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KONA PHOTON GEN2 IOT GATEWAY

USER GUIDE

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1.3	Sept. 3, 2024	Released	K. Minderhoud	Updated Product name Updated Power consumption in tables 5

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1 Product Description

1.1 Overview

The KONA Photon Gen2 Gateway, conceptually shown in Figure 1 is a solar powered carrier grade LoRa Gateway providing wide area coverage for the Internet of Things (IoT) ecosystem. It is designed to support various ISM Bands worldwide, including but not limited to US915, AU915, EU868, AS923, and allows connectivity for class A, B and C end-devices.
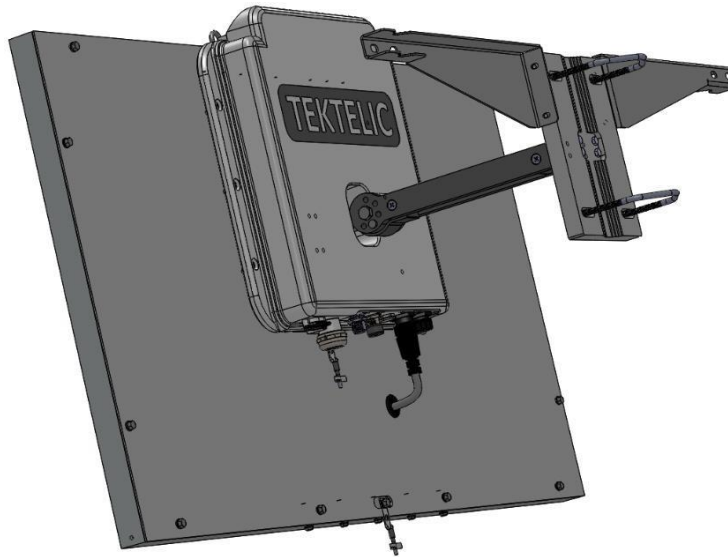
Figure 1: KONA Photon Gen2 Gateway

The KONA Photon Gen2 product is comprised of the KONA Photon Gen2 Radio Module (radio module) and the KONA Photon Gen2 Solar Panel Assembly (solar panel). The gateway module is available in two frequency variants and can be ordered with LTE (default). The KONA Photon Gen2 Radio Module product variants are listed in Table 1.

Table 1: KONA Photon Gen2 Radio Module Product Variants

T-Code	Product Descriptions	Region
T0008479	LORA GATEWAY MODULE, KONA PHOTON GEN2, 900 MHZ, CELLULAR MODEM	NA
T0008551	LORA GATEWAY MODULE, KONA PHOTON GEN2, 860 MHZ, CELLULAR MODEM	EU
T0008552	LORA GATEWAY MODULE, KONA PHOTON GEN2, 900 MHZ, CELLULAR MODEM	APAC

The KONA Photon Gen2 Solar Panel Assembly is available in two sizes, 50 and 95 W. The Photon Gen2 Radio Module can support the addition of a second solar panel assembly if an optional expansion cable.

Table 2: KONA Photon Gen2 Solar Panel Assembly Product Variants

T-Code	Product Descriptions
T0008623	SOLAR PANEL MECHANICAL ASSEMBLY, 95W, KONA PHOTON GEN2
T0008624	SOLAR PANEL MECHANICAL ASSEMBLY, 50W, KONA PHOTON GEN2

1.2 Specifications

1.2.1 Radio Capability

Table 3: Radio Specifications

Description	Specification	Comments

LoRa Transceiver: TDD operation
              RX
              TX
	8 x 125kHz, 1 wideband, 1 FSK
	1 TX
		Supports class A, B and C devices

Tx Power (max)	27 dBm	Conducted power
Rx Sensitivity	-142 dBm	SF12
Cellular Backhaul	3G/4G	Cat6 modem (Cat1 global modem will replace Cat6 modem in future release)
GNSS	GPS, GLONASS, Galileo, QZSS	Internal antenna

1.2.2 External Interfaces

Table 4: External Interfaces

Description	Specification	Comments
Panel Power (P1, P2)	4 pin bayonet style	Use P1 first as it does not have an environmental protection cap
LoRa Antenna Port	N-type Female	
3G/4G Antenna Port	N-type Female	
Ethernet Port	100/1000 BaseT PoE 802.3at Type 1 (802.3af)	Not intended for permanent connection

Access Port
        SIM tray
        USB
        Visible LED
	Nano SIM
	Micro-B
	Multi-color	

1.2.3 Power

Table 5: Power Specifications

Description	Specification	Comments
Solar Panel(s)		
Panel Type	Monocrystalline	site specific - more or less power may be
Panel Efficiency	20% (typical)	required depending on geographical
Rated Power	50 or 95 W	location
MPPT Charge Controller	100 W	
Energy Storage		
Battery technology	LiFEPO4	
Battery capacity	220 Wh	
Battery charge temperature	-30° to 50° C	
Battery discharge temperature	-40° to 60° C	
PoE[2]	not intended for permanent use	PoE is useful during factory test, debug, and commissioning
Radio Power Consumption	2.2 W (average)	

1.2.4 Mechanical

Table 6: Mechanical Specifications

Description	Specification	Comments
Dimensions	970 x 540 x 120mm	Based on gateway with 95 W panel; not including mounting arm
Weight		
Solar Panel Assembly	7 kg	95 W panel, including mounting frame
Radio Module Assembly	6 kg	
Mounting	Pole/Wall	
Solar Panel Tilt	10° to 90°	10° increments
Gateway thermal management	Passive	

1.2.5 Environmental

Table 7: Environmental Specifications

Description	Specification
Ingress Protection	IP-67

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[2] Although the KONA Photon Gen2 Gateway can be powered through either the solar DC input or the power over ethernet (PoE) input, simultaneous application of power to both inputs may result in unexpected operation and shall be avoided.

Description	Specification
Operating Temperature	-30 °C to 45 °C
Relative Humidity	10% to 100 % Condensing
Operating Altitude	-60 m to 4,000 m

1.2.6 Compliance

Table 8: Compliance Specifications

Description	Specification

Regulatory Compliance	Safety: UL/CSA/EN/IEC 62368-1
	Radiated Immunity: EN 61000-4-3
	ESD Immunity: EN 61000-4-2
	EFT Immunity: EN 61000-4-4
	Conducted Immunity: EN 61000-4-6
	Surge Immunity: EN 61000-4-5
	Emissions :
	    FCC pt. 15.109 Class B,
	    FCC pt. 15.209
	    FCC pt. 15.247
	    EN 300 220
	    EN 301 489

1.3 Physical Interfaces

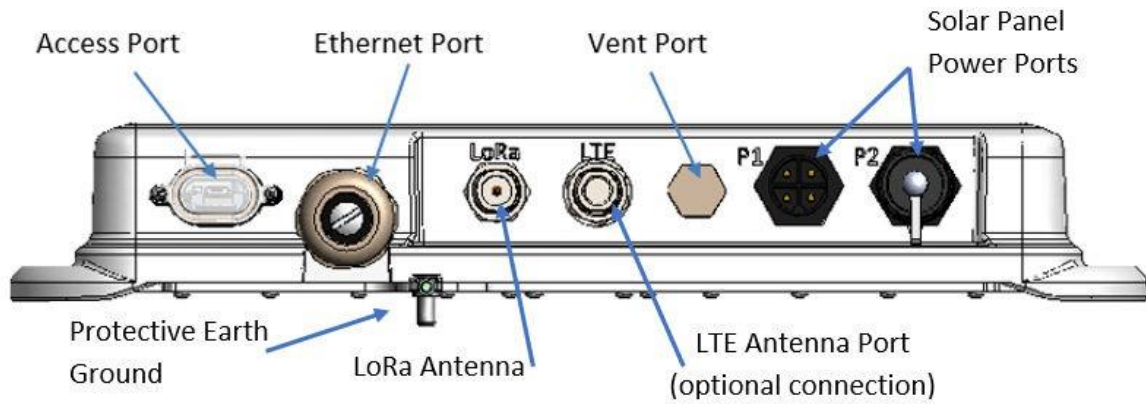Figure 2 illustrates the bulkhead layout for the KONA Photon Gen2 Gateway.

Figure 2: Photon Gen2 Radio Module Connector Field

The Photon Gen2 Radio Module external connectors are listed in Table 9.

Table 9: Photon Gen2 Radio Module External Connector Types

Interface	Connector Type	Comments
Solar Panel Power (P1, P2)	4 pin bayonet style	
Cellular Antenna	N-Type female	
LoRa Antenna	N-Type female	
Copper Ethernet	RJ45 Modular Jack	Module test only. Not intended for permanent connection
USB	Micro-B	Module test only. Not intended for permanent connection

2   Installation

2.1   Safety Precautions

- **CAUTION**: Parts of the KONA Photon Gen2 Gateway can become hot to the touch due to the systems direct exposure to high intensity solar radiation.

- The KONA Photon Gen2 Gateway contains an internal battery and can only be powered down by unplugging both solar panel connectors.

- The KONA Photon Gen2 Gateway has no internal field serviceable parts. The Photon Gen2 Radio Module must only be opened by an approved TEKTELIC service center.

- All installation practices must be in accordance with the local and national electrical codes.

- Do not work on the system during periods of lightning activity.

- The KONA Photon Gen2 Gateway is considered permanently connected equipment. The Protective Earth Ground connection (that is, the chassis ground) is always required.

- Ensure the KONA Photon Gen2 Gateway Protective Earth Ground connection is properly terminated prior to the connection of any other interface.

- The KONA Photon Gen2 Gateway contains primary lightning surge suppression on the copper Ethernet port, and the LoRa RF antenna port. The primary lightning protectors have the ability to bridge the interface to chassis during over-voltages. Ensure that the Protective Earth Ground connection is always in place.

- Ensure that the KONA Photon Gen2 Gateway is secured to eliminate any physical hazard to people or property. The Gateway must be securely mounted according to the mounting instructions prior to any cable connection and operation.

- Although the KONA Photon Gen2 Gateway can be powered through either the solar DC input or the power over Ethernet (PoE) input, simultaneous application of power to both inputs may result in unexpected operation and shall be avoided.

- Always ensure the Ethernet connection port and 3G/4G Modem SIM card access port are properly sealed after installation or servicing.

2.2   Required Equipment for Installation

The following tools are required to install the KONA Photon Gen2 Gateway:

1. A 6-point metric socket set and torque wrench drive.

2. Anti-oxidant compound (NO-OX-ID, Penetrox, Noalox, Ox-Gard or equivalent).

3. A small wire brush.

4. A clean cloth.

5. Weatherproofing tape kit for the RF connector (Scotch Wireless Weatherproofing Kit, WK-101 recommended).

6. Supplied pole mounting accessories (shown in Figure 6) for pole mounting or appropriate screws or bolts (four sized M6) with any required anchors according to the wall construction for wall mounting.

2.3   Unpacking and Inspection

The following should be considered during the unpacking of a new KONA Photon Gen2 Gateway.

1. Inspect the shipping carton and report any significant damage to TEKTELIC.

2. Unpacking should be conducted in a clean and dry location when possible.

3. Do not discard the shipping box or foam inserts as they will be required if a unit is returned for repair or re-configuration.

The KONA Photon Gen2 Gateway is shipped in two packages, one containing the Photon Gen2 Radio Module (Figure 3), and the other containing the Photon Gen2 Solar Panel Assembly (Figure 4).
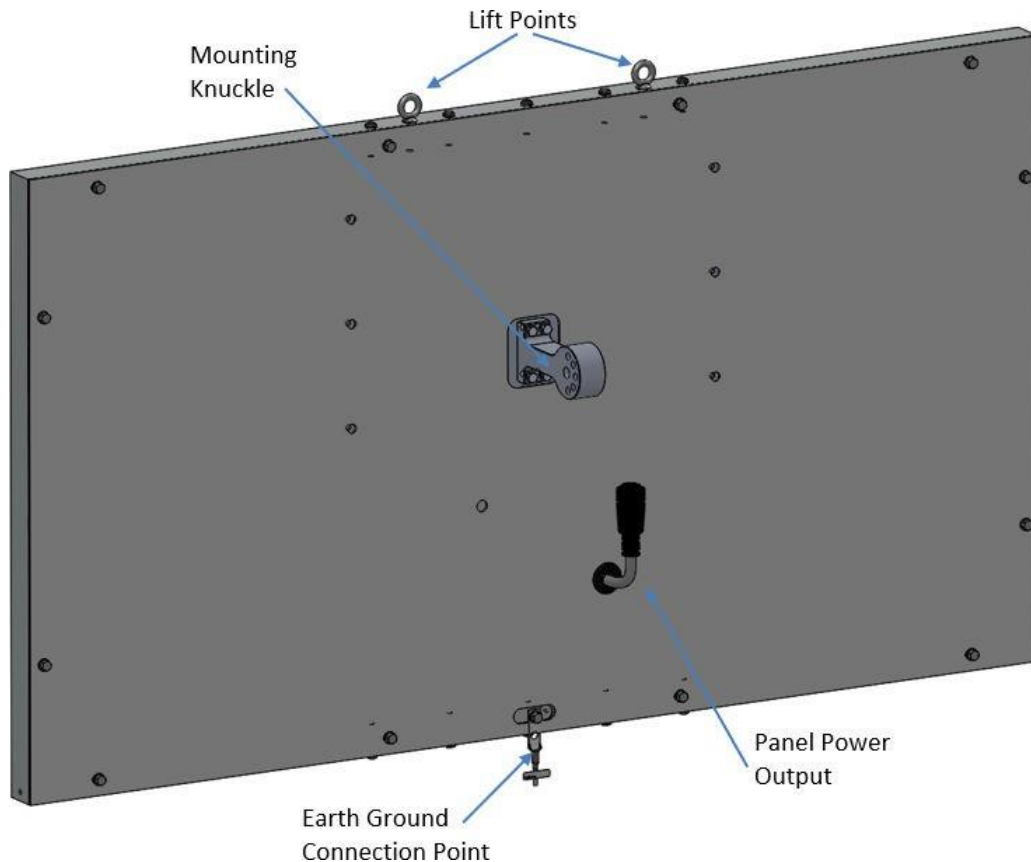

Figure 3: KONA Photon Gen2 Radio Module

Figure 4: Photon Gen2 Solar Panel Assembly

2.4 Gateway Commissioning

Once the Photon Gen2 Radio Module has been unpacked and inspected, it is advisable to perform all commissioning activities prior to assembling it to the Photon Gen2 Solar Panel Assembly. Access becomes more difficult once the Radio Module is assembled to the solar panel due to size and weight.

2.4.1 SIM Tray Access

Remove the two M2.5 x 8mm screws holding the access port cover in order to access the SIM tray.

The Photon Gen2 Radio Module is equipped with a dual SIM slot which can be configured to the user's liking. The primary and secondary slots can be configured in the software configuration. Prior to inserting or replacing SIM, please ensure that the unit is turned off. If 2 SIM cards are used, and the primary SIM fails or is missing, the failover mechanism will automatically switch over to the secondary SIM. When only one SIM is used, please place the SIM in slot 0 (primary SIM / inner slot) as indicated by Figure 4. Slot 1 is for the secondary SIM (outer slot).

Figure 5: SIM Tray Layout

NOTE: SIM Tray shall not be inserted or removed while the gateway is powered on

The SIM tray can be removed by pulling on the SIM tray cover's pull tab (refer to Figure 6 and Figure 7).
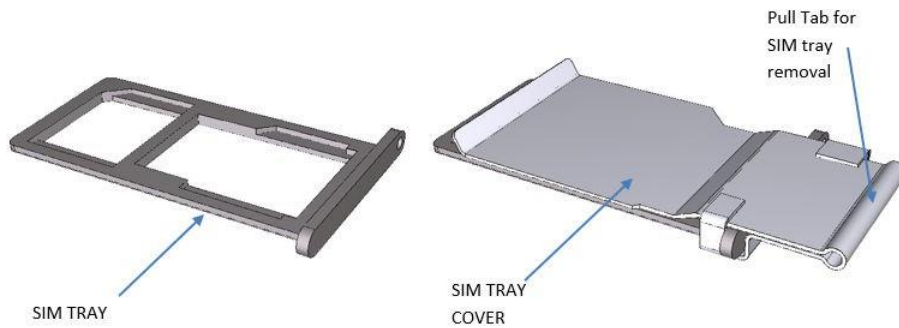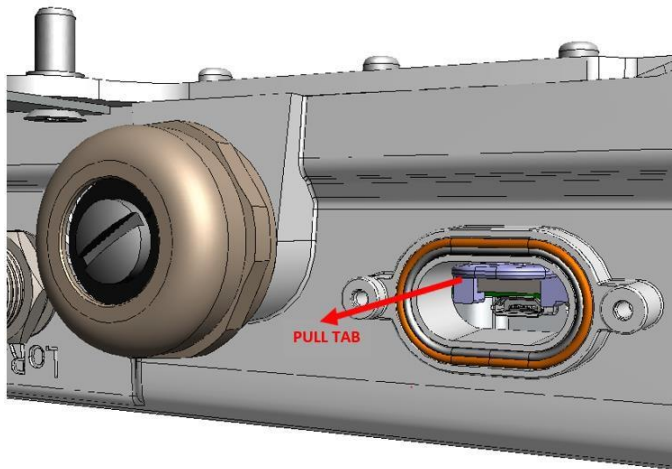

Figure 6: SIM Tray Cover

Figure 7: SIM Tray Removal

Ensure the SIM access cover gasket is properly in place and the cover is properly secured using the two M2.5 cover screws.

2.4.2 Photon Gen2 Radio Module Powering for Commissioning

During commissioning the radio module may be powered via PoE. To connect PoE, remove the ethernet port cable gland and plug the ethernet cable into the RJ45 jack on the radio module. Remove the cable when finished and reinstall the cable gland, tightening to 6 Nm.
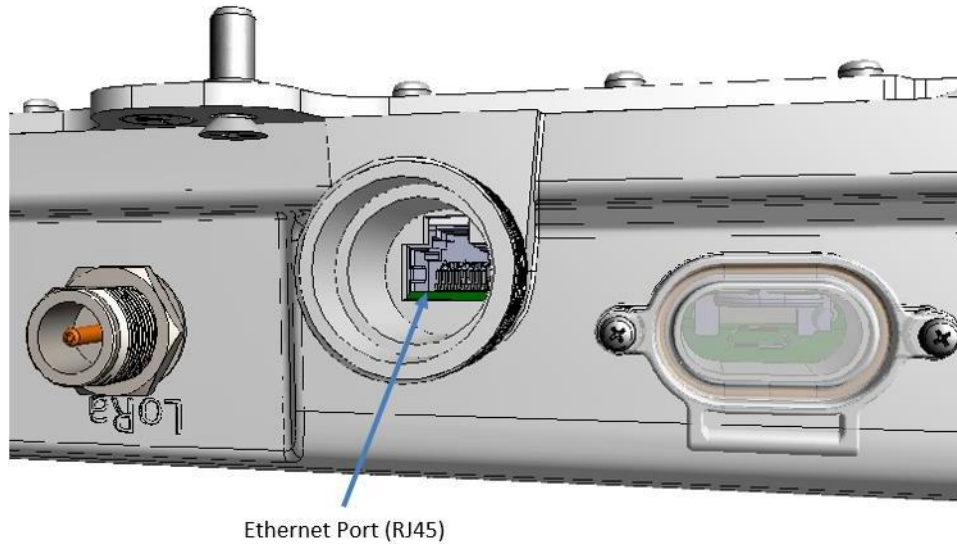

Ethernet Port (RJ45)

Figure 8: PoE Connection

2.5   KONA Photon Gen2 Gateway Mounting

The following assembly steps apply to both the Solar Gateway system as well as an expansion panel except that the expansion panel does not have a radio module attachment step.

2.5.1   Attach Mounting Knuckle to Solar Panel

Connect the mounting knuckle to the solar panel's mounting frame using the supplied M5 x 0.8 – 24mm machine screws. Tighten the mounting screws to 2.5 Nm (22 in·lbs).
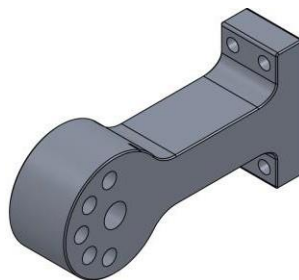

Figure 9: Mounting Knuckle

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2.5.2   Attach Radio Module to Solar Panel

The radio module mounts to the rear of the solar panel with 6 M5 X 0.8 - 14 MM machine screws (Phillips drive). Orient the radio module as shown in Figure 10 with the connector field facing down. Tighten the mounting screws to 2.5 Nm (22 in·lbs).
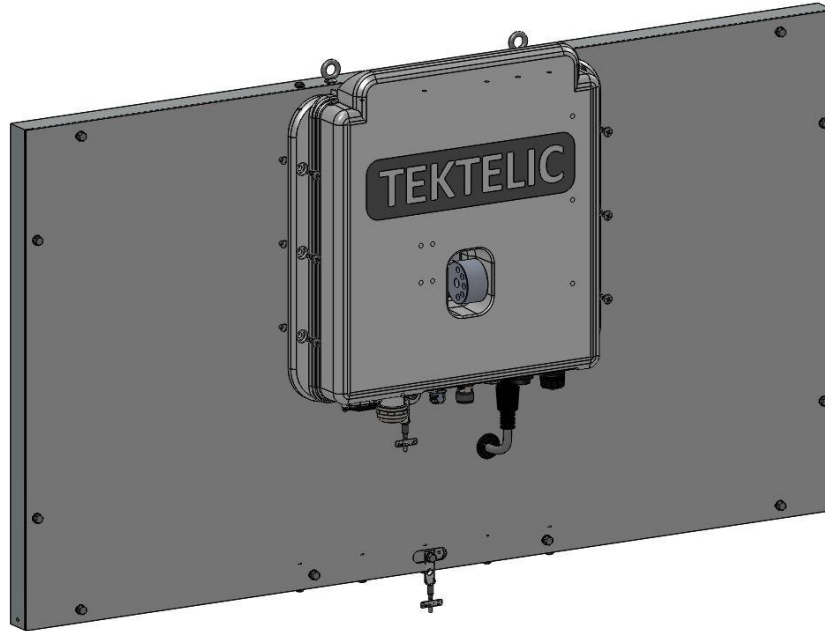

Figure 10: Photon Gen2 Gateway Assembly

2.5.3   Mounting Bracket/Arm Installation

2.5.3.1   Mounting Arm Attachment

Attach the assembled mounting arm to the mounting bracket using the supplied M5 X 0.8 - 25 MM machine screws (refer to Figure 11). Tighten the mounting screws to 2.5 Nm (22 in·lbs).
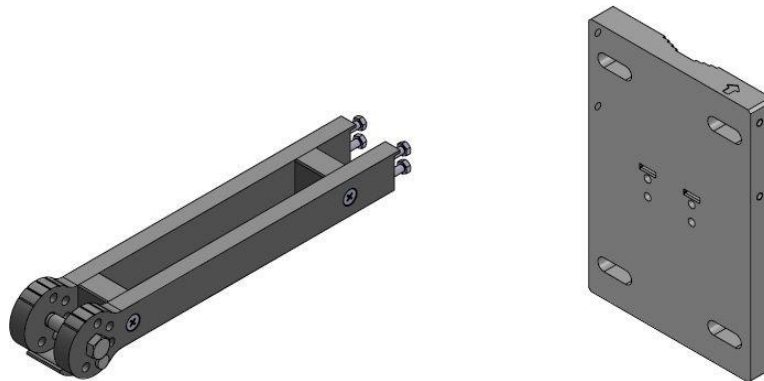

Figure 11: Mounting Arm Attachment

2.5.3.2 Attach Pole/Wall Mount Bracket Assembly

The mounting bracket assembly can be pole or wall mounted. For pole mounting option, shown in Figure 12, use the supplied U-bolt accessory kit. Tighten the mounting screws to 2.5 Nm (22 in·lbs).
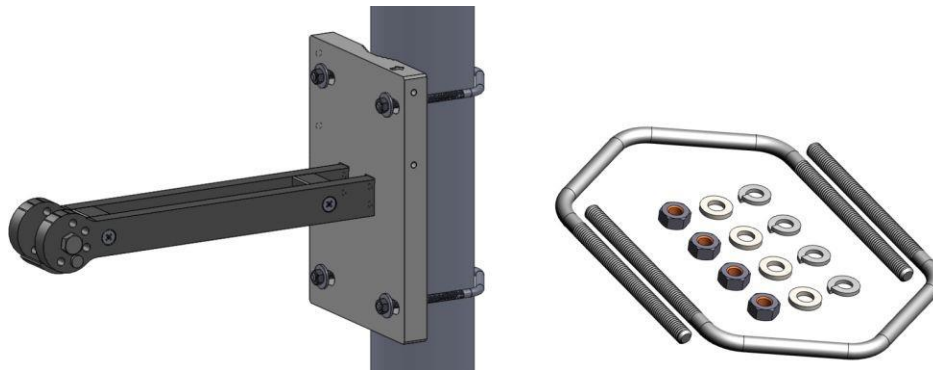

Figure 12: Pole Mounting Accessories

Wall mounting hardware is not included and shall be field supplied and selected to support the full system weight.

2.5.3.3 Solar Panel Assembly Attachment to Mounting Arm

Remove the bolt and quick release pin from the end of the mounting arm. Insert the mounting knuckle of the gateway panel assembly into the end of the mounting arm and secure by inserting the bolt through the center hole. Loosely affix the locknut to the end of the bolt.
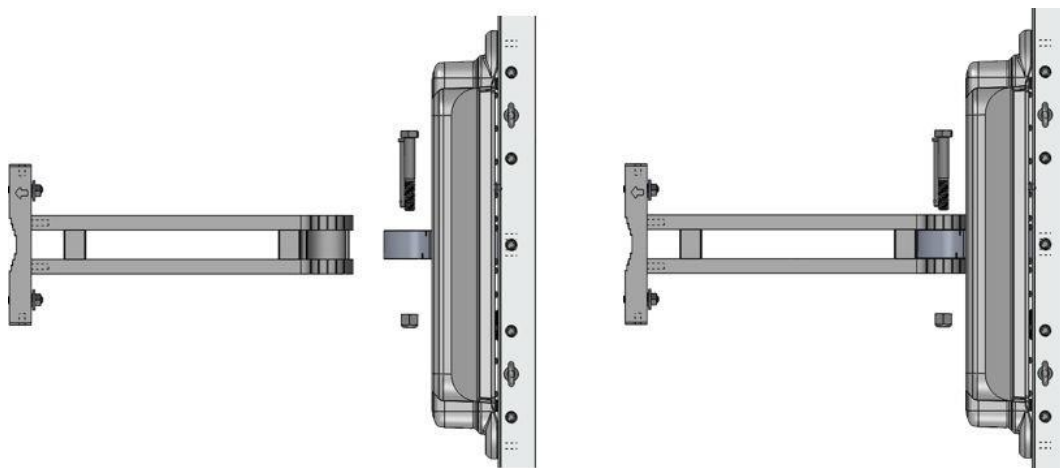

Figure 13: Solar Panel Assembly to Mounting Arm

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Adjust the panel tilt angle as desired and insert quick release pin to fix the angle. Tighten the locknut on the end of the bolt to 2.5 Nm (22 in·lbs).
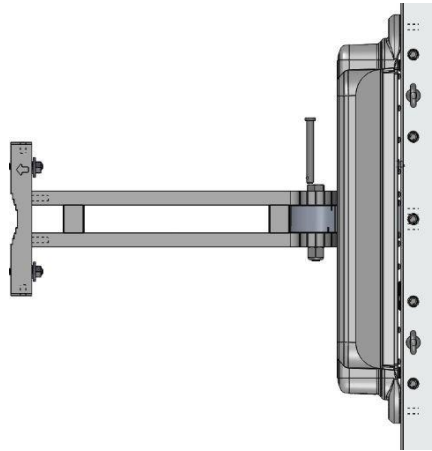

Figure 14: Solar Panel Angle Adjustment

Panel angle can be adjusted in 10-degree increments between the range of 10° - 90°. Please contact TEKTELIC Sales Support for assistance in determining the optimal panel angle for a specific location.

NOTE: The Photon Gen2 Gateway (solar panel plus radio module) weighs approximately 15kg, making attachment to the mounting arm difficult for a single person. Lift points are available on the panel to aid in panel installation.

2.6 Ground Cable Installation

The KONA Photon Gen2 Gateway is considered Permanently Connected Equipment and requires a permanently connected Protective Earth Ground (PEG) conductor. The Protective Earth Ground connection is made through a M4/#8 on center hole lug with 10mm maximum OD to the ground termination point illustrated in Figure 9. The recommended ground cable gauge is #10 AWG. The KONA Photon Gen2 Gateway grounding system shall follow local and national electrical codes. The Protective Earth Ground conductor terminated at the hole lug point is mandatory and must be the first connection made to the KONA Photon Gen2 Gateway during installation. Proper routing and termination of this cable is key to robust lightning withstand performance; in high susceptibility installations, every effort shall be made to minimize connection inductance and ground bed resistance. The ground cable installation steps are as follows:

1. Lightly abrade the surface of the casting ground area with a fine wire brush to remove the oxide layer.

2. Use a clean cloth to remove any debris from this surface.

3. Immediately coat the contact surface with a thin layer of anti-oxidant compound.

4. Install the ground cable through its single hole lug onto the chassis ground point using the supplied M4x0.7 – 12mm bolt with flat, lock, and star washers, torqued to 2.5 Nm (22 in·lbs).
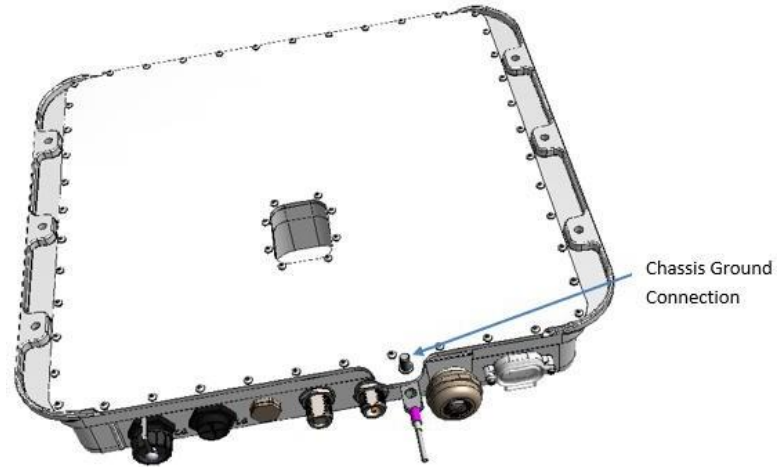

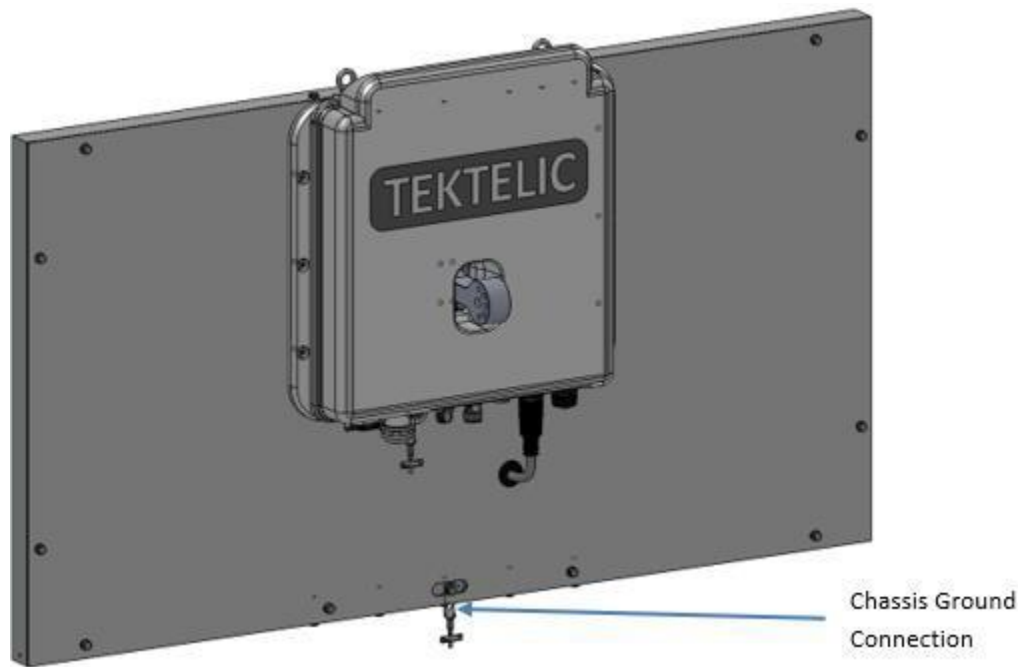Figure 15: KONA Photon Gen2 Radio Module Ground Connection Point

Chassis Ground Connection

Figure 16: KONA Photon Gen2 Solar Panel Ground Connection Point

2.7 RF Cable Installation

The KONA Photon Gen2 Radio Module installation requires connection to an external LoRa RF antenna and optionally to an external Cellular RF antenna. The RF cables attach to an N-Type connector located on the bulkhead of the radio module. Torque the cable RF connector to 0.79 to 1.13 Nm (7 to 10 in·lbs). The N-Type connector interface to a cable is not water proof and must be taped. TEKTELIC recommends taping with Scotch Wireless Weatherproofing Kit, WK-101. Follow the taping procedures outlined by the supplier of this tape system.

Note that the Cellular antenna port in not surge protected internal to the Gateway[3], therefore an external surge suppressor such as Polyphaser p/n TSX-NFM or equivalent is recommended any time an external cellular antenna is connected.

2.8 Solar Panel Power Cable Connection

The KONA Photon Gen2 Gateway allows for connection to one or two solar panels. Always use panel power port P1 first as it does not have a protective cap. Ensure the protective cap in installed onto panel power port P2 when not in use. The panel power port is a special interface, only panels provided by TEKTELIC can be used.

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[3] Cellular antenna port will be surge protected internally with Gen 2 radio hardware.

Use caution when handling a solar panel power connector as it can be energized from sunlight exposure. Hand-tighten the panel power port connector(s).

2.9   Copper Ethernet Cable Installation

The KONA Photon Gen2 Radio Module's ethernet port is not intended for permanent connection, but may used to power and communicate with the radio during commissioning. Remove the cable gland and plug the ethernet cable into the RJ45 jack on the radio module. Remove the cable when finished and reinstall the cable gland, tightening to 6Nm.

2.10 System Sighting

Proper sighting is key to optimum system performance. Photon Gen2 Gateway sighting should always be chosen with a goal of minimum of solar shadowing from buildings, trees, and other tall structures.

2.10.1 Azimuth Angle

The Gateway solar panel should always be oriented directly true south in the northern hemisphere or true north in the southern hemisphere. Note that true south or north are generally different from magnetic south or north but the latter can be used to determine the former along with a location-based correction. Today, most smartphones include an app to easily determine true north.

2.10.2 Elevation Angle

The Gateway solar panel elevation angle (also called altitude angle or tilt angle) follows a method of "maximization of the solar minimum" rather than "latitude tilt" which is commonly used to achieve maximum annual average irradiation. This means the solar panel tilt should be chosen to maximize the solar irradiation at the winter solstice in the northern hemisphere or the summer solstice in the southern hemisphere. By definition, the tilt angle is measured from horizontal such that 0° is horizontal and 90° is vertical.

The Photon Gen2 Gateway tilt angle is adjustable in 10° increments from 10° to 80°. Choose the most appropriate tilt angle by determining the latitude of the Gateway site and using Table 10 to look up the Gateway tilt angle setting. An easy way to determine site latitude is through Google Maps by right clicking on the site's location; the first number is the latitude.
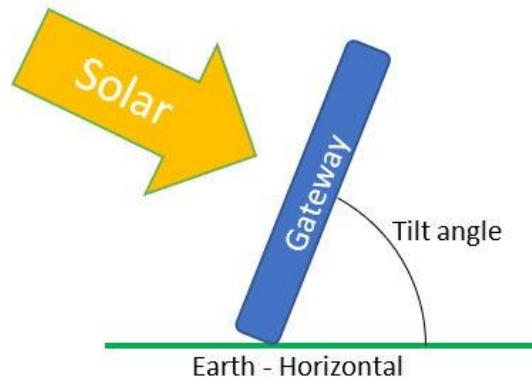
Figure 17: Photon Gen2 Gateway Panel Tilt

Table 10 lists the optimum latitude range associated with each Gateway panel tilt angle.

Table 10: Photon Gen2 Gateway Panel Tilt Angles and Latitude Ranges

Panel Tilt Angle	Latitude Range
80°	54° and above
70°	42° to 54°
60°	33° to 42°
50°	25° to 33°
40°	19° to 25°
30°	13° to 19°
20°	7° to 13°
10°	0° to 7°

3 Maintenance

3.1 Solar Panel

Clean the solar panel glass surface as dictated by local environmental conditions for optimum system performance.