

**UM01724**

**RHF2S024 User Manual**

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**V1.8**

**Document information**

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## 1. Preface

RHF2S024 is an intelligent home gateway with LoRaWAN and WiFi functions. It could be fixed and put at home or in hotel, high building and so on. It is developed and produced by RisingHF. RHF2S024 has a small size, simple appearance and high reliability, which could help customer to setup a LoRaWAN network quickly and with efficiency.

## 2. Advanced operation

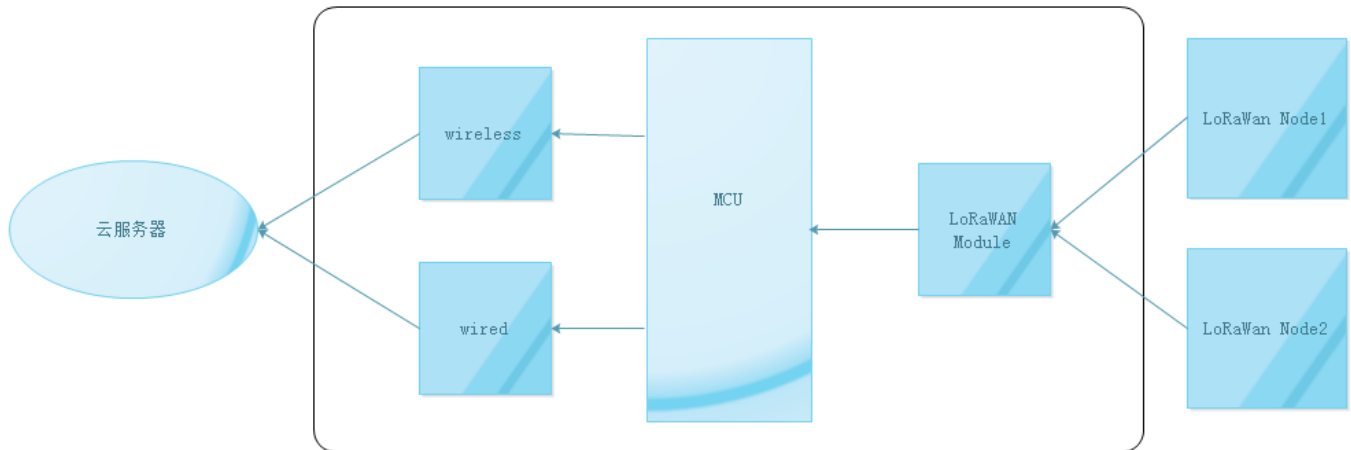


Figure 2-1 LoRaWAN communication structure

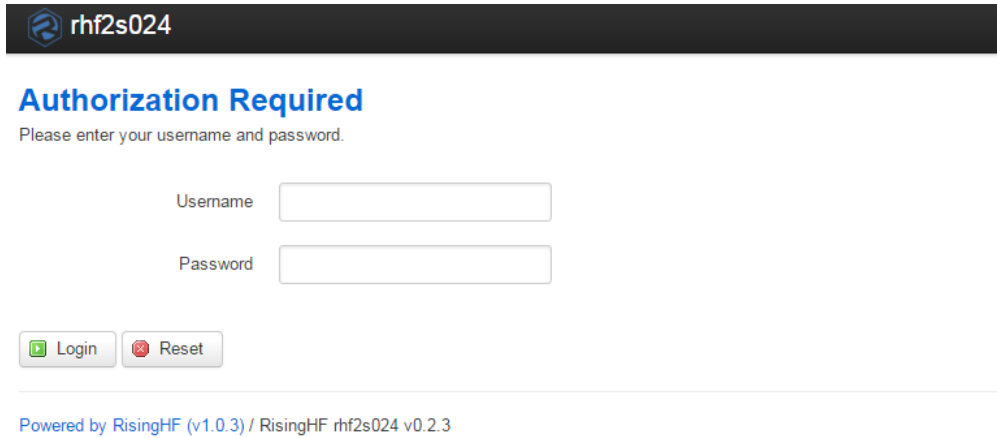
### 2.1. Login on the web

RHF2S024 is built-in a web which could be configured by users. The user can access the “192.168.100.1” into the web configuration interface. Default login user name: admin, password: admin. RHF2S024 factory default mode is the AP mode, and there are two ways to login into web interface.

Use your PC to scan the device SSID (ie WiFi name) which is “RisingHF\_XXXXXX”, “XXXXXX” stands for the last 3bytes of the device MAC address. After connection succeeding, use the browser to access 192.168.100.1 into the web configuration page.

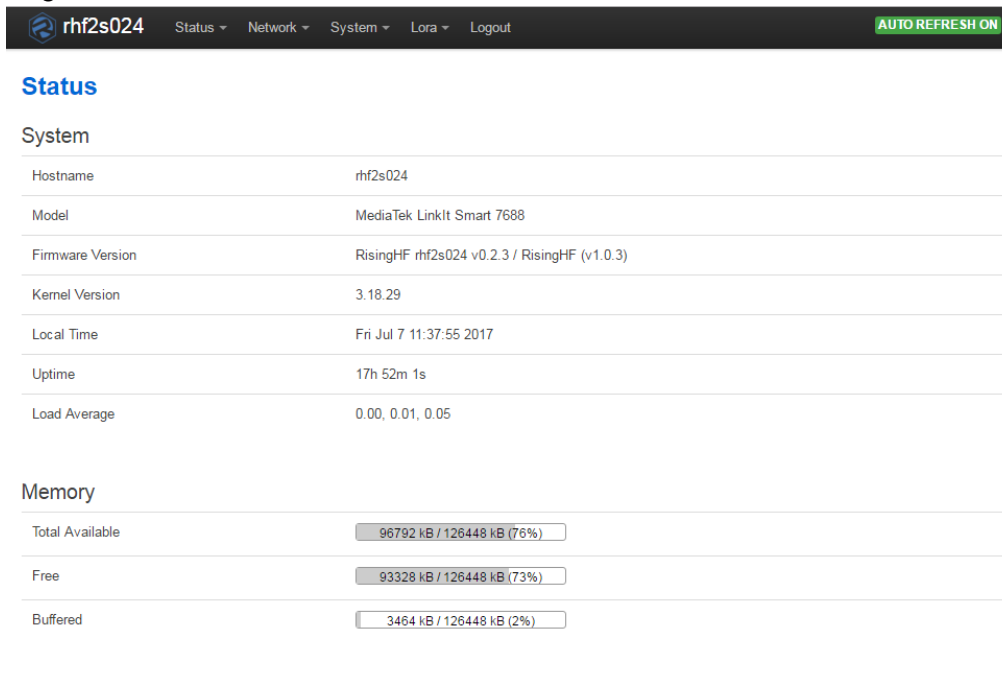
Connect the gateway to a router and use DHCP service to get the ip of the device. The hostname of the gateway also is rhf2s024.

1) Access the ip and open the web page:



**Figure 2-2 Login on the web page**

2) Page after login:



**Figure 2-3 Page after login**

RHF2S024 web interface menu is as follows:

**Level 1 menu:**

**Status:** Mainly show system status

**Network:** Network-related configuration, to provide settings of connecting to internet, test network and other functions

**System:** Common settings for the system

**Lora:** LoRaWAN SDK configuration

**Level 2 menu:**

## Status:

**Overview:** Display system status, such as: version, memory, network information and other functions

## Network:

**Mode:** Network configuration, switch modes to access to internet

**Ethernet:** Ethernet access, be valid in AP mode.

**LAN config:** LAN configuration, such as: LAN IP address

**Region:** Region of the gateway location

**Diagnostics:** check the connection to internet

## System

**System:** System property settings, such as: time, time zone, language

**Administration:** Modify the password for the current user

**Reboot:** Reboot the system

**Reset:** Restore factory settings, the user will lose all data

## Lora

**Sdk:** Built-in SDK, each level 2 menu represents an SDK

**Logout:** logout

## 2.2. LoRa SDK

### 2.2.1. Modify SDK configuration

RHF2S024 is built-in Packet Forwarder SDK, and provides a web page for configuration, User can configure their own SDK according to their needs. Currently available configuration options are shown below:

**Protocol Version:** The protocol version of the SDK.

**Gateway ID:** Gateway ID, unique logo on the cloud server. While the GW ID is a little different in different server, please check the cloud server related rules.

**Server Address:** Cloud server address.

**Port:** Cloud server upstream and downstream ports.

**Global Config:** RHF2S024 is built-in configuration file to modify frequency channels. Please check the HW of the gateway before doing the channel modifications.

**Note: The above configuration options vary depending on the SDK, and the options may be reduced.**

## Lora

### Lora SDK Config

Protocol Version	Semtech Packet Forwarder v2 ▾	
Gateway ID	d06f4aFFFF4f2899	
Server Address	cn1.loriot.io	
Port	1780	1780
Global Config	-- select one -- ▾	-- select one -- ▾

Enable

**Figure 2-4 LoRa SDK configuration**

### 2.2.2. Switch SDK

RHF2S024 currently supports the following SDK:

- a. Semtech Packet Forwarder
- b. TTN Packet Forwarder

In the web page Lora menu, each level 2 menu represents an SDK. If the menu name is appended with (enable), it means that the SDK is running. User can switch the SDK as needed. Just click Enable in the SDK page, you can close the previous SDK and run another one.

## 2.3. Led instruction

RHF2S024 panel provides a total of five LED for functional instructions, which make users know the different status of the device. They are Power, System, WiFi, LoRa and USB instruction LEDs. In the network RJ45 port there is another LED to show network status.





Figure 2-5 RHF2S024 panel display

Table 2-1 Led descriptions

Power led	Power ON.
System led	When the system is fully activated, the led shows green and blinks slowly; when you press the RESET button to restore the factory settings, the led blinks quickly; when you press RESET button to restart the system, the led keeps on; when the device is in upgrading, led blinks slowly.
WiFi led	The WiFi led is a tri-color led, which include green, red and orange. When the WiFi signal is strong, the led is green; if the WiFi signal is poor, the led is orange; in other cases it is red.
LoRa led	The LoRa led include green and red two instructions state. When the system is fully activated, and the gateway start the packet forwarder successfully, it is green; otherwise it is red.
USB led	When there is a U disk the led is always green. If the device is reading from U disk, the led will blink.
RJ45 led	When the device connect to network via cable, the led will blink.

**Note:** The System led, WiFi led, LoRa led and USB led will be on for 2 seconds during system startup.

## 2.4. Key

RHF2S024 have two keys, respectively FCT key and RESET key.

Table 2-2 Functions of the Keys

FCT key	Keep pressing the key for more than 1 second, to enter the WPS mode.
RESET key	Keep pressing the key for more than 1 second and less than 5 second, the device will restart; Keep pressing the key for more than 5 seconds, the device is restored to factory settings.

Wi-Fi Protected Setup (WPS;originally, Wi-Fi Simple Config) is a network security standard to create a secure wireless home network.Created by the Wi-Fi Alliance and introduced in 2006, the goal of the protocol is to allow home users who know little of wireless security and may be intimidated by the available security

options to set up Wi-Fi Protected Access, as well as making it easy to add new devices to an existing network without entering long passphrases. Prior to the standard, several competing solutions were developed by different vendors to address the same need.

**Note:** After the factory settings are restored, the user will lose all configuration data.

## 2.5. User interface

RHF2S024 provides a total of two external interfaces for users to use, respectively RJ45 and USB interface.

### 2.5.1. RJ45 interface

The RJ45 network port would be as WAN port in AP and PPPoE mode. Users could connect it to network via wired cable.

**AP mode:** Connect the device to router with network cable and configure it to AP mode. The higher-level gateway router can be in DHCP or Static IP allocation mode. For details, please refer to section 2.2 of this document.

**PPPoE mode:** The gateway could dial and connect to internet directly in PPPoE mode without a router. Please refer to Section 2.2 of this document for more details.

The RJ45 network port would be as LAN port in AP/STA mode.

AP/STA mode: Others station devices could connect to internet via this RJ45 port, please refer to Section 2.2 of this document for more details.

### 2.5.2. USB interface

This interface allows you to upgrade the firmware for RHF2S024. When there is a U disk with FW inserted, re-power the device will trigger the upgrading.

**NOTE:** Do not power off the device or perform other operations during the upgrade process to avoid upgrading failure. The others LEDs would be off for 3 min except the power LED after the FW upgrade successfully.

The device only supports storage device with the format of the FAT32. The NTFS ones are not supported.

## 3. Quick Start

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RHF2S024 is a plug and play LoRaWAN gateway, built-in with applications connected to cloud server. In default it will be connected to the <http://cn1.loriot.io> server. User doesn't need install any software. User just needs to read the MAC address from the label of the gateway device and register it in the Loriot server. And connect the GW to the router via cable. Open the web UI to set the gateway frequency. Then power on it that the device would connect to the server automatically.

### 3.1. Connect to the server

- 1) New users need register an account in <http://cn1.loriot.io>
- 2) Enter Dashboard -> Gateways -> Add Gateway

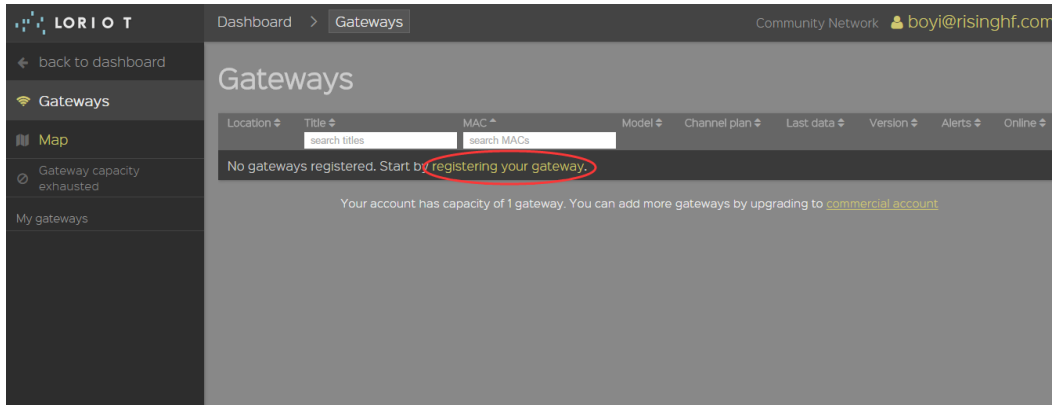


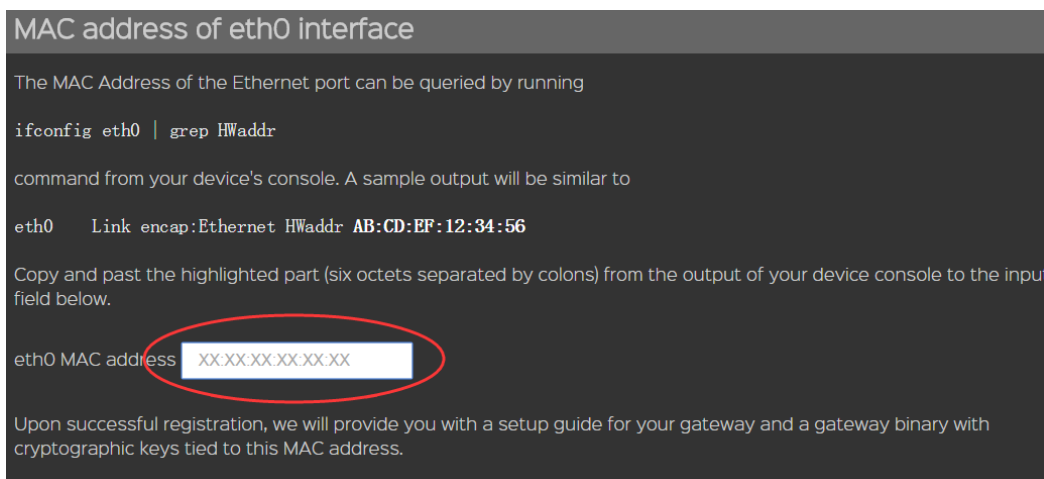
Figure 3-1 register gateway

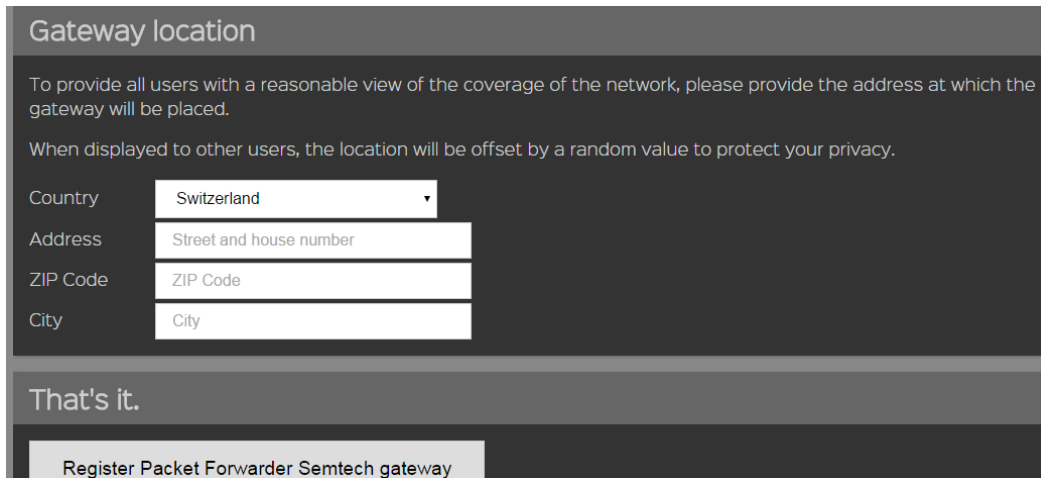
### 3) Select Packet Forwarder Semtech



Figure 3-2 select Packet Forwarder

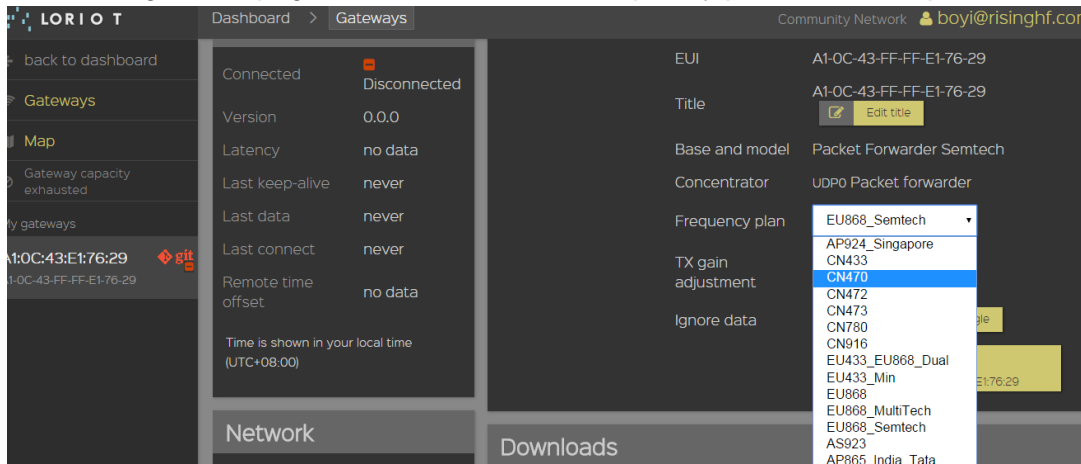
### 4) Fill in the MAC address, MAC address label is usually posted on the bottom of the gateway device, the format is xx:xx:xx:xx:xx:xx





**Figure 3-3 Fill in the gateway information**

- 5) Click “Register Packet Forwarder Semtech gateway” to complete the registration
- 6) Click “Go to the gateway detail page” or click “gateway xx:xx:xx:xx:xx:xx” from the left console to access into the configuration page. You can select the frequency plan that corresponds to this gateway.



**Figure 3-4 Select frequency plan**

7) Open the gateway web UI, enter “Lora->Packet forwarder” menu. The "Global Config" select the frequency plan corresponding to the gateway, click "Enable", submit the configuration and open the SDK.

8) LoRaWAN communication demo

note: Register a node in the cloud server to do LoRaWAN communication demo. Please refer to RisingHF RHF3M076 user manual "[RHF-PS01509]LoRaWAN Class AC AT Command Specification - v4.3" for how to use RisingHF LoRaWAN modem.

When the LoRa led turn to green from red, it connected to the cloud server. And you could do LoRaWAN communication with the node.

- The green power LED will be ON;
- The green system LED will blink;
- The red WiFi LED will be ON; (AP mode)
- The green LoRaWAN LED will be ON;
- The USB LED will be off;



Figure 3-5 Led instructions in default AP mode when connected to cloud server

### 3.2. Connect to internet in different modes and modes switch

There are wireless WiFi and wired cable two ways to connect to the internet for RHF2S024. In wireless WiFi mode, the device could connect to the network via the router by wireless way. And the device could also connect to the internet via DHCP, Static and PPPOE mode.

#### 3.2.1. AP mode

AP mode is RHF2S024’s factory default mode. In this mode, the gateway could connect to the network via DHCP way with a cable. Please connect RHF2S024 network port to the DHCP LAN port of the router with the network cable.

Except the DHCP, RHF2S024 also supports Static IP access. Please access to the web configuration to switch the mode.

1) Get IP address of the device

1. Scan the SSID of RHF2S024 in your PC and connect your PC to the device, usually with the default name “RisingHF\_XXXXXX”, “XXXXXX” stands for last 3bytes of the device MAC address. After your PC connecting to the device, you could get the default ip 192.168.100.1.

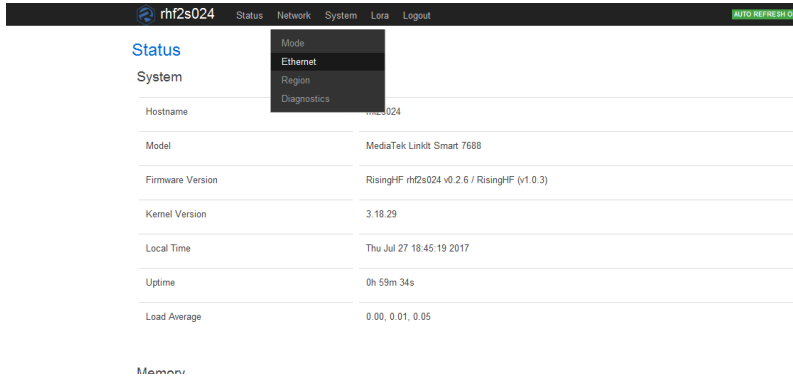
2. Connect both your PC and RHF2S024 to the same router, then you could obtain the IP address via DHCP service.

2) Login. Default Username: admin; Password: admin

Powered by RisingHF (v1.0.3) / RisingHF rhf2s024 v0.2.3

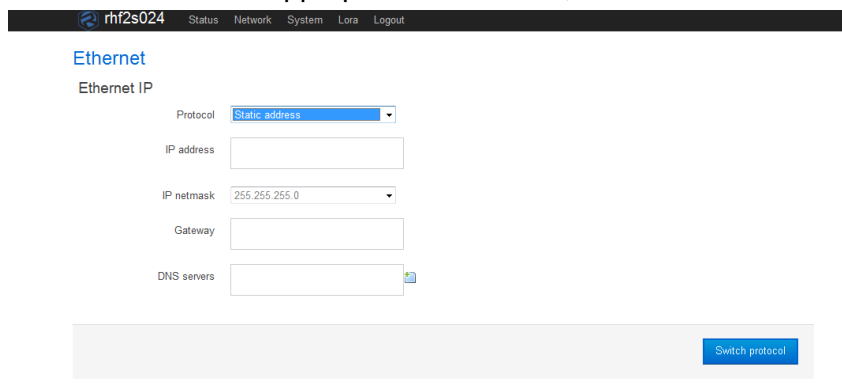
**Figure 3-6 Web page login**

3) On the Web page, click Network->Ethernet.



**Figure 3-7 The Ethernet menu**

4) Select static address, and fill in the appropriate IP address, IP netmask and other information.



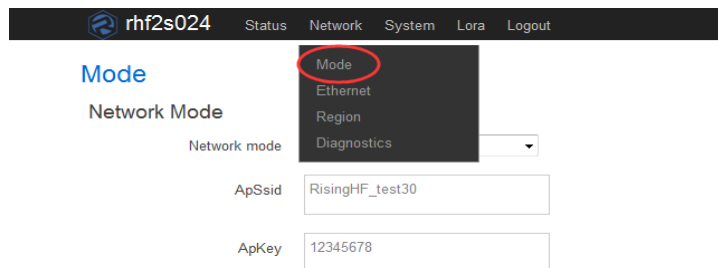
**Figure 3-8 Fill in information with static ip**

5) Click “Switch protocol” to wait for tens of seconds to connect to the internet.

### 3.2.2. AP/STA mode

In this mode, RHF2S024 gateway will have both AP and STA functions. The gateway will connect to the internet and cloud server via wireless WiFi, and also provide WiFi services to others stations.

1) On the web page, click Network->Mode



**Figure 3-9 Enter the mode menu**

2) Select APSTA in the “Network mode” field and click “Scan wifi”

Network Mode

Network mode:

ApSsid:

ApKey:

StaSsid:

StaKey:

**Figure 3-10 Select APSTA mode**

3) In the StaSsid field, select the gateway SSID you want to connect to and enter the password in StaKey

Network Mode

Network mode:

ApSsid:

ApKey:

StaSsid:

StaKey:

- select one --
- NTTVPN (100%)
- 0xE5B08FE99CB8E78E8B (76%)
- RisingHF\_TEST (100%)
- RisingHF (100%)
- XBW-sub (31%)
- OpenWrt (76%)
- ChinaNet-smdC (15%)
- ChinaNet-VqEk (63%)
- Xiaomi\_B53B (100%)
- ChinaNet-pwEJ (91%)
- UPRT2 (37%)
- 0xE782B9E889B2E69687E58C96 (76%)
- RisingHFNew (100%)
- INFEDIUM (34%)
- WITHSTUDIO\_WIFI (26%)
- ZHRY (68%)
- RisingHF\_E17629 (94%)

Powered by RisingHF (v1.0.3) / RisingHF

**Figure 3-11 Select the scanned SSID**

4) Click “Switch mode” to switch mode, wait about 1 minute till the page will automatically refresh, or you could refresh the page by manual. The WiFi led will turn green if it succeeds. If you fill in with wrong StaKey or invalid SSID, the device will return to AP mode.

- The green power LED will be ON;
- The green system LED will blink;
- The green WiFi LED will be ON; (AP/STA mode)
- The green LoRaWAN LED will be ON;
- The USB LED will be off;

Mode

Network Mode

Network mode: apsta

ApSsid: RisingHF\_test30

ApKey: 12345678

StaSsid: RisingHF

StaKey: RisingHF20150203

Figure 3-12 Switch mode



Figure 3-13 Led instructions in AP/STA mode when connected to cloud server

### 3.2.3. PPPoE mode

Customer could use PPPoE mode to dial and connect to internet with RHF2S024.

1) On the web page, click “Network->Mode” to select the “PPPoE” mode.

rhf2s024 Status Network System Lora Logout

Mode

Network Mode

Network mode: pppoe

ApSsid: RisingHF\_test30

ApKey: 12345678

Username:

Password:

Figure 3-14 Switch to PPPoE mode

2) Fill in the account and password and click “Switch mode” to access into the internet. Please check with your local network operator for your account and password first.



All the methods above could help you connect the gateway RHF2S024 access to the internet and also the cloud server. Then you can demo the LoRaWAN communication with the node.

### 3.3. LoRaWAN communication example

This example is based on RisingHF LoRaWAN modem RHF76-052AM/RHF3M076B (FW version v2.1.15) with AT command. Here we use the CN470 Prequel frequency plan as an example.



**Figure 3-15 RHF3M076B LoRaWAN Modem**

1) RHF3M076 is a USB CDC device. Please install the driver before using it. For installation drivers please refer to the RisingHF UM01516 User's manual. The driver file can be downloaded from the RisingHF Wiki or by contacting support@risinghf.com.

2) Open the SSCOM tool and select the COM port and open it.

3) Configure the node/Modem and demo uplink

- ❑ //Reset the modem
  - At+reset
- ❑ //check or re-wirte the DevAddr
  - At+id
  - At+id=DevAddr," 01 02 03 04"
- ❑ //set to ABP mode, ClassA mode
  - At+mode=LWABP
  - AT+CLASS=A
- ❑ //set the data rate scheme
  - At+dr=CN470prequel
- ❑ //configure the channel (keep the channels same for both GW/server and node side)
  - At+ch=0,471.5
  - At+ch=1,471.7
  - At+ch=2,471.9
  - ...
  - At+ch=7,472.9
- ❑ //set Rxwin2
  - At+rxwin2=471.3,dr3
- ❑ //set initial data rate
  - at+dr=dr0
- ❑ //set initial power
  - AT+POWER=20
- ❑ //ADR ON or OFF

- AT+ADR=ON
- ❑ //Configure Nwkskey and Appskey (keep the keys same for both server and node side)
- AT+KEY=NwkSKey, "2B 7E 15 16 28 AE D2 A6 AB F7 15 88 09 CF 4F 3C"
- AT+KEY=AppSKey, "2B 7E 15 16 28 AE D2 A6 AB F7 15 88 09 CF 4F 3C"
- ❑ //disable duty cycle function (please follow the local rules)
- at+lw=dc,off
- At+lw=jdc,off
- ❑ //Demo Uplink
- AT+MSGHEX="00 11 22 33"
- ❑ //Demo downlink

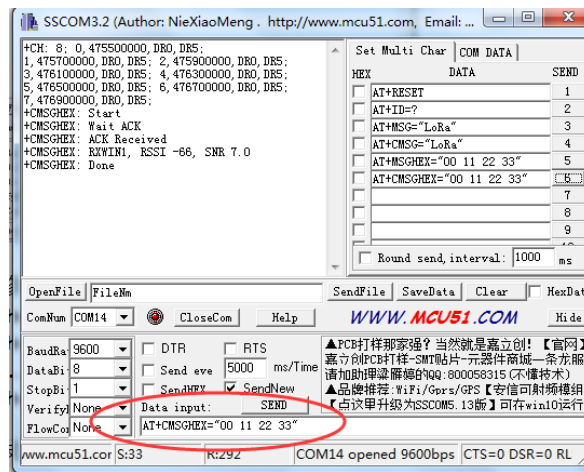


Figure 3-16 Demo uplink with ACK

4) Visit the <https://www.loriot.io/> server and go to Dashboard -> Applications -> SampleApp->Dataout-> Websocket sample.

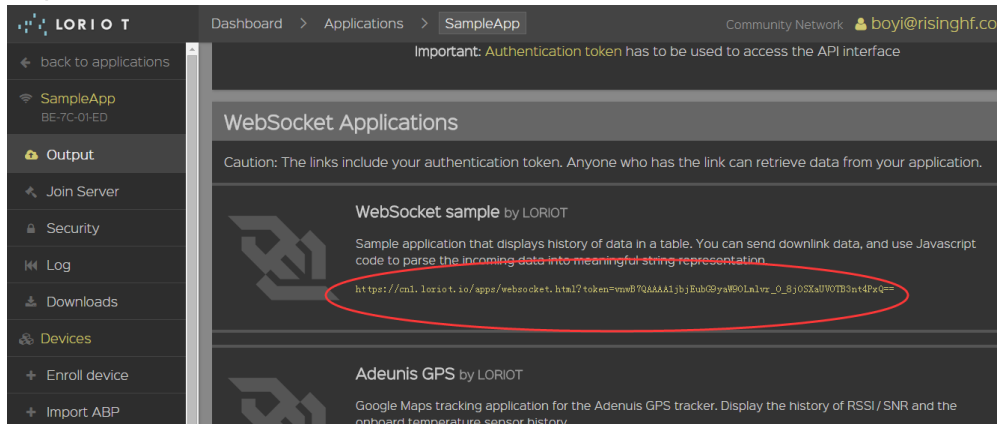


Figure 3-17 The link to show the uplink data

5) This page will show the uplink data received on the server.

Device EUI	Local time	Freq [MHz]	Data rate	RSSI	SNR	Seq #	Port	Payload
4799339500390044	2017/7/21 下午6:51:57					48	8	00 11 22 33
4799339500390044	2017/7/19 上午11:18:06					217	8	00 11 22 33
4799339500390044	2017/7/19 上午11:17:58					216	8	00 11 22 33
4799339500390044	2017/7/19 上午11:17:50					215	8	00 11 22 33
4799339500390044	2017/7/19 上午11:17:42					214	8	00 11 22 33
4799339500390044	2017/7/19 上午11:17:34					213	8	00 11 22 33
4799339500390044	2017/7/19 上午11:17:26					212	8	00 11 22 33
4799339500390044	2017/7/19 上午11:17:18					211	8	00 11 22 33

Figure 3-18 Uplink data received

## 4. Connect to others server

### 4.1. TTN server

RHF2S024 built-in TTN SDK. TTN cloud server currently support both 868MHz and 915MHz, with the node default to use OTAA mode. TTN server address <https://www.thethingsnetwork.org>.

#### 4.1.1. Get started

- a) Open the menu “Lora-> TTN Packet forwarder”, and set gateway\_ID. There are no special limitations for this configuration when you set ID. It is recommended to include the gateway MAC address to keep the ID uniqueness. The "Global Config" select the frequency plan corresponding to the gateway, click "Enable", submit the configuration and open the SDK.

#### Lora

##### Lora SDK Config

Protocol Version: TTN Packet Forwarder

Gateway ID: d06f4aFFFF4f2899

Global Config: -- select one --

Enable

Figure 4-1 Configuration TTN SDK

- b) New user should register a new account. Skip this step if user had already registered. <https://account.thethingsnetwork.org/register>
- c) Login to TTN cloud server, enter ” Gateway->register gateway”

Gateways > Register

### REGISTER GATEWAY

**Gateway ID**  
A unique, human-readable identifier for your gateway. It can be anything so be creative!

**I'm using the legacy packet forwarder**  
Select this if you are using the legacy [Semtech packet forwarder](#).

**Description**  
A human-readable description of the gateway

**Frequency Plan**  
The [frequency plan](#) this gateway will use

**Router**  
The router this gateway will connect to. To reduce latency, pick a router that is in a region which is close to the location of the router itself.

**Figure 4-2 Register the gateway in TTN**

Fill in the registration information, and select "I'm using the legacy packet forwarder", click "Register Gateway" to complete the registration.

- d) Enter "Applications->add application"

Applications > Add Application

### ADD APPLICATION

**Application ID**  
The unique identifier of your application on the network

**Description**  
A human readable description of your new app

**Application EUI**  
An application EUI will be issued for The Things Network block for convenience, you can add your own in the application settings page.

**Handler registration**  
Select the handler you want to register this application to

**Figure 4-3 Add application in TTN**

Fill in the registration information, click "Add application".

- e) Enter "Devices->register device"

Applications > testassdasda > Devices

**Device ID**  
This is the unique identifier for the device in this app. The device ID will be immutable.

**Device EUI**  
The device EUI is the unique identifier for this device on the network. You can change the EUI later.

 0 bytes
 

**App Key**  
The App Key will be used to secure the communication between you device and the network.

 this field will be generated
 

**App EUI**

 70 B3 D5 7E D0 00 6D B2

**Figure 4-4 Register the node in TTN**

Fill in with the nodes DevAddr, DevEui and APPKEY.

- f) Configure the nodes to the OTAA mode and join the network.  
For more information to how to configure the RHF76-052AM/RHF3M076B modem, please refer to RisingHF RHF3M076 user manual "[RHF-PS01509]LoRaWAN Class AC AT Command Specification - v4.3"  
AT+ID=AppEui,"70 B3 D5 7E D0 00 6D B2"  
AT+MODE=LWOTAA  
AT+JOIN=FORCE
- g) Do uplink demo and data received in TTN server.

Applications > testassdasda > Devices

applications

Overview Devices Payload Formats Integrations Data Settings

**DEVICES** + register device

< > 1 — 1 / 1

0140f463
47 68 C4 0A 00 37 00 29
●

Applications > testassdasda > Devices > 0140f463 > Data

Overview Data Settings

### APPLICATION DATA

Filters: uplink downlink activation ack error

time	counter	port	
▲ 17:58:06	1	8	payload: 11 22 33
⚡ 17:55:27			dev addr: 26 01 2EDF app eui: 70 B3 D5 7E D0 00 6D B2 dev eui: 47 68 C4 0A 00 37 00 29

Figure 4-5 uplink data in TTN server

## 5. Power adapter

RHF2S024 is powered by a 12V/1.5A adapter.



Figure 5-1 Power Adapter

## 6. Restore factory settings

Keep pressing the RESET key for more than 5 seconds, with system led being from the slow blinking to quick blinking, RHF2S024 will restore factory settings.

**Note:** After the factory settings are restored, the user will lose all configuration data.

## 7. Upgrade firmware

---

Follow the steps below to upgrade the firmware:

- 1) Download the FW into the U disk from RisingHF website. User can't change the firmware name, or the device will fail to upgrade.
- 2) Insert the U disk into the device and then power on again.
- 3) USB LED will blink fast, it means the firmware in the U disk is being read.
- 4) System led start blinking, the system is being upgraded.
- 5) The System led stop blinking and the system has been upgraded successfully.

Note: Don't power off when in upgrading, or you need re-do the step from 2) to 5)

## 8. Troubleshooting

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Q1: RHF2S024 provides three kinds of mode to connect to network, but how to use them?

A1: APmode: When the gateway is far away from the router, but a wired connection is possible.

APSTA mode: When the gateway is nearby the router and WiFi signal is strong.

PPPoE mode: No superior router, gateway device need dial and connect to network directly.

Q2: Fail to connect to internet after switching mode?

A2: If switching to APmode, please check whether the higher-level router can access to the Internet, or the higher-level router is in static IP mode.

If switching to APSTA mode, please check whether the StaSsid and StaKey are correct when connecting to the higher-level router. If it fail to switch mode, it will return to APmode.

If switching to PPPoE mode, please confirm whether Username and Password are correct, or whether the account has been disabled by the operator.

Q3: I want to switch to APSTA mode, but the device is in APmode?

A3: If you fill in with wrong SSID and StaKey, it will fail to switch to APSTA mode and return to APmode.

Q4: Why there is no instructions after switching mode?

A4: After switching mode, the gateway will restart WiFi or even switch LAN LAN / WAN lead to disconnect the computer from the device, then the computer will lose the gateway device IP.

Q5: Gateway/server can't receive uplink data?

A5: Please check the SDK configuration on the web page. Please make sure the configurations are same in both GW/server and node side.

Q6: How do I determine that the gateway is already connected to the cloud server?

A6: When the gateway is connected to the cloud server, the cloud server shows the gateway on line.

If the gateway is not connected to the cloud server, follow these steps to troubleshoot:

1) Check whether the gateway is connected to the Internet, you can do it in the web page Network->Diagnostics. Ping succeed means the device connect to network, ortherwise the device disconnect to network.



### Diagnostics

#### Network Utilities

dev.openwrt.org      dev.openwrt.org      dev.openwrt.org

IPv4   Ping       Traceroute       Nslookup

Install iputils-traceroute6 for IPv6 traceroute

```

PING dev.openwrt.org (217.115.15.26): 56 data bytes
64 bytes from 217.115.15.26: seq=0 ttl=49 time=239.848 ms
64 bytes from 217.115.15.26: seq=1 ttl=49 time=239.542 ms
64 bytes from 217.115.15.26: seq=2 ttl=49 time=239.316 ms
64 bytes from 217.115.15.26: seq=3 ttl=49 time=240.033 ms
64 bytes from 217.115.15.26: seq=4 ttl=49 time=239.806 ms

--- dev.openwrt.org ping statistics ---
 5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 239.316/239.709/240.033 ms
    
```

**Figure 8-1 Test to connect to Internet results**

2) If the device connects to the Internet, you have to check the cloud server address, the uplink and downlink port, and Lora boot SDK configuration.

Q7: How to do when the firmware upgrade fail?

A7: Power on RHF2S024, it means the upgrading fails when the system led doesn't start to blink slowly in 3 min. Please refer to section 6 of this document to repeat the upgrading steps.

Q8: What is the range of the DHCP pool?

A8: The DHCP pool is from xxx.xxx.xxx.100 ~ xxx.xxx.xxx.254. Modification is not acceptable.

Q9: How to modify RHF2S024 time zone?

A9: The East eight time zone is used in default. Please modify it in web page System-> System.

## Revision

V1.8 2017-12-04

- + Modify " 2.1. Connect to the server" configuration steps
- + The "3.Advanced operation" and "2.Quick Start" exchange order

V1.7 2017-09-28

- + Modify "Table 3-1"System led description
- + Change "FCT led" to "system led"
- + Fixed the "FCT" key error description

V1.6 2017-09-06

- + Revise

V1.5 2017-09-05

- + Add switch LoRa SDK
- + Add connect to TTN server

V1.4 2017-09-01

- + update the LoRaWAN communication demo

V1.3 2017-08-10

- + Revise

V1.2 2017-08-04

- + Add LoRa SDK

V1.1 2017-07-28

- + Revise

V1.0 2017-07-22

- + First version

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