

Objective

This example demonstrates the Whitelist functionality of the PSoC BLE Component.

Overview

Whitelist functionality in Bluetooth allows a device to filter out other devices trying to scan or connect with the device. Only the devices added to the whitelist will be given the privilege of scanning or connection or both (based on the filter policy selected). In this example, the BLE Component is programmed as a Peripheral and a Server, which has the whitelist setting as **Scan Request Whitelist; Connect Request Whitelist**. This means that only the Central devices that are added to the Peripheral's whitelist will be able to receive the scan response packet and establish a connection with it.

Requirements

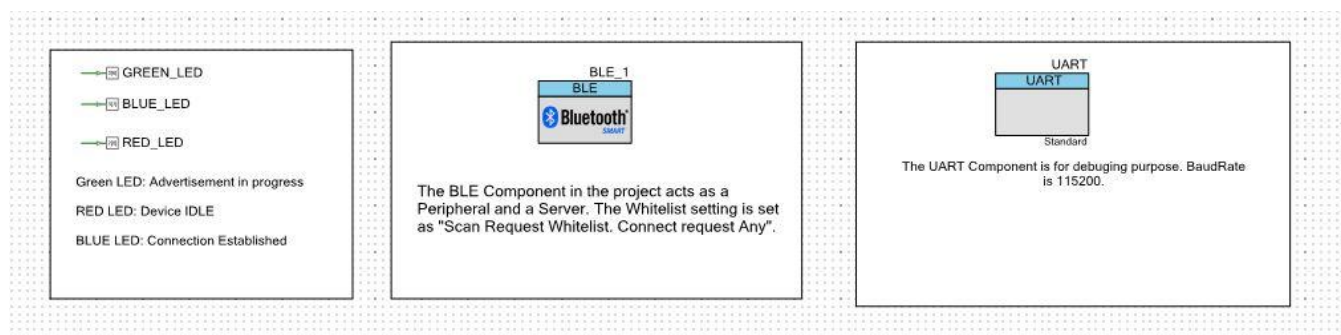
Design Tool: PSoC Creator 3.1 CP1, CySmart 1.0

Programming Language: C (GCC 4.8.4 – included with PSoC Creator)

Associated Devices: All PSoC 4 BLE devices

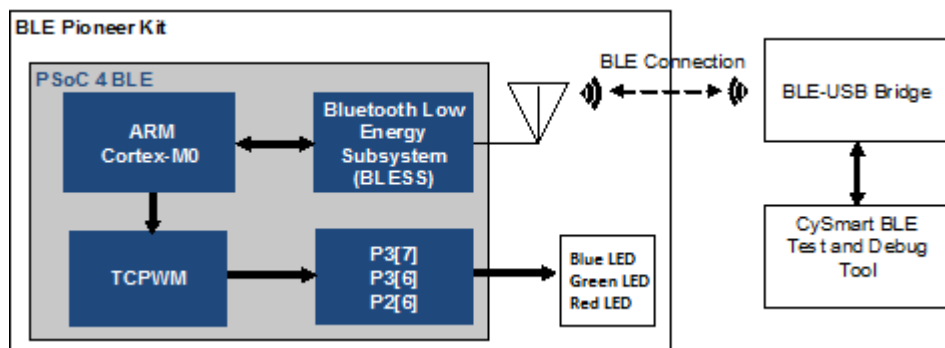
Required Hardware: CY8CKIT-042-BLE Bluetooth® Low Energy (BLE) Pioneer Kit

PSoC Creator Schematic

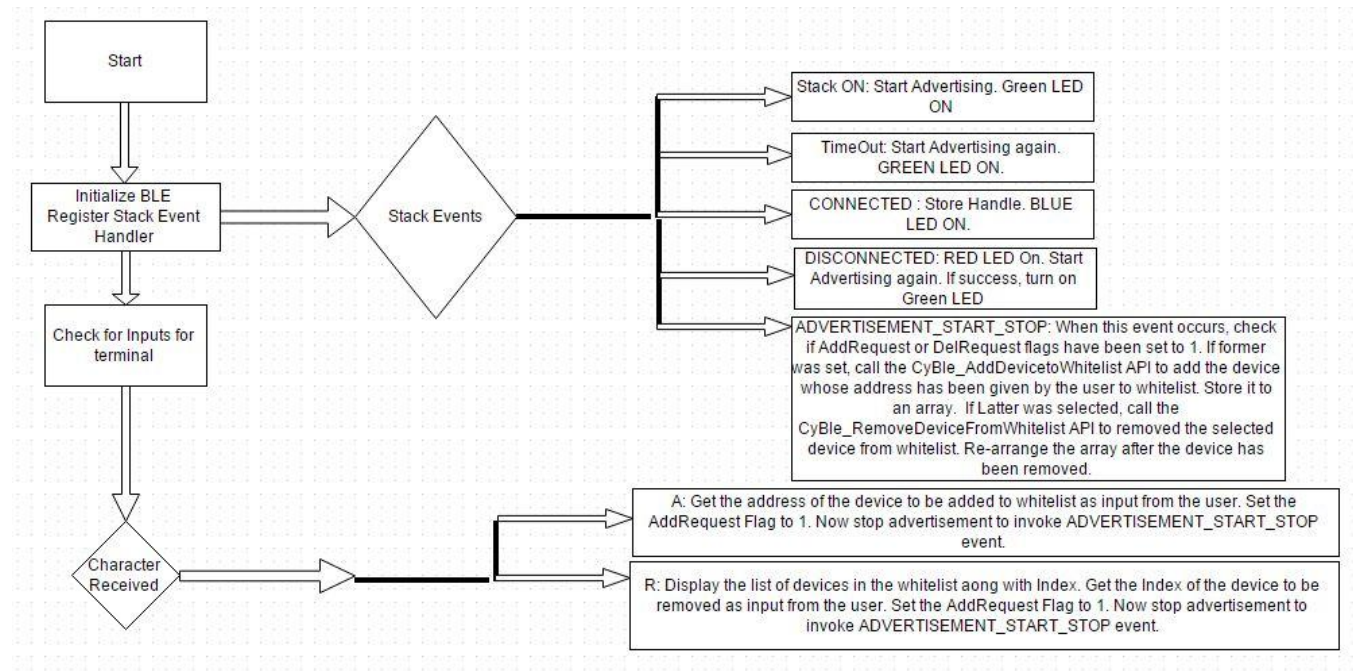


Hardware Setup

The BLE Component in a CY8CKIT-042-BLE Kit acts as a Peripheral. The BLE Dongle acts as a BLE Central.



Firmware Flow:



Build and Program

This section shows how to build the project and program the PSOC 4 BLE device using the CY8CKIT-042-BLE.

On PSOC Creator, select Build > Clean and Build **BLE_Whitelist**.

1. Open PSOC creator 3.1. Go to **File -> Open -> Project / Workspace**. Browse for the folder containing the project files and select **BLE_Whitelist.cyprj**.
2. Go to **Build -> Build BLE_Whitelist**

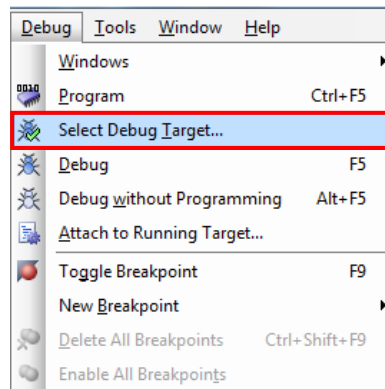
3. On a successful build, the total flash and SRAM usage is reported as shown below

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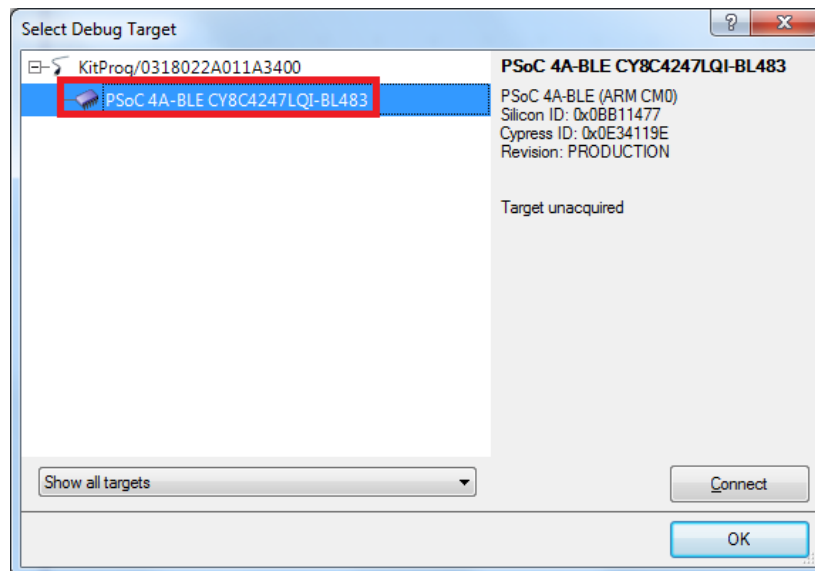
Flash used: 77431 of 131072 bytes (59.1 %).
SRAM used: 12676 of 16384 bytes (77.4 %). Stack: 2048 bytes. Heap: 1024 bytes.
----- Build Succeeded: 02/23/2015 12:47:39 -----
  
```

4. Select **Debug > Select Debug Target**, as shown below.

Selecting Debug Target

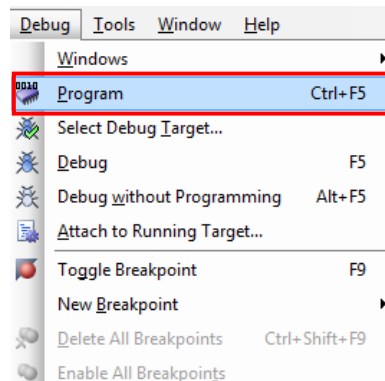


5. In the **Select Debug Target** dialog box, click **Port Acquire**, and then click **Connect** as shown in **Error! Reference source not found..** Click **OK** to close the dialog box.

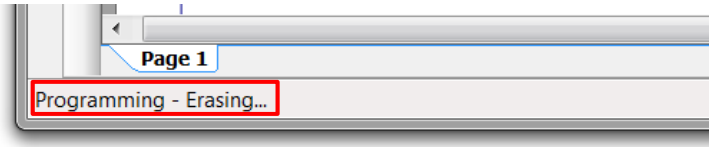


If you are using your own hardware, make sure the Port Setting configuration under Select Debug Target window for your programming hardware is configured as per your setup.

6. Select **Debug > Program** to program the device with the project, as shown below.



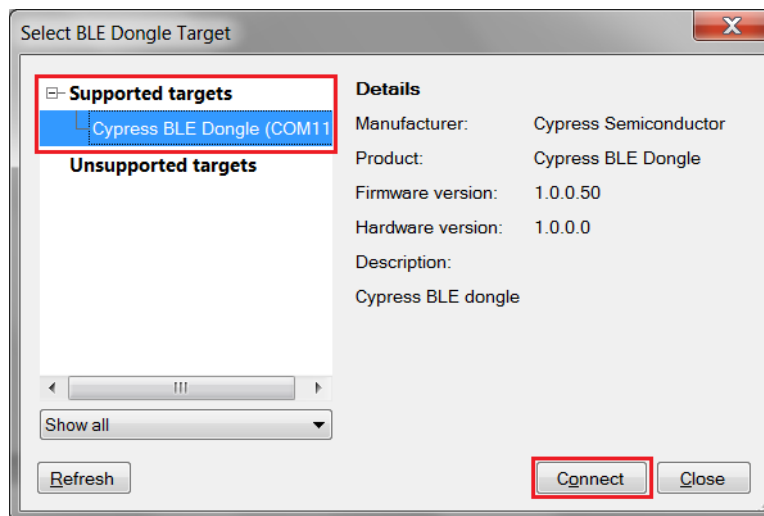
You can view the programming status on the PSoC Creator status bar (lower-left corner of the window), as shown below.



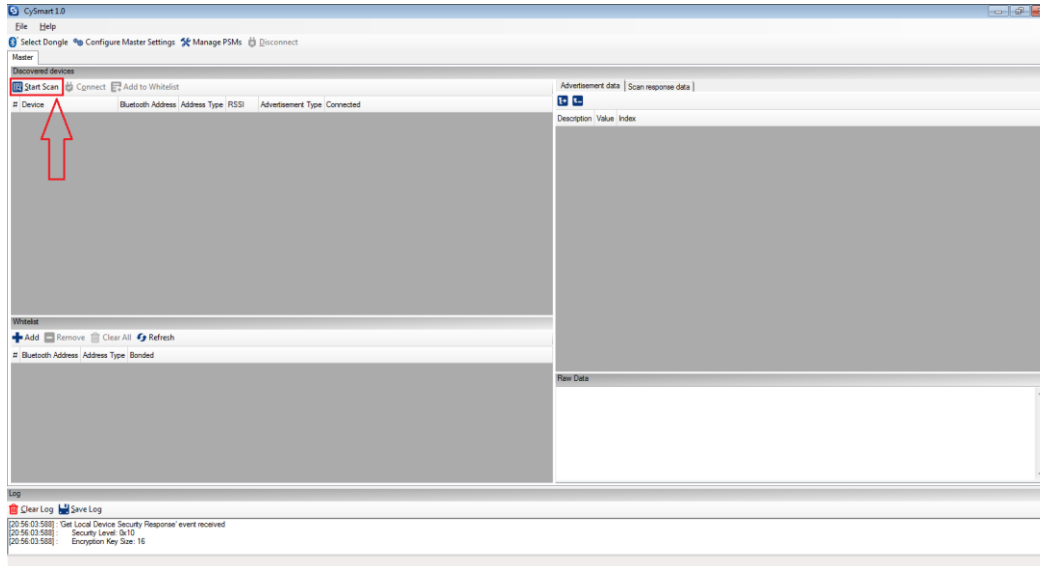
Operation and Testing

- 1) Having the kit connected and programmed, open a Serial terminal and have the BaudRate as 115200. Press SW1 in the Kit. You can see the **"BLE WhiteList Example. Press A to add a Device to WhiteList. R to remove the Device from Whitelist"** message to confirm if the terminal works.
- 2) On your computer, launch **CySmart 1.0**. It is located in the **All Programs -> Cypress -> CySmart** folder in the Windows start menu. The tool opens up and asks you to **Select BLE Dongle Target**. Select the **Cypress BLE Dongle (COMxx)** and click **Connect**, as shown in below.

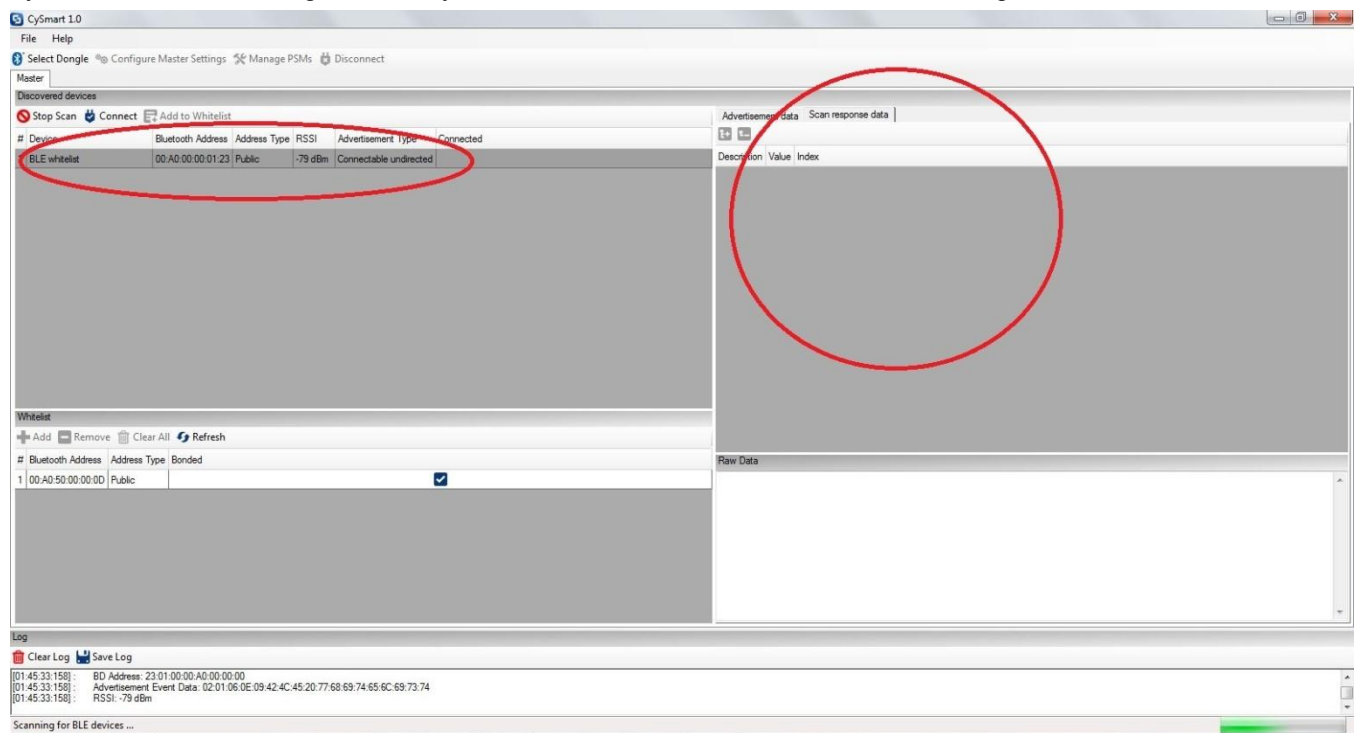
CySmart: Select BLE Dongle Target



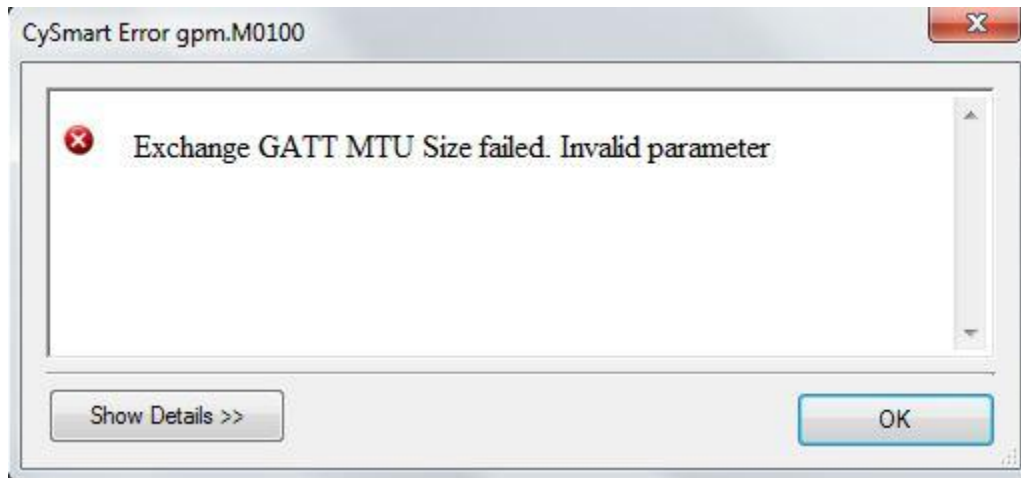
- 3) When the BLE-USB Bridge is connected, click on **Start Scan** to find your BLE device as shown below.



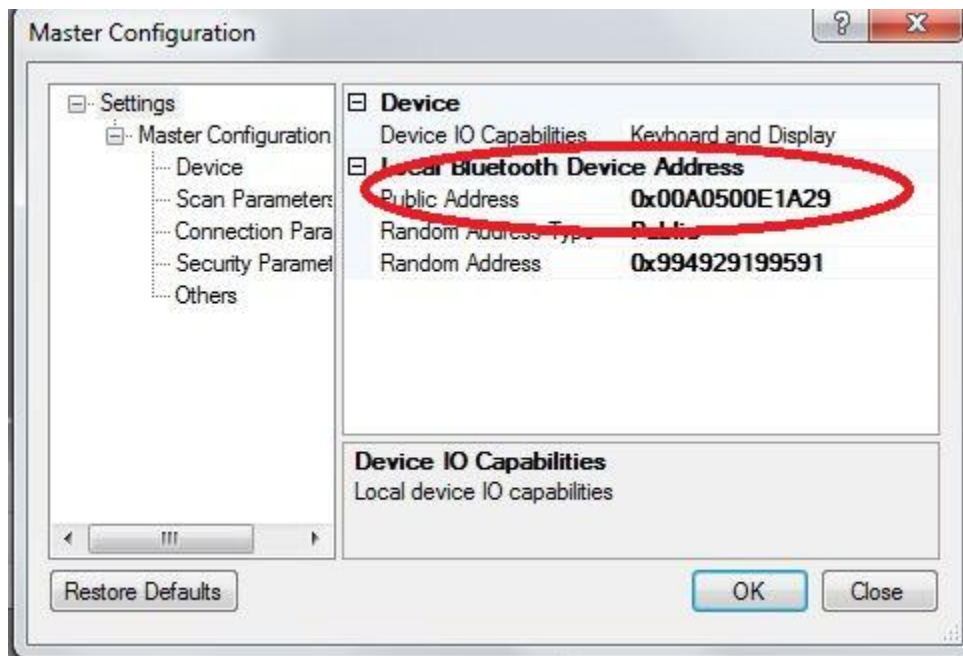
- 4) You can see the “BLE_Whitelist” device detected, but the **Scan response Data** is not obtained by CySmart as the BLE Dongle has not yet been added to the device’s Whitelist. See figure below.



- 5) Also, when you press the **Connect** button, you will see that the operation had failed with an error message as shown below. Scanning and Connection will not be possible until the BLE Dongle is added to our BLE Component's whitelist.



- 6) Now we will add the BLE Dongle to the Whitelist of our device. To do so, we need to know the address of the BLE Dongle. Click **Stop Scan** and select **Configure Master Settings** on the top of CySmart. The address will be shown as below:



- 7) Now, in the terminal, Press 'A' followed by the address of the device to be added to Whitelist. Press 'Z' if you entered the address wrongly middle way, to add again.
- 8) After the **Device Added to Whitelist** message appears, Click **Start Scan** in CySmart again. Now you will be able to see the Scan response data as:

The screenshot shows the CySmart 1.0 application window. The top menu bar includes "File" and "Help". Below it, there are tabs for "Select Dongle", "Configure Master Settings", "Manage PSMs", and "Disconnect".

The main area is divided into two sections:

- Discovered devices:** A table listing discovered Bluetooth devices. It has columns for "# Device", "Bluetooth Address", "Address Type", "RSSI", "Advertisement Type", and "Connected". One device is listed: "1 BLE whitelist" with address "00:AD:00:00:01:23", Public address type, -64 dBm RSSI, Connectable undirected advertisement type, and Connected status.
- Whitelist:** A section below the discovered devices with buttons for "+ Add", "- Remove", "Clear All", and "Refresh". It also has a table header for "# Bluetooth Address | Address Type | Bonded".

A red circle highlights the "Advertisement data" tab on the right side of the interface. This tab displays a tree view of advertisement data:

- Advertisement data:**
 - Scan response data:**
 - Description**: Value Index
 - AD Data 0: <<Shortened Local Name>>**
 - Length of this data: 0x02 [0]
 - <<Shortened Local Name>>: 0x08 [1]
 - B: 0x42 [2]
 - AD Data 1: <<Tx Power Level>>**
 - Length of this data: 0x02 [3]
 - <<Tx Power Level>>: 0x0A [4]
 - 0 dBm: 0x00 [5]
 - AD Data 2: <<Complete List of 128-bit Service Class UUIDs>>**
 - Length of this data: 0x11 [6]
 - <<Complete List of 128-bit Service Class UUIDs>>: 0x07 [7]
 - Service: Custom Service:
 - [0]: 0xF8 [8]
 - [1]: 0x34 [9]
 - [2]: 0x9B [10]
 - Raw Data:** 02 08 42 02 0A 00 11 07 FB 34 9B 5F 80 00 00 00 00 10 00 00 00 00 00 00

- 9) Also, pressing the **Connect** button this time would lead to establishment of a successful connection. After clicking **Connect** button, press the **Discover Attributes** button, to see the following details.

CySmart 1.0

File Help

Select Dongle

Configure Master Settings

Manage PSMs

Disconnect

Master

BLE whitelist [00:A0:00:0D:18:20]

Attributes

Discover All Attributes

Enable All Notifications

Read All Characteristics

Pair

Export

Clear

View: Category

Handle	UUID	UUID Description	Value	Properties
Primary Service Declaration: Generic Access				
0x0001	0x2800	Primary Service Declaration	00:18 (Generic Access)	
Characteristic Declaration: Device Name				
0x0002	0x2803	Characteristic Declaration	02:03:00:00:2A	
0x0003	0x2A00	Device Name		0x02
Characteristic Declaration: Appearance				
0x0004	0x2803	Characteristic Declaration	02:05:00:01:2A	
0x0005	0x2A01	Appearance		0x02
Characteristic Declaration: Peripheral Preferred Connection Parameters				
0x0006	0x2803	Characteristic Declaration	02:07:00:04:2A	
0x0007	0x2A04	Peripheral Preferred Connection Parameters		0x02
Primary Service Declaration: Generic Attribute				
0x0008	0x2800	Primary Service Declaration	01:18 (Generic Attribute)	
Characteristic Declaration: Service Changed				
0x0009	0x2803	Characteristic Declaration	22:0A:00:05:2A	
0x000A	0x2A05	Service Changed		0x22
0x000B	0x2902	Client Characteristic Configuration		
Primary Service Declaration: Custom Service				
0x000C	0x2800	Primary Service Declaration	FB:34:9B:5F:80:00:00:80:00:10:00:00:00:00:00 (Custom Service)	
Characteristic Declaration: Custom Service				
0x000D	0x2803	Characteristic Declaration	00:0E:00:FB:34:9B:5F:80:00:00:80:00:10:00:00:00:00:00	
0x000E	00000000000001000800000805F9B34FB	Custom Service		0x00
0x000F	00031234000800000805F9B34FB00000			

Attribute Details

Send Commands

Commands

GATT

Primary Service Discovery

Relationship Discovery

Characteristic Discovery

Characteristic Descriptor Discovery

Characteristic Value Read

Characteristic Value Write

Characteristic Descriptor

GAP

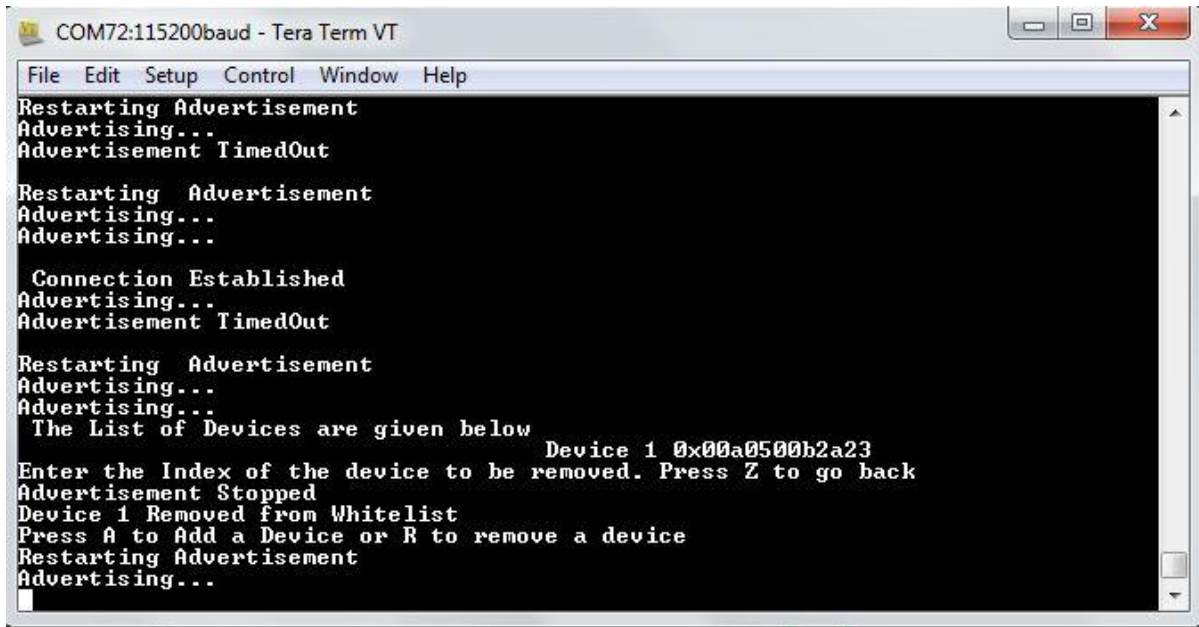
Discover All Primary Services Parameters

Parameters

Parameters

The command does not have any parameters

- 10) Now we will remove the BLE Dongle from the Whitelist and repeat the above steps. Press **Disconnect** Button in the CySmart.
- 11) Press 'R' to display the list of devices present to Whitelist, along with an index. You can see the BLE Dongle's address displayed along with the Index **1** as shown below. Enter **1** to remove the Dongle.



```

COM72:115200baud - Tera Term VT
File Edit Setup Control Window Help
Restarting Advertisement
Advertising...
Advertisement TimedOut

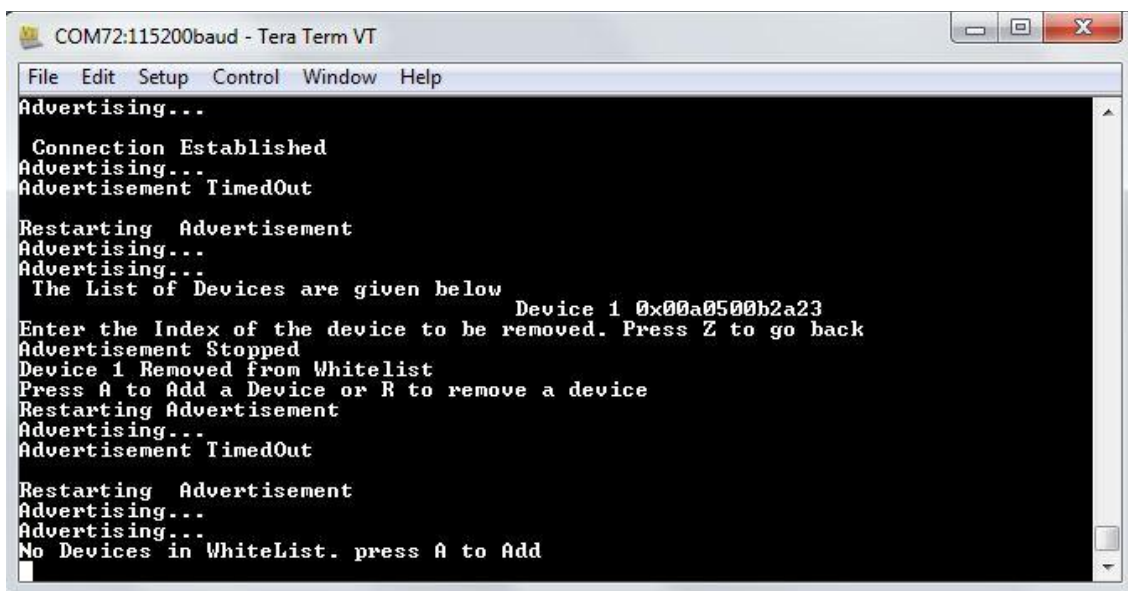
Restarting Advertisement
Advertising...
Advertising...

Connection Established
Advertising...
Advertisement TimedOut

Restarting Advertisement
Advertising...
Advertising...
The List of Devices are given below
                                Device 1 0x00a0500b2a23
Enter the Index of the device to be removed. Press Z to go back
Advertisement Stopped
Device 1 Removed from Whitelist
Press A to Add a Device or R to remove a device
Restarting Advertisement
Advertising...

```

- 12) Pressing 'R' again will display a message telling that no more devices can be removed from the Whitelist as only device we added to the device was removed.



```

COM72:115200baud - Tera Term VT
File Edit Setup Control Window Help
Advertising...

Connection Established
Advertising...
Advertisement TimedOut

Restarting Advertisement
Advertising...
Advertising...
The List of Devices are given below
                                Device 1 0x00a0500b2a23
Enter the Index of the device to be removed. Press Z to go back
Advertisement Stopped
Device 1 Removed from Whitelist
Press A to Add a Device or R to remove a device
Restarting Advertisement
Advertising...
Advertisement TimedOut

Restarting Advertisement
Advertising...
Advertising...
No Devices in WhiteList. press A to Add

```

- 13) Now, if you click Start Scan in the CySmart, you will be able to detect **BLE_Whitelist** Peripheral, but obtaining Scan response packet and establishing connection will not be possible now (The observation will be same as mentioned in points 4 and 5 above).

State of LEDs:

GREEN LED	Indicates that the BLE Component is currently advertising
RED LED	Indicates that the BLE Component is Idle (neither advertising nor connected)
BLUE LED	Indicates that the BLE Component is Connected

Related Documents

The table below lists all relevant application notes, code examples, knowledge base articles, device datasheets, and Component / user module datasheets.

Related Documents

Document	Title	Comment
AN91267	Getting Started with PSoC® 4 BLE	A guide for beginners on PSoC 4 BLE
001-90479	Programmable System-on-Chip (PSoC®)	PSoC® 4: PSoC 4XX7_BLE Family Datasheet