BLE Device Monitor User Guide

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The *Bluetooth* low energy (BLE) Device Monitor is a windows application that displays services, characteristics and attributes of any *Bluetooth* low energy device. In addition it features test and monitoring for the Bluetooth SensorTag and can also be used to download firmware over the air (OAD) for SensorTag and other TI devices that support this feature. The **BLE Device Monitor** requires a [dongle [2]] with a **HostTestApplication** to work. This is the same firmware that BTOOL relies on.

The BLE Device Monitor (current version is 1.2) has been tested on Windows XP, Windows 7 and Windows 8. . NB! **The** BLE Device Monitor **can be downloaded here** [3]**.**

Changes

Changes between version 1.2 and version 1.1:

- Significantly faster installer
- CDC (virtual COM port) drivers are installed automatically
- The application works on Windows 8
- OAD bug fixes: removed multiple error messages and corrected error in download time estimate
- Displays firmware revision after connect
- Visualization of SensorTag button presses
- Warns about obsolete HostTest firmware

Installation

Unpack the ZIP-file, run installer (Setup_BLE_Device_Monitor.exe) and confirm when Windows asks for permission to install executables and drivers. When the installation is complete there will be short-cuts on the Windows Desktop and in the Windows Start Menu.

Make sure to upload the correct image to the CC2540 USB dongle, *CC2540_USBdongle_HostTestRelease_All.hex*. The default location is: *C:\Program Files\Texas Instruments\SmartRFTools\BLE Device Monitor\firmware\cc254x*. Alternatively you can use a SmartRF05EB with a CC2540EM or CC2541EM as a dongle. In this case you need to connect the SmartRF05EB to a PC COM-port with a RS232 null-modem cable. Firmware for these platforms is also found in the *firmware* folder (CC2540_SmartRF_HostTestRelease_All.hex and CC2541_SmartRF_HostTestRelease_All.hex).

The Virtual COM port driver for the CC2540USB dongle can be found in (default): C:\Program Files\Texas Instruments\SmartRFTools\drivers\vcp.

Finding the correct COM port

On Windows 7 and 8 the COM-port number will be displayed as a notification when the dongle is inserted first time. On Windows XP you may need to open Windows Device Manager to find the correct COM port for the TI CC2540 Low-Power RF to CDC Serial Port (COMxx). If the CC2540 device doesn't show up as a COM port, it is probably listed as an unknown device. Select the unknown device, right click and install the driver from: C:\Program Files\Texas Instruments\SmartRFTools\drivers\vcp.

BLE Device Monitor first use

Open Device Monitor from: *C:\Program Files\Texas Instruments\BLE Device Monitor\ble_devmon.exe* or from Windows Start Menu. When BLE Device Monitor is opened for the first time, it will fail to open the COM port, as the predefined COM port is COM1 (this will obviously not happen if you use SmartRF05EB connected physically to COM1!).

Go to 'Options' and 'Serial Port' and select the correct COM port and click 'OK'. The BLE Device Monitor will automatically search for a *Bluetooth* low energy Host device, and display the message 'BLE Host found' and some other messages in the event log when successful. Then it will by default start scanning for BLE devices.
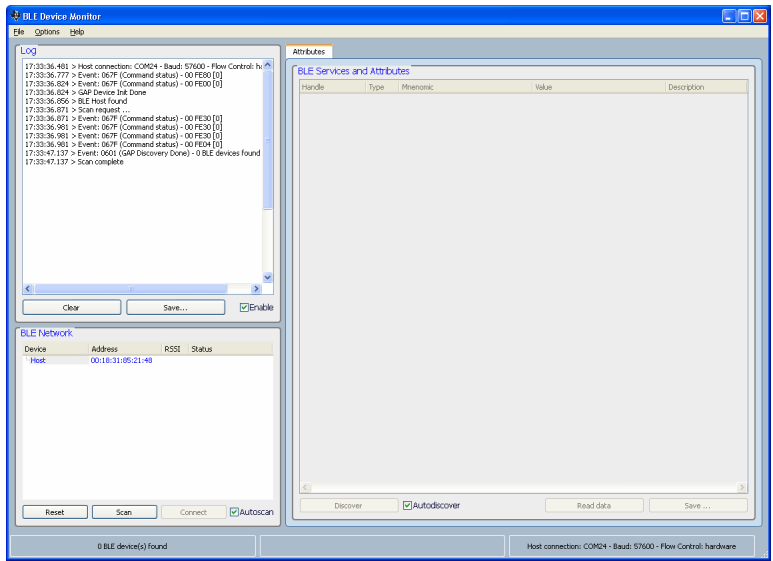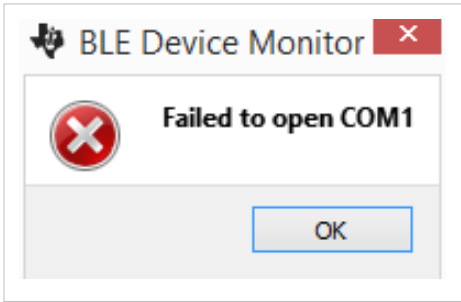
Connecting to a SensorTag (or any *Bluetooth* low energy device)

Insert a CR2032 (coin cell) battery in the SensorTag and click on the side button to enable advertising. The LED (D1) on the other side of the PCB should start to blink to indicate that it is ready to communicate with the BLE Device Monitor. If no connection is established within 30s the LED will stop blinking and the SensorTag will go back to sleep. If that happens, push the side button again to make the SensorTag advertise for another 30 seconds. Advertising on/off can be toggled via the side button any time.

Click 'Scan' in BLE Device Monitor to scan for the SensorTag
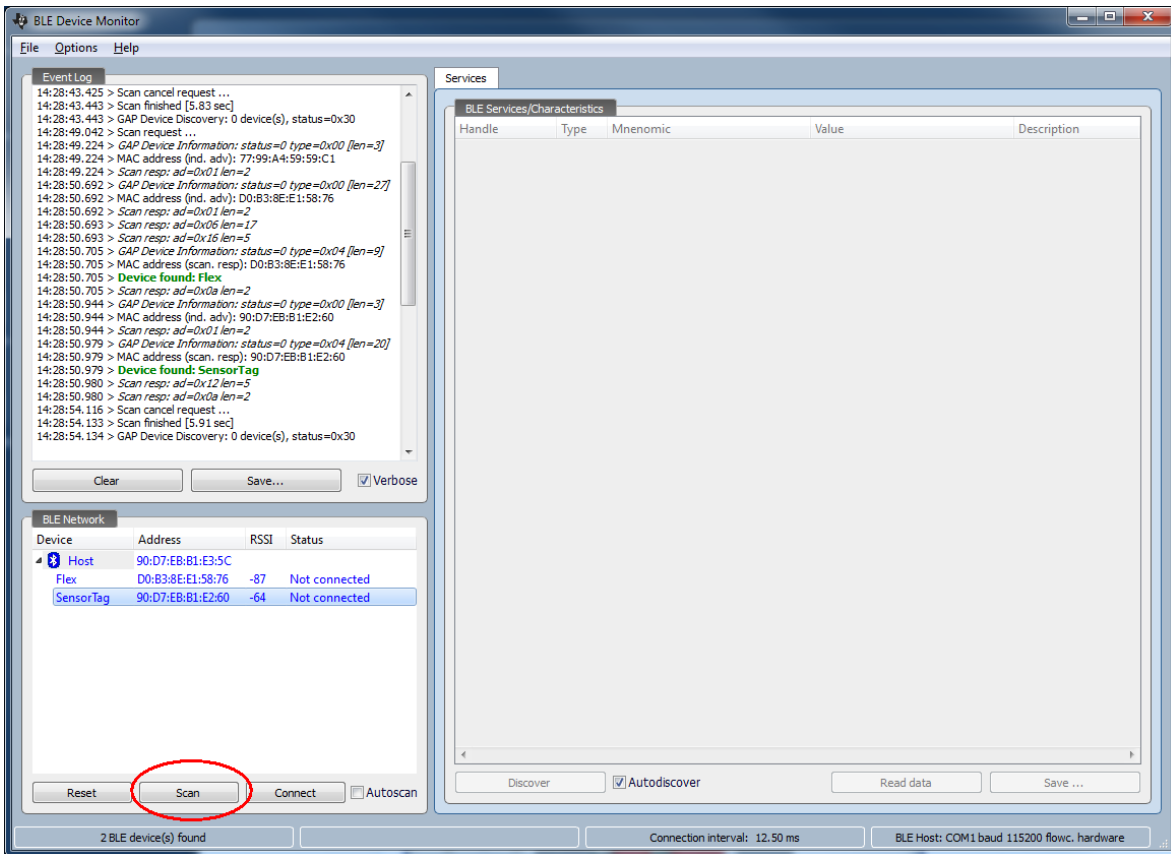
Select the SensorTag; either by double clicking on the SensorTag name or select the SensorTag and click on 'Connect'.
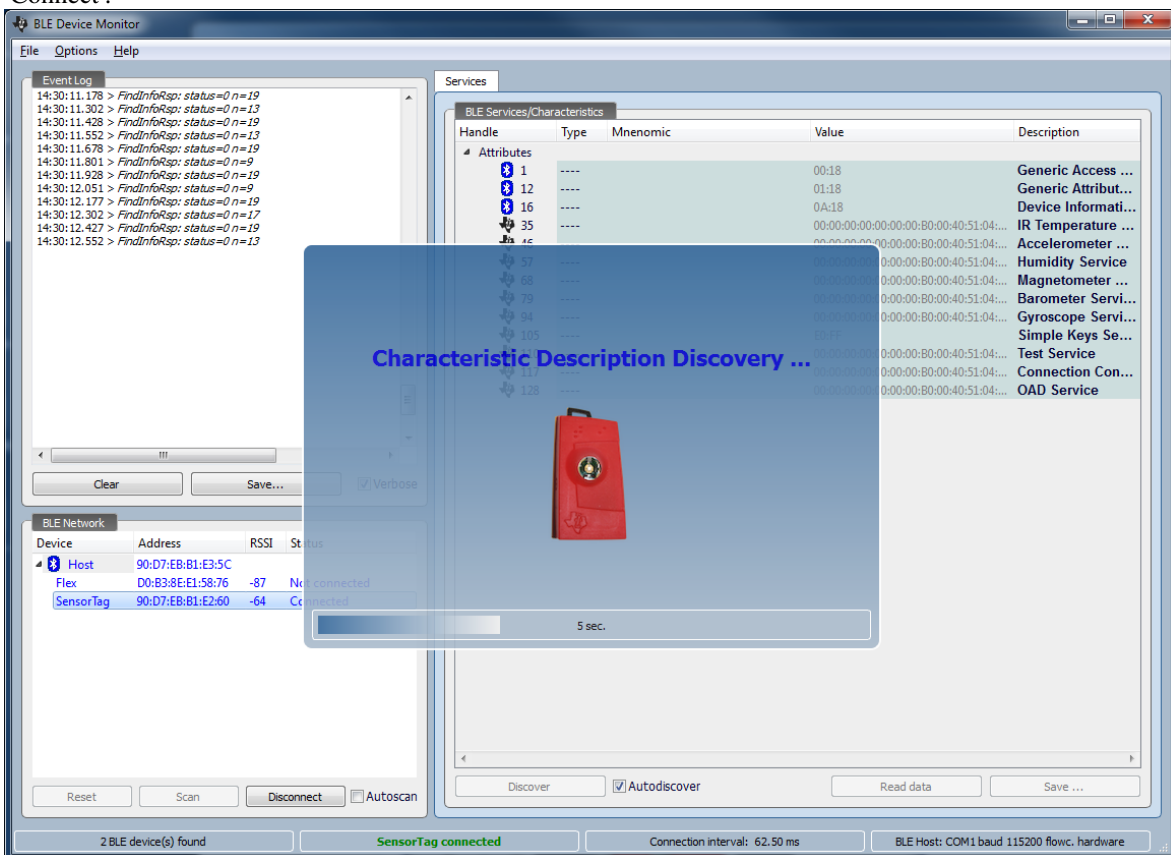
The SensorTag will now change status from **Not Connected** to **Connected** and all *Bluetooth* low energy Services and Characteristics appear.

The Device Monitor main window has two tabs: **Servicces** tab and **Sensor Tag** tab. The Services tab list all available GATT services, while the SensorTag tab demonstrates test mode for all sensors. If a SensorTag is connected the SensorTag will be selected by default.

Using Services tab

The Services tab will list all the GATT Primary Services that is available for the connected *Bluetooth* low energy device. Click on the + to display the Characteristics of the Service. As shown in the picture below, for the SensorTag IR temperature sensor, there is a characteristic, F000AA01, which shows the raw temperature data from the IR Temperature sensor. Notifications are enabled after connection but the SensorTag will not transmit any data as the sensors are off by default. Click on the IR Temperature Data characteristics to see the temperature readings (in hex). These will show 00:00:00:00 when the sensor is off.
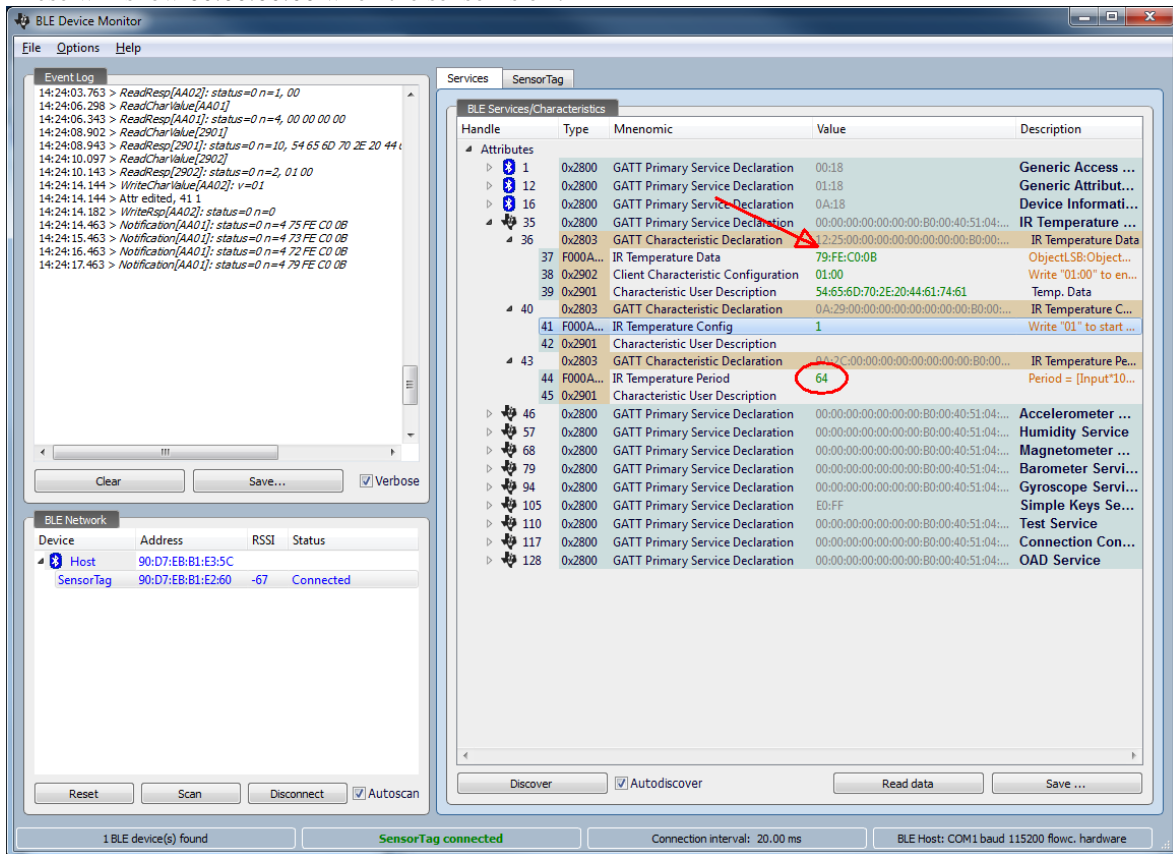
Turn on the sensor by double-clicking in the 'Value' field of the IR Temperature Config characteristic, and enter '1'. Now data from the sensor will appear in the Value column. If the log is set to "verbose" messages will appear also there. The readout period can be changed by applying a value to the 'IR Temperature Period characteristic'. The sensor is then turned off by writing '0' to the Config characteristic.

Explore the other sensors to by opening the corresponding Services. All sensors use a common set of characteristics and are operated in the same way.

Using the SensorTag tab

When using the Monitor mode you will be able to see the numerical readings of the sensors, as opposed to the raw (hex) values that are displayed in the log and in the Services tab. Select Monitoring and choose the sensors you want to monitor and then click 'Start'. Make sure that you haven't stopped notifications of any of the sensors you want to monitor.
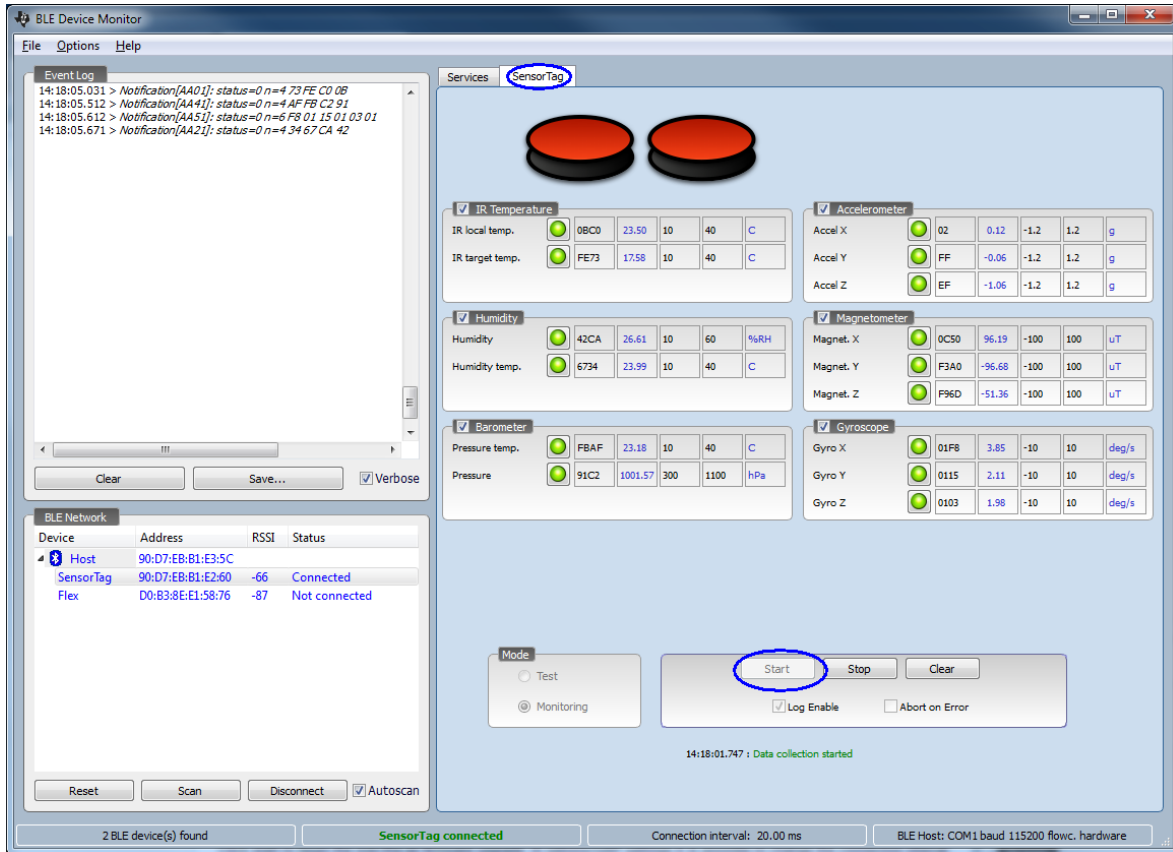
The Test Mode is a production test facility for the SensorTag which will enable you to test all the sensors and peripherals that are available on the SensorTag. The operator will be prompted for action when required, e.g. to confirm that, say, an LED has been turned on or when it is necessary to operate a button. The test results are stored in a time stamped log files, one for each calendar day (XML format). Test results are best accessed via File->Open Working Directory. This will open the storage directory used by the SensorTag (Douments\Texas Instruments\BLE Device Monitor).

The test limits may be changed by changing the following XML file: C:\Program Files\Texas Instruments\SmartRFTools\BLE Device Monitor\config\test_sensortag.xml.

Over-the-Air-Download (OAD)

New firmware can be downloaded to the SensorTag using the OAD feature of the BLE Device Monitor. This feature is accessed with File->Program (OAD), alternatively use CTRL + P. Select the image you want to download to the SensorTag. In \\Program Files\Texas Instruments\SmartRFTools\BLE Device Monitor\firmware\cc254x there are binary images containing the latest available firmware (at the moment version 1.5 based on BLE Stack 1.4).

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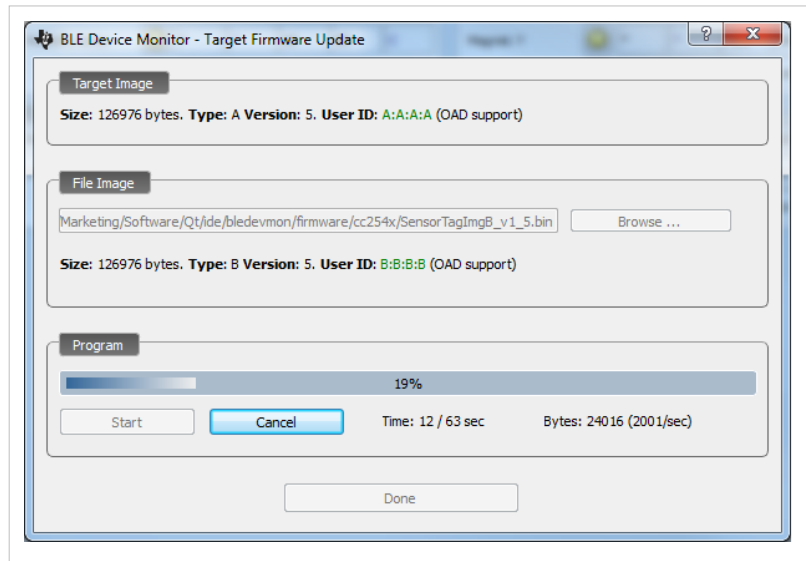
Click start to begin the over-the-air firmware upgrade. In options/GAP settings it is possible to change the connection interval, changing the connection interval will directly affect the time it will take to download a new firmware to the SensorTag as it defines how often the SensorTag is to communicate with the BLE Device Monitor. It is recommended to set both minimum and maximum connection interval to **20 milliseconds**. Higher values will slow down the programming unnecessarily, and too low values might cause lost packets and failed FW update. With these settings reprogramming of the SensorTag will take appx. 60 seconds (this may vary between PC's).

When a new firmware has been successfully downloaded to the SensorTag it will restart and the BLE Device Monitor loses connection with it. When ready the LED on the SensorTag will blink once and the SensorTag is reset and ready to use with the new firmware. Note that the side button must be pushed to restart advertising and the user may now reconnect and verify that the upgrade succeeded. Aborting the OAD upgrade is safe, the BLE device will continue to operate with its current firmware. This is easiest done by inspecting the log where the FW revision and the build date is displayed in **bold green**.

SensorTag Attributes

The complete Attribute Table for the SensorTag can be found in here BLE_SensorTag_GATT_Server.pdf
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References

[1] http://processors.wiki.ti.com/index.php/Bluetooth_SensorTag

[2] http://www.ti.com/tool/cc2540emk-usb|CC2540USB

[3] http://www.ti.com/lit/zip/swrc258

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