BT SDK 2.3 Technical Brief

BT SDK Version: 2.3

Abstract

ModusToolbox™ with the BT SDK provides a complete development environment to allow one to quickly create an IoT solution utilizing Cypress' world-class Bluetooth/BLE connectivity technologies. This document also provides the details of many supported features and modes, and limitations associated with supported hardware development platforms.

Contents

ModusToolbox™ and BT SDK Development Environment

ModusToolbox™ with the Bluetooth SDK is a software development environment allowing rapid application development of Bluetooth enabled IoT solutions. Cypress provides a steady release cadence for the BT SDK enabling new features, fixes, and improvements. Cypress tests and supports these releases and its features with the platforms defined in this document to provide easy migration from one version to the next. If customers choose to create solutions, platforms, or both that are not defined in this document, they are responsible for testing and technical support of these platforms.

ModusToolbox with the BT SDK includes the following features and capabilities:

- A cross-platform installer supporting Windows, Linux, and macOS environments
- An Eclipse-based IDE with integrated programming and debugging support
- Build system infrastructure, Configurators, and Utilities
- Bluetooth firmware
- Platform and board support packages
- A rich set of WICED™ connectivity APIs that allow for simplified programming of BT/BLE connectivity
- Various sample applications that serve as examples of how to utilize the BT/BLE APIs
- More complex code examples that utilize various APIs and middleware to create a more complete solution

Supported Platforms

The BT SDK includes support for several Cypress kits and platforms. The platforms listed in Table 1 are tested with the BT SDK 2.3 release. For support on platforms not listed, please contact Cypress for details on the relevant release appropriate for your project.

Board	MCU	Connectivity	Flash	RAM
CYW920819EVB-02	CYW20819	On-chip Bluetooth	256 KB OCF	160 KB
CYW920819REF-KB-01	CYW20819	On-chip Bluetooth	256 KB OCF	160 KB
CYBT-213043-MESH	CYW20819	On-chip Bluetooth	256 KB OCF	160 KB
CYBT-213043-EVAL	CYW20819	On-chip Bluetooth	256 KB OCF	160 KB
CYW920820EVB-02	CYW20820	On-chip Bluetooth	256 KB OCF	160 KB
CYW920735Q60EVB-01	CYW20735	On-chip Bluetooth	No on-chip flash (OCF)	320 KB
CYW920721B2EVK-01	CYW20721	On-chip Bluetooth	1 MB OCF	448 KB
CYW920721B2EVK-02	CYW20721	On-chip Bluetooth	1 MB OCF	448 KB
CYW920721B2EVK-03	CYW20721	On-chip Bluetooth	1 MB OCF	448 KB
CYW920719B2Q40EVB-01	CYW20719	On-chip Bluetooth	1 MB OCF	448 KB
CYW989820EVB-01	CYW89820	On-chip Bluetooth	256 KB OCF	160 KB
CYW920706WCDEVAL	CYW20706	On-chip Bluetooth	No on-chip flash (OCF)	352 KB
CYBT-353027-EVAL	CYW20706	On-chip Bluetooth	No on-chip flash (OCF)	352 KB

Table 1. List of Platforms Tested during BT SDK2.3 Releases

WICED™ APIs

WICED™ APIs are designed to reduce the number of steps needed to create connections over Bluetooth. Developers do not need to be experts in connectivity technologies, as the APIs will program many of the settings for the types of connections that the developer is trying to create. The result is that the functionality that often takes dozens of commands and domain-specific knowledge can be done with a few WICED APIs.

The BT SDK includes documentation for the APIs that are derived directly from the BT SDK source code. As new APIs are created or as existing APIs are augmented, the documentation stays synchronized.

Functional Support

The BT SDK provides functionalities in several different areas including:

- Core Bluetooth/BLE Technologies
- Bluetooth/BLE Protocols and Profiles
- Kit/Platform Support

This technical brief provides in-depth details on the functionality offered.

Core Bluetooth/BLE Technologies

Bluetooth Standards

All Bluetooth/BLE cores and chipsets supported in the BT SDK support a base set of Bluetooth functionalities:

- BR and EDR data rates
- Bluetooth Low Energy (BLE)

Additionally, each chip supports one of several Bluetooth SIG specification revisions. The following are the major features that are supported in each specification:

- Bluetooth 4.2
  - LE Secure Connections
  - LE Privacy 1.2
  - Data Length Extension
- Bluetooth 5.0
  - 2 Mbps LE phy data rate
  - SAM (Slot Availability Mask)
  - LE Channel Selection
  - High Duty Cycle Non-Connectable Advertisement

Note: Chips or cores that support a later Bluetooth specification also include the supported features of previous specifications.

Table 2 lists the supported Bluetooth/BLE chipsets and the Bluetooth SIG specification.

Chipset	Bluetooth SIG Specification	Specification Features
CYW20706A2	BT 5.0	4.2 Features: LE Secure connections, DPLE, LE Privacy 1.2
CYW20719B2	BT 5.0	LE 2 Mbps, SAM, LE ch selection #2, High Duty Cycle Non-Connectable Adv
CYW20721B2	BT 5.0	LE 2 Mbps, SAM, LE ch selection #2, High Duty Cycle Non-Connectable Adv
CYW20735B1	BT 5.0	LE 2 Mbps, SAM, LE ch selection #2, High Duty Cycle Non-Connectable Adv
CYW20819	BT 5.0	LE 2 Mbps, SAM, LE ch selection #2, High Duty Cycle Non-Connectable Adv
CYW20820	BT 5.0	LE 2 Mbps, SAM, LE ch selection #2, High Duty Cycle Non-Connectable Adv
CYW89820	BT 5.0	LE 2 Mbps, SAM, LE ch selection #2, High Duty Cycle Non-Connectable Adv

Table 2. List of Bluetooth Specification Support by Chipset and Support Features

Because of differences in peripheral support, memory optimization, available GPIO's, and software development life-cycle, some features of the hardware may not be available in the BT SDK 2.3 release. The below table lists those limitations.

Chipset	Platforms	Features that aren't supported in BT SDK2.3
CYW20721B2	CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03	• Programmable key-scan matrix interface • HID-OFF low power mode • I^2C2 Master/slave interface • PDM • MIPI DBI-C display interface • Dual/Quad SPI

Chipset	Platforms	Features that aren't supported in BT SDK2.3
CYW20719B2	CYW920719B2Q40EVB-01	• Programmable key-scan matrix interface • HID-OFF low power mode • I^2C2 Master/slave interface • PDM • MIPI DBI-C display interface • Dual/Quad SPI
CYW20819 CYW20820	CYW920819EVB-02 CYW920820EVB-02	• Programmable key-scan matrix interface • I^2C2 Master/slave interface • PDM • Dual/Quad SPI

Features, Profiles, and Protocols

In addition to the core Bluetooth/BLE functionality, the BT SDK provides a proven Bluetooth/BLE stack. Each of the profiles and protocols provided within the code examples (CE) in the BT SDK are validated in our System Validation Test (SVT) labs. The code examples give developers examples on how to use the BT protocols and APIs.

Bluetooth/BLE Features/Code Examples

Table 3 lists the features/code examples (organized by application group) that are actively supported in BT SDK2.3.

Application Group	Feature/Code example	Description	Board
BLE Mesh	BLE Mesh Demo Examples	dimmer: CE of a simple dimmer based on level client model.	CYW920819EVB-02, CYBT-213043-MESH, CYBT-213043-EVAL, CYW920820EVB-02, CYW920706WCDEVAL, CYW920719B2Q40EVB-01, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03 CYW920735Q60EVB-01
		light dimmable: CE of a dimmable light based on the BLE Mesh Light Lightness Server model.	CYW920819EVB-02, CYBT-213043-MESH, CYBT-213043-EVAL, CYW920820EVB-02, CYW920706WCDEVAL, CYW920719B2Q40EVB-01, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03 CYW920735Q60EVB-01
		light smart: CE of a smart light based on the light lightness and LC models.	CYW920819EVB-02, CYBT-213043-MESH, CYBT-213043-EVAL, CYW920820EVB-02, CYW920719B2Q40EVB-01, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03
		low power led: CE of a low power LED system, includes low power server and Friend node.	CYW920819EVB-02, CYBT-213043-MESH, CYBT-213043-EVAL, CYW920820EVB-02
		on off switch: CE of an on/off switch.	CYW920819EVB-02, CYBT-213043-MESH, CYBT-213043-EVAL, CYW920820EVB-02, CYW920719B2Q40EVB-01, CYW920721B2EVK-01,

			CYW920721B2EVK-02, CYW920721B2EVK-03 CYW920735Q60EVB-01
		sensor motion: Sensor Motion CE showing implementation of the BLE Mesh Sensor server model	CYW920819EVB-02, CYBT-213043-MESH, CYW920820EVB-02
		sensor temperature: Temperature sensor CE showing implementation of the BLE Mesh Sensor Server model	CYW920819EVB-02, CYBT-213043-MESH, CYW920820EVB-02
		switch smart: CE of a motion sensor combined with the on off button functionality.	CYW920819EVB-02, CYWBT-213043-MESH, CYBT-213043-EVAL, CYW920820EVB-02, CYW920719B2Q40EVB-01, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03
	BLE Mesh Snip Examples	Sample apps based on SIG mesh models (client & server, power on/off, level, battery, light control, transition location, property, time, scene, scheduler, provision, sensor, etc.)	CYW920819EVB-02, CYBT-213043-MESH, CYBT-213043-EVAL, CYW920820EVB-02, CYW920706WCDEVAL, CYBT-353027-EVAL, CYW920719B2Q40EVB-01, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03 CYW920735Q60EVB-01
BLE	hello_client	Hello client CE shows an implementation of a BLE vendor specific GATT client profile.	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920706WCDEVAL, CYBT-353027-EVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
	hello_sensor	Hello sensor CE shows an implementation of a BLE vendor specific GATT device and service	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920706WCDEVAL, CYBT-353027-EVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
	beacon	Beacon CE demonstrates implementation of Apple iBeacon and Google Eddystone	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920706WCDEVAL, CYBT-353027-EVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
	env sensing temp	CE demonstrates the implementation of a simple BLE Environmental Sensing profile.	CYW920819EVB-02, CYW920820EVB-02, CYW920719B2Q40EVB-01
	ans and anc	Sample apps for Alert Notification profile (ANC: Client and ANS: Service)	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920706WCDEVAL,

			CYBT-353027-EVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
	bas and bac	Sample apps for Battery Service profile (BAS - Service, BAC - Client)	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920706WCDEVAL, CYBT-353027-EVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
	hrs and hrc	Sample apps for Heart Rate profile (HRC - Client, HRS - Server)	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW920706WCDEVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
	le coc	Sample application for BLE Connection Oriented Channel	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01
	find me	Sample application for BLE FindMe Service	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01
Audio	watch	CE demonstrating BT A2DP source, AVRCP controller/target, Apple Media Service (AMS) and Apple Notification Center Service (ANCS), BT GATT, handling of the UART WICED protocol, SDP and GATT descriptor/attribute configuration.	CYW920819EVB-02, CYW920820EVB-02, CYW920706WCDEVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01
	audio gateway	CE demonstrates use of Bluetooth Audio Gateway profile – Handsfree, handling of the UART WICED protocol, and setting of the local BT device address from the host MCU	CYW920706WCDEVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01
	bt speaker	CE of a BT speaker device including A2DP sink (SBC decoding), AVRCP, HFP, and Google fast pair support.	CYW920721B2EVK-02
	headset	CE of a BT headset device including A2DP sink (SBC decoding), AVRCP, HFP, and Google Fast Pair support.	CYW920721B2EVK-02
	headset	CYW20706 CE for headset device that combines A2DP sink and AVRCP controller and AVRC target	CYW920706WCDEVAL
	a2dp sink	CE of a BT A2DP sink device.	CYW920706WCDEVAL CYW920721B2EVK-02

	hands-free	CE of a BT handsfree device. Use the client control application to send various commands.	CYW920706WCDEVAL CYW920721B2EVK-02
HID	dual_mode_keyboard	CE of a CYW20819 dual mode reference keyboard solution using the CYW20819 in a 112 pin module	CYW920819REF-KB-01
	ble_keyboard	CE of a turnkey BLE keyboard solution using on-chip keyscan HW component, based on HID over GATT profile (HOGP)	CYW920819EVB-02, CYW920820EVB-02 CYW920735Q60EVB-01
	ble_mouse	CE of a BLE mouse solution based on HID over GATT profile (HOGP)	CYW920819EVB-02, CYW920820EVB-02 CYW920735Q60EVB-01
	ble_remote	CE of a BLE remote control solution based on HID over GATT profile (HOGP)	CYW920819EVB-02, CYW920820EVB-02 CYW920735Q60EVB-01
RFCOMM	pbap client	CE of a Bluetooth PBAP client. It can connect to mobile phone that supports PBAP server profile and download phone book and call logs.	CYW920706WCDEVAL, CYBT-353027-EVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01
	map_client	Message Access Client application is designed to connect and access service on the Message Access Server device. It can be used to access SMS-MMS messages or email received on the Message Access Server device such as a smartphone.	CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01
	spp	Sample app uses SPP profile library to establish, terminate, send and receive SPP data over BR/EDR. Application supports a single SPP connection.	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920706WCDEVAL, CYBT-353027-EVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
	opp_server	CE of Object Push Profile (OPP) used to receive object files (e.g. vCard, Image, text, …) and send object files from OPP client (mobile phone or PC).	CYW920706WCDEVAL, CYBT-353027-EVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01
HAL	ADC	App demonstrates how to configure and use ADC to measure DC voltage on DC input channels.	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW920706WCDEVAL, CYW920721B2EVK-02, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
	PUART	App demonstrates how to use PUART API's to read data over WICED	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920706WCDEVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
	PWM	App demonstrates how to configure and use PWM in WICED Eval boards.	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920706WCDEVAL

			CYW920735Q60EVB-01
	GPIO	App demonstrates use of WICED GPIO apis to configure GPIOs as input/output	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920706WCDEVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
	I2C Master	App demonstrates how to use I2C interface to send and receive data	CYW920819EVB-02, CYW920820EVB-02, CYW989820EVB-01, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
	Low power	App demonstrates low power modes.	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02
OTA	ota_firmware_upgrade	CE that demonstrates BLE based over the air firmware upgrade functionality.	CYW920819EVB-02, CYBT-213043-MESH, CYW920820EVB-02, CYW989820EVB-01, CYW920706WCDEVAL, CYBT-353027-EVAL, CYW920721B2EVK-01, CYW920721B2EVK-02 CYW920721B2EVK-03, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01
EMPTY	empty_wiced_bt	Empty starter application that is a starting point for adding new code and functionality.	CYW920819EVB-02, CYBT-213043-EVAL, CYW920820EVB-02, CYW989820EVB-01, CYW920706WCDEVAL, CYBT-353027-EVAL, CYW920721B2EVK-01, CYW920721B2EVK-02, CYW920721B2EVK-03, CYW920719B2Q40EVB-01 CYW920735Q60EVB-01

Table 3. List of Actively Supported BT/BLE Profiles/Features

BT SDK Pro Packages

In addition to the code examples that are available in the BT SDK, Cypress has optional set of packages that add extra features to the BT SDK. These are typically more complex applications or require special licensing. The Pro CE are not available on GitHub repos. Contact Cypress sales to request.

Table 4 provide a list of code examples that are available with BT SDK Pro packages.

Application Group	Feature/Code example	Description	Supported Platforms
audio pro	bt_speaker_pro_aac	CE of a BT speaker device including A2DP sink (SBC and AAC decoding), AVRCP, HFP, and Google fast pair support	CYW920721B2EVK-01 CYW920721B2EVK-02 CYW920721B2EVK-03
	bt_speaker_pro_ama	CE of a BT speaker device including A2DP sink (SBC and AAC decoding), AVRCP, HFP, and button initiated AMA support	CYW920721B2EVK-01 CYW920721B2EVK-02 CYW920721B2EVK-03
	headset_pro_aac	CE of a BT headset device including A2DP sink (SBC and AAC decoding), AVRCP, HFP, and Google Fast Pair support.	CYW920721B2EVK-01 CYW920721B2EVK-02 CYW920721B2EVK-03
	headset_pro_ama	CE of a BT headset device including A2DP sink (SBC and AAC decoding), AVRCP, HFP, and button initiated AMA support.	CYW920721B2EVK-01 CYW920721B2EVK-02 CYW920721B2EVK-03
	headset_wass	CE of an untethered BT earbud solution demonstrating Cypress Wireless Audio Stereo Sync (WASS), A2DP sink (SBC decoding), AVRCP, HFP, and Google Fast Pair support.	CYW920721B2EVK-01 CYW920721B2EVK-02 CYW920721B2EVK-03
	headset_wass_aac	CE of an untethered BT earbud solution demonstrating Cypress Wireless Audio Stereo Sync (WASS), A2DP sink (SBC and AAC decoding), AVRCP, HFP, and Google Fast Pair support.	CYW920721B2EVK-01 CYW920721B2EVK-02 CYW920721B2EVK-03
pro-iap2	iap2	Sample app demonstrating use of the iAP2 protocol to communicate with an iOS device using the BT iAP2 library	CYW920819EVB-02 CYW920820EVB-02 CYW989820EVB-01 CYW920706WCDEVAL CYW920721B2EVK-01 CYW920721B2EVK-02 CYW920721B2EVK-03 CYW920719B2Q40EVB-01
pro-peps	Hub	Sample app demonstrating BLE Passive Entry Passive Start (PEPS) Hub that connects with the car key	CYW989820EVB-01
	key	Sample app demonstrating PEPS key usage to send localization packet (to be tracked)	CYW989820EVB-01
	Sensor	Sample app demonstrating PEPS sensor used for BLE localization (to track the key)	CYW989820EVB-01

Table 4. List of BT SDK Pro Code Examples

Technical Support

Cypress Developer Community also hosts Forums for technical support. You can search the forum to find answer to your question. If you are unable to find the answer, you can post it on the forum. These Forums are manned by Cypress engineers to assist you with issues that you encounter while using WICED Studio with platforms and features listed in this document. For quick access, here are the links to the Bluetooth forums:

https://community.cypress.com/community/wiced-studio-blueooth/wiced-studio-bluetooth-forums

If you need support beyond what is listed in this document, you can contact of our partners. List of our partners is available at https://community.cypress.com/community/partners.

Learning Resources

Cypress offers a wealth of learning resources as summarized in Table 5.

Information	Source
Cypress Wireless Solutions and Product Offerings	Wireless Product Offerings
Location to buy Kits	Cypress Kit Store
Cypress Developer Community	Community
Getting Started and Training Videos	Getting Started Videos
ModusToolbox	ModusToolbox
Bluetooth SDK, Application Notes, Support Blogs, and Help Articles	Bluetooth Documentation

Table 5. Learning Resources

To learn about new features, devices, and platform support since previous release and to find the list of any known issues and solutions, see the release notes provided with every BT SDK release.

Software Licensing

Express Logic ThreadX object files and headers are licensed by Cypress from Express Logic, Inc and provided to BT SDK users royalty-free.

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