



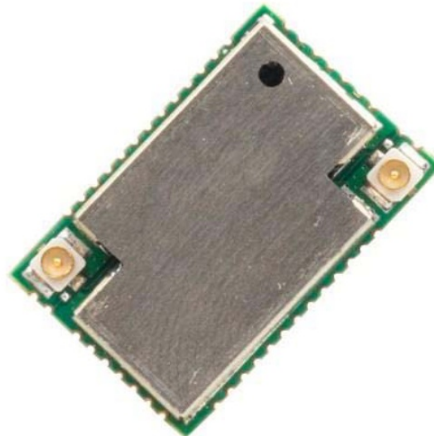
RAK4630 LoRa Module User Manual

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RAKwireless
Technology Co., Ltd.

RAK 4630



User manual for
RAK4630 LoRa Module
WisDuo-LoRa Series
Version V1.01 Oct. 2020

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Introduction

This document defines the RAK4630 module and describes the hardware interfaces which are connected with customers' applications. This document helps customers quickly understand the interface specifications, electrical and mechanical details, as well as other related information of RAK4630.

Overview

2.1 General description

RAK4630 is an embedded LoRa and BLE5.0 wireless communication module, it includes an nRF52840 MCU and a 5)(1262 LoRa chip, with Ultra-low power consumption of 2.0uA in sleep mode. The module complies with LoRaWAN 1.0.2 protocols, it also supports LoRa point-to-point communication. The module supports BLE 5.0 in addition to LoRa. Its RF communication capabilities make it suitable for a variety of applications in the IoT field.

2.2 Main Features

- LoRa module for Smart City, Smart Agriculture, Smart Industry
- TCXO crystal for LoRa chip
- Compact Form Factor: 15 x 23 x 3 mm
- 44 Pin Stamp Pad for PCB SMT mounting
- I/O ports: UART/12C/GPIO/USB/SPI (optional NFC interface)
- Temperature range: -40°C to +85°C
- Supply voltage: 2.0 — 3.6V
- LoRa Frequency range: 863-870MHz (EU) / 902-915MHz (US)
- BLE Frequency range: 2402-2480MHz
- Ultra-Low Power Consumption 2.0uA in sleep mode
- RF-Output Power : BLE: 4.17dBm(For FCC), 6.29dBm(For CE) LoRa: 15.76dBm(For FCC), 13.26dBm(For CE)

2.3 Supported LoRaWAN Bands

The following table shows support LoRaWAN bands of the RAK4630 module.

Table 1: Operating Frequencies

Region	Frequency (MHz)	
Indian	IN865	RAK4630(H)
Europe	EU868	RAK4630(H)
North America	US915	RAK4630(H)
Australia	AU915	RAK4630(H)
Korea	KR920	RAK4630(H)
Asia	AS923	RAK4630(H)
China	CN470	RAK4630(L)

2.4 Pin Assignment

The following figure shows the pin assignment of the RAK4630 module.

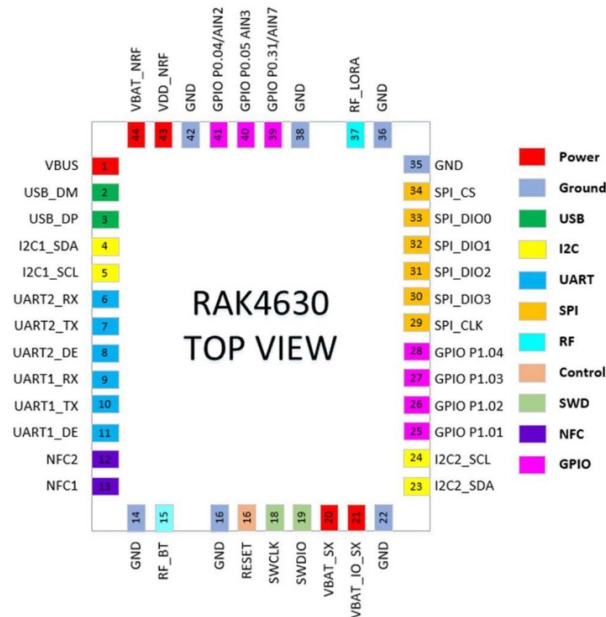


Figure 1: Pin Assignment
NOTES

- For a single 3.3V power supply, connect VBAT_BT, VDD_BT, VBAT_SX, VBAT_SX_I0 together with 3.3V power
- For the 3.6V li-SOCL2 battery, connect VBAT_BT AND VBAT_SX together with battery output, connect VDD_BT and VBAT_SX_I0 together to set 10 voltage level.
- For 4.2V li-MnO2 battery, connect VBAT_NRF with battery output, should add external DC-DC convertor LDO for VBAT_SX (3.3V), and connect VDD_BT and VBAT_SX_I0 together to set 10 voltage level.
- GND pins should be connected to the ground in the design.

2.5 Pin Description

The following tables show the pin definition and description of RAK4630.

Table 2: Definition of I/O Parameters

Table 2: Definition of I/O Parameters

Type	Type
PI	Power Input
PO	Power Output
DI	Digital Input
DO	Digital Output
10	Bidirectional
AI	Analog Input
AO	Analog Output

Table 3: Pin Description

Power Supply				
Pin Name	Pin No.	Type	Description	Comment
VDD_NRF	43	PI	Power supply	
VBAT_NRF	44	PI	High Power supply	
VBAT_SX	20	PI	Supply for the RFIC	Supply for 5)(1262 VBAT
VBAT SX I 0	21	PI	Supply for the Digital I/O interface pins	Supply for 5X1262 VBAT 10
GND	14,16,22,35,36, 3 8,42		Ground	
I2C Interface				
Pin Name	Pin No.	Type	Description	Comment
12C1_SDA	4	10	12C serial data	P0.13
12C1_SCL	5	OD	12C serial clock	P0.14
I2C2 SDA	23	10	12C serial data	P0.24

12C2 – SCL	24	OD	12C serial clock
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USD Interface				
Pin Name	Pin No.	Type	Description	Comment
VBLIS	1	PI	USB power	SV input for 3.3V regulator
USB_OP	3	10	USB differential data(+)	
USB_DM	2	10	USB differential data()	
DART Interface				
Pin Name	Pin No.	Type	Description	Comment
UART1_11 (10	DO	UART1 transmit	P0.20
UARTI_RX	9	DI	UART1 receive	P0.19
UARTI_DE	11	DI	VARTI detect	P0.21
UART2 TX	7	DO	UART2 transmit	P0.16
UART2_RX	6	DI	UART2 receive	P0.15
UART2 DE	8	DI	UART12detect	P0.17
Quad SIM Interlace				
Pin Name	Pin No.	Type	Description	Comment
SPI_CLK	29	DO	SPI clock	P0.03
SP1_CS	34	DO	WI chip select	P0.26
S1 ¹ 1_0100	33	10	WI data Input/output 0	P0.30
SP1_D101	32	TO	SPI data Input/output 1	P0.29

SPI_D102	31	10	WI data input/output 2	P0.28
SPI_D103	30	10	WI data input/output 3	P0.02
SWD Interface				
Pin Name	Pin No.	Type	Description	Comment
STUDIO	19	Debug	SWD 1/0 for debugging and programming	
SWCLX	18	Debug	SWD clock input for debugging and programming	
RESET				
Pin Name	Pin No.	Type	Description	Comment
RESET	17	DI	Reset the module	
NEC hitt: dace				
Pin Name	Pin No.	Type	Description	Comment
NEC1	13	DI	NEC Input 1	P0.09
NFC2	12	DI	NEC Input 2	P0.10
MUM' Interface				
Pin Name	Pin No.	Type	Description	Comment
RFBT —	15	10	Bluetooth antenna interface	SOO Impedance If unused, keep this pin open.
RI LORA —	37	10	Lora antenna Interface	son Impedance II unused , keep this pin open.

GPO Interface				
Pin Name	Pin No.	Type	Description	Comment
GPIO P1.0 1	25	10	General-purpose input/output	

GPIO P1.0 2	26	10	General-purpose input/output	
GPIO P1.0 3	27	10	General-purpose input/output	
GPIO P1.0 4	28	10	General-purpose input/output	

ADC interface				
Pin Name	Pin No.	Type	Description	Comment
GPIO P0.3 1	39	10	General-purpose input/output	
AJN7		AI	General-purpose ADC Interface	
GPIO P0.0 5	40	10	General-purpose Input/output	
A1N3		AI	General-purpose ADC Interface	
GPIO P0.0 4	41	10	General-purpose Input/output	
AIN2		AI	Generalpurpose ADC interface	

2.6 Power Consumption

The knowing table show the power consumption.

Table 4: Power Consumption

Item	Power Consumption	Condition
Tx mode Loita@l5d8m	85mA	LoRa @ PA_BOOST&BT sleep
Tx mode LoRa@13d8m	80mA	LoRa @ PA_BOOST&BT sleep
Tx mode BT@4dBm	9mA	BT Tx mode & Lora sleep
Rx mode LoRa037.5Kbps	17mA	LoRa @ Receive mode &BT sleep
Rx mode BTO2Mbps	11.5mA	ST Rx mode & Lora sleep
Sleep mode	2.OuA	LoRa&BT sleep

2.7 Absolute Maximum Ratings

The following table show the absolute maximum ratings of RAK4630 **Table 5: Absolute Maximum Ratings**

Symbol	Description	Min	Nom.	Max.	Unit
VEIAT_SX	LoRa chip supply voltage	.0.5	–	3.9	V
VBAT_SX_I0	LoRa chip supply for I/O pins	.0.5	–	3.9	V
V00_NRF	MCU power supply	.0.3	–	3.9	V
VBUS	USB supply voltage	.0.3	–	5.8	V
VBAT_NRF	MCU high voltage power supply	.0.3	–	BB	V
ESC. HBM	Human Body Model		•	2000	V
ESD CDM	Charged-Device Model	–	•	500	V

2.8 Recommended operating conditions

The following table shows the recommended operating conditions of RAK4630.

Table 6: Recommended operating conditions

Symbol	Description	Min.	Nom.	Max.	Unit
VBAT_SX	SX1262 supply voltage	2	3.3	3.7	V
VBAT_SX_10	SX1262 supply for I/O pins	2	3.3	3.7	V
VDD_NRF	NRF52840 power supply	2	3.3	3.6	V
VBUS	VBUS USB supply voltage	4.35	5	5.5	V
VBAT_NRF	NRF52840 high voltage power supply	2.5		5.5	V

Mechanical Dimensions

This chapter describes the mechanical dimensions of the module. All dimensions are measured in millimeters (mm), and the tolerances of the dimensions are $\pm 0.05\text{mm}$ unless otherwise specified.

3.1 Top and Side Dimensions

The following figure shows the mechanical dimension of the RAK4630 module.

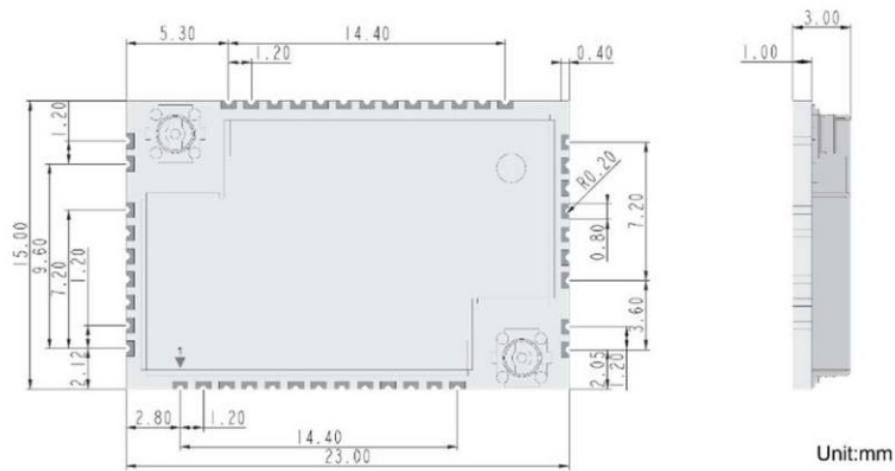


Figure 2: Top and Side Dimensions

3.2 Recommended Footprint

The following figure shows the recommended footprint of the RAK4630 module.

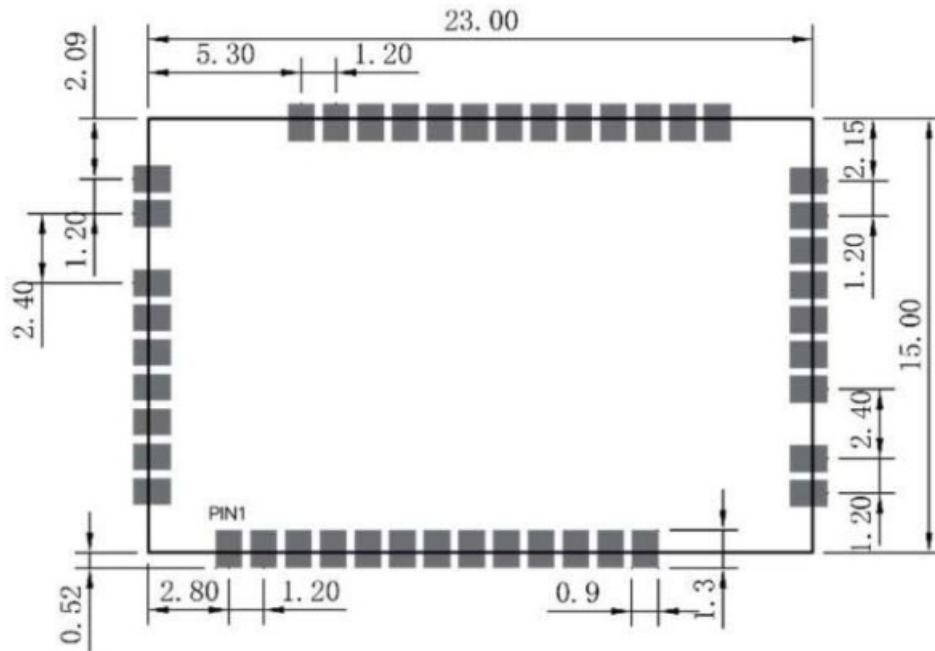


Figure3: Recommended Footprint (Unit: mm)

3.3 Recommended Reflow Profile

The following figure shows the Recommended Reflow Soldering Thermal Profile of RAX4630.

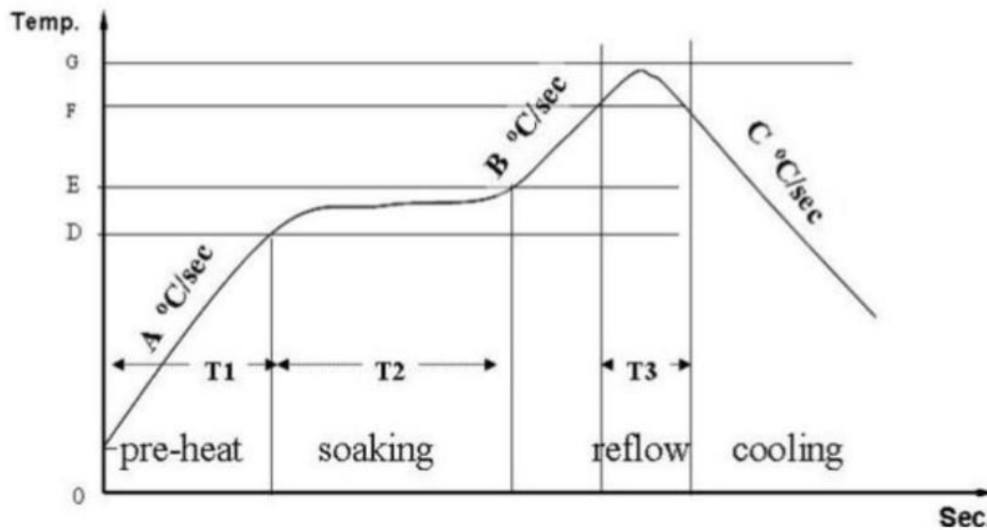


Figure 4: Recommended Reflow Soldering Thermal Profile

Certification Information

Conformity Assessment of the Radio Module to the RED This radio module is for professional installation only. When installing this radio module permanently into a host product to create a new radio equipment device; the manufacturer responsible for placing the final radio product on the market in the EU must assess if the combination of this radio module and the host product complies with the essential requirements of the RED Directive 2014/53/EU. Firmware version: V1.0 Test Antenna: Antenna 1(BLE Antenna): Internal Antenna and maximum gain 2.23dBi, Antenna 2(LoRa Antenna): External rod antenna and maximum gain 3.0dBi The final radio product will need to be fully assessed to Article 3.1a of the RED, for product safety With regard to RF exposure for Article 3.1a of the RED, the manufacturer of the final radio product will need to assess if the compliance assessment of the original radio equipment/module remains relevant to the final radio product, or if further action is necessary. This equipment should be installed and operated with a minimum distance 20cm between the radiator & your body. If the final radio equipment is used at the same distance from a person or domesticated animal as the radio module was assessed, (for example >20cm), then the final radio product assessment could conclude that the final radio product is compliant with the RF exposure requirements without additional actions. If the final radio equipment is used at a closer distance from a person or domesticated animal than the radio module was assessed, then the final radio product assessment could not automatically conclude that the final radio product is compliant with the RF exposure requirements without additional actions; and further assessment is necessary. The final radio product will need to be fully assessed to Article 3.1b of the RED, for EMC. EMC testing of the radio module will have been performed on some sort of temporary host or test jig; but now the module is in a new host product and the EMC performance of the final radio product must be assessed. Most likely the host product will have its own EMC assessment for other functions, which should be performed with the radio module installed; and inclusion of the radio module into the host product will also require an assessment, such as to the relevant applicable part of EN 301489, on the final radio product. In theory, radio transmitter or receiver measurements made as conducted measurements at a radio module antenna port may be considered applicable to the radio performance of the final radio product. However, in this example, the radio module does not have an antenna port. The radio module has a pin that leads through a PCB trace to an antenna on the host product. If the manufacturer of the final radio product wishes to use conducted power, conducted emissions or receiver performance measurements from the radio module to show compliance of the final radio product, then they will need to exactly follow the detailed instructions from the radio module manufacturer; including input voltage, driver software, environmental conditions, antenna trace layout design construction and material, circuit board layout design construction and material, nearby circuitry, etc. In reality, it is expected that manufacturers of final radio products will need to test the output power, conducted spurious emissions and receiver performance requirements on the final radio product; and not take the results of those test cases from the radio module test reports. Radiated test cases will also need to be performed on the final radio product.

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 particular installations. 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.

Caution: Any changes or modifications to this device not explicitly approved by the manufacturer could void your authority to operate this 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.

RF Exposure Information

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

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular. 2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer has to consult with the module manufacturer for the installation method in end system.

2.4 Limited module procedures Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

To maintain compliance with FCC's RF exposure guidelines, This equipment should be installed and operated with a minimum distance of 20cm from your body.

2.7 Antennas

This radio transmitter FCC ID: **2AF6B-RAK4630** has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that has a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna Description	Antenna interface	Frequency Range (MHz)	Impedance (Ω)	Maximum antenna gain(dBi)
BLE Antenna	IPEX	2402-2480	50	223
Lora Antenna	IPEX	902-915	50	200

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains FCC ID: 2AF8B-FtAK4830 •



2.9 Information on test modes and additional testing requirements

Host manufacturer S strongly recommended confirming compliance with FCC requirements for the transmitter when the module is installed in the host. 2.10 Additional testing. Part 15 Subpart B disclaimer Host manufacturer is responsible for compliance of the host system with the module installed with all other applicable requirements for the system such as Part 1513



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Documents / Resources

	<p>RAK RAK4630 LoRa Module [pdf] User Manual RAK4630, 2AF6B-RAK4630, 2AF6BRAK4630, RAK4630 LoRa Module, RAK4630, LoRa Module</p>
	<p>RAK RAK4630 LoRa Module [pdf] User Manual RAK4630, 2AF6B-RAK4630, 2AF6BRAK4630, RAK4630 LoRa Module, RAK4630, LoRa Module</p>