

RAK4200(H) LoRa Module

WisDuo LoRa Module

Version V1.4 Apr2020



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1. Overview

1.1 Introduction

RAK4200(H) LoRa Module includes an STM32L071 MCU and an SX1276 LoRa chip. It has Ultra-Low Power Consumption of 1.5uA in sleep mode and high LoRa output power up to 19dBm max in work mode.

The module complies with LoRaWAN 1.0.2 protocols. It also supports Lora Point to Point communications. The module is suitable for various applications that require long range data acquisition and low power consumption.

1.2 Main Features

- LoRa module for Smart City, Smart Agriculture, Smart Industry
- Compact Form Factor: 15 x 15.5 x 2.5 mm
- 20 Pin Stamp Pad for PCB SMT mounting
- I/O ports: UART/I2C/GPIO
- Temperature range: -40°C to +85°C
- Supply voltage: 2.0 ~ 3.6V
- Frequency range: 863–870MHz (EU) / 902–928MHz (US)
- Low-Power Wireless Systems with 7.8kHz to 500KHz Bandwidth
- Ultra-Low Power Consumption 1.5uA in sleep mode
- Core: ARM 32-bit Cortex – M0+ with MPU
- Up to 128KB flash memory with ECC
- 20KB RAM
- 6KB of data EEPROM with ECC

2. RAK4200(H) LoRa Module

2.1 Overview

The figure below shows the top view of the RAK4200(H) LoRa Module. The dimensions of the Module are 15 x 15.5 x 2.5 mm.



Figure 1 | RAK4200 LoRa Module

2.2 Block Diagram

The Block diagram below shows the external interfaces of the RAK4200(H) LoRa Module.

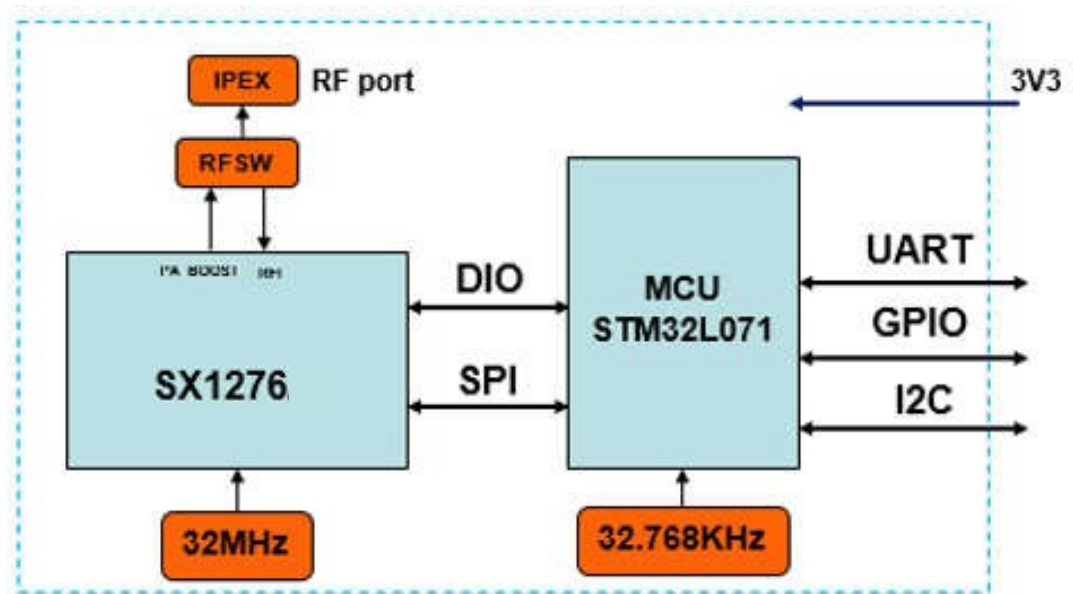


Figure 2 | Block Diagram

2.3 Supported LoRaWAN bands

The RAK4200(H) LoRa Module supports the high LoRaWAN bands (refer to the Table 1)

Module	Region	Frequency (MHz)
RAK4200(H)	Indian	IN865

	Europe	EU868
	North America	US915
	Australia	AU915
	Korea	KR920
	Asia	AS923

Table 1 | Operating Frequencies

2.4 Pin Definition & Pin Out

The figure below shows the pinout of the RAK4200(H) LoRa Module.

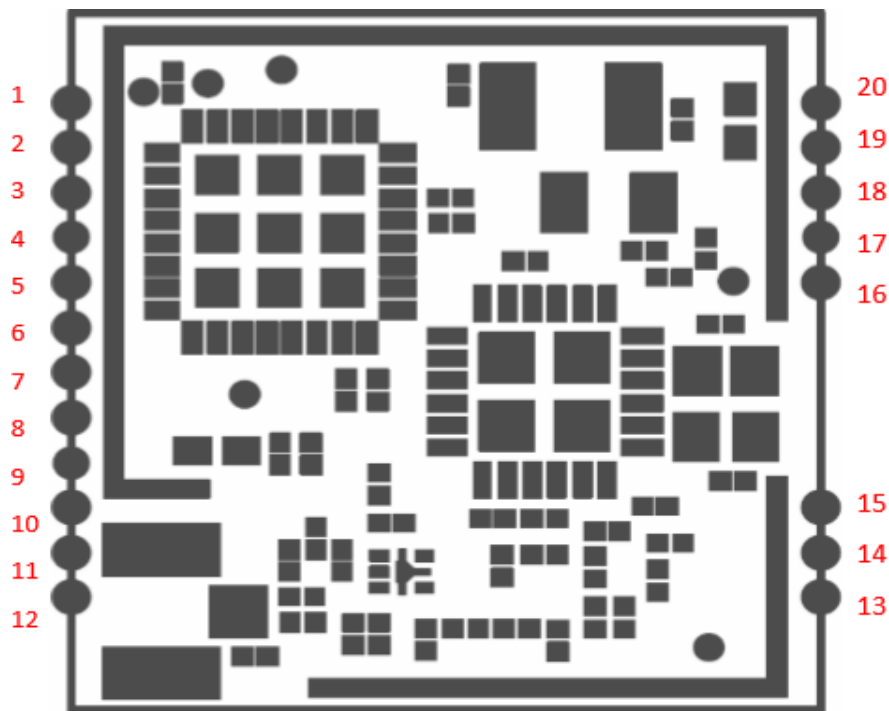


Figure 3 | Pinout

The table below shows the pin definition of the RAK4200(H) LoRa Module.

Pin	Name	I/O	Description	Alternate functions
1	UART2_RX	I	This UART port is used as an AT command port (STM32L071KBU6 PA3)	USART1_RX, I2C1_SDA
2	UART2_TX	O	This UART port is used as an AT command port (STM32L071KBU6 PA2)	MCO, USART1_TX, I2C1_SCL, I2C3_SMB
3	UART2_DE	I/O	GPIO (STM32L071KBU6	SPI1_MOSI, EVENTOUT,

			PA1)	USART1_RTS_DE, COMP2_OUT
4	UART1_TX	I/O	This UART port can be used as an AT command port and an upgrade port or General GPIO (STM32L071KBU6 PA9)	TIM21_CH1,TIM2_CH3, USART2_TX,LPUART1_TX, COMP2_OUT,COMP2_INM, ADC_IN2
5	UART1_RX	I/O	This UART port can be used as an AT command port and an upgrade port or General GPIO (STM32L071KBU6 PA10)	TIM21_CH2,TIM2_CH4, USART2_RX,LPUART1_RX, COMP2_INP,ADC_IN3
6	UART1_DE	I/O	General GPIO or UART(Reserved) (STM32L071KBU6 PA12)	EVENTOUT,TIM2_CH2,USART2_RTS_DE, TIM21_ETR, USART4_RX,COMP1_INP, ADC_IN1
7	SWDIO	I/O	Programming (STM32L071KBU6 PA13)	SWDIO, LPUART1_RX
8	SWCLK	I/O	Programming (STM32L071KBU6 PA14)	SWCLK, USART2_TX, LPUART1_TX
9	I2C_SCL	I/O	I2C interface (STM32L071KBU6 PB6)	USART1_TX,I2C1_SCL, LPTIM1_ETR,COMP2_INP
10	I2C_SDA	I/O	I2C interface (STM32L071KBU6 PB7)	USART1_RX,I2C1_SDA, LPTIM1_IN2,USART4_CTS, COMP2_INP,VREF_PVD_IN
11	GND	-	Ground	-
12	RF	I/O	RF port (reserved), default RF out by IPEX	-
13	GND	-	Ground	-
14	GND	-	Ground	-
15	SPI_CLK	I/O	Reserved PA5	SPI_CLK,leave it un-connect on mainboard
16	SPI_MISO	I/O	Reserved PA6	SPI_MISO, leave it un-connect on mainboard
17	SPI_MOSI	I/O	Reserved PA7	SPI_MOSI, leave it un-connect on mainboard
18	MCU_Nrst	I/O	MCU reset (STM32L071KBU6 NRST)	-
19	GND	-	Ground	Ground
20	VDD	-	DC3V3	Supply voltage 2.0~3.3V

Table 2 | Pin Definitions

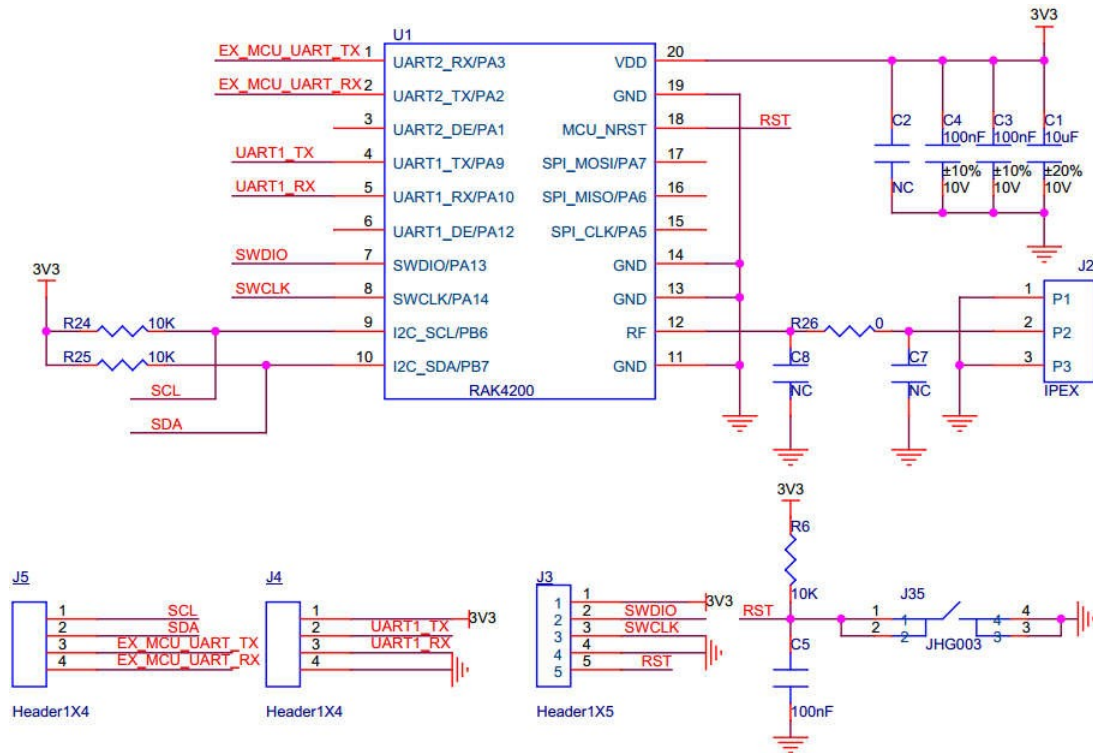
2.5 Power Consumption

Frequency	Output Power	Current
868MHZ	19dBm	120mA on PA_BOOST
	17 dBm	87mA on PA_BOOST
Receive Mode		15mA
Sleep Mode		1.5uA

Table 3 | Power Consumption

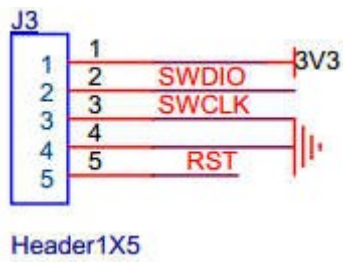
2.6 Recommended Circuit

RAK4200(H) module recommended circuit as below:



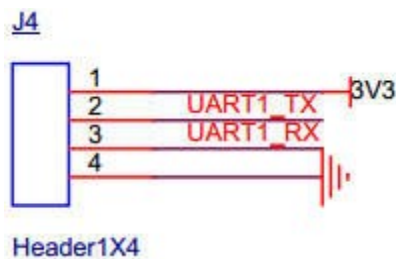
2.6.1 SWD programming Port

When programming with JLINK tool , it is need to connect 5 pins of 3V3,SWDIO, SWCLK,GND and MCU_N_RST. So it is better to leave these 5 pins for SWD programming.



2.6.2 UART port

There are two UART ports on RAK4200(H) module. UART2(pin1 and pin2) is used as a command port and UART1(pin4 and pin5) is used both as a command and an upgrade port. So it is better to connect UART2 to external MCU and UART1 is used as a debug or upgrade port.



2.6.3 I2C port

Pin9 and Pin10 are recommended as I2C port. Just pull up with 10K resistance if use it.

2.6.4 RF port

There are two types of RF port. One is with Ipex connector and another is PAD type. For Ipex type just connect the antenna to the Ipex connector on the module directly. For PAD type you can design the antenna as Ipex or SMA or Spring type.

2.6.5 SPI port

The SPI (pin15 ,pin16,pin17) has connected to the SX1276 in the internal of the module.

So it is better not to use these 3 pins and just leave it un-connect on the mainboard.

2.7 Mechanical Dimensions

The figure below shows the mechanical dimension of the RAK4200(H) LoRa Module.

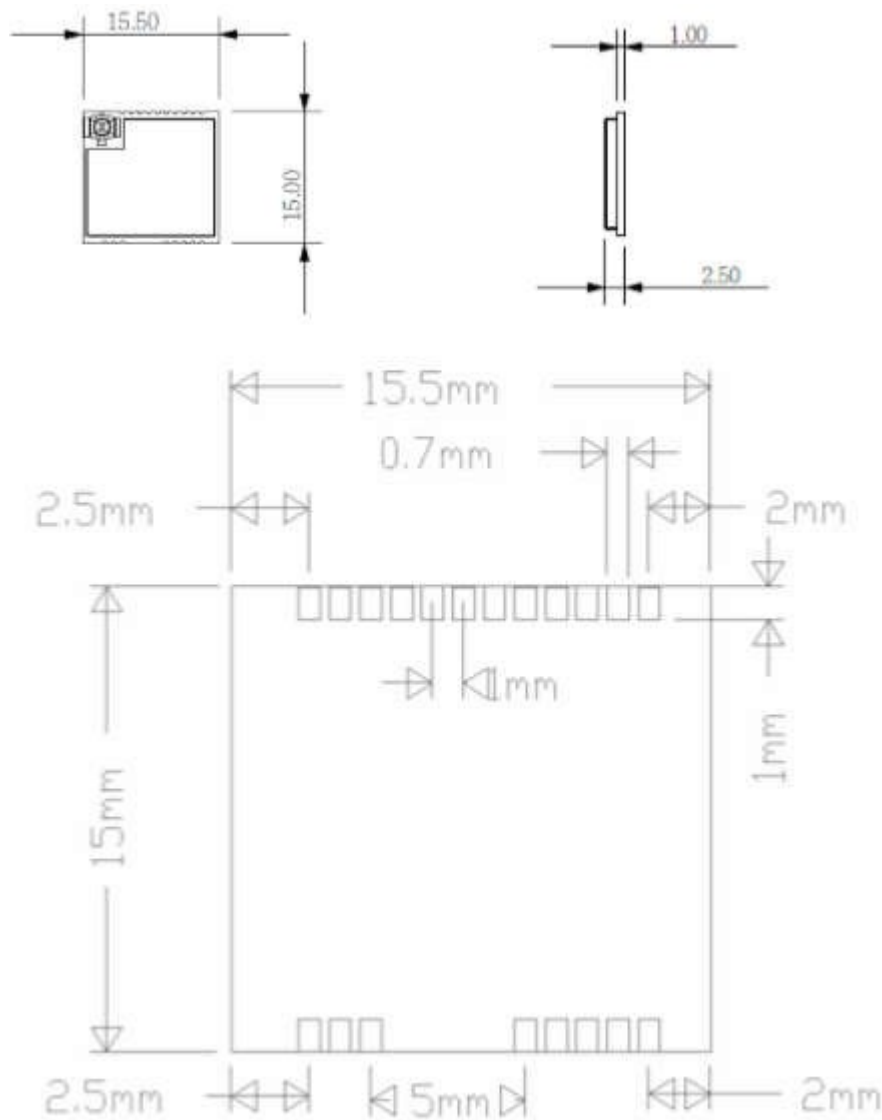


Figure 4 | Mechanical Dimensions

2.8 Recommended Footprint

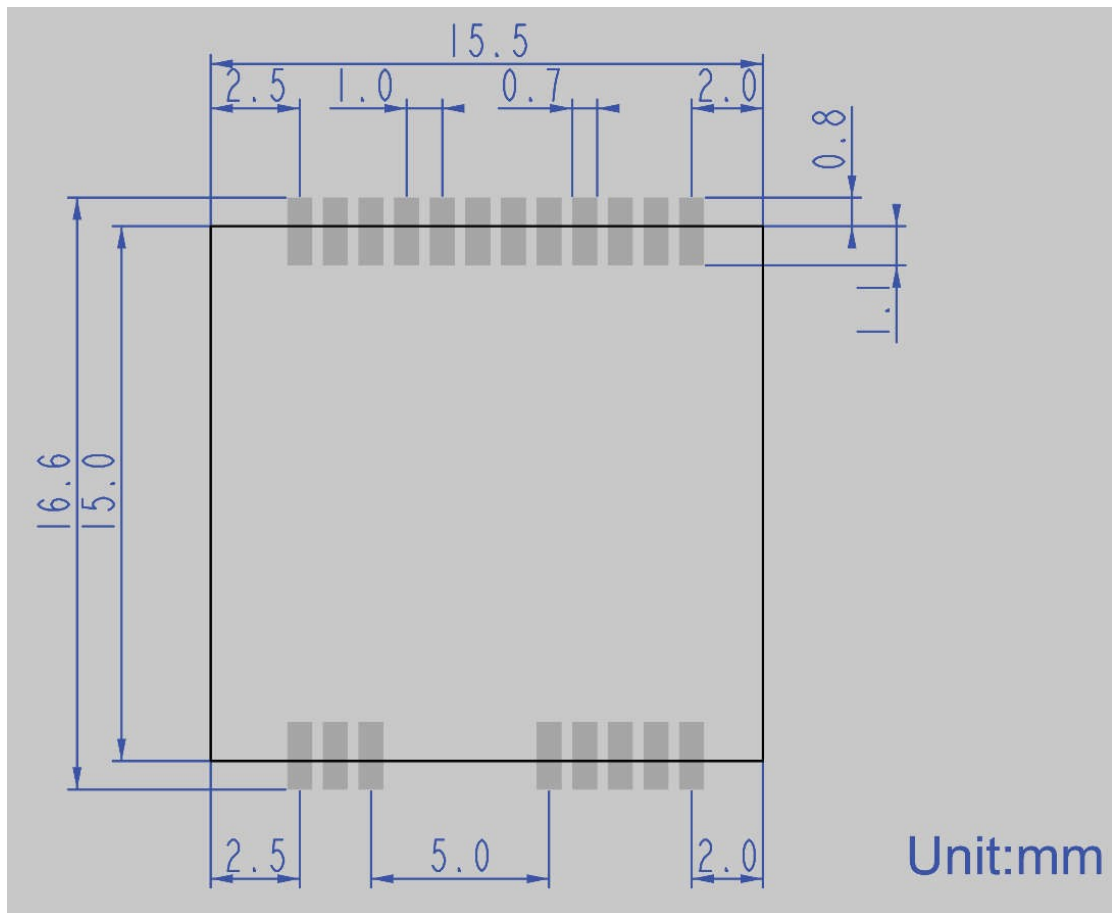


Figure 5 | Recommended Footprint

2.9 Recommended Reflow Profile

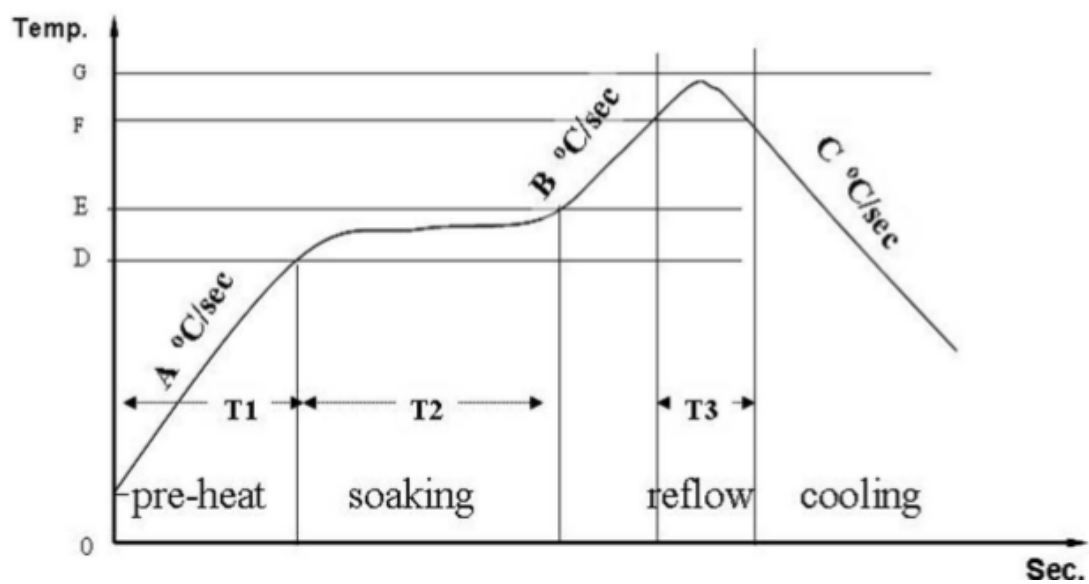


Figure 6 | Recommended Reflow Profile

Standard conditions for reflow soldering:

- Pre-heating Ramp (A) (Initial temperature: 150°C): 1~2.5°C/sec;
- Soaking Time (T2) (150°C~180°C): 60sec~100sec;
- Peak Temperature (G): 230~250°C;
- Reflow Time (T3) (>220°C): 30~60 sec;
- Ramp-up Rate (B): 0~2.5°C/ sec;
- Ramp-down Rate (C): 1~3°C/ sec.

Please contact us if you need technical support or need more information.

Support center: <https://forum.rakwireless.com/>

Email us: info@rakwireless.com

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.

FCC Caution:

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

FCC RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons.

FCC Statement:

"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."

IC statement:

This device complies with Industry Canada licence-exempt RSS standard(s).

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.

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 equipment complies with Industry Canada radiation exposure limits set forth with a separation
Cet émetteur doit être installé pour fournir une distance de séparation d'au moins 20 cm de toute personne.

The proposed FCC IC label format is to be placed on the module. If it is not visible when the module is installed into the system, "Contains FCC ID: 2AF6B-RAK4200H, Contains IC: 25908- RAK4200H" shall be placed on the outside of final host system.

Labelling

— This radio transmitter [25908-RAK4200H] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list and same type greater than the maximum gain are strictly prohibited for use with this device.

— L'émetteur [25908-RAK4200H] a été approuvé par innovation, sciences et développement économique Canada pour fonctionner avec les types d'antennes énumérés ci - dessous, avec les gains maximums admissibles indiqués ci - dessous. Les types d'antennes non inclus dans cette liste et les mêmes types d'antennes dont le gain est supérieur au gain maximal ne doivent pas être utilisés avec cet équipement.

Antenna info

Model	Manufacturer	Antenna Gain	Antenna Type	Connector Type
RAKARG19	Shenzhen RAKwireless Technology Co.,Ltd.	5.1dBi	Fiber Glass Antenna	N-type male connector
KRAKBJ2701C01C		2.3 dBi	Dipole Antenna	RPSMA connector

3. Revision History

Revision	Description	Date
1.0	Initial version	2019-05-24
1.1	Revision of parameters	2019-10-24
1.2	Revision of parameters	2020-01-07
1.3	Add Recommended Circuit Chapter	2020-03-17

4. Document Summary

Prepared by	Checked by	Approved by
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