Industrial Outdoor LoRa Gateway

RAK**7249**

Quick Start Guide

www.rakwireless.com
info@rakwireless.com

First Time Power Up

Step 1: Attach the antennas

First and foremost screw on the antennas. All 5 of them should be installed (WiFi, LoRa, LTE on the top, and GPS on the bottom).

Note: Do not power the device if the antenna port has been left open (not connected to the antenna).

Step 2: Power on the Gateway

It is recommended to use a CAT5 cable to provide power to the Gateway. Attach one end to the PoE injector and the other to the Ethernet port on the bottom of the casing.

Step 3: Connecting to the Gateway

Use either the Ethernet Port or WiFi.
In both modes you can access the Management UI via a web browser pointing to the IP address of the Gateway (check your router DHCP list).

- **WiFi AP mode**

  By default the Gateway is configured to work in Access Point (AP) mode.
  It has the following parameters:

  SSID: **RAK7249_xxxx**, “xxxx” means the last 4 characters of MAC (no password is required to connect via WiFi).

  Access Web UI: Connect via a browser to the default IP (**192.168.230.1**) of the gateway.

  UI user: **root**

  UI password: **root**

- **WAN port (DHCP IP) mode**

  Connect the Ethernet cable to the port marked “ETH” on POE injector and the other end to your Router. Find the IP address of your gateway on the DHCP list in your Router.

  Access Web UI: Connect via a browser to the IP address of your gateway.

  UI user: **root**

  UI password: **root**

Step 4: Connecting the Gateway to TTN

The Gateway EUI can be found via the Overview page in the Web UI.

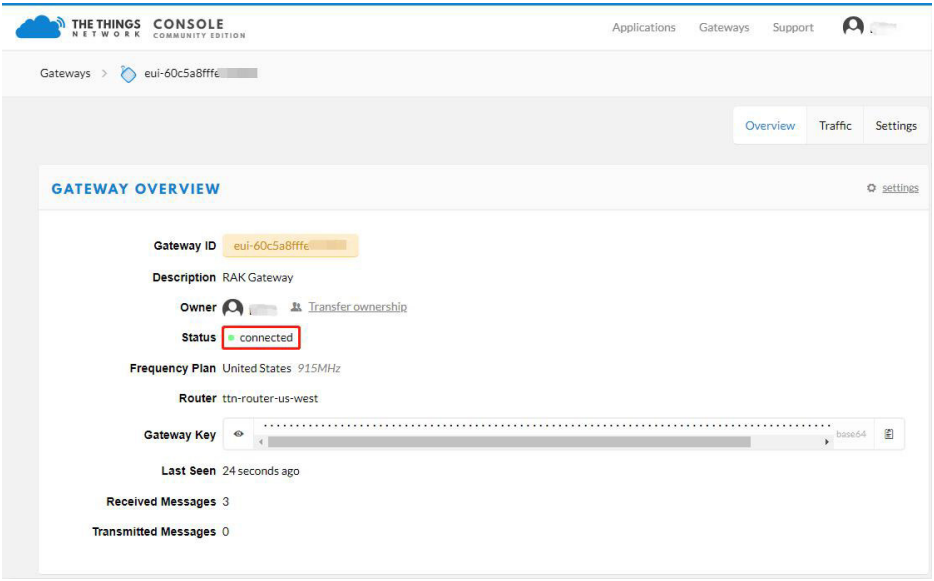
Go to your TTN console (you need to register an account first) and register your new gateway using the link below:

https://console.thethingsnetwork.org/gateways/register

Make sure to select the “I’m using the legacy packet forwarder” option, before entering the Gateway EUI.

Select your Frequency Plan depending on your location. This should populate the Router field. Optionally you can choose to enter the Gateway coordinates in the map’s upper right corner and select if the gateway is indoor or outdoor via the Antenna placement field below the map.

Upon successful registration you should see the following screen:



Your Gateway should now be registered with TTN and you should be able to forward LoRa packets.

Note: By Default the Gateway is set to connect to TTN (using it as its LoRa Network server). For detailed information about advanced configuration options refer to the Configuration Guide via the link:
https://www.rakwireless.com/en/download/LoRa/DIY-Gateway-RAK7249

Package Content

Gateway Device

Mounting Kit

PoE Injector GPS WiFi LTE LoRa

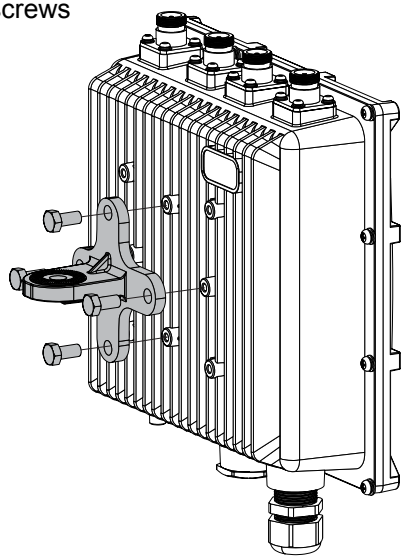
Casing and Ports

Assembly

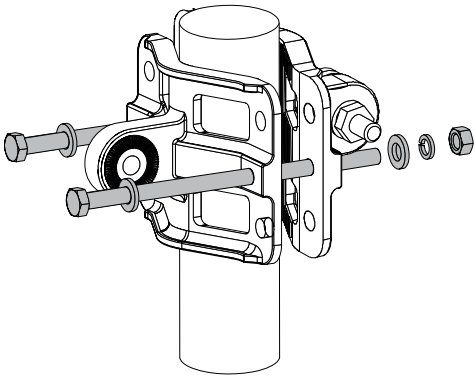
The gateway has already assembled before shipment. Also you can refer to the guide or video of the assembly procedure in case you want to know how to put the components together. Please email us for the guide and video.

Mounting

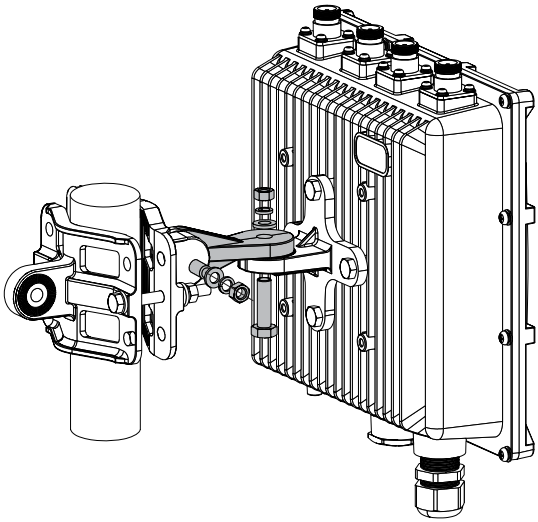
Step 1: Fix the device bracket to the backside of the enclosure with four M6x12 screws



Step 2: Tighten the pole clamp with hexagonal bolts M6x110, washers and nuts



Step 3: Connect the clamp and the bracket on the backside of the casing with hexagonal bolts M6x30, washers and nuts



Note: All the necessary components (bolts, washers, buts) come with the mounting kit.

Contact Us

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

Email us: info@rakwireless.com

Specifications for

DIY Enterprise LoRa Gateway

WisDevice Series

RAK7249

Version V1.4 | July 2019

www.RAKwireless.com

Visit our website for more documents.

15 PAGES

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1 Overview

1.1 Introduction

The Enterprise Grade DIY outdoor Gateway is an ideal product for IoT commercial deployment. It contains the Main Board, Operator-grade waterproof enclosure, backup battery and mounting accessories. The hardware main board completely integrates the WIFI, 4G, GPS and PoE main supply with an integrated back-up battery. The firmware implements a fully featured LoRaWAN™ complinant network base station. The Gateway has a range of over 15Km line-of-sight and over 2Km in dense urban environments.

The DIY Gateway brings more flexiblity for the developer to create an enterprise grade solution: our most important difference is our flexible development support structure, allowing for faster development and time to market. We offer both a ready to go firmware image for openWRT based platforms and an open SDK for integration into hardware to support the needs of each customer.

1.2 Main Features

- Enterprise grade network gateway with your own configuration.
- LoRaWAN™ Stack Inside and integrate the Web UI for management.
- Complete Hardware specification including LoRa concentrator, Cellular, GPS and WIFI.
- Supports Power of Ethernet (PoE) IEEE 802.3af/at-Compliant Class 4, 48V.
- Battery Backup sustains operation for about 10 hours under typical conditions.
- IP67 waterproof enclosure with cable gland.

2 DIY Enterprise Gateway

Create your own Enterprise Gateway using the supplied building Blocks:

- **Main Board**
- **Enclosure**
- **Backup Battery**
- **Accessories**

***Figure 1 | DIY** Enterprise Gateway*

Note: All the pictures are just for reference, if any discrepancy, please adhere to the actural product instead.

2.1 Main Board

- CPU:RAK634 Module(MT7628 inside)
  RAM:128MB DDR2
  Flash:16MB
  WIFI: 2x2 MIMO 802.11b/g/n

- LoRa concentrator

  Standard version with 8 channel Gateway and also support Max.16 channel Gateway.

  Tx Power is up to 27dBm and Rx sensitivity is down to -142dBm.
- 4G Cellular

  Quectel EG95 for CAT4 cellular network.
- L70 GPS Module
- Power-over-Ethernet (PoE)

  100M base-T Ethernet with IEEE802.3af/at standard Power-over-Ethernet.

2.2 Enclosure

- IP67 waterproof white color.
- Interface: 5 x N-Type connectors for Antenna,1 PoE port and 1 reserve port.
- Weight (with cable): approximately 70.54oz (2kg).
- Dimensions: 220mm x 220mm x 104mm.
- Wall thickness: 2mm.
- Support up to 70~100 mm diameter pole mount.

2.3 Backup Battery

- The maximum space in the Enclosure can be placed 12V/10AH batteries for about 10 hours lifetime under typical operation.
- Battery powered real time clock.
- Battery Within 140 x 70 x 30mm.
- DC 5.5 x 2.1 circular joint with two interfaces, one male and one female.

2.4 Accessories

- Mounting Kit
- PoE Injector
- WiFI Antenna
- GPS Antenna
- LoRa Antenna
- LTE Antenna

3 DIY Configuration

The bellow table shows the main board configurations of the DIY Enterprise Gateway.

Part Number	8 Channel SX1301	16 channel SX1301	Cat4 Cellular	GPS	WIFI	Battery Backup
RAK7249-0x-14x	√		√	√	√	
RAK7249-1x-14x		√	√	√	√	
RAK7249-2x-14x	√		√	√	√	√
RAK7249-3x-14x		√	√	√	√	√
RAK7249-0x	√			√	√	
RAK7249-1x		√		√	√	
RAK7249-2x	√			√	√	√
RAK7249-3x		√		√	√	√

Table 1 | DIY Configuration

4 Hardware Interfaces

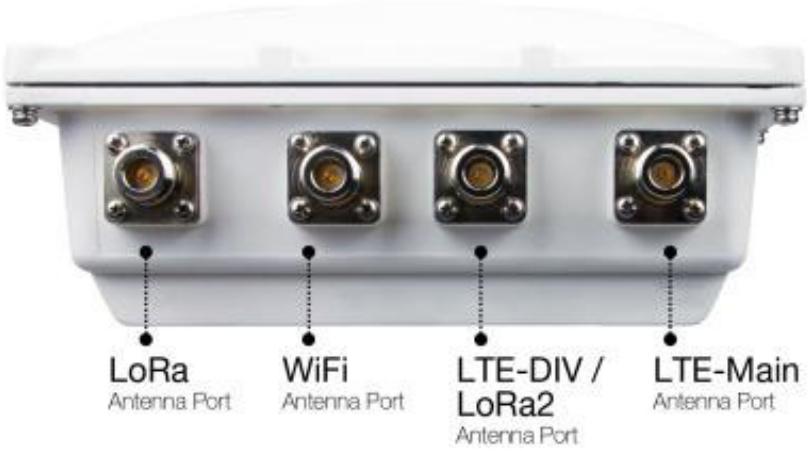

***Figure 2** | Hardware Interfaces - Front*

***Figure 3** | Hardware Interfaces - Rear*

5 Product Specifications

5.1 Main Specifications

Feature	Specifications
Computing	• MT7628, DDR2RAM 128MB
WIFI Feature	• **Frequency:** 2.400-2.4835GHz(802.11b/g/n) • **RX Sensitivity:** -95dBm (Min), **TX Power:** 20dBm (Max) • **Operation Channels:** 2.4GHz: 1-13
LoRa Feature	• SX1301 Mini PCIe card (connects maximum of two), 8Channels (Optional: 16channels) • **RX Sensitivity:** -142dBm (Min), **TX Power:** 27dBm (Max) • **Frequency:** EU433, CN470, EU868, US915 AS920, AS923, AU915, KR920, IN865
Cellular Feature	• **With EG95: LTE CAT 4** • **Cellular Variant for Europe** • LTE FDD: B1/B3/B7/B8/B20/B28A • WCDMA: B1/B8 • GSM: 900/1800MHz • **Cellular Variant for North America** • LTE FDD: B2/B4/B5/B12/B13 • WCDMA: B2/B4/B5
Power Supply	• PoE(IEEE 802.3af/at-Compliant), 42~57VDC
Power Consumption	• 12W (typical)
ETH	• RJ45(10/100M)
Antenna	• 5 N-Type connectors
Ingress Protection	• IP67
Enclosure Material	• Aluminum
Weight	• Approximately 111.11oz (3.15kg)
Dimension	• 220mm x 220mm x 104mm
Operating Temp.	• -30˚C to 65 ˚C
Installation method	• Pole or Wall mounting

***Table 2** | Main Specifications*

5.2 RF Specifications

5.2.1 WiFi Radio Specifications

Feature	Specifications
Wireless Standard	• IEEE 802.11b/g/n
Operating Frequency	• **ISM band:** 2.412~2.472(GHz)
Operation Channels	• 2.4GHz: 1-13
Transmit Power (The max. power may be different depending on local regulations) -per chain	• **802.11b** 19dBm@ 1Mbps 19dBm@ 11Mbps • **802.11g** 18dBm@ 6Mbps 16dBm@ 54Mbps • **802.11n (2.4G)** 18dBm@MCS0 (HT20) 16dBm@MCS7 (HT20) 17dBm@MCS0 (HT40) 15dBm@MCS7 (HT40)
Receiver Sensitivity (Typical)	• **802.11b** -95dBm@ 1Mbps -88dBm @11Mbps • **802.11g** -90dBm @6 Mbps -75dBm@54Mbps • **802.11n (2.4G)** -89dBm@MCS0 (HT20) -72dBm @MCS7(HT20) -86dBm @MCS0(HT40) -68dBm @MCS7(HT40)

***Table 3** | WiFi Radio Specifications*

5.2.2 LoRa Radio Specifications

Feature	Specifications
Operating Frequency	• EU433, CN470, EU868, US915 • AS920, AS923, AU915, KR920, IN865
Transmit Power	• 27dBm (Max)
Receiver Sensitivity	• -142dBm (Min)

***Table 4** | LoRa Radio Specifications*

5.3 Software Specifications

5.3.1 LoRa

- Supports class A, B & C
- Supports LoRaWAN protocol
- Supports country code setup
- Supports TX power setup
- Supports data logger
- Supports statistics
- Supports location setup
- Supports server address & port setup

5.3.2 Network

- Supports WiFi AP mode
- Supports LTE APN setup
- Supports uplink backup
- Supports 802.1q
- Supports DHCP Server/Client
- Supports router module NAT
- Supports firewall

5.3.3 Management

- Supports WEB Management
- Supports SSH2
- Supports firmware update
- Supports NTP

5.4 Block Diagram

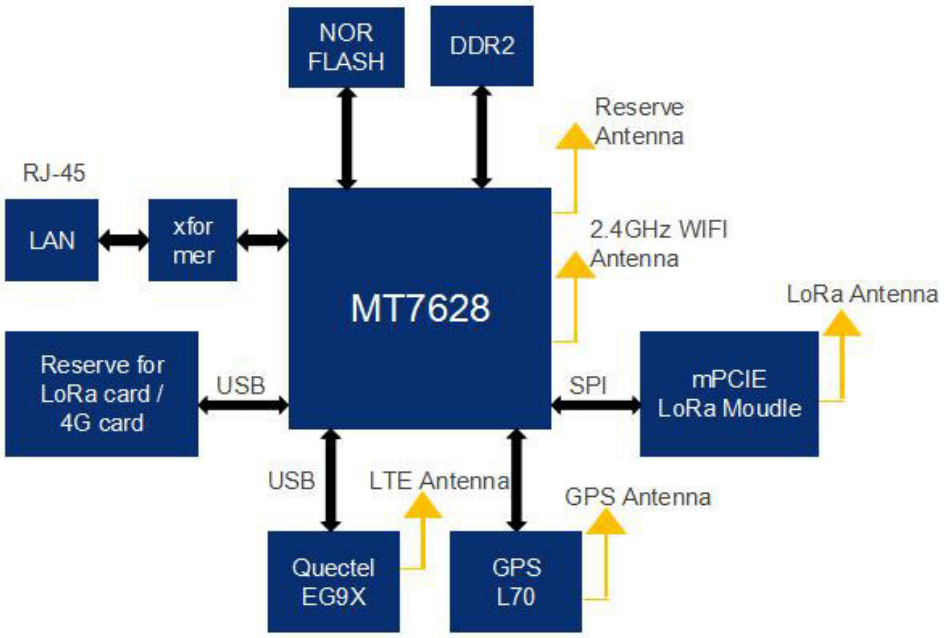

***Figure 4** | Block Diagram*

5.5 Main Board Overview

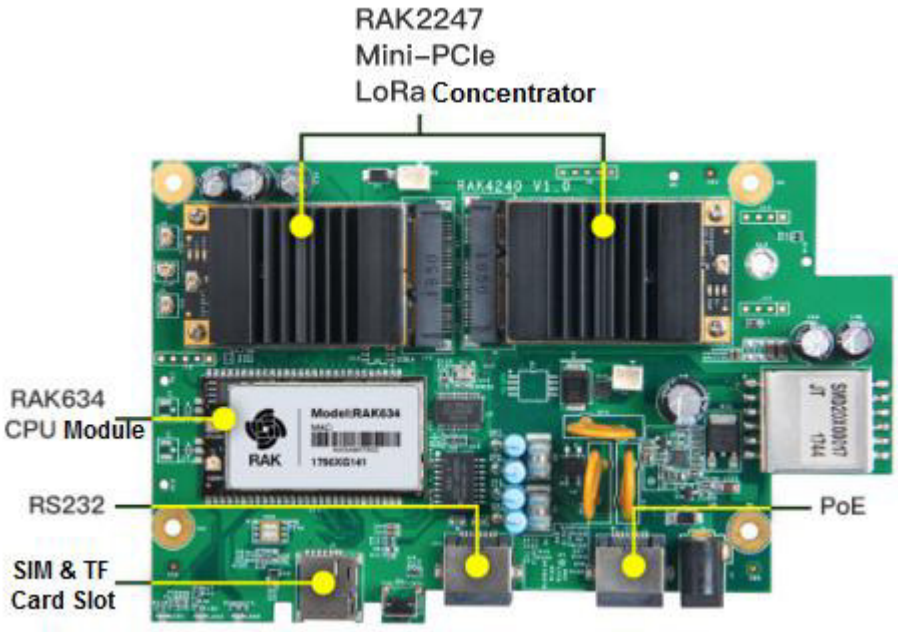

***Figure 5** | Circuit Board*

The RAK7249 mainboard provide a Reset key and 6* LEDs for status indication.The The function of the Reset key is as follows:

Short press: Restart the Gateway;

Long press (5s and above): Restore Factory Settings;

The status of the LEDs is described as below. Please refer to the printing of the LEDs on the mainboard.

LEDs	Status Indication Description
LED1(PWR)	• Power Indicator, Led on when device power on
LED2(ETH)	• **ON** - linkup • **OFF** - linkdown • **Flash** - Data Transmitting and Receiving
LED3(LoRa1)	• **ON** - LoRa1 is working • **OFF** - LoRa1 is not working • **Flash** - Indicate that LoRa1 Packet receiving and sending
LED4(LTE)	• **Slow Flash 1**(200ms Bright/1800ms Dark) - unregistered network (in search) • **Slow Flash 2**(200ms Dark/1800ms Bright) - idle status(online) • **Flash -** Data Transmitting and Receiving • **ON** - Voice is working
LED5(LoRa2 for 16 channel**)**	• **ON** - LoRa2 is working • **OFF** - LoRa2 is not working • **Flash** - Indicate that LoRa2 Packet receiving and sending
LED6(WLAN)	• **AP Mode** : **ON** - WLAN is working; **Flash** - Data Transmitting and Receiving • **STA Mode** : **Slow Flash**(1Hz) - Connection Disconnected; **ON** - Connection Successful; • **Flash** - Data Receiving and Sending;

Table 5 | LEDs Status Description

6 Configure the Gateway

You can login to the WEB Management page to overview the status of your gateway and configure your gateway.

For more information about the WEB Management platform and the configuration guide of the gateway, please refer to this document:

RAK_LoRaWAN_Industrial_Gateway_Configuration_Guide

7 Contact Information

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

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

Email us: info@rakwireless.com

8 Revision History

Revision	Description	Date
1.0	Initial version	2019-01-15
1.1	Modify pictures and the right context	2019-01-21
1.2	Modify the WEB configuration guide chapter	2019-03-11
1.3	Add the LEDs Status Indication Description	2019-03-13
1.4	Modify the title	2019-07-10

9 Document Summary

Prepared by	Checked by:	Approved by:
Terry & Penn	Jose & Jeff	

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.
For more information, please visit RAKwireless website at www.rakwireless.com.

DIY Enterprise Gateway

WisDevice Series

RAK7249

RAKwireless Technology Co.,Ltd.

Product Description

The Enterprise Grade DIY outdoor Gateway is an ideal product for IoT commercial deployment. It contains the Main Board, Operator-grade waterproof enclosure, backup battery and mounting accessories. The hardware main board completely integrates the WIFI, 4G, GPS and PoE main supply with an integrated back-up battery. The firmware implements a fully featured LoRaWAN™ complinant network base station. The Gateway has a range of over 15Km line-of-sight and over 2Km in dense urban environments.

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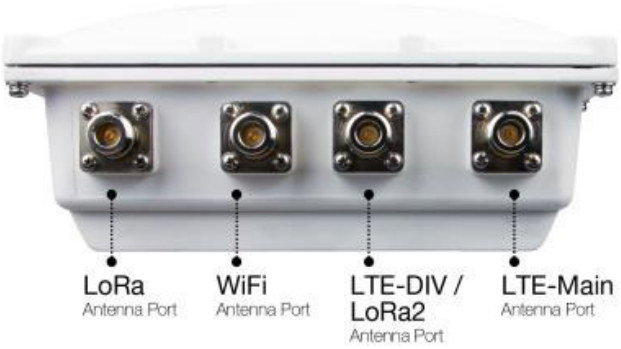
Package Content

Gateway Device

Mounting Kit

PoE Injector GPS WiFi LTE LoRa

Hardware Interfaces



Feature Set

- Enterprise grade network gateway with your own configuration.
- LoRaWAN™ Stack Inside and integrate the Web UI for management.
- Complete Hardware specification including LoRa concentrator, Cellular, GPS and WIFI.
- Supports Power of Ethernet (PoE) IEEE 802.3af/at-Compliant Class 4, 48V.
- Battery Backup sustains operation for about 10 hours under typical conditions.
- IP67 waterproof enclosure with cable gland.

DIY Enterprise Gateway

WisDevice Series

RAK7249

RAKwireless Technology Co.,Ltd.

Main Board

- CPU:RAK634 Module(MT7628 inside)
  RAM:128MB DDR2
  Flash:16MB
  WIFI: 2x2 MIMO 802.11b/g/n
- LoRa concentrator
  Standard version with 8 channel Gateway and also support Max.16 channel Gateway.
  Tx Power is up to 27dBm and Rx sensitivity is down to -142dBm.
- 4G Cellular: Quectel EG95 for CAT4 cellular network
- L70 GPS Module
- Power-over-Ethernet (PoE): 100M base-T Ethernet with IEEE802.3af/at standard PoE.

Accessories

- Mounting Kit
- PoE Injector
- Antennas(WiFI Antenna, GPS Antenna, LoRa Antenna, LTE Antenna)

Enclosure

- IP67 waterproof white color.
- Interface: 5 x N-Type connectors for Antenna,1 PoE port and 1 reserve port.
- Weight (with cable): approximately 70.54oz (2kg).
- Dimensions: 220mm x 220mm x 104mm.
- Wall thickness: 2mm.
- Support up to 70~100 mm diameter pole mount

Backup Battery

- The maximum space in the Enclosure can be placed 12V/10AH batteries for about 10 hours lifetime under typical operation.
- Battery powered real time clock.
- Battery Within 140 x 70 x 30mm.
- DC 5.5 x 2.1 circular joint with two interfaces, one male and one female.

Supported Software

For LoRa

- Supports class A,B&C
- Supports LoRaWAN protocol
- Country code setup
- TX power setup
- Data logger
- Statistic
- Location setup
- Server address & port setup

For Network

- WiFi AP mode
- LTE APN setup
- Uplink backup
- Supports 802.1q
- DHCP Server/Client
- Router module NAT
- Firewall

For Management

- WEB Management
- Supports SSH2
- Firmware update
- NTP

DIY Configuration

Part Number	8 Channel SX1301	16 channel SX1301	Cat4 Cellular	GPS	WIFI	Battery Backup
RAK7249-0x-14x	√		√	√	√	
RAK7249-1x-14x		√	√	√	√	
RAK7249-2x-14x	√		√	√	√	√
RAK7249-3x-14x		√	√	√	√	√
RAK7249-0x	√			√	√	
RAK7249-1x		√		√	√	
RAK7249-2x	√			√	√	√
RAK7249-3x		√		√	√	√

DIY Enterprise Gateway

WisDevice Series

RAK7249

RAKwireless Technology Co.,Ltd.

Key Features

Computing	• MT7628, DDR2RAM 128MB
WIFI Feature	• Frequency: 2.400 - 2.4835GHz • (802.11b/g/n) • RX Sensitivity: -95dBm (Min) • TX Power: 20dBm (Max)
LoRa Feature	• SX1301 Mini PCIe card • 8 Channels (Optional: 16 channels) • TX Power: 27dBm (Max) • RX Sensitivity: -142dBm (Min)
Cellular	• EG95: LTE CAT 4 • 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	• POE (IEEE 802.3af), 42~57VDC
Power Consumption	• 12W (typical)
ETH	• RJ45 (10/100M)
Antenna	• 5 N-Type connectors
Ingress Protection	• IP67
Enclosure Material	• Aluminum
Weight	• Approximately 111.11oz (3.15kg with mounting kit)
Dimension	• 220mm x 220mm x 104mm
Operating Temp.	• -30 to 65 ˚C
Installation Method	• Pole or Wall mounting

RF Specifications

Wireless Standard	• IEEE 802.11b/g/n
Wi-Fi Operating Frequency	• ISM band: 2.412~2.472(GHz)
Wi-Fi Operation Channels	• 2.4GHz: 1-13
Wi-Fi Transmit Power (The maximum power may be different depending on local regulations)	• 802.11b 19dBm@ 1Mbps • 802.11g 18dBm@ 6Mbps 16dBm@ 54Mbps • 802.11n(2.4G) 18dBm@MCS0 (HT20) 16dBm@MCS7 (HT20) 17dBm@MCS0 (HT40) 15dBm@MCS7 (HT40)
Wi-Fi Receiver Sensitivity (Typical)	• 802.11b -95dBm@ 1Mbps • 802.11g -90dBm @6 Mbps -75dBm@54Mbps • 802.11n(2.4G) -89dBm@MCS0 (HT20) -72dBm @MCS7(HT20) -86dBm @MCS0(HT40) -68dBm @MCS7(HT40)
LoRa Operating Frequency	• EU433 / CN470 / EU868 / US915 / AU915 / AS923 / AS920 / KR920 / IN865
LoRa TX Power	• 27 dBm (Max)
LoRa RX Sensitivity	• -142 dBm (Min)

Order Information

Part Number	Description
RAK7249-03-142	8 channel DIY Gateway with Cat 4 Cellular + GPS for EU868 region
RAK7249-04-141	8 channel DIY Gateway with Cat 4 Cellular + GPS for US915 region
RAK7249-13-142	Advanced version, 16 channel DIY Gateway with Cat 4 Cellular + GPS for EU868 region
RAK7249-14-141	Advanced version, 16 channel DIY Gateway with Cat 4 Cellular + GPS for US915 region

RAK IoT Made Easy

About RAKwireless:

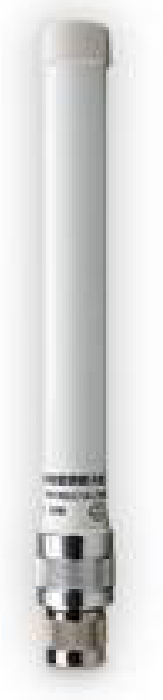
RAKwireless is the pioneer in providing innovative and diverse cellular and LoRaconnectivity solutions for IoT edge devices. It's easy and modular design can be used in different IoT applications and accelerate time-to-market. For more information, please visit Rakwireless website at www.rakwireless.com.

Features

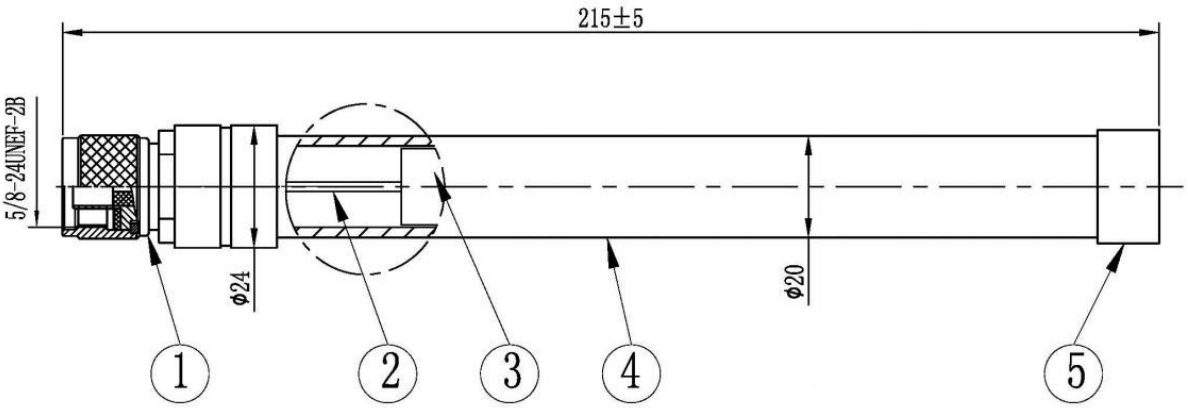
- 698~960MHz/1710~2690MHz
- Vertically polarized monopole
- 3dBi Max Gain
- High efficiency

Specifications

Frequency (MHz)	698~960MHz/1710~2690MHz
Gain (dBi)	3
VSWR	≤ 3.0
Efficiency	60%
Beamwidth	360°
Impedance (Ohms)	50Ω
Polarization	Vertical
Max Input Power	20W
Radome Body	White Fiber glass
Connector	N-Type Male
Dimensions (mm)	Φ 20×215mm
Operation Temp (°C)	-40℃ ~ +85℃



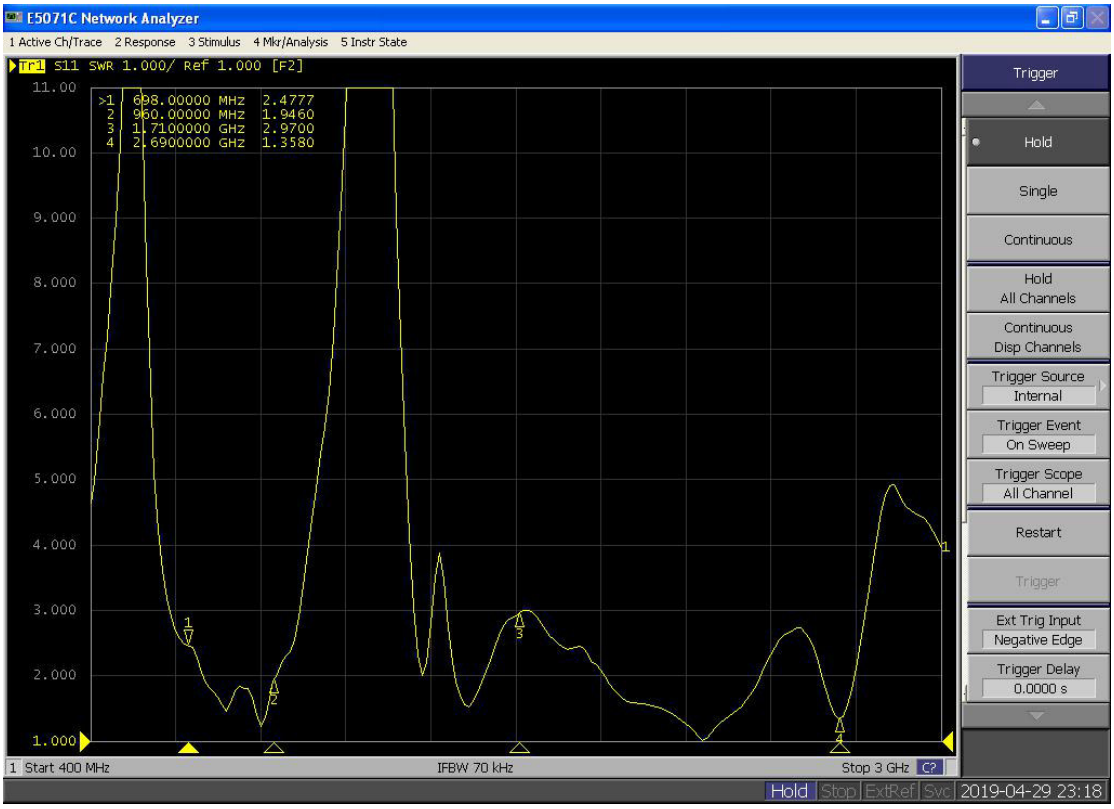
Mechanical Specifications

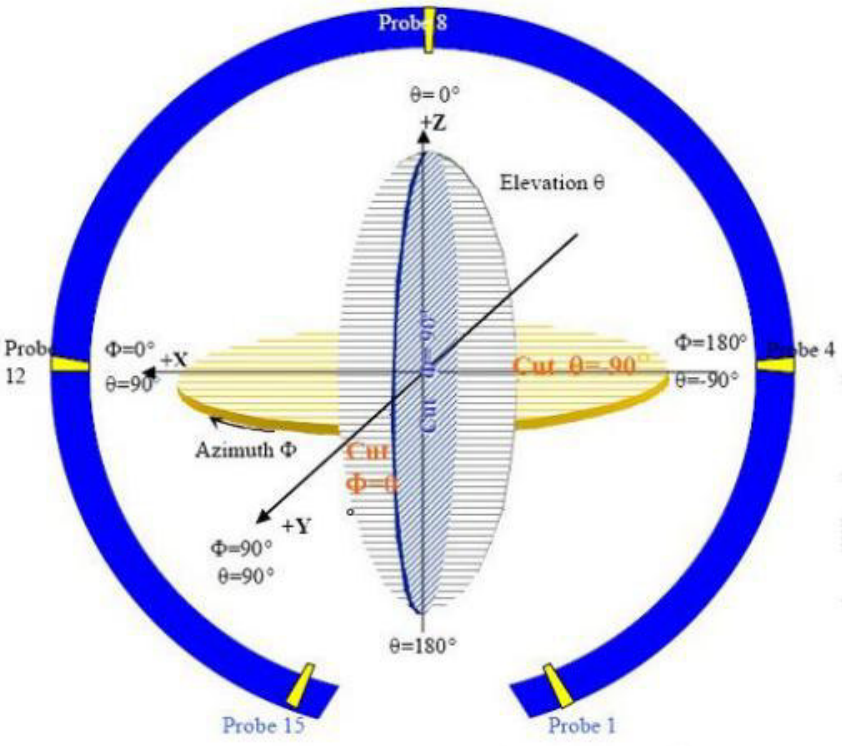


1. N Type connector
2. Coaxial cable
3. PCB
4. Φ 20 x 182 x2.0mm fiber glass
5. Φ 22.1 x 12mm antenna cap

VSWR

The S11 test report is shown as Figure below.





Efficiency vs Gain

Frequency	Efficiency	Peak Gain	Frequency	Efficiency	Peak Gain
680	45%	-1.4	2060	64%	0.9
700	44%	-1.4	2080	66%	1.3
720	41%	-1.1	2100	67%	1.5
740	44%	-1.0	2120	71%	1.8
760	44%	-0.9	2140	70%	1.9
780	43%	-0.8	2160	74%	2.2
800	45%	-0.4	2180	78%	2.5
820	37%	-1.1	2200	81%	2.8
840	36%	-1.1	2220	81%	2.9
860	36%	-1.0	2240	82%	3.0
880	36%	-0.7	2260	83%	3.0
900	36%	-0.3	2280	88%	3.3
920	34%	0.1	2300	88%	3.3
940	33%	0.3	2320	83%	3.0
960	31%	0.2	2340	80%	2.8
			2360	78%	2.7
1700	53%	0.1	2380	79%	2.8
1720	54%	0.0	2400	78%	2.7
1740	53%	0.2	2420	79%	2.9
1760	49%	0.8	2440	70%	2.4
1780	48%	0.9	2460	68%	2.4
1800	49%	0.7	2480	68%	2.5
1820	48%	0.6	2500	69%	2.6
1840	49%	0.4	2520	69%	2.7
1860	54%	0.4	2540	67%	2.6
1880	51%	0.3	2560	61%	2.2
1900	49%	0.5	2580	63%	2.4
1920	52%	0.3	2600	60%	2.2
1940	48%	0.8	2620	62%	2.2
1960	47%	1.1	2640	64%	2.1
1980	46%	1.4	2660	65%	2.0
2000	55%	0.4	2680	66%	1.8
2020	56%	0.5	2700	67%	1.4
2040	61%	0.5			

Features

- 1559~1577MHz
- High gain and high efficiency
- Designed with LNA (Lightning Protection, Antistatic)
- Widely used in power, base station and other time-service places

Specifications

Frequency	1559~1577MHz
Gain	28±2dB typ
Voltage	DC 3±0.3V
Current	≤10mA@3V
Noise Figure	1.5dB max
Bandwidth	18MHz min
Output VSWR	3.0 max
Polarization	R.H.C.P
Filter	SAW filter 30dB min fo±45MHz
Output Impedance	50ohm
Connector	N-Type Male
Dimensions	Φ96×129mm
Cable	2000±50mm (RG195)
Operation Temp	-40°C ~ +85°C
Operation Humidity	10% ~ 95% RH
Storage Temp	-40°C ~ +90°C
Storage Humidity	10% ~ 95% RH

Mechanical Specifications