

CC2541 SensorTag

From Texas Instruments Wiki

BLE Main Page (<http://processors.wiki.ti.com/index.php/Category:BluetoothLE>)

Welcome to the main page for the Bluetooth SensorTag

The SensorTag now supports iBeacon technology!

To upgrade your SensorTag to be compatible with iBeacon technology you need to sign up as an iBeacon licensee with Apple, then you can request access to the software by clicking here (<http://www.ti.com/tool/sensortag-sw>)

Once you signed up as an iBeacon licensee you can upgrade the SensorTag with the latest iBeacon enabled firmware to test and develop with iBeacon.

Instructions how to do the upgrade and configuring an iBeacon follow this link: SensorTag_with_iBeacon (http://processors.wiki.ti.com/index.php/SensorTag_with_iBeacon)

For more information how to use the Sensortag with iBeacon, watch the SensorTag iBeacon video (<https://www.youtube.com/watch?v=TvtrU9ICKmQ>).

The new location app with iBeacon technology is available to download on the App Store (<https://itunes.apple.com/us/app/locationing-with-ibeacon/id852315723?mt=8&uo=4>) for iPhone, iPad and iPod touch.

Bluetooth Smart is a new standard that allows Bluetooth equipment to run for years on a single coin cell battery. According to IMS Research the market for Bluetooth Smart accessories is expected to be the fastest growing mobile phone accessory market in the coming years. This new technology combined with new low power sensors and countless mobile phone app developers opens up limitless opportunities for mobile phone apps

The SensorTag is designed to shorten the design time for Bluetooth app development from months to hours, the kit removes the barriers to entry for smartphone app developers who want to take advantage of the growing number of Bluetooth low energy-enabled smartphones and tablets. This is the first Bluetooth low energy development kit focusing on wireless sensor applications and it is the only development kit targeting smartphone app developers.

The Bluetooth SensorTag demonstrates the low power capabilities of *Bluetooth* low energy(aka *Bluetooth* 4.0 and *Bluetooth* smart)

- NO embedded software design knowledge required
- NO embedded compiler required
- Includes 6 low-power MEMS sensors and Bluetooth low energy radio powered by a single coin cell battery
- iOS and Android sample apps are included to demonstrate use of the sensors

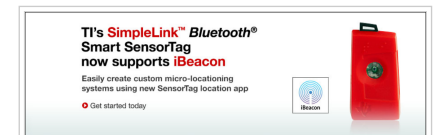
The SensorTag can be used as a reference design and development platform for a variety of smartphone accessories.

The block diagram shows the sensors on the SensorTag and lists some potential applications, most engineers that start working on the SensorTag comes up with their own app ideas!

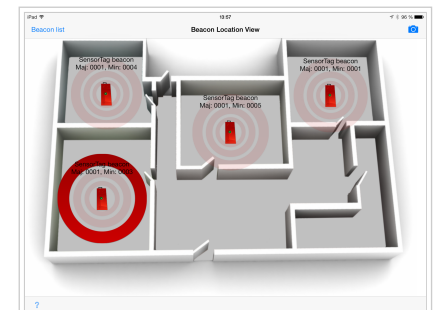
Buy the SensorTag on TI eStore (<https://estore.ti.com/CC2541DK-SENSOR-P3192.aspx>)

iOS

With the SensorTag App you can build your own SensorTag app in minutes by enabling the SensorTag sensors. It allows quick and easy prototyping and generates sample code for use in your own apps. The iOS SensorTag app can be downloaded from the Apple App Store



SensorTag with iBeacon



Location app screenshot



frameless



Supported iOS devices

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

- iPhone 4S and newer
- iPad(3) and newer
- iPad mini
- iPod Touch (5. gen)

Android

NEW! The Android SensorTag app is now available on Google Play [Google Play SensorTag \(https://play.google.com/store/apps/details?id=com.ti.ble.sensortag\)](https://play.google.com/store/apps/details?id=com.ti.ble.sensortag)

Supported Android devices

To use the SensorTag a Bluetooth Smart (4.0 or newer) device is required and the Android API 18 (Android 4.3) must be supported. The SensorTag app has been tested on the following Android devices:

- Nexus 4 (JWR66V)
- Nexus 7 (2012) (JWR66V)
- Nexus 7 (2013) (JSS15J)
- Nexus 5 (KTU84M)
- Nexus 9
- Samsung S4 (JWR66V.S11.130708)
- HTC One (M7), HTC One M8, HTC One M9
- Sony Xperia E1

Support for more devices will be announced. If you have tested other Android devices, please join the discussion on the Bluetooth low energy forum (http://e2e.ti.com/support/low_power_rf/f/538.aspx)

NB! **Nexus 7** and **Nexus 10** (2012) with Android 4.3+ is not delivered with BLE enabled. To work with BLE on this device you will need the Bluetooth Low Energy Enabler (<https://play.google.com/store/apps/details?id=com.manuelnaranjo.btle.installer2>) tool. Prerequisites for this to work is that the device is rooted and that the BusyBox app is installed.

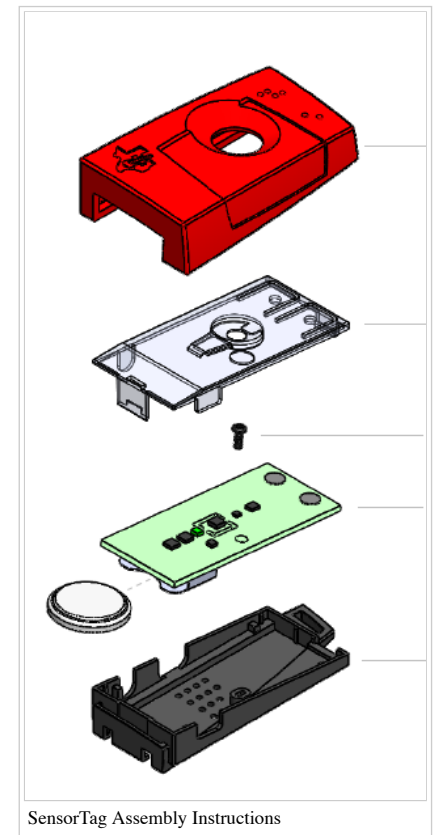
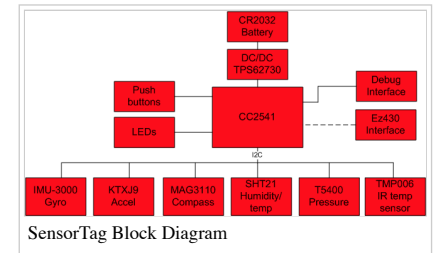
For Android the connection interval is currently fixed to 7.5ms. With early versions of the SensorTag firmware this is causing a timeout when using the humidity sensor. This problem is fixed with the latest version of the SensorTag firmware(1.4). To use the SensorTag with the Android apps, download the latest firmware here: SensorTag firmware (http://processors.wiki.ti.com/index.php/SensorTag_Firmware)
New firmware can be programmed with binary files over-the-air using the Windows BLE Device Monitor (<http://www.ti.com/product/cc2541#softTool>), the latest version of the SensorTag Android app, or with hex files using CC-Debugger (<http://www.ti.com/tool/cc-debugger>).

Windows

- Any Windows PC with CC2540 USB dongle (<http://www.ti.com/tool/cc2540emk-usb>) connected using BLE Device Monitor (<http://www.ti.com/product/cc2541#softTool>)

Windows Phone

SensorTag app for Windows phone is available in the Windows Phone App Store (<http://www.windowsphone.com/en-us/store/app/sensortag/36563599-0b32-4884-913a-4f4fd848fe6c>) and the source code is available at the following github project (<https://github.com/clovett/SensorTag-for-Windows>)



Quick Start Guide

The Quick Start Guide (<http://www.ti.com/lit/swru324>) shows the first steps for assembling the SensorTag, downloading the SensorTag App and get the sensor reading on the phone in minutes- Follow this link to download the Quick Start Guide (<http://www.ti.com/lit/swru324>)

Download summary

This section contains download links to all SW and HW resources for the SensorTag

Description	Download link
SensorTag app on App Store	http://itunes.apple.com/app/ti-ble-sensortag/id552918064?l=nb&mt=8
Locationing with iBeacon	http://itunes.apple.com/app/locationing-with-ibeacon/id852315723?mt=8&uo=4
SensorTag Android app code example	https://play.google.com/store/apps/details?id=com.ti.ble.sensortag
SensorTag iOS app source code example	http://www.ti.com/tool/sensortag-sw
BLE Device Monitor for Windows PC	http://www.ti.com/lit/zip/swrc258
TI Bluetooth low energy software stack	http://www.ti.com/tool/ble-stack
SensorTag HW reference design	http://www.ti.com/lit/zip/swrr109
SensorTag Firmware	http://processors.wiki.ti.com/index.php/SensorTag_Firmware

SensorTag User Guide

The User Guide (http://processors.wiki.ti.com/index.php/SensorTag_User_Guide) provides all details of the SensorTag hardware and firmware including conversion algorithms and overview of *Bluetooth* low energy commands used to communicate with the phone
SensorTag User Guide (http://processors.wiki.ti.com/index.php/SensorTag_User_Guide)

How to Certify your Bluetooth Product

The SensorTag reference design has passed FCC(US)/ETSI(Europe)/IC(Canada) RF certification. It is also received Bluetooth End Product certification (https://www.bluetooth.org/tpg/EPL_Detail.cfm?ProductID=24031). This section explains what certifications the SensorTag has completed and the steps required to certify your own product: How to Certify your Bluetooth product (http://processors.wiki.ti.com/index.php?title=How_to_Certify_your_Bluetooth_product&action=submit)

Not ready to go through full FCC/ETSI certification? Use certified modules from our 3rd party partners: [Bluetooth low energy modules (http://processors.wiki.ti.com/index.php/Category:BluetoothLE#TI_BLE_Module_Partners)]

BLE Device Monitor User Guide

The *BLE Device Monitor* is a PC tool that allows you to read and write the characteristics of *Bluetooth* low energy devices. For the SensorTag the BLE device monitor includes a production test panel that for testing the individual sensors. It can also be used to display sensor readout continuously. The BLE device monitor requires a CC2540 USB dongle (<http://www.ti.com/tool/cc2540emk-usb>)
BLE Device Monitor User Guide (http://processors.wiki.ti.com/index.php/BLE_Device_Monitor_User_Guide)

The BLE Device Monitor has been tested on Windows XP, Windows 7 and Windows 8.

SensorTag enabled iOS apps

The official TI SensorTag app Download app (<http://itunes.apple.com/app/ti-ble-sensortag/id552918064?l=nb&mt=8>)

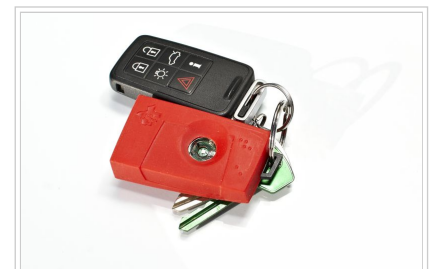
Instrument Works' all purpose app for controlling bluetooth instruments (with cloud storage options) Download app (<https://itunes.apple.com/au/app/dataworks/id821344356?mt=8&ign-mpt=uo%3D4&mt=8>)
Website (<http://www.instrument-works.com/#!dataworks/c14tq&mt=8>)



SensorTag IR temp sensor used for measuring cooking temperature



SensorTag IR temp sensor used for measuring coffee temperature



SensorTag used as keyfob for tracking keys

MyWeatherCenter - Your personal weather station Download app (<https://itunes.apple.com/de/app/my-weather-center/id824900305?ls=1&mt=8>) Website (<http://www.myweathercenter.net>)

Sensirion Confort Guide Download app (<http://itunes.apple.com/us/app/comfort-guide-sensible/id515236285?mt=8>)

Byteworks SensorTag app built using techBASIC Download app (<http://itunes.apple.com/us/app/sensortag/id579408063?mt=8>)

Weight Training-Genie Download app (<http://itunes.apple.com/us/app/weight-training-genie/id650541393?mt=8>)

Gammapoint Weather Run - Bike, Walk, Hike Tracker Download app (<http://itunes.apple.com/us/app/weather-run-bike-walk-hike/id599397919?mt=8>)

SensorTag enabled Android apps

Bluetooth SensorTag Download app (<https://play.google.com/store/apps/details?id=com.ti.ble.sensortag&hl=en>)

SenseView BT SensorTag Sensor Download app (<https://play.google.com/store/apps/details?id=si.mobili.senseview.serviceti&hl=en>)

BLE SensorTag Download app (<https://play.google.com/store/apps/details?id=sample.ble.sensortag&hl=en>)

SensorTag BLE App with Code Download app (<https://play.google.com/store/apps/details?id=com.togosoft.sensortag2>)

SensorTag enabled Windows phone apps

Bluetooth LE Explorer Download app (<https://code.msdn.microsoft.com/windowsapps/Bluetooth-LE-Explorer-91669105/view/SourceCode>)

Bluetooth LE Explorer is a sample freely available with the fully commented sources code, and it is available for Windows Phone 8.1 and allows to interact with BTLE services and characteristics exposed by BTLE devices, paired with Windows Phone. When used with TI SensorTag BTLE explorer allows to interact with all services and characteristics exposed by the SensorTag.

SensorTagIoT is a paid windows phone based app that can be used to install arbitrary firmware on the device. It also includes a version of firmware that allows you to configure it to emit an iBeacon or Eddystone compatible beacon signal. It also adds in a few additional GATT services to do interesting things. It is fully compatible with earlier versions of the firmware. Windows App Store (<https://www.microsoft.com/en-us/store/apps/sensortagiot/9nblggh5x5lg>)

Bluetooth low energy blogs

MAKE | Teardown of the TI SensorTag

“...try this, you’ll love it.” Teardown of the TI SensorTag (<http://blog.makezine.com/2013/04/18/teardown-of-the-ti-sensortag>)

Write your own Bluetooth Smart Sensor App in an Hour

Bluetooth SIG webinar on how to write apps for the SensorTag View Webinar recording (<http://developer.bluetooth.org/DevelopmentResources/Pages/Webinars.aspx?ItemID=11>)

Raspberry Pi and TI CC2541 SensorTag

Thanks to Michael Saunby, the SensorTag is now supported on Raspberry Pi
Michael Saunby Blog (<http://mike.saunby.net/2013/04/raspberry-pi-and-ti-cc2541-sensortag.html>)

BeagleBone Black Linux interface



SensorTag accelerometer used as level construction tool

Zephyr-Labs has posted a Linux example using BeagleBone black Zephyr-Labs blog (<http://www.zephyr-labs.com/?p=87>)

SensorTag Android app on HTC One

Lance Nanek has posted a cool example of SensorTag interface for Android on an HTC One NeatoCode Blog (<http://neatocode.tumblr.com/post/48928591866/esp-for-your-android-ti-sensortag>)
See Lance's presentation here (<http://www.slideshare.net/lancenane/htc-bluetooth-low-energy-and-the-ti-sensortag>)

Because Bluetooth Smart is happening !

Bluetooth Smart Log (<http://ble.stalliance.no>)

Byteworks Bluetooth low energy blog

Controlling the SensorTag with techBASIC blog (http://www.byteworks.us/Byte_Works/Blog/Entries/2012/10/31_Controlling_the_TI_SensorTag_with_techBASIC.html)

Building iPhone and iPad Electronic Projects

Real-World Arduino, Sensor, and Bluetooth Low Energy Apps in techBASIC, By Mike Westerfield. This book includes a lot of details about programming BASIC for Bluetooth low energy apps Order the book from O'Reilly (<http://shop.oreilly.com/product/0636920029281.do>)

iOS Apps Development

Start Developing iOS Apps Today (<https://developer.apple.com/library/ios/#referencelibrary/GettingStarted/RoadMapiOS/chapters/Introduction.html>)

***Bluetooth* low energy wiki**

When you are ready to develop your own firmware for the SensorTag, check out the: *Bluetooth* low energy wiki (<http://www.ti.com/ble-wiki>)

Dave The Android Guy

This blog By David Johnson explains how he modified a SensorTag to interface it to an exercise bicycle trainer. He has a video of his mother using the exercise bicycle while he monitors her progress on a Nexus 7. His goal is to make an interface to allow people to exercise and navigate Google Street Views. According to David he does Android Systems development for "People that deserve more and have less" Dave The Android Guy blog (<http://davetheandroidguy.blogspot.de/2013/12/successfully-interfaced-ti-sensortag-to.html>) On more reviews click here (<http://www.ipltwenty20news.com/technology-2/google-added-web-browser-to-the-google-glass.html>).

SensorTag with iBeacon support on Blackberry

Excellent blog post by Martin Woolley that explains all steps required to use iBeacon on a Blackberry 10 with the SensorTag Blackberry Developer Blog (<http://devblog.blackberry.com/2014/05/beacon-testing-and-configuration-using-blackberry-10/>)

Videos

TI SensorTag introduction video (http://focus.ti.com/general/docs/video/Portal.tsp?entryid=1_v2cduesl&lang=en)

TI promotion video (http://focus.ti.com/general/docs/video/Portal.tsp?entryid=1_wg5w9k04&lang=en)

Byte Works rocket flight video (<http://www.youtube.com/watch?v=8YNjwcNXOK4>)

SensorTag training at Embedded World 2013 (http://www.youtube.com/watch?v=wtC2L_PA7Q8)

Post your own projects

SensorTags BLE Explorer for Windows 8

NEW! BLE explorer for Windows 8

- <http://apps.microsoft.com/windows/nb-no/app/sensortags-ble-explorer/4267d14b-dfcf-4f5a-b432-a8d9ca48dc75>

Easy TI Sensor Tag development for JavaScript HTML5 programmers

Updated tutorial with kitchen sink template, and how-to video

- <http://evothings.com/quick-guide-to-making-a-mobile-app-for-the-ti-sensortag-using-javascript/>

Evothings Studio open source mobile development framework for Mac, PC and Linux can be downloaded here:

- <http://evothings.com/download>

It comes bundled with custom BLE Sensor Tag app, several BLE examples + code source w. Apache 2 licence. When you upgrade your SensorTag to act as a BLE beacon, there are suitable ibeacon examples too. Development clients available on Google Play and Apple's Appstore, find 'evothings'!

Driving AutoCad using a SensorTag

Take a look at this blog post to see how the SensorTag is connected to AutoCAD to rotate objects,

- http://through-the-interface.typepad.com/through_the_interface/2013/11/driving-autocad-via-the-accelerometer-in-a-sensortag.html

YmsCoreBluetooth

A framework for building Bluetooth 4.0 Low Energy (aka Smart or LE) iOS and OS X applications using the CoreBluetooth API. Includes Deanna and DeannaMac, applications to communicate with a TI SensorTag for iOS and OS X respectively.

Intended for iOS and OS X developers intent on shipping production-level code to communicate with BLE devices. Think of it as AFNetworking for BLE.

Features

- ObjectiveC Block-based API for Bluetooth LE communication
- Operations (e.g. scanning, retrieval, connection, reads, writes) map to the data object hierarchy of CoreBluetooth.

Where to get it

<http://kickingvegas.github.io/YmsCoreBluetooth/>

YmsCoreBluetooth in Action

SensorTag as iTunes Remote

Here is a video of an iOS app running in the background using YmsCoreBluetooth to characterize the SensorTag to control the Music app on an iPhone. Using YmsCoreBluetooth, time spent making this demo from concept to execution (including shooting the video) took a half-day, just in time to head for lunch.

- <http://yummymelon.com/ymsblog/sensortag-remote-control-for-itunes.html>

Bluetooth Dump

A simple xCode example of enumerating visible Bluetooth LE devices via Core Bluetooth and locating a TI SensorTag and connecting to it <https://github.com/jeradesign/BluetoothDump>

Sensor Tag C# application (BLEHealthDemo modification)

There is modification of BLEHealth Demo C# application to run with Keyfob and Sensor Tag without cleanup code. Sensor Tag Firmware modded to change period in Gyroscope (A and B img for download).
<http://www.orcs.sebsoft.com/index.php/79-vision/72-how-to-acquire-data-by-c-from-bluetooth-4-bluetooth-low-energy-ti-ble-keyfob-ti-sensor-tag>

Keyfob connected and tested by Samsung Galaxy S3 with Android 4.3

SensorTag library for Windows Store apps in C#

An easy to use C# library for Windows Store apps. This library uses the new GATT API available in Windows 8.1. Assembly, source and a sample are available at CodePlex: <http://sensortag.codeplex.com/>

There's also simple app available in the store: <http://x2codinglab.com/component/k2/item/29-ti-sensor-tag-reader>

Best TI SensorTag BLE

The Windows "Best TI SensorTag BLE" app is available from the Windows App Store (<http://apps.microsoft.com/windows/en-us/app/best-ti-sensortag-ble/ec511d25-9a15-4b52-8749-e4a05bfa4ed/m/ROW>). The free app provides basic access to the different sensors; with a low-cost in-app upgrade, data can be copied in tabular form. The in-app upgrade also provides access to the source code for the entire app. Many laptops and tablets are already Bluetooth 4.0 compatible; other computers may require a Bluetooth dongle to function correctly.

SensorTagIoT

NEW! This is a windows phone based app Windows App Store (<https://www.microsoft.com/en-us/store/apps/sensortagiot/9nblggh5x5lg>) that can be used to install arbitrary firmware on the device. It also includes a version of firmware that allows you to configure it to emit an iBeacon or Eddystone compatible beacon signal. It also adds in a few additional GATT services to do interesting things. It is fully compatible with earlier versions of the firmware.



For technical support please post your questions at <http://e2e.ti.com>. Please post only comments about the article **CC2541 SensorTag** here.

Links



Amplifiers & Linear
(http://www.ti.com/lstds/ti/analog/amplifier_and_linear.page)
Audio (http://www.ti.com/lstds/ti/analog/audio/audio_overview.page)
Broadband RF/IF & Digital Radio
(<http://www.ti.com/lstds/ti/analog/rfif.page>)
Clocks & Timers
(http://www.ti.com/lstds/ti/analog/clocksandtimers/clocks_and_timers.page)
Data Converters
(http://www.ti.com/lstds/ti/analog/dataconverters/data_converter.page)

DLP & MEMS (<http://www.ti.com/lstds/ti/analog/mems/mems.page>)
High-Reliability (http://www.ti.com/lstds/ti/analog/high_reliability.page)
Interface (<http://www.ti.com/lstds/ti/analog/interface/interface.page>)
Logic (http://www.ti.com/lstds/ti/logic/home_overview.page)
Power Management
(http://www.ti.com/lstds/ti/analog/powermanagement/power_portal.page)

Processors
(http://www.ti.com/lstds/ti/dsp/embedded_pr)

- ARM Processors
(<http://www.ti.com/lstds/ti/dsp/arm.pag>)
- Digital Signal Processors (DSP)
(<http://www.ti.com/lstds/ti/dsp/home.p>)
- Microcontrollers (MCU)
(<http://www.ti.com/lstds/ti/microcontro>)
- OMAP Applications Processors
(<http://www.ti.com/lstds/ti/omap-applic-processors/the-omap-experience.page>)

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