LNQNSM01

Lynq Module User Manual, revision 6

Updated 6/26/2020

1. Features

The LNQNSM01 LoRa module provides a turnkey solution for leveraging the Lynq Network Stack. It allows for the commissioning of networks using a simplified serial peripheral command interface. The FCC/IC certified design allows for rapid product development and fast time to market.

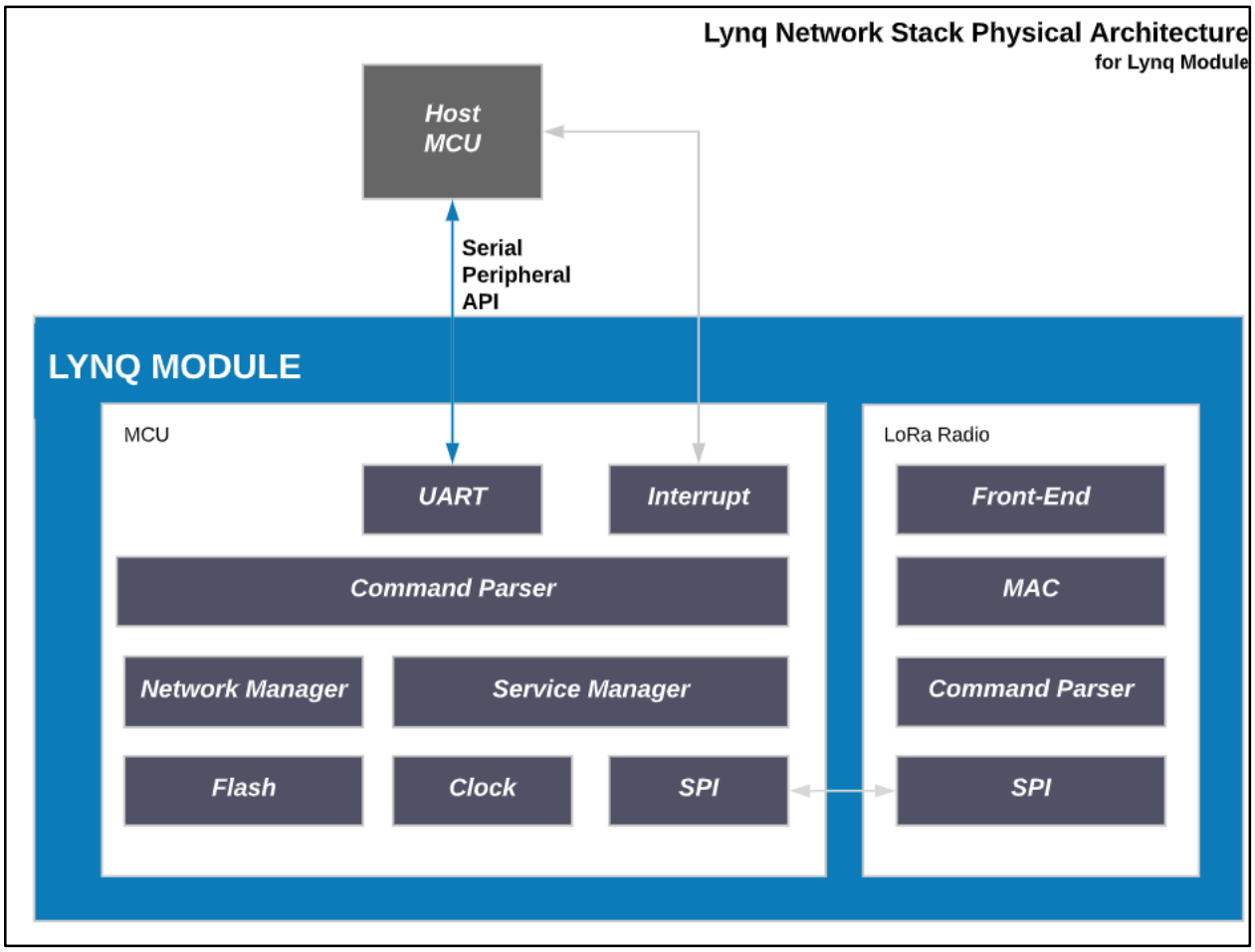
The front-end design of this module allows for operation at the limits of transmit power, providing longer range communication than competitive LoRa modules.

The LNQNSM01 is suited for long range point-to-point applications in which sensor and messaging applications are desired.

- UART command interface.
- Limited modular certification for FCC (USA) and IC (Canada) operation
- Castellated pads for easy design and debugging
- Compact Form Factor -- 22 x 22 x 2.5 mm
- On-board bootloader for easy device firmware upgrades
- RoHS Compliant

2. Block Diagram

2.1. Network Stack Module Block Diagram



3. General Specifications

4. Absolute Maximum Ratings

Parameter	Min	Max	Unit
Storage Temperature	-40	+85	°C
Operating Temperature	-40	+85	°C
VDD Operating Voltage	+2.0	+3.6	V
VFEM Operating Voltage	-0.3	+5.5	V

5. Electrical Characteristics

5.1. Transmitter Specification

Conditions: Vdd = Vfem = 3.3V, temperature = 25 C, 50 ohm matched antenna, unless otherwise specified.

Parameter	Condition	Min	Typ	Max	Unit

Output power at ANT		0	-	+27	dBm
Output power stability		-	+/- 1	-	dB
Output power stability vs temperature		-	+/- 1.5	-	dB
Current while transmitting	ANT_OP = +2 dBm	-	52	-	mA
	ANT_OP = +5 dBm	-	58	-	mA
	ANT_OP = +10 dBm	-	68	-	mA
	ANT_OP = +15 dBm	-	85	-	mA
	ANT_OP = +20 dBm	-	124	-	mA
	ANT_OP = +27 dBm	-	380	-	mA
	ANT_OP = +30 dBm @ 4.8V	-	490	-	mA

5.2. Receiver Specification

Conditions: Vdd = Vfem = 3.3V, temperature = 25 C, matched antenna

Parameter	Min	Typ	Max	Unit
Current while receiving	-	57	-	mA
Receiver sensitivity	-	-	-135	dBm

6. Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
VDD supply voltage	+2.0	+3.3	+3.6	V
VFEM supply voltage*	+2.0	+3.3	+4.8	V
Voltage Int logic high	0.75 x VDD	-	-	V
Voltage INT logic low	-	-	0..3 x VDD	V

* Operating at a supply voltage above 4.8V will disable power to the FEM.

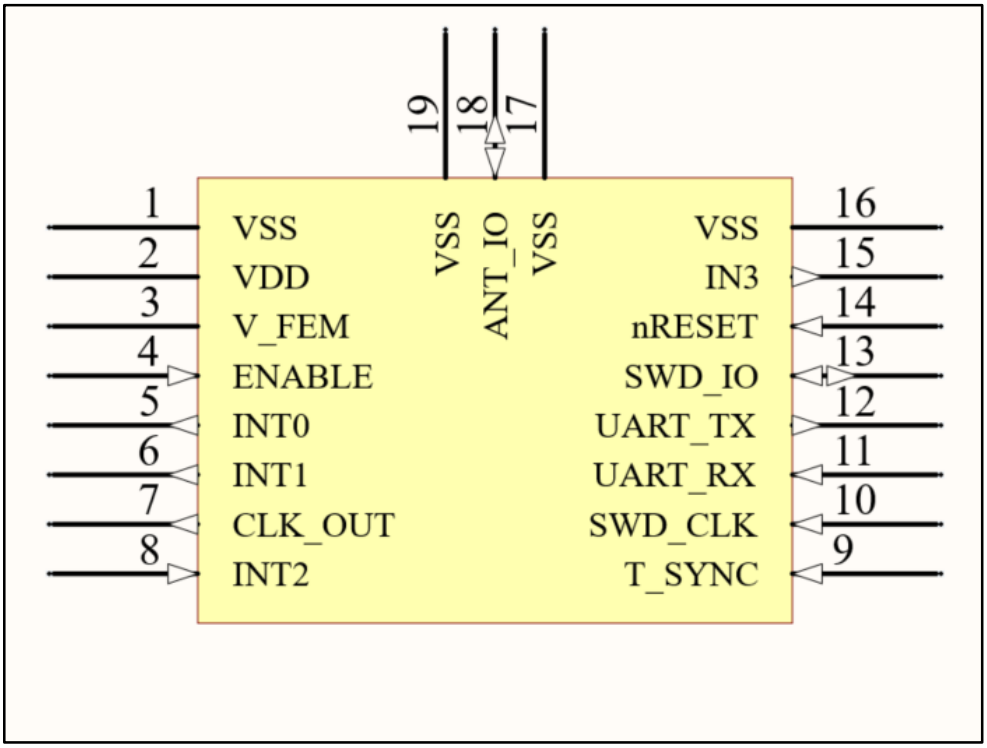
7. Pin Description

7.1. Pin Description

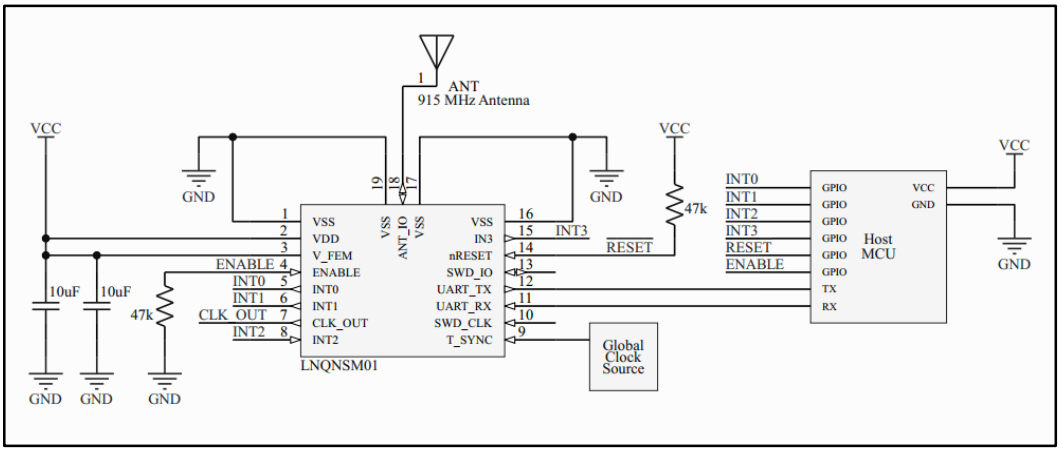
Pin	Name	Description	Type
1	VSS	Ground	Ground

2	VDD	Radio/MCU Supply Voltage	Power
3	VFEM	Front-End Supply Voltage	Power
4	ENABLE	Module Enable/Disable	Input
5	INT0	Event Interrupt 0	Input/Output
6	INT1	Event Interrupt 1	Input/Output
7	CLK_OUT	Module 32MHz Clock Out	Output
8	INT2	Event Interrupt 2	Input/Output
9	T_SYNC	Network Time Synchronization Clock	Input
10	SWD_CLK	SWD Programming Clock Line	Input
11	UART RX	115200 Baud UART Rx	Input
12	UART TX	115200 Baud UART Tx	Output
13	SWD_IO	SWD Programming Data Line	Input/Output
14	nRESET	Device Reset	Input/Output
15	INT3	Even Interrupt 3	Input/Output
16	VSS	Ground	Ground
17	VSS	Ground	Ground
18	ANT_IO	Antenna Rx/Tx	Input/Output
19	VSS	Ground	Ground

7.2. LNQNSM01 Pin Diagram



8. Typical Connection



8.1. Serial Connection to Host Processor

The LNQNSM01 has a UART serial peripheral interface dedicated to communication with the module via a host controller or processor. Default UART specifications are provided in the table below and complete command interface documentation can be found in the *"LNQNSM01 Module Command Interface Reference Manual" (DOCUMENT NUMBER HERE).*

8.1.1. Default UART Interface Settings

Parameter	Setting
Baud Rate	115200
Data Bits	8
Parity Bit	None
Stop Bit	1
Flow Control	None

8.2. Interrupt Pins

Four mappable interrupt pins are available based on application specific requirements. The available modes are detailed in the following table.

8.2.1. Interrupt Functions

Signal	Type
Read data available	Output
Transmit queue empty	Output
Service queue empty	Output
Transmit active	Output
Receive active	Output
Network in sync	Output
Transmit buffer full	Output
Interference detected	Output
Service ACK received	Output
Service ACK time-out	Output
High priority alert	Output
Receive Ready	Output

8.3. Antenna Pin

Pin 18 on the LNQNSM01 connects to a 915 MHz antenna. It is matched to 50 Ohms. To maximize performance, it is important to make sure that any traces from the pin are matched to 50 Ohms.

Antenna model:LNQNSM01
Antenna type:PCB
Antenna gain:0dBi
Manufacturer:LYNQ Technologies, Inc.

8.4. nReset Pin

The *nReset* pin is an active-low input that resets the LNQNSM01 module MCU. It is recommended to connect a weak pull-up resistor to this pin. To prevent potential framing issues at power on, nReset should be asserted after the host controller has been powered on and initialized.

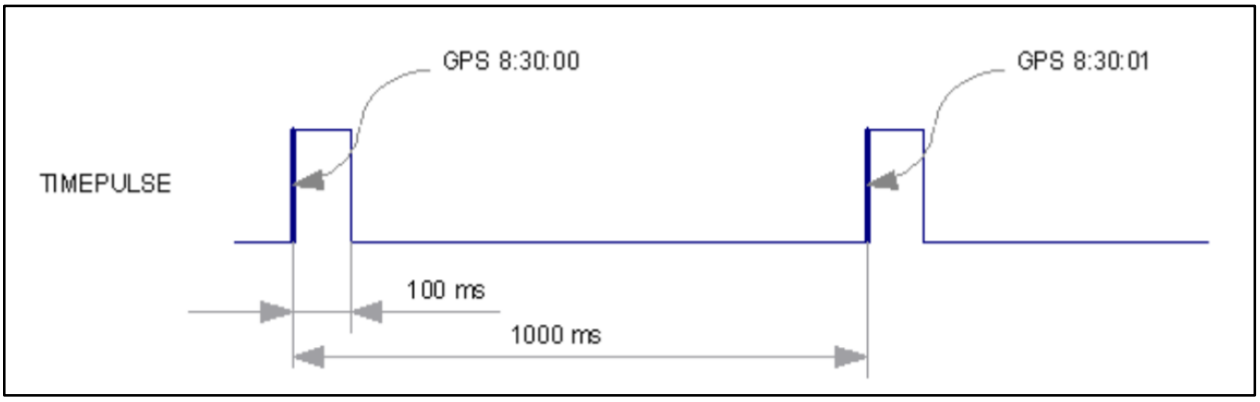
8.5. Time Synchronization Pin

The time synchronization pin allows for a global clock to be used to synchronize the network rather than relying on relying on synchronization packets to maintain a network connection. This can be particularly useful when connected radios have a high probability of going out of range from one another for extended periods of time. In these instances units can become desynchronized and require some time to resynchronize with a network when back in range.

Setting global times obviates the need for devices to resynchronize and allow devices to be perpetually synchronized regardless of time in isolation. The process for utilizing the global clock is generally as follows.

1. A one second timepulse, usually from a device with a global clock source such as a GNSS receiver, is provided to the T_SYNC pin (see figure 8.5.1). This will force the LNQNSM01 to keep time using this clock source. Time is synchronized on the rising edge of the pulse.
2. Host processor sends a *"Synchronize Time"* command via UART to the network processor. (see *"LNQNSM01 Module Command Interface Reference Manual"* for command information). Synchronization commands should be resent if the T_SYNC pin is every unapplied or if there is a system reboot.

8.5.1. Time Synchronization Pin Diagran



8.6. Enable Pin

The enable pin is an input pin serves as a means of deep sleeping module components. It is intended to minimize the current draw to the device to act as an effective 'off' switch for the module.

When high, device operation is normal and all aspects of the system can be controlled. When the pin is pulled low, all on board components are disabled and the module cannot be communicated with.

See current draw characteristics in section *6*, *Operating Characteristics*, for information on expected power consumption.

8.7. SWD Pins

SWD pins can be used for reprogramming the onboard microcontroller. It is highly recommended that all device firmware updates are issued using Lynq's UART bootloader and official Lynq support software only.

8.8. Power Supply Pins

The LNQNSM01 power supply pins must be provided with a power source that allows for operation under the operating conditions defined by the user's application. Refer to *6*, *Operating Conditions*, for more information.

It is recommended that additional capacitance is provided closely to each pin. Vdd and Vfem should be provided with a minimum of 4.7uF each.

8.9. Clock Output Pin

The 8MHz source clock of the LNQNSM01 can be provided to other devices via the clock output pin. The use of this pin can be useful in saving in design cost or to provide a fully synchronized clock source with the LNQNSM01 module.

9. Regulatory Compliance

9.1. Countries of operation

The LNQNSM01 has been approved for operation in the United States and Canada. Implementation of this product must follow the guidelines in this section under each respective country for the allowance of permissive operation.

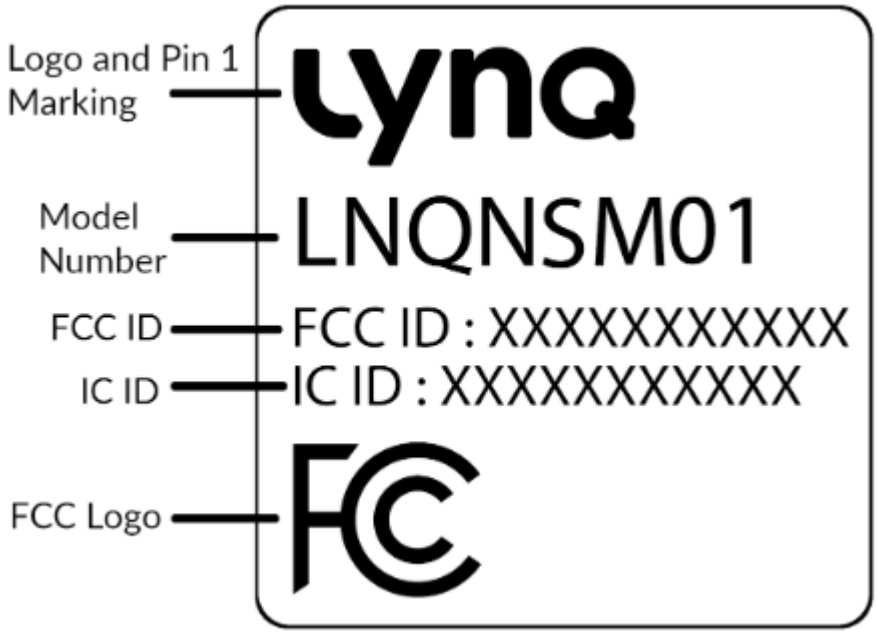
9.2. United States

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.

9.3. Canada

10. Label Information

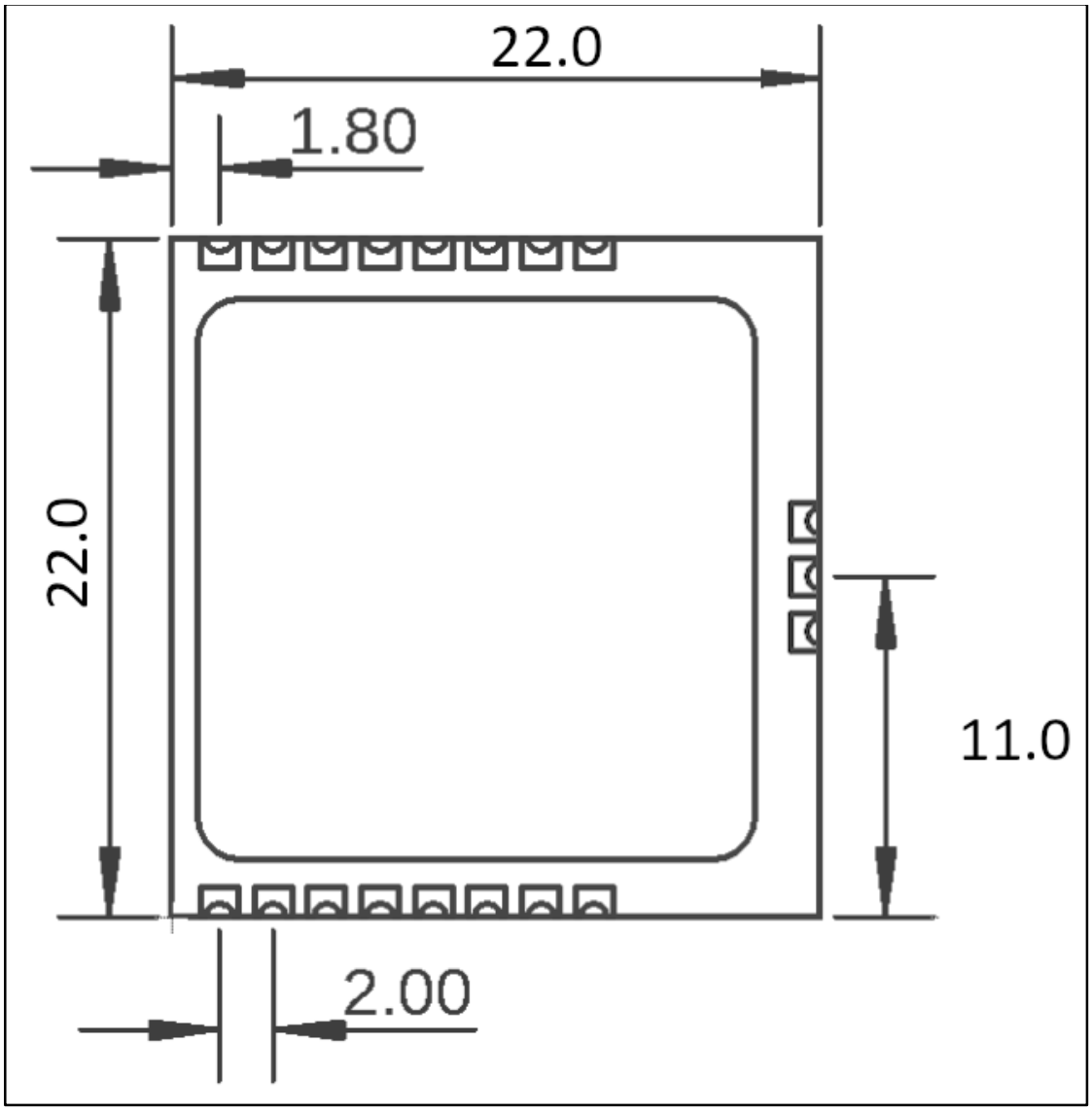


11. Module Dimensions

11.1. Module Dimension Table

Description	mm
PCB Length	22.00
PCB Width	22.00
Castellated pad width	1.00
Castellated pad pitch	2.00
Antenna Pin to board edge	11.0
Recommended pad length	1.8
Recommended pad width	1.6

11.2.



FCC 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.

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

The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device.

FCC Radiation Exposure Statement

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

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: 2ARHMLYNQNSM01 Or Contains FCC ID: 2ARHMLYNQNSM01”

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. 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.

(2) This device must accept any interference received, including interference that may cause undesired operation.

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

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with Single modular approval should perform the test of radiated emissionand spurious emission according to FCC part15.247 and 15.209 requirement, Only if the test result comply with FCC part15.247 and 15.209 requirement， then the host can be sold legally.

IC Warning

This device complies with Industry Canada’s licence-exempt RSSs. 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.

If the ISED number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module IC: 24896-LYNQNSM01 Or Contains IC: 24896-LYNQNSM01”

When the module is installed inside another device, the user manual of the host must contain below warning statements;
1. This device complies with RSS Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference.
(2) This device must accept any interference received, including interference that may cause undesired operation.
2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.
Any company of the host device which install this modular with limit modular approval should perform the test of radiated emissionand spurious emission according to RSS-247 requirement, Only if the test result comply with RSS-247 requirement, then the host can be sold legally.

Cet appareil est conforme aux CNR exemptes de licence d'Industrie Canada . Son fonctionnement est soumis aux deux conditions suivantes :
(1) Ce dispositif ne peut causer d'interférences ; et
(2) Ce dispositif doit accepter toute interférence, ycompris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

Si le numéro harmonisé n’est pas visible lorsque le module est installé à l’intérieur d’un autre dispositif,Ce label extérieur peut être utilisé comme suit:Module émetteur contenant: IC: 24896-LYNQNSM01 ou contenant: IC: 24896-LYNQNSM01

Lorsque le module est installé à l’intérieur d’un autre dispositif, le manuel de l’utilisateur du host doit contenir la mention suivante:
Cette opération est soumise à deux conditions:
(1) ce dispositif ne peut pas provoquer des nuisances.
(2) cet appareil doit recevoir toute intensité, y compris celle qui peut provoquer une opération non désirée.
Les modifications ou modifications qui ne sont pas expressément approuvées par la partie responsable de la conformité peuvent être approuvées par l’autorité de l’utilisateur chargée du fonctionnement du matériel.
L’appareil doit être installé et utilisé dans un format strict avec les instructions du fabricant décrites dans la documentation d’utilisation qui accompagne le produit.
Toute entreprise du dispositif hôte qui a installé ce module avec des restrictions d’agrément du département devrait effectuer l’essai d’émission radiée et d’émission spurieuse conformément aux exigences RSS-247,Seulement si le test est conforme aux exigences RSS-247, alors le serveur peut être vendu légalement.