

WM-N-BM-22

Lite Lora-gateway User Guide

Version: 1.3

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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

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1. Overview

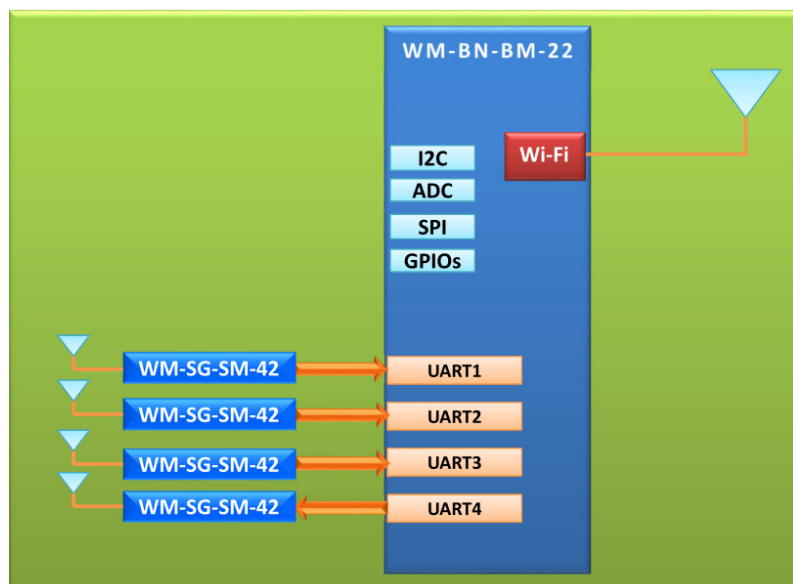
This document is for introduce the lite-gateway and how to set it up.

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.



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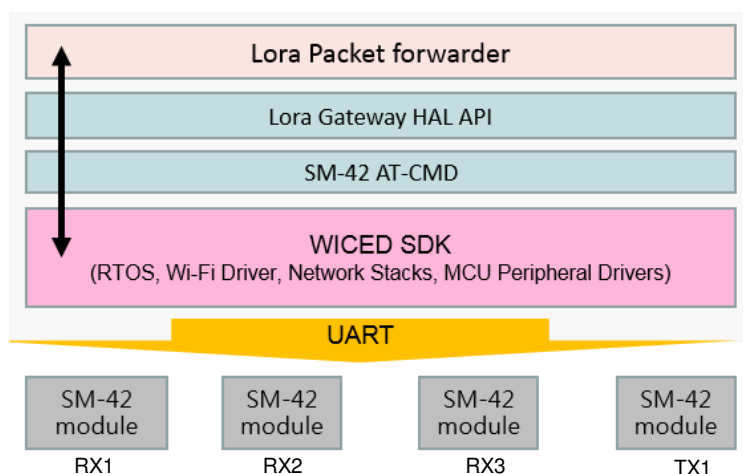
1.3 The software overview

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

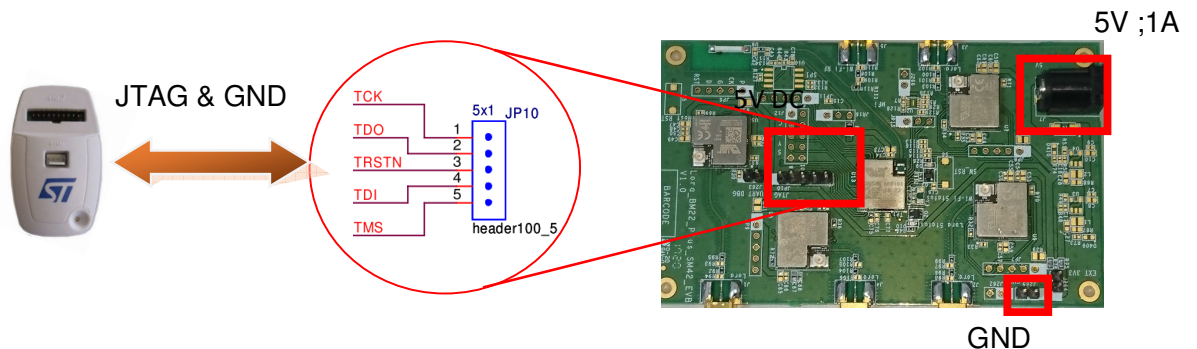
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2. Prebuild firmware images

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

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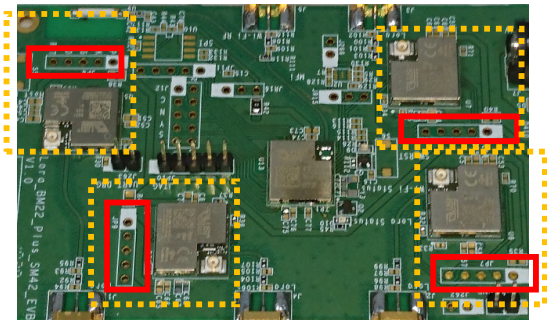
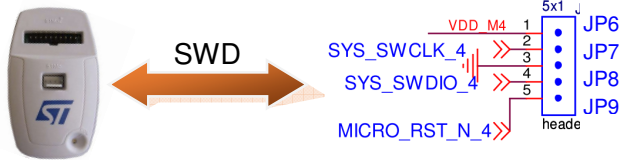
WICED™ Device Co

< Device Setup Starting to setup transmitter and receiver ...

Starting to setup the module on UART-2

lmm_setup_modem(): the SW version for LRWAN and FW on UART-2: 1.0.1 , 0.2.9
lmm_setup_modem(): the fw version of the device is too old.
Finished the setup for UART-2

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



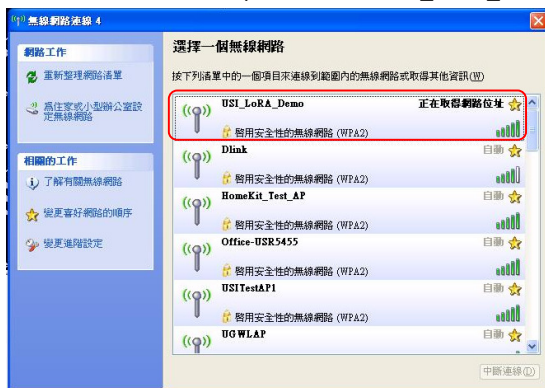
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3. Setup the lite Lora-gateway

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.
(192.168.0.1 is the IP address of the soft AP interface)
- 4) Click the LoraGW Setup to configure LoRA module



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< 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!

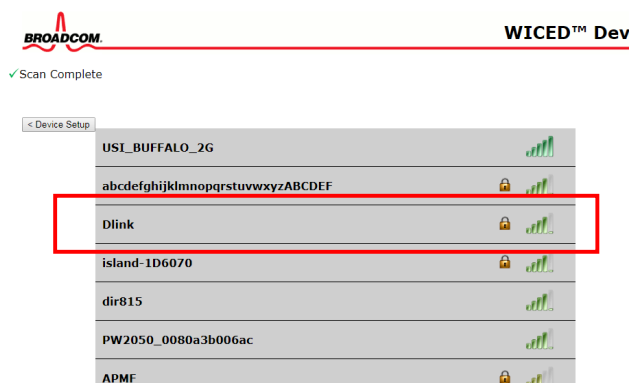
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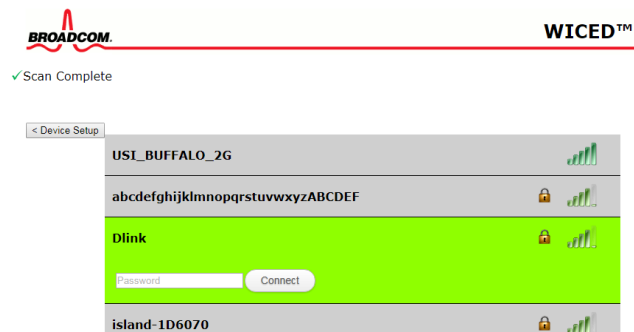
5) Click the Wi-Fi Setup button on the configuration home page.



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.



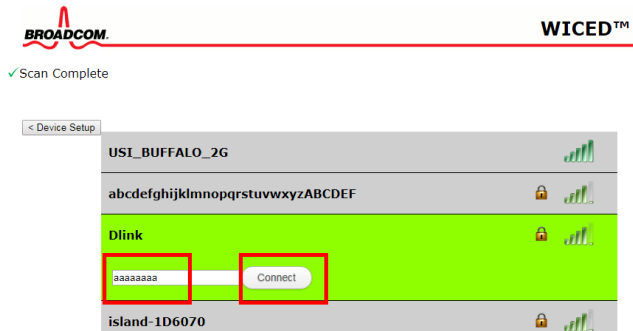
7) Find and click on a Wi-Fi AP which you want to join from the list and a password box will appears as below:



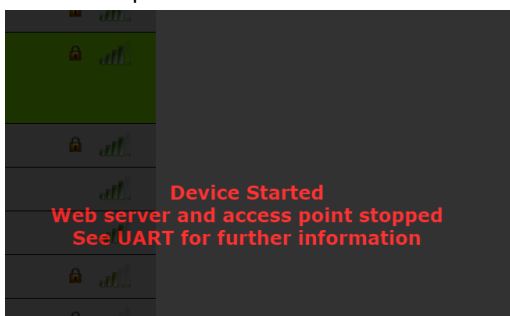
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- 8) Enter the password for the Wi-Fi AP in the password box, and then click button 'Connect'



- 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

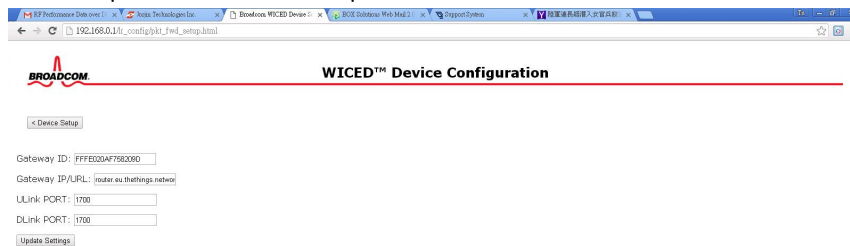
- 1) Click the packet forwarder button on the configuration home page.

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- 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.

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- 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:

Gateways > Register

REGISTER GATEWAY

Gateway EUI
The EUI of the gateway as read from the LoRa module

FF FE 02 0A F7 58 20 9E 8 bytes

☒ I'm using the legacy packet forwarder
Select this if you are using the legacy [Semtech packet forwarder](#).

Description
A human-readable description of the gateway

A Lite Lora-gateway

Frequency Plan
The [frequency plan](#) this gateway will use

Europe 868MHz

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Applications > Add Application

ADD APPLICATION

Application ID
The unique identifier of your application on the network

07 ✓

Description
A human readable description of your new app

My SM-42 network ✓

Application EUI
An application EUI will be issued for The Things Network block for convenience, you can add your own in the application settings page.

EUI issued by The Things Network

Handler registration
Select the handler you want to register this application to

ttn-handler-eu ✓

Cancel Add application

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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

Applications > 07

[Overview](#)
[Devices](#)
[Payload Formats](#)
[Integrations](#)
[Data](#)
[Settings](#)

APPLICATION OVERVIEW

[documentation](#)
Application ID 07
Description My SM-42 network
Created 3 seconds ago
Handler ttn-handler-eu (current handler)

APPLICATION EUIs

[manage euis](#)
<> 70 B3 D5 7E F0 00 5F E7

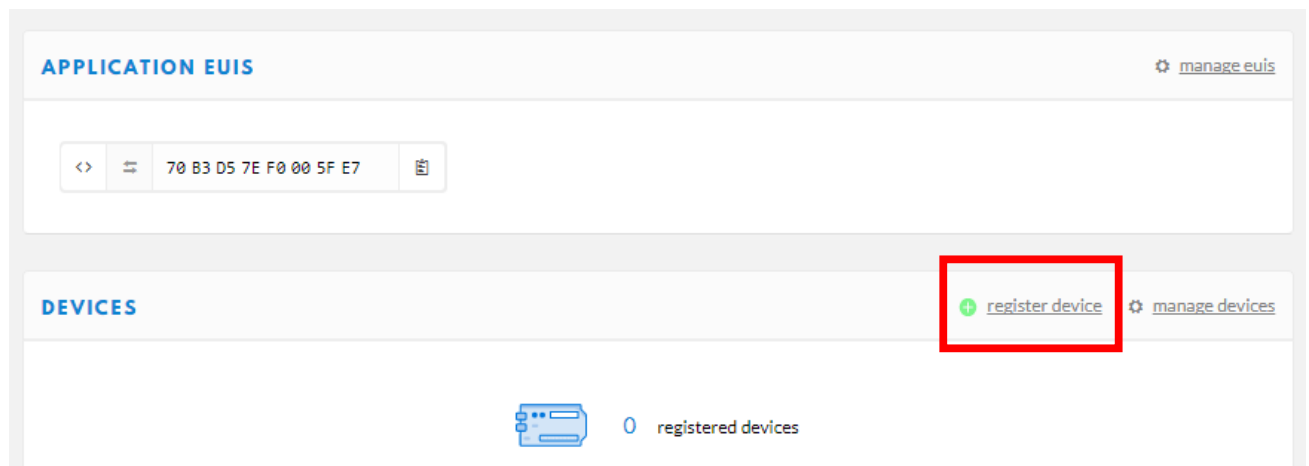
DEVICES

[register device](#)
[manage devices](#)
0 registered devices

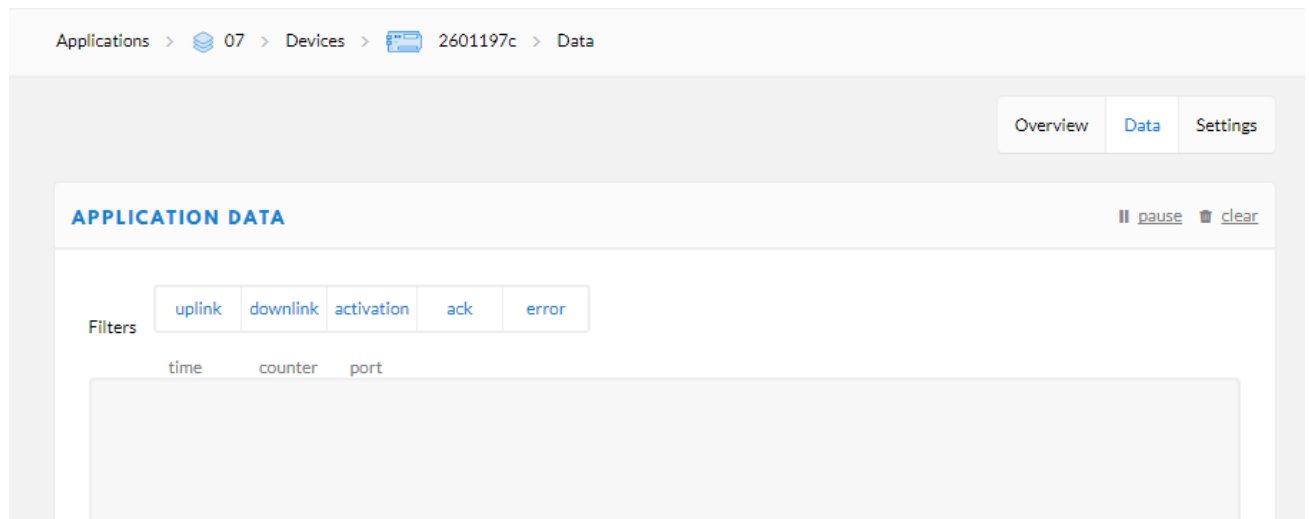
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- 4) After finish the application EUI setting, we need to join the SM-42 module in this application, please click the button 'register device' to starting the registration.



(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:

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```
# 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.

Applications > 07 > Devices > 2601197c > Data

Overview Data Settings

APPLICATION DATA || pause 🗑 clear

Filters uplink downlink activation ack error

	time	counter	port	
▲	20:21:15	3	7	payload: 12 34 56 78
▲	20:21:08	2	7	payload: 12 34 56 78

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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

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← → ↺ ⓘ 192.168.0.117/lite_gw_web/index.html

應用程式 將書籤放置在書籤列上，即可快速前往各個網頁。立即匯入書籤...

WM-N-BM-22 Lora Gateway Demonstration

Packet forwarder History Application Gateway Status	Packet Forwarding History							
	Time	Channel	CR	Datarate	SEQ	DevAddr	Size	Payload
	U 06:16:54	868.1	4/5	SF9BW125	9	26011600	17	40 00 16 01 26 00 09 00 07 AF CB 9B F4 DE E2 E4 A7
	U 06:11:17	868.3	4/5	SF9BW125	8	26011600	29	40 00 16 01 26 00 08 00 02 98 EA CB C8 F7 21 31 94 17 03 45 3F 22 2B 0A FB B3 74 51 68
	U 06:11:12	868.1	4/5	SF9BW125	7	26011600	29	40 00 16 01 26 00 07 00 02 1B 7B EA 2E 55 12 87 26 4D C2 52 51 7B 6A 12 99 FB 23 9C A2
	U 06:11:08	868.1	4/5	SF9BW125	6	26011600	29	40 00 16 01 26 00 06 00 02 BA B9 AF 90 28 3C C0 73 5A 6E CB 6D 8E 82 D1 A5 CF AC 90 E3
	U 06:10:58	868.1	4/5	SF9BW125	5	26011600	17	40 00 16 01 26 00 05 00 07 F0 75 38 A0 AA 77 8E F3
	U 06:10:14	868.1	4/5	SF9BW125	4	26011600	17	40 00 16 01 26 00 04 00 07 A9 A4 99 01 72 2D C5 EF
	U 06:10:08	868.1	4/5	SF9BW125	3	26011600	17	40 00 16 01 26 00 03 00 07 F8 69 82 8A FF 95 46 54
	U 06:09:16	868.1	4/5	SF9BW125	2	26011600	17	40 00 16 01 26 00 02 00 07 97 A4 FD 03 67 91 C2 B5
	U 06:08:57	868.3	4/5	SF9BW125	1	26011600	17	40 00 16 01 26 00 01 00 07 A1 AE FF 44 72 5E EE 96
	U 06:08:14	868.3	4/5	SF9BW125	7	26011600	17	40 00 16 01 26 00 07 00 07 09 4F BC 56 8F E5 7A 72
	U 06:07:19	868.3	4/5	SF9BW125	5	26011600	17	40 00 16 01 26 00 05 00 07 F0 75 38 A0 AA 77 8E F3
	U 06:05:40	868.5	4/5	SF9BW125	4	26011600	17	40 00 16 01 26 00 04 00 07 A9 A4 99 01 72 2D C5 EF
	U 06:05:24	868.3	4/5	SF9BW125	3	26011600	17	40 00 16 01 26 00 03 00 07 F8 69 82 8A FF 95 46 54
	U 06:04:48	868.1	4/5	SF9BW125	2	26011600	17	40 00 16 01 26 00 02 00 07 97 A4 FD 03 67 91 C2 B5
	U 06:04:06	868.3	4/5	SF9BW125	8	26011600	17	40 00 16 01 26 00 08 00 07 8A DE 9D B0 49 59 A6 1A
	U 06:03:37	868.3	4/5	SF9BW125	7	26011600	17	40 00 16 01 26 00 07 00 07 09 4F BC 56 8F E5 7A 72
	U 06:03:10	868.3	4/5	SF9BW125	6	26011600	17	40 00 16 01 26 00 06 00 07 A8 8D F9 E8 4C BB F0 12
	U 06:02:57	868.3	4/5	SF9BW125	5	26011600	17	40 00 16 01 26 00 05 00 07 F0 75 38 A0 AA 77 8E F3
	U 06:02:22	868.3	4/5	SF9BW125	4	26011600	17	40 00 16 01 26 00 04 00 07 A9 A4 99 01 72 2D C5 EF
	U 05:47:40	868.1	4/5	SF9BW125	3	26011600	17	40 00 16 01 26 00 03 00 07 F8 69 82 8A FF 95 46 54
	U 05:47:33	868.3	4/5	SF9BW125	2	26011600	17	40 00 16 01 26 00 02 00 07 97 A4 FD 03 67 91 C2 B5
	U 05:47:01	868.1	4/5	SF9BW125	1	26011600	29	40 00 16 01 26 00 01 00 02 B3 9A A9 3C 63 44 27 C6 EE DE 51 DB 55 00 66 9A A2 DB 29 7F
	U 00:48:43	868.3	4/5	SF9BW125	1	2601197C	17	40 7C 19 01 26 00 01 00 01 40 C5 69 4B 6D 22 B1 DE
	U 00:03:32	868.1	4/5	SF9BW125	2	2601197C	29	40 7C 19 01 26 00 02 00 02 69 15 10 0B 82 6B 40 04 8A 12 49 8E C9 2A 50 C4 A9 85 74 4F
	U 00:03:24	868.1	4/5	SF9BW125	1	2601197C	29	40 7C 19 01 26 00 01 00 02 52 F1 3F 33 59 FE 1C 79 1A 02 9D 38 64 FF 54 B6 F4 61 24 22

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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

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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>

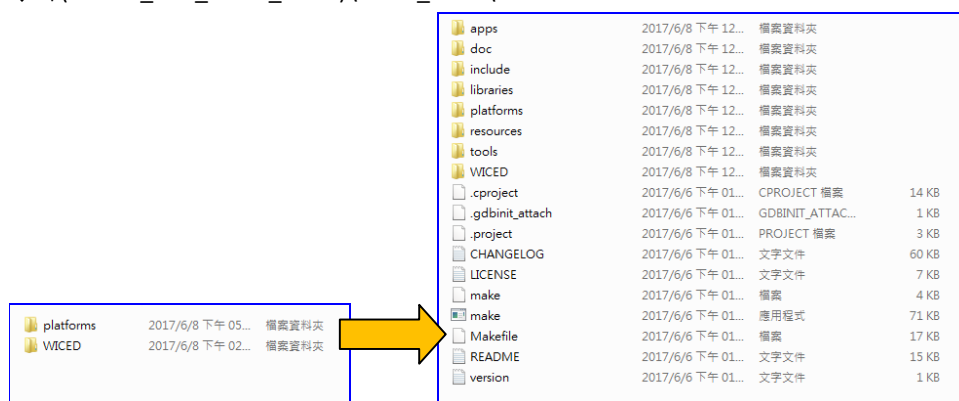
4.2 Install the platform patch for WM-N-BM-22

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

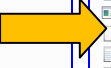
2. Unzip the platform patch package into the root path of WICED SDK (V4.x)as below:

\$(WICED_SDK_ROOT_PATH)\43xxx_Wi-Fi\

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名稱	修改日期	類型	大小
apps	2017/7/2 下午 01...	檔案資料夾	
libraries	2017/7/2 下午 01...	檔案資料夾	
resources	2017/7/2 下午 01...	檔案資料夾	
make_lite_gw_pkt_fwd	2017/6/29 上午 1...	Windows 批處理檔案	1 KB



apps	2017/6/8 下午 12...	檔案資料夾	
doc	2017/6/8 下午 12...	檔案資料夾	
include	2017/6/8 下午 12...	檔案資料夾	
libraries	2017/6/8 下午 12...	檔案資料夾	
platforms	2017/6/8 下午 12...	檔案資料夾	
resources	2017/6/8 下午 12...	檔案資料夾	
tools	2017/6/8 下午 12...	檔案資料夾	
WICED	2017/6/8 下午 12...	檔案資料夾	
.cproject	2017/6/6 下午 01...	CPROJECT 檔案	14 KB
.gdbinit_attach	2017/6/6 下午 01...	GDBINIT_ATTAC...	1 KB
.project	2017/6/6 下午 01...	PROJECT 檔案	3 KB
CHANGELOG	2017/6/6 下午 01...	文字文件	60 KB
LICENSE	2017/6/6 下午 01...	文字文件	7 KB
make	2017/6/6 下午 01...	檔案	4 KB
make	2017/6/6 下午 01...	應用程式	71 KB
Makefile	2017/6/6 下午 01...	檔案	17 KB
README	2017/6/6 下午 01...	文字文件	15 KB
version	2017/6/6 下午 01...	文字文件	1 KB

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.

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

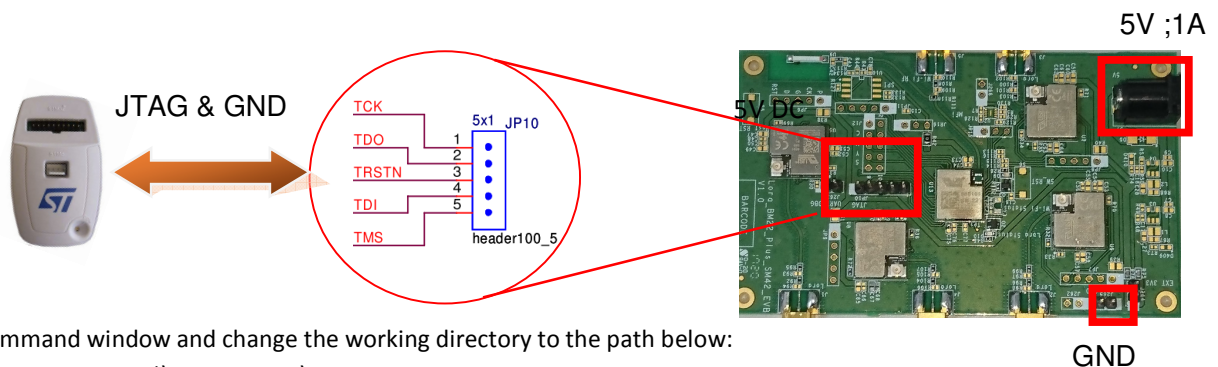
b) Please comment out this line which contains the description 'JTAG ?= BCM9WCD1EVAL1' (near by line #38) and insert a line contains the description below:

```

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

)