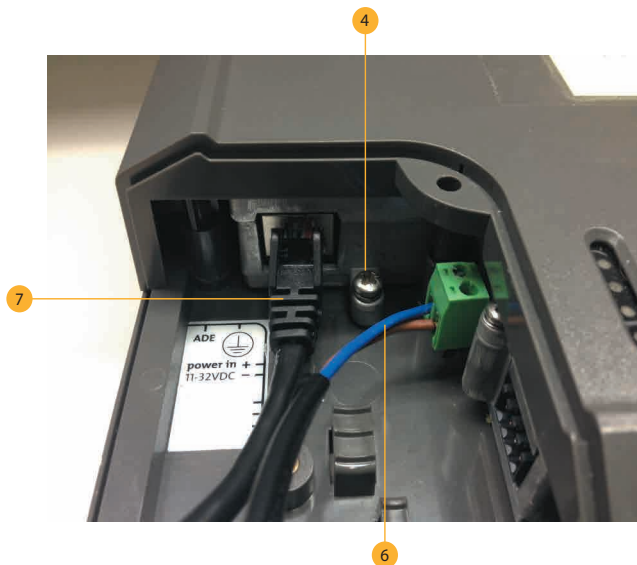
1. Remove the SIM cover (retain)

2. Make sure the ON/OFF switch is in the OFF position

3. Remove installation cover from bottom left hand corner of IDU (retain cover & screw)

4. Remove ground bolt, connect ground cable and replace the bolt to secure the ground connection (15 in-lbs recommended torque). See Figure 14, reference 4.

5. Connect the other end of the ground wire to a local ground connection (not an electrical system ground) using appropriate clamp or connection.

6. Fit power feed from the DC buss or from the supplied PSU to power connector on IDU, use strain relief provided within IDU. See Figure 14, reference 6.

7. Connect RJ-45 connector from ODU/IDU cable to the IDU (See Figure 14, reference 7) and use strain relief provided within IDU

8. After checking that all the connections are securely made and have strain relief, replace and fasten the installation cover.

Figure 15.

Data connection   Voice connections

Insert SIM card

Slide locking tab

Figure 16.

Provisioned lines will illuminate green

Reset button

SIM
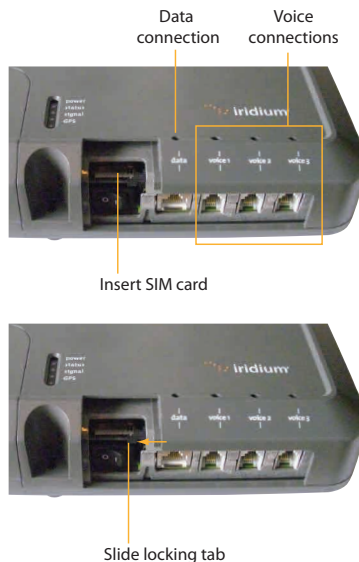
The data and handset connections are on the connector edge of the unit. There is one data connection and three handset connections. The data connection is marked as "data" and the handset connections are identified as "Voice 1", "Voice 2" and "Voice 3".

The user supplied handsets connected to the IDU must be POTS / RJ11 handsets. The data port on the IDU is a MDI-X port. If the Indoor Unit (IDU) is to be connected to a down-stream port of an Ethernet hub or switch then the user will need to use a cross-over cable. Again, the data port must be provisioned to connect to the Internet. The data LED will illuminate green.

Note: The maximum length of the ODU/IDU cable plus the Computer-to-Data port cable shall not exceed 100 meters total length to comply with Ethernet maximum length standards.

To connect external equipment to the IDU:

Note: In order for the data and handset ports to be active the SIM must be provisioned and placed in the IDU.

1. Connect external equipment to the appropriate port. (e.g.: computers are connected to the data port, handsets are connected to a port marked "Voice 1, 2 or 3").
2. Provide external strain relief for cables connected to the IDU.
3. Insert the SIM card and slide the locking tab in place. See Figure 15.
4. Switch ON/OFF switch to ON position. The POWER LED should light green, the STATUS LED should flash red for a few seconds, then illuminate amber (green with firmware VA012001 and higher). See Figure 16
5. Replace the SIM cover.

SIM Validation

In order to access the Iridium network the IDU must have a valid SIM installed. Upon activation by the Service Provider, the customer's SIM will be provisioned with the service level (available bandwidth) and the number of voice lines available. For example: There are three phone lines available but you choose to only provision one of them. Upon system activation only one phone line will be available.

Contact the service provider to add or remove voice phone lines. Once the service provider has added or removed voice lines, the IDU will automatically update the SIM at the next network connection.

Note: If the SIM card is removed or unlocked any voice or data calls will be terminated immediately. The SIM must be reinserted and locked into position using the locking mechanism on the SIM card holder, and then the unit must be switched off and back on again to be reactivated.

9. Install Performance Testing

This section will repeat the initial site survey tests done in Section 7.1 in order to validate the final installation of the equipment and use of the satellite links. The following steps should be followed:

1. Run the SST program again and compare the resulting graphs to the earlier "temporary installation" results. Retain both sets of results on the computer for future trouble shooting efforts. If the results are greatly different then contact your service provider or Iridium customer support for additional help.
2. Place a voice call to the same number used in the earlier voice test. Record the subjective results and verify the voice quality is substantially the same as the previous result.
3. Run the Speed Test tool and verify the uplink and down-link speeds are within +/- 20% of the provisioned data speed.

Testing the Voice Service

Connect a handset (user supplied) to the "Voice 1" port on the IDU and place a call.

1. Ensure the SST software has been stopped.

2. Lift the receiver and listen for a dial tone.

3. Dial the country code, area code and phone number of a phone that can be used for voice quality testing. Don't forget to press the # key to initiate the call.

4. When the call is answered verify there is intelligible voice in both directions.

5. If any issues are detected hang-up and attempt the call again. If the problem persists attempt a call to an alternate test number preferably in a different exchange (different provider) from the initial attempt.

6. If after all of these attempts there is still an issue consider the following

    a. Clear voice from the Iridium Pilot Land Station unit to the landline and garbled voice in the other direction is typical of local interference disturbing the down-link signal.

    b. If the clear voice is from the land-line side and the Iridium Pilot Land Station side is garbled then there is likely another issue and you should consult the trouble shooting section.

    c. If the call is not clear in either direction then there could be an interference issue. An alternate location should be considered.

    d. If the call fails to connect go to the trouble shooting section of this guide.

Note: Voice quality of the Iridium Pilot Land Station network is characterized as narrow band telephony. Significant voice compression is used in transporting voice and it can therefore sound slightly degraded from a typical mobile telephone call.

Testing the Data Service

With the PC connected to the "Data" port on the IDU open a browser on the Windows computer and attempt to connect to **http://speedtest.iridium.com**. Once the site is visible click the "start" button. This is a customized speed test that accurately measures the performance of satellite communications. Satellite communication differs from terrestrial communications. In transitioning from stand-by to full load about 20 seconds are required to acquire the network resources. The speedtest tool has been specifically designed to account for these characteristics.

Note the speed should typically be within 20% of the provisioned rate. While checking a 128kbps link note that local activity may have the effect of slowing the link. Seldom are the lower provisioned rates affected by traffic. If a rate is out of specification wait 5 minutes and try again.

Now that the site survey, voice call, and data call have provided nominal performance you can initiate routine use of the terminal.

Section III – NETWORK CONFIGURATION

The second half of this manual requires network administrative skills to complete the integration with the IT subsystem. It should only be performed if the installer has the appropriate knowledge and background.

If the Indoor Unit (IDU) is to be connected to a down-stream port of an Ethernet hub or switch then the user will need to use a crossover Ethernet cable. Data Service must be provisioned before you can connect to the Internet. The data LED will be illuminated green if your Iridium Pilot Land Station unit is provisioned for data.

For a Single PC
• Connect directly to the data port of the IDU

• Use a standard Ethernet cable

• Configure PC for static configuration (for more details see User Manual)

For Multiple PCs
• Connect the switch/hub/router to the data port on the IDU using a crossover Ethernet cable.

• Connect the PCs to the Ethernet switch, hub or router (Note: these multiple devices will be sharing the same satellite connection over the Iridium network, the more devices connected the smaller the share of the connection.)

• Depending on how your LAN is configured you may or may not want the IBSU to act as a DHCP server and to perform DNS forwarding, see the Iridium Pilot Land Station User Manual for instructions on how to change settings.

10. Initial System Configuration

There are two levels of diagnostic information available, basic and administrator. Configuring the system and full diagnostics can only be done by the System Administrator and requires a login password.

Accessing the IBSU Web Pages

1. Connect a PC to the data port on the IDU

2. Open the web browser and in the web browser address window, type: http://192.168.0.1.

Note: The default IP address is assigned to the IBSU at the factory. The IP address can be changed if there are multiple IBSU's at a single site (if this has been done then type in the new IP address). To reset the IP address back to the default (192.168.0.1), press the network reset button on the IDU.

1. Select "Login" for administrator level diagnostics. Type in the user name and password specified by Iridium (default user name and password is "admin"). Call your Service Provider if login fails.

2. Select the appropriate link:

Select to link to:

• Status

• Counters

• Diagnostic

• Configuration

• Admin Password

Figure 17.
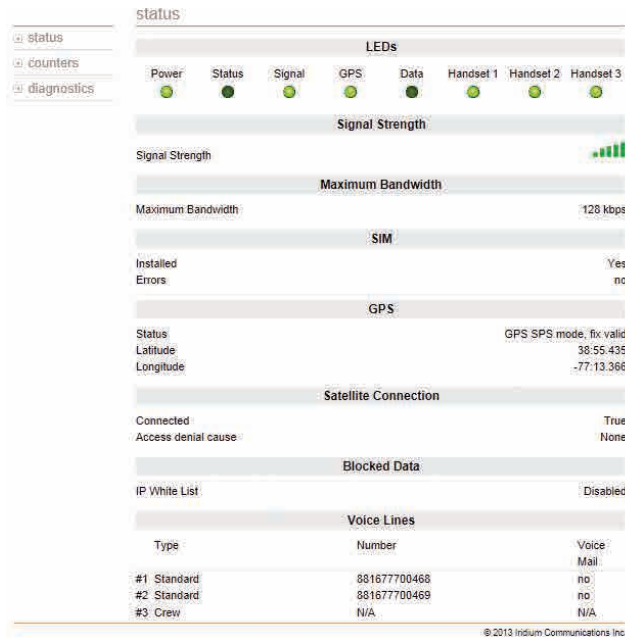
Status Page

The status page provides the condition of the Iridium Pilot Land Station hardware and software:

- The status of the LEDs located on the IDU is provided
- Signal strength of the current satellite down-link is displayed
- Status of the SIM card indicates if it is installed and operational
- GPS status and location are displayed
- Satellite connection status shows current connection along with historical statistics
- Voice line data displays line type, phone number and voice mail service

11. Configuration of LAN Settings

The Iridium Pilot Land Station IBSU allows you to configure the following LAN settings, via the web pages when logged on as 'admin'. These settings include:

- IP Address
- Subnet Mask
- DHCP Server and IP Address Range to Use
- DNS Forwarding

IP Address

This is the IP address of the IBSU as seen at the location. The factory default is **192.168.0.1**. You should not change this default unless there is already LAN equipment at the location, in which case you must set this to an unused IP address of the LAN.

Subnet Mask

This defines the subnet used at the location. The factory default is 255.255.255.0. You should only change this default if you change the IP address of the IBSU. All network devices must use the same subnet in order to communicate with one another.

Dynamic Host Configuration Protocol (DHCP) Server

This automatically provides unique IP addresses and appropriate configuration parameters to each network device connected to the IBSU. In the current configuration, DHCP is disabled.

Note: While DHCP is disabled, devices connected to the IBSU will need to have their network settings manually configured. There must only be one DHCP server on any network segment.

DHCP IP Address Minimum and Maximum

This sets the range of IP addresses for the DHCP server to use. The factory default is 192.168.0.2 to 192.168.0.254. The range specifies the maximum number of devices on the network. Both the maximum and minimum value must be in the same subnet.

Domain Name System (DNS) Forwarding

DNS is used to convert network names (such as www.iridium.com) into the IP addresses needed to connect to the device. The factory default is disabled. The IBSU acts as a switching station so that it automatically forwards DNS requests to the appropriate DNS server.

Once you change the LAN configuration and press the 'Update IP Configuration' button the IBSU will reboot to apply the configuration changes – this will drop any calls. Once the IBSU has rebooted any connected network devices may take up to 10 minutes to automatically obtain new settings. During this switch over time the network devices may not be able to communicate with the IBSU or/and duplicate IP address settings can occur.

If you change the LAN settings it is advisable to reboot any attached devices to avoid this issue Note: The LAN Settings can be reset to the factory defaults using the reset switch on the IDU.

Section IV – TROUBLESHOOTING

12. Fault Overview

Problems with Iridium Pilot Land Station can be grouped together in several classifications:

1. Fundamental problems where the unit will not function locally over the Ethernet port (no diagnostic page access) or the telephone lines are non-functional.

    a. Check the LED status and follow the fault tree

        i. Possible power supply issue

        ii. Possible ODU/IDU interface cable issue.

2. RF/Network Problem. Local communications over the Ethernet port works but connections to the internet and the PSTN are non-functional.

    a. Check LED status and status and diagnostic pages and follow the fault tree

        i. Possible SIM card issue

        ii. Possible GPS issue

        iii. Possible unit "black listed" at the gateway

        iv. Possible equipment issue

3. Performance Problem. Both local and Satellite communications work but voice and/or data issues persist.

    a. Possible interference or blockage issue

    b. Possible equipment issue.

13. LED State Table

• The Data and Voice LEDs will be off until the unit has initial contact with the Iridium network to register and verify service.

• The "Status" LED states were changed in firmware version AO100002 and newer. The LED state table, above, reflects this new functionality. Older versions of code should be updated to the current version to take advantage of performance improvements and enhancements.

14. Troubleshooting

There are 8 LED indicators located on the IDU that can be used to initially diagnose issues with the system. Initially these indicators may be the only feedback to service personnel if the unit has a fundamental issue. During trouble shooting service personnel need to determine if the unit has previously worked and recently failed or if this is a new installation that has never worked. While troubleshooting consider changes in performance and how they may relate to other equipment that has been added.

There are two main sources of information for troubleshooting:

1. The IBSU Web Pages (as detailed in Section 7)
2. The LEDs on the IDU

LED	Off	Green	Green Flashing	Amber	Red	Red Flashing
power	No power supplied to IDU	Power supplied to IDU. IDU is switched on. Power is being passed to ODU.	Not Used	Power supplied to IDU, IDU switched off	Not Used	Not Used
status	Not Used	Idle: connected to the Iridium network but no traffic	Active: Voice or data is being transferred to/ from the Iridium network	Not Used	System Unavailable	IDU cannot communicate with ODU – check connections
signal	Not Used	Strong network signal detected	Not Used	Weak network signal detected	No network signal detected	Not Used
GPS	Not Used	GPS signal available to ODU	Not Used	Not Used	No GPS signal	Not Used
data	Data port not provisioned.	Data port provisioned for use	Flashing when data call in progress	Access to network denied – see Web Page for details	SIM problem	Not Used
voice 1	Voice port 1 not provisioned. * Or handset off hook.	Voice port 1 provisioned for use	Incoming call (ringing) or call in progress	Access to network denied – see Web Page for details	SIM problem	Not Used
voice 2	Voice port 3 not provisioned. *Or handset off hook.	Voice port 2 provisioned for use	Incoming call (ringing) or call in progress	Access to network denied – see Web Page for details	SIM problem	Not Used
voice 3	Voice port 3 not provisioned. *Or handset off hook.	Voice port 3 provisioned for use	Incoming call (ringing) or call in progress	Access to network denied – see Web Page for details	SIM problem	Not Used

*The IDU does not know what services are provisioned until it has connected to the network so this LED will be off at initial power up.

Suggested actions for the following fault conditions:

LED	Color	Reason	Suggested Action
power	Off	No power supplied to IDU	Get a qualified person to check the power being supplied to the IDU, it should be between 11 – 32VDC at the input to the IDU and capable of providing up to 50W.
power	Amber	Power supplied to IDU, IDU switched off	Remove the SIM cover and ensure that the on/off switch is in the on positions. With this switch in the on position the LED should be green. If the switch is on and this LED remains amber then call your service provider for assistance.
status	Red Flashing	IDU cannot communicate with ODU – check connections	Get a qualified person to check the connection between the IDU and ODU, this should include the connections at the IDU and ODU and the entire cable between them.
signal	Red	No network signal detected	It is valid for this LED to go red for short periods of time but it should not remain red. If it remains red it implies that there is a problem with the equipment. Please call your service provider and report all the information you can see on the web pages as well as the LED colors.
GPS	Red	No GPS signal	You may be in an area where a GPS signal cannot be received. If the installation can be relocated, check again at a new location or wait 10 minutes to recheck. If the problem persists then contact your service provider and report that internal GPS has failed.
data	Amber	Access to network denied – see Web Page for details	Access to the Iridium network has been denied, there are a number of reasons for this below for details (see Access Denied table, page 32).
data	Red	SIM problem	Check SIM inserted correctly and SIM lock on SIM holder pushed across. Check you have a valid Iridium Pilot Land Station SIM.
voice	Amber	Access to network denied – see Web Page for details	Access to the Iridium network has been denied, there are a number of reasons for this below for details (see Access Denied table, page 32).
voice	Red	SIM problem	Check SIM inserted correctly and SIM lock on SIM holder pushed across. Check you have a valid Iridium Pilot Land Station SIM.

15. Access Denial

Denial of access will be indicated by amber Voice and Data LEDs on the IDU. Check the IBSU status webpage under the "Satellite Connection" heading for the Access Denial code. This may be helpful in diagnosing the problem with your service provider or Iridium customer support.

Reason	Details	Suggested Action
SIM non-functional	TMSI/IMSI Invalid	Contact service provider and install a new SIM
Network rejection	Authentication Failure	• Replace SIM with known good device • Potential Transmitter failure
Network rejection	IMEI Blacklisted	Contact service provider to rectify the status at the Iridium network
ODU RF transmission prohibited	Indeterminate Location	• Check GPS LED for Green indication • Check GPS status on the webpage for "OK" • If OK call service provider
ODU RF transmission prohibited	ODU does not have a valid GPS location fix	• If the installation can be relocated, move to different location and recheck. • Wait 10 minutes for updated GPS location fix • Contact Iridium customer support for assistance

16. Performance Problems

Voice and data problems can be attributed to several causes.

1. User expectation can be the first order of problem resolution. Is the IBSU provisioned for all the service levels the customer expects? Is the voice performance consistent with satellite communications? This may not be as good as the end user expects. Is the data rate slow due to abnormal application interaction with the IBSU? Is the user expecting the "ramp-up" time?

2. The voice and data may be actually impeded due to:

   a. Interference at the install location

   b. Blockage of the ODU view of the sky

3. Voice quality is poor

   a. Potential issue with terrestrial network the Iridium Pilot Land Station unit is attempting to connect to. Attempt to place a call to an alternate exchange and assess call quality.

Section V – APPENDICES

Appendix A – Regulatory Approvals

FCC Declaration for 9701

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment Off and On, the user is encouraged to try to correct the interference by one or more of the following measures:

• Reorient or relocate the receiving antenna.

• Increase the separation between the equipment and receiver.

• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

• Consult the dealer or an experienced radio/TV technician for help.

Modifications to this device not expressly approved by Iridium Satellite LLC may void authority granted under the rules of the Federal Communications Commission to operate this device.

Industry Canada

This product is compliant with Industry Canada RSS-102 for RF Exposure.

The 9701 IDU is a Class B digital apparatus and complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Declaration of Conformity

On behalf of Iridium Communication Incorporated, I declare under penalty of perjury that the following device complies with the requirements of the United States Federal Communication Commission pertaining to a personal computing peripheral device:

Identification: Iridium Broadband Terminal, Below Decks Equipment, Model 9701

Compliance Statement: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Responsible Party: Iridium Communication Inc.
 1750 Tysons Boulevard, Suite 1400
 McLean, VA 22102
 USA

 Telephone 1.703.287.7400

Date: 10 / 02 / 2013
 Oct. 2, 2013

Hermon Pon
Vice President, Technology
Iridium Communications Inc.

IRIDIUM　　　　　　　　Model

Declaration of Conformity — EC Directive

This is to certify that the following equipment complies with all relevant Essential Health and Safety Requirements of the Radio and Telecommunications Terminal Equipment Directive 1999/5/EC and the Low Voltage Directive 73/23/EC as amended by 93/68/EC.

Equipment description	Iridium Model 9801, Broadband Terminal, Above Decks Equipment
Serial numbers tested	900A0K, 900A0L, 900A0M, 900A0N, 900A0P
Manufacturer	Celestica, Johor Senai, Malaysia.
Issue date	15th August, 2008

The following harmonized standards were applied to the design of the handset:

Low Voltage Directive	Test Report	Report Date
EN 60950-1:2002	SU3664/8725	15th August 2008

R&TTE Directive - EMC	Test Report	Report Date
EN 301 489-20 V1.2.1 (2002-11) & EN 60945:2002	EU2780/8579	13th May 2008

R&TTE Directive - Radi	Test Report	Report Date
EN 301 441 V1.1.1 (2000-05)	RU1427/8509	2nd June 2008
	RU1496/8759	3rd Sept. 2008

The Test Report References above are test reports prepared by TRL Compliance Ltd, Moss View, Nip Lane, Up Holland, West Lancashire, WN89PY, UK.

Accreditation references: TRL - UKAS 0728 and BSI FS 21805

The project master file, which contains or references all necessary documents to make up a "technical file is retained by Iridium satellite, LLC

The Model 9801 Certification is dependent on the following criteria:
1. The Model 9801 is installed and used as described in Model 9801 User Guide
2. The Model 9801 is only used with Model 9701 Below Decks Equipment (BDE)
3. The Model 9801 is manufactured by Celestica or an equivalent competent manufacturer adopting the same process with equivalent quality levels.

I am satisfied that relevant standards have been used in the design, the above documentation exists in the project Master File, and that the product will be labelled with the CE mark before despatch.

Signed		Vice President, Technology
Date	Oct. 2, 2013	

Appendix B – Specifications

RF Performance		
Frequency of Operation	Transmit	1616 to 1625 MHz
	Receive	1616 to 1626.5 MHz
Channelization	FDMA Spacing	41.67 KHz
	TDMA Timing	8.3 ms slots in a 90 ms repeating frame
	Channels Available	250 Channels (max 64 per iOP)
Maximum ERIP	Voice (1 line)	6.3 Watts average power
	Data (64 ch)	12.6 Watts average power
Modulation	Voice/Data	QPSK
Antenna	Type	Electronically switched and phase steered 6 dual element azimuth array and 1 Zenith element
	Polarization	RHCP
	Maximum Gain	+8 dBi
	Beam Width	Hemispheric coverage (60˚ per element)
	Steering	Automatic solid state
	Coverage	Horizon to horizon
	Rolling Motion	Useful link margin up to 20˚ pitch and roll
	Turning Motion	Useful link margin up to 90 degrees/second turning motion

Power Requirements		
Mains Power (Power module)	Input Voltage	100 to 240 VAC
	Input Frequency	50 or 60 Hz
	Output Power	100 Watts (24 volts @ 4.2 Amps)
IDU DC Input	DC Input Voltage	11 to 32 VDC
	Standby Power	18 Watts
	Power During Call	22 Watts
	Power During Data	31 Watts (max power consumption)

Environmental Specifications		
Outdoor Unit ODU	Enclosure Type	RF Transparent dome with aluminum base
	Enclosure Type Rating	Meets IP56 resistance to dust and water ingress
	Temperature Range	-30 to + 70 degrees Celsius (operating) -40 to +85 degrees Celsius (Storage)
	Relative Humidity	0 to 93% Relative Humidity
	Wind	In excess of 100 mph with proper mounting (see section 12)
Indoor Unit IDU	Enclosure Type	IP33 compliant plastic enclosure
	Temperature Range	0 to +50 degrees Celsius (operating) -40 to +85 degrees Celsius (Storage)

Physical Description		
ODU	Diameter	58 cm
	Height	20 cm (40 cm with mounting bracket)
	Weight	12.5 kg (includes mounting bracket)
	Mounting	Mounting bolts are M10 arranged in a 15 cm diameter bolt circle
IDU	Length	250 mm
	Width	190 mm
	Height	55 mm
	Weight	1.35 kg
	Mounting	Wall mount (see attached template in appendix E)
Power Module	Length	140 mm
	Width	59 mm
	Height	35 mm
	Weight	1 kg
Interconnect Cable	Length	10 meters (30 m optional)
	Diameter	8 mm
	ODU Connector	Bulgin PX0728/S 9-way (IP68)
	IDU Connector	Shielded RJ-45 8-position

User Interfaces		
IDU	SIM Card	Furnished by Iridium service provider
	Data	10 bast T RJ-45 Ethernet port
	Voice 1	RJ-11 (2 wire) POTS interface
	Voice 2	RJ-11 (2 wire) POTS interface
	Voice 3	RJ-11 (2 wire) POTS interface

Appendix C – ODU/IDU Cable

ODU/IDU Interface Cable Drawing

Notes:

1. IDU connector to be RJ-45 shielded, connected as per table. Use Stewart Connector Part number 943-SP-370808SM2 or equivalent.

2. The ODU connector is Bulgin Buccaneer PX0728/S connected per the table below. To maintain weather proof seal the connector gland nut must be tightened to 10 lbf-inches of torque.

3. Cable to be marine grade, tri-shielded network cable such as Belcom part number M4884969 or equivalent.

4. The cable maximum length is 50 m. The combined length of the ODU/IDU interface cable plus the Computer-to-Data port cable shall not exceed 100 meters total length to comply with Ethernet maximum length standards.

5. If installer is not using Iridium provided cables and is creating a cable, please follow the pin out instructions as detailed below.

ODU Connector	Conductor Color Standard (T568A)	IDU Connector
I	White/Orange stripe	3
2	Orange solid	6
3	Brown solid	8
4	(drain wire)	SHIELD
5	White/Brown stripe	7
6	Green solid	2
7	White/Green stripe	1
8	Blue solid	4
9	White/Blue stripe	5

Figure 18.

Appendix D – Ground Cable

Figure 19.

3m ODU Ground Cable
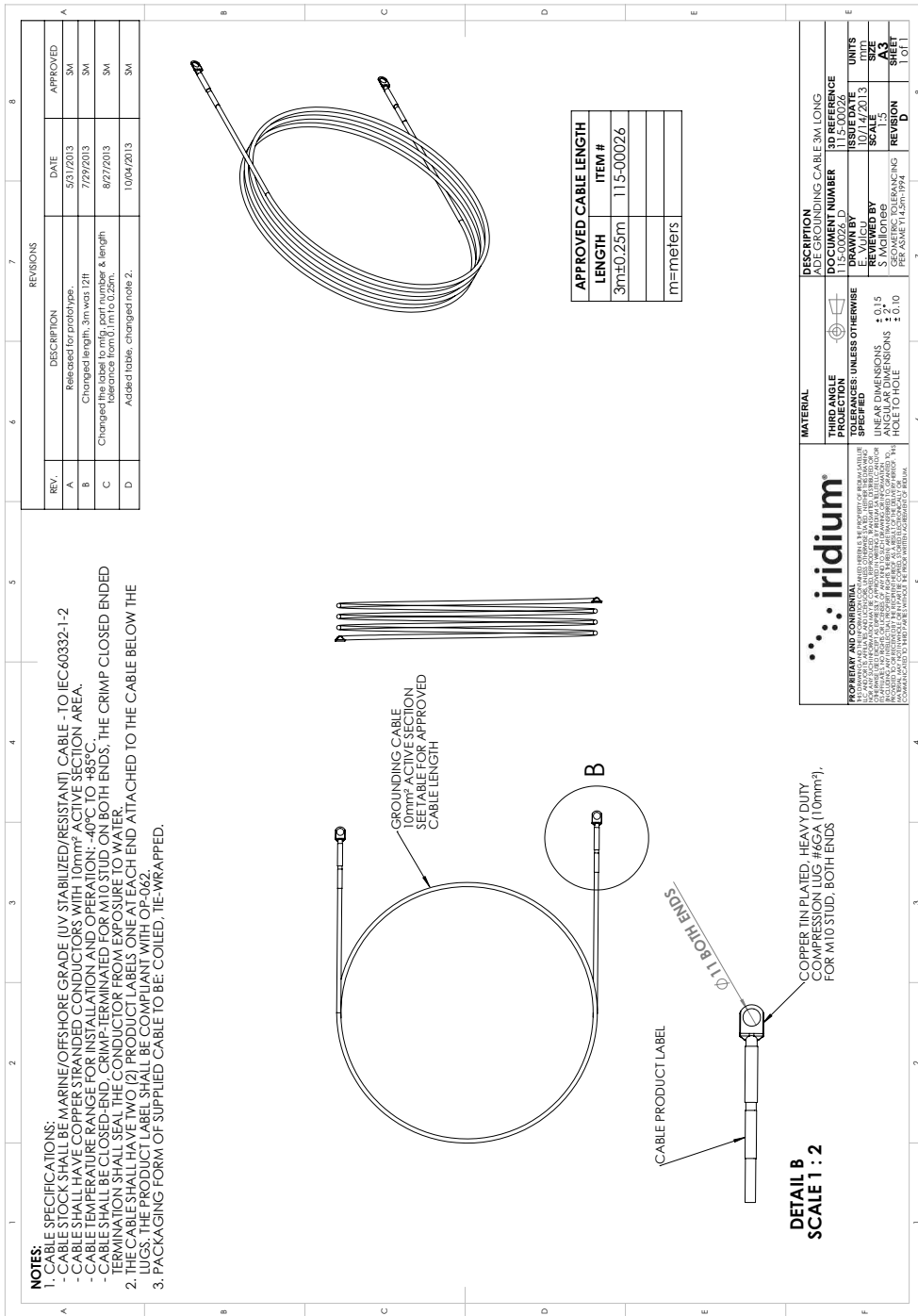
Figure 20.

8m ODU Ground Cable

NOTES:
1. CABLE SPECIFICATIONS:
   - CABLE STOCK SHALL BE MARINE/OFFSHORE GRADE (UV STABILIZED/RESISTANT) CABLE - TO IEC60332-1-2
   - CABLE SHALL HAVE COPPER STRANDED CONDUCTORS WITH 10mm² ACTIVE SECTION AREA.
   - CABLE TEMPERATURE RANGE FOR INSTALLATION AND OPERATION: -40°C TO +85°C.
   - CABLE SHALL BE CLOSED-END, CRIMP-TERMINATED LUG FOR M10 STUD ON ONE END AND BARE METAL STRIPPED AS INDICATED IN THE DRAWING AT THE OTHER END. THE CRIMP CLOSED ENDED TERMINATION SHALL SEAL THE CONDUCTOR FROM EXPOSURE TO WATER.
2. THE CABLE SHALL HAVE ONE (1) PRODUCT LABEL ATTACHED BELOW THE LUG. THE PRODUCT LABEL SHALL BE COMPLIANT WITH OP-062.
3. PACKAGING FORM OF SUPPLIED CABLE TO BE: COILED, TIE-WRAPPED.

BARE, STRIPPED CABLE TERMINATED

GROUNDING CABLE
10mm² ACTIVE SECTION
SEE TABLE FOR APPROVED CABLE LENGTH

CABLE PRODUCT LABEL

COPPER TIN PLATED, HEAVY DUTY COMPRESSION LUG #6GA (10mm²), FOR M10 STUD

DETAIL B
SCALE 1 : 2

14

11 Ø

B

APPROVED CABLE LENGTH

LENGTH	ITEM #
8m±0.25m	115-00027

m=meters

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
A	Released for production.	8/21/2013	SM
B	Added table, changed note 2.	10/04/2013	SM

MATERIAL

THIRD ANGLE PROJECTION

TOLERANCES: UNLESS OTHERWISE SPECIFIED
LINEAR DIMENSIONS ± 0.15
ANGULAR DIMENSIONS ± 2°
HOLE TO HOLE ± 0.10

DESCRIPTION
ADE GROUNDING CABLE - 8m (26.3FT) LONG

DOCUMENT NUMBER	3D REFERENCE
115-00027_B	115-00027

DRAWN BY	ISSUE DATE	UNITS
E. Vuicu	10/14/2013	mm

REVIEWED BY	SCALE	SIZE
S Mallonee	1:5	A3

GEOMETRIC TOLERANCING PER ASME Y 14.5m-1994	REVISION	SHEET
	B	1 of 1

iridium

PROPRIETARY AND CONFIDENTIAL
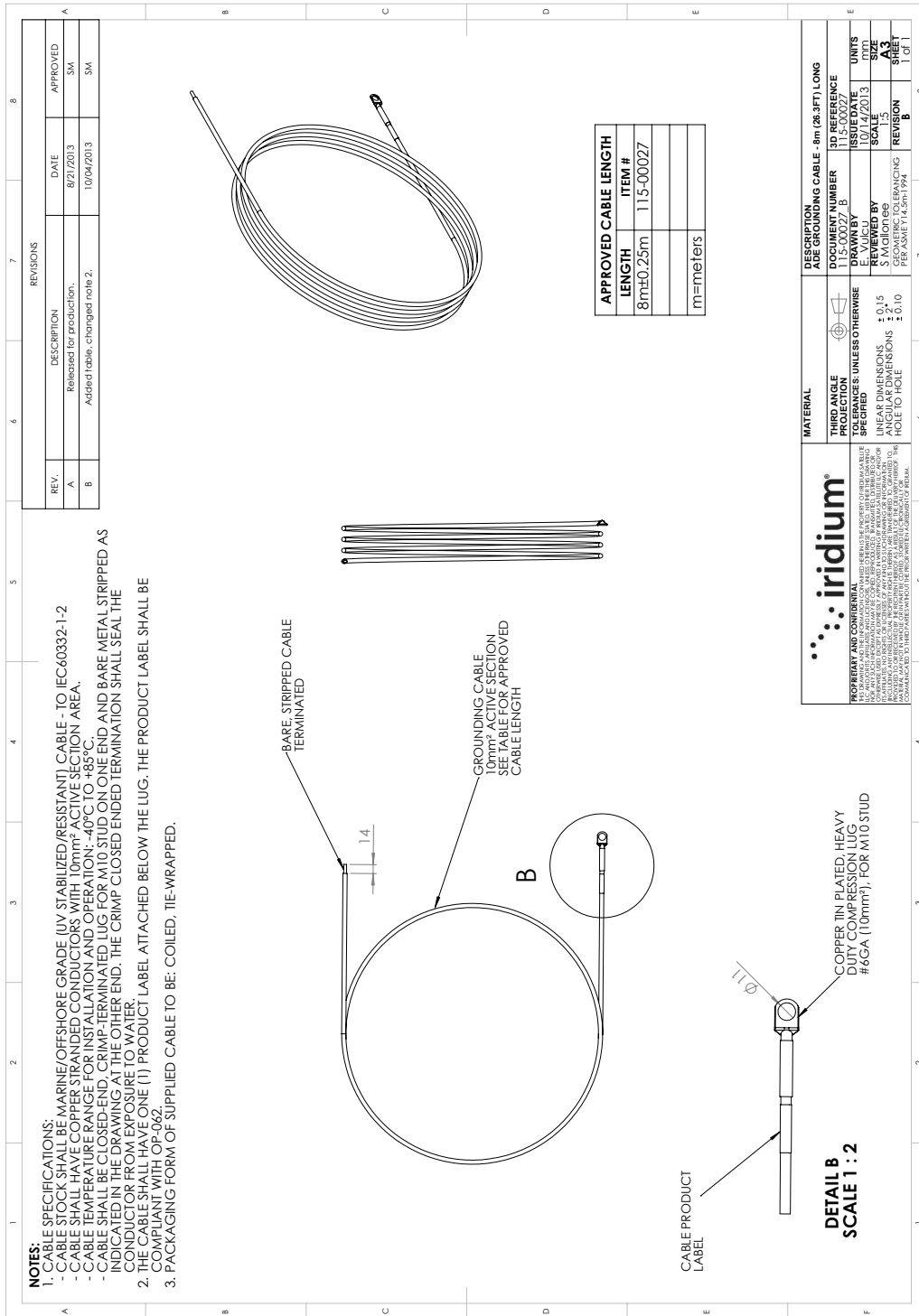
Figure 21.

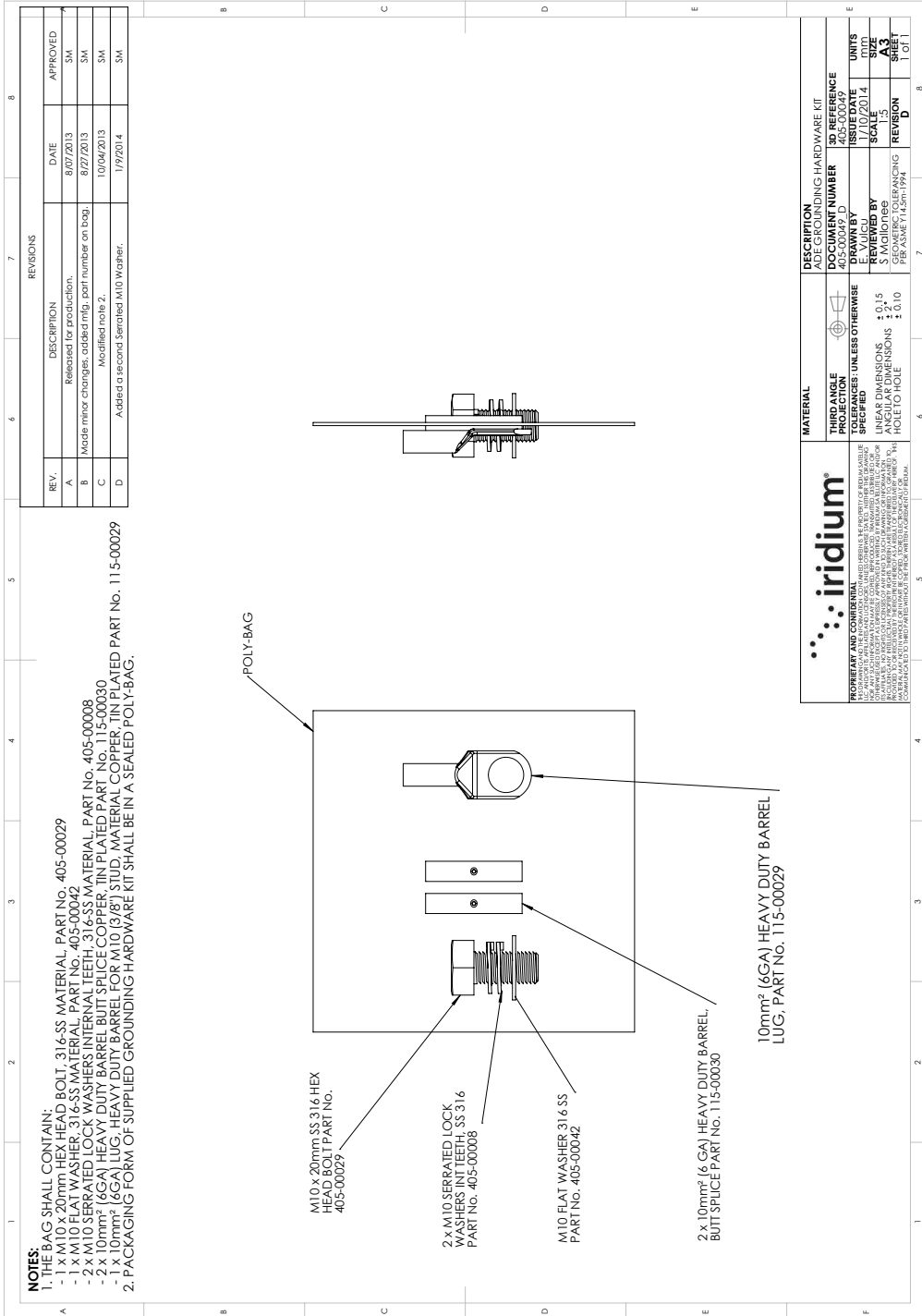**Grounding Hardware Kit (included with the 3m and 8m cable)**

Figure 22.

Figure 23.

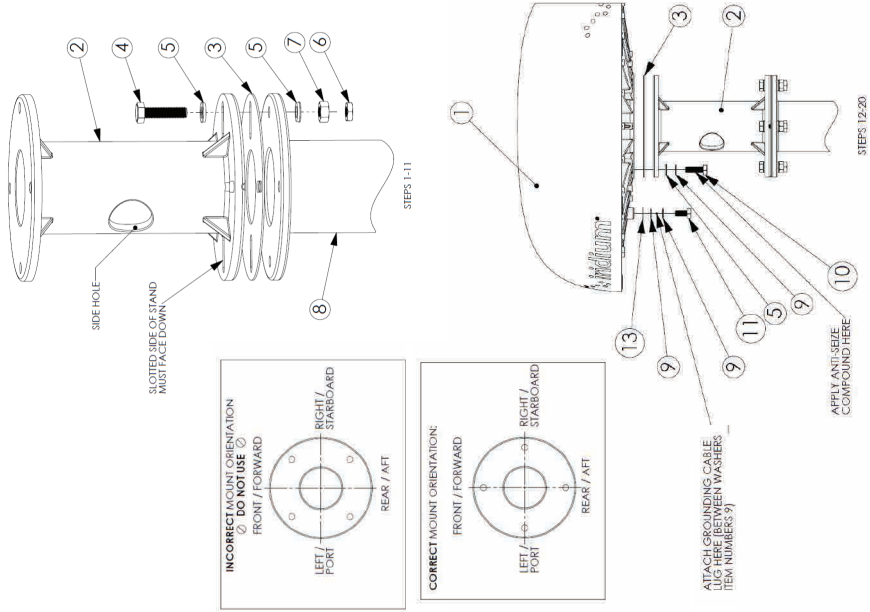

MOUNTING STAND & RADOME INSTALLATION INSTRUCTIONS

See Figure 24 for parts listing and responsible party for supply.

INSTALLATION INSTRUCTIONS: ANY BOM SUBSTITUTIONS TO BE APPROVED BY IRIDIUM

- **RECOMMENDED STAND MOUNTING**
  NOTE: LOCATION MOUNT MAY DIFFER FROM THE EXAMPLE SHOWN. NEOPRENE BONDED STAINLESS STEEL WASHERS ARE INCLUDED TO PROTECT THE ANTI-CORROSION COATING ON THE STAND AND TO PREVENT GALVANIC CORROSION OF THE ASSEMBLY. 316 STAINLESS STEEL INSTALLATION HARDWARE IS REQUIRED FOR INSTALLATION.
1. TAKE CARE WHEN TRANSPORTING THE RADOME (1) AND MOUNTING BRACKET (2) SO AS NOT TO DAMAGE THE CORROSION RESISTANT COATINGS
2. PLACE THE PROVIDED ISOLATION GASKET (3) ONTO THE FABRICATED MOUNT (8)
3. PLACE THE MOUNTING BRACKET (2), WITH THE SLOTTED SIDE FACING DOWN, ONTO THE GASKET (3)
4. SLIDE A NEOPRENE BONDED ISOLATION WASHER (5) ONTO AN M10 HEX HEAD BOLT (4), WITH ITS METAL SIDE FACING THE BOLT HEX HEAD
5. SLIDE THIS BOLT ASSEMBLY THROUGH THE SLOT IN THE MOUNTING BRACKET(2) THEN THROUGH THE HOLE IN THE INSTALL LOCATION MOUNTING PLATE (8).
6. SLIDE ON ANOTHER ISOLATION WASHER ON THE BOLT WITH THE RUBBER SIDE FACING THE MOUNTING PLATE AND THAT THE METAL SIDE WILL CONTACT THE NUT.
7. THREAD ON A HEX NUT (7) FINGER TIGHT.
8. REPEAT STEPS 4-7 FOR THE REMAINING THREE BOLTS.
9. TIGHTEN THE HEX NUTS (7) USING AN INTERMEDIATE TORQUE OF 5-6 FT-LBS AND THEN A FINAL TORQUE OF 10-12 FT-LBS, BOTH IN AN X PATTERN (NUT 1 AND 3, THEN 2 AND 4).
10. THREAD ON A JAM NUT (6) TO ALL FOUR BOLTS. IN ORDER TO PREVENT THE JAM NUT AND BOLT FROM TURNING, IMMOBILIZE / RESTRAIN THE HEX NUT (7) USING AN APPROPRIATE WRENCH AND THEN TIGHTEN THE JAM NUT (6) ON THE TOP OF IT, UNTIL THEY LOCK.
11. TIGHTEN THE JAM NUT (6) USING 8-10 FT-LBS.

- **RADOME MOUNTING**
  NOTE: GROUNDING LUG ON RADOME BASE MUST BE FACING AFT OR "REAR" OF INSTALL LOCATION. ORIENTATION OF THIS GROUNDING LUG IS USED IN DIAGNOSTIC SOFTWARE AS THE "AFT" ORIENTATION.
12. MAKING SURE NOT TO DAMAGE THE METAL RJ-45 SHIELD ON THE POWER / DATA CABLE (NOT SHOWN), GROUND THE CABLE TO A GROUND CONNECTION USING STRAP WIRE / CLIPS (NOT SHOWN).
13. PLACE AN ISOLATION GASKET (3) ON TOP OF THE MOUNTING BRACKET (2).
14. ROUTE THE POWER / DATA CABLE (NOT PICTURED) THROUGH THE BOTTOM OR SIDE HOLE ON THE MOUNTING BRACKET, AND CONNECT IT TO THE RADOME. PLUG THE CABLE INTO AND LOCK THE CONNECTOR ON THE BOTTOM OF THE RADOME BY TIGHTENING THE PLASTIC FERRULE. TAKING CARE NOT TO OVERTIGHTEN.
15. PLACE THE RADOME ONTO THE MOUNTING BRACKET, WITH THE GROUNDING LUG ORIENTED TO "REAR" OF LOCATION AND ARROW ON THE RADOME BASE WILL POINT TOWARDS FRONT OF LOCATION.
16. SLIDE A LOCK WASHER (9) THEN AN ISOLATION WASHER (5) ONTO AN M10x30mm HEX HEAD BOLT (10), THE METAL SIDE OF THE ISOLATION WASHER SHOULD FACE THE LOCK WASHER. APPLY ANTI-SEIZE COMPOUND ON BOLT.
17. SLIDE THE PREPARED BOLT UP THROUGH THE MOUNTING BRACKET, AND FINGER TIGHTEN INTO THE RADOME BASE.
18. REPEAT STEPS 16 AND 17 FOR THE REMAINING THREE BOLTS.
19. TIGHTEN THE FOUR BOLTS USING AN INTERMEDIATE TORQUE OF 5-6 FT-LBS AND THEN A FINAL TORQUE OF 10-12 FT-LBS, BOTH IN AN X PATTERN (BOLT 1 AND 3, THEN 2 AND 4).
20. ATTACH GROUND CABLE LUG (NOT SHOWN), BETWEEN TWO LOCK WASHERS (9) ON THE 20mm M10 BOLT (11). PLACE A LOCK WASHER (9), GROUND CABLE LUG AND A LOCK WASHER AND TIGHTEN INTO GROUND POST ON THE RADOME. TORQUE BOLT (10) 10-12 FT-LBS. ATTACH THE TERMINATING END OF THE GROUND CABLE TO GROUND CONNECTION (NOT AN EXISTING ELECTRICAL SYSTEM GROUND) AT THE LOCATION USING A SUITABLE, NONCORROSIVE CLAMP OR TERMINAL. USE THE GROUND CABLE ADAPTER KIT TO ALTER THE CABLE IF NEEDED.
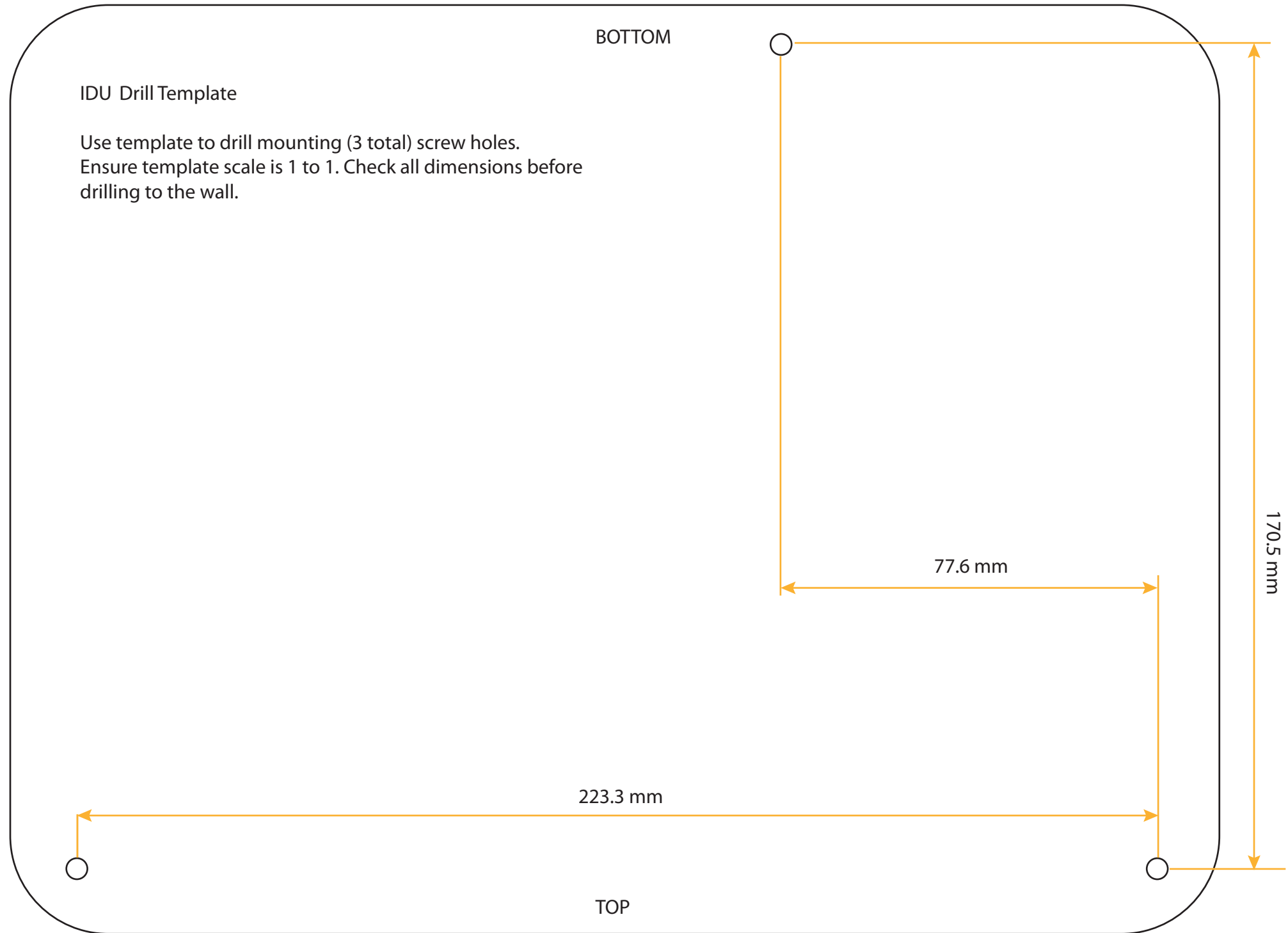
Appendix E – Installation Templates

Figure 24. Installation Instructions

ITEM NO.	DESCRIPTION	QTY	SUPPLY
1	RADOME ASSEMBLY	1	INCLUDED
2	ODU STAND (MOUNTING BRACKET)	1	INCLUDED
3	RUBBER ISOLATION GASKET	2	INCLUDED
4	M10X30MM HEX BOLT 316 S/S	4	USER SUPPLIED
5	RUBBER-STEEL WASHER 3/8	12	INCLUDED
6	M10 JAM NUT 316 S/S	4	USER SUPPLIED
7	M10 HEX NIT 316 S/S	4	USER SUPPLIED
8	POLE/MAST MOUNT	1	USER SUPPLIED
9	M10 LOCK WASHER M10	6	INCLUDED
10	M10-1.5X30MM HEX CAP SCREW 316 S/S	4	INCLUDED
11	M10X20MM HEX GROUND BOLT 316 S/S	1	INCLUDED
12	LOCTITE C5-A COPPER ANTI-SIEZE LUBE	1	INCLUDED
13	M10 FLAT WASHER 316 S/S (GROUND BOLT)	1	INCLUDED

Figure 25. IDU Drill Template

BOTTOM

IDU Drill Template

Use template to drill mounting (3 total) screw holes.
Ensure template scale is 1 to 1. Check all dimensions before
drilling to the wall.

77.6 mm

170.5 mm

170.5 mm

223.3 mm

TOP

Figure 26. ODU Mounting Bracket Template

Use the following template as needed in the fabrication of a mounting bracket or other. This template matches the flange dimensions on the ODU Mounting Bracket.
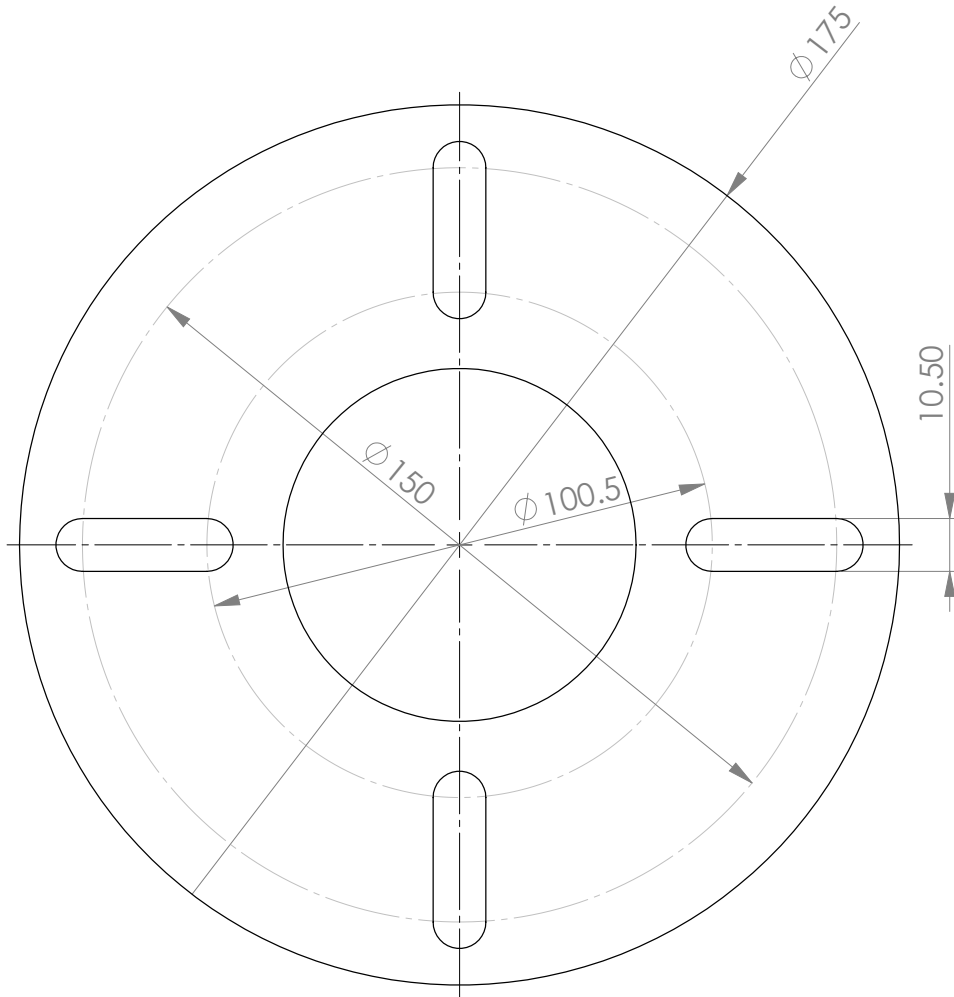
Appendix F -Limited Warranty – Including Exclusions, Disclaimers, Limitations of Liability and Conditions of Use; Warranty Claim Process; Privacy and Data Security and Software License

This Limited Warranty including Exclusions, Disclaimers, Limitations of Liability and Conditions of Use ("Limited Warranty") applies only to the Iridium Pilot Land Station (including hardware, Outdoor Unit, Indoor Unit, and Power Supply (collectively, "Product") and the Accessories listed herein (i.e. cables, mounts) ("Accessories") sold by Iridium or its authorized manufacturer, resellers and distributors (collectively, "Service Providers"). This Limited Warranty extends only to the first retail purchaser of the Product ("You") and is not assignable or transferable.

Subject to the Exclusions contained below, Iridium warrants to You that the Product will be free from defects in materials and workmanship under normal usage for a period of twenty-four (24) months (two (2) years), and that the Accessories will be free from defects in materials and workmanship under normal usage for a period of twelve (12) months (one (1) year) from the date of original retail purchase (the "Warranty Period"), and if Iridium receives, during the respective Warranty Period and in accordance with the instructions set out in this Limited Warranty, notice of a defect in the Product or Accessories covered by this Limited Warranty, Iridium will repair or replace the Product or Accessories or refund the purchase price of the Product or Accessories, at Iridium's sole option. Iridium shall have no obligation to repair, replace, or refund unless the defective Product or Accessory is returned in accordance with the instructions set out in this Limited Warranty and within the Warranty Period. You are required to provide proof of purchase as a condition of receiving warranty service as more fully described in "Warranty Claim Process" below.

Any replacement Product, parts or Accessories may contain new and used materials equivalent to new in performance and reliability. Any replacement Product, parts or Accessories will also have functionality at least equal to that of the Product, parts or Accessories being replaced. Replacement Product, parts or Accessories are warranted to be free from defects in material or workmanship under normal usage for the remainder of the applicable Warranty Period of the original Product or Accessory for which a replacement is provided under this Limited Warranty, or they will be repaired or replaced or Iridium will refund of the purchase price, at Iridium's sole option. A returned Product or Accessory for which a replacement has been provided shall become Iridium's property.

IRIDIUM DOES AND MAY CONTINUE, AT ITS SOLE DISCRETION, TO SUBCONTRACT TO AND ENGAGE A THIRD PARTY TO PROVIDE THE WARRANTY SERVICES PROVIDED FOR IN THIS LIMITED WARRANTY.

If you acquired this Product in Australia or in New Zealand, this Product comes with guarantees that cannot be excluded under the Australian Consumer Law or similar legislation in New Zealand. Notwithstanding other express terms and other limitations of this Limited Warranty (which other express terms and other limitations are negated by this paragraph, but only to the extend inconsistent with this paragraph, and will not be applied to limit consumer rights under such guarantees), where such guarantees operate, consumers are entitled to a replacement or a refund for a major failure of this Product or Accessory and for compensation for any other reasonably foreseeable loss or damage. Where such guarantees operate, consumers are also entitled to have this Product or Accessory repaired or replaced if this Product or Accessory fails to be of acceptable quality and the failure does not amount to a major failure. Please follow the instructions as to use and report problems promptly: problems caused by use that is abnormal or contrary to instructions will generally not be covered. You should contact your Product provider in relation to problems with the Product or Accessory and Iridium will assist your Product provider to resolve them, including replacement where required.

EXCLUSIONS

This Limited Warranty does not apply in the following circumstances:

Normal wear and tear. Periodic maintenance, repair or replacement of parts due to normal wear and tear including without limitation scratches or other damage to surfaces or the appearance of externally exposed parts caused by use are excluded from coverage.

Abuse and Misuse. Defects or damage that result from accident or neglect, including but not limited to dropping the Product or Accessories on hard surfaces, from improper operation or storage, installation or use of the Product or Accessories in a manner inconsistent with the information in the Installation Guide and/or User Manual, misuse or abuse, exposure to open, uncovered connectors including contact with liquid, water, rain, extreme humidity, submersion in water, or any alteration or modification of any kind, including spliced or improperly terminated cables, or other acts which are not the fault of Iridium, are excluded from coverage.

Use of Non-Iridium Products and Accessories. Defects or damage that result from the use of non-Iridium certified products, accessories, power supplies, or software or other ancillary or peripheral equipment are excluded from coverage.

Damage to Any Equipment Not Furnished by Iridium. Damage to any equipment that is not furnished by Iridium or its Service Providers is excluded by coverage.

Unauthorized Service or Modifications. Defects or damage resulting from any service, testing, adjustment, integration, installation, operation, maintenance, service, installation, adjustment, alteration, modification or from integration with any non-Iridium product in any manner other than in accordance with the User Manual or Installation Guide are excluded from coverage.

Altered Products. Products that have been tampered with, altered, have non-Iridium housings or parts, or have had the serial numbers or date tags removed, altered or obliterated are excluded from coverage.

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Attn: Iridium Warranty Administration

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By Mail:
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8440 South River Parkway
Tempe, AZ 85284 USA

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Appendix G – Site Survey Tool (SST)

The Site Survey Tool will display three graphs:

a. The **main scan graph** (large rectangle in the lower half of the display) indicates the activity of each frequency channel in three ways. The bar in light blue is the mean energy of all 7 antennae and may have multiple scans of data averaged together. The red bar indicates the peak energy discovered at any one of the 7 antennae and could represent the peak of the current scan or previous scan depending on the "window size selected (the default is 10). Lastly there is a black bar that indicates the red peak is historical or recently active. Normally the "Mean" RSSI (receive signal strength indication) will be -123 dBm across the channel band.

b. The smaller rectangular **antenna display** in the upper center of the GUI shows the activity on each of the 7 antennae for a single channel. The channel of interest is highlighted by moussing over the channel of interest on the main display and left clicking to select the channel. A yellow highlight box is drawn around the channel of interest and the text in the upper right of the screen will display "Selected Channel: XXX (NN Scans)" If the user has selected more than 1 scan and the application has had enough time to collect more than one scan, then the display will indicate the following: Light blue shows the "mean" RSSI value for each antenna over the completed number of scans; the red show the peak value obtained over the specified number of scans; and finally the black bar shows the value of the current scan.

c. The hexagonal **direction display** in the upper left corner of the GUI displays a top view of the ODU antenna array. The ground lug on the ODU aligns with the aft direction of the install. When a channel is selected in the main display the red and blue spots provide an approximate direction back to the source of the detected signal. This direction plot is based on a calculation of relative signal strengths of the 7 antennas.

In Figure 27 a single scan has completed in a nearly noise free environment. Channel 130 has been selected in the main display and both the "Mean" and "peak" maxima are seen on antenna 2 with slightly lesser amounts detected on antennas 1 and 3 while all the other antennae stay near the -123 dBm noise floor of the receiver. The direction display shows the probable direction of the detected signal. Since the display shows only a few discrete active channels, the signals are known to be in-band and are most likely real Iridium down links.
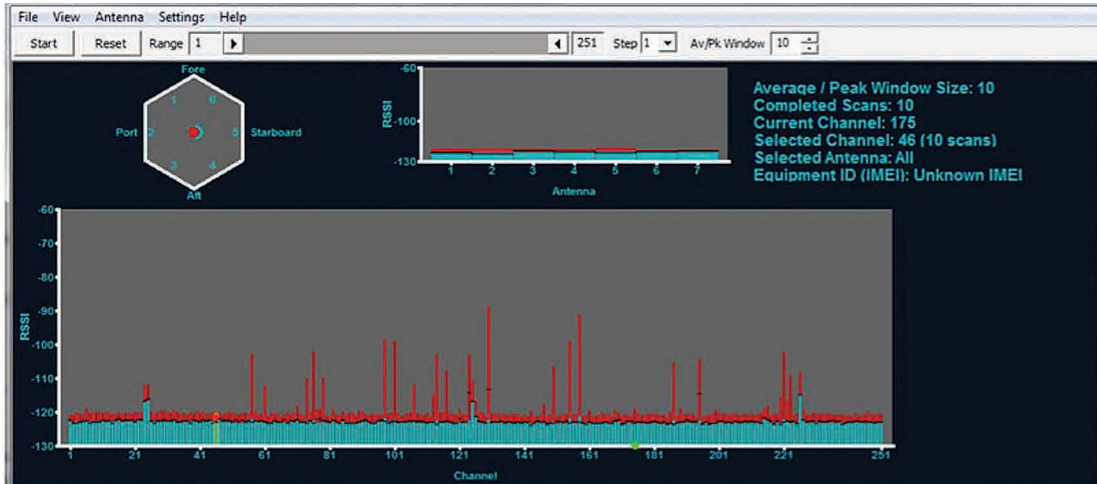
Figure 27.
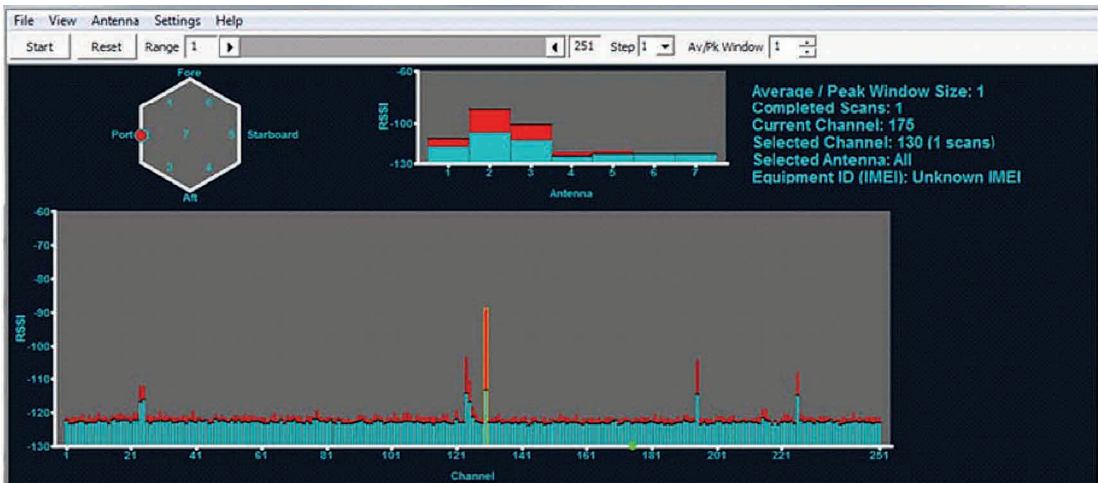
Reading the SST Graphs

The SST output can tell the installer much about the potential RF environment of the ODU's location during the test. It should also be noted that two or three scans will add to the knowledge about the RF environment

for slowly changing emissions. Interferers are classified as "in-band" and "out-of-band" and the signature can be quite different.

1. "In-band" interferers may occupy a single channel or several channels clustered together. Since the frequency band is regulated and only approved for Iridium, in-band interference is frequently a result of inter-modulation distortion (IMD). IMD is caused by two or more interfering signals that combine or "mix" in the ODU receiver. An example of this would be a transmitter at 1000 MHz combining with a 621 MHz to form a product frequency at 1621 MHz at the center of the Iridium band. IMD can also be a subtraction of two signals like 1721 MHz minus 100 MHz to achieve 1621 MHz. Other in-band sources can be unintended emissions from equipment like computers or digital electronics with fast switching speeds. The last potential for in-band emission is from harmonics of a device transmitting at ½ the Iridium band, 805 to 816 MHz, or some other frequency that is an integer multiple of the 1616 to 1625.5 MHz band. An example of in-band noise can be seen in Figure 28. It is caused by the harmonic or the ODU's internal analog to digital conversion frequency and appears as slightly elevated "mean" frequencies at channels 24/25, 125 and 226

   This becomes apparent in Figure 28 given that frequencies mentioned above have an elevated "mean" that has lasted for a significant portion of the 10 scans. In this case you can expect to see this "self-noise" in all installations and it does not detract from normal operation.
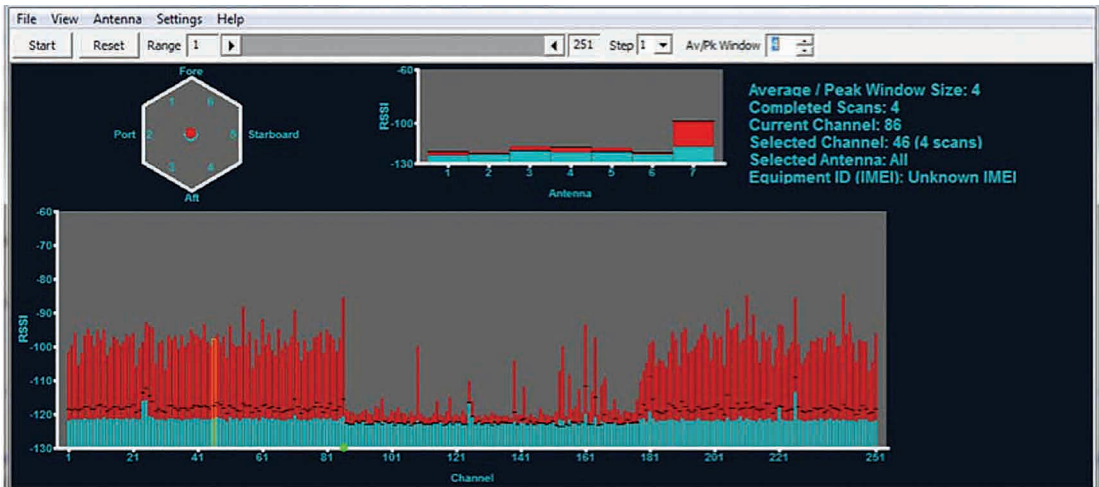
Figure 28.

2. "Out-of-band" emissions will typically be a single emission close to the iridium band. They are characterized as a broad-band noise that raises the "noise floor" of the receiver. Typically the noise floor should be below -120 dBm. Figure 28 shows noise that was produced by placing a laptop computer directly on top of the ODU. The antenna display shows a red peak on the vertical antenna number 7 where the noise floor was raised.

3. In Figure 29, the center section of the lower scan was not affected because the computer was not present during the time these channels were scanned.

Figure 29.

4. Figure 29 indicates a very good installation with a minimal noise environment. 100 scans were collected (2.7 hours of data) and a few interesting observations can be made.

a. First there are three evenly spaced "blue" peaks at the aforementioned channels 24/25, 125 and 226. As noted above these happen to be "self noise" caused by the harmonic of an internal clock and are expected to be present on all installations, but they are a good example of how CW or continuous wave interference will appear on a multiple scan plot.

b. Second, during this nearly three hour scan, no dynamic activity was seen in the lower portion of the Iridium band. This lower portion of the Iridium band is shared spectrum that we avoid using during normal operation. There are times during natural disasters when the lower portion of the band is active, however, so your plot may differ. *Dynamic activity is defined as a red peak in excess of -115 dBm while the mean value remains close to the -123 dBm receiver noise floor on a multi scan plot.*

c. Finally, as seen in Figure 30, channel 60 through 251 show a lot of dynamic activity with the peak indication showing considerably large signals while the mean values hover near -123 dBm. This display is just showing a 2.7 hour history of active channels the ODU could see and could have used.
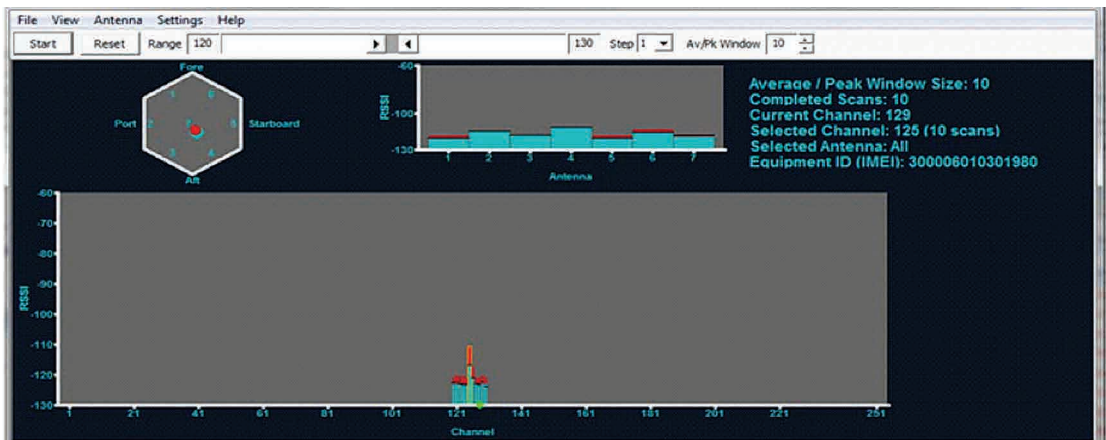
Figure 30.
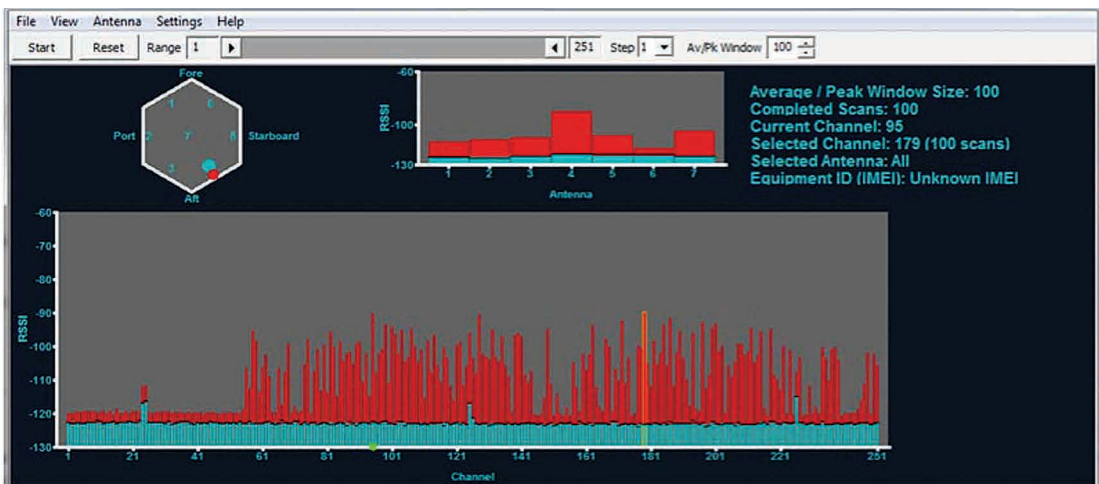
If RADAR presents a problem for Iridium Pilot Land Station it will most likely be an out of band type interference. Given the RADAR antenna spends most of the time facing away from the ODU the noise floor may display a cyclic pattern of raised and normal amplitude causing something like every third channel to be elevated. Since the scan rate of the SST and the sweep rate of the RADAR are not synchronous the affected channels may "walk" across the display from sweep to sweep causing the noise floor of a long duration scan (> 10 scans) to elevate nearly uniformly.

Peak values of normal Iridium signals are typically -90dBm or below. Peaks in excess of -85 dBm should be suspected as terrestrial interferers and be tracked down.

At the conclusion of the survey the user should stop the tool and then select the file menu button and save the file using the default naming convention which contains the IMEI of the unit under test along with a time date stamp. The data is stored as a comma separated value (CSV) and can be sent to a tier 2 or tier 3 organization for further assistance in analysis. *Tier 1 is end user support from the (SP) service provider. Tier 2 is SP support from Iridium. Tier 3 is engineering support to Tier 2.*

The tool has additional configuration parameters to allow the user to scan smaller portions of the band using the slider just below the command bar. This can be useful in focusing the display on say 10 channels of interest around a suspected interferer and collecting multiple short scans in 1/25th the time of a fill scan as shown in Figure 31.

Figure 31.

Examples of "Bad" Site Survey Plots

The following three examples simulate interference of the ODU receiver and are examples of bad installation locations. Figure 32 shows interference from a high power HF radio near the ODU. The transmitter was keyed for part of a 90 second scan (starting at ch 177 and ending on the subsequent scan at ch 88) and shows the current mean noise floor rising above the -120 dBm limit across the band (broadband noise). Additionally antenna 7 can be seen to 20 to 30 dB of excess noise meaning high elevation passes would be blocked.
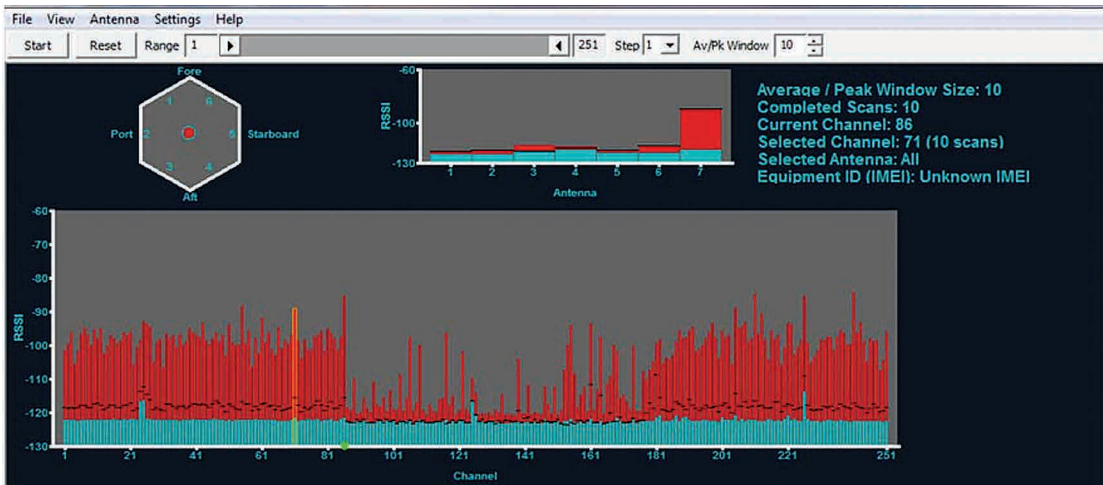
Figure 32.

Figure 33 shows noise from a nearby personal computer. This signature is typical with a pyramid type response peaking at channel 100 and the overall noise floor elevated above -120 dBm.
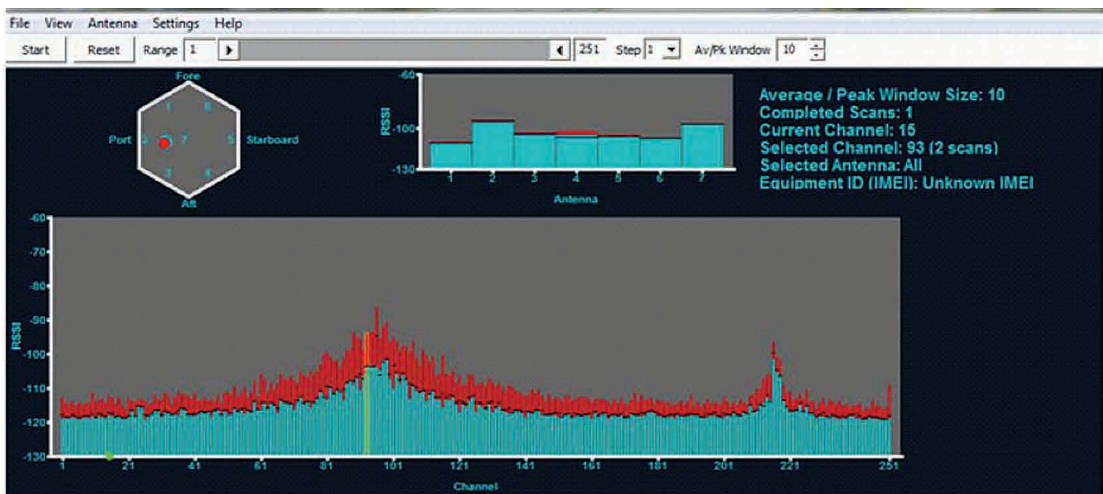
Figure 33.

Figure 34 simulates how RADAR might appear on a site survey. A definite periodic structure can be seen with peaks and valley repeating every 10 channels (or about every 3.5 seconds since the channels area sampled once every 0.35 seconds) this repetition is most likely the RADAR antenna rotation rate and will change as the radar sweep changes. The larger two valleys located at channels 50 and 190 are more a function of the RADAR PRF (pulse repetition frequency) and pulse width. Actual RADAR interference may look quite different from this example but the elevated noise floor will cause the ODU to function poorly or not at all. Switching the suspected RADAR to "standby" will return the noise floor to below -120 dBm if this is the actual cause of the interference.

By collecting plots from several potential sites the installer can choose the location that presents the least amount of interference and will provide normal Iridium service to the end user.

Figure 34.
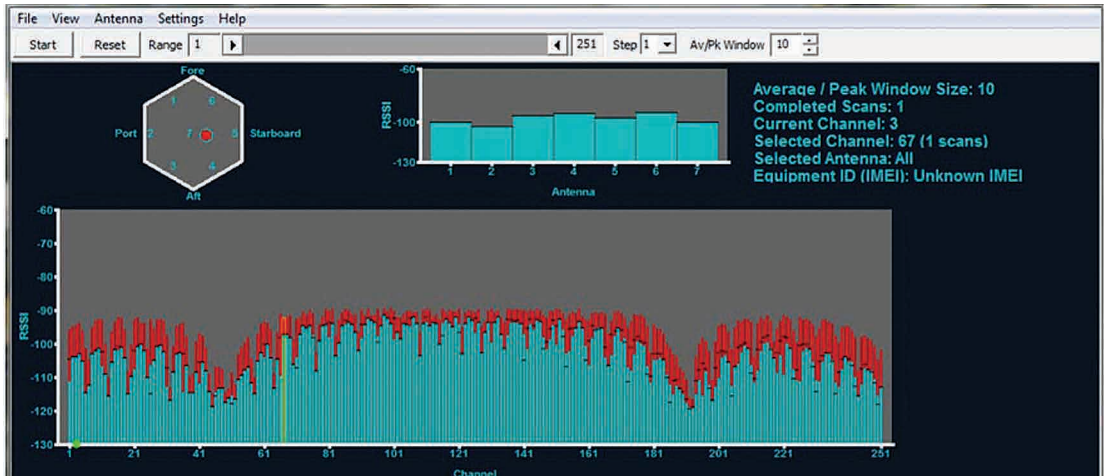
Additional information about the Site Survey Tool

- As long as the tool remains running data is collected regardless of the average/peak Window size.

- The user can select to sample every channel, every other channel, every 5th channel, or every 10th channel using the "Step" pull down on the control bar. This feature may be useful in tracking down broad band interferers by spot scanning across the entire frequency range and completing scans more quickly.

- By adjusting the "Av/Pk Window" the user is selecting the last "n" scans to be included in the averaging and peak selection. Note that the completed scans may be less than the window size meaning the average is performed on the lesser of these two values.

- The SST is not optimized to find Iridium Satellite downlinks but rather is designed to detect terrestrial interferers.

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