

# RAK811 TrackerBoard User Manual V1.0

© 2017 Rakwireless all rights reserved .

Mentioned in this document , the actual company

and product names, trademarks are their respective

owners.

After update the new version, this document

without prior notice.

COPYRIGHT © SHENZHEN RAKWIRELESS TECHNOLOGY CO., LTD ETDX1711291302



**PARAK** The simplest, the best Shenzhen Rakwireless Technology Co., Ltd

## Contents

1.	Introduction	3
2.	Open Source Project	4
	2.1 Project Structure	4
	2.2 Configuration Parameters	5
	2.3 Modify Region	6
3.	Firmware Download	7
	3.1 Use ColDE	7
	3.2 Use Keil5	8
	3.3 Use the Serial Port	9
	3.3.1 Install Serial Port Driver	9
	3.3.2 Start Upgrade	10
	3.4 Reset and Run	11
4.	Contact information	12
5.	Revision History	13

# 1. Introduction

RAK811 TrackerBoard is a wireless remote positioning solution based on RAK811 + GPS + MEMS. The RAR811 TrackerBoard uses the latest LoRaWAN1.0.2 protocol and supports LoRaWAN working mode, allowing users to conveniently link to the LoRaWAN network.

RAK811 TrackerBoard is an open all source code products, users can github find all the source code. About parameter configuration, the user can use the source code to develop their own serial AT command, can also be set directly in the program.

RAK811 TrackerBoard battery-powered, greatly increasing the product's application scenarios, in the outdoors can be very easy to use. Built-in 3D acceleration chip, you can detect the user's motion status, determine the device is stationary, it will enter the low-power mode, reducing the overall power consumption and increase battery life. The device with the data visualization interface provided by the Cayenne platform, allowing users to easily know their own trajectory. View your location in real time.

The difference between the RAK811 TrackerBoard and the RAK811 SensorNodeBoard is GPS, and the others are the same.





COPYRIGHT © SHENZHEN RAKWIRELESS TECHNOLOGY CO., LTD



# 2. Open Source Project

RAK811 TrackerBoard is an open source hardware. So the user can get all the information about the product. Includes schematics and program code. Here for everyone a brief introduction to the structure and basic use of open source code. (The open source code for the RAK811 TrackerBoard and RAK811 SensorNodeBoard is generic, So collectively referred to as BreakBoard.)

About the open source project, we can download it here: https://github.com/RAKWireless/RAK811 BreakBoard

This open source project is based on the official code LoRaWAN1.0.2 modified to support CoIDE and Keil5. Have ClassA and Ping-Pong two projects, respectively, can be used as LoRaWAN test and LoRaP2P test.

### 2.1 Project Structure

Because of the similar project structure of CoIDE and Keil5, we introduce the project structure of CoIDE as an example.





TrackerBoard User Manual

```
apps
```

-mcu.c application code

#### boards

-RAK811BreakBoard

-cmsis stm32lxx platform system initial

-STM32L1xx\_HAL\_Driver stm32lxx platform peripheral driver

-board.c... peripheral initial and stm32 related pins operate

-mcu

-stm32 stm32lxx platform system interrupted

components

-Retarget\_printf printf function configuration

mac

-LoRaMac.c LoRaMacCrypto.c lora mac driver

-region The region defined by LoRaWAN1.0.2

Peripherals

-lis3dh.c Acceleration chip LIS3DH driver files

radio

-sx1276.c support the semtech sx1276 driver

system

-crypto lora transmit security use AES and cmac check

-adc.c delay.c... delay ,timer, support and uart,adc,i2c,gpio Interface rewrite

### **2.2 Configuration Parameters**

In the classA project, if you want to modify the way the device joins the network and the parameters of joining the network, these parameters include Dev\_EUI, APP\_EUI, APP\_KEY, DEV\_ADDR, NWKS\_KEY, APPS\_KEY. You can modify it in the Commissioning.h file.

If you want to modify the way to join the network, please modify this parameter:

```
17
18 /*!
19 * When set to 1 the application uses the Over-the-Air activation procedure
20 * When set to 0 the application uses the Personalization activation procedure
21 */
22 #define OVER_THE_AIR_ACTIVATION 1
23
```



TrackerBoard User Manual

If you want to modify Dev\_EUI, APP\_EUI, APP\_KEY, DEV\_ADDR, NWKS\_KEY, APPS\_KEY these parameters, please modify here:

i main.c	🛅 Commissioning.h 🛛	
32 */ 33 #define 34	IEEE_OUI	0x60, 0xC5, 0xA8
36 * Mote	device IEEE EUI (big endian)	
38 * \rema 39 *	ark In this application the value is automat BoardGetUniqueId function	ically generated by calling
41 #define	LORAWAN DEVICE EUI	{ IEEE OUI, 0xFF, 0xEE, 0x00, 0x00, 0x20 }
42 43 /*! 44 * Appl: 45 */	ication IEEE EUI (big endian)	
46 <b>#define</b> 47 48 /*!	LORAWAN_APPLICATION_EUI	{ 0x70, 0x83, 0xD5, 0x7E, 0xD0, 0x00, 0x86, 0xE2 } //70b3d57ef00046a4 7083D57E D0007DFA
49 * AES (	encryption/decryption cipher application key	
50 */ 51 #define 52 53 /*! 54 * Curre	LORAWAN_APPLICATION_KEY	<pre>{ 0x19, 0xA1, 0xE6, 0x76, 0x77, 0xC4, 0x8E, 0x5E, 0xAC, 0xDE, 0x57, 0x29, 0x1F, 0x86, 0x8C, 0x38 } //a6b08140dae1d795ebfa5a6dee1f4dbd 09A503D6256F9EF612A15181F583880A</pre>
55 */ 56 <b>#define</b> 57 58 /*!	LORAWAN_NETWORK_ID	( uint32_t )0
59 * Devi 60 *	e address on the network (big endian)	
61 * \rem: 62 * 63 * 64 */	ark In this application the value is automat a pseudo random generator seeded with a BoardUniqueId value if LORAWAN_DEVICE_AD	Lcally generated using value derived from DRESS is set to 0
65 #define 66 67 /*1	LORAWAN_DEVICE_ADDRESS	( uint32_t )0x00000000
68 * AES ( 69 */	encryption/decryption cipher network session	key
70 #define 71 72 /*!	LORAWAN_NWKSKEY	{ 0x28, 0x7E, 0x15, 0x16, 0x28, 0xAE, 0xD2, 0xA6, 0xA8, 0xF7, 0x15, 0x88, 0x09, 0xCF, 0x4F, 0x3C }
73 * AES (	encryption/decryption cipher application ses	sion key
75 #define 76 77 #endif	LORAWAN_APPSKEY	{ 0x2B, 0x7E, 0x15, 0x16, 0x28, 0xAE, 0xD2, 0xA6, 0xAB, 0xF7, 0x15, 0x88, 0x09, 0xCF, 0x4F, 0x3C }
10		

### 2.3 Modify Region

The open source code is based on LoRaWAN1.0.2 modified from, so the supported regions have: EU868, US915, AS923, AU915, IN865, KR920. If you want to modify the region, you can modify the macro definition.

CooCox CoIDE C:/Users/Chace.Cao/Desktop/R	AK811_BreakBoard/coIDE/d	lassA/classA.coproj						
File Edit View Project Flash Debug Search	i Help							
B B B B B B B B B B B B B B B B B B B	1- 0200	· 한 · 한 · · · · · · ·						
Project 🕄 🔡 Component View	main.c Commissio	ning.h 💮 Configuration 🕄					-0	🗄 Outlin 🕄 🕞 Grap 🔲 Grap 📄 🗂
8 🕸 🏹 🛛	Compile atin	Contract Oliver OD	whurdow Doumload				- A	n outline is not available.
Target classA 👻	Compile Of Con		ennändes Annowunger					
RAKSIIBreakBoard     Cross	<ul> <li>Basic setting</li> <li>Advance setting</li> </ul>	Options: FPU: Interant (FPU) Debug: default debug STM321.15168J6	Optimizz Optimizz V/ARNNI All some Defined Symbols	ation: ate Size (Os) NG: tings		0		
i spi-board.c i spi-board.c i uart-board.c i uart-board.c i components i compone		USE_HAL_DRIVER USE_DEBUGGER REGION_AS923	1				Add	
RegionAS923c     RegionAU915c     RegionCammonc     RegionClu885c     RegionU885c     RegionU885c     RegionU885c     RegionU8915c     RegionU5915c     RegionU5915c     RegionU5915c		Compiler Control string: mcpu=cortex.m3 ; mthumb ; g2 OSTM32L151x8 ; OSTM32L151x816	; (-Watt); (-Ds); (-DREGION_A ; (-L,//src ); (-L,//src/board	Closs S923) ; -DUSE_DI Is/rak811breakbox	e) EBUGGER ; DUSE and ;	HAL_DRIVER ;		
Problems Q Console 23								r □ • r • • • •
No consoles to display at this time.								
😭 classA/apps	s/main.c						8	

COPYRIGHT ©

SHENZHEN RAKWIRELESS TECHNOLOGY CO., LTD ETDX1711291302

# 3. Firmware Download

RAK811 BreakBoard open source hardware supports three ways to download the firmware. First of all, it can support CoIDE to download program firmware using SWD interface.Secondly, support Keil5 use SWD interface to download program firmware. Finally, also support serial port BOOT burning firmware.

### 3.1 Use CoIDE

Use CoIDE to download the program, need to use J-link, through the J-link connected to the device's SWD interface for online debugging.

The SWD interface of RAK811 TrackerBoard is shown below:



After connecting the SWD interface, open CoIDE project, click compile, debug to download debugger, See below:



TrackerBoard User Manual





### 3.2 Use Keil5

Use Keil5 download program and use CoIDE is similar, also need J-link, also need to connect the SWD interface.

Open Keil5 project, click compile, download the program.



TrackerBoard User Manual



### 3.3 Use the Serial Port

#### 3.3.1 Install Serial Port Driver

This device uses USB to serial port chip CP2102, so after the device is connected to the computer, the driver will usually be installed automatically, if you find that your computer is not automatically installed, please go to this link to download the driver: <u>http://passport.rakwireless.com/stat/en/RAK811%20TrackerBoard/Tool/CP210x\_Window</u> <u>s\_Drivers.zip</u>



AK mplest, the best 深圳市瑞科慧联科技有限公司 Shenzhen Rakwireless Technology Co., Ltd

#### 3.3.2 Start Upgrade

This device also supports the use of serial BOOT upgrade, This need to use the BOOT0 pin.

If the BOOT0 pin is connected to GND, the device will normally run the application code. So the BOOT0 pin will be connected to GND by default

If the BOOT0 pin is connected to VCC, the device will enter the BOOT mode, then use ST's official upgrade tool Flash Loader Demonstrator burn bin file used to update the firmware. Upgrade tools, see the link to download:

http://passport.rakwireless.com/stat/en/RAK811%20LoRa%20Module/Firmware%20 upgrade/Flash%20Loader%20Demonstrator.zip

#### The steps shown below:

1.Open the Flash Loader Demonstrator tool, Set the serial port parameters;

2.Click the "NEXT" button, arrive the following interface;



The again the "Next" button, Choose STM32L1\_Cat2-128K;

Please, select	your device in th	e target kit		
Taget	AMONG AND	58		
PD N I	6429			
en es l	20			
on he i				
Version	31			
lisch mapping				
Name	Stat adden	End address	500	
Page0	Gx 8000000	0x 80000FF	0+100 (043	
Page1	0x8000100	0+90001FF	Ox100 (0K3	
Page2	Gx 9000200	Dx 80002FF	0x10080K3	
Page3	Gx 9000000	Dn 80003FF	Ov10030K3	
Page4	0x8000400	0x 80004FF	0x10030K3	
Page5	0x 9000500	0x80009FF	0x10030K3	
Page6	0x 8000600	0.80009FF	0v10030K3	
Page7	0x 8000700	Dx 80007FF	Ov100 (0K)	
Page8	0x 8000800	Dx 80003FF	Ox100 (0K3	
Pagel9	Ex 8000900	0+80009FF	0x100 (0K)	
Page10	0x 80004/00	On BODGAFF	0x100 (0K)	
Parell	0x 8000800	Dy BOODEFF	Ov100 IOK1	

4.Choose "Download to device", Set the path to the new firmware, and click "NEXT" button.

100			
a ia	C 14	inite:	
Download to device Download from tile			
CiUsenVideinist	alor/Desktop/JUK	11_V1013_868.5	
G Erare recesso	eypages C N	Ease Cd	Nobal Exece
@ N 000000	• ove some FFs)	I <sup>™</sup> Jump to the u I <sup>™</sup> Verify after do	er program er load
F Apply option by	/ec		_
Upload hors device Upload to the			
1			
CONTAILUE .	· Ewenter	SOTECTION .	1 1

	Line Suprember
Taget	STH02L1_Ca2128K
Mapfile	STM32L1_Cel2129KSTmap
Operation	DOWNLOAD
File name	CNUsen/Administrator/Desktop/RAK811_V101
File size	62.87 KB (54377 bytec)
Statue	10.67 KB (10901 bytes) of 62.87 KB (64077 bytes

5.Upgrading:



COPYRIGHT © SHENZHEN RAKWIRELESS TECHNOLOGY CO., LTD ETDX1711291302



TrackerBoard User Manual

Bin file needed for the upgrade can be compiled using keil5 or CoIDE tools. Of course, RAK company will also launch its own specific function of the bin file for users to upgrade and used.

If you want to compile the bin file using Keil5, you need to add these as shown below: fromelf.exe --bin -o "\$L@L.bin" "#L"

wice   Target   Output   Listin	ng User C/C++ Asm Linker Det	oug   Utilit	ies	
Command Items	User Command		Stop on Exi	S
Before Compile C/C++ File				
		<u> </u>	Not Specified	
🗌 Run #2		2	Not Specified	
Before Build/Rebuild				
		<u> </u>	Not Specified	
🗌 Run #2		<u>12</u>	Not Specified	
After Build/Rebuild				
🔽 Run #1	fromelf.exebin -o "\$L@L.bin" "#L"	<b>1</b>	Not Specified	
🗌 Run #2		<u> </u>	Not Specified	
□ Run 'After-Build' Conditionally ✓ Beep When Complete	Start Debugging			
	OK Cancel Defau	lts	н	elp

### 3.4 Reset and Run

After the user upgrades the firmware, the reset device will see the following log information in the serial port.

	ConnUart Assistant	×
COM Settings	Data receive	SAVAGE V4.2.3
PortNum COM41 -	RAK811 BreakBoard soft version: 1.0.2	
BaudR 115200 -	Selected LoraWAN 1.0.2 Region: EU868	
DPaity NONE 🔽	077.1.1.	
DataB 8 💌	DEV EVII: 60 C5 A8 FF EE 00 00 20	
StopB 1	AppEui: 70 B3 D5 7E D0 00 86 E2	
	AppKey: 19 A1 E6 F6 77 C4 BE 5E AC DE 57 29 1F 86 8C 3B	
🔘 Close	OTAA Join Start	
	Move Detected INT1 src.0x41 Move Detected INT1 src:0x41	
Recv Options	Move Detected INT1 src:0x41	
🔲 Receive to file	Move Detected INT1 src:0x41	
Auto linefeed		
🔲 Show timestamp		
🔲 Receive as hex		
Pause receive		
<u>Save</u> <u>Clear</u>		
Send Options		
🔲 Data from file		
🗌 Auto checksum		
🗌 Auto clear input		
🔲 Send as hex	1.DCD • 2.RXD • 3.TXD • 4.DTR • 5.GND • 6.DSR • 7.RTS •	8.CTS 🗢 9.RI 🗢
🗌 Period   5000 ms		
Load Clear		Send
🍯 Ready!	* 🖒 TX:0 BX:354	Reset



# 4. Contact information

#### Shanghai

FAE mailbox:allan.jin@rakwireless.com Tel : 185-1082-5762 Address: Room B205, Green light kechuang garden, 2588 Lane, Hongmei South road, Minhang District, Shanghai

#### Shenzhen

FAE mailbox: steven.tang@rakwireless.com

Tel: 0755-26506594

Fax: 0755-86152201

Address: Room 802, Yongfu building, No.1s06, Yongfu road, Baoan District, Shengzhen



TrackerBoard User Manual

# **5. Revision History**

Version	Date	Change	Author
V1.0	2017-11-29	First release	Chace

COPYRIGHT © SHENZHEN RAKWIRELESS TECHNOLOGY CO., LTD ETDX1711291302

www.rakwireless.com