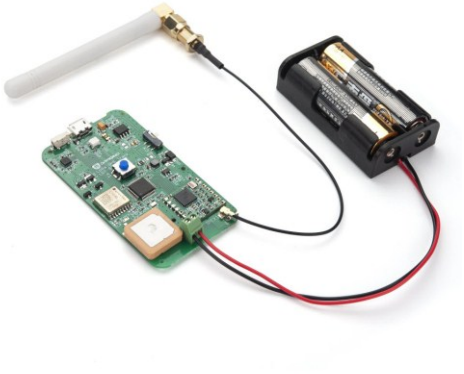


LGT-92 LoRaWAN GPS Tracker User Manual

Document Version: 1.4.0

Image Version: v1.4

Version	Description	Date
1.0	Release	2018-Dec-12
1.0.1	Correct GPS payload format in TTN	2019-Jan-23
1.0.2	Add more info for 8-Channel Mode Description	2019-Feb-21
1.0.3	Add LED description, Buttons, correct accelerometer payload info	2019-Mar-29
1.4.0	Add LGT-92-AA board description and photo Add Software/hardware change log Change Payload to add Alarm flag	2019-May-11
1.4.1	Correct payload format More description on the Payload	2019-May-14

1. Introduction

1.1 What is LGT-92 LoRa GPS Tracker

LGT-92 is a Long Range / low power consumption LoRaWAN GPS tracker. LGT-92 gets user's location info via GPS and sends it to IoT server via LoRaWAN wireless network.

Compare to traditional GPS trackers (base on GPRS or Cellular network), LGT-92 use **much lower power consumption** hence can last for longer time. It doesn't need cellular service; system integrator can build their tracking network base on LoRaWAN technology or Join the device to existing LoRaWAN network

LGT-92 uses STM32l0x chip from ST, STML0x is the **ultra-low-power** STM32L072xx microcontrollers incorporate the connectivity power of the universal serial bus (USB 2.0 crystal-less) with the high-performance ARM® Cortex®-M0+ 32-bit RISC core operating at a 32 MHz frequency, a memory protection unit (MPU), high-speed embedded memories (192 Kbytes of Flash program memory, 6 Kbytes of data EEPROM and 20 Kbytes of RAM).

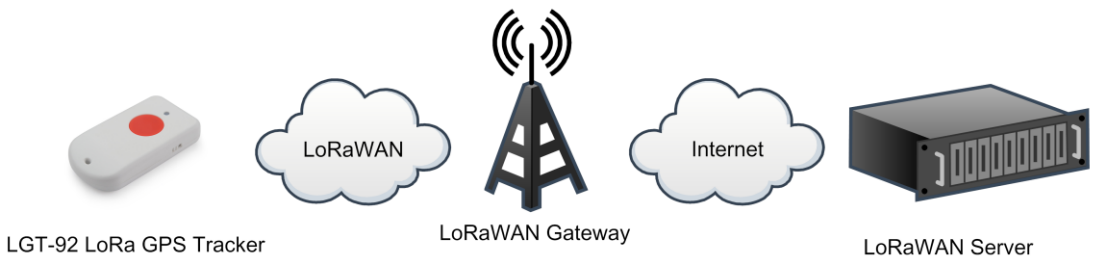
LGT-92 includes a low power GPS module L70 and a 9-axis accelerometer for motion and attitude detection. The power for both of the GPS module and accelerometer can be controlled by MCU to achieve the best energy profile for different applications.

LGT-92 series products include two major variants:

- **LGT-92-LI**: is powered by 1000mA rechargeable Li-on battery and charge circuit, which target for real time tracking with short tracking uplink.
- **LGT-92-AA**: Disable the charge circuit to get the lowest power consumption and power directly by AA battery. This is designed for asset tracking where only need to uplink a few times every day.

LGT-92 is an **open source product**, it is based on the STM32Cube HAL drivers and lots of libraries can be found in ST site for rapid development.

LGT-92 in a LoRaWAN Network



1.2 Specifications

Micro Controller:

- STM32L072CZT6 MCU
- MCU: STM32L072CZT6
- Flash:192KB
- RAM:20KB
- EEPROM: 6KB
- Clock Speed: 32Mhz

Common DC Characteristics:

- Supply Voltage: 2.1v ~ 3.6v
- Operating Temperature: -40 ~ 85°C

LoRa Spec:

- Frequency Range,
  - ✓ Band 1 (HF): 862 ~ 1020 Mhz

  or
  - ✓ Band 2 (LF): 410 ~ 528 Mhz
- 168 dB maximum link budget.
- +20 dBm - 100 mW constant RF output vs.
- +14 dBm high efficiency PA.
- Programmable bit rate up to 300 kbps.
- High sensitivity: down to -148 dBm.
- Bullet-proof front end: IIP3 = -12.5 dBm.
- Excellent blocking immunity.
- Low RX current of 10.3 mA, 200 nA register retention.
- Fully integrated synthesizer with a resolution of 61 Hz.
- FSK, GFSK, MSK, GMSK, LoRaTM and OOK modulation.
- Built-in bit synchronizer for clock recovery.
- Preamble detection.
- 127 dB Dynamic Range RSSI.
- Automatic RF Sense and CAD with ultra-fast AFC.
- Packet engine up to 256 bytes with CRC.
- LoRaWAN 1.0.2 Specification

Battery:

- 1000mA Li-on Battery power (for model LGT-92-LI)
- 2 x AA battery holder (for model LGT-92-AA)

Power Consumption

- Sleeping Mode: 77uA (for model LGT-92-LI), 17uA (for model LGT-92-AA)

- LoRa Transmit Mode: 125mA @ 20dBm 44mA @ 14dBm
- Tracking: max: 38mA

1.3 Features

- ✓ LoRaWAN 1.0.2 Class A,Class C
- ✓ STM32L072CZT6 MCU
- ✓ SX1276/78 Wireless Chip
- ✓ Pre-load bootloader on USART1/USART2
- ✓ MDK-ARM Version 5.24a IDE
- ✓ Preamble detection
- ✓ Frequency bands CN470/EU433/KR920/US915/IN865
- ✓ EU868/AS923/AU915
- ✓ Open source hardware / software
- ✓ Regular/ Real-time GPS tracking
- ✓ Built-in 9 axis accelerometer (MPU9250)
- ✓ Motion sensing capability
- ✓ Power Monitoring
- ✓ Charging circuit via USB port (for model LGT-92-LI)
- ✓ 1000mA Li-on Battery power (for model LGT-92-LI)
- ✓ 2 x AA battery holder (for model LGT-92-AA)
- ✓ Tri-color LED, Alarm button

1.4 Applications

- ✓ Smart Buildings & Home Automation
- ✓ Logistics and Supply Chain Management
- ✓ Significant Assets management.
- ✓ Human tracking

1.5 Hardware Changelog

LGT-92 v1.3:

- ✓ Add C25,R1, used to support LGT-92-AA version.

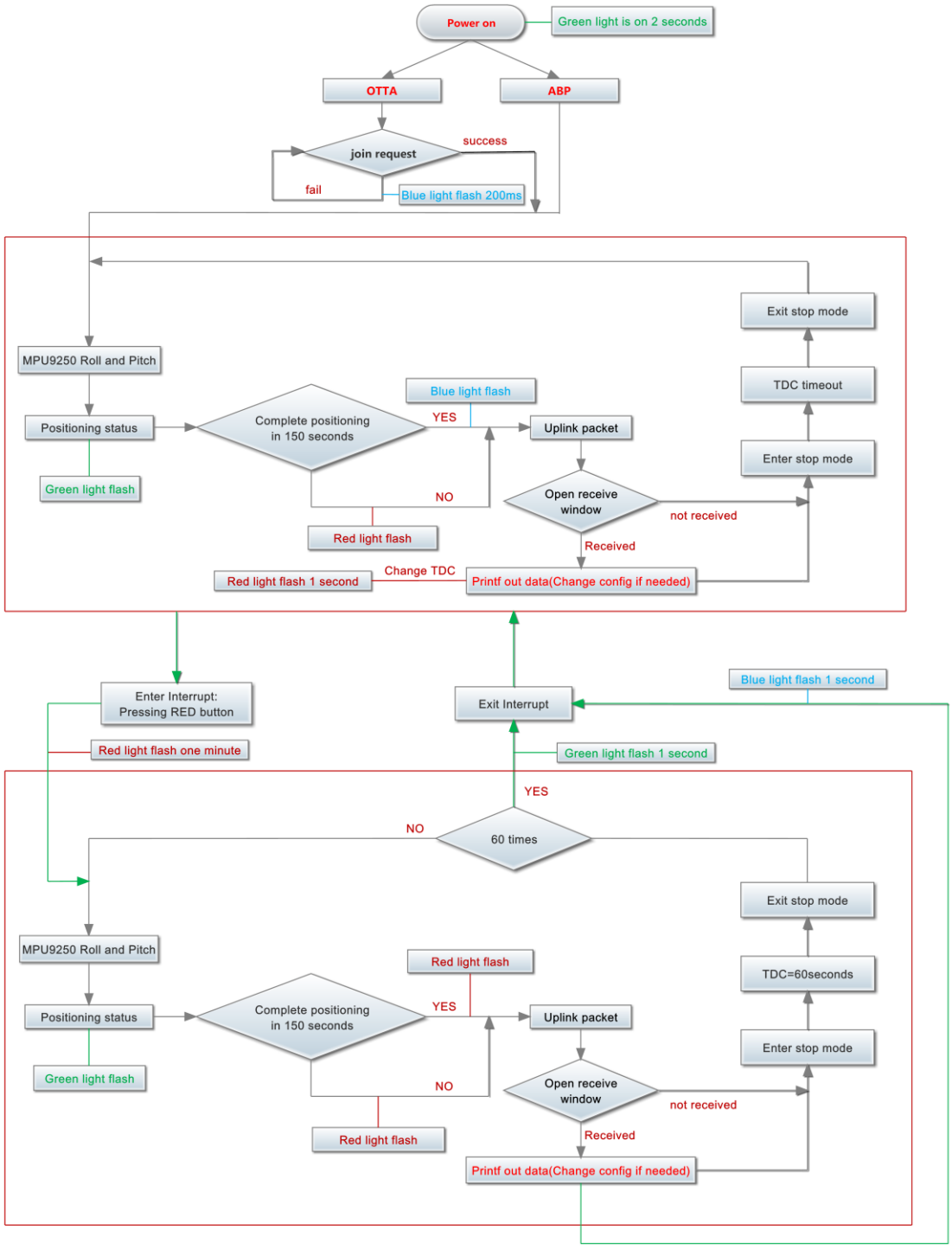
1.6 Variants

Part Number	Photo	Hardware Difference	Target Application
LGT-92-LI		--With Enclosure --With 1000mA li-on battery --Enable charge circuit --FPC internal LoRa Antenna --Can power by USB port	--Real time tracking --Short tracking period --Rechargeable
LGT-92-AA		--Without Enclosure --With AA type battery holder, no battery. --Disable charge circuit --Sticker LoRa Antenna --Can't powered by USB port (to be fixed)	--Asset tracking --Long tracking period --Not rechargeable

2. Use LGT-92 with stock LoRaWAN firmware

2.1 How it works?

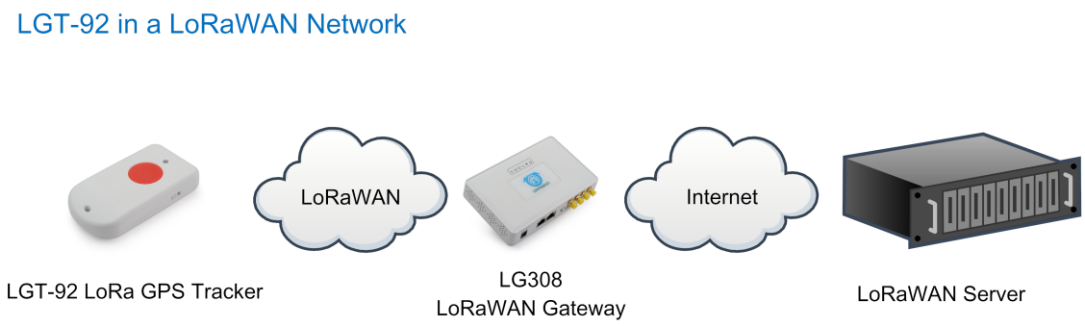
The LGT-92 is pre-loaded with a firmware and is configured as LoRaWAN OTAA Class A mode by default. It has OTAA keys to join LoRaWAN network. To connect a local LoRaWAN network, user just need to input the OTAA keys in the LoRaWAN IoT server and power on the LGT-92. It will auto join the network via OTAA.



In case user can't set the OTAA keys in the LoRaWAN OTAA server and has to use the keys from the server. User can use AT Command to set the keys in LGT-92.

2.2 Quick guide to connect to LoRaWAN server (OTAA)

Here is an example for how to join the TTN LoRaWAN Network. Below is the network structure, we use LG308 as LoRaWAN gateway in this example.



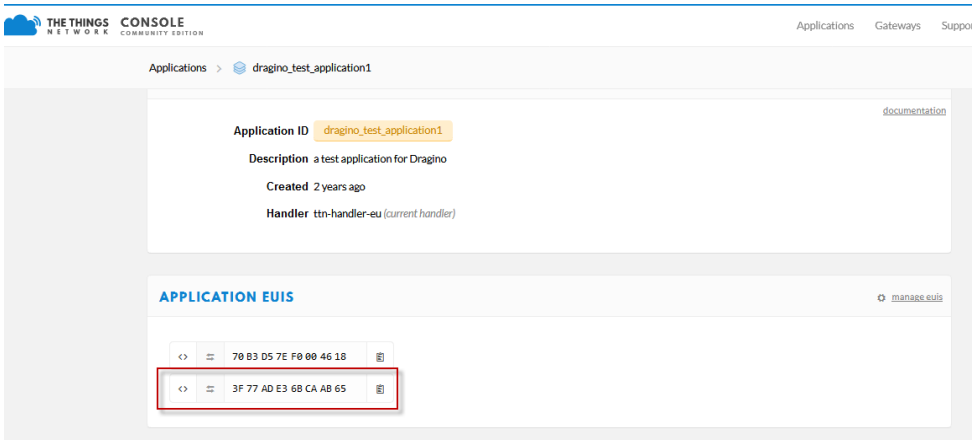
The LG308 is already set to connect to TTN network . So what we need to now is only configure the TTN:

Step 1: Create a device in TTN with the OTAA keys from LGT-92.

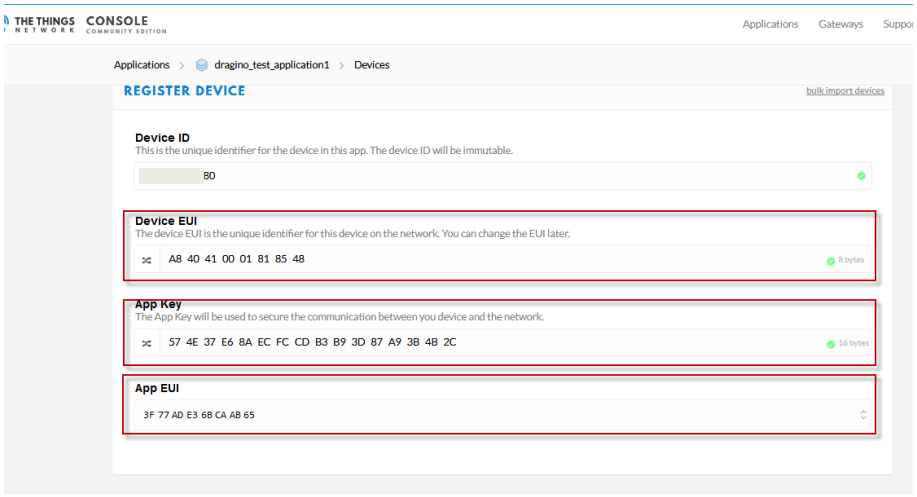
Each LGT-92 is shipped with a sticker with the default device EUI as below:

User can enter this key in their LoRaWAN Server portal. Below is TTN screen shot:

Add APP EUI in the application



Add APP KEY and DEV EUI



Step 2: Power on LGT-92 LoRaWAN GPS Tracker

Step 3: LGT-92 will auto join to the TTN network. After join success, LGT92 will start to upload message to IoT server.

By default, the upload period is 5 minutes. In the start of each period, LGT-92 will try to get GPS signal and the green LED will blink. Once LGT-92 get the GPS info, it will upload a LoRa message include battery / GPS info/ X,Y axis info. If LGT-92 can't get GPS info into 2 minutes, it will still upload the message but the GPS info will be all 00.

2.3 Uplink Payload

2.3.1 Payload Analyze

The uplink payload includes totally 12 bytes. Uplink packets use FPORT=2 and every 5 minutes send one uplink by default. (User can use AT+SGM to disable the motion sensor to get 8 payload)

Size(bytes)	3	3	2	2	2
Value	Latitude	Longitude	Alarm & BAT	Roll	Pitch

Alarm & BAT:

Size(bit)	1 bit	1bit	14 bits
Value	reserve	Alarm Indicate	BAT

Example: Payload: 0x06765F F2960A 4B45 04D2 FB2E

Location info:

✓ Latitude: 06765f ⇒ *if (0x06765f & 0x800000 = 0): value = 0x06765f /10000* = 42.3519

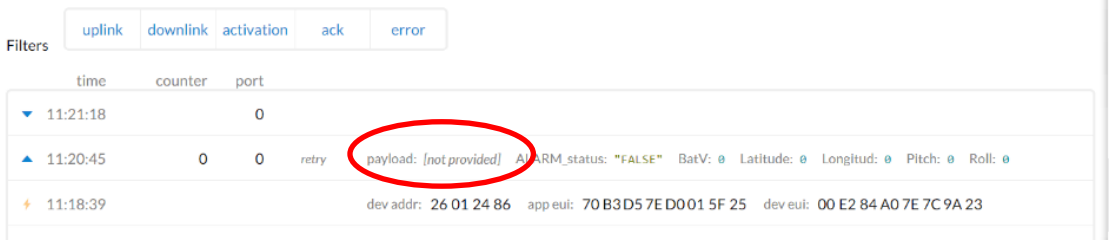
✓ Longitude: F2960a ⇒ *if (0xF2960a & 0x800000 = 1):*

value = (0xf2960a – 0x 1000000)/10000 -87.9094

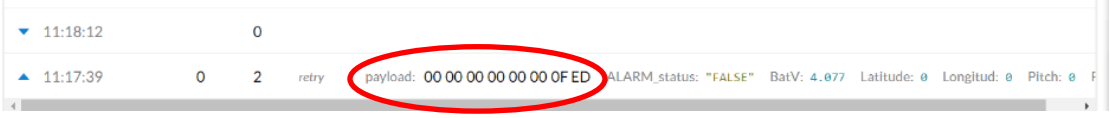
Important note:

a) When power is low, GPS won't be able to get location info and software will disable GPS fixing and send out 0x0FFFFF, 0x0FFFFF to server.

b) When enable 9-axis motion sensor, the total payload will be 12 bytes, while US915 DR0 accept only 11 bytes payload. In this case, the payload on server will be ignore and shows as below:



c) While GPS can't get location info after timeout, the payload will be 000000 & 000000:



✓ Alarm: Ex1: 0x4B & 0x40 >> 6 = 0x01

✓ BAT: Ex1: 0x0B45 & 0x3FFF ⇒ 3850 (mV)

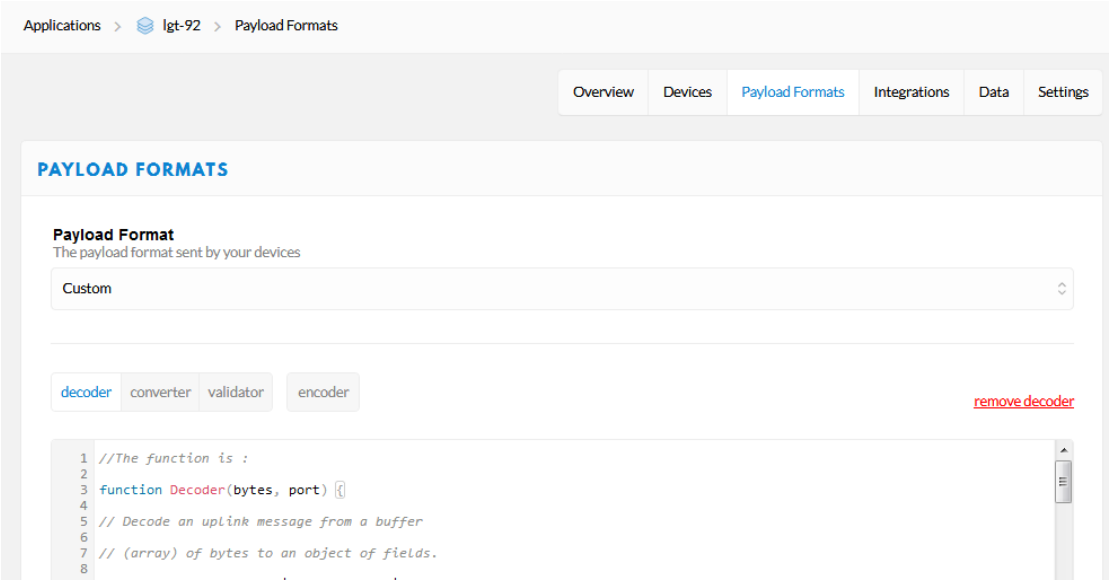
✓ Pitch: 04D2 = *if (0x04D2 & 0x8000 = 0): value* = 0x04D2 / 100 = +1234 ⇒ 12.34 degree

✓ *Roll: FB2E =if (0xFB2E & 0x8000 = 1): value =(0xFB2E - 0x10000)/100(dec)* ⇒ -12.34 degree

2.3.2 Add Payload format in TTN

In TTN, use can add a custom payload so it shows friendly.

In the page Applications --> Payload Formats --> Custom --> decoder

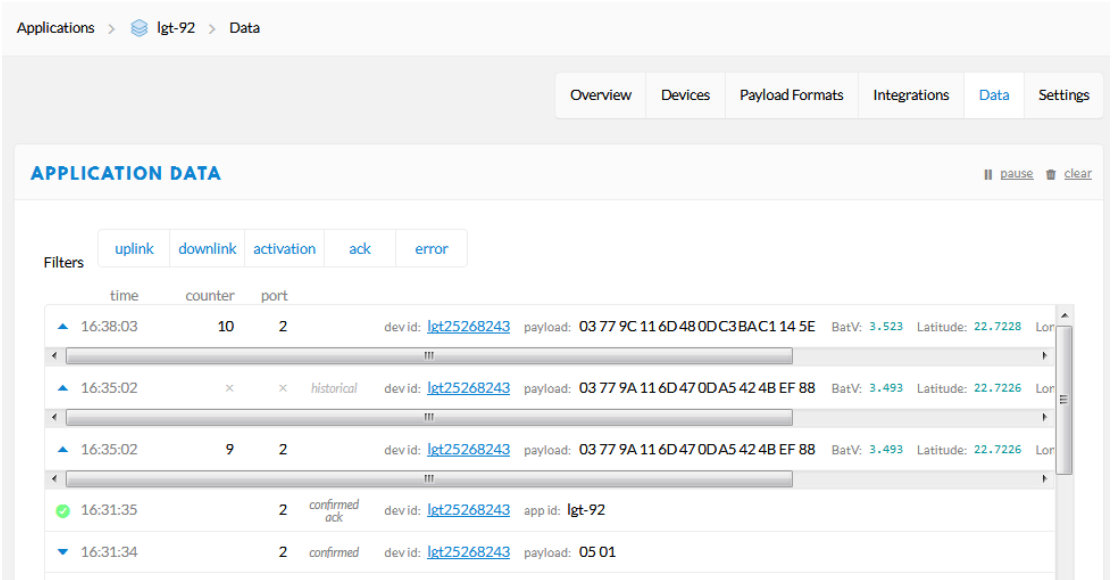


Add below code:

```
//The function is :
function Decoder(bytes, port) {
// Decode an uplink message from a buffer
// (array) of bytes to an object of fields.
var value=bytes[0]<<16 | bytes[1]<<8 | bytes[2];
if(bytes[0] & 0x80)
{
value |=0xFFFFFF000000;
}
var latitude=value/10000;//gps latitude,units: °

value=bytes[3]<<16 | bytes[4]<<8 | bytes[5];
if(bytes[3] & 0x80)
{
value |=0xFFFFFF000000;
}
var longitude=value/10000;//gps longitude,units: °

var alarm=(bytes[6] & 0x40)?"TRUE":"FALSE";//Alarm status

value=((bytes[6] & 0x3f) <<8) | bytes[7];
var batV=value/1000;//Battery,units:V
```

```
value=bytes[8]<<8 | bytes[9];
if(bytes[8] & 0x80)
{
value |=0xFFFF0000;
}
var roll=value/100;//roll,units: °

value=bytes[10]<<8 | bytes[11];
if(bytes[10] & 0x80)
{
value |=0xFFFF0000;
}
var pitch=value/100; //pitch,units: °

return {
 Latitude: latitude,
 Longitud: longitude,
 Roll: roll,
 Pitch:pitch,
 BatV:batV,
 ALARM_status:alarm,
 };
}
```

Save the change the uplink message will be parsed. As below:



2.4 Downlink Payload

Exit Alarm mode

Downlink Control Type	FPort	Type Code	Downlink payload size(bytes)
TDC (Transmit Time Interval)	Any	01	4
Exit interrupt	Any	02	2
RESET	Any	04	2

The FPort no fix , if the payload=0100003C, means to control the END Node's TDC to 0x00003C=60(S), while type code is 01.

Example Downlink payload setting in TTN:

If payload = 0x0201, exit positioning alarm interrupt.

If payload = 0x04FF, it will reset the LGT92.

2.5 LED Status

See work flow

2.6 Button Function

RESET button:

Press this button will reboot the device.

RED button:

See work flow

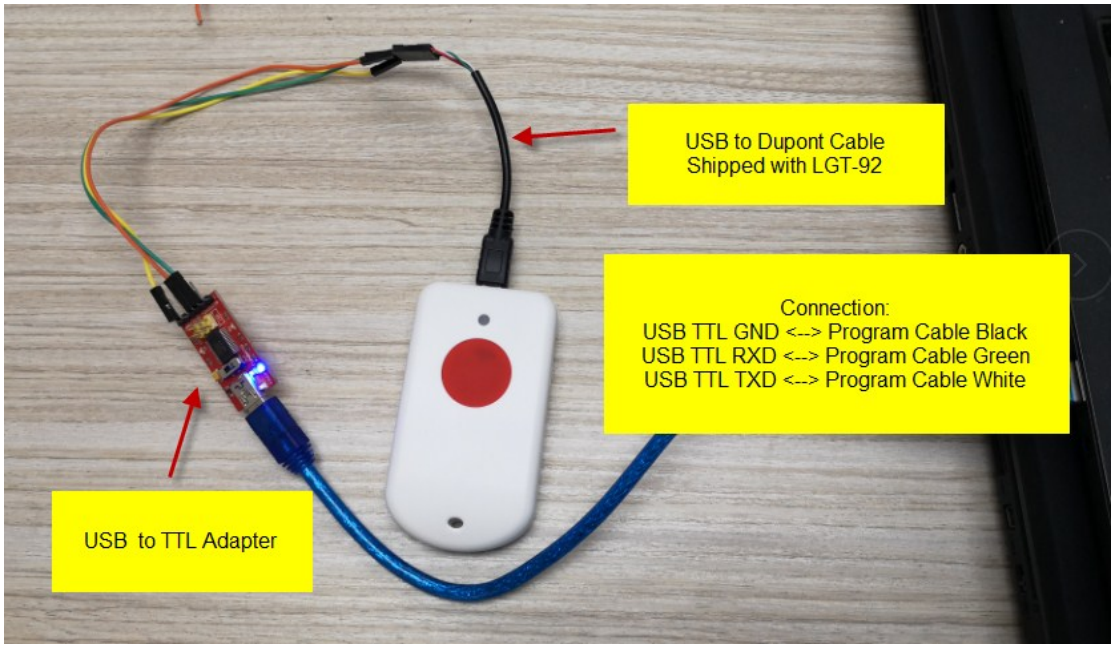
2.7 Firmware Change Log

See this link.

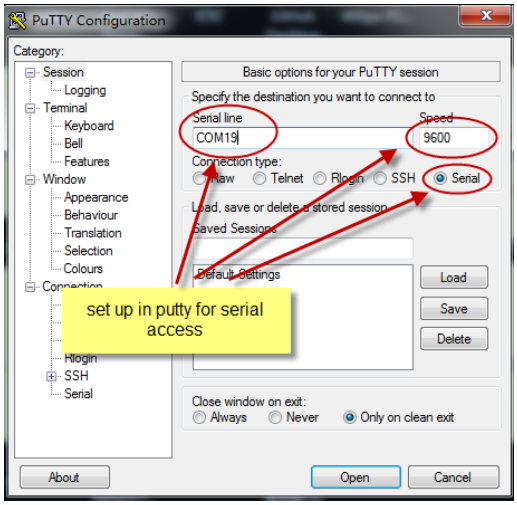
3. Use AT Command

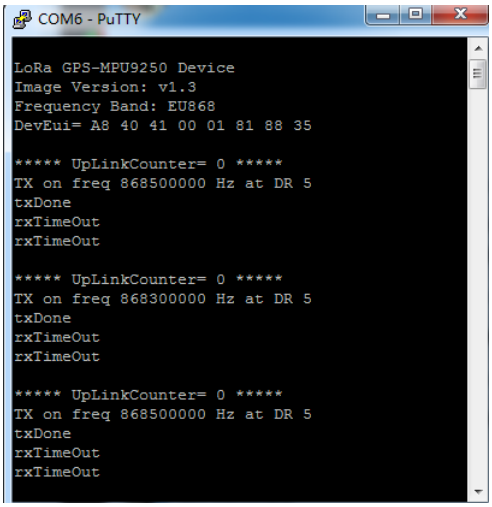
3.1 Access AT Command

LGT-92 supports AT Command set in stock firmware. User can use a USB to TTL adapter to connect to LGT-92 for using AT command, as below.



In PC, User needs to set serial tool baud rate to **9600** to access serial console for LGT-92. LGT-92 will output system info once power on and user will be able to send AT commands:





Below are the available commands, a more detail AT Command manual can be found at AT Command Manual

AT+<CMD>? : Help on <CMD>
AT+<CMD> : Run <CMD>
AT+<CMD>=<value> : Set the value
AT+<CMD>=? : Get the value

General Command
AT: Attention
AT?: Short Help
ATZ: MCU Reset
AT+TDC: Application Data Transmission Interval

Keys,IDs and EUIs management
AT+APPEUI: Application EUI
AT+APPKEY: Application Key
AT+APPSKEY: Application Session Key
AT+DADDR: Device Address
AT+DEUI: Device EUI
AT+NWKID: Network ID(You can enter this command change only after successful network connection)
AT+NWKSKEY: Network Session Key
Joining and sending date on LoRa? network
AT+CFM: Confirm Mode
AT+CFS: Confirm Status
AT+JOIN: Join LoRa? Network
AT+NJM: LoRa? Network Join Mode
AT+NJS: LoRa? Network Join Status
AT+RECV: Print Last Received Data in Raw Format
AT+RECVB: Print Last Received Data in Binary Format
AT+SEND: Send Text Data
AT+SENB: Send Hexadecimal Data

LoRa network management
AT+ADR: Adaptive Rate
AT+CLASS: LoRa Class(Currently only support class A
AT+DCS: Duty Cycle Setting
AT+DR: Data Rate (Can Only be Modified after ADR=0)
AT+FCD: Frame Counter Downlink
AT+FCU: Frame Counter Uplink
AT+JN1DL: Join Accept Delay1

AT+JN2DL: Join Accept Delay2

AT+PNM: Public Network Mode

AT+RX1DL: Receive Delay1

AT+RX2DL: Receive Delay2

AT+RX2DR: Rx2 Window Data Rate

AT+RX2FQ: Rx2 Window Frequency

AT+TXP: Transmit Power

Information

AT+RSSI: RSSI of the Last Received Packet

AT+SNR: SNR of the Last Received Packet

AT+VER: Image Version and Frequency Band

AT+FDR: Factory Data Reset

AT+PORT: Application Port

AT+CHS: Get or Set Frequency (Unit: Hz) for Single Channel Mode

AT+CHE: Get or Set eight channels mode, Only for US915, AU915, CN470

3.2 Common AT Command Sequence

3.2.1 Multi-channel ABP mode (Use with SX1301/LG308)

If device has not joined network via OTAA:

AT+FDR

AT+NJM=0

ATZ

If device already joined network:

AT+NJM=0

ATZ

3.2.2 Single-channel ABP mode (Use with LG01/LG02)

AT+FDR Reset Parameters to Factory Default, Keys Reserve

AT+NJM=0 Set to ABP mode

AT+ADR=0 Set the Adaptive Data Rate Off

AT+DR=5 Set Data Rate

AT+TDC=300000 Set transmit interval to 5 minutes

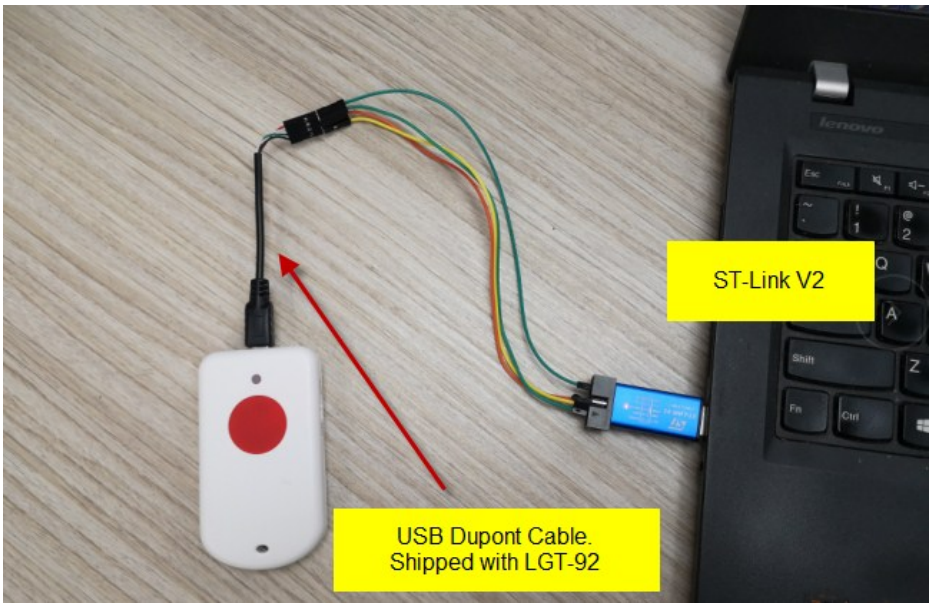
AT+CHS=868400000 Set transmit frequency to 868.4Mhz

AT+DADDR=26 01 1A F1 Set Device Address to 26 01 1A F1

ATZ Reset MCU

4. Upload Firmware

User can use the LGT-92's USB port to upgrade firmware into it. The hardware connection for upgrade firmware is as below:



Connection:

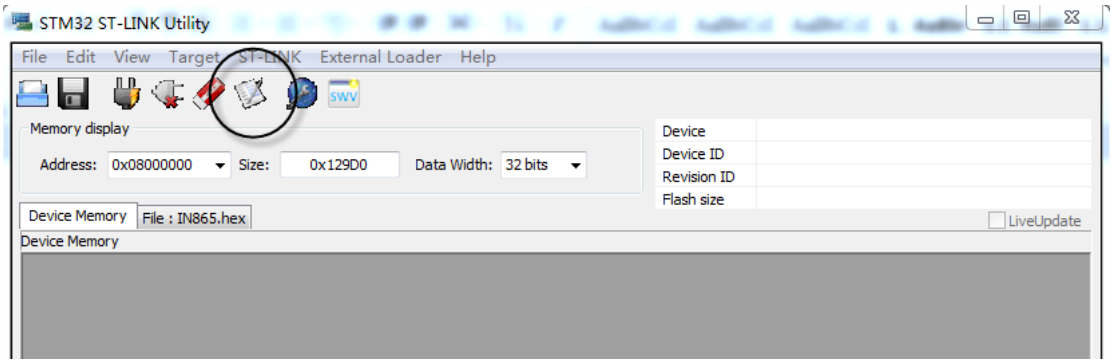
- ✓ ST-LINK v2 5.0v <--> Dupont red pin
- ✓ ST-LINK v2 GND <--> Dupont black pin
- ✓ ST-LINK v2 SWCLK <--> Dupont green pin
- ✓ ST-LINK v2 SWDIO <--> Dupont white pin
- ✓ LGT-92 power can be on or off.

Step1: Install ST-LINK driver first and then install ST-LINK Utility

Step2: Download the LGT-92 Image files.

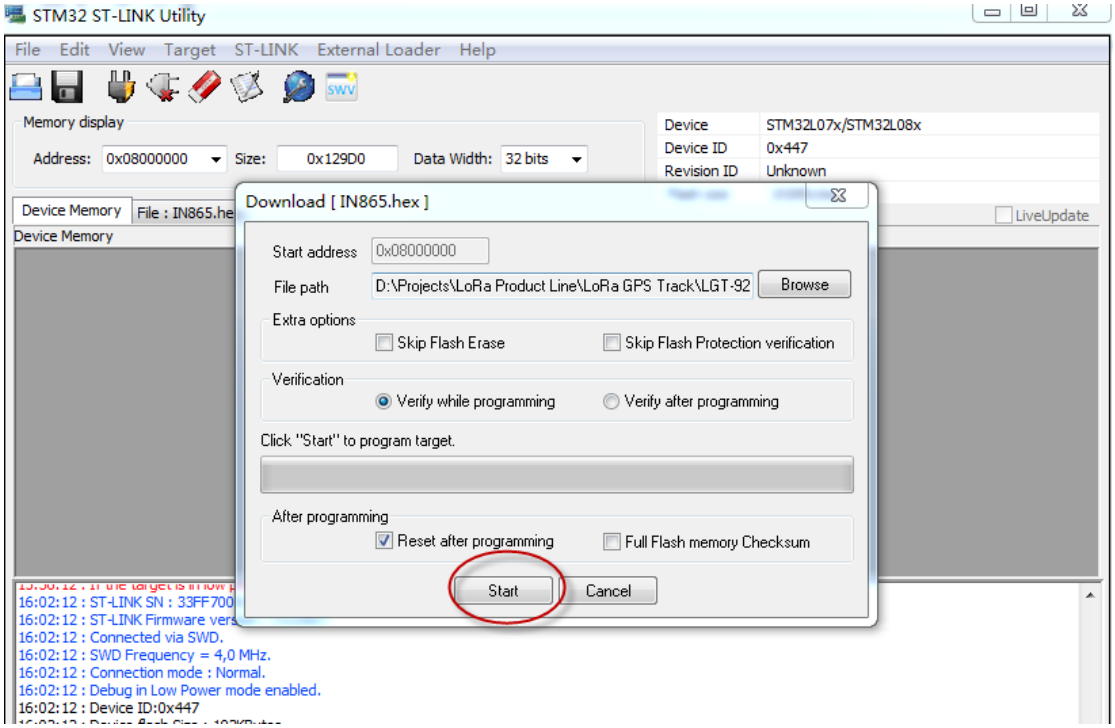
Step3: Open ST-LINK utility, **file --> open file** to select the image to be upgraded.

Step4: Keep pushing the small reset button on LGT92 and then click the "**Program Verify**" button on ST-LINK.



Step5: The led on the ST-LINK adapter will now blinking, once see it blinking; release the reset button on the LGT-92.

Step6: The led on the ST-LINK adapter will now blinking, once see it blinks; release the reset button on the LGT-92. The ST-Link utility will pop up a download window. Click the start button to download the image to LGT-92.



5. Developer Guide

5.1 Source Code

Software Source Code Download Link.

Hardware Source Code Download Link

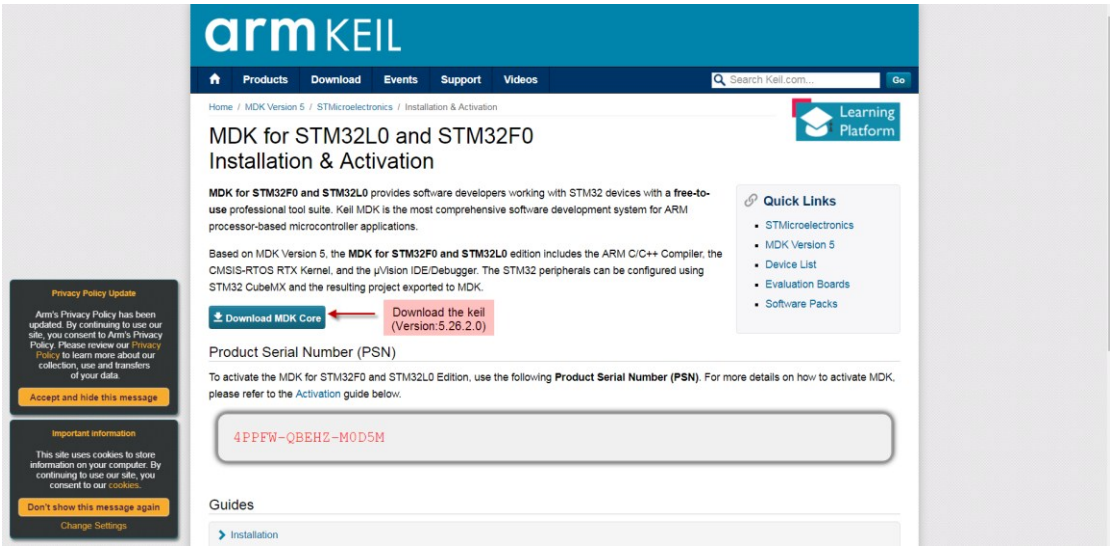
5.2 Compile Source Code

5.2.1 Set up Keil compile environment

Assume you already have Keil uVision5 installed. Below step shows how to install MDK support and get license.

1: Open the **web**: http://www2.keil.com/stmicroelectronics-stm32/mdk

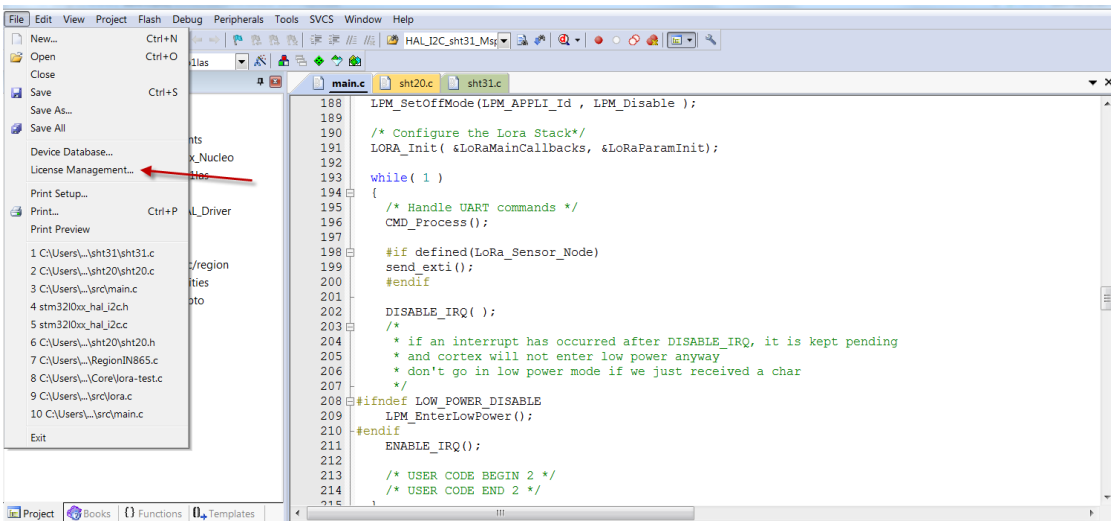
2: Download the **keil**:



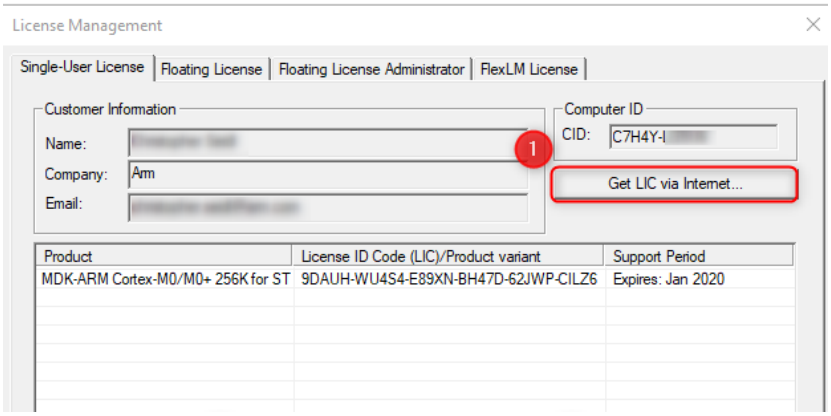
3: Login with an account that has administration rights.

4: Right-click the µVision icon and select **Run as Administrator...** from the context menu.

5: Open the dialog **File — License Management...** and select the **Single-User License tab**.

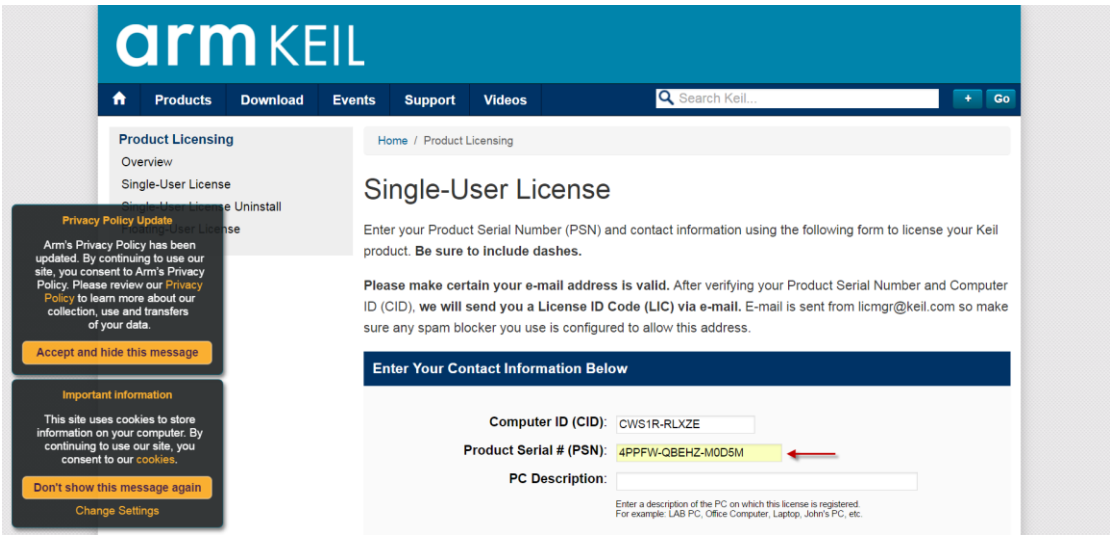


6: Click the button **Get LIC via Internet...**, then click the button **OK** to register the product. This action opens the License Management page on the Keil web site.

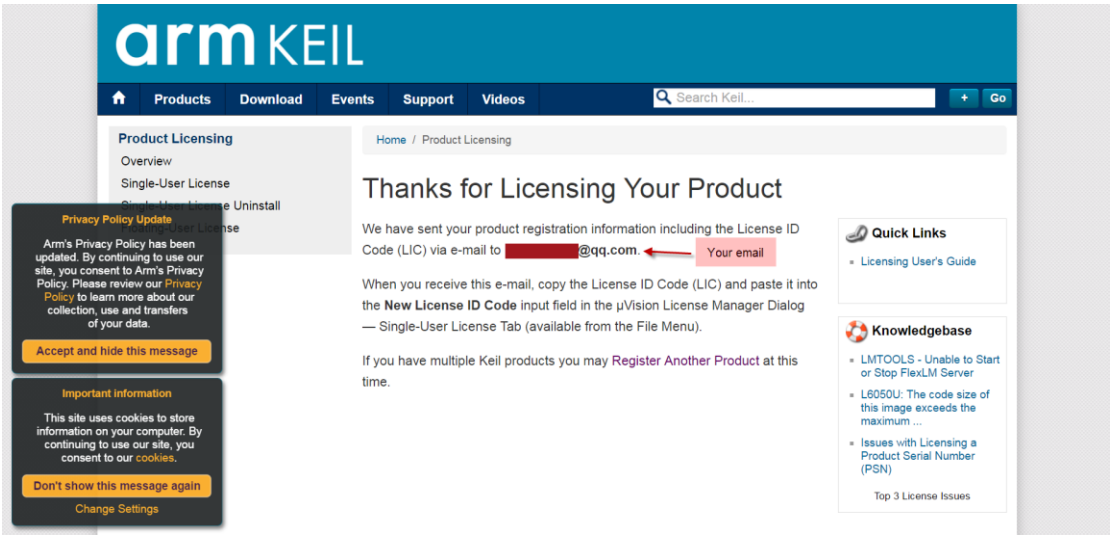


7: Enter the **Product Serial Number 4PPFW-QBEHZ-M0D5M** along with your contact information and click the button **Submit**. An e-mail is sent back with the **License ID Code (LIC)** within a few minutes.

(1)



(2)



(3)

Thank you for licensing your Keil product. Your License ID Code (LIC) is printed below. Print a copy of this e-mail to keep for your records.

MDK-ARM Cortex-M0/M0+ 256K
For ST Only
Support Ends 31 Jan 2020

PC Description : 111
Computer ID (CID): CWS1R-RLXZE

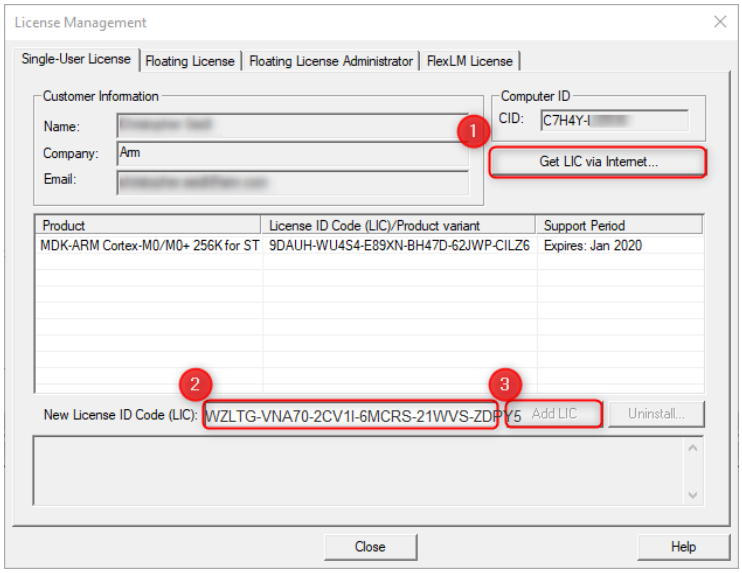
License ID Code (LIC): WZLTG-VNA70-2CV1I-6MCRS-21WVS-ZDPY5

To activate your Keil product, copy the License ID Code (LIC) and paste it into the New License ID Code input field on the Single-User License Tab in the uVision4 License Manager Dialog (available from the File menu).

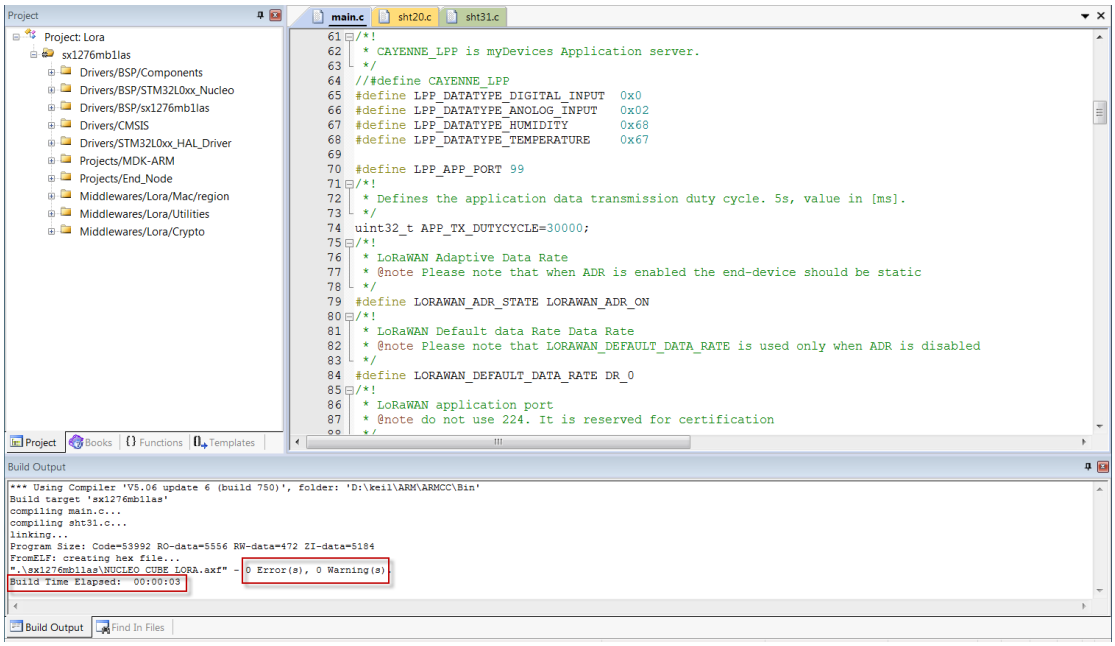
*** DO NOT REPLY TO THIS EMAIL: For licensing problems or questions, please contact Keil Technical Support.

Thank You,
Technical Support

8:To activate the Software Product, enter the **LIC** in the field **New License ID Code (LIC)** of the dialog **License Management...** and click **Add LIC**.



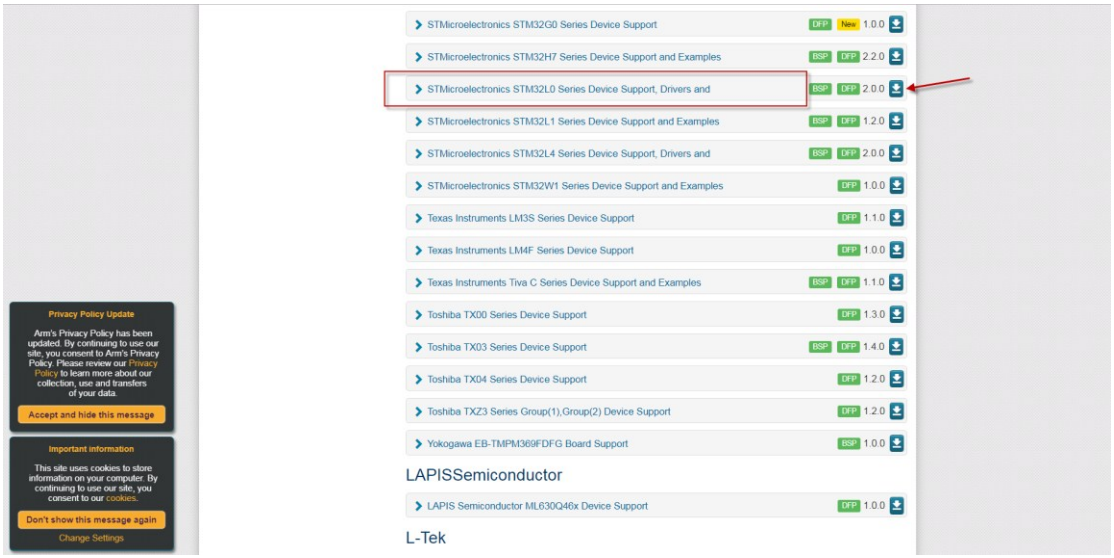
9:Finish



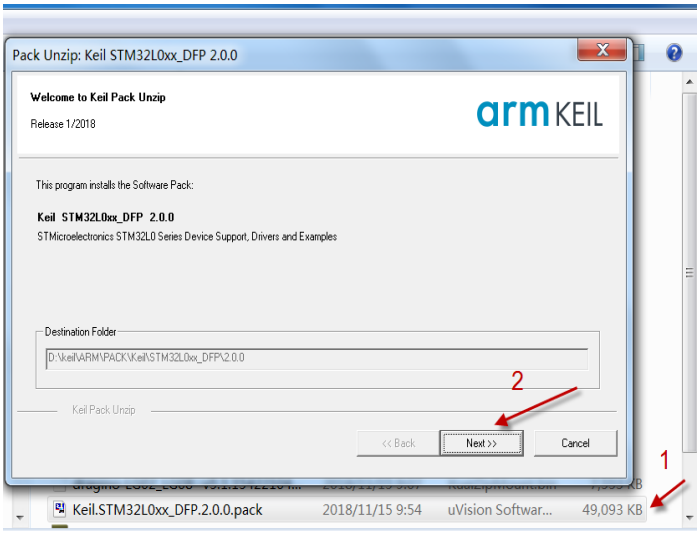
5.2.2 Install STM32L0 Series Device

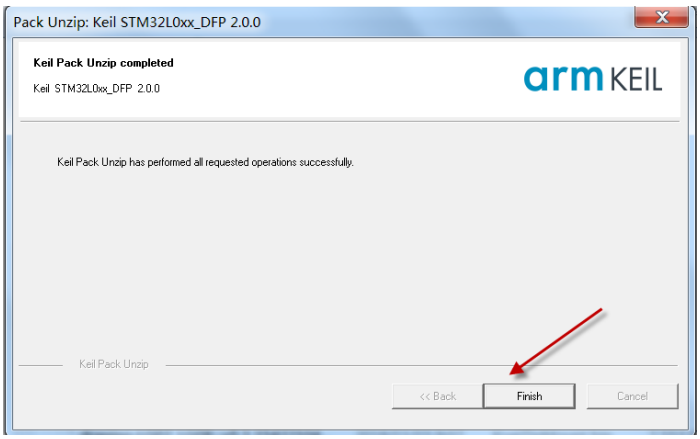
1:**Open** the web:http://www.keil.com/dd2/pack/eula-container;

2:**Find** the **STMicroelectronics STM32L0 Series Device** and **download** it;

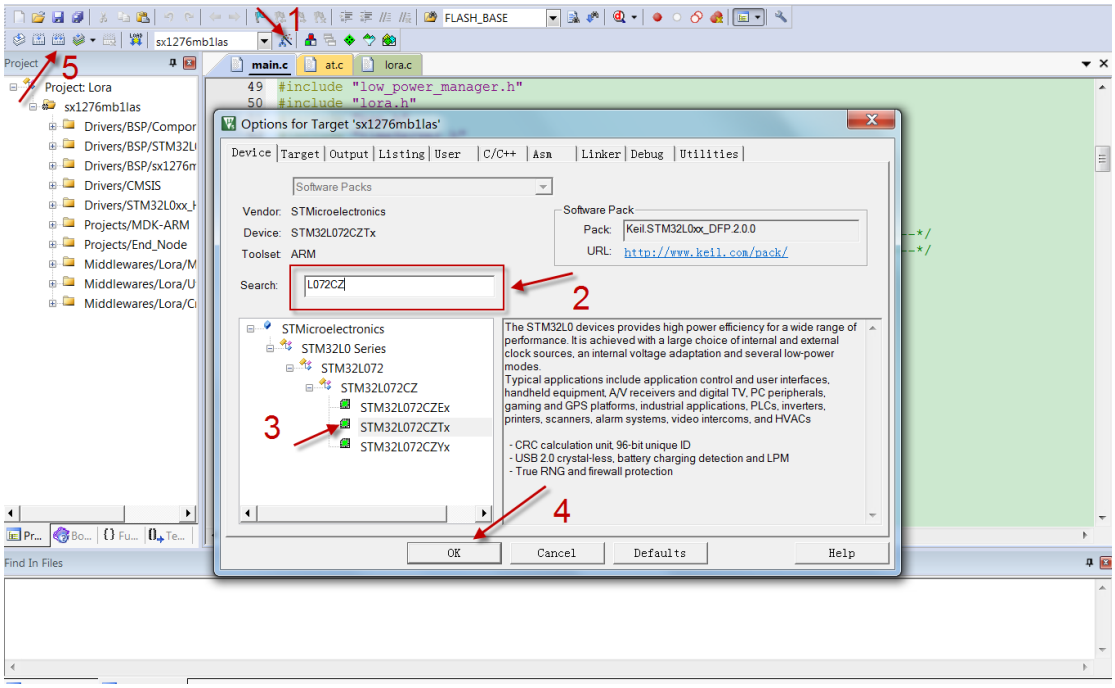


3:Find the Software Pack and installs it;

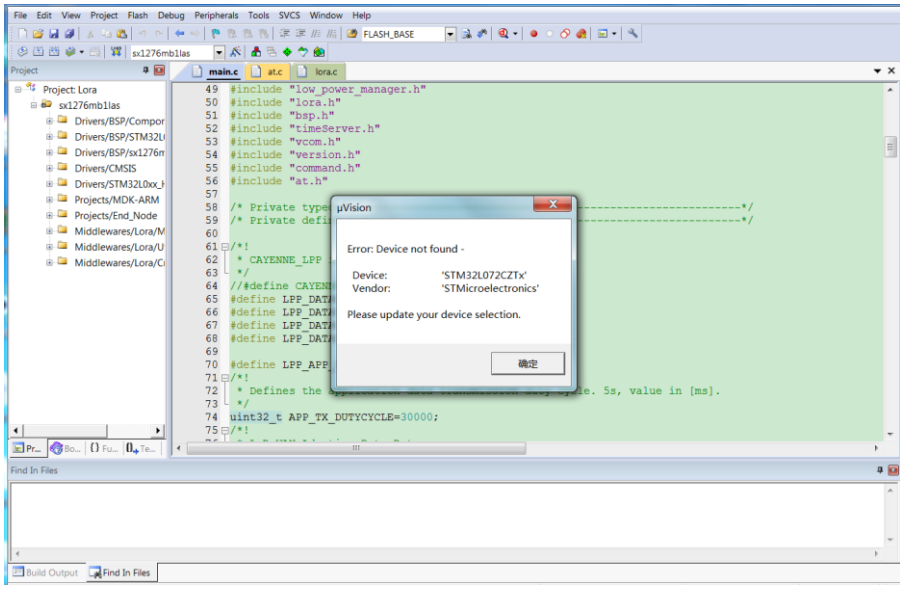




4:**Add** the Device ,then you can **rebuild** the project.

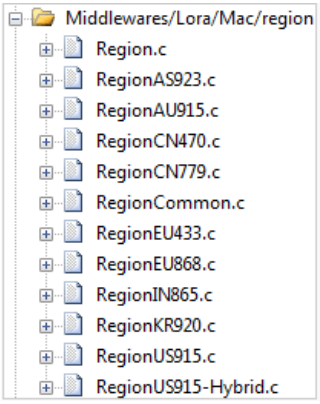


Notice: If without add the Device, the keil would report this error.

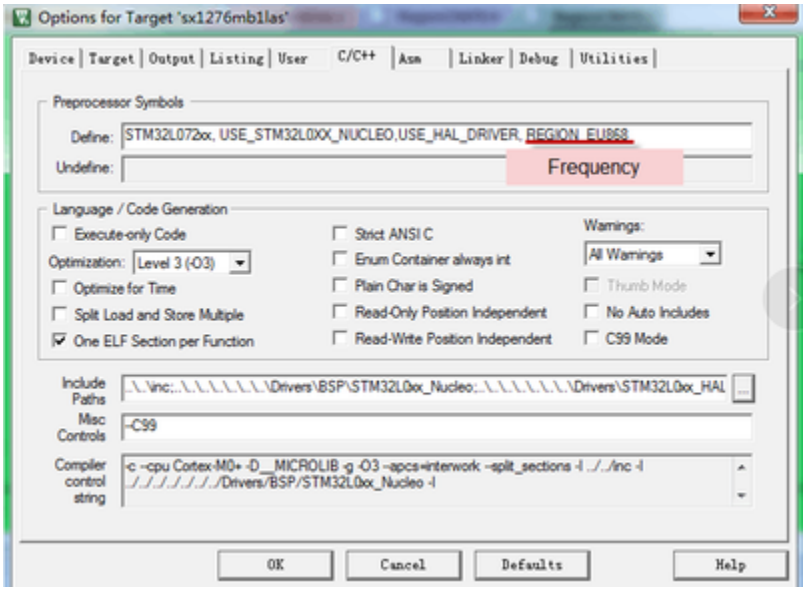


5.2.3 Compile Source Code

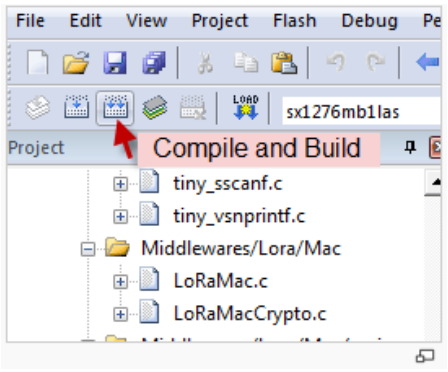
1. Download the source code from Software Source Code Download Link.
2. Use Keil to open the project file:
   STM32CubeExpansion_LRWAN/Projects/Multi/Applications/LoRa/DRAGINO-LRWAN(AT)/MDK-ARM/STM32L072CZ-Nucleo/Lora.uvprojx
3. In Keil, you can see what frequency band the code support.



4. If you want to change frequency, modify the Preprocessor Symbols. For example, change EU868 to US915



5. Compile and build



6. FAQ

6.1 Why there is 433/868/915 version?

Different country has different rules for the ISM band for using the LoRa. Although the LoRa chip can support a wide range of Frequency, we provide different version for best tune in the LoRa part. That is why we provide different version of LoRa.

6.2 What is the frequency range of LT LoRa part?

Different LT version supports different frequency range, below is the table for the working frequency and recommend bands for each model :

Version	LoRa IC	Working Frequency	Best Tune Frequency	Recommend Bands
433	SX1278	Band2(LF): 410 ~525 Mhz	433Mhz	CN470/EU433
868	SX1276	Band1(HF):862~1020 Mhz	868Mhz	EU868
915	SX1276	Band1(HF):862 ~1020 Mhz	915Mhz	AS923/AU915/ KR920/US915

6.3 How to change the LoRa Frequency Bands/Region?

User can follow the introduction for how to upgrade image. When download the images, choose the required image file for download.

6.4 Can I use Private LoRa protocol?

The stock firmware is based on LoRaWAN protocol. User can use a private LoRa protocol in LGT-92, this section describe an example for base LoRa transfer. It is a reference/demo and we didn't provide further software develop support on this topic.

In this demo, we will show the communication between LoRa Shield and LGT-92, both of them use the basic LoRa library. LGT-92 will send a message to LoRa Shield and LoRa Shield will print it to the console.

LoRa Shield + UNO:

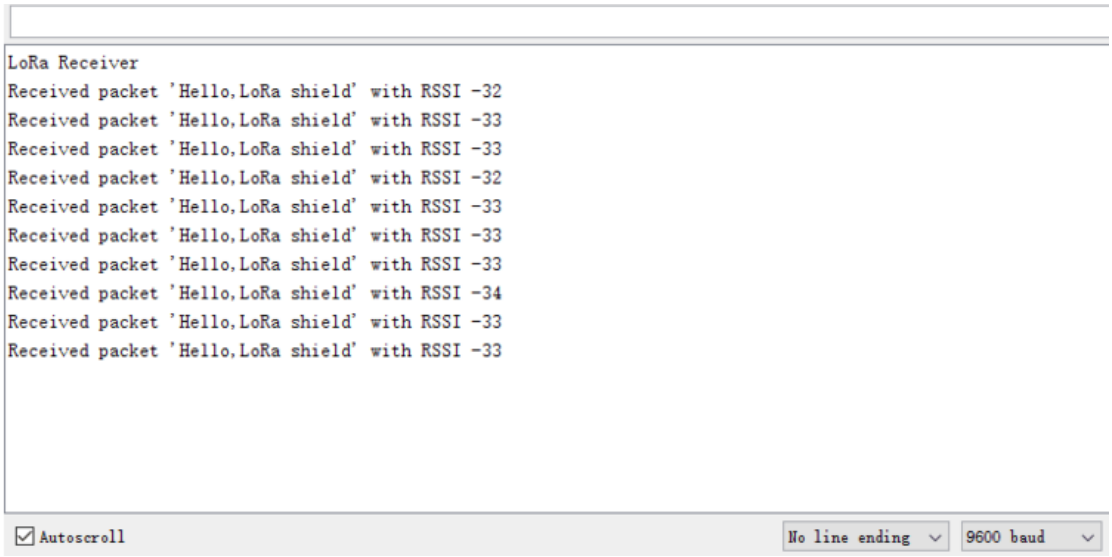
Use the <LoRa Library> and upload the LoRa_Receive Sketch to Arduino. Open the serial monitor to Arduino, it acts as a LoRa Receiver and listen on the frequency: 868.3Mhz

LGT-92:

Use the <LoRa RAW code> . The project file is in: MDK-ARM\STM32L072CZ-Nucleo\Lora.uvprojx

Compile it and Upload it to LGT-92, the LGT-92 will transfer on the frequency 868.3Mhz.

In Arduino Console, it will see:



6.5 How to set up LGT-92 to work in 8 channel mode in US915, AU915, CN470 bands?

By default, the frequency bands US915, AU915, CN470 works in 72 frequencies. Many gateways are 8 channel gateways, in such case, the OTAA joined time and uplink schedule is **long and unpredictable** while the end node hopping in 72 frequencies.

User can configure the end node to work in 8 channel models by using the AT+CHE command, the 500kHz channels are always includes for OTAA.

For example, in US915 band, the frequency table is as below. By default, end node will use all channels (0~71) for OTAA Join process. After OTAA JOINED, end node will use these all channels (0~71) to send uplink packets.

CHE	US915 Uplink Channels(125KHz,4/5,Unit:MHz,CHS=0)								
0	ENABLE Channel 0-63								
1	902.3	902.5	902.7	902.9	903.1	903.3	903.5	903.7	Channel 0-7
2	903.9	904.1	904.3	904.5	904.7	904.9	905.1	905.3	Channel 8-15
3	905.5	905.7	905.9	906.1	906.3	906.5	906.7	906.9	Channel 16-23
4	907.1	907.3	907.5	907.7	907.9	908.1	908.3	908.5	Channel 24-31
5	908.7	908.9	909.1	909.3	909.5	909.7	909.9	910.1	Channel 32-39
6	910.3	910.5	910.7	910.9	911.1	911.3	911.5	911.7	Channel 40-47
7	911.9	912.1	912.3	912.5	912.7	912.9	913.1	913.3	Channel 48-55
8	913.5	913.7	913.9	914.1	914.3	914.5	914.7	914.9	Channel 56-63
Channels(500KHz,4/5,Unit:MHz,CHS=0)									
	903	904.6	906.2	907.8	909.4	911	912.6	914.2	Channel 64-71

When user uses the TTN network, the US915 frequency bands use are:

- ✓ 903.9 - SF7BW125 to SF10BW125
- ✓ 904.1 - SF7BW125 to SF10BW125
- ✓ 904.3 - SF7BW125 to SF10BW125
- ✓ 904.5 - SF7BW125 to SF10BW125
- ✓ 904.7 - SF7BW125 to SF10BW125
- ✓ 904.9 - SF7BW125 to SF10BW125
- ✓ 905.1 - SF7BW125 to SF10BW125
- ✓ 905.3 - SF7BW125 to SF10BW125
- ✓ 904.6 - SF8BW500

Because the end node is now hopping in 72 frequency, it is makes the devices hard to Join the TTN network and uplink data. To solve this issue, user can access the device via AT Command and run:

AT+CHE=2

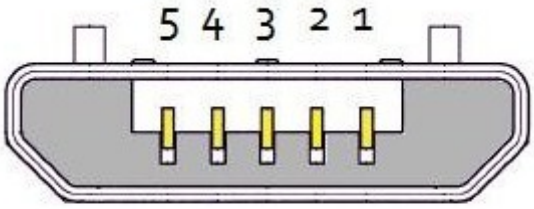
ATZ

to set the end node to work in 8 channel mode. The device will work in Channel 8-15 & 64-71 for OTAA, and channel 8-15 for Uplink.

AU915 is similar. Below is the AU915 Uplink Channels.

CHE	AU915 Uplink Channels(125KHz,4/5,Unit:MHz,CHS=0)								
0	ENABLE Channel 0-63								
1	915.2	915.4	915.6	915.8	916	916.2	916.4	916.6	Channel 0-7
2	916.8	917	917.2	917.4	917.6	917.8	918	918.2	Channel 8-15
3	918.4	918.6	918.8	919	919.2	919.4	919.6	919.8	Channel 16-23
4	920	920.2	920.4	920.6	920.8	921	921.2	921.4	Channel 24-31
5	921.6	921.8	922	922.2	922.4	922.6	922.8	923	Channel 32-39
6	923.2	923.4	923.6	923.8	924	924.2	924.4	924.6	Channel 40-47
7	924.8	925	925.2	925.4	925.6	925.8	926	926.2	Channel 48-55
8	926.4	926.6	926.8	927	927.2	927.4	927.6	927.8	Channel 56-63
Channels(500KHz,4/5,Unit:MHz,CHS=0)									
	915.9	917.5	919.1	920.7	922.3	923.9	925.5	927.1	Channel 64-71

6.6 What is the pin mapping for the USB program cable?



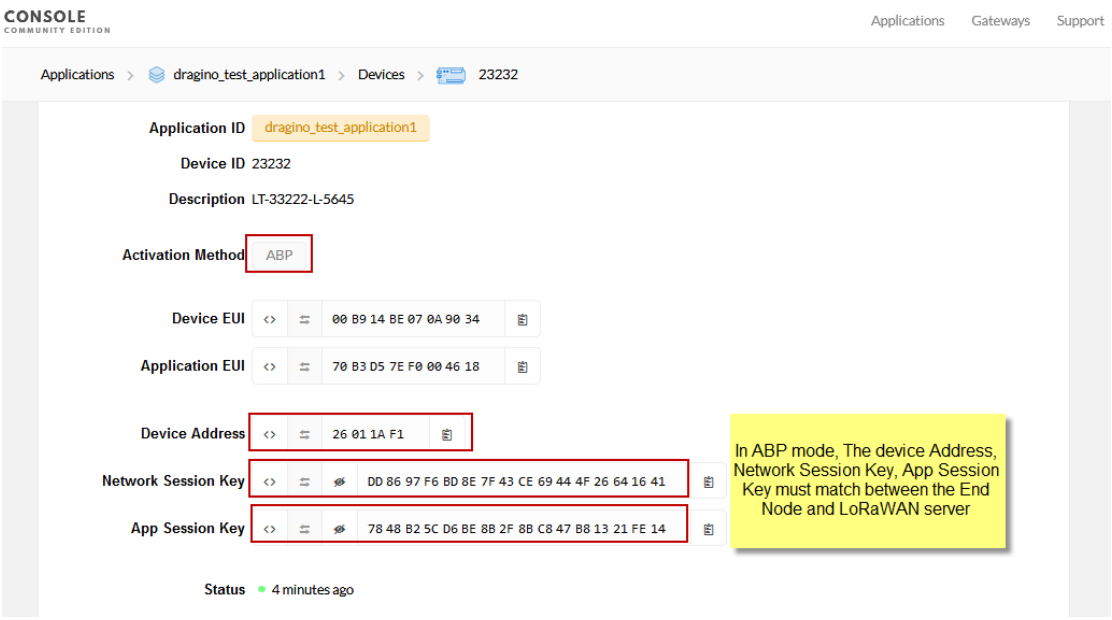
USB Micro-B

Pin	Color	USB Pin	UART pin	ST-Link Pin
1	Red	VCC	N/A	+5V
2	White	D- (N/A)	LGT-RXD	SWDIO
3	Green	D+(N/A)	LGT-TXD	SWCLK
4		ID (N/A)	N/A	
5	Black	GND	GND	GND

6.7 How to set up LGT-92 to work with Single Channel Gateway such as LG01/LG02?

In this case, users need to set LGT-92 to work in ABP mode & transmit in only one frequency. Assume we have a LG02 working in the frequency 868400000 now, below is the steps.

Step1: Log in TTN, Create an ABP device in the application and input the network session key (NETSKEY), app session key (APPSKEY) from the device.

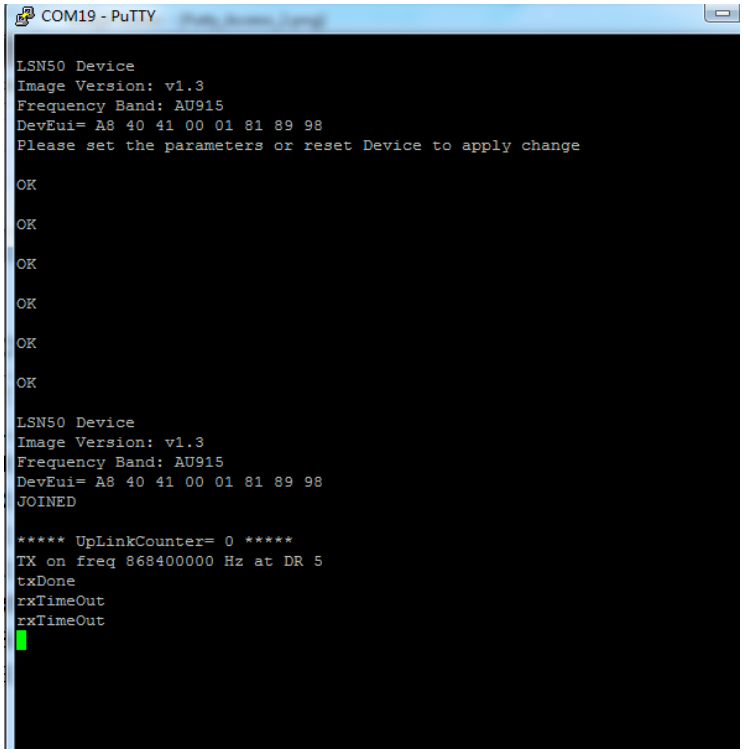


Note: user just need to make sure above three keys match, User can change either in TTN or Device to make then match. In TTN, NETSKEY and APPSKEY can be configured by user in setting page, but Device Addr is generated by TTN. User can also change the Device ADDR in TTN by using the The Things Network CLI.

Step2: Run AT Command to make LGT-92 work in Single frequency & ABP mode. Below is the AT commands:

AT+FDR Reset Parameters to Factory Default, Keys Reserve
AT+NJM=0 Set to ABP mode
AT+ADR=0 Set the Adaptive Data Rate Off
AT+DR=5 Set Data Rate (Set AT+DR=3 for 915 band)
AT+TDC=300000 Set transmit interval to 5 minutes
AT+CHS=868400000 Set transmit frequency to 868.4Mhz
AT+DADDR=26 01 1A F1 Set Device Address to 26 01 1A F1
ATZ Reset MCU

As shown in below:



7. Trouble Shooting

7.1 Why I can't join TTN in US915 /AU915 bands?

It is about the channels mapping. Please see this link for detail.

8. Order Info

See variants first:

Part Number: **LGT-92-XX-YYY**

XX: Major variant model

- ✓ **LI**: Li-on battery version
- ✓ **DE**: AA battery version

YYY: The default frequency band

- ✓ **AS923**: LoRaWAN AS923 band
- ✓ **AU915**: LoRaWAN AU915 band
- ✓ **EU433**: LoRaWAN EU433 band
- ✓ **EU868**: LoRaWAN EU868 band
- ✓ **KR920**: LoRaWAN KR920 band
- ✓ **US915**: LoRaWAN US915 band
- ✓ **IN865**: LoRaWAN IN865 band
- ✓ **CN470**: LoRaWAN CN470 band

9. Packing Info

Package Includes:

- ✓ LGT-92 LoRa GPS Tracker x 1
- ✓ USB recharge & program cable x 1

Dimension and weight:

- ✓ Device Size: 85 x 48 x 15 cm
- ✓ Device Weight: 50g

10. Support

- ➢ Support is provided Monday to Friday, from 09:00 to 18:00 GMT+8. Due to different timezones we cannot offer live support. However, your questions will be answered as soon as possible in the before-mentioned schedule.
- ➢ Provide as much information as possible regarding your enquiry (product models, accurately describe your problem and steps to replicate it etc) and send a mail to

support@dragino.com

11. Reference

- Product Page , DataSheet
- Image Download
- AT Command Manual
- TTN Frequency Bands