Shenzhen Rakwireless Technology RAK7248 WisGate Raspberry Pi Gateway User Manual

Contents

WisGate Raspberry Pi Gateway

User Manual for
WisGate RAK7248
Version1.3| September 2020

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1. Overview
1.1. Introduction

The RAK7248 WisGate is a device that consists of Raspberry Pi 4 Model B, RAK2287 which includes a GPS module and a Heat Sink for better performance and thermal heat dissipation management. And it’s housing is built with an aluminum casing.
For the build-in RAK2287 it uses the SX1302 chip from Semtech which built-in LoRa concentrator IP core is a powerful digital signal processing engine. It is able to receive up to 8 LoRa packets simultaneously sent with different spreading factors on different channels and available in multiple variants so it can be used for internartinal standard bands. This unique capability allows to implement innovative network architectures advantageous over other short range systems. It follows Raspberry Pi specifications and is easy to mount with Raspberry Pi and RAK2287 module.
WisGate is ideal for prototyping, proof-of-concept demonstration or for the evaluation. It includes a ready to use LoRaWan Gateway OS that can be connected to a LoRaWan server. Also it is developer friendly and simple even for no-so-techy users to set up LoRaWan system. It has to be the best value and function for connectivity to address a variety of applications like Smart Grid, Intelligent Farm and other IoT enterprise applications

1.2. Main Features

- Computing with Raspberry Pi4 Model B(Linux).
- 64-bit SX1302 base band processor, 500 kHz LoRa reception with 8
  x 8 channels LoRa® packet detectors,8 x SF5-SF12 LoRa® demodulators,8 x SF5-SF10 LoRa®

demodulators.

- Built-in the GPSModule.
- Built-in Heat Sink for thermal heat dissipation management.
- Supports 5V/3A powersupply.
- RX sensitivity down to -139dBm@SF12, BW500KHz.
- LoRa frequency supports global license-free frequency band (EU433,CN470, EU868, US915, AS923, AU915, KR920, IN865 andAS920).
- Housing with top cover, body, bottom cover with riveted mother board stand off.
- Includes Pi ready 'ID EEPROM', GPIO setup and device tree can be automatically configured from vendor information. Supports fully open source code connected to a LoRaWANserver.

1.3. Package Contents

Figure 2 | Package Contents

2. WisGate RAK7248

2.1. Overview

The shell of RAK7248 is made of metal
The outer dimension of WisGate is 92 x 68.3 x 57.2 mm as shown below.

Figure 3 | Outer Dimensions

2.2. Interface

Figure 3 | Outer Dimensions

Figure 4 | Interfaces

2.3. System Structure

The following figure shows the basic concept for LoRaWAN system. RAK7248 WisGate is the central hardware solution for all LoRa based radio communication. It receives and transmits radio messages. The processing of radio messages as well as the protocol related tasks is done by embedded host system (Raspberry Pi). Received and processed radio messages are being sent to a LoRaWAN server. The concrete segmentation of the protocol related tasks is outside the scope of this document.

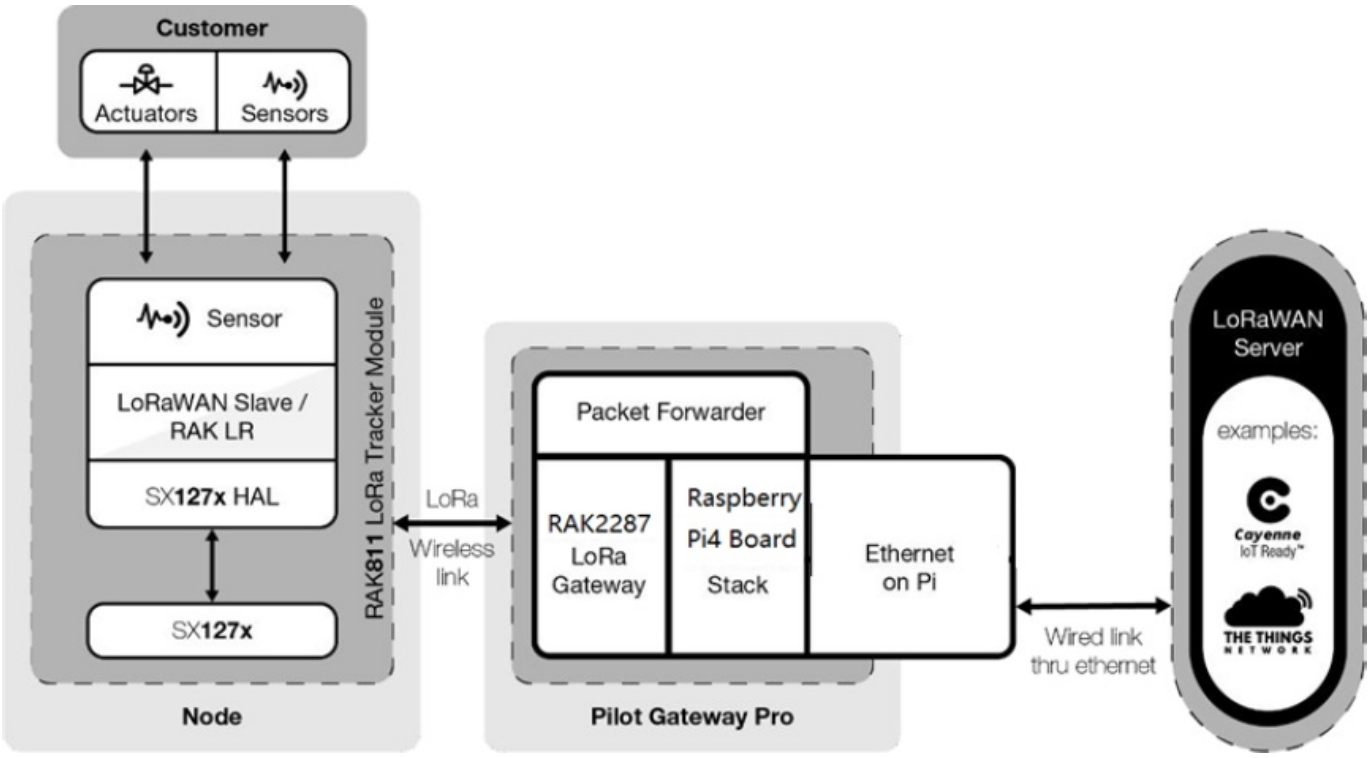

Figure 5 | WisGate System Structure

2.4. RaspberryPi

- Processor: Broadcom BCM2711, quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- Memory:2GB LPDDR4
- I/O Port:Gigabit Ethernet;2 × USB 3.0 ports;2 × USB 2.0 ports
- Connectivity:2.4 GHz and 5.0 GHz IEEE 802.11b/g/n/ac wirelessLAN, Bluetooth, BLE

2.5.LoRa Operating Frequencies

The WisGate supports all LoRaWAN frequency bands as below. Which is easy to configure while building the firmware from the source code.

Region	Frequency
Europe	EU433,EU868
China	CN470
North American	US915
Asia	AS923,AS920
Australia	AU915
Korea	KR920
Indian	IN865

Table 1 | LoRa Operating Frequencies

2.6.Hardware Structure

RAK2003 Pi HAT is a carrier board of RAK2287 LoRa Concentrator which follows the Pi 7

HAT standard, and can be mounted to Pi board with 40-pin connector. RAK2003 and

RAK2287 are connected by PCI-E interface.

2.7.Power Requirements

The WisGate operates at 5V/3A. It can be powered by micro USB with 5V.

Parameter Min. Typical Max.

LoRa Txmode	–	–	950mA
Standby mode	–	550mA	–
Burntest mode			930mA

Table 2| Power consumption

Note: LoRa Tx mode: The LoRa module works at the maximum transmit power state. Burn test mode: Raspberry Pi CPU and memory are running at full capacity

2.8.Environmental Requirements

The table below lists the operation and storage temperature requirements

Parameter Min. Typical Max.

Operation Temperature Range	-20 ºC	+25 ºC	+65 ºC
Extended Temperature Range	-40 ˚C		+85 ˚C
Storage Temperature Range	-40 ˚C		+85 ˚C

Table 3| Environment Requirements

2.9.LoRa RF Characteristics

2.9.1 Transmitter RF Characteristics

The RAK2287 has an excellent transmitter performance. It is highly recommended to use an optimized configuration for the power level configuration, which is part of the HAL. This results in a mean RF output power level and current consumption.

Frequency Range	Transmit Power	Modulation Technique
923.3-927.5 MHz	13.39dBm	LoRa / FSK

2.9.2 Receiver RF Characteristics

It is highly recommended, to use optimized RSSI calibration values, which is part of the HAL v3.1. For both, Radio 1 and 2, the RSSI-Offset should be set -169.0. The following table gives typically sensitivity level of the RAK2287.

Signal Bandwidth / [KHz]	Spreading Factor	Sensitivity / [dBm]
500	12	-134
500	7	-120

Table 5| RX RF Characteristics

3. Antenna

3.1.LoRa Antenna

3.1.1 Overview

The LoRa Antenna with RP-SMA female connector shown as follow figures.

Figure 6 | LoRa Antenna Overview

3.1.2Antenna Dimension

The antenna’s mechanical dimension is shown below:

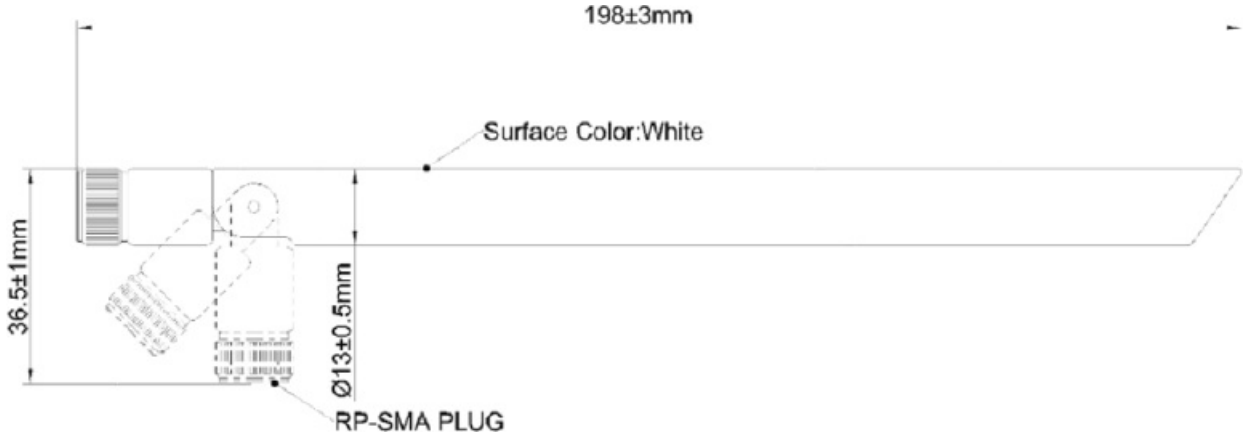

Figure 7 | LoRa Antenna Dimension

3.1.3Antenna Parameter

Model		KRAKBJ2701C01C
Electrical Specifications	Frequency Range	902MHz~928MHz
	Peak Gain	2.3 dBi
	VSWR	≤ 1.5
	Efficiency	>80%
	Feed Impedance	50 Ohms
	Polarization	Vertical
Mechanical Specifications	Cover material(color)	Plastic(Black)
	Interface	RPSMA
	Dimensions (mm)	Φ13.0mm x 198.0mm
	Operation Temp (°C)	-30°C ~ +75°C
	Humidity range	5%~95%

Table 6| LoRa Antenna Parameter

3.2.GPS Antenna

3.2.1Overview

Figure 8 | GPS Antenna

The GPS antenna for WisGate is shown below.

3.2.2GPS Antenna Dimensions

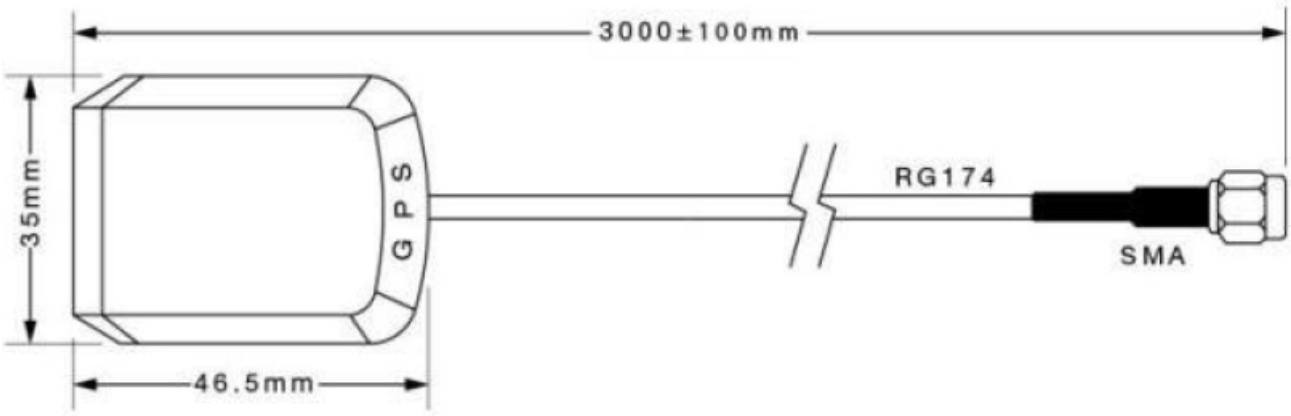

Figure 9 | GPS Antenna Dimensions

3.2.3GPS Environmental Requirements

The antenna environmental requirements are listed in the table below:

Conditions	Temperature	Humidity
Working	-35 ºC ~ +80 ºC	0% ~ 95%
Storage	-40 ºC ~ +85 ºC	0% ~ 95%

Table 7| GPS Environmental Requirements

3.2.4GPS Antenna Parameter

Antenna specifications are listed in the table below:

Item Specifications PET

Range of Receiving Frequency	1575.42±1.1	±2.5
Center Frequency (MHz) w/ 30mm2 GND plane	1575.42	±3.0
Bandwidth (MHz) (Return Loss ≤ -10dB)	≥10	±0.5
VSWR (in Center Frequency)	≤2.0	±0.5
Gain (Zenith) (dBi Typ.) w/ 70mm2 GND Plane	4.5	±0.5
Axial Ratio (dB) w/ 70mm2 GND Plane	3.0	±0.2
Polarization	Right-Handed Circular	–
Impedance (Ω)	50	–
Frequency Temperature Coefficient (ppm/ºC)	0±10	–

Table 8| GPS Antenna Parameter

Amplifier Specifications are listed in the table below:

Item Specifications

Frequency Range	1575.42 MHz
Gain	27 dB
VSWR	≤ 2.0 V
Noise Coefficient	≤ 2.0 dBm
DC Voltage	3 ~ 5 V
DC Current	5 ± 2 mA

Table 9| Amplifier Specifications

Environmental test performance specifications are listed below:

Item	Normal Temp.	High Temp.1	Low Temp.2
Amplifier Gain	27dB ± 2.0	27dB ± 2.0	27dB ± 2.0
VSWR	≤ 2.0	≤ 2.0	≤ 2.0
Noise Coefficient	≤ 2.0	≤ 2.0	≤ 2.0

1. High temperature test: soap in temperature (85º C) and humidity (95%) chamber for 24- hour and return to normal temperature (at least for 1-hour) without visual shape change.

2. Low temperature test: soap in temperature (-40º C) chamber for 24-hour and return to

normal temperature (at least for 1-hour) without visual shapechange.

Table 10| Environmental Test Performance

4. FCC Caution

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.

5. ISEDC Warning

ISEDC Warning

This device complies with Innovation, Science, and Economic Development Canada license exempt RSS standard(s). Operation is subject to the following two conditions:

RAK7248 this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

The device is compliance with RF exposure guidelines, users can obtain Canadian information on RF exposure and compliance. The minimum distance from body to use the device is 20cm.

6. Revision History

Revision Description Date
1.0 Initial Release August13, 2020 1.1 Add FCC/ISEDC information September 10 2020 1.2 Changeproductname September 14 2020 1.3 Add Raspberry Pi Hardwareinformation September 15 2020

7. Document Summary

Prepared by Checked by: Approved by:

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.

Documents / Resources

	Shenzhen Rakwireless Technology RAK7248 WisGate Raspberry Pi Gateway [pdf] User Manual RAK7248, 2AF6B-RAK7248, 2AF6BRAK7248, RAK7248 WisGate Raspberry Pi Gateway, WisGate Raspberry Pi Gateway

References

- The Official Website of RAKwireless - Where IoT Is Made Easy