

# CC2541 SensorTag Quick Start Guide



## Opening the Box and Using the SensorTag

The SensorTag simplifies development of *Bluetooth* low energy sensor applications. It allows app developers to quickly and easy write smart phone apps for *Bluetooth* low energy accessories without any embedded hardware or software development.

[www.ti.com/sensortag](http://www.ti.com/sensortag)

### 1. Kit Contents

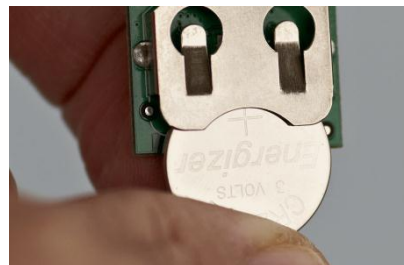


- 1 x CC2541 SensorTag with enclosure
- 1 x CR2032 Battery
- 1 x Screw (for the enclosure)
- Quick Start Guide

The RF board in this kit is FCC and IC certified and tested/complies with ETSI/R&TTE over temperature from 0 to +35°C<sup>1</sup>. The RF board has an integrated PCB antenna.

### 2. Assembly of the SensorTag

Insert the battery<sup>2</sup> in the battery connector and place the printed circuit board in the black plastic cover with the battery facing down. The screw may be used to secure the PCB to the black plastic cover.



Note that when inserting the battery for the first time, the PCB contact point surface may have a thin layer of solder residue that can prevent contact with the battery. Remove and insert the battery a few times to power the SensorTag.

Push the side button to check if the battery is correctly inserted. When the button is pushed the LED marked D1 should start to blink.

Add the transparent plastic cover to close the inner hard plastic pieces.



Complete the assembly of the SensorTag by adding the red plastic cover.



**Caution!** Dispose the battery properly and keep out of reach of children. If swallowed, contact a physician immediately.



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

### 3. Sensors

The SensorTag is fitted with six sensors and all sensors are chosen to be small, energy efficient and low cost surface mount devices. The sensors use I2C interface and are connected to the same interface bus with separate enable signals. To minimize current consumption all sensors are by default disabled and they are in sleep mode between measurements. Each sensor can be enabled and read individually. The SensorTag includes the following sensors:

- IR Temperature Sensor (TMP006) from Texas Instruments, <http://www.ti.com/product/tmp006>
- Humidity Sensor (SHT21) from Sensirion, <http://www.sensirion.com/en/products/humidity-temperature/humidity-sensor-sht21/>
- Pressure Sensor (T5400) from Epcos, <http://www.epcos.com/inf/57/ds/T5400.pdf>
- Accelerometer (KXTJ9) from Kionix, <http://www.kionix.com/accelerometers/kxtj9>
- Gyroscope (IMU-3000) from InvenSense, <http://www.invensense.com/mems/gyro/imu3000.html>
- Magnetometer (MAG3110) from Freescale, [http://www.freescale.com/webapp/sps/site/pr od\\_summary.jsp?code=MAG3110](http://www.freescale.com/webapp/sps/site/pr od_summary.jsp?code=MAG3110)

### 4. Downloading the app from App Store

The SensorTag can communicate with any *Bluetooth* 4.0 enabled devices, for instance a smart phone or a tablet.

Currently the TI *Bluetooth* SensorTag app is only supported for *Bluetooth* 4.0 enabled iOS devices (iPhone 4S, iPhone 5, iPod Touch and the new iPad). There is currently no common *Bluetooth* low energy Application Program Interface (API) for Android devices available.

Download the TI *Bluetooth* SensorTag app from Apple's App Store:

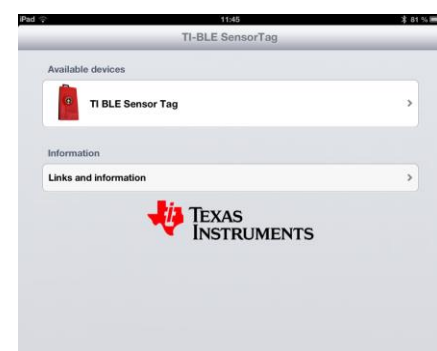


Or search for SensorTag on App Store.

### 5. Connecting to a Bluetooth 4.0 enabled iDevice

For a *Bluetooth* 4.0 iOS Device to communicate with the SensorTag, Bluetooth needs to be turned on and the SensorTag needs to be advertising. The SensorTag can enable and disable advertising by pushing the side button. When the SensorTag is advertising the green LED (D1) is blinking. It might be hard to see the blinking LED when the SensorTag is fully assembled.

Start the TI *Bluetooth* SensorTag app. When the app is launched it will search for all *Bluetooth* low energy devices in the area. Enable advertising by clicking on the side button. The SensorTag icon should appear indicating a successful connection.



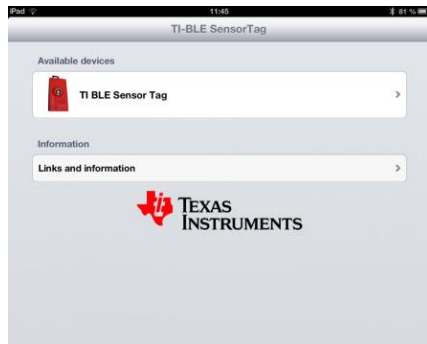
If no *Bluetooth* 4.0 devices are detected by the SensorTag within 30 seconds, advertising will stop and the SensorTag will go back to sleep. To re-activate advertising and turning on the SensorTag press the side button once more.

<sup>1</sup> Operating temperature for CC2541 is -40° to 85°C  
<sup>2</sup> Maximum input voltage is 3.6V

## 6. Use the SensorTag app

The TI *Bluetooth* SensorTag app allows you to create your “own” app by selecting the different sensors you want to use.

When connected to the SensorTag click on the SensorTag tab to see readings from the different sensors.



Turn on and off the different sensors by selecting ‘Profiles’ in the bottom, left corner. In the Profiles section it is possible to adjust the sensor data collection interval by moving the sliding bars, and select which axis to display for the multi-axis sensors. When you click ‘Back’ the TI *Bluetooth* SensorTag app will display the selected sensor data with the selected data interval.

To view and store the sample code select ‘Generate Source code’ in the Profiles section.

Enable sensor information data by clicking the different sensors, this will also allow for a graph view of the sensor readings. The data collected in the graph view can then be sent to an e-mail address by clicking on the icon in the bottom left corner.

An example source code for the *Bluetooth* low energy SensorTag app can be downloaded from: <http://www.ti.com/tool/sensortag-ios>

## 7. Using the app as an attribute and service explorer

In addition you can use the TI *Bluetooth* SensorTag app to read the services and attributes of any *Bluetooth* low energy enabled device.

Connect the *Bluetooth* low energy device, and make sure that the *Bluetooth* low energy device is advertising prior to connecting.

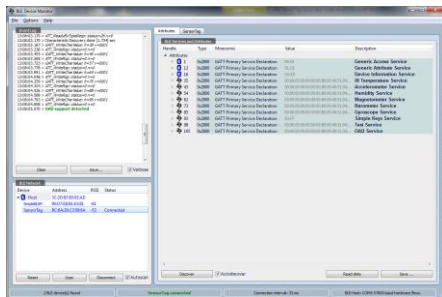
When the device is seen in the available device list select ‘Advanced Mode’ in the bottom left corner. In advanced mode an RSSI indicator is available and by clicking on the device it will connect to the iOS device. If you then click and hold on the device name you will be able to; Show Profiles, Show Services & Characteristics, Show Advertisement data or disconnect.

Select **Show Services & Characteristics** to view the services and characteristics of the *Bluetooth* low energy device.

When Show Services & Characteristics is selected, click on the arrow next to the different services to see the associated characteristics.

## 8. Using the SensorTag with TI’s BLE Device Monitor

Download and install TI’s BLE Device Monitor from: [www.ti.com/SensorTag](http://www.ti.com/SensorTag). Please note that you also need a CC2540 USB dongle to use the BLE Device monitor.



The BLE Device Monitor allows you to discover, read and alter attributes on any BLE device. More detailed information about the BLE Device Monitor can be found at: [www.ti.com/sensortag](http://www.ti.com/sensortag)

Note that BLE Device Monitor is currently only supported on Windows 7/XP.

## 9. Supported platforms

To use the SensorTag a *Bluetooth* 4.0 device is required and the API of the device must support the *Bluetooth* low energy API. Currently the following devices are supported:

- iPhone 4S
- iPhone 5
- iPad (3) or newer
- iPod Touch (5<sup>th</sup> generation)
- MacBook Air (2011 model and newer)
- MacBook Pro (2012 model and newer)
- Windows 7/XP PC with CC2540 USB dongle connected using BLE Device Monitor. Part of TI BLE stack v1.30 and newer.

## 10. Next steps

1. Learn more about the SensorTag and the BLE Device Monitor at:

[www.ti.com/sensortag](http://www.ti.com/sensortag)

2. Download the TI Bluetooth low energy stack at:

[www.ti.com/tool/ble-stack](http://www.ti.com/tool/ble-stack)

3. Download SensorTag app example source code at: <http://www.ti.com/tool/sensortag-ios>

4. Meet other Bluetooth low energy developers and get technical support at:

[http://e2e.ti.com/support/low\\_power\\_rf/f/538.aspx](http://e2e.ti.com/support/low_power_rf/f/538.aspx)

Electronic version of the quick start guide, got to: [www.ti.com/lit/swru324](http://www.ti.com/lit/swru324)

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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.

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### **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.

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### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

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