



Haxiot LoRaWAN 8-Channel Gateway Module Datasheet Version 1.0



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1. Version History

Version	Date	Author	Description
0.21	7/5/2018	N. Kitson	Initial draft combining 900, 868, 470
0.3	11/5/18	N. Kitson	Updated 52-pin, 3D files
0.35	07/22/19	N. Kitson	Updated reference antenna specification
0.9	08/02/19	S. King	Created SPI version
1.0	12/17/19	N. Kitson	Certification details added

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2. Product Introduction

All Haxiot LoRaWAN 8-channel Gateway module is designed in the USA and manufactured in China under ISO9001. The Haxiot SPI Gateway module is designed to integrate to a host system such as a gateway that contains a CPU, Operating System and an RF connector to an external antenna. The Haxiot SPI gateway module can be used for indoor or outdoor gateways, with ingress protection provided by the gateway.

2.1. Features

- LoRaWAN 8-channel gateway
- SPI interface
- Edge Computing & Analytics¹
- Automatic Gateway profile configuration¹
- Software support for Linux on ARM and x86
- Android/ARM support available on special request
- GPS time pulse input
- Regional support for 902-928Mhz
- Haxiot Gateway Manager for Windows & Linux¹
- Remote Firmware upgrade¹
- EU1-64 LoRaWAN Gateway Auto-Address¹
- Remote Radio Reset¹
- Cloud based Shell Access¹
- AES-256 secure Cloud connectivity¹

Table 1: HXGW Part numbers

MPN	Description
HXGW470	Haxiot SPI 470Mhz LoRaWAN Gateway Module
HXGW900	Haxiot SPI 900Mhz LoRaWAN Gateway Module

¹ Provided by Haxiot X-ON Cloud service

2.2. Block Diagram

Figure 1 shows the circuit block diagram for the HXGW series SPI gateway module. The major functional components of the SPI gateway module have the following parts:

- Haxiot LoRaWAN 8-channel Gateway module
- Control and Signal interfaces
- Antenna connectors

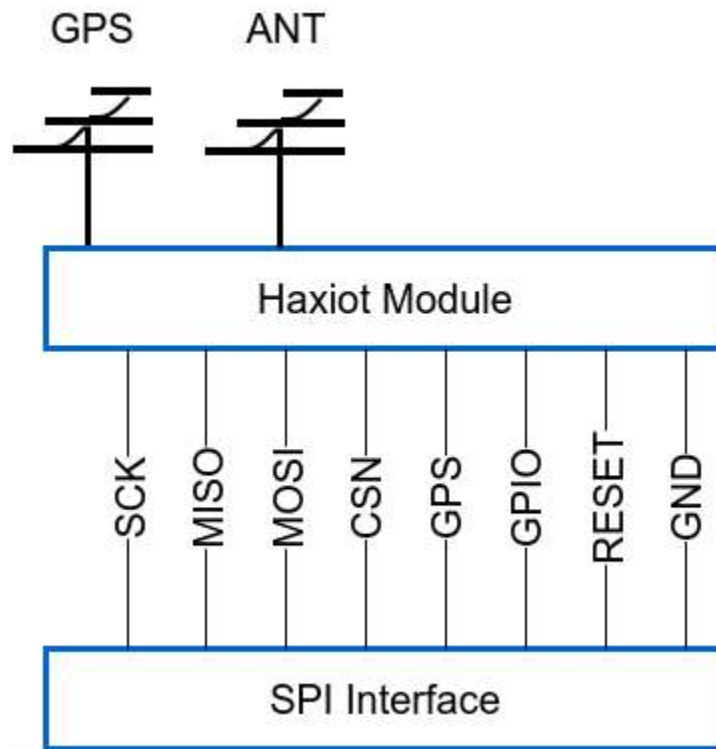


Figure 1 Circuit block diagram of the HXGWxxx SPI module

3. Specifications

3.1. Dimensions

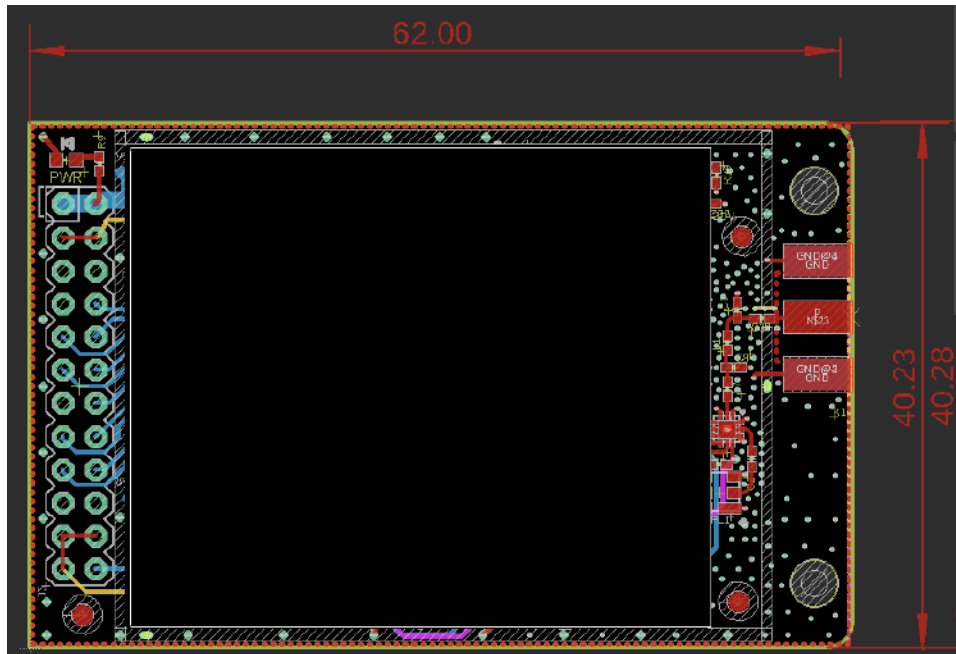


Figure 2: HXGW SPI card dimensions

The overall dimensions are 62 x 42mm. The card is supported at the 2x12 0.1" connector and requires 10mm x M3 posts to support the RF connector end. The HXGW SPI card requires 12mm of clearance above the PCB surface for the complete card and an additional 6mm clearance for the SMA edge mount connector.

The module contains a 50ohm SMA transceiver connector to a matching external dipole antenna that matches the required frequency band of the HXGW SPI module.

Recommended part for connecting the HXGWxxx SPI interface card to a PCB is Sullins Connector Solutions PPC122LFBN-RC. This connector is 8.5mm above the PCB. When combined with the 1.5mm 24-pin connector on the HXGWxxx SPI card this will ensure the card is parallel to the host PCB using 10mm M3 standoffs.

3.2. Host Interface

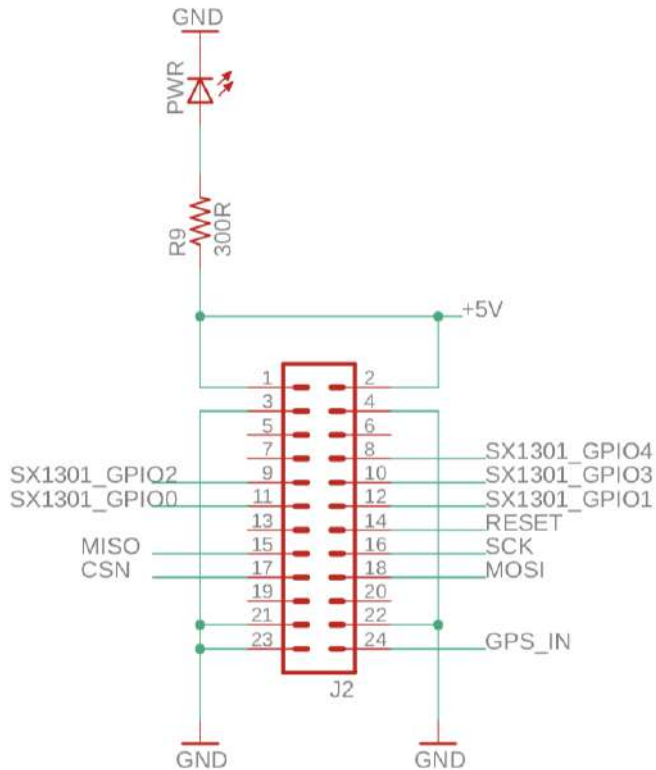
3.2.1. Header Pins

2×12-pin male header, 2.54mm pitch compliant to DIN 41612 Class C for 50 mating cycles.

3.2.2. Pin Assignment

Table 2: HXGW pinout

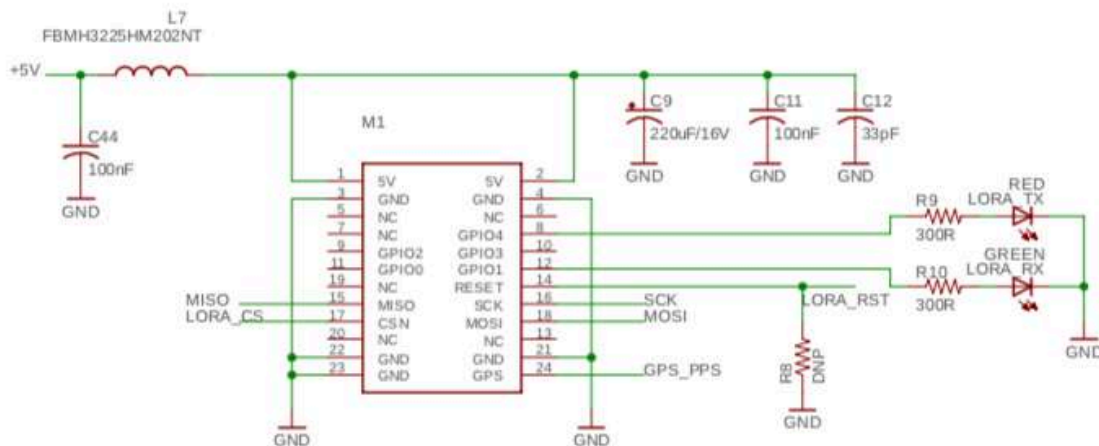
Pin	Name	Pin	Name
1	+5V VCC	13	NC
2	+5V VCC	14	Reset
3	Ground	15	MISO SPI interface
4	Ground	16	SCK SPI interface
5	NC	17	CSN SPI interface
6	NC	18	MOSI SPI interface
7	NC	19	NC
8	TX LED	20	NC
9	NC	21	Ground
10	NC	22	Ground
11	NC	23	Ground
12	RX LED	24	GPS PPS In (3.3V)



3.3. Reference Circuit

The HXGWxxx SPI series cards have internal power regulation. It is best practice to avoid introducing RF noise into the system to utilize the reference design below on the +5V input power supply and connection to ground. A ferrite bead such as FBMH3225HM202NT should be used on the +5V with a 100uF capacitor to ground. A series of 220uF, 100nF and 33pF capacitors to ground should be inserted as close as possible to the 2x10 pin connector to filter additional noise.

PCB layout for SPI traces should minimize trace length and avoid routing closely to power supplies or oscillators.



3.4. Radio Characteristics

The Haxiot SPI gateway module can support multiple LoRaWAN regions with 3 hardware variants with Software Defined Radio (SDR). The gateway module can provide up to 10 static receive channels and 1 dynamic transmit channel within the specified frequency synthesis ranges for each model.

3.4.1. Operating Frequencies

Model	Tx	Rx	Units
HXGW900	902-928	902-928	MHz
HXGW868	863-868	863-868	MHz
HXGW470	470-510	470-490	MHz

3.4.2. Receiver Specifications (HXGW900)

Parameter	Radio Configuration	Min	Typ	Max	Unit
Supply Current Rx	SF7, BW=125k		220	450	mA
	SF12 BW=125k		225	450	mA
RF Sensitivity	SF7, BW=125k		-125	-126	dBm
	SF12 BW=125k		-140	-142.5	dBm
Receive Frequency		902		928	MHz

Frequency Synthesis		-2	-	+2	kHz
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3.4.3. Transmitter Specifications (HXGW900)

Parameter	Radio Configuration	Min	Typ	Max	Unit
Supply Current Tx	SF7, BW=500k		489	~550	mA
	SF12 BW=500k		492	~550	mA
Tx Conducted Power	SF7, BW=500k	+7		+27	dBm
	SF12 BW=500k	+7		+27	dBm
Transmit Frequency		902		928	dBm

The HXGW900 should only be used with a +3dBi or less antenna gain when configured for maximum transmit power.

3.4.4. Receiver Specifications (HXGW868)

Parameter	Radio Configuration	Min	Typ	Max	Unit
Supply Current Rx	SF7, BW=125k		220		mA
	SF12 BW=125k		225		mA
RF Sensitivity	SF7, BW=125k		-125	-126	dBm
	SF12 BW=125k		-140	-142.5	dBm
Receive Frequency		863		870	MHz

3.4.5. Transmitter Specifications (HXGW868)

Parameter	Radio Configuration	Min	Typ	Max	Unit
Supply Current Tx	SF7, BW=500k		489		mA
	SF12 BW=500k		492		mA
Tx Conducted Power	SF7, BW=500k	+7	+14	+24	dBm
	SF12 BW=500k	+7	+14	+24	dBm
Transmit Frequency		863		868	MHz

The HXGW868 should only be used with a +3dBi or less antenna gain when configured for maximum power.

3.4.6. Receiver Specifications (HXGW470)

Parameter	Radio Configuration	Min	Typ	Max	Unit
Supply Current Rx	SF7, BW=125k		220		mA
	SF12 BW=125k		225		mA
RF Sensitivity	SF7, BW=125k			-127	dBm
	SF12 BW=125k			-143.5	dBm
Receive Frequency		470		490	MHz

3.4.7. Transmitter Specifications (HXGW470)

Parameter	Radio Configuration	Min	Typ	Max	Unit
Supply Current Tx	SF7, BW=500k		428		mA
	SF12 BW=500k		432		mA
Tx Conducted Power	SF7, BW=500k	+17		+21	dBm
	SF12 BW=500k	+17		+21	dBm
Transmit Frequency		470		510	MHz

The HXGW470 should only be used with a +3dBi or less antenna gain to be compliant with China radio frequency regulations.

3.4.8. Antenna Specifications

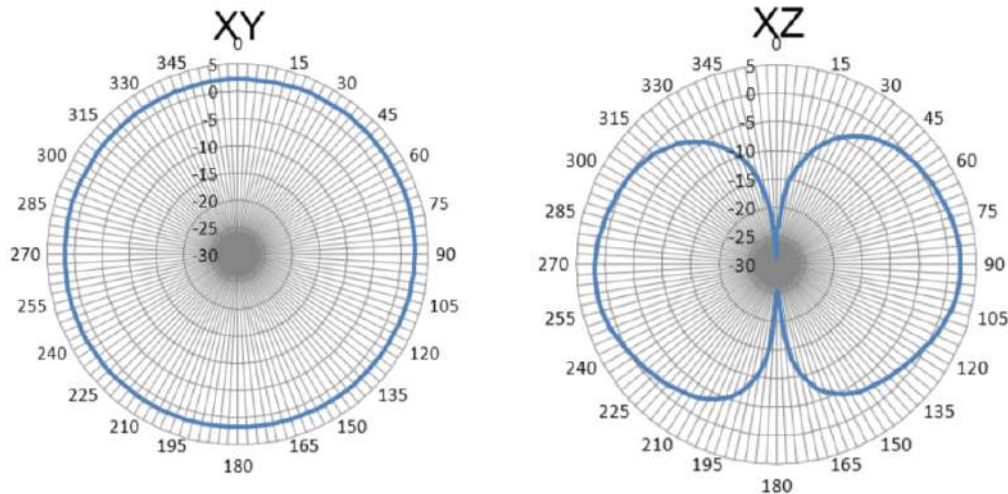
The Haxiot LoRaWAN 8-channel gateway module are modular adapter radio frequency transceivers. As part of modular certification, each model will be tested and certified with pre-defined antennas. OEMs that utilize the module should use the same pre-defined antennas or a new regulatory certification will be required.

HXGW900 gateway module is tested and certified with the Linx ANT-916-CW-HWR-ccc antenna.

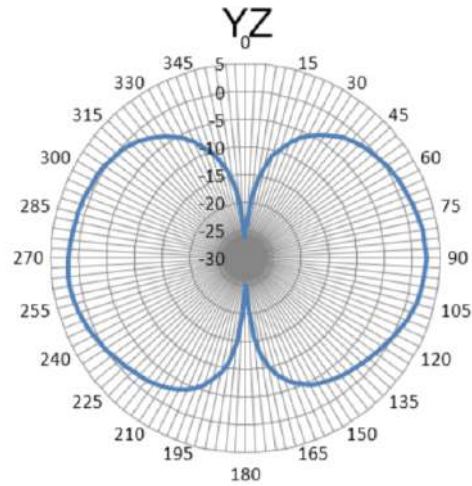
Electrical Specifications

- Center Frequency: 916MHz
- Recom. Freq. Range: 900–930MHz
- Bandwidth: 30MHz
- Wavelength: 1/2-wave
- VSWR: ≤ 2.0 typical
- Peak Gain: 1.2dBi
- Impedance: 50-ohms
- Connection: RP-SMA or SMA
- Oper. Temp. Range: -30°C to +80°C

Figure 3 ANT-916-CW-HWR-ccc specifications



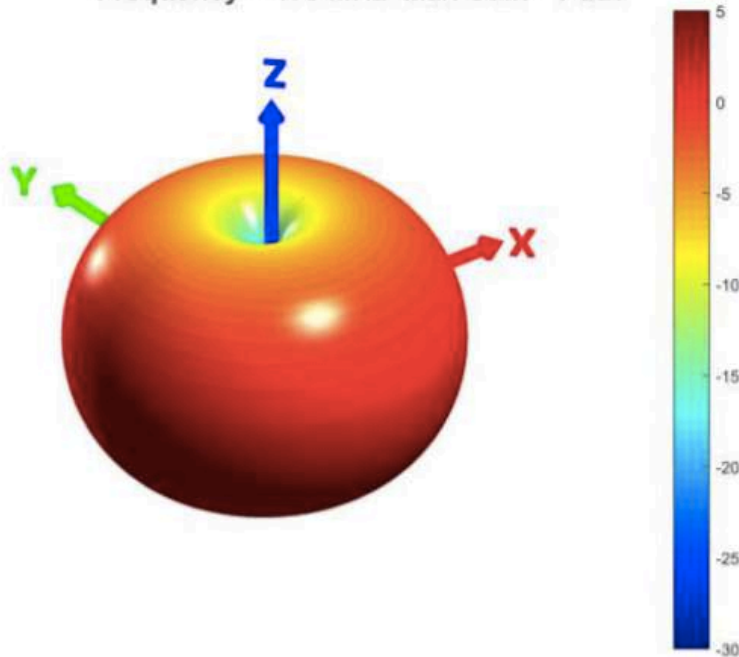
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The HXGW868M gateway module is tested and certified using the Airgain ET868NJMR.

The HXGW470M gateway module is tested against the Airgain ET470NPMRW.

Frequency = 470 MHz Max Gain= 1 dBi



Haxiot LoRaWAN 8-channel Gateway Module Data Sheet

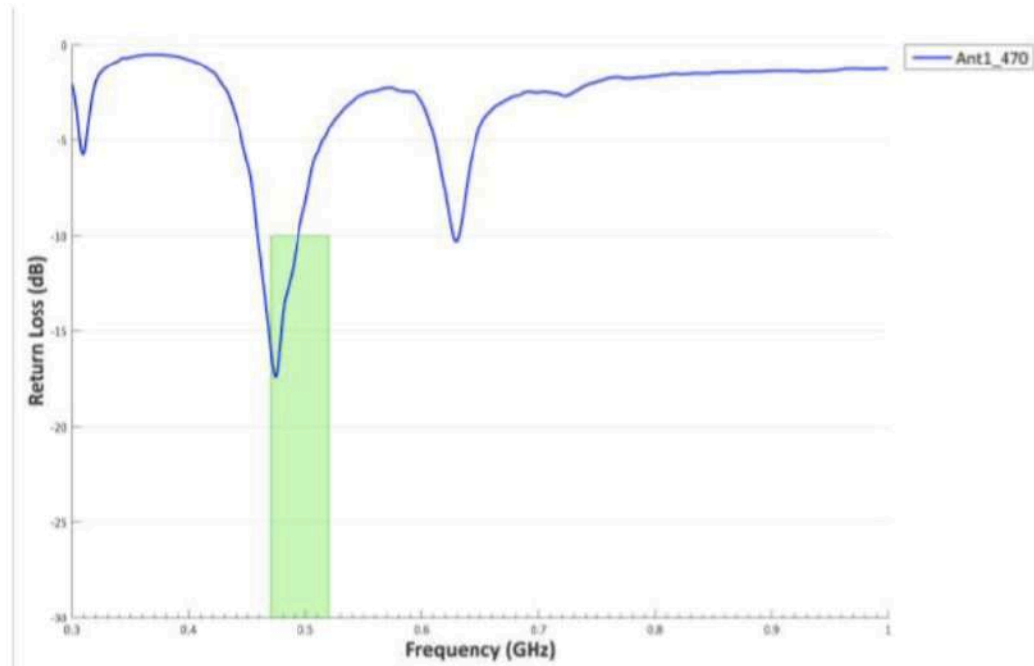
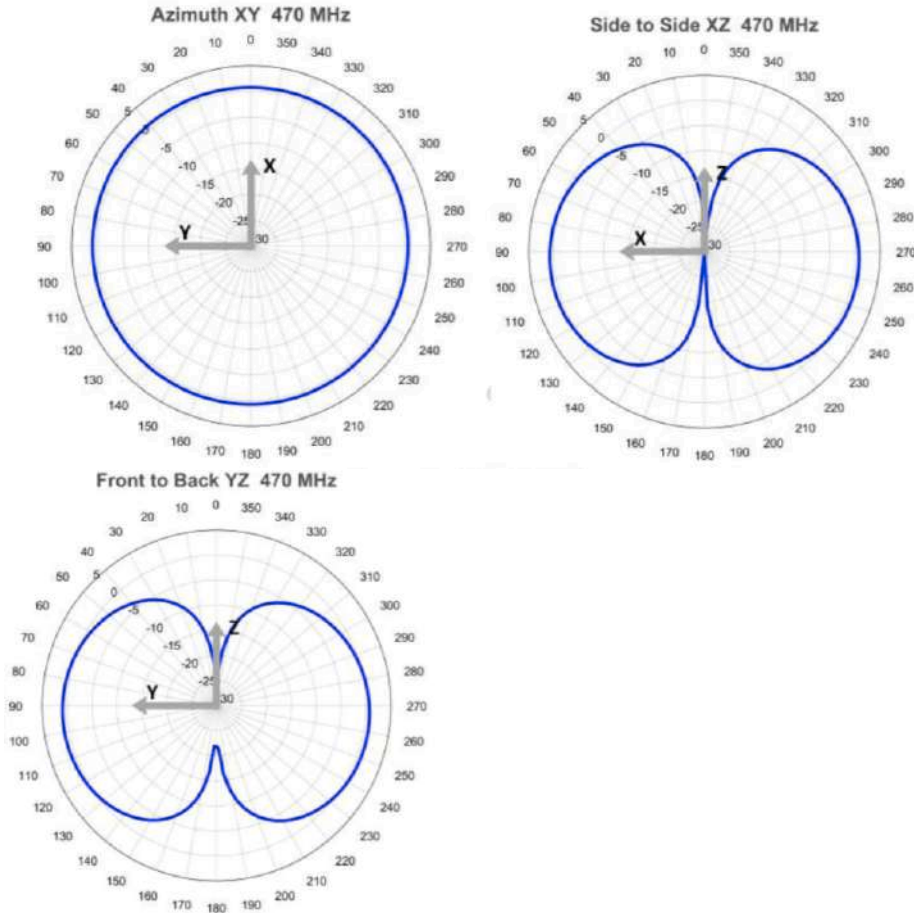


Figure 4 Airgain 470Mhz antenna return loss

3.5. GPS Interface (Optional)

The Haxiot HXGWxxx series modules support an external GPS PPS input interface to deliver higher timing accuracy of downlink packets using the LoRaWAN protocol. The 2x20 interface pin 24 is used for internal cross-connect of the GPS PPS to the Haxiot HXGW input. This interface requires a 1pps time pulse input from a separate GPS source. If a PPS input is not present, the downlink timing accuracy will have higher drift but still be within the LoRaWAN standard for Class A and C across the operating temperature range.

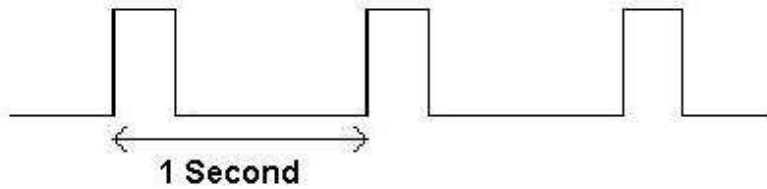


Figure 5 GPS PPS pulse waveform

3.6. Electrical Characteristics

The LoRa radio front end of the Haxiot SPI card is half duplex and supports either receive (Rx) or transmit (Tx) in TDD mode. System power consumption changes between idle, receive and transmit. In typical operation, the Haxiot SPI LoRaWAN Gateway card is in the receive state. Idle is used only when the host-based LoRaWAN software is not operational. Transmit mode is used only during packet send operations.

Parameter	Min	Typ	Max	Unit
Idle		8		mA
Rx Mode (4/8 channels)	300		560	mA
Rx + Tx Mode (4/8 channels)		550		mA
Module startup (<1500ms)	0	950	1200	mA

Note: The transmitter should always be operated at or under a 5% transmit duty cycle in normal operation to manage thermal output. The transmitter **MUST** also be operated at or under the Duty Cycle mandated for each regulatory region where the product is used.

3.7. Operating Conditions

Parameter	Min	Typ	Max	Unit
Operating Temperature	-25	+25	+85	°C
Supply Voltage	+3.5	+5.0	+5.5	V
Output RF Level	+7	-	+27	dBm
Transmit Duty Cycle	0	-	5	%
Receive Duty Cycle	-	-	100	%

3.8. Absolute Maximum ratings

Parameter	Min	Typ	Max	Unit
Storage Temperature	-40	+25	+90	°C
Supply Voltage	+0.5	+5.0	+6.0	V
Input RF Level			-10	dBm
Output RF Level	+7	-	+27	dBm
Transmit Duty Cycle			100	%

4. Operational Instructions

4.1. System Reset

The HXGW-series card supports a hardware reset function. The module can be reset from the SPI Interface by asserting the RST pin to High. The RST pin uses 3.3V logic. The radio software cannot operate with the RST pin is in the High state, so this can also be used for Radio Disable function.

4.2. WAN LED

The system supports a standard WWAN_LED signal for Rx Message and Tx Message. The Tx LED output is on pin 8 and the Rx LED output is on pin 12. These outputs can be connected to LED or digital inputs to signal message activity of the HXGW gateway module.

5. Software Support

The Haxiot LoRaWAN 8-channel gateway module is provided with support for the Haxiot X-ON Cloud network server with the Haxiot Gateway Manager software. Haxiot Gateway Manager provides an Edge Computing feature set for high performance gateways to enable data management, data transform and external API support on the gateway.

Support for the Generic Semtech Packet forwarder protocol for 3rd party network servers is provided as an option. The Generic Semtech Packet Forwarder protocol has no support for IoT Edge gateway capabilities.

Haxiot Gateway Manager software installed on the host Windows or Linux Operating System provides a complete gateway management, provisioning and security solution for LoRaWAN that works in conjunction with the Haxiot Cloud Network Server. Haxiot Gateway Manager provides the IoT Edge functionality for edge analytics.

NOTE: The majority of Windows 10 systems are x86 based which require additional hardware support for SPI or GPIO interfaces.

6. Regulatory

This equipment complies with FCC and IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This device complies with part 15 of the FCC rules and RSS-247 of Industry Canada. 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.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This Class B digital apparatus complies with Canadian ICES-003.

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

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help
- This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

Instructions to the OEM/Integrator:

This module has been granted modular approval for mobile applications. OEM integrators for host products may use the module in their final products without additional FCC/ISED (Innovation, Science and Economic Development Canada) certification if they meet the following conditions. Otherwise, Additional FCC/IC approvals must be obtained.

- The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: 2ANQY-HXGW900". Additionally, the following statement should be included on the label and in the final product's user manual:
"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 interferences, and (2) this device must accept any interference received, including interference that may cause undesired operation."
- The user's manual for the host product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC / IC RF exposure guidelines.
- The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.
- This Module is full modular approval, it is limited to OEM installation ONLY.
- The module is limited to installation in mobile application.
- A separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and difference antenna configurations.
- The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.
- The Grantee will provide guidance to the Host Manufacturer for compliance with the Part 15B requirements if requested.

IC Module and host product labelling requirements

The ISED certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the ISED certification number for the module, preceded by the word "contains" or similar wording expressing the same meaning, as follows:
Contains IC: 23185-HXGW900