

# Altiostar Networks iRM4451 Remote Radio Head

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Product Description and Installation Guide



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# Preface

## About the Manual

This document covers the basic installation of the Altiostar Networks, Inc., iRM4451 Remote Radio Head (RRH) on towers, walls, roof or other structures utilizing a universal mounting assembly.

Connections to external interfaces, including signaling, grounding, and power are described. Descriptions of the iRM4451 macro-cellular remote radio head indicators are also provided.

## Intended Users

The target audience for this document is installation and engineering personnel. It assumes personnel have a basic understanding of wireless telecommunications terminology, and experience in installing wireless telecommunications equipment.

## Revision History

This section describes the changes made to each revision of this document.

Revision	Change
Rev 1.0	First issue



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# 1 Introduction

This document covers the basic installation of the Altiostar Networks, Inc. iRM4451 macrocell wireless Remote Radio Head (RRH) on towers, walls, roof or other structures utilizing a universal mounting assembly.

Connections to external interfaces, cabling, grounding and power are described. Descriptions of the iRM4451 connectors and indicators are also provided.

## 1.1 Target audience

The target audience for this document is installation and engineering personnel

## 1.2 Conventions used

Illustrations and photos in this document are intended to show a basic installation. They show site and equipment configurations encountered during a typical installation. They do not show all details and exceptions, but highlight the main points of the installation.

Altiostar Networks, Inc. will often be referred to as Altiostar Networks, or simply Altiostar.

The Altiostar Networks, Inc. iRM4451 Remote Radio Head will often be referred to as the iRM4451 RRH, iRM4451 or simply, the RRH.

The Altiostar Networks iRB7200 virtual Baseband Unit (vBBU) is a server-based companion unit to the iRM4451 in the Altiostar Networks LTE macro eNodeB solution. The iRB1200 Baseband Unit or the iRB2400 Baseband Unit, are optional hardware companion units to the iRM4451, and are often referred to as the iRB1200/iRB2400 iBBU, or simply the iBBUs.

The Operator or Owner of the facility and equipment where the iRM4451 is to be installed is referred to as the Operator in this document.

**NOTE**

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*This is an example of a note used in this document that denotes important information about the text or procedure that follows it.*

## 1.3 eNodeB Overview

The iRM4451 Remote Radio Head is an integral component of the Altiostar Networks eNodeB macro solution and is based on a distributed architecture with the following two essential elements:

- iRM4451 RRH
- iRB1200 iRRH or iRB2400 (optional) or iRB7200 vBBU

The iRM4451 is a 4T4R outdoor macrocell radio head with integrated baseband for use in select frequency bands, which include:

- PCS (3GPP Band 2)

- 1800 MHz (3GPP Band 3)
- AWS (3GPP Band 4)
- 2.6 GHz (3GPP Band 7)
- AWS-1 & AWS-3 (3GPP Band 4 & AWS-3)

Connection to other compliant fronthaul devices is facilitated through two available GigE optical Ethernet fronthaul ports.

The iRM4451 interconnects with compliant radio antennas and the associated baseband unit, i.e., vBBU (or the optional iRB1200/iRB2400 iBBUs) which operate within the RAN portion of the LTE wireless network.

A block diagram of the iRM4451 RRH is shown in [Figure 1-1](#).

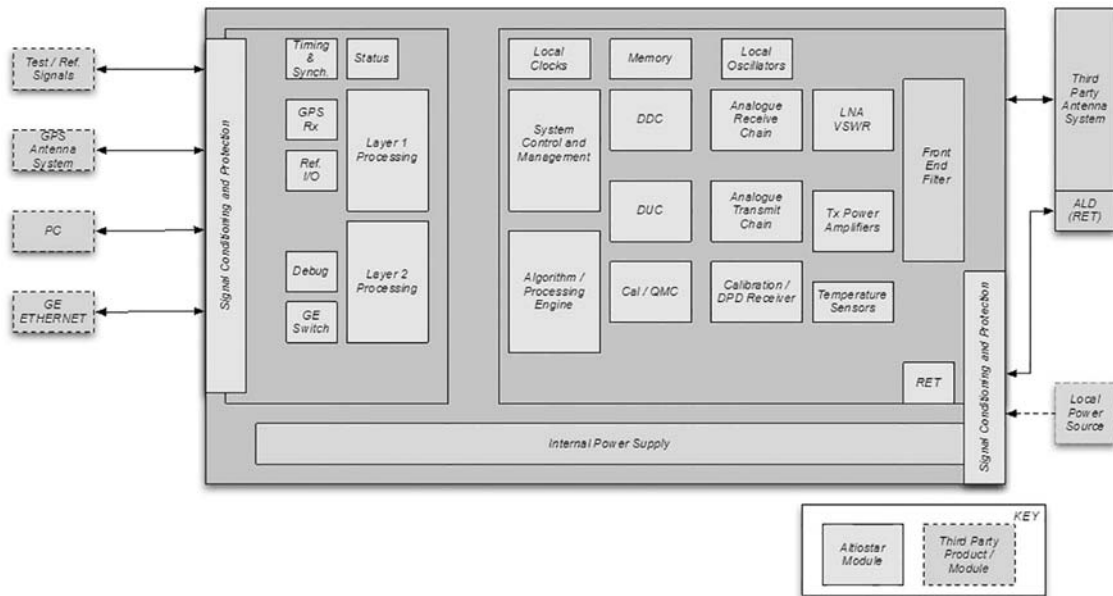


Figure 1-1 iRM4451 RRH block diagram



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## 2 Safety requirements

### 2.1 Overview

This section provides safety precautions that apply to the iRM4451 . The precautions statements are required by national or regional standards institutes in the country or region where they apply. This document complies with these requirements.

### 2.2 Purpose

To protect installation personnel, equipment and operations, this document contains safety statements. Safety statements are provided at points in procedures where risks may exist to personnel, equipment and network operations. Failure to follow the directions in the safety statements may result in serious consequences.

### 2.3 Warning symbols



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*Danger is used to indicate the presence of a hazard that will cause severe personal injury, death, or substantial property damage if the hazard is not avoided.*



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*Warning is used to indicate the presence of a hazard that can cause severe personal injury, death, or substantial property damage if the hazard is not avoided.*



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*Caution is used to indicate the presence of a hazard that will or can cause minor personal injury or property damage if the hazard is not avoided.*

### 2.4 General safety precautions

Safety precautions should be observed when performing these installation procedures. The following safety precautions are only intended to supplement the safety precautions usually practiced by the Operator.

The power system and RET cables will have hazardous energy and voltages present. Follow all safety warnings and practices when servicing this equipment.

This equipment must be installed, serviced, and operated only by authorized, qualified and trained personnel who have the necessary knowledge and practical experience with electrical equipment and who understand the hazards that can arise

when working on this type of equipment. Observe all local and national electrical, environmental and workplace codes.



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### ***HAZARDOUS VOLTAGES!***

*Hazardous voltages can be present when the system is operating. Use caution when removing or installing equipment.*



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### ***FALL HAZARD!***

*A fall hazard is present when installation of this equipment requires working on towers, poles or at elevated work sites. All telecommunications personnel who perform tower work or work at elevation must be qualified to perform this type work.*

*Installation of this equipment may require working on towers, poles or at elevated work sites. All telecommunications personnel who perform tower work or work at elevation must be trained and qualified to perform this work, have the proper equipment to perform the work safely, and follow all requirements in accordance with 29 CFR 1910.268, 29 CFR 1926, and any other safety requirements in force by the Operator, or local and regional authorities. In addition, the tower or structure must be certified safe for climbing according to TIA/EIA 222 and 29 CFR 1910.66, Appendix C for anchorage devices.*



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### ***Read and understand all instructions before starting this procedure!***

- Follow all warnings and safety instructions in this procedure.*
- Only trained personnel should install or operate this equipment.*
- Observe all local and national electrical, environmental and workplace codes.*
- Before working on equipment that is connected to power, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.*
- The equipment must have a direct disconnect device in line with the power source.*
- Grounding and circuit integrity is vital to a safe operating environment. Grounding conductors must be in place before installing the equipment. Never operate equipment when grounding or bonding conductor has been removed.*

- *Never install equipment not identified in this procedure. Fire or injury could result from improperly installed equipment.*
- *Caution should be exercised when installing or modifying telecommunications lines.*
- *Disconnect all power sources before servicing the equipment.*
- *Never touch uninsulated wiring or terminals unless power to the lines have been disconnected at the source. Always verify power has been removed using an approved voltage tester.*
- *To prevent electrical shock, never remove the cover or disassemble the equipment. There are no user serviceable components in the equipment.*
- *Never insert probes or objects of any kind into slots or openings to the equipment. Dangerous voltages may be present or the object may cause a short circuit and start a fire or damage the equipment.*



**CAUTION**

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***HEAVY OBJECT!***

- *Assisted carry ONLY! This object is heavy; over 75 lb. (34.0 kg). Follow instructions when lifting unit from shipping container and hoisting onto mounting bracket. Requires a minimum of two people to lift and hand carry the unit.*



**WARNING**

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***LIGHTNING STRIKE HAZARD!***

- *Lightning strikes are possible during stormy weather. Do not install equipment if stormy conditions exist.*
- *Never work on telecommunications power supply lines or antenna feeders at the cell site during stormy conditions.*



**WARNING**

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***SHOCK HAZARD!***

- *Some parts of all electrical systems are energized at all times. Exercise extreme caution at all times when working around telecommunications electrical systems. Short circuits can cause burns to the face or hands. Failure to observe this and other safety warnings may lead to bodily injury and property damage.*
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- *Only trained and qualified personnel may install or service equipment as defined in IEC 215 and EN 60215.*
- *Turn off or disconnect equipment from its energy source(s) by switching off the load disconnect switch in the distribution panel before performing service or maintenance.*



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### ***LASER RADIATION AND FIBER OPTIC CABLE USE CAUTION!***

- *Class 1 invisible laser radiation present. Avoid long-term viewing of laser. Never use a magnifying device to view optical fiber ends when fiber is connected to equipment.*
- *Fiber optic cables may be damaged if bent or curved to a radius that is less than the recommended minimum bend radius of two inches. Always observe the recommended bend radius limit when installing fiber optic cables and patch cords.*



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### ***SHORT CIRCUIT HAZARD!***

*Condensation on the equipment has a potential to cause short circuits!*

*Weather conditions may exist at the site where condensation may form on the equipment. Installing or operating the equipment when condensation is present may cause a short circuit and damage the equipment.*

*Equipment showing signs of condensation should be allowed to dry before installation.*



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### ***ELECTROSTATICALLY SENSITIVE EQUIPMENT!***

*Semiconductor components are sensitive to electrostatic electricity and may be damaged by static discharge.*

*When handling the equipment, the following rules must be followed:*

- *Wear conductive or anti-static clothing.*
- *Wear grounded ESD wrist strap.*
- *Wear shoes with conductive straps or soles.*
- *Verify anti-static safety devices are operating properly by testing yourself at an approved test station.*

- *Leave equipment in their original anti-static wrapping until ready for installation.*
- *When handling equipment or modules, use handles provided to carry the device and do not touch electrical contacts, pins or components.*
- *Only place equipment or modules on conductive surfaces.*
- *Use tools on equipment or modules only when equipment is grounded.*
- *Handle defective equipment or modules similarly to new equipment to prevent additional damage.*



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**GROUNDING CAUTION!**

- *This equipment's grounding connection is between the DC power circuit and the grounding conductor.*
- *This equipment must have a direct connection to the DC supply grounding point or to a bonding jumper from the grounding terminal bus bar to the DC supply ground electrode for the site.*
- *The DC supply source should be located in the same premises as the transmission equipment.*
- *The grounding circuit must not have a disconnect device located in line with the DC circuit grounding conductor.*



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### 3 Physical description

The Altiostar Networks iRM4451 Remote Radio Head is a compact, modular, outdoor radio unit constructed of aluminum with integrated heat sink fins to facilitate fanless convection cooling. Four independent RF outputs for a 4T4R configuration at 30 W per RF path for a total of 120 W maximum.

The iRM4451 has connections for -48 V dc power input and Gigabit Ethernet optical fronthaul.

[Figure 3-2](#) shows the iRM4451 with the solar shield.



**Figure 3-2 Altiostar networks iRM4451 (with solar shield)**

The Altiostar Networks iRM4451 can be mounted on a wall, mast or tower using the supplied mounting bracket assembly and mounting plate. [Table 3-1](#) lists the specifications of the iRM4451 by characteristic type.

Table 3-1 Altiostar Networks iRM4451 technical specifications

iRM4451 Technical Specifications	
<b>Frequency Bands</b>	
Model Number	Operation
<b>iRM44510200</b>	PCS (3GPP Band 2) UL 1850–1910 MHz DL 1930–1990 MHz
<b>iRM44510300</b>	1800 MHz (3GPP Band 3) UL 1710–1785 MHz DL 1805–1880 MHz
<b>iRM44510400</b>	AWS (3GPP Band 4) UL 1710–1755 MHz DL 2110–2155 MHz
<b>iRM44510700</b>	2.6 GHz (3GPP Band 7) UL 2500–2570 MHz DL 2620–2690 MHz
<b>iRM4451E400</b>	AWS-1 & AWS-3 (3GPP Band 4 & AWS-3) UL 1710–1780 MHz DL 2110–2180 MHz
<b>Item</b>	
<b>Specification</b>	
<b>Physical</b>	
Dimensions (H×W×D) - Excludes solar shield Radio Module SPM	17.7 × 21.1 × 6.1 in (450 × 535 × 156 mm) 13.8 × 6.0 × 0.9 in (350 × 153 × 24 mm)
Weight - Excludes brackets, solar shield	73.8 lb (33.5 kg)
Volume	< 40.0 L
<b>Electrical</b>	
Input power	–48 V dc
Current	18 A
Power distribution breaker/fuse	20 A (external)
<b>Environmental</b>	



Table 3-1 Altiostar Networks iRM4451 technical specifications (*continued*)

iRM4451 Technical Specifications	
Working temperature (non-condensing humidity)	-40°F to 131°F (-40°C to 55°C)
Operating altitude	-197 to 9,843 ft (-60 to 3000 m)
Relative humidity	5 to 100%
Cooling	Convection (fanless)

### 3.1 iRM4451 boards and modules

The iRM4451 Remote Radio Head is an integral unit with no user accessible boards or modules.

### 3.2 iRM4451 controls, indicators connectors and components

There are no controls on the RRH. The connectors are located on the bottom of the unit. They are for Global Positioning System antenna (**GPS**), Power (**-48v DC**), RF (**ANT 1–4**), Fronthaul (**FH1/FH2**), Ground (**⊕**), and Remote Electrical Tilt (**RET**).

LEDs for Fronthaul 1 (**FH1**), Fronthaul 2 (**FH2**), **STATUS**, and **POWER** are located on the side of the unit and are visible when the solar shield is installed.

Connector locations for RF input/output are shown in [Figure 3-3](#). Connector locations for -48V dc Power and Remote Electrical Tilt are shown in [Figure 3-4](#). Connector locations for GPS antenna and fronthaul are shown in [Figure 3-5](#).

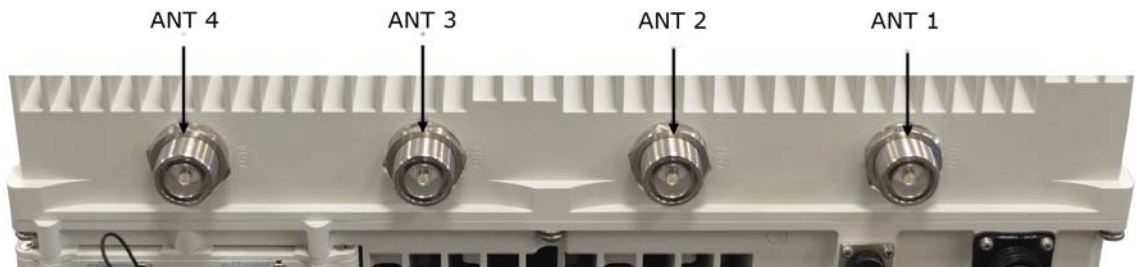


Figure 3-3 iRM4451 RF connectors location



**Figure 3-4 iRM4451 RET and -48v DC (power) connectors location**




**Figure 3-5 iRM4451 GPS and fronthaul connectors location**



Figure 3-6 iRM4451 ground connector location

Table 3-2 iRM4451 connectors

Description	Control/Connector Type	Quantity	Function
<b>-48V DC</b>	Tyco TE CPC Series 5, 3-pin	1	Power input
 (GND)	Dual-hole lug terminal	1	Equipment grounding
<b>GPS</b>	SMA (female), 50 Ω	1	Timing source input
<b>RET</b>	8-pin circular DIN	1	Provides +24 V dc and RS-485 control function for AISGv2.0-compliant antenna remote electrical tilt
<b>FH1</b>	Gigabit Ethernet optical SFP modules, Q-XCO ODC-2 outdoor connector socket	1	Fronthaul data
<b>FH2</b>		1	
<b>ANT 1-4</b>	7/16 conn (female), M29x1.5 threaded coupling, 50 Ω	4	RF to directional antennas

### 3.2.1 GPS connector

There is a 50-Ω GPS SMA female connector located on the bottom of the iRM4451 as shown in [Figure 3-6](#)

Operator supplies the GPS cable, GPS antenna and any required mounting hardware.

GPS cables are provided and pre-installed by the Operator. The GPS cable bend radius is  $\leq 0.75$  in (19 mm).

### 3.2.2 RF connectors

There are four 50- $\Omega$ , 7/16 RF jacks (M29x1.5 threaded couplings) that terminate on the bottom of the iRM4451. They are marked **ANT 1** through **ANT 4**. The RF cables are supplied and pre-installed by the Operator.

The RF 7/16 connectors are secured by torquing the M29 screw ferrule 15–20 in-lb (20–28 Nm) using a torque wrench.

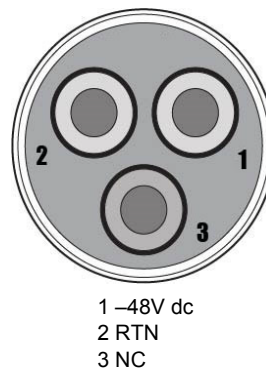


**NOTE**

*The Operator is responsible for determining the antenna type, and supplying and pre-installing the antennas at the site.*

### 3.2.3 Power connector

–48V dc power to the iRM4451 is through a 3-pin circular twist-lock power connector, Tyco TE CPC Series 5 (788189-1). The connector is keyed to prevent mis-mating. The mating plug (TE CPC Series 5 [7963075-1]) is fastened by turning the coupling nut clockwise until it 'clicks' into the locked position. The power connector pin assignments, as viewed from the bottom of the iRM4451, are shown in [Figure 3-7](#).



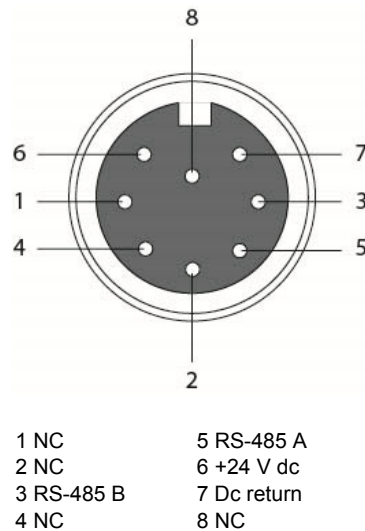
**Figure 3-7 –48 V dc 3-pin circular power connector**

We recommend cable type SOOW, 8 AWG (min.), 2-conductor, stranded copper wires, indoor/outdoor, round cable, rated at 600 V, or equivalent.

### 3.2.4 RET connector

The **RET** (Remote Electrical Tilt) connector provides the capability of electrical antenna control to all antennas connected to the iRM4451. Pin assignments for the **RET** 8-pin DIN connector is shown in [Figure 3-8](#). The connector is keyed to prevent mis-mating. The connector is fastened by turning the coupling nut clockwise until hand tight.

The RET cable can be daisy-chained to each of the PCS/AWS antenna inputs/outputs served by the iRM4451. Antenna remote electrical tilt control is facilitated within the EMS user interface.



**Figure 3-8 RET 8-pin DIN connector**

### 3.2.5 Fronthaul connectors

Two Gigabit Ethernet (GigE) optical SFP ports provide connection for up to two duplex multi-/single-mode optical GigE cables. The GigE entry ports, labeled **FH1** and **FH2**, are located on the bottom of the iRM4451 (see [Figure 3-5](#)). The Q-XCO quick-lock SFP connectors are RoHs compliant and meet the IEC 61753-1 Cat. E standard for performance. Connector **FH1** is intended for fronthaul support. **FH2** is used to daisy-chain sidehaul support to up to one other iRM4451.

The iRM4451 is shipped with captive dust covers over both of the fronthaul entry ports. The dust covers should remain in place until the GigE optical Ethernet cables are connected. The dust covers are keyed and have red alignment arrows to ensure proper installation. To remove the dust cover, twist 120° and pull. The dust covers are re-installed in the opposite manner.

The GigE 2× LC Huber + Suhner Q-XCO fiber optic cable is a specialty cable with a bulkhead cable gland integrated into the cable (see [Figure 3-9](#)). The cable gland has a ruggedized quick-lock SFP mating connector and is connected the same way as the dust cap.



**NOTE**

*Remove the dust cap only when ready to connect the cable to the iRM4451.*



**Figure 3-9 Huber + Suhner Q-XCO fiber optic fronthaul cable**

The GigE optical fronthaul cables are supplied and pre-installed at the site by the Operator.



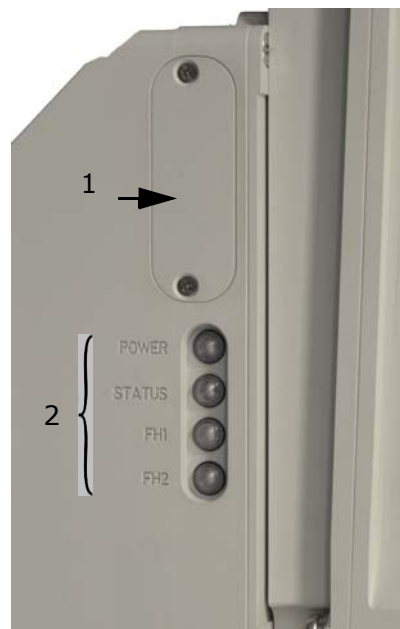
**NOTE**

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*There is a long lead time associated with ordering of this cable. Allow a minimum of 10 weeks lead time to ensure the cable is received at the time installation is to be performed.*

### 3.2.6 LED indicators

There are four LED indicators located on the right side of the iRM4451 as shown in [Figure 3-10](#). Each LED can be either off, green, amber or red. The description and operating characteristics of each LED is described in [Table 3-3](#). The blink rates for the LEDs are described in [Figure 3-4](#). [Table 3-5](#) describes the LED sequence during boot-up.



1 Test Access Port (*factory use only*)  
2 LEDs

**Figure 3-10 LED indicators**

**Table 3-3 LED indicators description and operating characteristics**

Indicator	Item No.*	Description	Operation
<b>POWER</b>	1	Indicated power ON/OFF status	<ul style="list-style-type: none"> <li>• OFF when no power is applied to the unit</li> <li>• Steady GREEN when power to the unit is normal</li> <li>• Steady RED when a power fault is present</li> </ul>
<b>STATUS</b>	2	Indicates the status of the iRM4451	<ul style="list-style-type: none"> <li>• OFF when no power is applied to the unit</li> <li>• Steady GREEN when the unit is operating within operational boundaries</li> <li>• Slow GREEN blink when booting up or shutting down</li> <li>• Steady AMBER when minor fault occurs (hardware or software)</li> <li>• Steady RED when a critical or major fault occurs (hardware or software)</li> </ul>

Table 3-3 LED indicators description and operating characteristics

Indicator	Item No.*	Description	Operation
FH1	2	Indicates the status of the Ethernet fronthaul data Port 1 throughput	<ul style="list-style-type: none"> <li>• OFF when no power is applied to the unit or when booting</li> <li>• Steady GREEN when port has link and operating at Gigabit Ethernet rate, but there is no Ethernet activity</li> <li>• Slow GREEN when port is operating at Gigabit Ethernet rate and has Ethernet activity</li> <li>• Steady AMBER when less than Gigabit Ethernet mode</li> <li>• RED when a critical fault occurs</li> </ul>
FH2	2	Indicates the status of the Ethernet fronthaul data Port 2 throughput	<i>Future use</i>

\*Refer to LED callouts in [Figure 3-10](#).

Table 3-4 LED blink rates

Indicator state	Description	Operation
Steady OFF	LED OFF	Not operational
Steady ON	LED is continuously ON, on interruption	System or component is operational (i.e., delivering service)
Slow blink	LED ON for about 0.5 s and OFF for about 0.5 s	On-going activity (i.e., system is booting, transition from one mode to another, etc.)
Fast blink	Varying blink rate, noticeably faster than a slow blink rate	Location aid, unit identification



Table 3-5 LED indicators boot-up sequence

Indication	Description	Operation
Boot-up sequence for all LEDs	Steady GREEN	1 second, except POWER LED controlled separately by hardware state
	Steady RED	1 second
	Steady AMBER	1 second, except POWER LED stays RED
	OFF	1 second, except POWER LED stays RED
	Normal state	n/a

### 3.2.7 Vent port

A gas permeable vent has been installed on the iRM4451 to help equalize air pressure inside the enclosure and prevent contaminants such as water, salt and dust from getting inside (see [Figure 3-11](#)). The vent fitting has a gas-permeable membrane integrated into a screw-in fitting. It meets the IEC 60529 standard for enclosure ingress protection against particulates and liquids. The vent should function maintenance-free over the lifetime of the iRM4451.



Figure 3-11 Vent port

Physical description

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## 4 Installation prerequisites

This section contains information on the documentation, tools, equipment, and conditions required for performing the installation procedure. The document assumes that the target audience has reasonable industry experience, is qualified, and has installed wireless base stations in the past.












### 4.1 Required tools

A typical telecommunications technician's toolkit is required to complete the iRM4451 installation. Additional required specialty tools and consumables are listed in [Table 4-6](#).

Table 4-6 Required tools

Required Tools			
ESD wrist grounding strap		Torque screwdriver and assorted bits	
Box cutter		Digital voltmeter	
Torque wrench, open-end, 8 mm		Crimp tool (2 to 8 AWG)	
Cordless electric screwdriver		Cable tie tool	

## Installation prerequisites

Required Tools			
Nylon bridle sling, 2-leg, 2 in (5.1 mm) straps, 6x19 EIPS, or equivalent		Pulley-minimum load-bearing capacity 880 lb (400 kg)	
Punch		Wire stripper	
Rope - minimum breaking strength 600 lb (272 kg) (optional)		Self-amalgamating waterproofing tape (e.g., Commscope Miracle Tape, Huber+Suhner Fast-Wrap, RFS CELL-Tape, EasyWrap® tape, etc.)	
Spirit level		Tape measure	
Assorted hook & loop fasteners (for fiber optic cables) and cable ties (for all other applications)		Torque wrench, 7/16, 29 mm head, 15–20 in-lb (20–28 Nm)	
McMaster eyebolts (Model 3040T13) M8x1.25, 16mm, quantity 2 min.			

### 4.2 Additional required site equipment

This section describes the additional interconnecting equipment required for the installation of the Altiostar Networks iRM4451. These are essentially cables, connectors and fixing arrangements. The specification of these items (specifically the length of cables) may need to be customized on site.

- Grounding cable connecting the iRM4451 to the grounding point is supplied by the Operator and assembled on site unless otherwise specified. Altiostar Networks provides the two-hole lug for crimping onto the cable.
- Power cable with plug connecting the iRM4451 to local –48 V dc power is supplied by the Operator and assembled on site unless otherwise specified. Operator must provide a lightning and surge suppression device on the power line to the unit.
- RF transmission cables are ordered and supplied by the Operator. They are ordered from the vendor Huber + Suhner in the length required according to Operator site requirements.

### 4.3 Site preparation

The conditions in this section must be fulfilled before starting work at the site.

### 4.4 Site pre-installation visit checklist

To verify site conditions required for the installation of the iRM4451 are known, a pre-installation visit, attended by the Operator's representative, Altiostar Networks, and other required parties, must be performed. Tasks required to be accomplished should include, at a minimum, those listed in [Table 4-7](#).

**Table 4-7 Site pre-installation visit checklist**

Item	Site pre-installation visit checklist	Check
1	Verify Site Installation Plan and installation documentation is available.	
2	Verify health and safety documentation specified by the Operator and Altiostar Networks are understood and installation personnel are trained accordingly.	
3	Know locations of fire equipment, eyewash stations, and evacuation procedures posted for fire/halon discharge.	
4	Know locations of first aid and emergency equipment and installation personnel are familiar with their operation and use.	
5	Verify site authorizations, clearances, and releases from Operator and local authorities are complete.	
6	Verify emergency telephone numbers are posted for fire, police, and ambulance/medical aid.	
7	Verify Operator and local authorities contact and phone numbers are posted.	
8	Verify installation schedule is approved.	
9	Wear approved protective equipment such as hard hats, safety glasses, gloves, etc. when needed.	
10	Verify the installation location of the iRM4451 meets the mounting requirements indicated in this document.	

Item	Site pre-installation visit checklist	Check
11	Verify main power supply is properly installed and tested and capable of supplying the required –48V dc voltage and current for proper operation of the iRM4451 system to within ±20% of rated output.	
12	Verify –48V dc power cable to the iRM4451 is labeled and tested as specified in the Site Installation Plan.	
13	Verify recommended size breakers/fuses for the external power source is properly installed and capable of protecting the –48V dc power to the unit.	
14	Verify earth ground bonding point, for connection of the grounding cable to the iRM4451, is correctly installed, labeled and tested as specified in the Site Installation Plan.	
15	Determine a safe method to hoist and secure iRM4451 RRH into position on selected structure and enter into Site Installation Plan.	
16	Verify proper in-line surge protectors are installed, where required, on power and RET cables as specified in the Site Installation Plan.	
17	Verify that the Operator, Altistar Networks and all other affected parties are in agreement with the equipment installation location, power source, and grounding location, to meet the installation checklist requirements.	

#### 4.5 Site installation checklist

Verify site conditions required for the installation of the iRM4451 are known. In addition, the site must be prepared by the Operator in accordance with the Site Installation Guide provided by the Operator which must include, at a minimum, the required tasks in [Table 4-8](#).

**Table 4-8 Site installation checklist**

Item	Site installation checklist	Check
1	Verify Site Installation Plan and installation documentation is available.	
2	Verify health and safety documentation specified by the Operator and Altistar Networks are understood and installation personnel are trained accordingly.	
3	Know locations of fire equipment, eyewash stations, and evacuation procedures posted for fire/halon discharge.	
4	Know locations of first aid and emergency equipment and installation personnel are familiar with their operation and use.	
5	Verify site authorizations, clearances, and releases from Operator and local authorities are complete.	
6	Verify emergency telephone numbers are posted for fire, police, and ambulance/ medical aid.	
7	Verify Operator and local authorities contact and phone numbers are posted.	
8	Verify installation schedule is approved.	

Table 4-8 Site installation checklist

Item	Site installation checklist	Check
9	Wear approved protective equipment such as hard hats, safety glasses, gloves, etc. when needed.	
10	Verify pre-installation work specified in the Site Installation Plan is complete.	
11	Verify the installation location of the iRM4451 meets the mounting requirements indicated in this document.	
12	Verify all required tools required for lifting the iRM4451 onto structure, and for installation, are available.	
13	Verify all ordered hardware, including that not provided as part of the Altiostar Networks intelligent eNodeB solution, is available and on site.	
14	Verify that the Operator, Altiostar Networks and all other affected parties are in agreement with the equipment installation location, power source, and grounding location, to meet the installation checklist requirements.	
15	Verify proper in-line surge protectors are installed, where required, on –48 V dc power and RET cables as specified in the Site Installation Plan.	
16	Verify recommended size wire is installed in the external power source supplying –48 V dc power to the unit.	
17	Verify custom pre-assembled cables, custom cables, wires and other material are properly labeled, installed and tested according to system and site requirements as specified in the Site Installation Plan.	
18	Verify earth grounding of the chassis/rack hosting the iRM4451 is correctly installed, using the correct size/type wire, and is tested.	
19	Verify main power supply is properly installed and tested and capable of supplying the required –48V dc voltage and current for proper operation of the iRM4451 3-sector system to within $\pm 20\%$ of rated output.	
20	Verify all cables are neatly routed through cable ladders, cable trays and ducts, are secured with cable ties, and dressed according to Company local practice.	





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## 6 Installing the iRM4451

This section provides the procedure for installing the iRM4451 RRH in remote locations such as on towers, poles, masts, walls, roofs, or other structures utilizing a universal mounting assembly.

Instructions for making connections to external interfaces, cabling, grounding and power are also provided.

### 6.1 Assembling cables

The operator will need to order, pre-assemble, and pre-install various cables to the iRM4451.

#### 6.1.1 Verify Operator-supplied –48 V dc power cable

The Operator supplies and pre-assembles the –48 V dc power connection cable. We recommend using a 8 AWG minimum, round, 2-wire with ground, shielded cable rated at 600 V minimum. The female plug (Tyco TE CPC Series PN 78818801), for assembly of the dc power cable, is also ordered by the Operator. The connection configuration for the supply side of the power cable is determined by site specific requirements.

#### 6.1.2 Verify Operator-supplied GigE optical cable

The GigE optical fronthaul cable is a custom cable sourced from Huber + Suhner. The Operator is responsible for ordering this cable in the appropriate length according to site requirements. The GigE 2× LC Huber + Suhner Q-XCO fiber optic cable (PN 09H02FG0-50-XA/88-2-L-*NN*; where *NN*=length in meters) is a fiber-to-the-antenna (FTTA), Q-XCO feeder to LC duplex, 5.5 mm in diameter.

A cable gland is integrated as part of the GigE optical fronthaul cable and seals the SFP optical connectors inside the bulkhead of the iRM4451 to conform to an IP65 standard, completing the weatherproof seal.

The cable gland screws directly into the fronthaul port on the bottom of the iRM4451. A gasket seals the cable gland at the fronthaul port. The sealing nut is then hand-tightened to complete the weatherproof seal.

#### 6.1.3 Verify Operator-supplied grounding cable

The grounding cable and ground bonding hardware is supplied by the Operator. The operator pre-assembles the grounding cable prior to routing to the iRM4451 . However, the grounding terminal lug is supplied with the iRM4451 .

**NOTE**

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The grounding cable to the iRM4451 should be 3.9 in (10 cm) longer than other cables to the unit. This will maintain ground connection should the cables be pulled off when the unit is extended beyond the length of the cables.

**To install ground terminal lug:**

1. Cut a 6 AWG (4.11 mm) stranded grounding cable the appropriate length for the iRM4451 installation.
2. Strip away insulation from one end to expose 3/4 in (19 mm) of bare wire.
3. Crimp the dual-lug grounding terminal (supplied) to the cable using the special-purpose crimp tool specified in [Required tools](#) on page 4-1 (or equivalent) as directed by tool manufacturer instruction manual. [Figure 6-12](#) shows an assembled cable/lug assembly.



**Figure 6-12** Grounding terminal lug assembled on grounding cable

**6.2 Routing pre-assembled power/GigE optical fronthaul/grounding cables**

This procedure provides instructions for routing the pre-assembled –48 V dc power cable, the GigE optical fronthaul cable, and the grounding cable to the iRM4451 mounting location before assembling components.

**To route cables:**

1. Route the cables from the iRM4451 installation location to cable sources as shown in [Figure 6-13](#).

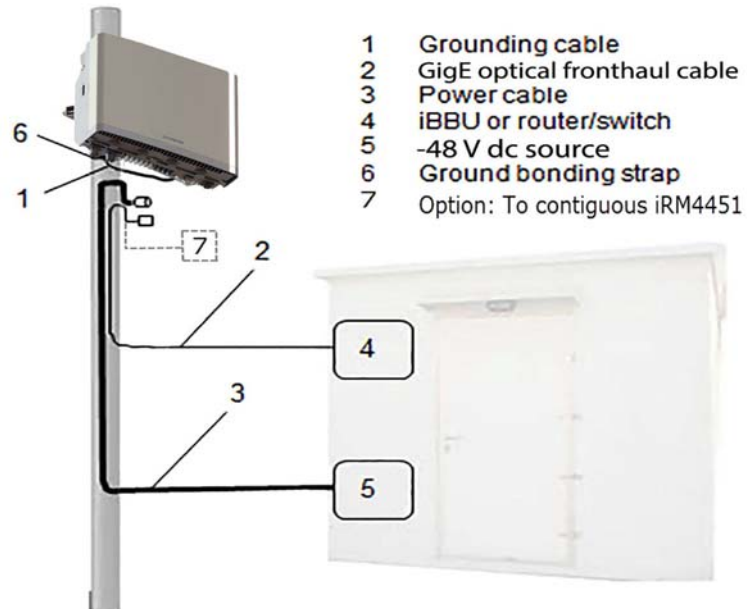


Figure 6-13 iRM4451 cable routing

2. Secure and dress all cables according to Operator local practice.

### 6.3 Installing the iRM4451 mounting bracket

This section provides the procedure for installing the iRM4451 on a mast/pole pipe, V-angle or H-angle, or mounting on a wall.

The iRM4451 can be installed on a pole/mast structure having the following dimensions using the supplied mounting bracket assembly:

- Pole/mast: 2.36-4.49 in (60-114 mm)
- U-frame: 1.97-3.94 in (50-100 mm)
- V-frame: 1.97-3.94 in (50-100 mm)



**NOTE**

The iRM4451 is shipped from the factory with the mounting plate pre-installed on the chassis as shown in [Figure 6-14](#).



**Figure 6-14 iRM4451 mounting plate**

### **6.3.1 Mounting on a pole/mast**

The following procedure provided instructions for mounting the iRM4451 on a pole/mast using the supplied mounting bracket assembly.

#### **To install mounting plate on a pole or mast:**

1. Install the mounting bracket and mounting clamp onto the pole/mast with mounting hardware as shown in [Figure 6-15](#).

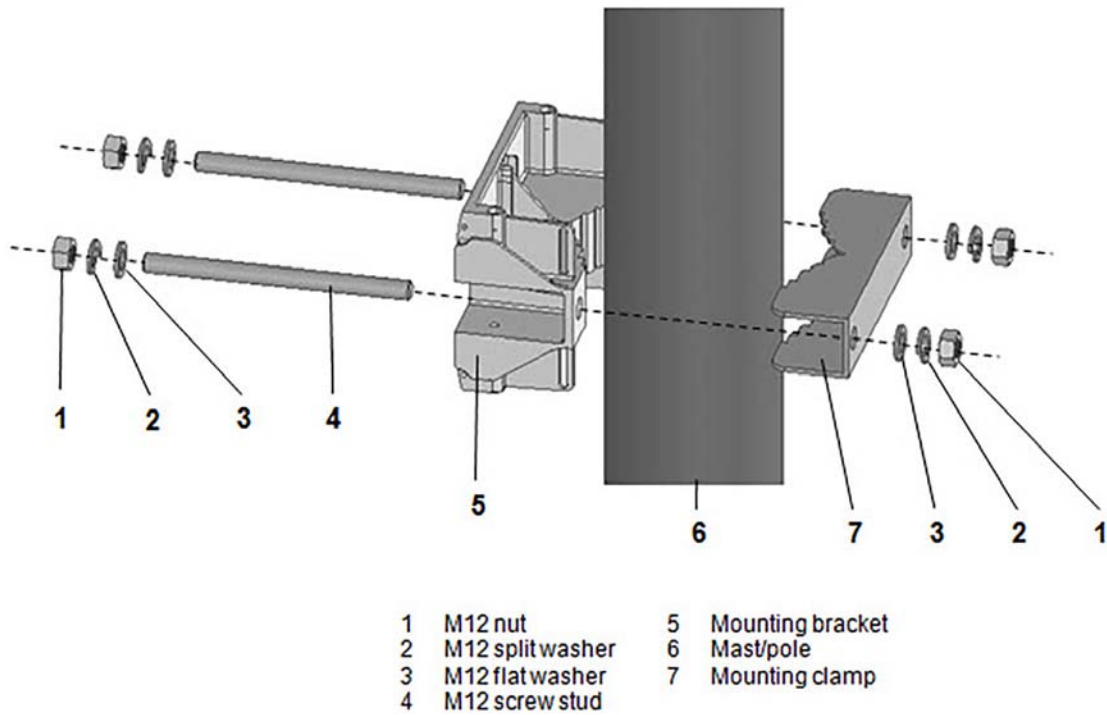


Figure 6-15 Installing mounting bracket on a pole



**NOTE**

**IMPORTANT!** Maintain the parallel orientation of the clamp and bracket while tightening the nuts. This will require alternating tightening the nuts on each screw stud until the final torque is achieved.

### 6.3.2 Mounting on a wall

The following procedure provides instructions for mounting the iRM4451 to a wall or other flat, vertical surface.



**NOTE**

The wall where the iRM4451 is to be mounted must be able to support four times the weight of the unit. The unit can be mounted at a deviation from vertical of  $\leq 10^\circ$ .



**NOTE**

The mounting clamp is not used when mounting the iRM4451 to a wall or other flat surface. In addition, the M12 bolts supplied in the hardware kit are not used for wall-mount applications.



**NOTE**

The Operator must provide four (4) M12 anchors, designed for outdoor use, that are compatible with the type structure on which the iRM4451 is to be installed.

**To install mounting plate on a wall:**

1. Determine the location where the mounting bracket is to be installed.



**NOTE**

The center-to-center distance for drilling holes to install the selected anchor is 5.5 in (140 mm).

2. Using a tape measure and spirit level, mark where the anchor will be installed using a center punch.
3. Drill the holes where the fastener will be installed on the wall using a drill bit sized for the fastener.
4. Install the iRM4451 mounting bracket to the wall using the four (4) M12 anchor bolts selected and supplied by the Operator, four (4) washers and four (4) lock washers supplied with the mounting hardware.
5. Tighten the bolts as specified by the M12 anchor's manufacturer using a torque wrench.

**6.4 Hoisting the iRM4451 on elevated structures**

Hoist line eye bolts are located on both sides and the top of the . The hoist line lift points for the iRM4451 is shown in [Figure 6-16](#).

An Operator-supplied 2-leg nylon lift sling is attached to the eye bolts and the iRM4451 is lifted directly from the packing container to the mounting location. These are the **ONLY** recommended points of attachment when hoisting the iRM4451 into position on elevated structures. A tag line can be attached to either eye bolt to control sway during the lift.



**NOTE**

Because of the differences Operator is responsible for determining an industry-approved, safe method of hoisting the iRM4451 into position onto elevated structures.



**WARNING**

*Be sure to follow all established Operator local practice and safety precautions when hoisting the equipment on elevated structures.*

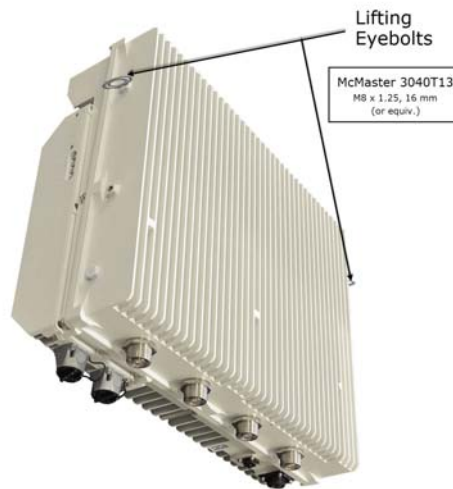


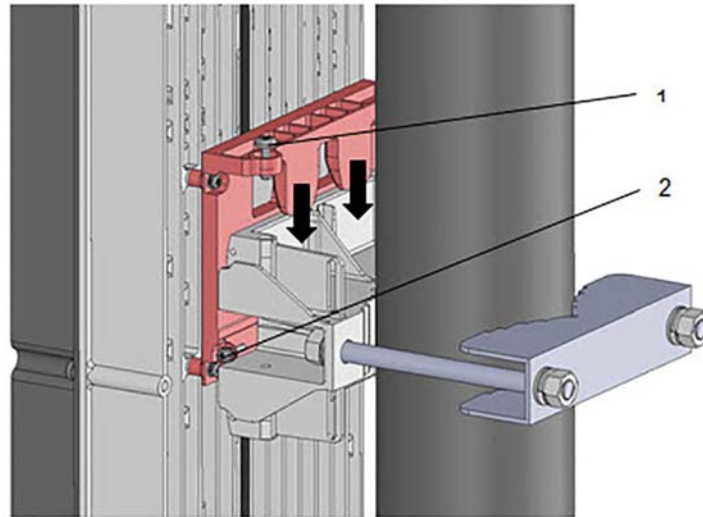
Figure 6-16 Hoist line carabiner attachment point

## 6.5 Installing the iRM4451 on the mounting bracket

This section provides the procedure for installing the iRM4451 main unit on the installed mounting bracket.

**To install iRM4451 on the mounting bracket:**

1. Hang the iRM4451 chassis on the mounting bracket by aligning the mounting plate tabs on the rear of the chassis to the mounting bracket slots (see [Figure 6-17](#)).



1 M6×20 mm SEMS screw  
2 M4×20 mm screw

**Figure 6-17** Aligning mounting plate tabs to mounting bracket

2. Lower iRM4451 onto the mounting bracket and align the tapped screw hole on top of the mounting plate with the tapped screw hole on the mounting bracket.
3. There are two (2) M6 × 20 mm SEMS captive screws on the top of the mounting plate. See [Figure 6-17](#). Start threading the M6 screws into the mounting bracket screws. Do NOT fully tighten.
4. Insert two (2) M4 × 20 mm SEMS screws into the screw holes on either side of the mounting plate.
5. Tighten the M4 screws on the side 13.3 in-lb (1.5 Nm) using a torque wrench.
6. Tighten the M6 screws to 9 in-lb (1 Nm) using a torque wrench.

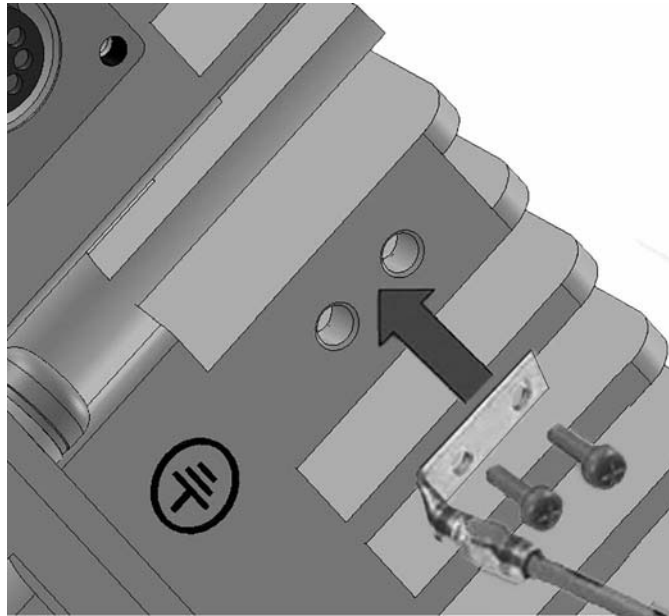
### **6.6 Connecting the grounding cable**

This section provides the procedure for properly grounding the iRM4451 to an earth grounding point. Verify that grounding cable/lug assembly is terminated at the other end to a tested earth grounding point according to Operator local practice.



**To connect grounding cable:**

1. Fasten the dual-hole grounding lug and cable assembly to the iRM4451 chassis grounding posts using two (2) M5-0.8 screws and washers (supplied by Operator). See [Figure 6-18](#).



**Figure 6-18** Connecting the grounding cable

2. Tighten the bolts to 2.4 ft-lb (3.2 Nm) using a torque screwdriver.

⋮

**6.1 Connecting the RET cables**

This section provides the procedure for connecting the RET cable to the **RET** connector socket.

**To connect RET cable:**

1. Insert RET cable into keyed 8-pin RET socket on iRM4451.
2. Twist the ferrule of the RET connector clockwise until it audibly 'clicks' into the locked position.

⋮

**6.1 Connecting the GigE optical fronthaul cables**

This section provides the procedure for connecting the GigE optical fronthaul cable to the **F1** or **FH2** SFP connector sockets.

**To connect GigE optical fronthaul cables:**

1. Remove the captive dust cover of the **FH1** fiber optic cable entry port by turning counterclockwise.
2. Remove the captive dust cover from the Huber + Suhner Q-XCO fiber optic cable connector by simultaneously squeezing the lock latches on either side of the quick-lock mating connector and turning the dust cover counterclockwise just past where the arrows come into alignment and pull, gently but firmly.
3. Remove the four (4) dust plugs on each of the duplex fiber ends and retain for future use.
4. Align the red arrow on the **FH1** cable gland of the iRM4451 with the arrow on the cable's quick-lock connector and insert the Q-XCO fiber optic connector into the **FH1** bulkhead connector.
5. Twist the quick-lock connector clockwise until an audible 'clicks' is heard and the arrows on the bulkhead connector and the cable connector are in alignment indicating the connector is in the locked position.
6. If required, repeat [step 1](#) through [step 5](#) for the **FH2** fiber optic cable entry port if two Q-XCO fiber optic cables are used to daisy-chain or sidehaul to another iRM4451.



**NOTE**

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The fronthaul connections must be waterproofed using a self-fusing tape made for that purpose. The application of the tape will vary by Operator, so local practice will determine how the tape is applied. Refer to [Required tools](#) on page 4-1.

### 6.1 Connecting the –48 V dc power cable

This section provide the procedure for connecting the –48 V dc power cable, with TE CPC Series 5, 3-wire, circular power plug to the iRM4451 power input connector. Recommended use type SOOW, 8/2, stranded copper conductor, indoor/outdoor, round cable, wire rated at 600 V, or equivalent.



**NOTE**

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Power to the –48 V dc power supply cable should be switched off at the breaker before connecting to the iRM4451 power input connector.

**To connect the dc power cable:**

1. Plug the power cable plug into the power input receptacle labeled POWER located on the bottom of the .
2. Secure the connection by hand tightening the coupling nut until you feel it 'click' into the locked position.

**NOTE**

It is recommended that the -48 V dc power connection be waterproofed using a self-fusing tape made for that purpose. The application of the tape will vary by Operator, so local practice will determine how the tape is applied.

3. Waterproof the connection by wrapping the connector with self-fusing tape (refer to [Required tools](#) on page 4-1) according to Operator local practice.

## 6.2 Checking power

This section provides the procedure for verifying power to the iRM4451 is connected correctly and operating normally.

**NOTE**

After applying -48 V dc power and verifying that the iRM4451 is functioning properly, leave power to the unit ON.

### To check power to the iRRU:

1. Switch ON the breaker (or insert the appropriate size and type of fuse) to provide power to the iRM4451 .
2. Verify that the iRM4451 powers up as indicated by the LEDs on the side of the iRM4451 lighting in the boot sequence provided in [Table 3-5](#).
3. Leave power to the iRM4451 ON.

## 6.3 Installing the solar shield

This section provides the procedure for installing the solar shield on the iRM4451 .

**DANGER**

*When installing the solar shield on the iRM4451 , be sure that you do not crimp or crush the RF coaxial cables.*

### To install the solar shield:

1. Place the solar shield over the iRM4451 .
2. Align the solar shield over the four (4) screw holes in the iRM4451 .
3. Secure the solar shield with four (4) M5-8 x 10 mm screws.
4. Tighten the screws 62 in-lb (7 Nm) using a torque screwdriver.



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## 7 Terms, Acronyms and Abbreviations

Term	Description
AWG	American Wire Gauge
AWS	Advanced Wireless Services
BBU	Baseband Unit
BOM	Bill of Materials
CBN	Common Bonding Network
CFR	Code of federal regulations
CPRI	Common Public Radio Interface
C-RAN	Cloud-Radio Access Network
DIN	Digital Input
EIPS	Electronics Industry Pallet Specification
EMS	Enterprise Management System
EN	Engineering Note
GPS	Global Positioning System
IEC	International Electrical Code
GigE	Gigabit Ethernet
iBBU	intelligent Baseband Unit
LED	Light Emitting Diode
RRH	Remote Radio Head
RET	Remote Antenna Tilt
RF	Radio Frequency
RX	Receive

## Terms, Acronyms and Abbreviations

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Term	Description
SEMS	Screw and Washer Assemblies
SS	Stainless Steel
TX	Transmit
vBBU	virtual Baseband Unit
VDC or V dc	Voltage direct current

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## 5 iRM4451 installation overview

This section provides an overview of the installation procedures and instructions for installing the Altiostar Networks iRM4451 remote radio head.

All required cabling for grounding, power, fronthaul, RF and optional GPS, are supplied by the Operator, as provided in the Site Installation Plan, and should already be pre-installed with drops to the iRM4451 remote radio head installation location, or according Operator local practice.

### 5.1 Installation procedures

The following list describes the top-level iRM4451 installation procedures. You can instantly navigate to any procedure by clicking on the procedure with the mouse.

- [Unpacking the shipping container](#) on page 5-1
- [Verifying all parts received](#) on page 5-2
- [Assembling cables](#) on page 6-1
- [Verify Operator-supplied -48 V dc power cable](#) on page 6-1
- [Verify Operator-supplied GigE optical cable](#) on page 6-1
- [Verify Operator-supplied grounding cable](#) on page 6-1
- [Routing pre-assembled power/GigE optical fronthaul/grounding cables](#) on page 6-2
- [Installing the iRM4451 mounting bracket](#) on page 6-3
- [Mounting on a pole/mast](#) on page 6-4
- [Mounting on a wall](#) on page 6-5
- [Hoisting the iRM4451 on elevated structures](#) on page 6-6
- [Installing the iRM4451 on the mounting bracket](#) on page 6-7
- [Connecting the grounding cable](#) on page 6-8
- [Connecting the RET cables](#) on page 6-9
- [Connecting the -48 V dc power cable](#) on page 6-10
- [Checking power](#) on page 6-11
- [Installing the solar shield](#) on page 6-11

### 5.2 Unpacking the shipping container

The following procedure describes removing the iRM4451 from the shipping container, inspecting the contents for damage, and what to do if damage is found.

**To unpack the shipping container:**

1. Verify no shipping damage to box.

**NOTE**

It is important to report damage or material shortages to the shipping carrier while a representative is on site. If concealed damage or material shortages are found at a later time, contact the shipper to make arrangements for inspection and claim filing.

2. Remove packing materials.

**NOTE**

The shipping materials can be recycled. In some regions or countries it is mandatory that packing materials be recycled or re-purposed. Please dispose of shipping material accordingly.

3. Remove equipment from packing material and inspect equipment for shipping damage or missing items.

**NOTE**

If concealed damage or material shortages are found at a later time, contact the shipper to make arrangements for inspection and claim filing.

### 5.3 Verifying all parts received

Verify all parts listed in the accessory list in [Table 5-9](#) were received.

**Table 5-9 iRM4451 parts list**

Qty	Part number	Part description
1	509-0n-0001	iRM4451: <i>n</i> = 2    PCS, Band 2 <i>n</i> = 3    1800 MHz, Band 3 <i>n</i> = 4    AWS, Band 4 <i>n</i> = 5    2.6 GHz, Band 7 <i>n</i> = 6    AWS-1, Band 4 <i>n</i> = 7    AWS-3
1	340-00-0019	iRM4451 macrocell (main unit) assy., 4T4R
1	420-00-0030	Mounting clamp (metal, powder-coated)
1	420-00-0157	Mounting bracket (metal, powder-coated)
1	350-00-0020	Kit, mounting bracket hardware



Table 5-9 iRM4451 parts list

Qty	Part number	Part description
1	350-00-0009	Kit, accessory, grounding cable lug & nuts
1	350-00-0007	Kit, mounting hardware & screws
2	460-00-0014	Screw, M4-0.7 × 12 mm, cross-head pan, SEMS, SS
2	460-00-0020	Screw stud, M12-1.75 × 168 mm, SS
4	495-00-0001	Washer, flat, M12, max. 24 mm OD, SS
4	495-00-0002	Washer, split, M12, max. 24 mm OD, SS
4	445-00-0003	Nut, M12-1.75, SS
1	440-00-0033	Dual-hole grounding lug, #6 AWG, 90 degree, 10 mm bolt spacing, 24 mm length
	460-00-0017	Screw, crosshead pan, M5-0.8 × 10 mm, split/plain washer, SEMS, SS
1	430-00-00xx	Solar shield
3+1	460-00-0017	Screw, sun shield mounting, M5-0.8 × 10 mm, crosshead pan, split/plain washer, SEMS, SS
Standard equipment shipped pre-installed		
1	420-00-0030	Mounting plate
Operator-acquired parts for pre-installation requirements		
1	360-00-0119	DC cable assy., Tyco TE CPC Series connector, PN 788188-1
1	As specified per site requirement	Power cable, 8 AWG min. (Alpha Wire PN 460819 or equiv.) (Operator ordered to length according to site requirements)
1	Huber + Suhner 09H02FG0-50-XA/88-2-L- <i>NN</i>	Gigabit optical Ethernet FTTA, Q-XC0 feeder to LC duplex fronthaul cable, 5.5 mm dia., <i>NN</i> =length in meters according to site requirement
2 (min)	McMaster 3040T13T or equiv.)	Eyebolt, M8x1.25, 16 mm, SS (A third eyebolt can be used for control line attachment)

