



LG308-AS923-TH-EC25 LoRaWAN Gateway User Manual

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Version	Description	Date
1.0	Release	2018-Nov-17
1.1	Add notice for recover mode. Add hardware source code Add FAQ for customized frequency.	2019-Jan-10
1.1.1	Add how to control LED. Add	
1.1.2	Remove SX1276 description and GPS.	
1.1.3	Change the HTTP Port and SSH port for firmware version > v5.3	2019-Nov-26

1. Introduction.....	4
1.1 What is LG308-AS923-TH-EC25	4
1.2 Specifications.....	4
1.3 Features.....	6
1.4 Hardware System Structure.....	6
1.5 LG308-AS923-TH-EC25 Applications	7
2. Access LG308-AS923-TH-EC25.....	8
2.1 Access and configure LG308-AS923-TH-EC25	8
3. Typical Network Setup	9
3.1 Overview	9
3.2 Use WAN port to access Internet.....	9
3.3 Access Internet as a WiFi Client.....	10
3.4 Use built-in 4G modem for internet access	12
3.5 Check Internet connection.....	14
4. Example : Configure as a LoRaWAN gateway.....	15
4.1 Create a gateway in TTN Server.....	15
4.2 Configure LG308-AS923-TH-EC25 to connect to TTN	17
4.3 Configure frequency.....	18
4.4 Add a LoRaWAN End Device	19



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1. Introduction

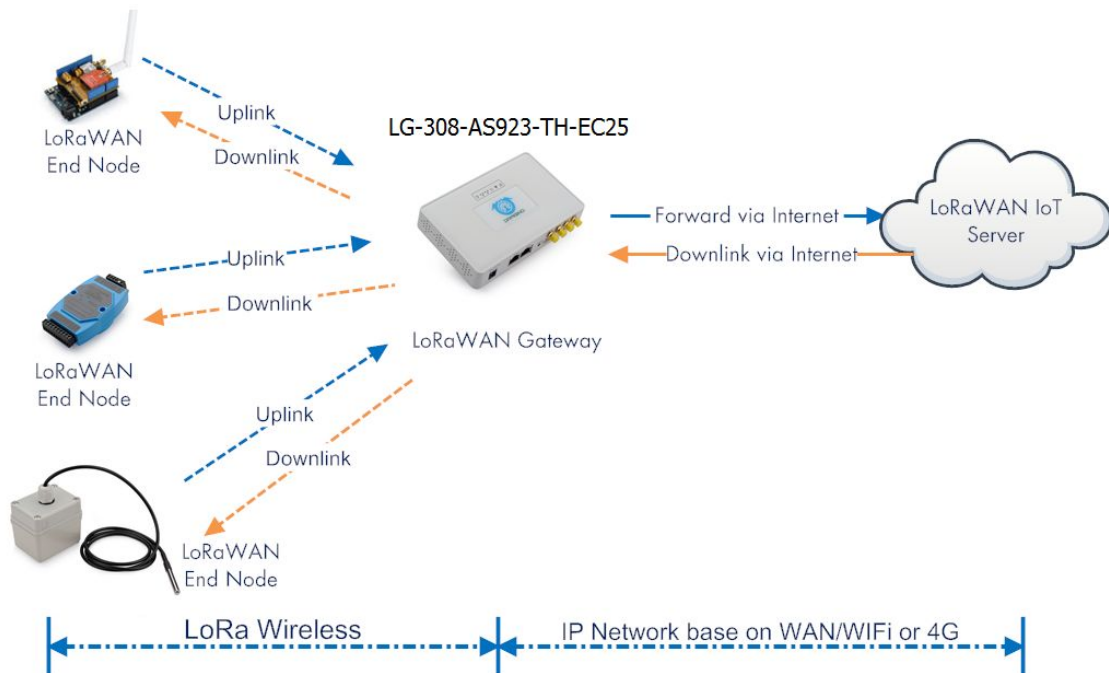
1.1 What is LG308-AS923-TH-EC25

The LG308-AS923-TH-EC25 is a **LoRaWAN 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 uses **Semtech packet forwarder** and fully compatible with LoRaWAN protocol. It includes a **SX1301 LoRa concentrator**, which provides 10 programmable parallel demodulation paths.

LG308-AS923-TH-EC25 has pre-configured Thailand standard LoRaWAN frequency bands, AS1 and AS2. The Frequency is from 920-925Mhz.

LG308-AS923-TH-EC25 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
- SX1301 + 2 x SX1257

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):

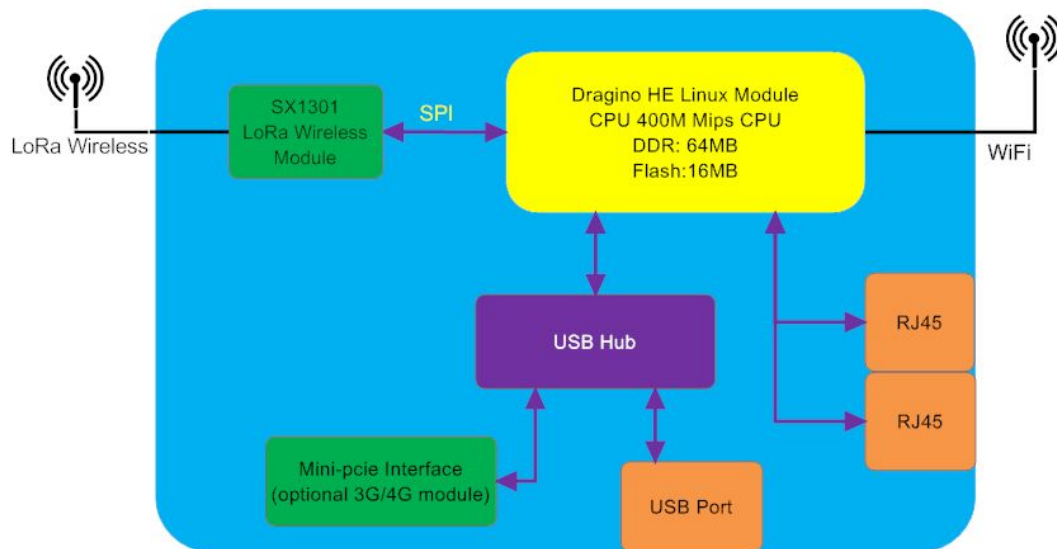
- Quectel [EC25 LTE module](#)
- Micro SIM Slot
- External 4G Sticker Antenna.
- Up to 150Mbps downlink and 50Mbps uplink data rates
- Worldwide LTE, UMTS/HSPA+ and GSM/GPRS/EDGE coverage
- MIMO technology meets demands for data rate and link reliability in modern wireless communication systems

1.3 Features

- ✓ Open Source OpenWrt system
- ✓ Managed by Web GUI via LAN or WiFi
- ✓ Emulates 49x LoRa demodulators
- ✓ LoRaWAN Gateway
- ✓ 10 programmable parallel demodulation paths

1.4 Hardware System Structure

LG308-AS923-TH-EC25 System Overview:



1.5 LG308-AS923-TH-EC25 Applications



2. Access LG308-AS923-TH-EC25

2.1 Access and configure LG308-AS923-TH-EC25

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-AS923-TH-EC25,
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

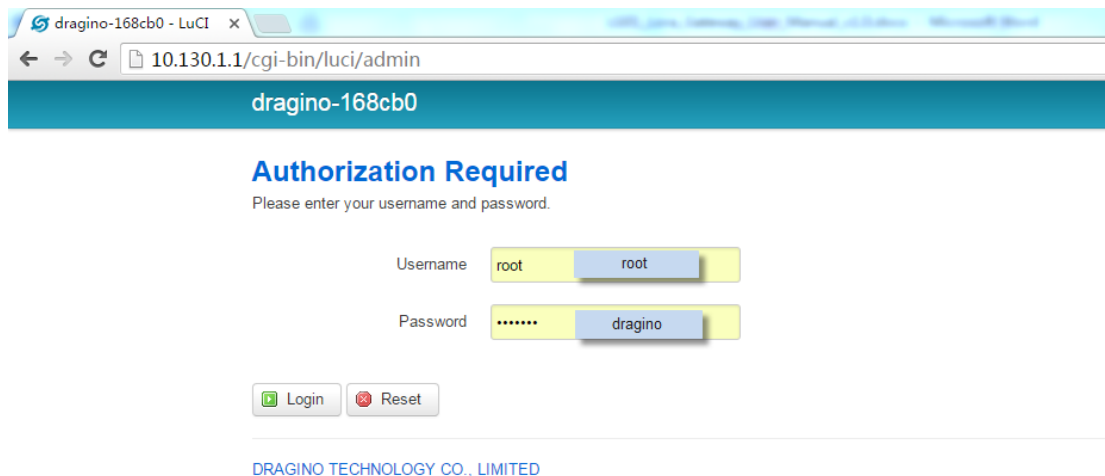
<http://10.130.1.1/>

User will see the login interface of LG308-AS923-TH-EC25

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.

Note: the LG308 can also be accessed via WAN interface (WAN port or WiFi when device acts as WiFi Client). But for security reason, for firmware version >5.3, the http access on WAN interface has been set to 8000.

3. Typical Network Setup

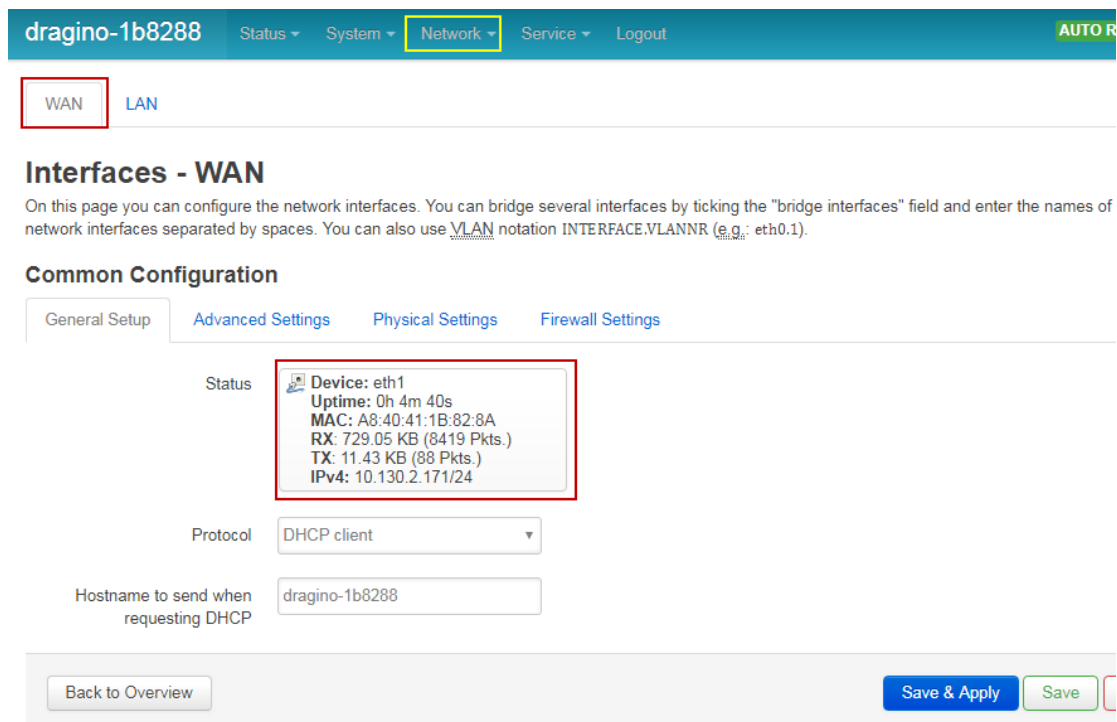
3.1 Overview

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

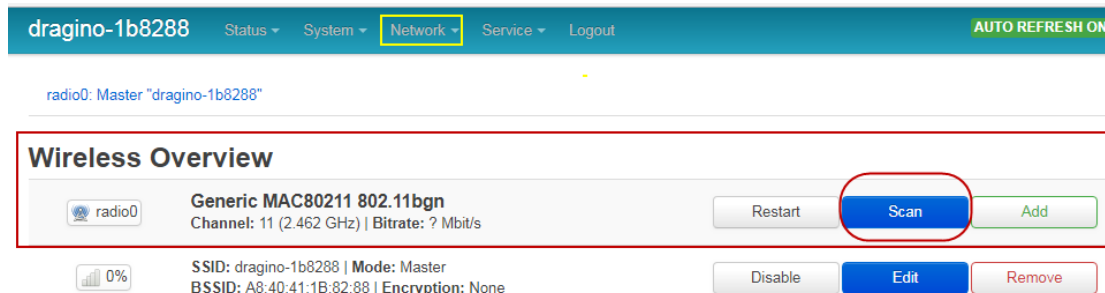
Back to Overview **Save & Apply** **Save**

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

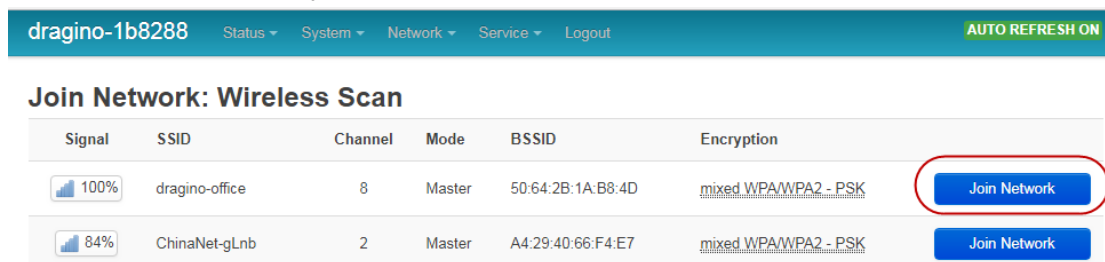
radio0: Master "dragino-1b8288"

Wireless Overview

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

Step2:

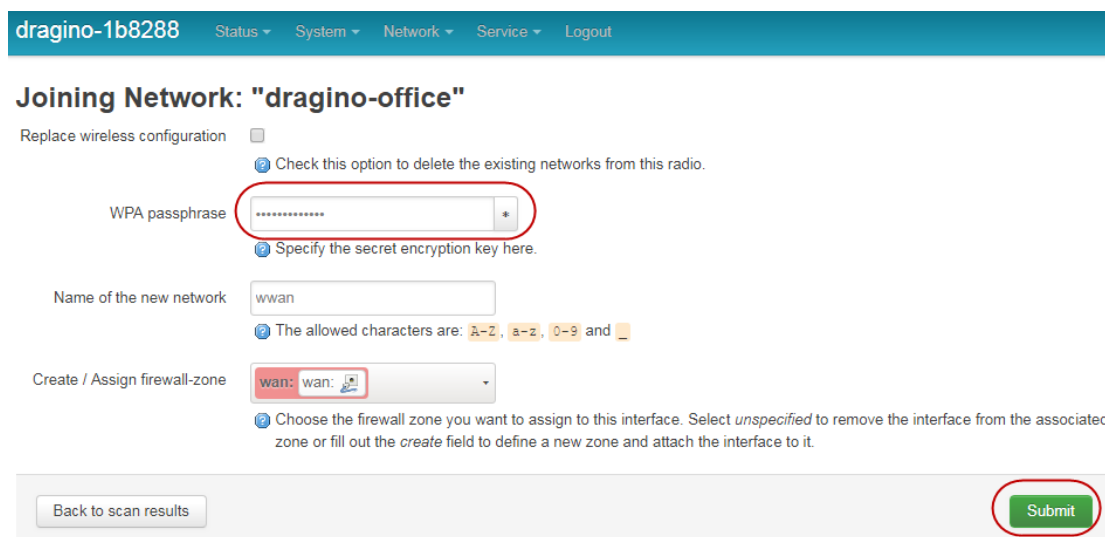
Select the wireless AP and join:



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

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

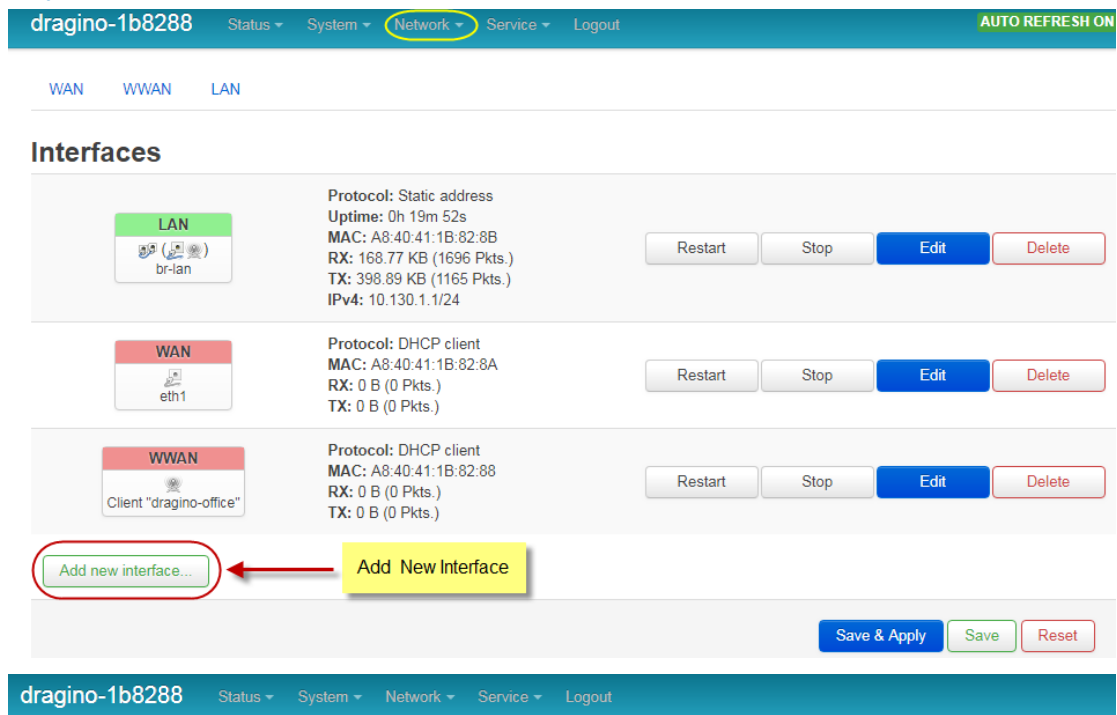
Add new interface...

Save & Apply Save Reset

3.4 Use built-in 4G modem for internet access

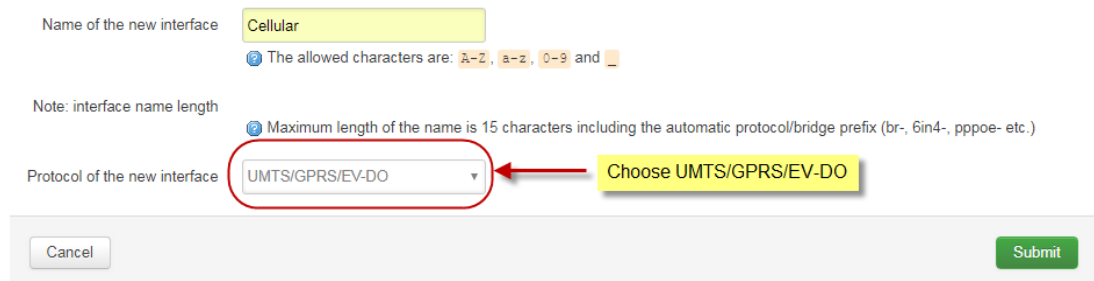
For the LG308 model with 4G version, user can configure the modem for internet access.

Step 1: Add New Interface



The screenshot shows the Dragino web interface for device 'dragino-1b8288'. The 'Network' tab is selected in the top navigation bar. Below the navigation bar, there are tabs for 'WAN', 'WWAN', and 'LAN'. The 'Interfaces' section displays three existing interfaces: LAN (br-lan), WAN (eth1), and WWAN (Client "dragino-office"). Each interface card shows its protocol, uptime, MAC address, and data statistics. At the bottom of the 'Interfaces' section, 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. Below the 'Add new interface...' button are 'Save & Apply', 'Save', and 'Reset' buttons.

Create Interface



The 'Create Interface' form is shown. The 'Name of the new interface' field contains the text 'Cellular'. Below this field, a note states: 'Note: interface name length'. A second note specifies: '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. At the bottom of the form are 'Cancel' and 'Submit' buttons.

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 Use ttyUSB2 to dial up

Service Type UMTS/GPRS

APN 3gnet Different provider has different APN

PIN

PAP/CHAP username

PAP/CHAP password

Dial number *99***1#

Some provider may need additional user info

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

Restart Stop Edit Delete

Get IP from provider means dial up

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

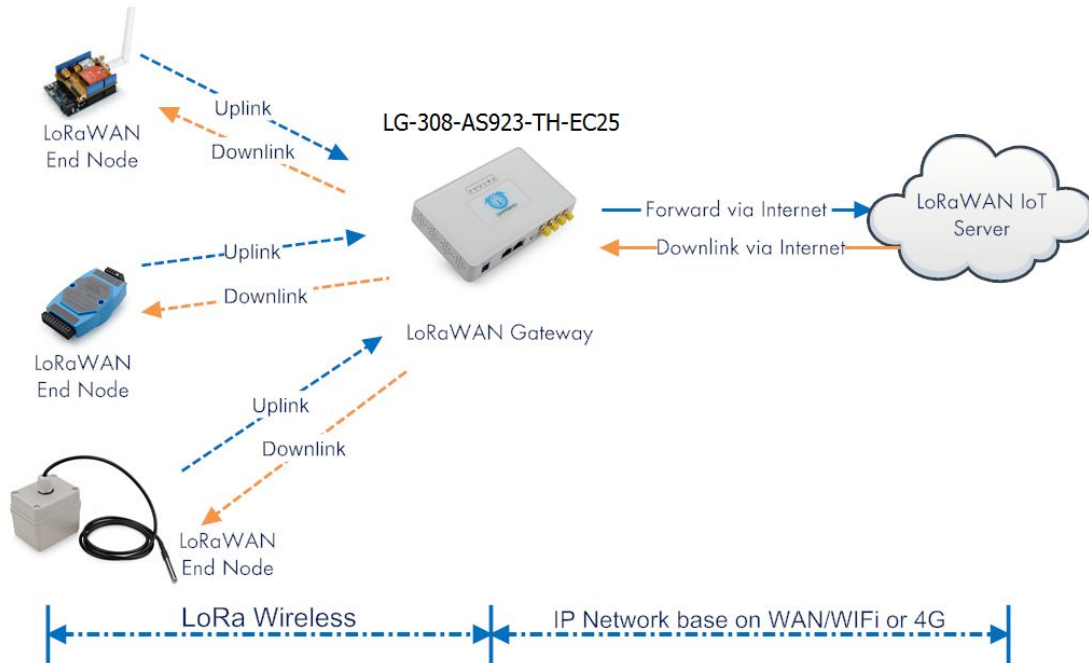
```
PING openwrt.org (139.59.209.225): 56 data bytes
64 bytes from 139.59.209.225: seq=0 ttl=45 time=386.898 ms
64 bytes from 139.59.209.225: seq=1 ttl=45 time=401.656 ms
64 bytes from 139.59.209.225: seq=2 ttl=45 time=387.708 ms
64 bytes from 139.59.209.225: seq=3 ttl=45 time=378.894 ms
64 bytes from 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-AS923-TH-EC25 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

Server Port

Gateway ID

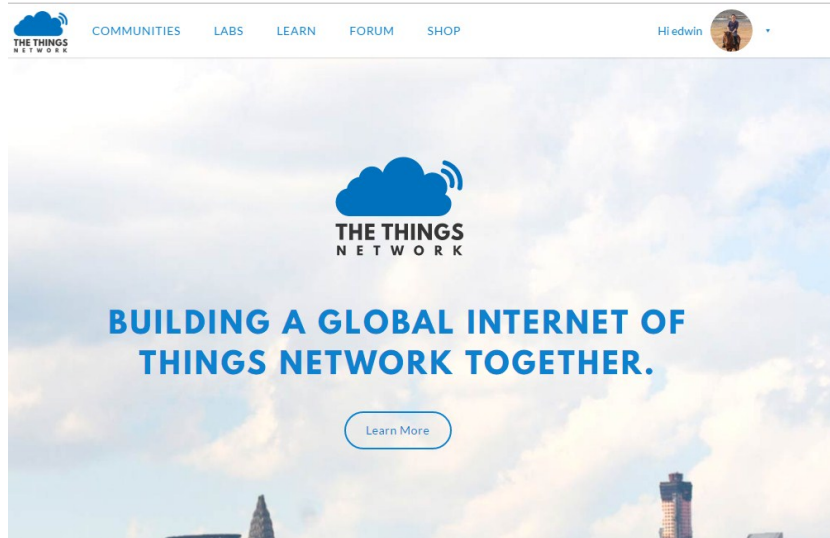
Mail Address

Latitude

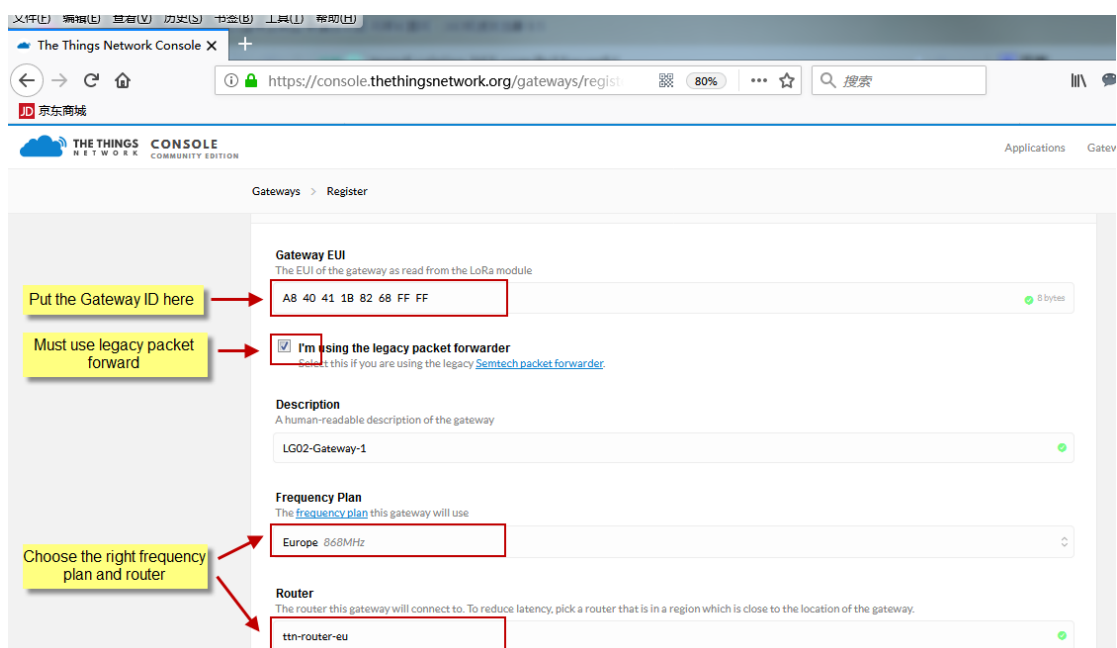
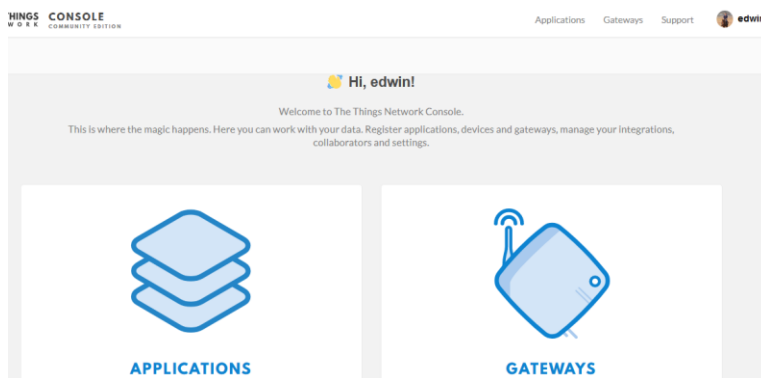
Longitude

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-AS923-TH-EC25 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-AS923-TH-EC25 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](#)

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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

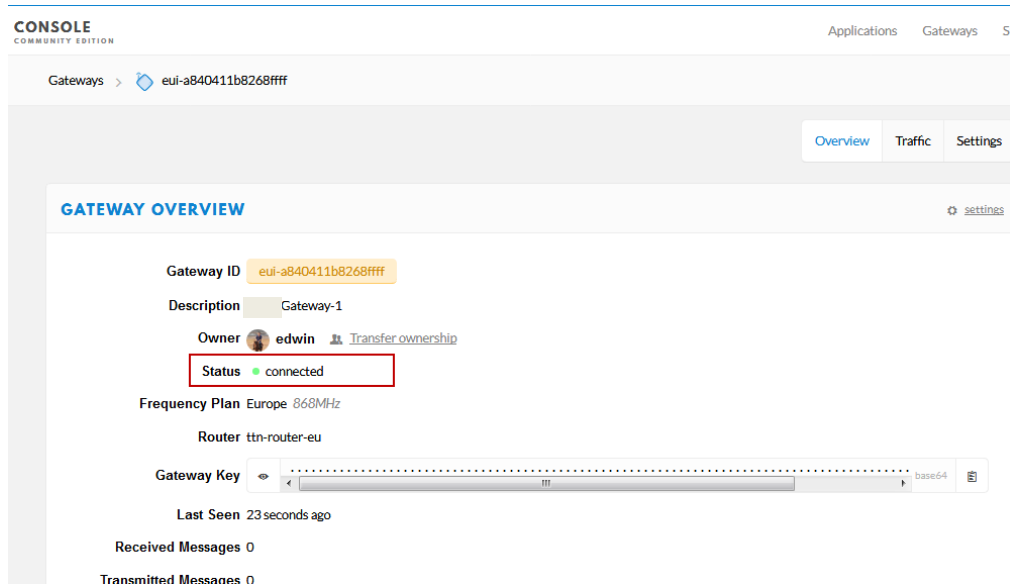
Mail Address edwin@dragino.com

Latitude 22.73

Longitude 114.23

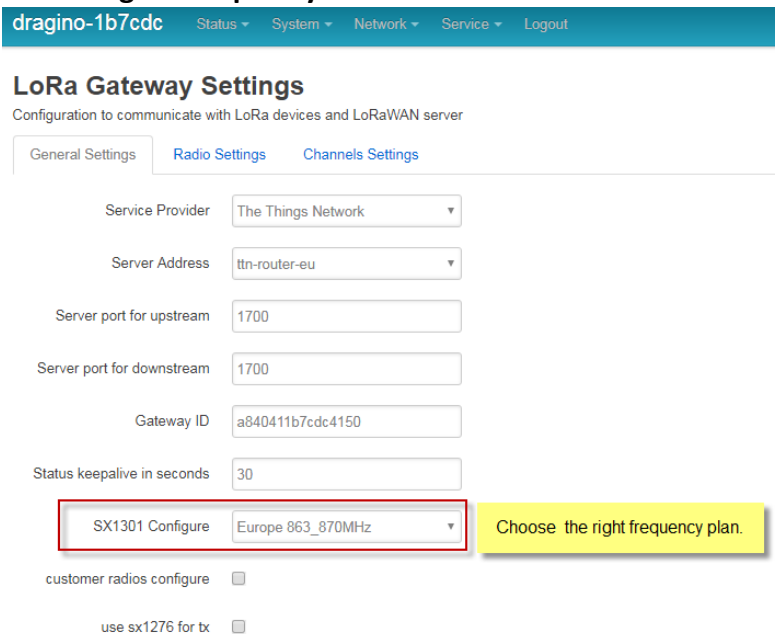
Check Result

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 displayed in a base64 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.

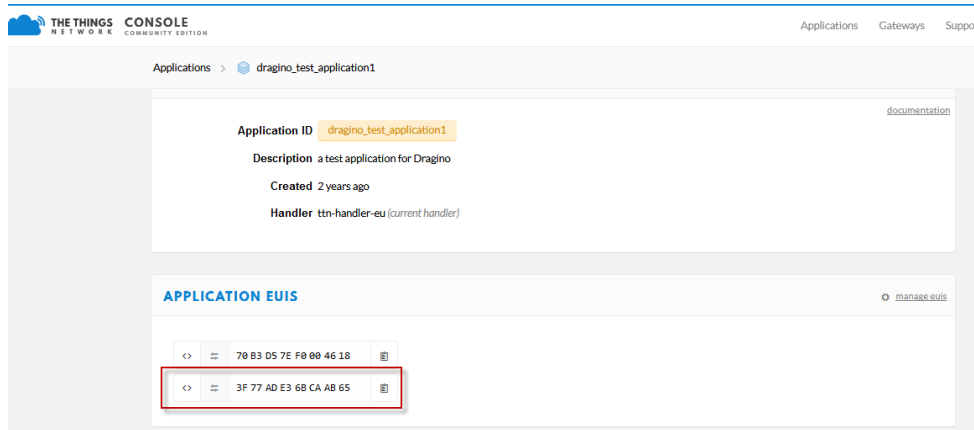
4.4 Add a LoRaWAN End Device



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

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.
AB 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 B9 3D 87 A9 3B 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	dev addr	app eui	dev eui
16:54:53	0	2	retry	00 02 01 36 04 C1 04 C2 38			
16:54:47					26 01 2C 6B	FCDEC9B2D32FA661	A8 40 41 00
16:54:40					26 01 2C 85	FCDEC9B2D32FA661	A8 40 41 00
16:54:33					26 01 2E EC	FCDEC9B2D32FA661	A8 40 41 00