USI® 環鴻科技股份有限公司
Universal Global Scientific Industrial Co., Ltd.

WM-N-BM-22

Lite Lora-gateway User Guide

Version: 1.3

Amendment Records

Item:	Date:	Revision:	Page:	Change Description:	Changed by:
1	7/1/2017	1.0	All	Initial release	Andy
2	7/17/2017	1.1	All	Section 4: change gateway ID configuration in lite_gw_pkt_fwd.c	Andy
3	8/7/2017	1.3	6~24	Sec.3~5 : SoftAP SSID Change ; WebPage Setup for LoRA GW	Daniel

Contents

1. Overview

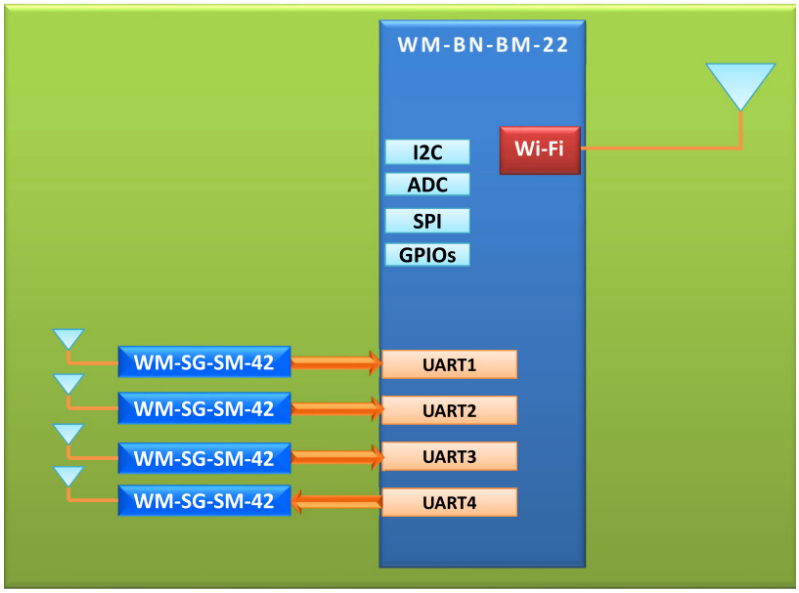
This document is for introduce the lite-gateway and how to set it up.

1.1 The features of the lite-gateway

- Packet forward for LoraWAN Class C compatible devices with ABP activation protocol
- EU868 & US915 Band
- Multiple I/O Function
  - SPI x 1
  - I2C x1
  - ADC x 3
  - PWM x 2
- Integrated with WiCED SDK

1.2 The hardware block diagram

The WM-N-BM-22 integrated IEEE 802.11b/g/n and BT4.1, it can connect 4 WM-SG-SM-42 Lora modules in maximum, and works as a network bridge for Wi-Fi and Lora. The gateway also provides multi IO function like I2C, SPI, GPIO and ADC which could be used for various IOT applications.



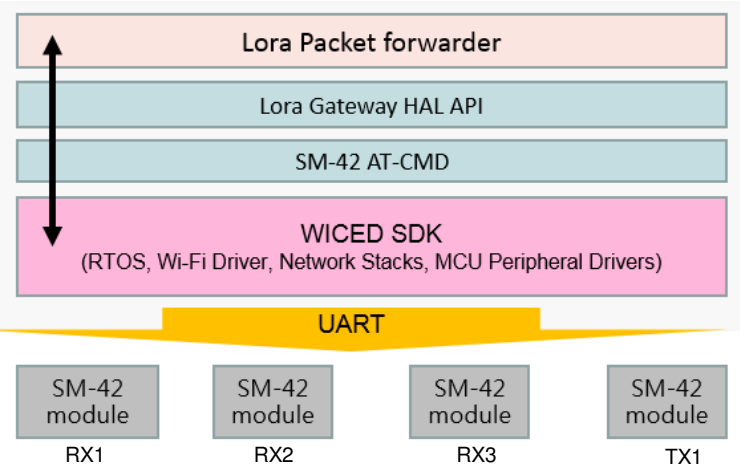
1.3 The software overview

The WM-BN-BM-22 provides rich software libraries based on the WiCED SDK for various IOT applications. There are 3 additional software parts for support the basic function for the lite Lora gateway.

SM-42 AT-CMD: this is used for control the four SM-42 modules through UART interface.

Lora Packet forwarder: this is used for forwarding nodes data to/from cloud server.

Lora Gateway HAL API: this is the Lora concentrator hardware abstraction layer API defined by Semtech, the purpose is for distinguish between the hardware driver (SM-42-AT-CMD) and software application (Lora Packet forward).



1.4 The software versions

The followings shows the required software version for this lora-gateway.

WM-N-BM-22:

- WICED SDK 4.x version above
- WM-N-BM-22 platform patch for lite Lora-gateway
- WM-N-BM-22 lit Lora-gateway Software Package v1.3

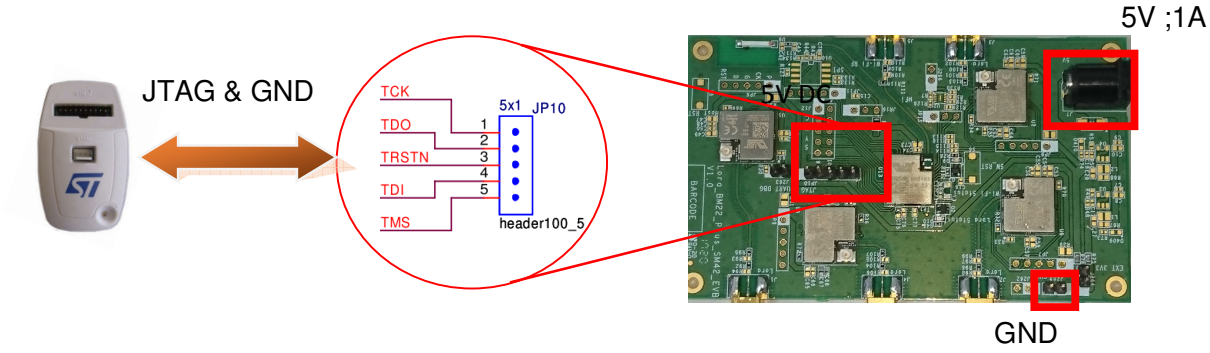
WM-SG-SM-42:

- WM-SG-SM-42 firmware version v3.0 above

2. Prebuild firmware images

2.1 Get the latest prebuild BM-22 LoRA packet forward image from USI's contact.

◆Connect ST-LINK programmer to the JP10 on the lite Lora-gateway as below :

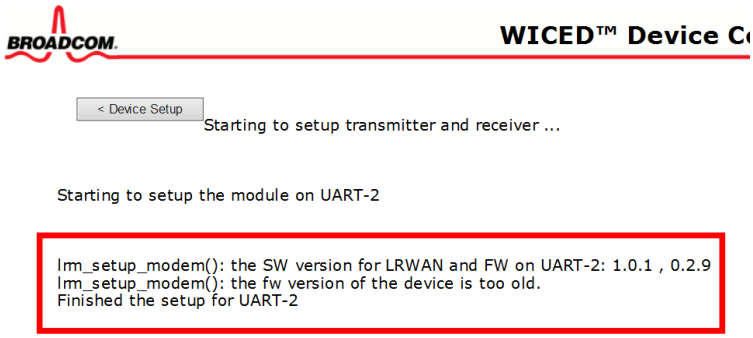


2.2 Update WM-SG-SM-42 preloaded software

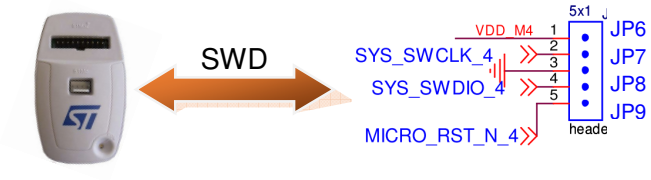
The Lora-gateway can connect 4 SM-42 modules in maximum, and the preloaded software version must be 3.0 above. When you get an error message about the incorrect SM-42 firmware version when initial the Lora the transmitter/receivers (as below), please refer to the preloaded software update application note to complete the firmware update.

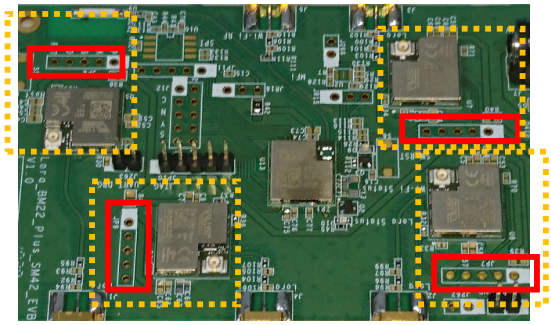
◆ The SM-42 preloaded software v3.0 link:
https://github.com/USILoRaModule/USI_I-NUCLEO-LRWAN1/blob/master/preloaded_firmware/wm-sg-sm-42_firmware_v3.0.hex

◆ The SM-42 preloaded software update manual link:
https://github.com/USILoRaModule/USI_I-NUCLEO-LRWAN1/blob/master/preloaded_firmware/WM-SG-SM-42%20Update%20Preloaded%20AT%20Command%20FW%20Application%20Note%20rev.%201.2.pdf



◆ The SWD interfaces mapping to each SM-42 module is as below:





3. Setup the lite Lora-gateway

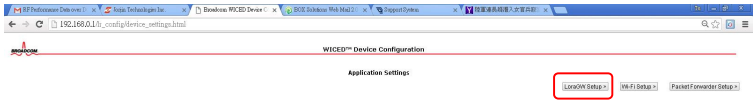
3.1 Setup the Wi-Fi network

1) Hold the software reset button”S6” then power on the gateway, keep button pressed until WiFi status LED blinks.(Could back to Factory Default)

2) Connect the device using Wi-Fi to the soft AP 'USI_LoRA_Demo'
The soft AP name and password is: 'USI_LoRA_Demo' and '12345678'

3) Open a web browser and enter '192.168.0.1' in the URL, and then the device configuration webpage appears. (192.168.0.1is the IP address of the soft AP interface)

4) Click the LoraGW Setup to configure LoRA module



BROADCOM

< Device Setup

Starting to setup transmitter and receiver ...

Starting to setup the module on UART-2

lrm_setup_modem(): the SW version for LRWAN and FW on UART-2: 1.0.1 , 0.2.9
lrm_setup_modem(): set baud rate 230400 for UART-2
lrm_setup_modem(): set 32MHz System Clock for UART-2
lrm_setup_modem(): Save changes on UART-2

Finished the setup for UART-2

Starting to setup the module on UART-0

lrm_setup_modem(): the SW version for LRWAN and FW on UART-0: 1.0.1 , 0.2.9
lrm_setup_modem(): set baud rate 230400 for UART-0
lrm_setup_modem(): set 32MHz System Clock for UART-0
lrm_setup_modem(): Save changes on UART-0
Finished the setup for UART-0

Starting to setup the module on UART-3

lrm_setup_modem(): the SW version for LRWAN and FW on UART-3: 1.0.1 , 0.2.9
lrm_setup_modem(): set baud rate 230400 for UART-3
lrm_setup_modem(): set 32MHz System Clock for UART-3

lrm_setup_modem(): Save changes on UART-3
Finished the setup for UART-3

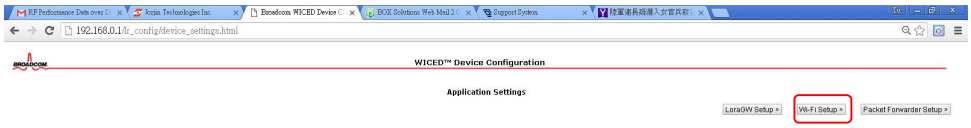
Starting to setup the module on UART-1

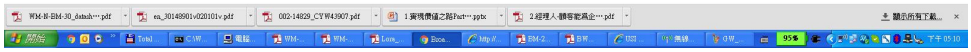
lrm_setup_modem(): the SW version for LRWAN and FW on UART-1: 1.0.1 , 0.2.9
lrm_setup_modem(): set baud rate 230400 for UART-1
lrm_setup_modem(): set 32MHz System Clock for UART-1
lrm_setup_modem(): Save changes on UART-1
Finished the setup for UART-1

lgw_setup(): setup was finished with no errors

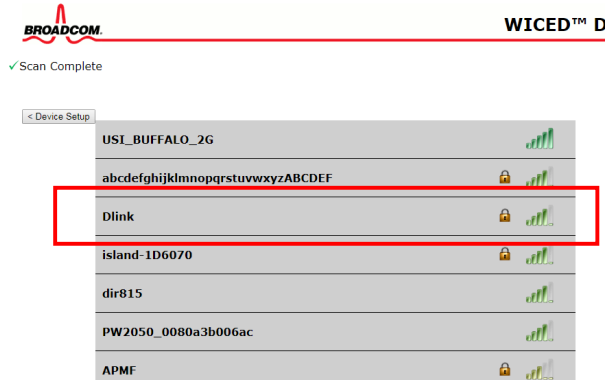
Setup Stopped!

5) Click the Wi-Fi Setup button on the configuration home page.

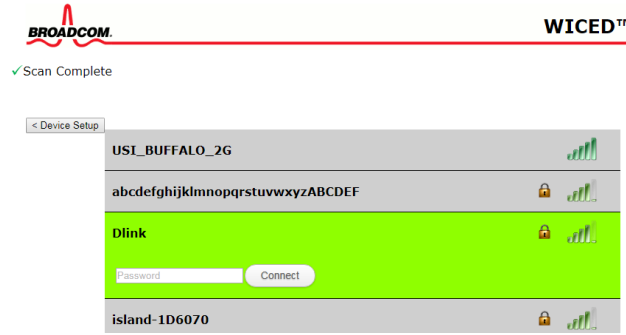




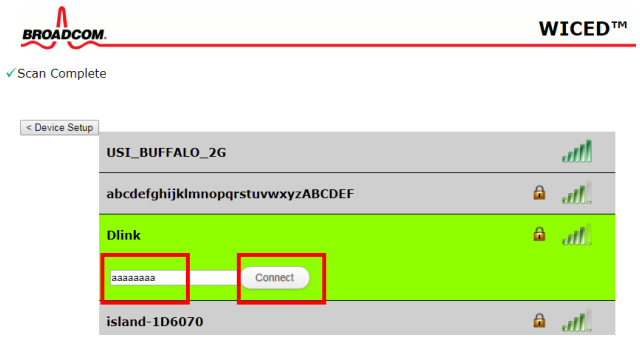
6) A Wi-Fi Setup webpage appears and scanning the Wi-Fi networks in the range and then will show the scan result in a list.



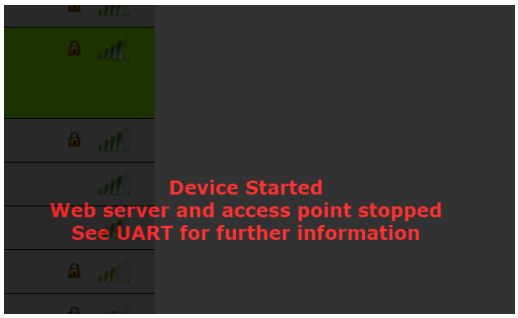
7) Find and click on a Wi-Fi AP which you want to join from the list and a password box will appears as below:



8) Enter the password for the Wi-Fi AP in the password box, and then click button 'Connect'

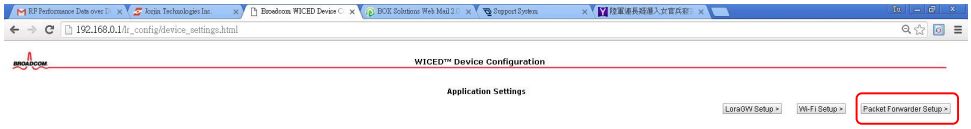


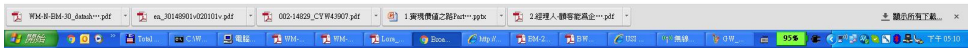
9) Wi-Fi setup is completed if you saw the screen as below, the Lora-Gateway will join the Wi-Fi network automatically at next power on.



3.2 Setup Packet Forwarder

1) Click the packet forwarder button on the configuration home page.





2) Click the 'packet forwarder' setup on the left list.

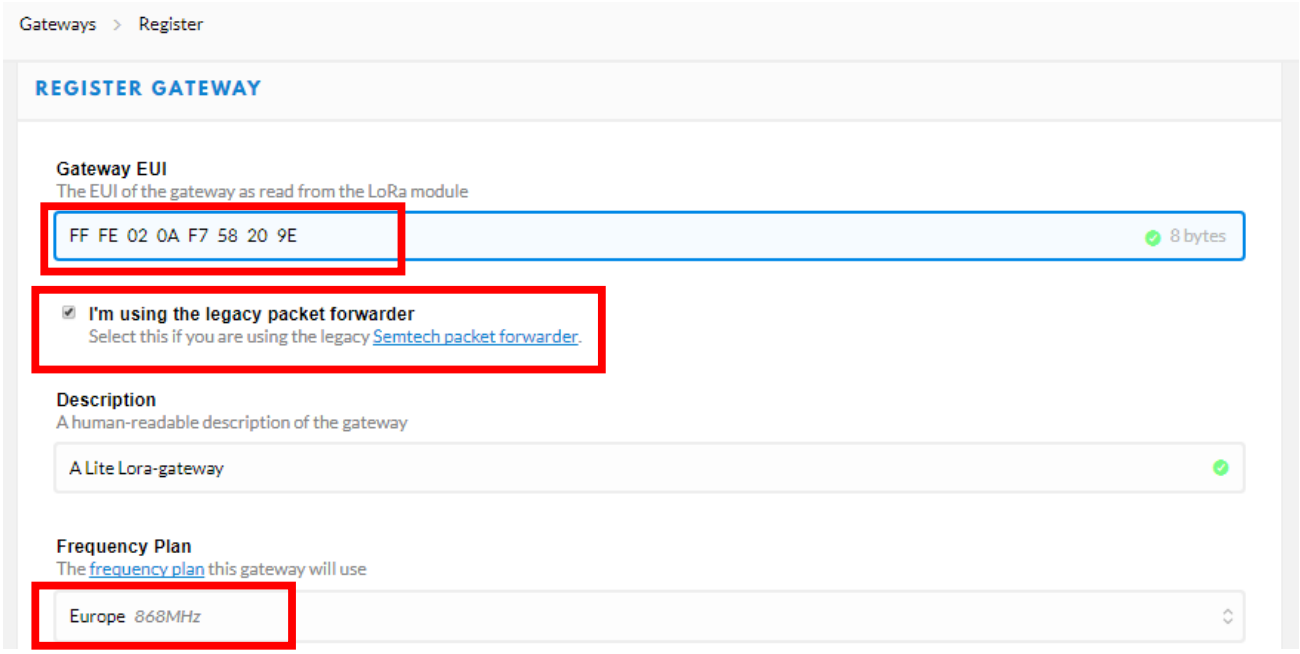
3) Input the correct packet forwarding settings and then click update changes button
4) Setup succeed if you saw the message 'write dct done' appears on the web page.

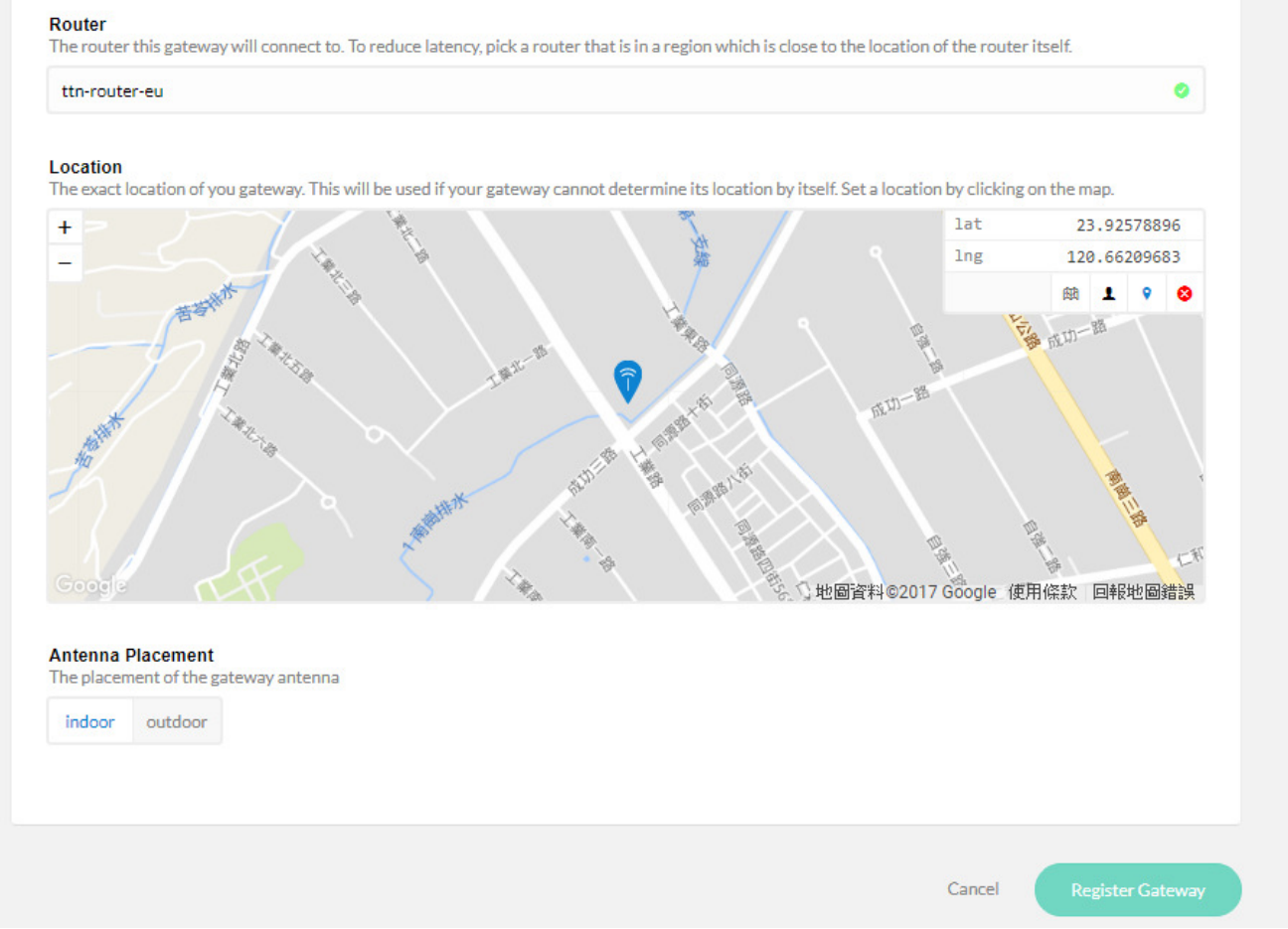
3.3 Test Packet forwarding on TTN

The followings demonstrates how to forwarding packets to/from TTN using the lite Lora-gateway and a standalone SM-42 module.

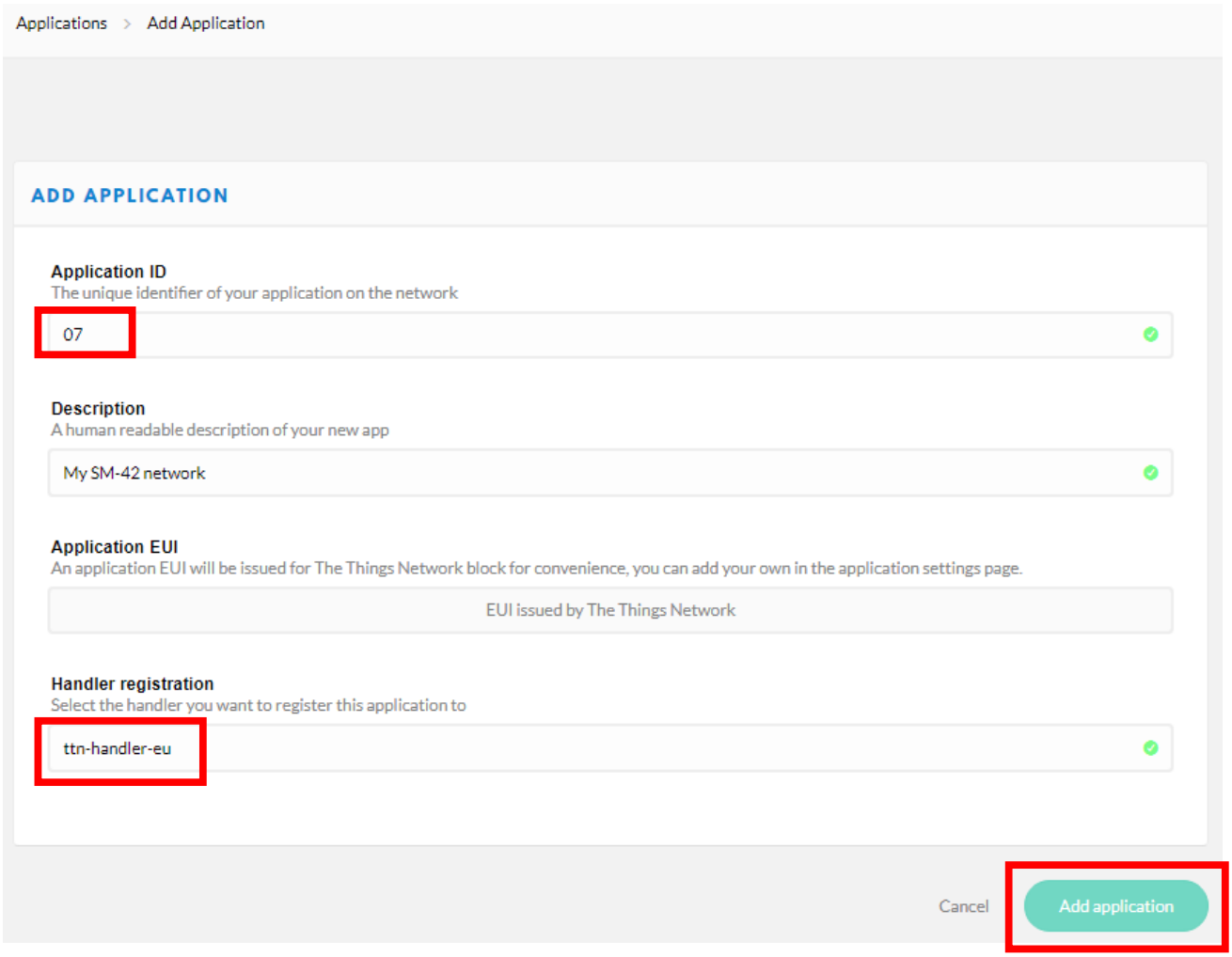
1) Please register a virtual gateway and application on TTN and open the device data webpage for monitor the traffic between the lite gateway and the virtual gateway on the TTN.

2) Sign up a TTN account then go to the gateway register webpage for register a gateway, and please fill the data by follow the red box below:



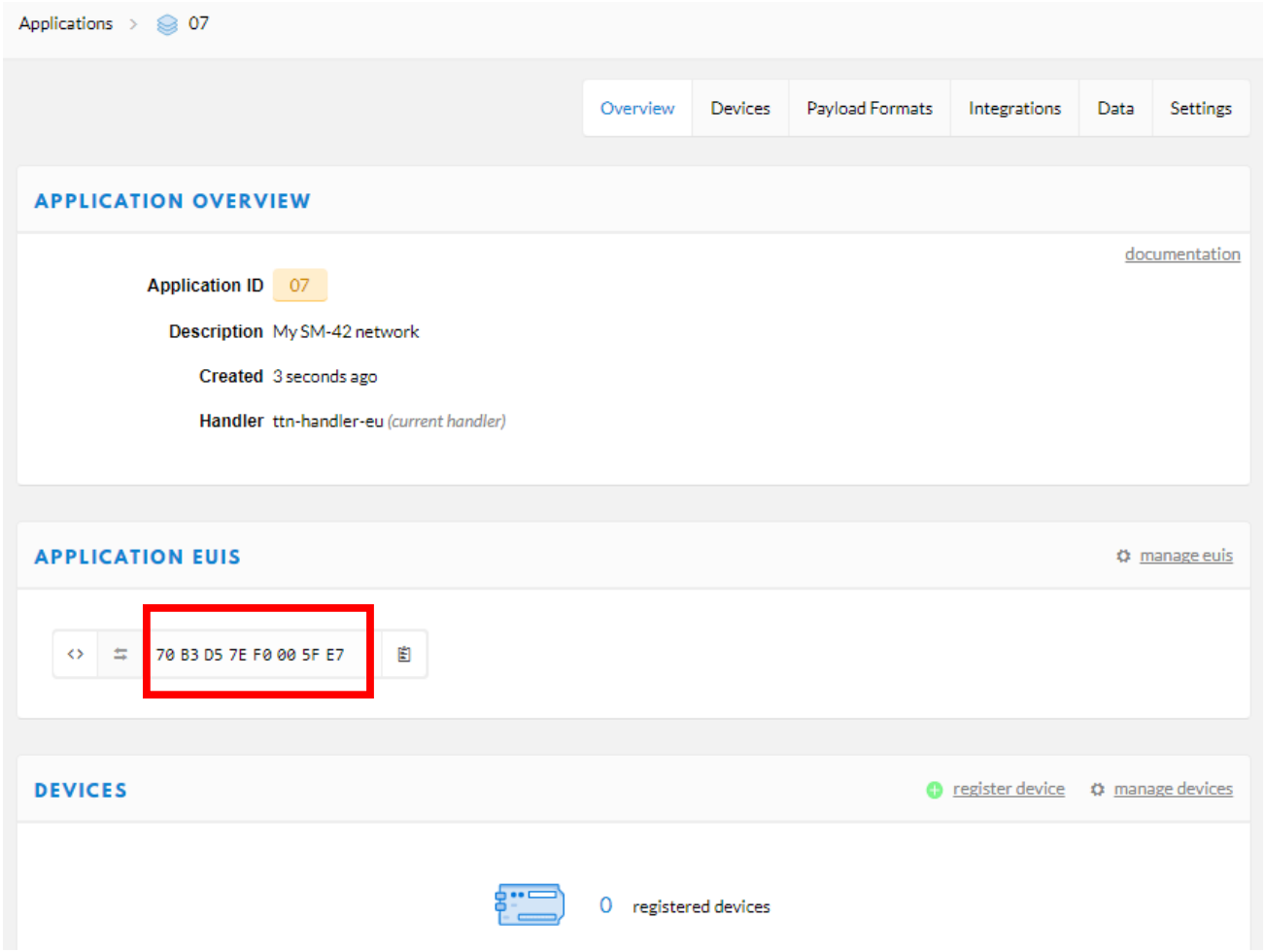


3) Go to the application webpage for register an application, and please fill the data by follow the red box below:

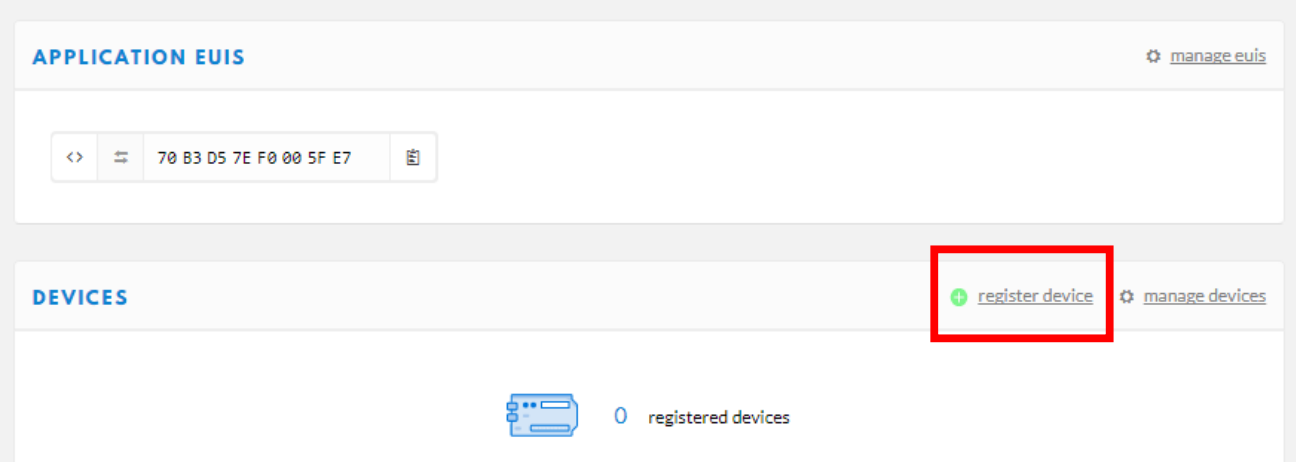


Then we will go to the new application webpage as below, we need to set the application EUI (shown in the red box below) in the SM-42 module by the AT command below:

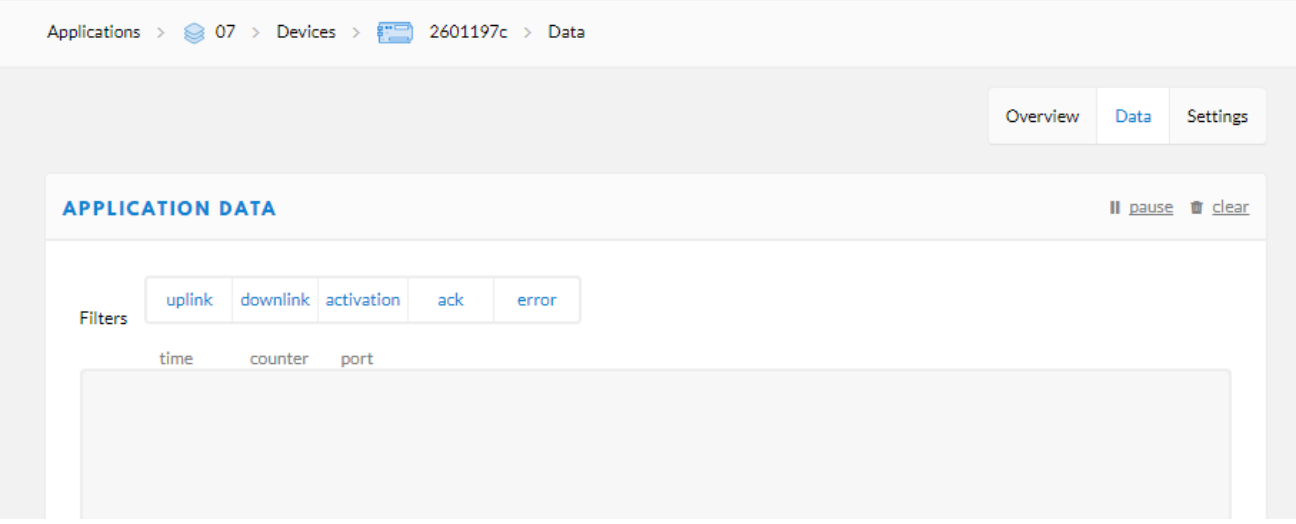
AT+APPEUI=70B3D57EF0005FE7



4) After finish the application EUI setting, we need to join the SM-42 module in this application, please click the button 'register device' to starting the registration.



(There is an example of registration in section 4, you can refer this example to create the gateway and application on TTN for this test)



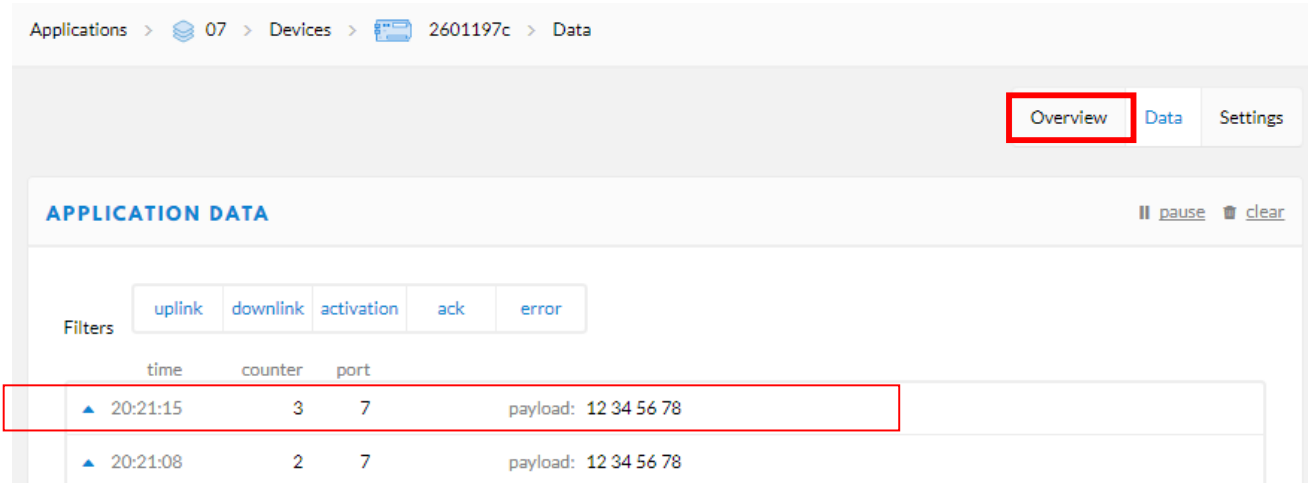
5) Join SM-42 module to the lite Lora-gateway using the command sequence below:

```
# ATZ
# AT+DR=3
# AT+RX2DR=3
# AT+CLASS=2
# AT+DC=0
# AT+JOIN=0
```

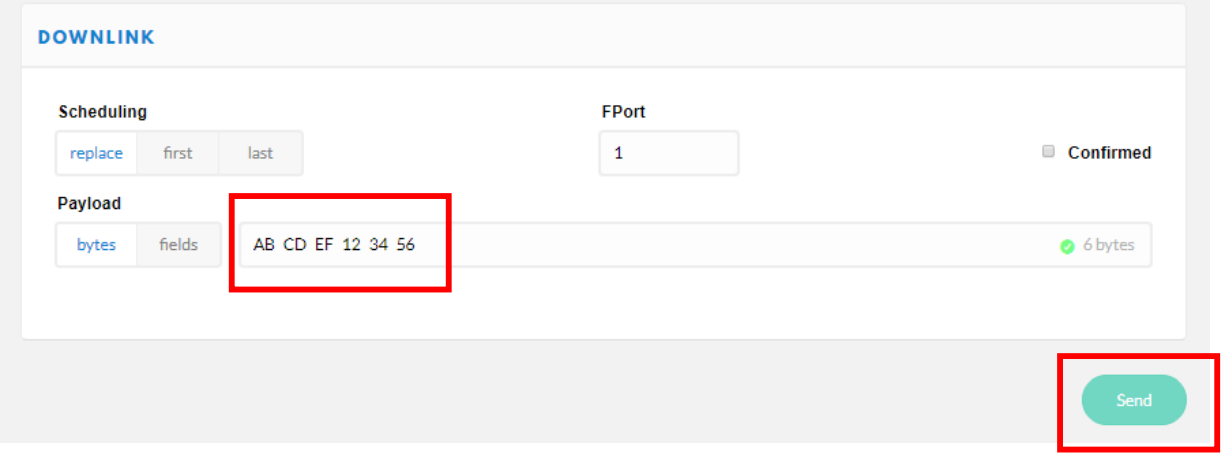
6) Transmit a packet from the SM-42 module to the application on TTN using the command below:

```
# AT+SEND=7 12345678 0
```

7) Then the packet from the SM-42 appears on the TTN device data webpage, it means the uplink is no problem. The next, please click the button 'Overview' for back to the device webpage.



8) Please fill the data by follow the red box below:



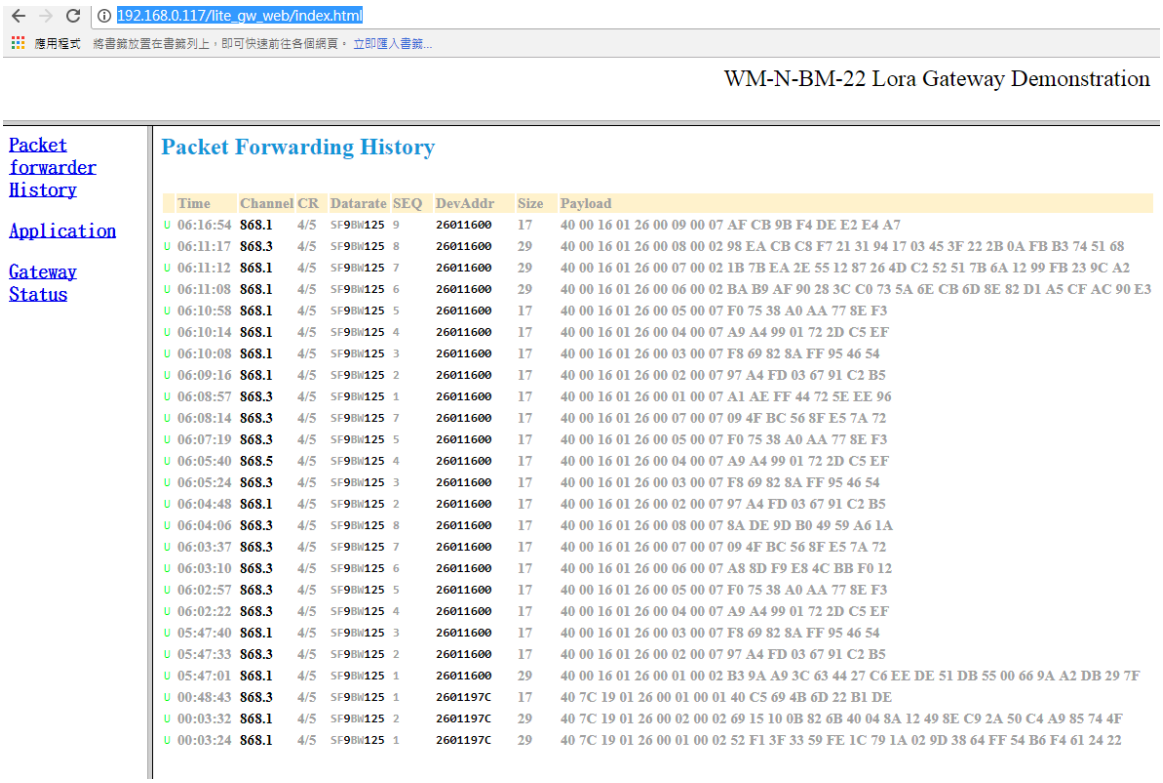
9) Transmit a packet from the SM-42 module to the application on TTN using the command below:

AT+SEND=7 12345678 0

10) And then SM-42 reports a +RCV event as below on the UART console, it means the downlink is no problem.
+RCV=1,6,ABCDEF123456

3.4 Packet forwarding history webpage

The lite Lora-gateway built-in a webpage for review the packet forwarding history, just enter the IP address of the Lora-gateway in the URL of web browser, you can see the packet history either downlink and uplink. You can execute udp_receive.py under "~WiCED SDK\libraries\lora_gateway\lib_log_tracer\" to get its IP Address



3.5

3.5.1 Monitoring debug log

By the default, all the debug log from the gateway application will be forwarded to UDP port 50007, a python script can be used for show the debug log. The file is located at the root path of WICED SDK as below:
$(WICED_SDK_ROOT_PATH)\43xxx_Wi-Fi\libraries\lora_gateway\lib_log_tracer\udp_receive.py

◆ The following is the snapshot of the debug log from the UDP port, the begin of each line is the device IP address and the line number of log ; use your pc to the same AP as BM-22 connected (same IP subnet mask)

```
<x.x.x.9::00000038> resp_OK(): got 12th OK.
<x.x.x.9::00000039> ---lrm_init()
<x.x.x.9::0000003A> +++lrm_init()
<x.x.x.9::0000003B> +++atcmd_init_uart()
<x.x.x.9::0000003C> atcmd_init_uart(): use default configuration for UART-0.
<x.x.x.9::0000003D> atcmd_init_uart(): allocating memory for UART-1 RX.
<x.x.x.9::0000003E> atcmd_init_uart(): allocating memory for UART-0 TX.
<x.x.x.9::0000003F> ---atcmd_init_uart()
<x.x.x.9::00000040> atcmd_add_console(): allocating CMD buffer for UART-0
<x.x.x.9::00000041> atcmd_add_console(): uses default size of CMD buffer for UART-0
<x.x.x.9::00000042> atcmd_add_console(): uses default size for RESP buffer on UART-0
<x.x.x.9::00000043> lrm_set_op_modem(): set op mode at 9
```

4 Build your own software

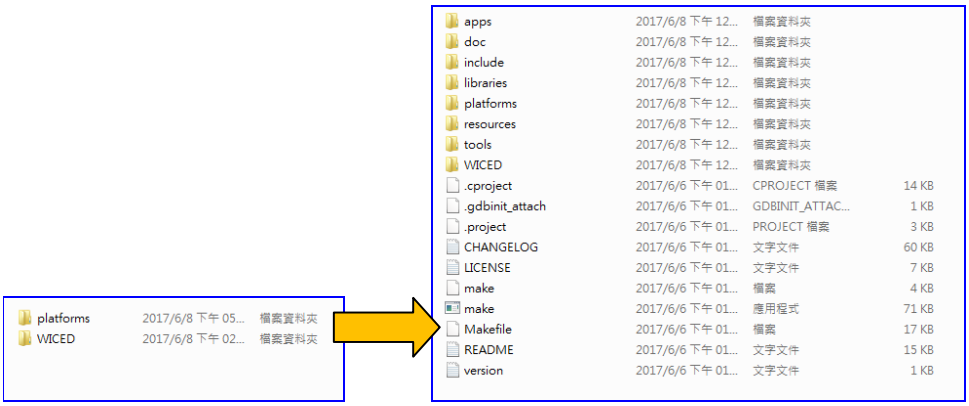
4.1 Install WiCED SDK

1. The lite gateway software package is developed with the WiCED SDK 4.x, please download WiCED SDK version 4.x from cypress web site and finish the installation.
https://community.cypress.com/community/wiced-wifi/wiced-wifi-documentation

4.2 Install the platform patch for WM-N-BM-22

1. Please get the WiCED platform patch for WM-N-BM-22 from the contact window of the product.
WM-BN-BM-22_SDK_4.1.x_platform_patch_for_lite_lrgw_V1.0.zip
2. Unzip the platform patch package into the root path of WICED SDK as below:

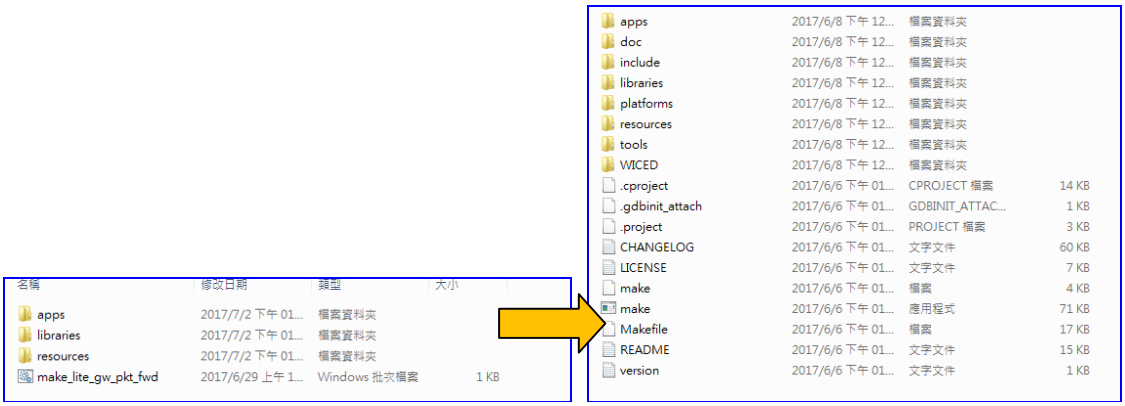
◆ $(WICED_SDK_ROOT_PATH)\43xxx_Wi-Fi\



4.3 Install the lite Lora-gateway software package (only available for WiCED SDK 4.1.x)

1. Please request the following patch from USI support system
WM-N-BM-22_lite_gateway_software_package_v1.3.zip

2. Unzip the platform patch package into the root path of WICED SDK (V4.x)as below:
$(WICED_SDK_ROOT_PATH)\43xxx_Wi-Fi\



4.4 Configure your defined SoftAP SSID and Security Key &CH#

~SDK \43xx_Wi-Fi\include\default_wifi_config_dct.h

```
* This is the soft AP used for device configuration
 */
#define CONFIG_AP_SSID      "USI_LoRA_Demo"
#define CONFIG_AP_CHANNEL    11
#define CONFIG_AP_SECURITY   WICED_SECURITY_WPA2_AES_PSK
#define CONFIG_AP_PASSPHRASE "12345678"

/**
```

4.5 Make & Download the lite Lora-gateway firmware into WM-N-BM-22

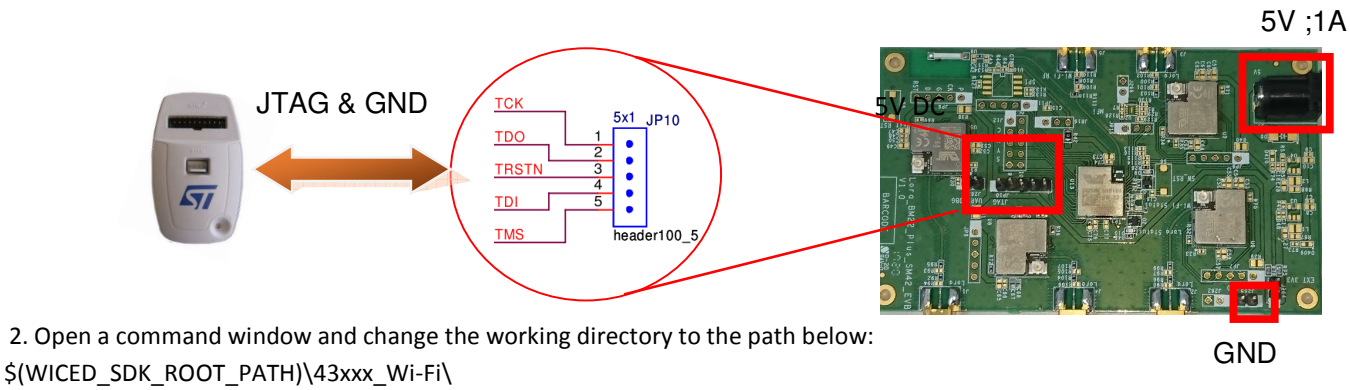
1. The WICED SDK build system uses OpenOCD + FTDI USB JTAG device for download the images on the WM-N-BM-22 EVB. Since the lite Lora-gateway just reserves a 5 pins JTAG interface for download the images, so the following shows how to modify the build system for download the images on the WM-N-BM-22 via ST-Link programmer.

a) Open file $(WICED_SDK_ROOT_PATH)\43xxx_Wi-Fi\tools\makefiles\wiced_toolchain_common.mk in WICED Eclipse IDE or text editor.

b) Please comment out this line which contains the description 'JTAG ?= BCM9WCD1EVAL1' (near by line #38) and insert a line contains the description below:

```
32
33 TOOLS_ROOT ?= $(SOURCE_ROOT)tools
34
35 OPENOCD_PATH       := $(TOOLS_ROOT)/OpenOCD/
36 PATH :=
37
38 #JTAG          ?= BCM9WCD1EVAL1
39 JTAG          ?= stlink-v2-1
40
41
```

c) Connect ST-LINK programmer to the JP10 on the lite Lora-gateway as below:



2. Open a command window and change the working directory to the path below:
$(WICED_SDK_ROOT_PATH)\43xxx_Wi-Fi\

3. Build all the code of lite Lora-gateway by using the command below:
make_lite_gw_pkt_fwd.bat

4. Download and run the lite Lora-gateway on WM-N-BM-22 by using the command below:
make_lite_gw_pkt_fwd.bat download run

)