

Chapter 1: Introduction

After completing this chapter, you will understand what this class is, what topics are covered, and the overall class objectives.

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Document conventions

Convention	Usage	Example
Courier New	Displays code and text commands	CY_ISR_PROTO (MyISR) ; make build
<i>Italics</i>	Displays file names and paths	<i>sourcefile.hex</i>
[bracketed, bold]	Displays keyboard commands in procedures	[Enter] or [Ctrl] [C]
Menu > Selection	Represents menu paths	File > New Project > Clone
Bold	Displays GUI commands, menu paths and selections, and icon names in procedures	Click the Debugger icon, and then click Next .

1.1 What is this Class

This class teaches you how to use Bluetooth® in ModusToolbox™ applications. The descriptions and exercises use a CYW20835 chip, which is supported by the AIROC™ Bluetooth® SDK (BTSDK).

After completing this class, you should be able to create and debug full Bluetooth® applications using ModusToolbox™ tools including peripherals, centrals, and beacons.

1.2 Prerequisites

This class assumes that you know the basics of using the ModusToolbox™ ecosystem, how to interact with AIROC™ Bluetooth® SDK MCUs including using peripherals, and how to program the device. If you are unfamiliar with these topics, review the following classes first:

- ModusToolbox™ Software Training Level 1 – Getting Started
- ModusToolbox™ Software Training Level 2 – AIROC™ Bluetooth® SDK (BTSDK) MCUs

1.3 Required Software

The following software is required for completing the exercises in this class. Installation instructions will be provided in the exercises.

1.3.1 ModusToolbox™ tools

You should already have ModusToolbox™ tools installed on your system from previous classes. If not, you will install it in the exercises.

1.3.2 AIROC™ Bluetooth® Connect App

We will make extensive use of a smart phone app called AIROC™ Bluetooth® Connect (also known as AIROC™ Connect) to act as a Bluetooth® LE central to connect to and test the peripherals that we will create. That tool is available for Android and iOS.

1.3.3 LightBlue

Another popular Bluetooth® development tool is called LightBlue. It is available on both Android and iOS and can perform similar functions as AIROC™ Connect. It will be used in the scan response exercise and can be used in other exercises instead of AIROC™ Connect.

1.3.4 Beacon Scanner app

For the chapter on Bluetooth® beacons, a beacon scanner app for Android or iOS used to test the exercises. Many free beacon scanner apps are available.

1.4 Bluetooth® Families and Development Kits

Infineon supports Bluetooth® on multiple families of devices. A high-level summary of the different solutions is:

- AIROC™ Bluetooth® device paired with an external host (e.g., CYW43012 + PSoC™ 6)
 - The CYW43xxx device runs the Bluetooth® controller in hosted mode while a host processor such as a PSoC™ 6 MCU runs the upper levels of the stack and the user's application.
 - This is a 2-chip solution.
 - The connectivity device used in this solution often supports both Bluetooth® LE, BR, EDR and Wi-Fi.
- AIROC™ Bluetooth® device with two MCUs (e.g., CYW20829 or PSoC™ 63 BLE)
 - This is a single chip solution with two MCU cores. One MCU runs the user's application and the Bluetooth® stack while the other MCU runs the Bluetooth® controller.
 - The CYW20829 additionally provides:
 - Bluetooth® LE long-range (<https://www.youtube.com/watch?v=TYwwHk0my5E>).
 - Periodic advertisements with response which can be used for Electronic Shelf Labeling.
 - ISOC channels which can be used for ultra-low latency HID (ULL-HID) and Bluetooth® LE audio.
- AIROC™ Bluetooth® device with a single MCU (e.g., CYW20819 or CYW20835)
 - This is a single chip solution with a single MCU core.
 - The device runs the entire Bluetooth® stack and the application.
 - Some of these devices support Bluetooth® BR, EDR, and LE.

Note: This class covers the third solution listed above. The first two solutions are covered in the Type1 class.

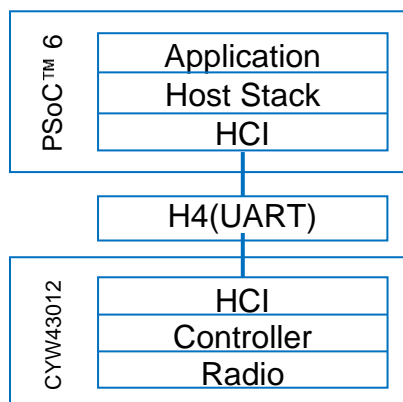
Note: All examples and exercises in this class are done using the CYW920835M2EVB-01 kit.

Development kits are available for each of the families described above. See the list of kits in the ModusToolbox™ Project Creator tool and the Infineon website for the most up-to date list.

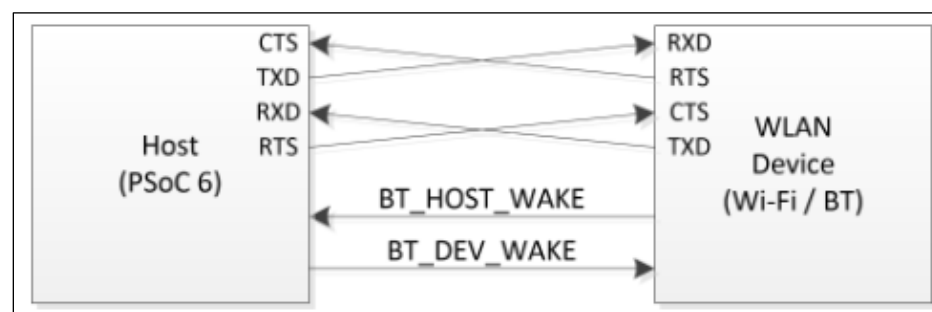
1.4.1 AIROC™ Bluetooth® device paired with an external host

In the 2-chip solution, the interface between the host (e.g., PSoC™ 6) and the radio device (e.g., CYW43012) uses the Host Controller Interface (HCI) to communicate between devices. The lower level of the Bluetooth® system (the Controller) runs on the CYW43012 while the higher level of the Bluetooth system (the Host Stack) runs on the PSoC™ 6 along with the user application.

Here is a picture that illustrates the connection:



The HCI interface physically runs using a 4-pin UART interface. The PSoC™ 6 that we are using has multiple UARTs on it so don't worry, you will still have a UART interface to print debug messages. There are also two wake pins that are used for low power which we will cover later.



Note: The CYW43012 also supports Wi-Fi which uses a completely independent SDIO interface (not shown) for communication between the PSoC™ 6 host and the CYW43012.

The controller (e.g., CYW43012) runs the radio physical layer (PHY) and link layer (LL). Everything above that runs on the PSoC™ 6.

1.4.2 AIROC™ Bluetooth® device with two MCUs

The CYW20829 and PSoC™ 63 devices each offer a single-chip Bluetooth® solution containing two MCU cores. For the PSoC™ 63, the upper-level Bluetooth® stack and user application runs on a CM4 while the lower-level Bluetooth® controller firmware runs on a CM0+. The CYW20829 contains two CM33 cores – the upper-level stack and user application runs on one CM33 while the controller runs on the other CM33.

The PSoC™ 63 also offers the benefit of CAPSENSE™ along with Bluetooth® LE in a single device.

1.4.3 AIROC™ Bluetooth® device with a single MCU

In the Bluetooth™ single MCU solution, the full stack and user application run on a single device. Many of the devices in this family are combo devices that support Bluetooth® BR/EDR and LE.

1.5 Bluetooth® Libraries

There are two libraries that are included into the application to support the different requirements of the first two solutions. The libraries are *btstack* and *btstack-integration*. The *btstack* library contains the stack functions and API that is common to all the solutions. The *btstack-integration* library provides three different interfaces to the low-level hardware on each type of device. The *btstack-integration* library uses the COMPONENT mechanism to include the required interface layer.

The three supported component values are:

Convention	Usage	Example
COMPONENT_HCI-UART	AIROC™ Wi-Fi and Bluetooth® Devices with Host MCU	PSoC™ 6 + CYW43012
COMPONENT_BLESS-IPC	PSoC™ 63 AIROC™ Bluetooth® Microcontroller	PSoC™ 63
COMPONENT_BTSS-IPC	CYW20829	CYW20829

Note: For PSoC™ 63 AIROC™ Bluetooth® devices, the controller code that runs on the CM0+ is supplied from the *cat1cm0p* library using `COMPONENT_CM0P_BLESS`.

Note: The CYW20829 contains the Bluetooth® controller code in ROM.

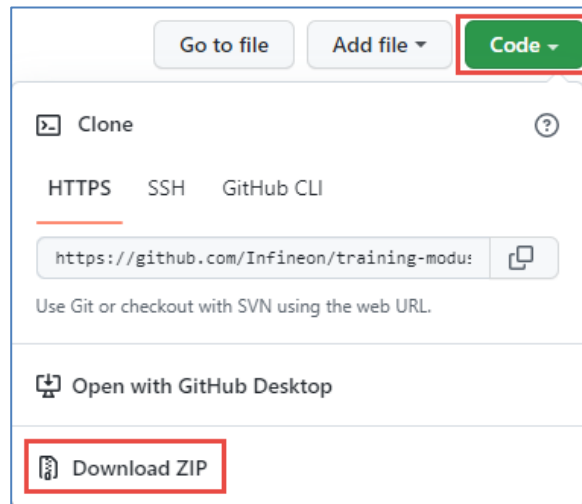
Note: For single MCU devices such as the CYW20819 and CYW20835, the host stack and controller code are both contained in ROM. Therefore, the *btstack* and *btstack-integration* libraries are not used.

1.6 Exercises

Exercise 1: Download Class Material

In this exercise, you will download the class material from GitHub. This will give you local access to the manuals and projects.

- ☐ 1. Use a Web browser to go to the class GitHub site at: <https://github.com/Infineon/training-modustoolbox-level3-bluetooth>
- ☐ 2. Click the Code button.



- ☐ 3. Click the Download ZIP button to download the repo to your local disk to a convenient location and then unzip it.

Note: If you are familiar with Git operations, you can clone the repository to your local disk using the URL instead of downloading a ZIP file if you prefer.

Exercise 2: Install Software

In this exercise, we will make sure you have all of the software needed for the class.

ModusToolbox™ tools



4. You should already have ModusToolbox™ tools installed on your system. If not, refer to the ModusToolbox™ Software Training Level 1 Getting Started class or visit <https://www.infineon.com/cms/en/design-support/tools/sdk/modustoolbox-software> for instructions.

Note: You must use ModusToolbox 2.3.1 or later. If you have ModusToolbox 2.3, you must install the 2.3.1 patch for the exercises in this class to work.

AIROC™ Bluetooth® Connect



1. Install AIROC™ Bluetooth® Connect onto your smartphone from the Android or iOS app store.

LightBlue



1. Install LightBlue onto your smartphone from the Android or iOS app store.

Beacon Scanner App



1. Install the beacon app of your choice onto your smartphone from the Android or iOS app store.

For Android, "Beacon Scanner" is a good choice.

For iOS, "BLE Scanner" is a good choice.

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