Quick Start Guide

Prerequisites

What do you need?

Before going through each and every step in the installation guide of the RAK5205 WisTrio LPWAN Tracker, make sure to prepare the necessary items listed below:

1. RAK5205 WisTrio LPWAN Tracker

- 2. Micro USB Cable
- 3. Gateway in Range for Testing
- 4. Windows PC

NOTE

This device released by RAKWireless is already pre-loaded with its latest firmware upon manufacturing. If you want to have your device firmware burned or upgraded, refer to the sections below:

1. Burning the Bootloader

2. Upgrading the Firmware

What's Included in the Package?

- 1pc RAK5205 WisTrio LPWAN Tracker
- 1pc Micro USB Cable
- 1pc LoRa Antenna
- 1pc GPS Antenna
- 1pc Battery connector cable (JST) requires soldering
- 5pcs Jumper Caps
- Male to Female Jumper Wires

Product Configuration

Interfacing with the RAK5205 WisTrio LPWAN Tracker

To interface with the RAK5205 WisTrio LPWAN Tracker with your Windows PC, you need to download the RAK Serial Port Tool 2.

WARNING

Before powering the RAK5205, you should install the LoRa and GPS antenna first. Not doing so might damage the board.

Use Figure 1 as a reference to connect the antennas.



Figure 1: RAK5205 GPS and LoRa antenna

- Connect your RAK5205 WisTrio LPWAN Tracker in your Windows PC using the provided micro-usb cable.
- Open the RAK Serial Port Tool.

🖴 RAK SERIAL PORT TOOL		_	\Box \times
6.044	Comma	and	
COM: COM16 - BaudRate: 15200 - OPEN	01	at+version	SEND
RECEIVING CLEAR RECV	02	at+get_config=device:status	SEND
	03	at+set_config=device:sleep:0	SEND
	04	at+set_config=device:restart	SEND
	05	at+set_config=device:gps:1	SEND
	06	at+set_config=lora:work_mode:0	SEND
	07	at+set_config=lora:join_mode:0	SEND
	08	at+set_config=lora:class:0	SEND
	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
	⊋ 20	at+get_config=lora:channel	SEND
SEND		/None	SAVE
Time 00:00:00 PASS: 0 FAIL: 0 SW_Version: V1.2.1 Make:2018-12	2-24 1/1	2/2020 9:38:42 PM	

Figure 2: RAK Serial Port Tool

• To setup the correct COM Port number for your device, go to Device Manager by pressing **Windows + R** and type **devmgmt.msc**. Or, search for **devmgmt.msc** in the Start Menu.

📥 Device Manager	—	\times
File Action View Help		
V 🗄 LAPTOP-DQ8UNHQE		
> 🐗 Audio inputs and outputs		
> 🤪 Batteries		
> 📓 Biometric devices		
> 🚯 Bluetooth		
> 👰 Cameras		
> 💻 Computer		
> 🕳 Disk drives		
> 🖼 Display adapters		
> 🎽 Firmware		
> 🛺 Human Interface Devices		
> 🔤 Keyboards		
> 📗 Mice and other pointing devices		
> 💻 Monitors		
> 🕎 Network adapters		
Y 🛱 Ports (COM & LPT)		
🐺 Silicon Labs CP210x USB to UART Bridge (COM3)		
> 🖪 Print queues		
> Processors		
> Security devices		
Software components		
Software devices		
Sound, video and game controllers		
> Variable Storage controllers		
> 🛄 System devices		
Vinversal Serial Bus controllers		

Figure 3: Device Manager

 Look for ports (COM & LPT) and find the name Silicon Labs CP210X USB to UART Bridge and take note of the COM Port Number.

📝 NOTE

If you can't find any port with the name Silicon Labs CP210X, make sure you have installed the **CP210X Drivers** in your Windows PC.

• Choose the correct port number and baud rate from the device manager, then click **Open**.

RAK SERIAL PORT TOOL	_	\Box \times
6 P 4//	Command	
Second Come Come Come Come Come Come Come Come	□ 01 at+version	SEND
RECEIVING CLEAR RECV	02 at+get_config=device:status	SEND
	03 at+set_config=device:sleep:0	SEND
	04 at+set_config=device:restart	SEND
	05 at+set_config=device:gps:1	SEND
	06 at+set_config=lora:work_mode:0	SEND
	07 at+set_config=lora:join_mode:0	SEND
	08 at+set_config=lora:class:0	SEND
	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
	☑ 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 1/12/2020 10:26:07 PM .::	

Figure 4: Correct COM Port and Baudrate

Connecting to The Things Network (TTN)

In this section, you will be connecting the RAK5205 WisTrio LPWAN Tracker to The Things Network (TTN). If you don't have an account yet, head on to TTN website and create one. Once done, log in to your account and go to the console.



Figure 5: The Things Network Home Page

THE THINGS CONSOLE NETWORK COMMUNITY EDITION		Application	Gateways	Support	0	~
	Welcome to The Thir Welcome to The Thir This is where the magic happens. Here you can work with your data. R collaborators	ngs Network Console. Legister applications, devices and gateways, manage your integrations, and settings.				
	APPLICATIONS	GATEWAYS				

Figure 6: TTN Console Page

• Choose "APPLICATIONS".

THETHINGS CONSOLE	Applications	Gateways	Support	Ś	~
Applications					
APPLICATIONS			() <u>a</u>	dd application	
You do not have any applications.					
Get started by adding one!					
You are the network. Let's build this thing together. — <u>The Things</u> .	Network				

Figure 7: Application Page

Adding An Application

• Click the "add application" button.

THETHINGS CONSOLE NETWORK COMMUNITY EDITION		Applications	Gateways	Support	Ś	
plications > Add Application						
ADD APPLICATION						
Application ID The unique identifier of your application on the	network					
rak_test_app						0
A human readable description of your new app						•
Application EUI An application EUI will be issued for The Things	Network block for convenience, you can a	add your own in the application se	ttings page.			
Handler registration Select the handler you want to register this app	ication to					
ttn-handler-eu						0

Figure 8: Adding an Application

Here are the things that you should take note in adding an application:

- 1. **Application ID** this will be the unique id of your application in the Network. Note that characters should be in lower case, and no spaces are allowed.
- 2. **Description** this is a short and concise human readable description of your application.
- 3. Application EUI this will be generated automatically by The Things Network for convenience.
- 4. Handler Registration handler you want to register this application to.
- After you fill in the necessary information, press the "Add application" button at the bottom of the page. If you see the same page as Figure 9, then this means that you have successfully registered your application.

		App	olications Gatewa	ys Support	(f)	
Applications > 😂 rak_test_app						
	Overview	Devices	Payload Formats	Integrations	Data	Settings
APPLICATION OVERVIEW						
Application ID rak_test_app Description RAK Test Application Created 6 minutes ago					do	ocumentation
Handler ttn-handler-eu (current handler)						
Handler ttn-handler-eu (current handler) APPLICATION EUIS					0	manage euis
Handler ttn-handler-eu (current handler) APPLICATION EUIS (> ≒ 70 B3 D5 7E D0 02 9B 5E)					o	<u>manage euis</u>

Figure 9: Application Overview

Register Device

• Scroll down until you see the Devices section, or you can also click the "Devices" button at the top.

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DEVICES		register device manage devices
	0 registered devices	

Figure 10: Device Section

• Click "Register device".

THE THINGS CONSOLE	Applications	Gateways	Support	G	~
Applications > 🥪 rak_test_app > Devices					
REGISTER DEVICE				bulk import devices	
Device ID This is the unique identifier for the device in this app. The device ID will be immutable.					
rak_test_lora_node				0	
Device EUI The device EUI is the unique identifier for this device on the network. You can change the EUI later.				0 bytes	
App Key The App Key will be used to secure the communication between you device and the network.					
this field will be generated					
App EUI					
70 B3 D5 7E D0 02 9B 5E				\diamond	

Figure 11: Add your Device

Here are the things that you should take note in registering your device:

- 1. **Device ID** this is the unique identifier for your RAK5205 WisTrio LPWAN Tracker in your application. You need to enter this manually.
- 2. **Device EUI** Device EUI of RAK5205 can be found on the sticker label of the RAK811 module. This will ensure you have a unique identification across LoRaWAN networks. You can still change it later, if you want.

The App Key should be in auto generation mode by default.

• Lastly, click the Register button. Now, your device is registered under the corresponding application.

THE THINGS CONSOL	E DITION					Applications	Gateways	Support	ģ	~	•
Applications > 😂 rak_test_app	> D	evices	> 8:) rak_test_lora_	node						
								Overview	Data	Settings	
DEVICE OVERVIEW											
Application ID Device ID	rak_ rak_te	<mark>test_a</mark> st_lora	pp _node								
Activation Method	OTA	λA									
Device EUI	\diamond	ţ	00 90 F	3 EA 85 C6 04 AA							
Application EUI	\diamond	↓	70 B3 D	5 7E DØ Ø2 9B 5E							
Арр Кеу	\leftrightarrow	ŧ	•••••								
Status	• nev	/er seei	1								Ŧ

Figure 12: Device Overview

Depending on which authentication method you want to use, proceed to either the **OTAA mode** or **ABP mode** section.

OTAA Mode

When setting up a new device in TTN, its default mode is **OTAA** or **Over-the-Air Activation**. For configuration, you need the following three parameters: **Device EUI, Application EUI**, and **App Key**. You can get them all from the **Overview page**.

THE THINGS CONSOL	E	Applications	Gateways	Support	\$
Applications > 🥪 rak_test_app	> Devices > Tak_test_lora_node				
				Overview	Data Settings
DEVICE OVERVIEW					
Application ID Device ID	rak_test_app rak_test_lora_node				
Activation Method	ΟΤΑΑ				
Device EUI	<> ⇒ 00 90 F3 EA 85 C6 04 AA 圕				
Application EUI	<>				
Арр Кеу	\diamond \Leftarrow \bullet				
Status	• never seen				

Figure 13: Device OTAA Parameters

Now, configure the RAK5205 to work in OTAA mode in the EU868 band, as an example.

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NOTE

The default LoRa working mode for the RAK5205 is LoRaWAN 1.0.2, while the default LoRa join mode is OTAA, and the default LoRa class is Class A.

 Set mode to OTAA, device class to Class A and your LoRaWAN region to your correct frequency band, with the following set of commands below. Remember to replace XXX with the your LoRaWAN region. Refer to RAK5205 Datasheet for your frequency plan.

at+set_config=lora:join_mode:0

at+set_config=lora:class:0

at+set_config=lora:region:XXX

NOTE

RAK5205 will be sleeping most of the time. You need to input again the command if the reply you get is **Wake up**.

	Command	
RAK COM: COM3 BaudRate: 15200 CLOSE	01 at+version	SEND
RECEIVING CLEAR RECV	02 at+get_config=device:status	SEND
>>at+set_config=lora:join_mode:0	03 at+set_config=device:sleep:0	SEND
at+set_config=lora:join_mode:0	04 at+set_config=device:restart	SEND
LoRa configure OTAA success	05 at+set_config=device:gps:1	SEND
ок	06 at+set_config=lora:work_mode:0	SEND
>>at+set_config=lora:class:0	07 at+set_config=lora:join_mode:0	SEND
at+set_config=lora:class:0	08 at+set_config=lora:class:0	SEND
LoRa configure ClassA success	09 at+set_config=lora:region:EU868	SEND
ок	10 at+set_config=lora:confirm:1	SEND
>>at+set_config=lora:region:EU868	11 at+set_config=lora:ch_mask:0:0	SEND
at+set_config=lora:region:EU868	12 at+set_config=lora:dev_eui:	SEND
Selected LoRaWAN 1.0.2 Region: EU868	□ 13 at+set_config=lora:app_eui:	SEND
Band switch success	□ 14 at+set_config=lora:app_key:	SEND
ок	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+set_config=lora:region:EU868	☑ 20 at+get_config=lora:channel	SEND
SEND	All/None	SAVE

Figure 14: Setting up the RAK5205 operation mode

 Now that RAK5205 is configured to be activated via OTAA, enter these parameters: Device EUI, Application EUI, and App Key using the commands below. Remember to replace the "XXXX" with the corresponding parameter value that matches the LoRaWAN network server. at+set_config=lora:dev_eui:XXXX

at+set_config=lora:app_eui:XXXX

at+set_config=lora:app_key:XXXX



Figure 15: Setting up the RAK5205 OTAA parameters

You should end up with a window as the one in Figure 15 with a series of OK messages.

3. Finally, execute the join command.





Figure 16: Join command

4. You can test the connection by sending an uplink frame. Use the following as an example:

RAK SERIAL PORT TOOL	- □ >
	Command
RAK COM: COM3 - BaudRate: 15200 -	CLOSE 01 at+version SEND
RECEIVING CLEAR	RECV 02 at+get_config=device:status SEND
at+set_config=lora:app_key:2618C14B9A13D4B73EDE3AF8519D	4FF ^ 🗌 03 at+set_config=device:sleep:0 SEND
0	at+set_config=device:restart SEND
LoRa app_key configure success	05 at+set_config=device:gps:1 SEND
ок	06 at+set_config=lora:work_mode:0 SEND
at+join	07 at+set_config=lora:join_mode:0 SEND
OTAA:	08 at+set_config=lora:class:0 SEND
DevEui:B2AF5462C7DEA970	at+set_config=lora:region:EU868 SEND
AppEui:70B3D57ED0028F42	10 at+set_config=lora:confirm:1 SEND
AppKey:2618C14B9A13D4B73EDE3AF8519D4FF0	11 at+set_config=lora:ch_mask:0:0 SEND
OTAA Join Start	12 at+set_config=lora:dev_eui:B2AF5462C7DEA970 SEND
[LoRa]:Join Success	at+set_config=lora:app_eui:70B3D57ED0028F42 SEND
ок	g=lora:app_key:2618C14B9A13D4B73EDE3AF8519D4FF0 SEND
at+send=lora:1:12345678	15 at+set_config=lora:dev_addr: SEND
[LoRa]: RUI_MCPS_UNCONFIRMED send success	16 at+set_config=lora:nwks_key: SEND
UK	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+send=lora:1:12345678	☑ 20 at+get config=lora:channel SEND

Figure 17: Sending an uplink frame

5. If you get a response in your TTN live data feed as shown in Figure 18, then you are all set.

📝 NOTE

Be sure to have the TTN console open prior to sending data through the RAK Serial Port. Else, you will not be able to see the packet sent.

	HE THING	COMMUN	SOLE								Applic	ations	Gatew	vays	Suppo	rt 📢	<u>j</u> n	~
Applications > 🥪 test_rak811_loranode > Devices > 📰 rak811_loranode868mhz > Data																		
	APPLI	CATION	DATA													II pause	🗑 <u>clear</u>	
	Filters	uplink	downlink	activation	ack	error												
	• :	time 23:36:17	counter	port 0														
	A :	23:36:18	0	1	retry	payload: 12	34 56 78											
	+ :	23:35:46				dev addr: 2	01 26 7C	app eui	i: 70 B3 D	05 7E D0 0	2 8F 42	dev eui: E	32 AF 54 (62 C7 D	DEA970			

Figure 18: Sending Data to TTN from RAK5205

ABP Mode

- 1. To join the ABP mode, go to device settings and switch the activation method to ABP.
- 2. By default, the **Device Address**, **Network Session Key**, and **App Session Key** will be generated automatically.



Figure 19: Switching to ABP mode

3. Save the mode change and return to the **Device Overview page**. You can copy the keys by pressing the button after the value fields marked in red in Figure 20.

	E	Applications Gateways Support 🏟 🗸									
Applications > 😂 rak_test_app > Devices > 📰 rak_test_lora_node											
DEVICE OVERVIEW											
Application ID Device ID	rak_test_app rak_test_lora_node										
Activation Method	ABP										
Device EUI	<>										
Application EUI	↔ ☆ 70 B3 D5 7E D0 02 9B 5E										
Device Address	↔ \$\frac{1}{25}\$ 26 01 12 BE \$\exists\$										
Network Session Key	↔ ≒ •	Ē									
App Session Key											

Figure 20: ABP parameters screen

4. Now, you need to update the RAK5205 configuration (mode and parameters). Open the Serial Tool and type the command below to change the region (in case you have not done so already):

RAK SERIAL PORT TOOL		X
	Command	
BaudRate: 115200 -	CLOSE 01 at+version	SEND
RECEIVING CLEAR	RECV 02 at+get_config=device:status	SEND
>>at+set_config=lora:region:EU868	□ 03 at+set_config=device:sleep:0	SEND
at+set_config=lora:region:EU868	□ 04 at+set_config=device:restart	SEND
Selected LoRaWAN 1.0.2 Region: EU868	05 at+set_config=device:gps:1	SEND
Band switch success	06 at+set_config=lora:work_mode:0	SEND
ок	07 at+set_config=lora:join_mode:0	SEND
	08 at+set_config=lora:class:0	SEND
	09 at+set_config=lora:region:EU868	SEND
	at+set_config=lora:confirm:1	SEND
	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
	at+set_config=lora:app_key:	SEND
	□ 15 at+set_config=lora:dev_addr:	SEND
	at+set_config=lora:nwks_key:	SEND
	at+set_config=lora:apps_key:	SEND
	at+set_config=lora:send_interval:	SEND
SENDING(With \r\n)	□ 19 at+get_config=lora:status	SEND
at+set_config=lora:region:EU868	☑ 20 at+get_config=lora:channel	SEND
	SEND	

Figure 21: Region setup

5. Change the mode to **ABP** with the command:

🔄 F K SERIAL PORT TOOL - 🗆							
	Command						
Second Com: COM3 BaudRate: 15200 CLOSE	01 at+version	SEND					
RECEIVING CLEAR RECV	02 at+get_config=device:status	SEND					
>>at+set_config=lora:region:EU868	03 at+set_config=device:sleep:0	SEND					
at+set_config=lora:region:EU868	04 at+set_config=device:restart	SEND					
Selected LoRaWAN 1.0.2 Region: EU868	05 at+set_config=device:gps:1	SEND					
Band switch success	06 at+set_config=lora:work_mode:0	SEND					
ок	07 at+set_config=lora:join_mode:1	SEND					
>>at+set_config=lora:join_mode:1	08 at+set_config=lora:class:0	SEND					
at+set_config=lora:join_mode:1	09 at+set_config=lora:region:EU868	SEND					
LoRa configure ABP success	10 at+set_config=lora:confirm:1	SEND					
ок	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+set_config=lora:join_mode:1	☑ 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 20/01/2020 8:37:30 pm						

Figure 22: Join mode setup

6. Now that the mode has been changed, enter the parameters listed below which are needed for ABP activation (Device Address, Network Session Key, and Application Session Key). Remember to replace the "XXXX" with the corresponding parameter value that matches the LoRaWAN network server. Refer to Figure 20 for the parameters.

at+set_config=lora:dev_addr:XXXX

at+set_config=lora:nwks_key:XXXX

at+set_config=lora:apps_key:XXXX



Figure 23: Setting up the RAK5205 ABP parameters

You should end up with a similar window shown in Figure 23 with a series of OK messages.

7. Finally, execute the join command:

-		
RAK SERIAL PORT TOOL	_	
	Command	
RAN COM. COMS & Badditate. 115200 CLOSE	01 at+version	SEND
RECEIVING CLEAR RECV	02 at+get_config=device:status	SEND
at+join	03 at+set_config=device:sleep:0	SEND
ABP:	04 at+set_config=device:restart	SEND
DevAddr: 26011937	05 at+set_config=device:gps:1	SEND
AppsKey: 77BFE744AF3613883A2ED0A2C964D0D3	06 at+set_config=lora:work_mode:0	SEND
NwksKey: BB9981A985C7B146296B1D358BCC2FD3	07 at+set_config=lora:join_mode:1	SEND
[LoRa]:Join Success	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:B2AF5462C7DEA970	SEND
	13 at+set_config=lora:app_eui:70B3D57ED0028F42	SEND
	□ 14 at+set_config=lora:app_key:	SEND
	□ 15 at+set_config=lora:dev_addr:26011937	SEND
	□ 16 =lora:nwks_key:BB9981A985C7B146296B1D358BCC2FD3	SEND
	17 =lora:apps_key:77BFE744AF3613883A2ED0A2C964D0D3	SEND
	□ 18 at+set_config=lora:send_interval:	SEND
, SENDING(With \r\n)	□ 19 at+get_config=lora:status	SEND
atticin	☑ 20 at+get config=lora:channel	SEND

Figure 24: Join command

8. You can test the connection by sending an uplink frame. Use the following as an example:



Figure 25: Sending an uplink frame

If you get the same response in your TTN live data feed as shown in Figure 26, then you are all set.

HE THINGS	COMMUN	SOLE								Ap	plications	S	Gateway	s	Support	ý	ja -	~
Applications	> 🥪 te	est_rak811_l	oranode >	Devices	> ::::)	rak811_lo	oranode86	68mhz	> Data									
APPLICATION DATA															П	pause	🛍 <u>clear</u>	
Filters	uplink	downlink	activation	ack	error													
▼ 23	time :36:17	counter	port 0															
^ 23	:36:18	0	1	retry	payload: 12	2 34 56 78	3											
/ 23	:35:46				dev addr: 2	6 01 26 70	C app eui	ui: 70 B3	3 D5 7E D	002 8F 4	2 dev eu	ii: B2	AF 54 62 0	C7DE	A9 70			

Figure 26: Sending Data to TTN from RAK5205

Connecting to ChirpStack

The **ChirpStack** or previously known as LoRaServer project provides open-source components for building LoRaWAN networks. To learn more about ChirpStack, visit their **website** .

You can use RAK5205 to connect with ChirpStack according to the following steps:

📝 NOTE

In this section, it is assumed that you have already connected your gateway to ChirpStack correctly. If not, look into the RAK Documentation Center is of your RAK Gateway in hand.

- 1. Open the web page of the ChirpStack which you want to connect with and login.
- 2. By default, there is already one or more items in this page. You can either use it or create a new item, but for this, create a new item by clicking the "**CREATE**" button.

€	ChirpStack			Q Search organization, ap		? 🕑 admin
•	All users					
٩	API keys	Applicatio	ons			+ CREATE
chirp	ostack 👻					
A	Org. dashboard	ID	Name	Service-profile	Description	
•	Org. users	2	арр	service-profile-build-in	арр	
٩	Org. API keys				Rows per page: 10 ▼ 1-1	of 1 < >
. =	Service-profiles					
	Device-profiles					
\bigcirc	Gateways					
	Applications					
ッ	Multicast-groups					

3. Fill up the necessary information, then click "CREATE APPLICATION".

	ChirpStack	Q Search organization, application, gateway or device ? e admin
ŧ	Dashboard	Applications / Create
•• ••	Network-servers	
\bigcirc	Gateway-profiles	Indication event
	Organizations	Application mane RAKWireless_Test_Application
•	All users	The name may only contain words, numbers and dashes.
٩	API keys	Application description * RAK Wireless Test Application Description
chirp	stack 👻	Service-profile* service-profile-build-in
f	Org. dashboard	The service-profile to which this application will be attached. Note that you can't change this value after the application has been created.
•	Org. users	CREATE APPLICATION
٩	Org. API keys	
. ≡	Service-profiles	
	Device-profiles	
\bigcirc	Gateways	
	Applications	•

4. Click the new item name "RAKwireless_Test_Application".

BAK[®] Documentation Center

€	ChirpStack			Q Search organization, applica	tion, gateway or device ? 😝 admin
	Network-servers Gateway-profiles	Applicat	ions		+ CREATE
•	Organizations	ID	Name	Service-profile	Description
chirp	ostack -	1	app	service-profile	app
¢	Org. settings	2	RAKWIFEIESS_LEST_Application	service-profile	Rows per page: 10 - 1-2 of 2 >
•	Org. users				
. ≡	Service-profiles				
븙	Device-profiles				
\bigcirc	Gateways				
	Applications				
ψ	Multicast-groups				

€	ChirpStack		Q Sea	rch organization, app	lication, gateway or device	? 🖰 admin				
	Network-servers Gateway-profiles	Applications / RAKwireless_Test_Application								
	Organizations	DEVICES	APPLICATION CONFIGURATION	INTEGRATIONS	FUOTA					
•	All users									
chir	ostack 👻									
ф	Org. settings	Last seen	Device name	Device EUI	Link margin	Battery				
•	Org. users				Rows per page: 10 👻 0	0-0 of 0 < >				
∎≡	Service-profiles									
	Device-profiles									
\bigcirc	Gateways									
	Applications									
2	Multicast-groups					2				

5. Add a LoRa node device into ChirpStack by clicking the "+ **CREATE**" button.

€	ChirpStack		Q Sea	rch organization, app	lication, gateway or device	? 🕒 admin					
	Network-servers Gateway-profiles	Applications / R/	Applications / RAKwireless_Test_Application								
	Organizations	DEVICES	APPLICATION CONFIGURATION	INTEGRATIONS	FUOTA						
•	All users					+ CREATE					
chirp	ostack 👻										
\$	Org. settings	Last seen	Device name	Device EUI	Link margin	Battery					
•	Org. users				Rows per page: 10 👻 0	0-0 of 0 < >					
. ≡	Service-profiles										
큪	Device-profiles										
\bigcirc	Gateways										
	Applications										
2	Multicast-groups										

Figure 31: Adding a Node Device

6. Fill them in. The Device EUI of RAK5205 can be found on the sticker label of the RAK811 module. Use this to ensure that you have a unique identification across LoRaWAN networks. You can also generate a random **Device EUI** automatically by clicking the Device EUI icon.

€	ChirpStack	Q Search organization, application, gateway or device	? 0	admin
: ©	Network-servers Gateway-profiles	Applications / RAKwireless_Test_Application / Devices / Create		
	Organizations	GENERAL VARIABLES TAGS		
•	All users	Device name *		
chirp	ostack 👻	RAK_LoRa_Node The name may only contain words, numbers and dashes.		- 1
۵	Org. settings	Device description * RAKwireless Test Device Description		
•	Org. users	Device EUI *		_
.≡	Service-profiles	fe e4 75 18 ea 59 7b 51	MSB	C
	Device-profiles	Device-profile * device_profile_otaa		-
\bigcirc	Gateways			_
	Applications	Disable frame-counter validation Note that disabling the frame-counter validation will compromise security as it enables people to perform replay-attacks.		
λ	Multicast-groups		CREATE DE	EVICE

Figure 32: Filling the Device Parameters

NOTE

- If you want to join in OTAA mode, select "device_profile_otaa" in the "Device-profile" item.
- If you want to join in ABP mode and CN470 frequency, select "DeviceProfile_ABP_CN470" in the "Device-Profile" item.
- If you want to join in ABP mode and other frequencies except AS923 and CN470, select "device_profile_abp" in the "Device-profile" item.

OTAA Mode

1. To join ChirpStack in OTAA mode, select "device_profile_otaa".

€	ChirpStack	${f Q}$ Search organization, application, gateway or device	? 0	admin
••••••••••••••••••••••••••••••••••••••	Network-servers Gateway-profiles	Applications / RAKwireless_Test_Application / Devices / Create		
	Organizations	GENERAL VARIABLES TAGS		
•	All users	Device name *		
chirp	ostack 👻	RAK_LoRa_Node The name may only contain words, numbers and dashes.		_
\$	Org. settings	Device description * RAKwireless Test Device Description		
•	Org. users	Device EUI *		_
.≞	Service-profiles	61 f2 53 02 68 0d cb 84	MSB	C
	Device-profiles	Device-profile * device_profile_otaa		-
\bigcirc	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 DE	VICE

Figure 33: Selecting OTAA Activation Mode in ChirpStack

2. Press "**CREATE DEVICE**" button. You may write the application key by yourself or generate it automatically by clicking the icon highlighted in Figure 34.

€	ChirpStack	Q Search organization, application, gateway or device ? e admin	
	Network-servers Gateway-profiles	Applications / RAKwireless_Test_Application / Devices / RAK_LoRa_Node]
	Organizations	DETAILS CONFIGURATION KEYS (OTAA) ACTIVATION DEVICE DATA LORAW.	
•	All users		
chirp	ostack 👻	Application key* b2 cb ee f9 76 0f ab 22 33 e9 2c 89 7c a4 48 cd MSB	
۵	Org. settings	For LoRaWAN 1.0 devices. In case your device supports LoRaWAN 1.1, update the device-profile first. Generate random key.	
•	Org. users	Gen Application key MSB C 🗋 🗞	
≡	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.	
违	Device-profiles	SET DEVICE-KEYS	
\bigcirc	Gateways		
	Applications		
2	Multicast-groups		

Figure 34: Application Key Generation

- 3. Click "SET DEVICE KEYS" button. Now, you've completed the configuration on ChirpStack.
- The Device EUI, which was set in the previous section to your RAK5205 WisTrio LPWAN Tracker as "dev_eui" is the same as highlighted in Figure 35.

€	ChirpStack		Q Sea	rch organization, applica	tion, gateway or device	? 😝 admin
R	Network-servers Gateway-profiles	Applications / R/	AKwireless_Test_Applicati	on		DELETE
	Organizations	DEVICES	APPLICATION CONFIGURATION	INTEGRATIONS	FUOTA	
•	All users					
chirp	stack 👻					T CREATE
\$	Org. settings	Last seen	Device name	Device EUI	Link margin	Battery
•	Org. users	n/a	RAK_LoRa_Node	61f25302680dcb84	n/a	n/a
. ≡	Service-profiles				Rows per page: 10 ▼ 1-1 of 1	< >
	Device-profiles					
\bigcirc	Gateways					
	Applications					
2	Multicast-groups					

Figure 35: Device EUI Code

• The same with the Application Key, which was set in the previous section as "app_key" is the same as highlighted in Figure 36.

€	ChirpStack	Q Search organization, application, gateway or device ? e admin
• •	Network-servers Gateway-profiles Organizations	Applications / RAKwireless_Test_Application / Devices / RAK_LoRa_Node
•	All users	
chirp	ostack 👻	Application key * b2 cb ee f9 76 0f ab 22 33 e9 2c 89 7c a4 48 cd MSB C 🕅 🐼
\$	Org. settings	For LoRaWAN 1.0 devices. In case your device supports LoRaWAN 1.1, update the device-profile first.
•	Org. users	Gen Application key
.≡	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.
井	Device-profiles	SET DEVICE-KEYS
\bigcirc	Gateways	
	Applications	
2	Multicast-groups	

Figure 36: Application Key LoRaWAN

VOTE:

The Application EUI which is set into RAK5205 via AT Command as "**app_eui**" is not needed for ChirpStack.

4. Next, **configure** RAK5205 WisTrio LPWAN Tracker by using **AT commands**. To do this, connect your RAK5205 WisTrio LPWAN Tracker to a PC, power it on and open **RAK Serial Port Tool** on your computer.

at+version

RAK	COM:	COM3 -	BaudRate:	15200	-	CLOSE
RECEIVING						
>>at+version						
at+version						
Firmware Versi	on: RUI v	3.0.0.12.H.	т			
ок						
SENDING(With	\r\n)					

Figure 37: RAK Serial Port Tool

5. If the join mode is not in OTAA, just set the LoRa join mode to **OTAA** and LoRa class to **Class A** by typing the AT commands shown in Figure 38.

Figure 38: Setting of LoRaWAN mode and class

6. Type the following AT command to set the Frequency/Region, Device EUI, Application EUI, and Application Key. Remember to replace the "XXXX" with the corresponding parameter value that matches the LoRaWAN network server.

at+set_config=lora:region:XXX

at+set_config=lora:dev_eui:XXXX

at+set_config=lora:app_eui:XXXX

at+set_config=lora:app_key:XXXX

Figure 39: Setting of Frequency and Device EUI

Figure 40: Setting of Application EUI and Key

7. Then, join in OTAA mode.

RAK	COM: COM3 - BaudRate: 115200	CLOSE
RECEIVING		CLEAR RECV
at+join		
OTAA:		
DevEui:B2AF546	52C7DEA970	
AppEui:B2AF54	62C7DEA970	
AppKey:A8E8C6	5F732A2932E9242C8613CC199B7	
OTAA Join Star	t	
[LoRa]:Join Suc	cess	
ок		
1		
CENIDINICOMAL	\r\n)	
SEINDING(With		

Figure 41: Joining in OTAA

8. You can view the "JoinRequest" and "JoinAccept" on ChirpStack console.

ChirpStack	Q Search organization, application, gateway or device ? e	admin
Network-servers	Applications / RAKwireless_Test_Application / Devices / RAK_LoRa_Node	LETE
Gateway-profiles		
Organizations	CONFIGURATION KEYS (OTAA) ACTIVATION DEVICE DATA LORAWAN FRAMES	>
All users		FAR
ostack 👻		
Org. settings	DOWNLINK 5:42:29 PM JoinAccept	~
Org. users	UPLINK 5:42:29 PM JoinRequest 5e9d1e0857cf25f1	~
Service-profiles		
Device-profiles		
Gateways		
Applications		
Multicast-groups		
	ChirpStack Network-servers Gateway-profiles Organizations All users ostack Org. settings Org. users Service-profiles Device-profiles Gateways Applications Multicast-groups	ChirpStack Network-servers Gateway-profiles Organizations All users org. settings Org. settings Org. settings Service-profiles Device-profiles Device-profiles Gateways Applications Multicast-groups

Figure 42: Join Request of the Device in the ChirpStack

9.Try sending data from our RAK5205 WisTrio LPWAN Tracker to the ChirpStack by typing the command below in the serial port.

at+send=lora:2:1234567890

Figure 43: Sending Data to ChirpStack

You can see the message on ChirpStack page as shown in Figure 44.

€	ChirpStack	Q Search organization, application, gateway or device ? e admin
81 81 81	Network-servers	Applications / RAKwireless_Test_Application / Devices / RAK_LoRa_Node
\bigcirc	Gateway-profiles	
	Organizations	S CONFIGURATION KEYS (OTAA) ACTIVATION DEVICE DATA LORAWAN FRAMES >
•	All users	⑦ HELP II PAUSE
chirp	ostack 👻	
	One setting a	UPLINK 5:44:32 PM UnconfirmedDataUp 0077e997 ~
÷	Org. settings	UPLINK 5:44:21 PM UnconfirmedDataUp 0077e997 ~
•	Org. users	DOWNLINK 5:42:29 PM JoinAccept ~
≞ ≡	Service-profiles	UPLINK 5:42:29 PM JoinRequest 5e9d1e0857cf25f1 ~
	Device-profiles	
\bigcirc	Gateways	
	Applications	
2	Multicast-groups	

Figure 44: Message Received in ChirpStack

ABP Mode

 If you select "device_profile_abp" or "device_profile_abp_cn470", it means you want to join ChirpStack in "ABP mode". Fill the parameters "Device name" and "Device description" then click on "CREATE DEVICE" button.

WARNING

Frequency AS923 in ABP Mode is not supported in Chirpstack.

€	ChirpStack	Q Search organization, application, gateway or device	? 0	admin
	Network-servers Gateway-profiles	Applications / RAKwireless_Test_Application / Devices / Create		
•	Organizations All users	GENERAL VARIABLES TAGS		
chirp	ostack 👻	RAK_LoRa_Node The name may only contain words, numbers and dashes.		
\$	Org. settings	Device description * RAKwireless Test Device Description		
•	Org. users	Device EUI *		
.≞≡	Service-profiles	61 f2 53 02 68 0d cb 84	MSB	C
	Device-profiles	Device-profile * device_profile_abp		-
\bigcirc	Gateways			_
	Applications	Disable frame-counter validation Note that disabling the frame-counter validation will compromise security as it enables people to perform replay-attacks.		
2	Multicast-groups		CREATE D	EVICE

Figure 45: Chirpstack ABP Activation

2. Then, you can see that there are some parameters for ABP in the "**ACTIVATION**" tab.

€	ChirpStack	Q Search organization, application, gateway or device ? e admin
: ©	Network-servers Gateway-profiles	Applications / RAKwireless_Test_Application / Devices / RAK_LoRa_Node
	Organizations	DETAILS CONFIGURATION KEYS (OTAA) ACTIVATION DEVICE DATA LOR/ >
•	All users	
chirp	ostack 👻	Device address* 01 dc 91 22 MSB C
\$	Org. settings	Network session key (LoRaWAN 1.0) *
•	Org. users	8d 70 21 e7 97 7e d0 a4 79 1c 82 d5 53 ea d9 cd MSB C 🗍 🔌
.	Service-profiles	Application session key (LoRaWAN 1.0)* b4 17 b2 b6 d2 5b e9 67 40 bb 85 fe 39 b0 8d 8f MSB C C C X
	Device-profiles	Uplink frame-counter *
$\widehat{\mathbb{N}}$	Gateways	0
	Applications	Downlink frame-counter (network) * 0
λ	Multicast-groups	(RE)ACTIVATE DEVICE

Figure 46: Chirpstack ABP Activation Parameters Needed

3. Use these parameters to set RAK5205 WisTrio LPWAN Tracker by using AT command. To set **LoRa join** mode to **ABP**, type the following command:

at+set_config=lora:join_mode:1

Figure 47: Chirpstack ABP Join Mode via RAK Serial Port Tool

4. Set LoRa class to Class A.

RAK SERIAL PORT TOOL		– 🗆 X
	Command	
COM: COM3 BaudRate: 115200	CLOSE 01 at+version	SEND
RECEIVING	RECV 02 at+get_config=device:status	SEND
at+set_config=lora:join_mode:1	03 at+set_config=device:sleep:0	SEND
LoRa configure ABP success	04 at+set_config=device:restart	SEND
ок	05 at+set_config=device:gps:1	SEND
at+set_config=lora:class:0	06 at+set_config=lora:work_mode:0	SEND
LoRa configure ClassA success	07 at+set_config=lora:join_mode:0	SEND
ок	08 at+set_config=lora:class:0	SEND
	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
	✓ 20 at+get config=lora;channel	SEND

Figure 48: Chirpstack ABP Set Class via RAK Serial Port Tool

5. Set the frequency/region to EU868.

at+set_config=lora:region:EU868

RAK SERIAL PORT TOOL	-	
	Command	
COM: COM3 BaudRate: 15200 CLOSE	☑ 01 at+version	SEND
RECEIVING CLEAR RECV	☑ 02 at+get_config=device:status	SEND
at+set_config=lora:join_mode:1	03 at+set_config=device:sleep:0	SEND
LoRa configure ABP success	04 at+set_config=device:restart	SEND
ок	05 at+set_config=device:gps:1	SEND
at+set_config=lora:class:0	06 at+set_config=lora:work_mode:0	SEND
LoRa configure ClassA success	07 at+set_config=lora:join_mode:0	SEND
ок	08 at+set_config=lora:class:0	SEND
at+set_config=lora:region:EU868	09 at+set_config=lora:region:EU868	SEND
Selected LoRaWAN 1.0.2 Region: EU868	10 at+set_config=lora:confirm:1	SEND
Band switch success	□ 11 at+set_config=lora:ch_mask:0:0	SEND
ок	□ 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+set_config=lora:region:EU868	☑ 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:2018-1	2-24 24/02/2021 2:44:45 PM .::	

Figure 49: Chirpstack ABP Set Region/Frequency via RAK Serial Port Tool

6. Set the **Device Address**.

RAK SERIAL PORT TOOL		- 🗆
	Command	
Sector COM: COM3 T BaudRate: 15200 CLOSE	☑ 01 at+version	SEN
RECEIVING CLEAR RECV	☑ 02 at+get_config=device:status	SEN
at+set_config=lora:join_mode:1	03 at+set_config=device:sleep:0	SEI
LoRa configure ABP success	04 at+set_config=device:restart	SEI
ок	05 at+set_config=device:gps:1	SEI
at+set_config=lora:class:0	06 at+set_config=lora:work_mode:0	SEI
LoRa configure ClassA success	07 at+set_config=lora:join_mode:0	SEI
ок	08 at+set_config=lora:class:0	SEN
at+set_config=lora:region:EU868	09 at+set_config=lora:region:EU868	SEN
Selected LoRaWAN 1.0.2 Region: EU868	10 at+set_config=lora:confirm:1	SEN
Band switch success	11 at+set_config=lora:ch_mask:0:0	SEN
ок	12 at+set_config=lora:dev_eui:	SEN
at+set_config=lora:dev_addr:01DC9122	□ 13 at+set_config=lora:app_eui:	SEI
LoRa dev_addr configure success	□ 14 at+set_config=lora:app_key:	SEI
ок	15 at+set_config=lora:dev_addr:	SEN
	16 at+set_config=lora:nwks_key:	SEN
	□ 17 at+set_config=lora:apps_key:	SEN
	□ 18 at+set_config=lora:send_interval:	SEN
, SENDING(With \r\n)	19 at+get_config=lora:status	SEN
at+set config=lorardev addr:01DC9122	☑ 20 at+get config=lora:channel	SEI

Figure 50: Chirpstack ABP Set Device Address via RAK Serial Port Tool

7. Set the Network Session Key.

	Command	
COM: COM3 BaudRate: 15200 CLOSE	☑ 01 at+version	SEND
RECEIVING CLEAR RECV	☑ 02 at+get_config=device:status	SEND
ок	03 at+set_config=device:sleep:0	SEND
at+set_config=lora:class:0	04 at+set_config=device:restart	SEND
LoRa configure ClassA success	05 at+set_config=device:gps:1	SEND
ок	06 at+set_config=lora:work_mode:0	SEND
at+set_config=lora:region:EU868	07 at+set_config=lora:join_mode:0	SEND
Selected LoRaWAN 1.0.2 Region: EU868	08 at+set_config=lora:class:0	SEND
Band switch success	09 at+set_config=lora:region:EU868	SEND
ок	10 at+set_config=lora:confirm:1	SEND
at+set_config=lora:dev_addr:01DC9122	□ 11 at+set_config=lora:ch_mask:0:0	SEND
LoRa dev_addr configure success	12 at+set_config=lora:dev_eui:	SEND
ок	13 at+set_config=lora:app_eui:	SEND
at+set_config=lora:nwks_key:8D7021E7977ED0A4791C82D553EAD	□ 14 at+set_config=lora:app_key:	SEND
9CD	15 at+set_config=lora:dev_addr:	SEND
LoRa nwks_key configure success	□ 16 at+set_config=lora:nwks_key:	SEND
ок	□ 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
+set_config=lora:nwks_key:8D7021E7977ED0A4791C82D5 53EAD9CD	All/None	SAVE

Figure 51: Chirpstack ABP Set Network Session Key via RAK Serial Port Tool

8. Set the Application Session Key.

RAK SERIAL PORT TOOL		- 🗆
	Command	
BaudRate: 115200 - CLOS	■ 01 at+version	SEI
RECEIVING CLEAR REC	✓ 02 at+get_config=device:status	SEI
at+set_config=lora:region:EU868	↑ 03 at+set_config=device:sleep:0	SEI
Selected LoRaWAN 1.0.2 Region: EU868	04 at+set_config=device:restart	SE
Band switch success	05 at+set_config=device:gps:1	SEI
ок	06 at+set_config=lora:work_mode:0	SEI
at+set_config=lora:dev_addr:01DC9122	07 at+set_config=lora:join_mode:0	SEI
LoRa dev_addr configure success	08 at+set_config=lora:class:0	SE
ок	09 at+set_config=lora:region:EU868	SE
at+set_config=lora:nwks_key:8D7021E7977ED0A4791C82D553EAD	10 at+set_config=lora:confirm:1	SE
9CD	□ 11 at+set_config=lora:ch_mask:0:0	SE
LoRa nwks_key configure success	12 at+set_config=lora:dev_eui:	SE
ок	□ 13 at+set_config=lora:app_eui:	SE
at+set_config=lora:apps_key:B417B2B6D25BE96740BB85FE39B08	14 at+set_config=lora:app_key:	SE
D8F	15 at+set_config=lora:dev_addr:	SE
LoRa apps_key configure success	16 at+set_config=lora:nwks_key:	SE
ок	□ 17 at+set_config=lora:apps_key:	SEI
	18 at+set_config=lora:send_interval:	SEI
SENDING(With \r\n)	□ 19 at+get_config=lora:status	SEI
at	☑ 20 at+get_config=lora:channel	SEI

Figure 52: Chirpstack ABP Set Application Session Key via RAK Serial Port Tool

VOTE:

After configuring all parameters, you need to reset RAK5205 WisTrio LPWAN Tracker to save the parameters.

9. After resetting RAK5205 WisTrio LPWAN Tracker, join in ABP mode.

RAK SERIAL PORT TOOL		– 🗆 🗙
	Command	
CLOSE COM: COM3 COM3 CLOSE	☑ 01 at+version	SEND
RECEIVING CLEAR RECV	☑ 02 at+get_config=device:status	SEND
9CD ^	□ 03 at+set_config=device:sleep:0	SEND
LoRa nwks_key configure success	04 at+set_config=device:restart	SEND
ок	05 at+set_config=device:gps:1	SEND
at+set_config=lora:apps_key:B417B2B6D25BE96740BB85FE39B08	06 at+set_config=lora:work_mode:0	SEND
D8F	07 at+set_config=lora:join_mode:0	SEND
LoRa apps_key configure success	08 at+set_config=lora:class:0	SEND
ок	09 at+set_config=lora:region:EU868	SEND
at+join	10 at+set_config=lora:confirm:1	SEND
ABP:	11 at+set_config=lora:ch_mask:0:0	SEND
DevAddr: 01DC9122	12 at+set_config=lora:dev_eui:	SEND
AppsKey: B417B2B6D25BE96740BB85FE39B08D8F	13 at+set_config=lora:app_eui:	SEND
NwksKey: 8D7021E7977ED0A4791C82D553EAD9CD	14 at+set_config=lora:app_key:	SEND
[LoRa]:Join Success	15 at+set_config=lora:dev_addr:	SEND
ок	16 at+set_config=lora:nwks_key:	SEND
Start Search Satellite(about 100 seconds)	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+join	☑ 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 24/02/2021 4:00:35 PM;	

Figure 53: Chirpstack ABP Join via RAK Serial Port Tool

NOTE:

Actually, it is not needed to join in ABP mode. But you still need to set this AT command to validate the parameters which you just set for ABP mode.

10. Try to send data from RAK5205 WisTrio LPWAN Tracker to ChirpStack.

at+send=lora:2:1234567890

Figure 54: Chirpstack Sample Data Sent via RAK Serial Port Tool

• You can then see the data which is just sent from RAK5205 WisTrio LPWAN Tracker on ChirpStack console.

€	ChirpStack	Q Search organization, application, gateway or device ? e admin
•	Network-servers	Applications / RAKwireless Test Application / Devices / RAK LoRa Node
\bigcirc	Gateway-profiles	
	Organizations	S CONFIGURATION KEYS (OTAA) ACTIVATION DEVICE DATA LORAWAN FRAMES >
•	All users	⑦ HELP II PAUSE
chirp	ostack 👻	
	One of this are	UPLINK 5:44:32 PM UnconfirmedDataUp 0077e997 ~
τ,	Org. settings	UPLINK 5:44:21 PM UnconfirmedDataUp 0077e997 V
•	Org. users	DOWNLINK 5:42:29 PM JoinAccept ~
∎≡	Service-profiles	UPLINK 5:42:29 PM JoinRequest 5e9d1e0857cf25f1 V
	Device-profiles	
\bigcirc	Gateways	
	Applications	
λ	Multicast-groups	

Figure 55: Chirpstack Data Received Preview

Configuration of GPS and Sensor Data Transmit Interval

With your RAK5205 already connected to the network server, you can set the interval of sending GPS coordinates and sensor data using the following command:

• where **Y** represents the time interval is seconds.

GPS Satellite Scan Time and Accuracy

The GPS module will try to get a fix from GPS satellites to get the location coordinates. You can modify the satellite scan time of RAK5205. In addition, you can also set the accuracy of GPS coordinates to 4-digit or 6-digit decimal places.

To set the GPS satellite scan time where **X** is in seconds:

at+set_config=device:gps_timeout:X

To set the GPS accuracy to 4-digit if X is 0 and 6-digit if X is 1:

at+set_config=device:gps_format:X

Decoding Sensor Data on ChirpStack and TTN Analyzing Sensor Data from RAK5205

In the previous section, you have successfully sent some raw data from our RAK5205 LPWAN Tracker to The Things Network, but the problem is that you can't really see the actual sensor data from the payload. In this section, you will solve that and understand what each payload means.

NOTE:

Depending on the GPS coordinates accuracy configured on RAK5205 (either 4-digit or 6-digit), you must use the right decoder that can be downloaded on the RAKwireless Github repository 2.

Take the payload data in Figure 56, for example.

Payload: 01 88 05 37 97 10 9D 59 00 DC 14 08 02 01 7A 07 68 58 06 73 25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF FD FC 2E

		PATA					
lters	uplink	downlink	activation	ack	error		
	time	counter	port				
1 5	:05:06	1	8		payload: 01	05 37 97 10 9D 59 00 DC 14 08 02 01 7A 07 68 58 0	06 73 25 6D 02 67 01 1D 04 02 14 AF 03
0.11.0							
Up	link						
Pay	load				Humidity	Temperature	
					+		
0	1 99 05 37	07 10 0D EC	0 00 DC 14 08	02 01 7A	07 68 58 P		EC 2E
0	1 00 00 07	9/ 10 90 35	00 00 1100			25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF FF DD	ICZL E
0	1 00 00 07	10 90 35		1		25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF FF DD	
Fie	lds	f Gps	1	↑ /oltage		25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF FD D	
Fie	lds	Gps	\ \	† /oltage		25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF FF DD ssure Gas_resistance Accele	erometer
Fie {	lds	f Gps	\	∱ /oltage	<u> </u>	25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF FF DD ssure Gas_resistance Accele	erometer
Fie {	Ids	Gps	\	∱ /oltage	1 <u>0, co 20</u> 6.	25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF FF DD ssure Gas_resistance Accele	erometer
Fie {	Ids	Gps eter_3": { .001, .035,	1	∱ /oltage	<u> </u>	25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF FD D ssure Gas_resistance Accele	erometer
Fie {	Ids ("acceleron "x": -0. "y": -0. "z": -0.	Gps eter_3": { .001, .035, .978	1	† /oltage	 	25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF FD D ssure Gas_resistance Accele	erometer
Fie	Ids () "acceleron "x": -0. "y": -0. "y": -0.], "analog ir	Gps eter_3": { .001, .035, .978 .4": 52.95	\	† /oltage	1 <u>0. 00 71</u> L	ssure Gas_resistance Accele	erometer
Fie	Ids " acceleron "x": -0. "y": -0. "z": -0. }, "analog_ir "analog_ir	Gps (.001, .035, .978 1.4": 52.95 .8": 3.78,	\ \ .,	↑ /oltage	<u>10- 00 20</u> F	ssure Gas_resistance Accele	erometer
Fie	Ids " acceleron "x": -0. "y": -0. "z": -0. "analog_ir "analog_ir" barometri "gns 1": 4	Gps 4 6 6 6 6 6 6 6 7 8 1 4 1 5 2 9 7 8 1 6 9 7 8 1 6 9 7 8 1 6 1 7 1 1 1 1 1 1 1 1 1 1 1 1 1	••••••••••••••••••••••••••••••••••••••	∱ /oltage	<u>10- 00 20</u> F	ssure Gas_resistance Accele	erometer
Fie	<pre>Ids of S, acceleron "x": -0. "y": -0 "y": -1 "y": -1</pre>	Gps deter_3": { .001, .035, .978 1_4": 52.95 .8": 3.78, .c_pressure de": 563.4,	ر بر من	† /oltage	<u>10- 00 20</u> F	ssure Gas_resistance Accele	erometer
Fie	<pre>ids of sy i accelerom "x": -0, "y": -0 "z": -0, "z": -1, "z": -0, "z": -1, "z": -1, "z":</pre>	Gps deter_3": { .001, .035, .978 1_4": 52.95 .8": 3.78, .c_pressure de": 563.4, .te": 563.4, .te:: 563.4		† /oltage	<u>10- 00 20</u> F	ssure Gas_resistance Accele	erometer
Fie	<pre>ids cors, ids "accelerom "x": -0, "y": -0, "y": -0, "z": -1, "analog_ir" "barometri"</pre>	Gps deter_3": { .001, .035, .978 1_4": 52.95 .8": 3.78, .c_pressure de": 563.4, .de": 34.191 .de": 108.8		† /oltage	<u>10- 00 20</u> F	25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF FD D ssure Gas_resistance Accele	erometer
Fie	<pre>ids of S, ids "accelerom "x": -0. "y": -0 "y": -0 "z": -0. "z": -0.""z": -0.""z</pre>	Gps deter_3": { .001, .035, .978 1_4": 52.95 .8": 3.78, .c_pressure de": 563.4, de": 108.8 humidity_7		† /oltage	<u>, , , , , , , , , , , , , , , , , , , </u>	25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF FD D ssure Gas_resistance Accele	erometer

Figure 56: Sample Payload

Now, analyze each data which is in Hexadecimal Format. You will be using the data mentioned above as an example and convert the Hexadecimal Data into Decimal Data using a converter \square to understand it.

Enter hex num	ber:	
a Count	u Baart an Gura	16
Decimal numb	er:	
Decimal from	signed 2's complement:	10
	igned 2 5 completion	10
2		11

Figure 57: Hexadecimal to Decimal converter

1. GPS Data

Example data: 01 88 05 37 97 10 9D 59 00 DC 14

Parameter	Hex Data	Decimal Equivalent	Multiplier	True Value
Data Flag	01 88			
Latitude	05 37 97	341911	0.0001° Signed MSB	34.1911°
Longitude	10 9D 59	1088857	0.0001° Signed MSB	108.8857°
Altitude	00 DC 14	56340	0.01 m Signed MSB	563.4 m

2. Battery Voltage

Example Data: 08 02 01 7A

Parameter	Hex Data	Decimal Equivalent	Multiplier	True Value
Data Flag	08 02			
Battery Voltage	01 7A	378	0.01 Signed	3.78 V

3. Humidity

Example Data: 07 68 58

Parameter	Hex Data	Decimal Equivalent	Multiplier	True Value
Data Flag	07 68			
Humidity	58	88	0.5% Unsigned	44.0% RH

4. Pressure

Example Data: 06 73 25 6D

Parameter	Hex Data	Decimal Equivalent	Multiplier	True Value
Data Flag	06 73			
Pressure	25 6D	9581	0.1 hPa Unsigned MSB	958.1 hPa

5. Temperature

Example Data: 02 67 01 1D

Parameter	Hex Data	Decimal Equivalent	Multiplier	True Value
Data Flag	02 67			
Temperature	01 1D	285	0.1 °C Signed MSB	28.5 °C

6. Gas Resistance

Example Data: 04 02 14 AF

Parameter	Hex Data	Decimal Equivalent	Multiplier	True Value
Data Flag	04 02			
Gas Resistance	14 AF	5295	$0.01 \ k\Omega$ Signed	52.95 kΩ

7. Accelerometer

Example Data: 03 71 FF FF FF DD FC 2E

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Parameter	Hex Data	Decimal Equivalent	Multiplier	True Value
Data Flag	03 71			
Acceleration X	FF FF	-1	0.001 g Signed MSB	-0.001 g
Acceleration Y	FF DD	-35	0.001 g Signed MSB	-0.035 g
Acceleration Z	FC 2E	-978	0.001 g Signed MSB	-0.978 g

Decoding Sensor Data in TTN Input Decoding Function in TTN

1. To start with, download the decoding function \square .

2. From your TTN console, go to application page and click the "**Payload Formats**" tab as shown in Figure 58.

Figure 58: Payload Format at TTN Application Page

3. Next, select "**Payload Format**" as "**Custom**". Then, from the decoder tab, copy and paste the decoder function from **step 1**.

THE THINGS CONSOLE COMMUNITY EDITION	Applications	Gateways	A .
Applications $\rightarrow \bigotimes$ app_taylor_001 \rightarrow P	ayload Formats		
PAYLOAD FORMATS			
Payload Format The payload format sent by your devices			
Custom			0
decoder converter validator e	ncoder		remove decoder
1 // the application function 2 // Decide decodes an array o	to decode uplink data. f bytes into an object.		
3 // - port contains the LoRa 4 // - bytes is an array of b	WAN fPort number ytes, e.g. [225, 230, 255,	, 0]	
5 // The function must return 6 // for RAK5205 return {	an object, e.g. {"temperat	ture": 22.5}	
7 // "D	ecodeDataHex": "" // RAK52	205 sensor data in H	ex format
8 // "D 9 // 3	ecodeDataObj": "" // RAK52	205 sensor data obje	ct. e.g. {"temper
10 // The function prototype ca	nnot be modified.		
1 function Decoder(bytes, port) { Hay", [] "DacadaDataObd",	. (11.	development and a second
13 (decoder has no changes

Figure 59: Inputting the Decoder Function

Testing the Validity of Decoding Sensor Data in TTN

Input the listed data below in the "**Payload**" box as shown in Figure 60.

Payload data: 01 88 05 37 97 10 9D 59 00 DC 14 08 02 01 7A 07 68 58 06 73 25 6D 02 67 01 1D 04 02 14 AF 03 71 FF FF DD FC 2E

COMMUNITY EDITION	Applications Gateways Support 🎮 🗸
vlications > 🤤 app_taylor_001 > Payload Formats	
decoder converter validator encoder	remove decoder
<pre>1 // ttn application function to decode uplink 2 // Decode decodes an array of bytes into an 3 // - port contains the LoRaWAN fPort number 4 // - bytes is an array of bytes, e.g. [225, 5 // The function must return an object, e.g. [6 // for RAK5205, return { 7 // "DecodeDataHex":"" 8 // "DecodeDataHex":"" 9 // \$ 10 // The function prototype cannot be modified 11 function Decoder(bytes, port) { 12 ************************************</pre>	<pre>data. object. 230, 255, 0] ("temperature": 22.5} " // RAK5205 sensor data in Hex format " // RAK5205 sensor data object. e.g. {"temperature": 22.5}</pre>
Payload	07 68 58 06 73 25 6D 0' 38 bytes 1
01 00 05 37 97 10 9D 59 00 DC 14 08 02 01 /A	
"x": "-0.001g", "y": "-0.035g", "z": "-0.978g" }, "battery": "3.78V", "environment": { "gasResistance": "52.95kD", "humidity": "44.0% RH", "pressure": "958.10hPa", "temperature": "28.50°C"	
<pre>"x": "-0.001g", "y": "-0.035g", "z": "-0.035g", "z": "-0.978g" "battery": "3.78V", "environment": { "gasResistance": "52.95k0", "humidity": "44.0% RH", "pressure": "958.10hPa", "temperature": "28.50°C" }, "gps": {</pre>	Payload was valid
<pre>"x": "-0.001g", "y": "-0.035g", "z": "-0.978g" "battery": "3.78V", "environment": { "gasResistance": "52.95k0", "humidity": "44.0% RH", "pressure": "958.10hPa", "temperature": "28.50°C" }, "gps": {</pre>	Payload was valid Cancel Save payload functions

Figure 60: Testing Payload Data

• Then, click "**Test**" and it will generate a code with the decoded data as shown in Figure 60.

{	json
DecodeDataHex": "0188053797109d5900dc140802017a0768580673256d0267011d040214af0371fffffff	ddfc2e'
"DecodeDataObj": {	
"acceleration": {	
"x": "-0.001g",	
"y": "-0.035g",	
"z": "-0.978g"	
},	
"battery": "3.78V",	
"environment": {	
"gasResistance": "52.95kΩ",	
"humidity": "44.0% RH",	
"pressure": "958.10hPa",	
"temperature": "28.50°C"	
},	
"gps": {	
"altitude": "563.4m",	
"latitude": "34.1911°",	
"longitude": "108.8857°"	
}	
}	
}	

• Click "save payload functions" button to save the decoding function.

Testing in Real System in TTN

After the gateway and node go online, click the **uplink data record** from the application data tab to check the decode status. In Figure 61, you can see the data decoded successfully in TTN.

	ORK COMMUNI	E ITY EDITION	Applications Gateways Support
Application	is > 🥪 a	1 > Data	
APPLI	CATION DAT	А	II pause @ c
Filters	uplink down	nlink activation	ack error
	time cou	nter port	
^ 1	16:59:38	349 8	devid: aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
Pa	ayload		
	01 88 05 37 97 10	9D 5F 00 B8 38 08 02	2 01 A2 07 68 24 06 73 25 EA 02 67 01 05 04 02 50 79 03 71 FC 30 FF D5 FF 47

Figure 61: Uplink Decoded Data

Decoding Sensor Data in ChirpStack Input Decoding Function in ChirpStack

- 1. To start with, download the decoding function \square .
- 2. From your ChirpStack, go to application page and click the "**APPLICATION CONFIGURATION**" tab as shown in Figure 62.

1		
APPLICATION CONFIGURATION	INTEGRATIONS	
	1 APPLICATION CONFIGURATION	1 APPLICATION CONFIGURATION INTEGRATIONS

Figure 62: Application Configuration Tab

3. Next, select "**Payload codec**" as "**Custom JavaScript codec functions**". Then, from the decoder tab, copy and paste the decoder function from **step 1**.

DEVICES	APPLICATION CONFIGURATION	INTEGRATIONS	
Application name *			
111			
The name may only co	tain words, numbers and dashes.		
Application description			
111			
Payload codec Custom JavaScri By defining a payload c	ot codec functions	binary device payload for you.	
Payload sodes Custom JavaScri By defining a payload c 1 // Decode dec 2 // - fPort c	ot codec functions odec, LoRa App Server can encode and decode th odes an array of bytes into an object. ontains the LoRaWAN FPort number	binary device payload for you.	
Payload codec Custom JavaScri By defining a payload c 1 // Decode dec 2 // - fPort c 3 // - bytes i 4 // The functi 5	ot codec functions odec, LoRa App Server can encode and decode th odes an array of bytes into an object. ontains the LoRaWAN fPort number s an array of bytes, e.g. [225, 230, 2 on must return an object, e.g. ["tempe	binary device payload for you. 55, 0] rature [«] : 22.5}	
Payload codoc Custom JavaScri By defining a payload c 1 // Decode dec 2 // - fPort c 3 // - bytes i 4 // The functi 5 6 function Decc 7 {	ot codec functions odec, LoRa App Server can encode and decode the odes an array of bytes into an object. ontains the LoRaWAN FPort number s an array of bytes, e.g. [225, 230, 2 on must return an object, e.g. ["tempe de (fPort, bytes)	binary device payload for you. 55, 0] rature [«] : 22.5}	
Paylood sodac Custom JavaScri By defining a payload c 1 // Decode dec 2 // - fPort c 3 // - bytes i 4 // The functi 5 function Decc 7 { 8 var myObj 9 var tosHe	bt codec functions bdec, LoRa App Server can encode and decode the odes an array of bytes into an object. ontains the LoRaWAN fPort number s an array of bytes, e.g. [225, 230, 2 on must return an object, e.g. {"temper de (fPort, bytes) = {"DecodeDataHeg":"", "DecodeDataObj xtring=bin2HexStr(bytes);	binary device payload for you. 55, 0] rature": 22.5}	
Raylood codec Custom JavaScri By defining a payload c 1 // Decode dec 2 // - fPort c 3 // - bytes i 4 // The function 5 6 function Decc 7 { 8 var myObj 9 var tosHe 10 myObj.Dec 11 myObj.Dec	bt codec functions bdec, LoRa App Server can encode and decode the odes an array of bytes into an object. ontains the LoRaWAN fPort number s an array of bytes! e.g. [225, 230, 2 on must return an object, e.g. ["temped de (fPort, bytes) = {"DecodeDataHex":"", "DecodeDataOb; xtring=bin2HexStr(bytes): odeDataHex = tosHextring; odeDataObj = rak5205_decodeObj(tosHext)	<pre>binary device payload for you. 55, 0] rature": 22.5} ": ""}; time);</pre>	
Payload sodac Custom JavaScri By defining a payload o 1 // Decode dec 2 // - fPort o 3 // - bytes i 4 // The function 5 6 function Deco 7 { 8 var myObj 9 var tosffe 10 myObj.Dec 11 myObj.Dec	bt codec functions bdec, LoRa App Server can encode and decode the odes an array of bytes into an object. ontains the LoRaWAN (Port number s an array of bytes; e.g. [225, 230, 2 on must return an object, e.g. {"temper de (fPort, bytes) = {"DecodeDataHes":"", "DecodeDataObj string=bin2HexStr(bytes): odeDataHes = tosHextring; odeDataObj = rak5205_decodeObj(tosHext Dbj:	<pre>binary device payload for you. 55, 0] rature": 22.5} ': ""}: ring);</pre>	
Payload sodat Custom JavaScri By defining a payload c 1 // Decode dec 2 // - fPort c 3 // - bytes i 4 // The function 5 function Decc 7 { 8 var myObj 9 var tosHe 10 myObj.Dec 11 myObj.Dec 13 return my 14 }	bt codec functions bdec, LoRa App Server can encode and decode the odes an array of bytes into an object. ontains the LoRaWAN (Port number s an array of bytes e.g. [225, 230, 2 on must return an object, e.g. {"temper de (fPort, bytes) = {"DecodeDataHes":"", "DecodeDataObj xtring=bin2HexStr(bytes): odeDataMes = tosHextring: odeDataObj = rak5205_decodeObj(tosHext Obj:	<pre>binary device payload for you. 55, 0] rature": 22.5} ": ""}: ring):</pre>	
Payload sodae Custom JavaScri By defining a payload of 1 // Decode dec 2 // - fPort of 3 // - bytes i 4 // The function 5 6 function Deco 7 { 8 var myObj.Dec 10 myObj.Dec 11 myObj.Dec 12 return my 14 } 15 16 function bin2 17 {	bt codec functions bdec, LoRa App Server can encode and decode the odes an array of bytes into an object. ontains the LoRaWAN fPort number s an array of bytes; e.g. [225, 230, 2 on must return an object, e.g. ["temped de(fPort, bytes) = { DecodeDataHex":", "DecodeDataObj xtring=bin2HexStr(bytes): odeDataHex = tosHextring; odeDataObj = rak5205_decodeObj(tosHext Obj; HexStr(arr)	<pre>binary device payload for you. 55, 0] rature": 22.5} ': ""}; ring);</pre>	

Figure 63: Decoded Function in Chirpstack

4. Click "UPDATE APPLICATION" button to save decoding function.

Testing in Real System in ChirpStack

After the gateway and node go online, click the uplink data record from the application data at "**LIVE DEVICE DATA**" tab to check the decode status. In Figure 64, you can see the data decoded successfully in ChirpStack.

DETAILS	CONFIGURATION	KEYS (OTAA)	ACTIVATION	LIVE DEVICE DATA	LIVE LORAWAN FRA
					HELP
9:30:46 AM	uplink				
adr: true					
applicationID:					
applicationName:	°111°				
data: "AYgFN5kQr	WsBNIQIAgF7B2gsBnMmAAJr	AOcEAiM+A3H/H//S/Ds="			
devEUI: "					
deviceName: *					
fCnt: 13					
fPort: 8					
▼ object: {} 2 keys					
DecodeDataHex:	"0188053799109d6b01348408	80201/b0/682c06/3260002	26700e70402233e0371ff1f	ffd2fc3b"	
DecodeDataHex: ▼ DecodeDataObj:	"0188053799109d6b01348408 {} 4 keys	30201/b0/682c06/3260002	26700e70402233e0371ff1f	ffd2fc3b"	
DecodeDataHex: ▼ DecodeDataObj: ▼ acceleration:	"0188053799109d6b0134840 {} 4 keys {} 3 keys	80201/60/682c06/3260002	26700e70402233e0371ff1	ffd2fc3b"	
DecodeDataHex: ▼ DecodeDataObj: ▼ acceleration: x: *-0.225g*	"0188053799109d6b0134840 {} 4 keys } 3 keys	802017607682c0673260002	26700e70402233e0371ff1f	ffd2fc3b"	
DecodeDataHex: ▼ DecodeDataObj: ▼ acceleration: x: "-0.225g" y: "-0.046g"	"0188053799109d6b0134840 () 4 keys) 3 keys	802017607682c0673260002	26700e70402233e0371ff1f	ffd2fc3b*	
DecodeDataHex: ▼ DecodeDataObj: ▼ acceleration: x: "-0.225g" y: "-0.046g" z: "-0.965g"	"0188053799109d6b0134840 () 4 keys) 3 keys -	30201/b0/682c06/326000	6700e70402233e0371ff1	ffd2fc3b*	
DecodeDataHex: ▼ DecodeDataObj: ▼ acceleration: x: "-0.225g" y: "-0.046g" z: "-0.965g" battery: "3.79V	"0188053799109d6b01348400 {} 4 keys } 3 keys	902017607682c067326000 .	66700e70402233e0371ff1f	ffd2fc3b*	
DecodeDataHex: ▼ DecodeDataObj: ▼ acceleration: x: "-0.225g" y: "-0.046g" z: "-0.965g" battery: "3.79V ▼ environment:	"0188053799109d6b01348400 {} 4 keys } 3 keys {} 4 keys	902017607682c067326000 .	6700e70402233e0371ff1f	ffd2fc3b*	
DecodeDataHex: ▼ DecodeDataObj: ▼ acceleration: x: "-0.225g" y: "-0.046g" z: "-0.965g" battery: "3.79V ▼ environment: gasResistanc.	"0188053799109d6b0134840 {} 4 keys } 3 keys (} 4 keys ; 9 4 keys ; "90.22KQ"	902017607682c067326000 .	6700e70402233e0371ff1f	ffd2fc3b*	
DecodeDataHex: V DecodeDataObj: V acceleration: y: "-0.225g" y: "-0.046g" z: "-0.965g" battery: "3.79V V environment: gasResistance humidity: "2.2	"0188053799109d6b0134840 {} 4 keys } 3 keys (} 4 keys e: "90.22KΩ" .0% RH" tool 0.	902017607682c067326000 .	6700e70402233e0371ff1f	ffd2fc3b*	
DecodeDataHex: V DecodeDataObj: V acceleration: x: "-0.225g" y: "-0.046g" z: "-0.965g" battery: "3.79V V environment: gasResistanc humidity: "21 pressure: "97	"0188053799109d6b0134840; {} 4 keys } 3 keys (} 4 keys e: "90.22KQ" 2.80hPa" 2.80hPa"	902017607682c067326000 .	6700e70402233e0371ff1f	ffd2fc3b*	
DecodeDataHex: V DecodeDataObj: V acceleration: x: "-0.225g" y: "-0.046g" z: "-0.965g" battery: "3.79V V environment: gasResistanc humidity: "22 pressure: "97 temperature: V composition:	"0188053799109d6b0134840; {} 4 keys } 3 keys (} 4 keys e: "90.22KQ" 2.0% RH" 2.80hPa" "23.10°C"	9020176076822067326000 .	6700e70402233e0371ff1f	ffd2fc3b*	
DecodeDataHex: V DecodeDataObj: V acceleration: 4 x: "-0.225g" y: "-0.046g" z: "-0.965g" battery: "3.79V V environment: gasResistance humidity: "22 pressure: "97 temperature: V gps: [) 3 keys with a "700"	"0188053799109d6b0134840; {} 4 keys } 3 keys (} 4 keys e: "90.22KQ" 2.80hPa" "23.10°C"	902017607682c067326000 .	6700e70402233e0371ff1f	ffd2fc3b*	
DecodeDataHex: ▼ DecodeDataObj: ▼ acceleration: * x: *-0.225g" y: *-0.965g" battery: *3.79V ▼ environment: gasResistano- humidity: *2j pressure: *97 temperature: ▼ gps: {} 3 keys alitude: 788 Luide: 768	"0188053799109d6b0134840; {} 4 keys } 3 keys " (] 4 keys e: "90.22KΩ" .20% RH" 2.80hPa" "23.10°C"	902017607682c067326000 .	6700e70402233e0371ff1f	ffd2fc3b*	

Cayenne Integration

MyDevice/Cayenne is a service that allows one to monitor node data in real time and can also send downlink control messages. Additionally, it has a wide range of integrations for alerts, notifications, and alarms. Its visualization tools provide various ways of representing both real time and statistical data such as graphs, dials, gauges, scales, and charts.

The Things Network Configuration

Before you can use Cayenne, you need to configure our Application in TTN to properly work with it.

- 1. Log into your TTN Console and navigate to the desired application and RAK5205 device.
- 2. Go to the **Payload Formats** tab as seen in Figure 65 and choose "Cayenne LPP".

THE THINGS CONSOLE		Applications	Gateways	Support
	Applications > 🎯 rak7205 > Payload Formats			
	Overview Devices Payload Formats Integrations Data Settings			
	PAYLOAD FORMATS			
	Payload Format The payload format sent by your devices			
	Cayenne LPP ©			
	Cayenne LPP			
	Cancel)		

Figure 65: Device Payload Formats

3. Next, go to the Integrations Tab and press the "add integration" button.

	Applications	Gateways	Support
Applications > 😝 rak7205 > Integrations			
Overview Devices Payload Formats Integrations Data Settings			
INTEGRATIONS • addingeration			
There are no integrations for application rak/7205. Get started hycreating one!			

Figure 66: Device Integration

4 Select the MyDevices icon.

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THE THINGS CONSOLE COMMUNITY EDITION				Applications	Gateways	Support
	Applications > 🤤 rak7205 > Integrations					
	EVRYTHNG V2.6.0 EVRYTHNG	HTTP Integration v2.6.0 The Things Industries B.V.	IFTTT Maker v2.6.0 The Things Industries B.V.			
	my Devices	OpenSensors.io				
	MyDevices v2.6.0 myDevices	OpenSensors v2.6.0 The Things Industries B.V.	TTN Mapper v2.7.1 JP Meljers			

Figure 67: My Devices Integration

5. You will be redirected to a page the same as shown in Figure 68, where you need to enter a Process ID and select an Access Key (Choose the default key).

THE THINGS CONSOLE COMMUNITY EDITION												Applications	Gateways	Support
	Applications > 😂 rak7205	i > Integra	rations											
						Overview	Devices	Payload Formats	Integrations	Data	Settings			
	ADD INTEGRATION	E.												
	my Devices	MyDevic myDevic Quickly de document	vices (v2 vices design, prototy ntation	2.6.0) type and commer	rcialize lo T soluti	ions with myl	Devices Caye	nne						
	The unique identifier of the 7205	e new integra	ration process	5.							۰			
	Access Key The access key used for dow default key lowless messo	wnlink									0			
									Cancel	Add in	tegration)		
										-	-			

Figure 68: myDevices Integration Configuration

Cayenne Configuration

If you don't have an account in Cayenne, head on to https://mydevices.com/cayenne/signup/ 🖾 and create an account for free.

my Devices	IOT IN A BOX™	CAYENNE ^	IOT READY™	MARKETPLACE	
	Sig	gn In to Caye	nne		
	Email Address				
	Password				
	Forgot Password?				
		SIGN IN			
	Don	't have an account yet	ign up.		

Figure 69: Cayenne start screen

1. Once logged in, navigate to the "Add New" drop down menu in the upper left corner and choose "Device/Widget".

Cayenne Powered by myDevices	LoRa Raspberry Pi	LS	+	c	ැන Gireate App	C Submit Project		ද් Docs	≣ User Menu
Add new Device/Widget Event	Overview	Data				Netwo	Caye k: The Things	nne LP Networ	P •
Trigger Project									

Figure 70: Adding a device

2. Select **LoRa** in the list of Devices and Widgets and navigate to The Things Network at the end of the list.

Figure 71: Choosing your device from the list

3. A list of LoRa Products and Widgets are now displayed. Scroll down and look for "Cayenne LPP".

Figure 72: Cayenne LPP device selection

4. Lastly, input the Device EUI and optionally set if your device is moving or stationary.

Devices & Widgets					Enter Settings
Search	Q	6.0	1M2M ED1608 Generic with many sensors and connectors	>	
IEVICES					Cavenne Cavenne LPP
Single Board Computers	>		AAEON AIOT-II NOO1		LPP
MicroControllers	>		Industrial LoRa Node platform	>	This device uses Caustral IDD
Sensors	~				Name Cavenne LPP
Actuators	~	-	Abeeway MasterTracker	>	\bigcirc
Extensions	~		Low Power Industrial GPS Tracker		DevEUI
oRa	~				Accusation Mode Already Registered
Acklio		5	AC Outlet and Switch Tektelic AC Control and Energy Monitoring	>	Tracking
Actility			57 S		Hucking
CityKinect					This device moves
Everynet			AcSiP EK-S76SXB	>	

Figure 73: Setting device parameters

• If everything went well, you should end up with a screen the same as Figure 74.

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Figure 74: Dashboard live view of RAK5205

NOTE

There are two widgets that appear as general Analog ones. The first one on channel 8 is the **speed** as measured by the GPS receiver. The second one on channel 9 is the **Air Quality Index** (AQI). You need to edit the names and choose an appropriate UI representation by hand. Because, as of this moment, LPP doesn't support data of such type, and they are transmitted as general analog values. In Rev2 of the LPP standard, it is expected these issues will be addressed.

LoRa P2P Mode

This section shows how to use LoRa P2P mode. You will be using EU868 as the frequency, although it is applicable to other standard bands.

- 1. First, find two **RAK5205 LoRa Tracker** which can work on EU868 frequency and make sure their firmware version isn't less than **V3.0.0.1**.
- 2. Next, connect these two RAK5205 LoRa Tracker with PC through UART, and open two serial port tool on PC.
- 3. Now, configure them to both work in LoRaP2P mode as follow:

at+set_config=lora:work_mode:1

The device will automatically restart when mode is set to LoRa P2P.

RECEIVING	CLEAR REG
at+set_config=lora:work_mode:1	
.oRa configure LoRaP2P success	
DK	
Reset now	

AK5205 Version:3.0.0.12.H.T1	
AKT1 work mode: KUTUAKT_NORAMAL	
IMEBBU init success.	
ISSUE INTO CK.	
In UKups timeout: Ious	
utosend_interval: 30s	
urrent work_mode:P2P	
ENDING(With \\n)	
at+set_config=lora:work_mode:1	
	SEND

Figure 75: P2P Initialization

4. Then configure LoRaP2P parameters for both of them as follow, for example:

RAK SERIAL PORT TOOL				- 🗆
		Comm	and	
BaudRate: 115200 V	CLOSE	☑ 01	at+version	SEND
RECEIVING CLEAN	R RECV	☑ 02	at+get_config=device:status	SEND
**********	^	03	at+set_config=device:sleep:0	SEND
RAK5205 Version:3.0.0.12.H.T1		04	at+set_config=device:restart	SEND
**********		05	at+set_config=device:gps:1	SEND
	===	06	at+set_config=lora:work_mode:0	SEND
		07	at+set_config=lora:join_mode:0	SEND
UART1 work mode: RUI_UART_NORAMAL		08	at+set_config=lora:class:0	SEND
BME680 init success.		09	at+set_config=lora:region:EU868	SEND
LIS3DH init OK.		10	at+set_config=lora:confirm:1	SEND
GPS Init OK.GPS timeout:100s		11	at+set_config=lora:ch_mask:0:0	SEND
autosend_interval: 30s		12	at+set_config=lora:dev_eui:	SEND
Current work_mode:P2P		13	at+set_config=lora:app_eui:	SEND
	- 61	14	at+set_config=lora:app_key:	SEND
at+set_config=lorap2p:869525000:7:0:1:5:5		15	at+set_config=lora:dev_addr:	SEND
LoRaP2P configure success		16	at+set_config=lora:nwks_key:	SEND
ок		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+set_config=loran2n;869525000;7:0:1:5:5		⊋ 20	at+get_config=lora:channel	SEND

Figure 76: Configuring P2P in both RAK5205 Nodes

5. Try to send a message from LoRa Tracker 1 (the left one) to LoRa Tracker 2 (the right one):

at+send=lorap2p:1234567890

📝 NOTE

In LoRa P2P mode, RAK5205 is in RX mode by default and will automatically switch to TX mode when it needs to transmit data. After the successful transmission, it will go back again to RX mode. You cannot set RAK5202 exclusively as RX or TX mode.

RAK SERIAL PORT TOOL	RAK SERIAL PORT TOOL
SRAK COM: COM3 - BaudRate: 115200 - CLOSE	SRAK COM: COM7 - BaudRate: 15200 - CLOSE
RECEIVING CLEAR RECV	RECEIVING CLEAR RECV
^	at+recv=-82,6,5:1234567890
UART1 work mode: RUI_UART_NORAMAL	
BME680 init success.	
LIS3DH init OK.	
GPS Init OK.GPS timeout:100s	
autosend_interval: 30s	
Current work_mode:P2P	
at+set_config=lorap2p:869525000:7:0:1:5:5 LoRaP2P configure success OK at+send=lorap2p:1234567890 LoRaP2P send success OK [LoRa] P2PTxDone.	
SENDING(With \r\n) at+send=lorap2p:1234567890	SENDING(With \r\n)
Time 00:00:00 PASS: 0 FAIL: 0 SW_Version: V1.2.1 Make:2018-1	Time 00:00:00 PASS: 0 FAIL: 0 SW_Version: V1.2.1 Make:2018-12

Figure 77: Message sent and received status in the two Nodes

6. You can send more messages.

at+send=lorap2p:12345678901234567890

NOTE

RAK5205 in LoRa P2P mode of operation is also compatible to other RUI based devices like WisDuo modules and others as long as the modules are configured in P2P mode as well.

Figure 78: Succeeding Messages sent to the other Node

Now, you have successfully finished your RAK5205 LPWAN Tracker set up.

Miscellaneous

Burning Bootloader into the Device

Get the Bootloader Firmware 🖆 for the RAK5205 WisTrio LPWAN Tracker from RAKwireless download site. Burning the Bootloader into the device is done as follows:

🚹 WARNING

Skip this section if you have a RAK5205 V3.0.0.0 firmware or newer, for it already has a bootloader.

You need to make sure you have the latest firmware on your device. To be able to do this, you need to follow these steps:

- 1. To start with, download and install the **STM32CubeProgrammer** I tool in your PC. You can also get it in the RAK directory I.
- 2. Then, configure your RAK5205 by jumping the "**BOOT**" pin and "**VCC**" pin for boot mode. Refer to Figures 79 and 80.

Figure 79: Boot and VCC Pins

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Figure 80: Jumper at Boot and VCC pins

3. Connect your RAK5205 to your PC using the USB cable.

📝 NOTE

The jumper on the BOOT pin must be placed first before connecting to the USB Cable.

Figure 81: RAK5205 connected to your PC via USB cable

4. Choose the correct port number in the **COM Port** field. You can check this in the **Device Manager**.

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≡	All	Apps	Documents	s Settings	Email	More	*					Feed	back	
ŵ	Best	match												
		Device Control p	Manager Janel		\rightarrow	l.					1			
									Devic Co	ce Ma	nage mel	r		
							다 Ope	n						
©														
2														
	Q	Device Ma	nager											
-	a (۰ و	🎯 F 🔹	🗞 🔘 🚺	0	•	i _e x 💦	Ps	🛛 😕		٢	<u></u>		

Figure 82: Checking COM Port through Device Manager

- 5. Open the STM32CubeProgrammer tool.
- 6. Select **UART type**. Go to COM Port and look for your RAK5205 Board COM Port (example: COM5).
- 7. Configure the **baud rate** and **parity**.

Pro ST	M32CubeProgrammer			- 🗆 ×
STM32 Cube	rogrammer	(19)	f 🖻	¥ 🛪 🛐
	Memory & File edition			Not connected
	Device memory Open file +		UART	Connect
1	Address Size Data width 32-bit - Read		UA	RT configuration
			Port	COM5 👻 💋
			Baudrate	115200 -
			Parity	Even 👻
			Data bits	8
			Stop bits	1.0 -
	NO GALA LO DISPLAY		Flow control	on 🔸
		ō.	-	
	Log Verbosity level • 1 • 2			
٢	12:50:04 : SIMSZCUDEPFOGRAMMER AFI V2.0.0	8	Device	vice information
\bigcirc			Type Device ID	
0			Flash size	
Ø			CPU	

Figure 83: UART Settings in STM32CubeProgrammer

8. Then, press the "**Connect**" button at the top right corner.

If there are some errors in the Log box or it can't connect, close the STM32CubeProgrammer and reset RAK5205. Then, open the STM32CubeProgrammer and connect again.

Figure 84: Errors Occurred During Connecting

• You should see a similar log as shown in Figure 85.

STM32 Cube	r 🗊 Programmer							f 🖸	y 🛪 🖌	57
=	Memory & File	edition							😑 Connec	ted
	Device memory	Open file	+					UART	 Discon 	inect
2	Address 0x0	800000 -	Size 0x400	Data width	32-bit	•	Read 🔹	UA	RT configuration	
ОВ	Address 0x08000000	0	4 08010FE9	8 08011031	C 08010385	ASCII	~	Baudrate	COM5	0
	0x08000010 0x08000020	08011031	08011031	08011031 00000000	00000000	111		Parity	Even	
	0x08000030 0x08000040	08011031	00000000	08011031 08011031	08001E69 08011031	11i 111		Data bits	8	~
	0x08000050 0x08000060	08011031 08002181	08011031 080021C1	08002191 080021D1	080021A1 08011031	11		Stop bits	1.0	
	0x08000070 0x08000080	08011031 08011031	08011031 08011031	08011031 08011031	08011031 08011031	1111			1384	
	0x08000090	08011031	08011031 08011031	08011031 08011031	080021E1 08011031	111ál 1 1 1	~			
	Log					Verbosity level 💿 1	O 2 O 3			
(11:04:52 : Act 11:04:52 : Chi 11:04:53 : UPL(11:04:53 : UPL(11:04:53 : Add 11:04:53 : Add 11:04:53 : Siz 11:04:54 : UPL(11:04:54 :	vating device p ID: 0x429 tLoader protoc DADING OPTION 1 k: 0x00 ress: 0x1ff80 e: 24 Bytes DADING	: OK ol version: 3.1 BYTES DATA 000					De Device STM	evice information 432L100x6xxA/STM32I	.100x8x
$\textcircled{\begin{subarray}{c} \hline \end{subarray}}$	11:04:54 : Add 11:04:54 : Rea 11:04:55 : Dat 11:04:55 : Tim	ress : 0x80000 d progress: a read success e elapsed duri	00 fully ng the read operat	ion is: 00:00:01	. 150			Type Device ID		MCU 0x429
?								CPU CPU	G	ortex-M3

Figure 85: Successful Connection Log to your Device

9. Before uploading the firmware, **erase all data** on the RAK5205 WisTrio LPWAN Tracker as shown on Figure 86.

STM32	132CubeProgram	ner					(19)	f D	 * *	
Cube	Memory & F	ile edition							Conne	cted
	Device memor	RAK7200_EU8	68_test.bin 🛪 📃					Lu4at	- Disco	
	Address 0x	0 👻	Size 0x400	Data width	32-bit	•	Download *	UA	RT configuration	
<u>~</u>	Address	0	4	8	c	ASCII		Part	COM21	- 3
	0x00000000	20005000	08011101	08011211	08002511	.P. Á%	â	Baudrate	and the second se	
OB	0x00000010	00000000	00000000	00000000	00000000			-		
	0x00000020	00000000	00000000	00000000	0800FE35	5b		Parity	Even	•
	0x0000030	00000000	00000000	0800FF01	08008E81	· · · · · · · · · · · · · · · · · · ·		Data bits	1	
	0x00000040	08011211	08011211	08009241	08011211	A		Stop bits	and the second second	
	0x00000050	08011211	L 08009B4D	08009861	08009B75	Mau		Elever contend		
	0x00000060	08011211	08011211	080097E5	080097CD	åť		Thow control	AND .	
11	0x00000070	08011211	08011211	08011211	08009E09					
	0x0000080	08011211	08011211	08011211	00000000					
	0x00000090	08011211	08011211	08011211	08011211					
	0x000000A0	08011211	08011211	08011211	08009625	%				
	0x000000B0	080097C9	08011211	08011211	08011211	É				
	0x000000c0	4C06B510	2B007823	4B05D107	D0022B00	.µ.L#x.+.Ñ.K.+.Đ				
H	0.0000000	F0004004	33010500	00103033	30000630	·· * ##. 1/	~			
	Log 18:55:17 : A 18:55:17 : S 18:55:18 : U	paress : 0x1TT8 ize : 20 Bytes	50000			Verbosity level	2 3			
٢	18:55:18 : 5 18:55:18 : A 18:55:18 : R 18:55:19 : D 18:55:19 : T	ize : 1024 Byte ddress : 0x8000 ead progress: sta read succes ime elapsed dur	es 0000 sfully ring the read opera	ation is: 00:00:01.	128		8	D	vice information STM32L07x/	L08x/L010
\odot	18:58:54 : R 18:58:54 : N 18:58:54 : S 18:59:17 : E	ead File: D:\IO umber of segmen egment[0]: addr ase all flash	01&7200\RAK7200_EU8 hts: 1 ess= 0x0, size= 0x sectors	368_test.bin (19578		Erase chip		Type Device ID Flash size		мсu 0x447
?	[8	CPU	Cc	ortex-M0+

Figure 86: Erasing the Data in the Chip

10. Press "Open file" and select the bootloader file in the pop-up window.

Pro ST	M32Cube	Progra	mmer								- 🗆 X
STM32 Cube	• 🍞 Programmer	6							(19)	f 🕒	🔰 🛪 🖅
Ξ	Memory	& File	editio	n						102	Connected
	Device me	emory	Open	file	+					UART	Disconnect
	Address	0x08	00000	-	Size	0x400	Data width	32-bit	• Read •		UART configuration
	Add	ress		0		4	8	С	ASCII	Port	COM5 - O
OB	0x08000	000	0000	00000		00000000	00000000	00000000		△ Baudrate	115200
	0x08000	010	0000	00000		00000000	00000000	00000000		Davity	
	0x08000	020	0000	00000		00000000	00000000	00000000			even 👻
	0x08000	030	0000	00000		00000000	00000000	00000000		Data bits	
	0x08000	040	0000	00000		00000000	00000000	00000000			
	0x08000	050	0000	00000		00000000	00000000	00000000		Stop bits	10 *
	0x08000	060	0000	00000		00000000	00000000	00000000		Flow cont	rol 👘
	0x08000	070	0000	00000		00000000	00000000	00000000			
	0x08000	080	0000	00000		00000000	00000000	00000000			
	0x08000	090	0000	00000		00000000	00000000	00000000			
	0x08000	0A0	0000	00000		00000000	00000000	00000000			
	0x08000	080	0000	00000		00000000	0000000	00000000		~	
	<								13	<u>)</u>	
	Log								Verbosity level 💿 1 💿 2 🔘 3	3	
©	14:22:19 14:26:35 14:26:41 be erase 14:26:42 14:26:42 14:26:42 14:26:43 14:26:43	: Data : Time : Eras : Flas d. : UPLO : Size : Addr : Read : Data : Time	elapse e all f h page/ ADING . : 1024 ess : 0 progre elapse	Bytes Bytes Sector Bytes SS: Uccess d duri	fully ector eras	e read operat s e command cor	tion is: 00:00:01 rectly executed.	.140 Note: if flash .142	sector is protected, it will not	Device Type Device ID Flash size	Device information STM32L07x/L08x/L010 MCU 0x447
?									(СРИ	- Cortex-M0+

Figure 87: Opening the Bootloader file

11. Click the "Download" button to start the burning process.

STM32 Cube	Programmer								3	f 🕒	• * []
	Memory	& File	edition								Connected
	Device me	emory	RAKE11_BOOT.	bin ×	+					UART	Disconnect
.	Address	0x0	*	Size	0x400	Data width	32-bit	*	Download +	UAR	tT configuration
	Add	ress	0		4	8	С	AS	CII	Port	conis - Ø
OB	0x00000	000	20000828		08000191	08000199	0800019B	(Baudrate	115300
	0x00000	010	08000190		0800019F	080001A1	00000000			and the second s	
	0x00000	020	00000000		00000000	00000000	080001A3	f		Parity	iwea 😁
	0x00000	030	080001A5		00000000	080001A7	08001721	¥§!		Data bits	
	0x00000	040	080001AB		080001AB	080001AB	080001AB	««««		20-11-0	
	0x00000	050	080001AB		080001AB	080003A5	080003E1	«¥á		Stop bits	1.0
	0x00000	060	080003E7		080003ED	080003F3	080001AB	çió«		Flow control	
	0x00000	070	080001AB		080001AB	050001AB	080001AB	««««			No.
	0x00000	080	080001AB		080001AB	080001AB	080001AB	««			
	0x00000	090	080001AB		080001AB	080001AB	080003F9	««ů			
	0x00000	DAO	00000000		080001AB	080001AB	080001AB	····«···«····«···			
										-	
	Log							Verbosity level	1 2 3		
() () () () () () () () () () () () () (18:22:41 18:22:45 18:22:45 18:22:45 18:22:48 18:22:48 18:22:48 18:22:48 18:22:48 18:22:49 18:22:49 18:22:59 18:22:59 18:22:59	: Time Erasy : Flasi d. : UPLO/ : Size : Addro : Read : Time : Read : Numb- : Segme	elapsed duri e all flash s h page/sector ADING : 1024 Bytes ess : 0x80000 progress: read success read success elapsed duri File: C:\Use er of segment ent[0]: addre	ng th ector eras 00 fully ng th rs\Fo s: 1 ss= 0	e read operat s e command cor e read operat mi\Desktop\∰ x0, size= 0x1	<pre>ion is: 00:00:01 rectly executed.1 cion is: 00:00:01 s118[14\RAX811_B00 044</pre>	.147 Note: if fla .148 DT.bin	sh sector is protected, 4	it will not	Device STM3 Type Device ID Flash size	vice information 2L100x6xxA/STM32L100x8x MCU 0x429 -
\bigcirc	1								8	CPU	Cortex-M3

Figure 88: Downloading of Bootloader to the device

STM32 Cube	Programmer								(19)	f 🕒	* *	A77
Ξ	Memory &	ι File e	dition								🔵 Conr	nected
	Device mem	lory R	AK811_800T	.bin ×						MART	e e De	connect
1	Address	0x0	-	Size	0x400	Data width	32-bit	•	Download 💌	-	UART configuration	00
	Addre	S S	0		4	8	С	ASCI	I	Port	COMS	- 0
OR	0x0000000	0	20000828		08000191	08000199	0800019B	(Baudrate	115200	
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	0x0000002	0	00000000		00000000	00000000	080001A3	£		C. Carrier	1.540	
	0x0000003	0	080001A5		00000000	080001A7	08001721	¥§!		Data bits		
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	0x0000005	0	080001AB		080001AB	080003A5	080003E1	«¥á		Stop bits	1.0	*
	0x0000006	0	080003E7		080003ED	080003F3	080001AB	çió«		Flow con	trol	
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	0x0000008	0	080001AB		080001AB	080001AB	080001AB	«««				
	0x0000009	0	080001AB		080001AB	080001AB	080003F9	««ù				
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(\mathbf{S})									8	CPU		Cortex-M3

Figure 89: Completing the Download of Bootloader into the device

12. Now, you have successfully burned the firmware into RAK5205 WisTrio LPWAN Tracker.

STM32 Cube	Programmer	r in the second s								10	f 🖸	¥ *	57
Ξ	Memory	& File	edition									💛 Conn	ected
	Device m	emory	RAK811_BOOT	lbin ×	+						UART	Disc	connect
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=	Add	iress	0		4	8	С	ASCI	I		Port	COMS	- 0
OB	0x00000	000	20000828		08000191	08000199	0800019B	(_	Baudrate	115200	
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	0x00000	080	080001AB		080001AB			确定					
	0x00000	090	080001AB		080001AB								
	0x00000	0A0	00000000		080001AB	080001AB	080001AB	····«···«···		~			
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0	1									\otimes	CPU		Cortex-M3

Figure 90: Successfully Burned the Bootloader to the device

13. **Disconnect** and close the **STM32CubeProgrammer** tool. Then, power down and remove the connection between BOOT pin and VCC pin to let RAK5205 WisTrio LPWAN Tracker work in normal mode.

Figure 91: Jumper connection removed

14. Connect RAK5205 with your PC's USB interface again. Open your serial port tool and if you can see boot mode as shown in Figure 92.

Figure 92: Successfully Downloading the Bootloader

You can now start burning the firmware into RAK5205 WisTrio LPWAN Tracker.

Upgrading the Firmware

If the firmware version of your RAK5205 WisTrio LPWAN Tracker is newer than V3.0.0.0 or you have just burned the bootloader into RAK5205 WisTrio LPWAN Tracker according to the Burning Bootloader into the Device section, then you just need to burn the upgrade firmware by executing the following steps:

1. Type the command to let the RAK5205 WisTrio LPWAN Tracker work in boot mode.

📝 NOTE

If you have just burned the bootloader by yourself according to the section 2, it works in boot mode now. If the current version of the RAK5205 firmware is newer than V3.0.0.0, you need to set an AT command to let it work in boot mode.

at+set_config=device:boot

发送

Figure 93: Turning the Boot Mode on

2. Close the serial port tool and download the **RAK Upgrade Tool V1.0** . Then, extract and open the tool.

	on Upgrade T	1001 V 1.0		Ц	
Config					
COM port:	COM5	~			
Baudrute:	115200	~	Choose File		
Name	Size	Location			
ease choose	e download	I firmware			
ease choose	e download	I firmware			

Figure 94: RAK Upgrade Tool

3. Get the RAK5205 Firmware ^[] from RAKwireless download site and click "**Choose File**" button to select the firmware file.

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onfig						
COM port:	СОМЗ	~		boose File	٦	
Baudrute:	115200	~		noose rile		
ame	Size	Location				
JI_RAK5205	129KB	C:\Users\Fomi\Deskto	p\新的产品分数	だ\LoRa Nod	e\RAK52	05.
ase Start!						

Figure 95: Choosing the Correct Upgrade file

4. Click "Start" to upgrade. This may take a minute.

SAK LoRaButto	on Upgrade To	ol V1.0		1 <u>4.14</u> 1		×
Config						
COM port:	COM3	~		Choose File		
Baudrute:	115200	~		choose the		
Name	Size	Location				
RUI_RAK5205	129KB	C:\Users\Fomi\E	esktop\新的产	品分类\LoRa Node	e\RAK52	05
Start sending.						
	Start			Stop]	

Figure 96: Start Upgrading your Firmware

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RAK LoRaButt	on Upgrade To	pol V1.0	—		×
Config					
COM port:	сомз	~	Choose File		
Baudrute:	115200	~	choose File		
Namo	Sizo	Location			_
	5120	Location			
	129KB	C:\Users\Fomi\Deskto	p\新的产品分类\LoRa Nod	e\RAK52	05
IOI_INAN3203	129KB	C:\Users\Fomi\Deskto	p\新的产品分类\LoRa Nod	e\RAK52	05
01_188320511	129KB	C:\Users\Fomi\Deskto	p\新的产品分类\LoRa Nod	e\RAK52	05
01_NAK3203	129KB	C:\Users\Fomi\Deskto	p\谢的产品分类\LoRa Nod	e\RAK52	05
01_11416200111	129KB	C:\Users\Fomi\Deskto	p\新的产品分类\LoRa Nod	e\RAK52	05
	129KB	C:\Users\Fomi\Deskto	p\新的产品分类\LoRa Nod	e\RAK52	05
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	129KB	C:\Users\Fomi\Deskto	p\谢的产品分类\LoRa Nod	e\RAK52	05
	129KB	C:\Users\Fomi\Deskto	p\新的产品分类\LoRa Nod	e\RAK52	05
pgrade succ	129KB	C:\Users\Fomi\Deskto	p\谢的产品分类\LoRa Nod	e\RAK52	05
pgrade succ	129KB	C:\Users\Fomi\Deskto	p\新的产品分类\LoRa Nod	e\RAK52	.05

Figure 97: Successfully Upgraded your Firmware

- 5. Now, close the upgrade tool and open a serial port tool to configure your RAK5205.
- It is recommended to use the RAK Serial Port Tool because there are some ready AT commands in this tool which very useful for you. You can get it from the RAK directory if for free.
- Choose the correct **COM port** and set the baud rate to **115200**. Then open the serial port and enter the AT command to restart.

接收窗口				清空接收
	. I_ III\			
********	******	*****	****	
RAK5205 Versi	on:3.0.0.1.H			
******	*******	*********	*****	
				=====
BME680 init su	ccess!			
LIS3DH init suc	cessed!			
Selected LoRa	VAN 1.0.2 Regio	on: EU868		
Initialization OI	Current work	mode:LoRaW	AN, Class: A	
Parameter not	found.			
发送窗口(默认发	送回车)			

Figure 98: Restarting your Firmware

at+set_config=device:restart

Assembly Guide for RAK5205 Enclosure

This section provides you assistance when installing the Tracker Node Enclosure of your RAK5205.

Assembly List

The assembly includes the following

- 1x Enclosure
- 1x Installation Kit
- 1x LoRa Antenna
- 1x GPS Antenna
- 1x Supporting Plate
- 4x M16, 2x M12 Cable Gland Covers
- 1x PCB
- Battery and Adhesive

1x Enclosure

1x LoRa Antenna

1x Installation Kit

1x GPS Antenna

1x Supporting Plate

1x PCB

(4xM16, 2xM12) Cable Gland Covers

Battery and Adhesive Glue

Figure 100: Assembly List

- 1. To start with, assemble the cover of your RAK5205 enclosure.
 - a. If a solar panel is necessary, attached it to the cover, as shown in Figure 101, using silicon glue.

Figure 101: Attached Solar Panel in Cover

b. If not, then directly plug the opening cover with M16 Dome plug.

Figure 102: Inserting Plug in Cover with no Solar Panel

2. Install the Supporting Plate along with the two M4x5 screws as shown in Figure 103.

Figure 103: Installed Supporting Plate

3. Using the three M16 Dome plugs and two M12 Dome plugs, plug the opening of the bottom shell (left of Figure 104). Then, if an external antenna or an external interface is needed, replace the corresponding hole with the corresponding cable (right).

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Figure 104: Opening for External Antenna

4. Fix the PCB in the enclosure using the three M2.5x4 screws.

Figure 105: Fixing of RAK5205 in Enclosure

5. Attach the LoRa and GPS antenna at the bottom shell. The LoRa antenna is glued above the M12 Dome plug while the GPS is on the shorter side, as shown in Figure 106.

Figure 106: Attached GPS and LoRa Antenna

6. Install two M2.5x15 hexagonal standoffs.

Figure 107: Installed Hexagonal Standoffs

7. Plug the connector of the battery into the socket of the PCB. If you use solar panels, then connect the cable to the PCB. After that, fix the supporting plate on the standoff with two M2.5x4 screws.

Figure 108: Fixed Supporting Plate and Battery Cable Connected

8. Remove the double-sided adhesive on the surface of the battery and attached it to the supporting plate.

Figure 109: Attaching of Battery in Supporting Plate

9. Lastly, install the cover.

Figure 110: Enclosure Cover Installed

Installation Wall Mounting

1. Fix the installation kit on the bottom of the enclosure with four M5x10 screws.

Figure 111: Fixing Installation Kit

2. Using a **Ø5mm drill head**, drill four holes on the wall according to the dimension shown in Figure 112, and then plug the screw anchors in the wall.

Figure 112: Drill Holes into Wall according to this Dimension

3. Using the tapping screws, attach the device to the wall.

Figure 113: Mounting of Enclosure in Wall

Pole Mounting

1. The same with wall mounting, first, fix the installation kit on the bottom of the enclosure with four M5x10 screws.

Figure 114: Installation Kit Attached in Enclosure

2. Slide the steel band clamps through the rectangular hole of the mount kit. Then, wrap the band clamps around the pole, lock them, and tighten the clamps using a screwdriver.

Figure 115: Enclosure Clamped around the Pole

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