CC2541 Mini Development Kit Quick Start Guide

Opening the Box and Evaluating *Bluetooth*® Low Energy

Kit Contents

- 1 x CC2540 USB dongle
- 1 x CC2541 Keyfob board
- 1 x Keyfob plastic case
- 1 x CC Debugger with cables
- 1 x CR2032 Battery
- Documentation

The RF Boards in this kit are FCC and IC certified and tested to comply with ETSI/R&TTE over temperature from 0 to +35°C.

Caution! The kit contains ESD sensitive components. Handle with care to prevent permanent damage.

Introduction

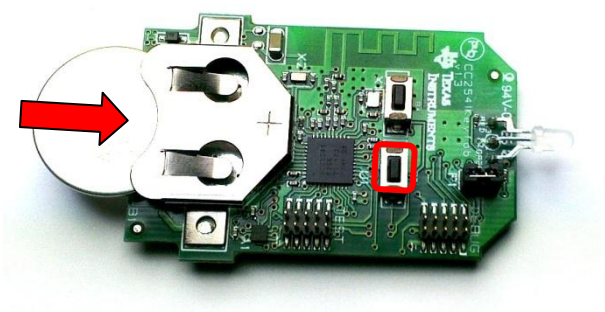
This document will guide you through the initial steps required in order to run the pre programmed *Bluetooth*® low energy (BLE) demo application.

You will get familiar with the hardware in the box and some of the tools that can be used for developing your own software at a later stage. For the CC2541DK-MINI, there are two ways of getting started:

1. **Evaluate Using BTool**. BTool is a Windows application that allows you to control a central device using the serial interface and perform various BLE functions while connected to a peripheral device, such as the CC2541 Keyfob.
2. **Evaluate Using iOS Device**. There are a couple of Apple iOS devices that support BT4.0 and Texas Instruments have created an iOS Application to evaluate a peripheral device, such as the CC2541 Keyfob. The iOS Application runs on:
   - iPhone 4S / 5
   - iPad 3
   - iPod Touch (5. gen)

Hardware Setup

First, you will need to power up the CC2541 Keyfob. When you insert the CR 2032 battery, the LED will be lit green for one second.



You can toggle Advertisements on and off by pushing the right button on the CC2541 Keyfob. During advertisement, the LED will be blinking red.

Warning! This kit includes a non-rechargeable lithium battery. To minimize risk of personal injury and/or property damage due to potential of explosion/rupture of battery, **always make sure battery is completely removed from the CC2541 Keyfob when connected to an external power source**. External power source cannot exceed 3.6VDC. Dispose the battery properly and keep out of the reach of children at all times.

Evaluate Using BTool

1. Download & Install BLE-Stack

The latest BLE software can be downloaded at www.ti.com/ble-stack.

After the BLE-Stack software installation is complete, the USB Dongle driver must be associated with the device in order to use the BTool application. To associate the USB Dongle driver, you must first connect the USB Dongle to the PC's USB port, or to a USB hub that connects to the PC

The first time that the dongle is connected to the PC, a message will pop-up, indicating that Windows does not recognize the device.

The driver is found in the folder Accessories\ Drivers in the default install directory. For more information on how to install the driver, please refer to the CC2540/41 Mini Development Kit User Guide, found at www.ti.com/lit/swru270.

2. Identify the COM Port Number

Once the driver is installed, you need to determine which COM port Windows has assigned to the USB Dongle. Right-click on "Computer", listed in the Start Menu, and select "Properties".

The "System Properties" window should open up, where you can select "Device Manager".

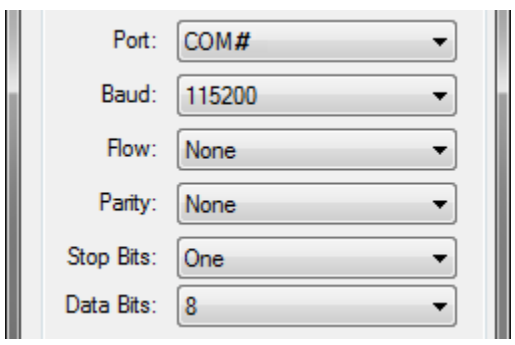
A list of all hardware devices should appear. Under the section "Ports (COM & LPT)", the device "TI CC2540 Low-Power RF to USB CDC Serial Port" should appear. Next to the name should be the port number (COM#)

Take note of this port number, as it will be needed in order to use BTool.

3. Start BTool

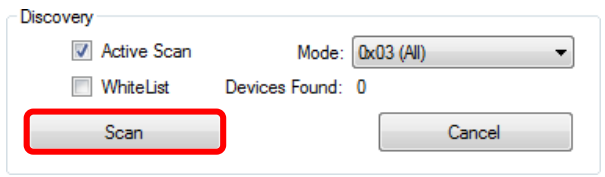
BTool is included as part of the installation of the BLE stack and can be found in the folder \Projects\BTool in the default install directory.

When you start up BTool, you will be prompted to set port settings. Select the options below and press "OK".

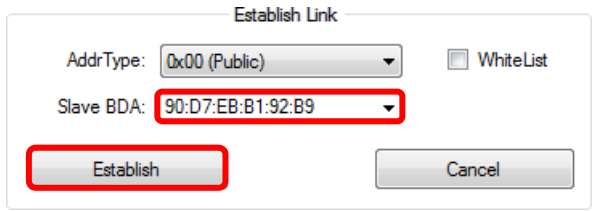


4. Connect to CC2541 Keyfob

Pressing the right button on the CC2541 Keyfob starts the advertisement. The device advertises for 30 seconds. In BTool, press SCAN button:

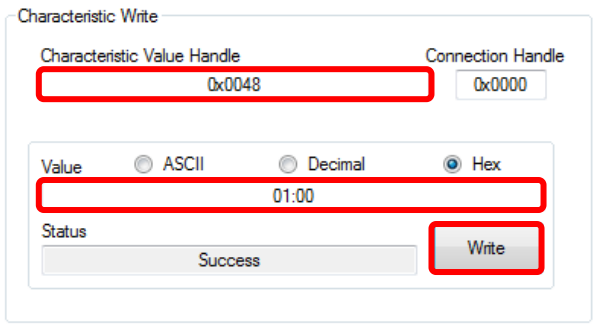


After the scanning is complete, choose the device to connect to and press "Establish".



5. Button Notifications

To notify when buttons are presses on the CC2541 Keyfob, notifications need to be enabled. This is done in the "Read/Write" Tab of BTool. Simply write 01:00 to character handle 0x0048.

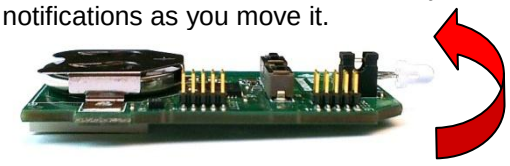


If a button on the CC2541 Keyfob is now pushed, notifications will be sent and can be monitored in the BTool log window.

6. Enable Accelerometer

Similar to the button notifications, the notifications for the accelerometer data can be enabled. In this example we will only enable notifications for the x-axis.

First of all, the accelerometer need to be enabled, which is done by writing 01:00 to characteristic handle 0x0034 in the "Read/Write" tab of BTool. To enable notifications for the x-axis, write 01:00 to characteristic handle 0x003B. This will enable the CC2541 Keyfob to send notifications as you move it.



For more information about the Accelerometer Service please refer to the CC2540/41 Mini Development Kit User Guide, found at www.ti.com/lit/swru270.

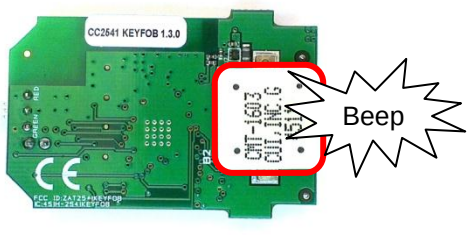
Web sites: www.ti.com/ble
E2E Forum: www.ti.com/ble-forum

7. Immediate Alert

To sound the buzzer located on the CC2541 Keyfob, write the following value to the characteristic handle 0x0028:

- 01:00 for low Alert
- 02:00 for high Alert
- 00:00 to turn off.

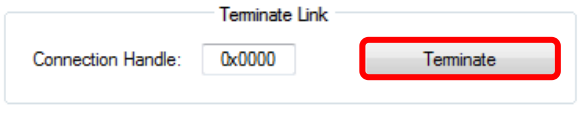
The buzzer will sound for 10 seconds.



8. Terminate Connection

To terminate the connection you will have three options:

- Press the “Terminate” button in BTool as indicated in the image below.
- Remove the battery from the CC2541 Keyfob, which will trigger a supervision timeout.
- Move the CC2541 Keyfob out of range (typically >10m), which will trigger a supervision timeout.



9. Source Code

The project and source code files for the pre programmed application (as well as many others) are included with the Bluetooth low energy (BLE) stack from Texas Instruments, which can be downloaded at www.ti.com/ble-stack.

The project implementing this demo is called Keyfobdemo (*CC2541DK-mini Keyfob Slave* configuration). The project can be modified as desired, and should provide a good framework for developing your own custom BLE applications.

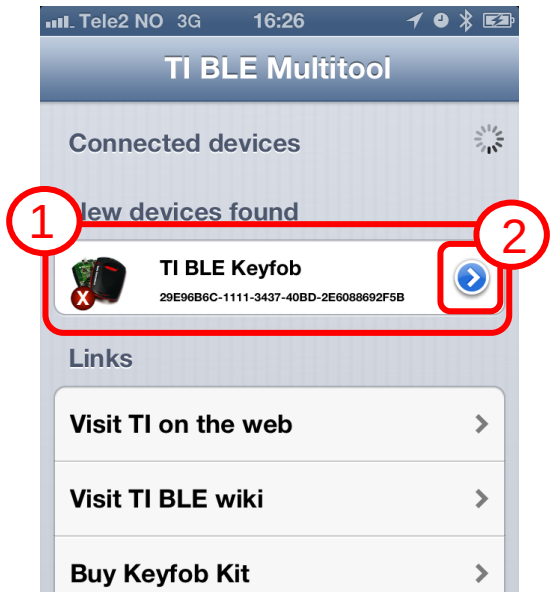
More details on these projects can be found within the BLE Software Developer’s Guide (www.ti.com/lit/swru271), which is also included with the stack installer. For troubleshooting please refer to the CC2540/41 Mini Development Kit User Guide, found at www.ti.com/lit/swru270.

Evaluate Using an iOS device (iPod, iPad, iPhone)

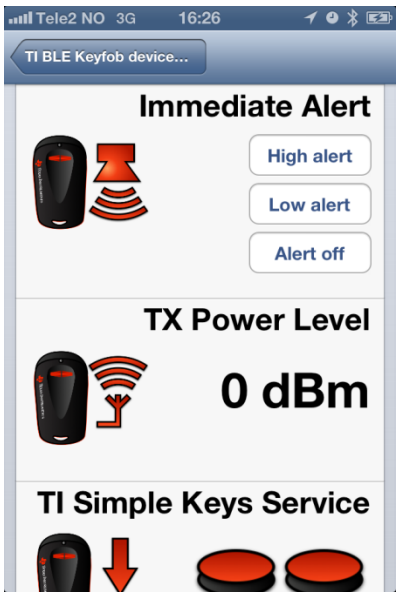
1. Download the Multitool app

The iOS app can be downloaded via iTunes (found at www.apple.com/**itunes**) or App Store which is pre-installed on iOS devices.

2. Connect to CC2541 Keyfob



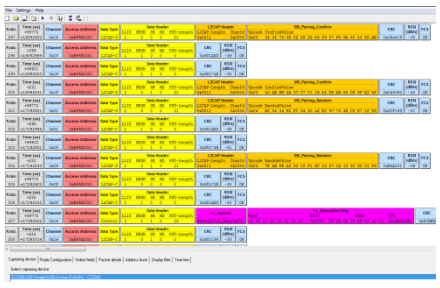
3. Evaluate the Application



Additional Tools and Links

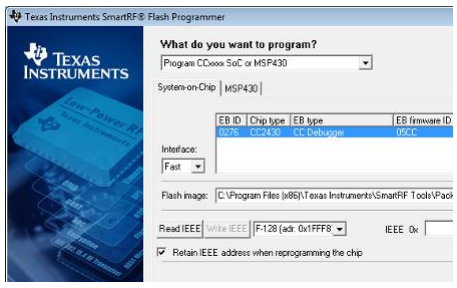
BLE Packet Sniffer

The CC2540 USB Dongle can be used as a BLE sniffer and monitor packets while the iPhone 4S Demo is running.



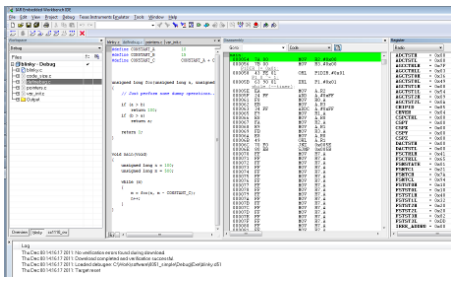
The SmartRF Protocol Packet Sniffer software can be downloaded at www.ti.com/packetsniffer.

SmartRF Flash Programmer



SmartRF Flash Programmer can be downloaded at www.ti.com/tool/flash-programmer.

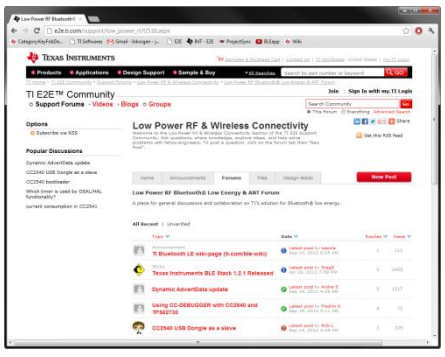
IAR Embedded Workbench



More information on IAR EW8051, including a free evaluation version download, can be found at www.iar.com/ew8051.

BLE E2E Forum

For additional help, visit the TI Bluetooth low energy E2E forum, www.ti.com/ble-forum, for instant support during your development.



BLE Wiki

Our BLE Wiki contains application examples, guides and documentation covering those extra steps you might need help with. The Wiki is not only managed by Texas Instruments employees but also E2E community members. Anyone can share, edit and make use of the information posted here.

The Wiki is found at www.ti.com/ble-wiki.

Useful Links

TI BLE Stack and Software:
www.ti.com/ble-stack

CC2540/41 Mini Development Kit User Guide:
www.ti.com/lit/swru270

CC2540/41 BLE Software Developer’s Guide:
www.ti.com/lit/swru271

CC2540/41 User’s Guide:
www.ti.com/lit/swru191

CC2541 Product Page:
www.ti.com/cc2541

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General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

Texas Instruments Japan Limited
(address) 24-1, Nishi-Shinjuku 6 chome, Shinjuku-ku, Tokyo, Japan

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http://www.tij.co.jp

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3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

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