

Configuration Guide for

RAK LORaWAN Industrial Gateway WisDevice Series RAK7249/58

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35 PAGES



Table of Contents

1 Overview	3
2 Gateway Start-up	4
3 Web Management Platform	6
3.1 Status	6
3.1.1 Overview	
3.1.2 LoRaWAN Packet Logger	9
3.1.3 System Log	9
3.1.4 Firewall	9
3.2 Network	
3.2.1 WAN Interface	
3.2.2 Cellular Interface	
3.2.3 Wi-Fi	
3.2.4 Firewall	11
3.2.5 Diagnostics	
3.2.6 Ping Watchdog	
3.3 LoRa Gateway	14
3.3.1 LoRa Packet Forwarder	14
3.3.2 LoRa Gateway Bridge	
3.4 LoRa Network Server	
3.4.1 Status	
3.4.2 General	21
3.4.3 Gateway	
3.4.4 Applications	
3.4.5 Global Integration	
3.5 System	
3.5.1 System	
3.5.2 Administration	
3.5.3 License	
3.5.4 Backup / Flash Firmware	
3.5.5 Reboot	
4 Appendix – LoRa Network Server Global Integration Interfac	e API(Topic definition and
Data Format)	
5 Revision History	
6 Document Summary	



1 Overview

This document describes in detail the functionality of the Web Management UI. The interface builds on top of OpenWRT and all gateway products of the RAK72xx line share it.

The document gives instructions on configuring WAN, the LoRa Packet Forwarder and Gateway MQTT Bridge. It explains how to do system-monitoring, update of the firmware and reset the device. Last, but not least in provides information on using the built-in LoRa Server.

This guide functions as reference for several products with similar functionality. Thus, some sections will apply to certain products and not others.

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2 Gateway Start-up

Make sure all the antennas are connected before powering the Gateway.

For RAK7258 use the included adapter. RAK7249 comes with a PoE injector, which you need to connect to the grid on one side and to the Gateway on the other (Ethernet cable not included).

The Gateway comes configured in such a way that you can use either the Ethernet port or the Wi-Fi in AP mode to connect to the Management platform.

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). Alternately, the IP Address (192.168.230.1) is preconfigured as the one to use for access to the device provided you are directly connected to it.

WiFi AP mode

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

<u>Wi-Fi</u>

SSID: RAK72XX_xxxx (no password is required to connect via Wi-Fi)

<u>Web UI</u>

Connect via a browser to the IP address assigned to the gateway, which is 192.168.230.1 by default. You should see the login window in Figure 1. Use the credentials below:

UI user: root

UI password: root



Figure 1 | Login window





WAN port (DHCP IP) mode

Connect the Ethernet cable to the port marked "ETH" and the other end to your Router. Use the same credentials for the <u>Web UI</u> as for AP mode.

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3 Web Management Platform

After you have entered the correct credentials, you can start exploring the configuration and monitoring interface of the RAK LoRa Gateway.

3.1 Status

This is where statistics about the Gateway behavior can be monitored in real time.

3.1.1 Overview

Upon logging in the browser displays the page in Figure 2.

The following are the parts of the Overview window:

Received:

Shows the total number of uplink LoRa messages received by the gateway.

Transmitted:

Shows the total number of downlink LoRa message sent by the gateway.



🏟 RAK							AUTO REFRESH ON	Logout
🕑 Status	Status							
Overview LoRa Packet Logger System Log	Received	Trans	smitted	0	Active Nodes	2	Busy Nodes	2
Firewall	Duty Cycle Of the Lo	Ra Channel			LoRa Traffic			
(3) Network			100		pkt/min -O- SF7 -C)- SF8 - <mark>-</mark> - SF9		
LoRa Network Server	06:56 07:28 08:00 08:32 09:04				10-			_
 ♣ System 	0036 0040 1040 1112 11144 1216 1246 1320 1352 1424 1456 1528 1600 1528 1600 1528 1600 1528 1600 1528 1632 1736 1632 1736 1632 1736 1632 1736 1641 1641 1647 1657,3 867,3 87,4	RAK7240 RAK7240 RAK7240 I.1.0050, Release r184 Sun Oct 13 15:44:04 27 Oh 10n 475	, <u>, 868.5</u> 868.3 668.8 fre	rq.(MHz)	B C C C C C C C C C C C C C	11 17/21 17/31 94112 kB 9064 kB 3448 kB	17;41 17;51 18;01 18;11 18;21 /126336 K8 (74%) /126336 K8 (74%) /126336 K8 (2%)	18:31 18:41
	Load Average GPS LoRa Network Serve	0.05, 0.16, 0.16			Network			
	Uptime Received Uplink Received Join MQTT Integration Connect	16 Days 22:13:57 0 0 Connected	LoRa Nodes Transmitted Downlink Rejected Join Request	0 0 0	JPv4 WAN Status	eth0.2 Addr eth0.2 Addr Netm Gata DNS : Conn	: dhcp ess: 192.168.11.240 ess: 255.255.05 www.st 292.168.11.1 i 192.168.11.1 ected: 0h 10m 4s	
	Cellular				Wireless			
	Cellular IPv4 Status Network ICCID IMSI Phone Number	Not connected SIM Card Not Found - - -			Generic 802.11bg Wireless Controller (radio0)	SSID: 10% Mode: Chann Bitrate BSSID: 0% Mode: Chann Brate Wirele	RAK7240_A885 Master et al: (2.447 GHz) et al: 00 MbH/s t: 60:C5:A8:71:A8:85 UplinUkp Client et: 8 (2.447 GHz) et: 90 MbH/s as of disabled or not associated	

Figure 2 | Status Overview page

Active Nodes:

Shows the number of active LoRa nodes within the LoRa gateway coverage (those that have sent no data for more than 10 min are discarded from the count).

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 the LoRa Channel

The graph represents the Duty Cycle load by frequency channel (Data is kept for the last 12 hours). The minimum resolution along the time axis is 60s. Each value is an average over 60s. The values are color code – green to red, low to high.

LoRa Traffic:

The graph shows the packet per minute rate as a function of time. Above the image, one can see the color-coding of the different Spreading Factors, where the actual height of the values is a sum of all the packets over all spreading factors for the time sample.

Additionally you have sub-windows displaying the System, Memory, LoRa Netowrk Server, Network (WAN). Cellular, and Wi-Fi information. Those have their separate sections and will be discussed in detail further down.

System:

Information for the Hostname and model of the Gateway can be found here. There is also the Local Time and Uptime of the Gateway. Most importantly you can see the Firmware version here.

Memory:

There are bars in this section that show how much the Total Available, Free and Buffered Memory is.

LoRa Network Server:

You can see statistics for you network server. Number of associated LoRa Nodes, Uplink, Downlink, Received Join, Rejected Join, those types of packets all have a numerical value associated with them. Additionally, you can check the Uptime and whether you have the MQTT Integration running.

Network:

The WAN status with its Type and Addressing parameters, together with the time since it has been connected are displayed here.

Cellular:

The connection status of your cellular together with the corresponding Network ID and the parameters of your Sim (ICCID, IMSI, Phone number).

Wireless:

The status of the Wi-Fi is displayed here. There is the connectivity status, signal strength and Ip addressing parameters for both the AP and Client interfaces.



3.1.2 LoRaWAN Packet Logger

This is where a log of the LoRa messages is shown in real time. There are several options for filtering as well as the possibility to download the statistics in a file. Additionally there is a summary (Total, Uplink, and Downlink), below the filter fields.

🏟 RAK	Logout
🎯 Status	LoRaWAN Packet Logger
Overview LoRa Packet Logger	LoRaWAN Packet Logger
System Log Firewall	Type All Texhddr Hide CRC_ERR packet
3 Network	Total:2 Upink:2 Downlink:0 II Pause 🖞 Clear 🛓 Download time freq. rssi sar crc mod. CR datarate cnt
🖞 LoRa Gateway	* 04-45-20 867.5 - 452 9.3 CRC_OK LORA 45 SP108W125 691 dev add/ 26012A01 FPiort 3 Payload 03 P1 97 7C 8E F8 68 41 90 12 83 99 CF FE BC 7F DE C0 90 85 66 28 44
kill Lofia Network Server	<pre> figur: 1; figur:</pre>

Figure 3 | LoRa Packet Logger page

The user can choose to filter the packets by one of the following:

Type:

Filter by message type. By default, all messages are displayed, where possible options are: Join Request/Accept, Unconfirmed Data Up/Down, and Confirmed Data Up/Down

DevAddr:

Filter messages based on the Device Address in order to single out a node.

Hide CRC_ERR packet:

This check box hides messages that are corrupted in some way and will not be forwarded.

The buttons for Pause/Play, Clear and Download of the data are in the top right over the list.

If the user clicks on a given packet the window is expanded detailed information about the contents of the message is displayed

3.1.3 System Log

The complete system log. It is useful mainly for debugging purposes.

3.1.4 Firewall

Statistics for the Gateway Firewall



3.2 Network

3.2.1 WAN Interface

ର୍ତ୍ତ୍ର RAK			AUTO REFRESH ON	Logout
Status	WAN Interface			
Network WAN Interface LAN Interface Wi-Fi Static Routes Diagnostics Firewall	Status Protocol Use DNS servers advertised by peer	Uptime: 0h 2m 37s MAC-Address: 60:C5:A8:74:D2:F1 RX: 142.27 KB (1826 Pkts.) TX: 2.42 MB (2958 Pkts.) IPv4: 19.1.56.50.60/24 IPv4: 169.254.210.241/16 DHCP client •		
역사 LoRa Gateway 네비 LoRa Network Server	Use gateway metric Override MTU	0 1500		
System -		Sav	e & Apply Save	Reset

Figure 4 | WAN Interface

The user can check the Status (Uptime, IPv4 Address, etc.), or configure the protocol to be used for connecting to your provider's network.

The following options are available: DHCP/PPPoE/Static address.

ର୍ତ୍ତ୍ତ RAK		AUTO REFRESH ON LOGOUT
🕑 Status	Cellular Cellular Network Configuration	
3 Network WAN Interface Cellular Interface Wi-Fi	Status	Uptime: 0h 0m 0s MAC-Address: 8E:82:32:D3:EC:AF RX: 0.00 B (0 Pkts.) TX: 1.87 MB (5703 Pkts.)
Firewall Diagnostics Ping Watchdog	LTE network is enabled APN	Disable
(썄) LoRa Gateway 네비 LoRa Network Server	Password	
🗞 Services	PIN Code	
🗐 System	Use gateway metric	20
		Save & Apply Reset

3.2.2 Cellular Interface

Figure 5 | Cellular Interface

The same statistics as with the WAN Interface are available. It is here that you set the **APN**, **User**, and **Password**. The gateway metric determines the priority of this interface, compared with the other connectivity options. The lower the value the higher the priority.



There is also a field for the PIN Code in case your SIM card is locked.

3.2.3 Wi-Fi

🏟 RAK			Logout
🖲 Status	Wi-Fi Wrokess		
🐼 Network WAN Interface	Radio		
Cellular Interface Wr-FI 4 Firowall Diagnostics Bina Waterfalsa	Winters natural is indeked Channel	Disable Auto	
% LoRa Gatoway	Wireless Access Point		
네비 LoRa Network Server	Access Point is enabled	Disablo	
🗞 Services	ESSD	RAK7240_A885	
System	Encryption	WPM2 PSK T	
	Key	*******	<i>g</i>
	Wireless Client		
	Wireless Client is enabled	Disable	
	EssiD	UplinkAp	Scan
	Encryption	WPA PSK Y	
	Кеу		8
			Smo & Arch Drove
			Copyright (C RAKWireless Technology Co., Ltd, All Rights Reserved.

Figure 6 | Wi-Fi Interface

Enabling/Disabling the Wi-Fi is done from this page via the blue button at the top. Additionally you can pick a radio channel or leave it on Auto configuration. The Wi-Fi can work in one of two modes:

Access Point:

By default, there is no password. One can access the Web UI via the IP address: 192.168.230.1 once connected to the AP. The SSID is RAK72xx_xxx by default.

Client:

Choose this option to use Wi-Fi as a backhaul for the Gateway. You need to manually enter the SSID, Encryption method and the Key itself.

By default, the client mode is disabled. If you want to use it you have to click the "Enable" button. Click the "Scan" button to choose your preferred wireless network. Choose the encryption method, fill in the password and press Save & Apply.

3.2.4 Firewall

You can configure a number of settings including, but not limited to: Zones, Port Forwarding, NAT, etc.



							UNSAVED CHANGES: 2	Logout
🛞 Status	General Settings Port Forwards Traffic Rules	Custom Rules						
Network	Firewall - Zone Settings The firewall creates zones on	er vour network interfaces to con	strol network traffic flow.					
WAN Interface LAN Interface Wi-Fi	General Settings							
Static Routes Diagnostics	Ene	ble SYN-flood protection	2					
Ping Watchdog		Input acc	opt •					
⁶ ₩ LoRa Gateway		Output acc	copt *					
네네 LoRa Network Server		Forward rojo	sct •					
E System								
	Zones							
	$Zone \Rightarrow$ Forwardings	Input	Output	Forward	Masquerading	MSS clamping		
	lan: lan: ഈ ⊕ ⇒ wan	accept *	accept *	reject *	00	0	Edit	Delete
	wan: wan 👷 wan0 🙍 🔿 REJECT	reject *	accept *	reject •			Edit	Delete
	Add							
							Save & Apply Save	e Reset

Figure 7 | Firewall Settings

3.2.5 Diagnostics

🏟 RAK				UNSAVED CHANGES: D	Logout
Status	Diagnostics				
🐼 Network	Network Utilities				
WAN Interface LAN Interface Wi-Fi Static Routes Diagnostics Freevall Ping Watcholog	devopenset org	dev openiet.org Tacceroule Install gubils traceroute6 for IPv6 traceroute	dev openwrt org Nedodoug		
역 ¹ LoRa Gateway					
LoRa Network Server					
System					



This is where you can perform checks via the built-in tools: Ping, Traceroute, Nslookup.

You can enter either an URL or an IP Address in the text box and execute the command with the button. Both IPv4 and IPv6 are supported. The results are conveniently displayed in a CLI box.

3.2.6 Ping Watchdog

Ping Watchdog monitors the 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 detected, scheduled measures are taken automatically. Those include: Interface restart, Interface priority reduction, Device restart, etc.

Note: Reducing the priority of an uplink interface only works when the LoRa Gateway uses both Ethernet and Cellular as uplink methods at the same time.

WAN interface represents the Ethernet uplink interface and WWAN represents the LTE cellular network uplink interface.



For example if Ping Watchdog is enabled for both uplink interfaces at the same time and the response to degradation of the link quality is set as Increase Gateway Metric the two uplink interfaces work as backups for each other. In the event of significant degradation on one, the Gateway switches to the other.

The Gateway Metric determines the priority of interfaces. The default value can be adjusted in the Network menu for the corresponding interface. The lower the Gateway metric, the higher the priority of the link.

ର୍ତ୍ତ୍ର RAK				UNSAVED CHANGES: 3	Logout
Status	Ping Watchdog Interface Configuration - wan				
Network					
WAN Interface	Enabled	No	Ŧ		
LAN Interface	Track IPs		11		
		This IP address will be pinged to dem	nine if the link is up or down.		
Static Routes	Tracking reliability	1			
Diagnostics		Acceptable values: 1-100. This many	Tracking IP addresses must respond for the link to be deemed up		
Firewall	Ping count	1	τ		
Ping Watchdog	Ping timeout	2 seconds	Ŧ		
⁽ X ⁰) LoRa Gateway	Ping interval	10 seconds	τ		
네 LoRa Network Server	Interface down	3	Ŧ		
System		Interface will be deemed down after t	this many failed ping tests		
	Interface up	5	¥		
		Downed interface will be deemed up	after this many successful ping tests		
	Action	Increase Gateway Metric	Ŧ		
	Offline metric	50			
		Metric of the default gateway on this	interface will be modified when the interface were deemed up		
	Back to Overview			Save & Apply Save	e Reset

Figure 9 | Ping Watchdog Interface Configuration

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3.3 LoRa Gateway

All the LoRa Settings reside in this section.

3.3.1 LoRa Packet Forwarder

🏟 RAK		Logout
Ø Status <	LoRa Packet Forwarder Lonawaw Packet Forwarder Configuration	
Network	Gateway Configuration	
⁰ X ⁰ LoRa Gateway	Gateway Comiguration	
LoRa Packet Forwarder	General Setup Beacon Setup Packet Filter GPS Information	
l aRa Gateway MQTT Bridge	Gateway EUI 80C5A8FFFE71A885	
네 LoRa Network Server	Protocol Semtech UDP GWMP Protocol *	
🗞 Services	Server Address trouter autheblings network.	
System	Server Port Up 1700	
	Server Port Down 1700	
	Push Timeout (ms) 200	
	Statistic Interval (s) 30	
	Keepalitive Interval (s) 5	
	Automatic data recovery 🕖 Data messages are automatically stared when the connections to the server is lost	
	Auto-restant Threshold 30	
	Pecket forwarder will automatically reduct when the keepalive timeout exceeds this threshold. Set 'U to disable	
	Imore Freesance Plan Terminate	
	Standard Frouency Setus Made Switch to Advanted Mode	
	Premiske 26.81401.00.000 Technology (* 1.141.3	All Dialsta Decensed

Figure 10 | Packet Forwarder General Setup

As this is the most important part of the LoRaWAN Gateway, the number of settings and options is greatest here. Thus, this section will be larger and provide information in more detail than previous ones. For the aforementioned reasons this section has several configuration tabs, which are listed in the following paragraphs. Additionally some of the configuration options have their own documents, with detailed explanation of the configuration process.

General Setup

This is where the core settings are: Gateway EUI, Frequency channels, etc.

Gateway EUI:

The value in this field is necessary for registering your gateway with any LoRaWAN Network Server.

Protocol:

You have three options, which define how the Gateway will function:

Semtech UDP GWMP Protocol:

By default, this is the Semtech Packet Forwarder, which sends packets to the Server Address of your choice (IP or URL). By default, it points to the local TTN router.

The default port value is 1700 used by TTN.



One can also set parameters as the *Push Timeout (ms), Statistic Interval (s), Keep Alive Interval (s)* and the *Auto-restart Threshold*.

Automatic Data Recovery

This is an important feature that allows LoRa Frames to be stored on the SD card (provided there is one in the slot), if there is no connection to the LoRa Network Server. Upon restoring connectivity, these buffed messages will be forwarded, so no data will be lost. This is done in blocks of 8 (FIFO), until all are cleared from the buffer.

LoRa Gateway MQTT Bridge:

By choosing this option, you make the Gateway act as a bridge to the MQTT Broker, which is hosted somewhere separate. You need to configure the Gateway to point to the correct address of the MQTT broker

Built-in LoRa Server:

In case you require an integrated solution where the LoRa Network Server is hosted on the gateway itself you choose this option. The configuration of the LoRa MQTT Bridge itself is done in a separate section of the configuration UI, which is discussed in Paragraph 3.3.2

Log Level

You can choose from 5 different log levels (*Error/Warning/Notice/Info/Debug*). This will affect System Log. From Errors only to full system log for debugging.

Beacon Setup

In the case of Class B LoRa devices, you need to have a beacon in order to synchronize downlink message windows. Thus, you have to configure its parameters: Frequency Channel, SF, Bandwidth, Tx Power, etc. Make sure you adhere to the LoRa Alliance recommendations.

Packet Filter

By enabling this functionality, you can filter incoming traffic and only forward packets from the desired nodes in order to optimize bandwidth usage over backhaul. You can filter by OUI or Network ID by whitelisting.

The *Enable Auto Filter* slider allows nodes to be automatically dropped in accordance with a set of parameters. One can set threshold values for *Discard Period*, *Join Period*, *Join Interval*, and *Join Count* (1 and 2 for Join Interval and Join Period respectively).

GPS Information

In case, you want to enter the GPS parameters for the Gateway manually.

Frequency Plan

This is a part of the page, common for all gateway from the RAK72xx series, however depending on the number of Concentrator modules installed there are variations. The difference when there is a second Concentrator is that first it has to also be configured, and second only the fields for the central frequencies for Radio 0 and Radio 1 need be set.



There are two mode for setting the frequencies:

Standard Mode:

You can start by importing a region via the drop down menu (EU868 is the default one). You will get the defaults channels for the chosen frequency band and the option to add additional ones. Simply enter the frequency in the text box (in MHz) and click the "Add" button. You can add as many channels as you need as long as they fall in the Regional band.

Additionally, there is a field for adding the Standard LoRa Channel and FSK channel (you need also choose the SF, Bandwidth and data rate of each of the aforementioned).

🏟 RAK				UNSAVED CHANGES: 1	Logout
③ Status	Server Address	router.eu.thethings.network			
Network	Server Port Up	1700			
(W) L - D- C-+	Server Port Down	1700			
A LOKA Galeway	Statistic Interval (s)	30			
LoRa Packet Forwarder	Push Timeout (ms)	200			
Bridge	Auto-quit Threshold	30			
네네 LoRa Network Server	Import Frequency Plan Template	Select Frequency Plan V	Import		
🗐 System	Standard Frquency Setup Mode	Switch to Advanced Mode			
	Frequency Plan				
	Region	EU863-870 ~			
	Multi-SF LoRa Channel	868.1MHz 868.3MHz	868.5MHz		
		Freq.(MHz) Add			
	Standard LoRa Channel				
		Freq.(MHz) SF7	✓ BW250 ✓ Add		
	FSK Channel				
		Freq.(MHz) 50bps	Add		

Figure 11 | Packet Forwarder General Setup

Advanced Mode:

Because of the presence of double SX1257s, you need to configure the two radios separately. You have eight Multi Spreading Factor Channels, The LoRa Standard Channel and the FSK Channel. The sliders can enable or disable those, so you can choose to have any number of them active. Additionally you can choose which radio to use for a given, channel as long as you do not assign more than five channels per radio. In order to set the desired channel to a given frequency you need to input an offset value in the *If* field. Thus, the channel frequency will be the central frequency (*Radio 0 Freq* or *Radio 1 Freq* parameter) summed with the offset value (in Hz).

Additionally for the LoRa Standard and FSK channels, you are also required to select the Bandwidth and Data Rate.

As mentioned before you can choose to import those settings for the Indian, Russian and EU Regions (in accordance with the LoRa Alliance specifications).



--Select Frequency Plan-Import Import Frequency Plan Template ۳ EU863-870 IN865-867 RU864-870 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 Radio Radio 1 🔻 Radio 1 🔻 Radio 1 🔻 Radio 0 v Radio 0 v Radio 0 v Radio 0 v Radio 1 v Radio 1 🔻 Radio 0 🔻 If -40000C -40000C 200000 400000 -200000 • 300000 • -200000 0 -200000 0 Freq. 868.1MHz 868.3MHz 868.5MHz 867.1MHz 867.3MHz 867.5MHz 867.7MHz 867.9MHz 868.3MHz 868.8MHz 125 KHz Bandwidth 250 KHz 🔻 125 KHz 🔻 DataData All SE

For details on the procedure refer to the <u>Packet Forwarder Customs Spectrum Settings</u> <u>Guide</u>.

Figure 12 | Frequency Plan configuration

3.3.2 LoRa Gateway Bridge

The Gateway is capable of working with an external LoRa Server, where the MQTT Broker is functioning separately. For this purpose, there are several tabs with their corresponding parameters to be filled.

Generation Generation			Logout
Status	LoRa Gateway MQTT Bridge		
Network	LoRa Gateway MQTT Bridge Configuration		
🙀 LoRa Gateway			
LoRa Packet Forwarder	General Setup MQTT Topic Template Setup		
LoRa Gateway MQTT Bridge	Enable		
LoRa Network Server	LoRa Network Server Type	loraserver 3 x *	
🗞 Services	MQTT Broker Address	192.168.50.181	
M Sustam	MQTT Broker Port	1883	
un system	Client ID		
	Clean Session		
	Will Retain		
	Qos	1 - Atleast Once *	
	keepalive	10	
	Enable User Authentication		
	SSL/TLS Mode	Disable *	
		Save & App	y Reset

Figure 13 | MQTT Bridge



General Setup

The tab starts with the button to enable/disable this functionality, followed by:

MQTT Broker Address:

You have 3 options here.

• Built-in LoRa Network Server

Choose this if you are going to be using the Built-in LoRa Network Server

ChirpStack 2x

Choose this if you are pointing to an MQTT 2x Broker (JSON)

ChirpStack 3x

Choose this if you are pointing to an MQTT 3x Broker (Protobuf)

MQTT Broker Address:

The IP Address where the MQTT Broker is hosted.

MQTT Broker Port:

The corresponding port.

Enable Authentication:

The switch turns on Encryption of the transmitted data. You need to configure the Certificates used to encrypt the data in order for secure authentication to be performed.

TLS Version:

The version of the TLS protocol to be used. Options are TLSv1, TLSv1.1, TLSv1.2

Username/Password:

Credentials the MQTT Bridge is to use for connecting to the LoRa Server instance

CA Certificate, TLS Certificate, TLS Key:

Those are to be generated via the appropriate algorithm and distributed between the MQTT Broker and the LoRa Server.

Please refer to the <u>MQTT Bridge with TLS Encryption Configuration Manual</u> for details on how to edit the settings in order for the Gateway to work as an MQTT Bridge with TLS Encryption.



MQTT Topic Template Setup

Refer to the image below for the MQTT 2x Topic Template

LoRa Gateway	MQTT Bridge							
LoRa Gateway	MQTT Bridge Configuration							
General Setup	MQTT Topic Template Setup							
		Uplink MQTT Topic	gateway/{{eul}}/nx					
		Downlink MQTT Topic	gateway/{{eui}}/tx					
	Downl	ilink acknowledge MQTT Topic	gateway/{(eul)}/ack					
	(Gateway Statistic MQTT Topic	gateway/{{eul}}/stats					
			{{eul}} stands for LoRaGateway's EUL and must be i	included in the t	template			
							Save & Apply Reset	

Figure 14 | MQTT 2x

Refer to the image below for the MQTT 3x Topic Template

LoRa Gateway MQTT Bridge		
LoRa Gateway MQTT Bridge Configuration		
General Setup MQTT Topic Template Setup		
Uplink MQTT Topic	gateway/{{eui}}/event/up	
Downlink MQTT Topic	gateway/{{eui}}/command/down	
Downlink acknowledge MQTT Topic	gateway/{{eul}}/event/ack	
Gateway Statistic MQTT Topic	gateway/{{eui}}/event/stats	
	{{eui}} stands for LoRaGateway's EUI and must be in	schuded in the template
		Save & Apply Reset

Figure 15 | MQTT 3x

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3.4 LoRa Network Server

The Gateway comes with an integrated LoRa Networks server. This makes the Gateway a standalone solution for the whole LoRaWAN chain in one device, which is immensely helpful for testing purposes, and provided for flexibility in deployment options.

Naturally, one can opt to disable this feature and use a LoRa Network Server hosted separately.



3.4.1 Status

Figure 16 | LoRa Network Server Status page



3.4.2 General

In order to use the LoRa Server you need to enable its protocol from the following menu: LoRa Gateway Menu -> LoRa Packet Forwarder -> Protocol -> Built-in LoRa Server Now you can choose to enable/disable it via the slider in the General Configuration tab.

🏟 RAK		l ogsut
Status	LoRa Network Server General Configuration	
🔯 Network	General Configuration	
🕅 ToRa Galeway		
Luli LoRa Network Server	Enable	
Status	Region	2083-373 *
General	Enable ADR	0
Gateway	Minimum allowed data rate	DILO SFI2DW125 V
Application		Minimum allowed data sate. Used for ADR.
Global Integration	Maximum allowed data-rate	DR_0 SF12DW125 T
🚓 Services		Noteman allowed data rate, Used for ACR.
🚍 System	ADR Margin (dB)	10
		A signer number means that the network server will keep more margin, resulting in a lower data rate but decreasing the chance that the device gets disconnected bocause it is unable to reach one of the surrounded gateways.
	Network (2	1
	Rx 1 Delay (sec)	1
	Rx 1 DataRate Offset	0
	Rx 2 Frequency (Hz)	807525000
	Rx 2 Datarate	DR, 0 SF 128W125
	Downlink Tx Power (dBm)	20 *
	Device status request interval (sec)	0
		Intervel to initiate an Crid-Device status request (seconds). Set to 0 to deadle.
	Log Level	NFO T
	Statistic Period	10 Meules v
		Sane & Apply Reset

Figure 17 | NS General Configuration

Below is a short explanation of the main parameters:

Frequency Plan (Region)

A drop-down menu list including the following: EU-863-870, IN868-867, US902-928, AS923, CN470-510, AU915, KR920

Enable ADR

If you choose to use Adaptive Data Rate, you need to enable it via the slider and further configure the Minimum and Maximum allowed value.

Minimum and maximum allowed data-rate

Note the DR_0, to DR_15 values represent a bits/s value and max payload size. Those are dependent on your region of operation and the bandwidth and SF used. However as they are predefined by the LoRa Alliance the menu does not list the full parameter values. Please refer to the official documentation for details.

ADR Margin

This value is in dB and it directly affects the probability of a node being disconnected if channel quality is poor. Higher value will result in a lower data rate, but better range.

Network ID

The ID of the network to be advertised to end devices in case you want to have roaming to other networks



Rx 1 Delay (sec)

The First Receive window delay can be west here (check with local recommendations)

Rx 1 DataRate Offset

In case you want to have a different data rate for the Downlink (synch with node)

Rx 2 Frequency (Hz)

The frequency of the Second Receive window.

Rx 2 Datarate

A value can be picked that corresponds to a combination of Spreading Factor and Bandwidth.

Downlink Tx Power

This is the maximum power in dBm the Gateway is allowed to use when transmitting frames to the nodes. It is region specific (for example EU – 14dBm)

Device-status request interval

The time in *seconds* between node status request messages sent by the Gateway. Default value of 0 (disabled status requests).

Log Level

You can choose from 5 different log levels (*Error/Warning/Notice/Info/Debug*). This will affect System Log. From Errors only to full system log for debugging.

Statistics Period

This is the aggregation interval for the Gateway Statistics

3.4.3 Gateway

In this section you can add and External Gateways to work with your LoRa Network Server. This way packet forwarded by the listed Gateways will be forwarded as though they were within the range of this device. Refer to Figure 11 for an overview of the section window:



@ RAK							Logout
Status	LoRa Network Server Gateway Overview	1					
S Network	Gateway						
⁸ X ⁶ LoRa Gateway							
네 LoRa Network Server	Galeway EUI	Namo /	dd time	Descrip	tion Last See	en.	
Status General Gatoway	60C5A8FFFE74D313	Testing	kon Oct 28 15:07:11 2019	Testing	Never		Edit Delete
Application Global Integration	E	udet -					
🗞 Services	Gateway Backend Configuration						
E System	General Setup MQTT Topic						
		MOTT Broker Addr	ss 127.0.0.1				
		MQTT Broker F	ort 1883				
		Clen	iD				
		Clean Sea	an 💽				
		Will Re	an D				
			Ios 1 - Atleast Once	τ			
		koopa	NO 10				
		Enable User Authentica		-			
		550115 10	ure croquite				
							Save & Apply Reset



Below is a short explanation of the main parameters:

Gateway

Here you can add a Gateway. You simply need to input the EUI into the text box and press the *Add* button. Additionally you can add a Name, Description and the coordinates of the Gateway.

Gateway Backend Configuration

By filling this section, you are pointing the LoRa Network Server to the MQTT Broker

MQTT Broker Address:

The IP Address where the MQTT Broker is hosted.

MQTT Broker Port:

The corresponding port.

Enable User Authentication:

If this is switched on, an Username, Password, and a Certificate (Disabled by default) will be required for user authentication.

SSL/TLS Mode:

Choose the certificate type here:

CA Signed server certificate, Self-signed server certificate, Self-signed server & client certificate. All certificated have support for TLSv1, TLSv1.1, and TLSv1.2.

MQTT Topic

www.RAKwireless.com



3.4.4 Applications

Here you can get information on the topic templates: *Uplink MQTT topic, Downlink MQTT Topic, Downlink Acknowledge MQTT Topic, Gateway Statistic MQTT Topic.*

🏟 RAK						Logout
 Status Network 	LoRa Network Ser	ver Application Overview	v			
°₩ LoRa Gateway	Applications					
네 LoRa Network Server Status	ID	Name	Devices	Creation Date	Description	
General Gateway Application	This section contains	no values yet				
Global Integration						Save & Apply Reset
🗏 System						

Figure 19 | NS Application

The first time you access the menu it will have no applications listed. Create one by Entering a name in the field and pressing the "Add" button

ର୍ତ୍ତ୍ତ RAK				Logout
Status	Application Edit - 2			
Network	Application Testing			
"A" LoRa Gateway	Application Configuration Integrations			
Status	Name	Testing		
General Gataway	Application FUI		e 🗈	
Application Global Integration	Appication Key Auto Add LoRa Device	()) If enabled, Lotin Device cell be added accord	🖉 🖬	
💩 Services	Description			
🖽 System				
	Back to Overtwiew		Save & Appl	y Reset

Figure 18 | NS Application Configuration

You will be automatically forward to the Application Edit screen. You have two tabs here, which are explained below:

Application Configuration

This is where you configure the parameters required to successfully create your application.

Name

A way of identifying it in the Built-in NS.

Application EUI

The *Application EUI* is a global application ID in IEEE EUI64 address space that uniquely identifies the entity able to process the JoinReq frame. Thus, you need one which you can either enter yourself (for example if you have copied it from TTN) or press the green button after the text field to generate a random one.

Application Key

The Key is used to generate the Application Session Key and Network Session Key in cause of using OTAA. As with the EUI you can either enter it itself or generate a random one.

Auto Add LoRa Device



This slider determines if the device will be automatically added if the application EUI and Key are valid.

Description

An optional field for entering information describing the Application.

Integrations

There is an option to have a HTTPS integration for your application. See Figure 19 for details:

ର୍ତ୍ତ୍ର RAK					Logout
💮 Status	Application Edit - 2				
🗟 Network	Application Tecting				
👷 LoRa Gateway	Apprecision resting				
Lull ToRa Network Server	Application Configuration Integrations				
Status	Data Encode/Decode Type	Base04 T			
General	Report LoRa Radio Intomation	Ø			
Galeway Application	Enable HTTPHITTPO Integration	0			
Global Integration	HTTPHTTPS Headers	Heater Name	: Header Value	1	
💩 Services	Uplink data URL				
📰 System	Join motification URL				
	Ack notification URL				
	Device-status notification URL				
	Maximum number of concurrent connections	16			
	Maximum length of queue	64			
	Back to Overniew			Save & D	pply Reset

Figure 20 | Application Integration Tab

There are several fields that need to be filled in, starting with the Data Encoder/Decoder type (Base 64 or HEX String). Once selected you can Enable the functionality with the slider.

Afterwards make sure to fill the rest of the fields: HTTP/HTTPS Headers, Uplink data URL, Join notification URL, Ack notification URL, Device-status notification URL.

You can test the HTTP endpoint integration with a free service like https://webhook.site

Last but not least select a value for the Maximum number of concurrent connections and the Maximum length of the queue (default values are 16 and 64 respectively).

One done with filling in the parameters "Save & Apply".

Adding and configuring a device

Below is in depth explanation of the data available per device. You can enter this section by either inputting a valid EUI and pressing the *Add* button, or pressing the *Edit* button for an existing device:

🏟 RAK								Logout	
😨 Status	Application Edit - 2								
S Network	Application Testing								
⁹ ₩ LoRa Galoway									
네 LoRa Network Server	Devices Application Configuration Integrations								
Status	Last seen Device name	Device EUI Cla	ss Activation mode	Device Address	Link margin	Battery	Packet Lost	Description	
Gelerony	Select All Remove. Device FUI	Q					Rows per page 10	Page 1 In 0 Prev Next	1
Application	60C5A8FFFE000001 Add	Batch Add Import Export							
& Services	Back to Overview							Save & Apply Re	set
🖽 System									



Figure 21 | NS Adding a Device

ର୍ତ୍ତ୍ର RAK		Logout
Status	Application - Edit Device 60c5a8fffe000001	
Ø Network	Device-60c5a8fffe000001	
(X) LoRa Gateway		
네 LoRa Network Server	Overview Configuration Activation Downlink Live Device Data	
Status	Device name	
General	Class A v	
Gateway	Join mode OTAA *	
Global Integration	Frame-counter Width 32 bit v	
🗞 Services	Eanble frame-counter Validation 🔍	
🗐 System	Description	
	Back to Overview	Save & Apply Reset

Figure 22 | NS Device Configuration (OTAA)

Overview

This page displays per device metrics. Things as RSSI, SNR and Traffic are displayed in a graph for the user's convenience

® RAK							Logout
⊕ Status El Network	Application - Edit Device 60:5a8ffe000001 Device-60:5a8ffe000001						
👷 Loka Gabway	Dierves Geolguston Advation Down	nink Live Dence Octa					
Robs General Laterary	Basic Infomation	1970/01/01 02:00:00	Devce Address		Lost Pecket	0 - Nordelly	
Application Order Integration	Total Downink	0	sutery	Ration	Link Margin	unoetresse	
i Sonta		20 ¹ (20 ¹ (20 ¹ (10	SNR Distribution		DataBate Distribution	- 000 * 000 * 000 * 000 * 000 * 000 * 000 * 000 * 000 * 000 * 000 * 000 * 000 * 000 * 000 * 000 * 000 * 000 * 0	200 200

Figure 23 | Device Overview page

Configuration

Here you can edit device parameters as follows:

Name - does not need to match the EUI, batch loading results in a match by default

Class – both Class A and Class C devices are supported

Join Mode – both OTAA and ABP are supported



Frame counter width – 32 or 64 bits

Enable frame-counter Validation - turn the counter on or off with the slider

Description - optional explanation

If you choose Join mode to be ABP you have to additionally enter the Device Address, Application Session Key, Network Session Key (optionally you can generate random ones). Refer to Figure 21 if you want to see how the window changes with ABP mode.

🏟 RAK		Logout
🙆 Status	Application - Edit Device 60c5a8fffe000001	
Network		
'ጲ' LoRa Gateway		
네 LoRa Network Server	Overview Configuration Activation Downlink Live Device Data	
Status	Device name	
General	Class A v	
Application	Join mode ABP v	
Global Integration	Device Address	
💫 Services	Application Session Key	
🗐 System	Network Session Key	
	Frame-counter Width 32 bit *	
	Eanble frame-counter Validation	
	Description	
	Back to Overview Save & Apply	Reset

Figure 24 | NS Device Configuration (ABP)

Activation

Once you have properly configured the parameters of the device mentioned above you should see the data in the following picture (Activation tab):

🏟 RAK		Logout
Status	Application - Edit Device 60c5a8fffe000001	
l Network	Device-60c5a8fffe000001	
⁽ ⁽), LoRa Gateway		
네 LoRa Network Server	Overview Configuration Activation Downlink Live Device Data	
Status	Device address	
General	Application session key 00000000000000000000000000000000000	
Gateway	Network session key 00000000000000000000000000000000000	
Global Integration	Uplink frame-counter 0	
🗞 Services	Downlink frame-counter 0	
System	Clear frame-counter Clear frame-counter	
	Back to Overview Save & Appl	Reset

Figure 25 | NS Device Activation



Device Address – The field is generated automatically and displays the address assigned to the node. This is how you distinguish devices in the LoRa Packet Logger.

Application session key – The key assigned to the device upon OTAA Activation, or the one input manually if ABP is used.

Network session key – Same as for the Application Session Key

Uplink frame-counter – The number of messages that have been received by the Gateway since the device activation

Downlink frame-counter - The number of messages the Gateway has sent to the node

Downlink

You can send a downlink frame with this tool. The slider determines if the frame is Confirmed or Unconfirmed. You need to enter the number of the Frame Port (Fport) and a payload in HEX format. The downlink will be transmitted in the next Rx window in case of Class A for example.

🏟 RAK		Logout
Status	Application - Edit Device 60c5a8fffe000001	
🐼 Network	Device-50r5a8fffe000001	
⁽ ^{M)} LoRa Gateway		
네 LoRa Network Server	Overview Configuration Activation Downlink Live Device Data	
Status General Gateway Application Global Integration	Confirmed Confirmed HEX Bytes Send	
 Services System 		
	Back to Overview Save & Apply	Reset

Figure 26 | NS Device Downlink

Live Device Data

You can see the packets for the selected devices in real time in this section.



ର୍ତ୍ତ RAK		Logout
🕑 Status	Application - Edit Device 3638333567386312	
🐼 Network	Device-3638333567386312	
⁽ Å ⁾ LoRa Gateway		
네 LoRa Network Server	Configuration Activation Live Device Data	
General Gateway	2019/07/09 01:51:27 Uplink 09 02 08 ef	^
Application	"applicationID": "5", "applicationName": "RAN7205",	
System	<pre>"dovDD1:" "dodBa3306/08012", "dotBa1200ame": "D0420306, "fort": 000, "fort": 000, "fort": 000, "fort": fais, "datast: "qQTTN==", "datast: "QQTTN==", "datast: rist", "datast: rist", "dat</pre>	
	2019/07/09 01:26:45 Uplink 02 67 01 2c 05 68 51 06 73 25 d1	

Figure 27 | NS Device Live Data

3.4.5 Global Integration

This feature allows for integration of the Built-in LoRa Application Server with an External MQTT broker.

🏟 RAK		Logout	
Status	Application Server Integration		
옚 Network	Application Server Integration		
(X) LoRa Gateway			
네 LoRa Network Server	General Setup MQTT Topic template Setup		
Status	MQTT Broker Address 127.0.0.1		
General Gateway	MQTT Broker Port 1883		
Application	Client ID		
Global Integration	Clean Session		
🗞 Services	Will Retain		
System	Qos 1 - Atleast (Dice v	
	keepalive 10		
	Enable User Authentication		
	SSL/TLS Mode Disable	×	
		Save & Apply Reset	

Figure 28 | NS Global Integration

General Setup

MQTT Broker Address - the IP Address of the external MQTT broker

MQTT Broker Port - the Port of the external MQTT broker

Client ID – the Client ID





Clean Session – a slider that determines if you will start fresh when the integration runs

Will Retain - a slider for data retention

QoS - the service level (Almost/At least/Exactly once)

Keep Alive - the Keep Alive interval is seconds

Enable User Authentication - a slider to enable/Disable Authentication

In addition to setting an Username and Password, there is a drop-down menu for the SSL/TLS Mode (Disabled by default). The following certificates are supported: *CA Signed server certificate, Self-signed server certificate, Self-signed server & client certificate*

MQTT Topic Template Setup

Here you can get information on the topic templates: *Join Topic, Uplink Topic, Downlink Topic, Ack Topic.*

🏟 RAK					Logout
Status	Application Ser	ver Integration			
l Network	Application Ser	ver Integration			
⁽ X) LoRa Gateway	, ippression out				
네 LoRa Network Server	General Setup	MQTT Topic template Setup			
Status			Join Topic	application/{{application_ID}}/device/{{device_EUI}}/join Event published when a device joins the network.	
General Gateway			Uplink Topic	application/{{application_ID}}/device/{{device_EUI}}/rx Contains the data and meta-data for an uplink application payload.	
Application		1	Downlink Topic	application/{{application_ID}}/device/{{device_EUI}}/tx Scheduling downlink data by application server	
			Ack Topic	application/{{application_ID}}/device/{{device_EUI}}/ack Event published on downlink frame acknowledgements.	
System			Status Topic	application/{{application_ID}}/device/{{device_EUI}}/status Event for battery and margin status received from devices.	
				Save & App	y Reset

Figure 29 | NS Global Integration MQTT Topic Template



3.5 System

This is the place where you configure general device parameters.

3.5.1	S	/stem	

🏟 RAK		AUTO REFRESH ON	Logout
🏵 Status	System Here you can configure the basic aspects of your device like its hostname or the timezone.		
1 Network	System Properties		
⁽ Å ⁾ LoRa Gateway			
네 LoRa Network Server	General Settings Logging Language		
🖾 System	Local Time Mon Jul 8 23:17:13 2019 Sync with browser		
System	Hostname RAK7258		
Aaministration Backup / Flash Firmware	Timezone UTC V		
Reboot			
	Time Synchronization		
	Enable NTP client		
	NTP server candidates 0.000mwt.pool.ntp.org		
	1.openwrt.pool.ntp.org		
	2.openwrt.pool.ntp.org		
	3.opanwrt.pool.ntp.org		

Figure 30 | System Tab

General Settings

The system time is displayed here. Additionally you can edit the Host Name and select the Time zone.

Another way to get the correct time is to use Timing Synchronization. You can Enable NTP client mode, enable NTP server and provide server candidate URLs.



Note that the Time Synchronization tab is displayed in all System submenus.

Logging

In case you want to keep a log of system events you can configure how this is done here:

You can set the Buffer size, provide the IP Address and port of an External log server, and set the Log Level.

Language

By default, this is in Auto (English), however you can choose from several options including German, Spanish, Russian, etc.

3.5.2 Administration

This is where you change the administration password of the device.

🏟 RAK				Logout
Status	Router Password Changes the administrator password for acce	essing the device		
🐼 Network				
(¼) LoRa Gateway	Password		19 12	
네 LoRa Network Server	Confirmation		8	
🗐 System				
System				Save & Apply Reset
Administration				

Figure 31 | Administration Tab

3.5.3 License

This is the status of your license. You can see the Type, Number of Supported Nodes, Expiration date, and the Number of External Gateways Supported. There is a field to ender the License data in case you are upgrading.

🏟 RAK			Logout
③ Status	License		
🖾 Network	Lissano Status	normal	
🖓 LoRa Gateway	License Type	free	
네 LoRa Network Server	Expire at	never	
🗞 Services	LoRa Device	128	
🛅 System	External LoRa Galeway	5	
System	License		
License 4			
Backup / Flash Firmware			
Report File Browser			
			<i>b</i>
		Ruteret	Reset







3.5.4 Backup / Flash Firmware

ର୍ତ୍ତ RAK		Logout
🖲 Status	Flash operations	
🐼 Network	Backup / Restore	
⁽ ሏ ⁾ LoRa Gateway		
네네 LoRa Network Server	Click "Generate archive" to download a tar archive of the current confluctation files. To reset the firmware to its initial state, click "Perform reset" (only possible with squashts images). Download backup	
🗐 System	Reset to defaults: Perform reset	
System Administration Backup / Flash Firmware Reboot	To restore configuration files, you can upload a previously generated backup archive here. Browse Upload archive	
	Flash new firmware image	
	Upload a sysupgrade-compatible image here to replace the running firmware. Check "Keep settings" to retain the current configuration (requires an OpenWrt compatible firmware image) Keep settings: Imago: Browso Flash image	

Figure 33 | Backup Tab

Generate archive - downloads an archive of the current configuration

Perform reset - resets the Gateway to the default settings

Restore – you can upload a previously generated archive to restore the configuration settings at the time of its making

Flash new firmware – update the firmware by flashing a *bin* file. Use the button to select the location of the new firmware file and the blue button to initiate the flashing process. There is a tick box to toggle the option of keeping the current settings of the gateway.

Note it is selected by default as unchecking it will results in having a gateway with stock settings after the firmware update.

3.5.5 Reboot

Reboots the gateway. All unsaved changes will be discarded. This is not a reset in any way and only power cycles the device. All configuration settings will be left intact.

ର୍ତ୍ତ୍ର RAK		Logout
③ Status	Reboot	
Retwork	Reboot	
(A) LoRa Gateway	Balacate the exercision puttern of your device	
네 LoRa Network Server	Perform reboot	
E Surtom		

Figure 33 | Reboot Tab

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

Support center: <u>https://forum.rakwireless.com/</u>

Email us: info@rakwireless.com



4 Appendix – LoRa Network Server Global Integration Interface API(Topic definition and Data Format)

Built-in LoRa Network Server supports integration to the user's application server through MQTT protocol.

MQTT messages are published automatically when the following events occur:

join - When OTAA request occurs to LoRa node

uplink - When LoRa node sends uplink message

ack – When the downlink message pushed by the application server receives the confirmation message

status – When LoRa node status is updated (information such as battery capacity / Link margin)

Built-in LoRa Network Server will subscribe to the downlink topic, so the third-party application server should publish messages to the topic. After receiving the message, LoRa network server will push the downlink message to the LoRa node.

Event	join
type	Event published when a device joins the network.
Торіс	application/[applicationID]/device/[devEUI]/join
	{
	"applicationID": "123",
	"applicationName": "temperature-sensor",
Evennle	"deviceName": "garden-sensor",
Example	"devAddr": "06682ea2", // assigned device address
	"devEUI": "020202020202020202" // device EUI
	}

The topic and message payload format are defined as follows:





Event	uplink
type	Contains the data and meta-data for an uplink application payload.
Topic	application/[applicationID]/device/[devEUI]/rx
	{
	"applicationID": "123",
	"applicationName": "temperature-sensor",
	"deviceName": "garden-sensor",
	"devEUI": "0202020202020202",
	"rxInfo": [
	{
	"gatewayID": "0303030303030303", //ID of the receiving gateway
	"name": "rooftop-gateway", // name of the receiving gateway
	"time": "2016-11-25T16:24:37.295915988Z", // time when the package was received (GPS time of gateway, only set when available)
Example	"rssi": -57, // signal strength (dBm)
	"loRaSNR": 10, // signal to noise ratio
	"location": {
	"latitude": 52.3740364, // latitude of the receiving gateway
	"longitude": 4.9144401, // longitude of the receiving gateway
	"altitude": 10.5, // altitude of the receiving gateway
	}
	}
],
	"txInfo": {
	"frequency": 868100000, // frequency used for transmission
	"dr": 5 // data-rate used for transmission
	},



"adr": false,	// device ADR status
"fCnt": 10,	// frame-counter
"fPort": 5,	// FPort
"data": ""	// base64 encoded payload (decrypted)
}	

Event	ack	
type	Event published on downlink frame acknowledgements.	
Topic	application/[applicationID]/device/[devEUI]/ack	
Example	{	
	"applicationID": "123",	
	"applicationName": "temperature-sensor",	
	"deviceName": "garden-sensor",	
	"devEUI": "0202020202020202", // device EUI	
	"acknowledged": true, // whether the frame was acknowledged or not (e.g. timeout)	
	"fCnt": 12 // downlink frame-counter	
	}	

Event type	status	
	Event for battery and margin status received from devices.	
Topic	application/[applicationID]/device/[devEUI]/status	
Example	{	
	"applicationID": "123",	
	"applicationName": "temperature-sensor",	
	"deviceName": "garden-sensor",	
	"devEUI": "0202020202020202",	



"battery": 200,
"margin": 6,
"externalPowerSource": false,
"batteryLevelUnavailable": false,
"batteryLevel": 75.5
}

When a third-party server needs to send a downlink message to a LoRa node, you should publish the message to the downlink topic in the following format:

Event	downlink	
type	Scheduling downlink data by application server	
Topic	application/[applicationID]/device/[devEUI]/tx	
Example	<pre>{ "confirmed": true, // whether the payload must be sent as confirmed data down or not "fPort": 5, // FPort to use (must be > 0) "data": "" // base64 encoded data (plaintext, will be encrypted by LoRa Server) }</pre>	

Note:

All messages are in JSON format. The data field contents in the uplink and downlink messages are in base64 encoding format.



5 Revision History

Revision	Description	Date
1.0	Initial Release	2019-04-02
1.1	Add the LoRa Gateway MQTT Bridge Configuration	2019-04-03
1.2	Add Customize the Channel and MQTT Bridge Chapter	2019-04-23
1.3	Add LoRa Network Server Chapter. Remove Frequency channel settings and MQTT Bridge Chapter (will be in separate documents)	2019-05-31
1.4	Addition of new features set	2019-06-16
1.5	Features update for new Firmware	2019-07-22
1.6	Features update for new Firmware	2019-10-15
1.7	Features update for new Firmware	2019-10-28

6 Document Summary

Prepared by	Checked by	Approved by
Penn, Vladislav	Vladislav	



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.