



# R900<sup>®</sup> IoT Gateway

## Installation Supplement

## Contents

Overview.....	3
Scope .....	3
Configurations .....	4
Components .....	5
Required Installation Equipment .....	6
Installing the UPS.....	7
Installing the PoE Injector .....	8
Installing the Ethernet Surge Protector .....	10
Installing the Gateway.....	11
Installing the GPS Antenna.....	12
Installing the RF (900 MHz) Antennas.....	13
Installing the Cellular Antenna .....	14
Appendix A - Reference Documents List.....	15
Appendix B - Mounting Hardware.....	16
Appendix C - Specifications .....	17
Appendix D - RF Antenna Best Practices.....	20
Appendix E - Feed Line Requirements .....	21
Appendix F - Gateway LED States.....	21

## Overview

The R900 IoT Gateway is a LoRaWAN™ IoT gateway that supports the full range of LoRaWAN channels. The hardware architecture supports two Neptune RF antennas, a GPS antenna, direct DC input power or Power over Ethernet (PoE), and backhaul options including copper Ethernet and 3G/4G wireless. The gateway model specified for deployments is the TEKTELIC Kona Mega T0004250. The connector panel for this model is shown below.



Figure 1 Gateway Connector Panel

## Scope

This document serves as a supplement to the manufacturer's documentation for each component of the gateway system (referenced in the appendix) and serves as a pictorial installation reference only. For detailed installation and safety information from the manufacturer of each system component, please refer to the referenced documentation and any other documentation available directly from the component manufacturer **before** beginning the installation process. This documentation is listed in Appendix A.

## Configurations

It is recommended to install the gateway at the top of the tower, although it can also be installed at the bottom as shown in the following figure. The selected options for powering and cabling from the required materials list will depend on the selected configuration. When the gateway is installed at the bottom of the tower, the RF coax is longer and two extra jumpers are required per RF antenna. When the gateway is installed at the top of the tower, a PoE injector is required between the UPS and gateway.

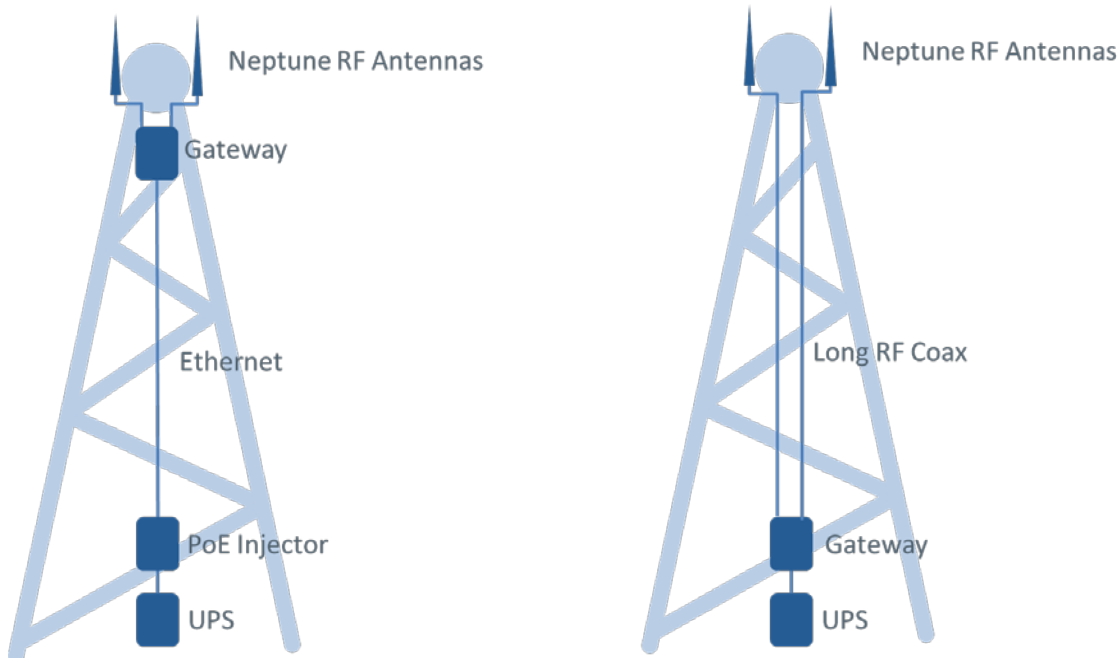


Figure 2 Gateway Placement

**Please note, power should not be applied to the gateway via PoE and DC simultaneously.**

The figure below illustrates the connections when using DC power or the PoE injector.

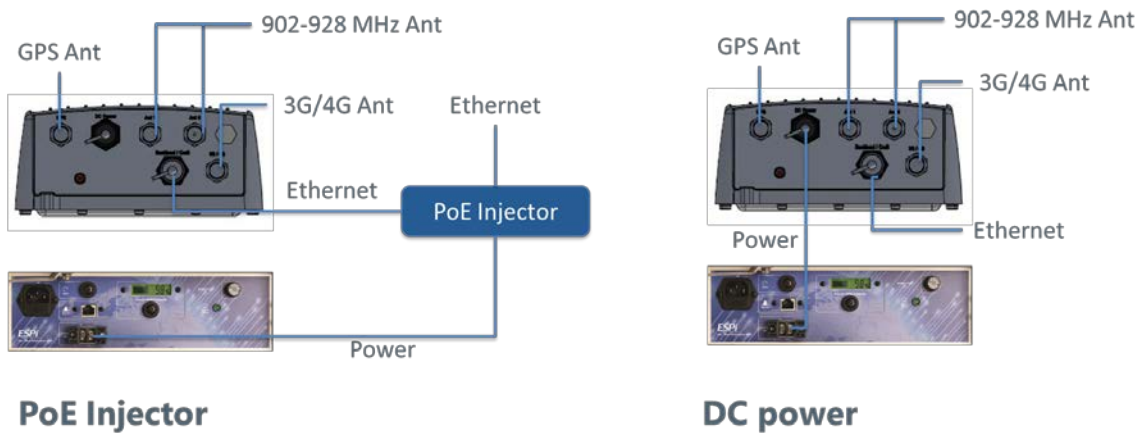


Figure 3 Powering Options

## Components

ALL ITEMS IN THIS TABLE ARE REQUIRED PER UNIT			
	PART NO.	DESCRIPTION	QTY.
UPS Kit (13878-000)	13800-001	UPS, 48V DC Output	1
	13823-001	Power Cable Gland	1
	13865-001	Can Wrench	1

THE ITEMS IN THIS TABLE ARE ONLY REQUIRED IF USING THE POWER OVER ETHERNET OPTION			
	PART NO.	DESCRIPTION	QTY.
Power Over Ethernet (PoE) Kit (13879-000)	13839-001	PoE, 48V DC Input	1
	13840-001	PoE Mounting Bracket	1
	13798-001	Ground Terminal Wire	1
	13867-001	12' Power Cable for PoE	1

ALL ITEMS IN THIS TABLE ARE REQUIRED PER UNIT			
	PART NO.	DESCRIPTION	QTY.
Accessories Kit (13877-000)	13146-100	ANTENNA, RF w/ BRACKETS, 902-928 MHz, Neptune RF	2
	13797-000	MOUNTING KIT, U-BOLTS	1
	13799-001	ANTENNA, CELLULAR 3G/4G LTE, OMNIDIRECTIONAL	1
	13090-001	COAX CABLE ASS'Y, LMR-400-UF	1

SELECT PREFERRED CABLE LENGTH FROM THIS TABLE (1 ROW SELECTION REQUIRED PER UNIT)			
LENGTH (FT.)	PART NO.	DESCRIPTION	QTY.
6	10046-112	LMR-400-UF JUMPER NM-NM 6FT	2
8	10046-113	LMR-400-UF JUMPER NM-NM 8FT	2
10	13090-001	COAX CABLE ASS'Y, LMR-400-UF 10FT	2
15	10046-114	LMR-400-UF JUMPER NM-NM 15FT	2
20	13090-002	COAX CABLE ASS'Y, LMR-400-UF 20FT	2
30	13090-003	COAX CABLE ASS'Y, LMR-400-UF 30FT	2
40	13090-004	COAX CABLE ASS'Y, LMR-400-UF 40FT	2
50	13090-006	COAX CABLE ASS'Y, LDF4-50 50FT	2
60	13090-007	COAX CABLE ASS'Y, LDF4-50 60FT	2
UNDER 100	8138-200	CONNECTOR, COAX N MALE	4
	10046-119	CABLE, COAX 1/2" DIA. (HELIAX)	A/R
UNDER 200	8138-190	CONNECTOR, COAX FEMALE	4
	10046-117	CABLE, COAX 6' JUMPER	4
	10046-118	CABLE, COAX, (HELIAX) (7/8" DIA.)	A/R

THESE OPTIONAL ACCESSORIES MAY BE NECESSARY IN SOME INSTANCES		
PART NO.	DESCRIPTION	QTY.
13793-000	EXTERNAL CELLULAR ANTENNA MOUNTING KIT, R900 IoT GATEWAY	1
13089-001	CLAMP, 1 3/4" TO 16" DIA. RANGE, SS	4
13086-001	STAND, BALLAST ROOF MOUNT	1
12955-001	ROOF MOUNT STAND RUBBER PAD	1
13866-001	10-METER POWER CORD	1
13818-001	N-CONNECTOR FOR GPS COAX ASSEMBLY	1
13841-001	ETHERNET SURGE PROTECTOR	1
ALL ITEMS IN THIS TABLE ARE INCLUDED WITH EACH R900 IoT GATEWAY		
PART NO.	DESCRIPTION	QTY.
13795-001	BRACKET, POLE AND WALL MOUNT w/ MTG. SCREWS, KONA	1
13796-001	POWER CORD, DC, R900 IoT GATEWAY	1
13798-001	GROUND TERMINAL WIRE, 2 HOLE LUG, 1/4" x 75" SPACING	1
13801-001	ETHERNET CONNECTOR, RJ-45, WATERPROOF	1

## Required Installation Equipment

Item	Description	Use
Toolkit	Medium, flat-head, Phillips, etc. screwdrivers Cordless electric drill with assorted bits Crescent wrench Standard socket wrench set Hammer Channel Locks T27 Torx Pin-Head Tool PPE as required	Various
Weatherizing kit	Scotch WK-101	Weatherizing cable connections
Corrosion inhibitor	NOCO Company's NCP-2 or Sanchem Inc.'s No-OxID Grease "A"	Apply to battery terminals
CAN wrench 3/8"	The <i>Jonard double end can socket wrench 3/8" by 7/16" hex</i> found <a href="#">here</a> is recommended.	The can wrench is required to open the UPS box.
UV stable cable ties	8" to 12 " (20 cm to 30 cm)	Securing short coax cable
Cable hangers	Various Sizes	Securing coaxial cable
Copper Wire	Copper wire with a minimum temperature rating of 75°C	AWG #4 or #6
Coax ground kits	Ground wire attachment to tower	Grounding
Coax hoisting grips	As recommended by coaxial cable manufacturer	Hoisting and/or support
Cable clips	Various sizes	Securing coax cable
Ethernet Cable	Cat 5e or better, outdoor rated, maximum 300ft (100 m)	PoE from injector to gateway
DC power cable	1 Pair 16AWG Tinned Copper, PVC-NYL Insulation E2	Belden P/N: 9487 recommended

Note: Ethernet cable and DC cable for the PoE injector are site-supplied and should adhere to the specifications provided in the required equipment table.

## Installing the UPS

Note: Before installing the UPS, a quick disconnect method for AC power should be installed near the UPS at the AC Input by a licensed electrician.



### Required Items

- UPS with AC and DC cables
- UPS battery
- Can wrench (thin-walled 7/16" socket wrench) (included)
- Site-supplied mounting hardware (see appendix)
- Phillips head screwdriver
- Wire strippers
- Adjustable wrench or socket set (for wall or strut mounting)

### Instructions

1. Mount the UPS to a pole, wall, or strut channel.



2. Ground UPS in accordance with local regulations/code using the included grounding wire.
3. Unlock the UPS door using the can (thin-walled) socket wrench.

4. Run the DC cable through the pre-punched 3/4" (19 mm) hole at the bottom of the UPS enclosure via the cable gland.



5. Strip the DC cable (coming from the PoE injector or gateway) and connect the DC Negative wire to the negative DC output terminal on the UPS and tighten the screw. Connect the stripped DC positive wire to the positive DC output terminal on the UPS and tighten the screw.



6. Place the battery inside the UPS box between the battery strap brackets and apply corrosion inhibitor to the battery terminals.
7. Secure the red UPS battery wire to the positive battery terminal and the black UPS battery wire to the negative battery terminal using the included bolts and washers.



## Installing the PoE Injector

### Required Items

- PoE injector with grounding cable and Ethernet cable covers
- Ethernet cable with 2x RJ45 connectors
- 2x adjustable wrench
- Drill (for wall or strut mounting)
- Zip ties
- Mounting hardware
- Site-supplied DC power cord

### Installation Instructions

The connections are shown in the following figure. See Microsemi PD-9501GzO user guide for detailed instructions on mounting, grounding and cabling.

1. Connect the ground wire to the chassis earth ground bolt and tighten top nut while holding bottom nut in place.



2. Mount the PoE injector to a pole or wall at a distance near the UPS allowing for proper maintenance loops of DC cable.
  - a. For wall mounting, use 3 screws to secure the PoE injector to the wall.

- b. If pole mounting, first secure the PoE injector to the base of the mount.



- i. For poles size 1" (25.4mm) to 3" (76.2mm) use the pole mount kit.



- ii. For pole mounting 3" (76.2mm) to 8" (203.2mm), use the stainless-steel clamp.

3. Strip the DC outer jacket of the DC power cord approximately 0.6" (15 mm).





4. Assemble the DC power cord with the DC power connector (included) for the PoE injector.



5. Connect the DC power cable to the DC input connector and tighten.



6. Run the Ethernet cable through the watertight connector before terminating it.



7. Terminate the Ethernet cable.
8. Plug the Ethernet cable into the PoE injector's DATA PWR OUT port.



9. Secure all cables with zip ties.
10. Assemble the Ethernet connector at the gateway unit, connecting the Ethernet cable to the Ethernet/PoE input port on the gateway.

## Installing the Ethernet Surge Protector

The Ethernet surge protector (SPD) is only required for use of Ethernet backhaul. Install the Ethernet SPD at the building's Ethernet cable entrance to protect the indoor networking equipment. The Ethernet SPD should be grounded to the building's earth ground to provide adequate protection.

### Required Items

- 1x surge protector
- 1x mounting hardware
- 1x ground wire
- 1x site-supplied Ethernet cable (see required equipment section)

### Procedure

1. Mount the surge protector at the building's Ethernet cable entrance
  - a. For wall mounting, use the included mounting bracket.
  - b. For pole mounting, remove the mounting bracket by removing the two screws that hold the bracket to the surge protector and use a site-supplied worm clamp to secure it to the pole.
2. Use the ground wire to ground the surge protector to the building's earth ground according to applicable electric codes.
3. Disassemble the watertight connectors on each side of the surge protector.
4. Run the Ethernet cable coming from the indoor networking equipment through the watertight connector to one side of the surge protector.
5. Run the Ethernet cable coming from the R900 IoT Gateway or PoE injector through the

watertight connector to the other side of the surge protector.

6. Terminate the Ethernet cables with RJ-45 connectors.

## Installing the Gateway

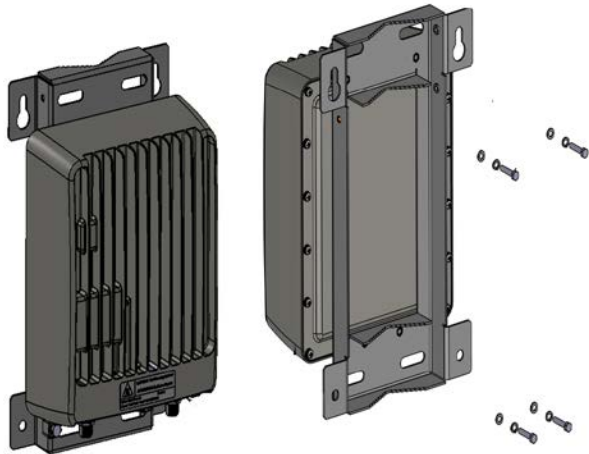
Before starting, it is recommended to review the mounting hardware table, the Kona Mega Gateway User Guide and the Kona Mega Quick Start Guide referenced in the appendix.

### Required Items

- Socket and/or adjustable wrench set
- Cordless drill (if mounting to wall)
- Gateway w/mounting bracket
- 4xM8 bolts if mounting to wall or strut channel
- 2x U-bolts (2" to 3 ½" pole mounting)
- 2x Pipe clamps (3" to 16" pole mounting)

### Wall or Strut mounting procedure:

1. Bolt the wall mounting bracket to the gateway module using the supplied four M6x1.0 - 14 mm bolts with flat and star lock washers.



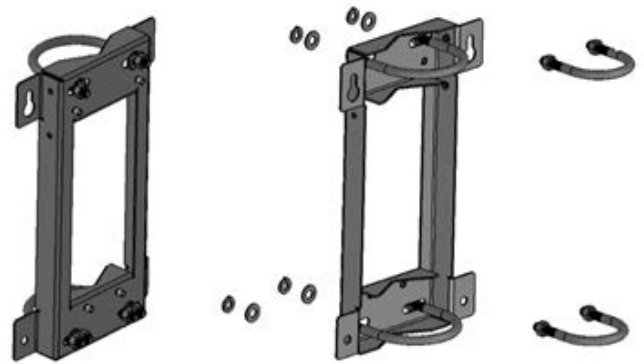
2. Install two site-supplied M8 bolts into the wall or strut at 5 ½" (139.7 mm) center spacing, leaving the bolt heads protruding with a 2mm gap from the wall surface.
3. Hang the Kona Mega Gateway with bracket from the two bolts by inserting the keyhole slots at the top of the bracket onto the two

bolts and tightening the bolts. Orient the gateway with connector bulkheads facing downward toward the earth.

4. Insert and tighten two additional site-supplied M8 bolts through the holes at the bottom of the bracket.

### Pole Mounting Procedure

1. Bolt the wall mounting bracket to the gateway module using the supplied bolts and washers.
2. Install the U-bolts for 2" to 3 ½" (50.8 to 88.9 mm) mounting poles or pipe clamps for 3" to 16" (76.2-406.4 mm) poles, through each of the upper and lower slotted clamp mounting



points.

### Powering

1. Always ground the unit first via the two-hole grounding lug.
2. For powering via PoE, assemble the Ethernet cable with the Ethernet cover as shown in the PoE injector installation section and plug it into the PoE input port on the gateway.
3. For power via DC cable, insert the CPC direct DC connector and tighten the cover.

## Installing the GPS Antenna

The diameter of the mounting pole supported is 1 5/8" to 2 3/8" (40-60 mm).

### Required Items

- 1x adjustable wrench
- 1x GPS w/ Accessories

### Installation Procedure

1. Open the packaging, take out the antenna, mounting kit, and the mounting pipe.
2. Insert the cable connector into the mounting pipe, connect the cable with the antenna connector and screw it down. Torque the connector to 15 in-lbs.
3. Connect the mounting pipe and the antenna and screw it down.
4. Attach the antenna to the clamp with the fastening accessories and lock it down.
5. Fix the clamp to the mounting pole with the u bolt and the fastening accessories.



6. Check that all bolts and nuts are tightened completely.
7. Secure the cable to the mounting pole with the cable strip.

8. Connect the coax to the GPS port on the gateway. Care should be taken not to damage the RF connectors while tightening. Care should be taken not to exceed the bend radius of the coax.
9. Weatherproof the RF connection using Scotch P/N: WK-101.



## Installing the RF (900 MHz) Antennas

### Required Items

- 2x RF Antennas
- 2x pairs of antenna mounting brackets
- RF cables and jumpers (see required parts)
- Adjustable wrench and/or socket wrench set
- Scotch WK-101 kit
- Torque wrench for the N-type connector

### Installation Steps

1. Attach the antenna to the mounting brackets.



2. Hoist the antenna to the mast location. Care should be taken not to damage the RF connectors while hoisting.
3. Mount the RF antennas on the antenna mast at a recommended horizontal separation of 12 to 20 feet (3.6 to 6 meters) using the mounting brackets. The minimum separation is 6 feet (1.8 meters).



4. Attach the coax cables to the RF antennas. Care should be taken not to damage the RF connectors while tightening. Care should also be taken not to exceed the bend radius of the coax.
5. Weatherize RF antenna connections using the scotch WK-101 kit.



6. Secure the coaxial cable every 2 feet (0.6 m) along the mast using UV-stable wire ties.



Note: If only one RF antenna is being utilized for the gateway, the 50 Ohm termination (PN 13818-001) should be connected to the ant 1 port and weatherized using scotch WK-101.

## Installing the Cellular Antenna

### Required Items

- Torque wrench for the N-Type Connector
- Scotch WK-101 kit
- External mounting kit (if needed)
- Socket wrench and/or adjustable wrench (for external mounting)
- Zip ties (for securing cable when mounting externally)

### To mount the cellular antenna directly on the gateway

1. Tighten the antenna base onto the Gateway's N-female port to 14 in-lbs.
2. Weatherize the connection according to the instructions in the weatherproofing kit.



### To mount the cellular antenna externally:

1. Use the mounting hardware from the mounting kit to secure the antenna in place (see the mounting guide in the appendix for more information on the included mounting hardware).
2. Connect the cable to the cellular antenna and tighten to 14 in-lbs. Care should be taken not to exceed the bend radius of the coax.
3. Connect the surge protector to the base of the gateway and tighten to 14 in-lbs.
4. Connect the cellular antenna cable to the surge protector and tighten to 14 in-lbs.
5. Weatherize the connections from previous steps using Scotch WK-101.
6. Secure the coax with the zip ties.

## Appendix A - Reference Documents List

<b>Document</b>	<b>Purpose</b>
<i>Kona Mega Quick Start Guide</i>	Gateway installation and maintenance
<i>Kona Mega Gateway User Guide</i>	Gateway installation and maintenance
<i>TEKTELIC Kona -PoE Powering</i>	Gateway and PoE reference
<i>Gateway Solar Power Guide</i>	Solar powering reference
<i>Gateway Battery Back-up Powering Guide</i>	Battery backup power reference
<i>Microsemi PD-9501GO-48VDC User Guide</i>	PoE injector installation and maintenance
<i>ESPI Mega Titan 48 UPS Technical Specifications</i>	UPS specifications and installation guide
<i>Microsemi PD-OUT/SP11 User Guide</i>	Surge protector user guide

## Appendix B - Mounting Hardware

Component	Installation Option	Recommendations	Comments
UPS	Wall Mount	4x 5/16" bolts. Adhere to national and local codes and regulations.	
UPS	Large Pole	2x site-supplied Neptune stainless steel bands (PN: 13089-001) or other ¾-inch wide stainless-steel straps for poles larger than 4" (102 mm)	Not Included
UPS	Strut	4x site-supplied 5/16" bolts. Adhere to national and local codes and regulations.	
PoE Injector	Small Pole	Use included pole mounting bracket for 1" to 3" (25.4 to 76.2 mm) pole	
PoE Injector	Large Pole	Use included pole mounting clamp for 3" to 8" (76.2 to 203.2 mm) pole	
Neptune RF Antennas	Small Pole	Use included mounting hardware for up to 2 3/8" (60 mm) pole	
Kona Mega Gateway	Wall	Use included hardware and site-supplied M8 bolts. Adhere to all local codes and regulations.	
Kona Mega Gateway	Strut	Use included hardware and site-supplied bolts. Adhere to all local codes and regulations.	
Kona Mega Gateway	Small Pole	Use included mounting kit 13797-000 for 2" to 3 1/2" (50.8 to 88.9 mm) pole	
Kona Mega Gateway	Large Pole	Use optional pipe clamp 13089-001 for 3" to 16" (76.2-406.4 mm) pole	
GPS Antenna	Small Pole	Use included hardware to mount to 1 5/8" to 2 3/8" (40-60 mm) pole.	See also datasheet
Cellular Antenna	Strut	Use strut clamp when mounting to 1-5/8" strut channel	Only if needed to improve RF signal
Cellular Antenna	Small Pole	Use included mounting hardware to mount to 1"- 2 1/2" (25.4 to 63.5 mm) pole.	Only if needed to improve RF signal



## Appendix C - Specifications



<b>TEKTELIC Gateway Specifications</b>	
Input power	(-48)VDC or PoE++ (803.3bt)
Power consumption	<40 Watts
Operational Temperature	(-40) to +55 °C
Operational Humidity	10% to 100% condensing
Weather Rating	IP67
Size	222.2x267.6x101 mm
Weight	5 Kg
Ethernet Interface	RJ-45
GPS Interface	N-Type
Cellular Interface	N-Type
RF Antenna Interface	N-Type
Safety	UL 60950-1
Environmental	ETSI EN 300 019-2-1, 300 019-2-2, ETSI EN 300 019-2-3, 300 019-2-4
Regulatory	FCC Part 15
Frequency Range	902-915 (Rx), 923-928 MHz (Tx)



<b>UPS Specifications</b>	
AC Input Voltage	90V-305Vac
AC Input Frequency	47/63 Hz
Input Plug Type	3 prong grounded
Input Cable Length	12'
DC output Power	150 Watts
DC Output Voltage	45-50V
DC output Connector	2 position screw terminal
Alarms	Battery On, Battery Low, Battery Fail, Battery Missing
Battery Type	Lead acid
Model	GS Battery PYL12V80TT
Capacity	80Ah
Physical Dimensions	16"H x 12"W x 8"D (in./approx)
Weight	75 lbs
Power Cable	12AWG
Alarms	Cat-5 connection
Mounting Options	Wall or pole mount
Operating Temperature	(-)40°C to +55°C ( -40°F to + 131°F)
Operating Humidity	0% to 95% non condensing
Safety Spec	EN-60950-1, EN-60950-2
Emissions Certification	FCC 47 CFR Part 15 Class B



<b>PoE Injector Specifications</b>	
Data rates	10/100/1000 Mbps
PoE Output Power	60W @ 50-57VDC
PoE pin assignment	4/5 (+), 7/8 (-), 1/2(-), 3/6(+)
Standards Compliance	IEEE 802.3af (PoE, PoH Type1) IEEE 802.3at (PoE+ including 2-event, PoH Type 2), RoHS Compliant, WEEE Compliant, CE
DC Input Power	36 to 60 VDC
Dimensions	214 mm x 150 mm x 70 mm (8.42 in. x 5.90 in. x 2.75 in)
Weight	1.65 lbs
Connectors	Shielded rugged RJ-45 with gasket
Operating Temperature	(-)40° to 122°F (-40 to 50°C) for 60W -40° to 131°F (-40 to 55°C) for 30W
Storage Temperature	-40° to 185°F (-40° to 85°C)
Operating and Storage Humidity	Maximum 95% non-condensing
Operating Altitude	Up to 6,560 ft. (2000 m)
Weather Rating	IP66, NEMA 4X

## Appendix D - RF Antenna Best Practices

The following section highlights best practices for installing the antennas:

- Mount antennas as high as possible, in a location which provides clear line-of-sight (LOS) to connecting devices. Note:
  - o Nearby objects, including the antenna's supporting structure can change the antenna pattern and cause areas of limited coverage
  - o Water towers often block the line of sight path between antenna and the connecting devices, reducing coverage in some directions.
  - o On traditional 3-leg and 4-leg towers, the standoff mount for the antenna must position the antenna at least 5 feet away from the tower to minimize coverage area problems
- The Neptune RF antennas should have a minimum horizontal separation of 6 feet (1.8 meters). Maximum performance is achieved by a horizontal separation of approximately 12-20 feet (3.6 to 6 meters).
- For sites with multiple antennas, mount the antennas one above the other if possible. Separate each antenna by 10 (3 meters) feet to minimize interference.
- Antenna sites that must share space with multiple transmitting systems may require additional equipment to protect the systems from interfering with each other. These sites could also require additional engineering to make them perform well
- Managed antenna sites can require additional equipment and might dictate how an installation is to be performed. Follow the site's requirements if the installation meets Neptune's minimum requirements.
- The antenna must be carefully hoisted up the tower so that it is not damaged.
- The feed line should not be attached to the antenna while it is being hoisted up the tower or other supporting structure. The feedline should be attached after the antenna is in place.
- The antenna connector must not be damaged during installation. A damaged connector can result in additional signal loss or complete failure of the RF connection.

## Appendix E - Feed Line Requirements

Consider the following feed line requirements:

- The antenna and feed line system installation must be certified by the installer after it is completed. The installer confirms that the installation is performing according to specifications.
- The cable must be secured at intervals per manufacturer specifications on vertical and horizontal runs. Horizontal runs may require a bridge to prevent damage.
- The feed line and connectors maximum loss must be less than 3dB.
- The feed line must be grounded at the top of the tower and at the base of the tower. Use Andrew bonding kits and procedures.
- The feed line should be bonded at regular intervals down the tower for towers over 150 feet (46 meters) tall. The general recommendation is that the feed line should be bonded by a minimum of 200 feet (61 meters). Site requirements and standard practices should dictate the configuration.
- A surge protector can be installed on the tower near the antenna to help protect the feed line, but it is optional.
- The cable should not exceed the bend radius. This helps prevent damage, which is not always visible on the exterior of the cable.

## Appendix F - Gateway LED States

LED State	Functional Description	State Condition
No LEDs	No power to gateway.	Until power is applied.
Flashing Green	No downlink packets have been transmitted by the gateway in the last 10 minutes. When GPS signal is unlocked from locked state for 24 hours.	Until the gateway starts transmitting packets. (downlink packets) Until GPS is locked again.
Solid Green	Gateway is operational with a packet forwarder running. LoRaWAN packet transmission and reception functions are operating normally.	It should be stable in this state.
Solid RED	Unit is in fault condition and requires service	Undesired stable state. Power cycle the gateway. If the condition persists, contact customer support.