Box

LPWAN gateway

User Guide

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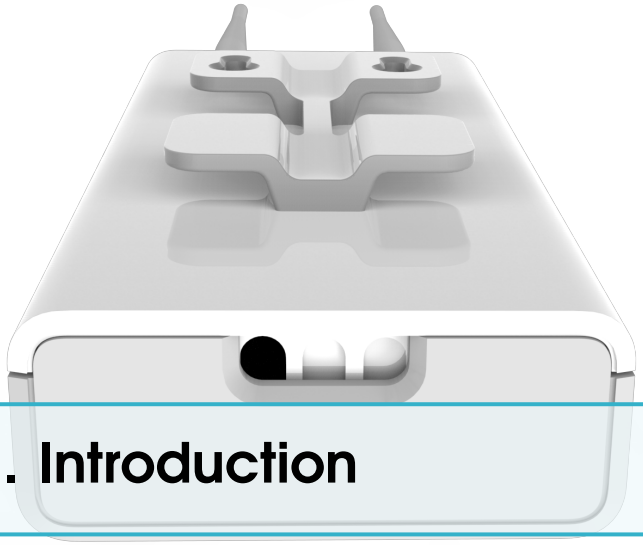


1. Introduction

1.1 Product overview

Thanks for choosing MatchX LPWAN products for your IoT applications. The Box includes a set of high-performance hardware and MatchX LPWAN controller software that allows you to manage your IoT devices through web browser or API.

This guide covers the US and EU version of Box, with the MatchX LPWAN controller version 1.0 or above. The main difference between the US and EU version is listed in the Table 1.1:

Item	US MX1702	EU MX1701
Band	902-928MHz	863-873MHz
Special RX	920-925MHz	865-867MHz
Maximum Conducted Power	+30dBm	+27dBm
LBT	South Korea	Europe
SF	7-10	7-12
Certification	IEC 60950 -1 FCC PART 15.247	EN 300200 EN 301489
IP Rating	IP65	IP65

Table 1.1: Comparison of US and EU Box

1.1.1 Lora

The MatchX Box supports LoraWAN protocol, covering a massive vicinity of up to 20km+ in open spaces, with superior network capacity the Box can accommodate more than 65535 nodes in a cell, including larger network coverage.

The MatchX Box supports network roaming and adaptive data rate management, offering convenience to system managers for IoT network plan and deployment. The Box fully supports

LoraWAN V1.0.2 and can be remotely upgraded for the future versions of LoraWAN. The whole solution is fully compatible with all LoraWAN devices.The RX band in some regions is narrower than US and EU version, please refer to the details in Section 3.4.

1.1.2 WiFi

Box augmented WiFi for the on-site device configuration and for management. WiFi is used both as an access point and wireless bridge to local networks, it provides integrated web interface for LoraWAN device management. The Box supporta 802.11 abgn and runs in 2.4GHz.

1.2 Main Features

The MatchX Box is the industry's FIRST IoT gateway that brings breakthroughs in both hardware and software, the network capacity, range coverage, security and device management are enhanced in both the US and EU versions.

1.2.1 Hardware

- Maximum +27dBm conducted output power in 868MHz, +30dBm in 915MHz
- -143dBm sensitivity of LoraWAN packets
- FPGA integrated for Listen-Before-Talk AFA
- 580MHz CPU and 128MB RAM, 32MB flash
- 24V passive POE for power supply
- USB-C for debug and management
- Wifi,Ethernet or backhaul

1.2.2 Software

- Supports OpenWrt and LEDE
- Integrated with the most updated packet forwarder
- Supports LoraWAN class A,B,C
- Runs LoraWAN network server and application server locally (optional)
- Firmware upgrade over the air
- Gateway and end device management on-site

Currently Class B support in MatchX cloud is still in beta version, but the hardware is fully prepared for Class B specification, it is expected to have a final Class B support in future cloud upgrade.

1.3 Interface and Connectors

1.3.1 Front panel of Box

The MatchX Box lower shell can be removed to connect cables and check the status of the Box. The panel has USB, USB-C and POE connectors and Link status LED.

USB2.0 is used to connect USB disk.

USB-C can be used to debug the Box.

Ethernet port supports 24V passive POE, please pay attention to the voltage rating of the POE injector.

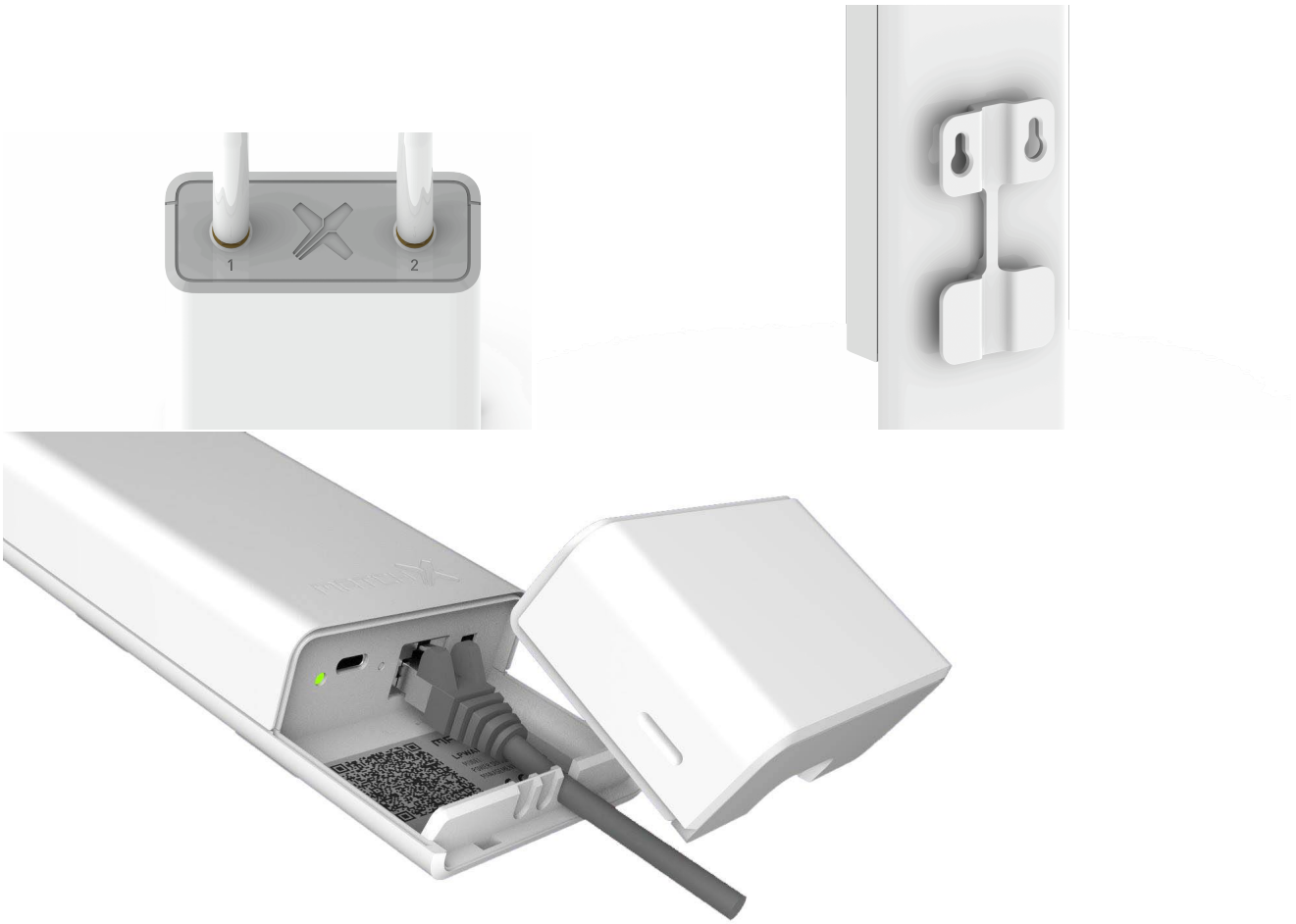
1.3.2 Link activity of Box

The Box uses one RGB LED to indicate the activity of the connections. The Table 1.2 describes the LEDs on the Box

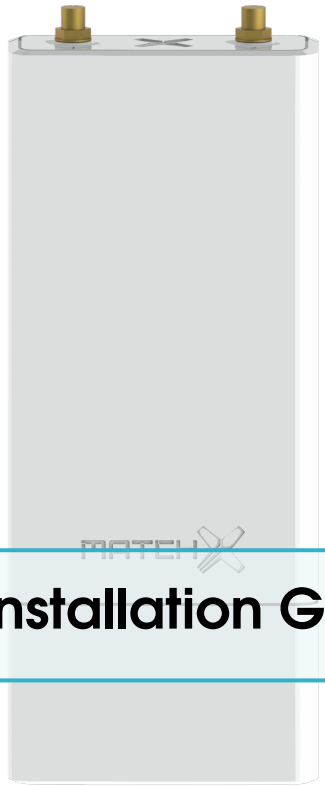
LED Color	Activity
Flashing Blue	Initializing
Steady Blue	Connected to Internet, no LoraWAN is configured
Alternative Blue and Red	Device is busy, don't unplug power
Flashing Red	No GPS fix
Steady Red	No Internet or no LoraWAN
Flashing Green	Configuring Box
Steady Green	Indicates that the Box is well-connected

Table 1.2: LED activity of Box

1.3.3 Connector of Box



Antenna 2 is for Lora radio and antenna 1 is for GPS. It is waterproof and has a mounting facility that can mount in fields, rooftops or the outside walls of a building. The enclosure is made of ASA plastic, which is extremely UV, wind, sand and yes, even acid rain resistant.



2. Quick Installation Guide

The Box is pre-configured "Plug 'n Play", this means you can simply connect the MatchX network without any need of setup, the installation guide will introduce you how to set it up and configure the WiFi and Lora parameter.

This device must be professionally installed.

2.1 Software environment

To configure the Box, users will need to have the following software environment:

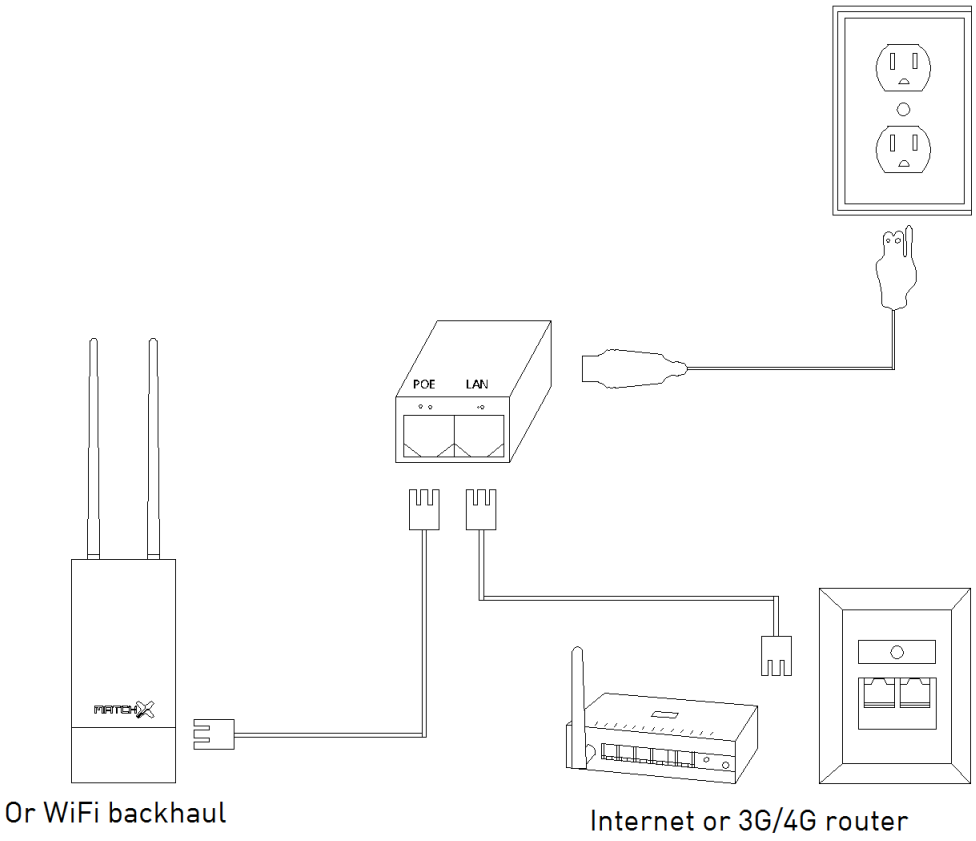
- Windows system with SSH client or iOS/Linux distributions with terminal
- Web browser like Chrome or Firefox
- Mobile browser like Chrome or Safari
- MatchX network account

2.2 Hardware environment

- WiFi or Ethernet connection
- Laptop or PC
- Mobile phone
- LoraWAN compatible end device

2.3 Connection

Here we only illustrate the POE power supply method, and the USB-C power option is not discussed here. Users can find the POE power supply inside the package, and the corresponding plug that specific to the country or region.



1: Connect to power cords from your wall sockets or panel sockets to POE 2: Connect the RJ45 cable from your Internet modem/switch/wall port, or any 3G/4G router to the POE's port labeled with "LAN". Next, grab a RJ45 cable and connect from the POE's port labeled with "POE" to Box.

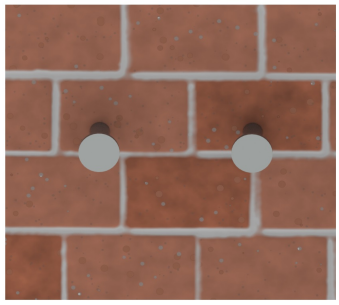
The Box can also use any 2.4GHz WiFi as a backhaul while powered by POE.

2.4 Mounting

2.4.1 Wall Mounting

The screws and screw anchors are included in the package, users can drill two 6mm hole on the wall and apply screw anchors to them.

- Determine the place of mount, it should be an even surface
- Mark two holes that are going to be drilled, the distance is 32.2mm, should be horizontally aligned
- Drill two 6mm hole, apply screw anchors and screws
- Adjust the screw space
- Mount the Box to the screws



32.2mm

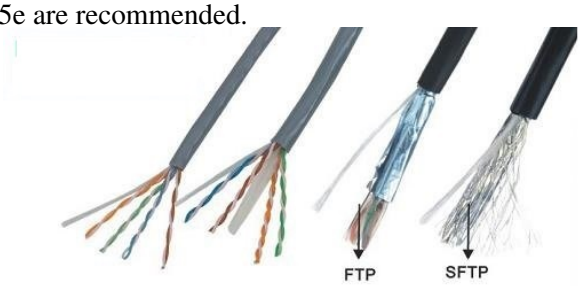
2.4.2 Pole mounting

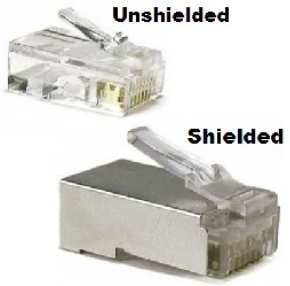
To mount the Box to a pole, users can find the stainless steel clamps in the package. The steps are:

- Determine the place of mount, we recommend a round pole
- Position the Box to the place, and fasten the stainless steel clamp.

2.5 Surge protection and Shielded Ethernet cable

We highly recommend to use the shielded RJ45 cable to connect the Box, in order to protect the device from any possible lightning or electricity surges. Both shielded FTP and S-FTP cable from Cat5e are recommended.



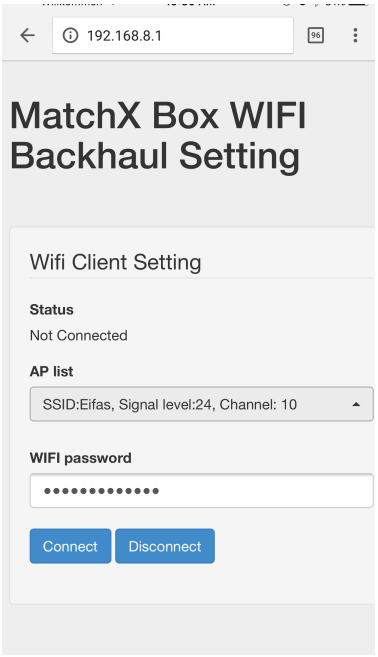


2.6 Setup

The Box will be automatically connected to MatchX cloud after the Internet is connected. This guide will illustrate how to connect to the Box and configure it.

2.6.1 WiFi connection

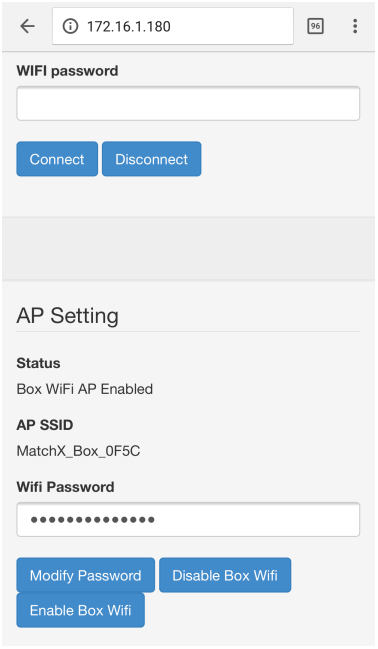
Users need to have a laptop or a PC that has WiFi connectivities, then after the Box is powered on, the SSID that in a format "**MatchX_Box_xxxx**" will be available for connection. The default password is **S/N of the device**. After connected, users can use their web browser to configure the wifi backhaul at 192.168.8.1 . The following picture shows the interface of WiFi connection.



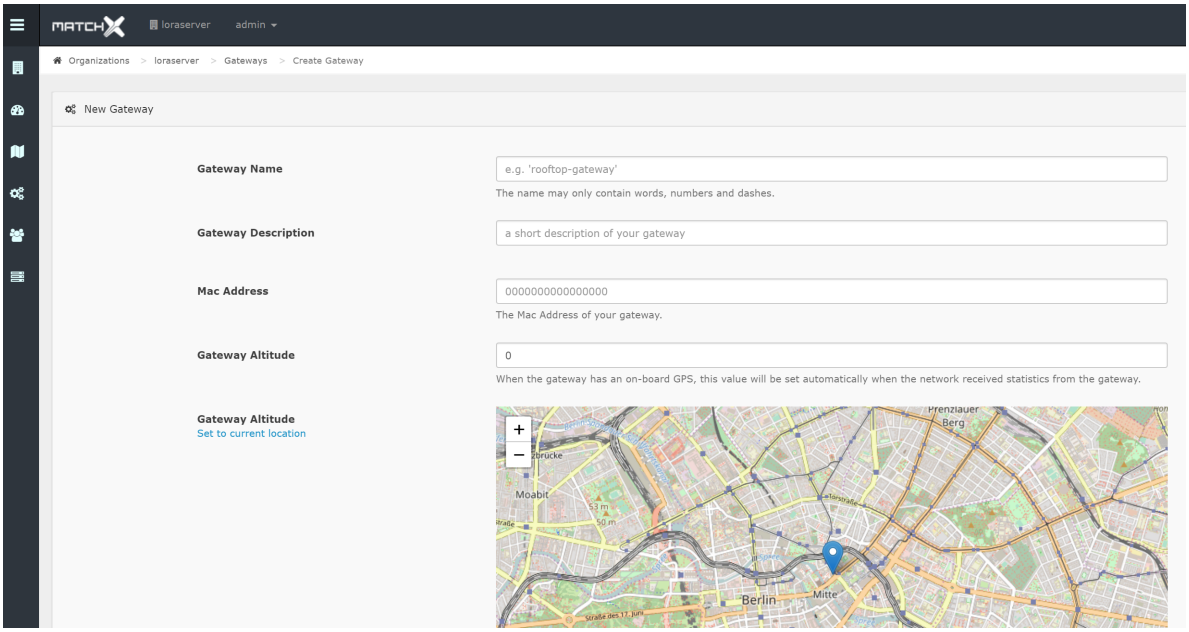
2.6.2 Ethernet connection

In this case users should have connection to LAN by either an Ethernet cable or WiFi, and they should know the IP address of the BOX in their LAN.

In this example we assume that the IP address that obtained by Box is 172.16.1.180, and we connect from the LAN through web browser to the IP address in LAN. Here users can configure the WIFI AP and backhaul setting.



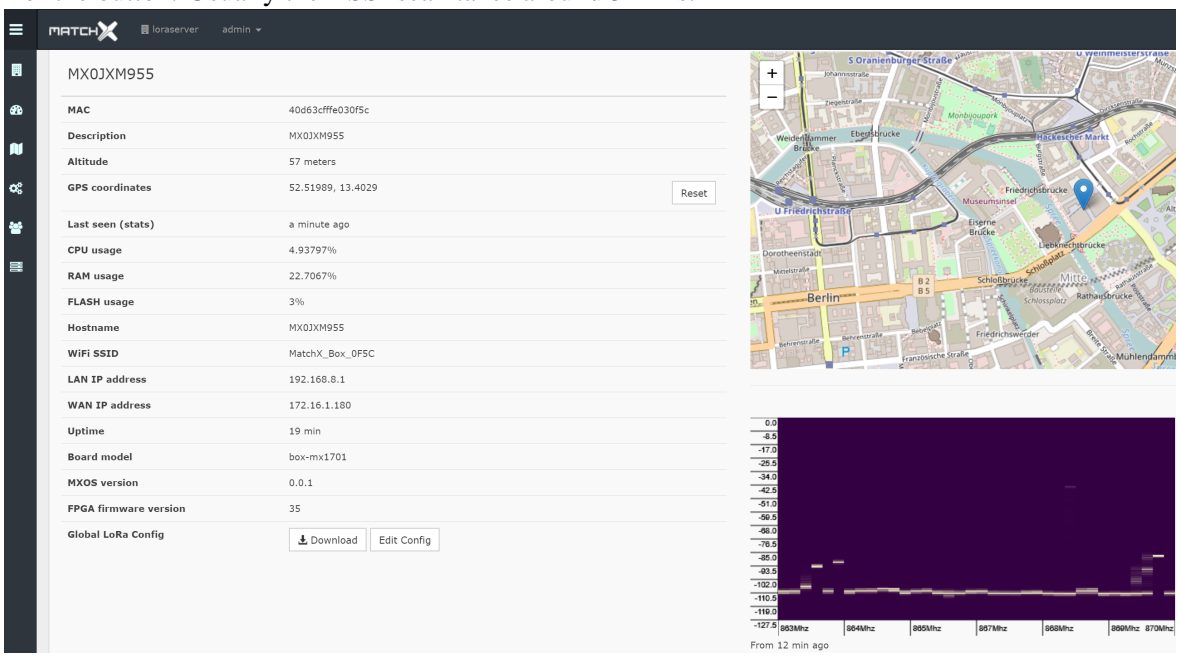
2.6.3 LPWAN server setting



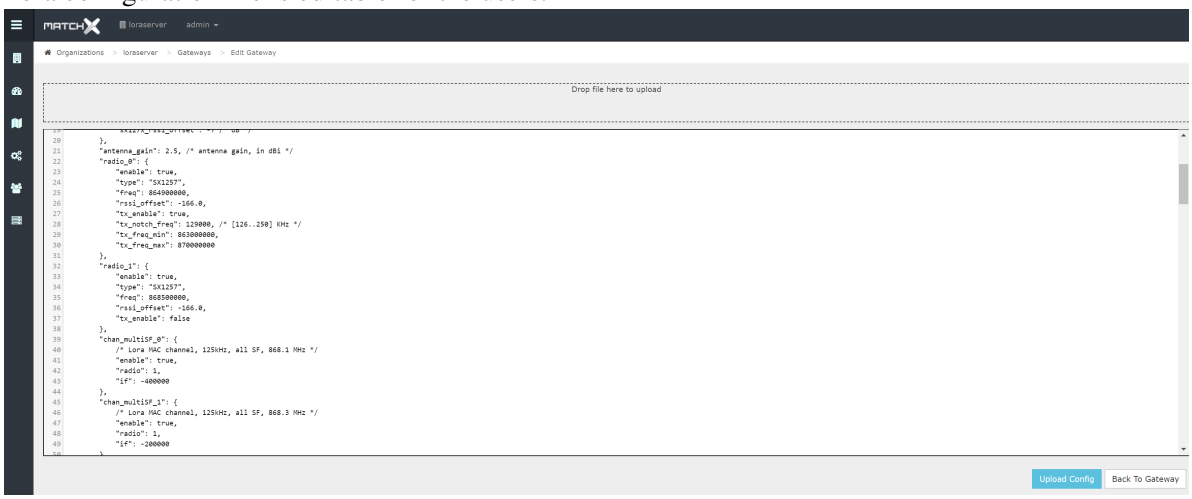
With the MatchX LPWAN cloud account, users can register their Box on the website, and remotely configure the device. It is also convenient to get the data out of the MatchX Sticks from

either MQTT data stream or the reporting tool. The above figure shows the registration of the MatchX Box using the S/N or MAC address and its physical location.

The following figure shows the device configuration page of the Box, where users can check the GPS status, runtime statistics like CPU, WiFi and Flash. The RSSI histogram is displayed upon the click of the button. Usually the RSSI scan takes around 5 mins.



It is also possible to modify the Lora configuration file, just by clicking the Edit config button, the Lora configuration file is editable for the users.



3. Product specification

The Box is designed for better LPWAN performance and manageability. In this chapter we briefly introduce the specifications for both hardware and software.

3.1 Hardware environment

The MatchX Box is mainly designed for network operators, it can both be deployed outdoor and indoor, the enclosure is made of weather-resistant material. Therefore the Box is much more durable than the normal plastics. The hardware specification is listed in the table blow:

Item	Description
CPU	MT7688AN 580MHz MIPS
Memory	128MB DDR2 RAM/ 32MB FLASH
GPS	UBlox Max 7Q
LAN	10/100 Mbit LAN with 24V POE
Interface	USB-C connector (no USB interface) with GPIO, console UART and I2C; USB-A 2.0
Enclosure	ASA plastic, anti-UV
Size	78 x 340 x 30mm
Operating Temperature	-20°C to 55°C
Extreme Temperature[1]	-40°C to 85°C
Power	3.5W in average, peak 6W

[1] device has been tested in environmental chamber for 24h in -40°C and 24h in +85°C.

Table 3.1: Key hardware specifications

3.2 Software environment

To facilitate the network deployment, we have included a lot of good features, which include:

- Open source operating system
- LoraWAN network server and application server running inside of Box
- Official packet-forwarder and lora-gateway libraries
- OTA upgrade and end device firmware upgrade
- remote management of gateway and connectivity

3.3 RF performance

There are several RF systems in the Box, which include Lora, WiFi and GPS . In this section we will briefly introduce the performance of these systems.

For Lora, the transmission + receive performance are listed in Table 3.2:

For WiFi, Table 3.3 listed the performance, and GPS is listed in Table 3.4. The GPS's performances are in accordance with the models' data sheets.

Item	Description
TX	Maximum +27dBm in 868 version
TX	Maximum +30dBm in 915 version
RX	-128dBm at SF7BW125
RX	-143dBm at SF12BW125

Table 3.2: Lora RF performance

Item	Description
RF	1T1R 150Mbps
Protocol	IEEE 802.11 a/b/g/n
TX Power	+19dBm
RX Sensitivity	-91.5dBm

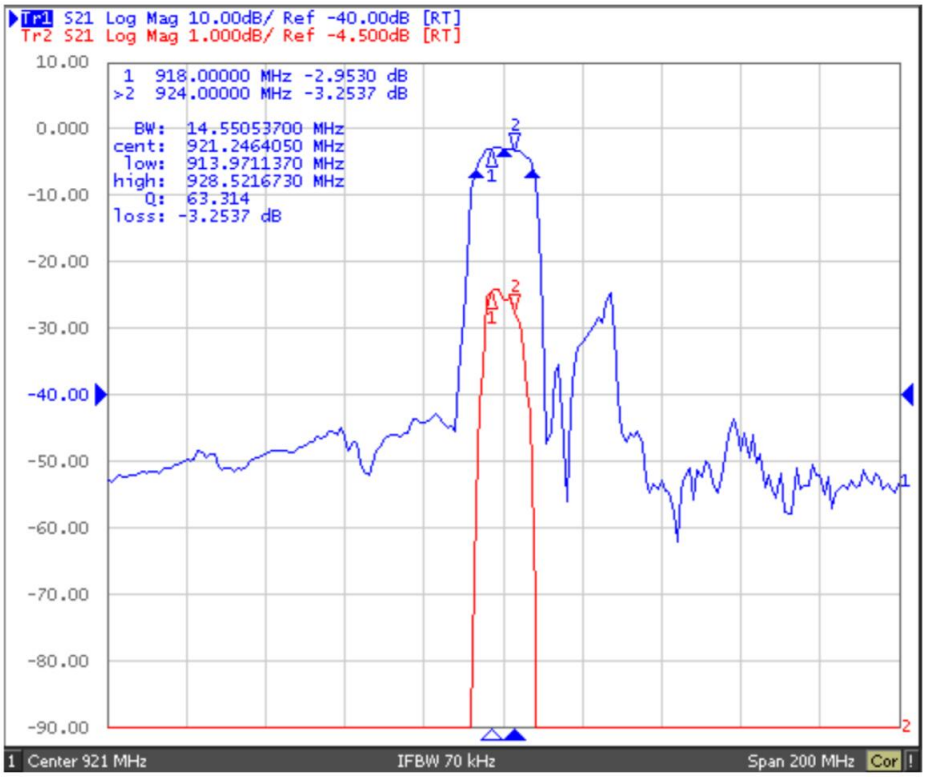
Table 3.3: WiFi RF performance

Item	Description
Tracking	-160dBm
Cold Start	-147dBm

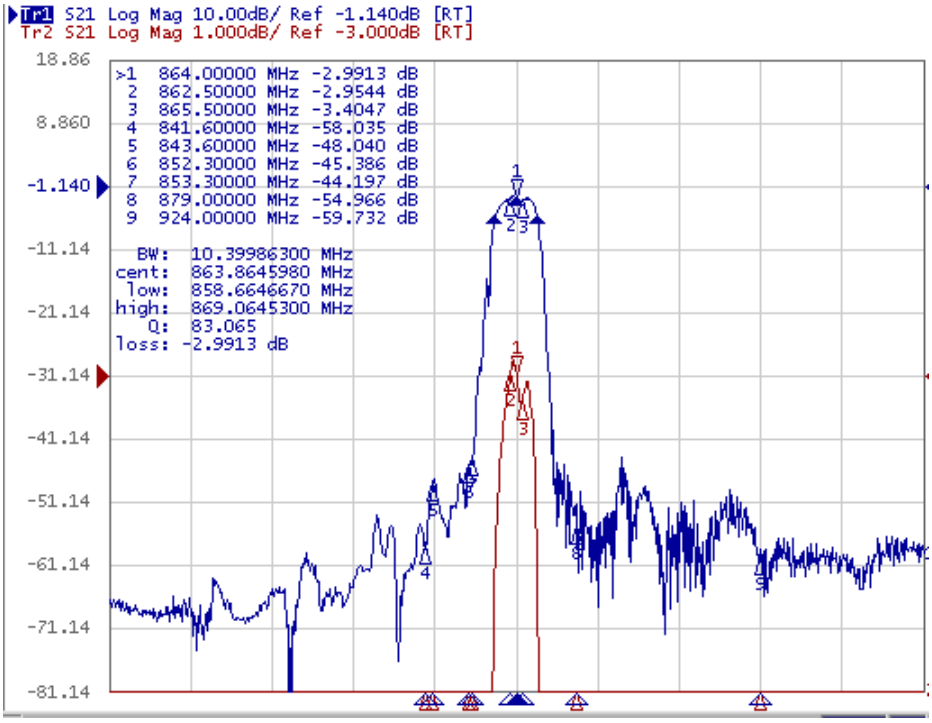
Table 3.4: GPS RF performance

3.4 RX Filter for narrow band regions(IN/HK/SIN/THA)

Different regions like Thailand, Singapore, India and Hongkong allocate just 2-5MHz to ISM usage, which usually near the LTE/CDMA bands. In order to prevent the receiver desensitization and saturation, the following filters are used in RX path.



920-925MHz RX filter for Singapore, Hong Kong, Thailand, Vietnam



865-867MHz RX filter for India

3.5 Antenna Performance

The performance of the GPS antenna 1 is listed in the following table:

Item	Description
Frequency range	1574 - 1606MHz
Impedance	50ohms
VSWR	<1.2:1
Max gain	2.5dbi
Polarization	Vertical
Radiation Pattern	Omni-directional
Connector	SMA(M)
Length	108mm
IP Rating	IP65

Table 3.5: GPS Antenna performance

The performance of the Lora antenna 2 is listed in the following table:

Item	Description
Frequency range	863-873MHz
Or	902-928MHz
Impedance	50ohms
VSWR	<1.2:1
Max gain	2.5dbi
Polarization	Vertical
Radiation Pattern	Omni-directional
Connector	SMA(M)
Length	108mm
IP Rating	IP65

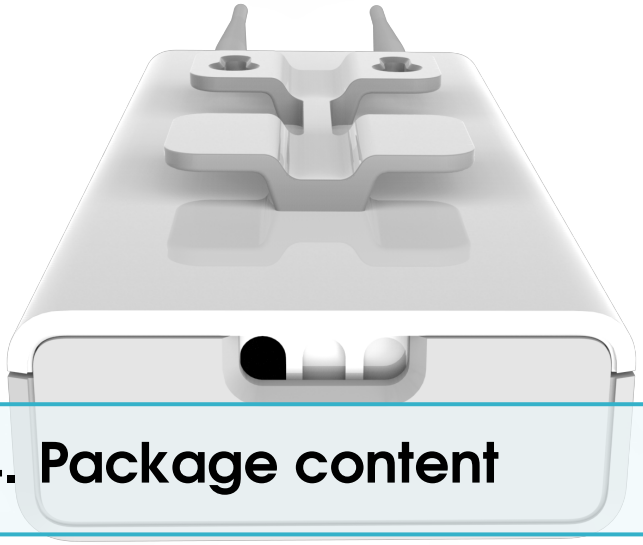
Table 3.6: Lora Antenna performance

3.6 Operational frequencies

The operational frequencies in European countries are listed in the table.

Operational Frequency band		Maximum e.r.p	Channel access and occupation rules (e.g. Duty cycle or LBT + AFA)	Band number from EC Decision 2013/752/EU [i.3]	Class 1 sub-class number according Commission Decision 2000/299/EU [i.7]
K	863 MHz to 865 MHz	25 mW e.r.p.	⩽ 0.1 % duty cycle or polite spectrum access	46a	66
L	865 MHz to 868 MHz	+6.2 dBm/100 kHz	⩽ 1 % duty cycle or polite spectrum access	47	67
M	868.0MHz to 868.6 MHz	25 mW e.r.p.	⩽ 1 % duty cycle or polite spectrum access	48	28
N	868.7 MHz to 869.2MHz	25 mW e.r.p.	⩽ 0.1% duty cycle or polite spectrum access	50	29
P	869.4MHz to 869.65MHz	500 mW e.r.p.	⩽ 10 % duty cycle or polite spectrum access	54b	30
Q	869.7MHz to 870.0 MHz	5 mW e.r.p.	No requirement	56a	31

The rest of the frequency plans in US, Australia, India, Korea and the rest of the world can be found on the MatchX website.



4. Package content

Thank you for purchasing the MatchX Box LPWAN gateway, it carries the most advanced IoT technology with a plug-and-play design. With the default package users can easily setup an IoT LPWAN. The package includes the following items:

Box(1 pcs)

Antenna(2 pcs)

30mm M6 Screw anchor,M4 Screw(3 sets)

Stainless Steel Clamp(1 pcs)

24V POE(1 pcs)

Power cords(1 pcs)