Siliconlabs_Silica Documentation

Release 0

Silica

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Contents

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CHAPTER 1

Silicon Labs' Smallest, Lowest Power Bluetooth Smart Module

CHAPTER 2

INTRODUCTION

The SiliconLabs Sensor Node has the **BGM111** device that is a Bluetooth® Smart module targeted for Bluetooth Smart applications. That permits good RF performance, low power consumption and easy application development as key requirements. At +8 dBm TX power BGM111 has best-in-class RF performance and can provide long range, robust Bluetooth Smart connectivity. This device integrates all of the necessary elements required for a Bluetooth Smart application: Bluetooth radio, software stack and GATT based profiles and it can also host end user applications, which means no external microcontroller is required in size, price or power constrained devices. SiliconLabs Sensor Node has several sensors connected to the BGM111 Bluetooth Smart module, thanks its highly flexible hardware interface to connect to different peripherals. Another valuable characteristic is the ultra-low power consumption that permits to operating using a standard 3V coin cell battery.

This board shows you the capability of the **BGM111** sending data by Bluetooth read from the sensors of:

- Temperature
- Humidity
- Accelerometer
- Magnetometer
- Gyroscope
- Ambient Light
- Proximity

BGM111 Features:

- Bluetooth 4.1 Compliant (Bluetooth Smart)
- Software upgradable to Bluetooth 4.2
- TX power: up to +8 dBm
- RX sensitivity: down to -93 dBm
- Range: up to 200 meters
- CPU core: 32-bit ARM® Cortex-M4

- Flash memory: 256 kB
- RAM: 32 kB
- Autonomous Hardware Crypto Accelerator and True Random Number Generator
- Integrated DC-DC Converter

Developement tools

Firmware developed using: **Blue Gecko Software**, for installation and configuration of the project, follow instruction inside *Developing guide*

Document references

The board reference documentation is available on the architech-board website.

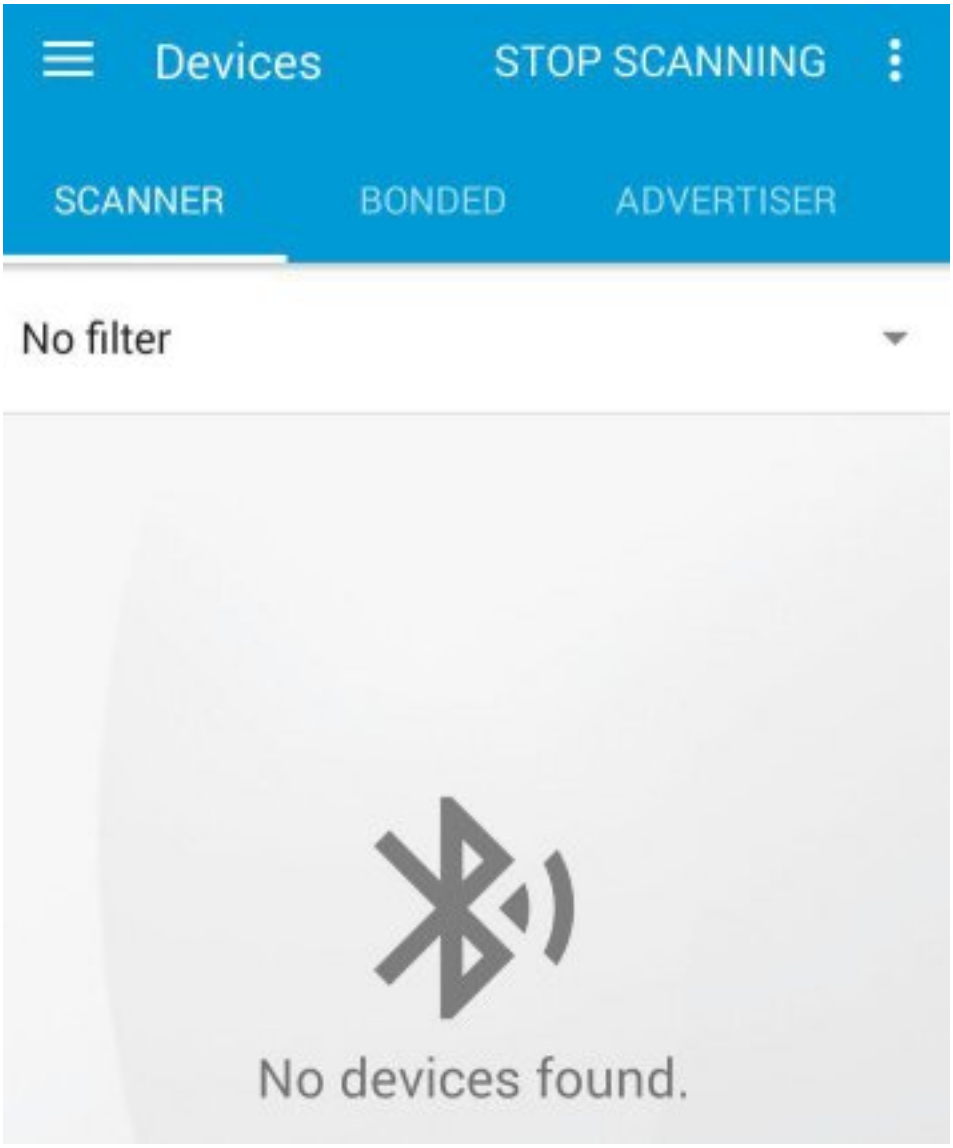
Contents:

Quick start guide

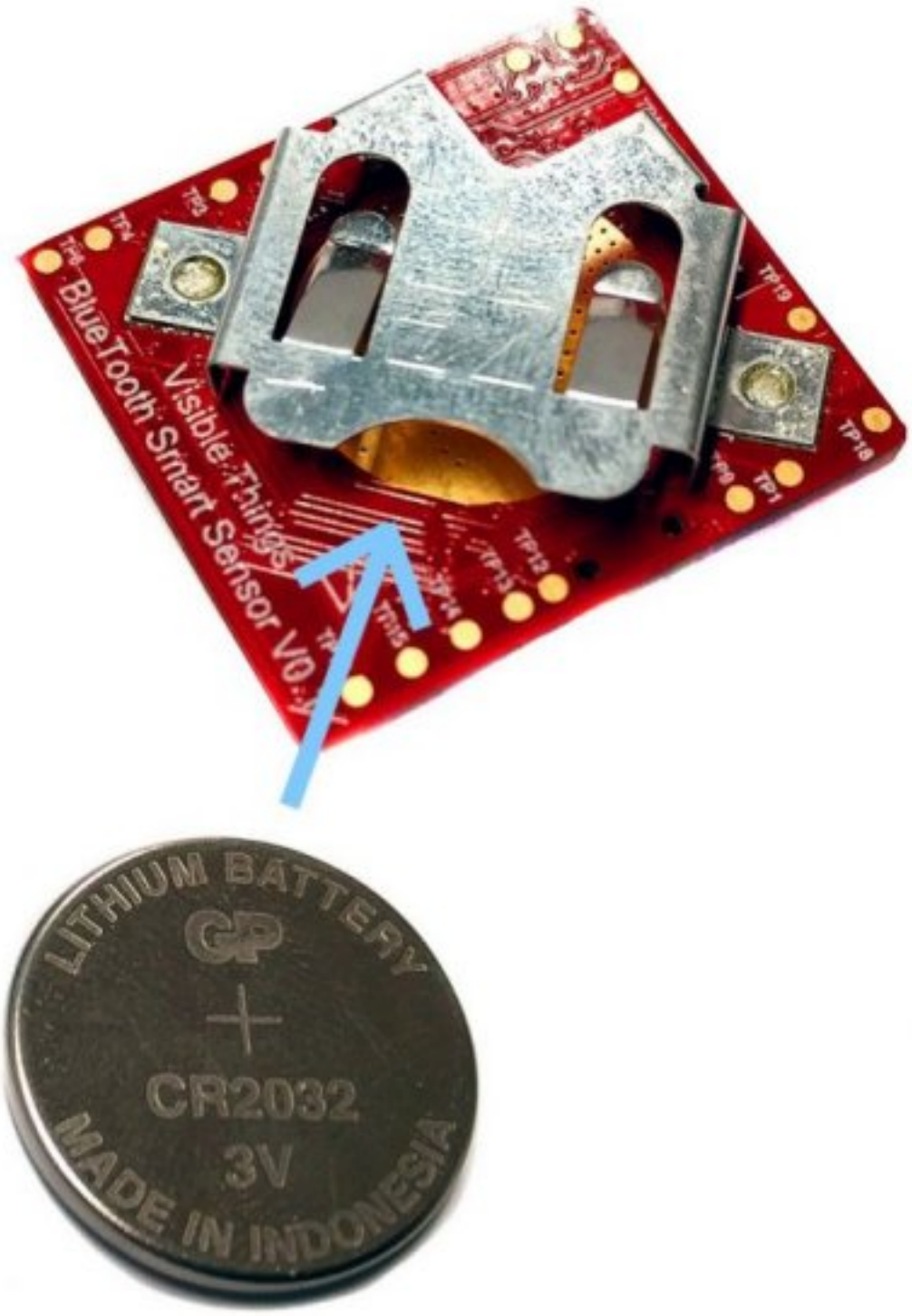
This guide shows you what kind of data are sent by the **SiliconLabs Sensor Node**. in order to follow the next steps it is necessary to use an Android phone or an iOS device.

1. Install the application **nRF Master Control Panel** from **Google Play Store** or from **Apple Store**.

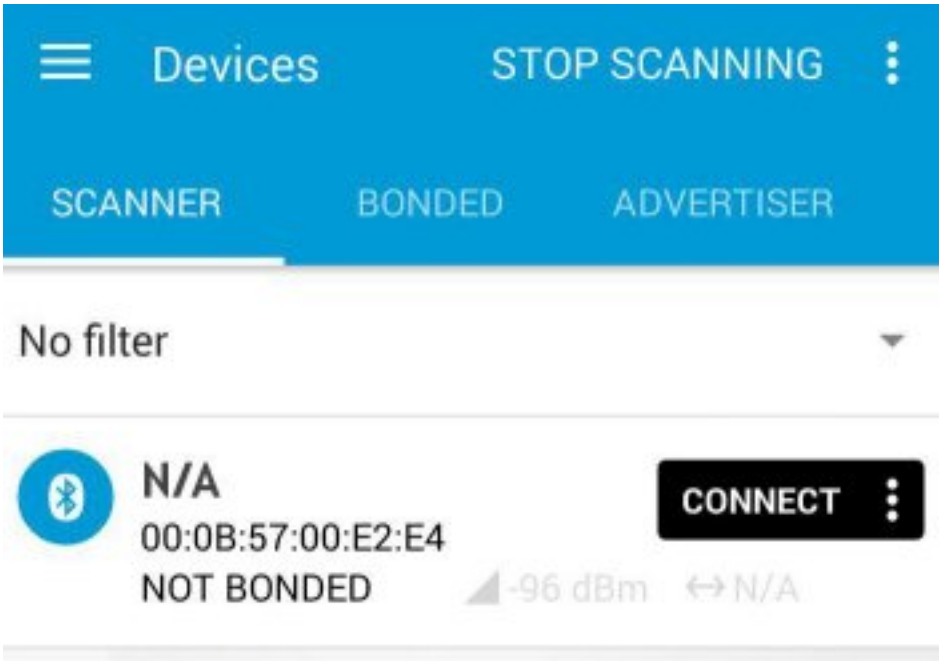
2. Launch the installed application and go to **Scanner** tab. At the first time no device will be seen. Turn on the Bluetooth from the settings of your phone.



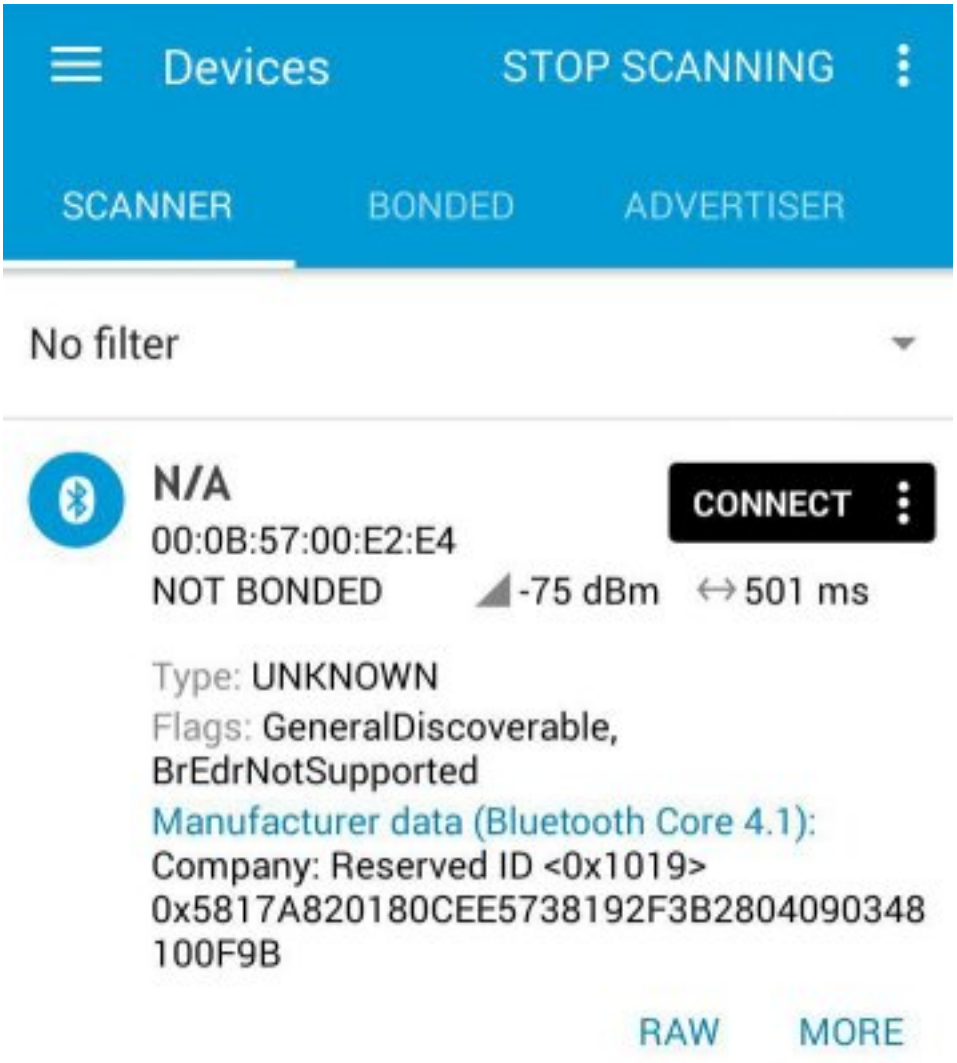
3. Turn on the **SiliconLabs Sensor Node** board inserting the battery.



4. The **nRF Master Control Panel** will find out the device.



5. To see the details of the frame sent by the device found, touch on the row just showed.



6. Every 2 seconds the SiliconLab Sensor Node will send a new frame with the last data read from the sensors. To understand what are these numbers here there is a simple schema:

Bytes	Significance
0x58	Temperature
T	signed value from -20 to +40 celsius
0xA8	Humidity
H	Humidity in %, scale 100%, unit 1%
0x18	Accelerometer
X	2'complement value in units of 0.01g
Y	2'complement value in units of 0.01g
Z	2'complement value in units of 0.01g
0x38	Magnetometer
X	2' complement value in units of 10-6T
Y	2' complement value in units of 10-6T
Z	2' complement value in units of 10-6T
0x28	Gyroscope
X	2' complement value in units od 0.1deg/s
Y	2' complement value in units od 0.1deg/s
Z	2' complement value in units od 0.1deg/s
0x48	Ambient light & Proximity
A	units ok klux
P	

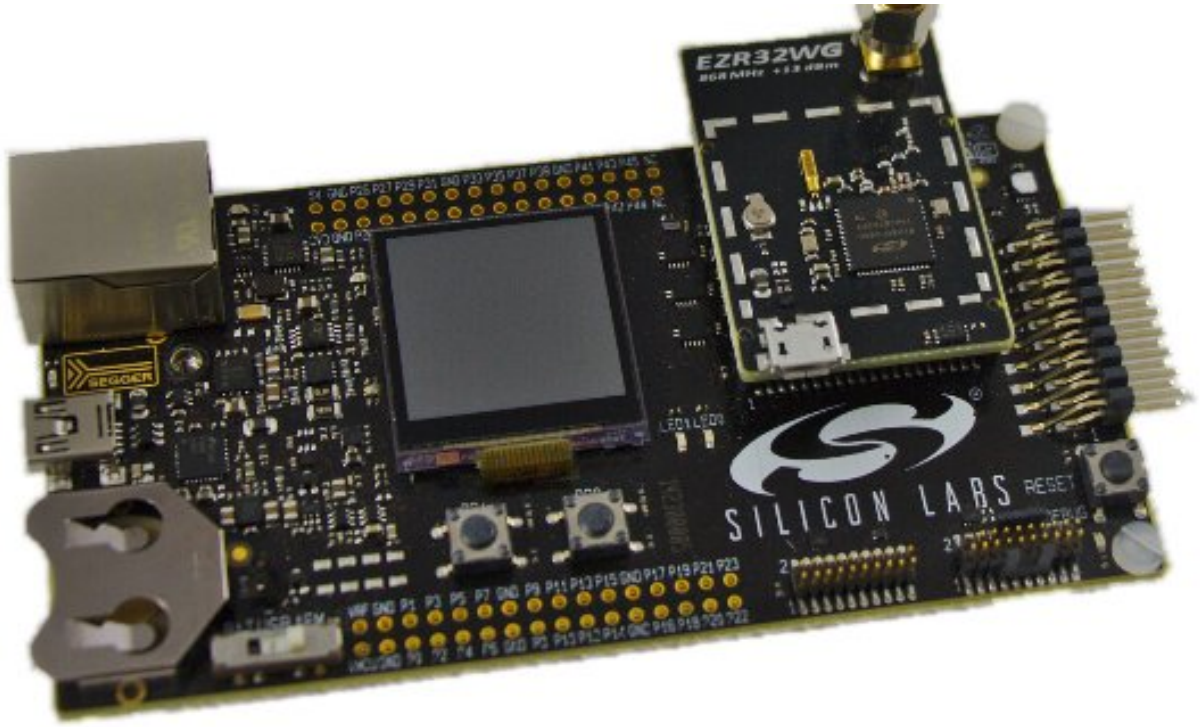
Developing guide

This page explains how to develop under *Windows* with the **BG Tool** showing where to download, install and use it. To program the BGM111 it is necessary not only the SiliconLab Sensor Node itself but also the board named **SLWSTK6201A**.

Installing

The software can be downloaded from the SiliconLabs website the version used in this guide is v0.9.2-446. In the silabs webpage under the *download now* you can find documents about BGScript, BGAPI, and example applications. Once it downloaded install following default options.

SLWSTK6201A board

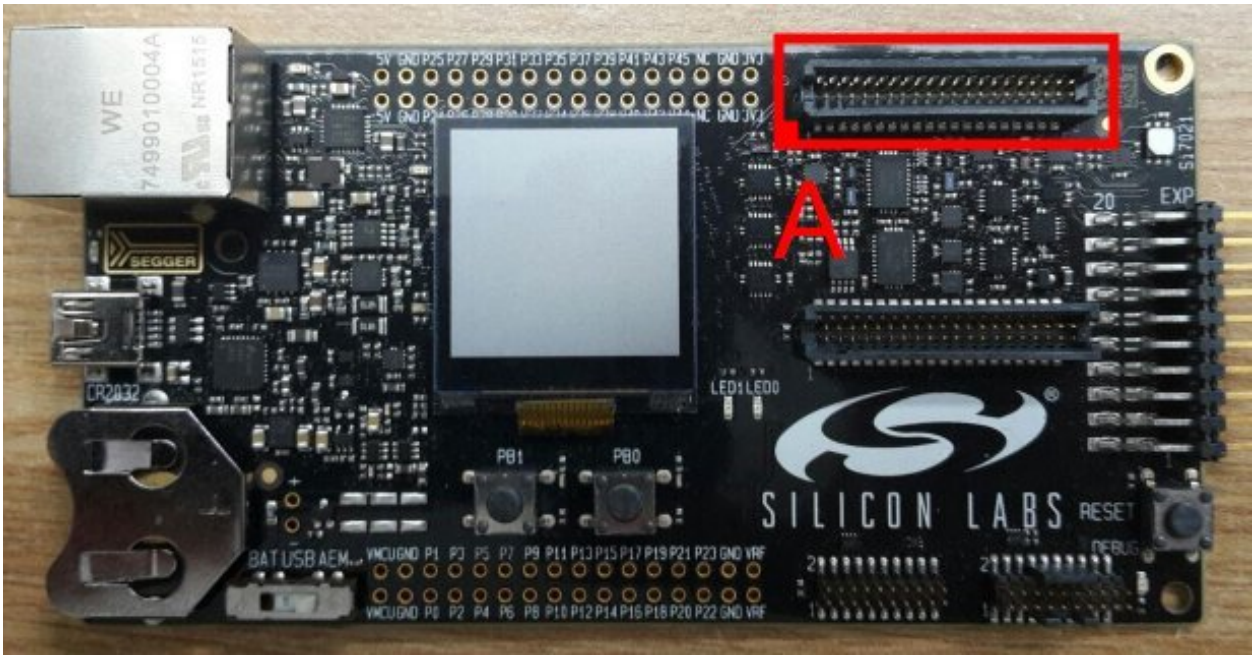


The board EZR32 Leopard Gecko Starter Kit is needed to program the firmware in the **SiliconLab Sensor Node**. It is used as a J-Link. Without this hardware it is not possible to flash the BGM111. It is necessary also to make connections from the connector of the board with the device. To make this connection please follow this scheme:

As in figure:

PT	Line
18	VCC
19	GND
11	RESET
7	SWDIO
8	SWCLK

Connect these lines to the **SLWSTK6201A** board, red connector:



Sensor Node	SLWSTK6201A	Line
TP18	A Pin 1	VCC
TP19	A Pin 2	GND
TP11	A Pin 18	RESET
TP7	A Pin 13	SWDIO
TP8	A Pin 14	SWCLK

Before to continue, connect the **SiliconLab Sensor Node** to the **SLWSTK6201A** and connect the PC via USB to the **SLWSTK6201A**. Windows will install a virtual COM when recognizes the board.

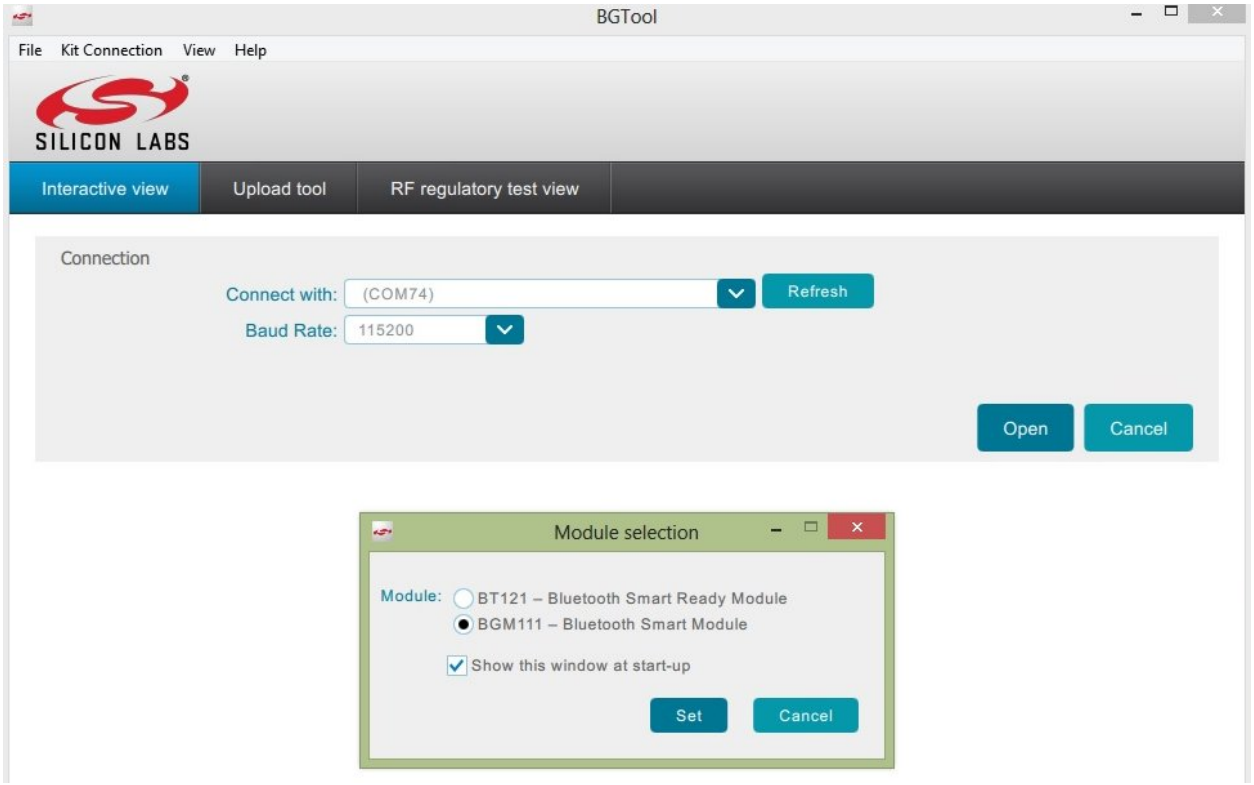
The Project

The project is developed with the **BGScript**. This language is compiled by **BGTool** and interpreted by **BGM111**. To know details about this programming language we suggest to read the specific document Bluetooth Smart BGScript Developer Guide and read about the API functions with the document BGM API Reference Guide. Summarizing the BGScript is a simple event-driven BASIC-like application scripting language. It abstracts away the complexity of Bluetooth development, embedded programming and hardware interfaces. This kind of design enables fast, simple firmware development into BGM111 module. Obviously, it is not needed external MCU.

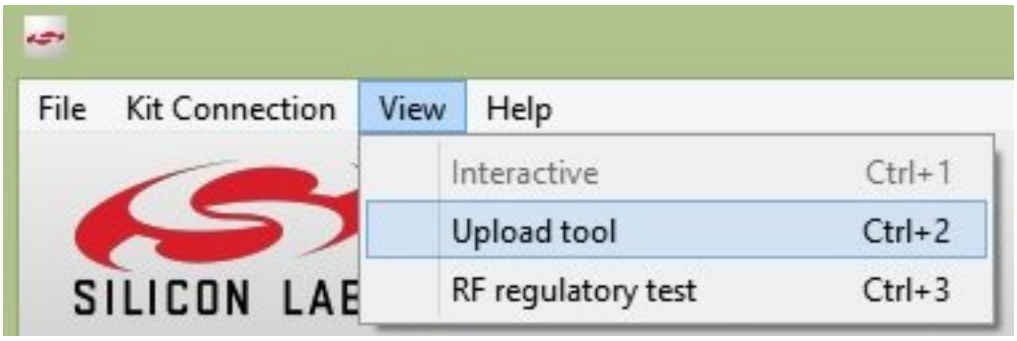
The BGScript project include several files:

- bgm111demo.bgproj: index file project, it is written all the files included in the project. The **BGTool** uses this file to open the project.
- hardware.xml: definitions of the hardware configuration, UART settings, GPIO uses,...
- gatt.xml: gatt specification used by the bluetooth pheriperal.
- bgm111demo.bgs: main source code, entry point of the firmare.
- peripheral.bgs: source code to comunicate with the sensors by I2C.

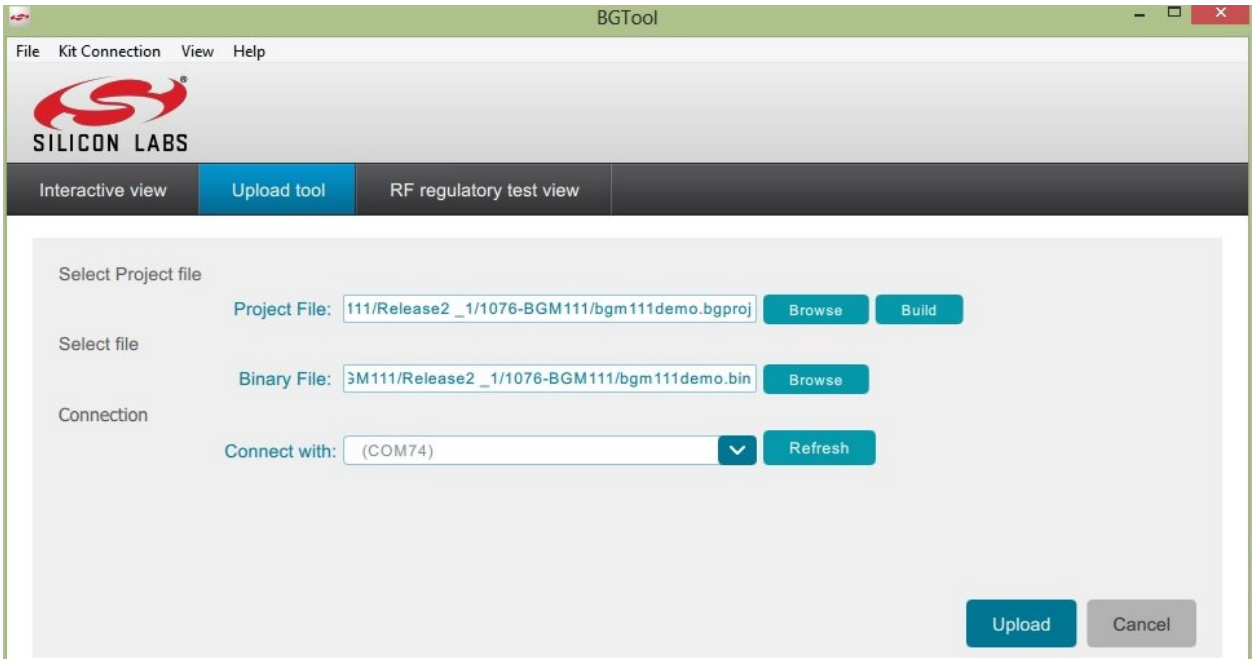
Now, to compile the project first up, download from architechboards website the source code of the project. Extract it and launch **BGTool**. Choose **BGM111** module and select the COM connected to the **SLWSTK6201A** board.



After that, go to the menu clicking on *View->Upload Tool*.



Will appear a new window where to open the project file.



Before to build the project select where to put the binary file, this file will be uploaded into the **BGM111**. The last step is flash the firmware, to do this verify that all the connections are steady and click on *Upload* button. In few seconds the board will be programmed.

Hardware Guide

The SiliconLab Sensor Node is provided with several sensor:

- Si114x: The monolithic Si114x sensors integrate multiple photodiodes, an analog-to-digital converter, a signal processor, up to 3-LED drivers and a digital I2C control interface. In this device are read proximity, ambient light and temperature.
- Si7021: The Si7021 I2C Humidity and Temperature Sensor is a monolithic CMOS IC integrating humidity and temperature sensor elements, an analog-to-digital converter, signal processing, calibration data, and an I2C Interface.
- MPU-9250: MPU-9250 is a multi-chip module (MCM) consisting of two dies integrated into a single QFN package. One die houses the 3-Axis gyroscope and the 3-Axis accelerometer. The other die houses the AK8963 3-Axis magnetometer er from Asahi Kasei Microdevices Corporation. Hence, the MPU-9250 is a 9-axis MotionTracking device that combines a 3-axis gyroscope, 3-axis accelerometer, 3-axis magnetometer and a Digital Motion Proc essorTM (DMP) all in a small 3x3x1mm package available as a pin-compatible upgrade 2 from the MPU-6515.
- Magnetometer is initialized wrongly if the voltage is lesser than 2.4V.

The **BGM111** uses I2C interface to communicate with sensors.

Datasheet and more

Please refer to architechboards website.

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