

Get Start with RAK7200 Tracker Device

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www.RAKwireless.com

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36 PAGES

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1. Where is the latest firmware file?

If you want to get a pre-compiled firmware instead of compiling the source code by yourself, you can find the latest firmware on RAK website after it is released.

2. How to burn the update firmware into RAK7200?

Firstly, please install the “STM32CubeProgrammer” tool on your Windows PC. You can download it from here:

https://www.st.com/content/st_com/en/products/development-tools/software-development-tools/stm32-software-development-tools/stm32-programmers/stm32cubeprog.html#overview

Secondly, connect RAK7200 with your PC's USB interface as follow:

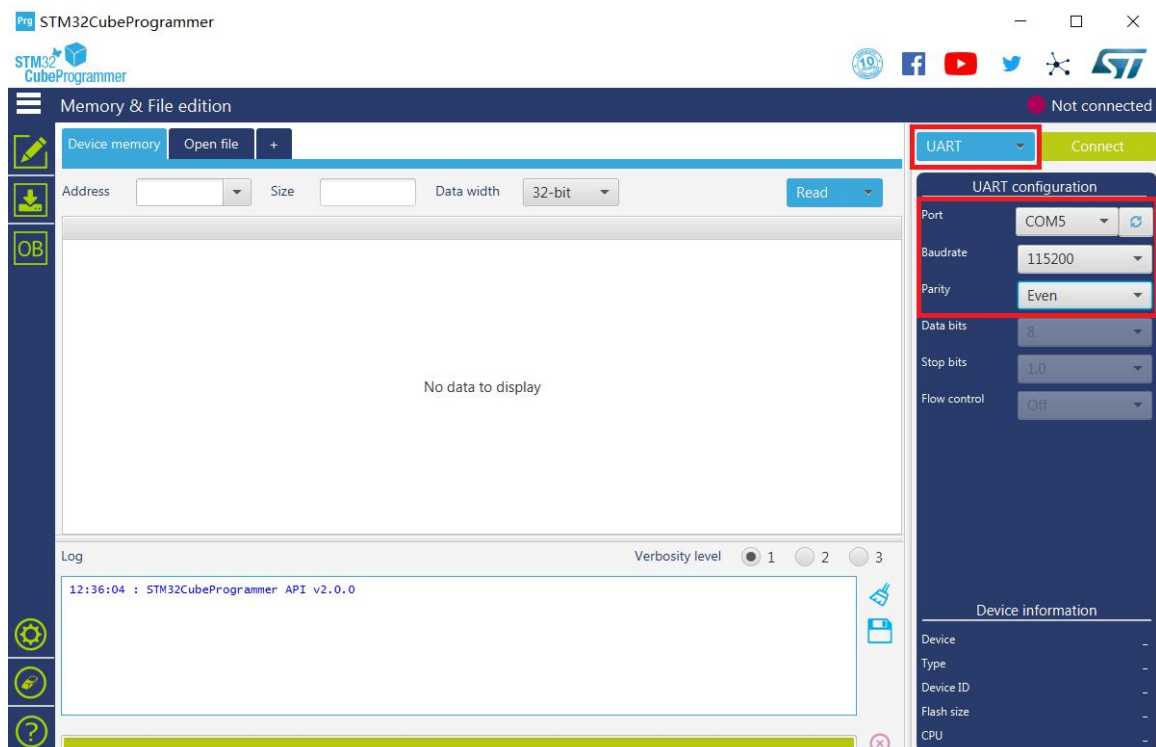


Now, you need to let RAK7200 work in boot mode. You can do it as follow:

1. Hold down the BOOT0 button, then press the Reset button;
2. Loosen the Reset button, then Loosen the BOOT0 button.

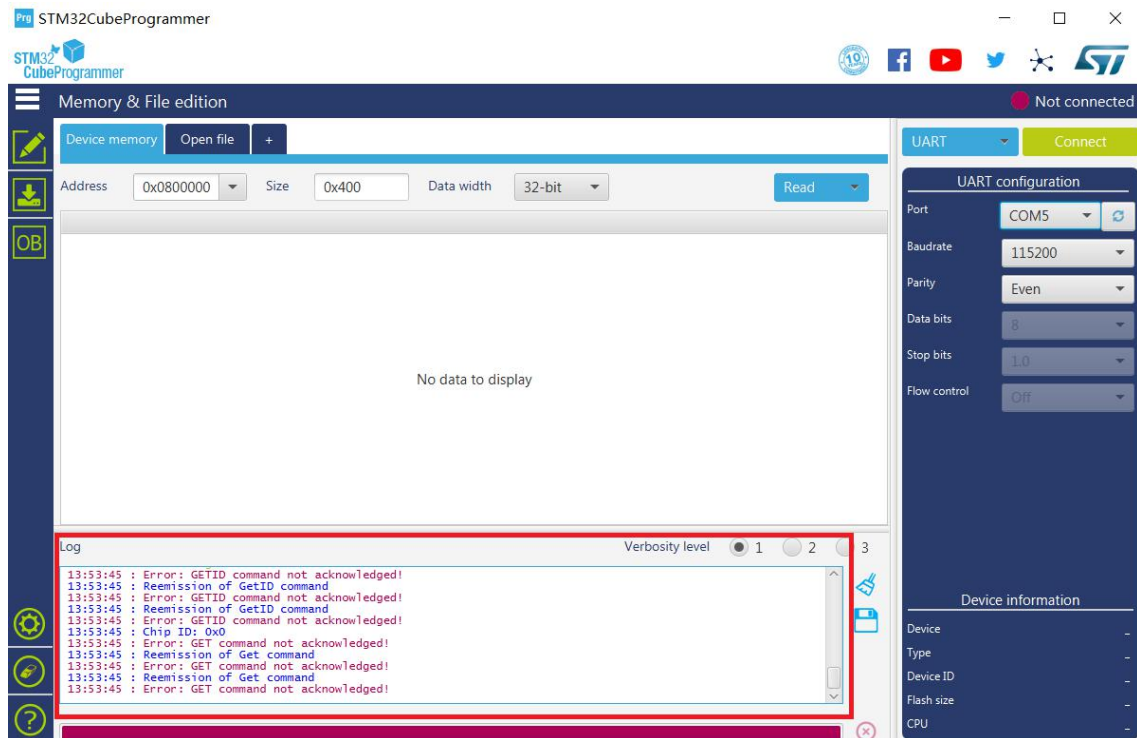


Open the “STM32CubeProgrammer” tool, and select UART type, then configure the Port, Baudrate, and Parity as the following picture shows:



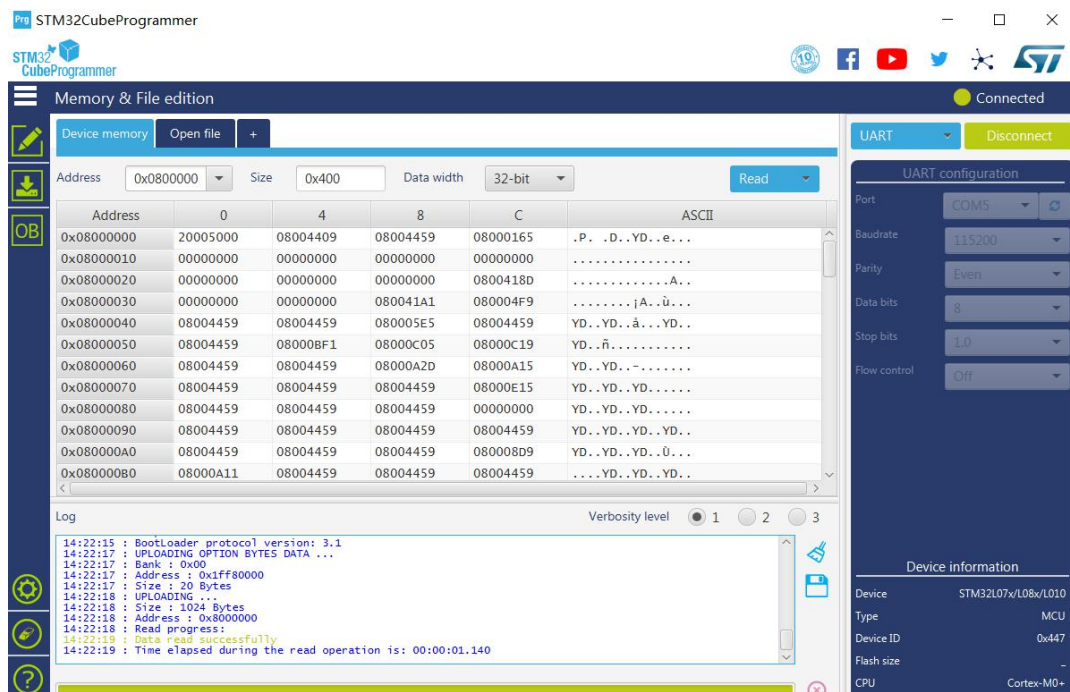
Note: It is COM5 on my computer, and it may be another COM port on your computer.

Then press “Connect” button at the top right corner. If there are some errors in the Log box as follow:



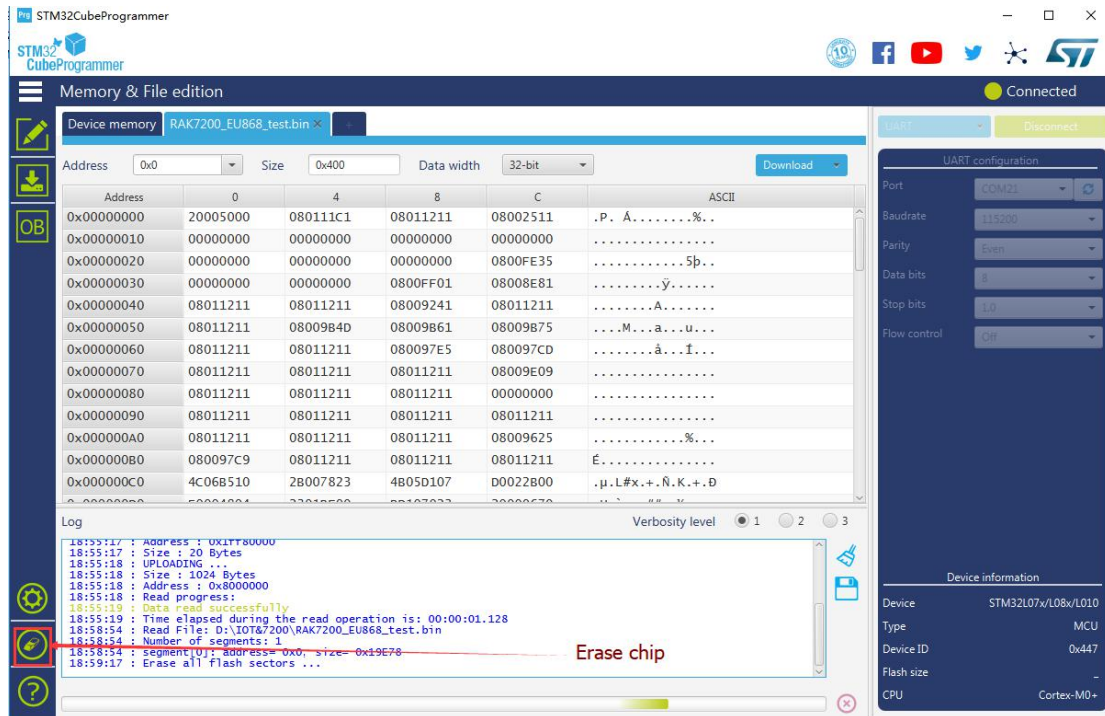
It means that RAK7200 don't work in BOOT mode. You should let it work in boot mode firstly.

The correct Log you should see is the information like the following picture shows:

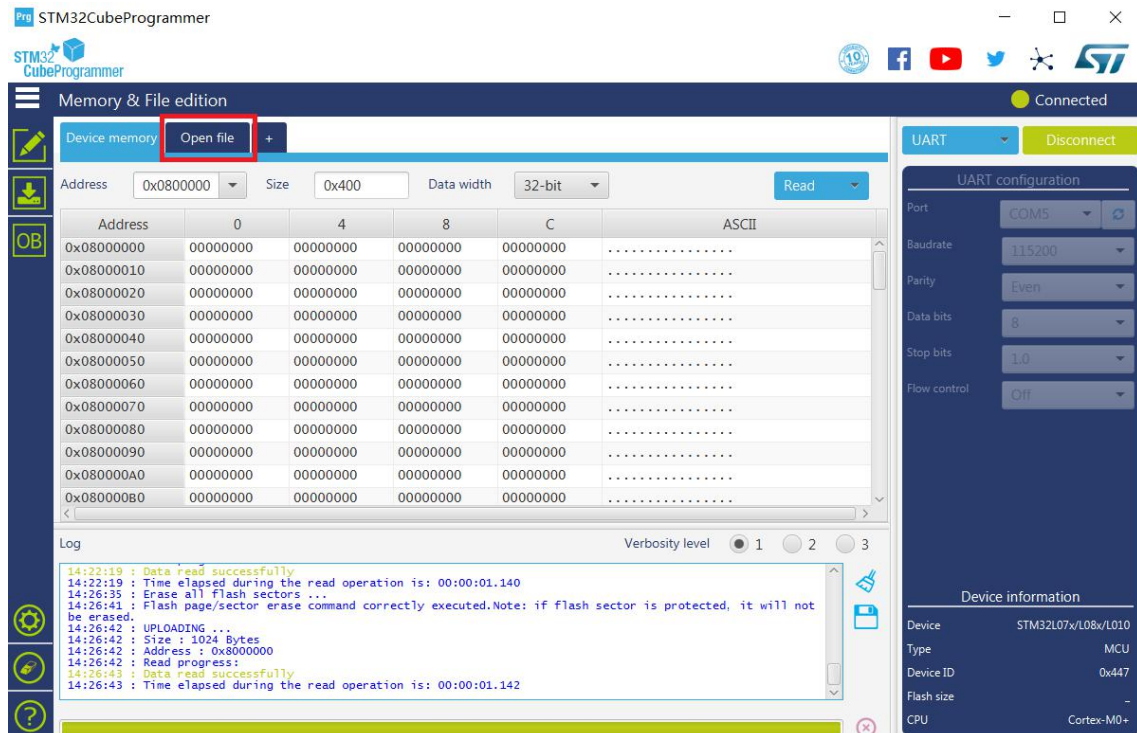


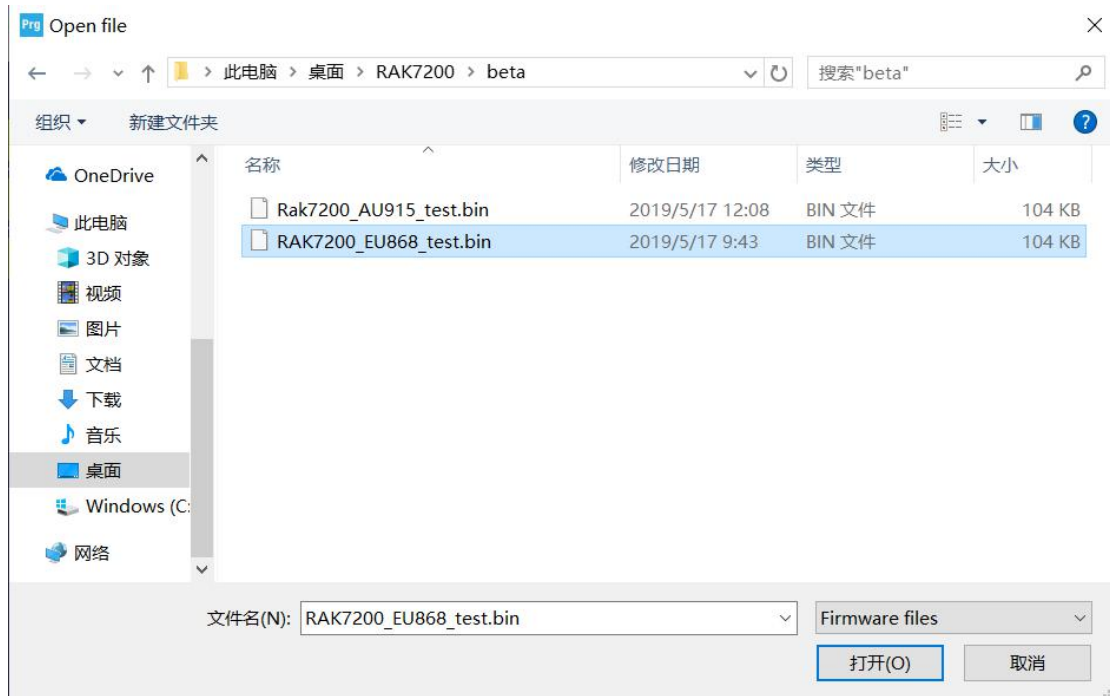
Now, let's start to burn a firmware into RAK7200.

At first, erase all data on RAK7200 according the following picture shows, it may take several seconds:

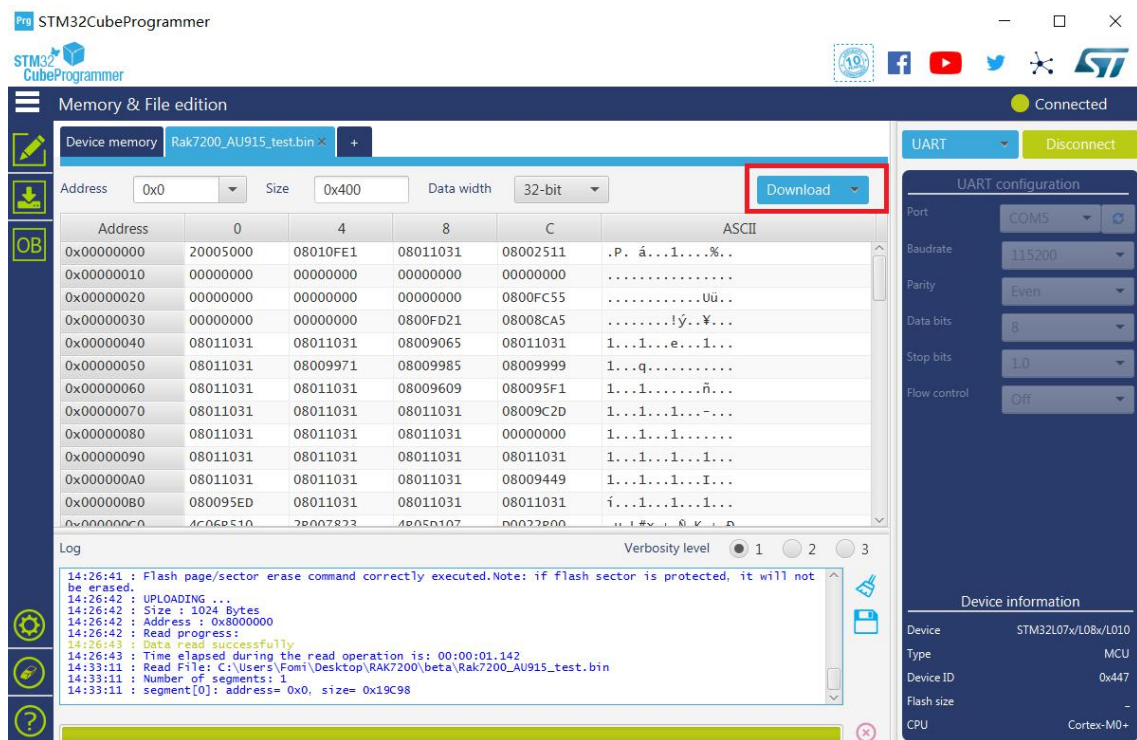


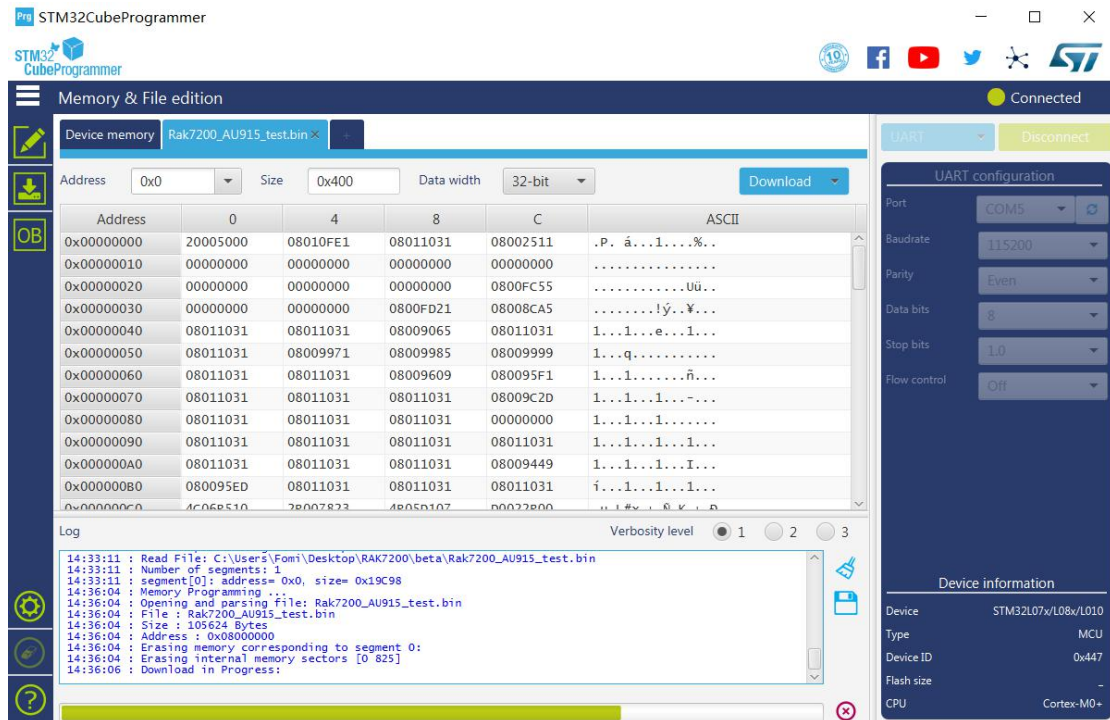
Press “Open file” and select the correct firmware file in the pop-up window as follow:



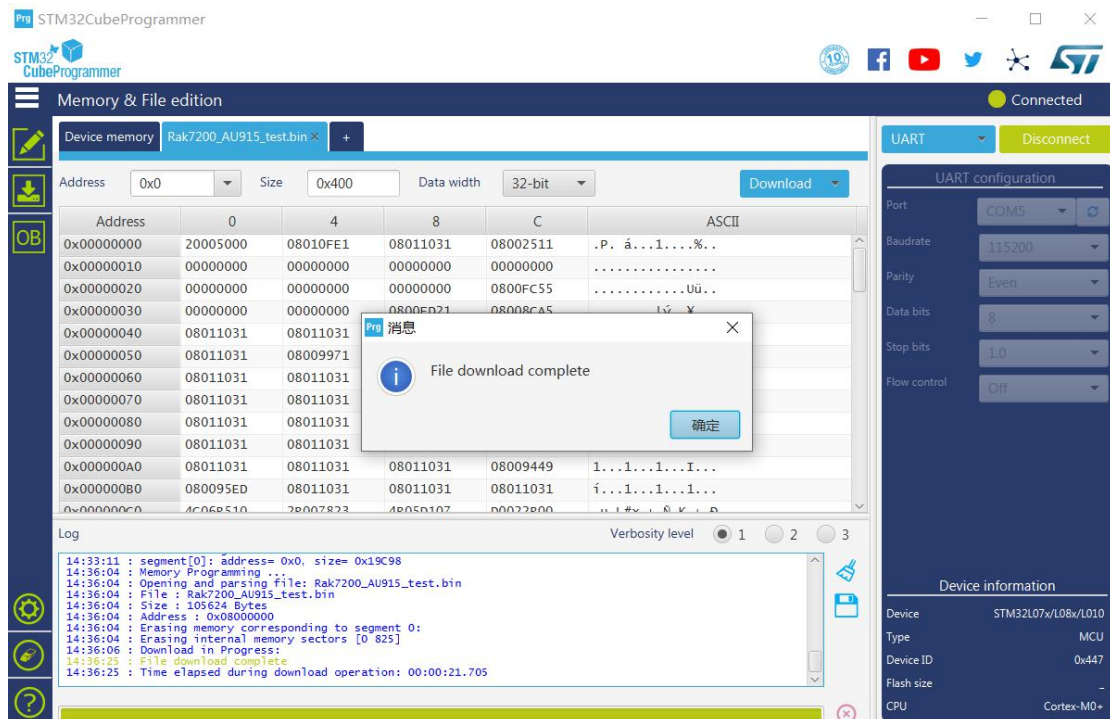


Press the "Download" button to start the burning process:





OK, you have upgraded the firmware for RAK7200 successfully!



Now, “Disconnect” and close the “STM32CubeProgrammer” tool, then open a serial port tool on your PC. Choose the correct COM port and baud rate is 115200. Then press the Reset button on RAK7200, you’ll see the following log on serial port tool:

[14:17:22.929]收←◆

RAKwireless

S76G_B version:2.0.0.0.0

[14:17:23.215]收←◆DMP is disabled

[14:17:24.603]收←◆GPS Init OK

Selected LoRaWAN 1.0.2 Region: AU915

[14:17:24.655]收←◆Parameter not found.

Note: If you haven't a serial port tool, we recommend you to use RAK serial port tool.
You can get it from RAK website and use it freely.

http://docs.rakwireless.com/en/LoRa/RAK811/Tools/RAK_SERIAL_PORT_TOOL_V1.2.1.zip

3. How to configure RAK7200?

You can configure LoRa Button by sending AT commands into it from a serial port tool running on your PC.

The following list shows the AT commands:

AT Command	Description
at+version	Get the current firmware version number.
at+get_config=device:status	Get all information about the device's hardware components and their current status.
at+set_config=device:restart	After set, the device will restart.

at+set_config=device:XXX:YYY	<p>Set a certain sensor's status.</p> <p>XXX definition: the sensor's flag, gps means GPS, acc means Accelerate, magn means Magnetic, gyro means Gyroscope, pressure means Pressure, temperature means Temperature, humidity means Humidity, light_strength means Light_strength, voltage means Voltage.</p> <p>YYY definition: 0: close, 1: open</p>
at+join	Start to join LoRa network.
at+send=X:YYY	<p>Send a customized data.</p> <p>X definition: LoRa port</p> <p>YYY definition: the data which you want to send. The limited length is 50 Bytes, and the data must be in HEX format.</p>
at+set_config=lora:work_mode:X	<p>Set the work mode for LoRa.</p> <p>X definition: 0: LoRaWAN, 1: LoRaP2P, 2: Test Mode.</p>
at+set_config=lora:join_mode:X	<p>Set the join mode for LoRaWAN.</p> <p>X definition: 0: OTAA, 1: ABP</p>
at+set_config=lora:class:X	<p>Set the class for LoRa.</p> <p>X definition: 0: Class A, 1: Class B, 2: Class C</p>
at+set_config=lora:region:XXX	<p>Set the region for LoRa.</p> <p>XXX define: one of the following items: EU868 EU433, CN470, IN865, EU868, AU915, US915, KR920, AS923.</p>

at+set_config=lora:confirm:X	<p>Set the type of messages which will be sent out through LoRa.</p> <p>X definition: 0: unconfirm, 1: confirm</p>
at+set_config=lora:ch_mask:X:Y	<p>Set a certain channel on or off.</p> <p>X definition: the channel number, and you can check which channel can be set before you set it.</p> <p>Y definition: 0: off, 1: on</p>
at+set_config=lora:dev_eui:XXXX	<p>Set the device EUI for OTAA.</p> <p>XXXX definition: the device EUI, for example, 3534353165375300</p>
at+set_config=lora:app_eui:XXXX	<p>Set the application EUI for OTAA.</p> <p>XXXX definition: the application EUI, for example, 70B3D57ED001A1E2</p>
at+set_config=lora:app_key:XXXX	<p>Set the application key for OTAA.</p> <p>XXXX definition: the application key, for example, D9988A5F02D80FAB8BA5F453C4A2C D2B</p>
at+set_config=lora:dev_addr:XXXX	<p>Set the device address for ABP.</p> <p>XXXX definition: the device address, for example, 2601116D</p>
at+set_config=lora:apps_key:XXXX	<p>Set the application session key for ABP.</p> <p>XXXX definition: the application session key, for example, 573BD4DEC56BA4A9C462DF29E54B9 BCE</p>
at+set_config=lora:nwks_key:XXXX	<p>Set the network session key for ABP.</p> <p>XXXX definition: the network session key, for example, C2AA51E61BA45F57045BF48249BC3 6F6</p>
at+set_config=lora:send_interval:X	<p>Set the interval time of sending data.</p>

	X definition: the interval time, units are seconds.
at+get_config=lora:status	It will return all of the current information of LoRa, except LoRa channel.
at+get_config=lora:channel	It will return the state of all LoRa channels, then you can see which channel is closed and which channel is open very clearly.

More information, please have a look at the next section <How to Connect with TTN?>.

4. How to connect with TTN?

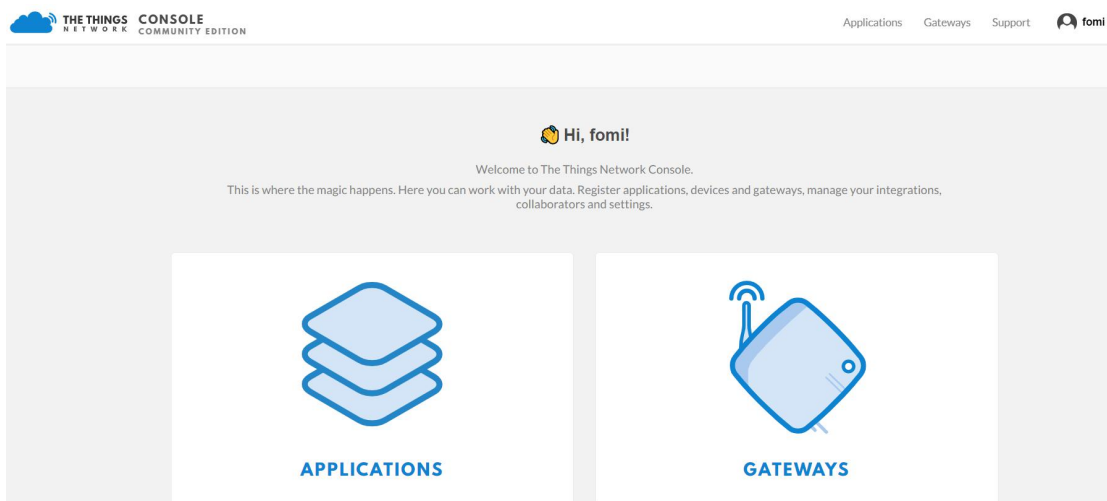
In this section, we'll do some practice to show how to connect RAK7200 with TTN.

Firstly, open the serial port tool on your PC.

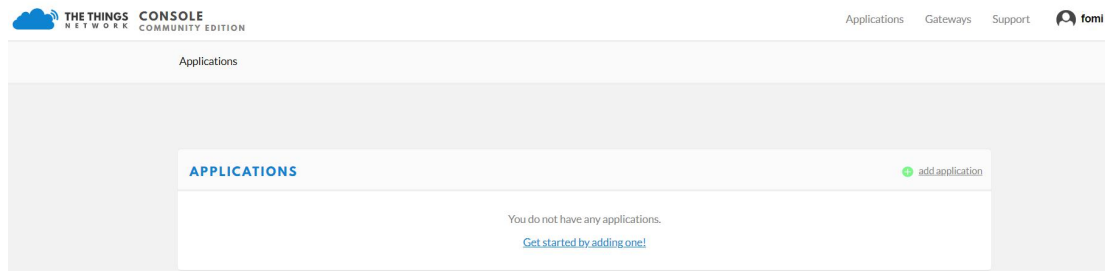
Open the serial port by click the following button:



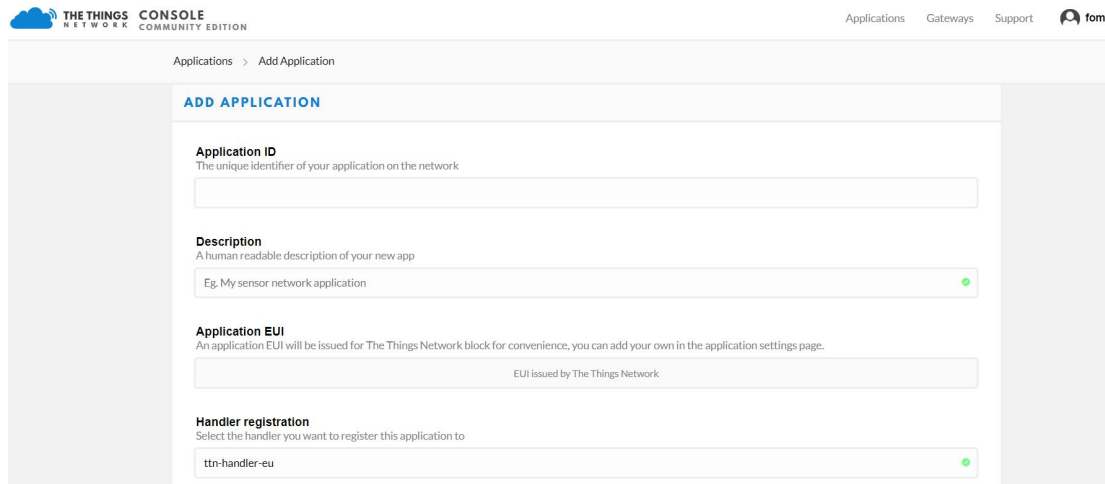
Open the link <https://www.thethingsnetwork.org/> and login, then open the “Console” page from the right corner at the top:



Press “APPLICATIONS”:

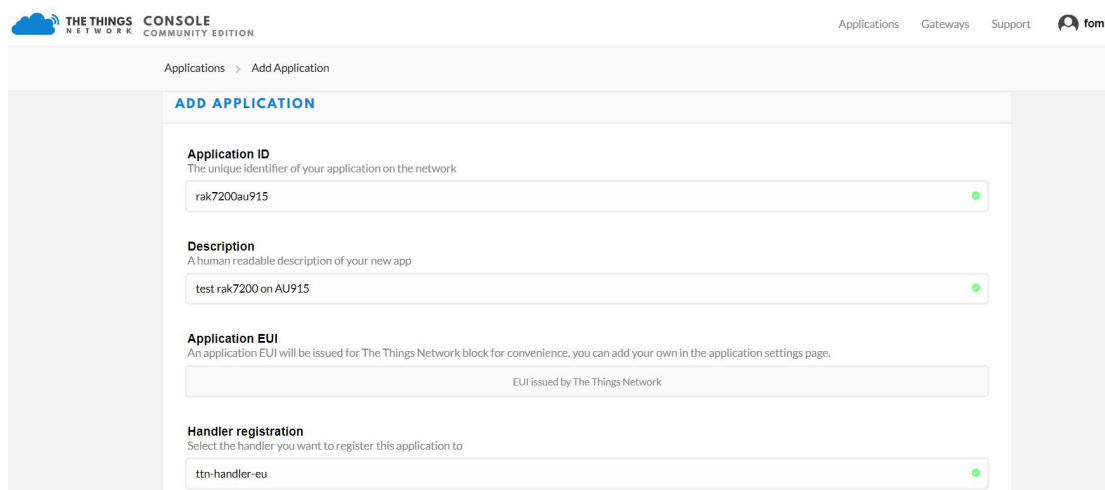


“add application”:

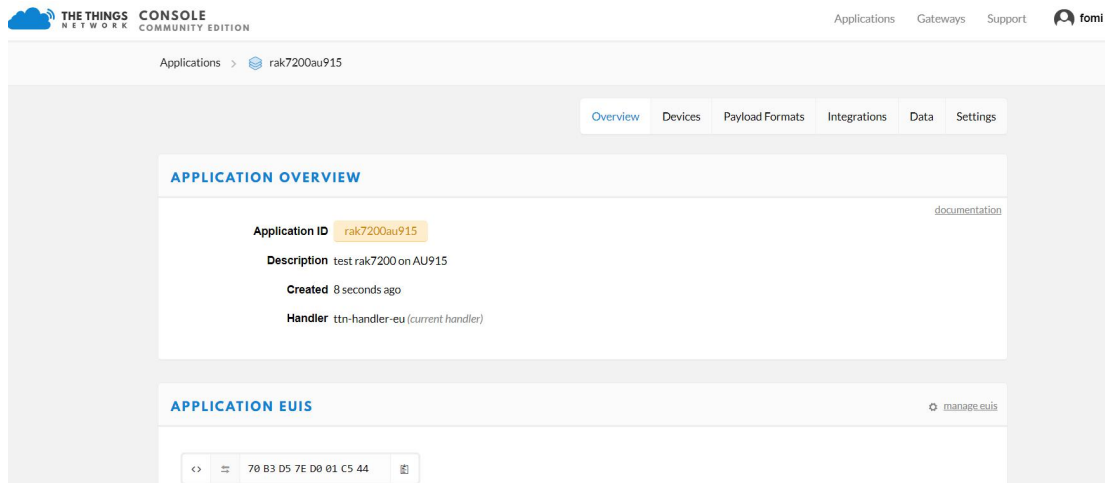


Fill in the correct contents.

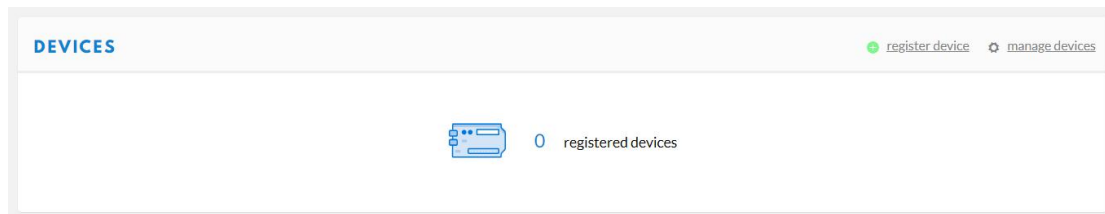
Please note that the content you fill in “Application ID” item should be in low case, and it must be the unique ID on TTN network.



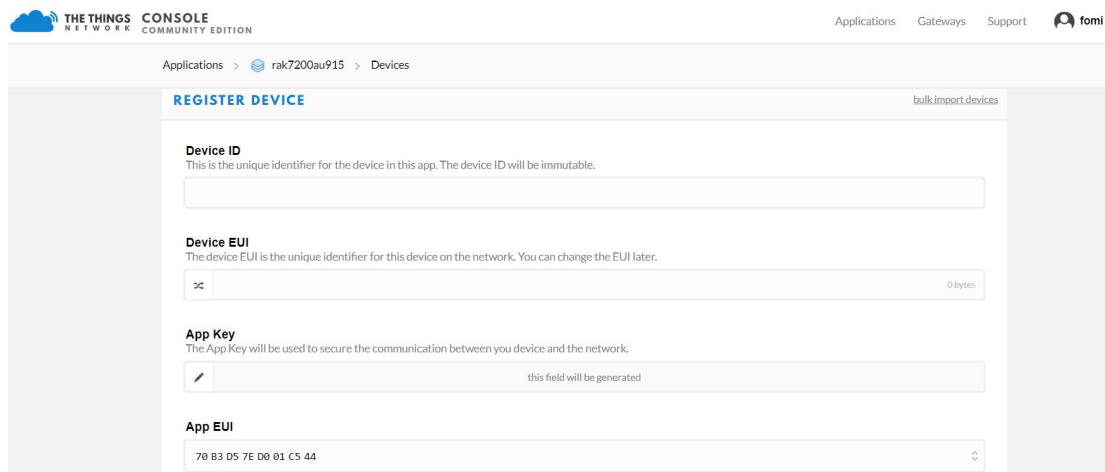
Then press the “Add application” button at the bottom of this page, and you can see the following page:



At the middle of this page, you can find the box named “DEVICES”:



Just “register device”:



You can click the following icon and “Device EUI” will be generated automatically in the next step:

THE THINGS NETWORK CONSOLE COMMUNITY EDITION

Applications > rak7200au915 > 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.
353730345a377e11

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

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

App EUI
70 B3 D5 7E D0 01 C5 44

The following picture shows the final page:

THE THINGS NETWORK CONSOLE COMMUNITY EDITION

Applications > rak7200au915 > 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.
353730345a377e11

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

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

App EUI
70 B3 D5 7E D0 01 C5 44

Cancel [Register](#)

Then press the “Register” button at the bottom of this page to finish.

THE THINGS NETWORK CONSOLE COMMUNITY EDITION

Applications > rak7200au915 > Devices > 353730345a377e11

[Overview](#) [Data](#) [Settings](#)

DEVICE OVERVIEW

Application ID **rak7200au915**

Device ID 353730345a377e11

Activation Method **OTAA**

Device EUI

Application EUI

App Key

Status ● never seen

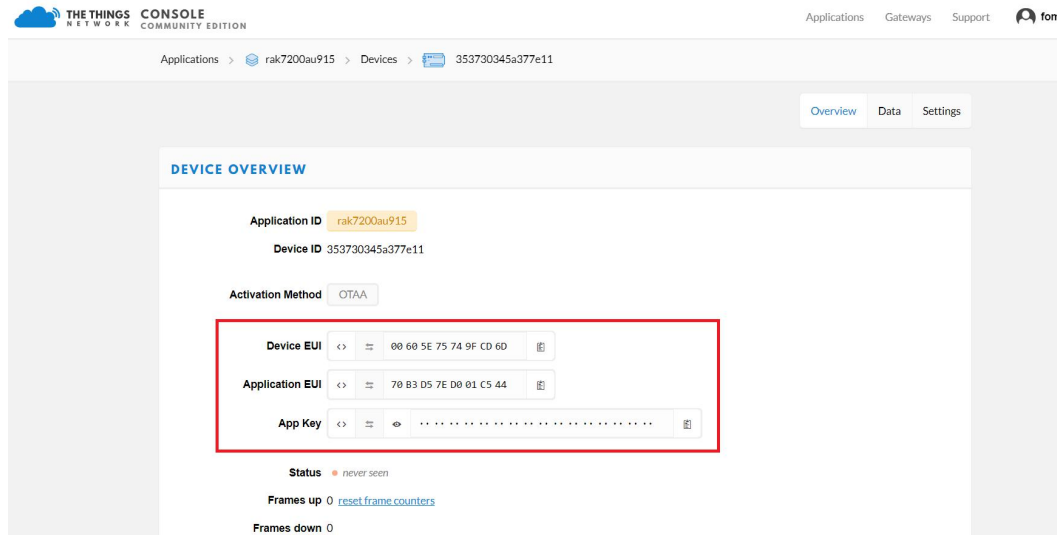
Frames up 0 [reset frame counters](#)

Frames down 0

4.1 Join in OTAA mode

As you see in the above page, the default activation method is OTAA.

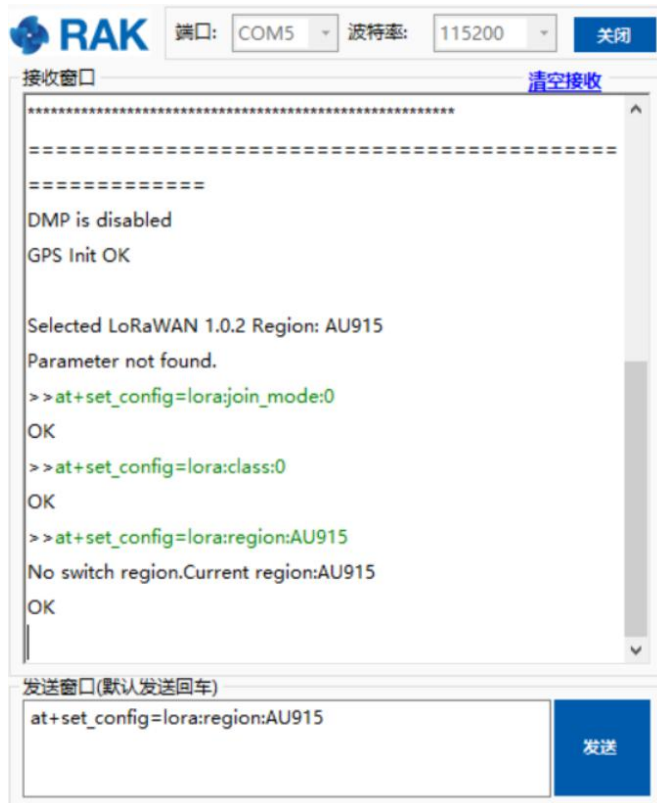
These three parameters will be used on RAK7200:



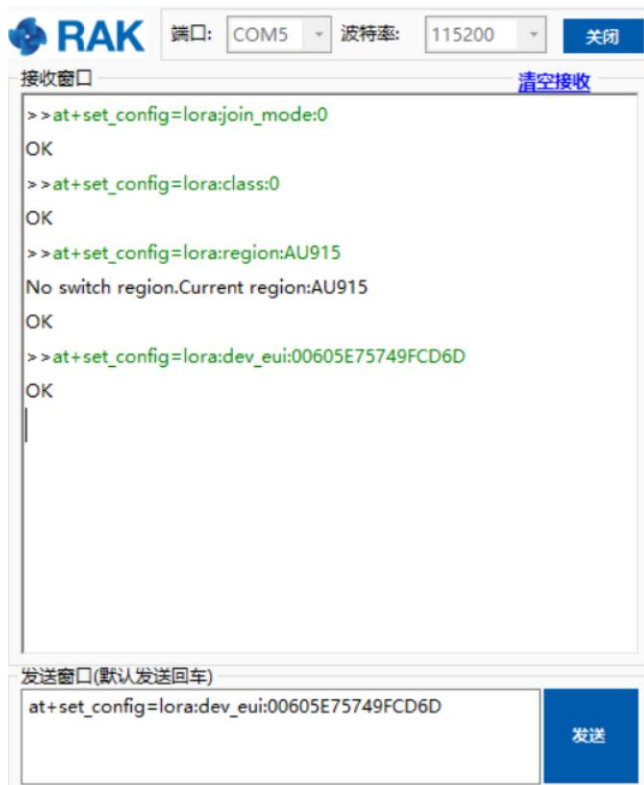
OK! Now, let's join in OTAA mode and AU915 frequency for example!

The default LoRa work mode is LoRaWAN 1.0.2, the default LoRa join mode is OTAA, and the default LoRa class is Class A.


Set the frequency/region to AU915:



Set the Device EUI:



Set the Application EUI:



端口: COM5
 波特率: 115200
 关闭

接收窗口

清空接收

```

>>at+set_config=lora:join_mode:0
OK
>>at+set_config=lora:class:0
OK
>>at+set_config=lora:region:AU915
No switch region.Current region:AU915
OK
>>at+set_config=lora:dev_eui:00605E75749FCD6D
OK
>>at+set_config=lora:app_eui:70B3D57ED001C544
OK

```

发送窗口(默认发送回车)

at+set_config=lora:app_eui:70B3D57ED001C544

发送

Set the Application Key:



端口: COM5
 波特率: 115200
 关闭

接收窗口

清空接收

```

>>
at+set_config=lora:app_key:4E2003296FC5CD26F46E940A6DAFA9D1
OK

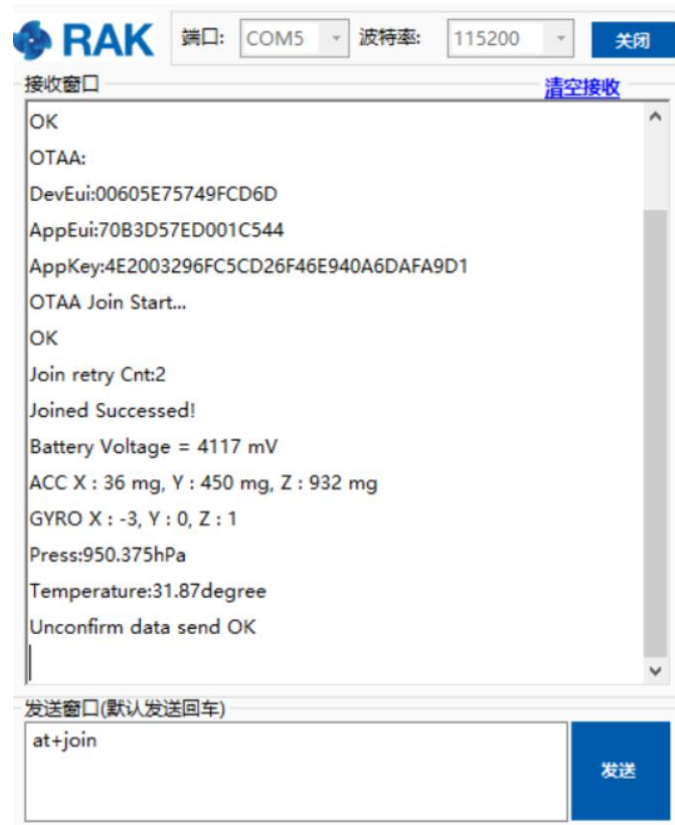
```

发送窗口(默认发送回车)

at
+set_config=lora:app_key:4E2003296FC5CD26F46E940A6DAFA9D1

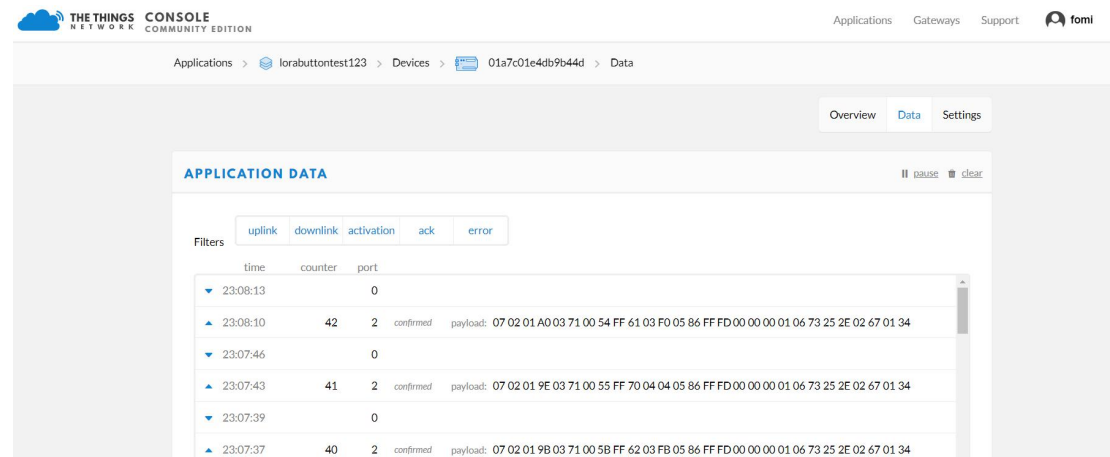
发送

Join in OTAA mode:



Join successfully! You can see that RAK7200 is sending data frequently.

Now, you can see the sensor data send from RAK7200 on TTN website as follow:



Great! That's all about OTAA mode.

4.2 Join in ABP mode

(to add)

5. How to connect with LoRaServer?

The LoRaServer is an open source project which you can find in <https://www.loraserver.io/>.

You can use RAK7200 to connect with LoRaServer according to the following steps:

In this document, i assume that you are using RAK LoRa gateway and its built-in LoRaServer, or you are using RAK cloud testing LoRaServer. But if you are using a LoRaServer which is built by yourself, maybe you need to configure it by yourself too.

OK! Let's get start!

Open the web page of the LoRaServer which you want to connect with and login.

By default, there is already one or more items in this page, you can use it or create a new item. Now, let's create a new item by click the "CREATE" button, and fill in them.

Applications / Create

Application name*
RAK7200_test
The name may only contain words, numbers and dashes.

Application description*
This application is used to test RAK7200

Service-profile*
ServiceProfileModel
The service profile to which this application will be attached. Note that you can't change this value after the application has been created.

Payload codec
Cayenne LPP
By defining a payload codec, LoRa App Server can encode and decode the binary device payload for you.

[CREATE APPLICATION](#)

“CREATE APPLICATION”.

Applications [+ CREATE](#)

ID	Name	Service-profile	Description
1	AppModel	ServiceProfileModel	AppModel
2	RAK7200_test	ServiceProfileModel	This application is used to test RAK7200

Rows per page: 10 ▾ 1-2 of 2 < >

Click the new item name “RAK7200_test”:

Applications / RAK7200_test [DELETE](#)

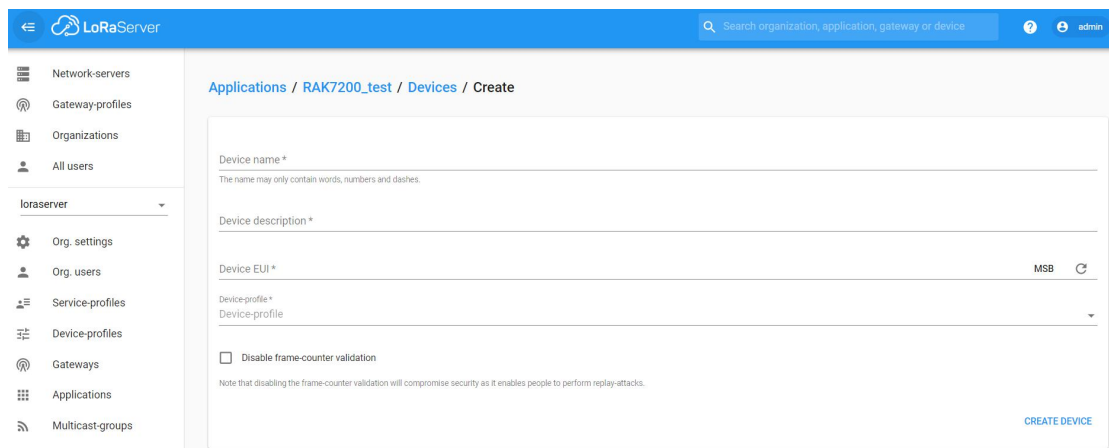
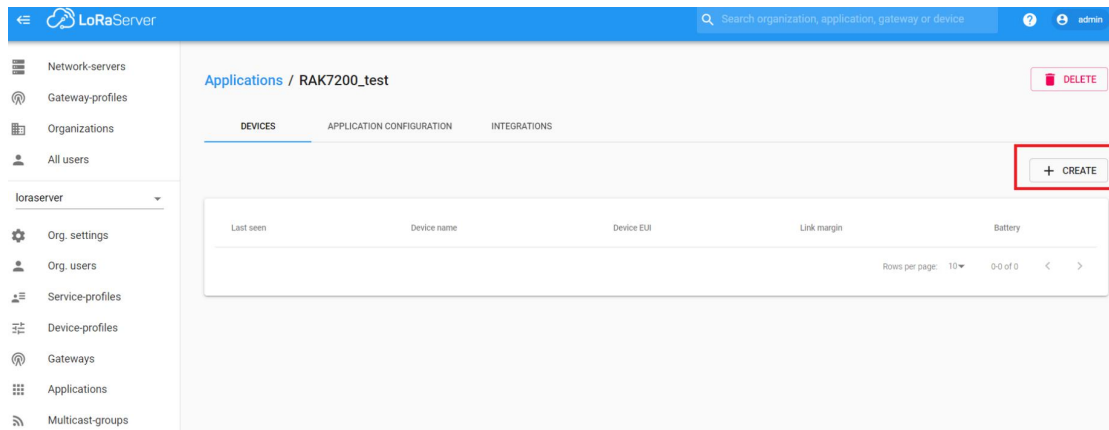
DEVICES APPLICATION CONFIGURATION INTEGRATIONS

[+ CREATE](#)

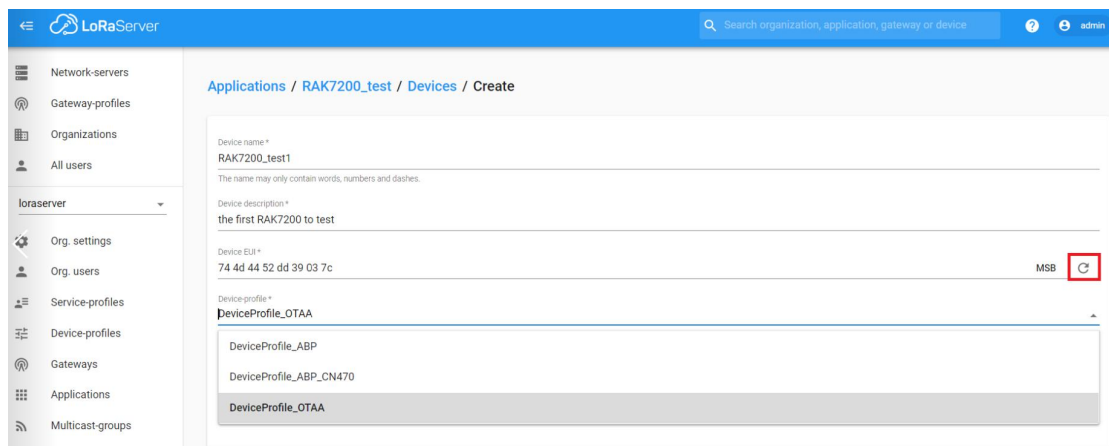
Last seen	Device name	Device EUI	Link margin	Battery
-----------	-------------	------------	-------------	---------

Rows per page: 10 ▾ 0-0 of 0 < >

Add a LoRa node device into LoRaServer by clicking the “CREATE” button:



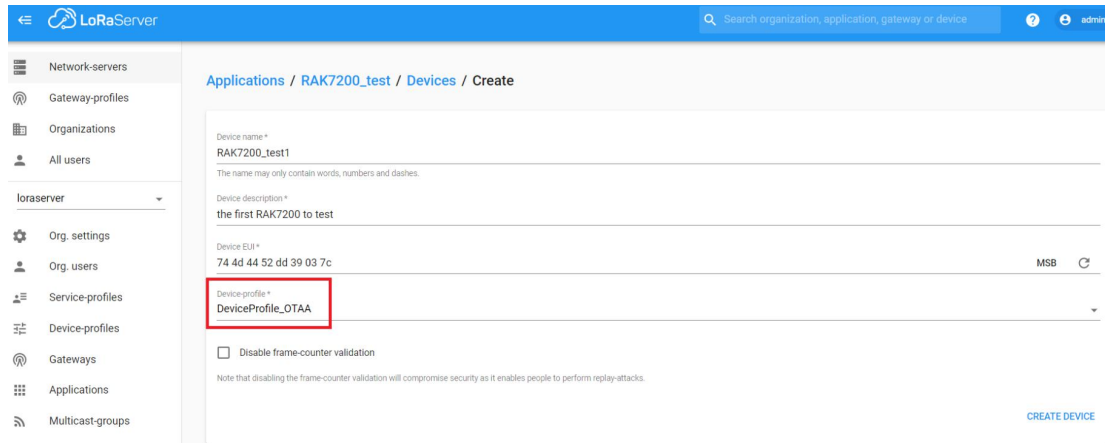
Fill in them. You can generate a Device EUI automatically by click the following icon, or you can write a correct Device EUI in the edit box.



Note: If you want to join in OTAA mode, you should select “**DeviceProfile_OTAA**” in the “Device-profile” item. If you want to join in ABP mode and CN470 frequency, you should select “**DeviceProfile_ABP_CN470**” in the “Device-profile” item. If you want to join in ABP mode and other frequencies except AS923 and CN470, you should select “**DeviceProfile_ABP**” in the “Device-profile” item. What about AS923 in ABP mode? Sorry! LoRaServer can not support it now.

5.1 Join in OTAA mode

If you select “DeviceProfile_OTAA”, it means you want to join LoRaServer in OTAA mode.

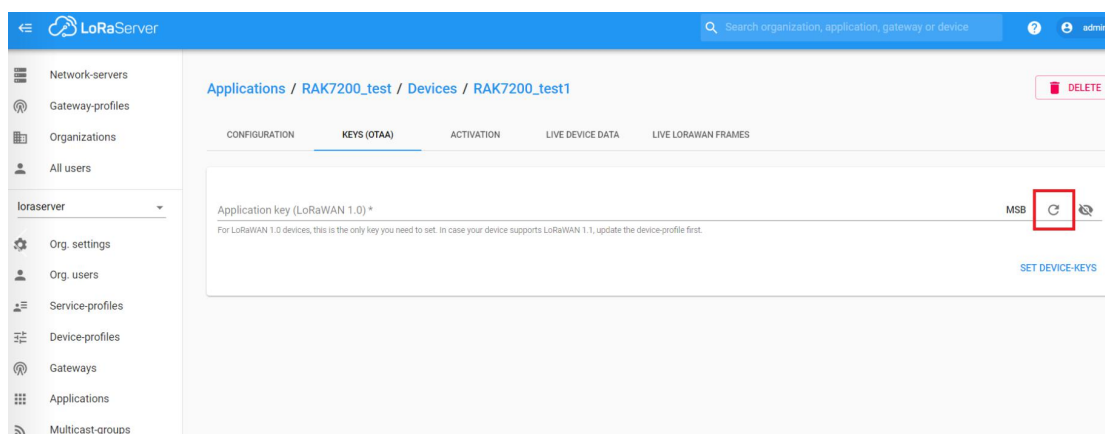


The screenshot shows the 'Create Device' page in the LoRaServer interface. The breadcrumb trail is 'Applications / RAK7200_test / Devices / Create'. The form contains the following fields:

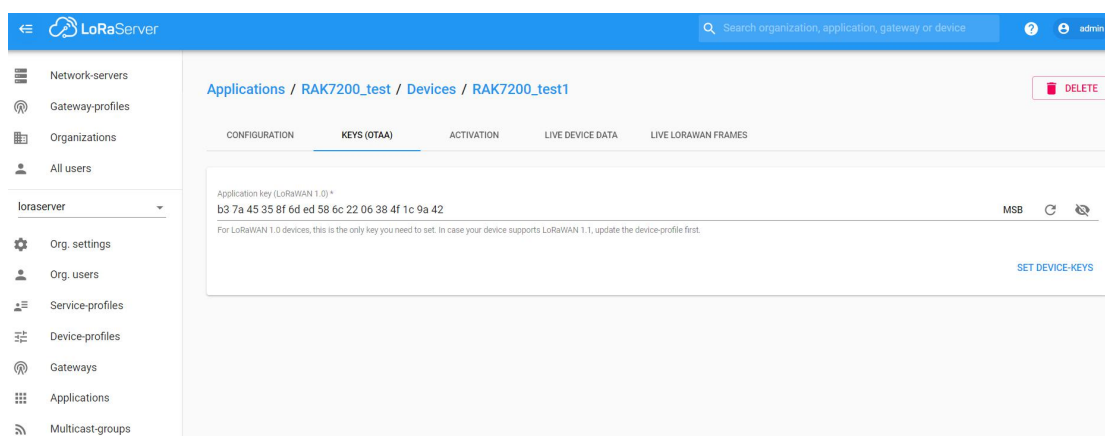
- Device name ***: RAK7200_test1
- Device description ***: the first RAK7200 to test
- Device EUI ***: 74 4d 44 52 dd 39 03 7c
- Device-profile ***: DeviceProfile_OTAA (highlighted with a red box)
- Disable frame-counter validation**: ☐ (unchecked)

A 'CREATE DEVICE' button is located at the bottom right of the form.

“CREATE DEVICE”. Then generate the application key in this page. You can write it by yourself or generate it automatically by clicking the following icon:



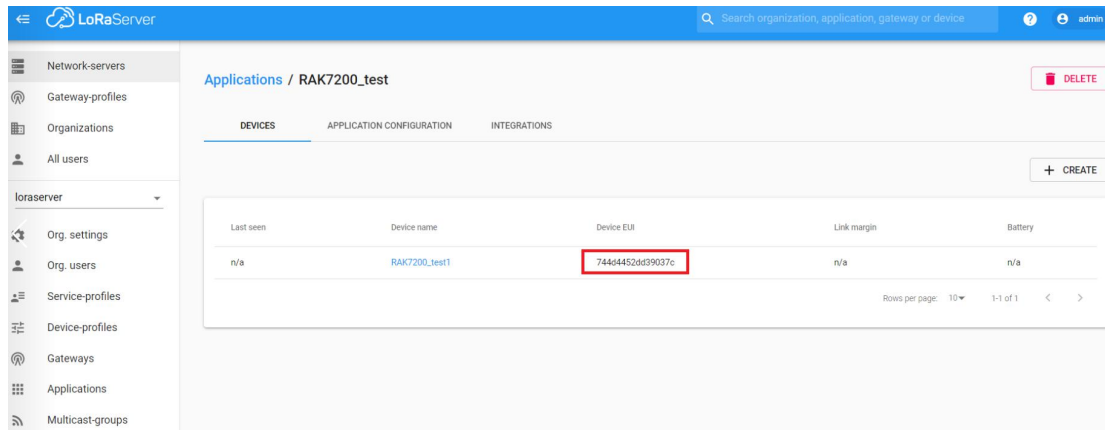
The screenshot shows the 'KEYS (OTAA)' tab for the device 'RAK7200_test1'. The breadcrumb trail is 'Applications / RAK7200_test / Devices / RAK7200_test1'. The 'Application key (LoRaWAN 1.0) *' field is empty. To the right of the field is a 'Generate' icon (a circular arrow) which is highlighted with a red box. Below the field is a 'SET DEVICE-KEYS' button.



The screenshot shows the 'KEYS (OTAA)' tab for the device 'RAK7200_test1'. The 'Application key (LoRaWAN 1.0) *' field now contains the value 'b3 7a 45 35 8f 6d ed 58 6c 22 06 38 4f 1c 9a 42'. The 'Generate' icon is no longer highlighted. The 'SET DEVICE-KEYS' button is still present at the bottom right.

“SET DEVICE-KEYS”. That’s OK! You’ve complete the configuration on LoRaServer.

As you see, the Device EUI which will be set into RAK7200 as “dev_eui” is this one:



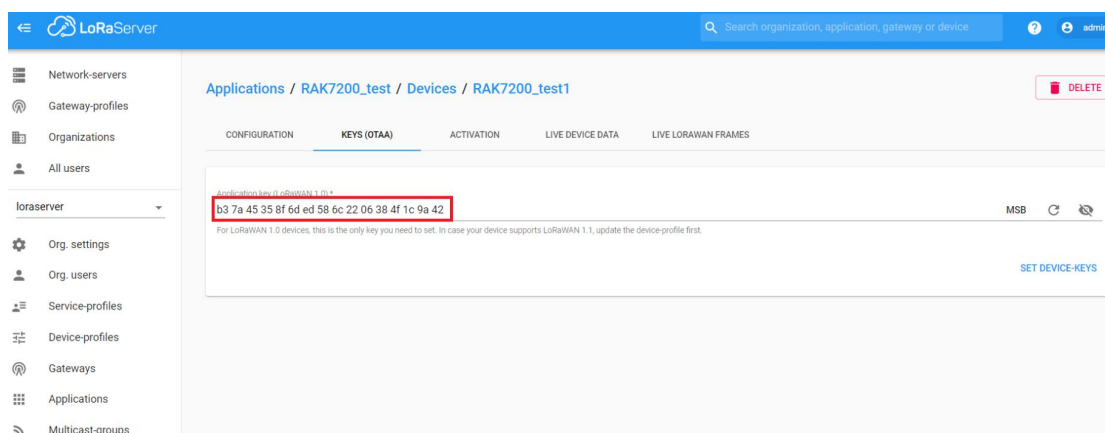
Applications / RAK7200_test

DEVICES APPLICATION CONFIGURATION INTEGRATIONS

Last seen	Device name	Device EUI	Link margin	Battery
n/a	RAK7200_test1	74404452d9d9537c	n/a	n/a

Rows per page: 10 1-1 of 1

The Application Key which will be set into RAK7200 as “app_key” is this one:



Applications / RAK7200_test / Devices / RAK7200_test1

CONFIGURATION KEYS (OTAA) ACTIVATION LIVE DEVICE DATA LIVE LORAWAN FRAMES

b3 7a 45 35 8f 6d ed 58 6c 22 06 38 4f 1c 9a 42

For LoRaWAN 1.0 devices, this is the only key you need to set. In case your device supports LoRaWAN 1.1, update the device-profile first.

SET DEVICE-KEYS

The Application EUI which will be set into RAK7200 as “app_eui” is useless for LoRaServer, and you can set it to any value with a correct format, for example: 7083D57ED001C1CF.

Next, let's configure RAK7200 by using AT command.

Connect your RAK7200 with a PC, power on and open RAK Serial Port Tool.

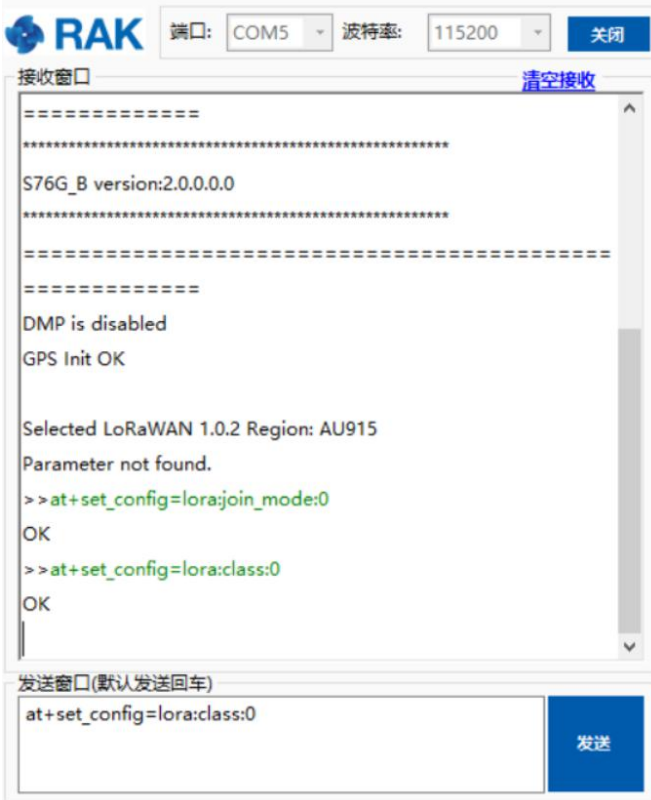


The default LoRa work mode is LoRaWAN 1.0.2.

Set the LoRa join mode to OTAA:



Set the LoRa class to Class A:



端口: COM5 波特率: 115200 关闭

接收窗口 清空接收

```

=====
*****
S76G_B version:2.0.0.0.0
*****
=====
=====
DMP is disabled
GPS Init OK

Selected LoRaWAN 1.0.2 Region: AU915
Parameter not found.
>>at+set_config=lora:join_mode:0
OK
>>at+set_config=lora:class:0
OK
  
```

发送窗口(默认发送回车)

```
at+set_config=lora:class:0
```

发送

Set the frequency/region to AU915:



端口: COM5 波特率: 115200 关闭

接收窗口 清空接收

```

=====
*****
DMP is disabled
GPS Init OK

Selected LoRaWAN 1.0.2 Region: AU915
Parameter not found.
>>at+set_config=lora:join_mode:0
OK
>>at+set_config=lora:class:0
OK
>>at+set_config=lora:region:AU915
No switch region.Current region:AU915
OK
  
```

发送窗口(默认发送回车)

```
at+set_config=lora:region:AU915
```

发送

Set “dev_eui”:




The screenshot shows the RAK terminal application. At the top, there is a header bar with the RAK logo, a dropdown menu for the port (COM5), a dropdown menu for the baud rate (115200), and a '关闭' (Close) button. Below the header, there is a '接收窗口' (Receive Window) and a '发送窗口(默认发送回车)' (Send Window (Default Send Enter)) section. The '接收窗口' contains the command '>>at+set_config=lora:dev_eui:744d4452dd39037c' and the response 'OK'. The '发送窗口' contains the command 'at+set_config=lora:dev_eui:744d4452dd39037c' and a '发送' (Send) button.

Set “app_eui”:



The screenshot shows the RAK terminal application. At the top, there is a header bar with the RAK logo, a dropdown menu for the port (COM5), a dropdown menu for the baud rate (115200), and a '关闭' (Close) button. Below the header, there is a '接收窗口' (Receive Window) and a '发送窗口(默认发送回车)' (Send Window (Default Send Enter)) section. The '接收窗口' contains the command '>>at+set_config=lora:dev_eui:744d4452dd39037c' and the response 'OK', followed by the command '>>at+set_config=lora:app_eui:7083D57ED001C1CF' and the response 'OK'. The '发送窗口' contains the command 'at+set_config=lora:app_eui:7083D57ED001C1CF' and a '发送' (Send) button.

Set "app_key":



RAK 端口: COM5 波特率: 115200 关闭

接收窗口 [清空接收](#)

```
> at+set_config=lora:app_key:b37a45358f6ded586c2206384f1c9a42
OK
```

发送窗口(默认发送回车)

```
at
+set_config=lora:app_key:b37a45358f6ded586c2206384f1c9a42
```

发送

Start to join:



RAK 端口: COM5 波特率: 115200 关闭

接收窗口 [清空接收](#)

```
DevEui:744D4452DD39037C
AppEui:7083D57ED001C1CF
AppKey:B37A45358F6DED586C2206384F1C9A42
OTAA Join Start...
OK
Join retry Cnt:1
Joined Succeeded!
Start Search Satellite ...
FAIL.The Satellite signal not found!
Battery Voltage = 3807 mV
ACC X : 15 mg, Y : -492 mg, Z : 866 mg
GYRO X : -3, Y : 0, Z : 2
Press:951.238hPa
Temperature:32.70degree
Unconfirm data send OK
```

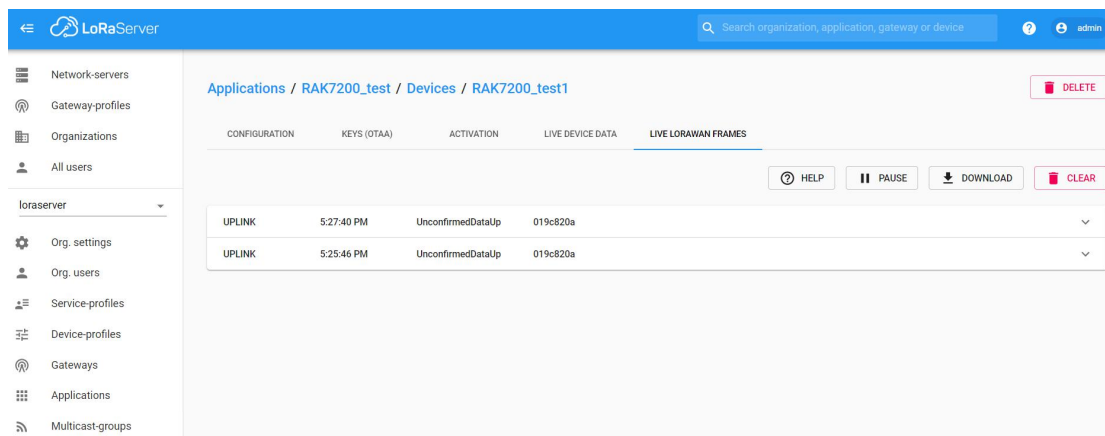
发送窗口(默认发送回车)

```
at+join
```

发送

Join successfully!

You can see the data which RAK7200 sends on LoRaServer page:



The screenshot shows the LoRaServer web interface. On the left is a sidebar with navigation links: Network-servers, Gateway-profiles, Organizations, All users, loraserver (selected), Org. settings, Org. users, Service-profiles, Device-profiles, Gateways, Applications, and Multicast-groups. The main content area is titled 'Applications / RAK7200_test / Devices / RAK7200_test1'. Below this are tabs for CONFIGURATION, KEYS (OTAA), ACTIVATION, LIVE DEVICE DATA, and LIVE LORAWAN FRAMES (which is active). In the LIVE LORAWAN FRAMES tab, there are buttons for HELP, PAUSE, DOWNLOAD, and CLEAR. A table shows the received frames:

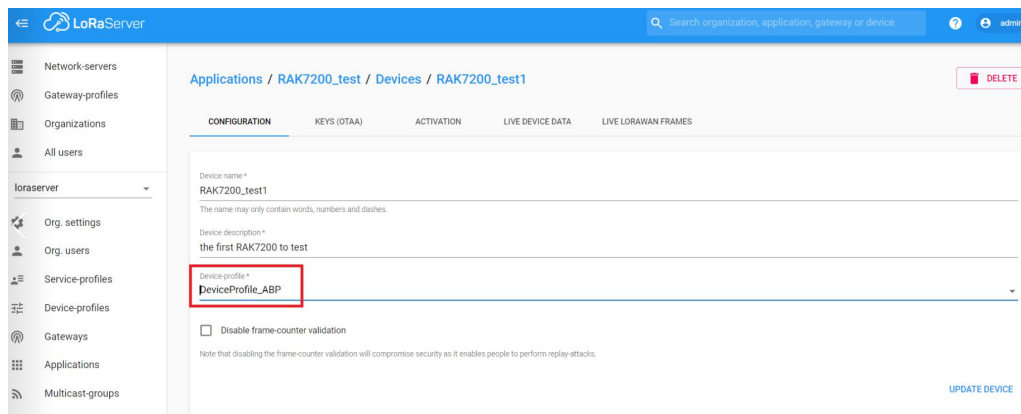
Direction	Time	Data	Port
UPLINK	5:27:40 PM	UnconfirmedDataUp	019c820a
UPLINK	5:25:46 PM	UnconfirmedDataUp	019c820a

The data format is LPP.

OK, that's all about "Join in OTAA mode" with LoRaServer.

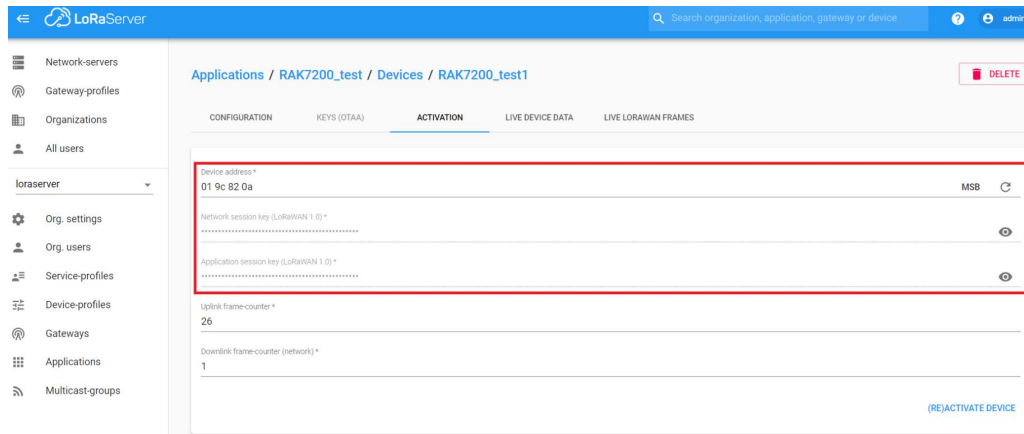
5.2 Join in ABP mode

If you select "DeviceProfile_ABP" or "DeviceProfile_ABP_CN470", it means you want to join LoRaServer in OTAA mode.



The screenshot shows the LoRaServer web interface for the 'CONFIGURATION' tab of device RAK7200_test1. The configuration fields are: Device name (RAK7200_test1), Device description (the first RAK7200 to test), and Device-profile (DeviceProfile_ABP, which is highlighted with a red box). There is a checkbox for 'Disable frame-counter validation' which is currently unchecked. A note below states: 'Note that disabling the frame-counter validation will compromise security as it enables people to perform replay-attacks.' An 'UPDATE DEVICE' button is at the bottom right.

Then you can see that there are some parameters for ABP in the "ACTIVATION" item:

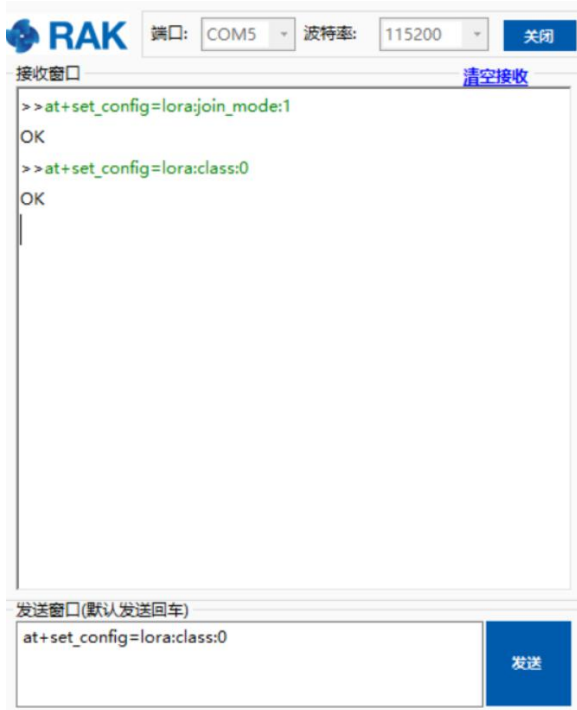


Next, let's use these parameters to set RAK7200 by using AT command.

Set LoRa join mode to ABP:



Set LoRa class to Class A:



端口: COM5 波特率: 115200 关闭

接收窗口 清空接收

```

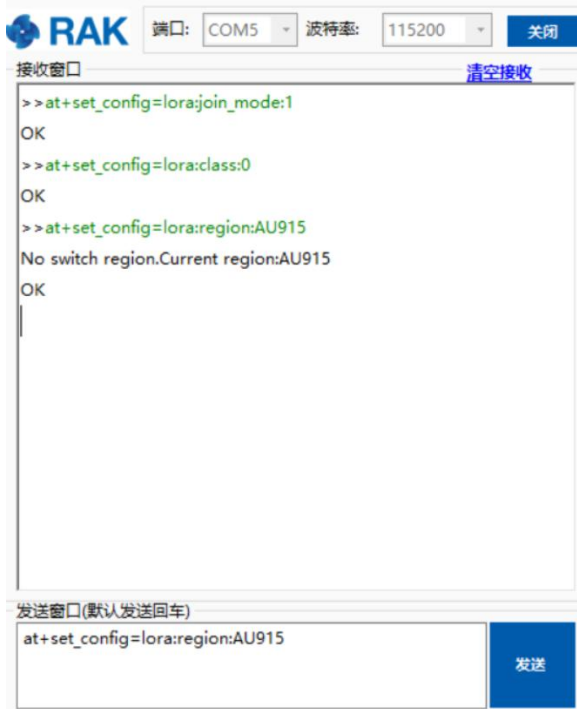
>>at+set_config=lora:join_mode:1
OK
>>at+set_config=lora:class:0
OK
  
```

发送窗口(默认发送回车)

```
at+set_config=lora:class:0
```

发送

Set the frequency/region to AU915:



端口: COM5 波特率: 115200 关闭

接收窗口 清空接收

```


>>at+set_config=lora:join_mode:1
OK
>>at+set_config=lora:class:0
OK
>>at+set_config=lora:region:AU915
No switch region.Current region:AU915
OK
  
```

发送窗口(默认发送回车)

```
at+set_config=lora:region:AU915
```

发送

Set "dev_addr":



端口:

COM5

波特率:

115200

关闭

接收窗口 [清空接收](#)

```

>>at+set_config=lora:join_mode:1
OK
>>at+set_config=lora:class:0
OK
>>at+set_config=lora:region:AU915
No switch region.Current region:AU915
OK
>>at+set_config=lora:dev_addr:019c820a
OK
    
```

发送窗口(默认发送回车)

at+set_config=lora:dev_addr:019c820a

发送

Set “nwks_key”:



端口:

COM5

波特率:

115200

关闭

接收窗口 [清空接收](#)

```

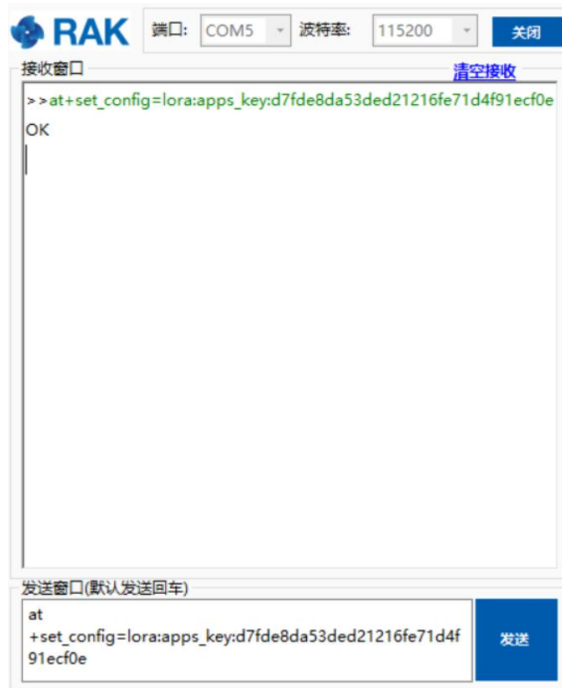
>>at+set_config=lora:join_mode:1
OK
>>at+set_config=lora:class:0
OK
>>at+set_config=lora:region:AU915
No switch region.Current region:AU915
OK
>>at+set_config=lora:dev_addr:019c820a
OK
>>
at+set_config=lora:nwks_key:34fb174daa6dc34733495f73bd2b1ba1
OK
    
```

发送窗口(默认发送回车)

at+set_config=lora:nwks_key:34fb174daa6dc34733495f73bd2b1ba1

发送

Set “apps_key”:



Start to join:



Great! Join and send data successfully!

You can see the data which is just sent from RAK7200 on LoRaServer page:

LoRaServer

Search organization, application, gateway or device

admin

Network-servers

Gateway-profiles

Organizations

All users

loraserver

Org. settings

Org. users

Service-profiles

Device-profiles

Gateways

Applications

Multicast-groups

Applications / RAK7200_test / Devices / RAK7200_test1

DELETE

CONFIGURATIONKEYS (OTAA)ACTIVATIONLIVE DEVICE DATALIVE LORAWAN FRAMES

HELPPAUSEDOWNLOADCLEAR

UPLINK	5:59:03 PM	UnconfirmedDataUp	019c820a	
UPLINK	5:58:13 PM	UnconfirmedDataUp	019c820a	

That’s all about “Join in ABP mode” with LoRAServer.

6. Revision History

Revision	Description	Date
1.0	Initial version	2019-07-16

7. Document Summary

Prepared by	Checked by	Approved by
Fomi	Penn&Fomi	



About RAKwireless:

RAKwireless is the pioneer in providing innovative and diverse cellular and LoRa connectivity solutions for IoT edge devices. It's easy and modular design can be used in different IoT applications and accelerate time-to-market.

For more information, please visit RAKwireless website at www.rakwireless.com.