

UDK-CC2540

BLE-USB Dongle (BT02-2)

**Bluetooth Low Energy
Development Kit**

User Manual

DOC. VERSION 1.2

DIGIMORE ELECTRONICS CO., LTD
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Revision History		
Version	Revision Description	Date
1.0	Preliminary Version	2017-08-31
1.1	Update Pictures	2017-09-15
1.2	Modify the descriptions in - Chapter 4 - Appendix A-3	2017-10-25

Chapter 1 General Description

1.1 Description

BLE-USB Dongle (BT02-2) is a development kit for user to design Bluetooth Low Energy (BLE) application with integrated USB to the system with existing USB host.

BLE-USB Dongle (BT02-2) contains a Bluetooth module BT02-2 using TI Bluetooth low energy controller CC2540. TI CC2540 is a world-leading chip in Bluetooth Low Energy 4.0 and offers variety of peripherals such as USB, UART, SPI and Timer.

BLE-USB Dongle (BT02-2) also embeds a High-PSRR 300mA LDO, Buttons and LEDs, and General Purpose I/O Test Points. The Dongle can let user focus on their project development and verify the project easily and rapidly.



Chapter 2 Application

2.1 Application

- Bluetooth Low Energy Project Design and Verify
 - Rapid design End Product by importing the same module on the Dongle.
- Education Environment
- Quality Control Inspection Equipment for Assembly / Production line
- BLE Packet Capture Device with TI's PC Application SmartRF Protocol Packet Sniffer
- Concept or Prototype Demonstration Kit
- Pre Programmed Firmware of Dongle demonstrates a HostTestRelease application which acts as a Central Device (BLE Master). The Dongle creates a virtual serial port over the USB interface and supports to run with TI's PC Applications such as BTool or Device Monitor.

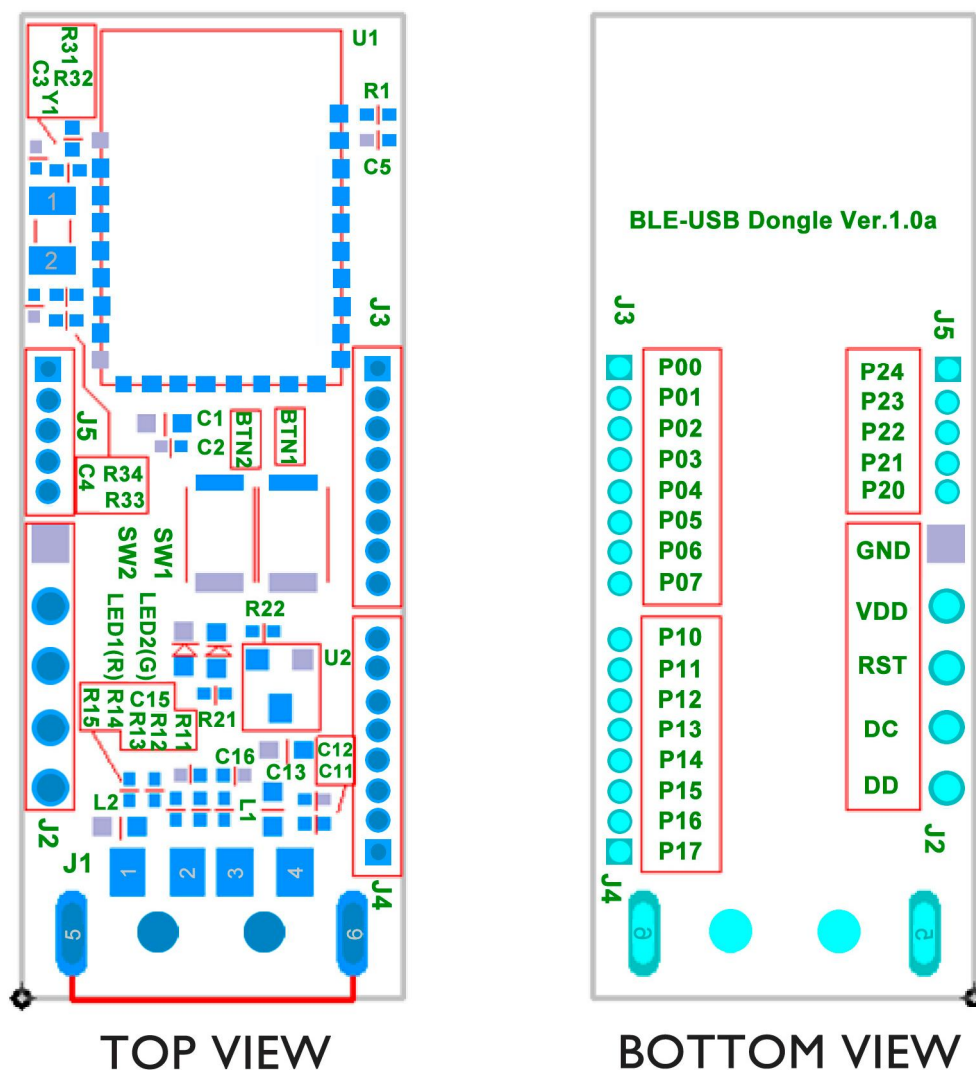
Chapter 3 Features

3.1 Features

- BT02-2 Bluetooth Module with TI CC2540
 - Bluetooth Version 4.0 low energy (LE, Single Mode) compliant.
 - High-Performance and Low-Power 8051 Microcontroller Core With Code Prefetch.
 - In-System-Programmable Flash, 256KB.
 - 12-Bit ADC With Eight Channels and Configurable Resolution.
 - 21 General Purpose I/O.
 - Full-Speed USB Interface.
 - Powerful USARTs With Support for Several Serial Protocols.
 - On Board PCB Antenna and Crystal.
 - Module Dimension: 14.8mm x 10mm.
- LDO
 - Fast Ultra High-PSRR, Low-Noise 300mA CMOS LDO.
 - 3.3V Output Voltage.
- Variety of Individual Test Point Sections
 - Flash Programming and Debugging.
 - General Purpose I/O (GPIO).
- Buttons and LEDs
 - Input / Output function control.
- Dongle Dimension: 16mm x 41mm (PCB)
16mm x 56mm (including USB Connector)

Chapter 4 Hardware Description

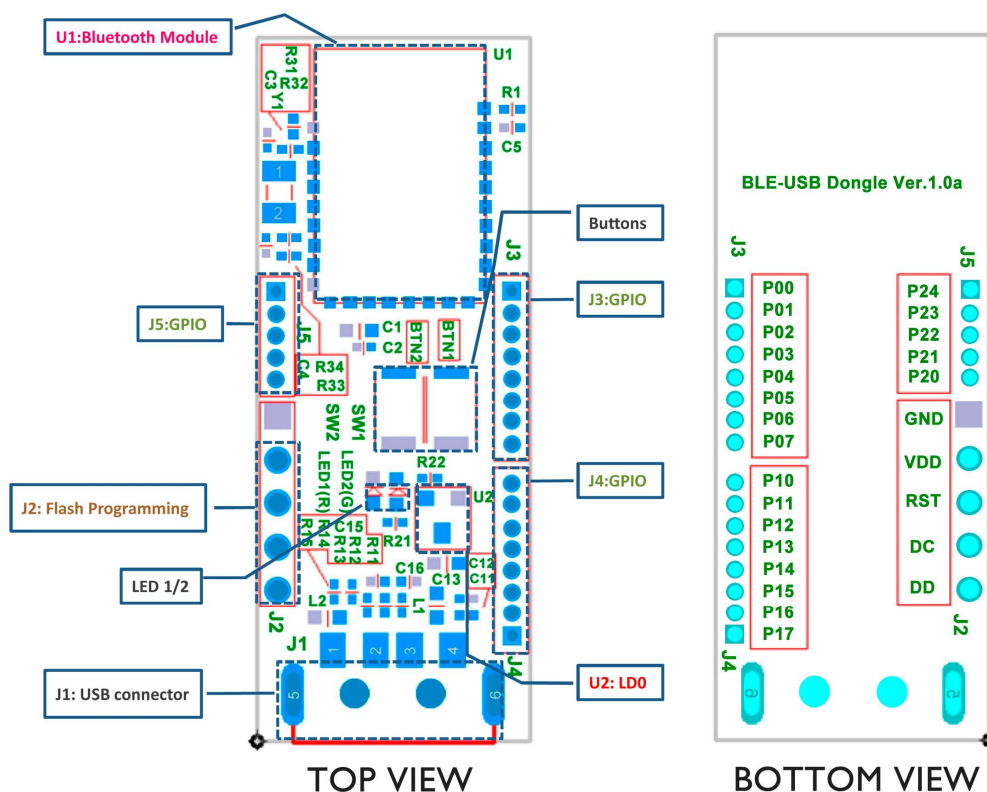
4.1 Hardware Placement



Note:

- The Dongle designs for variety of TI Bluetooth Low Energy chips.
e.g., BT02-2 embeds TI CC2540
HS-BT02-3 embeds TI CC2540T
(* The BT02-3 module is in PVT stage and the part no. may change.)
- In this document, it will introduce for the Dongle using CC2540.**
- The picture did not show the USB connector.

4.2 Hardware Definition



Flash Programming and Debugging

Marking Name	Description	Note
J2	<p>Contain 5 pins for Flash Programming and Debugging of CC2540.</p> <p>Marking Pins (BOTTOM VIEW) are GND, VDD, RST, DC and DD.</p> <p>** GND: Ground Pin for CC2540.</p> <p>** VDD: Power Supply Pin for CC2540. (Fix 3.3V by LDO)</p> <p>** RST: RESET_N pin of CC2540.</p> <p>** DC: Debug Clock (Port 2.2) Pin of CC2540.</p> <p>** DD: Debug Data (Port 2.1) Pin of CC2540.</p>	<ol style="list-style-type: none"> 1. Operate With TI CC Debugger 2. Refer to Chapter 6.3 for details 3. In pitch 2.54mm

GPIO

Marking Name	Description	Note
J3	<p>Contain I/O Port 0.0 to Port 0.7 of CC2540.</p> <p>Marking Pins (BOTTOM VIEW) are P00 to P07.</p>	In pitch 1.27mm
J4	<p>Contain I/O Port 1.0 to Port 1.7 of CC2540.</p> <p>Marking Pins (BOTTOM VIEW) are P10 to P17.</p>	In pitch 1.27mm

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J5	Contain I/O Port 2.0 to Port 2.4 of CC2540. Marking Pins (BOTTOM VIEW) are P20 to P24. ** For I/O Port 2.3 and Port 2.4, they are used for Crystal 32.768K Hz while shipped.	In pitch 1.27mm
----	--	-----------------

Buttons		
Marking Name	Description	Note
BTN1 (SW1)	Button Input for User Application. ** BTN1 connects to Port 1.2 of CC2540. ** Active Low.	—
BTN2 (SW2)	Button Input for User Application. ** BTN2 connects to Port 1.3 of CC2540. ** Active Low.	—

LEDs		
Marking Name	Description	Note
LED1 (R)	LED Operation for User Application. ** LED1 connects to Port 1.1 of CC2540. ** Active High. ** In color Red.	In demonstrated HostTestRelease FW, LED1 (R) configures as Active High (On).
LED2 (G)	LED Operation for User Application. ** LED2 connects to Port 0.0 of CC2540. ** Active Low. ** In color Green.	—

Auxiliary Units		
Marking Name	Description	Note
U1	Bluetooth Module BT02-2 with TI CC2540. ** Dimension: 14.8mm x 10mm.	—
U2	Fast Ultra High-PSRR, Low-Noise 300mA CMOS LDO 3.3V Output Voltage.	—
J1	USB Type A Plug (Male) Connector.	—

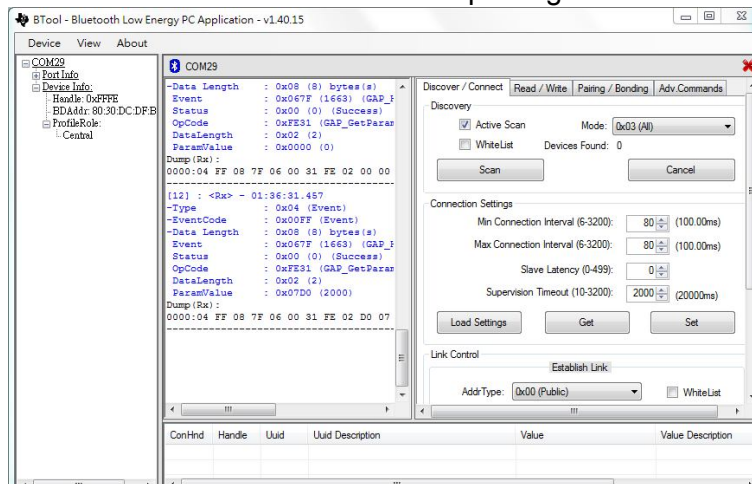
Chapter 5 Getting Started with BLE-USB Dongle (BT02-2)

5.1 Introduction

The Dongle ships with a HostTestRelease application as demonstration which acts as a Central Device (BLE Master). The Dongle creates a virtual serial port over the USB interface and supports to run with TI's PC Applications such as BTool or Device Monitor. Based on this demonstration, you can get started with Bluetooth Low Energy (BLE) Application.

In this chapter, it will guide you through the several steps required to get familiar with the Dongle. There are some of hardware devices or tools that can be used for using current demonstration application or developing your own application at later days. For the Dongle, you can use these ways to get started:

1. Demonstrate / Develop using TI BTool and BLE LaunchPad (BT01-2):



2. Demonstrate / Develop using Virtual Com Port (Serial Port) Tool Application (For BLE LaunchPad (BT01-2) Use).

5.2 Hardware and Software Setup

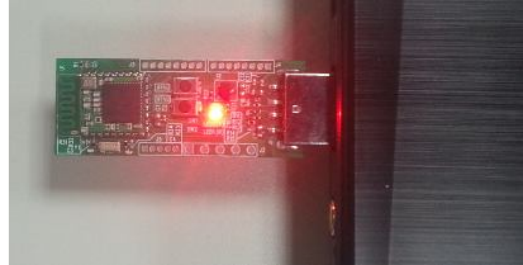
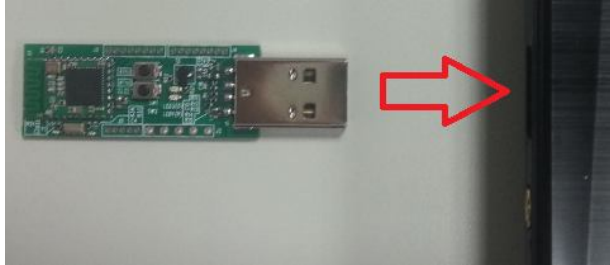
1. Install TI BTool

TI BTool is a Windows application that allows you to control a central device using the serial interface and perform various BLE functions while connected to a peripheral device, e.g., **BLE LaunchPad (BT01-2)** shown above.

For the installation of TI BTool, it can be installed automatically while you install the TI BLE-Stack. About TI BLE-Stack, please download it at TI website www.ti.com/ble-stack.

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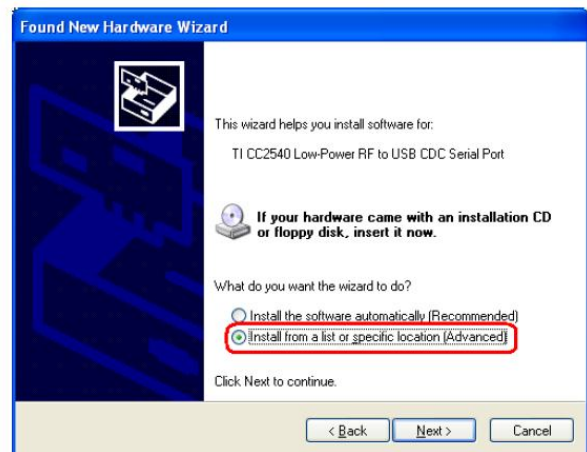
2. Connect (Insert) the Dongle into Laptop or Desktop Computer.
 - a. The LED1 (R) will be lit Red.



- b. After the BLE-Stack software (including BTool) installation is complete, the USB dongle driver is associated with the Dongle to use the BTool application.
** If the driver did not associate with the Dongle, e.g., a message pops up indicating that Windows does not recognize the Dongle, please associate the driver to the Dongle by the specific path in TI folder.



** Do not choose via Windows Update

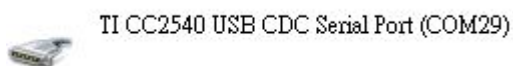


** Install the Driver via specific path [Advanced]

The USB driver can be found in the Accessories\ Drivers folder in the default install directory of BLE-Stack. Select the following directory (assuming the default installation path was used):

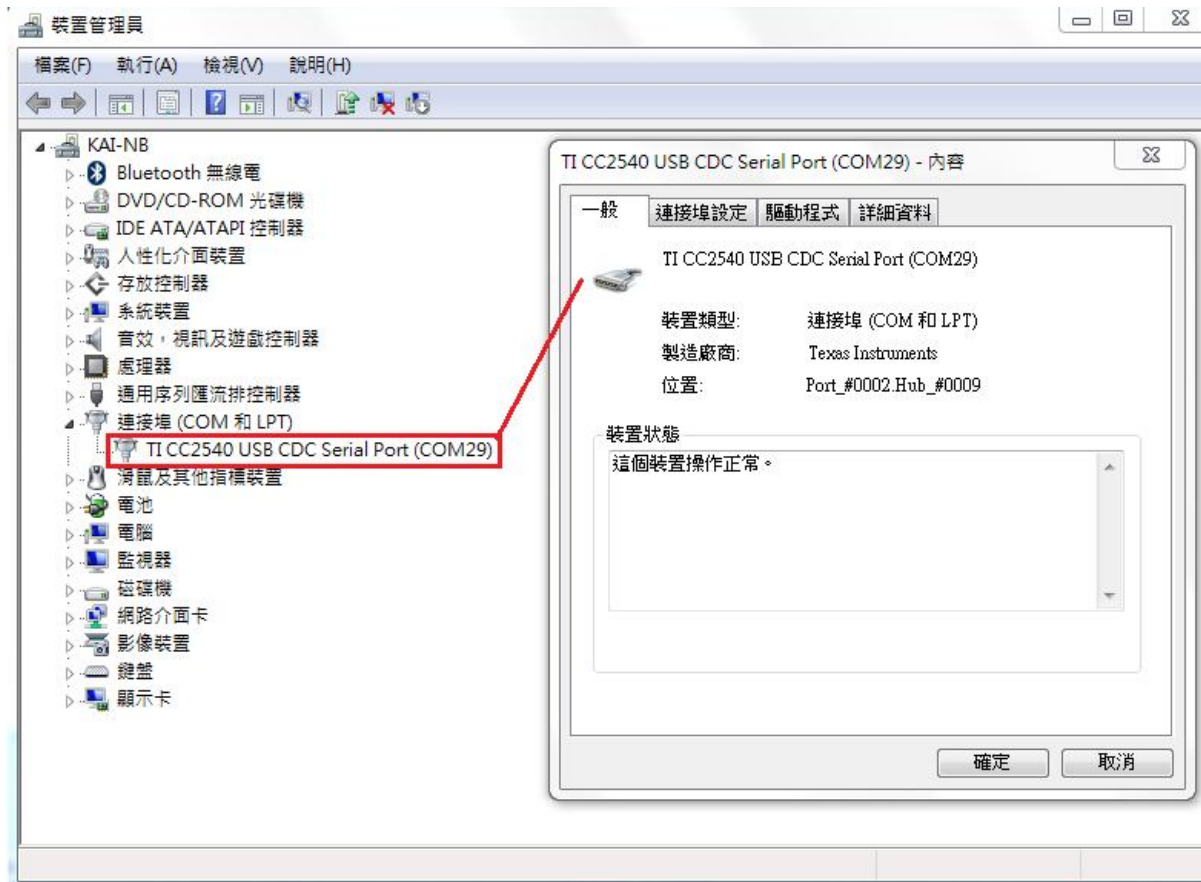
C:\Texas Instruments\BLE-CC254x-1.4.2.2\Accessories\Drivers

After the USB CDC driver installation, Windows will show the Dongle as TI CC2540 USB CDC Serial Port as below.



3. After you have completed the Dongle driver association above, please find the COM port of Dongle assigned by Windows. Please check your Windows Device Manager for information as below.

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** Dongle will operate as a USB CDC Serial Port, e.g., COM29 as above.

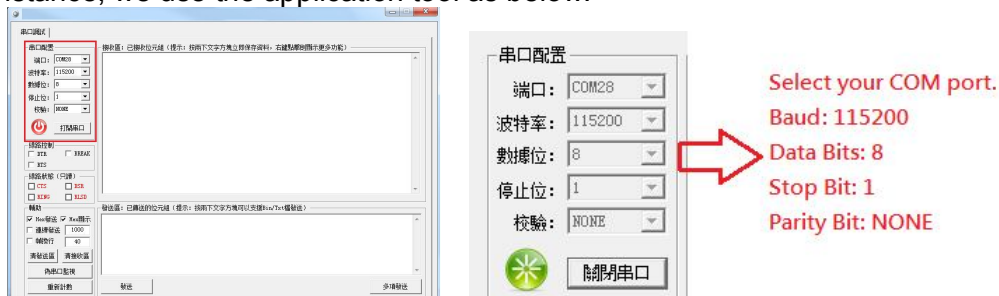
** Take note of this port number, as it will be needed in order to use with TI BTool.

4. Virtual Com Port (Serial Port) Application (For **BLE LaunchPad (BT01-2)** Use)

While you are using the demonstrated application (BLE-UART bridge) of **BLE LaunchPad (BT01-2)**, you will need a virtual com port (serial port) application on your Laptop or Desktop Computer.

This virtual com port (serial port) application communicates with FT232R and FT232R communicates with the Bluetooth Low Energy Application by UART.

For instance, we use the application tool as below:



** The demonstration uses the baud in 115200 and the format is 8-N-1.

** If you are using the demonstration, please follow the setting value above.

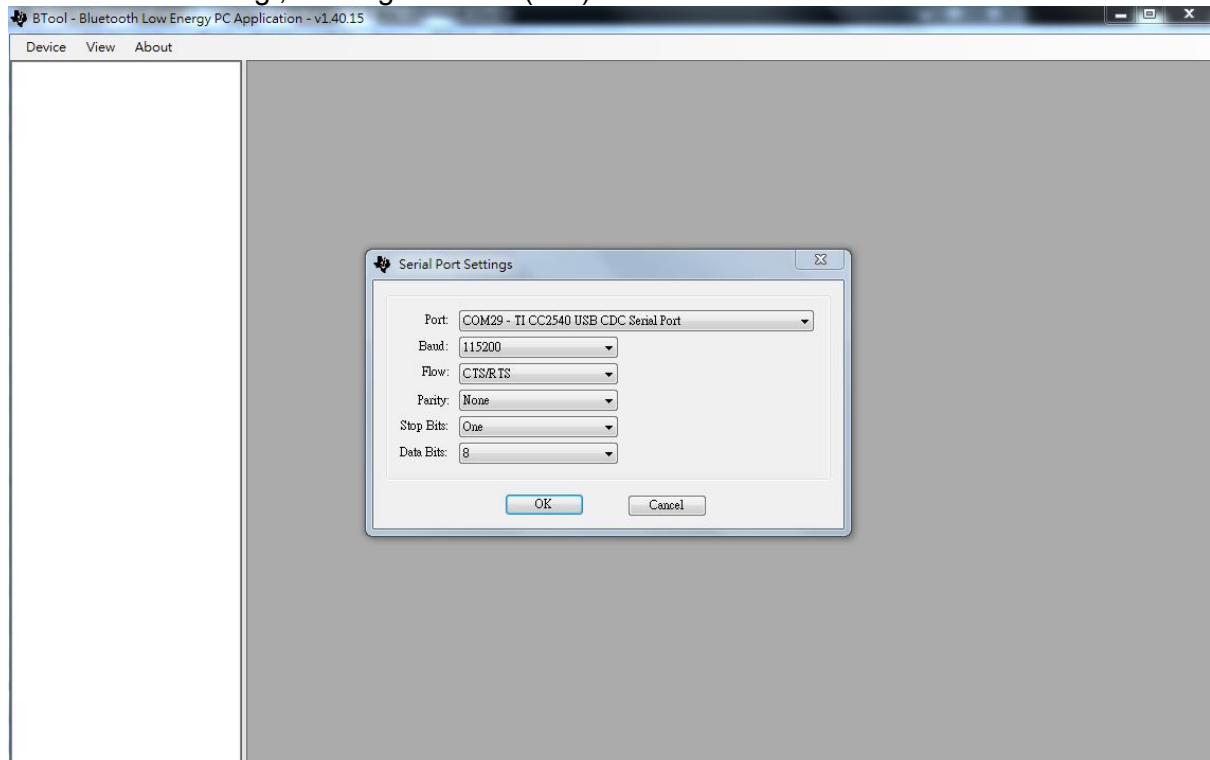
UDK-CC2540 BLE-USB Dongle (BT02-2)

Bluetooth Low Energy Development Kit

5. Demonstrate / Develop using **TI BTool** and **BLE LaunchPad (BT01-2)**:
 - a. For the installation of **BLE LaunchPad (BT01-2)**, please refer to the user manual of BLE LaunchPad (BT01-2).
 - b. **TI BTool** is a Windows application that allows you to control a central device using the serial interface and perform various BLE functions while connected to a peripheral device.
** In this demonstration,
Central Device: BLE-USB Dongle
Peripheral Device: BLE LaunchPad
 - c. Connect your Dongle and control by BTool, please follow these steps:
Step 1
Start (Execute) BTool



** Start with the Shortcut Icon or specific path you installed,
e.g., C:\Program Files (x86)\Texas Instruments\BTool

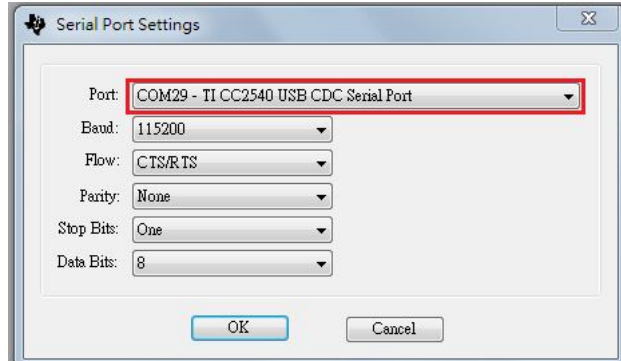


UDK-CC2540 BLE-USB Dongle (BT02-2) Bluetooth Low Energy Development Kit

Step 2

Set the Serial Port of Dongle

- Choose the COM port No. you noted from Windows Device Manager.
- Parameters use default value or refer to the picture below



Select the COM No. of your BLE-USB Dongle (HS-BT02-2)

Baud: 115200

Flow: CTS/RTS

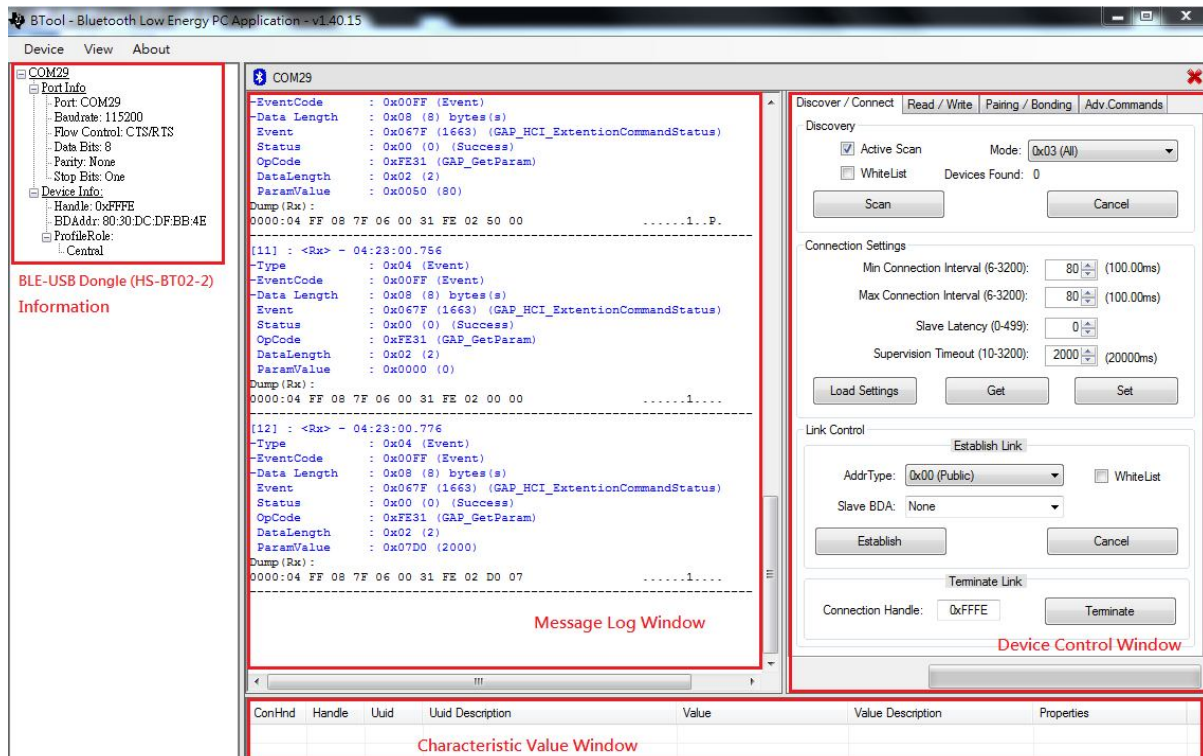
Parity: None

Stop Bits: One

Data Bits: 8

After the process above, you will see the BTool as the overview picture shown below.

- The left window shows the Dongle Information.
- The middle window shows the message log between BTool and Dongle.
- The right window shows the Parameter and Function for Device Control.
- The bottom window shows the characteristic value operates with the device in peripheral role you connected.



5.3 Demonstration

In the Pre Programmed Firmware of Dongle, it demonstrates a HostTestRelease application which acts as a Central Device (BLE Master) and controls by TI BTool. In this section, we will introduce the demonstration that the Dongle and BTool collocate with BLE LaunchPad (BT01-2).

For the demonstrated application of BLE LaunchPad (BT01-2), it offers several functions for demonstration including of Bluetooth Low Energy transmission or digital operation functions. For instance, you can observe BLE-UART bridge function, Button State via BLE and LED brightness by PWM. For detail description of BLE LaunchPad (BT01-2), please refer to the user manual of LaunchPad.

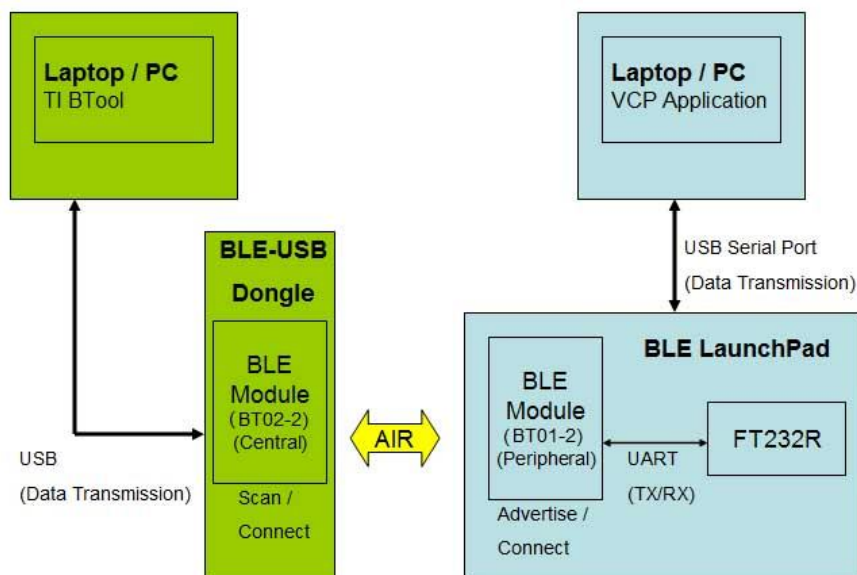
1. BLE-UART bridge function

In Bluetooth classic (BR/EDR) systems, a Serial Port Profile (SPP) is an adopted profile defined by the Bluetooth Special Interest Group (SIG) used to emulate a serial port connection over a Bluetooth wireless connection. For Bluetooth low energy systems, an adopted profile for implementing SPP over BLE is undefined, thus emulation of a serial port must be implemented as a vendor-specific custom profile.

The BLE-UART bridge function herein demonstrates for SPP over BLE implementation by using the environments (tools) as below.

Using **TI BTool** and **BLE LaunchPad (BT01-2)**:

The block diagram of this demonstration is shown below.



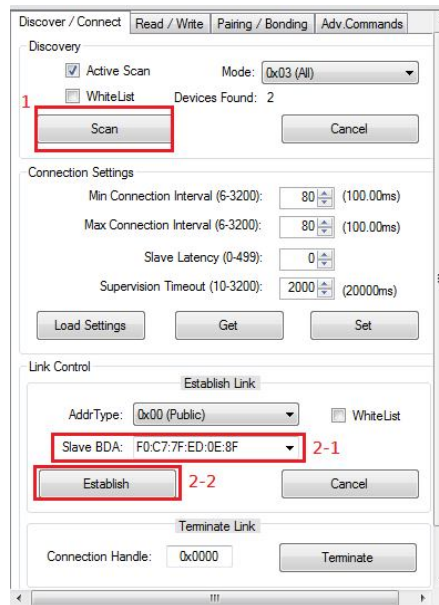
Before the process below, please

- Refer to Chapter 5.2 for installation and operation of the Dongle and BTool.
- Refer to Chapter 5.2 and the user manual of LaunchPad for installation and operation of the LaunchPad.

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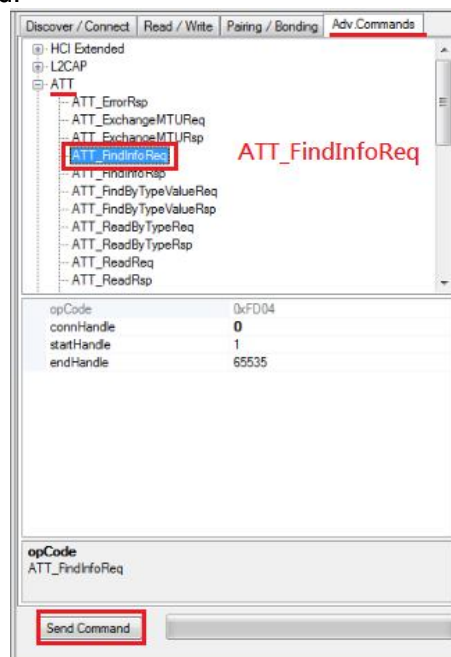
Step 1:

- Connect the LaunchPad by BTool.
- Select Discover / Connect Tab Window
- Press “Scan” Button
- Select Slave BDA of the LaunchPad
- Press “Establish” button



Step 2:

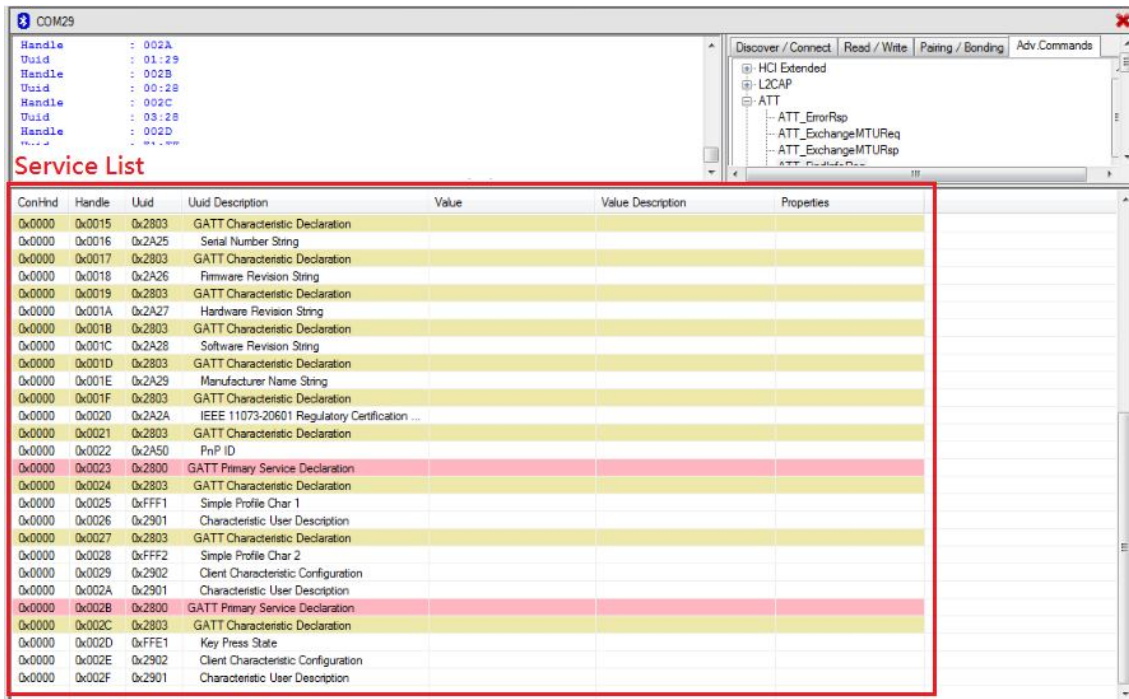
- Choose the “Adv. Commands” Tab Window.
- Select the “ATT_FindInfoReq” command inner the “ATT” block.
- You can double click the command area or press “Send Command” button to send the command.



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Step 3

Extend the bottom window on BTool, you can find all of Service List of the LaunchPad.

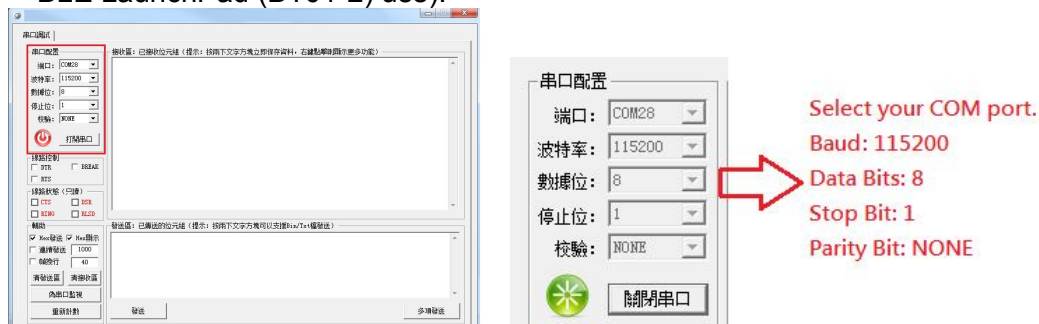


** To read the content in service list: Single Click the row.

** To write the content in service list: Double Click the row.

Step 4

Ensure your Virtual Com Port (Serial Port) Application is ready to work. (For BLE LaunchPad (BT01-2) use).



** The demonstration uses the baud in 115200 and the format is 8-N-1.

Step 5

For the service of BLE-UART bridge function, you can refer to UUID 0xFFFF1 and 0xFFFF2 shown in the picture below.

0x0000	0x0023	0x2800	GATT Primary Service Declaration	F0 FF	
0x0000	0x0024	0x2803	GATT Characteristic Declaration	0A 25 00 F1 FF	
0x0000	0x0025	0xFFFF1	Simple Profile Char 1	00 00	Rd Wr 0x0A
0x0000	0x0026	0x2901	Characteristic User Description	APP_10_BLE_UART_Tx	
0x0000	0x0027	0x2803	GATT Characteristic Declaration	10 28 00 F2 FF	
0x0000	0x0028	0xFFFF2	Simple Profile Char 2		Nfy 0x10
0x0000	0x0029	0x2902	Client Characteristic Configuration	00 00	
0x0000	0x002A	0x2901	Characteristic User Description	BLE_UART_Rx_10_APP	

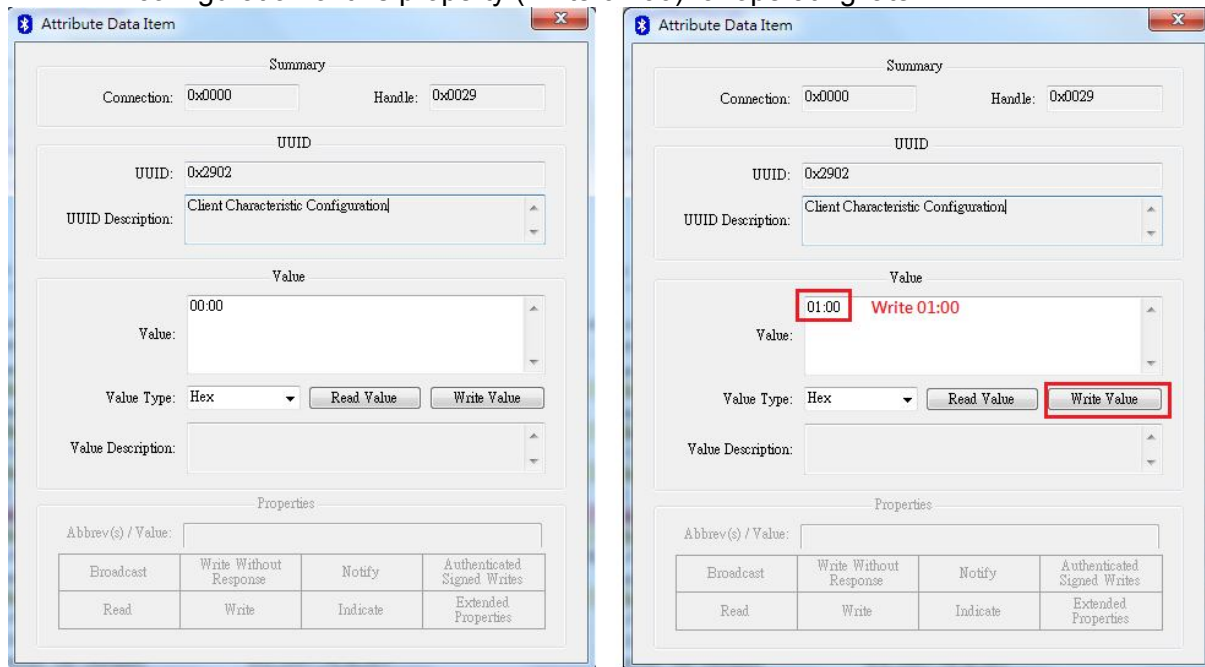
** UUID 0xFFFF1:

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- Description is APP_to_BLE_UART_Tx.
- This operation transmission way is:
BTool → BLE-USB Dongle → AIR Transmission →
LaunchPad → Virtual Com Port Application
- The maximum payload is 20 Bytes.
- ** UUID 0xFFFF2:
- Description is BLE_UART_Rx_to_App.
- This operation transmission way is:
Virtual Com Port Application → LaunchPad → AIR Transmission →
BLE-USB Dongle → BTool
- The maximum payload is 20 Bytes.

Step 6

UUID 0xFFFF2 uses the property in Notification. Please enable the configuration of this property (Write 01:00) for operating later.



0x0000	0x0023	0x2800	GATT Primary Service Declaration	F0.FF		
0x0000	0x0024	0x2803	GATT Characteristic Declaration	0A:25:00:F1:FF		
0x0000	0x0025	0xFFFF1	Simple Profile Char 1	00:00:00:00:00:00:00:00:00:00:00:00:00:00:00:00:00:00		Rd Wr 0x0A
0x0000	0x0026	0x2901	Characteristic User Description	APP_to_BLE_UART_Tx		
0x0000	0x0027	0x2803	GATT Characteristic Declaration	10:28:00:F2:FF		
0x0000	0x0028	0xFFFF2	Simple Profile Char 2	01:00	Ensure the content is 01:00	Nfy 0x10
0x0000	0x0029	0x2902	Client Characteristic Configuration			
0x0000	0x002A	0x2901	Characteristic User Description	BLE_UART_Rx_to_APP		

Step 7

UUID 0xFFFF1 Operation

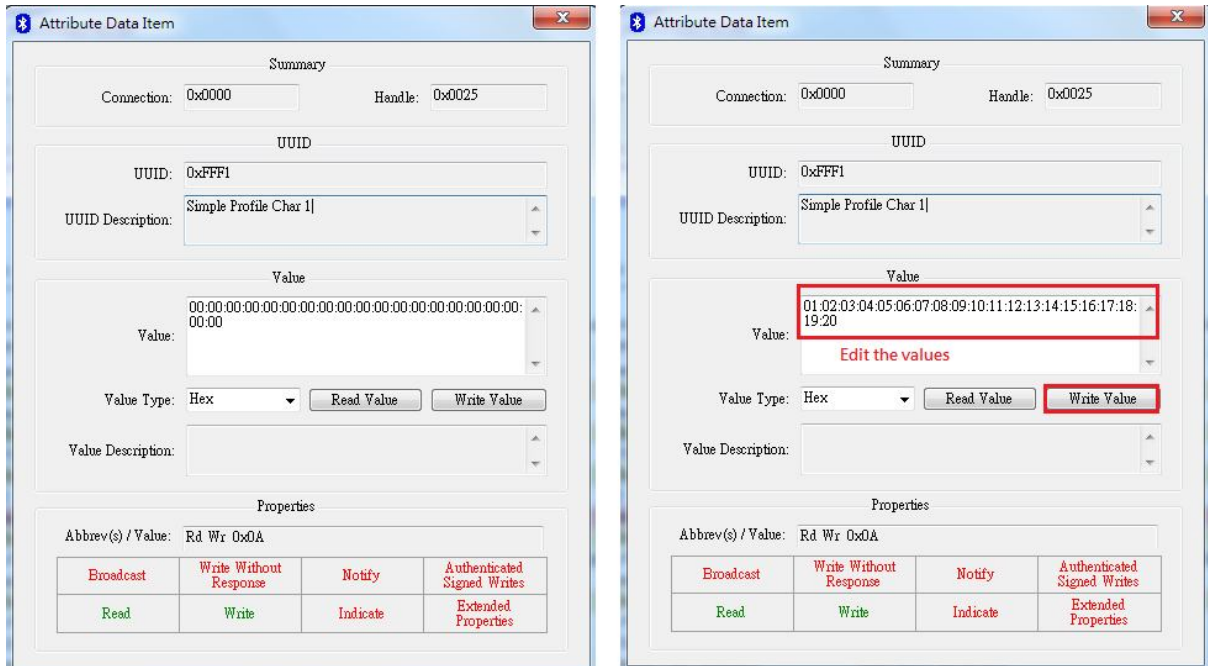
(BTool → BLE-USB Dongle → AIR Transmission →
LaunchPad → Virtual Com Port Application)

- Double click the row of UUID 0xFFFF1.

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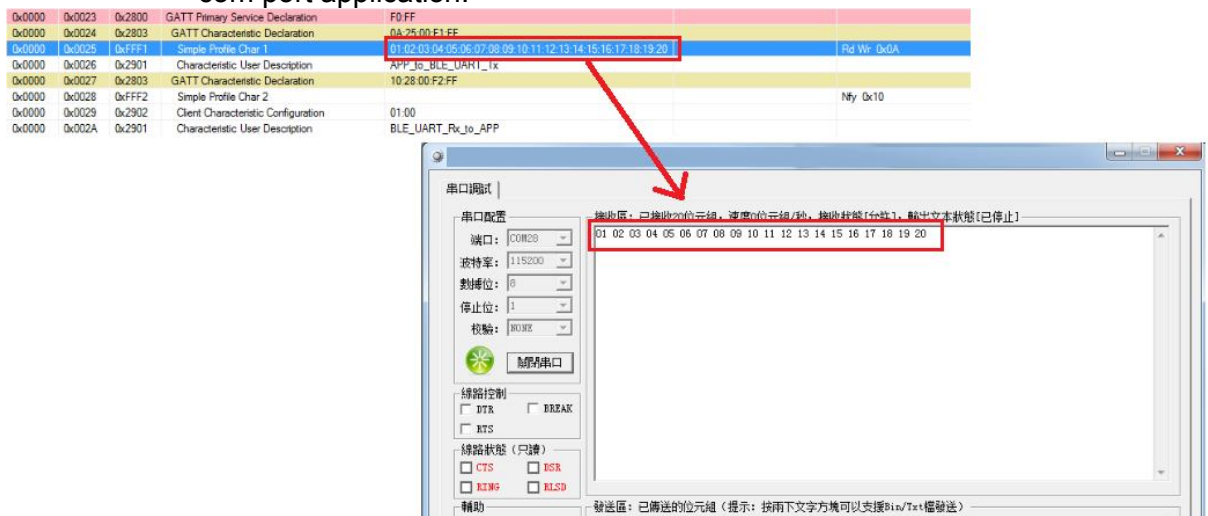
0x0000	0x0023	0x2800	GATT Primary Service Declaration	F0 FF		
0x0000	0x0024	0x2803	GATT Characteristic Declaration	0A 25 00 F1 FF		
0x0000	0x0025	0xFF01	Simple Profile Char 1	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	- Double click	Rd Wr 0x0A
0x0000	0x0026	0x2901	Characteristic User Description	APP_Io_BLE_UART_Tx		
0x0000	0x0027	0x2803	GATT Characteristic Declaration	10 28 00 F2 FF		
0x0000	0x0028	0xFF02	Simple Profile Char 2			Nfy 0x10
0x0000	0x0029	0x2902	Client Characteristic Configuration	00 00		
0x0000	0x002A	0x2901	Characteristic User Description	BLE_UART_Rx_Io_APP		

- Edit the value you want to transmit on the BTool and then press “Write Value” button.



** In this instance, we use 20 bytes data and the data structure is in 01:02:03:04:05:06:07:08:09:10:11:12:13:14:15:16:17:18:19:20.

- After the operation, you can observe the data is transmitted to your virtual com port application.



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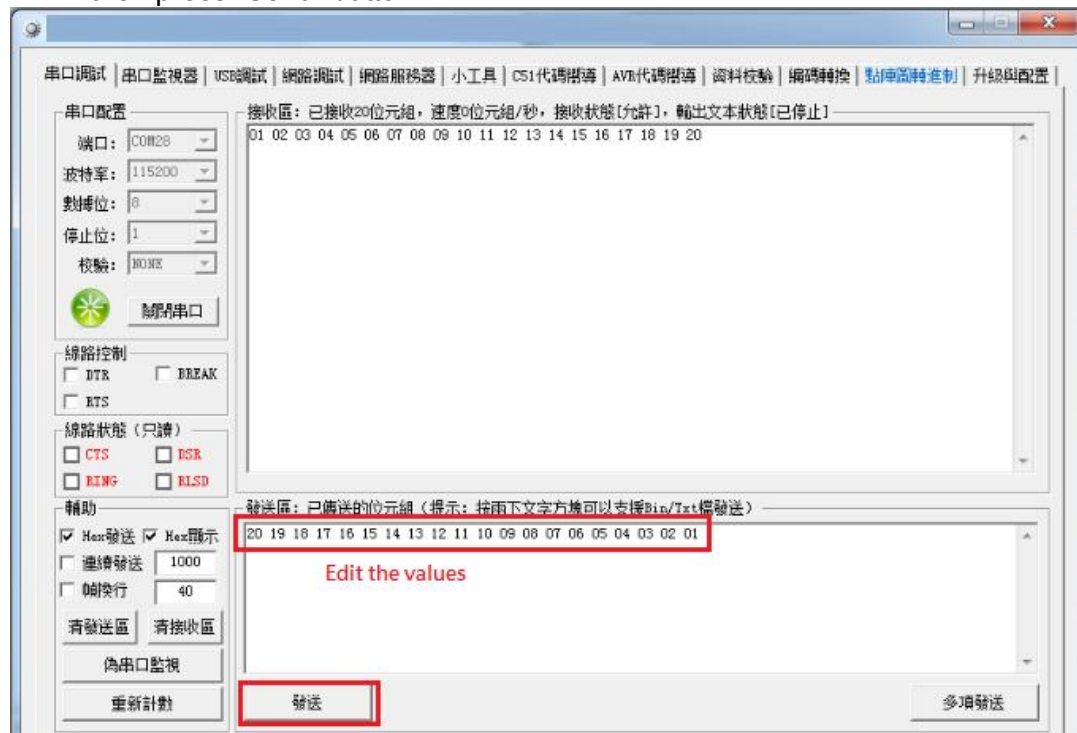
Step 8

UUID 0xFFFF2 Operation

(Virtual Com Port Application → LaunchPad → AIR Transmission → BLE-USB Dongle → BTool)

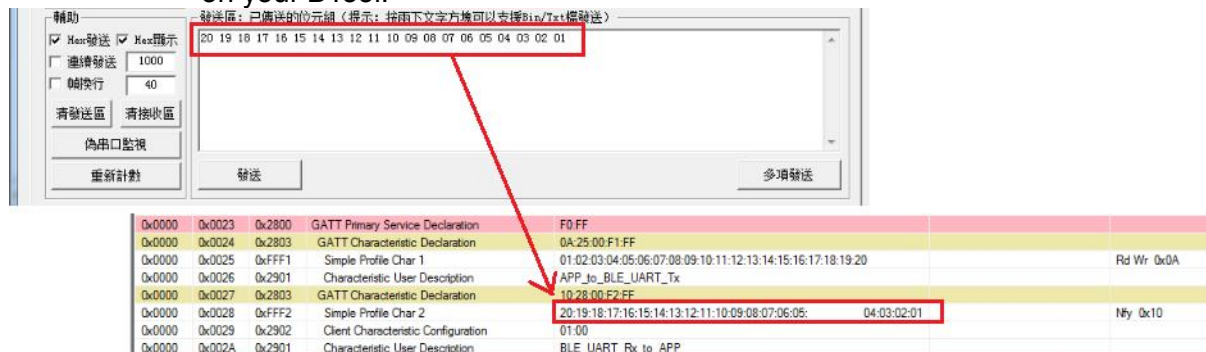
** Note: You have to enable the configuration of Notification in Step 6.

- Edit the value you want to transmit on the virtual com port application and then press "Send" button.



** In this instance, we use 20 bytes data and the data structure is in 20 19 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03 02 01.

- After the operation, you can observe the data is transmitted to UUID 0xFFFF2 on your BTool.



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2. Button State via BLE

Base on the LaunchPad embeds two physical buttons for application, we can use Dongle and BTool to receive the button state via BLE. Similar to BLE-UART bridge function we describe above, we will demonstrate Button State via BLE implementation by using the environments (tools) as below. Before the description below, please setup your hardware and software in chapter 5.2. You also need to refer several prior steps in description of BLE-UART bridge function for connecting LaunchPad and finding services.

Using TI BTool and BLE LaunchPad (BT01-2):

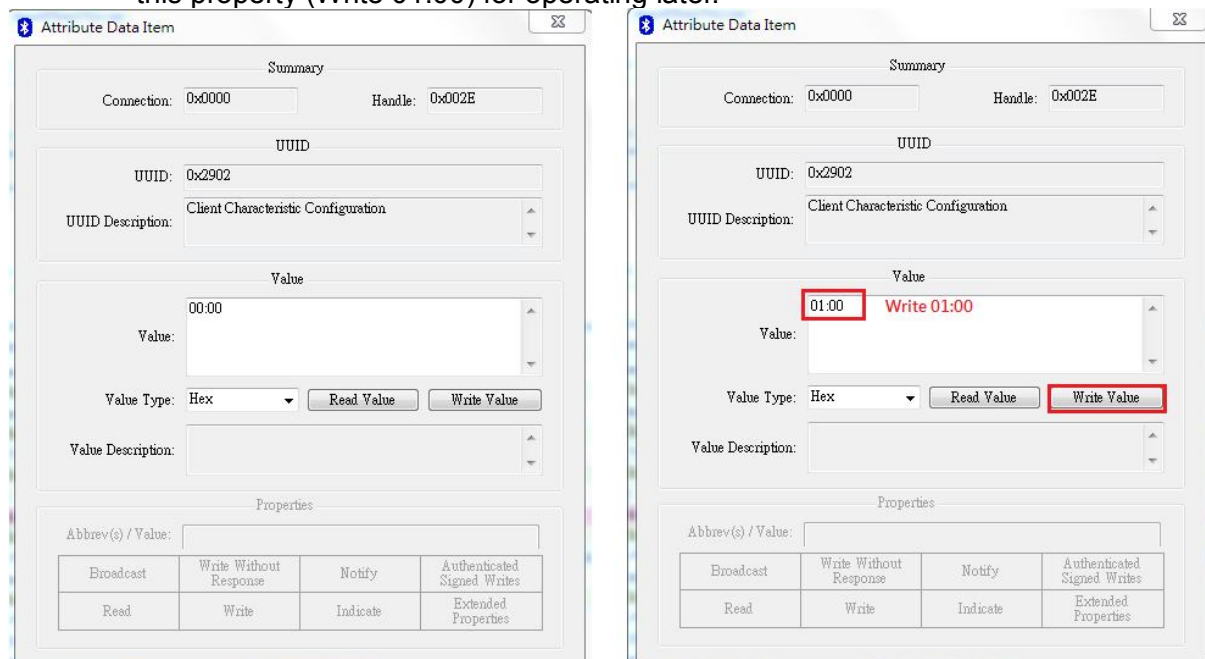
After connecting the LaunchPad by BTool, you can find the service of Button State in UUID 0xFFE1 shown in the picture below.

0x0000	0x002B	0x2800	GATT Primary Service Declaration	E0:FF		
0x0000	0x002C	0x2803	GATT Characteristic Declaration	10:2D:00:E1:FF		
0x0000	0x002D	0xFFE1	Key Press State			Nfy 0x10
0x0000	0x002E	0x2902	Client Characteristic Configuration	00:00		
0x0000	0x002F	0x2901	Characteristic User Description	Key Press State		

** UUID 0xFFE1

- Description is Key Press State.
- This operation transmission way is:
Button Activities on LaunchPad → AIR Transmission →
BLE-USB Dongle → BTool

UUID 0xFFE1 uses the property in Notification. Please enable the configuration of this property (Write 01:00) for operating later.



0x0000	0x002B	0x2800	GATT Primary Service Declaration	E0:FF		
0x0000	0x002C	0x2803	GATT Characteristic Declaration	10:2D:00:E1:FF		
0x0000	0x002D	0xFFE1	Key Press State			Nfy 0x10
0x0000	0x002E	0x2902	Client Characteristic Configuration	01:00	— Ensure the content is 01:00	
0x0000	0x002F	0x2901	Characteristic User Description	Key Press State		

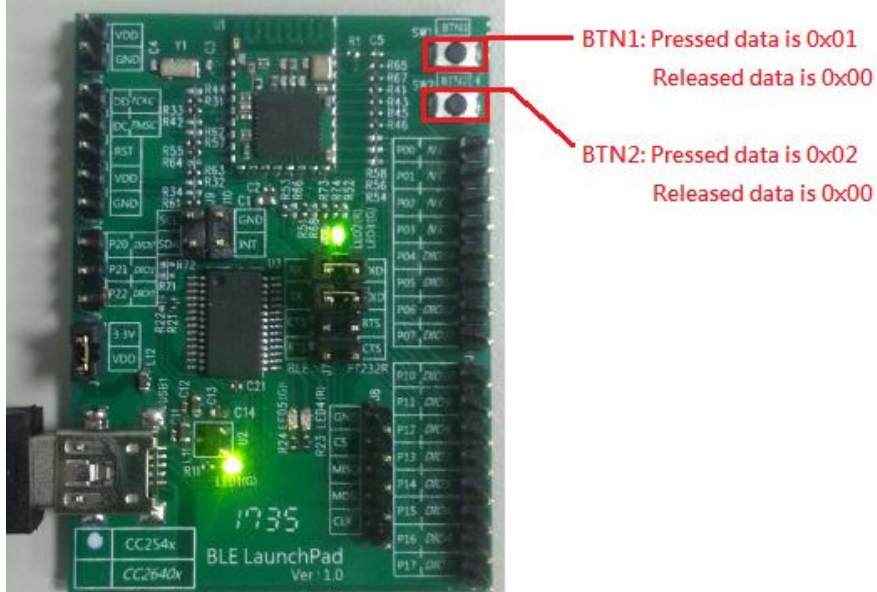
For the UUID 0xFFE1 Operation

(Button Activities on LaunchPad → AIR Transmission →

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BLE-USB Dongle → BTool)

- Operate (Press / Release) the physical buttons BTN1 or BTN2 on the LaunchPad.



- By changing the states of Button Activities on LaunchPad, you can observe the different states (values) in the UUID 0xFFE1. In the picture below, we capture four states including the initial state (No BTN is pressing), BTN1 is pressing, BTN2 is pressing and BTN1 + BTN2 are pressing.

0x0000	0x002B	0x2800	GATT Primary Service Declaration	E0:FF		
0x0000	0x002C	0x2803	GATT Characteristic Declaration	10:2D:00:E1:FF		
0x0000	0x002D	0xFFE1	Key Press State	00	No BTN is pressing	Nfy 0x10
0x0000	0x002E	0x2902	Client Characteristic Configuration	01:00		
0x0000	0x002F	0x2901	Characteristic User Description	Key Press State		
0x0000	0x002B	0x2800	GATT Primary Service Declaration	E0:FF		
0x0000	0x002C	0x2803	GATT Characteristic Declaration	10:2D:00:E1:FF		
0x0000	0x002D	0xFFE1	Key Press State	01	BTN1 is pressing	Nfy 0x10
0x0000	0x002E	0x2902	Client Characteristic Configuration	01:00		
0x0000	0x002F	0x2901	Characteristic User Description	Key Press State		
0x0000	0x002B	0x2800	GATT Primary Service Declaration	E0:FF		
0x0000	0x002C	0x2803	GATT Characteristic Declaration	10:2D:00:E1:FF		
0x0000	0x002D	0xFFE1	Key Press State	02	BTN2 is pressing	Nfy 0x10
0x0000	0x002E	0x2902	Client Characteristic Configuration	01:00		
0x0000	0x002F	0x2901	Characteristic User Description	Key Press State		
0x0000	0x002B	0x2800	GATT Primary Service Declaration	E0:FF		
0x0000	0x002C	0x2803	GATT Characteristic Declaration	10:2D:00:E1:FF		
0x0000	0x002D	0xFFE1	Key Press State	03	BTN1 and BTN2 are pressing	Nfy 0x10
0x0000	0x002E	0x2902	Client Characteristic Configuration	01:00		
0x0000	0x002F	0x2901	Characteristic User Description	Key Press State		

Chapter 6 Developing, Flash Programming and Debugging

6.1 Introduction

BLE-USB Dongle (BT02-2) contains a Bluetooth module BT02-2 using TI Bluetooth low energy controller CC2540. TI CC2540 is a 8051-based System-on-Chip (SoC) and with 256 KB In-System-Programmable Flash.

To develop your Bluetooth Low Energy Application, TI supports variety of hardware or software tools. In the Dongle, it offers standard pitch 2.54mm or 1.27mm Test Point Sections for connecting to these tools easily.

6.2 Hardware and Software Tools

Hardware tool

CC Debugger

- TI website:

<http://www.ti.com/tool/CC-DEBUGGER>

- Description:

The CC Debugger is primarily used for Flash programming and debugging software running on CCxxxx 8051-based System-on-Chip (SoC) devices from Texas Instruments.



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Software tool

BLE-STACK (For CC2540 / CC2541)

- TI website:

<http://www.ti.com/tool/ble-stack>

- Description:

TI Bluetooth low energy BLE-Stack software stack for TI's C2540 and CC2541 devices is a full-featured Bluetooth 4.0 stack that includes all necessary software to get started on the development of single-mode Bluetooth Smart applications.

The BLE-Stack is available royalty-free to customers using TI's C2540/41 Bluetooth low energy system-on-chip (SoC) family

SmartRF Flash Programmer

- TI website:

<http://www.ti.com/tool/flash-programmer>

- Description:

TI SmartRF Flash Programmer can be used to program the flash memory in Texas Instruments 8051-based low-power RF wireless MCUs and for upgrading the firmware and bootloader on the SmartRF05 Evaluation Board, SmartRF Transceiver Evaluation Board (TrxEB) and the CC-Debugger.

SmartRF Protocol Packet Sniffer (PACKET-SNIFFER)

- Website:

<http://www.ti.com/tool/PACKET-SNIFFER>

- Description:

TI SmartRF Packet Sniffer is a PC software application that can display and store radio packets captured by a listening RF device. The capture device is connected to the PC via USB. Various RF protocols are supported. The Packet Sniffer filters and decodes packets and displays them in a convenient way, with options for filtering and storage to a binary file format.

Protocol	Version	Capture device	Can be used to capture packets from
Bluetooth® low energy	Bluetooth core spec 4.0	BLE-USB Dongle (HS-BT02-2) (CC2540)	CC2540 CC2541 CC2640, CC2650 Bluetooth® low energy devices

IAR Embedded Workbench for 8051

- Website:

www.iar.com

- Description:

All embedded software for the CC2540 and CC2541 is developed using Embedded Workbench for 8051 from IAR Software.

6.3 Hardware Connection

By using CC Debugger and software tools to develop with the Dongle, you will need to connect the CC Debugger to the Dongle at first.

The Dongle offers standard pitch 2.54mm Test Points (J2) for connecting to CC Debugger. The detail connection diagram is shown below.

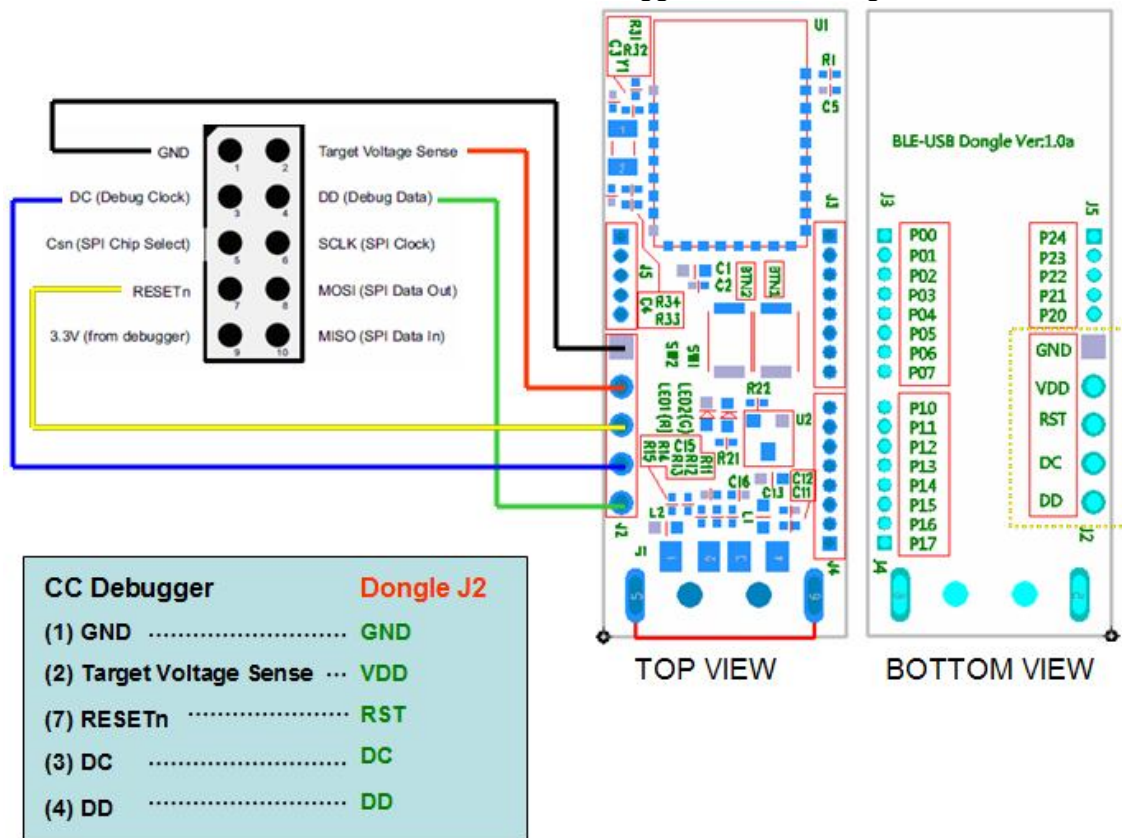
**** CC Debugger Target Connector**



**** Connector Pin Definition**

GND	1	2	Target Voltage Sense
DC (Debug Clock)	3	4	DD (Debug Data)
Csn (SPI Chip Select)	5	6	SCLK (SPI Clock)
RESETn	7	8	MOSI (SPI Data Out)
3.3V (from debugger)	9	10	MISO (SPI Data In)

**** The Connection Definition between the CC Debugger and the Dongle J2**



**** Please ensure the Dongle is supplied power by USB port, e.g., Insert to Laptop or Desktop Computer.**

APPENDIX A

A-1. References and Other Useful Material

1. TI CC2540
 - Product website:
<http://www.ti.com/product/CC2540>
 - Data Sheet:
<http://www.ti.com/lit/ds/symlink/cc2540.pdf>
 - Software Developer's Guide:
<http://www.ti.com/lit/ug/swru271g/swru271g.pdf>
 - User's guide:
<http://www.ti.com/lit/ug/swru191f/swru191f.pdf>
2. BT02-2 Bluetooth Module
 - Product specification:
BT02-2 Product Specification 20170727 V1.0.pdf

A-2. Service List of Demonstrated BLE-UART Bridge Application in BLE LaunchPad (BT01-2)

In the Pre Programmed Firmware of Dongle, it demonstrates a HostTestRelease application which acts as a Central Device (BLE Master) and controls by TI BTool. In Chapter 5.3, we introduce the demonstration that the Dongle and BTool collocate with BLE LaunchPad (BT01-2). Please refer to the table shown below to find the BLE service list of BLE LaunchPad (BT01-2).

Handle	Uuid	UuidDesc	Value	Properties
0x0001	0x2800	GATT Primary Service Declaration	00:18	
0x0002	0x2803	GATT Characteristic Declaration	02:03:00:00:2A	
0x0003	0x2A00	Device Name	BLE LaunchPad CC2541	Rd 0x02
0x0004	0x2803	GATT Characteristic Declaration	02:05:00:01:2A	
0x0005	0x2A01	Appearance	00:00	Rd 0x02
0x0006	0x2803	GATT Characteristic Declaration	0A:07:00:02:2A	
0x0007	0x2A02	Peripheral Privacy Flag	00	Rd Wr 0x0A
0x0008	0x2803	GATT Characteristic Declaration	08:09:00:03:2A	
0x0009	0x2A03	Reconnection Address		Wr 0x08
0x000A	0x2803	GATT Characteristic Declaration	02:0B:00:04:2A	
0x000B	0x2A04	Peripheral Preferred Connection Parameters	50:00:A0:00:00:00:E8:03	Rd 0x02

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0x000C	0x2800	GATT Primary Service Declaration	01:18	
0x000D	0x2803	GATT Characteristic Declaration	20:0E:00:05:2A	
0x000E	0x2A05	Service Changed		Ind 0x20
0x000F	0x2902	Client Characteristic Configuration	00:00	
0x0010	0x2800	GATT Primary Service Declaration	0A:18	
0x0011	0x2803	GATT Characteristic Declaration	02:12:00:23:2A	
0x0012	0x2A23	System ID	8F:0E:ED:00:00:7F:C7:F0	Rd 0x02
0x0013	0x2803	GATT Characteristic Declaration	02:14:00:24:2A	
0x0014	0x2A24	Model Number String	Model Number	Rd 0x02
0x0015	0x2803	GATT Characteristic Declaration	02:16:00:25:2A	
0x0016	0x2A25	Serial Number String	Serial Number	Rd 0x02
0x0017	0x2803	GATT Characteristic Declaration	02:18:00:26:2A	
0x0018	0x2A26	Firmware Revision String	Firmware Revision	Rd 0x02
0x0019	0x2803	GATT Characteristic Declaration	02:1A:00:27:2A	
0x001A	0x2A27	Hardware Revision String	Hardware Revision	Rd 0x02
0x001B	0x2803	GATT Characteristic Declaration	02:1C:00:28:2A	
0x001C	0x2A28	Software Revision String	Software Revision	Rd 0x02
0x001D	0x2803	GATT Characteristic Declaration	02:1E:00:29:2A	
0x001E	0x2A29	Manufacturer Name String	Manufacturer Name	Rd 0x02
0x001F	0x2803	GATT Characteristic Declaration	02:20:00:2A:2A	
0x0020	0x2A2A	IEEE 11073-20601 Regulatory Certification Data List	FE:00:65:78:70:65:72:69:6D:65:6E:74:61:6C	Rd 0x02
0x0021	0x2803	GATT Characteristic Declaration	02:22:00:50:2A	
0x0022	0x2A50	PnP ID	01:0D:00:00:00:10:01	Rd 0x02
0x0023	0x2800	GATT Primary Service Declaration	F0:FF	
0x0024	0x2803	GATT Characteristic Declaration	0A:25:00:F1:FF	
0x0025	0xFFFF1	Simple Profile Char 1		Rd Wr 0x0A
0x0026	0x2901	Characteristic User Description	APP_to_BLE_UART_Tx	
0x0027	0x2803	GATT Characteristic Declaration	10:28:00:F2:FF	
0x0028	0xFFFF2	Simple Profile Char 2		Nfy 0x10
0x0029	0x2902	Client Characteristic Configuration	00:00	
0x002A	0x2901	Characteristic User Description	BLE_UART_Rx_to_APP	
0x002B	0x2800	GATT Primary Service Declaration	E0:FF	
0x002C	0x2803	GATT Characteristic Declaration	10:2D:00:E1:FF	
0x002D	0xFFE1	Key Press State		Nfy 0x10
0x002E	0x2902	Client Characteristic Configuration	00:00	
0x002F	0x2901	Characteristic User Description	Key Press State	

A-3. HostTestRelease Application for BLE-USB Dongle (BT02-2)

In the Pre Programmed Firmware of Dongle, it demonstrates a HostTestRelease application which acts as a Central Device (BLE Master). The Dongle creates a virtual serial port over the USB interface and supports to run with TI's PC Applications such as BTool or Device Monitor.

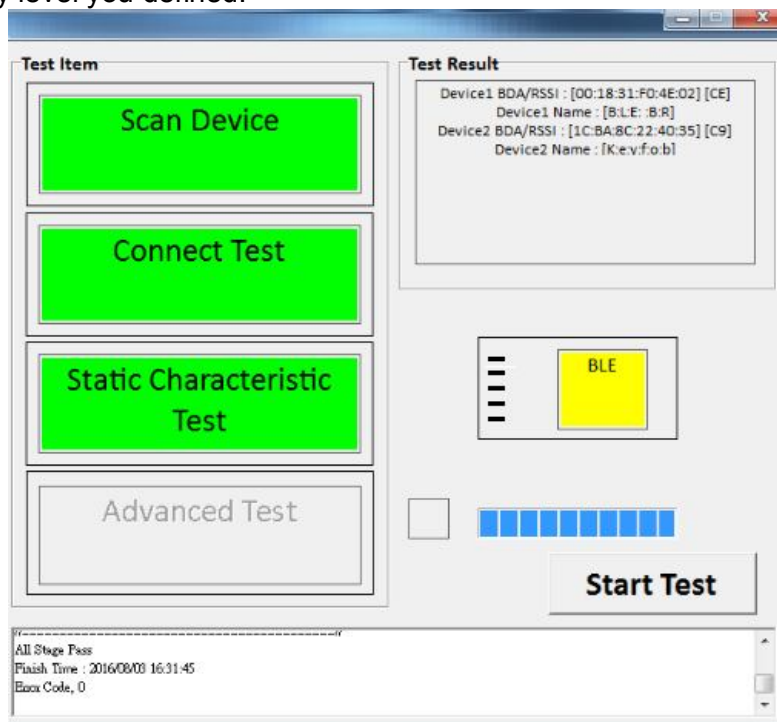
For the HostTestRelease application, you can find the reference source file or image in TI BLE-Stack as below:

- Source file
C:\Texas Instruments\BLE-CC254x-1.4.2.2\Projects\ble\HostTest
- Image file
C:\Texas Instruments\BLE-CC254x-1.4.2.2\Accessories\HexFiles
CC2540_USBdongle_HostTestRelease_All.hex

The HostTestRelease application can also be used together with several of the PC (Windows and Linux) examples found on the TI BLE Wiki.

http://processors.wiki.ti.com/index.php/CC254X_PC_Examples

For the BLE End Product manufacturer, you can use the BLE-USB Dongle (BT02-2) with HostTestRelease application to build or setup Quality Control Inspection Equipment for Assembly / Production line easily and rapidly. For instance, the Dongle acts as a BLE Central Device and scans your BLE Peripheral product or executes several testing items such as connect and read / write characteristic value. You can record and use the testing result to judge the quality level you defined.



A-4. Packet Sniffer Application for BLE-USB Dongle (BT02-2)

The BLE-USB Dongle (BT02-2) can be used as is as a packet sniffer for Bluetooth Low Energy by TI's SmartRF Protocol Packet Sniffer software. If you want to do the application, please follow the steps below:

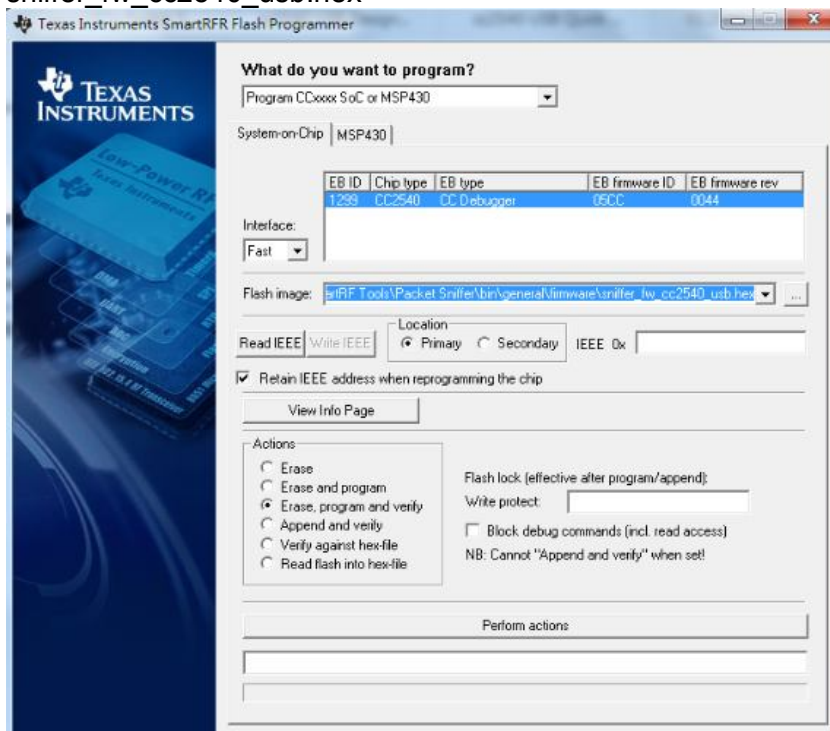
1. Download and Install the software from TI website

<http://www.ti.com/tool/PACKET-SNIFFER>

** When installing the Packet Sniffer, you will also automatically install the USB driver required for proper communication between the dongle and the packet sniffer

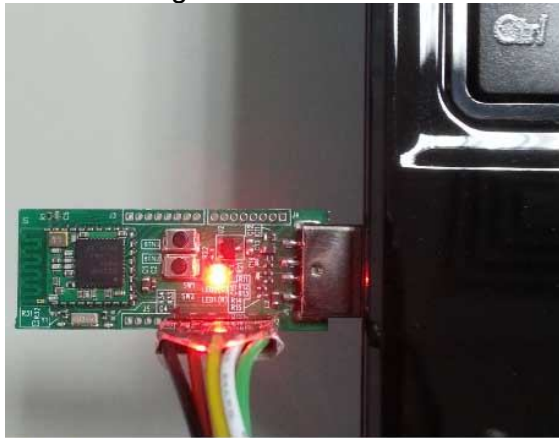
2. Program the Dongle by TI CC Debugger and SmartRF Flash Programmer
 - a. For the Hardware and Software requirement and operation in programming process, please refer to Chapter 6 in detail.
 - b. The image file for Packet Sniffer application can be found in the path below (After installing Packet Sniffer Software):
C:\Program Files (x86)\Texas Instruments\SmartRF Tools\Packet Sniffer\bin\general\firmware\sniffer_fw_cc2540_usb.hex

Please use SmartRF Flash Programmer and select the image file as sniffer_fw_cc2540_usb.hex



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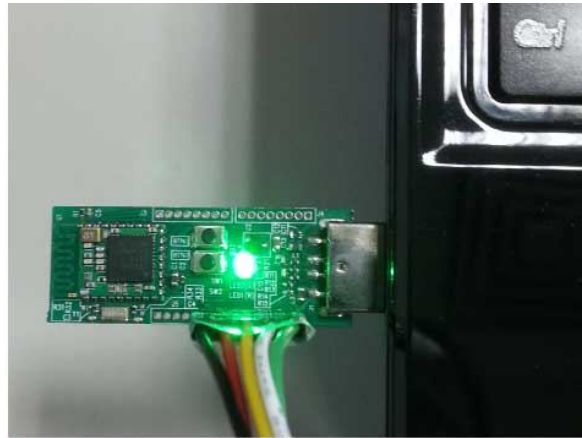
- c. After programming the image file as sniffer_fw_cc2540_usb.hex, the LED2 (G) of Dongle will be lit Green.



Before Programming.

The shipped image in BLE-USB Dongle (BT02-2) is
- CC2540_USBDongle_HostTestRelease_All.hex

The LED1(R) will be lit Red.



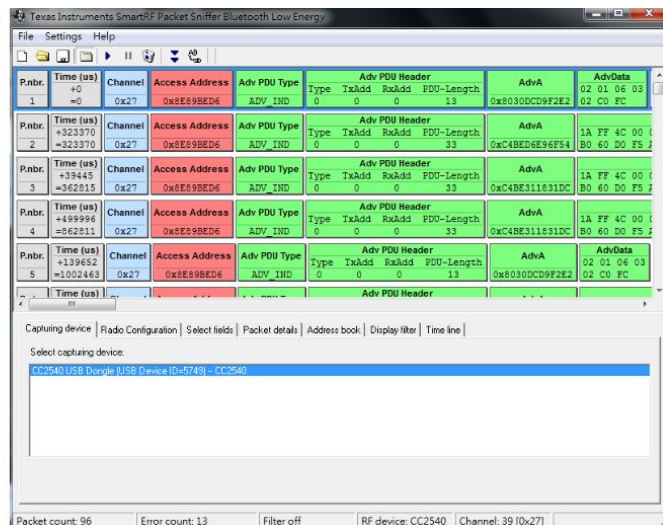
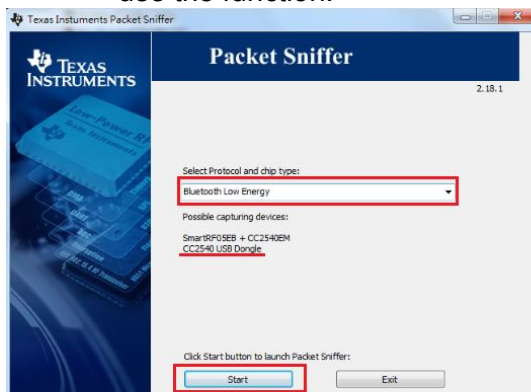
After Programming.

The new image in BLE-USB Dongle (BT02-2) is

- sniffer_fw_cc2540_usb.hex

The LED2(G) will be lit Green.

- d. Execute the Packet Sniffer software and select the Bluetooth Low Energy protocol to use the function.



3. The detail guide and user manual to operate the Dongle and TI's SmartRF Protocol Packet Sniffer software, please refer to the links below:

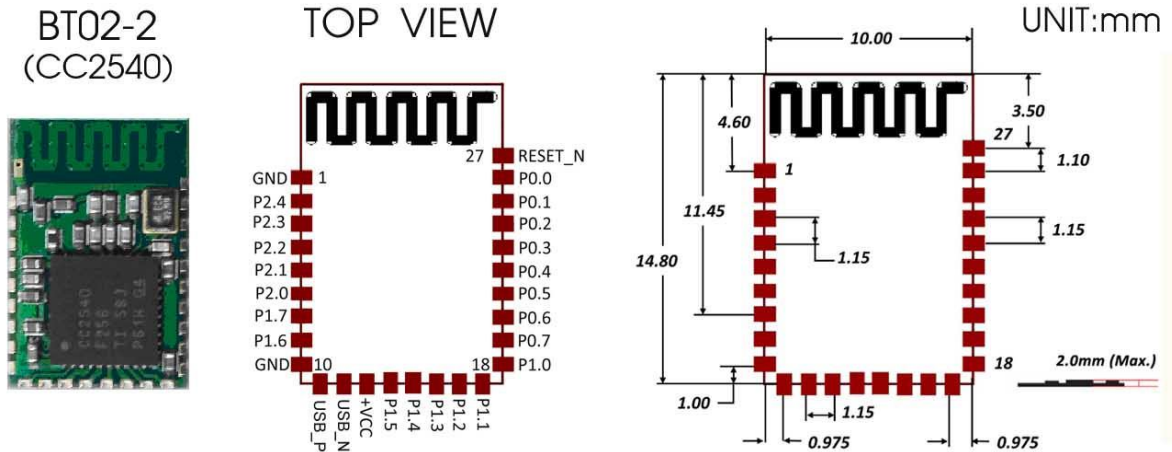
- BLE sniffer guide

http://processors.wiki.ti.com/index.php/BLE_sniffer_guide

- User's Manual

<http://www.ti.com/lit/ug/swru187g/swru187g.pdf>

A-5. BT02-2 Module Pin Assignment and Dimension



Pin	Symbol	Pin Type	Description
1	GND	Power	System GND
2	P2.4	Digital I/O, Analog I/O	Port 2.4 / 32.768 kHz XOSC
3	P2.3	Digital I/O, Analog I/O	Port 2.3 / 32.768 kHz XOSC
4	P2.2	Digital I/O	Port 2.2 / debug clock (DC)
5	P2.1	Digital I/O	Port 2.1 / debug data (DD)
6	P2.0	Digital I/O	Port 2.0
7	P1.7	Digital I/O	Port 1.7
8	P1.6	Digital I/O	Port 1.6
9	GND	Power	System GND
10	USB_P	Digital I/O	USB P
11	USB_N	Digital I/O	USB N
12	+VCC	Power	System Power-Input 2V–3.6V digital power-supply connection
13	P1.5	Digital I/O	Port 1.5
14	P1.4	Digital I/O	Port 1.4
15	P1.3	Digital I/O	Port 1.3

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16	P1.2	Digital I/O	Port 1.2
17	P1.1	Digital I/O	Port 1.1 (20-mA drive capability)
18	P1.0	Digital I/O	Port 1.0 (20-mA drive capability)
19	P0.7	Digital I/O	Port 0.7
20	P0.6	Digital I/O	Port 0.6
21	P0.5	Digital I/O	Port 0.5
22	P0.4	Digital I/O	Port 0.4
23	P0.3	Digital I/O	Port 0.3
24	P0.2	Digital I/O	Port 0.2
25	P0.1	Digital I/O	Port 0.1
26	P0.0	Digital I/O	Port 0.0
27	RESET_N	Digital input	Reset, active-low