

KONA ENTERPRISE/PHOTON GEN2 GATEWAY

USER GUIDE

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1 Product Description

1.1 Overview

The KONA Enterprise Gateway (Figure 1) is a 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. The KONA Photon Gateway (Figure 2) is a solar powered variant of the Enterprise gateway.

The module consists of 1 Semtech SX1303 base-band processor multiplexed through an FPGA to provide 8 simultaneous narrowband channels. The design offers both downlink and uplink operations in time-duplex mode. The gateway supports internal LoRa antenna¹, internal GPS, copper Ethernet backhaul, and optional 3G/4G wireless backhaul² with internal cellular antennas. The gateway also supports external LoRa³ and Main Cellular antennas via switched-N bulk connectors. The KONA Enterprise Gateway is powered through Power Over Ethernet (PoE 802.3af). The KONA Photon Gateway is powered via an external solar panel in conjunction with a MPPT charge controller and LiFEPO4 rechargeable battery.

Table 1 presents the currently available KONA Enterprise Gateway models.

Table 1: KONA Enterprise Gateway Models

Model	Description
T0007430	LORA GATEWAY MODULE, KONA ENTERPRISE GEN2, 900 MHZ, LTE MODEM
T0007431	LORA GATEWAY MODULE, KONA ENTERPRISE GEN2, 860 MHZ, LTE MODEM
T0007432	LORA GATEWAY MODULE, KONA ENTERPRISE GEN2, 900 MHZ
T0007433	LORA GATEWAY MODULE, KONA ENTERPRISE GEN2, 860 MHZ
T0008479	LORA GATEWAY MODULE, KONA PHOTON, 900MHZ, CELLULAR MODEM
T0008551	LORA GATEWAY MODULE, KONA PHOTON, 860MHZ, CELLULAR MODEM

The KONA Photon product is comprised of the KONA Photon Radio Module (radio module) and the KONA Photon Solar Panel Assembly (solar panel). The KONA Photon Solar Panel Assembly is available in two sizes, 50 and 95 W. The Photon Radio Module can support the addition of a second solar panel assembly with an optional expansion cable.

¹ Internal LoRa antenna is not available in the Photon gateway.

² Cellular backhaul is standard in the Photon gateway.

³ External LoRa antenna is required with the Photon gateway.



Figure 1: KONA Enterprise Gateway

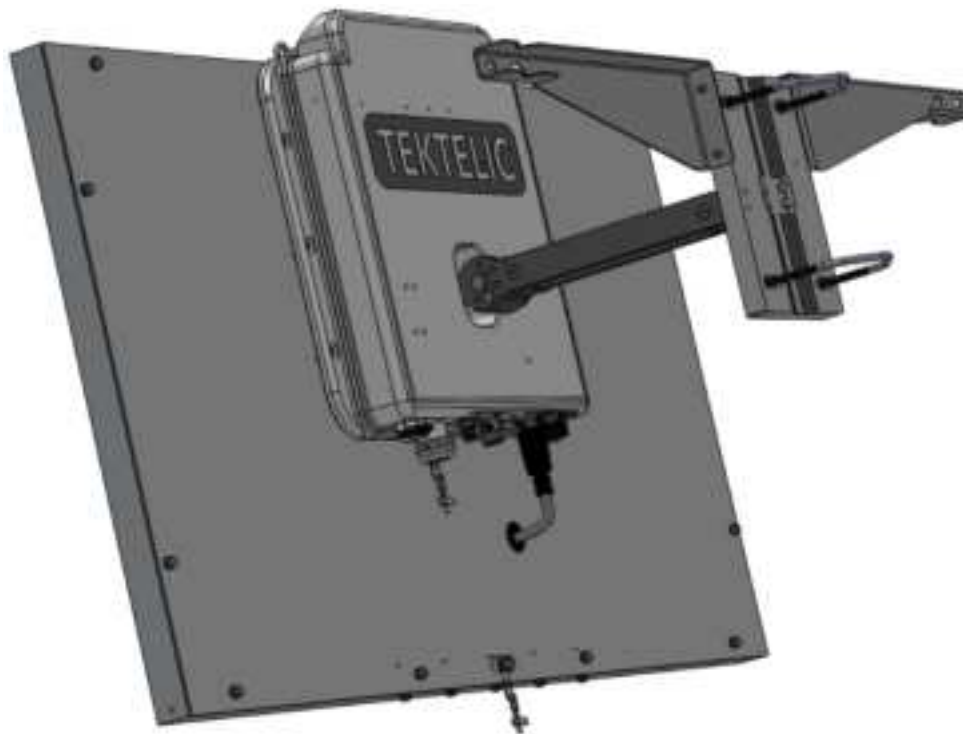


Figure 2: KONA Photon Gateway

1.2 Specifications

1.2.1 Radio Capability

Table 2: 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	Cat1 global modem
GNSS	GPS, GLONASS, Galileo, QZSS	Internal antenna

1.2.2 External Interfaces

Table 3: External Interfaces

Description	Specification	Comments
PHOTON: Power (P1, P2)	4 pin bayonet style	Use P1 first as it does not have an environmental protection cap
ENTERPRISE: Power	PoE, IEEE 802.3af, Mode A or Mode B or 4-pair Mode	48 VDC nominal, 37 to 57 VDC operating range, 0.3 A maximum
LoRa Antenna Port	N-type Female	
3G/4G Antenna Port	N-type Female	
Ethernet Port	100/1000 BaseT	
Access Port SIM tray USB Visible LED	Nano SIM (x2) Micro-B Multi-color	

1.2.3 Solar Power (Photon Only)

Table 4: Power Specifications

Description	Specification	Comments
Solar Panel(s) Panel Type Panel Efficiency Rated Power	Monocrystalline 20% (typical) 50 or 95 W	site specific - more or less power may be required depending on geographical location
MPPT Charge Controller	100 W	
Energy Storage Battery technology Battery capacity Battery charge temperature Battery discharge temperature	LiFePO4 220 Wh -30° to 50° C -40° to 60° C	

1.2.4 Mechanical

Table 5: Mechanical Specifications

Description	Specification	Comments
Dimensions		
Photon	970 x 540 x 120 mm	Based on gateway with 95 W panel; not including mounting arm
Enterprise	208 x 146 x 80 mm	
Weight		
Photon Solar Panel Assembly	7 kg	95 W panel, including mounting frame
Photon Radio Module	6 kg	
Enterprise Radio Module	1.2 kg	
Mounting	Pole/Wall	
Photon Solar Panel Tilt	10° to 90°	10° increments
Gateway thermal management	Passive	

1.2.5 Environmental

Table 6: Environmental Specifications

Description	Specification
Ingress Protection	IP-67
Operating Temperature	-40 °C to 60 °C
Relative Humidity	10% to 100 % Condensing
Operating Altitude	-60 m to 4,000 m

1.3 Physical Interfaces

1.3.1 Enterprise Gateway

Figure 3 illustrates the bulkhead layout for the KONA Enterprise Gateway.

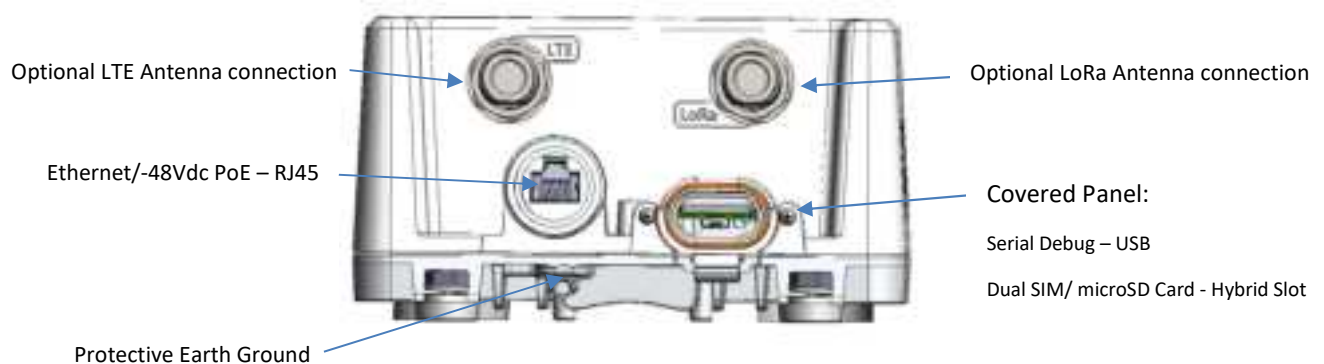


Figure 3: KONA Gateway Bulkhead Layout

The KONA Enterprise Gateway connectors are listed in Table 7.

Table 7: KONA Enterprise Gateway Interface Connector Types

Interface	Connector Type	Mating Connector
LoRa Antenna	N-Type female	Industry standard N-Type male
Cellular Antenna	N-Type female	Industry standard N-Type male
Copper Ethernet	RJ45 Modular Jack	RJ45 modular plug followed by CAT 5e cable
Earth Ground	Compression lug	Industry standard single-hole lug, M4 (#8)

1.3.2 Photon Gateway

Figure 4 illustrates the bulkhead layout for the KONA Photon Gateway.

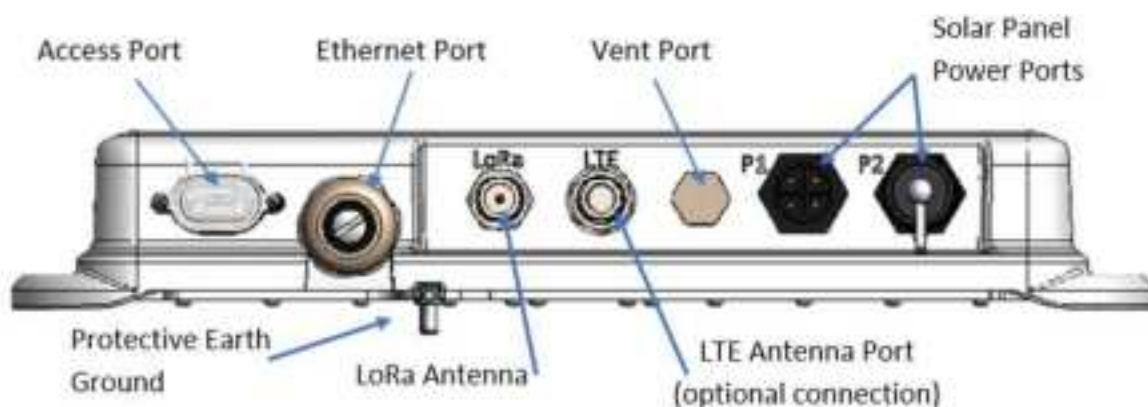


Figure 4: Photon Radio Module Connector Field

The Photon Radio Module external connectors are listed in Table 7.

Table 8: Photon 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 Gateway can become hot to the touch due to the systems direct exposure to high intensity solar radiation.
- 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 Gateway is considered permanently connected equipment. The Protective Earth Ground connection (that is, the chassis ground) is always required.
- Ensure the Gateway Protective Earth Ground connection(s) is (are) properly terminated prior to the connection of any other interface.
- The Gateway has no internal field serviceable parts. The Gateway module must only be opened by an approved TEKTELIC service center.
- The 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.
- An external inline surge protector must be applied to the External Cellular antenna port when used.
- Ensure that the 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.
- The KONA Photon Gateway contains an internal battery and can only be powered down by unplugging both solar panel connectors.
- The KONA Photon Gateway is designed to be powered via the solar DC power input(s). Powering KONA Photon via power over Ethernet (PoE) input is not supported and shall be avoided. Simultaneous application of power to the solar DC power input and by PoE is not supported and shall be avoided as it may result in unexpected operation.
- The KONA Enterprise Gateway does not contain a power disconnection device; a readily accessible disconnection device must be incorporated external to the KONA Enterprise Gateway.

- The KONA Enterprise Gateway can only be powered either via PoE (Power-Over-Ethernet) or passive POE combiner. Please note that when using a passive POE combiner, it is vital to use a (minimum 10W) 48V power supply with Hiccup Mode Current Limiting.
- 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 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 for pole mounting or appropriate screws or bolts 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 Enterprise 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 Gateway is shipped in two packages, one containing the Photon Radio Module (Figure 5), and the other containing the Photon Solar Panel Assembly (Figure 6).



Figure 5: KONA Photon Radio Module

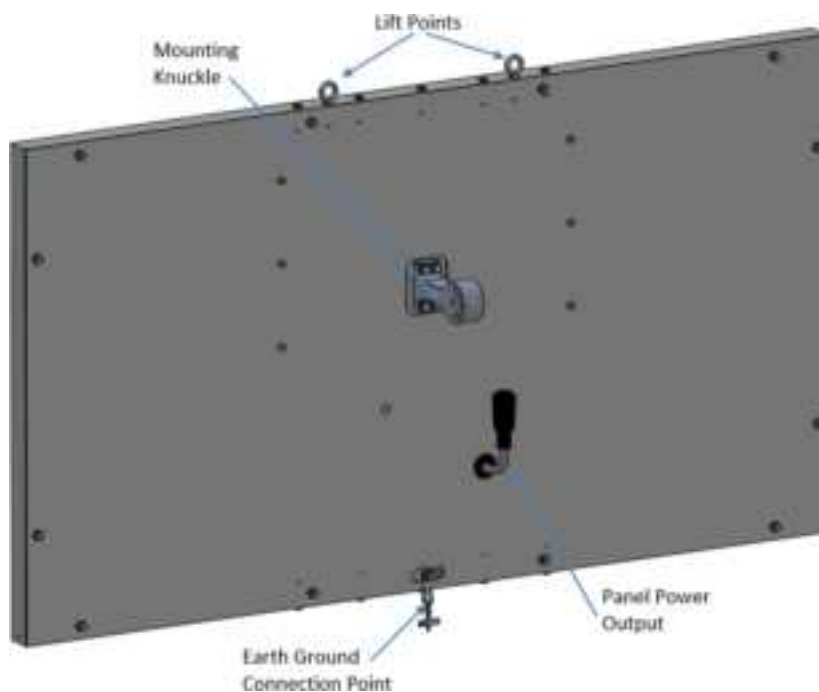


Figure 6: Photon Solar Panel Assembly

2.4 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 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 7: 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 8 and Figure 9).



Figure 8: SIM Tray Cover

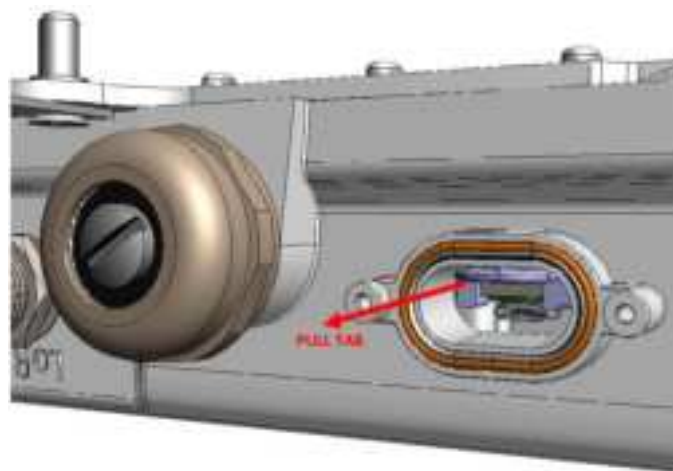


Figure 9: SIM Tray Removal

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

2.5 Gateway Mounting and Grounding

2.5.1 KONA Enterprise Mounting

KONA Enterprise Gateway PoE **must** be mounted to a vertical pole or wall using the supplied mounting hardware which attaches to the back of the module as illustrated in 5. The vertical orientation is required for the GPS to function properly.

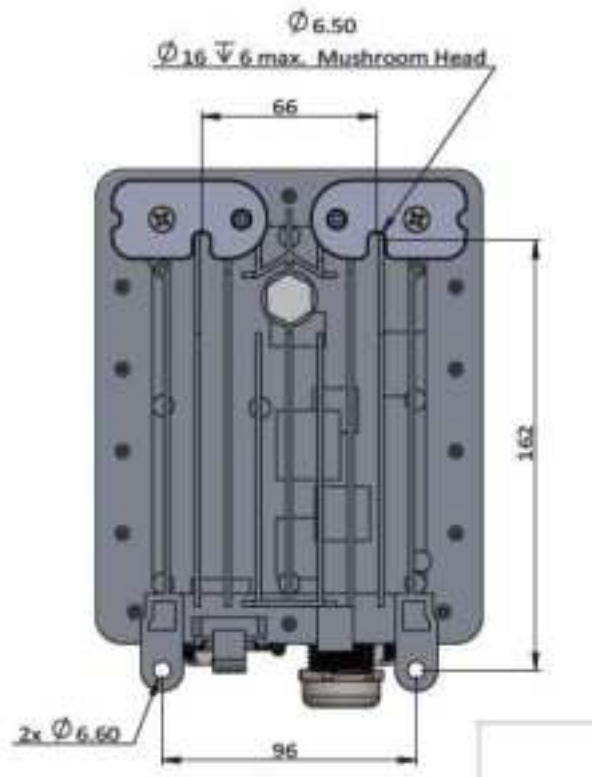


Figure 10: KONA Enterprise Gateway Wall Mounting Screw Locations

When mounted, the Gateway module must be oriented with the connector bulkhead pointed down towards earth as shown in Figure 11 and Figure 13.



Figure 11: KONA Enterprise Gateway Module Wall Mounting Orientation



Figure 12: KONA Enterprise Gateway Module Pole Mounting Accessories

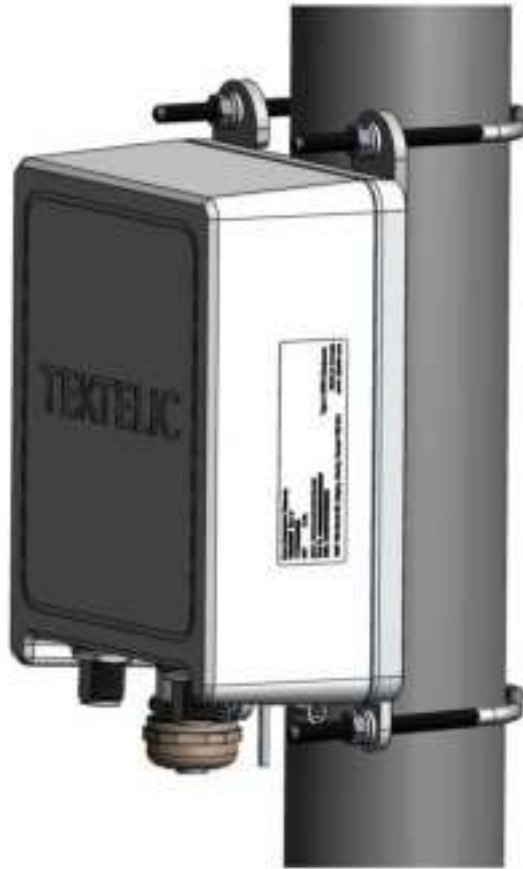


Figure 13: KONA Enterprise Gateway Module Pole Mounting Orientation

2.5.2 KONA Enterprise Ground Cable Installation

The KONA Enterprise 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 14. The recommended ground cable gauge is #10 AWG. The KONA Enterprise 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 Enterprise 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 2.4Nm (22 in·lbs).

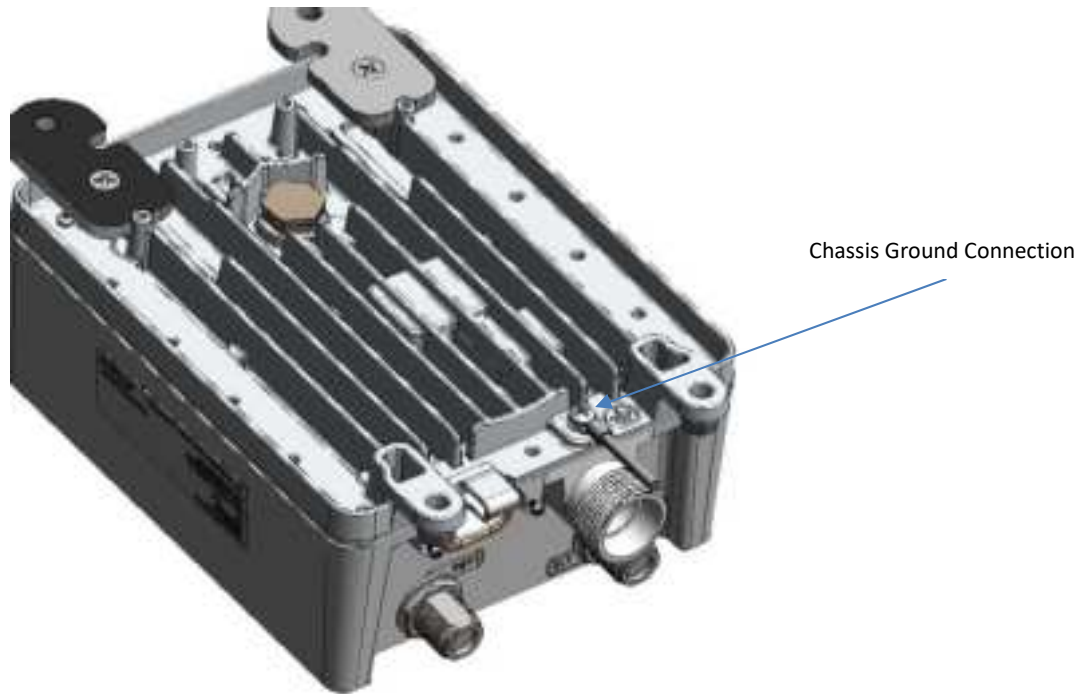


Figure 14: KONA Enterprise Gateway Module Ground Connection Point

2.5.3 KONA Photon 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.

1. 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 15: Mounting Knuckle

2. 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 16 with the connector field facing down. Tighten the mounting screws to 2.5 Nm (22 in·lbs).

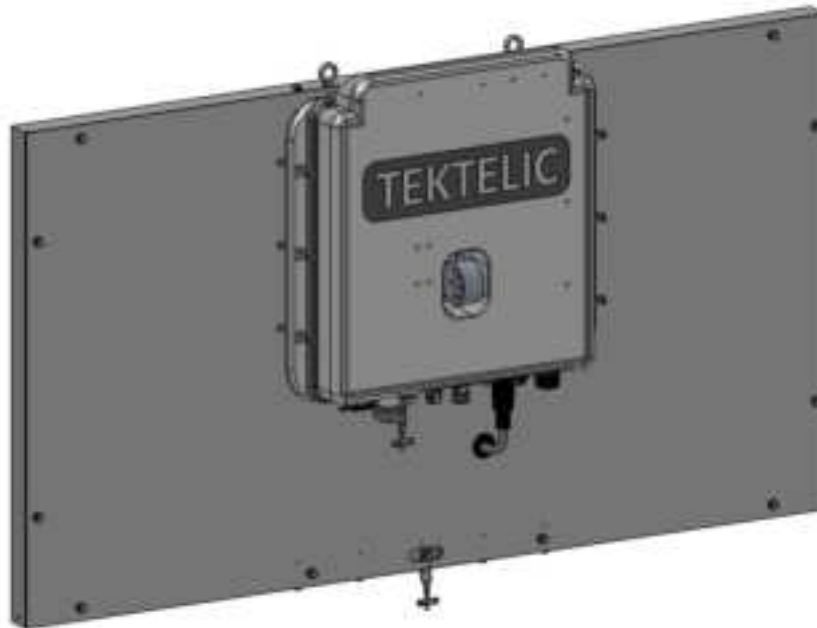


Figure 16: Photon Gateway Assembly

3. Attach the assembled mounting arm to the mounting bracket using the supplied M5 X 0.8 - 25 MM machine screws (refer to Figure 17). Tighten the mounting screws to 2.5 Nm (22 in·lbs).



Figure 17: Mounting Arm Attachment

4. The mounting bracket assembly can be pole or wall mounted. For pole mounting option, shown in Figure 18, use the supplied U-bolt accessory kit. Tighten the mounting screws to 2.5 Nm (22 in·lbs). NOTE: Wall mounting hardware is not included and shall be field supplied and selected to support the full system weight.



Figure 18: Pole Mounting Accessories

5. 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.

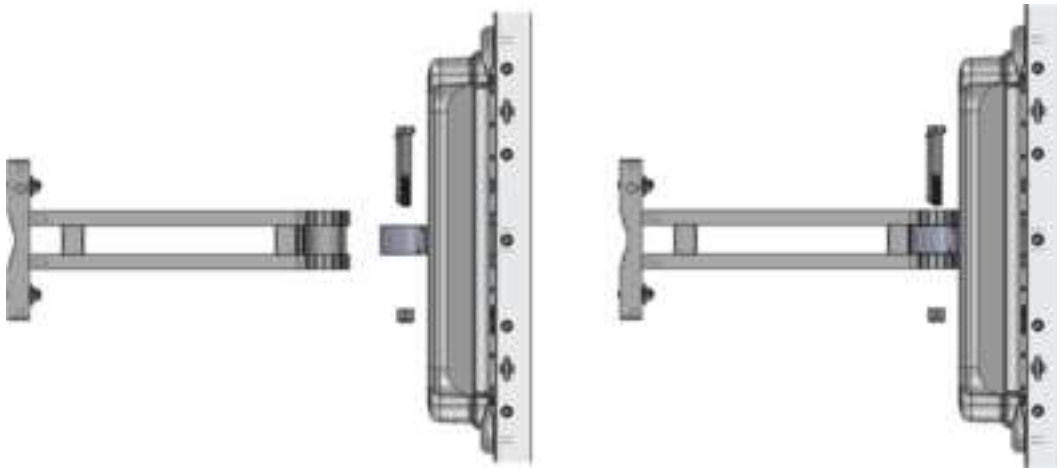


Figure 19: Solar Panel Assembly to Mounting Arm

6. 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). 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.

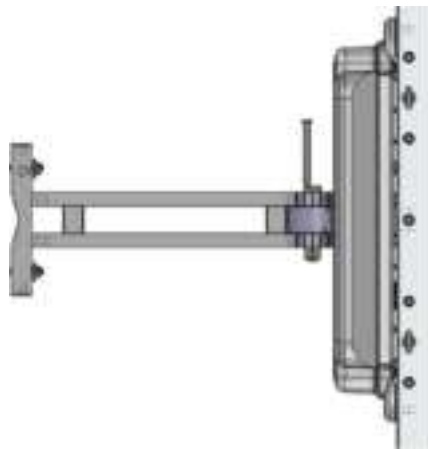


Figure 20: Solar Panel Angle Adjustment

NOTE: The Photon 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.

2.5.4 KONA Photon Ground Cable Installation

The KONA Photon Gateway is considered Permanently Connected Equipment and requires a permanently connected Protective Earth Ground (PEG) conductor. Protective Earth Ground connection points are located on the gateway module and on the solar panel, as illustrated in

Figure 21. The recommended ground cable gauge is #10 AWG. Grounding cable and ground lug termination are not provided.

The KONA Photon 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 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.



Figure 21: Protective Earth Ground Connection Points

The ground cable installation steps for the gateway are as follows:

1. Remove the supplied M5x0.8 10mm pan head screw from the gateway chassis ground point.
2. Lightly abrade the surface of the casting ground area with a fine wire brush to remove the oxide layer.
3. Use a clean cloth to remove any debris from this surface.
4. Immediately coat the contact surface with a thin layer of anti-oxidant compound.

5. Attach the earth grounded cable through its single hole lug (not provided) onto the chassis ground point using the previously removed M5x0.8 10mm pan head screw. Tighten screw to 2.5 Nm (22 in·lbs).



Figure 22: KONA Photon Radio Module Ground Connection Point

The ground cable installation steps for the solar panel are as follows:

1. Remove the supplied T25 Torx head, 10-24 X 3/8" self tapping pan head screw from the solar panel ground point.
2. Lightly abrade the surface of the casting ground area with a fine wire brush to remove the oxide layer.
3. Use a clean cloth to remove any debris from this surface.
4. Immediately coat the contact surface with a thin layer of anti-oxidant compound.
5. Attach the earth grounded cable through its single hole lug (not provided) onto the chassis ground point using the previously removed #10-24 x 3/8" self tapping pan head screw. Tighten screw to 2.5 Nm (22 in·lbs).

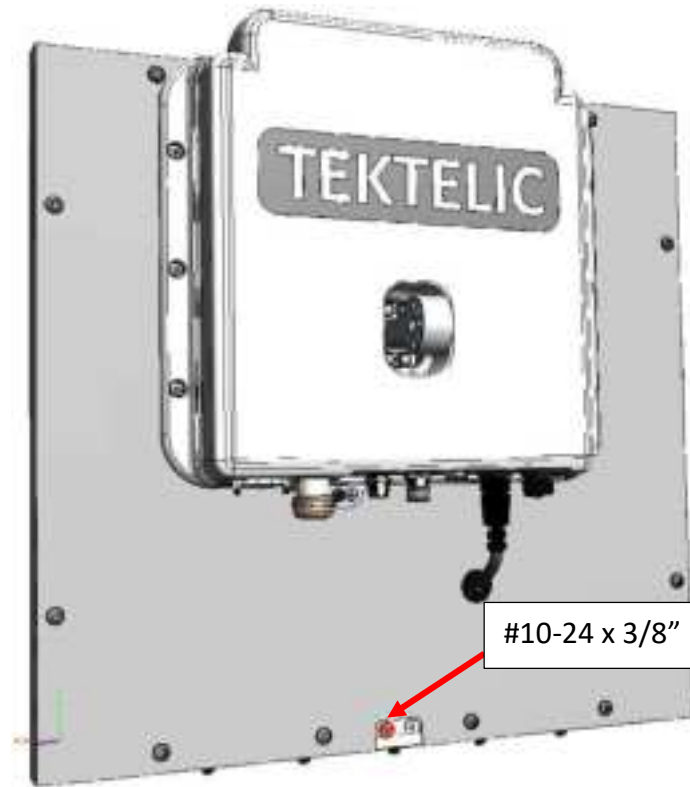


Figure 23: KONA Photon Solar Panel Ground Connection Point

2.6 RF Cable Installation

The Gateway installation may require connection to an external LoRa RF antenna and an external Cellular RF antenna. The RF cables attach to an N-Type connector located on the bulkhead of the Gateway. 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.

For second generation radio hardware (i.e., the radio hardware described by this User Guide) the cellular antenna interface is internally surge protected. Prior hardware revisions are not equipped with internal surge protection on the cellular interface and therefore an external surge suppressor such as Polyphaser p/n TSX-NFM or equivalent is recommended any time an external cellular antenna is connected.

2.7 Copper Ethernet Cable Installation

The KONA Enterprise Gateway Ethernet port must be used to power the gateway and may further be used for backhaul or commissioning and maintenance. As shown in Figure 24, pass the Ethernet cable through the cable gland supplied with the module. Plug the cable into the modular jack on the module, then tighten the cable gland to the module with torque 6 Nm.

The cable gland grommet is designed to accept Ethernet cables with a jacket diameter in the range of 4 to 6 mm.

The Ethernet cable must have minimum 24 AWG conductors and shall be rated according to local and national electrical codes.



Figure 24: KONA Enterprise Gateway Module Cable Gland

The KONA Photon Radio Module's ethernet port is not intended for permanent connection, but may be used to 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 6 Nm.

2.8 Adding an Additional Solar Panel (Photon Only)

The KONA Photon 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 is 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.

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 System Sighting (Photon Only)

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

2.9.1 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.

2.9.2 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 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 9 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.

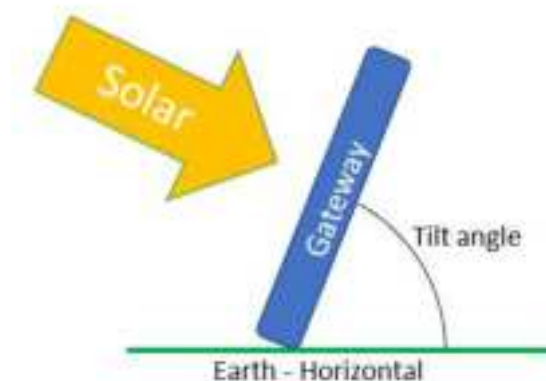


Figure 25: Photon Gateway Panel Tilt

Table 9 lists the optimum latitude range associated with each Gateway panel tilt angle.

Table 9: Photon 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 Radio Compliance Statements

Federal Communications Commission

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 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.

To comply with FCC/IC RF exposure limits for general population / uncontrolled exposure, the antennas used for this transmitter must be installed to provide a separation distance of at least 30 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. This product must be installed by professional trained RF technicians.

Industry Canada

This Device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

This radio transmitter 22504-T0009193 has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

The required antenna impedance is 50 ohms.

Only omnidirectional type antennas with maximum gain of 8dBi can be used for the LoRa radios of this product. Maximum allowed output power at the antenna port is 27 dBm. Antenna(s) shall be installed to location providing a separation distance of at least 15.75 inches (40 cm) from any human body.

During product operation, always keep a separation distance of at least 15.75 inches (40 cm) from any connected antenna(s). Before servicing the product, the antenna(s) or cables, turn off the transmission function or the unit power if you have to get closer than the minimum separation distance. This product must be installed by professional trained RF technicians.

Cet appareil est conforme aux normes CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'utilisation de cet appareil est soumise aux deux conditions suivantes :

1. Cet appareil ne doit pas provoquer d'interférences, et
2. Cet appareil doit accepter toute interférence reçue, y compris les interférences susceptibles de provoquer un fonctionnement indésirable.

Cet émetteur radio 22504-T0009193 a été approuvé par Industrie Canada pour fonctionner avec les types d'antennes énumérés ci-dessous, avec le gain maximum autorisé indiqué. Les types d'antennes non inclus dans cette liste, ayant un gain supérieur au gain maximum indiqué pour ce type, sont strictement interdits à l'utilisation avec cet appareil.

L'impédance requise pour l'antenne est de 50 ohms. Seules les antennes de type omnidirectionnel avec un gain maximum de 8 dBi peuvent être utilisées pour les radios LoRa de ce produit. La puissance de sortie maximale autorisée au port de l'antenne est de 27 dBm. L'antenne(s) doit être installée à un emplacement offrant une distance de séparation d'au moins 15,75 pouces (40 cm) de tout corps humain.

Pendant le fonctionnement du produit, maintenez toujours une distance de séparation d'au moins 15,75 pouces (40 cm) de toute antenne(s) connectée(s). Avant d'intervenir sur le produit, les antennes ou les câbles, désactivez la fonction de transmission ou éteignez l'appareil si vous devez vous rapprocher de la distance de séparation minimale. Ce produit doit être installé par des techniciens RF formés et professionnels.