CE217637 - BLE Find Me Profile with PSoC 6 MCU with BLE Connectivity

Objective

This example project demonstrates the Find Me Profile application workflow.

Overview

This example project demonstrates the Find Me Profile operation of the BLE Component. The Find Me Target uses the Find Me Profile with one instance of the Immediate Alert Service to display the alerts if the Client has configured the device for alerting. The Find Me Target operates with other devices that implement the Find Me Locator Profile. The device switches to Deep Sleep mode between BLE connection intervals.

Requirements

Tool: PSoC® Creator™ 4.2

Programming Language: C (Arm® GCC 5.4-2016-q2-update)

Associated Parts: All PSoC 6 MCU with BLE Connectivity parts

Related Hardware: CY8CKIT-062-BLE PSoC 6 BLE Pioneer Kit

Hardware Setup

This example uses the kit's default configuration. Refer to the kit guide to ensure the kit is configured correctly.

1. Connect the BLE Pioneer Kit to the computer's USB port.
2. Connect the BLE Dongle to one of the USB ports on the computer.

LED Behavior

If the V_{DDD} voltage is set to less than 2.7 V in the DWR settings **System** tab, only the red LED is used. The red LED blinks to indicate that the device is advertising. The red LED is OFF when a device is connected to a peer device. When the device is in Hibernate mode, the red LED stays ON.

LED behavior for V_{DDD} > 2.7 volts is described in the Operation section.

Software Setup

BLE Host Emulation Tool

This example requires the CySmart application. Download and install either the CySmart Host Emulation Tool PC application or the CySmart app for iOS or Android. You can test behavior with any of the two options, but the CySmart app is simpler. Scan one of the following QR codes from your mobile phone to download the CySmart app.

iOS

Android

Terminal Tool

This example uses a terminal window. You must have terminal software, such as Tera Term or PuTTY.

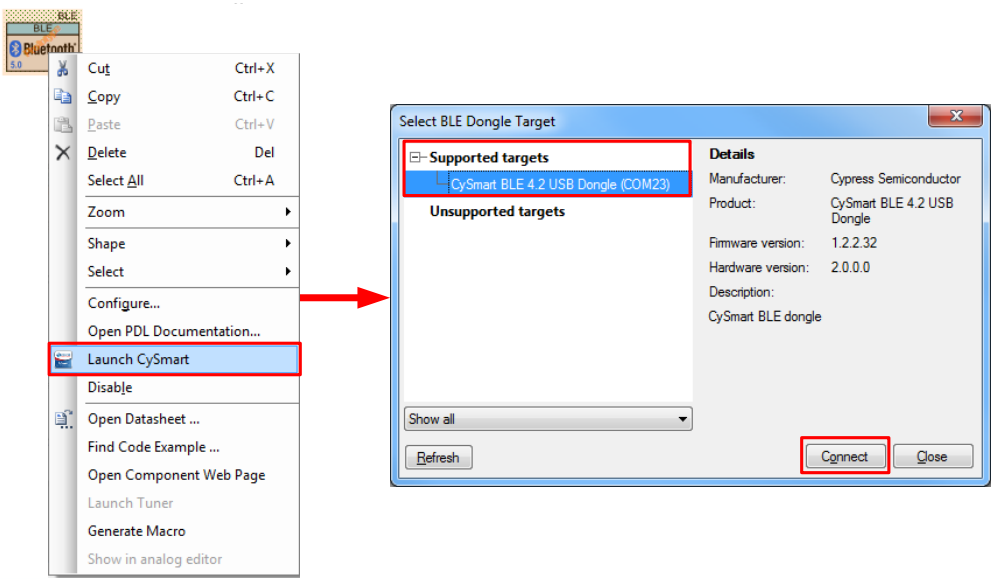
Operation

You can connect to the Find Me Target device with a BLE 4.0 or BLE 4.1-compatible device configured in the GAP Central role and capable of discovering the Immediate Alert service and Alert Level characteristic. To connect to the Find Me Target device, send a connection request to the device when the device is advertising. The green LED is turned ON while the device is advertising. If the Client is connected to the Find Me Target, the Alert Level Characteristic can be written to the trigger alerts on a remote device. If the Alert Level is set to CY_BLE_MILD_ALERT, the blue LED starts blinking. If the Alert Level is set to CY_BLE_HIGH_ALERT, the blue LED is turned ON. To clear the alerts, send a request from the Client to set the Alert Level Characteristic to CY_BLE_NO_ALERT. The alerts are also cleared when the connection with the Client is canceled or lost.

Operation Steps

1. Plug the CY8CKIT-062-BLE kit board into your computer's USB port.
2. Build the project and program it into the PSoC 6 MCU device. Choose **Debug** > **Program**. For more information on device programming, see PSoC Creator Help. Flash for both CPUs is programmed in a single program operation.
3. Observe the green LED blinks while the device is advertising, and the output in the terminal window.
4. Do the following to test example, using the CySmart Host Emulation Tool application as Find Me Target Client:
   a. Connect the BLE Dongle to your Windows PC. Wait for the driver installation to complete, if necessary.
   b. Launch the CySmart Host Emulation Tool by right-clicking on the BLE Component and selecting **Launch CySmart**. Alternatively, you can launch the tool by navigating to **Start** > **Programs** > **Cypress** and clicking on **CySmart**.
   c. CySmart automatically detects the BLE dongle connected to the PC. Click **Refresh** if the BLE dongle does not appear in the **Select BLE Dongle Target** pop-up window. Click **Connect**, as shown in Figure 1.

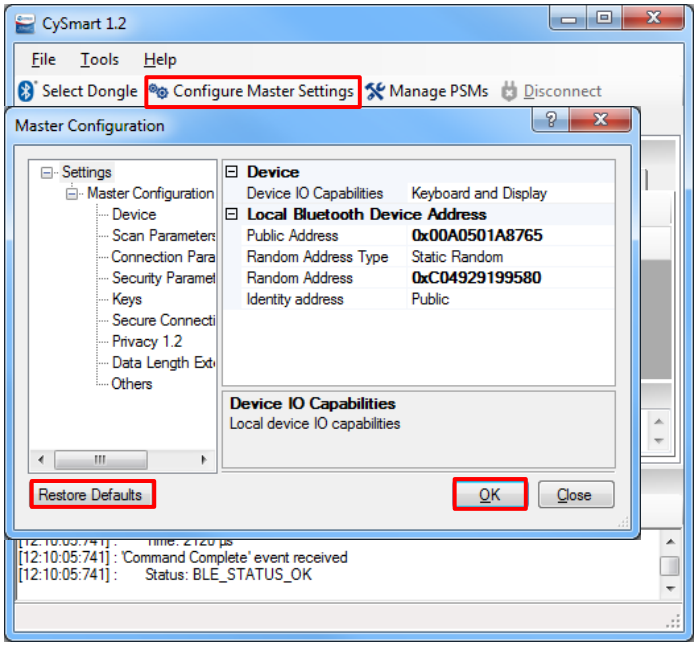
Figure 1. CySmart BLE Dongle Selection



Note: If the dongle firmware is outdated, you will be alerted with an appropriate message. You must upgrade the firmware before you can complete this step. Follow the instructions in the window to update the dongle firmware.

   d. Select **Configure Master Settings** and then click **Restore Defaults**, as Figure 2 shows, and then click **OK**.

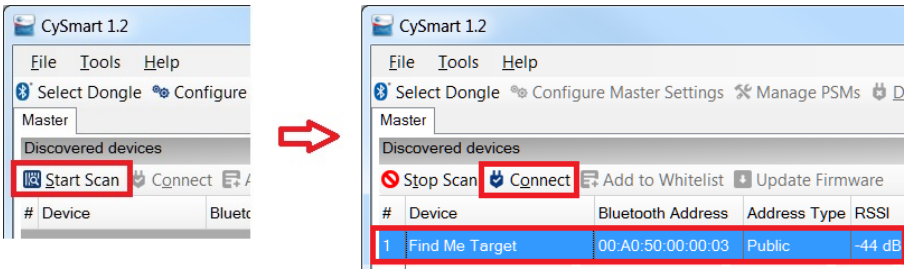
Figure 2. CySmart Master Settings Configuration



e. Press the reset switch on the Pioneer Kit to start BLE advertisement if no device is connected or device is in Hibernate mode (red LED is on). Otherwise, skip this step.

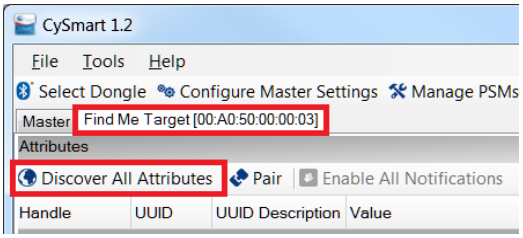
f. On the CySmart Host Emulation Tool, click **Start Scan**. Your device name (configured as **Find Me Target**) should appear in the Discovered devices list, as Figure 3 shows. Select the device and click **Connect** to establish a BLE connection between the CySmart Host Emulation Tool and your device.

Figure 3. CySmart Device Discovery and Connection



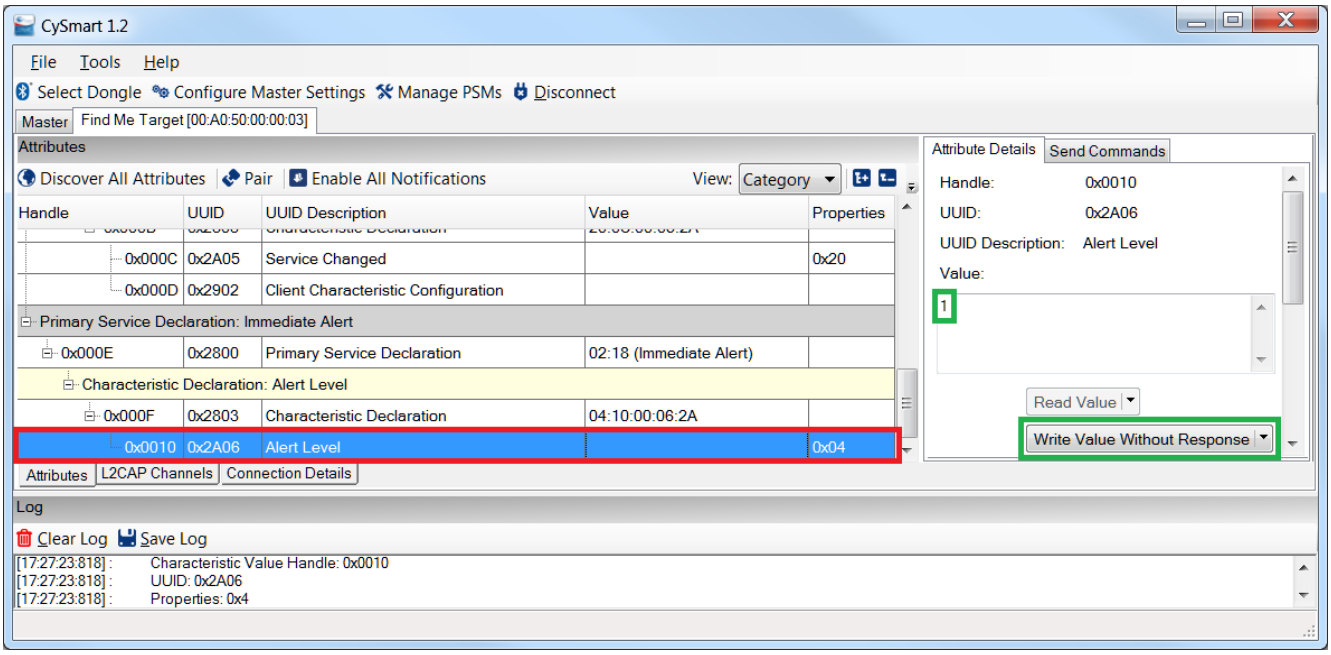
g. Once connected, switch to the **Find-Me Target** device tab and **Discover all Attributes** on your design from the CySmart Host Emulation Tool, as shown in Figure 4.

Figure 4. CySmart Attribute Discovery



h. select the **Alert Level** characteristic value and write '1' value in it (mild alert) and observe the blue LED is blinking.

Figure 5. CySmart Write Alert Level characteristic

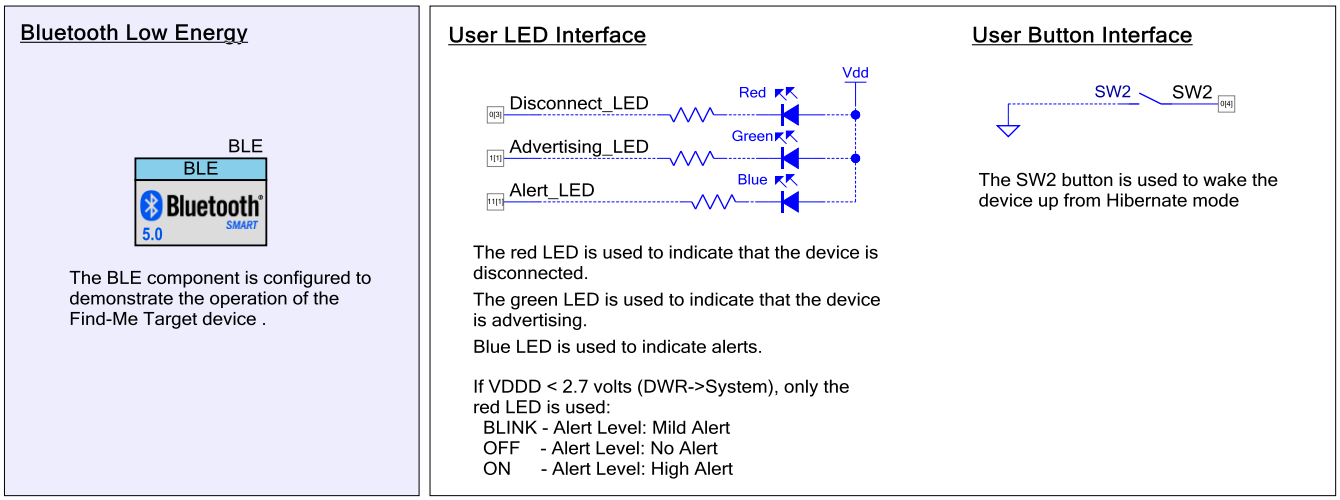


5. Do the following to test example, using the CySmart mobile app as **Find-Me Target** Client:
   a. Launch CySmart mobile app and swipe down the screen to refresh the list of BLE devices available nearby.
   b. Make sure that the development kit is advertising (green LED is blinking): you may need to press the **SW1** button in order to wake up the device from Hibernate mode.
   c. Once the Find-Me Target device appears on the BLE devices list, connect to it and choose **Find Me** in the service selector.
   d. Press **Select** > **Mild Alert** and observe the blue LED is blinking.

Design and Implementation

Figure 6 shows the top design schematic.

Figure 6. BLE Find Me Profile Code Example Schematic



The project demonstrates the core functionality of the BLE Component configured as a Find Me Target. After a startup, the device performs initialization of the BLE Component. In this project, two callback functions are used for the BLE operation. One callback function (StackEventHandler()) is required for receiving generic events from the BLE stack, and the other (IasEventHandler()) is required for receiving events from the Immediate Alert Service. The CY_BLE_EVT_STACK_ON event indicates the successful initialization of the BLE stack. After this event is received, the Component starts advertising with the packet structure as configured in the BLE Component Customizer. The BLE Component stops advertising once the 180-second advertising period expires. On an advertisement event timeout, the device goes to a low-power mode (Stop mode) and waits for a device reset event to wake up the device again.

While connected to a Client and between the connection intervals, the device is put into Deep Sleep mode.

Pin Assignments

Pin assignments and connections required on the development board for supported kits are in Table 1.

Table 1. Pin Assignment

Pin Name	Development Kit	Comment
	CY8CKIT-062	
Advertising_LED	P1[1]	The green color of the RGB LED
Disconnect_LED	P0[3]	The red color of the RGB LED
Alert_LED	P11[1]	The blue color of the RGB LED
SW2	P0[4]	

Components and Settings

Table 2 lists the PSoC Creator Components used in this example, how they are used in the design, and the non-default settings required so they function as intended.

Table 2. PSoC Creator Components

Component	Instance Name	Purpose	Non-default Settings
Bluetooth Low Energy (BLE)	BLE	The BLE component is configured to demonstrate the operation of the Find Me Target device.	See Parameter Settings
Digital Input Pin	SW2	The **SW2** button is used to wake the device up from Hibernate mode.	**[General tab]** Uncheck HW connection Drive mode: Resistive Pull Up
Digital Output Pin	Disconnect_LED Advertising_LED Alert_LED	These GPIOs are configured as firmware-controlled digital output pins that control LEDs.	**[General tab]** Uncheck HW connection Drive mode: Strong Drive

For information on the hardware resources used by a Component, see the Component datasheet.

Parameter Settings

The BLE Component is configured as the Find Me Target in the GAP Peripheral role with the settings shown in the figures below.

Figure 7. General Settings

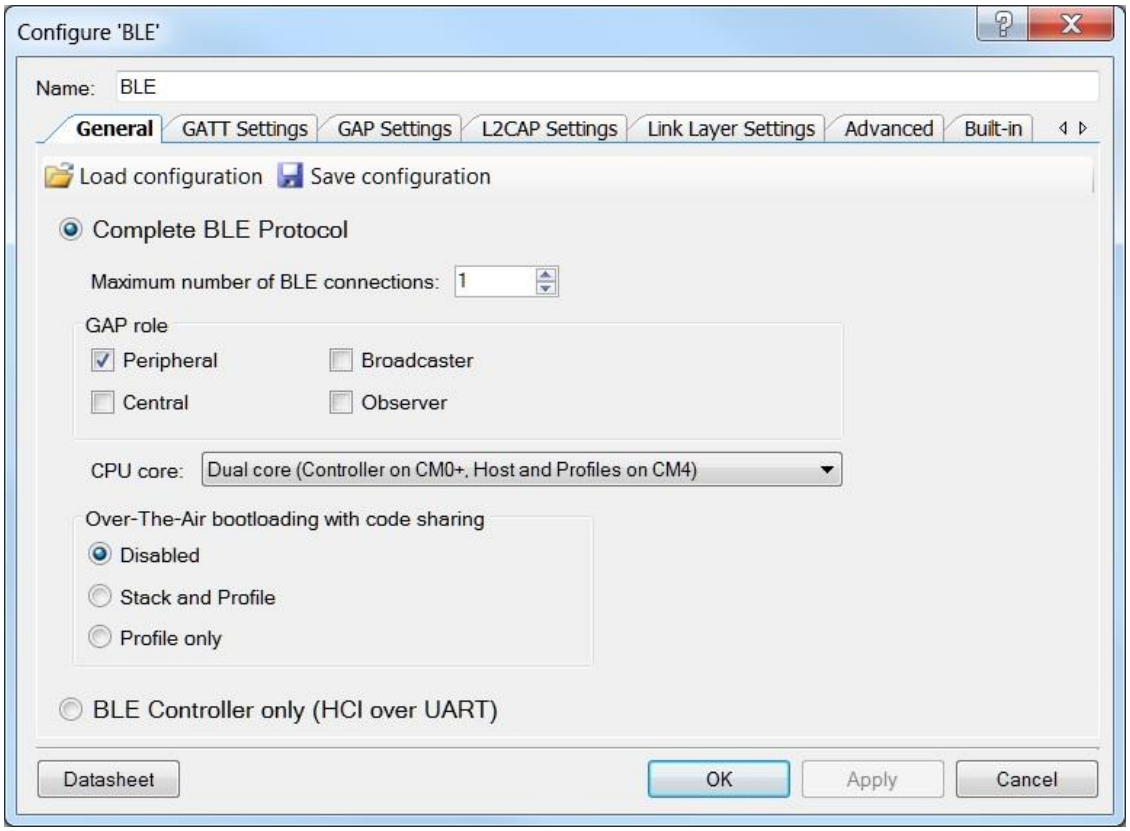


Figure 8. GATT Settings

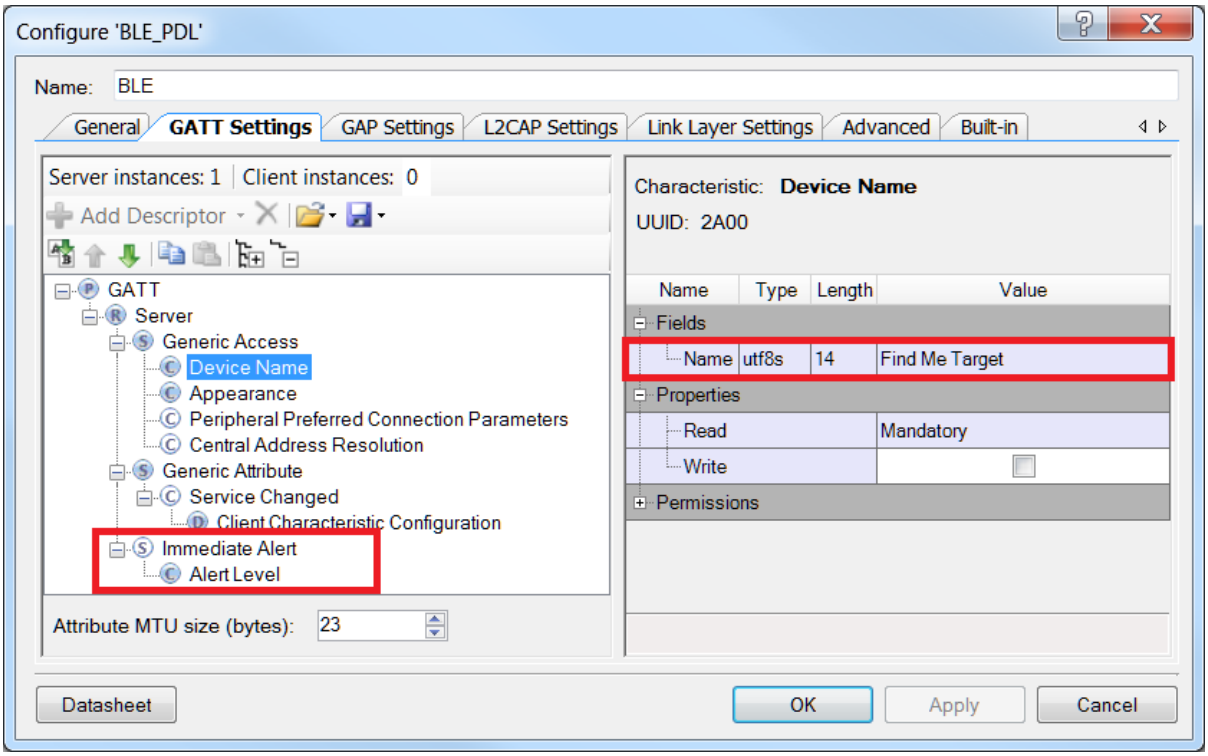


Figure 9. GAP Settings

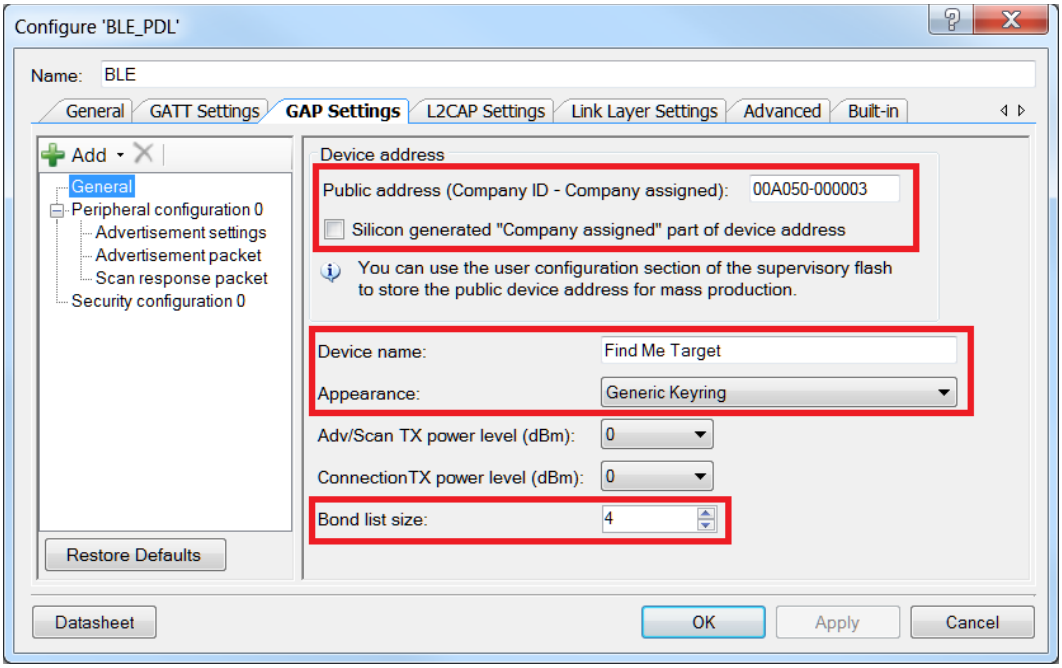


Figure 10. GAP Settings: Advertisement Settings

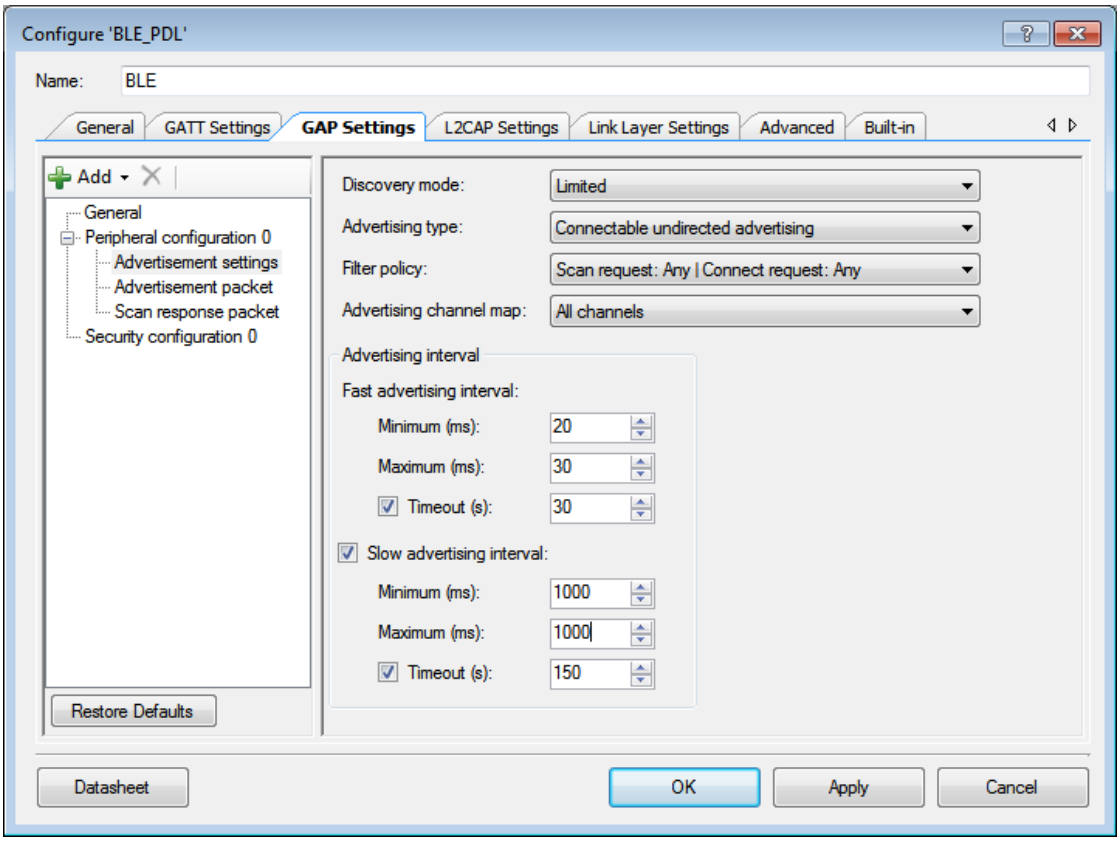


Figure 11. GAP Settings: Advertisement Packet

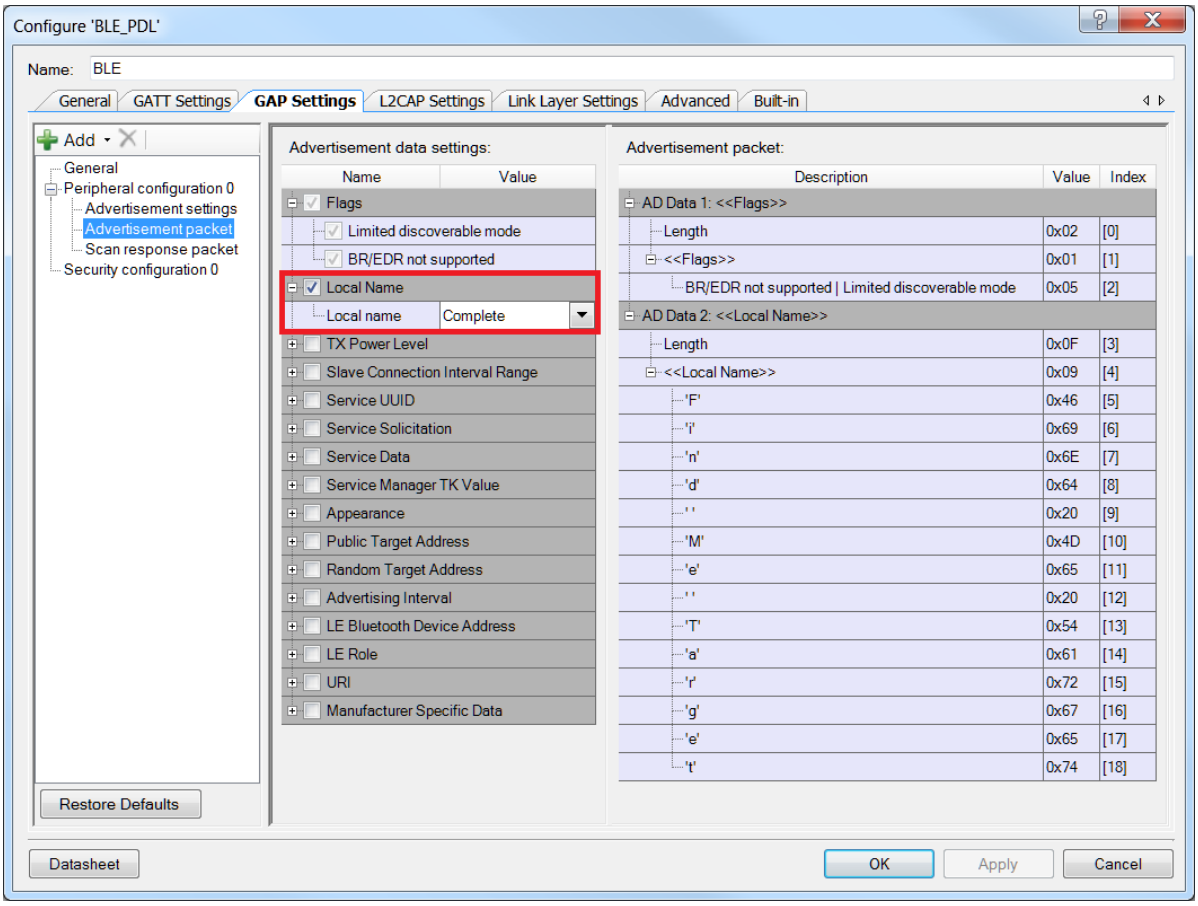
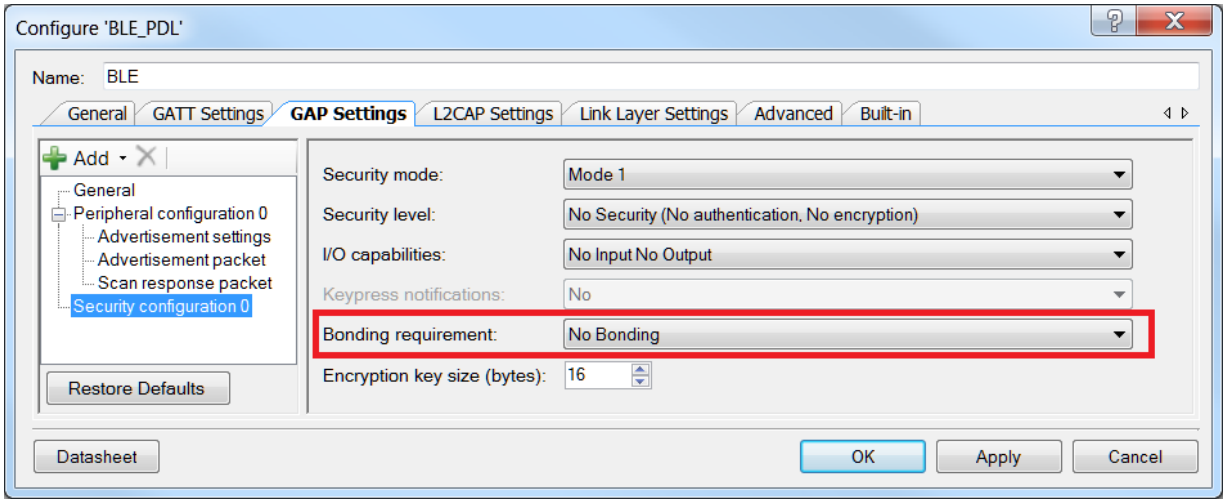


Figure 12. Security Settings



Switching the CPU Cores Usage

This section describes how to switch between different CPU cores usage (Single core/ Dual core) in the BLE PDL examples.

The BLE component has the CPU Core parameter that defines the cores usage. It can take the following values:

- Single core (Complete Component on CM0+) – only CM0+ will be used.
- Single core (Complete Component on CM4) – only CM4 will be used.
- Dual core (Controller on CM0+, Host and Profiles on CM4) – CM0+ and CM4 will be used: CM0+ for the Controller and CM4 for the Host and Profiles.

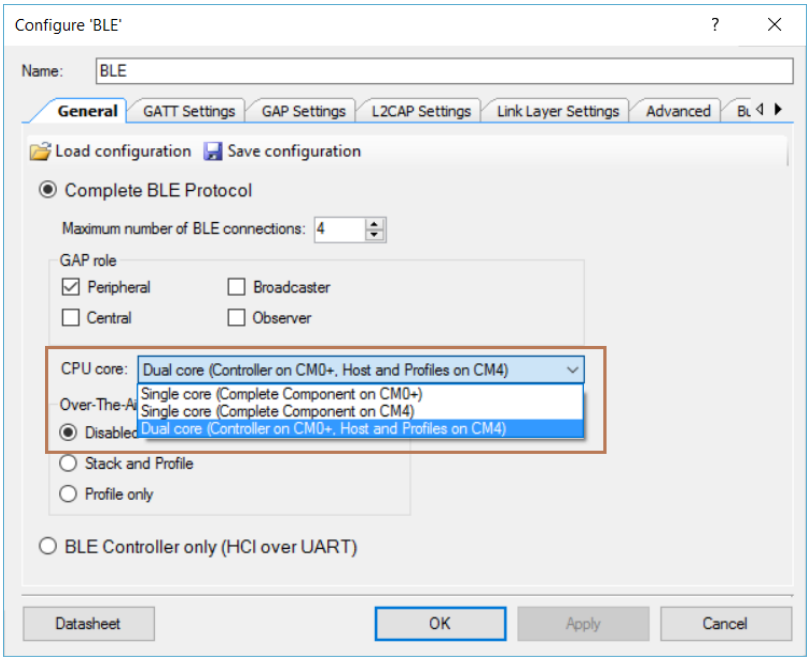
The BLE example structure allows easy switching between different CPU cores options. Important to remember:

- All application host-files must be run on the host core.
- The BLESS interrupt must be assigned to the core where the controller runs.

Steps for switching the CPU Cores usage:

1. In the BLE customizer **General** tab, select appropriate CPU core option.

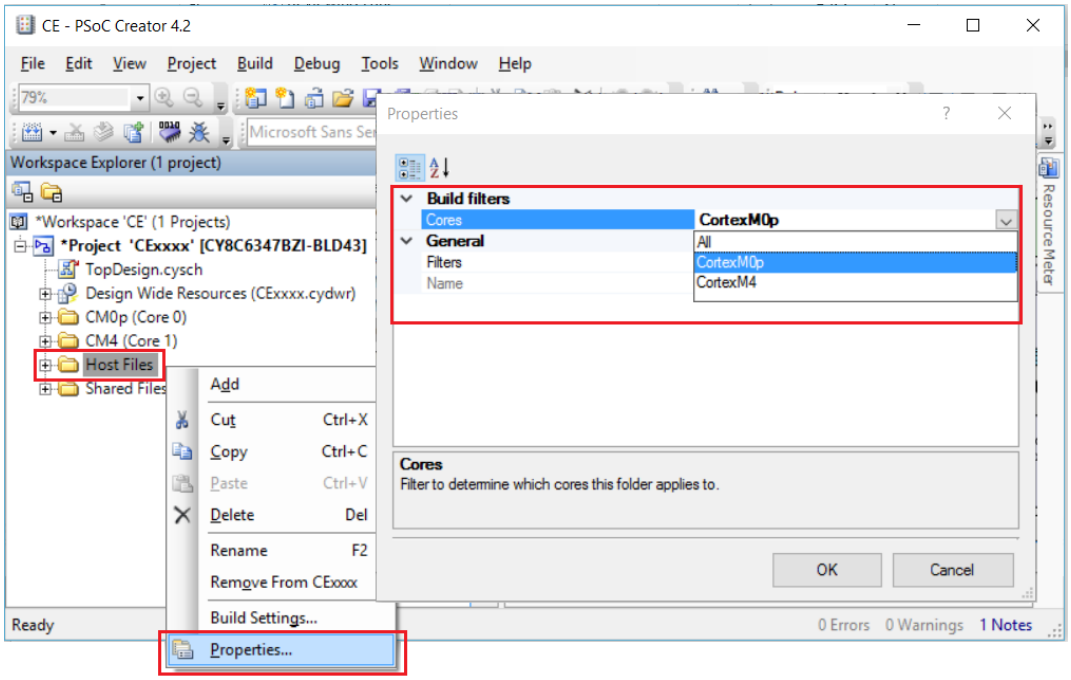
Figure 13. Select CPU Core



2. Identify the core on which host files will run. In the workspace explorer panel, right click **Host Files**, choose **Properties**. Set the **Cores** property corresponding to the CPU core chosen in step 1, as shown in Figure 14.

   - for Single core (Complete Component on CM0+) option – CM0+
   - for Single core (Complete Component on CM4) option – CM4
   - for Dual core (Controller on CM0+, Host and Profiles on CM4) option – CM4

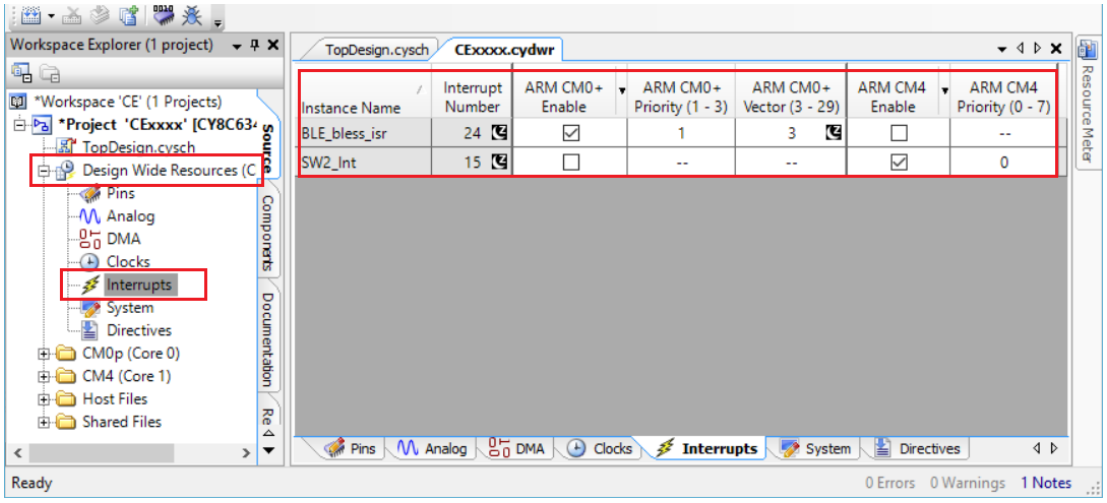
Figure 14. Change Core Properties



3. Assign the BLE_bless_isr and other peripheral (button – SW2, timer(s) etc.) interrupts to the appropriate core in **DWR** > **Interrupts** tab:

   - for **Single core (Complete Component on CM0+)** option: BLE_bless_isr and peripheral interrupts on **CM0+**
   - for **Single core (Complete Component on CM4)** option: BLE_bless_isr and peripheral interrupts on **CM4**
   - for **Dual core (Controller on CM0+, Host and Profiles on CM4)** option: BLE_bless_isr interrupt on **CM0+,** other peripheral interrupts on **CM4**

Figure 15. Assign Interrupts



Reusing This Example

This example is designed for the CY8CKIT-062-BLE pioneer kit. To port the design to a different PSoC 6 MCU device and/or kit, change the target device using the Device Selector and update the pin assignments in the Design Wide Resources Pins settings as needed.

Related Documents

Application Notes		
AN210781	Getting Started with PSoC 6 MCU with Bluetooth Low Energy (BLE) Connectivity	Describes PSoC 6 BLE, and how to build a basic code example.
AN215656	PSoC 6 MCU Dual-CPU System Design	Presents the theory and design considerations related to this code example.
Software and Drivers		
CySmart – Bluetooth® LE Test and Debug Tool		CySmart is a Bluetooth® LE host emulation tool for Windows PCs. The tool provides an easy-to-use Graphical User Interface (GUI) to enable the user to test and debug their Bluetooth LE peripheral applications.
PSoC Creator Component Datasheets		
Bluetooth Low Energy (BLE_PDL) Component		The Bluetooth Low Energy (BLE_PDL) Component provides a comprehensive GUI-based configuration window to facilitate designing applications requiring BLE connectivity.
Device Documentation		
PSoC® 6 MCU: PSoC 63 with BLE. Datasheet.		PSoC® 6 MCU: PSoC 63 with BLE Architecture Technical Reference Manual
Development Kit (DVK) Documentation		
CY8CKIT-062-BLE PSoC 6 BLE Pioneer Kit		

Document History

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**	6090384	NPAL	06/05/2018	New spec

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