

User Manual



LoRa Base Station

Outdoor Series

ufiSpace

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1. General Description

This Outdoor LoRa Gateway is designed with Semtech version 2.0 technology to provide low power and wide area (LPWA) unlicensed band wireless connection. This gateway supports connectivity for wide range of Internet of Things (IoT) applications.



This outdoor gateway uses LoRaWAN technology from Semtech and is complied with specification defined by LoRa Alliance. This gateway has two LoRa, one GPS & one LTE antenna ports and is powered through 48 VDC PoE. Its LoRa interface operates in 863-870 MHz band and supports end-devices with class A & C, Listen Before Talk, Spreading Factor, Adaptive Data Rate (ADR), GPS Timing and Geo-Localization Service.

2. HW Overview

This section describes HW overview of the Outdoor LoRa V2.1 Gateway.

Connectors and Interfaces

Figure 1. Gateway External Ports

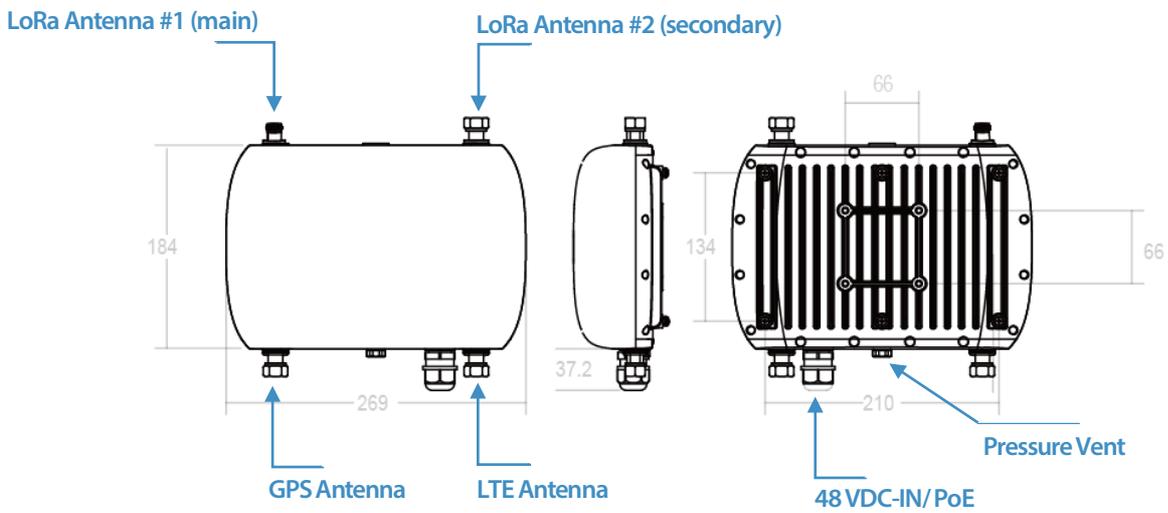


Figure 2. Cabling

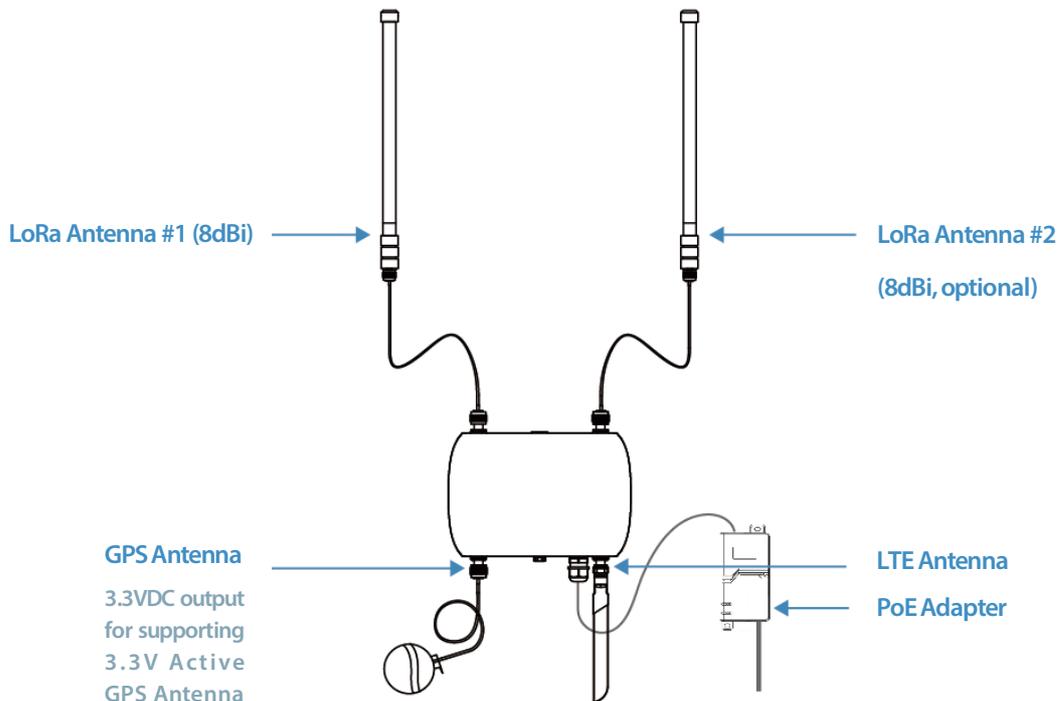


Table 1. Product Specifications

| Specification | Description |
|-------------------------------|---|
| LoRa | |
| LoRa Frequency | <ul style="list-style-type: none"> ▪ 863 – 870 MHz and its subset, complying with region/ country local radio requirements |
| TX Power (ERP) | <ul style="list-style-type: none"> ▪ 27 dBm @ 869.525MHz, 14 dBm @ other channels (with 8 dBi antenna + 1.5 dB cable loss) |
| RX Sensitivity | <ul style="list-style-type: none"> ▪ -138 dBm @ SF12 |
| Sectorization | <ul style="list-style-type: none"> ▪ Omni |
| LoRa Channels | <ul style="list-style-type: none"> ▪ 16 |
| ADR Support | <ul style="list-style-type: none"> ▪ YES |
| Data Rate | <ul style="list-style-type: none"> ▪ 250 bps to 5 kbps |
| End Device Support | <ul style="list-style-type: none"> ▪ Class A & C ▪ Class B pending |
| Applicable Regions | <ul style="list-style-type: none"> ▪ Europe |
| Baseband | |
| Processor | <ul style="list-style-type: none"> ▪ Cortex-A8 |
| Flash/ Memory | <ul style="list-style-type: none"> ▪ 4GB eMMC/ 4Gb DDR3 |
| USB | <ul style="list-style-type: none"> ▪ One internal USB 2.0 port |
| Reset Button | <ul style="list-style-type: none"> ▪ One internal system reset button |
| Antenna Interface | |
| LoRa Antenna Connector | <ul style="list-style-type: none"> ▪ Two extendable N type RF antenna port |
| GPS Antenna Connector | <ul style="list-style-type: none"> ▪ One extendable N type RF antenna port |
| LTE Antenna Connector | <ul style="list-style-type: none"> ▪ One extendable N type RF antenna port |
| WAN Interface | |
| Ethernet | <ul style="list-style-type: none"> ▪ 10/100/1000 Mbps RJ45 port |
| LTE | <ul style="list-style-type: none"> ▪ With built-in LTE NGFF M.2 card |
| WiFi | <ul style="list-style-type: none"> ▪ IEEE 802.11 b/g/n 2.4 GHz |
| GPS | |
| GPS | <ul style="list-style-type: none"> ▪ With built-in 1575.42 MHz, GLONASS, BeiDou module ▪ With 3.3 VDC output for active GPS antenna |
| Power | |

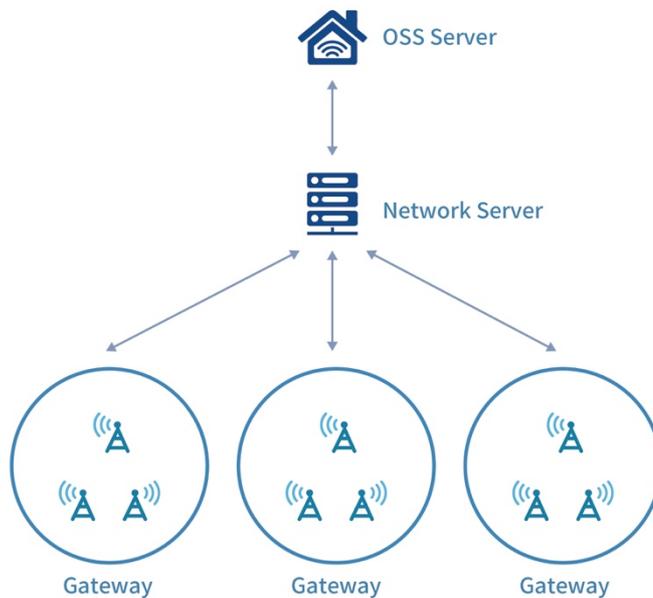
| | |
|--------------------------------|----------------------------------|
| Power Input | ▪ PoE (47-57VDC) |
| Power Consumption | ▪ Maximum 40 watts |
| Antenna | |
| LoRA | ▪ 0/ 8 dBi antenna |
| LTE | ▪ < 1.6 dBi antenna |
| GPS | ▪ 3.3VDC active antenna |
| Lighting Protection | ▪ DC ground |
| Physical Specifications | |
| Mounting | ▪ Wall and pole mount |
| Housing Material | ▪ Aluminum, plastic |
| IP Rating | ▪ IP67 |
| Operation Humidity | ▪ 20% ~ 90% |
| Operation Temperature | ▪ -20 ~ 70 °C |
| Net Weight | ▪ 2.4 kg |
| Dimension | ▪ 269 × 184 × 85 mm |
| Reliability | |
| MTBF | ▪ 5 years at 25 °C prediction |
| Operating System | |
| Firmware | ▪ Base on Linux with kernel 3.14 |

3. SW Overview

LoRa Network Solution

This outdoor LoRa gateway receives data from end-devices, then relay it to a backend server and routed to an application server for information processing.

Figure 3. LoRa Network



3.1 Network Access

The backhaul network configuration on Outdoor LoRa Gateway supports several connection types which can be selected as primary and secondary WAN. It will try to bring up primary WAN interface when device powered up. If primary WAN is not available, the device will try to bring up the secondary WAN interface. Device still continue to try to monitor the availability of the primary WAN interface. Once primary interface is ready, device will switch to primary WAN immediately and shutdown secondary WAN interface.

3.1.1 Use Default Configuration

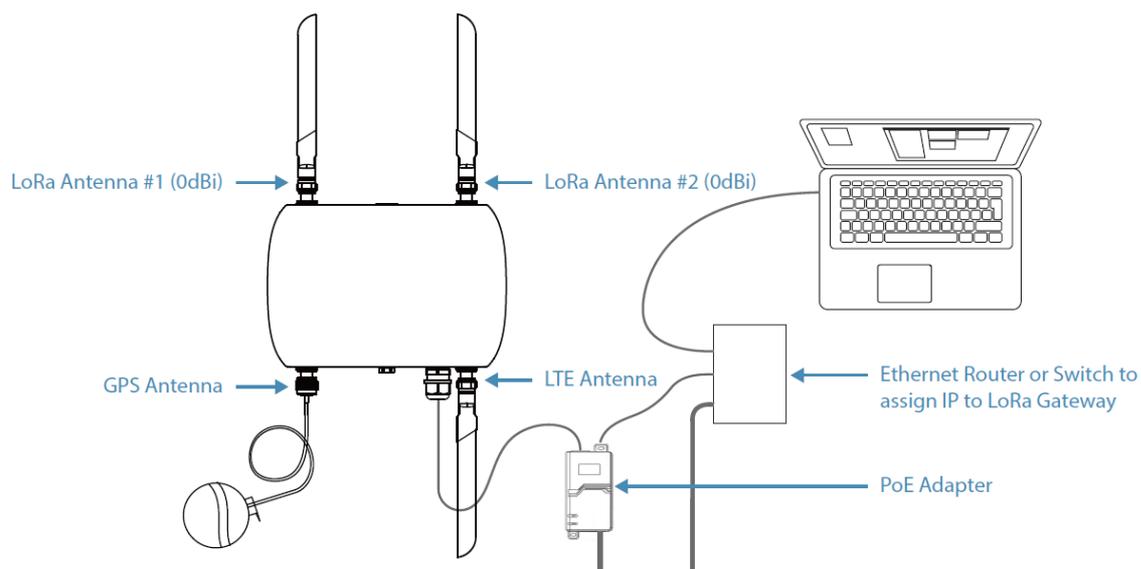
The primary WAN is configured as Ethernet with DHCP client through the PoE connectivity. On the device with LTE support, LTE is configured as secondary WAN. In the installation environment, no extra configuration is needed if a DHCP server is available through Ethernet connection. For making device to have sufficient interface parameters, following information has to be supplied by DHCP server:

- [Device IP]
- [Device Netmask]
- [Default Gateway]
- [DNS server]

3.1.2 Changing Configuration

If default configuration does not fit the usage in installation environment, please use setup showed in following picture to change configuration. You will need a Router that have DHCP server to offer IP to Outdoor LoRa Gateway, or use a switch/ hub and running a DHCP server on PC for the same purpose. After device acquired IP, you need to use PC on the same network to access device.

Figure 3. Configuration Setup



3.2 Web Interface

The outdoor LoRa Gateway has a built-in web interface which supplies the configuration of the backhaul network and displays the status of gateway. You can access it with opening a web browser and enter the IP of device.

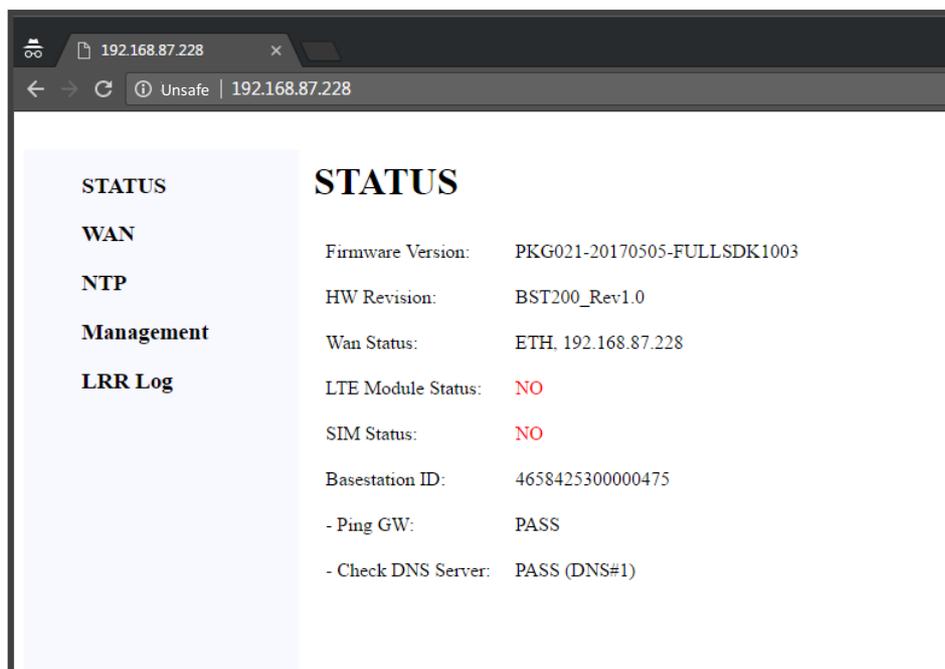
After entered IP of outdoor LoRa Gateway in the URL of web browser, you will be prompted to input the username and password. The user name is "bsconfig". As for the password, please check the last page of the **Administrator Card**. After login, you will be directed to the [Status] page.

NOTE :

Web interface can only support Chrome and Firefox. It may not function properly if using other types of web browser.

3.2.1 Status Page

This page displays some basic information and current state of device. On every visit to this page, a simple task is performed to acquire the latest status.



Description of displayed items

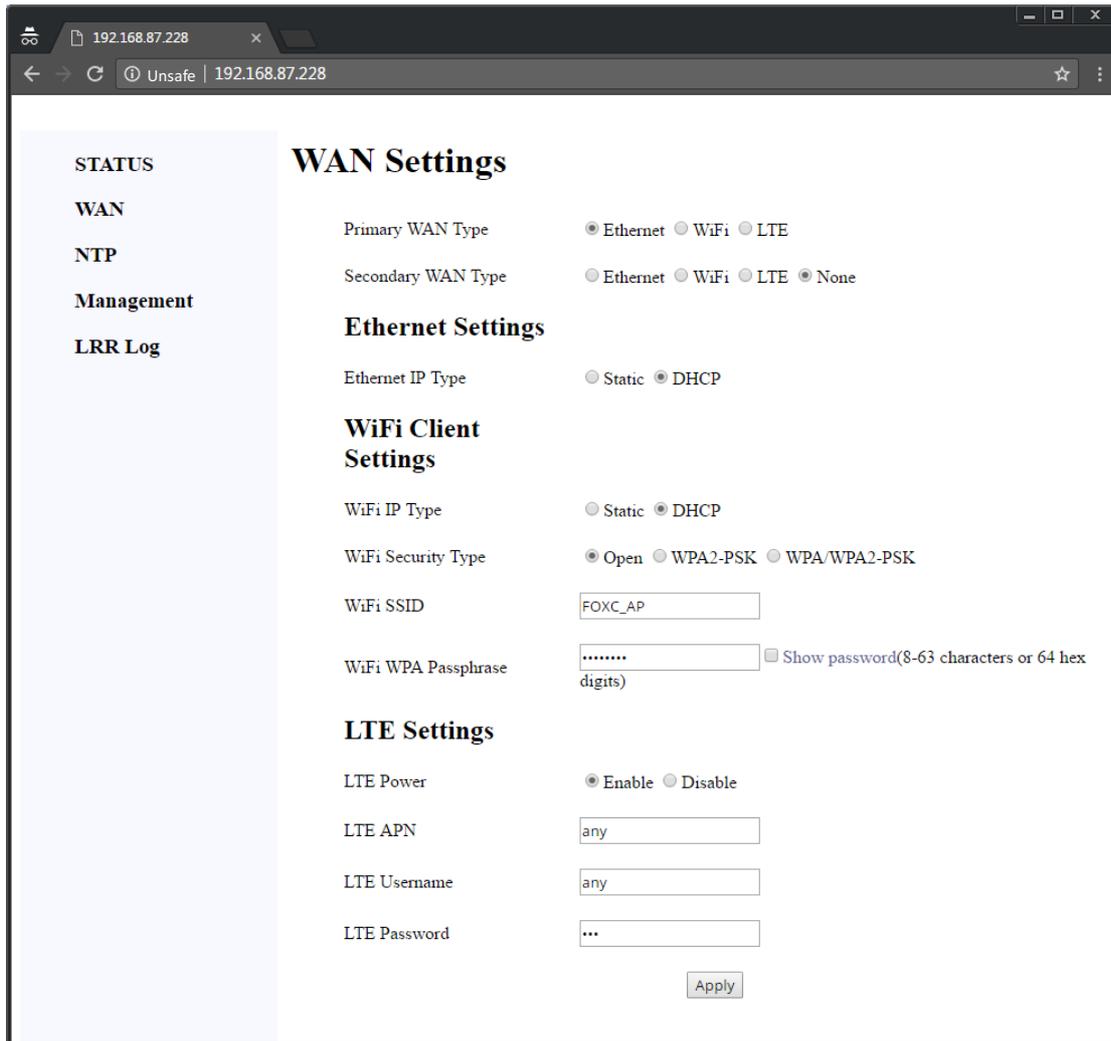
| | |
|--------------------------|--|
| Firmware Version | Show version of current firmware (May change after firmware upgrade) |
| HW Revision | Show version of current hardware |
| WAN Status | Show settings and state of current backhaul connection: <WAN_type>,<IP address> or NO if WAN connection is not ready. <WAN_type>: ETH – use Ethernet (over PoE) WIFI – use WiFi client to associate with AP LTE – use LTE with SIM card <IP address>: Acquired IP per WAN connection |
| LTE Module Status | Show the availability of LTE module: YES – LTE module is installed and ready NO – no LTE module installed or LTE module is powered off |
| SIM Status | Show the status of SIM card: NO – no SIM card READY – SIM card is ready <other_msg> - displayed the SIM test result from LTE module |
| Base Station ID | Show the unique ID of this outdoor LoRa gateway |
| Ping GW* | Show the ping test result to default gateway PASS – default gateway is reachable FAIL – default gateway is either unreachable or had a firewall that block ping test. |
| Check DNS Server* | Show the result of connection test with DNS PASS(<IP>) – connection is validated by ping to DNS with IP address <IP> PASS(DNS#n) - connection is validated by ping to DNS n FAIL – connection test failed QUERY OK - connection is validated by querying to DNS |

Note :

'*' means a test is performed during loading of this page

3.2.2 WAN Page

This page describes the backhaul configuration. There are three kinds of backhaul which are Ethernet over PoE, WiFi client mode and LTE (if both LTE module and SIM card are installed) and can be selected and configured through their own settings.



Select Ethernet as WAN

- Use DHCP Mode to get IP address automatically

| | |
|--------------------------|---|
| Primary WAN Type | <input checked="" type="radio"/> Ethernet <input type="radio"/> WiFi <input type="radio"/> LTE |
| Secondary WAN Type | <input type="radio"/> Ethernet <input type="radio"/> WiFi <input type="radio"/> LTE <input checked="" type="radio"/> None |
| Ethernet Settings | |
| Ethernet IP Type | <input type="radio"/> Static <input checked="" type="radio"/> DHCP |

- (1) Set Primary WAN type as “Ethernet”
- (2) Set Secondary WAN type as “None”
- (3) Set Ethernet IP Type under **Ethernet Settings** as “DHCP”
- (4) Press [Apply] button

- **Use static IP Mode**

| | |
|--------------------------|---|
| Primary WAN Type | <input checked="" type="radio"/> Ethernet <input type="radio"/> WiFi <input type="radio"/> LTE |
| Secondary WAN Type | <input type="radio"/> Ethernet <input type="radio"/> WiFi <input type="radio"/> LTE <input checked="" type="radio"/> None |
| Ethernet Settings | |
| Ethernet IP Type | <input checked="" type="radio"/> Static <input type="radio"/> DHCP |
| IP Address | <input type="text" value="192.168.128.250"/> |
| Netmask | <input type="text" value="255.255.255.0"/> |
| Gateway IP address | <input type="text" value="192.168.128.1"/> |
| Primary DNS IP address | <input type="text" value="168.95.1.1"/> |
| Secondary DNS IP address | <input type="text" value="8.8.8.8"/> |

- (1) Set **Primary WAN type** as "Ethernet"
- (2) Set **Secondary WAN type** as "None"
- (3) Set **Ethernet IP Type** under **Ethernet Settings** as "Static"
- (4) Configure proper settings in **IP address/Netmask/Gateway /Primary DNS/Secondary DNS** under Static IP Settings
- (5) Press [Apply] button

Select WiFi client as WAN

- **Use DHCP Mode to get IP address automatically**

| | |
|--------------------|---|
| Primary WAN Type | <input type="radio"/> Ethernet <input checked="" type="radio"/> WiFi <input type="radio"/> LTE |
| Secondary WAN Type | <input type="radio"/> Ethernet <input type="radio"/> WiFi <input type="radio"/> LTE <input checked="" type="radio"/> None |

| | |
|-----------------------------|---|
| WiFi Client Settings | |
| WiFi IP Type | <input type="radio"/> Static <input checked="" type="radio"/> DHCP |
| WiFi Security Type | <input checked="" type="radio"/> Open <input type="radio"/> WPA2-PSK <input type="radio"/> WPA/WPA2-PSK |
| WiFi SSID | <input type="text" value="FOXC_AP"/> |
| WiFi WPA Passphrase | <input type="text" value="....."/> <input type="checkbox"/> Show password(8-63 characters or 64 hex digits) |

- (1) Set **Primary WAN type** as “WiFi”
- (2) Set **Secondary WAN type** as “None”
- (3) Set **WiFi IP Type** under **WiFi Client Settings** as “DHCP”
- (4) Set **WiFi SSID** / **WiFi Security Type** / **WEP** or **WPA Passphrase** per external AP configuration
- (5) Press [Apply] button

- **Use static IP Mode**

WiFi Client Settings

WiFi IP Type Static DHCP

WiFi Security Type Open WPA2-PSK WPA/WPA2-PSK

WiFi SSID

WiFi WPA Passphrase Show password(8-63 characters or 64 hex digits)

WiFi IP Address

WiFi Netmask

WiFi Gateway IP address

WiFi Primary DNS IP address

WiFi Secondary DNS IP address

- (1) Set **Primary WAN type** as “WiFi”
- (2) Set **Secondary WAN type** as “None”
- (3) Set **WiFi IP Type** under **WiFi Client Settings** as “Static”
- (4) Set **WiFi SSID** / **WiFi Security Type** / **WEP** or **WPA Passphrase** per external AP configuration
- (5) Configure proper settings in **WiFi IP address** / **WiFi Netmask** / **WiFi Gateway** / **WiFi Primary DNS** / **WiFi Secondary DNS** for WiFi IP setting
- (6) Press [Apply] button

- **Select LTE as WAN**

Primary WAN Type Ethernet WiFi LTE

Secondary WAN Type Ethernet WiFi LTE None

LTE Settings

LTE Power Enable Disable

LTE APN

LTE Username

LTE Password

- (1) Set Primary WAN type as "LTE"
- (2) Set Secondary WAN type as "None"
- (3) Set LTE APN / LTE Username / LTE Password
- (4) Set LTE Power to "Enable"
- (5) Press [Apply] button

Note :

If LTE username and LTE password are not used, please enter with "any"

3.2.3 NTP Page

To maintain proper log records and have good reference on timestamp, NTP is used to synchronize the time from network time server. A proximity time is also been recorded every 10 minutes. This is a quick time adjustment on next boot up prior to the network is ready.

STATUS

WAN

NTP

Management

LRR Log

NTP Settings

NTP Server 1 IP/Domain

NTP Server 2 IP/Domain

NTP Server 3 IP/Domain

NTP Server 4 IP/Domain

NTP Server 5 IP/Domain

In this page, at most 5 NTP servers can be set for time synchronization. At least one server should be set in order to have NTP working properly. Un-used server settings could be left as blank. You need to click on [Apply] button for any changes to take effect immediately.

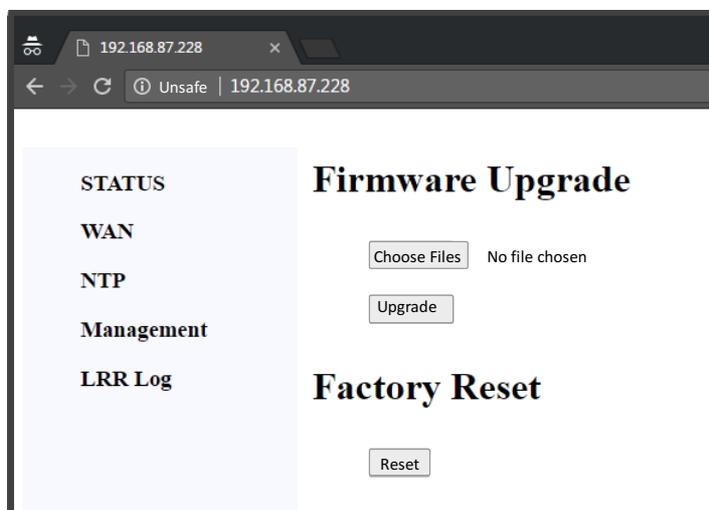
As showed in the above picture, the default value uses NTP POOL project (<http://www.pool.ntp.org>) configuration which automatically select nearest time server to use.

For a device installed used a private network (or Intranet) and access to Internet is not available, you have to set a local/ internal time server and clear other x.pool.ntp.org settings to save the query to unknown FQDN name in settings.

The default poll time of NTP service is a random value from 64-1024 seconds.

3.2.4 Management Page

Firmware upgrade via web interface is available. And, a factory reset facility can be used once device entered an abnormal state. After reset, the device will be configured to a default value.



Firmware upgrade

Before performing FW upgrade, please check the Status page for current firmware version. You need to be aware that only firmware for the same product could be used. Using invalid firmware or firmware from other products will get a "FW Upgrade Fail" message.

The firmware file usually had a name in following format:

FW_<date code>_T11003TP

where <date code> is the release date of this firmware. You may refer the release note for version information.

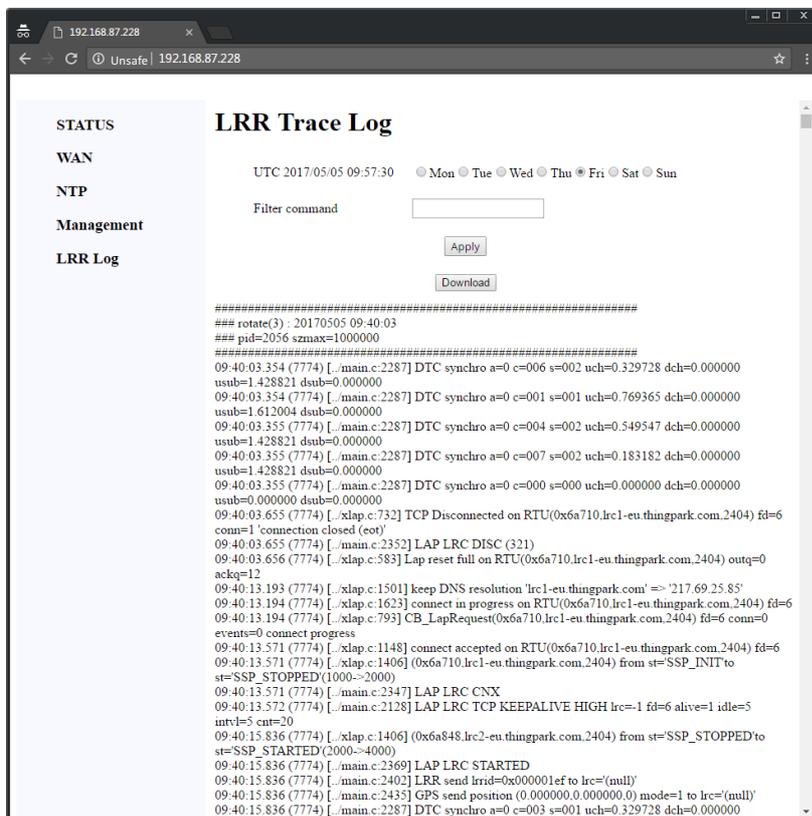
For firmware upgrade, first use [Browse...] button to select firmware file, then press [Upgrade] to start the upgrade process. After a success upgrade, the device will reboot automatically.

Factory reset

If the device is not function as expected, or the release note of new firmware request to do a factory reset due to configuration adjustment, you may use [Reset] to reset all configurations to default value of firmware. After completion of reset operation, a message “Factory reset is done!! Waiting for rebooting...” will be shown and the device reboots automatically.

3.2.5 LRR Log Page

With integrated ThingPark Wireless client application – LRR, both LoRa traffic and control can be observed via the application log. This page provides an easy way to do filtering, selection and saving on the log.



On page loading, the current date information of device is shown before the radio selection, and week day of today is selected as default. Since LRR log on device is preserved as the last 7 week days, please do selection before further operation if you want to view log of other past day,.

View log in web browser

The Filter command controls a simple content filter in log, you may enter keyword (case sensitive) to it, and only a line contained such keyword will be displayed. If keyword contained white space, double quota (") must be used around the whole key word. You will still need to enter "" in Filter command to display full log without filtering.

After all, press [Apply] button and the log content will be displayed below. And, log output may be truncated if it was too large for browser to show.

Download log as a file

After selected week day, you can use [Download] button to download log of selected day to a file. The Filter command is not used, since full log is retrieved.

4. Warranty Coverage

The ufiSpace Gateway comes with a 3-year limited hardware warranty.

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LoRaWAN™ is a trademark of Semtech Corporation.

5. Administrator Card

Every outdoor LoRa Gateway is produced with a unique password for supplying better security. You may need to cut following information and keep it in a safe place.

[Outdoor LoRa Gateway]

BS ID: 46584253xxxxxxxx

Web login username: bsconfig

Web login password: aup6g/t;3

Console login username: mlbadmin

Console login password: xm3zj4yji4

[Security Constraint on Activity Customized Build]

The outdoor LoRa Gateway with Activity customized build limited the access to gateway. You have to configure your PC/NB with

IP address: 94.23.12.15

Netmask: 255.255.255.0

and setup a DHCP server with following settings:

Pool Range: 94.23.12.16-20

Netmask: 255.255.255.0

Def Gateway: 94.23.12.15

to let gateway to have IP in 94.23.12.x net for direct access.

After gateway booted and acquired IP from DHCP server, use SSH connection from PC/NB with console access information. After login, run

`firewall-reset.sh`

then you can use web interface on gateway.