RG-1008M LoRa Gateway Module

User Manual

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1 Functional description

The RG-1008M is a LoRaWAN module card with mini PCIe form factor based on SX1301, which enables an easy integration into an existing Gateway router and other network equipment.

The card enables LoRaWAN connectivity for any embedded platform that has mini-PCIe slot with USB interface.

1.1 Product Specification

Category		Specification	
Picture		 	LoRaWAN Gateway module with Mini PCI-e connector Dim: 50.95mm x 30mm
CPU	Main Chip	NXP i.MX6ULL	
Memory	Main Chip	512MB DDR3L / 4GB eMMC	
LoRa	Frequencies	902-928MHz	
	Spreading Factor	7 - 12	
	Topology	Star network	
	Transmit Power	Up to +25dBm: actual o/p power will follow the regulation requirement	
	Rx Sensitivity	Up to -139.5dBm at SF = 12 / 125KHz	
	RF Data Rate	21.875 kbps at SF7 BW500KHz mode	
Interfaces	RF Connector	IPEX	
	Mini-PCIe for Backhaul	USB signal line in Mini-PCIe connector	
Hardware	Voltage	3.3V	
	Operating Temp	-40°C to +80 °C	
	Storage Temp	-40°C to +85°C	
	Humidity Range	5% to 95% (Non-condensing)	
Software	LoRaWAN	Packet forwarder, Network Server, Application Server	
	MQTT DataAgent	Uplink data retrieval, Downlink data dispatch, Node Status indication	
	RESTFul APIs	Gateway configuration get/set, Node add/delete/modify	
	OS Compatibility	Yocto (Linux kernel 4.1.15), mBed OS 5.4.3	

2 Interface

2.1 Pin definition with mini-PCIE

No	Mini PCIEx PIN Rev.2.0	RG-1008M PIN	Power	I/O	Description	Remarks
1	WAKE#	NC		N/A		Internally not connected
2	3.3Vaux	3.3Vaux	3.3Vaux	N/A	Supply input	Connect to 3.3V
3	COEX1	NC		N/A		Internally not connected
4	GND	GND	GND	N/A	Ground	Connect to Ground
5	COEX2	NC		N/A		Internally not connected
6	1.5V	NC		N/A		Internally not connected
7	CLKREQ#	NC		N/A		Internally not connected
8	UIM_PWR	NC		N/A		Internally not connected
9	GND	GND	GND	N/A	Ground	Connect to ground
10	UIM_DATA	NC		N/A		Internally not connected
11	REFCLK-	NC		N/A		Internally not connected
12	UIM_CLK	NC		N/A		Internally not connected
13	REFCLK+	NC		N/A		Internally not connected
14	UIM_RESET	NC		N/A		Internally not connected
15	GND	GND	GND	N/A	Ground	Connect to ground
16	UIM_SPU	NC		N/A		Internally not connected
17	UIM_IC_DM	NC		N/A		Internal 10K ohm pull-up
18	GND	GND	GND	N/A	Ground	Connect to ground
19	N/A	N/A		N/A		Internally not connected
20	W_DISABLE1#	N/A		I/O		Reserved
21	GND	GND	GND	N/A	Ground	Connect to ground
22	PERST#	RESET		I	Reset input	Active low for CPU
23	PERn0	NC		N/A		Internally not connected
24	3.3Vaux	3.3Vaux	3.3Vaux	I	Supply input	Connect to 3.3V
25	PERp0	NC		N/A		Internally not connected
26	GND	GND	GND	N/A	Ground	Connect to ground
27	GND	GND	GND	N/A		Connect to ground
28	1.5V	NC		N/A		Internally not connected
29	GND	GND	GND	N/A	Ground	Connect to ground
30	SMB_CLK	UART_TX		O	UART transmit data	
31	PETn0	NC		N/A		Internally not connected
32	SMB_DATA	UART_RX		I	UART receive data	
33	PETp0	NC		N/A		Internally not connected
34	GND	GND	GND	N/A	Ground	Connect to ground
35	GND	GND	GND	N/A	Ground	Connect to ground
36	USB_D-	USB_D-	USB	I/O	USB Data Line D-	
37	GND	GND	GND	N/A	Ground	Connect to ground
38	USB_D+	USB_D+	USB	I/O	USB Data Line D+	
39	3.3Vaux	3.3Vaux	3.3Vaux	I	Supply input	Connect to 3.3V
40	GND	GND	GND	N/A	Ground	Connect to ground

41	3.3Vaux	3.3Vaux	3.3Vaux	I	Supply input	Connectto3.3V
42	LED_WWAN#	NC		N/A		Internally not connected
43	GND	GND	GND	N/A	Ground	Connect to ground
44	LED_WLAN#	NC		N/A		Internally not connected
45	Reserved	NC		I/O		
46	LED_WPAN#	NC		N/A		Internally not connected
47	Reserved	NC		I/O		
48	1.5V	NC		N/A		Internally not connected
49	Reserved	NC		I/O		
50	GND	GND	GND	N/A	Ground	Connect to ground
51	W_DISABLE2#	NC		I/O		
52	3.3Vaux	3.3Vaux	3.3Vaux	I	Supply input	Connect to 3.3V

2.2 Module supply input

RG-1008M card must be supplied through the 3.3Vaux pins by a DC power supply. The voltage must be stable, because during this operation the current drawn from 3.3Vaux can vary significantly, based on the power consumption profile of the SX1301 chip (see SX1301 DS).

2.3 Antenna RF interfaces

The modules have one RF interfaces over a standard MHF connector with a characteristic impedance of 50Ω. The RF port (CN2) supports both Tx and Rx, providing the antenna interface.

2.4 USB interface

It includes a high-speed USB 2.0 compliant interface with maximum 480 Mb/s data rate, representing the interface for any communication with an external host application processor. The module itself acts as a USB device and can be connected to any USB host equipped with compatible drivers.

2.5 Reset

The card includes the RESET active-low input signal to reset the CPU.

3 Operating Conditions

3.1 Operating temperature range

Parameter	Min.	Typ.	Max.	Unit	Remark
operating temperature	–40	+25	+80	°C	Normal operating temperature

					range

3.2 Supply power

Symbol	Parameter	Min.	Typ.	Max.	Unit
3.3Vaux	Module supply operating input voltage	3.125	+3.3	+3.475	V

3.3 LoRa RF characteristics

The following table gives typically sensitivity level of the RG-1008M card

Sensitivity with 125 kHz Mode

SF	Data rate (bit/sec)	Sensitivity (dBm)
7	5469	-126.5
8	3125	-129.0
9	1758	-131.5
10	977	-134.0
11	537	-136.5
12	293	-139.5

Sensitivity with 250 kHz Mode

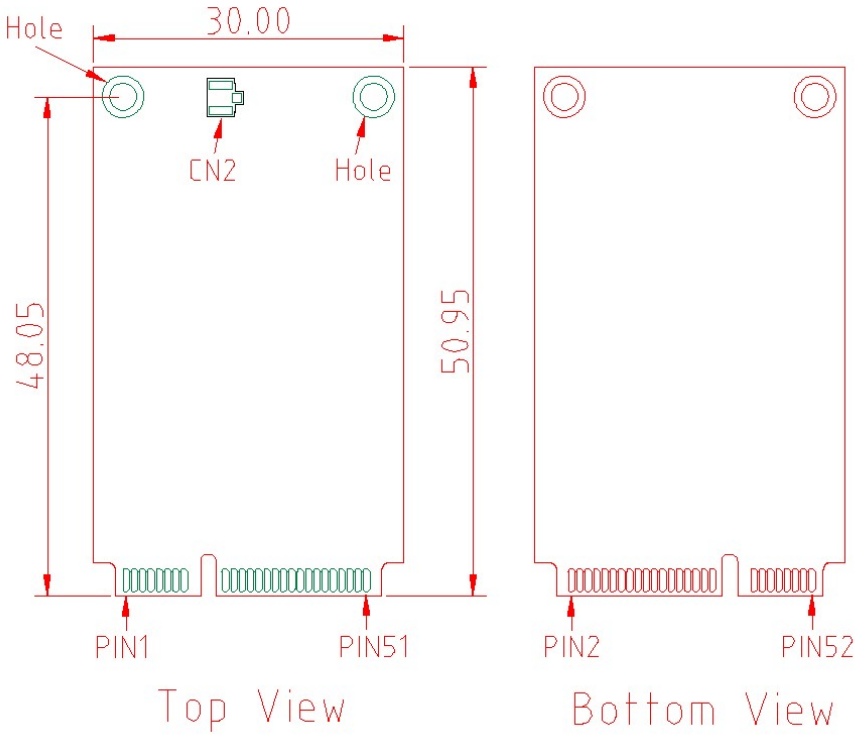
SF	Data rate (bit/sec)	Sensitivity (dBm)
7	10938	-123.5
8	6250	-126.0
9	3516	-128.5
10	1953	-131.0
11	1074	-133.5
12	586	-136.5

Sensitivity with 500 kHz Mode

SF	Data rate (bit/sec)	Sensitivity (dBm)
7	21875	-120.5
8	12500	-123.0
9	7031	-125.5
10	3906	-128.0
11	2148	-130.5

4 Mechanical specifications

RG-1008M card is compliant to the 52-pin PCI Express Full-Mini Card Type F1 form factor, with top-side and bottom-side keep-out areas, and with 50.95 mm nominal length, 30 mm nominal width.



5 Contact

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Federal Communication Commission Interference Statement

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.

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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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.

This module is intended for OEM integrators only. Per FCC KDB 996369 D03 OEM Manual v01 guidance, the following conditions must be strictly followed when using this certified module:

KDB 996369 D03 OEM Manual v01 rule sections:

2.2 List of applicable FCC rules

This module has been tested for compliance to FCC Part(15.247).

2.3 Summarize the specific operational use conditions

The module is tested for standalone mobile RF exposure use condition. Any other usage conditions such as co-location with other transmitter(s) or being used in a portable condition will need a separate reassessment through a class II permissive change application or new certification.

2.4 Limited module procedures

The EUT uses standard antenna connectors which are subject to professional installation only. Photos of antenna and antenna connector are shown in the test report. Please refer to the approved antennas in

section 2.7 (on P13) and professional installation instructions on P15 of this user manual for detailed antenna information and installation requirement.

2.5 Trace antenna designs

Not applicable.

2.6 RF exposure considerations

This equipment complies with FCC mobile radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. If the module is installed in a portable host, a separate SAR evaluation is required to confirm compliance with relevant FCC portable RF exposure rules.

2.7 Antennas

The following antennas have been certified for use with this module; antennas of the same type with equal or lower gain may also be used with this module. The antenna must be installed such that 20 cm can be maintained between the antenna and users.

Model	Antenna Gain (dBi)	Frequency range	Antenna Type	Connecter Type	*Cable Length (mm)
MFB9153	3	902-928 MHz	Dipole	N Female	1169.4(Outdoor) 1014.4(Indoor)
MFB9155NF	5	902-928MHz	Dipole	N Female	1169.4(Outdoor) 1014.4(Indoor)
MPAMB700MSMA	2	698-960 MHz	Dipole	SMA Male	100
ET915NPMR	2.7	902-928 MHz	Dipole	N Male	255

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following: “Contains FCC ID: **2ARXKRG1008M**”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

2.9 Information on test modes and additional testing requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) or portable use will require a separate class II permissive change re-evaluation or new certification.

2.10 Additional testing, Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15

Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable.

As long as all conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

OEM/Host manufacturer responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment

Professional installation instruction

1. Installation personal

   This product is designed for specific application and needs to be installed by a qualified personal who has RF and related rule knowledge. The general user shall not attempt to install or change the setting.

2. Installation location

   The product shall be installed at a location where the radiating antenna can be kept 20cm from nearby person in normal operation condition to meet regulatory RF exposure requirement.

3. External antenna

   Use only the antennas which have been approved by the applicant. The non-approved antenna(s) may produce unwanted spurious or excessive RF transmitting power which may lead to the violation of FCC limit and is prohibited.

4. Installation procedure

   Please refer to user's manual for the detail.

5. Warning

   Please carefully select the installation position and make sure that the final output power does not exceed the limit set force in relevant rules. The violation of the rule could lead to serious federal penalty.