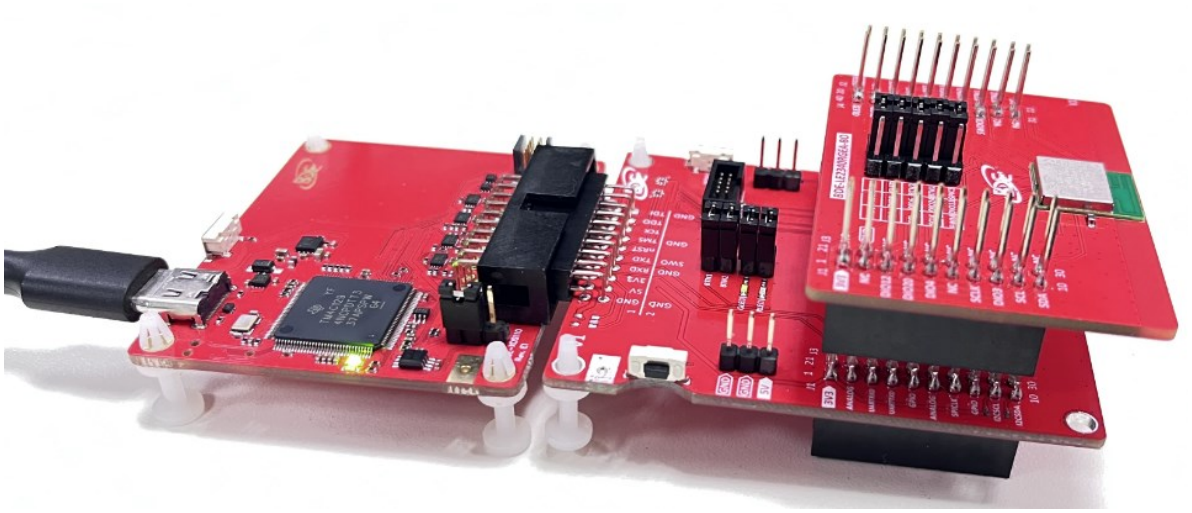
BDE-LE2340RGE Module User Guide

V1.1



Contents

1. General Description

This user guide is intended to assist the users in evaluating the module by providing instructions on how to effectively use the evaluation kit.

BDE-LE2340RGE is a Bluetooth 5.3 Low Energy module series based on TI's CC2340R SoC. The BDE-LE2340R52GE module series is with 512KB flash and 36KB SRAM and the BDE-LE2340R21GE module series is with 256KB flash and 28KB SRAM. For more information on the module variants, please refer to module datasheet.

The kit includes a breakout board with module (board number: BDE-LE2340RxxGEAx-BO), a Launchpad™ evaluation module which can connect with the breakout board through the BoosterPack™ interface (board number: BDE-LPEM), and also a XDS110 debugger used for debugging CC2340R device (board number: BDE-XDS110).

2. Launchpad Evaluation Module: BDE-LPEM

The BDE-LPEM is an evaluation module designed as an interface module with BoosterPack interface which can connect with any boards that come with the standard BoosterPack interface, including the BDE-LE2340RxxGEAx-BO board. For more details on the BoosterPack pinout standard, please refer to this link.

The board overview is shown as Figure 1.

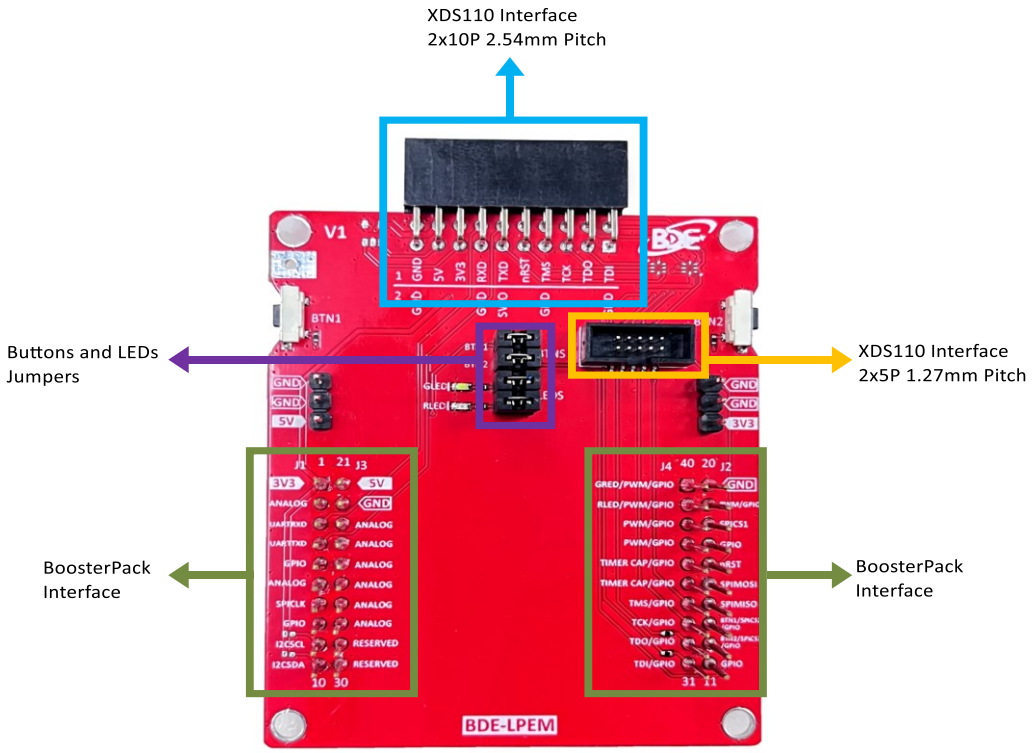


Figure 1. Board Overview of BDE-LPEM

3. Breakout Board: BDE-LE2340RxxGEAx-BO

We provide a breakout board for module to enable easy access to every exposed pad on module with the 2.54mm-pitch pins. The breakout board can be stacked to the BDE-LPEM board for evaluation.

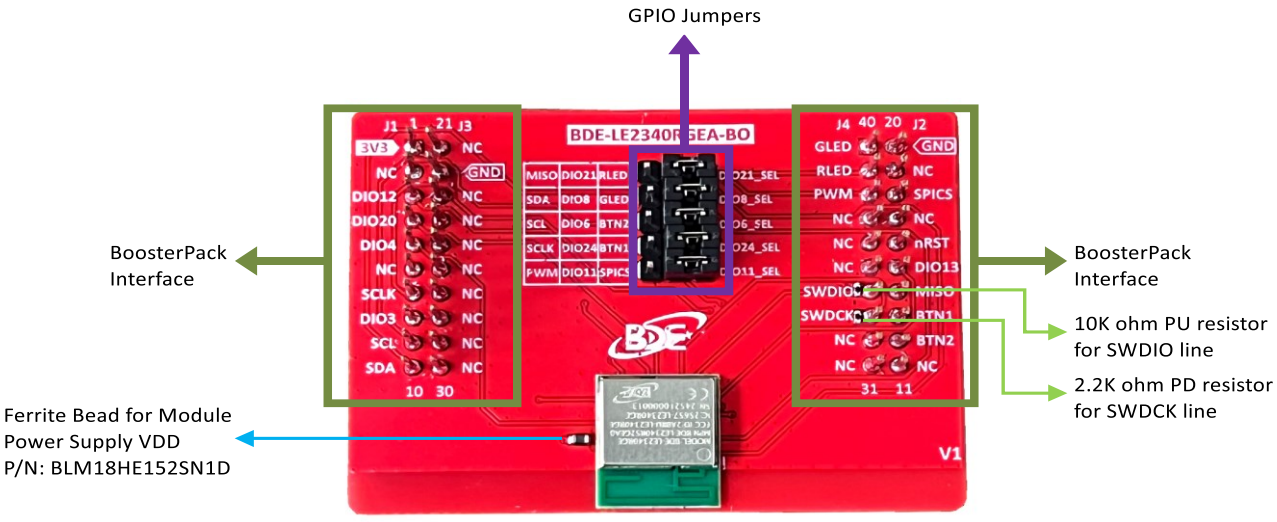


Figure 2. Board Overview of BDE-LE2340RxxGEAx-BO

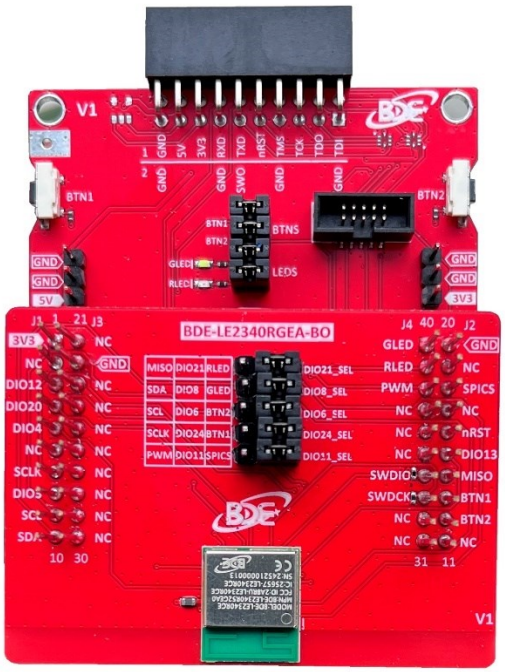


Figure 3. The Photo of BDE-LPEM Stacked with the Breakout Board with Module

3.1. Breakout Board Header Pin Assignment

Table 1 shows the pin assignment for breakout board header J1, J2, J3 and J4.

Table 1. Breakout Board Headers Pin Assignment

Pin Number	Pin Name	Type/Direction	Description
1	3V3	Power	Board power supply, connect with module VDD through a ferrite bead
2	NC	-	No connect
3	DIO12	I/O	GPIO, module RX in BoosterPack pin
4	DIO20	I/O	GPIO, module TX in BoosterPack pin
5	DIO4	I/O	GPIO
6	NC	-	No connect
7	SCLK	I/O	SPI_CLK in BoosterPack pin, GPIO24 can be assigned to it by jumper “DIO24_SEL”
8	DIO3	I/O	GPIO
9	SCL	I/O	I2C_SCL in BoosterPack pin, GPIO6 can be assigned to it by jumper “DIO6_SEL”
10	SDA	I/O	I2C_SDA in BoosterPack pin, GPIO8 can be assigned to it by jumper “DIO8_SEL”
11	NC	-	No connect
12	BTN2	I/O	Button 2 in BoosterPack pin, GPIO6 can be assigned to it by jumper “DIO6_SEL”
13	BTN1	I/O	Button 1 in BoosterPack pin, GPIO24 can be assigned to it by jumper “DIO24_SEL”
14	MISO	I/O	SPI_MISO in BoosterPack pin, GPIO21 can be assigned to it by jumper “DIO21_SEL”
15	DIO13	I/O	GPIO
16	nRST	Input	Reset pin, active low
17	NC	-	No connect
18	SPICS	I/O	SPI_CS in BoosterPack pin, GPIO11 can be assigned to it by jumper “DIO11_SEL”
19	NC	-	No connect
20	GND	GND	Board ground
21	NC	-	No connect
22	GND	GND	Board ground
23	NC	-	No connect
24	NC	-	No connect
25	NC	-	No connect
26	NC	-	No connect
27	NC	-	No connect
28	NC	-	No connect
29	NC	-	No connect
30	NC	-	No connect
31	NC	-	No connect
32	NC	-	No connect
33	SWDIO	I/O	SWDIO for SWD debug or DIO16

Pin Number	Pin Name	Type/Direction	Description
34	SWDCK	I/O	SWDCK for SWD debug or DIO17
35	NC	-	No connect
36	NC	-	No connect
37	NC	-	No connect
38	PWM	I/O	PWM/GPIO in BoosterPack pin, GPIO11 can be assigned to it by jumper “DIO11_SEL”
39	RLED	I/O	RED LED in BoosterPack pin, GPIO21 can be assigned to it by jumper “DIO21_SEL”
40	GLED	I/O	Green LED in BoosterPack pin, GPIO8 can be assigned to it by jumper “DIO8_SEL”

3.2. Debug Header Pin Assignment

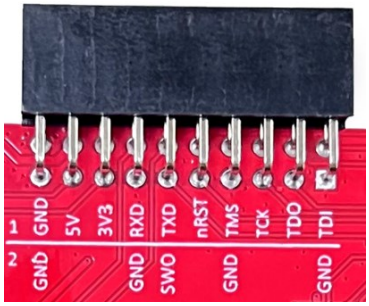


Figure 4. Debug Header

Table 2 shows the pin assignment for the debug header.

Table 2. Debug Header Pin Assignment

Pin Number	Pin Name	Type/Direction	Description
1, 2, 8, 14, 20	GND	GND	Board ground
3	5V	Power	5V supply from XDS110
4, 6, 12, 16, 18	NC	-	No connect
5	3V3	Power	Module power supply
7	RXD	Input	Module UART RXD
9	TXD	Output	Module UART TXD
10	SWO	I/O	SWO for JTAG
11	nRST	Input	Reset pin, active low
13	TMS	I/O	TMS for JTAG/XDS110, or SWDIO for SWD debug
15	TCK	I/O	TCK for JTAG/XDS110, or SWDCK for SWD debug
17	TDO	I/O	TDO for JTAG/XDS110
19	TDI	I/O	TDI for JTAG/XDS110

BDE recommends using XDS110 for the debug. J-Link or other debuggers support SWD could also work.

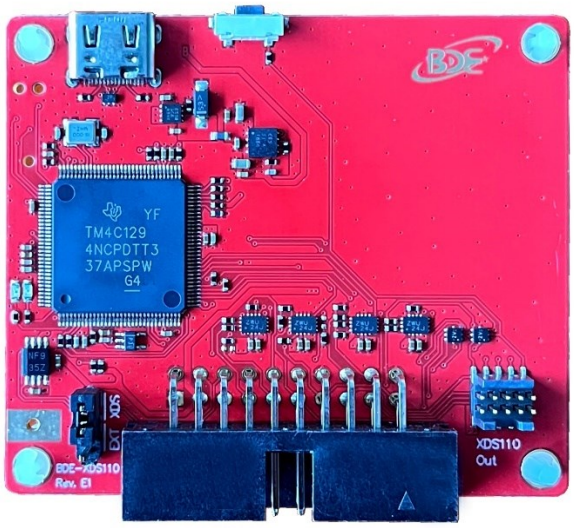
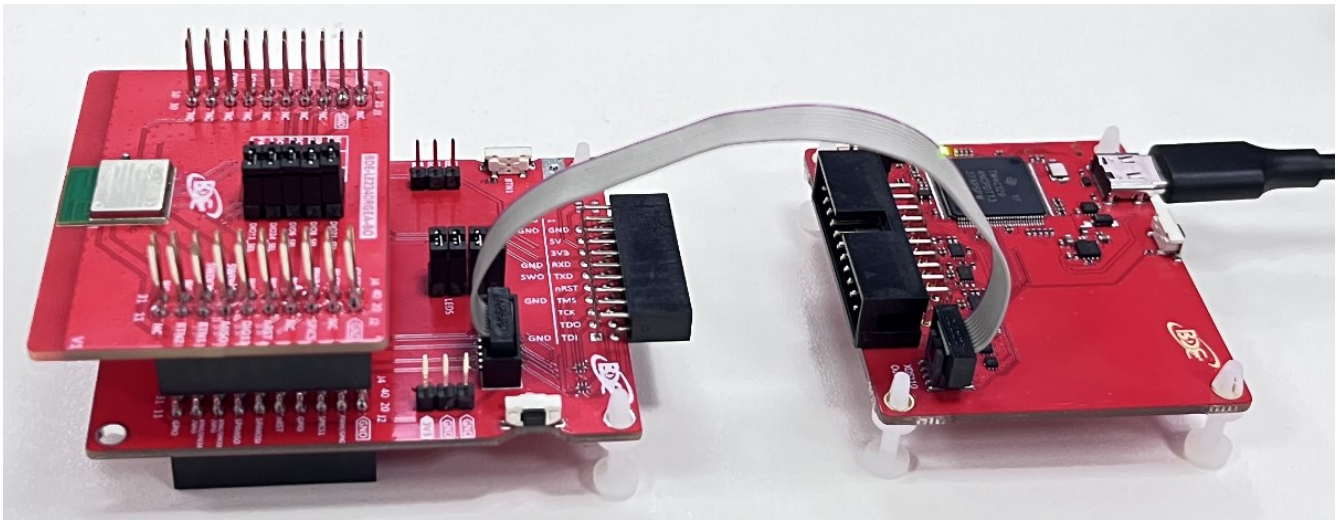


Figure 5. BDE-XDS110

The board can also be connected via a 2x5P 1.27-pitch ribbon cable to the XDS110 debugger.



4. Getting Started

Below section describes how to set up the development environment of BDE-LE2340RGE module, including the hardware and software.

4.1. Prerequisites

4.1.1. Hardware

- BDE-LE2340RxxGEAx-BO, breakout board with module BDE-LE2340R52GEAx, depending on what module variant you are choosing;
- BDE-LPEM, Launchpad evaluation interface module;
- BDE-XDS110, XDS110 debugger;

- USB type C cable;
- PC

4.1.2. Software and Tools

- Code Composer Studio
- SIMPLELINK-LOWPOWER-F3-SDK
- SimpleLink Connect mobile app
- UniFlash
- SmartRF Studio
- PuTTY

4.2. Hardware Setup

1. Plug BDE-LE2340RxxGEAx-BO into the BDE-LPEM evaluation module and connect BDE-LPEM to BDE-XDS110, as shown in Figure 6;
2. Connect the jumpers as shown in Figure 6;
3. Connect the BDE-XDS110 to the PC via a USB type C cable. The XDS110 will power the module with 3.3V if the jumper on BDE-XDS110 is plugged to XDS.

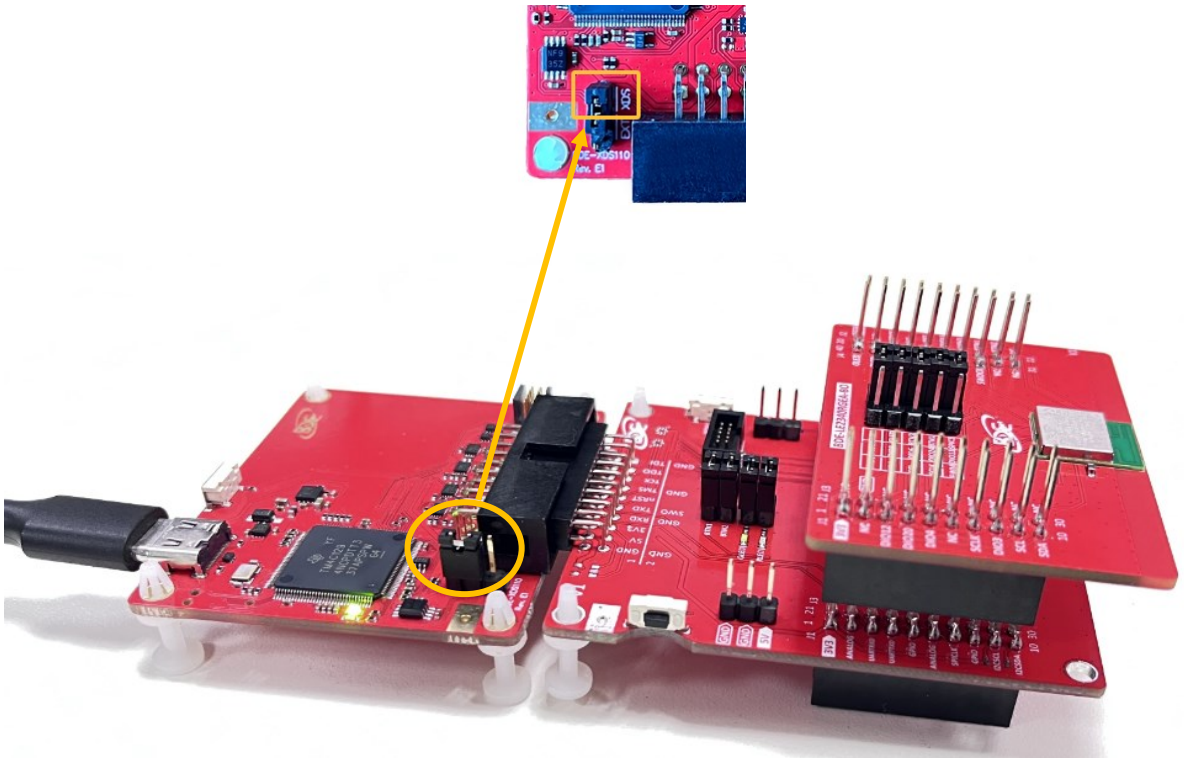
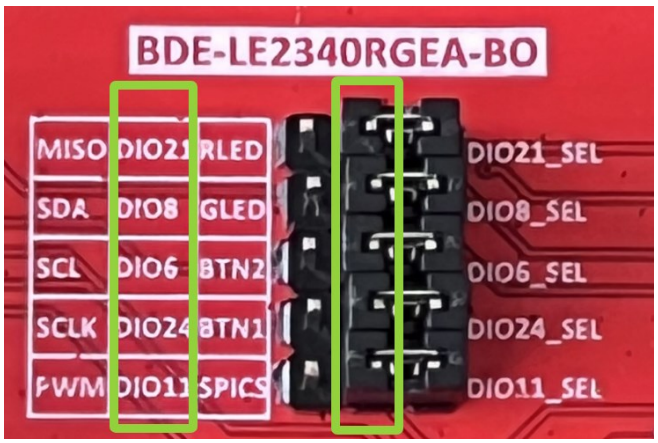


Figure 6. Hardware Setup

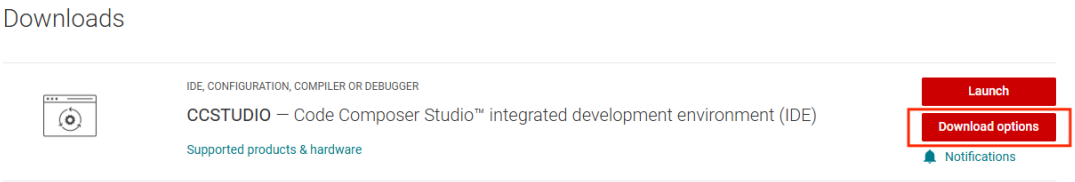
Due to the limited pin resources of the BDE-LE2340RGE module, below jumpers are provided on the breakout board for configuring the GPIOs for different uses. For instance, if you want to use DIO21 as RLED, plug the jumper of “DIO21_SEL” to the right, if you want to use it as MISO, plug the jumper to the left.



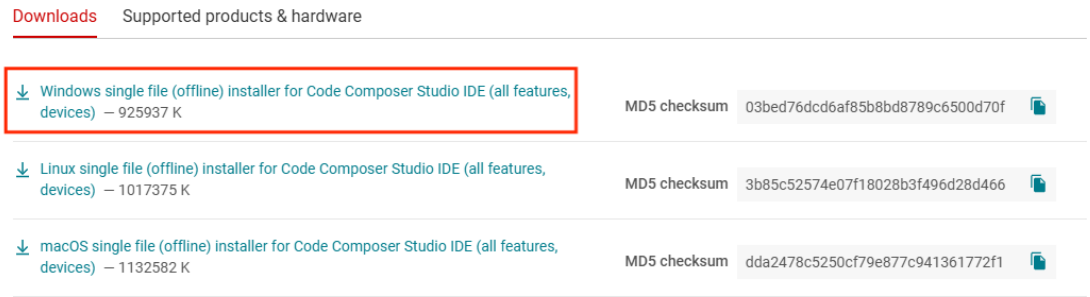
4.3. Software Setup

4.3.1. Download and Install CCS

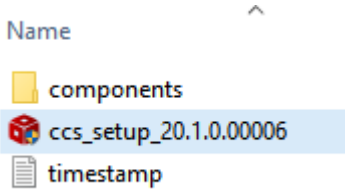
1. Visit the following link.
   https://www.ti.com/tool/CCSTUDIO
2. Find CCSTUDIO item, and click “Download options”.



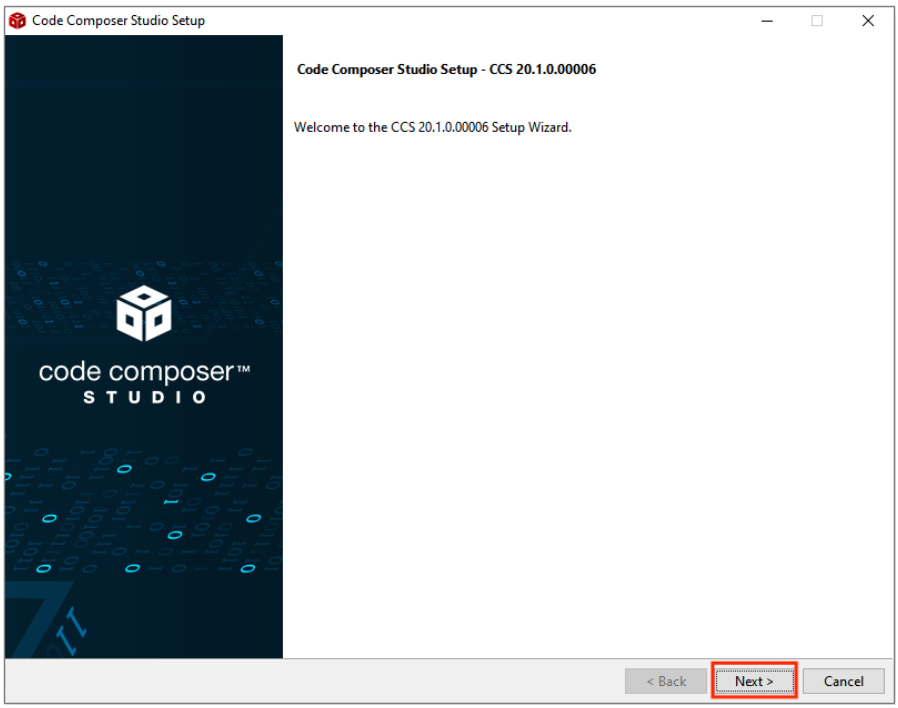
3. Choose the target platform, in this case, Windows is selected.



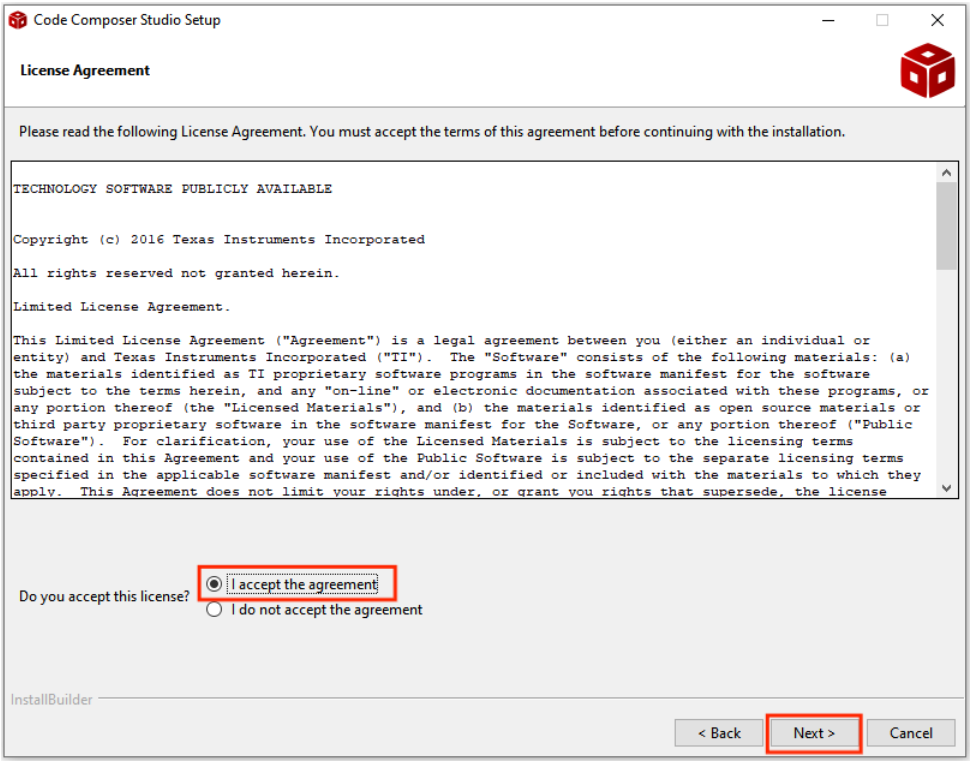
4. Decompress the zip file, and double-click “ccs_setup_xx.exe”.



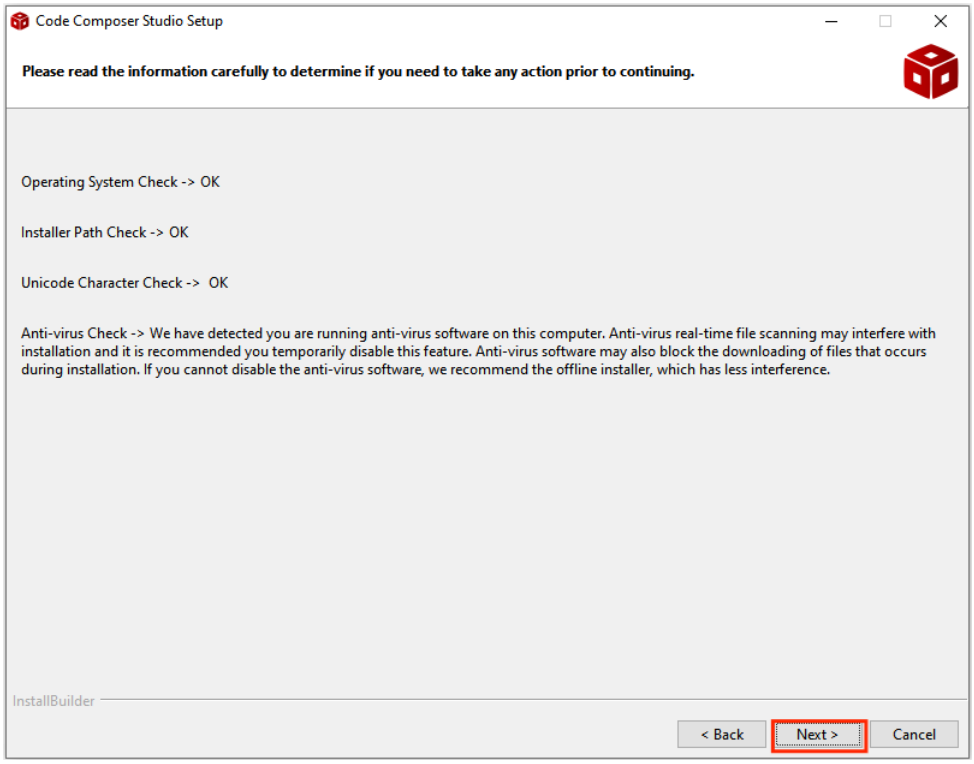
5. Click “Next”.



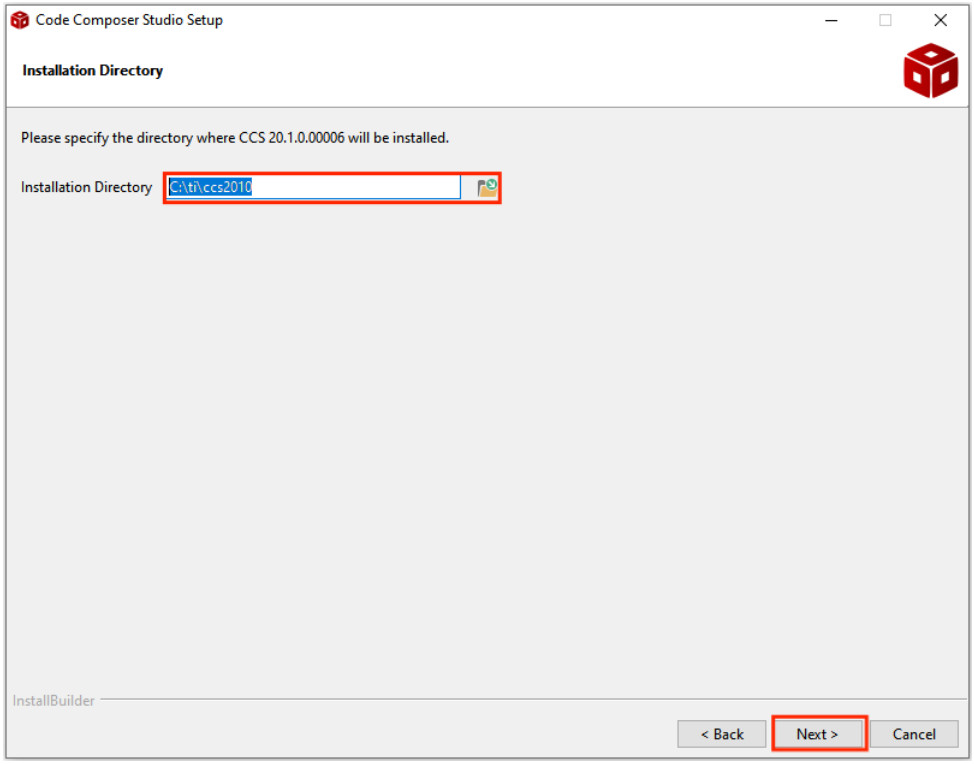
6. Select “I accept the agreement”, and then click “Next”.



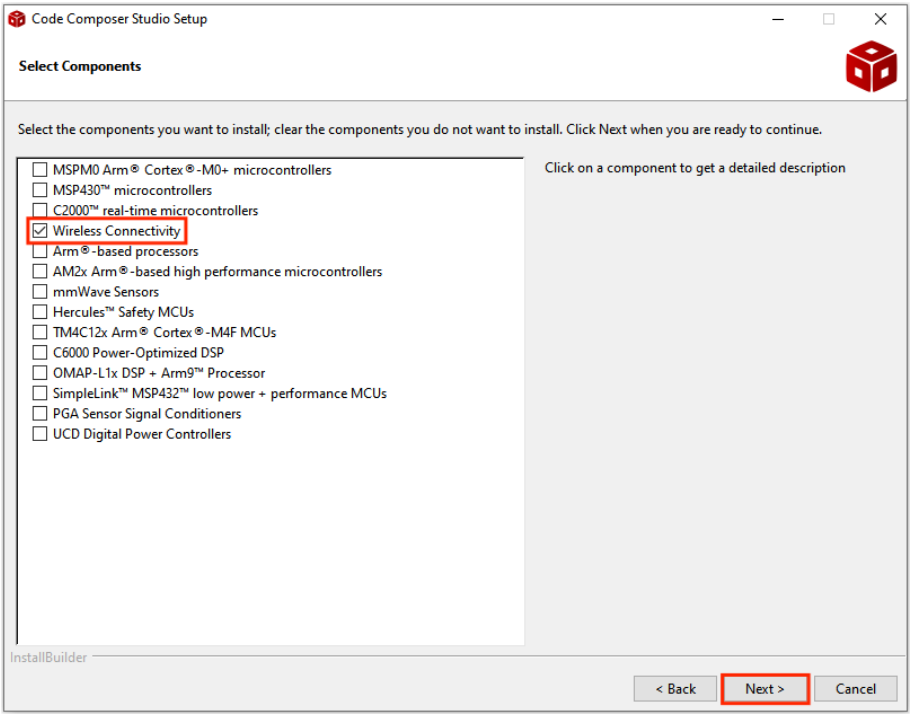
7. Click “Next”.



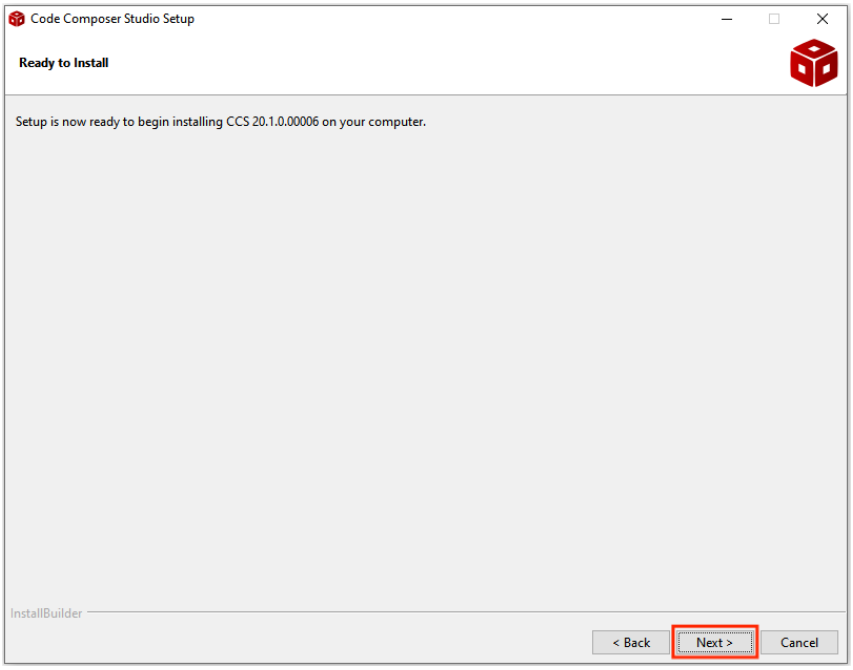
8. Choose the installation directory, and then click “Next”.



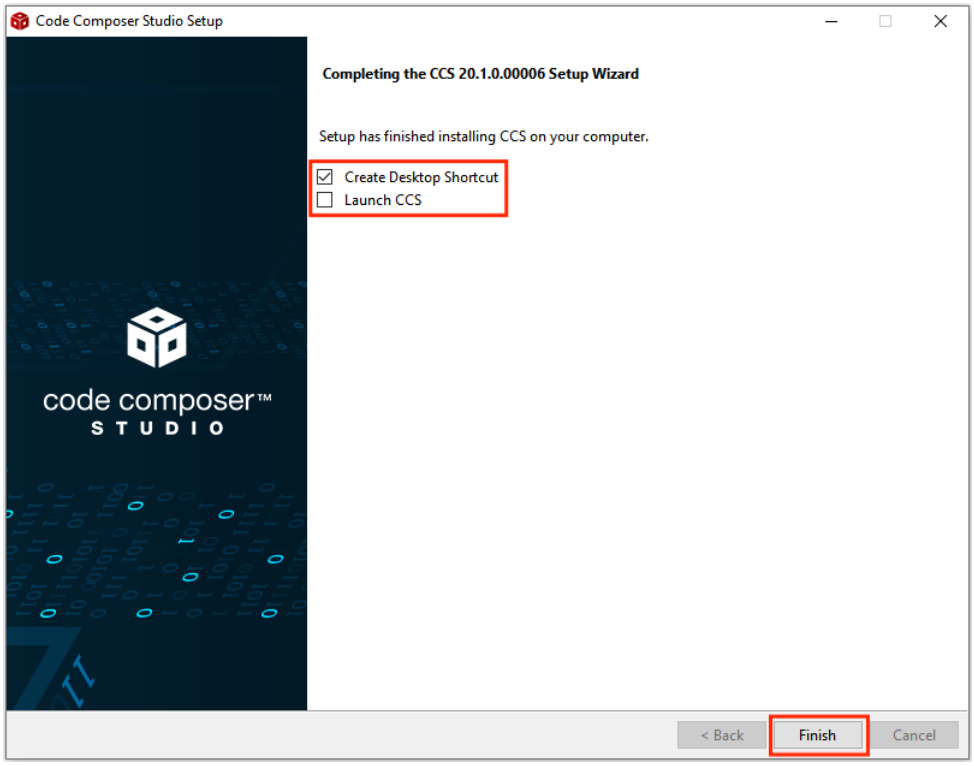
9. Select “Wireless connectivity” components, and then click “Next”.



10. Click “Next”, and the installation will start. Wait until the installation is complete.

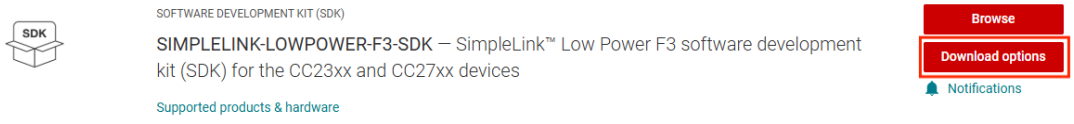


11. Click “Finish”.

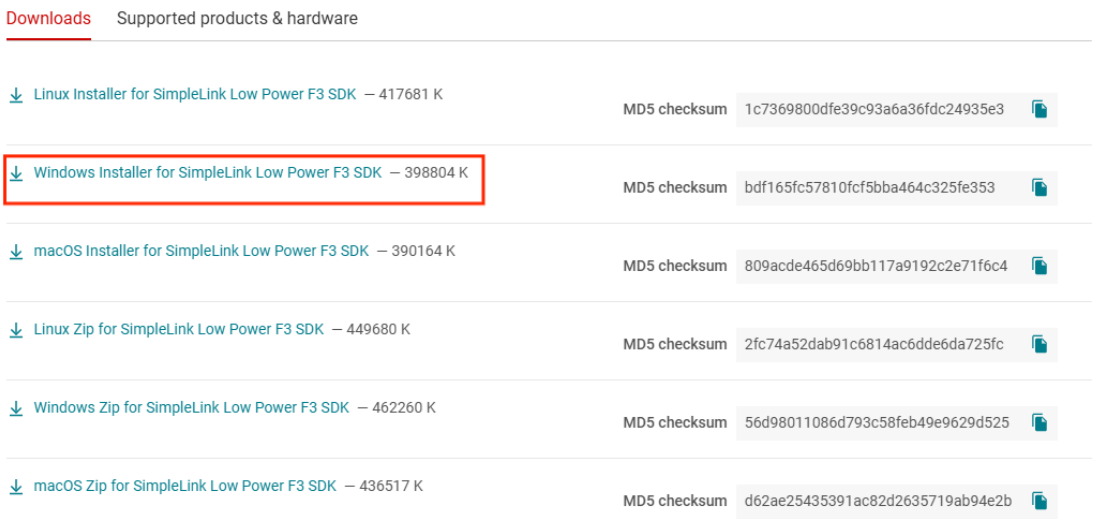


4.3.2. Download and Install SDK

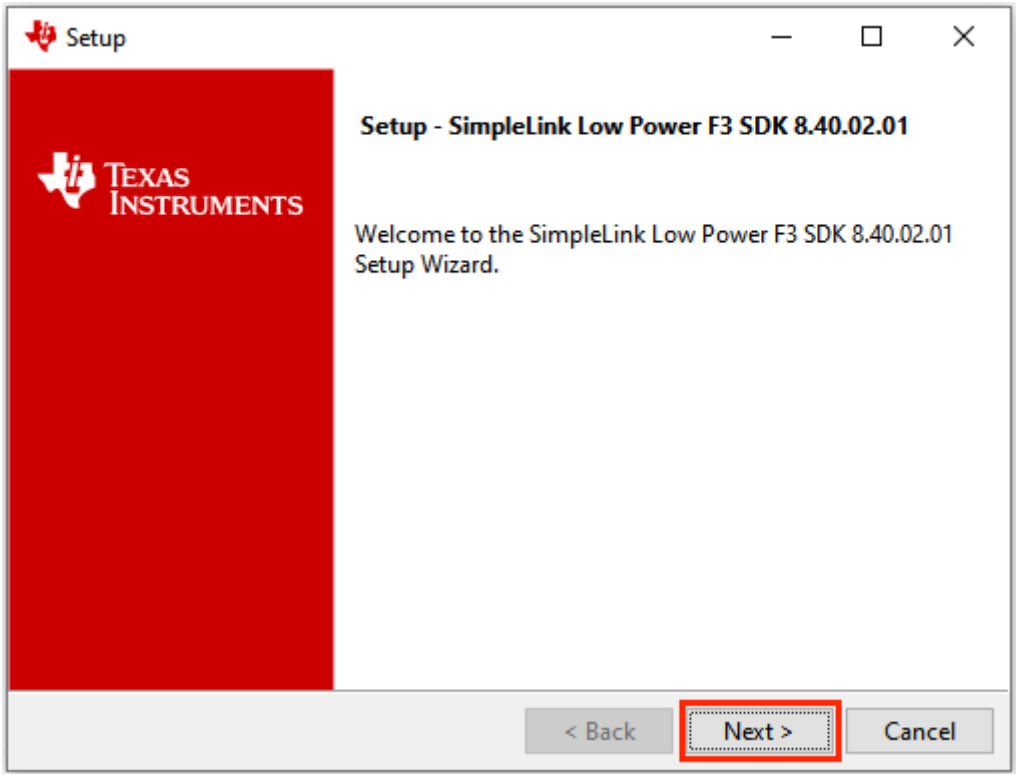
1. Visit the following link.
   https://www.ti.com/tool/SIMPLELINK-LOWPOWER-SDK
2. Find “SIMPLELINK-LOWPOWER-F3-SDK” item, and click “Download options”.



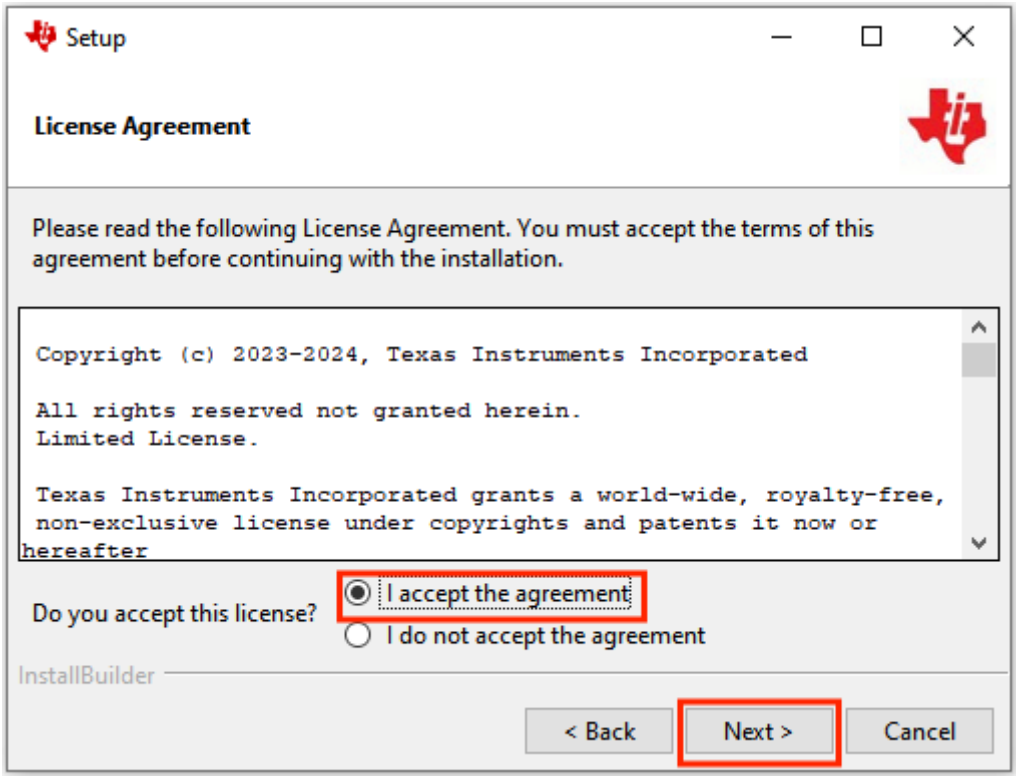
3. Choose the target platform, in this case, Windows is selected.



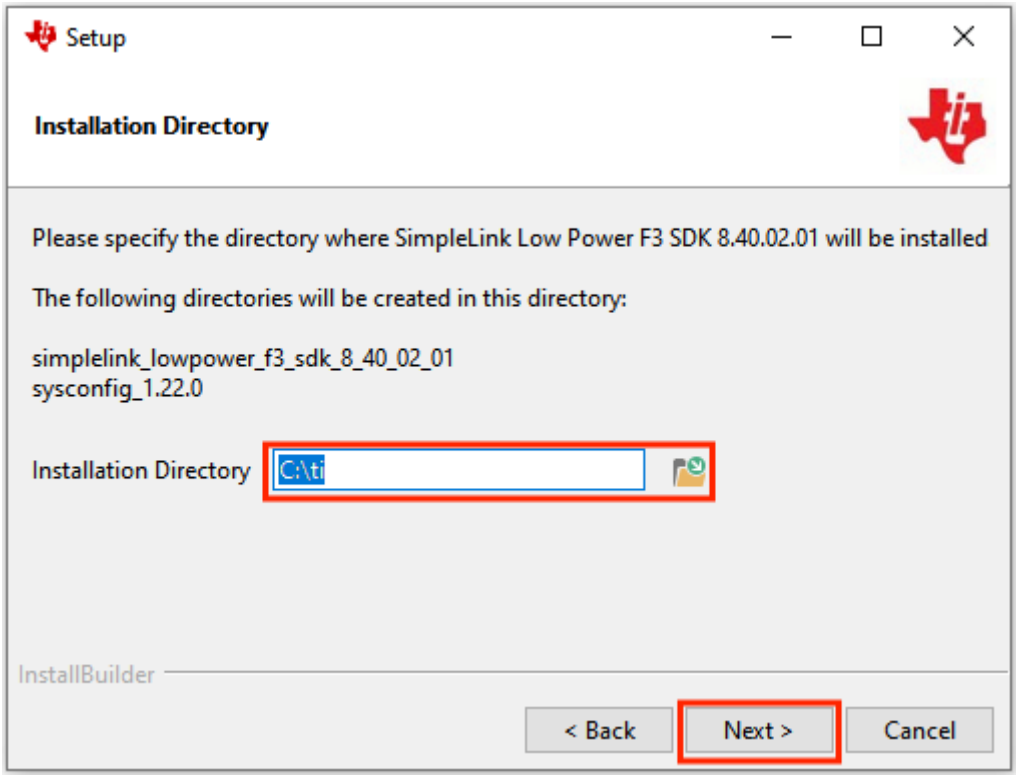
4. Double-click the installation package.
5. Click “Next”.



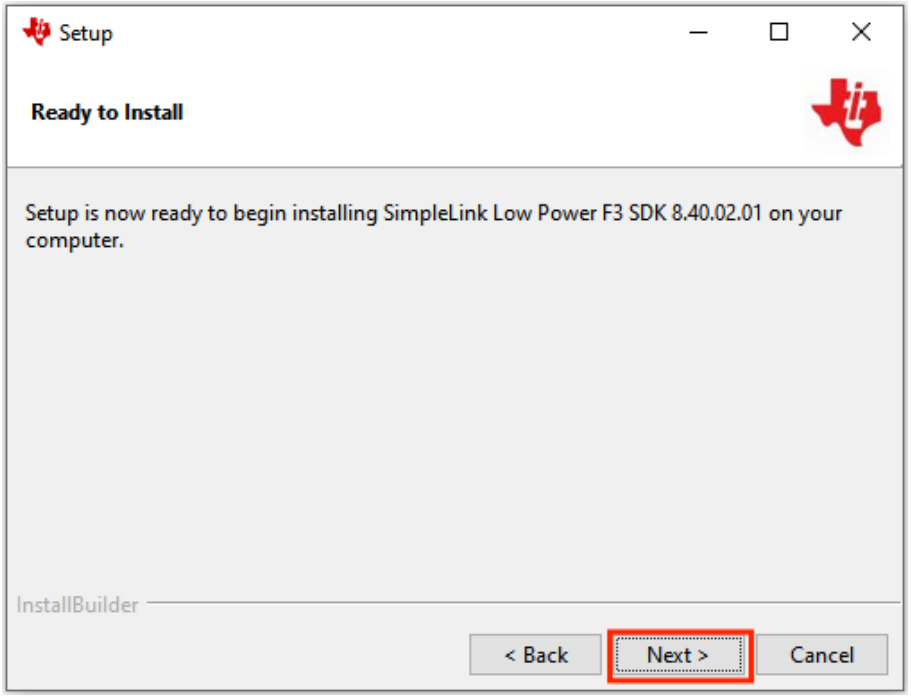
6. Select “I accept the agreement”, and then click “Next”.



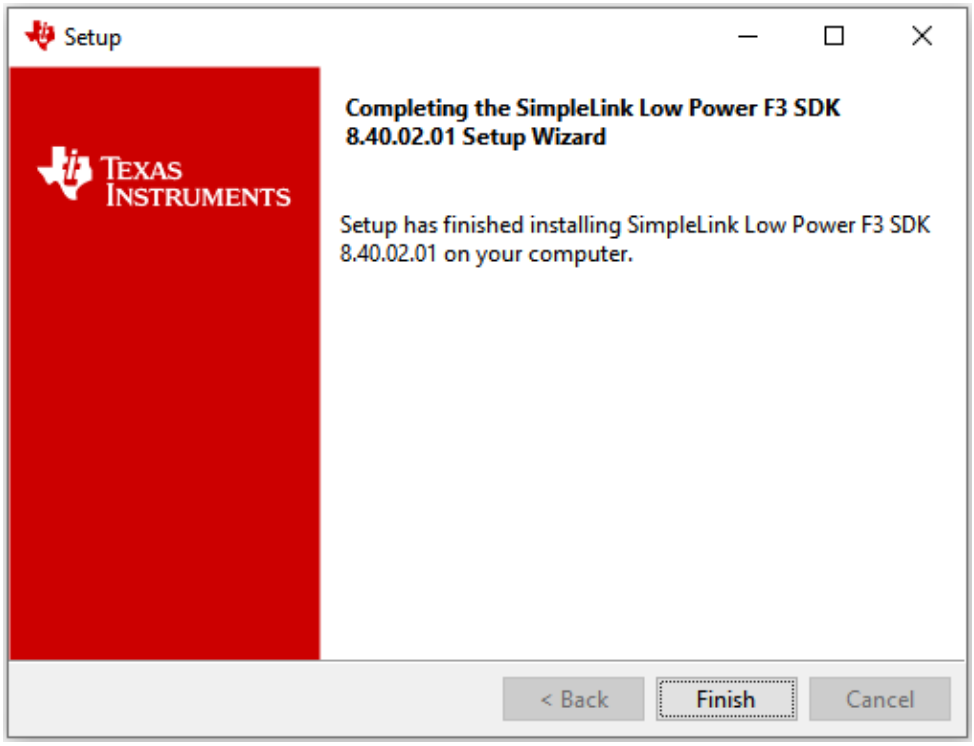
7. Choose the installation directory, and then click “Next”. Make sure the installation directory does not include non-ASCII characters or spaces.



8. Click “Next”, and the installation will start. Wait until the installation is complete.



9. Click “Finish”.



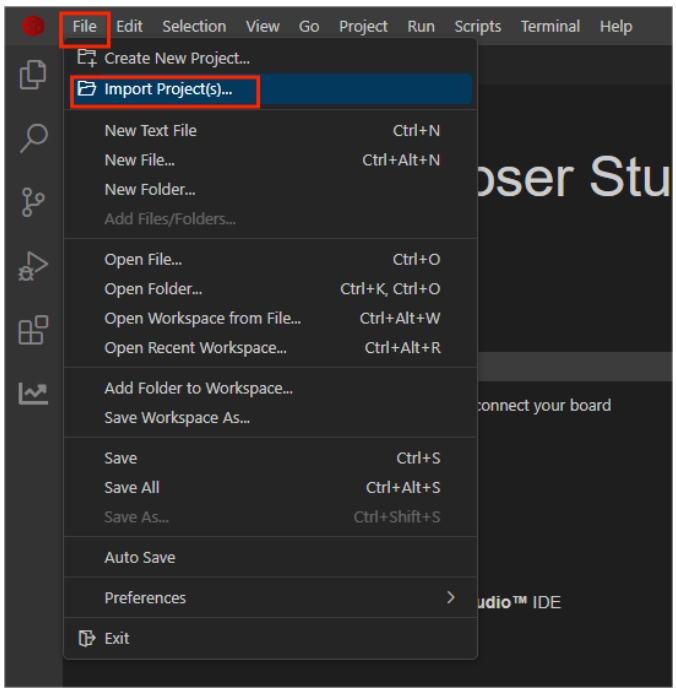
4.4. BLE5-STACK

This section describes how to use the BLE5-Stack projects with CCS.

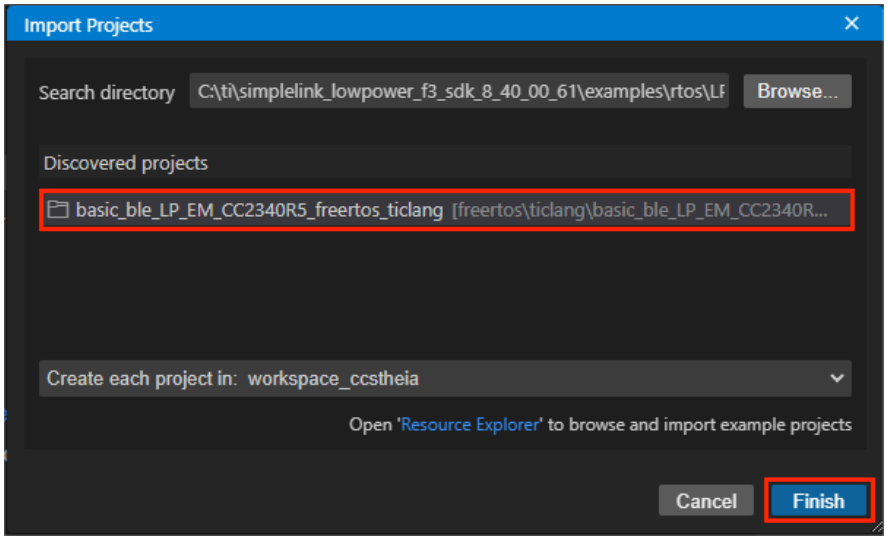
The BLE5-Stack examples are located at
C:\ti\simplelink_lowpower_f3_sdk_8_40_02_01\examples\rtos\LP_EM_CC2340R5\ble5stack

4.4.1. Import Project into CCS

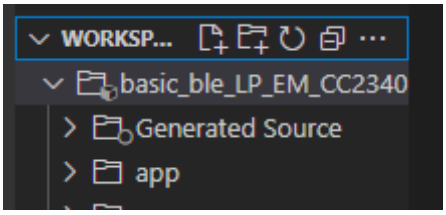
1. Open the CCS IDE.
2. Go to **File** -> **Import Project(s)** in the menu toolbar.



3. Click “Browse”, navigate to the “basic_ble” project folder. The default path is: C:\ti\simplelink_lowpower_f3_sdk_8_40_02_01\examples\rtos\LP_EM_C C2340R5\ble5stack\basic_ble
4. Select the project, and click “Finish”.

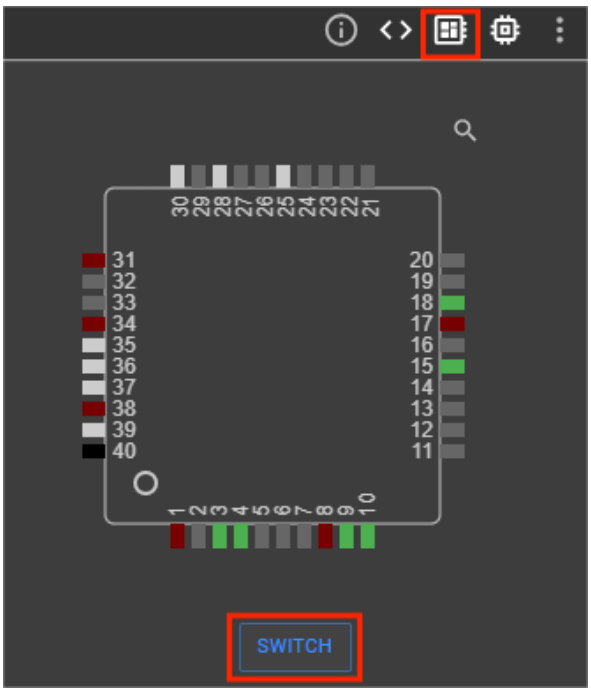


5. The “basic_ble” project will be imported into the IDE.

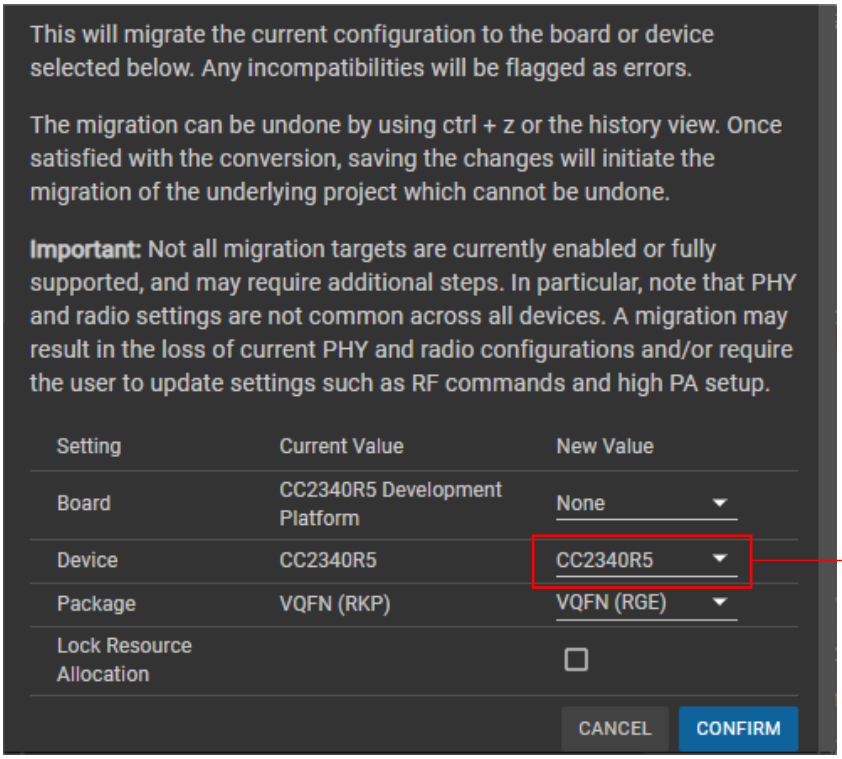


4.4.2. Migrate CC2340R5RKP to CC2340R5RGE

1. Open syscfg file. Go to “Device View” and click on “SWITCH”.

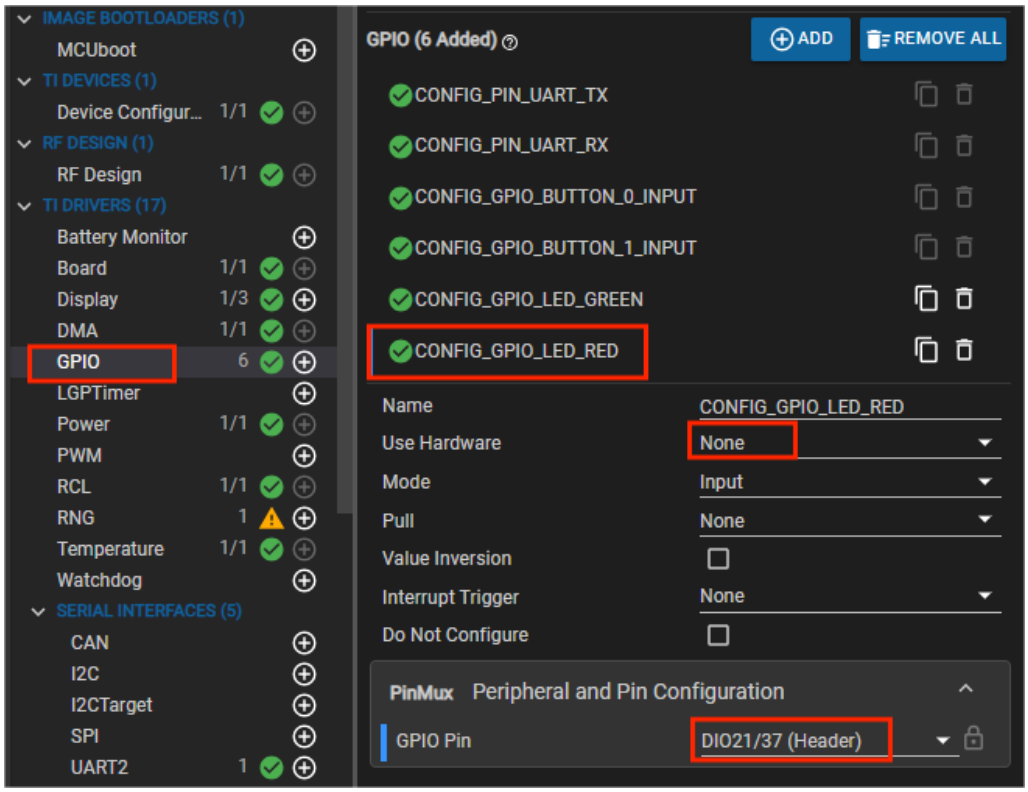


2. Modify the settings shown as the figure below and click on “CONFIRM”.

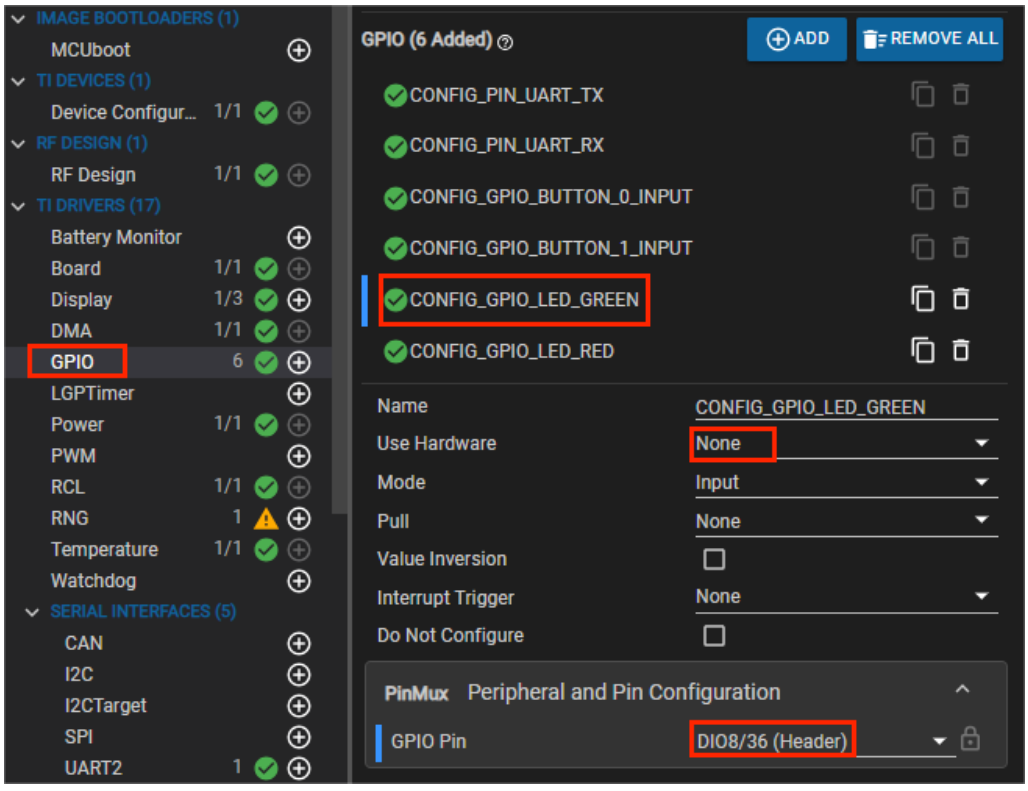


Select CC2340R2 if you are using BDE-LE2340R21GE module

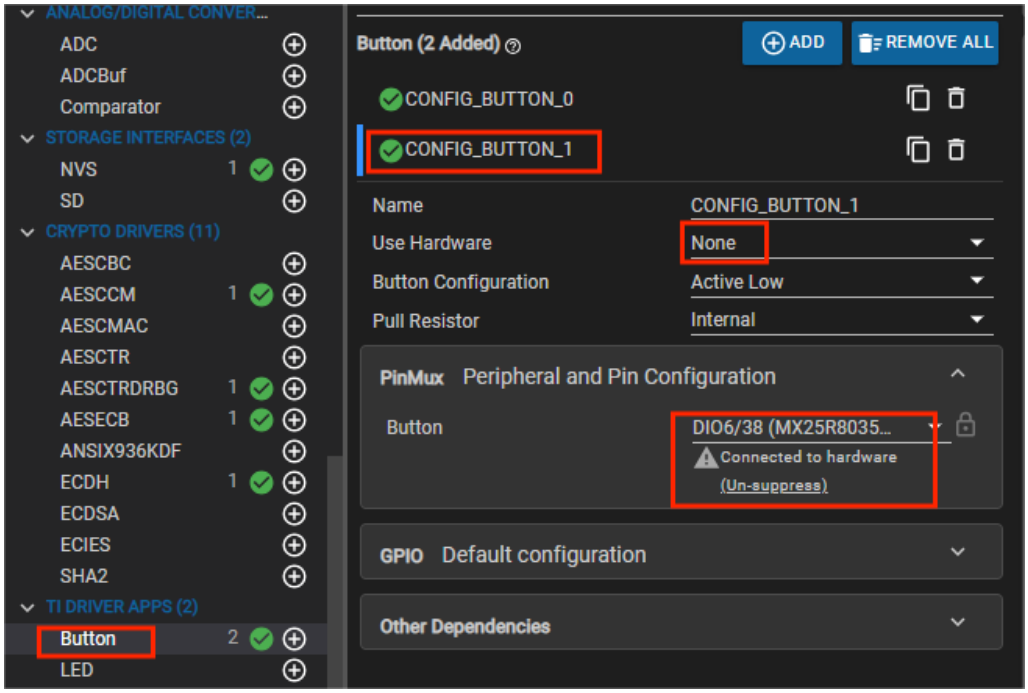
3. Change the red LED pin to DIO21.



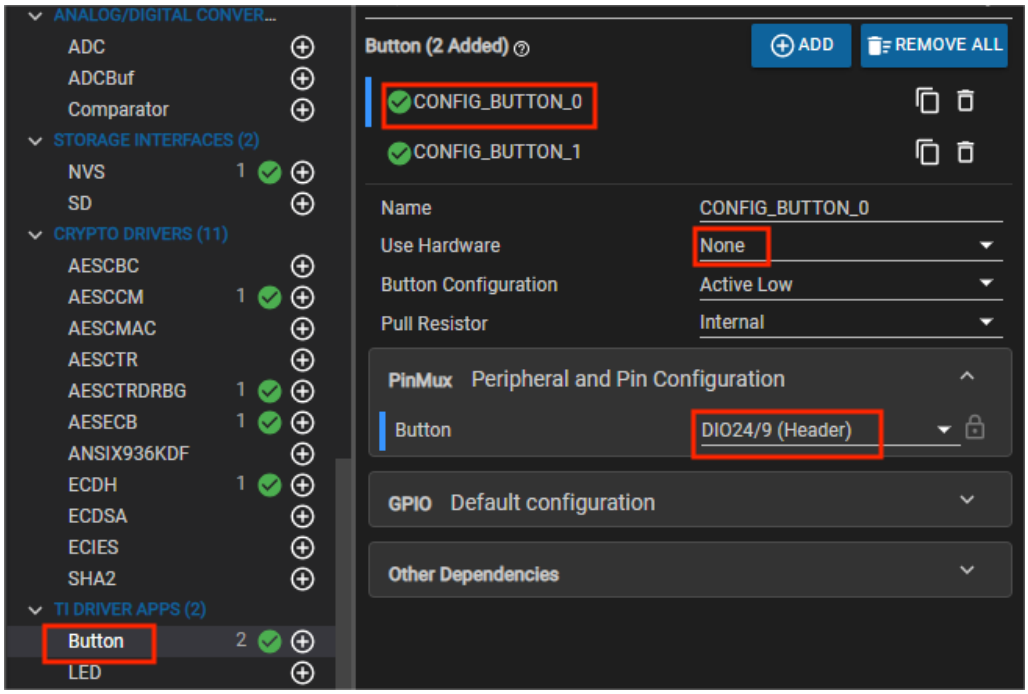
4. Change the green LED pin to DIO8.



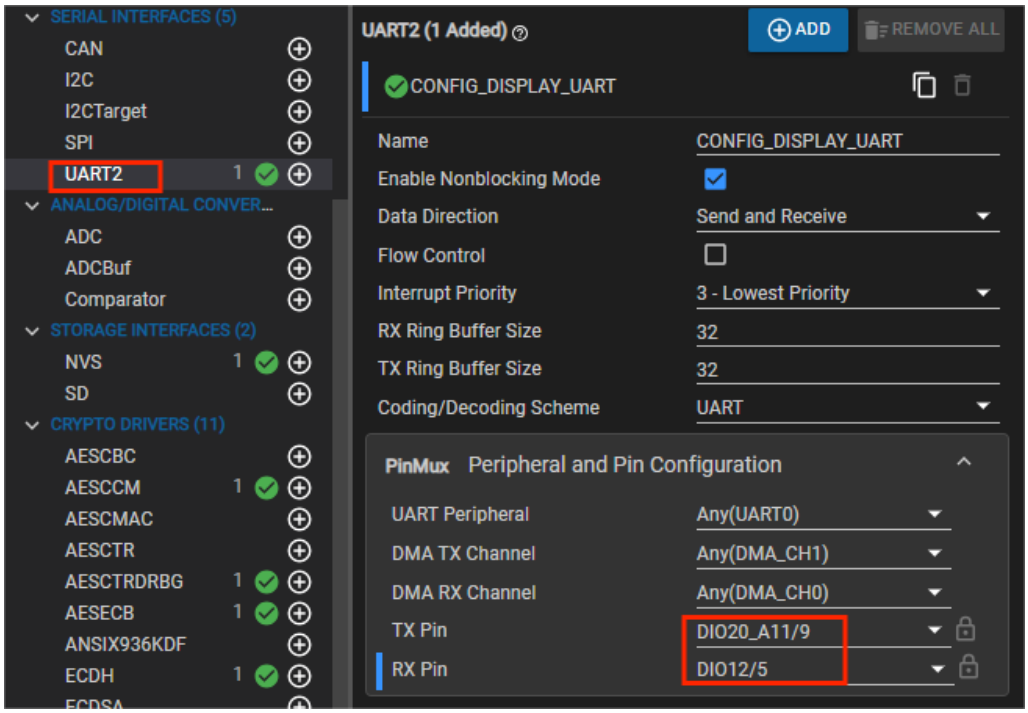
5. Change the button1 pin to DIO6.



6. Change the button0 pin to DIO24.



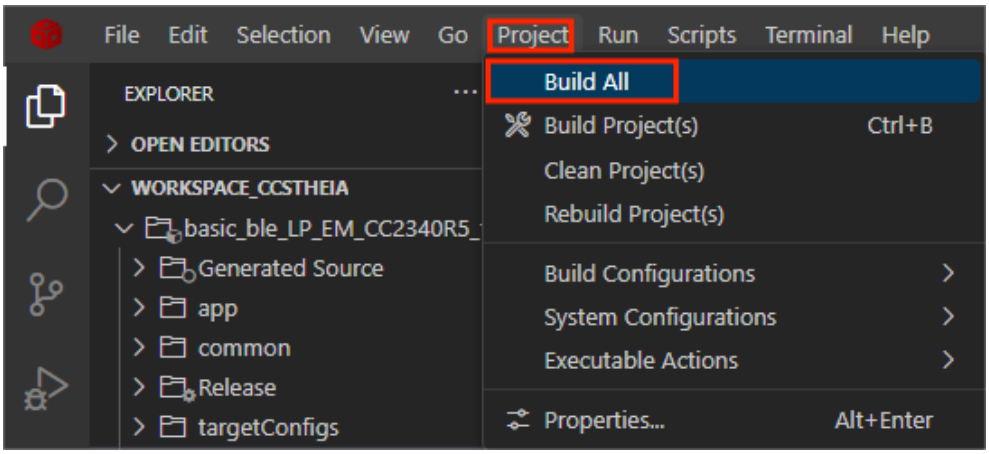
7. Change the display UART TX pin to DIO20 and RX pin to DIO12.



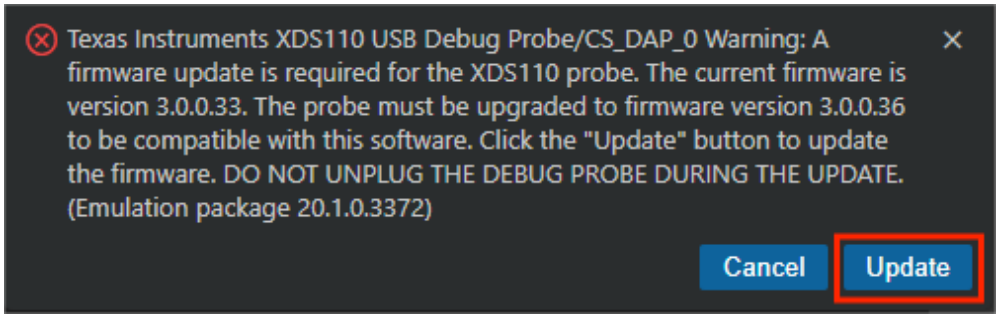
8. Save the syscfg file.

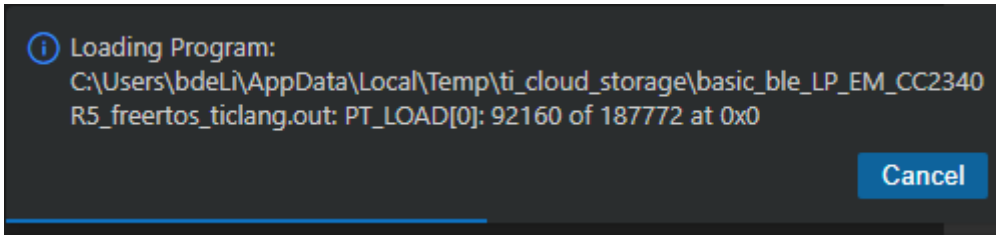
4.4.3. Build and Download Project

1. Select **Project** -> **Build All** to build the application project.

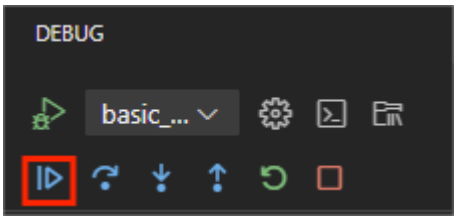


2. After building successfully, select **Run** -> **Debug** to download the application to the module.
3. If the following message occur, click “Update”



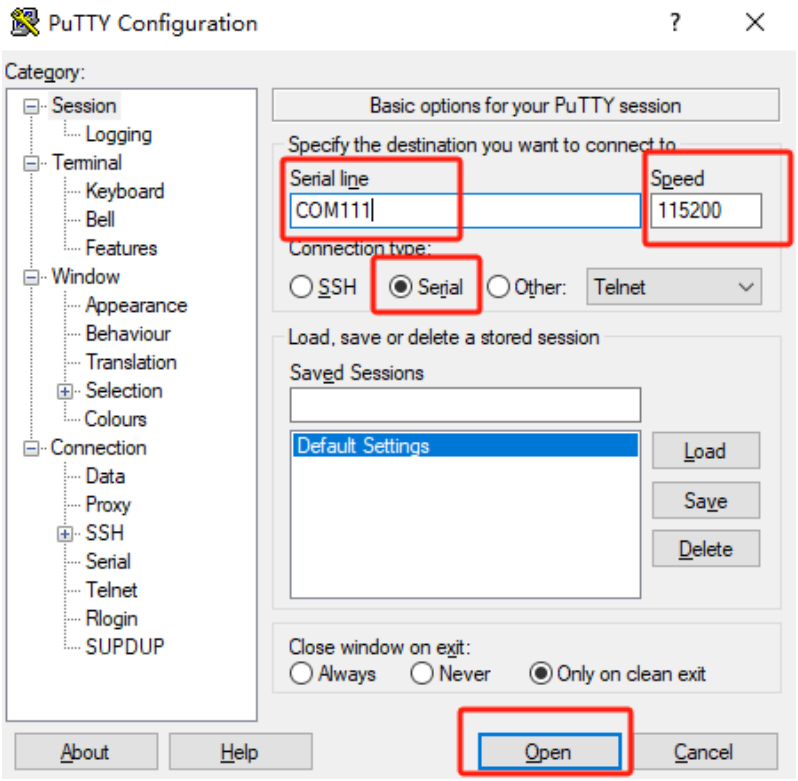


4. After the update process is finished, click “Continue”.

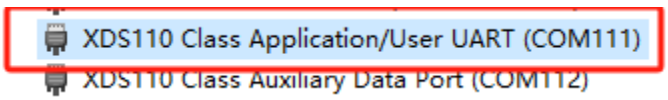


4.4.4. Running the Demo

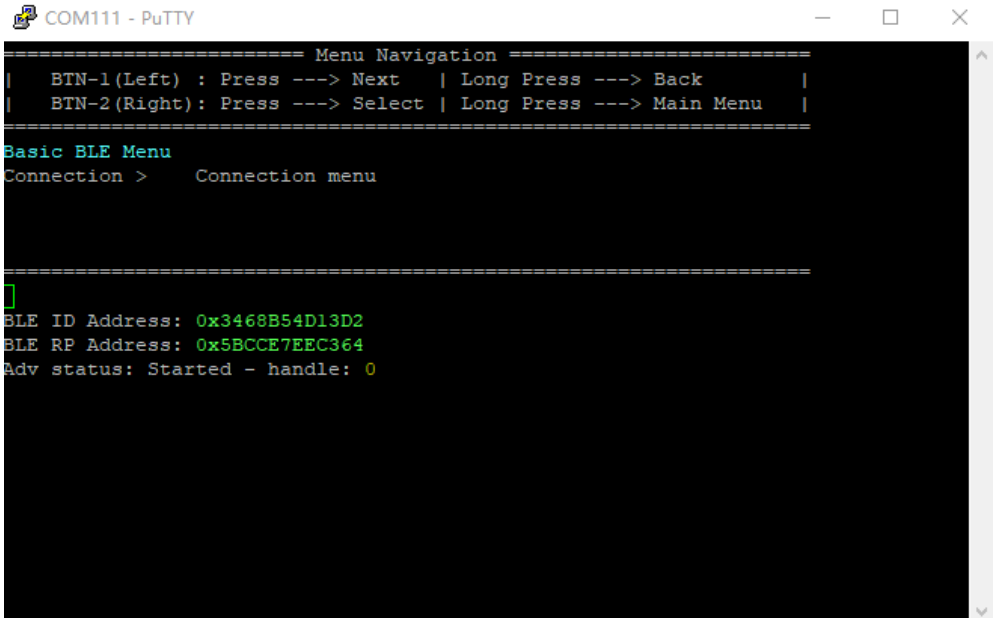
1. Open PuTTY, open the serial port with the following settings:



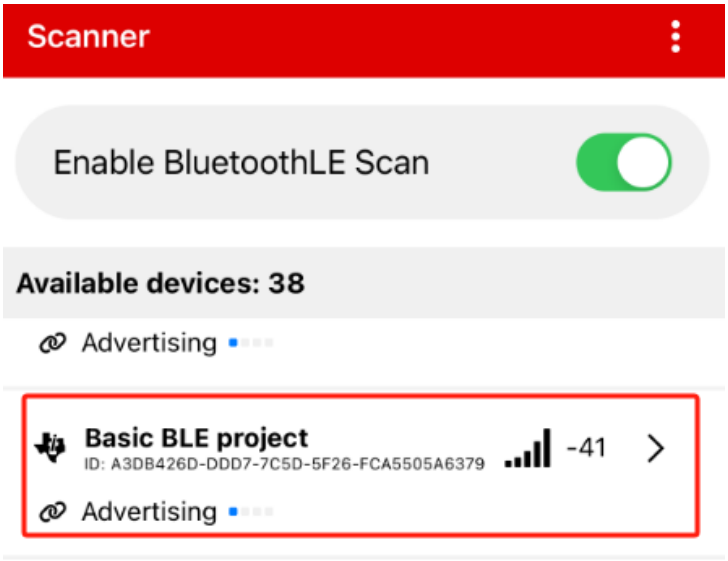
The COM number can be found in the System Device Manager:



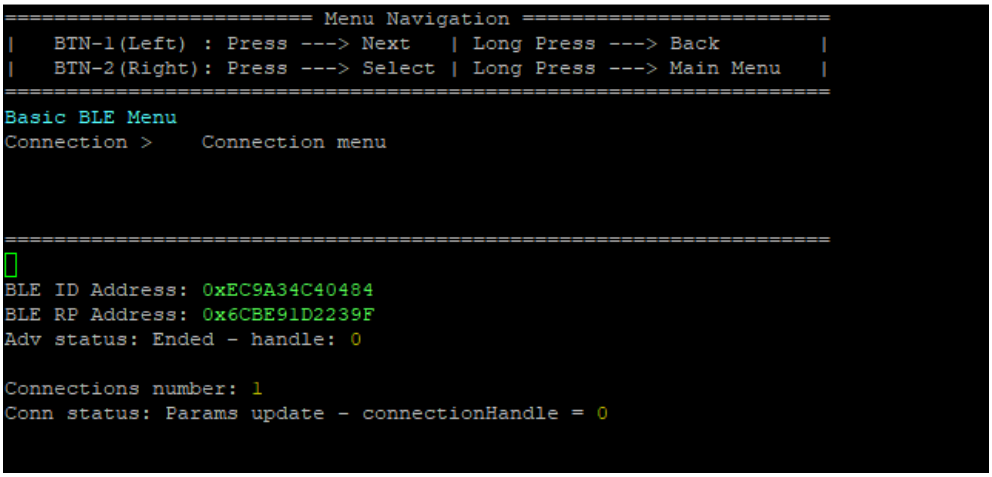
2. Debug the project and click “Continue” in CCS. The demo will begin execution. The PuTTY will display the menu as shown below:



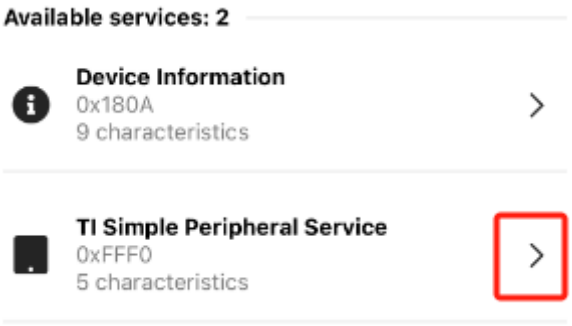
3. Open SimpleLink Connect mobile app. Click “Enable BluetoothLE Scan”, and you will see that the module is advertising.



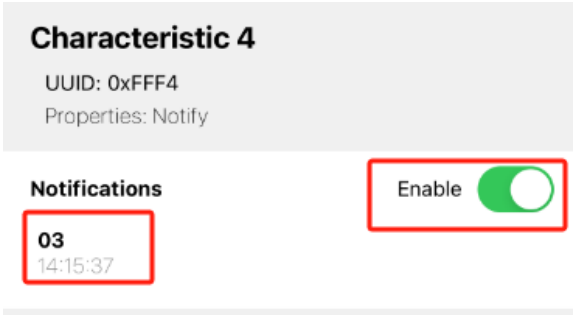
4. Click the right arrow on the right of “Simple Peripheral” item to connect to the module. After a successful connection, you will see PuTTY update the information.



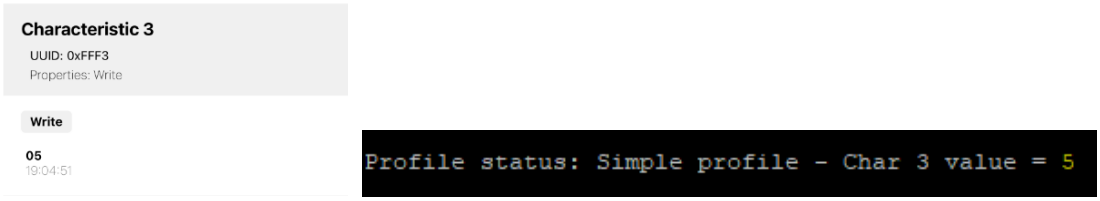
5. Select “TI Simple Peripheral Service”.



6. Enable the notification of “Characteristic 4”, the app will receive notification sent by the module.



7. Write “05” to “Characteristic 3”. PuTTY will print the write information.



4.5. Host_test Project & Btool Software

TI provides a PC tool called “btool” to help developers simplify development. Developers can use Btool to scan and connect to peripheral devices, or to send raw HCI commands.

The directory for Btool is:
C:\ti\simplelink_lowpower_f3_sdk_8_40_02_01\tools\ble5stack\btool

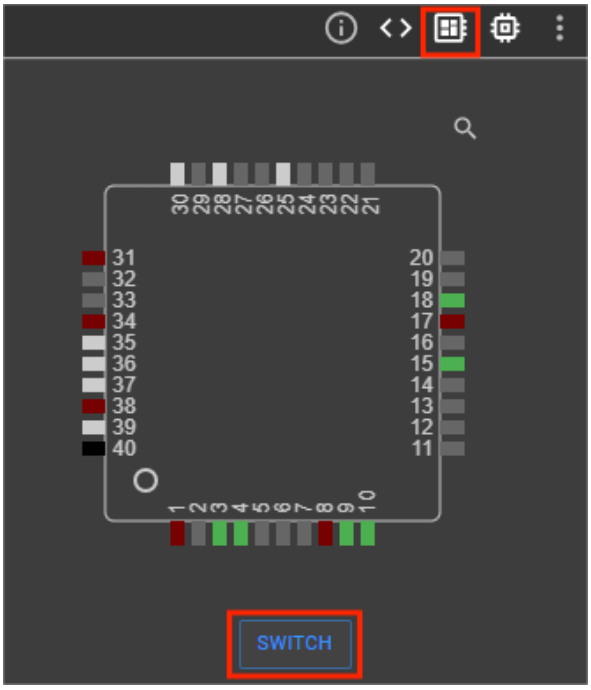
Before using Btool, the module must have the host_test application flashed onto it first.

The project directory for host_test is:
C:\ti\simplelink_lowpower_f3_sdk_8_40_02_01\examples\rtos\LP_EM_CC2340R5\ble5stack\host_test

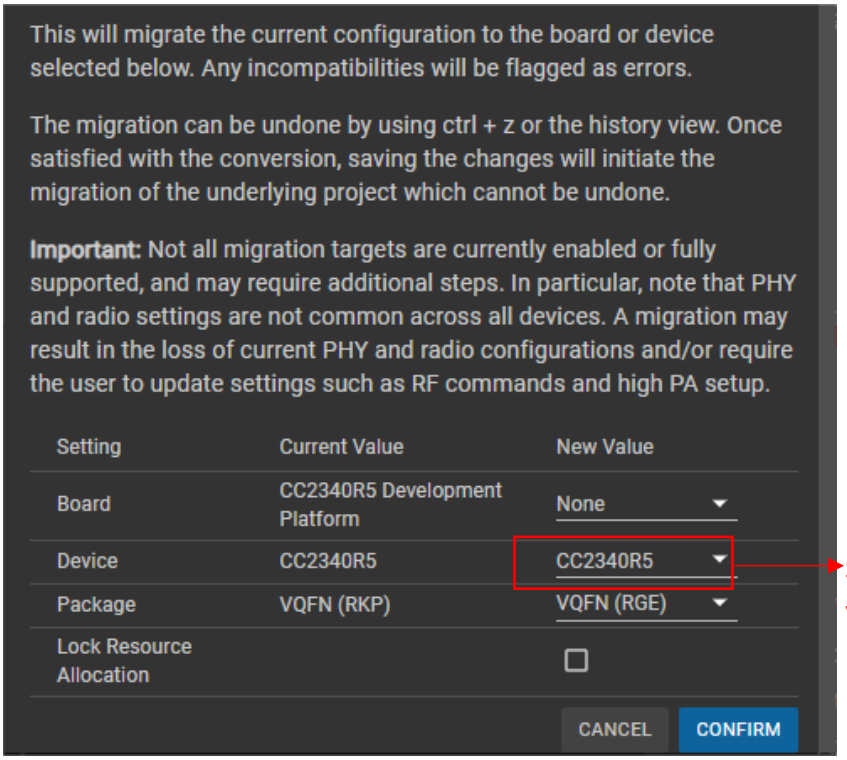
The module will enter DTM mode once the host_test application is flashed. Btool can connect to the module through UART interface.

Before building the host_test project, the project needs to be migrated to CC2340R5RGE. Follow the steps below to complete this process.

1. Open syscfg file. Go to “Device View” and click on “SWITCH”.

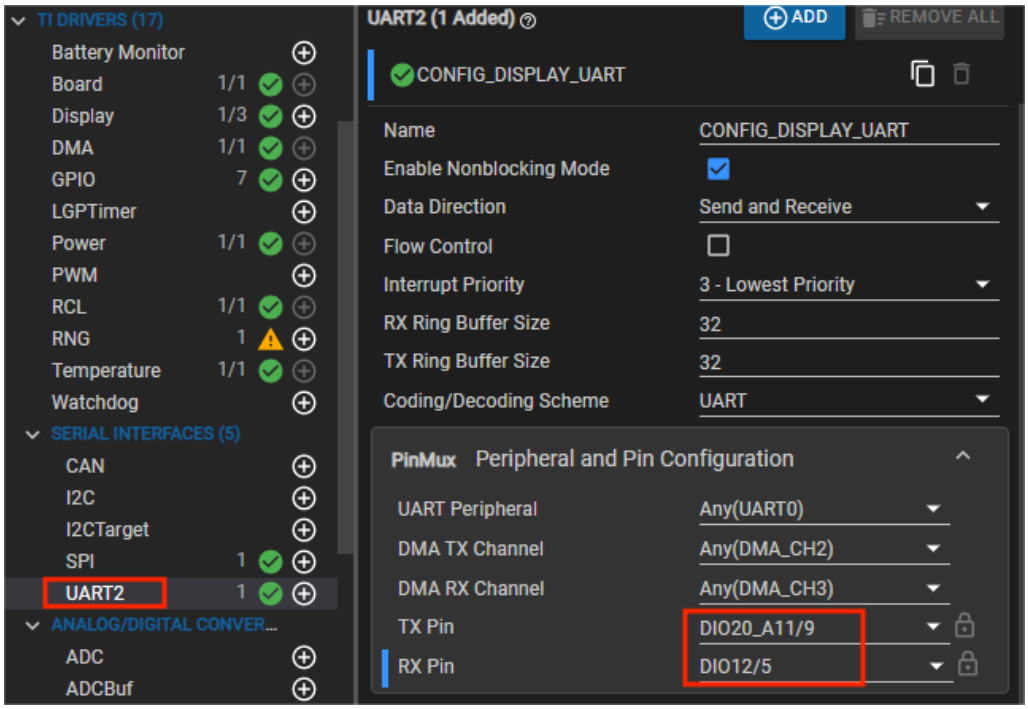


2. Modify the settings shown as the figure below and click on “CONFIRM”.



Select CC2340R2 if you are using BDE-LE2340R21GE module

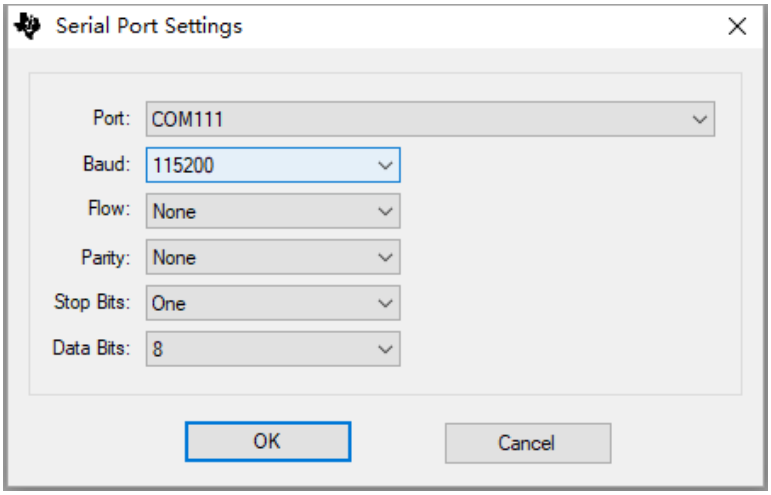
3. Change the display UART TX pin to DIO20 and RX pin to DIO12.



4. Save syscfg file and build the project.

The following steps demonstrate how to operate Btool.

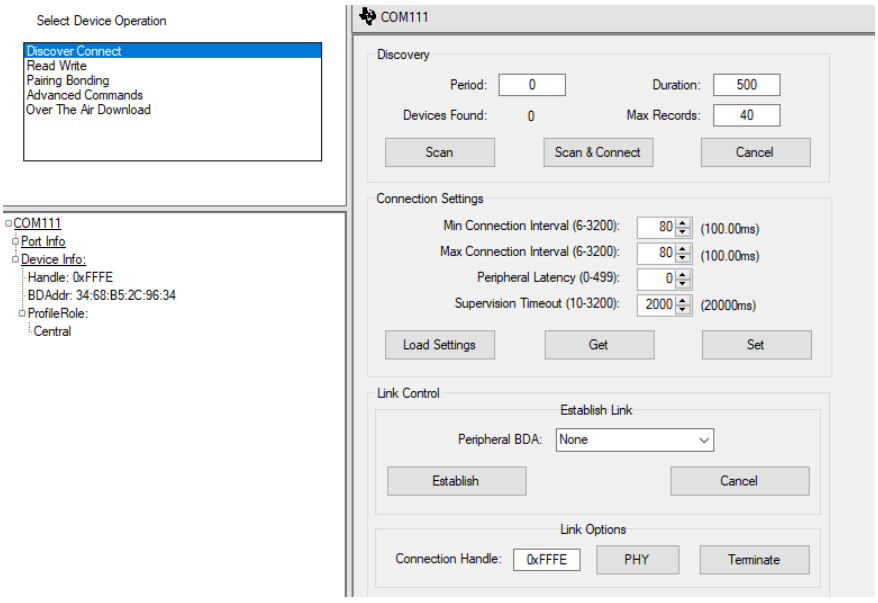
1. Open Btool.
2. Open the serial port with the following settings, and make sure the correct port is selected.



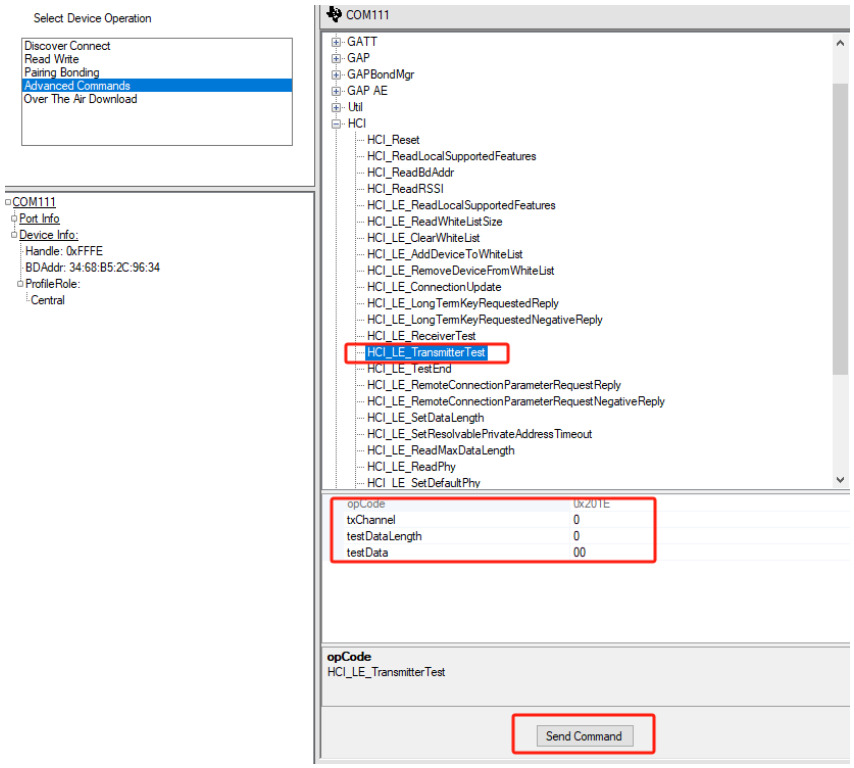
3. If the hardware functions properly, the following UART logs will be printed.

```
[1] : <Info> - 02:40:25.158
Port opened at 2024/10/22 14:40:25
--------------------------------------------------------------------
[2] : <Tx> - 02:40:25.237
-Type            : 0x01 (Command)
-OpCode          : 0xFC1D (HCIExt_ResetSystemCmd)
-Data Length     : 0x01 (1) byte(s)
 Type            : 0x00 (0) (Chip Reset)
Dump(Tx):
0000:01 1D FC 01 00                                        .....
--------------------------------------------------------------------
[3] : <Rx> - 02:40:25.384
-Type            : 0x04 (Event)
-EventCode       : 0x00FF (HCI_LE_ExtEvent)
-Data Length     : 0x05 (5) bytes(s)
 Event           : 0x041D (1053) (HCIExt_ResetSystemCmdDone)
 Status          : 0x00 (0) (SUCCESS)
 CmdOpCode       : 0xFC1D (HCIExt_ResetSystemCmd)
Dump(Rx):
0000:04 FF 05 1D 04 00 1D FC                               ........
--------------------------------------------------------------------
[4] : <Tx> - 02:40:25.903
-Type            : 0x01 (Command)
-OpCode          : 0xFE00 (GAP_DeviceInit)
-Data Length     : 0x08 (8) byte(s)
 ProfileRole     : 0x08 (8) (
                   Central)
 AddrMode        : 0x00 (0) (ADDRMODE_PUBLIC)
 RandomAddr      : 00:00:00:00:00:00
Dump(Tx):
0000:01 00 FE 08 08 00 00 00 00 00 00 00                   ............
--------------------------------------------------------------------
[5] : <Rx> - 02:40:25.980
-Type            : 0x04 (Event)
-EventCode       : 0x00FF (HCI_LE_ExtEvent)
-Data Length     : 0x06 (6) bytes(s)
 Event           : 0x067F (1663) (GAP_HCI_ExtentionCommandStatus)
 Status          : 0x00 (0) (SUCCESS)
```

4. Developers can scan for and connect to peripheral devices on the “Discover Connect” page.



5. The “Advanced Commands” page provides a variety of HCI commands. For example, developers can send “HCI_LE_Transmitter_Test” command in the following diagram.



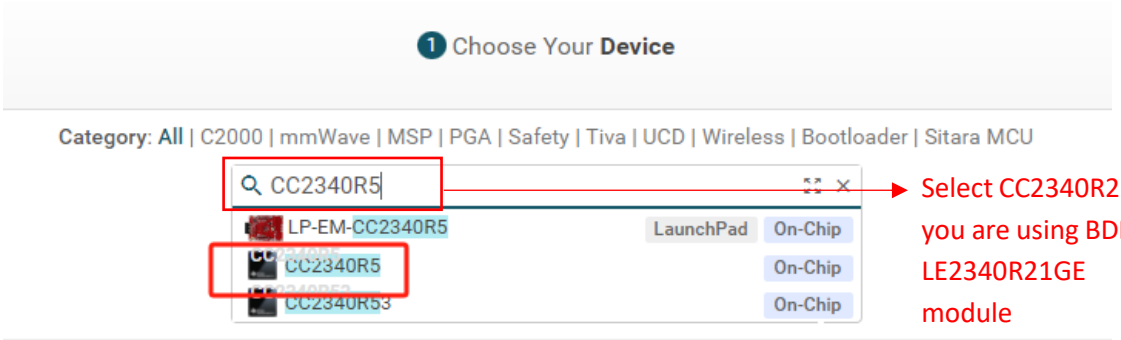
4.6. Use UniFlash to Download Firmware

In the section above, the method to flash the firmware is through debugging in the CCS IDE.

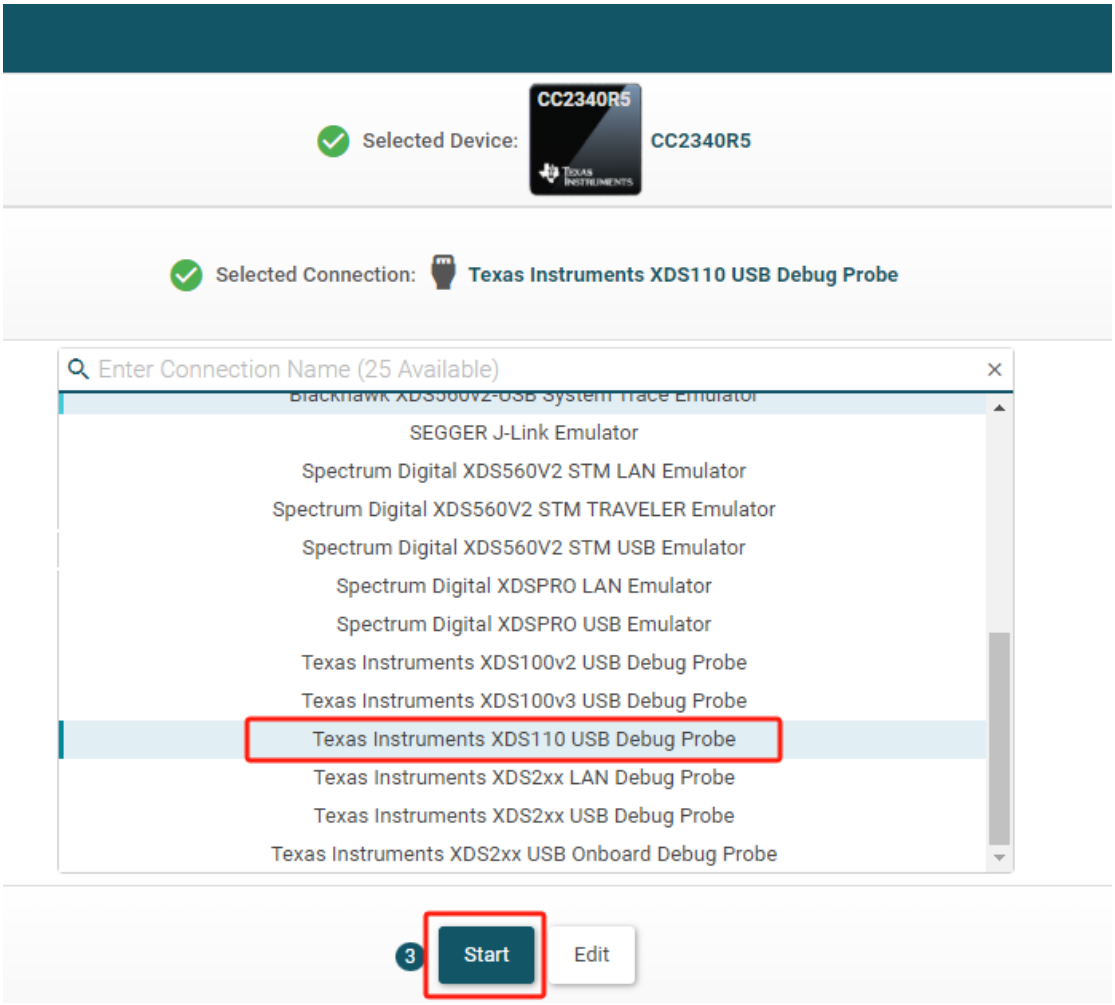
TI provides a software tool called UniFlash, which can be used for programming on-chip flash on TI microcontrollers and wireless connectivity devices.

4.6.1. Configure UniFlash

1. Open UniFlash.
2. Select “CC2340R5”.

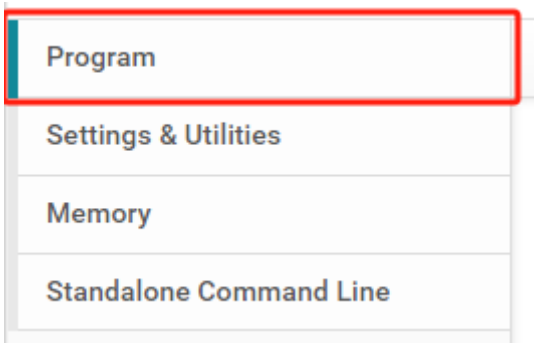


3. Select “Texas Instruments XDS110 USB Debug Probe”, then click the “Start” button.

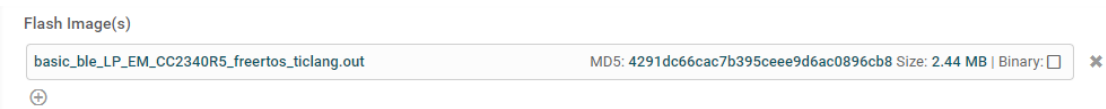


4.6.2. Programming

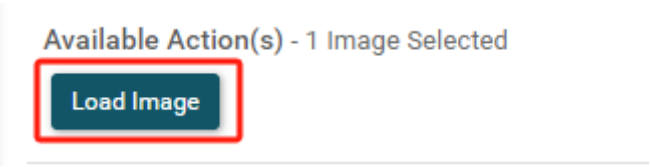
1. Select “Program” item.



2. Select the image file prepared for programming. By default, the image file is located in the Release/Debug folder within the project folder in the workspace.



3. Click the “Load Image” button to begin programming.



4. When programming is successful, the console will display the following information.

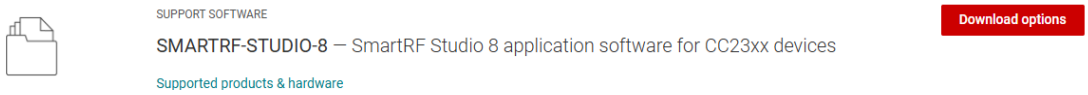
Please refer to the UniFlash quick start guide for more information about the UniFlash tool. Click the “Help” icon to open the quick start guide.

4.7. SmartRF™ Studio

SmartRF™ Studio is a Windows application that helps developers to easily evaluate the radio for all TI CC1xxx and CC2xxx low-power RF devices.

This tool can also be used for RF certification testing.

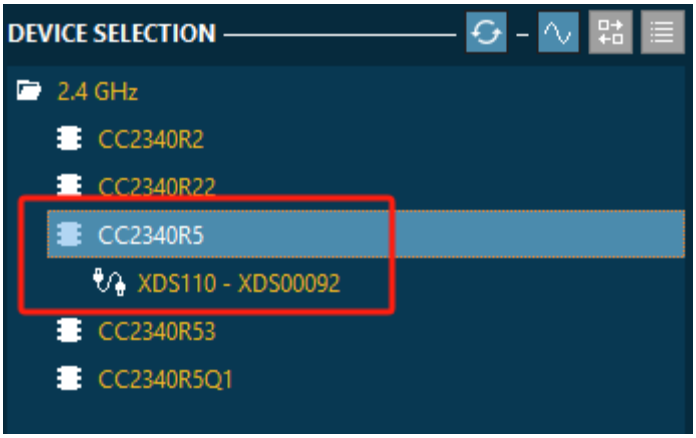
Visit the link below to download and install SmartRF™ Studio.
https://www.ti.com/tool/SMARTRFTM-STUDIO



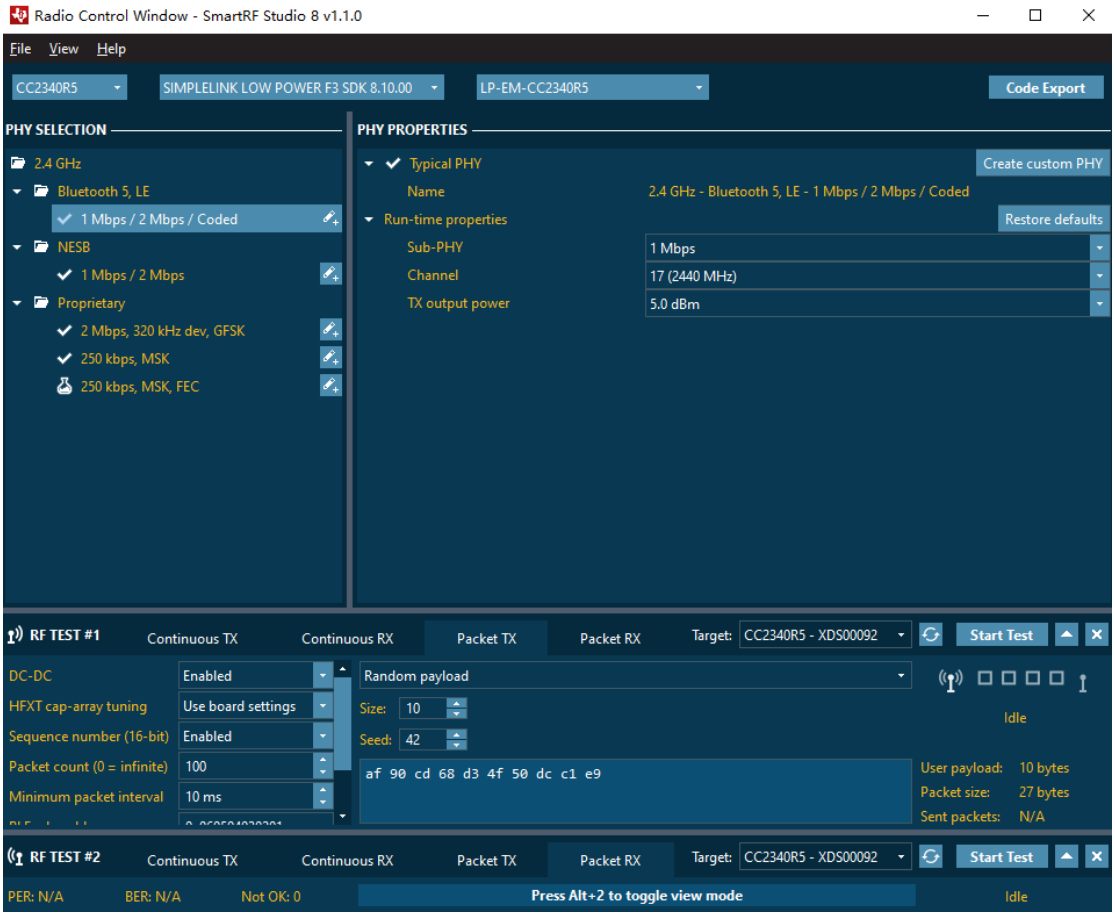
If the installer becomes locked during the download process, follow the instructions provided by TI.

4.7.1. Connect to the Module

1. Connect the module to the PC using the XDS debug probe.
2. Open SmartRF Studio 8.
3. SmartRF Studio will indicate that the CC2340R5 is connected to the XDS110.

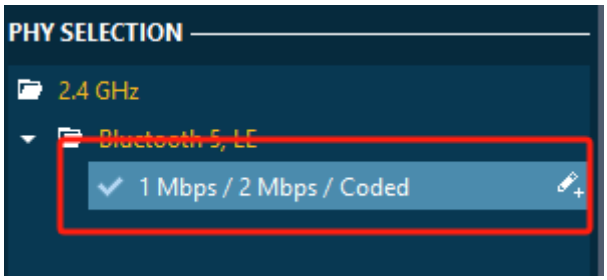


4. Double-click the “CC2340R5” item.
5. SmartRF Studio will open a new window called “Radio Control Window”.

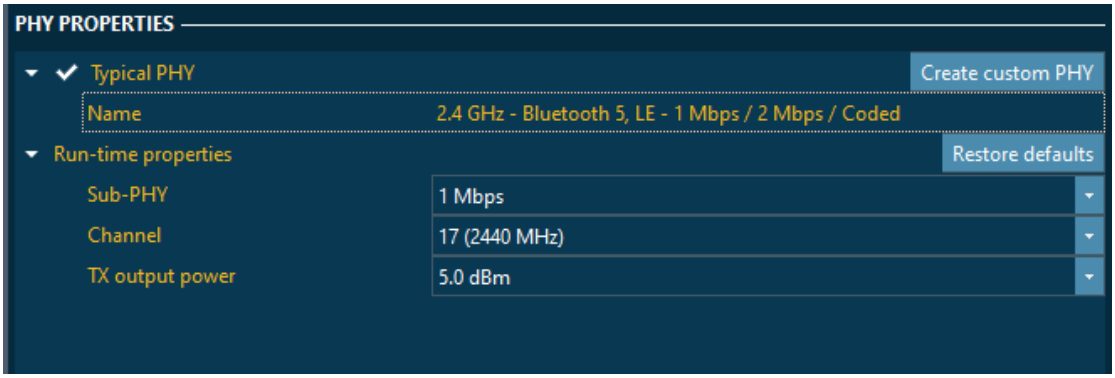


4.7.2. Change the Default Settings

1. Select the PHY setting. In this example, “Bluetooth 5, LE” is selected.



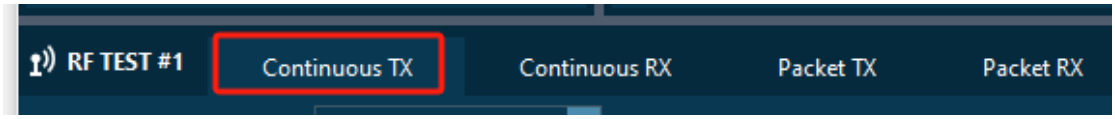
2. Select “Sub-PHY”, “Channel” and “TX output power” parameters.



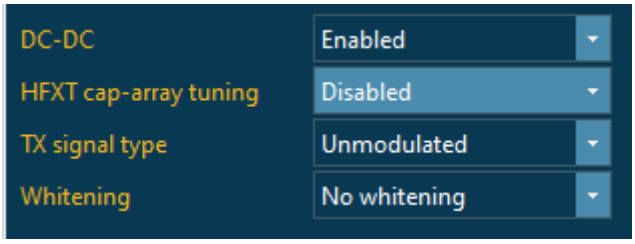
4.7.3. Perform RF Test

RF testing is divided into continuous TX/RX and packet TX/RX. The signal duty cycle is 100% when operating in continuous mode. The following steps use continuous TX as an example to demonstrate how to start the RF test.

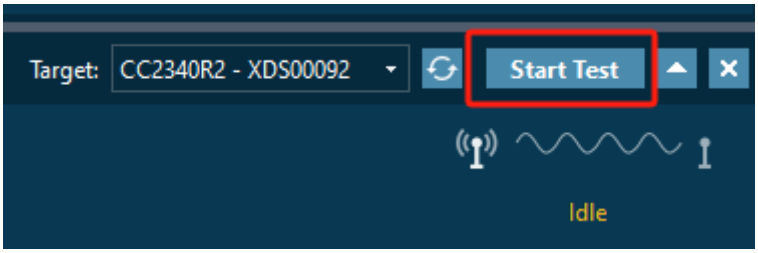
1. Click “Continuous TX”.



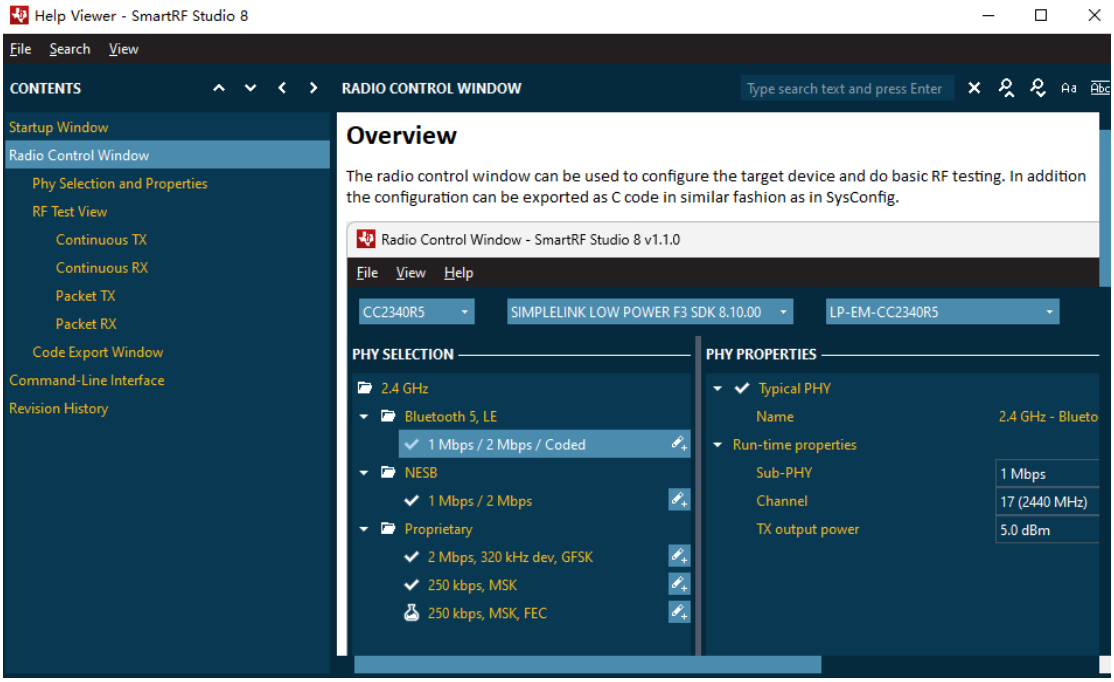
2. Modify the settings as shown in the following diagram. When the “Unmodulated” is selected, the signal is a carrier wave.



3. Click “Start Test” to start transmitting the RF signal.



Please refer to the user guide for more information about the SmartRF Studio tool. Press the “F1” key on the keyboard to open the user guide.



5. Other Resources

Access more documents by visiting the TI CC2340R5 page at the link below.
https://www.ti.com/product/CC2340R5

Additionally, refer to the guides for different components for more information about the Simplelink SDK. The guides are located in the directory below:
C:\ti\simplelink_lowpower_f3_sdk_8_40_02_01\docs

For other related documentations of the module, please visit the module product page at bdecomm.com.

6. Ordering Information

Table 3. Ordering Information

Product Type	Orderable Part Number	Description
Evaluation Kit	BDE-LE2340R52GEA0-K1	Evaluation kit 1 for module BDE-LE2340R52GEA0, includes 1x BDE-LE2340R52GEA0-BO, 1x BDE-LPEM, 1x BDE-XDS110, 1x USB type C cable
Evaluation Kit	BDE-LE2340R52GEA32-K1	Evaluation kit 1 for module BDE-LE2340R52GEA0, includes 1x BDE-LE2340R52GEA32-BO, 1x BDE-LPEM, 1x BDE-XDS110, 1x USB type C cable
Evaluation Kit	BDE-LE2340R21GEA0-K1	Evaluation kit 1 for module BDE-LE2340R21GEA0, includes 1x BDE-LE2340R21GEA0-BO, 1x BDE-LPEM, 1x BDE-XDS110, 1x USB type C cable

Product Type	Orderable Part Number	Description
Evaluation Kit	BDE-LE2340R21GEA32-K1	Evaluation kit 1 for module BDE-LE2340R21GEA0, includes 1x BDE-LE2340R21GEA32-BO, 1x BDE-LPEM, 1x BDE-XDS110, 1x USB type C cable
Module Breakout Board	BDE-LE2340R52GEA0-BO	Breakout board with BDE-LE2340R52GEA0 module
Module Breakout Board	BDE-LE2340R52GEA32-BO	Breakout board with BDE-LE2340R52GEA0 module
Module Breakout Board	BDE-LE2340R21GEA0-BO	Breakout board with BDE-LE2340R21GEA0 module
Module Breakout Board	BDE-LE2340R21GEA32-BO	Breakout board with BDE-LE2340R21GEA0 module
Interface Evaluation Module	BDE-LPEM	Launchpad evaluation module with BoosterPack interface
Debugger	BDE-XDS110	XDS110 debugger

7. Revision History

Table 4. Revision History

Revision	Date	Description
V1.0	2024-3-6	First release
V1.1	2025-3-31	• Updated EVK • Updated IDE • Updated SDK version

8. Additional Information

8.1. Trademarks

Bluetooth® is a registered trademark of Bluetooth SIG, Inc.
Launchpad™ is a registered trademark of Texas Instruments.
BoosterPack™ is a registered trademark of Texas Instruments.
SmartRF™ is a registered trademark of Texas Instruments.
All trademarks are the property of their respective owners.

Important Notice and Disclaimer

The information contained herein is believed to be reliable. BDE makes no warranties regarding the information contain herein. BDE assumes no responsibility or liability whatsoever for any of the information contained herein. BDE assumes no responsibility or liability whatsoever for the use of the information contained herein. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the user. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for BDE products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information.

Contact

BDE Technology Inc.

USA: 67 E Madison St, # 1603A, Chicago, IL 60603, US
Tel: +1-312-379-9589
Website: www.bdecomm.com Email: info@bdecomm.com

China: B2-403, 162 Science Avenue, Huangpu District, Guangzhou 510663, China
Tel: +86-20-28065335
Website: www.bdecomm.com Email: info@bdecomm.com