# **RAK3272S Quick Start Guide**

This guide covers the following topics:

- RAK3272S Breakout Board as a Stand-Alone Device Using RUI3
- RAK3272S Breakout Board as a LoRa/LoRaWAN Modem via AT Command
- Connecting to The Things Network (TTN)
- Connecting with Chirpstack
- LoRa P2P Mode

# Prerequisites

## What Do You Need?

Before going through the step in the installation guide of the RAK3272S Breakout Board, make sure to prepare the necessary items listed below:

## Hardware

- RAK3272S Breakout Board
- RAKDAP1 Flash and Debug Tool 🗹 (or any USB-Serial Adapter)
- Windows/Mac OS/Linux Computer with USB port

### Software

• Download and install the Arduino  $\mathsf{IDE}\, \square$  .

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*If you are using Windows 10*. Do *NOT* install the Arduino IDE from the Microsoft App Store. Instead, install the original Arduino IDE from the Arduino official website. The Arduino app from the Microsoft App Store has problems using third-party Board Support Packages.

- Add RAK3272S as a supported board in Arduino IDE by updating Board Manager URLs in Preferences settings of Arduino IDE with this JSON URL
   https://raw.githubusercontent.com/RAKWireless/RAKwireless-Arduino-BSP Index/main/package\_rakwireless.com\_rui\_index.json
   After that, you can then add RAKwireless RUI STM32 Boards via Arduino board manager.
- RAK Serial Port Tool
   Z

## **List of Acronyms**

Acronym	Definition
DFU	Device Firmware Upgrade
JTAG	Joint Test Action Group
LoRa	Long Range
ΟΤΑΑ	Over-The-Air-Activation
ABP	Activation-By-Personalization (ABP)
TTN	The Things Network
DEVEUI	Device EUI (Extended Unique Identification)
APPEUI	Application EUI (Extended Unique Identification)
APPKEY	Application Key
DEVADDR	Device Address
NWKSKEY	Network Session Key
APPSKEY	Application Session Key
P2P	Point-to-Point

# **Product Configuration**

# RAK3272S Breakout Board as a Stand-Alone Device Using RUI3

## **Hardware Setup**

The RAK3272S requires a few hardware connections before you can make it work. The bare minimum requirement is to have the power section properly configured, reset button, antenna, and USB connection.

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Firmware update is done via UART2 pins. If you will connect the module to an external device that will be interfacing with UART2, take extra precaution in your board design to ensure you can still perform FW update to it. There should be a way in your board design that can disconnect the external device to RAK3272S breakout board UART2 before connecting the module to the PC (via USB-UART converter) for the FW update process.

An alternative option to update firmware aside from UART2 is to use SWD pins (SWCLK & SWDIO). This method will require you to use external tools like ST-LINK or RAKDAP1.

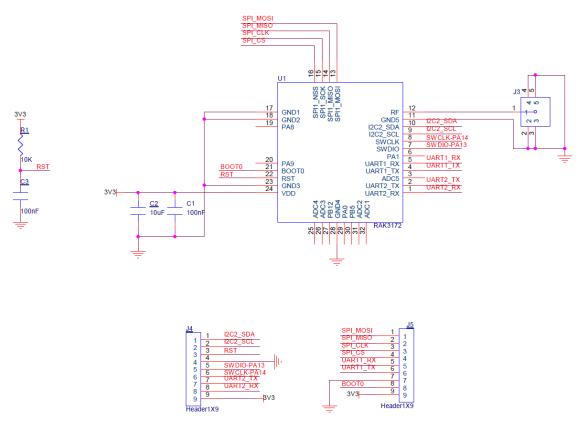


Figure 1: RAK3272S Schematic

Ensure that the antenna 🖾 is properly connected to have a good LoRa signal. Also, note that you can damage the RF section of the chip if you power the module without an antenna connected to the RP-SMA connector.



Figure 2: LoRa Antenna

RAK3272S has RP-SMA connector compatible to the included LoRa antenna, as shown in Figure 3.

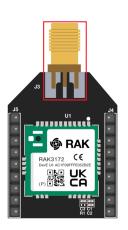


Figure 3: RP-SMA Connector of RAK3272S for LoRa Antenna

#### 📝 NOTE

Detailed information about the RAK3272S LoRa antenna can be found on the antenna datasheet  $\square$ .

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When using the LoRa transceiver, make sure that an antenna is always connected. Using this transceiver without an antenna can damage the module.

### **Software Setup**

The default firmware of RAK3272S is based on RUI3, which allows you to develop your custom firmware to connect sensors and other peripherals to it. To develop your custom firmware using Arduino IDE, first, you need to add **RAKwireless RUI STM32 Boards** in the Arduino board manager, which will be discussed in this guide. You can then use RUI3 APIs for your intended application and upload also the custom firmware via UART. The AT commands of RAK3272S is still available even if you compile custom firmware via RUI3. You can send AT commands via UART2 connection.

### **RAK3272S RUI3 Board Support Package in Arduino IDE**

If you don't have an Arduino IDE yet, you can download it on the Arduino official website 🖸 and follow the installation procedure in the miscellaneous section of this document.

#### **NOTE**

**For Windows 10 and up users**: If your Arduino IDE is installed from the Microsoft App Store, you need to reinstall your Arduino IDE by getting it from the Arduino official website. The Arduino app from the Microsoft App Store has problems using third-party Board Support Packages.

Once the Arduino IDE has been installed successfully, you can now configure the IDE to add the RAK3272S in its board selection by following these steps.

1. Open Arduino IDE and go to File > Preferences.

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Figure 4: Arduino preferences

2. To add the RAK3272S to your Arduino Boards list, edit the **Additional Board Manager URLs** and click the icon, as shown in **Figure 5**.

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Figure 5: Modifying Additional Board Manager URLs

3. Copy the URL https://raw.githubusercontent.com/RAKWireless/RAKwireless-Arduino-BSP-Index/main/package\_rakwireless.com\_rui\_index.json and paste it on the field, as shown in **Figure 6**. If there are other URLs already there, just add them on the next line. After adding the URL, click **OK**.

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Figure 6: Add additional board manager URLs

- 4. Restart the Arduino IDE.
- 5. Open the Boards Manager from Tools Menu.

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Figure 7: Opening Arduino boards manager

Write RAK in the search bar, as shown in Figure 8. This will show the available RAKwireless module boards that you can add to your Arduino Board list. Select and install the latest version of the RAKwireless RUI STM32 Boards.

	$\times$
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Figure 8: Installing RAKwireless RUI STM32 boards

7. Once the BSP is installed, select **Tools > Boards Manager > RAKWireless RUI STM32 Modules > WisDuo RAK3172 Evaluation Board**. The RAK3272S Breakout Board uses RAK3172 WisDuo module.

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Figure 9: Selecting WisDuo RAK3172 Evaluation Board

## **Compile an Example with Arduino Serial**

1. After completing the steps on adding your RAK3272S to the Arduino IDE, you can now try to run a simple program to test your setup. You need to add a USB connection to the schematic of the RAK3272S breakout board, as shown in **Figure 10**.

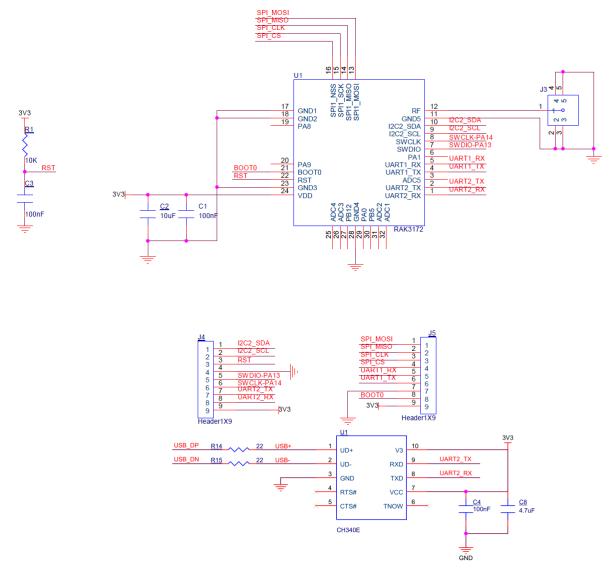


Figure 10: RAK3272S with USB to Serial Schematic

2. Connect the RAK3272S via UART and check RAK3272S COM Port using Windows **Device Manager**. Doubleclick the reset button if the module is not detected.

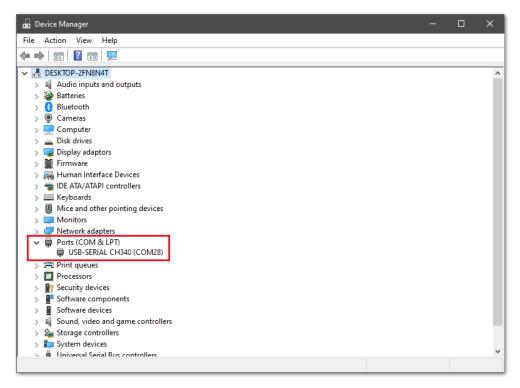


Figure 11: Device manager ports (COM & LPT)

 Choose RAK3272S on board selection select via Tools > Boards Manager > RAKWireless RUI STM32 Modules > WisDuo RAK3172 Evaluation Board.

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Figure 12: Selecting RAK3272S Breakout Board

4. Open the **Tools** menu and select a COM port. **COM28** is currently used.

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Figure 13: Select COM port

5. You can see the serial monitor icon and click it to connect COM port.

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Figure 14: Open Arduino serial monitor

6. If the connection is successful, you can send AT Commands to RAK3272S. For example: To check the RUI version, type AT+VER=? on the text area, then click on the **Send** button, as shown in **Figure 15**.

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#### Figure 15: Send AT command

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Figure 16: Arduino serial monitor COM28

7. Open the Arduino\_Serial example code.

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		Firmata >		LoRaWan_Info			1
		LiquidCrystal >		LoRaWan_Multicast			1
		SD >		LoRaWan_OTAA			1
		Servo >		LoRaWan_P2P			1
		Stepper >		RAK4631			1
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Figure 17: Arduino Serial example

8. Click on the **Verify** icon to check if you have successfully compiled the example code.

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Arduino Serial			
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void setup()			
{			
// initialize serial communication at ll5200 bits per second, and use the AT mode			
Serial.begin(115200, RAK_AT_MODE);			
// initialize serial communication at 115200 bits per second, and use the custom mode			
Serial1.begin (115200, RAK_CUSTOM_MODE);			
<pre>Serial.println("RAKwireless Arduino Serial Example");</pre>			
Serial.println("");			
delay (3000);			
Serial.print("Current time out: ");			
<pre>Serial1.println(Serial.getTimeout()); // get Serial timeout</pre>			
Serial1.println("Set Timeout to 5000");			
<pre>Seriall.setTimeout(5000); // set the Serial timeout to 5 seconds</pre>			
<pre>Serial.print("Current time out: ");</pre>			
Seriall.println(Serial.getTimeout()); // get Serial timeout after changed			
}			
void loop()			
(			
String returnString = " ";			
// reply only when receive data on Serial port			
<pre>Serial1.println("Please type any words in 5 seconds");</pre>			
returnString = Seriall.readStringUntil('\r'); // Read the string until the end of enter			
if (returnString == " ")			
Serial1.println("read nothing");			
else (			~
WisDus	RAK3172 Evaluation Board, Level 0 (	(Release) on 1	COM28



9. Click the Upload icon to send the compiled firmware to your RAK3272S.

#### VOTE:

RAK3272S should automatically go to BOOT mode when the firmware is uploaded via RAK DFU Tool or WisToolBox.

If BOOT mode is not initiated, you can manually send AT+BOOT command to start bootloader mode.

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// initialize serial communication at 115200 bits per second, and use the custom mode			
Seriall.begin (115200, RAK CUSTOM MODE);			
Serial.println("RAKwireless Arduino Serial Example");			
Serial.println("");			
delay(3000);			
<pre>Serial1.print("Current time out: ");</pre>			
<pre>Serial1.println(Serial.getTimeout()); // get Serial timeout</pre>			
Serial1.println("Set Timeout to 5000");			
Serial1.setTimeout(5000); // set the Serial timeout to 5 seconds			
<pre>Serial1.print("Current time out: ");</pre>			
<pre>Serial1.println(Serial.getTimeout()); // get Serial timeout after changed</pre>			
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// reply only when receive data on Serial port			
Serial1.println("Please type any words in 5 seconds");			
returnString = Serial1.readStringUntil('\r'); // Read the string until the end of enter			
if (returnString == " ")			
<pre>Serial.println("read nothing");</pre>			
else (			Y
			Ę
Wist	Duo RAK3172 Evaluation Board, Level 0 (Release)	) on COM28	



10. If the upload is successful, you will see the Device programmed message.

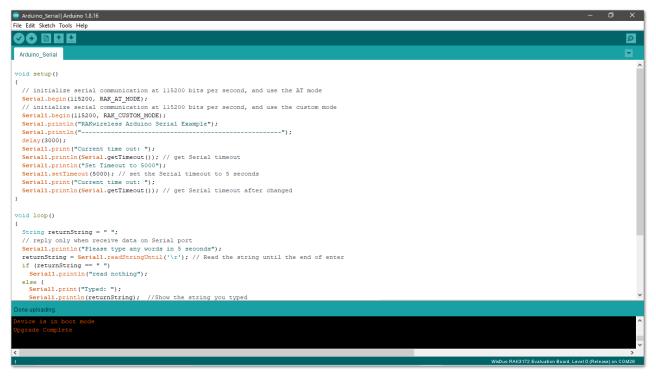


Figure 20: Device programmed successfully

11. After the Device Programmed is completed, you will see the working Arduino\_Serial example.

## RAK3272S Breakout Board as a LoRa/LoRaWAN Modem via AT Command

### **AT Command via UART2**

RAK3272S breakout board can be configured using AT commands via the UART2 interface. You need a USB to UART TTL adapter to connect the RAK3272S to your computer's USB port and a serial terminal tool. You can use the RAK Serial Port Tool C so you can easily send AT commands and view the replies from the console output. The RAK Serial Port Tool commands still uses the RUI V2 AT commands by default, you can modify it to have RUI3 AT commands and save.

#### **WARNING**

Firmware update and AT command functionality is done via UART2 pins. If you will connect the module to an external host MCU that will send AT commands via UART2, take extra precaution in your board design to ensure you can still perform FW update to it. There should be a way in your board design that can disconnect the host MCU UART to connect to RAK3272S UART2 before connecting the module to the PC (via USB-UART converter) for the FW update process.

An alternative option to update firmware aside from UART2 is to use SWD pins (SWCLK & SWDIO). This method will require you to use external tools like ST-LINK or RAKDAP1.

### **Connect to the RAK3272S Breakout Board**

1. Connect the RAK3272S to the serial port of a general-purpose computer (USB port) using a USB to UART TTL adapter like RAKDAP1<sup>C</sup>, as shown in **Figure 21**.

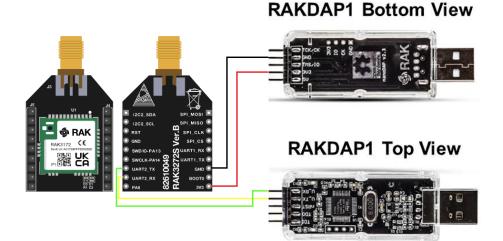


Figure 21: RAK3272S Breakout Board to USB-Serial Connection

- 2. Any serial communication tool can be used; but, it is recommended to use the RAK Serial Port Tool Z .
- 3. Configure the serial communication tool by selecting the proper port detected by the computer and configure the link as follows:
- Baud Rate: 115200 baud
- Data Bits: 8 bits
- Stop Bits: 1 stop bit
- Parity: NONE

### **RAK3272S I/O Pins and Peripherals**

This section discusses how to use and access RAK3272S peripherals pins using RUI3 APIs. It shows basic code on using Digital I/O Pins, UART, and I2C.

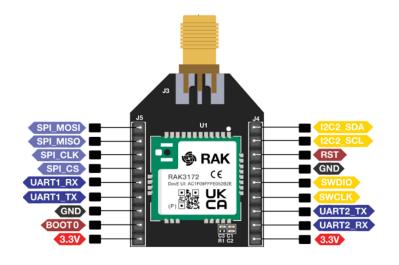


Figure 22: Available Peripheral pins in RAK3272S Breakout Board

### How to Use Digital I/O

You can use any of the pins below as Digital Pin:

Pin Name	J Connector pin
PA4	J5 pin 4
PA5	J5 pin 3
PA6	J5 pin 2
PA7	J5 pin 1
PA8	J4 pin 1
PA9	J4 pin 2
PB6	J5 pin 5
PB7	J5 pin 6

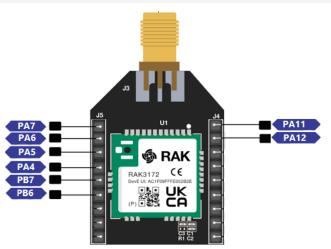


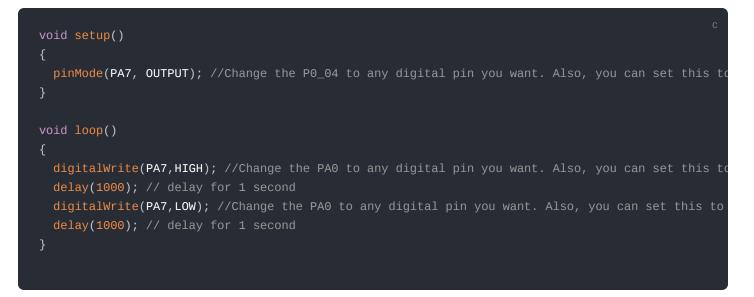
Figure 23: Available Digital I/O pins in RAK3172S

- Use Arduino digitalRead <sup>I</sup> to read the value from a specified Digital I/O pin, either HIGH or LOW.
- Use Arduino digitalWrite 🖆 to write a HIGH or a LOW value to a Digital I/O pin.

#### **NOTE**:

The GPIO Pin Name is the one to be used on the digitalRead and digitalWrite and NOT the pin numbers.

#### Example code



### How to Use Serial Interfaces

#### UART

There are two UART peripherals available on the RAK3272S. There are also different Serial Operating Modes possible in RUI3, namely Binary Mode ☐ , AT Mode ☐ , and Custom Mode ☐ .

Serial Port	UART pin number	Serial Instance Assignment	Default Mode
UART1_TX	J5 pin 6	Serial1	Custom Mode
UART1_RX	J5 pin 5	Serial1	Custom Mode
UART2_TX	J4 pin 7	Serial	AT Command
UART2_RX	J4 pin 8	Serial	AT Command

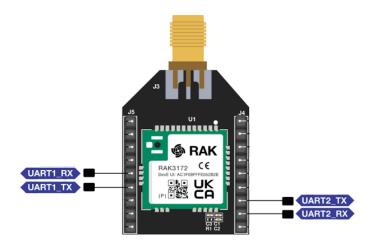
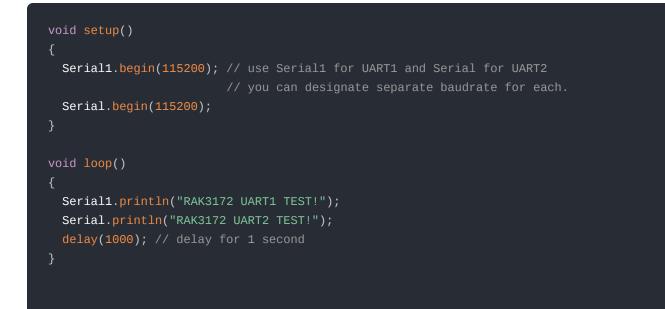


Figure 24: Available UART pins in RAK3272S



#### I2C

There is one I2C peripheral available on RAK3272S.

I2C Pin Number	I2C Pin Name
J4 pin 1	I2C2_SDA
J4 pin 2	I2C2_SCL

• Use Arduino Wire ☐ library to communicate with I2C devices.

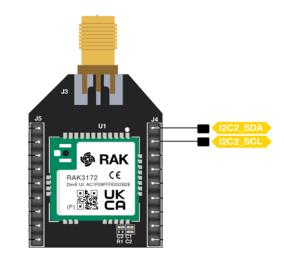


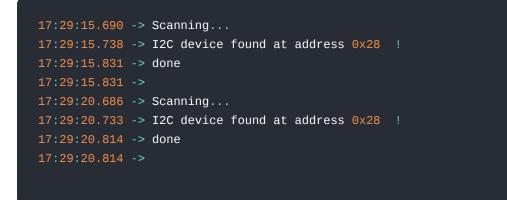
Figure 25: Available I2C pins in RAK3272S

#### **Example Code**

Make sure you have an I2C device connected to specified I2C pins to run the I2C scanner code below:

```
#include <Wire.h>
void setup()
 Wire.begin();
 Serial.begin(115200);
 while (!Serial);
 Serial.println("\nI2C Scanner");
void loop()
 byte error, address;
 int nDevices;
 Serial.println("Scanning...");
 nDevices = 0;
  for(address = 1; address < 127; address++ )</pre>
   // a device did acknowledge to the address.
   Wire.beginTransmission(address);
   error = Wire.endTransmission();
   if (error == 0)
     Serial.print("I2C device found at address 0x");
     if (address<16)
       Serial.print("0");
     Serial.print(address, HEX);
     Serial.println(" !");
     nDevices++;
   else if (error==4)
     Serial.print("Unknown error at address 0x");
     if (address<16)
       Serial.print("0");
     Serial.println(address,HEX);
  if (nDevices == 0)
   Serial.println("No I2C devices found\n");
 else
   Serial.println("done\n");
 delay(5000);
```

The Arduino Serial Monitor shows the I2C device found.



#### SPI

If your RUI3 project uses SPI, then J5 pins 1 to 4 are reserved for RUI3 SPI interface.

SPI Pin Number	SPI Pin Name
J5 pin 1	SPI_MOSI
J5 pin 2	SPI_MISO
J5 pin 3	SPI_CLK
J5 pin 4	SPI_CS

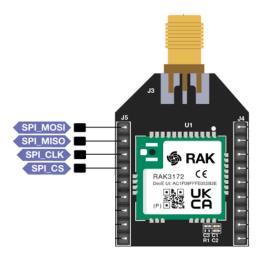


Figure 26: Available SPI pins in RAK3272S

#### **NOTE**:

The J4 pins 5 and 6 are reserved for SWD debug interface. Check the Connect to the RAK3272S Breakout Board section.

### **RAK3272S Configuration for LoRaWAN or LoRa P2P**

To enable the RAK3272S breakout board as a LoRa P2P module or a LoRaWAN end-device, the module must be configured and parameters must be set by sending AT commands. You can configure the RAK3272S in two ways:

- LoRaWAN End-Device RAK3272S Breakout Board as LoRaWAN IoT device.
- LoRa P2P Point-to-point communication between two RAK3272S breakout board modules.

## Configuring RAK3272S Breakout Board as LoRaWAN End-Device

To enable the RAK3272S breakout board as a LoRaWAN end-device, a device must be registered first in the LoRaWAN network server. This guide will cover both TTN and Chirpstack LoRaWAN network servers and the associate AT commands for the RAK3272S breakout board.

This guide covers the following topics:

- The Things Network Guide How to login, register new accounts and create new applications on TTN.
- RAK3272S Breakout Board TTN OTAA Guide How to add OTAA device on TTN and what AT commands to use on RAK3272S OTAA activation.
- RAK3272S Breakout Board TTN ABP Guide How to add ABP device on TTN and what AT commands to use on RAK3272S ABP activation.
- Chirpstack Guide How to create new applications on Chirpstack.
- RAK3272S Breakout Board Chirpstack OTAA Guide How to add OTAA device to Chirpstack and what AT commands to use on RAK3272S OTAA activation.
- RAK3272S Breakout Board Chirpstack ABP Guide How to add ABP device on Chirpstack and what AT commands to use on RAK3272S ABP activation.

### **Connecting to The Things Network (TTN)**

In this section, a quick tutorial guide will show how to connect the RAK3272S Breakout Board to the TTN platform.

#### **NOTE**:

In this guide, you need to have a working gateway that is connected to TTN or coverage of the TTN community network.



Figure 27: RAK3272S in the context of the TTN

As shown in **Figure 22**, The Things Stack (TTN V3) is an open-source LoRaWAN Network Server suitable for global, geo-distributed public and private deployments, as well as for small, local networks. The architecture follows the LoRaWAN Network Reference Model for standards compliance and interoperability. This project is actively maintained by The Things Industries

LoRaWAN is a protocol for low-power wide-area networks. It allows for large-scale Internet of Things deployments where low-powered devices efficiently communicate with Internet-connected applications over long-range wireless connections.

The RAK3272S Breakout Board can be part of this ecosystem as a device, and the objective of this section is to demonstrate how simple it is to send data to The Things Stack using the LoRaWAN protocol. To achieve this, the RAK3272S Breakout Board must be located inside the coverage of a LoRaWAN gateway connected to The Things Stack server.

## **Registration to TTN and Creating LoRaWAN Applications**

1. The first step is to go to The Things Network ☐ and sign up an account shown in Figure 28. Then select a cluster as shown in Figure 30.



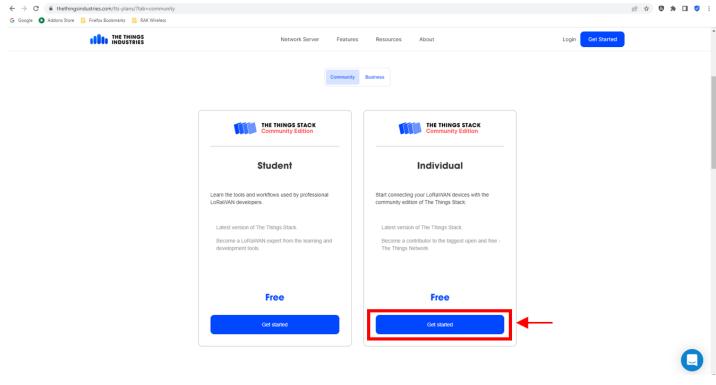


Figure 29: Signing up an account in TTN

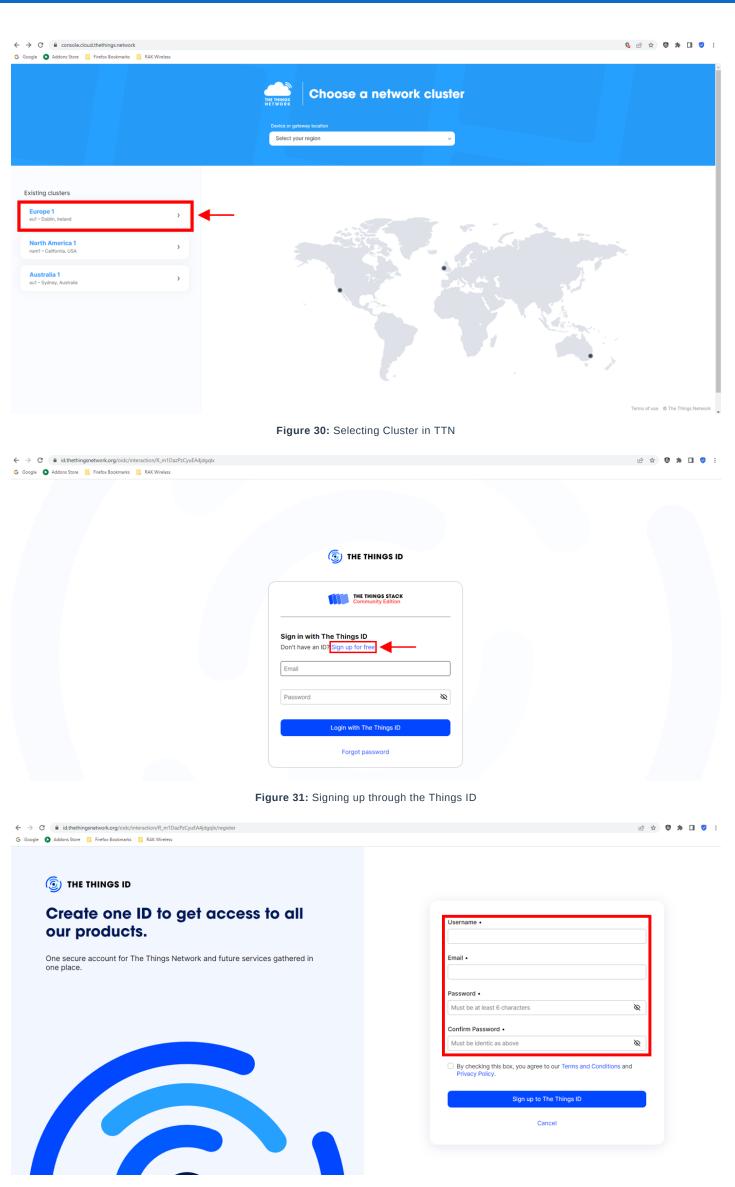


Figure 32: Creation of an account through the Things ID

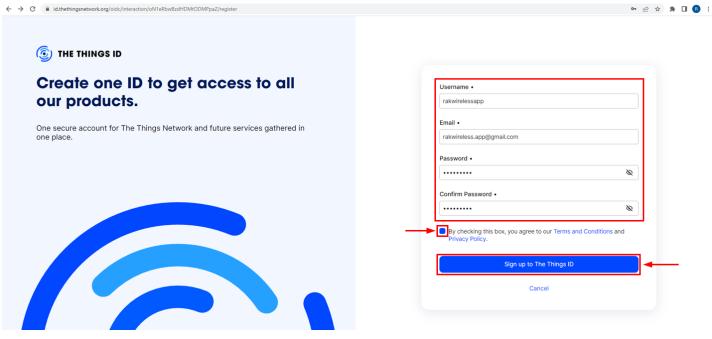


Figure 33: Creation of an account through the Things ID

You can use the same login credentials on the TTN V2 if you have one. If you have no account yet, you need to create one.

2. Now that you are logged in to the platform, the next step is to create an application. Click **Create an application**.

$\leftrightarrow \rightarrow c$	eu1.cloud.thethings.net	twork/console/								🖻 🏚 🗯 🖬 📵 🗄
THE THINGS NET WORK	THE THINGS STACK Community Edition	Overview	Applications	🛋 Gateways	K Organizations				EU1 Community Fair use policy applies <sup>(2)</sup>	rakwirelessapp •
					Wel	come to the C	Console!			
					Get started right awa	why creating an applicat	ion or registering a gateway.			
							tation I or Get support I.			
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					000			2		
					$\bigcirc \bigcirc \square$					
								7		
				Create	an application		Register a gatewa	ау		

Figure 34: The Things Stack Platform

←

← → C	eu1.cloud.thethings.net	twork/console/					ie 🖈 🗯 🖬 🚯 i
THE THINGS NET WORK	THE THINGS STACK Community Edition	Overview	Applications	🗳 Gateways 🛛 🗮 Organizations		EU1 Community Fair use policy applies (*)	rakwirelessapp •
				Get started right away	Console! tion or registering a gateway. ttation <sup>∞</sup> or <u>Get support</u> <sup>∞</sup> .		
	-		•	000       1       1       1       1       1       1       1       1       1	Register a gateway		

Figure 35: Creating TTN application for your LoRaWAN devices

3. To have an application registered, input first the specific details and necessary information about your application then click **Create application**.

$\leftrightarrow$ $\rightarrow$ C	eu1.cloud.thethings.net	twork/console/app	lications/add										€ ☆ 🛊	≓J 🔲 🖪 :
THE THINGS NETWORK	THE THINGS STACK Community Edition	Overview	Applications	🔒 Gateways	K Organizations							EU1 Community No SLA applicable ⑦		rakwirelessapp 🔹
				you can register and o pass relevant data	manage end devices and their n to your external services. p <u>lications</u> <sup>(2)</sup> ,	twork data. After s	etting up your	device fleet, use c	one of our many					
			Application ID* my-new-applicatio Application name My new application Description Description for my Optional application Create applicati	new application description; can als	o be used to save notes about th	application								
					Figure 36:	Details	of the	TTN ap	plication	ı				
		Within app integration	n options to p	i can register ass relevant (	and manage end de data to your external I <u>g Applications</u> 🖄 .		eir netwo	ork data. Af	fter setting (	up your device f	fleet, use one of	our many		
		Applicatio	n ID* new-device											
		Applicatio	n name N Devices App	lication										
		Descriptio	n											
			ication involv		devices. n also be used to sav	e notes abo		plication						
			application	]+	-			F						

Figure 37: Details of the TTN application

4. If you have no error on the previous step, you should now be on the application console page. The next step is to add end-devices to your TTN application.

LoRaWAN specifications enforce that each end-device has to be personalized and activated. There are two options in registering devices depending on the activation mode selected. Activation can be done either via Over-The-Air-Activation (OTAA) or Activation-By-Personalization (ABP).

### **TTN OTAA Device Registration**

1. Go to your application console to register a device. To start adding an OTAA end-device, click + **Register end device**, as shown in **Figure 38**.

$\leftrightarrow$ $\rightarrow$ C $$ eu1.cloud.thethings.ne	twork/console/app	olications/lorawan-n	ew-device					1	6 🕁 🛸	≕ 🛯 🖪 :
THE THINGS STACK	Overview	Applications	🔒 Gateways 🛛 🚢 Organiz	ations				EU1 Community Fair use policy applies ③	<b>1</b> ra	akwirelessapp 👻
111 LORaWAN Devices Application			Applications > LoRaWAN De	vices Application						
- Conawan Devices Application				vevices Application						
Overview			ID: lorawan-new-d							
1 End devices			• No recent activity 🗇				🙏 0 End devices 🛛 🚢 1 Collabo	rator 🛛 🗛 0 API keys		
🔲 Live data			General information			Live data		See all activity →		
<> Payload formatters ~			Application ID	lorawan-new-device	6	© 23:40:46 lorawan-ne C:	reate application	See all activity		
大 Integrations ~			Created at	Jan 11, 2023 23:40:46						
Collaborators			Last updated at	Jan 11, 2023 23:40:46						
Or API keys										
General settings										
			End devices (0)			Q Search	=+ Import end devices +	Register end device	<b></b>	
			ID ¢	Name ¢	DevEUI	JoinEUI		Last activity 🗢		
					No items	found				
				Figure 38: Regist	er end de	evice				

2. To register the board, click the **Enter end device specifics manually**.

THE THINGS STACK	Overview      Applications	🚠 Gateways 🏛 Organizations	EU1 Community No SLA applicable ③	rakwirelessapp 🔹
LoRaWAN Devices Application		Applications > LoRaWAN Devices Application > End devices		
- contain an Devices Application				
Overview		Register end device		
🙏 End devices		Does your end device have a QR code? Scan it to speed up onboarding.		
💷 Live data		Scan end device QR code		
<> Payload formatters ~		End device type		
尤 Integrations ✓		Input Method 🗇		
Collaborators		Select the end device in the LORBWAN Device Repository     Enter end device specifics manually		
Or API keys		End device brand 🗇 *		
General settings		Type to search		
		Cannot find your exact end device? Get help here and try enter end device specifics manually option above.		

Figure 39: Enter end device specifics manually

3. Next step is to set up **Frequency plan**, compatible **LoRaWAN version**, and **Regional Parameters version** supported. Then provide the **JoinEUI** credentials by entering zeroes into it.

Applications > LoRaWAN Devices Application > En	ind (	uevice.
---	-------	---------

#### **Register end device**

Does your end device have a QR code? Scan it to speed up onboarding.

Scan end device QR code

#### End device type

Input Method 🗇

<ul> <li>Select the end device in the LoRaWAN Device Repository</li> </ul>
--

~		
۲	Enter end device specifics manually	

Select	
LoRaWAN version ⑦ *	
Select	
Regional Parameters version 🗇 *	
Select	

#### Figure 40: Setting up for your device

Applications	>	LoRaWAN Devices Application	>	End devices

#### **Register end device**

Does your end device have a QR code? Scan it to speed up		
Scan end device QR code	help 🖸	
End device type		
Input Method 🗇		
Select the end device in the LoRaWAN Device Reposit	ory	
<ul> <li>Enter end device specifics manually</li> </ul>		
<ul> <li>Enter end device specifics manually</li> <li>Frequency plan ⑦*</li> </ul>		
	·	_
Frequency plan ⑦ * Europe 863-870 MHz (SF9 for RX2 - recommended)	· ·	_
Frequency plan ⑦ * Europe 863-870 MHz (SF9 for RX2 - recommended)	<b>↓</b>	-
Frequency plan ③ * Europe 863-870 MHz (SF9 for RX2 - recommended) LoRaWAN version ③ * Select		_
Frequency plan () * Europe 863-870 MHz (SF9 for RX2 - recommended) LoRaWAN version () *		_

To continue, please enter versions and frequency plan information

#### Figure 41: Setting up for your device

#### **Register end device**

Does your end device have a QR code? Scan it to speed up onboarding.

 Scan end device QR code
 Device registration help

#### End device type

Input Method 🗇	
Select the end device in the LoRaWAN Device Repository	
Enter end device specifics manually	
Frequency plan 🗇 *	
Europe 863-870 MHz (SF9 for RX2 - recommended)	
LoRaWAN version ⑦ *	
LoRaWAN Specification 1.0.3	<b>↓</b>
Regional Parameters version ⑦ *	
RP001 Regional Parameters 1.0.3 revision A	$\sim$

Show advanced activation, LoRaWAN class and cluster settings ~

#### Provisioning information

#### JoinEUI 🗇 \*

····· Confirm

To continue, please enter the JoinEUI of the end device so we can determine onboarding options

Figure 42: Setting up for your device

#### **Register end device**

Scan end device QR code		
Scan end device QK code	■ <u>Device registration help</u> <sup>[2]</sup>	
End device type		
Input Method ②		
Select the end device in the LoF	RaWAN Device Repository	
<ul> <li>Enter end device specifics manual</li> </ul>	ually	
Frequency plan 🗇 *		
Europe 863-870 MHz (SF9 for RX2	- recommended)	
.oRaWAN version ⑦ *		
LoRaWAN Specification 1.0.3		<b>v</b>
Regional Parameters version 🗇 *		
RP001 Regional Parameters 1.0.3	revision A	×
Show advanced activation, LoRaWA	N class and cluster settings ∽	
Provisioning information		
JoinEUI 🗇 *	-	
00 00 00 00 00 00 00 00	Confirm	
To continue, please enter the JoinE	Ul of the end device so we can d	determine onboarding ontions

Figure 43: Setting up for your device

4. Then click **Show advanced activation, LoRaWAN class and cluster settings**. Configure the activation mode by selecting **Over the air activation (OTAA)** and Additional LoRaWAN class capabilities to **class A only**. Then click **Confirm**.

Register end devi	ice
Does your end device have a QR	code? Scan it to speed up onboarding.
Scan end device QR code	Device registration help
End device type	
Input Method ⑦	
<ul> <li>Select the end device in the</li> </ul>	LoRaWAN Device Repository
<ul> <li>Enter end device specifics m</li> </ul>	anually
Frequency plan ⑦ *	
Europe 863-870 MHz (SF9 for R	X2 - recommended)
LoRaWAN version ⑦*	
LoRaWAN Specification 1.0.3	
Regional Parameters version ③	•
RP001 Regional Parameters 1.0	).3 revision A 🗸 🗸
Show advanced activation, LoRa	WAN class and cluster settings $\checkmark$
Provisioning information	
JoinEUI ⑦*	
00 00 00 00 00 00 00 00	Confirm
To continue, please enter the Joi	inEUI of the end device so we can determine onboarding options

Figure 44: Setting up for your device

<ul> <li>Over the air activation (OTAA)</li> </ul>	
<ul> <li>Activation by personalization (ABP)</li> </ul>	
O Define multicast group (ABP & Multicast)	
Additional LoRaWAN class capabilities 📎	
None (class A only)	
Network defaults ②	
✓ Use network's default MAC settings	
Cluster settings ⑦	
Skip registration on Join Server	
Provisioning information	
JoinEUI ⑦ *	



5. Once done, provide the DevEUI credentials of your device into the **DevEUI** portion. This will automatically generate the specific End device ID of your board. Then click **Generate** under **AppKey** under Provisioning information section. Then click **Register end device**.

#### VOTE:

- The AppEUI, DevEUI, and AppKey are hidden in this section as these are unique from a specific device. The DevEUI credential is unique to every RAK3272S device. Also, you should generate your own AppEUI and AppKey credentials for your specific device and application.
- The AppEUI is the same as JoinEUI.

JoinEUI ⑦*	
00 00 00 00 00 00 00 00 00	Reset
This end device can be registered on	the network
DevEUI 🔿 *	
AC	
АррКеу 🗇 *	
	🗘 Generate
End device ID ⑦ *	
eui-ac1f09fffe053776	
This value is automatically prefilled u	ising the DevEUI
After registration	
<ul> <li>View registered end device</li> </ul>	
	lis type

Figure 46: Setting up for your device

Provisioning information
JoinEUI 🗇 *
00 00 00 00 00 00 00 Reset
This end device can be registered on the network
DevEUI 🗇 *
AC 15 09 FF FE 05 37 78 Ø Generate 0/50 used
AppKey ⑦*
End device ID ⑦ *
eui-acif09fffe053776
This value is automatically prefilled using the DevEUI
After registration
View registered end device
<ul> <li>Register another end device of this type</li> </ul>
Register end device
Figure 47: Setting up for your device
Provisioning information
JoinEUI ② * 00 00 00 00 00 00 00 Reset
This end device can be registered on the network
DevEUI 🗇 *
AC 15 09 FF FE 05 37 76 ØGenerate 0/50 used
AppKey ⑦ ⁺
44 D1 14 D8 50 30 FD 23 65 C9 C0 10 67 87 A8 36
End device ID <sup>®</sup> *
eui-ac1f09fffe053776
This value is automatically prefilled using the DevEUI
After registration
View registered end device
Register another end device of this type
Register end device
Figure 48: Register end device

6. You should now be able to see the device on the TTN console after you fully register your device, as shown in **Figure 49**.

#### **NOTE**:

- The **AppEUI**, **DevEUI**, and **AppKey** are the parameters that you will need to activate your LoRaWAN end-device via OTAA. The **AppKey** is hidden by default for security reasons, but you can easily show it by clicking the show button. You can also copy the parameters quickly using the copy button.
- The three OTAA parameters on the TTN device console are MSB by default.
- These parameters are always accessible on the device console page, as shown in Figure 36.

## **AK** Documentation Center

THE THINGS STACK Community Edition	Source Applications	🔒 Gateways 🛛 🗮 Organiza	ations		EU1 Community No SLA applicable (?)	rakwirelessapp 🔹
LoRaWAN Devices Application		Applications > LoRaWAN Dev	vices Application > End devices > eul-ac1f09fffe053776			
Overview     End devices		eui-ac1f09ff ID: eui-ac1f09fffe05 ↑ n/a ↓ n/a • No activit	3776			
Elive data			Messaging Location Payload formatters Claiming	General settings		
<> Payload formatters ~		General information		Live data	See all activity →	
		End device ID	eui-aclf09fffe053776	80:36:54 Create end device		
Collaborators		Frequency plan	Europe 863-870 MHz (SF9 for RX2 - recommen_			
Or API keys		LoRaWAN version	LoRaWAN Specification 1.0.3			
General settings		Regional Parameters version Created at	RP001 Regional Parameters 1.0.3 revision A 🚡 Jan 12,2023 00:36:54			
				Location	Change location settings →	
		Activation information	00 80 00 00 00 00 00 00 00 🚯		entinge location settings	
		DevEUI	AC 11 09 75 75 66 50 75 76 66 77 76 16			
		АррКеу	••••••	AND AND		
		Session information		No location information available		
		This device has not joined the	network yet			
		MAC data				
		Download MAC data				

Figure 49: OTAA device successfully registered to TTN

## **OTAA Configuration for TTN**

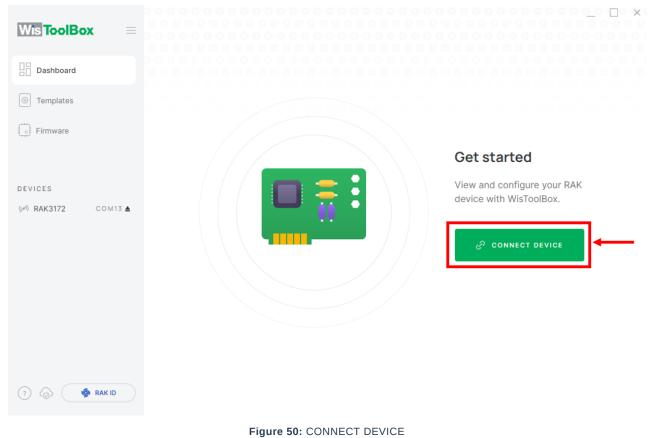
The RAK3272 Breakout Board which has a RAK3172 module in it can be configured using WisToolBox to do the OTAA configuration. **WisToolBox** is a software tool that supports **RAK3172** module. It automatically detects RAK3172 module once connected to PC. Below are the options in WisToolBox that the OTAA configuration can be done.

- OTAA Configuration for TTN via WisToolBox UI
- OTAA Configuration for TTN via WisToolBox Console

## OTAA Configuration for TTN via WisToolBox UI

The **RAK3172** should have correct OTAA credentials to connect to TTN. This can be done using **WisToolBox UI**. Below are the steps on setting up your **RAK3172** using **WisToolBox**.

- 1. Connect your **RAK3172** with your chosen WisBlock base board to the PC via USB cable and open the **WisToolBox** application.
- 2. Click **CONNECT DEVICE** button to launch the WisToolBox Dashboard.



- Figure 50: CONNECT DEVICE
- 3. Then select your target port where your **RAK3172** is connected. Once recognized, click **CONNECT** as shown in **Figure 52**.

Wis ToolBox =	Connecti	_
Dashboard	Connectio	on settings
Templates	Port	COM12 ~
C Firmware	Device	Unidentified Select manually
	Baud Rate	115200 ~
DEVICES (☞) RAK3172 COM13 ▲	Byte Size	8 ~
	Parity	None ~
	Stop Bits	1 2
	<i>ि</i> c	ONNECT
	CA	NCEL

Figure 51: Setting up your device

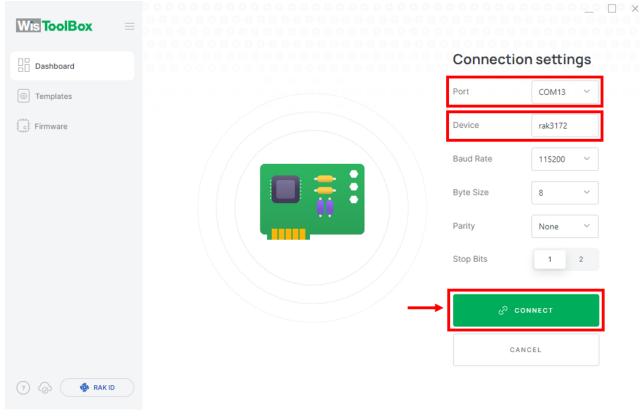


Figure 52: Setting up your device

4. Once done, RAK3172 will appear in the dashboard then select it.

Wts ToolBox ≡		
Dashboard	WisDuo LPWAN Module for LoRaWAN	(ອ໌) Lorawan 🔳 100%
Templates	MODEL RAK3172 EUI 00 AT DE	PORT COM13
Firmware		
DEVICES		
() RAK3172 COM13 ▲		
Ø		
? 🔕 🏟 RAK ID		

Figure 53: Device seen from WisToolBox dashboard

5. Then click **PARAMETERS** to do the configuration in your RAK3172.

× ≡	P 🚳 RAK	WisDuo LP LoRaWAN	WAN Module for	
	RAK3172 CE DevE UI: AC1F09FFFE052B2E	STATUS	(( <i>p</i> 1) - 🗰 100%	
		DEVICE EUI	00	Q
		MODEL	rak3172	
	DEVICE INFO	FIRMWARE	RUI_3.5.4_RAK3172-E AT DEFA	AULT
	PARAMETERS	HARDWARE ID	stm32wle5xx	Q
	ADVANCED	LAST SYNC	1/19/2023, 3:03:56 PM	C
	FIRMWARE			
		DOCUMEN	TATION [2]	
D				

Figure 54: Setting up your device

- 6. Click Global settings to set the network mode into LoRaWAN and join mode to OTAA. Make sure that the active region is using EU868 for this configuration. If you wish to work on other regional band, you can choose among active regions based on your location.
- LoRa network mode: LoRaWAN
- LoRaWAN join mode: OTAA
- LoRaWAN region: EU868

Wis ToolBox =			_ 🗆 ×
		<b>Device Parameters</b>	Sync less then 1 min ago $ C$
Dashboard	🔛 🍥 RAK	SAVE AS TEMPLATE	APPLY A TEMPLATE
Templates	RAK3172 CE		
Firmware		<ul> <li>Global settings</li> </ul>	~
		<ol> <li>LoRaWAN keys, ID, EUI</li> </ol>	~
DEVICES			
()≠1) RAK3172 COM13 ▲	DEVICE INFO	<ol> <li>Data on LoRa<sup>®</sup> network</li> </ol>	~
	PARAMETERS		
	ADVANCED		
	FIRMWARE	<ul> <li>LoRa<sup>®</sup> network management</li> </ul>	~
		() Generic LoRaWAN instructions	~
		<ol> <li>LoRaWAN multicast group</li> </ol>	~
🧿 🙆 🐠 RAK ID		<ol> <li>Custom Commands</li> </ol>	~
	Figure 55:	Global settings	

Wis ToolBox =				_ 🗆 ×
		Device Para	meters	Sync less then 1 min ago
Dashboard	🔛 🏟 RAK 👔	SAVE AS TEM	PLATE	APPLY A TEMPLATE
Templates	RAK3172 CE			
Firmware		<ol> <li>Global setting</li> </ol>	S	^
		Network mode	LoRaWAN	P2P
DEVICES		Join mode	ΑΑΤΟ	ABP
()≠1) RAK3172 COM13 ▲	DEVICE INFO			
	PARAMETERS	Active region	EU868	~
	ADVANCED			
	FIRMWARE			
		<ol> <li>LoRaWAN keys</li> </ol>	s, ID, EUI	~
		ĵ Data on LoRa <sup>©</sup>	network	~
7 🔊 🏟 RAK ID		<ul> <li>LoRa<sup>©</sup> network</li> </ul>	k management	~

Figure 56: Global settings

7. Then click LoRaWAN keys, ID, EUI to configure the Application EUI (AppEUI), Application key (AppKey) and Device EUI (DevEUI).

		Device Param	eters	>
Dashboard	💾 🍥 RAK	SAVE AS TEMPL	ATE	APPLY A TEMPLATE
Templates	RAK3172 CE DevE UI: AC1F09FFFE052B2E	<ol> <li>Global settings</li> </ol>		^
		Network mode	LoRaWAN	P2P
DEVICES		Join mode	ΟΤΑΑ	ABP
()#) RAK3172 COM13 ▲	DEVICE INFO			
	PARAMETERS	Active region	EU868	~
	ADVANCED			
	FIRMWARE	→ () LoRaWAN keys, I	ID, EUI	~
		⊕ Data on LoRa <sup>©</sup> n	etwork	~
? 🐼 🐠 RAK ID		∂ LoRa <sup>©</sup> network r	nanagement	~



oolBox =		Device Para	meters Sync less then 1 min ago
shboard	🔛 🏟 RAK 🛔	SAVE AS TEM	IPLATE APPLY A TEMPLATE
nplates	RAK3172 CE Deve UI: AC1F09FFFE052B2E	Join mode	OTAA ABP
vare		Active region	EU868 ~
s			
K3172 COM13 ▲	DEVICE INFO	LoRaWAN keys	s, ID, EUI
	PARAMETERS	Application EUI	000000000000000000000000000000000000000
	ADVANCED		
	FIRMWARE	Application key	@ 000000000000000000000000000000000000
		Device EUI	000000000000000000000000000000000000000
		Network ID	000000

Figure 58: Setting up your device

8. Then go back to console where your RAK3172 End device is created previously. Then copy all the credentials from there. Those will be the ones to be used also in the WisToolBox dashboard. Once encoded into the dashboard, click **APPLY COMMAND** to update your device as shown in **Figure 66**.

#### **NOTE**:

• The **AppEUI**, **DevEUI**, and **AppKey** are hidden in this section as these are unique from a specific device.

THE THINGS STACK	Overview Applications	🔒 Gateways 🛛 🚢 Organia	zations		EU1 Community No SLA applicable (?)	rakwirelessapp
LoRaWAN Devices Application		Applications > LoRaWAN De	<pre>rvices Application &gt; End devices &gt; eui-ac1f09fffe053776</pre>			
Overview		ID: eui-ac1f09ffe0				
Lend devices		↑ n/a 🔸 n/a 🔹 No activi	ity yet 🗇			
Elve data		Overview Live data	Messaging Location Payload formatters Claiming	General settings		
<> Payload formatters ~		General information		Live data	See all activity $\rightarrow$	
大 Integrations ~		End device ID	eui-ac1f09fffe053776	00:36:54 Create end device		
Collaborators		Frequency plan	Europe 863-870 MHz (SF9 for RX2 - recommen_ 🖷			
Ov API keys		LoRaWAN version	LoRaWAN Specification 1.0.3			
🗱 General settings		Regional Parameters version	RP001 Regional Parameters 1.0.3 revision A			
		Created at	Jan 12, 2023 00:36:54			
		Activation information		Location	Change location settings $\rightarrow$	
		AppEUI	00 00 00 00 00 00 00 00 00 00 00 00 00			
		DevEUI	AC LF 09 FF FE 05 37 76			
		АррКеу	••••••	30000 - 100		
		Session information		No location information avai	lable	
	This device has not joined the network yet					
		MAC data				
		Download MAC data				

Figure 59: Your created OTAA device from your console

• For Application EUI (AppEUI)

THE THINGS NET WORK	THE THINGS STACK Community Edition	Overview	Applications	🛋 Gateways 🛛 👫 Organiza	ations		EU1 Community No SLA applicable (?)	rakwirelessapp •
ul Lo	RaWAN Devices Application				vices Application > End devices > eul-ac1f09fffe053776			
<b>.</b> ov	erview			eui-ac1f09ff ID: eui-ac1f09fffe05				
🙏 En	d devices			↑ n/a ↓ n/a • No activit	ty yet 🗇			
💷 Liv	re data			Overview Live data	Messaging Location Payload formatters Claiming	General settings		
<> Pa	yload formatters ~			General information		Live data	See all activity $\rightarrow$	
大 Int	regrations ~			End device ID	eui-ac1f09fffe053776	00:36:54 Create end device		
<b>41</b> Co	llaborators			Frequency plan	Europe 863-870 MHz (SF9 for RX2 - recommen_			
OT AP	l keys			LoRaWAN version	LoRaWAN Specification 1.0.3			
🔅 Ge	neral settings			Regional Parameters version	RP001 Regional Parameters 1.0.3 revision A			
				Created at	Jan 12, 2023 00:36:54			
				Activation information		Location	Change location settings $\rightarrow$	
			$\rightarrow$	AppEUI	00 00 00 00 00 00 00 00 00 00 00 00 00			
				DevEUI	AC 1F 69 FF FE 65 37 76			
				АррКеу	••••••			
				Session information		No location information available	le statistica de la companya de la c	
			This device has not joined the network yet					
				MAC data Download MAC data				

Figure 60: Copying the AppEUI credential from TTN to WisToolBox

Wis ToolBox =		Device Parar	meters	Sync less t	
Dashboard	Part 🚳 🖗	SAVE AS TEM		APPLY A TE	MPLATE
© Templates	RAK3172 CE DevE UI: AC1F09FFFE052B2E	Join mode	ΟΤΑΑ		ABP
; Firmware		Active region	EU868	~	
DEVICES					
M RAK3172 COM13 ▲	DEVICE INFO	i LoRaWAN keys	s, ID, EUI		~
	PARAMETERS				
	ADVANCED	Application EUI 🛑	0000000000	00000	16/16
	FIRMWARE	Application key	J 0000000	000000000000000000000000000000000000000	0000 32/32
		Device EUI	0000000000	000000	16/16
		Network ID			
? 🔊 🏟 RAK ID	1 Command MODEL RAK3172	Network ID PORT COM13		APPLY	co



• For Application key (AppKey)

THE THINGS NETWORK	THE THINGS STACK Community Edition	Overview	Applications	🗳 Gateways 🛛 🚢 Organiza	tions		EU1 Community No SLA applicable (?)	rakwirelessapp •
III LO	RaWAN Devices Application			Applications > LoRaWAN Dev	ices Application > End devices > eui-ac1f09fffe053776			
	name benes appression			eui-ac1f09ff	fe053776			
N OV	erview			ID: eui-ac1f09fffe05				
🙏 En	d devices			↑n/a ↓n/a • No activit	y yet 🗇			
💷 Liv	e data			Overview Live data	Messaging Location Payload formatters Claiming	General settings		
<> Pa	yload formatters 🗸 🗸			General information		Live data	See all activity $\rightarrow$	
夫 Int	egrations ~			End device ID	eui-ac1f09fffe053776	© 80:36:54 Create end device		
🚜 Co	llaborators			Frequency plan	Europe 863-870 MHz (SF9 for RX2 - recommen_			
OT AP	l keys			LoRaWAN version	LoRaWAN Specification 1.0.3			
🔹 Ge	neral settings			Regional Parameters version	RP001 Regional Parameters 1.0.3 revision A			
				Created at	Jan 12, 2023 00:36:54			
				Activation information		Location	Change location settings →	
				AppEUI	00 00 00 00 00 00 00 00 00 00 00 00 00			
				DevEUI	AC 12 69 75 76 65 37 76			
			$\rightarrow$	АррКеу	••••••			
				Session information		No location information available		
				This device has not joined the r	network yet			
				MAC data				

Figure 62: Copying the AppKey credential from TTN to WisToolBox

		Device Paran	neters	X
Dashboard	💾 🏟 RAK	SAVE AS TEMPLATE		APPLY A TEMPLATE
Templates	RAK3172 CE Deve UI: AC1F09FFFE05282E	Join mode	ΟΤΑΑ	ABP
	(P) CA	Active region	EU868	~
DEVICES				
() MAK3172 COM13 ▲	DEVICE INFO	LoRaWAN keys, ID, EUI     ^		
	PARAMETERS			
	ADVANCED	Application EUI	000000000000000000000000000000000000000	00 (16/16)
	FIRMWARE	Application key 🔶	J 44D11	1F02165C9C01C 32/32
		Device EUI	000000000000000000000000000000000000000	000 (16/16)
		Network ID		
7 💩 🏟 RAK ID	1 Command MODEL RAK3172	PORT COM13		APPLY COMMAND



• For Device EUI (DevEUI)

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THE THINGS STACK Community Edition	Overview Applications	🔒 Gateways 🛛 🏔 Organiza	ations		EU1 Community No SLA applicable (7)	rakwirelessapp •
LoRaWAN Devices Application			vices Application > End devices > eui-ac1f09fffe053776			
Overview	eui-ac1f09fffe053776 ID: eui-ac1f09fffe053776 ↑ n/a ↓ n/a ◆ No activity yet ③					
End devices				General settings		
<> Payload formatters ~		General information		• Live data	See all activity $\rightarrow$	
↑ Integrations ✓ Collaborators		End device ID Frequency plan	eui-acif09fff0053776 🚡 Europe 863-870 MHz (SF9 for RX2 - recommen_ 🚡	00:36:54 Create end device		
<ul> <li>↔ API keys</li> <li>General settings</li> </ul>		LoRaWAN version Regional Parameters version	LoRaWAN Specification 1.0.3       RP001 Regional Parameters 1.0.3 revision A			
General settings		Created at	Jan 12, 2023 00:36:54			
		Activation information	60 00 00 00 00 00 00 00 00 00 00 00 00 0	Location	Change location settings →	
	-	DevEUI AppKey				
		Session information This device has not joined the	network yet	No location information available		
		MAC data  Download MAC data				

Figure 64: Copying the DevEUI credential from TTN to WisToolBox

Wis ToolBox =		Device Para	meters	Sync less	_ 🗌 🗡
Dashboard	💾 🏟 RAK	SAVE AS TEM	IPLATE	APPLY A T	EMPLATE
Templates	RAK3172 CE Deve UI: AC1F09FFFE052B2E	Join mode	ΟΤΑΑ		ABP
Eirmware		Active region	EU868	~	
DEVICES					
() MAK3172 COM13 ▲	DEVICE INFO	IoRaWAN keys	s, ID, EUI		^
	PARAMETERS				
	ADVANCED	Application EUI	000000000	000000	(16/16)
	FIRMWARE	Application key	A4D11		90010 32/32
		Device EUI	AC	053776	16/16
		Network ID	000000		
7 🔕 🏟 RAK ID	1 Command MODEL RAK3172	PORT COM13 A		APPL	Y COMMAND



• WisToolBox Dashboard

Wis ToolBox =		Device Para	meters	Sync less then 1 min ago $ C $
Dashboard	🔛 🏟 RAK	SAVE AS TEM	IPLATE	APPLY A TEMPLATE
Templates	RAK3172 CE DevE UI: AC1F09FFFE052B2E	Join mode	ΟΤΑΑ	ABP
Eirmware		Active region	EU868	~
DEVICES				
()≠1) RAK3172 COM13 ▲	DEVICE INFO	LoRaWAN keys	s, ID, EUI	^
	PARAMETERS	Application EUI	00	16/16
	ADVANCED	Application EOI	00	
	FIRMWARE	Application key	44D1	5031FD2165C9C010
		Device EUI	AC	3776
		Network ID	000000	
? (2) (2) RAK ID	1 Command MODEL RAK3172	PORT COM13		APPLY COMMAND
Fig	gure 66: Used credentials from yo	our console in WisTo	olBox dashboard	t

9. Once done, you will see the summary of commands that is applied to your device. Then click **CLOSE**.

Wts ToolBox =				
Dashboard		Commands applied to RAK3172 WisDuo LPWAN Module		
Templates		for LoRaWAN		
Eirmware	Oevice EUI		Successful	15:42
DEVICES	Application key		Successful	15:42
()≠1) RAK3172 COM13 ▲	Application key		Gaooborar	10/12
? ⊘ 🐠 RAK ID		CLOSE		

Figure 67: Summary of commands

10. Now you will see it returns back to the dashboard with updated credentials of your device.

Wis ToolBox =		Device Param	neters	_ $\square$ X
Dashboard	🔛 🍥 RAK 🚦	SAVE AS TEMP	LATE	APPLY A TEMPLATE
Templates	RAK3172 CE DevE UI: AC1F09FFFE052B2E			
Firmware		Global settings		^
		Network mode	LoRaWAN	P2P
DEVICES		Join mode	ΟΤΑΑ	ABP
()#) RAK3172 COM13 ▲	DEVICE INFO			
	PARAMETERS	Active region	EU868	~
	ADVANCED			
	FIRMWARE			
		i LoRaWAN keys,	ID, EUI	^
		Application EUI	000000000000000000000000000000000000000	000 (16/16)
		Application key	J 44D1	31502165C9C010 (32/32)
? (2) (2) RAK ID		Device EUI	AC FOOFFFEOSS	16/16

Figure 68: Successfully configured OTAA device via WisToolBox dashboard

11. After your device's credentials update, it can now join the network. To do this, you need to go to **Data on LoRa network** under **PARAMETERS**. Then click the **JOIN NETWORK** under **LoRaWAN join settings**. After a few seconds, it will notify you that your OTAA device already joined the TTN server. You can also to your TTN console if your device has successfully joined the TTN.

				>
		Device Parameters	5	Sync less then 1 min ago 🛛 😋
Dashboard	🚰 🍥 RAK 🚦	SAVE AS TEMPLAT	E	APPLY A TEMPLATE
Templates	RAK3172 CE DevE UI: AC1F09FFFE052B2E	LoRaWAN keys, ID, EUI		^
Firmware		Application EUI	00	(16/16)
DEVICES		Application key	44D1	32/32
() RAK3172 COM13 ▲	DEVICE INFO			
	PARAMETERS	Device EUI	AC	16/16
	ADVANCED	Network ID		
	FIRMWARE			
		i Data on LoRa® network	]	^
		Confirm mode		
		Confirm status		
		LoRaWAN join settings		~
🧿 🔕 🏟 RAK ID	<b>→</b>		JOIN NETWORK	

Figure 69: Joining mode of your OTAA device

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Wis ToolBox =		Device Parameters		> Sync less then 1 min ago ♂
Dashboard	💾 🏟 RAK	SAVE AS TEMPLAT	E	APPLY A TEMPLATE
Templates	RAK3172 CE			
Firmware		<ol> <li>Global settings</li> </ol>		^
	(P) 🖥 🗱 CA	Network mode	LoRaWAN	P2P
DEVICES		Join mode	ΟΤΑΑ	ABP
(**) RAK3172 COM13 📥	DEVICE INFO			
	PARAMETERS	Active region	EU433 ~	
	ADVANCED			
	FIRMWARE	i LoRaWAN keys, ID, EUI		^
		Application FLU	Enter 16 HEX characters value	0(15)
$\rightarrow$	③ WisDuo LPWAN Module for LoRaWAN - Join Network	etwork : Joined		×
	() WisDuo LPWAN Module for LoRaWAN - Join Ne	etwork : Joined		×
	() WisDuo LPWAN Module for LoRaWAN - Join Ne	etwork : Joined		×
🧿 🔕 🔹 🕸 RAK ID	() WisDuo LPWAN Module for LoRaWAN - Join Ne	etwork : Joined		×



	eui-ac1f09fffe053776						
$\uparrow$ n/a $~\downarrow$ n/a $~\bullet$ Last activi	ty 2 minutes ago 🕲						
Overview Live data	Messaging Location Payload formatters Claiming	General settings					
General information	N 199	• Live data See all activity					
End device ID	eui-ac1f09fffe053776	↑ 10:52:46 Forward join-accept message DevAddr: 26 0D F3 C5 💠 🖺					
Frequency plan	Europe 863-870 MHz (SF9 for RX2 - recommen	GD 10:52:44 Accept join-request DevAddr: 26 0D F3 C5 🔿 🌇					
LoRaWAN version	LoRaWAN Specification 1.0.3	↑ 10:49:15 Forward join-accept message DevAddr: 26 0D E5 57 ↔      ←     GP 10:49:13 Accept join-request DevAddr: 26 0D E5 57 ↔      ←					
Regional Parameters version	RP001 Regional Parameters 1.0.3 revision A	↑ 10:48:56 Forward join-accept message DevAddr: 26 0D E2 D8 ↔ 🐞					
Created at	Jan 27, 2023 10:22:51	G⊃ 10:48:54 Accept join-request DevAddr: 26 0D E2 D8 ↔ 🐴					
		Location Change location settings					
Activation information		Location Change location settings	i.				
AppEUI	00 00 00 00 00 00 00 00 00 00 00 00 00						
DevEUI							
АррКеу	••••••						

Figure 71: OTAA device successfully joined the TTN server

## **OTAA Configuration for TTN via WisToolBox Console**

Here's another way of OTAA configuration using **WisToolBox Console**. Below are the steps on setting up your **RAK3172** using **WisToolBox Console**.

- 1. Connect your **RAK3172** with your chosen WisBlock base board to the PC via USB cable and open the **WisToolBox** application.
- 2. Click **CONNECT DEVICE** button to launch the WisToolBox Dashboard.

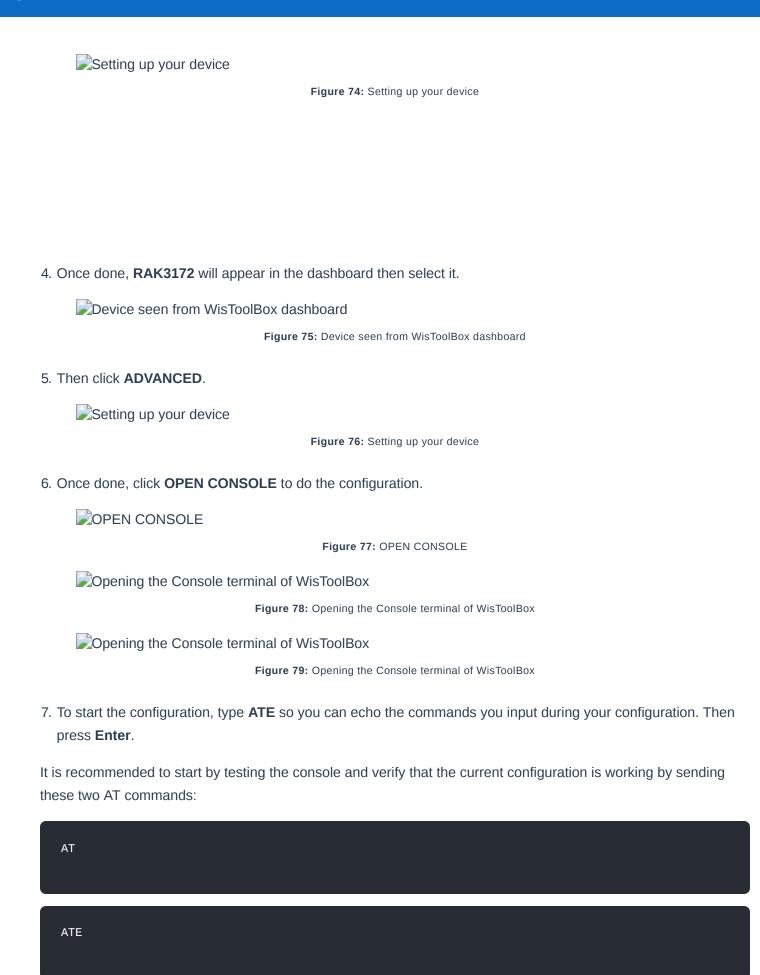
CONNECT DEVICE

Figure 72: CONNECT DEVICE

3. Then select your target port where your **RAK3172** is connected. Once recognized, click **CONNECT** as shown in **Figure 74**.

Setting up your device





ATE is useful for tracking the commands and troubleshooting.

You will receive OK when you input the two commands. After setting ATE , you can now see all the commands you input together with the replies.

#### **NOTE**:

If there is no ok or any reply, check if the device is powered correctly. If you are getting power from a USB port, ensure that you have a good USB cable.

Setting up your Console	
	Figure 80: Setting up your Console
Setting up your Console	
	Figure 81: Setting up your Console
Setting up your Console	
	Figure 82: Setting up your Console

 Then configure the LoRaWAN join mode to OTAA. You can check what parameter you will input by typing AT+NJM? then Enter into the console terminal. For OTAA, you should input AT+NJM=1 then press Enter as shown in Figure 85.

Setting up your Console	
	Figure 83: Setting up your Console
Setting up your Console	
	Figure 84: Setting up your Console
Setting up your Console	
	Figure 85: Setting up your Console

9. Once done, set-up your LoRaWAN region to EU868. You can check what parameter you will input by typing AT+BAND? then Enter into the console terminal. For EU868, you should input AT+BAND=4 then press Enter. If you wish to work on other regional band, you may check the list of band parameter options below.

Set the frequency/region to EU868.

AT+BAND=4
<b>NOTE:</b> Depending on the Regional Band you selected, you might need to configure the sub-band of your RAK3172 to match the gateway and LoRaWAN network server. This is especially important for Regional Bands like US915, AU915, and CN470.

To configure the masking of channels for the sub-bands, you can use the AT+MASK command that can be found on the AT Command Manual

To illustrate, you can use sub-band 2 by sending the command AT+MASK=0002.

### List of band parameter options

Code	Regional Band
0	EU433
1	CN470
2	RU864
3	IN865

Code	Regional Band
4	EU868
5	US915
6	AU915
7	KR920
8	AS923-1
9	AS923-2
10	AS923-3
11	AS923-4
Setting up your Console	Figure 86: Setting up your Console
Setting up your Console	
	Figure 87: Setting up your Console
Setting up your Console	
	Figure 88: Setting up your Console

Then next to this will be updating the OTAA credentials of your device. First to this will be the Application EUI (AppEUI). Go back to your console where your RAK3172 End device was created to copy the AppEUI credential then paste it to the WisToolBox Console then press Enter.

THE THINGS STACK	Overview	Applications	🗳 Gateways 🛛 🚢 Organiza	ations			EU1 Community No SLA applicable ⑦	rakwirelessapp
LoRaWAN Devices Application			Applications > LoRaWAN Dev	vices Application > End devices > eui-ac1f09	ffe053776			
Overview			eui-ac1f09ff ID: eui-ac1f09fffe05					
👗 End devices			↑ n/a ↓ n/a • No activit	y yet 🗇				
Live data			Overview Live data	Messaging Location Payload formatter	Claiming	General settings		
<> Payload formatters ~			General information			Live data	See all activity $\rightarrow$	
大 Integrations ~			End device ID	eui-acif09fffe053776	6	🕒 00:36:54 Create end device		
Collaborators			Frequency plan	Europe 863-870 MHz (SF9 for RX2 - re	commen			
API keys			LoRaWAN version	LoRaWAN Specification 1.0.3	1			
			Regional Parameters version	RP001 Regional Parameters 1.0.3 revi	sion A 🖷			
General settings			Created at	Jan 12, 2023 00:36:54				
			Activation information			Location	Change location settings $\rightarrow$	
			AppEUI	00 00 00 00 00 00 00 00 00	•	17 M 20		
			DevEUI	AC 12 09 FF FE 65 37 76	•			
			АррКеу	·····	•••• 🖺 🛛			
			Session information			No location information a	available	
			This device has not joined the	network yet				
			MAC data					
			🛓 Download MAC data					

Figure 89: Your created OTAA device from your TTN console

Setting up your Console

Figure 90: Setting up your Console

Setting up your Console

Figure 91: Setting up your Console

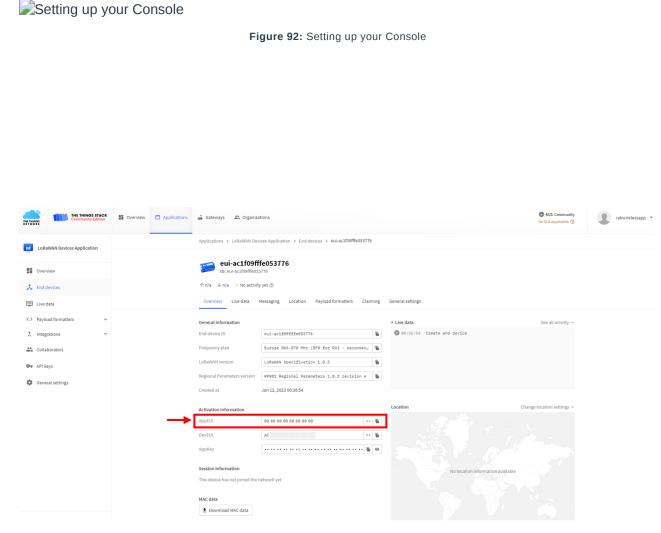


Figure 93: Copying the AppEUI credential from TTN to WisToolBox

Setting up your Console

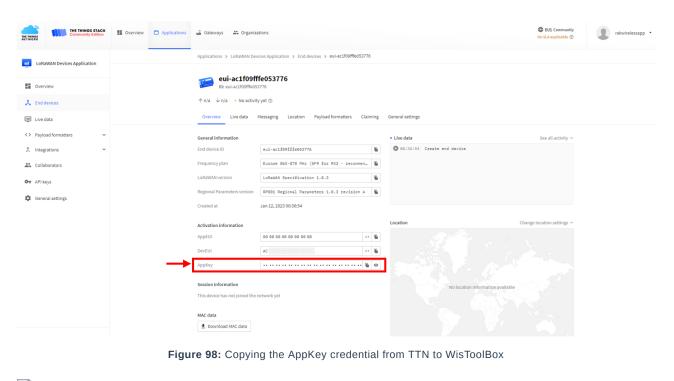
Figure 94: Setting up your Console

11. Once done, do the same procedure to Application key (AppKey) and Device EUI (DevEUI).

### • For Application key (AppKey)

Setting up your Console	
	Figure 95: Setting up your Console
Setting up your Console	
	Figure 96: Setting up your Console
Setting up your Console	
	Figure 97: Setting up your Console

# **BAK**<sup>®</sup> Documentation Center



Setting up your Console

Figure 99: Setting up your Console

### • For Device EUI (DevEUI)

Setting up your Console

Figure 100: Setting up your Console

Setting up your Console

Figure 101: Setting up your Console

THE THINGS NETWORK	THE THINGS STACK Community Edition	Overview	Applications	🗳 Gateways 🛛 🚢 Organiz	ations		EU1 Community No SLA applicable ③	rakwirelessapp •
LoR	aWAN Devices Application			Applications > LoRaWAN Dev	vices Application > End devices > eui-ac1f09fffe053776			
End	devices			eui-ac1f09ff ID: eui-ac1f09fffe05 ↑ n/a ↓ n/a • No activit Overview Live data	3776	General settings		
Live	data oad formatters ~			General information		Live data	See all activity $\rightarrow$	
🏌 integ				End device ID Frequency plan	eui-acif09fffe053776 Europe 863-870 MHz (SF9 for RX2 - recommen_ 🖷	<pre>00:36:54 Create end device</pre>		
OT API	reys			LoRaWAN version Regional Parameters version	LORANAN Specification 1.0.3			
🛱 Gen	eral settings			Created at	Jan 12, 2023 00:36:54			
				Activation information	00 00 00 00 00 00 00 00 00 00 <b>%</b>	Location	Change location settings $\rightarrow$	
				DevEUI				
				АррКеу				
				Session information This device has not joined the	network yet	No location information availab	le	
				MAC data				

Figure 102: Copying the DevEUI credential from TTN to WisToolBox

Setting up your Console

Figure 103: Setting up your Console

12. Once done, click **Dashboard** to check the updated credentials of your OTAA device. Click **PARAMETERS** to open the **Global Settings** and **LoRaWAN keys, ID, EUI** and check whether these portions are updated.

Setting up your Console

Figure 104: Setting up your Console

Setting up your Console

PARAMETERS

Figure 106: PARAMETERS

Global settings and LoRaWAN keys, ID, EUI

Figure 107: Global settings and LoRaWAN keys, ID, EUI

Global settings and LoRaWAN keys, ID, EUI details

Figure 108: Global settings and LoRaWAN keys, ID, EUI details

- 13. Now you have a configured OTAA device using WisToolBox Console. You can now join the network using the WisToolBox console.
- 14. To do this, you need to go again to WisToolBox console and type **AT+JOIN**. Then edit it to **AT+JOIN=1** then press **Enter** to join the network.

### VOTE:

AT+JOIN command parameters are optional. You can configure the settings for auto-join, reattempt interval, and the number of join attempts if your application needs it. If not configured, it will use the default parameter values.

AT+JOIN and AT+JOIN=1 also share the common functionality of trying to join the network.

Join command format: AT+JOIN=w:x:y:z

Parameter	Description
W	Join command - 1: joining, 0: stop joining.
Х	Auto-join config - 1: auto-join on power-up, 0: no auto-join
у	Reattempt interval in seconds (7-255) - 8 is the default.
Z	Number of join attempts (0-255) - 0 is default.

After 5 or 6 seconds, if the request is successfully received by a LoRa gateway, you should see +EVT: JOINED status reply, as shown in the figure below:

### **NOTE**:

If the OTAA device failed to join, you need to check if your device is within reach of a working LoRaWAN gateway that is configured to connect to TTN. It is also important to check that all your OTAA parameters (DEVEUI, APPEUI, and APPKEY) are correct using the AT+DEVEUI=?, AT+APPEUI=?, and AT+APPKEY=? commands. Lastly, ensure that the antenna of your device is properly connected.

After checking all the things above, try to join again.

Joining mode using WisToolBox Console
Figure 109: Joining mode using WisToolBox Console
Joining mode using WisToolBox Console
Figure 110: Joining mode using WisToolBox Console
Joining mode using WisToolBox Console
Figure 111: Joining mode using WisToolBox Console
Joining mode using WisToolBox Console
Figure 112: Joining mode using WisToolBox Console
CTAA device successfully joined the network
Figure 113: OTAA device successfully joined the network
CTAA device successfully joined the network
Figure 114: OTAA device successfully joined the network

15. With the end-device properly joined the TTN, you can now try to send some payload after a successful join.Send command format: AT+SEND=<port>:<payload>

### AT+SEND=2:12345678

OTAA device sending payload to the network

Figure 115: OTAA device sending payload to the network

OTAA device sending payload to the network

Figure 116: OTAA device sending payload to the network

CTAA device sending payload to the network

Figure 117: OTAA device sending payload to the network

CTAA device sending payload to the network

Figure 118: OTAA device sending payload to the network

16. You can see the data sent by the RAK3172 module on the TTN device console *Live data* section. Also, the *Last seen* info should be a few seconds or minutes ago.

CTAA Test Sample Data Sent Viewed in TTN

Figure 119: OTAA Test Sample Data Sent Viewed in TTN

## **TTN ABP Device Registration**

1. To register an ABP device, go to your application console and select the application where you want your device to be added. Then click + **Register end device**, as shown in **Figure 120**.

# **BAK**<sup>®</sup> Documentation Center

THE THINGS STACK Community Edition	Overview	Applications	🚽 Gateways 🛛 🚢 Organ	nizations				EU1 Community Fair use policy applies ⑦	rakwireless
LoRaWAN Devices Application			Applications > LoRaWAN	Devices Application					
Overview			LORaWAN ID: lorawan-new	Devices Application					
End devices			• No recent activity ⊘				🙏 0 End devices 🛛 🚉 1 C	ollaborator 🛛 🛛 🗛 0 API keys	
Live data			General information			Live data		See all activity →	
Payload formatters 🗸 🗸			Application ID	lorawan-new-device	6	23:40:46 lorawan-ne	Create application		
ntegrations ~			Created at	Jan 11, 2023 23:40:46					
Collaborators			Last updated at	Jan 11, 2023 23:40:46					
API keys									
General settings									
			End devices (0)			Q Search	=+ Import end devices	+ Register end device	
			ID ¢	Name ¢	DevEUI	JoinEUI		Last activity 🗢	
					No item	ns found			

2. To register the board, click the **Enter end device specifics manually**.

THE THINGS	TACK Ition Uverview	Applications	🚡 Gateways 👫 Organizations	EU1 Community No SLA applicable ⑦	rakwirelessapp 🔹
LoRaWAN Devices Applicatio			Applications > LoRaWAN Devices Application > End devices		
Overview			Register end device		
👗 End devices			Does your end device have a QR code? Scan it to speed up onboarding.		
Live data			Image: Constraint of the second s		
<> Payload formatters	~		End device type		
久 Integrations	~		Input Method $\odot$		
Collaborators			Select the end device in the LORAWAN Device Repository     O Enter end device specifics manually		
Or API keys			End device brand ⑦ *		
General settings			Type to search		

Figure 121: Enter end device specifics manually

3. Next step is to set up **Frequency plan**, compatible **LoRaWAN version**, and **Regional Parameters version** supported.

	End devices		
Register end device			
Does your end device have a QR code? Scan it to	speed up onboarding.		
Scan end device QR code	stration help 🛛		
End device type			
Input Method ⑦			
Input Method ⑦  Select the end device in the LoRaWAN Device	Repository		
Select the end device in the LoRaWAN Device	Repository		
<ul> <li>Select the end device in the LoRaWAN Device</li> <li>Enter end device specifics manually</li> </ul>	e Repository		
Select the end device in the LoRaWAN Device	Repository		
<ul> <li>Select the end device in the LoRaWAN Device</li> <li>Enter end device specifics manually</li> </ul> Frequency plan ③ *			
<ul> <li>Select the end device in the LoRaWAN Device</li> <li>Enter end device specifics manually</li> <li>Frequency plan () *</li> <li>Select</li> </ul>			
Select the end device in the LoRaWAN Device  Enter end device specifics manually  Frequency plan ③ *  Select  LoRaWAN version ③ *			

Figure 122: Setting up for your device

F	
F	
-	Register end device
D	pes your end device have a QR code? Scan it to speed up onboarding.
	Scan end device QR code
E	nd device type
In	put Method $\odot$
	) Select the end device in the LoRaWAN Device Repository
(	Enter end device specifics manually
Fi	requency plan 🗇 *
ſ	Europe 863-870 MHz (SF9 for RX2 - recommended)
L	→ DRaWAN version ⑦ *
	Select 🗸
R	egional Parameters version ⑦ *
	Select
	Figure 123: Setting up for your device
<b>Registe</b> Does your en	<b>Figure 123:</b> Setting up for your device <b>er end device</b> d device have a QR code? Scan it to speed up onboarding.
Registe Does your en Scan en	Figure 123: Setting up for your device er end device d device have a QR code? Scan it to speed up onboarding. d device QR code
<b>Registe</b> Does your en	Figure 123: Setting up for your device er end device d device have a QR code? Scan it to speed up onboarding. d device QR code
Registe Does your en Scan en End device input Methoo	Figure 123: Setting up for your device er end device device have a QR code? Scan it to speed up onboarding. device QR code e type to
Registe Does your en Scan en End device	Figure 123: Setting up for your device rend device device have a QR code? Scan it to speed up onboarding. device QR code Prediction help 2 to be type to be the LoRAWAN Device Repository
Registe Does your en Scan en End device Input Methoo Select th Select th	Figure 123: Setting up for your device rend device device have a QR code? Scan it to speed up onboarding. device QR code Device registration help to to to to to to to to to to
Registe Does your en Scan en End device Select th Select th Enter enco Frequency pl	Figure 123: Setting up for your device rend device device have a QR code? Scan it to speed up onboarding. device QR code Device registration help to e type to a end device in the LoRaWAN Device Repository Idevice specifics manually an O
Registe Does your en Scan en End device Input Methoo Select th Enter enc Frequency pl Europe 863	Figure 123: Setting up for your device rend device device have a QR code? Sca it to speed up onboarding. device QR code Previce registration help to retupe to retupe to reture the LoRaWAN Device Repository: device specifics manually: an • • -870 MHz (SP9 for RX2 - recommended)
Registe Does your en Scan en End device Input Methoo Select th Enter enc Frequency pl Europe 863 LorawAN ver	Figure 123: Setting up for your device rend device device have a QR code? Sca it to speed up onboarding. device QR code Previce registration help to retupe to retupe to reture the LoRaWAN Device Repository: device specifics manually: an • • -870 MHz (SP9 for RX2 - recommended)
Registe Does your en Scan en End device Input Method Select th Select th Europe 863 Lurope 863 LoRaWAN vei LoRaWAN S	Figure 123: Setting up for your device rend device device have a QR code? Scan it to speed up onboarding. device QR code Period Period Registration help to to to to to to to to to to
Registe Does your en Scan en End device Input Method Select th Select th Europe 863 LoRaWAN ver LoRaWAN S	Figure 123: Setting up for your device rend device device have a QR code? Scan it to speed up onboarding. device QR code Period registration help to retype to e type to set device in the LoRaWAN Device Repository: I device specifics manually: an • • 
Registe Does your en Scan en End device Input Method Select th Select th Europe 863 LoRaWAN ver LoRaWAN S	Figure 123: Setting up for your device rend device device have a QR code? Scan it to speed up onboarding. device QR code Device registration help Device registration he

Figure 124: Setting up for your device

4. Then click **Show advanced activation**, **LoRaWAN class and cluster settings**. Configure the activation mode by selecting **Activation by personalization (ABP)** and Additional LoRaWAN class capabilities to **class A only**.

	de? Scan it to speed up onboarding.		
Scan end device QR code	■ <u>Device registration help</u> Ø		
End device type			
Input Method 💿			
Select the end device in the LoP	RaWAN Device Repository		
• Enter end device specifics man	ually		
Frequency plan ⑦ *			
Europe 863-870 MHz (SF9 for RX2	- recommended) V		
LoRaWAN version ⑦*			
LoRaWAN Specification 1.0.3	v		
Regional Parameters version ⑦*			
RP001 Regional Parameters 1.0.3	revision A		
Show advanced activation, LoRaWA	N class and cluster settings ∽		
To continue place enterthe leipE	Confirm	a appearding options	
	UI of the end device so we can detern		
	UI of the end device so we can detern	ne onboarding options : Setting up for your device	
To continue, please enter the JoinE	UI of the end device so we can detern		
To continue, please enter the JoinE	UI of the end device so we can detern		
To continue, please enter the JoinE how advanced activation, LoRaWAN	UI of the end device so we can detern		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode Over the air activation (OTAA) Activation by personalization (AE	UI of the end device so we can detern Figure 12 I class and cluster settings ~		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode Over the air activation (OTAA)	UI of the end device so we can detern Figure 12 I class and cluster settings ~		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode ③ Over the air activation (OTAA) Activation by personalization (AE Define multicast group (ABP & M	UI of the end device so we can detern <b>Figure 12</b> <u>I class and cluster settings</u> ~ BP) ulticast)		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode ③ Over the air activation (OTAA) Activation by personalization (AE Define multicast group (ABP & M	UI of the end device so we can detern <b>Figure 12</b> <u>I class and cluster settings</u> ~ BP) ulticast)		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode ③ Over the air activation (OTAA) Activation by personalization (AE Define multicast group (ABP & M dditional LoRaWAN class capabilit None (class A only) etwork defaults ③	UI of the end device so we can detern <b>Figure 12</b> <u>I class and cluster settings</u> ~ BP) ulticast) ies ©		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode ③ Over the air activation (OTAA) Activation by personalization (AE Define multicast group (ABP & M dditional LoRaWAN class capabiliti None (class A only) letwork defaults ③	UI of the end device so we can detern <b>Figure 12</b> <u>I class and cluster settings</u> ~ BP) ulticast) ies ©		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode ③ Over the air activation (OTAA) Activation by personalization (AE Define multicast group (ABP & M dditional LoRaWAN class capabiliti None (class A only) tetwork defaults ③ Use network's default MAC settin	UI of the end device so we can detern <b>Figure 12</b> <u>I class and cluster settings</u> ~ BP) ulticast) ies ©		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode ③ Over the air activation (OTAA) Activation by personalization (AE Define multicast group (ABP & M dditional LoRaWAN class capabiliti None (class A only) letwork defaults ③ Use network's default MAC settin luster settings ③	UI of the end device so we can detern <b>Figure 12</b> <u>I class and cluster settings</u> ~ BP) ulticast) ies ©		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode ③ Over the air activation (OTAA) Activation by personalization (AE Define multicast group (ABP & M dditional LoRaWAN class capabiliti None (class A only) etwork defaults ③ Use network's default MAC settin luster settings ③	UI of the end device so we can detern <b>Figure 12</b> <u>I class and cluster settings</u> ~ BP) ulticast) ies ©		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode ③ Over the air activation (OTAA) Activation by personalization (AE Define multicast group (ABP & M dditional LoRaWAN class capabiliti None (class A only) etwork defaults ③ Use network's default MAC settin luster settings ③ Skip registration on Join Server	UI of the end device so we can detern <b>Figure 12</b> <u>I class and cluster settings</u> ~ BP) ulticast) ies ©		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode © Over the air activation (OTAA) Activation by personalization (AE Define multicast group (ABP & M dditional LoRaWAN class capabiliti None (class A only) etwork defaults © Use network's default MAC settin luster settings © Skip registration on Join Server	UI of the end device so we can detern <b>Figure 12</b> <u>I class and cluster settings</u> ~ BP) ulticast) ies ©		
To continue, please enter the JoinE how advanced activation, LoRaWAN ctivation mode Over the air activation (OTAA) Activation by personalization (AE Define multicast group (ABP & M dditional LoRaWAN class capabilit	UI of the end device so we can detern <b>Figure 12</b> <u>I class and cluster settings</u> ~ BP) ulticast) ies ©		

Figure 126: Setting up for your device

 Once done, provide the DevEUI credentials of your device into the DevEUI portion. This will automatically generate the specific End device ID of your board. Then click Generate under Device address, AppSKey and NwkSKey under Provisioning information section. Then click Register end device.

### VOTE:

• The **DevEUI**, **Device address**, **AppSKey**, and **NwkSKey** are hidden in this section as these are unique from a specific device. The **DevEUI** credential is unique to every RAK3272S device. Also, you should generate your own **Device address**, **AppSKey**, and **NwkSKey** credentials for your specific device and application.

Activati	ion mode 🗇		
🔿 Ove	er the air activation (OTAA)		
<ul> <li>Acti</li> </ul>	tivation by personalization (ABP)		
🔿 Defi	fine multicast group (ABP & Multicast)	)	
Additio	onal LoRaWAN class capabilities 🔊		
None	(class A only)		v
Networl	rk defaults ⑦		
	e network's default MAC settings		
✓ Use	2 network's default MAC settings		
Cluster	r settings ⑦		
Skip	ip registration on Join Server		

#### **Provisioning information**

DevEUI ⑦	
Device address ⑦*	
🗘 Generate	
AppSKey ⑦ *	
·····	$\phi$ Generate
NwkSKey (2) *	
·····	$\phi$ Generate
End device ID ② *	
my-new-device	
This value is automatically prefilled using the DevEUI	
After registration	

View registered end device

 $\bigcirc\,$  Register another end device of this type

Register end device

\_

Figure 127: Setting up for your device

Provisioning information	
DevEUI 🗇	
AC Generate 0/50 used	
Device address ⑦ *	
••••••• 🗘 Generate	
AppSKey 💮 *	
	🗘 Gen
NwkSKey ⑦*	
	🗘 Gen
End device ID 📀 *	
eui-ac1f09fffe0536df	
This value is automatically prefilled using the DevEUI	
After registration	
<ul> <li>View registered end device</li> </ul>	
<ul> <li>Register another end device of this type</li> </ul>	

Register end device

Figure 128: Setting up for your device

#### **Provisioning information**

DevEUI 💿	
AC 12 09 FF FE 05 36 05	
Device address ③ *       ·······            Generate           AppSKey ③ *	
	$\phi$ Generate
NwkSKey 🗇 *	
··· ·· ·· ·· ·· ·· ·· ·· ·· ·· ·· ·· ··	$\phi$ Generate
End device ID ⑦ *	
eui-ac1f09fffe0536df	
This value is automatically prefilled using the DevEUI	
After registration	
View registered end device	

Register another end device of this type

Register end device

Figure 129: Setting up for your device

### **Provisioning information**

DevEUI 🗇		
AC 1999 FF F5 05 36 0F		
Device address ⑦ *		
26 00 52 00 ¢ Generate		
AppSKey ⑦ *		
	$\phi$ Generate	-
NwkSKey ⑦ *		
·····	$\phi$ Generate	
End device ID 🗇 *		
eui-ac1f09fffe0536df		
This value is automatically prefilled using the DevEUI		
After registration		
View registered end device		
<ul> <li>Register another end device of this type</li> </ul>		

Register end device

Figure 130: Setting up for your device

#### **Provisioning information**

DevEUI 🗇
AC 17 09 17 17 05 05 07 0/50 used
Device address ⑦*
26 08 52 00
AppSKey ② *
1F FA 86 81 65 70 35 CD 34 AA 11 A5 EA 89 18 40
NwkSKey ③ *
••••••••••••••••••••••••••••••••••••••
End device ID <sup>®</sup> * eui-ac1f09fffe0536df
This value is automatically prefilled using the DevEUI
After registration
View registered end device
Register another end device of this type
Register end device
Finner 101. Catting up for your device
Figure 131: Setting up for your device
Provision in a information
Provisioning information
DevEUI (2)
AC Generate 0/50 used
DevEUI ⑦
AC       Image: Constraint of the second secon
DevEUI ③ AC Generate 0/50 used 0/50 used 0/50 used 0/50 used
DevEUI      AC        O/50 used        Device address ③*      26
DevEUI AC C Generate Device address ③* 26 C Generate AppSKey ③*
DevEUI ③ AC O/50 used Device address ③* 26 ④ Generate AppSKey ③* 1F FA NwkSKey ③* 92 DD
DevEUI ③ AC Device address ③* 26 AppSKey ③* 1F FA NwkSKey ③* 92 DD End device ID ③*
DevEUI ③ AC O/50 used Device address ③* 26 ④ Generate AppSKey ③* 1F FA NwkSKey ③* 92 DD
DevEUI ③ AC AC Obvice address ③* 26 Comment
DevEUI ③ AC O O O O O O O O O O O O O O O O O O O
DevEUI ③ AC AC Comments Ac Comments Comments AppSKey ③* IF FA AppSKey ③* 92 DD Comments End device ID ③* eui-actfosfffe0536df This value is automatically prefilled using the DevEUI After registration

Figure 132: Register end device

6. You should now be able to see the device on the TTN console after you fully register your device, as shown in **Figure 133**.

## **BAK**<sup>®</sup> Documentation Center

THE THINGS NETWORK	THE THINGS STACK Community Edition	Overview	Applications	🔒 Gateways	** Organizations			EU1 Community No support plan ⑦	rakwirelessapp 👻
LoRa	WAN Devices Application				Applications > LoRaWAN Dev	rices Application > End devices > eui-ac1f09fffe0536df			
Over	new				eui-ac1f09ff ID: eui-ac1f09fffe053				
🙏 End d	levices				↑ n/a ↓ n/a • No activity	yyet 🗇			
🗐 Live d	lata				Overview Live data	Messaging Location Payload formatters General sett	ings		
<> Paylo	ad formatters 🗸 🗸				General information		• Live data See	all activity →	
犬 Integ	rations ~				End device ID	eui-acif09fffe0536df	② 23:23:20 Create end device DevAddr: 26 08 52 DC ↔ 6		
🚉 Colla	borators				Frequency plan	Europe 863-870 MHz (SF9 for RX2 - recommen			
Ov API k	2)/5				LoRaWAN version	LoRaWAN Specification 1.0.3			
🔅 Gene	ral settings				Regional Parameters version	RP001 Regional Parameters 1.0.3 revision A			
					Created at	Jan 16, 2023 23:23:20			
					Activation information		Location Change location	on settings →	
					AppEUI	n/a			
					DevEUI	AC 2002312000 0			
					Session information				
					Session start	Jan 16, 2023 23:23:21	No location information available		
					Device address	26 0 0 0 0 0			
					NwkSKey	••••••			
					SNwkSIntKey	••••••			
					NwkSEncKey	••••••	and the second		
					AppSKey	••••••			

Figure 133: ABP device successfully registered to TTN

## **ABP Configuration for TTN**

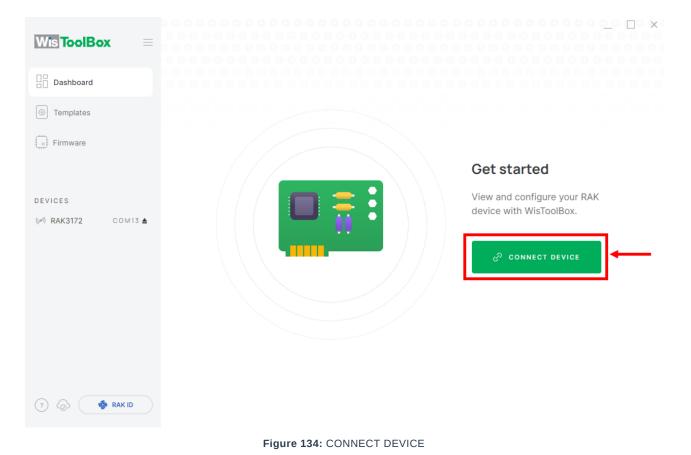
The RAK3272 Breakout Board which has a RAK3172 module in it can be configured using WisToolBox to do the ABP configuration. **WisToolBox** is a software tool that supports **RAK3172** module. It automatically detects RAK3172 module once connected to PC. Below are the options in WisToolBox that the ABP configuration can be done.

- ABP Configuration for TTN via WisToolBox UI
- ABP Configuration for TTN via WisToolBox Console

## ABP Configuration for TTN via WisToolBox UI

The **RAK3172** should have correct ABP credentials to connect to TTN. This can be done using **WisToolBox**. Below are the steps on setting up your **RAK3172** using **WisToolBox**.

- 1. Connect your **RAK3172** with your chosen WisBlock base board to the PC via USB cable and open the **WisToolBox** application.
- 2. Click **CONNECT DEVICE** button to launch the WisToolBox Dashboard.



- 3. Then select your target port where your **RAK3172** is connected. Once recognized, click **CONNECT** as shown in
  - Figure 136.

Wis ToolBox =		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Dashboard	Connecti	on settings
	Port	СОМ12 ~
Templates	Device	Unidentified
Firmware		Select manually
	Baud Rate	115200 ~
DEVICES (⊭1) RAK3172 COM13 ▲	Byte Size	8 ~
	Parity	None ~
	Stop Bits	1 2
	ð	CONNECT
	с	ANCEL

Figure 135: Setting up your device

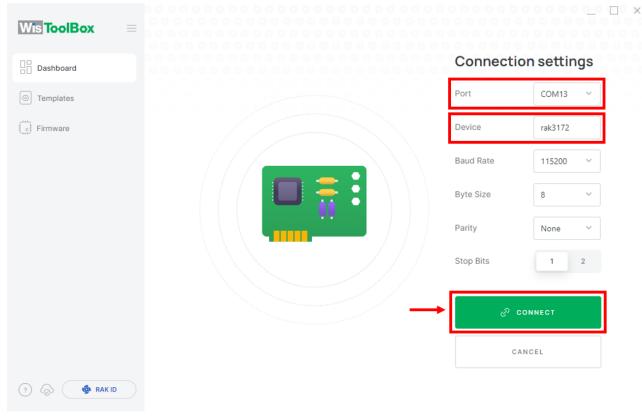


Figure 136: Setting up your device

4. Once done, RAK3172 will appear in the dashboard then select it.

Wts ToolBox =	000000		1	
Dashboard	RAK     RAK3172     CE     Ded to ACTIVITIES	WisDuo LPWAN Module for LoRaWAN		100%
O Templates		(MODEL RAK3172) (EUI 00 (AT DEFAULT)	PORT C	ом13
Firmware				
DEVICES				
()≠) RAK3172 COM13 ▲				
🤊 🕼 🏟 RAK ID	C			

Figure 137: Device seen from WisToolBox dashboard

5. Then click **PARAMETERS** to do the configuration in your RAK3172.

### **NOTE**:

 The AppSKey, Device address, and NwkSKey are hidden in this section as these are unique from a specific device.

Wis ToolBox =	P 🚳 RAK	WisDuo LF LoRaWAN	WAN Module for	_ □ ×
Templates	RAK3172 CE Deve UI: AC1F09FFFE052B2E	STATUS	((m)) - 🗩 100%	
E Firmware		DEVICE EUI	00	Ð
		MODEL	rak3172	
ICES		FIRMWARE	RUI_3.5.4_RAK3172-E AT DEF	AULT
<b>(3172</b> COM13 ▲	PARAMETERS	HARDWARE ID	stm32wle5xx	Q
	ADVANCED	LAST SYNC	1/19/2023, 3:03:56 PM	C
	FIRMWARE			
		DOCUMEN	TATION [2	
🔊 🍈 🧔 RAK ID				

Figure 138: Setting up your device

- 6. Click **Global settings** to set the network mode into **LoRaWAN** and join mode to **ABP**. Make sure that the active region is using **EU868** for this configuration. If you wish to work on other regional band, you can choose among active regions based on your location.
- LoRa network mode: LoRaWAN
- LoRaWAN join mode: ABP
- LoRaWAN region: EU868

Wis ToolBox =			_
		Device Parameters	Sync less then 1 min ago $$ $$ $$ $$ $$ $$
Dashboard	💾 🏟 RAK	SAVE AS TEMPLATE	APPLY A TEMPLATE
Templates	RAK3172 CE DevE UI: AC1F09FFFE052B2E		
Firmware		Global settings	~
		<ol> <li>LoRaWAN keys, ID, EUI</li> </ol>	~
DEVICES			
() <b>RAK3172</b> COM13 ▲	DEVICE INFO	<ol> <li>Data on LoRa<sup>®</sup> network</li> </ol>	~
	PARAMETERS		
	ADVANCED	<ul> <li>LoBo<sup>®</sup> notwork management</li> </ul>	~
	FIRMWARE	<ul> <li>LoRa<sup>®</sup> network management</li> </ul>	·
		<ol> <li>Generic LoRaWAN instructions</li> </ol>	~
		① LoRaWAN multicast group	~
(7) (2) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4		<ol> <li>Custom Commands</li> </ol>	~
	Figure 139:	Global settings	

Wis ToolBox =		Device Parameter	'S Syr	×
Dashboard	💾 🏟 RAK	SAVE AS TEMPLATE	APPL	Y A TEMPLATE
Templates		<ol> <li>Global settings</li> </ol>		^
		Network mode	LoRaWAN	P2P
DEVICES		Join mode	ΟΤΑΑ	ABP
() / RAK3172 COM13 ▲	DEVICE INFO	Join mode	UTAA	АВР
	PARAMETERS	Active region EU8	68 V	
	ADVANCED			
	FIRMWARE	<ol> <li>LoRaWAN keys, ID, EUI</li> </ol>		~
		<ol> <li>Data on LoRa<sup>®</sup> network</li> </ol>	k	~
		i LoRa <sup>©</sup> network manag	ement	~
? 🔊 🏟 RAK ID	1 Command MODEL RAK3172	PORT COM13 A		APPLY COMMAND
	Figure 140	: Global settings		

7. Then click LoRaWAN keys, ID, EUI to configure the Application session key (AppSKey), Device address and Network session key (NwkSKey).

Wis ToolBox =		Device Paran	neters	Sync less then 1 min ago 💍
Dashboard	Part 🗐 🖗	SAVE AS TEMP		APPLY A TEMPLATE
Templates	RAK3172 CE Deve UI: AC1F09FFFE052B2E			
Firmware		<ol> <li>Global settings</li> </ol>		^
		Network mode	LoRaWAN	P2P
DEVICES		Join mode	OTAA	ABP
(x <sup>4</sup> ) RAK3172 COM13 ▲	DEVICE INFO			
	PARAMETERS	Active region	EU868	~
	ADVANCED			
	FIRMWARE	→ () LoRaWAN keys,	ID, EUI	~
		⑦ Data on LoRa <sup>©</sup> r	network	~
		<ol> <li>LoRa<sup>®</sup> network</li> </ol>	management	~
? 🔕 🏟 RAK ID	1 Command MODEL RAK3172	PORT COM13		APPLY COMMAND
	Figure 141: Lo	RaWAN keys, ID, EUI		

		Device Parame	eters	Sync less then 1 min ago 💍
Dashboard	🔛 🏟 RAK 👔	SAVE AS TEMPLA	ATE A	PPLY A TEMPLATE
Templates	RAK3172 CE DevE UI: AC1F09FFFE052B2E	Join mode	ΟΤΑΑ	ABP
Firmware		Active region	EU868 ~	
DEVICES				
() PN RAK3172 COM13 ▲	DEVICE INFO	🚯 LoRaWAN keys, ID	), EUI	^
	PARAMETERS			
	ADVANCED	Application session key	000000000000000000000000000000000000000	00000000000(32/32)
	FIRMWARE	Device address	0000000	8/8
		Network session key	000000000000000000000000000000000000000	00000000000 32/32
		Network ID	000000	
? 🔊 🏟 RAK ID	1 Command MODEL RAK3172	PORT COM13		APPLY COMMAND
	Figure 142: Se	tting up your device		

- 8. Then go back to console where your RAK3172 End device is created previously. Then copy all the credentials from there. Those will be the ones to be used also in the WisToolBox dashboard. Once encoded into the dashboard, click **APPLY COMMANDS** to update your device as shown in **Figure 150**.

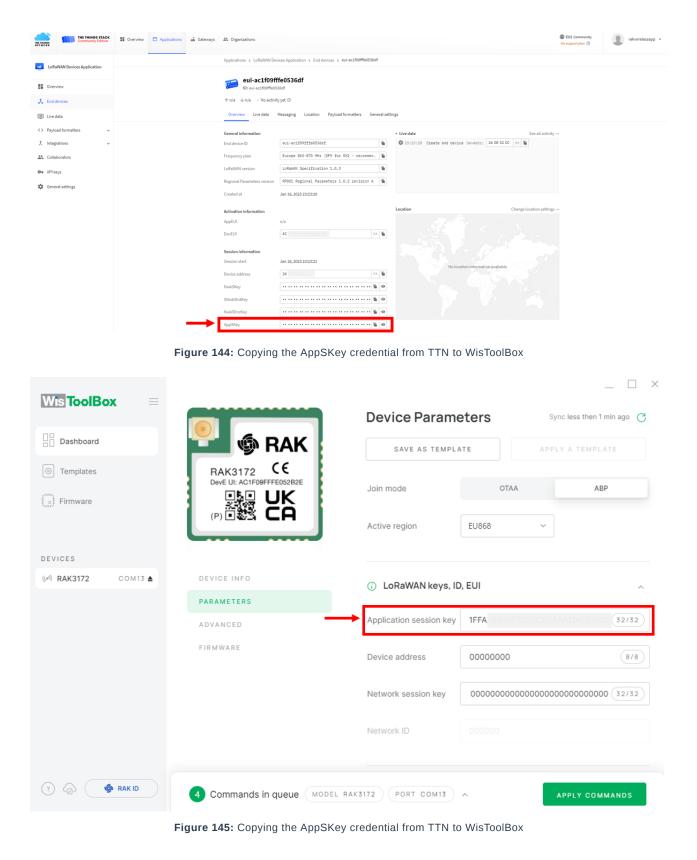
### **NOTE:**

• The **AppSKey**, **Device address**, and **NwkSKey** are hidden in this section as these are unique from a specific device.

THE THINGS STACK	📰 Overview 🗖 Applications 🚔 Gateway	s 🚢 Organizations			EUI Community     No support plan ()
LoRaWAN Devices Application		Applications > LoRaWAN D	evices Application > End devices > eui-ac1f09fffe0536df		
Cverview  Locate  Live data		eui-ac1f09f ID: eui-ac1f09ffe0 ↑n/a ↓n/a • No activ Overview Live data	0536df	tings	
<ul> <li>C&gt; Payload formatters</li> <li>↓</li> <li>Integrations</li> <li>↓</li> <li>Collaborators</li> <li>Or API keys</li> <li>Øreneral settings</li> </ul>		General information End device ID Frequency plan LoRaWAN version Regional Parameters version Created at		Live data     See all activ     Q 23:23:20 Create end device DevAddr: 26 05 52 DC 0	ty →
		Created at Activation Information AppEUT DevEUT Session Information Session start Device address HwkSKey SilvukSintKey HwkSEncKey AppSkey	Jan 16, 2023 23:23:20 n/a Ac ↔ • Jan 16, 2023 23:23:21 26 ↔ • • • • • • • • • • • • • •	Coation Change location setting	P -

Figure 143: Your created ABP device from your console

• For Application session key (AppSKey)



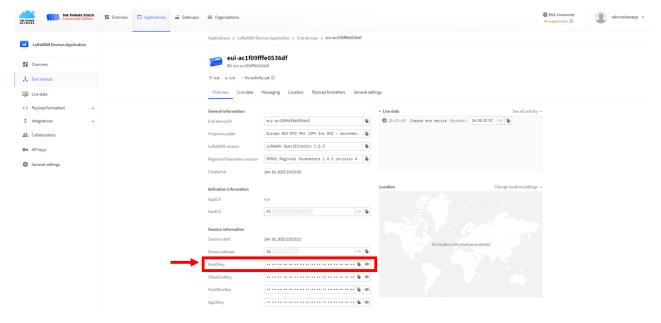
#### • For Device address

THE THINGS STACK	Cverview	Applications	🔒 Gateways	A Organizations			EUI Community No support plan ①
LoRaWAN Devices Application				Applications > LoRaWAN De	vices Application > End devices > eui-ac1f09fffe0536df		
				eui-ac1f09f	ffe0536df		
Overview				ID: eui-ac1f09fffe05	i36df		
🙏 End devices				↑ n/a ↓ n/a • No activi	ty yet 🗇		
Uve data				Overview Live data	Messaging Location Payload formatters General set	ttings	
C> Payload formatters ~				General information		Live data	See all activity →
犬 Integrations ~				End device ID	eui-acif09fffe0536df	23:23:20 Create end device DevAddr: 26 08 52 DC <:	· 56
Collaborators				Frequency plan	Europe 863-870 MHz (SF9 for RX2 - recommen_		
<b>D</b> ₩ API keys				LoRaWAN version	LoRaWAN Specification 1.0.3		
General settings				Regional Parameters version	RP001 Regional Parameters 1.0.3 revision A		
*				Created at	Jan 16, 2023 23:23:20		
				Activation information		Location Cha	nge location settings $\rightarrow$
				AppEUI	n/a		
				DevEUI	AC 2000 1000 00 00 00 00 00 00 00 00 00 00 0		
				Session information			
				Session start	Jan 16, 2023 23:23:21	No location information available	
			$\rightarrow$	Device address	26		
				NwkSKey	••••••		
				SNwkSIntKey	••••••		
				NwkSEncKey	••••••		
				AppSKey	•••••		



Wis ToolBox =		Device Parame	eters	Sync less then 1 min ago $C$
Dashboard	🔛 🏟 RAK 👔	SAVE AS TEMPLA	AT E	APPLY A TEMPLATE
© Templates	RAK3172 CE			
Firmware		Join mode	OTAA	ABP
-11-		Active region	EU868	~
DEVICES				
()≠1) RAK3172 COM13 ▲	DEVICE INFO	<ol> <li>LoRaWAN keys, ID</li> </ol>	), EUI	^
	PARAMETERS			
	ADVANCED	Application session key	1FFA \6816F7D	3ECE3AAA11A5EAB01 32/32
	FIRMWARE	Device address	26	8/8
		Network session key	00000000000	00000000000000 32/32
		Network ID		
? ⊘ 🔹 RAK ID	4 Commands in queue MODEL	RAK3172 PORT COM13	^	APPLY COMMANDS
Fig	ure 147: Copying the Device add	ress credential from TTI	N to WisToolB	OX

### • For Network session key (NwkSKey)



#### Figure 148: Copying the NwkSKey credential from TTN to WisToolBox

Wis ToolBox =		Device Param	eters	Sync less then 1 min ago
Dashboard	💾 🏟 RAK	SAVE AS TEMPL	ATE	APPLY A TEMPLATE
Templates	RAK3172 CE DevE UI: AC1F09FFFE052B2E			
Firmware		Join mode	OTAA	ABP
		Active region	EU868	~
DEVICES				
() MAK3172 COM13 ▲	DEVICE INFO	<ol> <li>LoRaWAN keys, II</li> </ol>	D, EUI	^
	PARAMETERS			
	ADVANCED	Application session key	1FFA_6816F7D	3ECE3AAA11A5EAB01 32/32
	FIRMWARE	Device address	26085200	8/8
	-	Network session key	92DD	7831F68E4796CCFA 32/32
		Network ID	000000	
🤊 💩 🏟 RAK ID	Commands in queue MODEL	RAK3172 PORT COM13	^	APPLY COMMANDS

- Figure 149: Copying the NwkSKey credential from TTN to WisToolBox
- WisToolBox Dashboard

Wis ToolBox =		Device Param	eters	X
Dashboard	💾 🏟 RAK	SAVE AS TEMPL	ATE	APPLY A TEMPLATE
© Templates	RAK3172 CE DevE UI: AC1F09FFFE052B2E			
Firmware		Join mode	OTAA	ABP
		Active region	EU868	~
DEVICES				
()≠1) RAK3172 COM13 ▲	DEVICE INFO	<ol> <li>LoRaWAN keys, I</li> </ol>	D, EUI	^
	PARAMETERS			
	ADVANCED	Application session key	1FFA 681617D	SECESAAAIIASEABOI 32/32
	FIRMWARE	Device address	26085200	(8/8)
		Network session key	92DD	7681F68E479600FA 32/32
		Network ID		
(?) 🐼 🐠 RAK ID	Commands in queue MODEL F	RAK3172 PORT COM13	^ <b>—</b>	APPLY COMMANDS

Figure 150: Used credentials from your console in WisToolBox dashboard

9. Once done, you will see the summary of commands that is applied to your device. Then click **CLOSE**.

Wis ToolBox =			
Dashboard	Commands applied to RAK3172 WisDuo LPWAN Module for LoRaWAN		
I Templates	TOF LORAWAN		
Firmware	Soin mode	Successful	16:55
DEVICES	Application session key	Successful	16:55
(⊮) RAK3172 COM13 ▲			
	O Device address	Successful	16:55
	Network session key	Successful	16:55
?	CLOSE		

Figure 151: Summary of commands

10. Now you will see it returns back to the dashboard with updated credentials of your device.

Wis ToolBox =		Device Parame	eters	X
Dashboard	💾 🏟 RAK 🛛	SAVE AS TEMPLA	AT E	APPLY A TEMPLATE
I Templates	RAK3172 CE DevE UI: AC1F09FFFE052B2E			
Firmware		Global settings		^
		Network mode	LoRaWAN	P2P
DEVICES		Join mode	ΟΤΑΑ	ABP
() / RAK3172 COM13 ▲	DEVICE INFO			
	PARAMETERS	Active region	EU868	~
	ADVANCED			
	FIRMWARE			
		i LoRaWAN keys, ID	D, EUI	^
		Application session key	1FFA	ECE3AAAMA5EABOI (32/32)
		Device address	26085200	8/8
(?) (a) (b) RAK ID		Network session key	92DD	831F08E4790CCF4 (32/32)
		Network ID		



## ABP Configuration for TTN via WisToolBox Console

Here's another way of ABP configuration using **WisToolBox Console**. Below are the steps on setting up your **RAK3172** using **WisToolBox Console**.

1. Connect your **RAK3172** with your chosen WisBlock base board to the PC via USB cable and open the **WisToolBox** application.

2. Click **CONNECT DEVICE** button to launch the WisToolBox Dashboard.

CONNECT DEVICE
Figure 153: CONNECT DEVICE
3. Then select your target port where your <b>RAK3172</b> is connected. Once recognized, click <b>CONNECT</b> as shown in <b>Figure 155</b> .
Setting up your device
Figure 154: Setting up your device
Setting up your device
Figure 155: Setting up your device
righte 100. Cealing up your device
4. Once done, <b>RAK3172</b> will appear in the dashboard then select it.
Device seen from WisToolBox dashboard
Figure 156: Device seen from WisToolBox dashboard
5. Then click <b>ADVANCED</b> .
Setting up your device
Figure 157: Setting up your device
6. Once done, click <b>OPEN CONSOLE</b> to do the configuration.
POPEN CONSOLE
Figure 158: OPEN CONSOLE
Dpening the Console terminal of WisToolBox
Figure 159: Opening the Console terminal of WisToolBox
Copening the Console terminal of WisToolBox
Figure 160: Opening the Console terminal of WisToolBox

7. To start the configuration, type **ATE** so you can echo the commands you input during your configuration. Then press **Enter**.

It is recommended to start by testing the console and verify that the current configuration is working by sending these two AT commands:



ATE is useful for tracking the commands and troubleshooting.

You will receive OK when you input the two commands. After setting ATE , you can now see all the commands you input together with the replies.

### **NOTE:**

If there is no or any reply, check if the device is powered correctly. If you are getting power from a USB port, ensure that you have a good USB cable.

Setting up your Console	
	Figure 161: Setting up your Console
Setting up your Console	
	Figure 162: Setting up your Console
Setting up your Console	
	Figure 163: Setting up your Console

 Then configure the LoRaWAN join mode to ABP. You can check what parameter you will input by typing AT+NJM? then Enter into the console terminal. For ABP, you should input AT+NJM=0 then press Enter as shown in Figure 166.

Setting up your Console	
	Figure 164: Setting up your Console
Setting up your Console	
	Figure 165: Setting up your Console
Setting up your Console	
	Figure 166: Setting up your Console

9. Once done, set-up your LoRaWAN region to EU868. You can check what parameter you will input by typing AT+BAND? then Enter into the console terminal. For EU868, you should input AT+BAND=4 then press Enter. If you wish to work on other regional band, you may check the list of band parameter options below.

Set the frequency/region to EU868.

AT+BAND=4
VOTE:
Depending on the Regional Band you selected, you might need to configure the sub-band of your RAK3172 to match the gateway and LoRaWAN network server. This is especially important for Regional Bands like US915, AU915, and CN470.
To configure the masking of channels for the sub-bands, you can use the AT+MASK command that can be found on the AT Command Manual 🖸 .
To illustrate, you can use sub-band 2 by sending the command AT+MASK=0002 .

### List of band parameter options

Code

**Regional Band** 

EU433

Code	Regional Band	
1	CN470	
2	RU864	
3	IN865	
4	EU868	
5	US915	
6	AU915	
7	KR920	
8	AS923-1	
9	AS923-2	
10	AS923-3	
11	AS923-4	
Setting up your Console	Figure 167: Setting up your Console	
Setting up your Console	rigure 107. Setting up your console	
	Figure 168: Setting up your Console	
Setting up your Console	Figure 169: Setting up your Console	

10. Then next to this will be updating the ABP credentials of your device. First to this will be the Application session key (AppSKey). Go back to your console where your RAK3172 End device was created to copy the AppSKey credential then paste it to the WisToolBox Console then press Enter.

THE THINOS STACK	👪 Overview 🗖 Applications 🚔 Gateways	2 Organizations			EUI Community No support plan ①
LoRaWAN Devices Application		Applications > LoRaWAN De	vices Application > End devices > eui-ac1f09fffe0538df		
Overview C End devices		eui-ac1f09ff ID: eui-ac1f09ffe0: ↑n/a ↓n/a • No activi	536df		
Live data		Overview Live data	Messaging Location Payload formatters General sett	ings	
Payload formatters     v      Integrations     v      th Collaborators     or API keys     General settings		General Information End device ID Frequency plan LoRaWAN version Regional Parameters version Created at	evi-acif09fffe0536df Europe 863-870 Wrz (SF9 for RC2 - zecomen. ) LoBaAAN Specification 1.0.3 SP001 Regional Pazzweters 1.0.3 zevision A Jan 16,2022 232320	Live data     23123120 Czeste end device DevAddr: 26 08 52 00	See all activity –
		Activation information AppEUI DevEUI Session start Device address NuckSkey SNukStrukkey NuckStenokey App:Skey	Jan 16, 2022 222200           AC         O           Jan 16, 2023 222321           26         O           Image: State	Location No location information available	Onarge location settings –

Figure 170: Your created ABP device from your TTN console

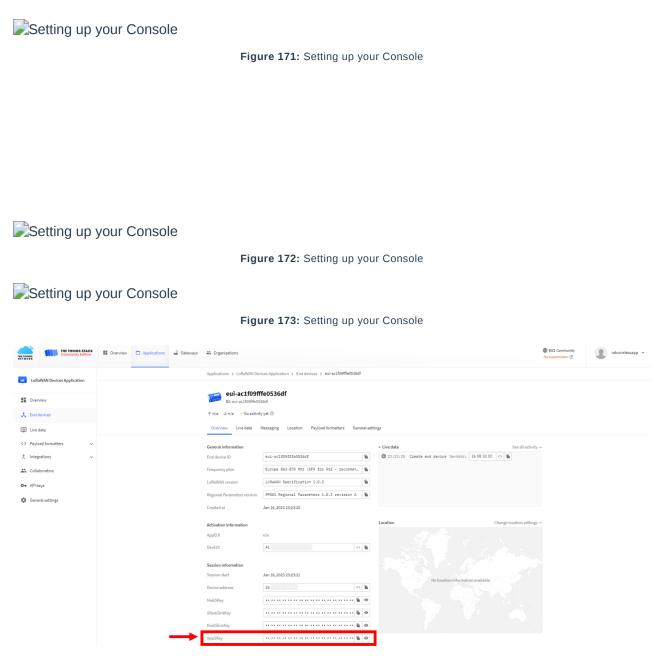


Figure 174: Copying the AppSKey credential from TTN to WisToolBox

Setting up your Console

Figure 175: Setting up your Console

11. Once done, do the same procedure to Device address and Network session key (NwkSKey).

### • For Device address

 Setting up your Console
 Figure 176: Setting up your Console

 Setting up your Console
 Figure 177: Setting up your Console

 Setting up your Console
 Figure 178: Setting up your Console

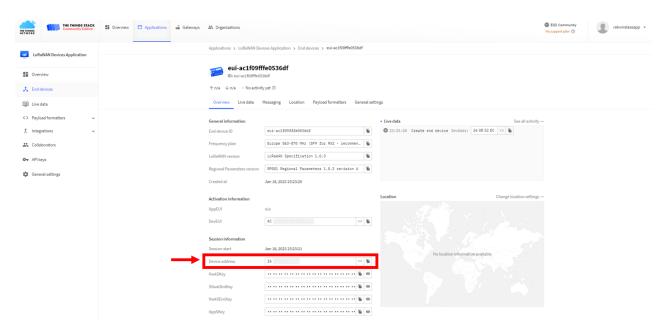


Figure 179: Copying the Device address credential from TTN to WisToolBox

Setting up your Console

Figure 180: Setting up your Console

### • For Network session key (NwkSKey)

Setting up your Console

Figure 181: Setting up your Console

Setting up your Console

Figure 182: Setting up your Console

Setting up your Console

Figure 183: Setting up your Console

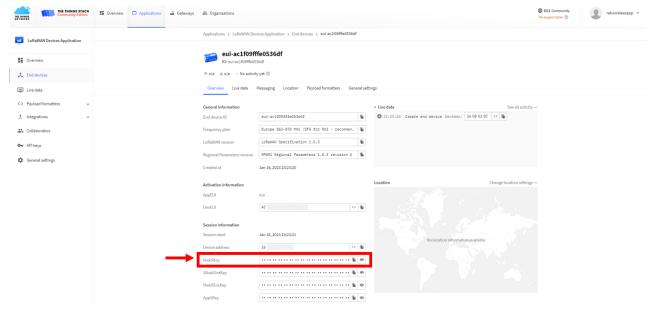


Figure 184: Copying the NwkSKey credential from TTN to WisToolBox

Setting up your Console

Figure 185: Setting up your Console

12. Once done, click **Dashboard** to check the updated credentials of your ABP device. Click **PARAMETERS** to open the **Global Settings** and **LoRaWAN keys, ID, EUI** and check whether these portions are updated.

Setting up your Console

Setting up your Console

Figure 187: Setting up your Console

### PARAMETERS

Figure 188: PARAMETERS

Global settings and LoRaWAN keys, ID, EUI

Figure 189: Global settings and LoRaWAN keys, ID, EUI

Global settings and LoRaWAN keys, ID, EUI details

Figure 190: Global settings and LoRaWAN keys, ID, EUI details

- 13. Now you have a configured ABP device using WisToolBox Console. **ABP-configured devices** are directly tied to network once done with the above procedures so joining procedure is not needed.
- 14. Now you can try sending payload to TTN. Open again the terminal console of WisToolBox to send some payload using it. Send command format: AT+SEND=<port>:<payload>

AT+SEND=2:12345678

BABP device sending payload to the network

Figure 191: ABP device sending payload to the network

ABP device sending payload to the network

Figure 192: ABP device sending payload to the network

BABP device sending payload to the network

Figure 193: ABP device sending payload to the network

BABP device sending payload to the network

Figure 194: ABP device sending payload to the network

15. You can see the data sent by the RAK3172 module on the TTN device console *Live data* section. Also, the *Last seen* info should be a few seconds or minutes ago.

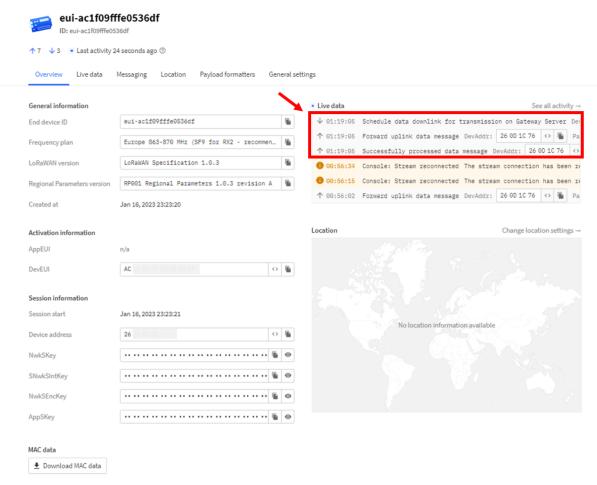


Figure 195: ABP Test Sample Data Sent Viewed in TTN

## **Connecting with ChirpStack**

In this section, it shows how to connect the RAK3272S Breakout Board to the ChirpStack platform.

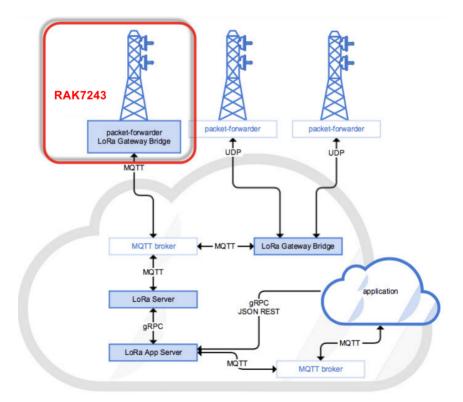


Figure 196: RAK3272S Breakout Board in the Context of the ChirpStack Platform

The ChirpStack or previously known as the LoRaServer project provides open-source components for building LoRaWAN networks. Like the case of TTN, the RAK3272S Breakout Board is located in the periphery and will transmit the data to the backend servers through a LoRaWAN gateway. Learn more about ChirpStack

### **NOTE:**

It is assumed that you are using RAK Gateway and its built-in ChirpStack. Also, the gateway with the ChirpStack must be configured successfully. For further information, check the RAK documents.

- In summary, these are the requirements:
  - 1. Have ChirpStack online gateway, the frequency band of the nodes should be consistent with the frequency band of the gateway in use.
    - Connect the Gateway with Chirpstack
  - 2. The RAK Serial Port Tool provided by RAK
  - 3. RAK3272S Breakout Board

### **NOTE**:

The frequency band used in the demonstration is EU868. Use a high-frequency version of RAK3272S. The product number should be "**RAK3272S (H)**".

### **Create a New Application**

- 1. Log in to the ChirpStack server using your account and password.
- 2. Go to the Application section, as shown in Figure 197.

€	ChirpStack				<b>Q</b> Search organization, application, gateway or device	? 😑 admin
	Network-servers	Applications				+ CREATE
R	Gateway-profiles					
	Organizations	ID	Name	Service-profile	Description	
-	All users	1	арр	service-profile	арр	
chirpstack +					Rows per page: 10 ▼ 1-1 of	1 < >
۵	Org. settings					
*	Org. users					
±≡	Service-profiles					
	Device-profiles					
R	Gateways					
	Applications					
2	Multicast-groups					

Figure 197: Application Section

 By default, you should create a new application, although you can reuse the existing ones. For this setup, create a new Application by clicking on the "CREATE" button, and filling the required parameters, as shown in Figure 198 and Figure 199.

# **BAK**<sup>®</sup> Documentation Center

€	ChirpStack	Q Search organization, application, gateway or device
	Network-servers Gateway-profiles	Applications / Create
•	Organizations All users	Application name * The name may only contain words, numbers and dashes.
	stack -	Application description *
¢ •	Org. settings Org. users	Service-profile * Select service-profile *
≛≡	Service-profiles	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
井	Device-profiles	None  Weddrining a payload codec, ChirpStack Application Server can encode and decode the binary device payload for you.Important nete: the payload fields have moved to the device-profile. For backward-compatibility and migration, existing codec settings are still visible. Codec settings on the device-profile are priority over the application code settings.
R	Gateways	CREATE APPLICATION
2	Applications Multicast-groups	

Figure 198: Creating a New Application

• For this setup, create an Application named "rak\_node\_test".

ChirpStack LoraServer supports multiple system configurations, with only one by default.

- Service profile: Field is to select the system profile.
- **Payload codec**: It is the parsing method for selecting load data such as parsing LPP format data.

€	ChirpStack	Q Search organization, application, gateway or device 🕜 😝 admin
	Network-servers Gateway-profiles	Applications / Create
Ē	Organizations	Application name *
•	All users	rak_node_test The name may only contain words, numbers and dashes.
chirp	ostack 👻	Application description * test
\$	Org. settings	Service-profile *
*	Org. users	service-profile The service-profile to which this application will be attached. Note that you can't change this value after the application has been created.
±≡	Service-profiles	Payload codec
11	Device-profiles	None By defining a payload codec, ChirpStack Application Server can encode and decode the binary device payload for you.Important note: the payload fields have moved to the device-profile. For backward-compatibility and migration, existing codec settings are still visible. Codec settings on the device-profile have priority over the application codec settings.
$\bigcirc$	Gateways	CREATE APPLICATION
	Applications	CREATE APPLICATION
2	Multicast-groups	



### **Register a New Device**

- 1. Choose the **Application** created in the previous step, then select the **DEVICES** tab, as shown in **Figure 200** and **Figure 201**.
- 2. Once done, click "+ CREATE".

	ChirpStack					? \varTheta admin
	Network-servers	Applications				+ CREATE
R	Gateway-profiles					
	Organizations	iD	Name	Service-profile	Description	
*	All users	1	арр	service-profile	арр	
chirp	ostack +	2	rak_node_test	service-profile	test	
۵	Org. settings				Rows per page: 10 💌	1-2 of 2 < >
*	Org. users					
±≡	Service-profiles					
	Device-profiles					
R	Gateways					
	Applications					
2	Multicast-groups					

@	Network-servers Gateway-profiles	Applications /	rak_node_test				DELETE
Ð	Organizations	DEVICES	APPLICATION CONFIGURATION INTEGRATIONS	FUOTA			
*	All users						+ CREATE
chir	ostack 👻						+ GREATE
۵	Org. settings	Last seen	Device name	Device EUI	Link margin	Battery	
*	Org. users				Rows p	er page: 10 🔻 0-0 of 0	< >
±≡	Service-profiles						
	Device-profiles						
R	Gateways						
	Applications						
2	Multicast-groups						

Figure 201: Device Tab of an Application

### 3. Once inside of the DEVICE tab, create a new device (LoRaWAN node) by clicking on the "+ CREATE" button.

€	ChirpStack			? 😝 admin
	Network-servers Gateway-profiles	Applications / rak_node_test		<b>DELETE</b>
	Organizations	DEVICES APPLICATION CONFIGURATION INTEGRATIONS FUOTA		
•	All users			
chir	pstack -			+ CREATE
\$	Org. settings	Last seen Device name Device EUI	Link margin Battery	
•	Org. users		Rows per page: 10 👻 0-6	< > 0 to 0
±≡	Service-profiles			
	Device-profiles			
R	Gateways			
	Applications			
2	Multicast-groups			



€	ChirpStack	Q. Search organization, application, gateway or device 2 e admin	
	Network-servers Gateway-profiles	Applications / rak_node_test / Devices / Create	
•	Organizations All users	GENERAL VARIABLES TAOS	
chirp	stack +	Device name * The name may only contain words, numbers and dashes.	
۵	Org. settings	Device description *	
<u>*</u>	Org. users		
≟≡	Service-profiles	Device EUI *	
	Device-profiles	Device-profile	
$\mathbb{R}$	Gateways		
	Applications	Disable frame-counter validation Note that disabiling the frame-counter validation will compromise security as it enables people to perform replay-attacks.	
2	Multicast-groups	CREATE DEVICE	

Figure 203: Chirpstack Adding Node into the RAK3272S Breakout Board

6. Once the node is created, fill in the necessary data. You can generate a Device EUI automatically by clicking the following icon, or you can write a correct Device EUI in the edit box.

Fill in the parameters requested:

- Device name and Device description: These are descriptive texts about your device.
- **Device EUI**: This interface allows you to generate a Device EUI automatically by clicking the generate icon. You can also add a specific Device EUI directly in the form.
- Device Profile:
  - If you want to join in OTAA mode, select "DeviceProfile\_OTAA".

• If you want to join in ABP mode, select "DeviceProfile\_ABP".

## **NOTE**:

- Device profiles DeviceProfile\_OTAA and DeviceProfile\_ABP are only available if you are using the built-in Chirpstack LoRaWAN Server of RAK Gateways.
- If you have your own Chirpstack installation, you can set up the device profile with LoRaWAN MAC version 1.0.3 and LoRaWAN Regional Parameters revision B to make it compatible with RAK3272S.

∉	ChirpStack	Q Search organization, application, gateway or device e admin	
R	Network-servers Gateway-profiles	Applications / rak_node_test / Devices / Create	
•	Organizations All users	GENERAL VARIABLES TAOS	
chirp	ostack -	rak_node The name may only contain words, numbers and dashes.	
٠	Org. settings	Device description * 1est	
<u>*</u>	Org. users	Perce EUI*	
≛≡	Service-profiles	5E 9D 1E 08 57 CF 25 F1 MSB C	
	Device-profiles	Device-profile * Kevice-profile_otaa	
R	Gateways	device_profile_abp	
	Applications		
2	Multicast-groups	device_profile_otaa	
		CREATE DEVICE	

Figure 204: Generate a New Device EUI

## **Chirpstack OTAA Device Registration**

1. If you have selected "**DeviceProfile\_OTAA**", as shown in **Figure 205**, then after the device is created, an Application Key must be also created for this device.

€	ChirpStack	Q Search organization, application, gateway or device 3	admin
	Network-servers	Applications / rak_node_test / Devices / Create	
R	Gateway-profiles		
	Organizations	GENERAL VARIABLES TAGS	
-	All users	Device name *	
chirp	ostack -	rak_node The name may only contain words, numbers and dashes.	
۵	Org. settings	Device description * test	
-	Org. users	Device EUI *	_
£≡	Service-profiles	5E 9D 1E 08 57 CF 25 F1 MS8	C
	Device-profiles	Device_profile * device_profile_otaa	
R	Gateways		
	Applications	Disable frame-counter validation Note that disabiling the frame-counter validation will compromise security as it enables people to perform replay-attacks.	
٣	Multicast-groups	CREATE D	EVICE

Figure 205: Chirpstack OTAA Activation

2. A previously created Application Key can be entered here, or a new one can be generated automatically by clicking the icon highlighted in red in **Figure 206**.

€	ChirpStack	Q Search organization, application, gateway or device	?	e admi	
	Network-servers	Applications / rak_node_test / Devices / rak_node		DELETE	
$\mathbb{R}$	Gateway-profiles	Applications / Tak_Tode_test / Devices / Tak_Tode			
	Organizations	DETAILS CONFIGURATION KEYS (OTAA) ACTIVATION DEVICE DATA LORAWAN FRAMES FIRMWARE			
*	All users				
chirp	stack 👻	Application key * F9 21 D5 0C D7 D0 2E E3 C5 E6 14 21 54 F2 74 B2 MSB	G	jQ	
۵	Org. settings	For LoRaWAN 1.0 devices. In case your device supports LoRaWAN 1.1, update the device-profile first.			
<u>*</u>	Org. users	Gen Application key MSB	G	j Q	
≛≡	Service-profiles	For LoRaWAN 1.0 devices. This key must only be set when the device implements the remote multicast setup specification / firmware updates over the air (FU0TA). Else leave this field blank.			
븄	Device-profiles		SET DEV	ICE-KEYS	
R	Gateways				-1
	Applications				
2	Multicast-groups				

Figure 206: Chirpstack OTAA Set Application Keys

- 3. Once the Application Key is added to the form, the process can be finalized by clicking on the "SET DEVICE-KEYS" button.
- As shown in **Figure 207**, a new device should be listed in the DEVICES tab. The most important parameters, such as the Device EUI are shown in the summary.

€	ChirpStack				Q Search organization, application, gateway or device		e adm	in
	Network-servers	Applications / ra	ık_node_test				DELET	E
$\bigcirc$	Gateway-profiles							
	Organizations	DEVICES	APPLICATION CONFIGURATION	INTEGRATIONS FUOTA				
•	All users							
chir	pstack +						+ CREAT	E
۵	Org. settings	Last seen	Device name	Device EUI	Link margin	Battery		
*	Org. users	n/a	rak_node	5e9d1e0857cf25f1	n/a	n/a		
<b>≟</b> ≡	Service-profiles				Rows per page: 10 👻	1-1 of 1	< >	
	Device-profiles							
R	Gateways							
	Applications							
٣	Multicast-groups							

Figure 207: Chirpstack OTAA List of Device in the Device Tab

4. To end the process, it is a good practice to review that the Application Key is properly associated with this device. The Application Key can be verified in the **KEYS(OTAA)** tab, as shown in **Figure 208**.

ChirpStack	Q Search organization, application, gateway or device	?	edmin
Network-servers	Applications / rak_node_test / Devices / rak_node		DELETE
Gateway-profiles			
Organizations	DETAILS CONFIGURATION KEYS (OTAA) ACTIVATION DEVICE DATA LORAWAN FRAMES FIRMWARE		
All users			
stack 👻	Application key* 10 21 45 0x 47 40 2x x2 x5 x6 14 21 54 42 74 h2	аБ	66
Org. settings	For LORaWAN 1.0 devices. In case your device supports LORaWAN 1.1, update the device-profile first.		
Org. users			0
Service-profiles	For LoRaWAN 1.0 devices. This key must only be set when the device implements the remote multicast setup specification / firmware updates over the air (FUOTA). Else leave this field blank.		
Device-profiles		SET DEVIC	E-KEYS
Gateways			
Applications			
Multicast-groups			
	Network-servers Gateway-profiles Organizations All users stack • Org. settings Org. users Service-profiles Device-profiles Gateways Applications	Network servers   Gateway-profiles   Organizations   DETAILS   ConFlOURATION   KEYS (OTA)   All users	Network servers   Gateway-profiles   Organizations   all users   stack   org. settings   org. users   Service-profiles   Devices. This key must only be set when the device implements the remote multicast setup specification / fitmware updates over the abr (PUOTA). Ete leave this field black.   Service-profiles   Devices. This key must only be set when the device implements the remote multicast setup specification / fitmware updates over the abr (PUOTA). Ete leave this field black.   Service profiles   Device profiles   Devices. This key must only be set when the device implements the remote multicast setup specification / fitmware updates over the abr (PUOTA). Ete leave this field black.

Figure 208: Application Key Associated with the New Device

## **NOTE**:

Standard OTAA mode requires the **Device EUI**, **Application Key**, and **Application EUI**, but in the ChirpStack's implementation, only the Device EUI and the Application Key are mandatory. The Application EUI is not required and not recorded in the Application tab. Nevertheless, you can reuse the Device EUI as the Application EUI during the configuration on the side of the node.

## **OTAA Configuration for Chirpstack**

The RAK3272S Breakout Board supports a series of AT commands to configure its internal parameters and control the functionalities of the board.

 To set up the RAK3272S Breakout Board to join the Chirpstack using OTAA, start by connecting the RAK3272S Breakout Board to the computer (see Figure 21) and open the RAK Serial Port Tool. Select the right COM port and set the baud rate to 115200.

It is recommended to start by testing the serial communication and verify that the current configuration is working by sending these two AT commands:



ATE will echo the commands you input to the board which is useful for tracking the commands and troubleshooting.

You will receive OK when you input the two commands. After setting ATE, you can now see all the commands you input together with the replies. Try again AT and you should see it on the terminal followed by OK, as shown in **Figure 209**.

### 📝 NOTE:

If there is no ok or any reply, you need to check if the wiring of your UART lines is correct and if the baud is correctly configured to 115200. Also, you can check if the device is powered correctly. If you are getting power from a USB port, ensure that you have a good USB cable.

	Command	
RAK COM: COM3 - BaudRate: )600 - CLOS	■ 01 at+version	SEND
RECEIVING CLEAR REC	✓ 02 at+get_config=device:status	SEND
	03 at+set_config=device:sleep:0	SEND
ок	04 at+set_config=device:restart	SEND
	05 at+set_config=device:gps:1	SEND
ок	06 at+set_config=lora:work_mode:0	SEND
AT	07 at+set_config=lora:join_mode:0	SEND
	08 at+set_config=lora:class:0	SEND
ОК	09 at+set_config=lora:region:EU868	SEND
	10 at+set_config=lora:confirm:1	SEND
	□ 11 at+set_config=lora:ch_mask:0:0	SEND
	12 at+set_config=lora:dev_eui:	SEND
	□ 13 at+set_config=lora:app_eui:	SEND
	□ 14 at+set_config=lora:app_key:	SEND
	□ 15 at+set_config=lora:dev_addr:	SEND
	□ 16 at+set_config=lora:nwks_key:	SEND
	□ 17 at+set_config=lora:apps_key:	SEND
	18 at+set_config=lora:send_interval:	SEND
SENDING(With \r\n)	□ 19 at+get_config=lora:status	SEND
AT	☑ 20 at+get_config=lora:channel	SEND
SEND	□ All/None	SAVE

Figure 209: at+version command response

- 2. The next step is to configure the OTAA LoRaWAN parameters in RAK3272S:
- LoRa work mode: LoRaWAN
- LoRaWAN join mode: OTAA
- LoRaWAN class: Class A
- LoRaWAN region: EU868

Set the work mode to LoRaWAN.



AT+NJM=1

Set the LoRaWAN class to Class A.

AT+CLASS=A

Set the frequency/region to EU868.

AT+BAND=4

## **NOTE:**

- Depending on the Regional Band you selected, you might need to configure the sub-band of your RAK3272S to match the gateway and LoRaWAN network server. This is especially important on Regional Bands like US915, AU915, and CN470.
- To configure the masking of channels for the sub-bands, you can use the AT+MASK command that can be found on the AT Command Manual 🖸 .
- To illustrate, you can use sub-band 2 by sending the command AT+MASK=0002 .

## List of band parameter options

Code	Regional Band
0	EU433
1	CN470
2	RU864
3	IN865
4	EU868
5	US915
6	AU915
7	KR920
8	AS923-1
9	AS923-2
10	AS923-3
11	AS923-4

🖹 RAK SERIAL PORT TOOL — E							
	Command						
BaudRate: 9600 - CLOSE	☑ 01 at+version	SEND					
RECEIVING CLEAR RECV	☑ 02 at+get_config=device:status	SEND					
AT	03 at+set_config=device:sleep:0	SEND					
	04 at+set_config=device:restart	SEND					
ок	05 at+set_config=device:gps:1	SEND					
AT+NWM=1	06 at+set_config=lora:work_mode:0	SEND					
	07 at+set_config=lora:join_mode:0	SEND					
ок	08 at+set_config=lora:class:0	SEND					
AT+NJM=1	09 at+set_config=lora:region:EU868	SEND					
	10 at+set_config=lora:confirm:1	SEND					
ок	11 at+set_config=lora:ch_mask:0:0	SEND					
AT+CLASS=A	12 at+set_config=lora:dev_eui:	SEND					
	13 at+set_config=lora:app_eui:	SEND					
ок	□ 14 at+set_config=lora:app_key:	SEND					
AT+BAND=4	□ 15 at+set_config=lora:dev_addr:	SEND					
	□ 16 at+set_config=lora:nwks_key:	SEND					
ок	□ 17 at+set_config=lora:apps_key:	SEND					
v	18 at+set_config=lora:send_interval:	SEND					
, SENDING(With \r\n)	19 at+get_config=lora:status	SEND					
	☑ 20 at+get_config=lora:channel	SEND					
SEND	All/None	SAVE					
ime 00:00:00   PASS: 0   FAIL: 0   SW_Version: V1.2.1   Make:2018-12-24 04/04/2021 11:23:52 PM							

Figure 210: Configuring LoRa Parameters

3. After the configuration of the LoRaWAN parameters, the next step is to set up the DevEUI and AppKey. You need the use the values from the Chirpstack device console.

#### **NOTE**:

The Application EUI parameter is not required in the ChirpStack platform; therefore, it is possible to use the same id as the Device EUI.

- Device EUI: 5E9D1E0857CF25F1
- Application EUI: **5E9D1E0857CF25F1**
- Application Key: F921D50CD7D02EE3C5E6142154F274B2

Set the Device EUI.

AT+DEVEUI=5E9D1E0857CF25F1

Set the Application EUI.

AT+APPEUI=5E9D1E0857CF25F1

Set the Application Key.

AT+APPKEY=F921D50CD7D02EE3C5E6142154F274B2

RAK SERIAL PORT TOOL					
	Command				
RAK COM: COM12 - BaudRate: )600 - CLOSE	☑ 01 at+version	SEND			
RECEIVING CLEAR RECV	☑ 02 at+get_config=device:status	SEND			
AT+CLASS=A	□ 03 at+set_config=device:sleep:0	SEND			
	□ 04 at+set_config=device:restart	SEND			
ОК	05 at+set_config=device:gps:1	SEND			
AT+BAND=4	06 at+set_config=lora:work_mode:0	SEND			
	07 at+set_config=lora:join_mode:0	SEND			
ок	08 at+set_config=lora:class:0	SEND			
AT+DEVEUI=5E9D1E0857CF25F1	09 at+set_config=lora:region:EU868	SEND			
	10 at+set_config=lora:confirm:1	SEND			
ок	11 at+set_config=lora:ch_mask:0:0	SEND			
AT+APPEUI=5E9D1E0857CF25F1	12 at+set_config=lora:dev_eui:	SEND			
	13 at+set_config=lora:app_eui:	SEND			
ок	□ 14 at+set_config=lora:app_key:	SEND			
AT+APPKEY=F921D50CD7D02EE3C5E6142154F274B2	15 at+set_config=lora:dev_addr:	SEND			
	at+set_config=lora:nwks_key:	SEND			
ок	17 at+set_config=lora:apps_key:	SEND			
v	18 at+set_config=lora:send_interval:	SEND			
SENDING(With \r\n)	19 at+get_config=lora:status	SEND			
AT+APPKEY=F921D50CD7D02EE3C5E6142154F274B2	☑ 20 at+get_config=lora:channel	SEND			
SEND	All/None	SAVE			
Time 00:00:00   PASS: 0   FAIL: 0   SW_Version: V1.2.1   Make:2018-12	-24 28/04/2021 5:17:49 AM				

Figure 211: Configuring LoRa Parameters

4. After EUI and key configuration, the device can now join the network and send some payload.

AT+JOIN=1:0:10:8			

Join command format: AT+JOIN=w:x:y:z

Parameter	Description
W	Join command - 1: joining, 0: stop joining.
х	Auto-join config - 1: auto-join on powerup, 0: no auto-join
у	Reattempt interval in seconds (7-255) - 8 is the default.
Z	Number of join attempts (0-255) - 0 is default.

5. After 5 or 6 seconds, if the request is successfully received by a LoRaWAN gateway, then you should see JOINED status reply.

## **NOTE**:

- If the OTAA device join failed, you need to check if your device is within reach of a working LoRaWAN gateway that is configured to connect to Chirpstack. It is also important to check that all your OTAA parameters (DEVEUI and APPKEY) are correct by using AT+DEVEUI=? and AT+APPKEY=? commands. Lastly, ensure that the antenna of your device is properly connected.
- After checking all the things above, try to join again.

6. With the end-device properly activated, you can now try to send some payload after successful join.

AT+SEND=2:12345678

RAK SERIAL PORT TOOL					- C
BaudRate: 1600			mm		
BaudRate: 3600	CLOSE	¥	01	at+version	
RECEIVING	CLEAR RECV	V	02	at+get_config=device:status	
	^		03	at+set_config=device:sleep:0	
ок			04	at+set_config=device:restart	
AT+APPEUI=5E9D1E0857CF25F1			05	at+set_config=device:gps:1	
			06	at+set_config=lora:work_mode:0	
ок			07	at+set_config=lora:join_mode:0	
AT+APPKEY=F921D50CD7D02EE3C5E6142154F274B2			08	at+set_config=lora:class:0	
			09	at+set_config=lora:region:EU868	
ок			10	at+set_config=lora:confirm:1	
AT+JOIN=1:0:10:8			11	at+set_config=lora:ch_mask:0:0	
			12	at+set_config=lora:dev_eui:	
ок			13	at+set_config=lora:app_eui:	
+EVT:JOINED			14	at+set_config=lora:app_key:	
AT+SEND=2:12345678			15	at+set_config=lora:dev_addr:	
			16	at+set_config=lora:nwks_key:	
ок			17	at+set_config=lora:apps_key:	
	~		18	at+set_config=lora:send_interval:	
sENDING(With \r\n)			19	at+get_config=lora:status	
AT+SEND=2:12345678		V	20	at+get_config=lora:channel	
	SEND		Al	/None	

Figure 212: OTAA Test Sample Data Sent via RAK Serial Port Tool

7. On the ChirpStack platform, you should see the join and uplink messages in the LORAWAN FRAMES tab, as shown in Figure 213. By convention, messages sent from nodes to gateways are considered as Uplinks while messages sent by gateways to nodes are considered as Downlinks.

€	ChirpStack							Q Search organization, application, gateway or device 2 e admin
	Network-servers Applications / rak_node_test / Devices / rak_node					The second secon		
R	Gateway-profiles							
	Organizations	DETAILS	CONFIGURATION	KEYS (OTAA)	ACTIVATION	DEVICE DATA	LORAWAN FRAMES	FIRMWARE
-	All users							
chirpstack -								⑦ HELP II PAUSE
\$	Org. settings	UPLINK	5:42:43 PM	UnconfirmedDataUp	018153f7			×
<u>.</u>	Org. users	DOWNLINK	5:42:17 PM	JoinAccept				~
T≘	Service-profiles	UPLINK	5:42:17 PM	JoinRequest	5e9d1e0857cf25f1			~
	Device-profiles							
R	Gateways							
	Applications							
۳	Multicast-groups							

Figure 213: Chirpstack Data Received Preview

## **Chirpstack ABP Device Registration**

1. During the registration of a new device, if you select "**DeviceProfile\_ABP**", as shown in **Figure 214**, then the ChirpStack platform will assume that this device will join the LoRaWAN network using the ABP mode.

### **NOTE:**

Check "**Disable counting frame verification**". During the test, when the board is restarted, the frame counting number will be also be restarted from zero. This would cause a synchronization problem with the ChirpStack server treating it as a replay attack. For the testing purpose, it is safe to disable this feature, but remember to activate it in a production environment.

€	ChirpStack	Q. Search organization, application, gateway or device ? e admin
<b></b>	Network-servers Gateway-profiles	Applications / rak_node_test / Devices / Create
	Organizations	OENERAL VARIABLES TAGS
*	All users	Device name *
chirp	ostack +	rak_node The name may only contain words, numbers and dashes.
۵	Org. settings	Device description * test
*	Org. users	Device EUI *
±≡	Service-profiles	5e 9d 1e 08 57 cf 25 f1 C
	Device-profiles	Device-profile * device_profile.abp
R	Gateways	
	Applications	Disable frame-counter validation           Note that disabling the frame-counter validation will compromise security as it enables people to perform replay-attacks.
ψ	Multicast-groups	CREATE DEVICE

Figure 214: ChirpStack Console, Configuring a Device

- 2. After selecting the ABP mode, the following parameters appear in the Activation tab, then you can see that there are some parameters for ABP in the **"ACTIVATION"** item:
- Device address
- Network Session Key
- Application Session Key

€	ChirpStack	Q. Search organization, application, gateway or device	?	θ	admin
<b>R</b>	Network-servers Gateway-profiles	Applications / rak_node_test / Devices / rak_node		T DI	ELETE
•	Organizations All users	DETAILS CONFIGURATION KEYS (OTAA) ACTIVATION DEVICE DATA LORAWAN FRAMES FIRMWARE			
chirp	ostack 👻	Device address * 26 01 1a f9	Ν	ISB	c
¢	Org. settings Org. users	Network session key (LaRaWAN 1.0) * c2 80 cb 8d 1d f6 88 bc 18 60 1a 97 02 5c 54 88 MSB	C	0	8
<u>_</u> ≡	Service-profiles	Application session key (LofatVMI 1.2)*         4d 42 ec 5c af 97 f0 3d 83 3c da f5 00 3f 69 e1         MSB	C	0	8
# @	Device-profiles Gateways	Uplink frame-counter * 0			۲
<u>۳</u>	Applications Multicast-groups	Downlink frame-counter (network) * 0			٤
		0	RE)ACTIV	ATE DE	VICE

Figure 215: Chirpstack ABP Activation Parameters Needed

3. The parameters can be generated as random numbers by the platform or can be set with user values. Once these parameters are filled in properly, the process is completed by clicking on the "ACTIVATE DEVICE" button.

## **ABP Configuration for Chirpstack**

 To set up the RAK3272S Breakout Board to join the Chirpstack using ABP, start by connecting the RAK3272S Breakout Board to the computer (see Figure 21) and open the RAK Serial Port Tool. Select the right COM port and set the baud rate to 115200.

It is recommended to start by testing the serial communication and verify that the current configuration is working by sending these two AT commands:



ATE will echo the commands you input to the board which is useful for tracking the commands and troubleshooting.

You will receive OK when you input the two commands. After setting ATE, you can now see all the commands you input together with the replies. Try again AT and you should see it on the terminal followed by OK, as shown in **Figure 216**.

## **NOTE**:

If there is no ok or any reply, you need to check if the wiring of your UART lines is correct and if the baud is correctly configured to 115200. Also, you can check if the device is powered correctly. If you are getting power from a USB port, ensure that you have a good USB cable.

	Command	
RAK COM: COM3 - BaudRate: )600 - CL	OSE 01 at+version	SEND
RECEIVING CLEAR R	ECV 02 at+get_config=device:status	SEND
	03 at+set_config=device:sleep:0	SEND
ок	04 at+set_config=device:restart	SEND
	05 at+set_config=device:gps:1	SEND
ок	06 at+set_config=lora:work_mode:0	SEND
AT	07 at+set_config=lora:join_mode:0	SEND
	08 at+set_config=lora:class:0	SEND
ок	09 at+set_config=lora:region:EU868	SEND
	□ 10 at+set_config=lora:confirm:1	SEND
	□ 11 at+set_config=lora:ch_mask:0:0	SEND
	□ 12 at+set_config=lora:dev_eui:	SEND
	□ 13 at+set_config=lora:app_eui:	SEND
	□ 14 at+set_config=lora:app_key:	SEND
	15 at+set_config=lora:dev_addr:	SEND
	16 at+set_config=lora:nwks_key:	SEND
	17 at+set_config=lora:apps_key:	SEND
	18 at+set_config=lora:send_interval:	SEND
ENDING(With \r\n)	19 at+get_config=lora:status	SEND
AT	☑ 20 at+get_config=lora:channel	SEND
SEN	D All/None	SAVE

Figure 216: at+version command response

- 2. The next step is to configure the ABP LoRaWAN parameters in RAK3272S:
- LoRa work mode: LoRaWAN
- LoRaWAN join mode: ABP
- LoRaWAN class: Class A
- LoRaWAN region: EU868

Set the work mode to LoRaWAN. It can be set to P2P as well, but by default, the device is in LoRaWAN mode.

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#### Set the LoRaWAN activation to ABP.

ļ	AT+NJM=0	
Set	et the LoRaWAN class to Class A.	
ļ	AT+CLASS=A	

## Set the frequency/region to EU868.

AT+BAND=4
NOTE:
Depending on the Regional Band you selected, you might need to configure the sub-band of your
RAK3272S to match the gateway and LoRaWAN network server. This is especially important on Regional
Bands like US915, AU915, and CN470.

To configure the masking of channels for the sub-bands, you can use the AT+MASK command that can be found on the AT Command Manual

To illustrate, you can use sub-band 2 by sending the command AT+MASK=0002 .

## List of band parameter options

Code	Regional Band
0	EU433
1	CN470
2	RU864
3	IN865
4	EU868
5	US915
6	AU915
7	KR920
8	AS923-1
9	AS923-2

	AS923-3	
	AS923-4	
RAK SERIAL PORT TOOL	- 0	×
	Command	
• RAK СОМ: СОМЗ •	BaudRate: }600 CLOSE I I at+version SEP	ID
RECEIVING	CLEAR RECV 02 at+get_config=device:status	D
AT	↑ 03 at+set_config=device:sleep:0 SEN	ND ND
	04 at+set_config=device:restart SEN	ID
ок	05 at+set_config=device:gps:1 SEN	ID
AT+NWM=1	06 at+set_config=lora:work_mode:0 SEN	ID
	07 at+set_config=lora;join_mode:0 SEN	ID
ок	08 at+set_config=lora:class:0 SEN	ID
AT+NJM=0	09 at+set_config=lora:region:EU868 SEN	ID
	10 at+set_config=lora:confirm:1 SEN	ID
ок	11 at+set_config=lora:ch_mask:0:0 SEN	ID
AT+CLASS=A	12 at+set_config=lora:dev_eui: SEN	ID
	13 at+set_config=lora:app_eui: SEN	ID
ок	□ 14 at+set_config=lora:app_key: SEN	ID
AT+BAND=4	15 at+set_config=lora:dev_addr: SEN	ID
	16 at+set_config=lora:nwks_key: SEN	ID
ок	□ 17 at+set_config=lora:apps_key: SEN	ID
	↓ 18 at+set_config=lora:send_interval: SEN	ID
,. SENDING(With \r\n)	□ 19 at+get_config=lora:status SEN	ID
AT+BAND=4	20 at+get_config=lora:channel SEN	ID
	SEND	VE

Figure 217: Configuring LoRa Parameters

- 3. After the configuration of the LoRaWAN parameters, the next step is to set up the device address and session keys. You need to use the values from the TTN device console.
- Device Address: 26011AF9
- Application Session Key: 4D42EC5CAF97F03D833CDAf5003F69E1
- Network Session Key: C280CB8D1DF688BC18601A97025C5488

Set the Device Address.

AT+DEVADDR=26011AF9

Set the Application Session Key.

AT+APPSKEY=4D42EC5CAF97F03D833CDAf5003F69E1

Set the Network Session Key.

AT+NWKSKEY=C280CB8D1DF688BC18601A97025C5488

🖺 RAK SERIAL PORT TOOL — [							
Command							
RAK COM: COM12 · BaudRate: )600 · CLOSE	☑ 01 at+version	SEND					
RECEIVING CLEAR RECV	☑ 02 at+get_config=device:status	SEND					
AT+CLASS=A ^	03 at+set_config=device:sleep:0	SEND					
	04 at+set_config=device:restart	SEND					
ок	05 at+set_config=device:gps:1	SEND					
AT+BAND=4	□ 06 at+set_config=lora:work_mode:0	SEND					
	07 at+set_config=lora:join_mode:0	SEND					
ок	08 at+set_config=lora:class:0	SEND					
AT+DEVADDR=26011AF9	09 at+set_config=lora:region:EU868	SEND					
	10 at+set_config=lora:confirm:1	SEND					
ок	11 at+set_config=lora:ch_mask:0:0	SEND					
AT+APPSKEY=4D42EC5CAF97F03D833CDAf5003F69E1	12 at+set_config=lora:dev_eui:	SEND					
	13 at+set_config=lora:app_eui:	SEND					
ок	14 at+set_config=lora:app_key:	SEND					
AT+NWKSKEY=C280CB8D1DF688BC18601A97025C5488	15 at+set_config=lora:dev_addr:	SEND					
	16 at+set_config=lora:nwks_key:	SEND					
ок	17 at+set_config=lora:apps_key:	SEND					
v	18 at+set_config=lora:send_interval:	SEND					
SENDING(With \r\n)	19 at+get_config=lora:status	SEND					
AT+NWKSKEY=C280CB8D1DF688BC18601A97025C5488	☑ 20 at+get_config=lora:channel	SEND					
SEND	All/None	SAVE					
Time 00:00:00   PASS: 0   FAIL: 0   SW_Version: V1.2.1   Make:2018-12	2-24 28/04/2021 5:35:13 AM						

Figure 218: Configuring LoRa Parameters

4. After EUI and keys configuration, the device can now join the network and send some payload.

AT+JOIN=1:0:10:8			

Join command format: AT+JOIN=w:x:y:z

Parameter	Description
W	Join command - 1: joining, 0: stop joining.
х	Auto-join config - 1: auto-join on power-up, 0: no auto-join
У	Reattempt interval in seconds (7-255) - 8 is the default.
Z	Number of join attempts (0-255) - 0 is default.

5. After 5 or 6 seconds, if the request is successfully received by a LoRaWAN gateway, then you should see JOINED status reply.

You can now try to send some payload after successful join.

AT+SEND=2:12341234

Send command format: AT+SEND=<port>:<payload>

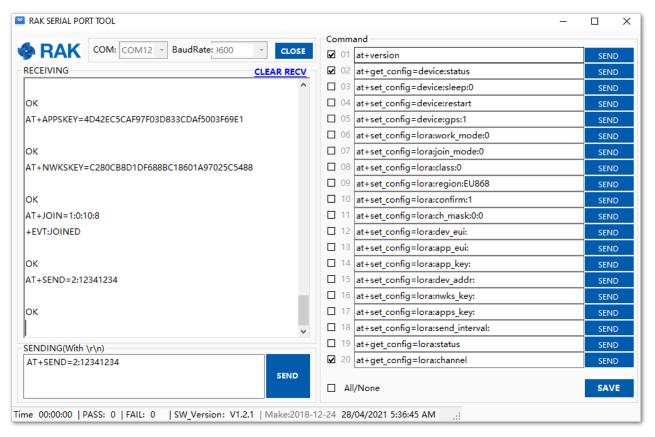


Figure 219: ABP Test Sample Data Sent via RAK Serial Port Tool

# LoRa P2P Mode

This section will show you how to set up and connect two RAK3272S units to work in the LoRa P2P mode. The configuration of the RAK3272S units is done by connecting the two modules to a general-purpose computer using a USB-UART converter. The setup of each RAK3272S can be done separately, but testing the LoRa P2P mode will require having both units connected simultaneously. This could be done by having one computer with two USB ports or two computers with one USB port each.

It is recommended to start by testing the serial communication and verify the current configuration is working by sending these two AT commands:



ATE will echo the commands you input to the module, which is useful for tracking the commands and troubleshooting.

You will receive OK when you input the two commands. After setting ATE , you can now see all the commands you input together with the replies.

Try again AT and you should see it on the terminal followed by OK.

# **AK** Documentation Center

Wis ToolBox ≡	Device Console	Wis ToolBox ≡	Device Console
Dashboard		Dashboard	
		Templates	
		Firmware	
DEVICES		DEVICES	
■ RAK3172 COM12 ▲	ATE enabled	■ RAK3172 COM12 ▲	ATE disabled
	23:55 AT I Input Command 23:55 OK Response AT	(?) 🖉 🍎 RAK ID	00:16 0K < Response ONLY

Figure 220: at+version command response

1. In setting up the RAK3272S to work in LoRa P2P mode, you need to change the LoRa network work mode command on both RAK3272S Breakout Board.

AT+N	NWM=0	

AT+NWM parameter mode can be either 0=LoRa P2P or 1=LoRaWAN.

Wis ToolBox ≡	Device Console	RAK SERIAL PORT TOOL     Serial PORT TOOL     COM: COM11      BaudRate 15200      CLOSE
Dashboard		RECEIVING CLEAR RECV
		AT+NWM=0
Templates		RAKwireless RAK3172-E Example
Firmware		Current Work Mode: LoRa P2P.
DEVICES		
■ RAK3172 COM12 ▲	Device 1 (Transmitter)	Device 2 (Receiver)
	00:49 AT+NWM=0 00:49 RAKwireless RAK3172-E Example	' SENDING(With \r\n)
? 🖉 季 RAKID	00:49 00:49 Current Work Mode: LoRa P2P. 00:53 DISCONNECTED Type command to send_	AT+NWM=0         SEND           Time 00:00:00   PASS: 0   FAIL: 0   SW_Version: V1.2.1   Make:2018-12

Figure 221: P2P Mode

### **NOTE**:

- The device will start automatically if you change modes from LoRaWAN to LoRa P2P and vice-versa.
- You might need to input the ATE command again to ensure that your succeeding commands on P2P mode echo on the terminal.
- 2. You need to input the P2P setup on both RAK3272S Breakout Board. The parameters should be exactly the same on the two modules.

AT+P2P=868000000:7:125:0:10:14

For this P2P setup, the LoRa parameters are the following:

- Link frequency: 868000000 Hz
- Spreading factor: 7
- Bandwidth: 125 kHz
- Coding Rate: 0 = 4/5
- Preamble Length: 10
- Power: 14 dBm

### **NOTE**:

Refer to the P2P Mode section of the AT command documentation to learn more about the definition of the parameters used and the individual commands if you want specific parameter changed.

Wis ToolBox ≡	Device Console	RAK SERIAL PORT TOOL     RAK COM: COM11 BaudRate: 115200 CLOSE
Dashboard		RECEIVING CLEAR RECV
		AT+VER=3.4.2-rui3_22q1_update.112
		OK AT+P2P=868000000:7:125:0:10:14
		ок
DEVICES		
■ RAK3172 COM12 ▲	Device 1 (Transmitter)	Device 2 (Receiver)
	01:18 AT+VER=3.4.2-rui3_22q1_update.112	SENDING(With \r\n)
	01:18 OK 01:20 AT+P2P=868000000:7:125:0:10:14 01:20 OK	AT+P2P=868000000:7:125:0:10:14
	Type command to send_	Time 00:00:00   PASS: 0   FAIL: 0   SW_Version: V1.2.1   Make:2018-12

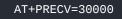
Figure 222: Configuring P2P in both RAK3272S Breakout Board

3. To set one module as the receiver (RX), you need to set the value of the P2P receive command.

### **NOTE**:

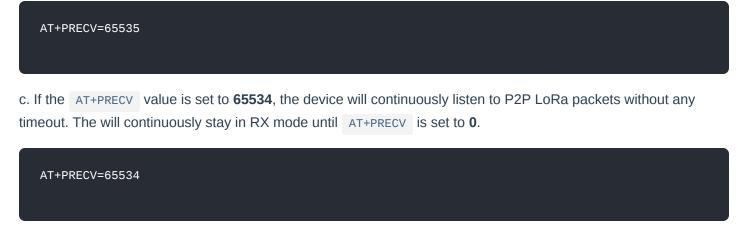
LoRa P2P default setting is Transmitter (TX) mode. This consumes lower power compared to Receiver (RX) mode where the radio is always listening for LoRa packets.

a. P2P LoRa RX configurable duration value is from 1 to 65533 ms. In this example, the device will listen and wait for LoRa P2P Packets for 30000 ms or 30 seconds. It will automatically disable RX mode and switch to TX mode after the timeout. If the device did not receive any packets within the time period, then the callback after timeout is +EVT:RXP2P RECEIVE TIMEOUT.



b. If the AT+PRECV value is set to **65535**, the device will listen to P2P LoRa packets without a timeout, but it will stop listening once a P2P LoRa packet is received. After done receiving the packets, it will disable RX mode and

automatically switch to TX mode again.



d. If the AT+PRECV value is set to **0**, the device will stop listening to P2P LoRa packets. It disables LoRa P2P RX mode and switch to TX mode.

AT+PRECV=0

4. With one module configured as Transmitter (TX) and the other device will be the Receiver (RX), you can now try to send or transmit P2P payload data.



### VOTE:

- AT\_PARAM\_ERROR is returned when setting wrong or malformed value.
- AT\_BUSY\_ERROR is returned if the device is still in RX mode and you try to send or reconfigure RX period. If the AT+PRECV command is set to **65534**, you need to execute first AT+PRECV=0 to be able to configure again the TX and RX state and avoid AT\_BUSY\_ERROR.
- <payload> : 2~500 digit length, must be an even number of digits and character 0-9, a-f, A-F only, representing 1~256 hexadecimal numbers. For example, if the payload is like 0×03, 0×AA, 0×32, therefore the AT command should be AT+PSEND = 03AA32.

<b>Wis</b> ToolBox ≡	Device Console	RAK SERIAL PORT TOOL
Dashboard		RECEIVING CLEAR RECV
Templates     Firmware		OK +EVT:RXP2P:-32:13:123456 AT+PRECV=65535 OK +EVT:RXP2P:-33:12:112233
DEVICES		+EV1:KXP2P:-3312:112233 AT+PRECV=65534
<b>RAK3172</b> COM12 ▲	Device 1 (Transmitter)	OK +EVT:RXP2P:-27:12:332211 +EVT:RXP2P:-31:11:11
	02:04 AT+PSEND=123456 02:04 OK 02:05 AT+PSEND=112233 02:05 OK	AT+PRECV=0 OK v
🧿 🛆 🏼 🏘 RAK ID	02:05 AT+PSEND=332211 02:05 OK 02:05 AT+PSEND=11 02:05 OK Type command to send_	SENDING(With \r\n)         SEND           Time 00:00:00   PASS: 0   FAIL: 0   SW_Version: V1.2.1   Make:2018-12

Figure 223: Configuring P2P in both RAK3272S Module

# Miscellaneous

# **Upgrading the Firmware**

If you want to upgrade to the latest version firmware of the module, you can follow this section. The latest firmware can be found in the software section of RAK3272S Datasheet.

## **NOTE**:

## What if the RAK3272S board stops responding to AT commands and firmware update?

You can recover your device by using the .hex file in the datasheet and upload it using STM32CubeProgrammer. The guide on updating STM32 firmware using STM32CubeProgrammer can be found in the Knowledge Hub section.

## **WARNING**

Uploading the .hex file via STM32CubeProgrammer will erase all configured data on the device.

# **Firmware Upgrade Through UART2**

## **Minimum Hardware and Software Requirements**

Refer to the table for the minimum hardware and software required to perform the firmware upgrade via UART2.

Hardware/Software	Requirement
Computer	A Windows/Ubuntu/Mac computer
Firmware File	Bin firmware file downloaded from the website
Others	A USB to TTL module

## **Firmware Upgrade Procedure**

Execute the following procedure to upgrade the firmware in Device Firmware Upgrade (DFU) mode through the USB interface.

## VOTE:

RAK3272S should automatically go to BOOT mode when the firmware is uploaded via RAK DFU Tool or WisToolBox.

If BOOT mode is not initiated, you can manually send AT+BOOT command to start bootloader mode.

- 1. Download the latest application firmware of the RAK3272S.
  - RAK3272S Firmware
- 2. Download the RAK Device Firmware Upgrade (DFU) tool.
  - RAK Device Firmware Upgrade (DFU) Tool

- 3. Connect the RAK3272S Breakout Board to the computer via a USB-Serial adapter. Refer to Figure 21.
- 4. Open the Device Firmware Upgrade tool. Select the serial port and baud rate (115200) of the module and click the "Select Port" button.

### **NOTE**:

If your firmware upload always fail, check your current baudrate setting using AT+BAUD=? command and use that baud rate value in the RAK DFU Tool. You can also check if you selected the right COM port.

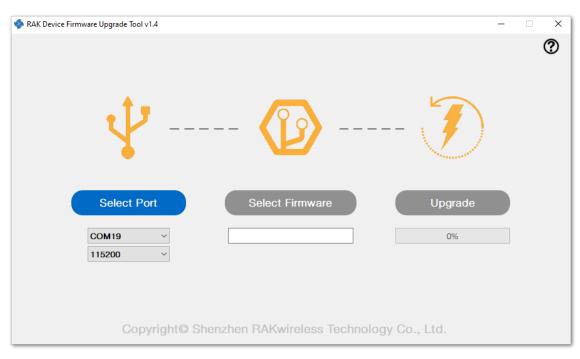


Figure 224: Device Firmware Upgrade Tool

5. Select the application firmware file of the module with the suffix ".bin".

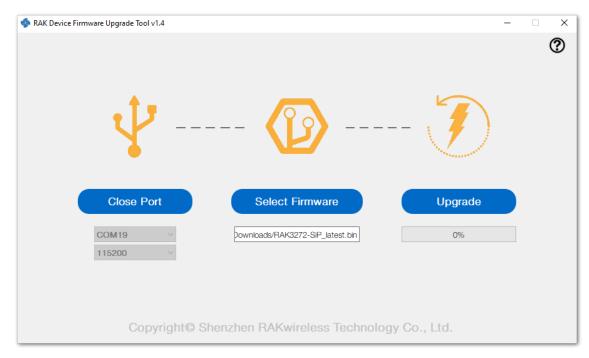


Figure 225: Select firmware

6. Click the "**Upgrade**" button to upgrade the device. After the upgrade is complete, the RAK3272S will be ready to work with the new firmware.

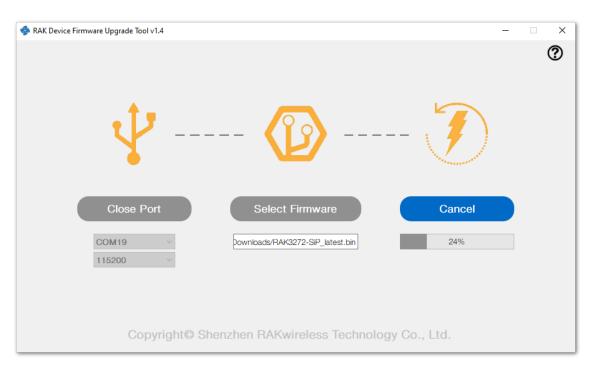


Figure 226: Firmware upgrading

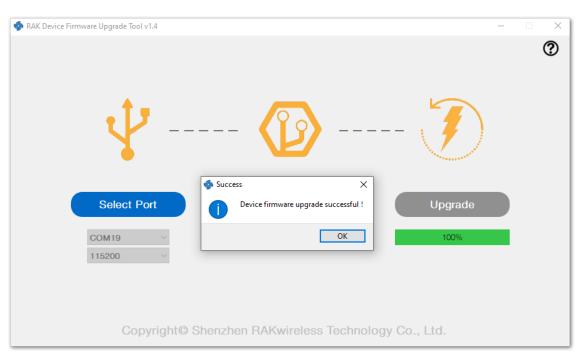


Figure 227: Upgrade successful

# **Arduino Installation**

Go to the Arduino official website 🖾 and download the Arduino IDE. You can see the multiple versions available for Windows, Linux, and Mac OS X. Choose the correct version of Arduino IDE and download it.



## Arduino IDE 1.8.16

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

Refer to the Getting Started page for Installation instructions.

#### SOURCE CODE

Active development of the Arduino software is **hosted by GitHub**. See the instructions for **building the code**. Latest release source code archives are available **here**. The archives are PGP-signed so they can be verified using **this** gpg key.

Figure 228: Arduino IDE latest version

DOWNLOAD OPTIONS

Windows ZIP file

Linux 32 bits

Linux 64 bits Linux ARM 32 bits

Linux ARM 64 bits

Mac OS X 10.10 or newer

Release Notes Checksums (sha512)

Windows Win 7 and newer

Windows app Win 8.1 or 10 Get 📑

## **For Windows**

### 📝 NOTE

**For Windows 10 users**: Do **NOT** install the Arduino IDE from the Microsoft App store. Install the original Arduino IDE from the Arduino official website instead, since the Arduino app from the Microsoft App Store has problems using third-party Board Support Packages.

1. Install the Arduino IDE, which you just downloaded, on your Windows PC.

2. Click I Agree then Next to proceed.

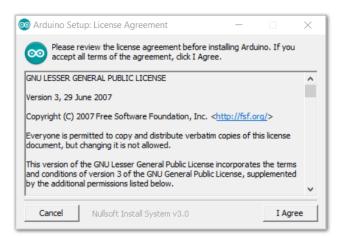


Figure 229: Arduino setup license agreement

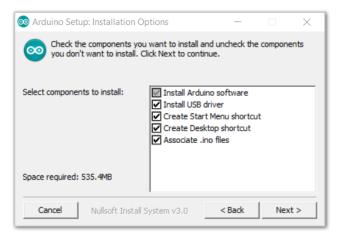


Figure 230: Arduino setup installation options

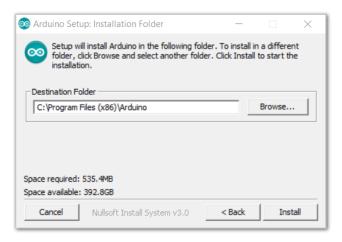


Figure 231: Installing Arduino IDE

🥺 Arduino Setu	o: Installing			×
Extract: p	arity.h			
Show details				
		c Dards	ch.	
Cancel	Nullsoft Install System v3.0	< Back	Clo	se

Figure 232: Ongoing installation

After 100% progress, the Arduino IDE has been installed successfully.

🥺 Arduino Setu	o: Completed			$\times$
	1			
Show details	1			
	1			
Cancel	Nullsoft Install System v3,0	< Back	Clos	se

Figure 233: Successful installation

# **For Linux**

First, you need the check the compatibility with your system and choose between the 32-bit, 64-bit, and ARM versions of the Arduino IDE for Linux.

## Installing via a Tarball

After downloading the correct Arduino version, open a terminal, then run ls to check the installation file on the download folder.



Figure 234: Check the download folder

A tarball is a type of compressed folder, like a .zip file, commonly used to distribute software in Linux. To extract the files from the tarball, change the directory to where the downloaded tarball is, then run:

□ msam@msam-s145: ~/Desktop/Downloads Q = _ □ (	
nsam@msam-s145;~/Desktop/Downloads\$ tar xvf arduino-1.8.16-linux64.tar.xz	

Figure 235: Tarball extract command

When the tar command finishes, run 1s again. A folder named **arduino-version** will be created.

F	msam@msam-s145: ~/Desktop/Downloads	Q =	-	٥	8
nsam@msam-s145:~/Desktop/Downloads\$ ls arduino-1.8.16 arduino-1.8.16-linux64.tar.xz msam@msam-s145:~/Desktop/Downloads\$					

Figure 236: Arduino install folder created

Change the current directory and go to the newly created folder directory. There will be a file named install.sh in the folder. Execute sudo ./install.sh to install the Arduino IDE.

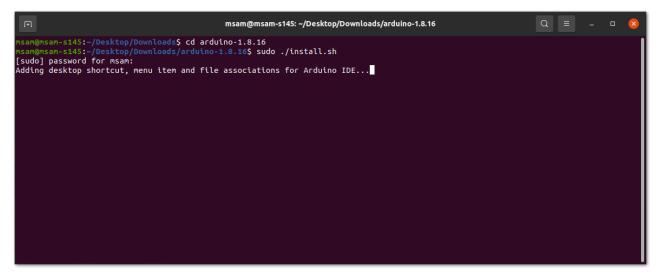


Figure 237: Arduino install script running

The sudo command temporarily elevates privileges allowing the installer to complete sensitive tasks without logging in as the root user.

# For Mac OS X

In Mac OS X, the same as Linux, there is no installation process. It is just a process of decompression, then you can open Arduino IDE successfully.

# **Arduino IDE Parts Guide**

Figure 238 shows the five (5) parts of Arduino IDE.

# **BAK**<sup>®</sup> Documentation Center



Figure 238: Arduino IDE

### 1. IDE Option Menu

You can configure some general parameters such as the serial port, the board information, the libraries, the edit parameters, and so on.

### 2. Operating Buttons

The operating buttons have five operations:

- Verify/Compile the source code;
- Upload the compiled code into WisBlock;
- Open a New Arduino IDE window or existing application;
- **Save** the current application.

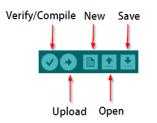


Figure 239: Operating buttons

### 3. Code Area

You can edit the source code, which will be compiled and uploaded into WisBlock later in this area.

#### 4. State Area

5. Output Message Area You can see the output message in this area, whether it's failure or success information.

Last Updated: 3/18/2023, 12:43:08 PM