RAK11720 WisDuo LPWAN Module Datasheet

Overview

Description

The RAK11720 is a low-power long-range transceiver module.It consists of a Bluetooth integrated MCU and a LORA transceiver. RAK11720 is designed based on AMA3B1KK-KBR-B0 form Ambiq Micro that supports Bluetooth 5.0 (Bluetooth Low Energy) and the newest SX1262 LoRa transceiver from Semtech. This module complies with Class A, B, & C of LoRaWAN 1.0.3 specifications and also supports LoRa Point-to-Point (P2P) communication mode which helps you in implementing your own customized long-range LoRa network quickly. The two RF communication characteristic of the module (Lora® + BLE) makes it suitable for a variety of applications in the IoT field, such as home automation, sensor networks, building automation, and IoT network applications.

NOTE

There are two variants available for the RAK11720 Module: (1) MHF4 IPEX connector on RAK11720 to connect to the external antennas (2) The antenna signal route to stamp holes so users can use their own antennas.

Features

- Based on **AMA3B1KK-KBR-B0** and **SX1262**
- ARM Cortex-M4F
- 1MB Flash and 348KB SRAM
- I/O ports: UART/I2C/SPI/ADC/GPIO
- **LoRaWAN 1.0.3** specification compliant
- **Supported bands**: EU433, CN470, IN865, EU868, AU915, US915, KR920, RU864, and AS923-1/2/3/4
- LoRaWAN activation via OTAA/ABP
- LoRa Point-to-Point (P2P) communication
- Easy to use AT command set via UART interface
- Long-range - greater than 15 km with optimized antenna
- Ultra-low-power consumption of 2.37 µA in sleep mode
- **Supply Voltage**: 1.8 V ~ 3.6 V
- **Temperature range**: -40° C ~ 85° C

Specifications

This section covers the hardware and software specifications of RAK11720. Also, it includes the block diagram and the update firmware link of the RAK11720 WisDuo module.

Overview

Block Diagram

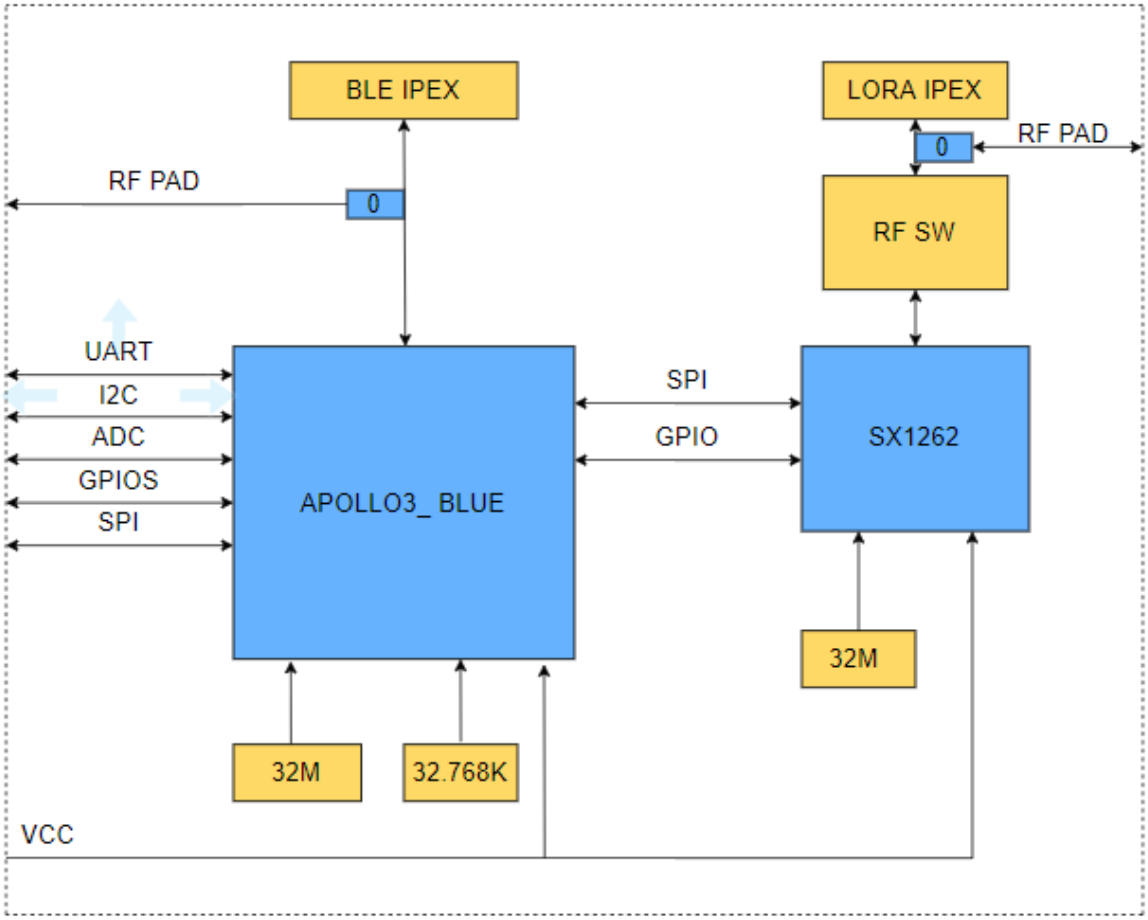


Figure 1: RAK11720 System Block Diagram

Hardware

The hardware specification discusses the interfaces, pinouts and corresponding functions and diagrams. It also covers the parameters of both RAK11720 modules in terms of RF, electrical, mechanical, and operating characteristics.

Pin Definition

Pin No.	Name	Type	Description
1	GP43/UART1_RX	I/O	GPIO and UART2 Interface (RX)
2	GP42/UART1_TX	I/O	GPIO and UART2 Interface (TX)
3	GP12/ADC9	I/O	GPIO and ADC
4	GP39/UART0_TX	I/O	GPIO and UART0 Interface(TX)
5	GP40/UART0_RX	I/O	GPIO and UART0 Interface(RX)
6	GP45	I/O	GPIO only
7	GP21/SWDIO		GPIO and SWD debug pin (SWDIO)

Pin No.	Name	Type	Description
8	GP20/SWDCK		GPIO and SWD debug pin (SWDCK)
9	GP27/I2C2_SCL	I/O	GPIO and I2C2 (SCL)
10	GP25/I2C2_SDA	I/O	GPIO and I2C2 (SDA)
11	GND	POWER	Ground connections
12	LORA RF	RF	LORA RF Port (only available on **RAK11720 No-IPEX connector variant**)
13	GP7/SPI0_MOSI	I/O	GPIO and SPI0 (MOSI)
14	GP6/SPI0_MISO	I/O	GPIO and SPI0(MISO)
15	GP5/SPI0_CLK	I/O	GPIO and SPI0 (CLK)
16	GP1/SPI0_NSS	I/O	GPIO and SPI0 (NSS)
17	GND	POWER	Ground connections
18	GND	POWER	Ground connections
19	GP4	I/O	GPIO only
20	GP36	I/O	GPIO only
21	SWO	I/O	SBL log output
22	RST		MCU Reset (nRST)
23	GND	POWER	Ground connections
24	VDD	POWER	VDD - Voltage Supply
25	GP32/ADC4	I/O	GPIO and ADC
26	GP31/ADC3	I/O	GPIO and ADC
27	GP37	I/O	GPIO only
28	GND	POWER	Ground connections
29	GP44	I/O	GPIO only
30	GP38	I/O	GPIO only
31	GP33/ADC5	I/O	GPIO and ADC
32	GP13/ADC8	I/O	GPIO and ADC
33	BLE RF	RF	BLE RF Port (only available on **RAK11720 No-IPEX connector variant**)
34	GND	POWER	Ground connections

RF Characteristics

LORA

The RAK11720 module supports the LoRaWAN bands shown in the table below. When buying a RAK11720 module, pay attention to specifying the correct core module RAK11720 H/L for your region, in which H stands for high-frequency regions and L for low-frequency regions.

Operating Frequencies

Module	Region	Frequency
RAK11720(L)	Europe	EU433
	China	CN470
RAK11720(H)	Europe	EU868
	North America	US915
	Australia	AU915
	Korea	KR920
	Asia	AS923-1/2/3/4
	India	IN865
	Russia	RU864

Electrical Characteristics

Operating Voltage

Feature	Minimum	Typical	Maximum	Unit
VCC	1.8	3.3	3.6	Volts (V)

Operating Current

Feature	Condition	Minimum	Typical	Maximum	Unit
Operating Current	BLE TX Mode	-	12.7 (@6.0 dBm)	-	mA
	LORA TX Mode	-	87 (@ 22 dBm 868Mhz)	-	mA

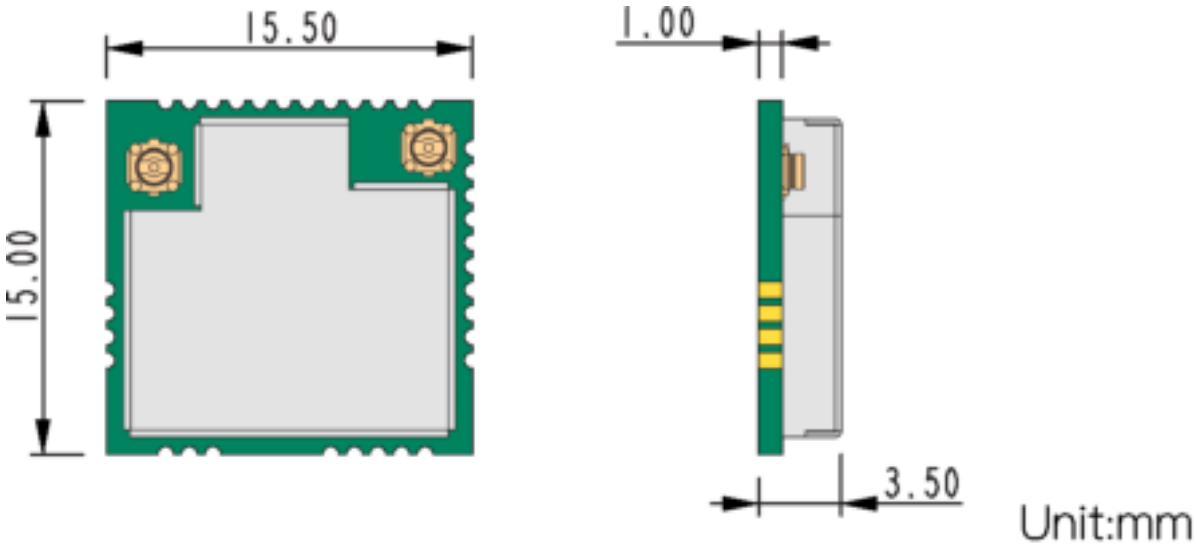
Sleep Current

Feature	Condition	Minimum (2.1V)	Typical (3.3V)	Maximum	Unit
Current Consumption	EU868	-	2.37	-	µA

Feature	Condition	Minimum (2.1V)	Typical (3.3V)	Maximum	Unit
	US915	-	2.37	-	μA
	CN470	-	2.37	-	μA

Mechanical Characteristics

Module Dimensions



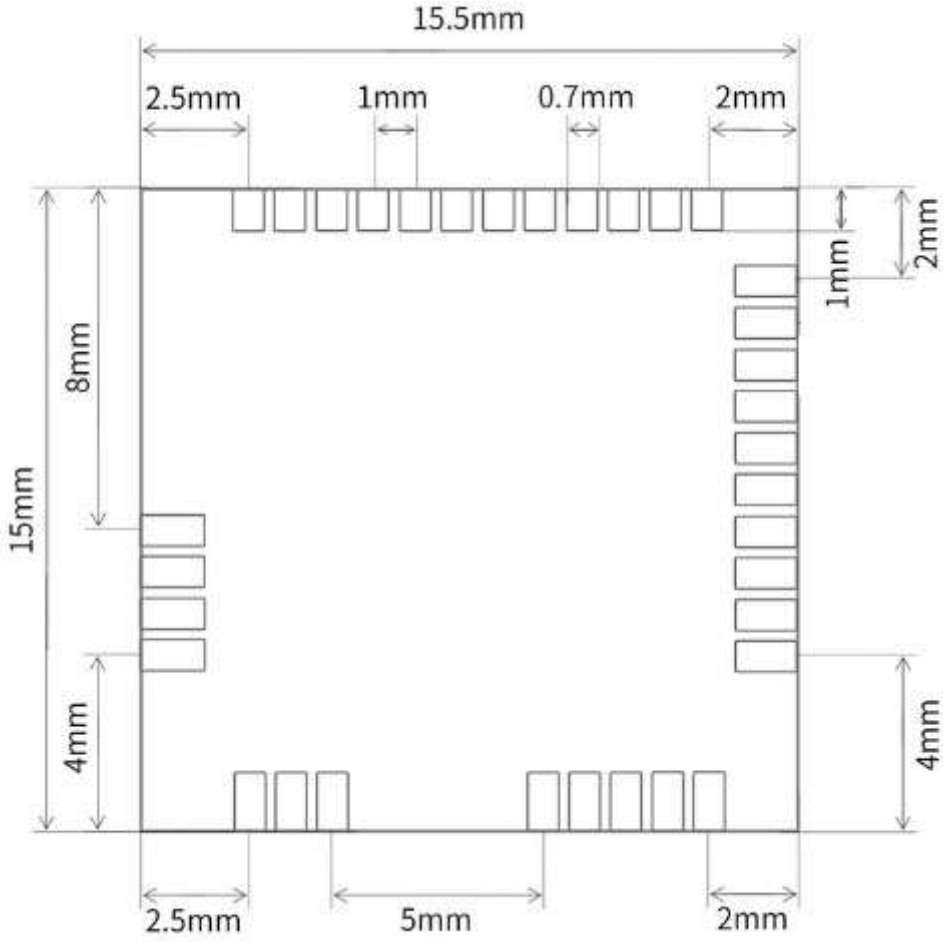


Figure 3: RAK11720 Physical Dimension

Layout Recommendation

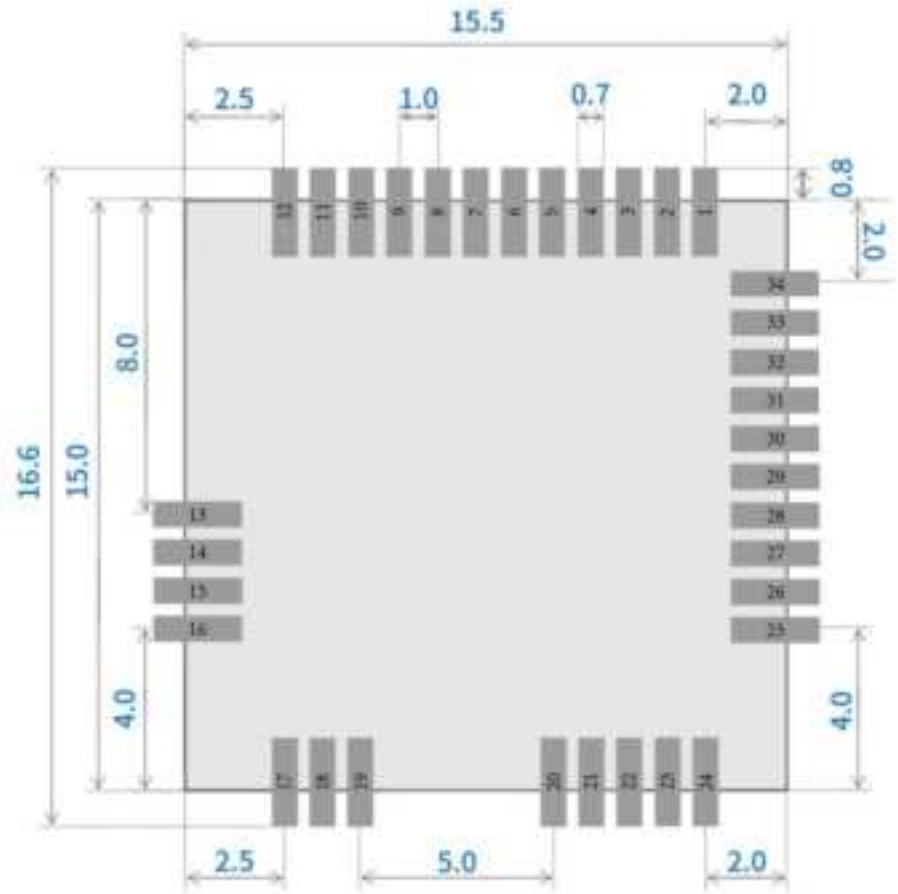


Figure 4: RAK11720 Layout

Environmental Characteristics

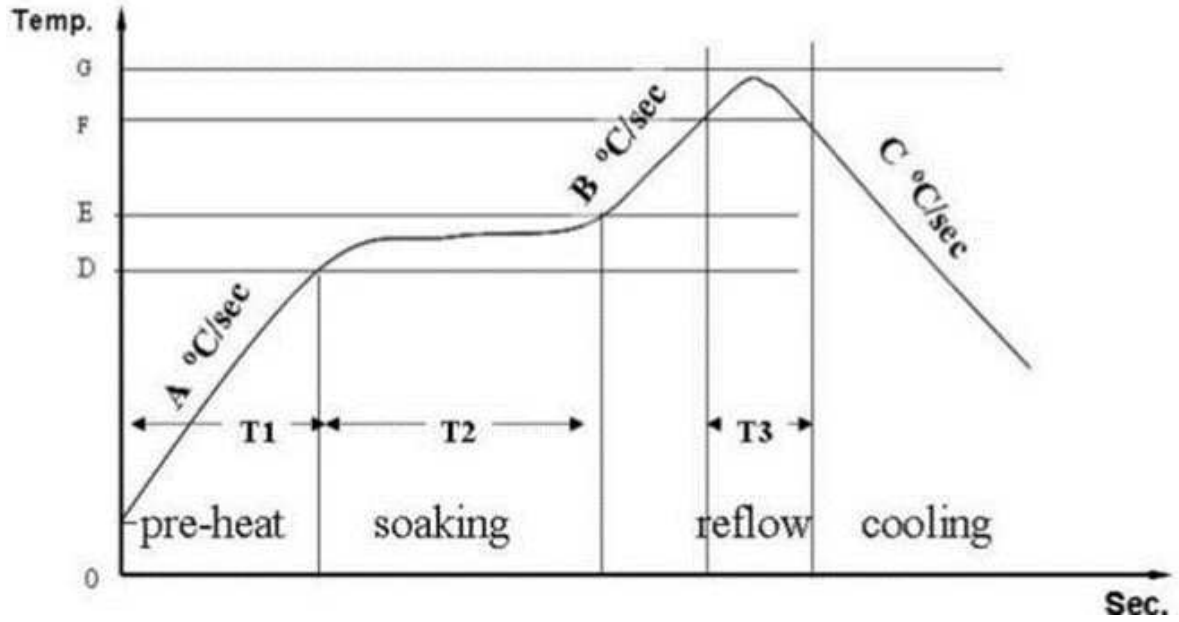
Operating Temperature

Feature	Minimum	Typical	Maximum	Unit
Operating Temperature	-40	25	85	°C

Storage Temperature

Feature	Minimum	Typical	Maximum	Unit
Storage Temperature	-40	-	85	°C

Recommended Reflow Profile



Standard conditions for reflow soldering:

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

1 Warning

FCC Warning：

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.

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

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."

INTEGRATION INSTRUCTIONS

1. This module has been tested and found to comply with the FCC Part15.247 for Modular Approval.

2. This Modular Approval is limited to OEM installation for mobile and fixed applications only. The antenna installation and operating configurations of this transmitter, including any applicable source-based time- averaging duty factor, antenna gain and cable loss must satisfy MPE categorical Exclusion Requirements of 2.1091. This modular should be installed and operated with minimum distance 20 cm between the radiator& your body.

3. The RPSMA connector antenna has been approved for the modular. The maximum antenna gain is 2.3dBi for Lora and 3.12dBi for BLE. For situations where the host manufacturer is responsible for an external connector, the integration instructions shall inform the installer that a unique antenna connector must be used on the Part 15 authorized transmitters used in the host product.

4. 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 removed. If not, a second label must be placed on the outside of the final device that contains the following text: —Contains FCC ID: 2AF6B-RAK11720.

5. The Shenzhen Rakwireless Technology Co., Ltd. uses various test mode programs for test set up which operate separate from production firmware. Host integrators should contact Shenzhen Rakwireless Technology Co., Ltd. for assistance with test modes needed for module/host compliance test requirements.

6. The Shenzhen Rakwireless Technology Co., Ltd. modular transmitter is only FCC authorized for the FCC Part15.247 listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

ISED Warning:

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada’s licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.

2. This device must accept any interference, including interference that may cause undesired operation of the device.

L’émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d’Innovation, Sciences et Développement économique 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;

2. L’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

This equipment complies with ISED 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 transmitter must not be

co-located or operating in conjunction with any other antenna or transmitter located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme avec les limites d'exposition à la radiation de l'ISED émises dans un environnement contrôlé. Cet équipement devrait être installé et fonctionnel avec un minimum de distance entre le radiateur et votre corps d'au moins 20 cm. Ce transmetteur ne doit pas être co-situé près d'une autre antenne ou en conjonction avec un autre transmetteur.

The host product shall be properly labelled to identify the modules within the host product. 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: 25908-RAK11720

Le numéro d'homologation d'ISDE, le NIVM, le NMP et le NIVL ne doivent pas nécessairement être adjacents.

Le numéro d'homologation se compose d'un numéro de compagnie (NC), attribué par le Bureau d'homologation et de services techniques d'ISDE, suivi du numéro de produit unique (NPU) attribué par le requérant. Le numéro d'homologation doit apparaître comme suit : IC: 25908-RAK11720

Labelling

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-RAK11720, Contains IC: 25908- RAK11720" shall be placed on the outside of final host system.

Labelling

— This radio transmitter [25908- RAK11720] 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 that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

— Le présent émetteur radio [25908- RAK11720] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés cidessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont trictement interdits pour l'exploitation de l'émetteur.

Antenna info

For Lora:

Antenna #	Model	Antenna Gain	Antenna Type	Connector Type
1#	KRAKBJ2701C01A	2.3 dBi	Dipole Antenna	RPSMA connector
2#	KRAKBJ2701C01C	2.3 dBi	Dipole Antenna	RPSMA connector
3#	RAKARJ14	2.3 dBi	Dipole Antenna	RPSMA connector
4#	RAKARJ16	2.3 dBi	Dipole Antenna	RPSMA connector

For BLE:

Antenna #	Model	Antenna Gain	Antenna Type	Connector Type
1#	S2B1BH2A1B01000	3.12 dBi	PCB Layout Antenna	IPEX connector

Firmware Version Identification Number:

RUI_3.5.2+user_final.hex

Manufacturer name and address:

Shenzhen Rakwireless Technology Co., Ltd.
Room 506, Bldg B, New Compark, Pingshan First Road, Taoyuan Street, Nanshan District, Shenzhen

About RAKwireless:
RAKwireless is a pioneer in providing innovative and diverse Cellular and LoRaWAN connectivity solutions for both Edge and Gateway IoT devices. We believe that through easy to use and modular designs we can accelerate the time to market for various IoT Applications in order to optimize system deployment in both Developer and Commercial settings.