



User Manual for

WisDevice Series

Outdoor LoRa Gateway RAK7240

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19 PAGES

Table of Contents

1 General Description	4
1.1 Product Description	4
1.2 Product Features.....	4
2 Product Specifications	5
2.1 Main Specifications	5
2.2 RF Specifications	6
2.2.1 WiFi Radio Specifications	6
2.2.2 LoRa Radio Specifications	6
2.3 Software Specifications	7
2.2.3 LoRa.....	7
2.2.4 Network	7
2.2.5 Management.....	7
2.4 Block Diagram	7
2.5 Main Electronic Circuit Board	8
2.6 WisDevice RAK7240 Enclosure.....	8
2.7 Antenna Requirement.....	9
3 WEB Configuration Guide	10
3.1 Connect the Gateway.....	10
3.2 WEB Management Platform.....	10
3.2.1 Status Overview	10
3.2.2 LoRaWAN Packet Logger	12
3.2.3 WAN Network Configuration	13
3.2.4 Cellular Network Configuration	13
3.2.5 Packet Forwarder Configuration	14
3.2.6 Network Ping Watchdog	15
4 Certification	17
5 Declaration of Conformity	17
6 Contact Information	18
7 Revision History.....	19
8 Document Summary	19

List of Tables

Table 1 Main Specifications	5
Table 2 WiFi Radio Specifications	6
Table 3 LoRa Radio Specifications	6
Table 4 Antenna Requirement.....	9

List of Images

Image 1 Network Architecture.....	4
Image 2 Block Diagram	7
Image 3 Circuit Board	8
Image 4 WisDevice RAK7240 Enclosure.....	8
Image 5 Status Overview	11
Image 6 LoRaWAN Packet Logger	12
Image 7 WAN Network Configuration	13
Image 8 Cellular Network Configuration	13
Image 9 Packet Forwarder Configuration	14
Image 10 Radio Configuration	14
Image 11 Ping Watchdog Interface.....	15
Image 12 Ping Watchdog Configuration	16

1 General Description

1.1 Product Description

RAK7240 is an outdoor gateway equipment with 8 receiving channels. Gateway uplink connects the LoRacloud platform to a standard Ethernet cable, making LoRaWAN wireless to cable network forwarding a breeze.

This equipment built-in EG9x module which supports IoT/M2M-optimized LTE Cat 4 cellular network, when in the absence of a wired network, it can readily use local operators' network uplink data to provide a 300Mbps local WiFi access.

Our built-in software is based on OpenWRT development for LoRaWAN transmission / forwarding. It is designed for all kinds of network environment, parameter configuration and firewall functions. Configurations and management of gateway devices are made easy for users through web configuration management system.

Warning: This device should be professionally installed.

RAK7240 is equipped with IP67 protection level enclosure and can withstand hot and cold environments. It is suitable for outdoor use. And it can be installed in a pole or a wall and has a Power-over-Ethernet (POE) supply mode, making it convenient for site construction and installation.

1.2 Product Features

- Supports standard version with 8RX 1TX
- Supports IoT/M2M-optimized LTE Cat 4 cellular network
- Supports GNSS (Global Navigation Satellite System)
- Supports WiFi and Bluetooth extended
- 100Mbase-T Ethernet with POE (Power-over-Ethernet)
- OpenWRT software supports LoRaWAN gateway and network configurations
- With IP65 ingress protection and surge protection
- Supports TTN and Cayenne LoRaWAN platform
- Supports TF card for storage
- Industrial operation temperature



Image 1 | Network Architecture

2 Product Specifications

2.1 Main Specifications

Feature	Specifications
Computing	<ul style="list-style-type: none"> MT7628, DDR2RAM 128MB
WiFi Feature	<ul style="list-style-type: none"> Frequency: 2.400-2.4835GHz(802.11b/g/n) RX Sensitivity: -95dBm (Min), TX Power: 20dBm (Max) Operation Channels: 2.4GHz: 1-11
LoRa Feature	<ul style="list-style-type: none"> SX1301 Mini PCIe card, 8Channels RX Sensitivity: -142dBm (Min), TX Power: 27dBm (Max) Frequency: EU433, CN470, EU868, US915, AS920, AS923, AU915, KR920, IN865
Cellular Feature	<ul style="list-style-type: none"> Variant for Europe LTE FDD: B1/B3/B7/B8/B20/B28A WCDMA: B1/B8 GSM: 900/1800MHz Variant for North America LTE FDD: B2/B4/B5/B12/B13 WCDMA: B2/B4/B5
Power Supply	<ul style="list-style-type: none"> POE (IEEE 802.3af), 42~57V DC
Power Consumption	<ul style="list-style-type: none"> 12W (typical)
ETH	<ul style="list-style-type: none"> RJ45(10/100M)
Console	<ul style="list-style-type: none"> RJ45 (RS232)
Antenna	<ul style="list-style-type: none"> 5 N-Type connectors
LEDs	<ul style="list-style-type: none"> LoRa LED(1), Cellular(2), POWER(1), ETH(1) , WIFI(1)
Ingress Protection	<ul style="list-style-type: none"> IP67
Enclosure Material	<ul style="list-style-type: none"> Aluminum
Weight	<ul style="list-style-type: none"> 1.3kg
Dimension	<ul style="list-style-type: none"> 224mm x 121mm x 42mm
Operating Temp.	<ul style="list-style-type: none"> -20 to 55 °C
Installation method	<ul style="list-style-type: none"> Pole or Wall mounting

Table 1 | Main Specifications

2.2 RF Specifications

2.2.1 WiFi Radio Specifications

Feature	Specifications
Wireless Standard	• IEEE 802.11b/g/n
Operating Frequency	• ISM band: 2.412~2.462(GHz)
Operation Channels	• 2.4GHz: 1-11
Transmit Power (The max. power may be different depending on local regulations) -per chain	<ul style="list-style-type: none"> • 802.11b <ul style="list-style-type: none"> 19dBm@ 1Mbps 19dBm@ 11Mbps • 802.11g <ul style="list-style-type: none"> 18dBm@ 6Mbps 16dBm@ 54Mbps • 802.11n(2.4G) <ul style="list-style-type: none"> 18dBm@MCS0 (HT20) 16dBm@MCS7 (HT20) 17dBm@MCS0 (HT40) 15dBm@MCS7 (HT40)
Receiver Sensitivity (Typical)	<ul style="list-style-type: none"> • 802.11b <ul style="list-style-type: none"> -95dBm@ 1Mbps -88dBm @11Mbps • 802.11g <ul style="list-style-type: none"> -90dBm @6 Mbps -75dBm@54Mbps • 802.11n(2.4G) <ul style="list-style-type: none"> -89dBm@MCS0 (HT20) -72dBm @MCS7(HT20) -86dBm @MCS0(HT40) -68dBm @MCS7(HT40)

Table 2 | WiFi Radio Specifications

2.2.2 LoRa Radio Specifications

Feature	Specifications
Operating Frequency	<ul style="list-style-type: none"> • EU433, CN470, EU868, US915 • AS923, AU915, KR920, IN865
Transmit Power	• 27dBm (Max)
Receiver Sensitivity	• -142dBm (Min)

Table 3 | LoRa Radio Specifications

2.3 Software Specifications

2.2.3 LoRa

- Supports country code
- Supports statistic
- Supports location setup
- Server address and port setup

2.2.4 Network

- Supports CPE and AP mode
- Supports Bridge, WISP and Router module
- Supports 802.1q
- Supports DHCP Server/Client
- Supports router module NAT
- Supports firewall

2.2.5 Management

- Supports WEB management
- Supports SSH2
- Supports firmware update
- Supports NTP

2.4 Block Diagram

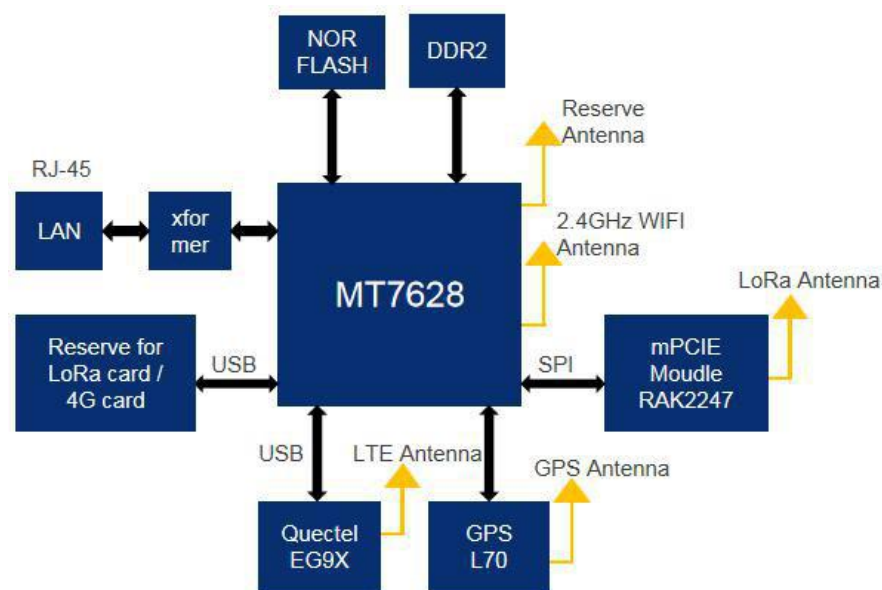


Image 2 | Block Diagram

2.5 Main Electronic Circuit Board

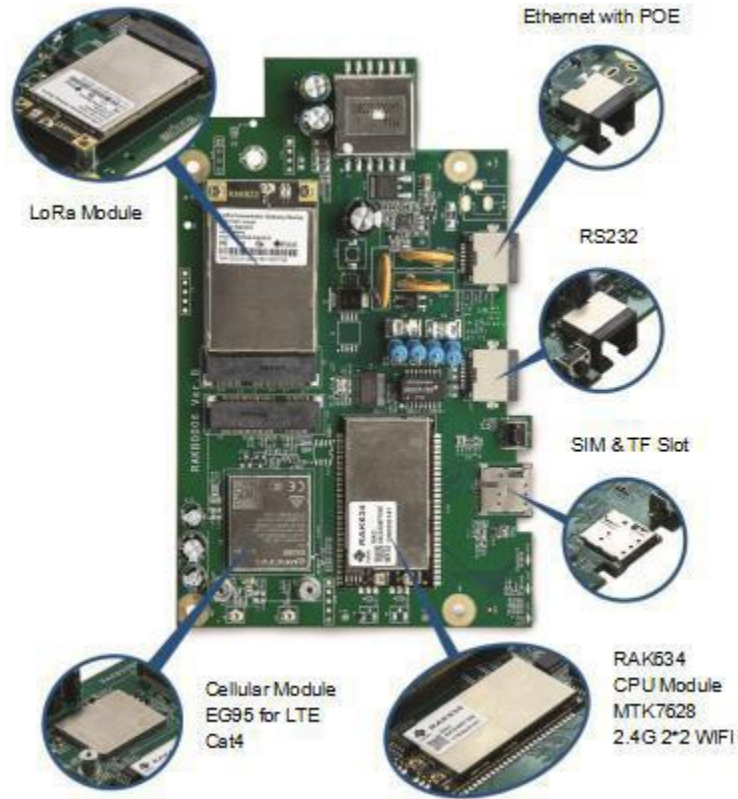


Image 3 | Circuit Board

2.6 WisDevice RAK7240 Enclosure



Image 4 | WisDevice RAK7240 Enclosure

2.7 Antenna Requirement

Type	Gain Requirements
LoRa antenna	$\leq 5.5\text{dBi}$
WIFI antenna	$\leq 3.5\text{dBi}$
LTE antenna	$\leq 1.0\text{dBi}$ (LTE FDD: B5/B12/B13;WCDMA: B5)
	$\leq 3.0\text{dBi}$ (LTE FDD: B2/B4;WCDMA: B2/B4)

Table 4 | Antenna Requirement

3 WEB Configuration Guide

3.1 Connect the Gateway

1. Via WiFi

The WiFi of the gateway works in AP mode by default. The default SSID format is "RAKxxxx_xxxx" such as "RAK7240_D3BD", "D3BD" is the last two bytes of the gateway MAC address. Connecting to the SSID using your PC, then can automatically get the IP address. After successful connection, the WEB management platform can be accessed through the IP address 192.168.230.1 of the gateway LAN interface.

2. Via IP Alias of WAN Port

The WAN interface of the gateway has a static IP (Auto IP Alias) generated automatically according to the MAC address. The format of the IP address is 169.254.x.x/255.255.0.0. The 3 and 4 bytes of IP correspond to the decimal representation of the fifth and sixth bytes of the MAC address, respectively. For example, the MAC address is xx: xx: xx: xx: D3: BD, and the Alias IP is 169.254.211.189/255.255.0.0.

Connecting your PC's Ethernet interface to gateway WAN interface, and adding 169.254.x.x/255.255.0.0 IP address to PC's Ethernet interface, then we can access gateway's WEB management platform through Alias IP.

3. Via WAN Port DHCP IP

When DHCP Server is in the network where the gateway WAN interface is located, the WAN interface can automatically get the IP address. After inquiring the IP address of the gateway through DHCP Server, the WEB management platform of the gateway can be accessed through the DHCP IP address of WAN interface.

3.2 WEB Management Platform

Open the browser, enter the IP address of the gateway, and open the login page of the WEB Management Platform. Enter the user name and password (user name and password default is **root**) and click login.

3.2.1 Status Overview

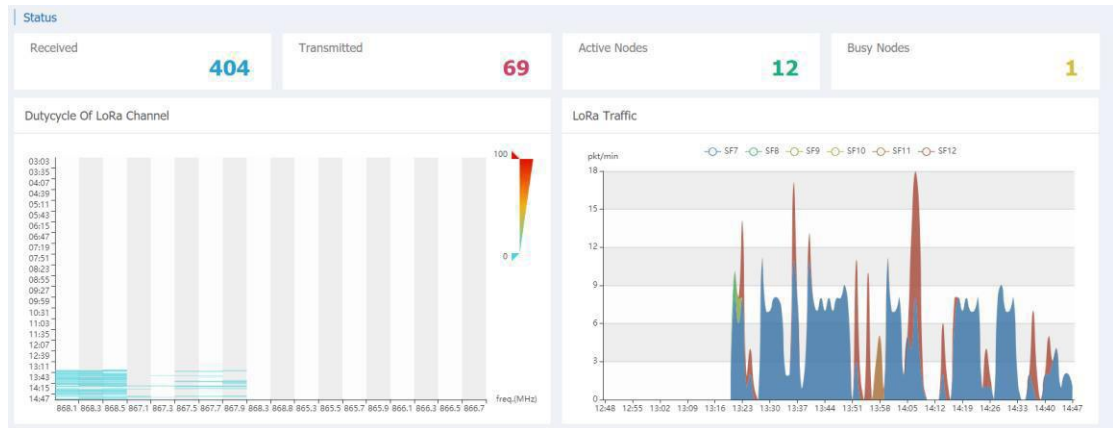


Image 5 | Status Overview

Received: Shows the total number of LoRa messages received by the LoRa gateway;

Transmitted: Shows the LoRa message sent by the LoRa gateway;

Active Nodes: Shows the number of active LoRa nodes within the LoRa gateway coverage (nodes that sent messages in 10 minutes)

Busy Nodes: Shows the number of busy nodes within the LoRa gateway coverage (nodes with an average message spacing of less than 60s)

Duty Cycle Of LoRa Channel:

The chart shows the thermodynamic charts of the "duty cycle" of all channels over time over a period of 12 hours. The longitudinal axis is time and the minimum interval is 60s. The horizontal axis is the channel frequency. Each value represents the average duty cycle of the channel within 60s (range is: 0%-100%), green represents the low duty cycle, and red represents the high duty cycle.

LoRa Traffic:

The chart shows the LoRa packet rate (packet/min) of each spread factor in two hours. The vertical axis represents the LoRa packet rate, in packet/min, six colors represent six spread factors, and the total height represents the sum of all the rates of LoRa packet.

3.2.2 LoRaWAN Packet Logger

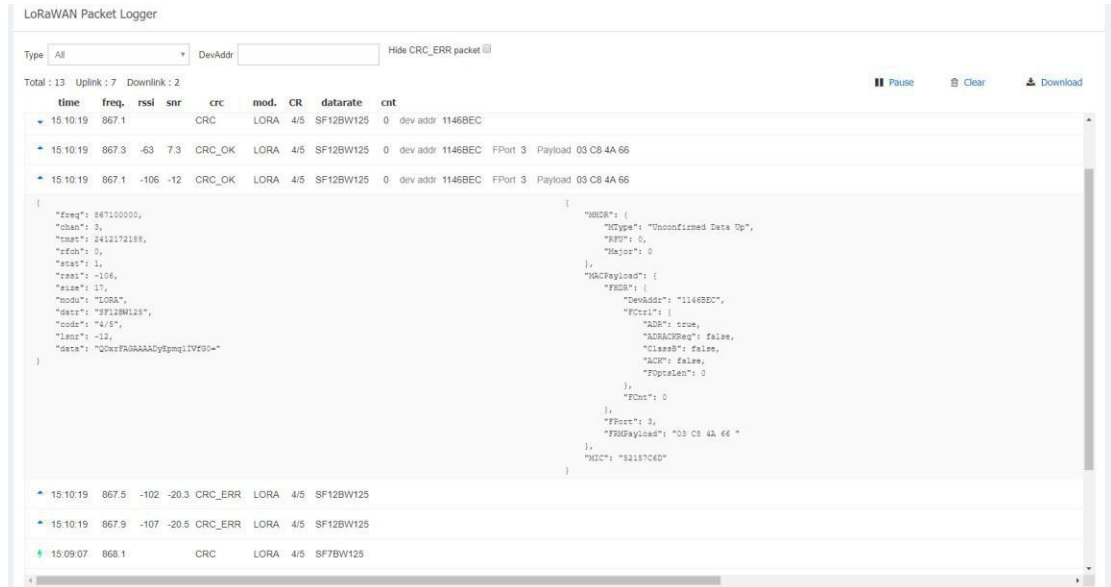


Image 6 | LoRaWAN Packet Logger

LoRaWAN Packet Logger: Real-time recording and parsing of messages sent and received by LoRa gateway and can be filtered according to message type and node address.

Type: Filter by message type. Select ALL as unfiltered and display all messages.

DevAddr: Filter messages based on node addresses.

Hide CRC_ERR packet: When it is selected, no CRC check error message will be displayed.

Pause/Play: Pause/start message recording.

Clear: Clear the current record.

Download: Save the current record locally in CSV format.

3.2.3 WAN Network Configuration

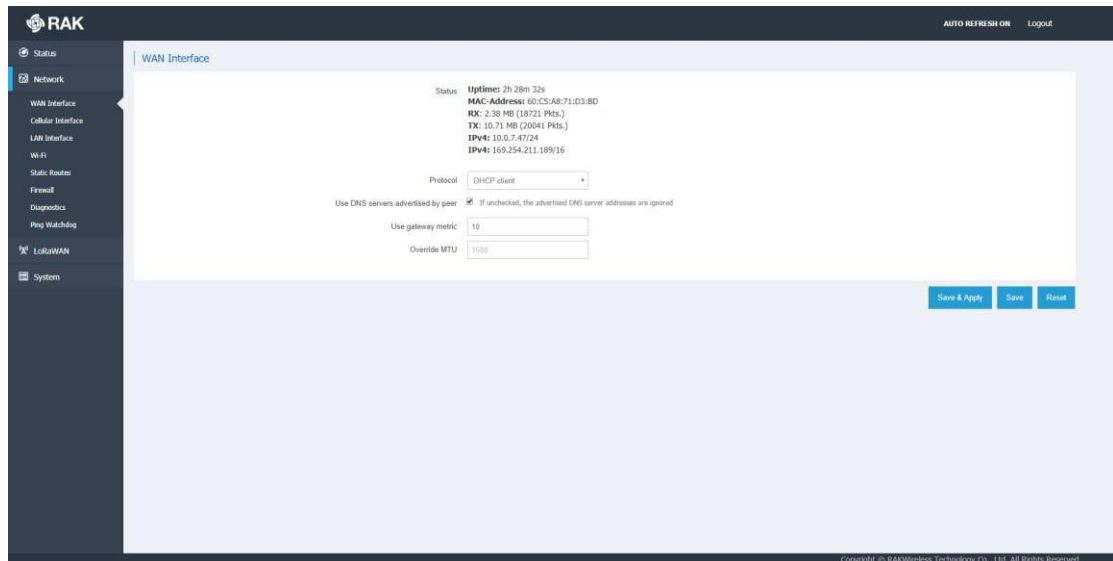


Image 7 | WAN Network Configuration

This is for Ethernet uplink network (WAN) configuration. It supports the DHCP/PPPoE/static IP three protocols.

3.2.4 Cellular Network Configuration

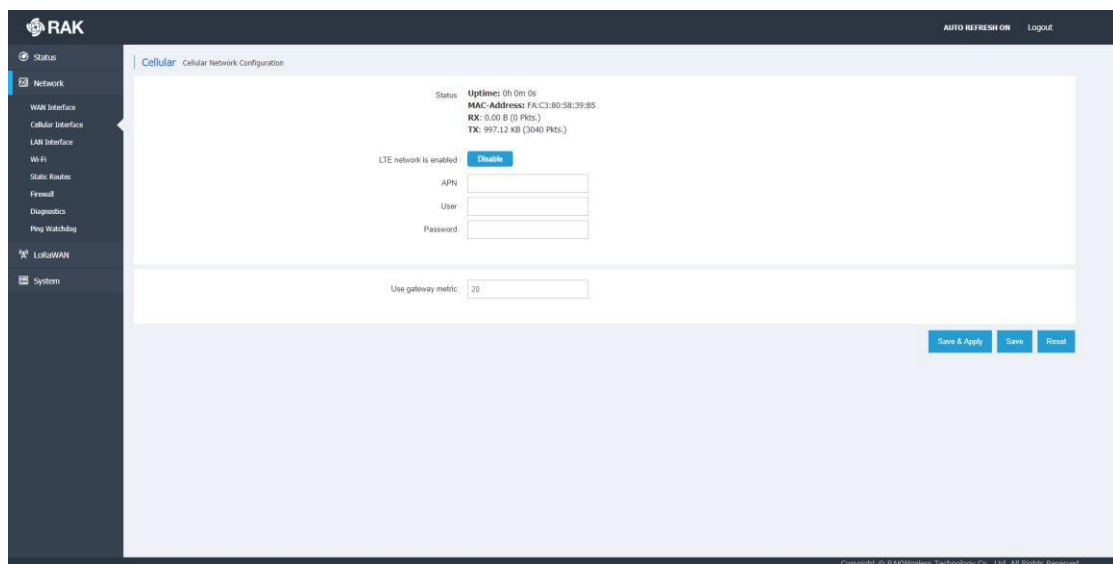


Image 8 | Cellular Network Configuration

This is for LTE cellular uplink network (WWAN) configuration. Please fill in APN/User/Password correctly according to the information provided by the network operators.

3.2.5 Packet Forwarder Configuration

Gateway Configuration

General Setup **Beacon Setup** GPS Information

Gateway EUI: 69C5A8FFFE71D38D

Server Address: 10.0.7.87

Server Port Up: 1700

Server Port Down: 1700

Statistic Interval (s): 30

Push Timeout (ms): 200

Image 9 | Packet Forwarder Configuration

General Setup : LoRa Network Server Configuration

Beacon Setup : Class B / Beacon Configuration

GPS Information : GPS Location Setup

LoRa Concentrator 0

radio configuration **Tx Gains**

Radio 0 Freq: 867500000

Radio 0 Tx Freq Min: 863000000

Radio 0 Tx Freq Max: 870000000

Radio 1 Freq: 868500000

Chan. ID	Multisf 0	Multisf 1	Multisf 2	Multisf 3	Multisf 4	Multisf 5	Multisf 6	Multisf 7	LoRa std	FSK
Enable	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Radio	Radio 1	Radio 1	Radio 1	Radio 0	Radio 0	Radio 0	Radio 0	Radio 0	Radio 1	Radio 1
If	-400000	-200000	0	-400000	-200000	0	200000	400000	-200000	300000
Freq.	868.1MHz	868.3MHz	868.5MHz	867.1MHz	867.3MHz	867.5MHz	867.7MHz	867.9MHz	868.3MHz	868.8MHz
Bandwidth	125 KHz	125 KHz	125 KHz	125 KHz	125 KHz	125 KHz	125 KHz	125 KHz	250 KHz	125 KHz
DataRate	All SF	All SF	All SF	All SF	All SF	All SF	All SF	All SF	SF7	50000

Image 10 | Radio Configuration

Radio Configuration : Rx Setup

Tx Gains : Tx Power Setup

3.2.6 Network Ping Watchdog

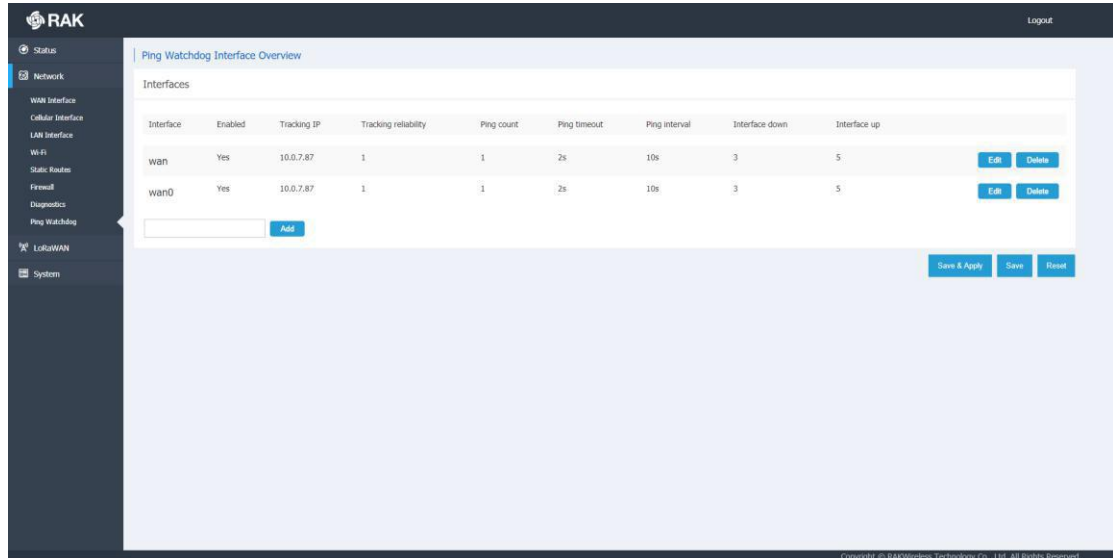


Image 11 | Ping Watchdog Interface

Ping Watchdog monitors the communication quality of network links by constantly pinging the specified IP address or domain name on the specified uplink network interface. When network link failures are found, scheduled measures are taken automatically, such as <restart interface>/<reduce the priority of this uplink network interface>/<restart the device>.

Note: Reducing the priority of an uplink interface only works when the LoRa gateway uses both the Ethernet uplink link and the LTE cellular network uplink link.

WAN interface represents the Ethernet uplink interface and WWAN represents the LTE cellular network uplink interface. If Ping watchdog is opened on both uplink network interfaces at the same time and action is set to Increase Gateway Metric, the two uplink links form backup links and automatically switch to another link when one link fails. The priority of the two links is determined by the default gateway metric of their respective network interfaces. The default gateway metric can be set in Network->WAN Network and Network->Cellular Network. The lower the gateway metric, the higher the priority of the link.


Enabled	<input type="text" value="Yes"/>	
Track IPs	<input type="text" value="10.0.7.87"/>	
	This IP address will be pinged to determine if the link is up or down.	
Tracking reliability	<input type="text" value="1"/>	
	Acceptable values: 1-100. This many Tracking IP addresses must respond for the link to be deemed up	
Ping count	<input type="text" value="1"/>	
Ping timeout	<input type="text" value="2 seconds"/>	
Ping interval	<input type="text" value="10 seconds"/>	
Interface down	<input type="text" value="3"/>	
	Interface will be deemed down after this many failed ping tests	
Interface up	<input type="text" value="5"/>	
	Downed interface will be deemed up after this many successful ping tests	
Action	<input type="text" value="Increase Gateway Metric"/>	
Offline metric	<input type="text" value="50"/>	
	Metric of the default gateway on this interface will be modified when the interface were deemed up	

Image 12 | Ping Watchdog Configuration

4 Certification



CE Class B (with LVD) without DFS

FCC Class B without DFS

ESD $\pm 4\text{KV}$; Direct (Air): $\pm 8\text{KV}$

5 Declaration of Conformity

RF Exposure Information and 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 of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.


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
- This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

6 Contact Information


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7 Revision History

Revision	Description	Date
1.0	Initial Release	2018-08-15
1.1	Modify the images and contents	2018-10-19
1.2	Improved layout and contents	2018-11-05
2.0	Modify context and the block diagram	2018-12-07
2.1	Modify the gateway WEB configuration chapter	2019-03-04

8 Document Summary

Document Title: Outdoor LoRa Gateway RAK7240 User Manual
Product Name: RAK7240
Revision Number: V2.1

Prepared by	Checked by	Approved by
Penn	Terry	



About RAKwireless:

RAKwireless is the pioneer in providing innovative and diverse cellular and LoRa connectivity solutions for IoT edge devices. It's easy and modular design can be used in different IoT applications and accelerate time-to-market turnover. For more information, please visit RAKwireless website at www.rakwireless.com.

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