LoRaWAN Gateway Module Datasheet

Gateway module series

GL5311 LoRaWAN Gateway Module Datasheet

Version： V1.0.0 Data：2021-11-15

Version	Time	Description	Remark
V1.0.0	2021-11-15	Preliminary version	Ming

Document Information

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Table of Contents

1. Description

1.1 Overview

GL5311 is a LoRa gateway module with industrial standard mini PCI express form factor based on SX1303 chipset. This mPCIe module can be used in any embedded platform offering a free mPCIe slot with SPI connectivity and capable of providing enough power for the module, enables low-power wide area communication capabilities to your new gateway design or existing industrial routers/computer.

GL5311 is a complete and cost efficient LoRa gateway solution offering up to eight(8) programmable parallel demodulation paths, an 8 x 8 channel LoRa packet detectors, 8 x SF5-SF12 LoRa demodulators and 8 x SF5-SF10 LoRa demodulators. It is capable of detecting uninterrupted combination of packets at 8 different spreading factors and 8 channels with continuous demodulation of up to 16 packets. It targets Internet-of-Things (IoT) applications, covering up to 500 nodes per square kilometer in an environment with moderate interference.

NO.	Model	Description	Remark
1	GL5311-U	923.3~927.5 MHz, is mainly designed for operation in America south-east Asia.	

Table 1.1 Product model list

1.2 Product features

- ✓ **Multichannel:** eight(8) programmable parallel demodulation paths.
- ✓ **SPI Interface:** The SPI interface gives access to the configuration register of SX1303 via a synchronous full-duplex protocol.
- ✓ Compact min-PCI express form factor TYP. 50.95*30*10.5mm (W*L*H)
- ✓ Environmentally friendly RoHS compliant
- ✓ Voltage of mini PCI-e is 3.3V
- ✓ Tx power up to 15.83dBm, Rx sensitivity down to -120dBm@SF12, BW500kHz

2. Specifications

2.1 General specifications

Parameters	Description
Modulation type	ISM Band LoRa®
LoRa chipset	SX1303
Multi-channel	Eight (8) uplink, one (1) down link
Package	Mini PCI express

Host interface	SPI
Frequency	923.3~927.5MHz
Receiving sensitivity	-120dBm@SF11, BW500kHz
Tx power	+15.83dBm
Supply voltage	+3.3V
Power consumption	Tx (Max)<415mA,Rx <40mA, standby 7.5mA
Operating temperature	-40～+85℃ (industrial grade)
Operating humidity	10%～90%, no-condensing
Dimensions	TYP. 50.95*30*10.5mm (W*L*H)
ESD (Human Body Model)	JEDEC JS-001 Standard ±1kV, Class 2

Table2.1 General specification

2.2 Electric specifications

ESD Notice: GL5311 is a high-performance radio frequency device. It satisfies:

- ✓ Class 2 of the JEDEC standard JESD22-A114 (Human Body Model) on all pins.
- ✓ Class III of the JEDEC standard JESD22-C101 (Charged Device Model) on all pins

It should thus be handled with all the necessary ESD precautions to avoid any permanent damage.

The limiting values given are in accordance with the Absolute Maximum Rating System. Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only, and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to these limits for extended periods may affect device reliability.

2.3 Absolute maximum rating

Symbol	Description	Condition	Min	Max.	Unit
3.3Vaux	Module supply voltage	Input DC voltage at 3.3Vaux pins	–0.3	3.6	V
RESET	MPCI reset input	Input DC voltage at RESET input pin	–0.3	3.6	V
SPI	SPI interface	Input DC voltage at SPI interface pin	–0.3	3.6	V
GPS_PPS	GPS 1 pps input	Input DC voltage at GPS_PPS input pin	–0.3	3.6	V
I2C	Temperature detection	Input DC voltage at I2C input pin	–0.3	3.6	V
Rho_ANT	Antenna ruggedness	Output RF load mismatch ruggedness at ANT1		10:1	VSWR
Tstg	Storage Temperature		–40	85	°C

Table2.3 absolute maximum rating

Stressing the device beyond the “Absolute Maximum Ratings” may cause permanent damage. The product is not protected against over-voltage or reversed voltages. If necessary, voltage spikes

exceeding the power supply voltage specification, given in table above, must be limited to values within the specified boundaries by using appropriate protection diodes.

2.4 Operating conditions

All specifications are at an ambient temperature of 25° C. Extreme operating temperatures can significantly impact specification values. Applications operating near the temperature limits should be tested to ensure the specification.

Parameter	Min.	Typ	Max.	Unit	Remarks
Normal operating temperature	-40	+25	+85	°C	Normal operating temperature range

Table2.4 operating temperature range

Operating beyond the specified operating conditions can affect device reliability.

2.5 Operating conditions

2.5.1 Power Supply Range

The table below lists the power supply range.Input voltage at 3.3Vaux must be above the normal operating range minimum limit to switch-on the module.

Symbol	Parameter	Min.	Typical	Max.	Unit
3.3V	Module supply operating input voltage	3.00	3.30	3.60	V

Table3.5.1 Operating power supply range

Operating beyond the specified operating conditions can affect device reliability.

2.5.2 Power Consumption

Mode	Condition	Min.	Typical	Max.
Active-Mode(TX)	The power of TX channel is 15.83dBm and 3.3V supply.	500mA	520mA	550mA
Active-Mode(RX)	TX disabled and RX enabled.	70mA	85mA	105mA

Table2.5.2 Working current

2.6 RF Characteristics

The following table gives typically sensitivity level of the GL5311 .

Signal Bandwidth/[KHz]	Spreading Factor	Sensitivity/[dBm]
125	SF12	-139
125	SF10	-134
125	SF7	-125
125	SF5	-121

GFSK_50	50 kbps, GFSK modulation	-111
250	SF9	-124
500	SF9	-120

Table2.6 RF characteristics

2.7 Electrical Requirements

Stressing the device above one or more of the ratings listed in the Absolute Maximum Rating section may cause permanent damage. These are stress ratings only. Operating the module at these or at any conditions other than those specified in the Operating Conditions sections of the specification should be avoided. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.
The operating condition range define those limit within which the functionality of the device is guaranteed.Where application information is given, it is advisory only and does not form part of the specification.

3. Typical Hardware Connections

3.1 Physical dimensions

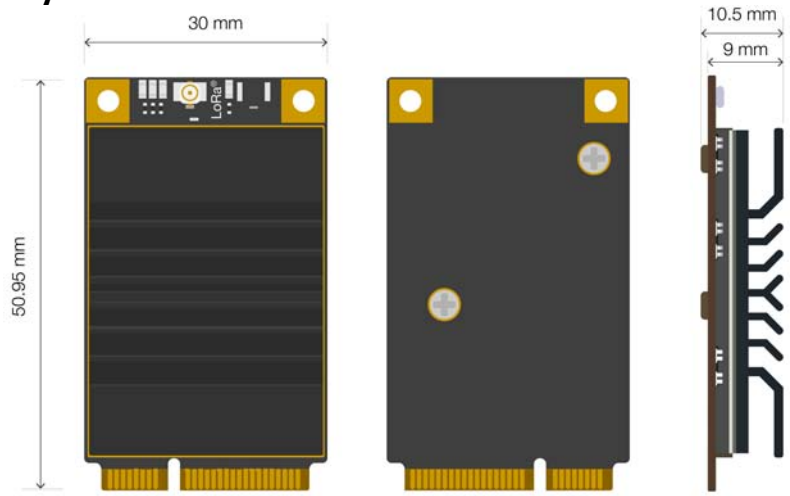

Figure 3.1 **dimensions**

Item	Length	Width	Thickness	Unit	Remark
Dimensions	50.95	30	10.5	mm	

Table4.1 dimensions

3.2 Interfaces

Reference circuit design shows the typical hardware connections for the module. Interfacing to the module requires connecting to the signals provided on the GL5311 mPCIe connector as listed in pin description. Specific interface connections are discussed in this chapter.

3.2.1 SPI Interface

SPI interface is provided on the Host_SCK, Host _MISO, Host _MOSI, Host _CSN pins of the system connector. The

SPI interface gives access to the configuration register of SX1303 via a synchronous full-duplex protocol. Only the slave side is implemented.

3.2.2 Power pins

GL5311 series modules has multiple power and ground pins available on the mPCIe connector.
It is recommended that all power and ground pins be used when connecting to the module.

3.2.3 RF connection

The modules have one RF interfaces over standard UFL connector (Hirose U. FL-R- SMT) with the characteristic impedance of 50Ω.

3.2.4 RESET pin

GL5311 series modules card includes the RESET active-high input signal to reset the radio operations as specified by the SX1303 Specification.

3.2.5 GPS_PPS

GL5311 card includes the GPS_PPS input for received packets time-stamped.

3.2.6 I2C Interface

GL5311 integrates STTS series temperature sensor, which is connected by I2C interface. The PIN on the golden finger provides I2C connection, allowing I2C to directly connect to the sensor, and obtain the temperature information detected by the current module sensor

4. Reliability Test and Approves

Tests for product family qualifications are according to ISO 16750 "Road vehicles – Environmental conditions and testing for electrical and electronic equipment", and appropriate standards.

Products marked with this lead-free symbol on the product label comply with the "Directive 2002/95/EC and Directive 2011/65/EU of the European Parliament and the Council on the Restriction of Use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS). All Naviecare GL5311 modules are RoHS compliant.

FCC Caution:

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

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.

IMPORTANT NOTE:

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.

FCC Radiation Exposure Statement:
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment .This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.

OEM/Integrators Installation Manual

List of applicable FCC rules This module has been tested and found to comply with part 15.247 requirements for Modular Approval.

Summarize the specific operational use conditions This module can be applied in household electrical appliances as well as TV and IP camera. The input voltage to the module should be nominally 3.0 - 3.6 VDC, typical value 3.3VDC and the ambient temperature of the module
should not exceed 85℃.

Limited module procedures
N/A

Trace antenna designs
N/A

Antennas
The module of GL5311-U has one Antenna port and the antenna gain is 1.0dBi.

Label and compliance information When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re - moved. If not, a second label must be placed
on the outside of the final device that contains the following text: Contains Transmitter Module
FCC ID: 2A3A5-GL5311, the FCC ID can be used only when all FCC ID compliance requirements are met.

Information on test modes and additional testing requirements

a) The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to retest all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing

additional emissions).

b) The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure).
This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand‑alone configuration. It is important to note that host product manufacturers should not assume that because
the modular transmitter is certified that they do not have any responsibility for final product compliance.

c) If the investigation indicates a compliance concern the host product manufacturer is obligated tomitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as wellas to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference.
The operator of the host product will be obligated to stop operating the device until the interference
have been corrected .

Additional testing, Part 15 Subpart B disclaimer

The final host / module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part15 digital device. The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369. For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation. When testing the host product, all the transmitters must be operating. The transmitters can be enabled by using publicly available drivers and turned on, so the transmitters are active. In certain conditions it might beappropriate to use a technology-specific call box (test set) where accessory devices or drivers are not available. When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 and ANSI C63.26 for further general testing details.

5. Package

Module	Package			Article number
	Form	QTY	Size	
GL5311	Trays	As required	As required	Undetermined

Table5.1 package

6. Contact US

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