



## LG308 LoRaWAN Gateway User Manual

### Document Version: 1.0

Firmware Version: LG02\_LG08--build-v5.1.1542210480-20181114-2349

| Version | Description  | Date        |
|---------|--|-------------|
| 1.0     | Release  | 2018-Nov-17 |
| 1.1     | Add notice for recover mode. Add hardware source code<br>Add FAQ for customized frequency. | 2019-Jan-10 |
|         |  |             |

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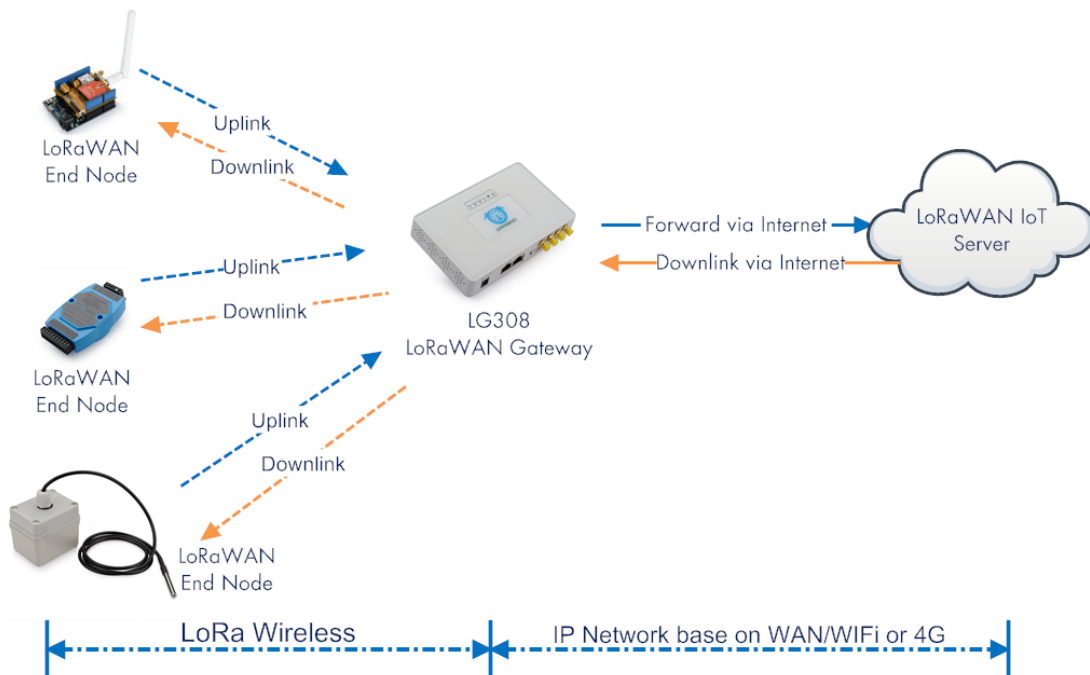
## 1. Introduction

### 1.1 What is LG08 & LG308

The LG308 is an open source **LoRaWAN Pico Gateway**. It lets you bridge LoRa wireless network to an IP network via WiFi, Ethernet, 3G or 4G cellular network. The LoRa wireless allows users to send data and reach extremely long ranges at low data-rates.

The LG308 is fully compatible with LoRaWAN protocol. It includes a SX1308 LoRa concentrator and a SX1276 LoRa transceiver, the **sx1308 provides 10 programmable parallel demodulation paths** and the **SX1276 acts as TX channel** so the SX1308 won't be block during TX. This combination provides higher capacity compare with a standalone SX1308 concentrator solution.

#### LG308 In a LoRaWAN IoT Network:



### 1.2 Specifications

#### Hardware System:

##### Linux Part:

- 400Mhz ar9331 processor
- 64MB RAM
- 16MB Flash

#### Interface:

- 10M/100M RJ45 Ports x 2
- WiFi : 802.11 b/g/n
- LoRaWAN Wireless

- Power Input: 12V DC, 1 A
- USB 2.0 host connector x 1
- Mini-PCI E connector x 1
- SX1308 + SX1276

**WiFi Spec:**

- IEEE 802.11 b/g/n
- Frequency Band: 2.4 ~ 2.462GHz
- Tx power:
  - ✓ 11n tx power : mcs7/15: 11db      mcs0 : 17db
  - ✓ 11b tx power: 18db
  - ✓ 11g 54M tx power: 12db
  - ✓ 11g 6M tx power: 18db
- Wifi Sensitivity
  - ✓ 11g 54M : -71dbm
  - ✓ 11n 20M : -67dbm

**LoRa Spec:**

- Up to -142.5dBm sensitivity with SX1257 Tx/Rx front-end
- 70 dB CW interferer rejection at 1 MHz offset
- Able to operate with negative SNR, CCR up to 9dB
- Emulates 49x LoRa demodulators and 1x (G)FSK demodulator
- Dual digital TX&RX radio front-end interfaces
- 10 programmable parallel demodulation paths
- Dynamic data-rate (DDR) adaptation
- True antenna diversity or simultaneous dual-band operation

**Cellular 4G LTE (optional):**

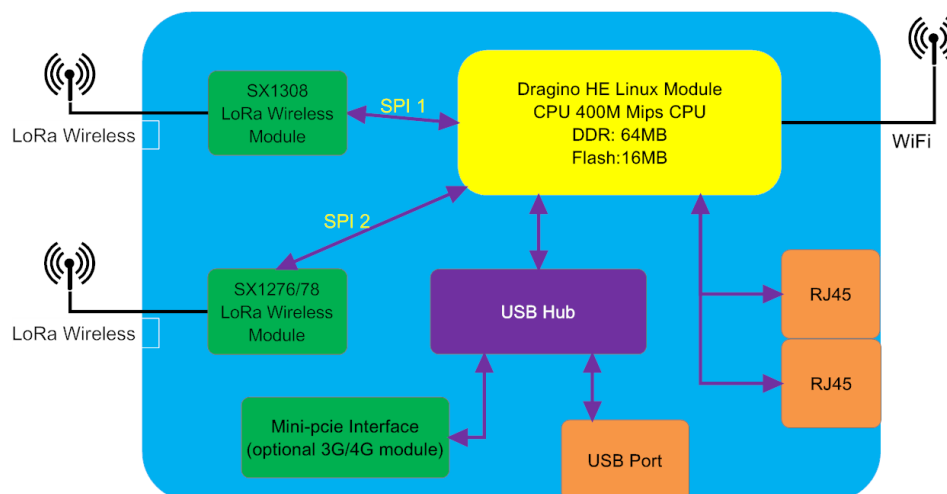
- Quectel [EC25 LTE module](#)
- Micro SIM Slot
- External 4G Sticker Antenna.
- Up to 150Mbps downlink and 50Mbps uplink data rates
- Worldwide LTE, UMTS/HSPA+ and GSM/GPRS/EDGE coverage
- MIMO technology meets demands for data rate and link reliability in modern wireless communication systems

### 1.3 Features

- ✓ Open Source OpenWrt system
- ✓ Managed by Web GUI, SSH via LAN or WiFi
- ✓ Emulates 49x LoRa demodulators
- ✓ LoRaWAN Gateway
- ✓ SX1276 base separate TX path
- ✓ 10 programmable parallel demodulation paths

### 1.4 Hardware System Structure

LG308 System Overview:



## 1.5 LG308 Applications



## 2. Access LG308

### 2.1 Access and configure LG308

The LG308 is configured as a WiFi AP by factory default. User can access and configure the LG308 after connect to its WiFi network.

At the first boot of LG308, it will auto generate an unsecure WiFi network call **dragino-xxxxxx**

User can use the laptop to connect to this WiFi network. The laptop will get an IP address 10.130.1.xxx and the LG308 has the default IP **10.130.1.1**



Open a browser in the laptop and type

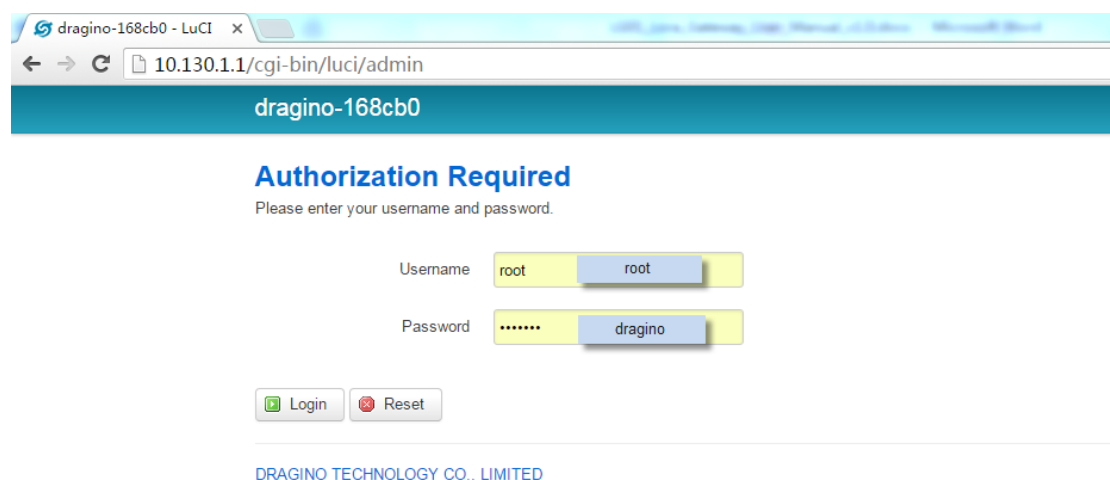
<http://10.130.1.1/>

User will see the login interface of LG308.

The account for Web Login is:

**User Name:** root

**Password:** dragino



**Notice:** In case the WiFi network is disabled, user can connect PC to LG308's LAN port, the PC will get DHCP from LG308, and be able to access it.



### 3. Typical Network Setup

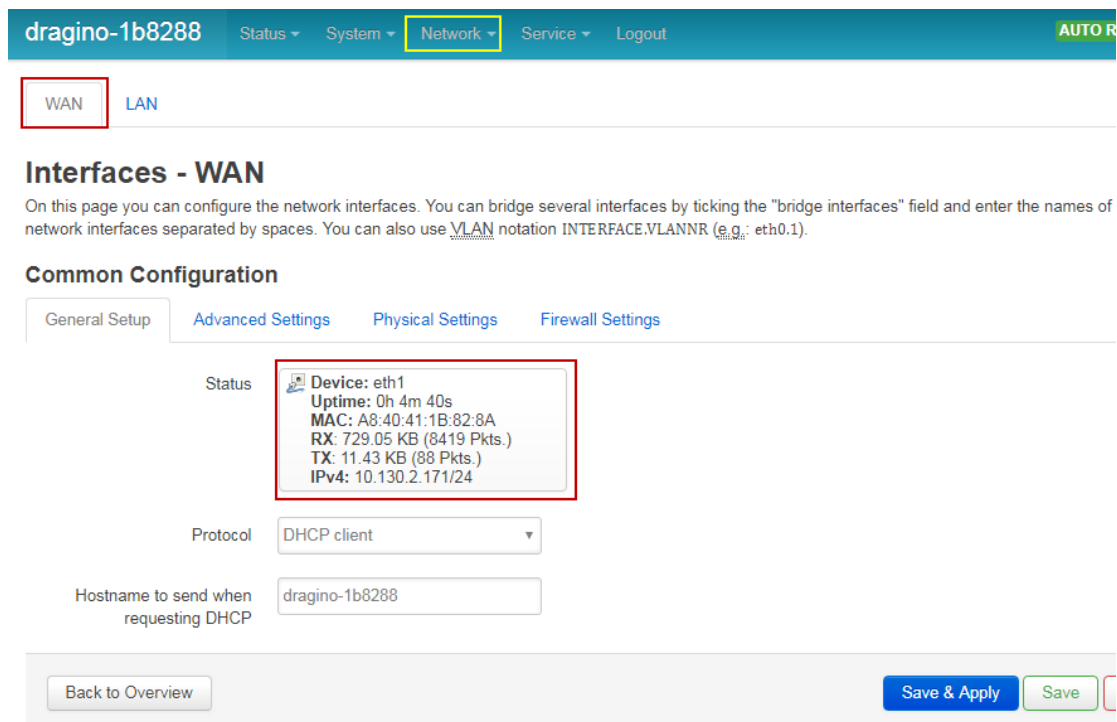
#### 3.1 Overview

LG308 supports flexible network set up for different environment. This section describes the typical network topology can be set in LG308. The typical network set up includes:

- ✓ **WAN Port Internet Mode**
- ✓ **WiFi Client Mode**
- ✓ **WiFi AP Mode**
- ✓ **USB Dial Up Mode**

#### 3.2 Use WAN port to access Internet

By default, the LG308 set to use WAN port as network connection. When connect LG308's WAN port to router, LG308 will get IP from router and have internet access. The network status can be checked as below:



dragino-1b8288   Status ▾   System ▾   **Network ▾**   Service ▾   Logout   **AUTO R**

**WAN**   LAN

### Interfaces - WAN

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge interfaces" field and enter the names of network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANNR (e.g.: eth0.1).

#### Common Configuration

General Setup   **Advanced Settings**   Physical Settings   Firewall Settings

Status   **Device: eth1**  
**Uptime: 0h 4m 40s**  
**MAC: A8:40:41:1B:82:8A**  
**RX: 729.05 KB (8419 Pkts.)**  
**TX: 11.43 KB (88 Pkts.)**  
**IPv4: 10.130.2.171/24**

Protocol   DHCP client ▾

Hostname to send when requesting DHCP   dragino-1b8288

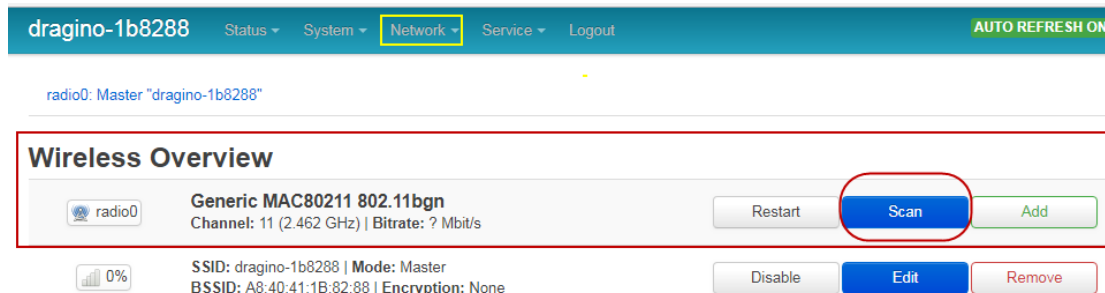
Back to Overview   **Save & Apply**   **Save**

### 3.3 Access Internet as a WiFi Client.

In the WiFi Client Mode, Dragino acts as a WiFi client and gets DHCP from uplink router via WiFi. The step to set is as below:

#### Step1:

In network -> Wireless, select Radio0 interface and scan.



dragino-1b8288 Status System **Network** Service Logout AUTO REFRESH ON

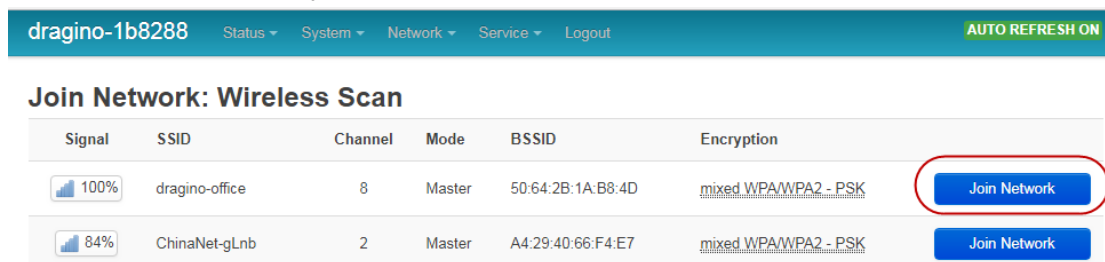
radio0: Master "dragino-1b8288"

#### Wireless Overview

|        |  |         |             |        |
|--------|--|---------|-------------|--------|
| radio0 | <b>Generic MAC80211 802.11bgn</b><br>Channel: 11 (2.462 GHz)   Bitrate: ? Mbit/s   | Restart | <b>Scan</b> | Add    |
| 0%     | SSID: dragino-1b8288   Mode: Master<br>BSSID: A8:40:41:1B:82:88   Encryption: None | Disable | Edit        | Remove |

#### Step2:

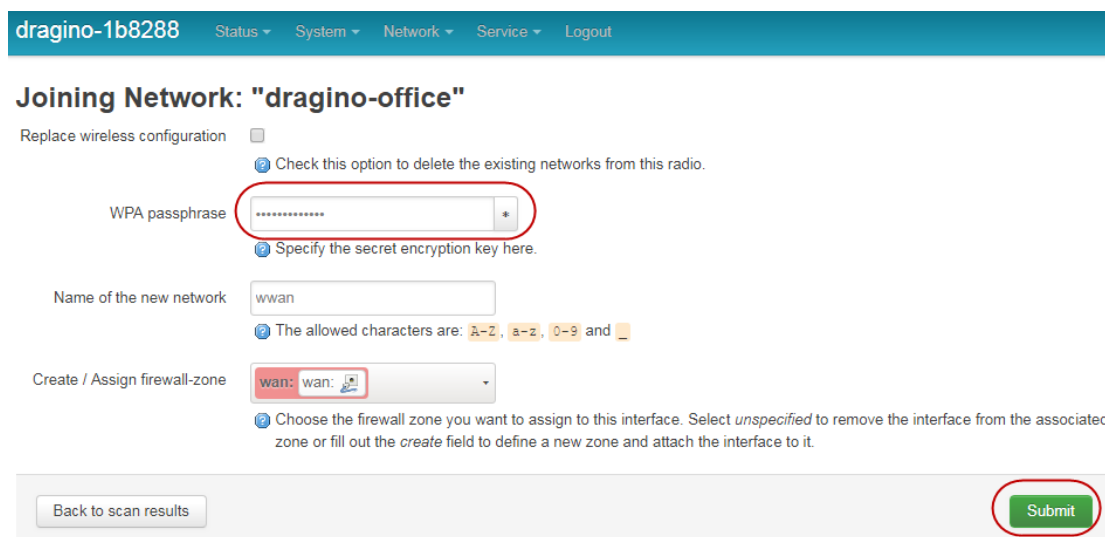
Select the wireless AP and join:



dragino-1b8288 Status System Network Service Logout AUTO REFRESH ON

#### Join Network: Wireless Scan

| Signal | SSID           | Channel | Mode   | BSSID             | Encryption           |                     |
|--------|----------------|---------|--------|-------------------|----------------------|---------------------|
| 100%   | dragino-office | 8       | Master | 50:64:2B:1A:B8:4D | mixed WPA/WPA2 - PSK | <b>Join Network</b> |
| 84%    | ChinaNet-gLnb  | 2       | Master | A4:29:40:66:F4:E7 | mixed WPA/WPA2 - PSK | Join Network        |



dragino-1b8288 Status System Network Service Logout

#### Joining Network: "dragino-office"

Replace wireless configuration ☐

☒ Check this option to delete the existing networks from this radio.

WPA passphrase:  \*

☒ Specify the secret encryption key here.

Name of the new network:

☒ The allowed characters are: A-Z, a-z, 0-9 and \_

Create / Assign firewall-zone:

☒ Choose the firewall zone you want to assign to this interface. Select *unspecified* to remove the interface from the associated zone or fill out the *create* field to define a new zone and attach the interface to it.

Back to scan results **Submit**

#### Step3:

In network->wireless page, disable WiFi AP network. Notice: After doing that, you will lose connection if your computer connects to the LG308 via LG308's wifi network.

dragino-1b8288
Status ▾ System ▾ Network ▾ Service ▾ Logout
UNSAVED CHANGES: 13 AUTO REFRESH ON

radio0: Master "dragino-1b8288"

### Wireless Overview

|        |  |                     |
|--------|--|---------------------|
| radio0 | <b>Generic MAC80211 802.11bgn</b><br>Channel: 11 (2.462 GHz)   Bitrate: ? Mbit/s   | Restart Scan Add    |
| 0%     | SSID: dragino-1b8288   Mode: Master<br>BSSID: A8:40:41:1B:82:88   Encryption: None | Disable Edit Remove |
| 0%     | SSID: dragino-office   Mode: Client<br>BSSID: 50:64:2B:1A:B8:4D   Encryption: -    | Disable Edit Remove |

### Associated Stations




| Network                  | MAC-Address | Host | Signal / Noise | RX Rate / TX Rate |
|--------------------------|-------------|------|----------------|-------------------|
| No information available |             |      |                |                   |

After successful associate, the WiFi network interface can be seen in the same page:

dragino-1b8288
Status ▾ System ▾ Network ▾ Service ▾ Logout
AUTO REFRESH ON

WAN WWAN LAN

### Interfaces

|   |   |                          |
|---|---|--------------------------|
| <b>LAN</b><br><br>br-lan                   | Protocol: Static address<br>Uptime: 2h 0m 4s<br>MAC: A8:40:41:1B:82:8B<br>RX: 1.40 MB (13346 Pkts.)<br>TX: 2.79 MB (10321 Pkts.)<br>IPv4: 10.130.1.1/24 | Restart Stop Edit Delete |
| <b>WAN</b><br><br>eth1                     | Protocol: DHCP client<br>MAC: A8:40:41:1B:82:8A<br>RX: 4.30 MB (51840 Pkts.)<br>TX: 55.77 KB (429 Pkts.)  | Restart Stop Edit Delete |
| <b>WWAN</b><br><br>Client "dragino-office" | Protocol: DHCP client<br>Uptime: 0h 6m 6s<br>MAC: A8:40:41:1B:82:88<br>RX: 549.38 KB (5659 Pkts.)<br>TX: 14.90 KB (94 Pkts.)<br>IPv4: 10.130.2.169/24   | Restart Stop Edit Delete |

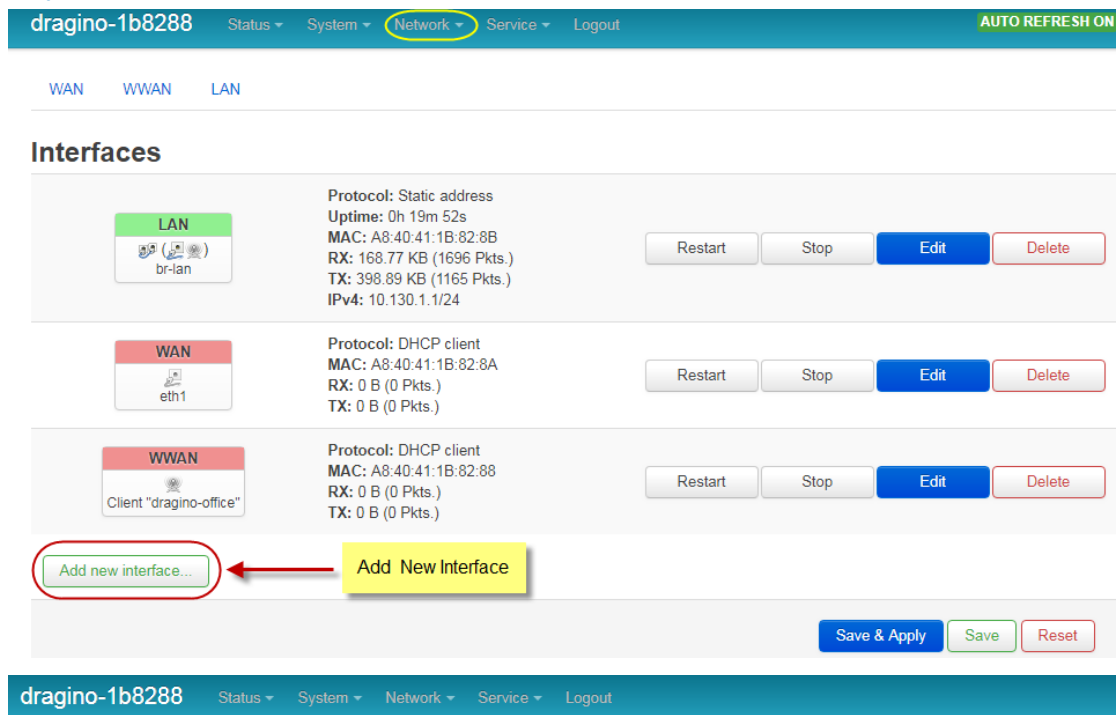
Add new interface...

Save & Apply Save Reset

### 3.4 Use built-in 4G modem for internet access

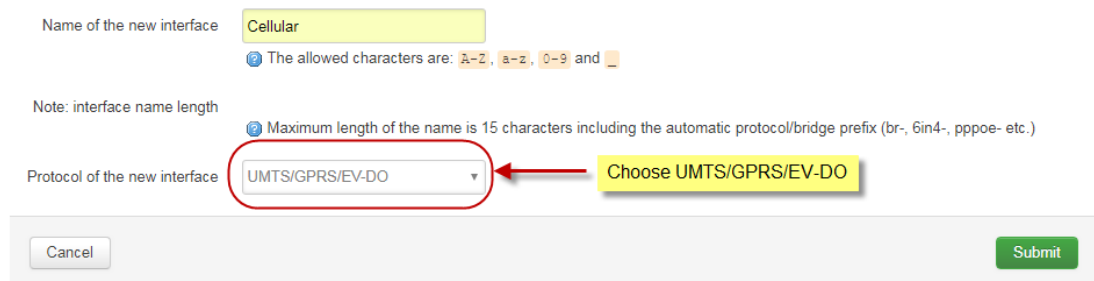
For the LG308 model with 4G version, user can configure the modem for internet access.

#### Step 1: Add New Interface



The screenshot shows the Dragino web interface for device 'dragino-1b8288'. The 'Network' menu item is selected. Below the navigation bar, there are tabs for 'WAN', 'WWAN', and 'LAN'. The 'Interfaces' section lists three interfaces: LAN (Static address), WAN (DHCP client), and WWAN (DHCP client). At the bottom of the list, there is a button labeled 'Add new interface...' which is circled in red. A yellow callout box with the text 'Add New Interface' and an arrow points to this button. At the bottom right of the interface list, there are buttons for 'Save & Apply', 'Save', and 'Reset'.

#### Create Interface



The screenshot shows the 'Create Interface' form. The 'Name of the new interface' field is set to 'Cellular'. Below this field, there is a note: 'Note: interface name length' followed by a question mark icon and the text 'Maximum length of the name is 15 characters including the automatic protocol/bridge prefix (br-, 6in4-, pppoe- etc.)'. The 'Protocol of the new interface' dropdown menu is set to 'UMTS/GPRS/EV-DO', which is circled in red. A yellow callout box with the text 'Choose UMTS/GPRS/EV-DO' and an arrow points to this dropdown menu. At the bottom left, there is a 'Cancel' button, and at the bottom right, there is a 'Submit' button.

## Step 2: Configure cellular interface


dragino-1b8288 Status System Network Service Logout **UNSAVED C**

### Interfaces - CELLULAR

On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge interfaces" field and network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANNR (e.g.: eth0.1).

#### Common Configuration

General Setup Advanced Settings Firewall Settings

Status  Device: 3g-Cellular  
RX: 0 B (0 Pkts.)  
TX: 0 B (0 Pkts.)

Protocol UMTS/GPRS/EV-DO

Modem device /dev/ttyUSB2 Use ttyUSB2 to dial up

Service Type UMTS/GPRS

APN 3gnet Different provider has different APN

PIN

PAP/CHAP username

PAP/CHAP password Some provider may need additional user info

Dial number \*99\*\*\*1#

## Step 3: Check Result

dragino-1b8288 Status System Network Service Logout **AUTO REFRESH ON**

WAN WWAN **CELLULAR** LAN

### Interfaces

**CELLULAR**  
3g-Cellular

Protocol: UMTS/GPRS/EV-DO  
Uptime: 0h 0m 49s  
MAC: 00:00:00:00:00:00  
RX: 116 B (6 Pkts.)  
TX: 680 B (16 Pkts.)  
IPv4: 10.160.169.29/32 Get IP from provider means dial up

Restart Stop Edit Delete

**Note:** In case you don't know whether your device has 4G modem, you can run `lsusb` command in SSH access to check, as below:

```
10.130.1.1 - SecureCRT
文件(F) 编辑(E) 查看(V) 选项(O) 传输(T) 脚本(S) 工具(L) 帮助(H)
10.130.1.1
root@dragino-1b8288:~# lsusb
Bus 001 Device 003: ID 2c7c:0125
Bus 001 Device 002: ID 1a40:0101 Terminus Technology, Inc. Hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 USB
root@dragino-1b8288:~#
root@dragino-1b8288:~#
root@dragino-1b8288:~#
```

use lsusb command

This is the 4G modem

### 3.5 Check Internet connection

User can use the diagnostics page to check and analyze Internet connection.

dragino-1b8288

Status ▾

System ▾

Network ▾

Service ▾

Logout

## Diagnostics

### Network Utilities

openwrt.org

IPv4 ▾

Ping

openwrt.org

Traceroute

openwrt.org

Nslookup

Install iputils-traceroute6 for IPv6 traceroute

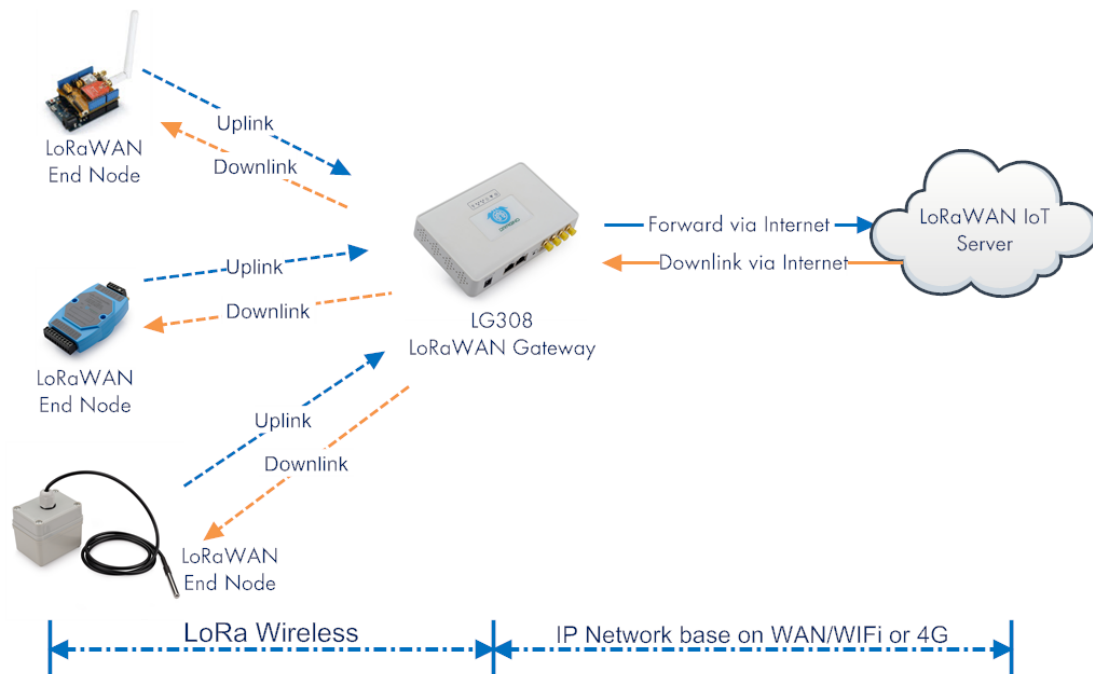
```
PING openwrt.org (139.59.209.225): 56 data bytes
64 bytes from 139.59.209.225: seq=0 ttl=45 time=386.898 ms
64 bytes from 139.59.209.225: seq=1 ttl=45 time=401.656 ms
64 bytes from 139.59.209.225: seq=2 ttl=45 time=387.708 ms
64 bytes from 139.59.209.225: seq=3 ttl=45 time=378.894 ms
64 bytes from 139.59.209.225: seq=4 ttl=45 time=384.156 ms

--- openwrt.org ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 378.894/387.862/401.656 ms
```

#### 4. Example : Configure as a LoRaWAN gateway

LG308 is fully compatible with LoRaWAN protocol. It use the legacy Semtech Packet forwarder to forward the LoRaWAN packets to server, the structure is as below.

##### LG308 In a LoRaWAN IoT Network:



This chapter describes how to use LG308 to work with [TTN LoRaWAN Server](#). The method to work with other LoRaWAN server is similar.

#### 4.1 Create a gateway in TTN Server

##### Step 1: Get a Unique gateway ID.

Every LG308 has a unique gateway id. The id can be found at LoRaWAN page:

dragino-1b8288    Status ▾    System ▾    Network ▾    Service ▾    Logout

### LoRa Gateway Settings

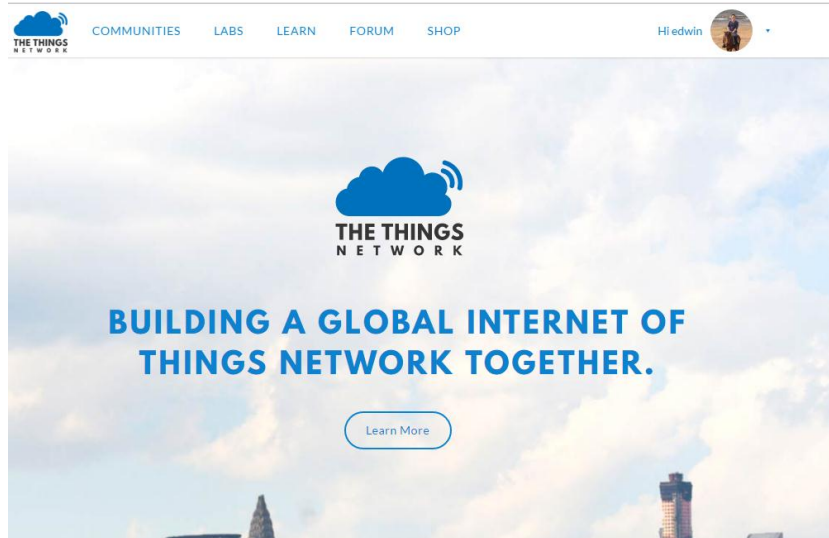
Configuration to communicate with LoRa devices and LoRaWAN server

#### LoRaWAN Server Settings

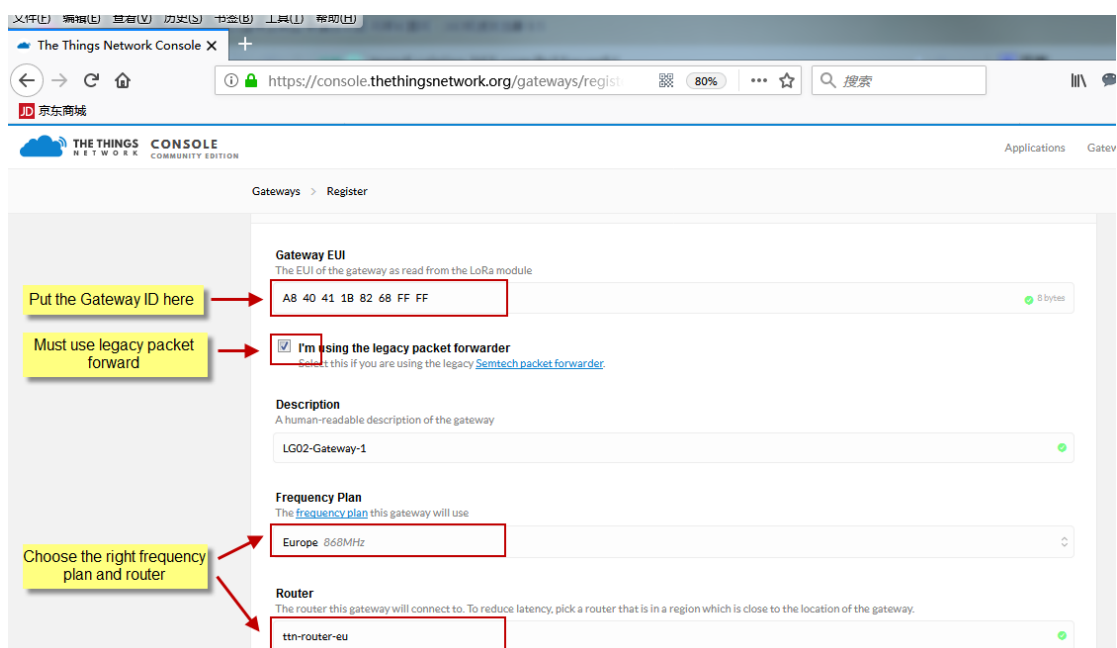
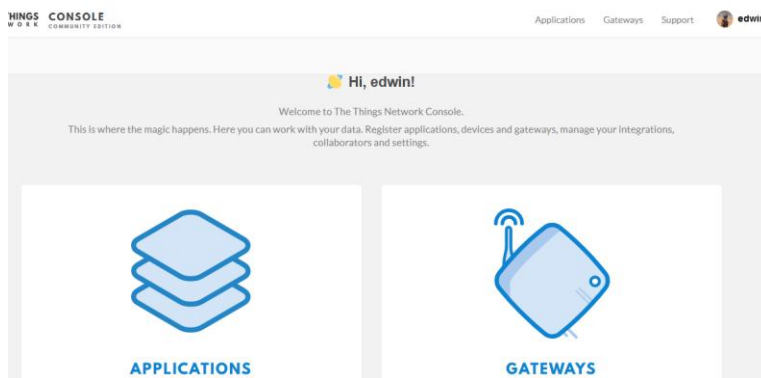
|                |  |
|----------------|--|
| Server Address | <input type="text" value="Domain or IP"/>  |
| Server Port    | <input type="text" value="1700"/>  |
| Gateway ID     | <div style="border: 1px solid orange; padding: 2px;"><input type="text" value="a840411b8268ffff"/></div> |
| Mail Address   | <input type="text" value="Mail address sent to Server"/>   |
| Latitude       | <input type="text" value="Location Info"/>   |
| Longitude      | <input type="text" value="Location Info"/>   |

The gateway id is: **a840411b8268ffff**

## Step 2: Sign up a user account in TTN server



## Step 3: Create a Gateway





After create the gateway, we can see the gateway info, as below

**GATEWAY OVERVIEW**
[settings](#)

**Gateway ID** eui-a840411b8268ffff

**Description** Gateway-1

**Owner** edwin [Transfer ownership](#)

**Status** not connected

**Frequency Plan** Europe 868MHz

**Router** ttn-router-eu

**Gateway Key** base64

## 4.2 Configure LG308 to connect to TTN

We should configure the LG308 now to let it connect to TTN network. Make sure your LG308 has Internet Connection first.

### Step1: Configure LG308 to act as raw forwarder

dragino-1b8288
Status ▾
System ▾
Network ▾
Service ▾
Logout

### IoT Service

**IoT Service** Lorawan/RAW forwarder ▾

**Debug Level** No debug ▾

Save & Apply
Save
Reset

DRAGINO TECHNOLOGY CO., LIMITED

### Step2: Input server info and gateway id

Choose the correct the server address and gateway ID.

dragino-1b8288
Status ▾
System ▾
Network ▾
Service ▾
Logout

### LoRa Gateway Settings

Configuration to communicate with LoRa devices and LoRaWAN server

#### LoRaWAN Server Settings

Service Provider
The Things Network ▾

Server Address
ttn-router-eu ▾

Server Port
1700

**Gateway ID** a840411b8268ffff

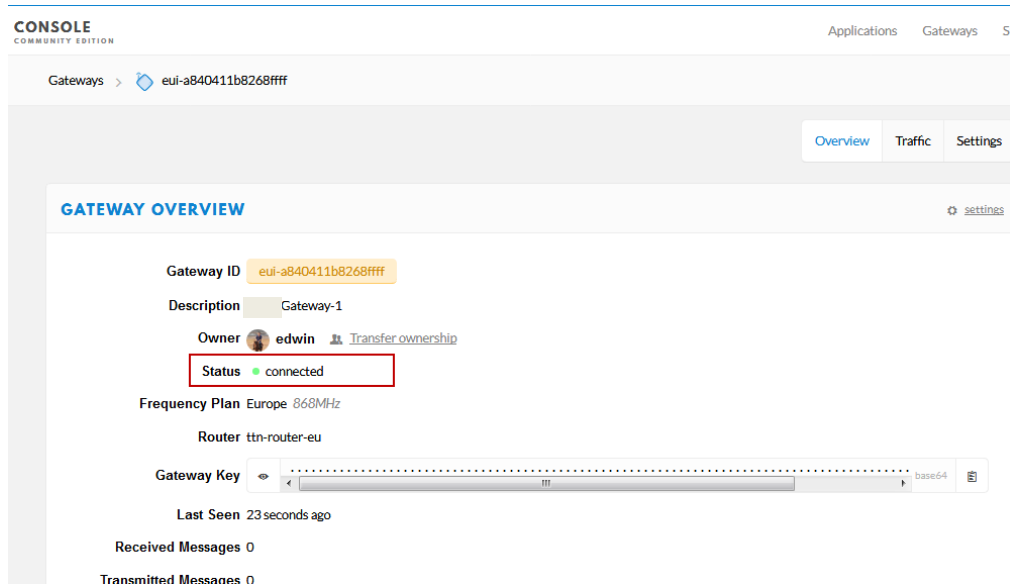
**Mail Address** edwin@dragino.com

**Latitude** 22.73

**Longitude** 114.23

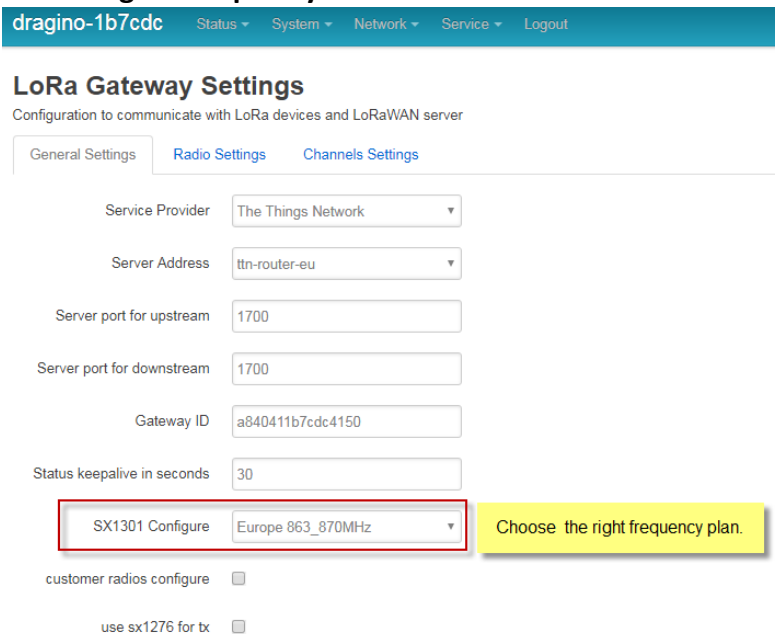
## Check Result

After above settings, the LG308 should be able to connect to TTN, below is the result seen from TTN:



The screenshot shows the TTN Console Gateway Overview page. The gateway ID is eui-a840411b8268ffff. The description is Gateway-1. The owner is edwin. The status is connected (highlighted with a red box). The frequency plan is Europe 868MHz. The router is ttn-router-eu. The gateway key is shown in a base64 encoded format. The last seen time is 23 seconds ago. The received and transmitted messages are both 0.

## 4.3 Configure frequency



The screenshot shows the LoRa Gateway Settings page in the dragino-1b7cdc interface. The settings are as follows:

- Service Provider: The Things Network
- Server Address: ttn-router-eu
- Server port for upstream: 1700
- Server port for downstream: 1700
- Gateway ID: a840411b7cdc4150
- Status keepalive in seconds: 30
- SX1301 Configure: Europe 863\_870MHz (highlighted with a red box)
- customer radios configure: ☐
- use sx1276 for tx: ☐

A yellow box highlights the SX1301 Configure dropdown with the text "Choose the right frequency plan."

After doing above LG308 will be able to act as LoRaWAN. Below section shows how to add a LoRaWAN End device in this LoRaWAN network and see the data from TTN.

We use LT-33222-L as a reference below, for other LoRaWAN devices will be more or less the same.

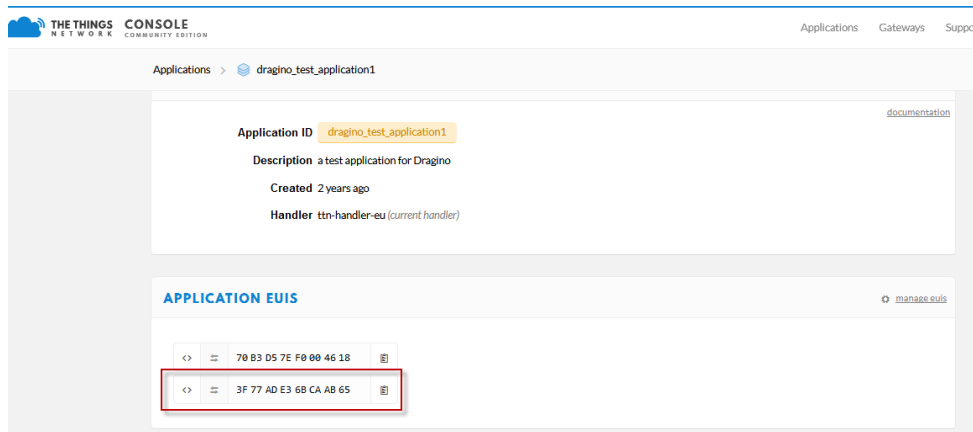
## 4.4 Add a LoRaWAN End Device



**Step 1:** Create a device in TTN with the OTAA keys from LT IO controller.  
Each LT is shipped with a sticker with the default device EUI as below:



User can enter this key in their LoRaWAN Server portal. Below is TTN screen shot:  
Add APP EUI in the application.



## Add APP KEY and DEV EUI

THE THINGS NETWORK CONSOLE COMMUNITY EDITION

Applications Gateways Support

Applications > dragino\_test\_application1 > Devices

**REGISTER DEVICE** [bulk import devices](#)

**Device ID**  
This is the unique identifier for the device in this app. The device ID will be immutable.  
It-33222-I-5480

**Device EUI**  
The device EUI is the unique identifier for this device on the network. You can change the EUI later.  
A8 40 41 00 01 81 85 48

**App Key**  
The App Key will be used to secure the communication between you device and the network.  
57 4E 37 E6 8A EC FC CD B3 89 3D 87 A9 38 4B 2C

**App EUI**  
3F 77 AD E3 68 CA AB 65

**Step 2:** Power on LT and it will auto join to the TTN network. After join success, it will start to upload message to TTN and user can see in the panel and analyze the data

ONSOLE COMMUNITY EDITION

Applications Gateways Settings

Applications > dragino\_test\_application1 > Devices > It-33222-I-5362 > Data

Overview **Data** Settings

**APPLICATION DATA** [pause](#) [clear](#)

Filters: [uplink](#) [downlink](#) [activation](#) [ack](#) [error](#)

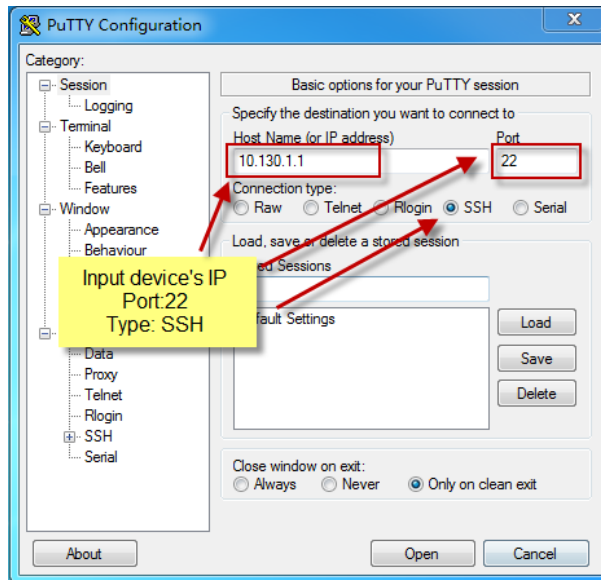
| time     | counter | port | retry | payload   |
|----------|---------|------|-------|---|
| 16:54:53 | 0       | 2    | retry | 00 02 01 36 04 C1 04 C2 38  |
| 16:54:47 |         |      |       | dev addr: 26 01 2C 6B app eui: FCDEC9B2D32FA6 61 dev eui: A8 40 41 00 |
| 16:54:40 |         |      |       | dev addr: 26 01 2C 85 app eui: FCDEC9B2D32FA6 61 dev eui: A8 40 41 00 |
| 16:54:33 |         |      |       | dev addr: 26 01 2E EC app eui: FCDEC9B2D32FA6 61 dev eui: A8 40 41 00 |

## 5. Linux System

The LG308 bases on OpenWrt Linux System. It is open source, and user are free to configure and modify the inside Linux settings.

### 5.1 SSH Access for Linux console

User can access to the Linux console via SSH protocol. Make sure your PC and the LG01 is in the same network, then use a SSH tool (such as [putty](#)) to access it. Below are screenshots:



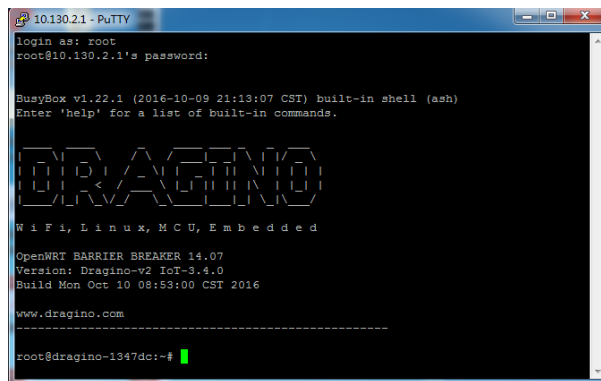
IP address: IP address of LG308

Port: 22

User Name: **root**

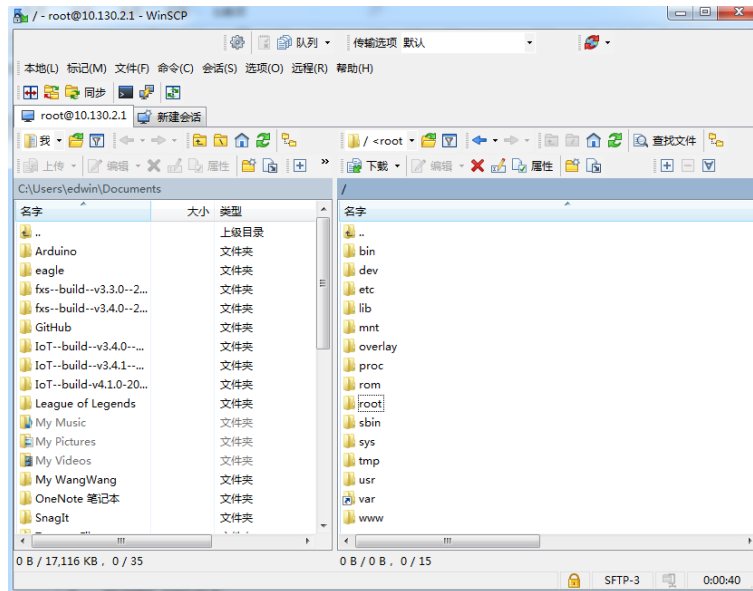
Password: **dragino** (default)

After log in, you will be in the Linux console and type command here.



## 5.2 Edit and Transfer files

The LG308 support **SCP protocol** and has a built **SFTP server**. There are many ways to edit and transfer files using these two protocols. One of the easiest is through [WinSCP](#) utility. After access via WinSCP to the device, use can use a FTP alike window to drag / drop files to the LG308 or Edit the files directly in the windows. Screenshot is as below:



## 5.3 File System

The LG308 has a 16MB flash and a 64MB RAM. The /var and /tmp directory are in the RAM, contents stored in /tmp and /var will be erased after reboot the device. Other directories are in the flash and will keep after reboot.

The Linux system use around 8MB ~10MB flash size which means there is not much room for user to store data in the LG308 flash. User can use an external USB flash to extend the size for storage.

## 5.4 Package maintain system

LG308 uses [OPKG package maintain system](#). There are more than 3000+ packages available in our package server for user to install for their applications. For example, if user wants to add iperf tool, they can install the related packages and configure LG308 to use iperf

Below is some examples opkg command, more please refer [OPKG package maintain system](#)

In Linux Console run:

```
root@dragino-169d30:~# opkg update // to get the latest packages list
```

```
root@dragino-169d30:~# opkg list //shows the available packages
```

```
root@dragino-169d30:~# opkg install iperf // install iperf, it will auto install the required packages.
```

```
root@dragino-169d30:/etc/opkg# opkg install iperf
```

```
Installing iperf (2.0.12-1) to root...
```

```
Downloading http://downloads.openwrt.org/snapshots/packages/mips_24kc/base/iperf_2.0.12-1_mips_24kc.ipk
```

```
Installing uclibcxx (0.2.4-3) to root...
```

```
Downloading
```

```
http://downloads.openwrt.org/snapshots/packages/mips_24kc/base/uclibcxx_0.2.4-3_mips_24kc.ipk
```

```
Configuring uclibcxx.
```

```
Configuring iperf.
```

## 6. Upgrade Linux Firmware

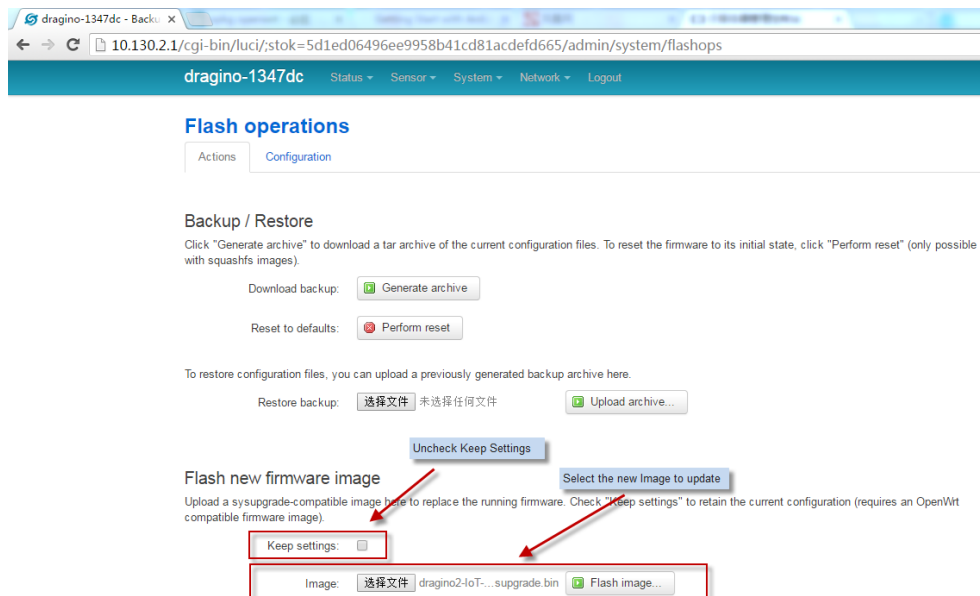
We keep improving the LG308 Linux side firmware for new features, bug fixes. The latest firmware can be found on [LoRa Gateway Firmware](#), and the Change Log can be found here: [Firmware Change Log](#).

The file named as **xxxxx--xxxxx-squashfs-sysupgrade.bin** is the upgrade Image. There are different methods to upgrade, as below:

### 6.1 Upgrade via Web UI

Go to the page: **Web --> System --> Back Up and flash firmware**, Select the image and click Flash Image, the image will be uploaded to the device and then click Process Update to upgrade.

System will auto boot to the new firmware after upgrade.



### 6.2 Upgrade via Linux console

SCP the firmware to the system **/var** directory and then run

```
root@OpenWrt:~# /sbin/sysupgrade -n /var/Your_Image
```

**note:** it is important to transfer the image in the /var directory, otherwise it may exceed the flash size.



## 7. FAQ

### 7.1 How can I configure for customized frequency band?

User can customized their LoRaWAN channel since firmware after 2018-Dec-28.

For example: if user want to set the gateway to meet the India LoRoIT frequency band:

LoRoIT Frequency plan for India

| Channel                | Frequency   | Modulation / BW |                  |
|------------------------|-------------|-----------------|------------------|
| 0                      | 865.400 MHz | MultiSF         | 125 kHz          |
| 1                      | 865.600 MHz | MultiSF         | 125 kHz          |
| 2                      | 865.800 MHz | MultiSF         | 125 kHz          |
| 3                      | 866.000 MHz | MultiSF         | 125 kHz          |
| 4                      | 866.200 MHz | MultiSF         | 125 kHz          |
| 5                      | 866.400 MHz | MultiSF         | 125 kHz          |
| 6                      | 866.600 MHz | MultiSF         | 125 kHz          |
| 7                      | 866.800 MHz | MultiSF         | 125 kHz          |
| LoRa                   | 865.700 MHz | SF7             | 250 kHz          |
| FSK                    | 865.700 MHz | FSK             | 250 kHz, 64 kbps |
| RX2 channel (downlink) |             |                 |                  |
| RX2                    | 865.200 MHz | SF12            | 125 kHz          |

### Step 1: Choose Frequency Band to use “Customized Bands”

#### LoRa Gateway Settings

Configuration to communicate with LoRa devices and LoRaWAN server

General Settings
Radio Settings
Channels Settings

IoT Service: LoRaWAN/RAW forwarder

Debug Level: Little message output

Service Provider: The Things Network

Server Address: ttn-router-eu

Server port for upstream: 1700

Server port for downstream: 1700

Gateway ID: a840411b7e104150

Status keepalive in seconds: 30

Frequency Plan: Customized Bands

## Step 2: Configure Radio 0 & 1 Frequency

The LG308 has two Radios from SX1308, we can configure these eight channels base on these two radios. Go to page Radio Settings and enable Radio 0 to 865700000 / enable Radio 1 to 866500000.

[General Settings](#)
[Radio Settings](#)
[Channels Settings](#)

radio 0 enable ☒

Radio\_0 frequency

Radio\_0 for tx ☒

Radio\_0 tx min frequency

Radio\_0 tx max frequency

radio 1 enable ☒

Radio\_1 frequency

Radio\_1 for tx ☐

## Step 3: Configure Channel Frequency.

What we need to configure for LoRait is 0~7 multiSF channel frequency and LoRa frequency as per LoRiot frequency plan.

Each Channel Configure include below parameters:

- ✓ Radio used for this channel.
- ✓ Channel IF, frequency shift base on Radio Frequency.

Below is the settings for the LoRiot frequency plan:

[General Settings](#)
[Radio Settings](#)
[Channels Settings](#)

multiSF channel 0 enable ☒

Channel 0 frequency=radio0 – 300000Hz  
= 865700000-300000 = 865.4Mhz

multiSF channel 0 radio

multiSF channel 0 IF

multiSF channel 1 enable ☒

Channel 1 frequency= 865.6Mhz

multiSF channel 1 radio

multiSF channel 1 IF

multiSF channel 2 enable ☒

Channel 2 frequency= 865.8Mhz

multiSF channel 2 radio

multiSF channel 2 IF

|                          |                                      |  |
|--------------------------|--------------------------------------|--|
| multiSF channel 3 enable | <input checked="" type="checkbox"/>  | Channel 3 frequency= 866.0Mhz                      |
| multiSF channel 3 radio  | <input type="text" value="radio0"/>  |  |
| multiSF channel 3 IF     | <input type="text" value="300000"/>  |  |
| multiSF channel 4 enable | <input checked="" type="checkbox"/>  | Channel 4 frequency= 866.2Mhz                      |
| multiSF channel 4 radio  | <input type="text" value="radio1"/>  |  |
| multiSF channel 4 IF     | <input type="text" value="-300000"/> |  |
| multiSF channel 5 enable | <input checked="" type="checkbox"/>  | Channel 5 frequency= 866.4Mhz                      |
| multiSF channel 5 radio  | <input type="text" value="radio1"/>  |  |
| multiSF channel 5 IF     | <input type="text" value="-100000"/> |  |
| multiSF channel 6 enable | <input checked="" type="checkbox"/>  | Channel 6 frequency= 866.6Mhz                      |
| multiSF channel 6 radio  | <input type="text" value="radio1"/>  |  |
| multiSF channel 6 IF     | <input type="text" value="100000"/>  |  |
| multiSF channel 7 enable | <input checked="" type="checkbox"/>  | Channel 7 frequency= 866.8Mhz                      |
| multiSF channel 7 radio  | <input type="text" value="radio1"/>  |  |
| multiSF channel 7 IF     | <input type="text" value="300000"/>  |  |
| lorastd channel enable   | <input checked="" type="checkbox"/>  | Channel LoRaSTD frequency= 865.7Mhz, SF7, BW250Khz |
| LoRa channel radio       | <input type="text" value="radio0"/>  |  |
| LoRa channel IF          | <input type="text" value="0"/>       |  |
| LoRa channel SF          | <input type="text" value="7"/>       |  |
| LoRa channel BW          | <input type="text" value="250k"/>    |  |

**Step 4: Save & Apply & check result in logread page.**

#### Logread

| FreqINFO   | Report | RxTxJson | ErrorMSG |
|--|--------|----------|----------|
| <pre> SX1301 Channels frequency ----- chan_multiSF_0 LORA MAC, 125kHz, all SF, 865400000 Hz ----- chan_multiSF_1 LORA MAC, 125kHz, all SF, 865600000 Hz ----- chan_multiSF_2 LORA MAC, 125kHz, all SF, 865800000 Hz ----- chan_multiSF_3 LORA MAC, 125kHz, all SF, 866000000 Hz ----- chan_multiSF_4 LORA MAC, 125kHz, all SF, 866200000 Hz ----- chan_multiSF_5 LORA MAC, 125kHz, all SF, 866400000 Hz ----- </pre> |        |          |          |



## **7.2 Can I make my own firmware for LG308? Where can I find the source code of LG308?**

Yes, User can make own firmware for LG308 for branding purpose or add customized application. The LG308 source code and compile instruction can be found at:

[https://github.com/dragino/openwrt\\_lede-18.06](https://github.com/dragino/openwrt_lede-18.06)

## **7.3 Can I use the 868Mhz version for 915Mhz bands?**

It is possible, you can select US915 frequency band in 868Mhz version hardware, it will work but you will see performance is highly decrease because the 868Mhz version has RF filter for band 863~870Mhz, all other frequency will have high attenuation.

## **7.4 More FAQs about general LoRa questions**

We keep updating more FAQs in our Wiki about some general questions. The link is here:

[http://wiki.dragino.com/index.php?title=LoRa\\_Questions](http://wiki.dragino.com/index.php?title=LoRa_Questions)

## 8. Trouble Shooting

### 8.1 I get kernel error when install new package, how to fix?

In some case, when install package, it will generate kernel error such as below:

```
root@dragino-16c538:~# opkg install kmod-dragino2-si3217x_3.10.49+0.2-1_ar71xx.ipk
Installing kmod-dragino2-si3217x (3.10.49+0.2-1) to root...
Collected errors:
* satisfy_dependencies_for: Cannot satisfy the following dependencies for
kmod-dragino2-si3217x:
*   kernel (= 3.10.49-1-4917516478a753314254643facdf360a) *
* opkg_install_cmd: Cannot install package kmod-dragino2-si3217x.
```

In this case, user can use the `--force-depends` option to install such package.

```
opkg install kmod-dragino2-si3217x_3.10.49+0.2-1_ar71xx.ipk --force-depends
```

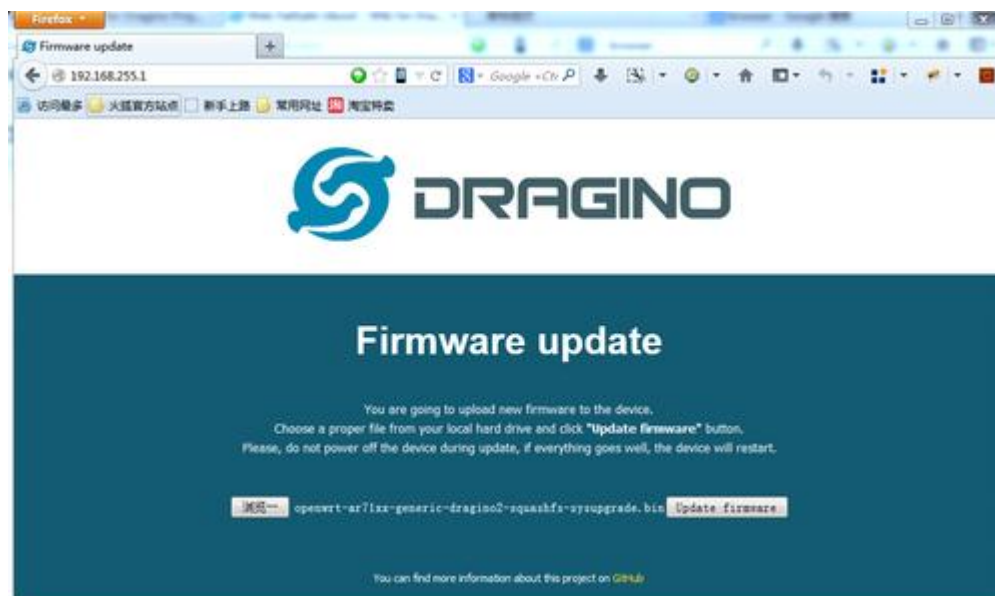
## 8.2 How to recover the LG308 if firmware crash

LG308 provide user a full control on its Linux system, it is possible that the device will brick and can't boot after improper modification in some booting files.

In this case, user can recover the whole Linux system by uploading a new firmware via Web Failsafe mode.

Procedure is as below:

- Use a RJ45 cable to connect the PC to LG308's port directly.
- Set the PC to ip 192.168.255.x, netmask 255.255.255.0
- Pressing the toggle button and power on the device
- All LEDs of the device will blink, release the toggle button after four blinks
- All LEDs will then blink very fast once, this means device detect a network connection and enter into the web-failsafe mode. Your PC should be able to ping 192.168.255.1 after device enter this mode.
- Open 192.168.255.1 in web browser
- Select a squashfs-sysupgrade type firmware and update firmware.



Note: If user sees all LEDs blink very fast in Step 5. This means the network connection is established. If in this case, PC still not able to see the web page, user can check:

- ✓ Try different browser.
- ✓ Check if your PC is in 192.168.255.x
- ✓ Check if you have connected two RJ45 cable to device, If so, remove the unused one

### 8.3 I configured LG308 for WiFi access and lost its IP. What to do now?

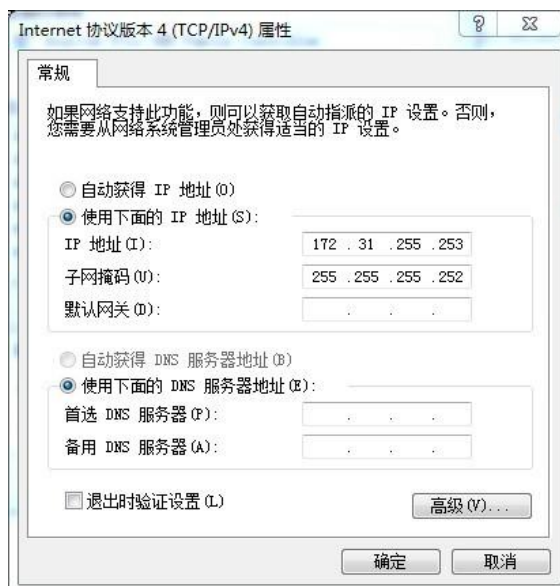
The LG01 has a fall-back ip in its LAN port. This IP is always enabled so user can use fall back ip to access LG01 no matter what the WiFi IP is. The fall back ip is useful for connect and debug the unit.

(Note: fallback ip can be disabled in the LAN and DHCP page)

Steps to connect via fall back IP:

1. Connect PC's Ethernet port to LG01's LAN port
2. Configure PC's Ethernet port has IP: 172.31.255.253 and netmask: 255.255.255.252

As below photo:



3. In PC, use 172.31.255.254 to access LG01 via Web or Console.



## 9. Order Info

### **PART: LG308-XXX-YYY:**

#### **XXX: Frequency Band**

- **868**: valid frequency: 863Mhz ~ 870Mhz. for band EU868 or IN865.
- **915**: valid frequency: 902Mhz ~ 928Mhz. for bands US915, AU915, AS923 or KR920

#### **YYY: 4G Cellular Option**

- **EC25-E**: EMEA, Korea, Thailand, India.
- **EC25-A**: North America/ Rogers/AT&T/T-Mobile.
- **EC25-AU**: Latin America, New Zeland, Taiwan
- **EC25-J**: Japan, DOCOMO/SoftBank/ KDDI

More info about valid bands, please see [EC25-E product page](#).

## 10. Packing Info

### **Package Includes:**

- ✓ LG308 or LG08 LoRa Gateway x 1
- ✓ Stick Antenna for LoRa RF part. Frequency is one of 433 or 868 or 915Mhz depends the model ordered
- ✓ Power Adapter: EU/AU/US type power adapter depends on country to be used
- ✓ Packaging with environmental protection paper box

### **Dimension and weight:**

- ✓ Device Size: 12 x 8.5 x 3 cm
- ✓ Device Weight: 150g
- ✓ Package Size / pcs : 21.5 x 10 x 5 cm
- ✓ Weight / pcs : 360g
- ✓ Carton dimension: 45 x 31 x 34 cm. 36pcs per carton
- ✓ Weight / carton : 12.5 kg

## 11. Support

- Try to see if your questions already answered in the [wiki](#).
- Support is provided Monday to Friday, from 09:00 to 18:00 GMT+8. Due to different timezones we cannot offer live support. However, your questions will be answered as soon as possible in the before-mentioned schedule.
- Provide as much information as possible regarding your enquiry (product models, accurately describe your problem and steps to replicate it etc) and send a mail to

[support@dragino.com](mailto:support@dragino.com)



## 12. Reference

- ✧ Source code for LG08 LoRa Gateway  
[https://github.com/dragino/openwrt\\_lede-18.06](https://github.com/dragino/openwrt_lede-18.06)
- ✧ OpenWrt official Wiki  
<http://www.openwrt.org/>
- ✧ Firmware  
[http://www.dragino.com/downloads/index.php?dir=LoRa\\_Gateway/LG308-OLG308/Firmware/](http://www.dragino.com/downloads/index.php?dir=LoRa_Gateway/LG308-OLG308/Firmware/)
- ✧ Hardware Source code:  
<https://github.com/dragino/motherboard-hardware/tree/master/LG308>