

Introduction

This getting started guide describes the setup of the Atmel® ATBTLC1000 with a supported platform bringing up an example profile supplied as part of BLuSDK release. The Bluetooth® Heart Rate Profile is an example application that is embedded as part of the software release package.

The Heart rate Profile enables the collector device (GATT Client) to connect and interact with a Heart Rate Sensor (GATT Server) for use in fitness applications. The Heart rate sensor sends the heart rate measurement in bpm, energy expended in kilojoules and R-R intervals in seconds. In addition to the heart rate service the heart rate profile also implements the Device Information Service, which provides the information about the Heart Rate Sensor Device.

The example application simulates a Heart Rate Sensor (GATT Server role).

This document explains the details about:

1. Getting started with the setup of supported platform to be used as a Heart Rate Sensor.
2. Getting the Heart Rate Monitor Application working on the above mentioned setup.

Features

- Device Discovery and Disconnection
- Pairing / Bonding
- Heart Rate Sensor Measurements
- Console Display

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1 Demo Setup

Figure 1-1. Demo Set-up for Heart Rate Profile



2 Supported Hardware Platforms and IDEs

Table 2-1. BluSDK – Supported Hardware and IDEs

Platform	MCU	Supported BLE Module	Supported evaluation kits	Supported IDEs
SAM L21 (MCU)	ATSAML21J18B	ATBTLC1000	ATBTLC1000-XSTK (ATSAML21-XPRO-B + ATBTLC1000 XPRO)	Atmel Studio v7.0
SAM L21 (MCU)	ATSAML21J18A	ATBTLC1000	ATSAML21 XPRO + ATBTLC1000 XPRO	Atmel Studio v7.0
SAM D21 (MCU)	ATSAMD21J18A	ATBTLC1000	ATSAMD21-XPRO + ATBTLC1000 XPRO	Atmel Studio v7.0
SAM G55 (MCU)	ATSAMG55J19	ATBTLC1000	ATSAMG55-XPRO + ATBTLC1000 XPRO	Atmel Studio v7.0
SAM 4S (MCU)	ATSAM4SD32C	ATBTLC1000	ATSAM4S-XPRO + ATBTLC1000 XPRO	Atmel Studio v7.0

3 Hardware Setup

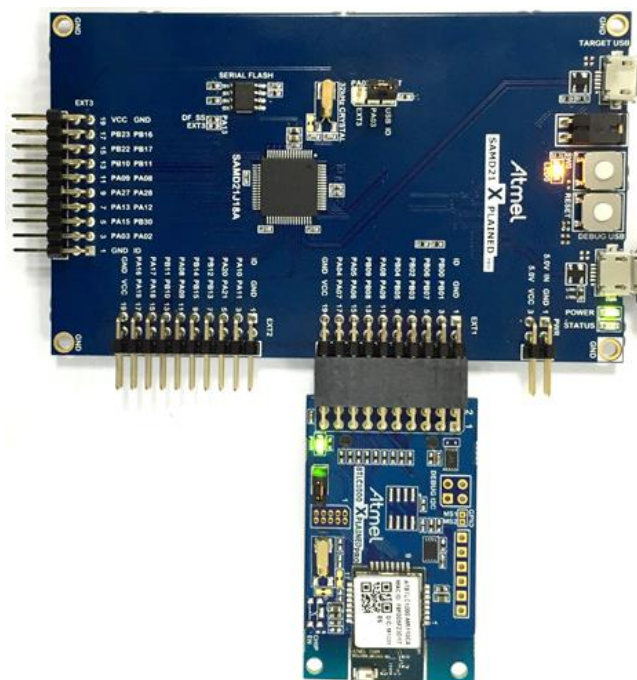
3.1 SAM L21 Xplained Pro Heart Rate Sensor Setup

Figure 3-1. ATBTLC1000 Xplained Pro Extension Connected to a SAM L21 Xplained Pro



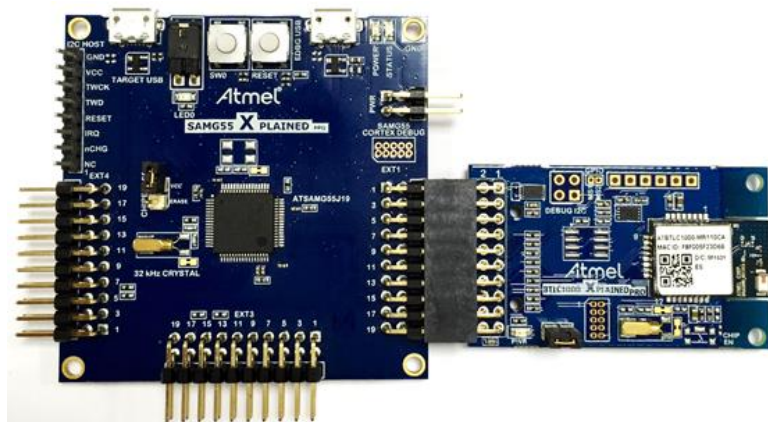
3.2 SAM D21 Xplained Pro Heart Rate Sensor Setup

Figure 3-2. ATBTLC1000 Xplained Pro Extension Connected to a SAM D21 Xplained Pro



3.3 SAM G55 Xplained Pro Heart Rate Sensor Setup

Figure 3-3. ATBTLC1000 Xplained Pro Extension Connected to a SAM G55 Xplained Pro



3.4 SAM 4S Xplained Pro Heart Rate Sensor Setup

Figure 3-4. ATBTLC1000 Xplained Pro Extension Connected to a SAM 4S Xplained Pro



4 Heart Rate Measurements

Heart Rate Profile provided by Bluetooth SIG has defined three characteristics for the exchange of heart rate parameters between the sensor and monitor. The characteristics of the profile are used to transfer

heart rate parameters like beats per minute, R-R Interval Measurements, and other parameters like Body Sensor location and Energy Expended values. The optional characteristic Heart Rate Control Point characteristic is used by the Heart Rate Monitor to reset the energy expended in the heart rate sensor. The Heart Rate sensor, which is the GATT server, will hold the characteristics and send the measurement values to the Heart Rate Monitor.

- The heart rate, R-R interval, and energy expended are sent using the Heart Rate Measurement Characteristics
- The Heart rate measurements are notified to the monitor on a value change if the monitor has enabled the notifications
- The body sensor location will be read by the monitor by reading the body sensor location characteristic. The energy expended sent in the heart rate measurement can be reset by the monitor by writing to the heart rate control point characteristic.

The example application simulates the sensor measurements and sends to the Heart Rate Collector.

5 Software Setup

5.1 Installation Steps

1. Atmel Studio installation [**Atmel Studio 7.0 (build 594) Installer – with .NET**]
<http://www.atmel.com/tools/atmelstudio.aspx>.
(Note: SAM L21 Rev B/SAM D21/SAM G55/SAM 4S part pack is built-in as part of Atmel Studio 7.0)
2. Atmel USB Driver Installer from <http://www.atmel.com/tools/atmelstudio.aspx>.
3. Install the standalone ASF package from
<http://www.atmel.com/tools/AVRSOFTWAREFRAMEWORK.aspx>.

Note: Refer to the BluSDK release notes for updates to version numbers of the components mentioned above.

This package will install the following examples within the Atmel Studio environment:

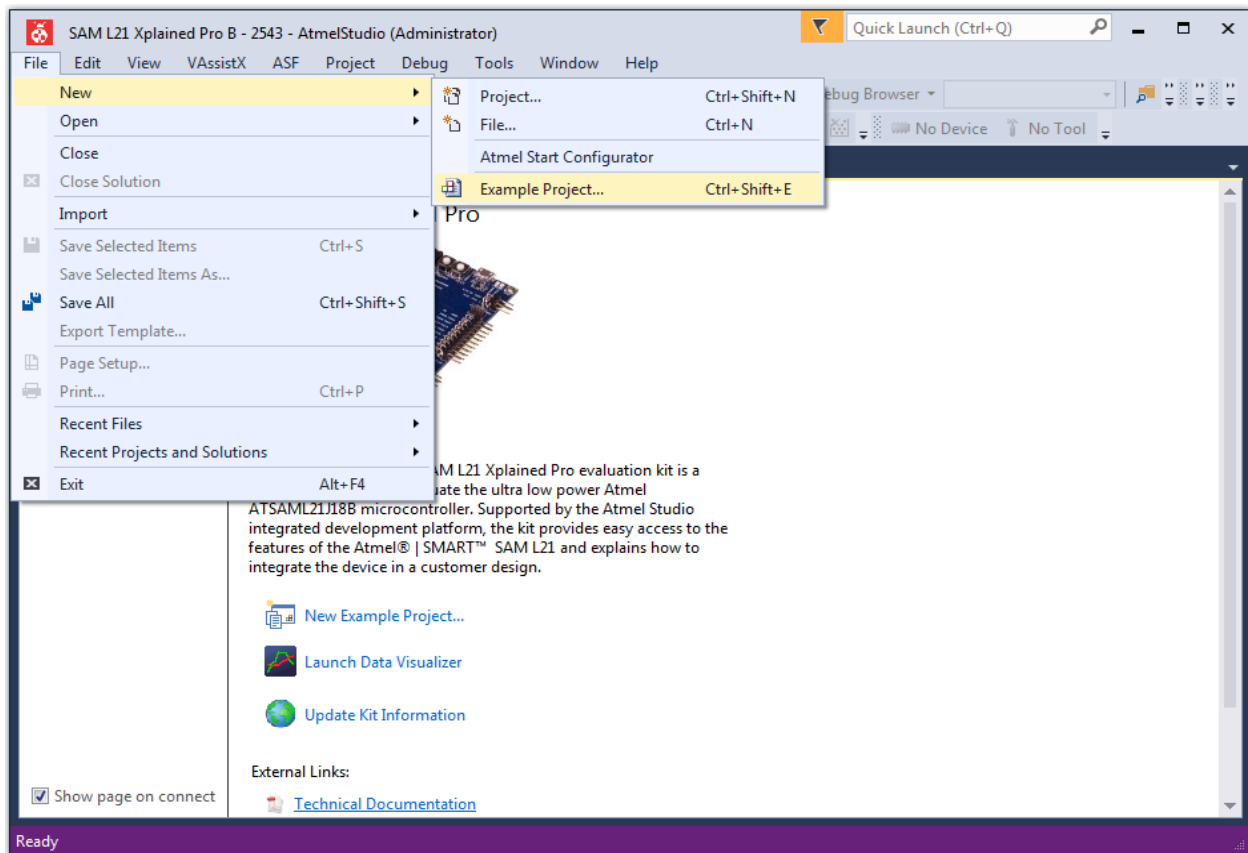
1. Heart Rate Application for SAM L21.
2. Heart Rate Application for SAM D21.
3. Heart Rate Application for SAM G55.
4. Heart Rate Application for SAM 4S.

5.2 Build Procedure

The following procedure is explained for SAM L21 application example. The same procedure is valid for the case of all the other supported platform as well.

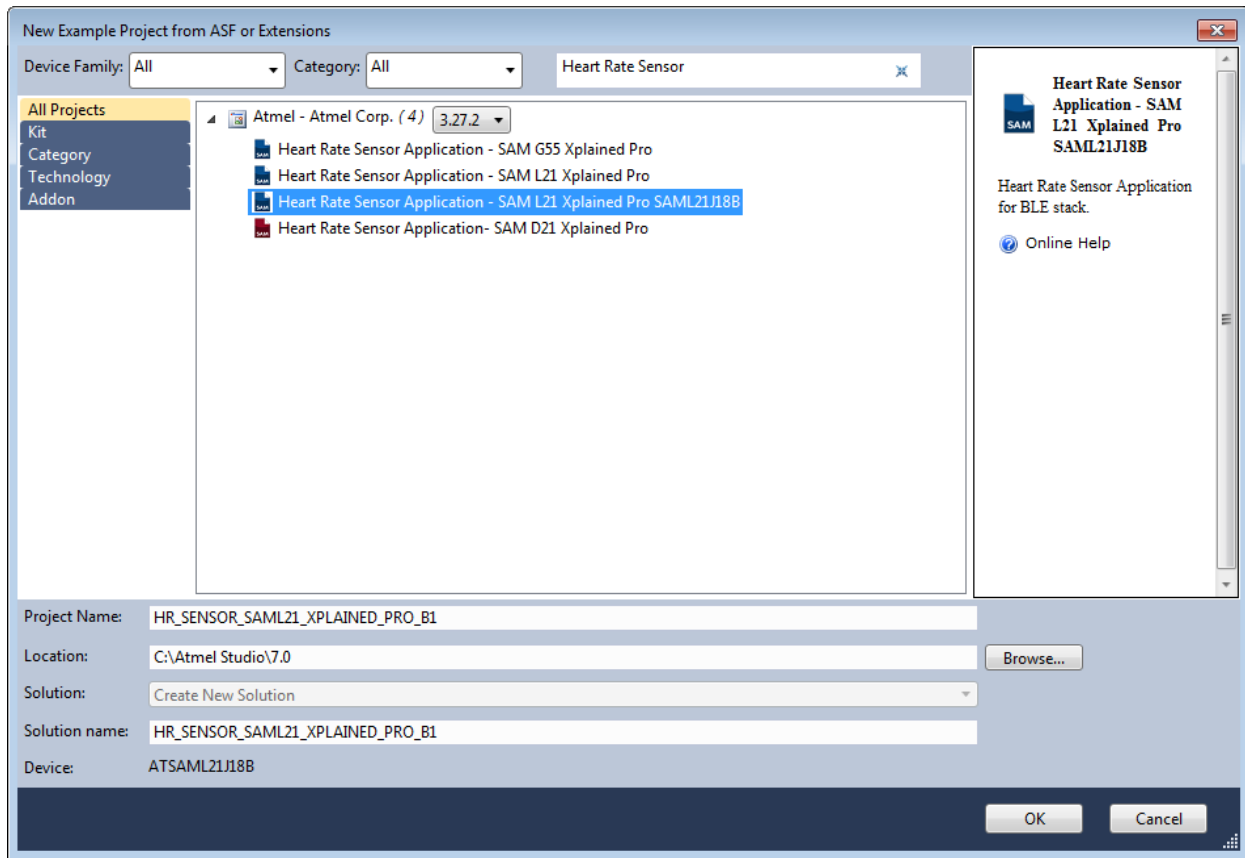
Select New Example Project.

Figure 5-1. Creating a New Project



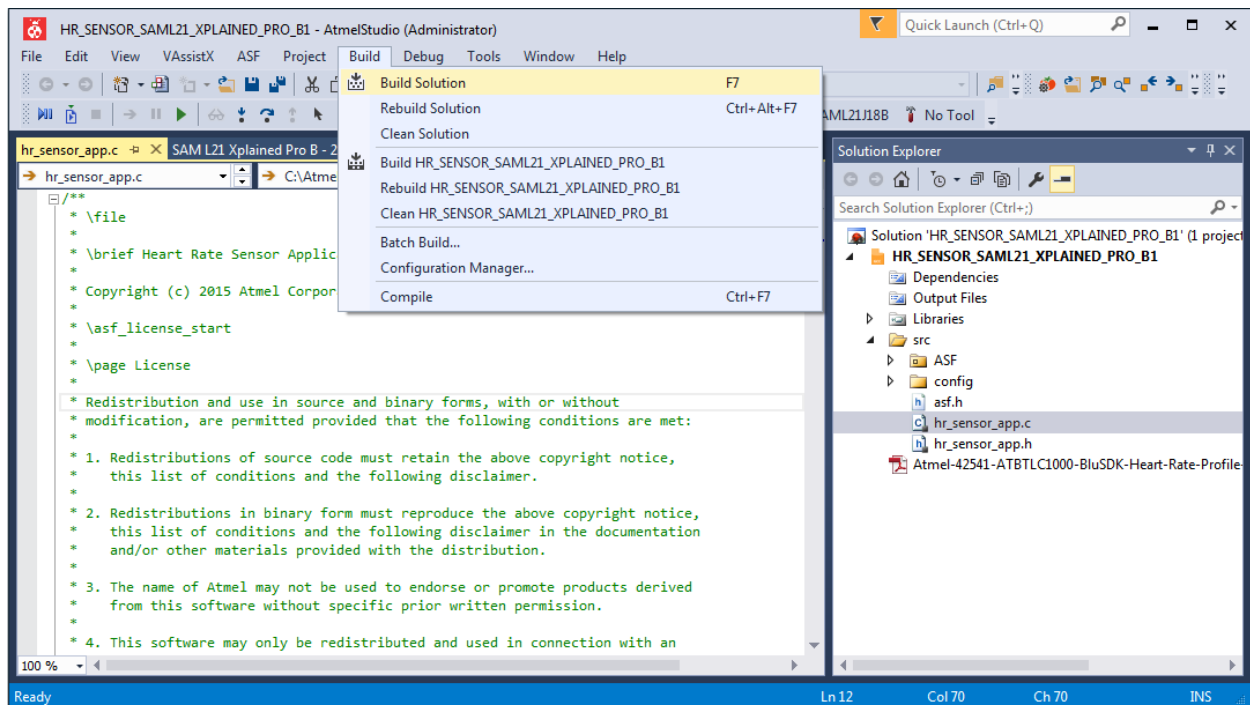
1. Select "SAML,32-bit" in device family, enter "Heart Rate Sensor" in the search window and expand Atmel Corp. Projects. The location and the name of the project can be selected in the respective fields. Click OK.

Figure 5-2. Selecting the Heart Rate Sensor Application from Example Projects



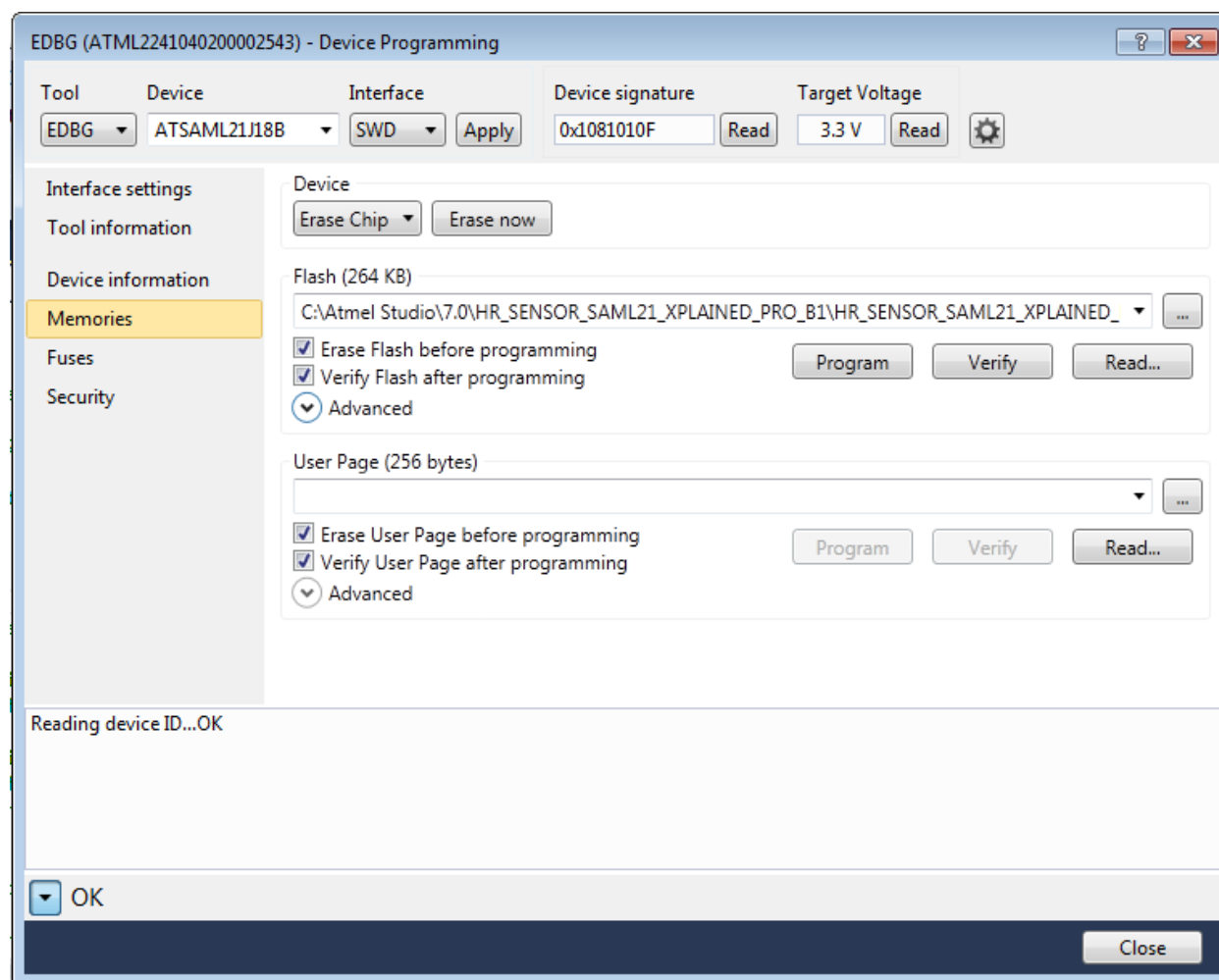
2. Accept the license Agreement. The studio will generate the Heart Rate Profile project for SAM L21.
3. Build the solution.

Figure 5-3. Building the Heart Rate Sensor Application



4. Download the application via the USB to the SAM L21 board using the Device Programming option available in Tools as mentioned below.
5. Inside device programming the user has to select the correct configuration for the device and finally program the device using the program button.

Figure 5-4. Flashing the Heart Rate Sensor Application to the SAM L21 Board



6. Once the application is flashed the HEART RATE application is ready for usage.

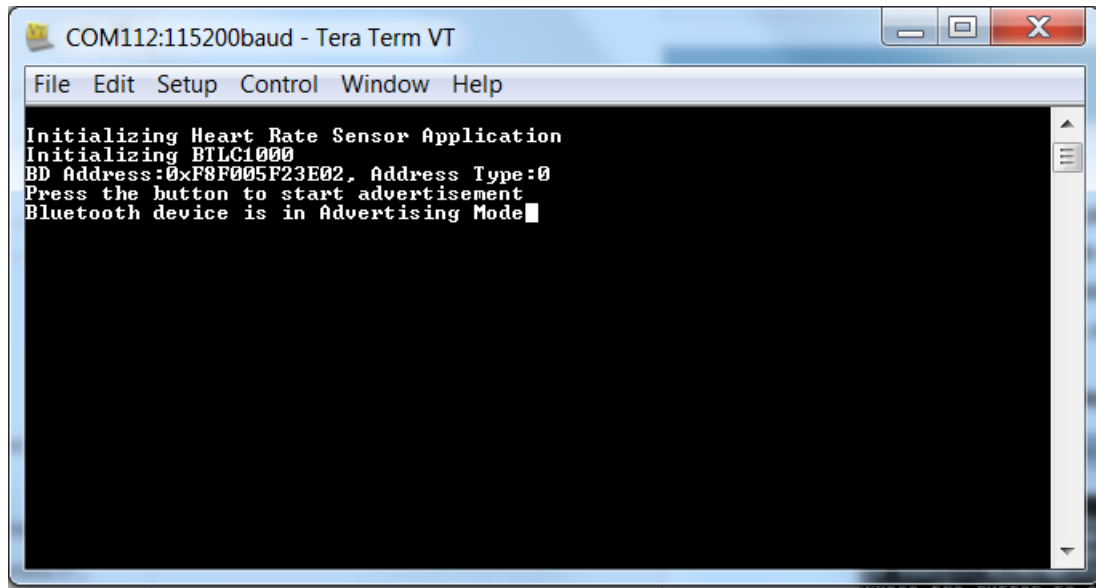
6 Console Logging

For the purpose of debugging, a logging interface has been implemented in the HEART RATE application. The logging interface utilizes the same EDBG port that connects to the supported platform. A serial port monitor application (for example Tera Term) shall be opened and attached to the corresponding COM port enumerated on the PC by the device. The baud rate should be set to 115200.

7 Running the Demo

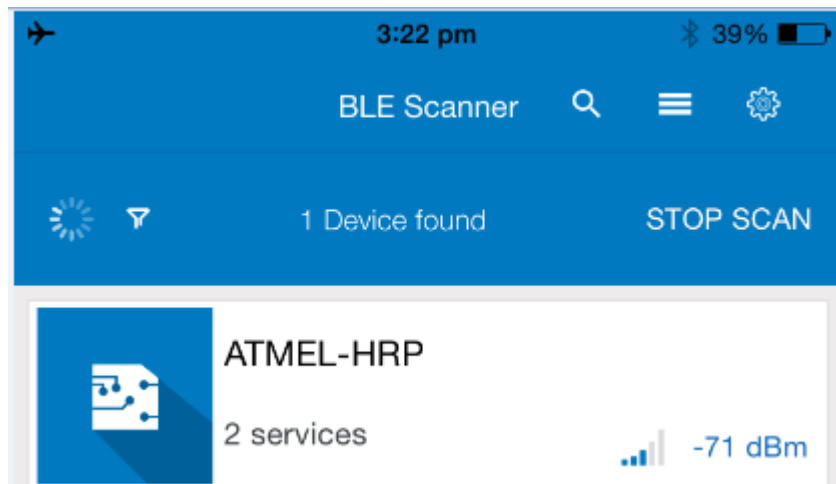
1. Power on the SAM L21 + ATBTLC1000 setup by connecting the USB cable as indicated in [Figure 3-1](#).
2. Open a console window using TeraTerm or any equivalent serial port monitor application and connect to the corresponding COM port enumerated on the PC. Serial Port Settings: Baudrate 115200, None Parity, one Stop bit, one Start bit, no Hardware Handshake
3. Press the Reset button on the SAM L21 or supported platform board.
4. Press the SW0 button on the board to start advertisement.

Figure 7-1. Device in Advertising Mode



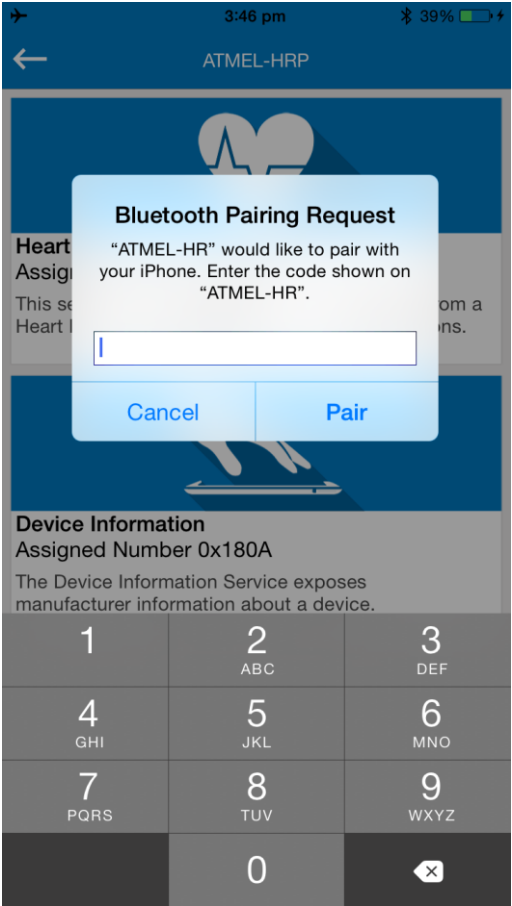
5. On a BLE compatible Android phone or on an iPhone®, enable Bluetooth in the Settings page. Open the Atmel Smart Connect mobile application. The phone will start to scan for devices. ATMEL-HRP will appear among the devices scanned. Click on ATMEL-HRP to connect to the SAM L21 or supported platform + ATBTLC1000 device.

Figure 7-2. Device Discovery in Atmel Smart Connect Mobile Application



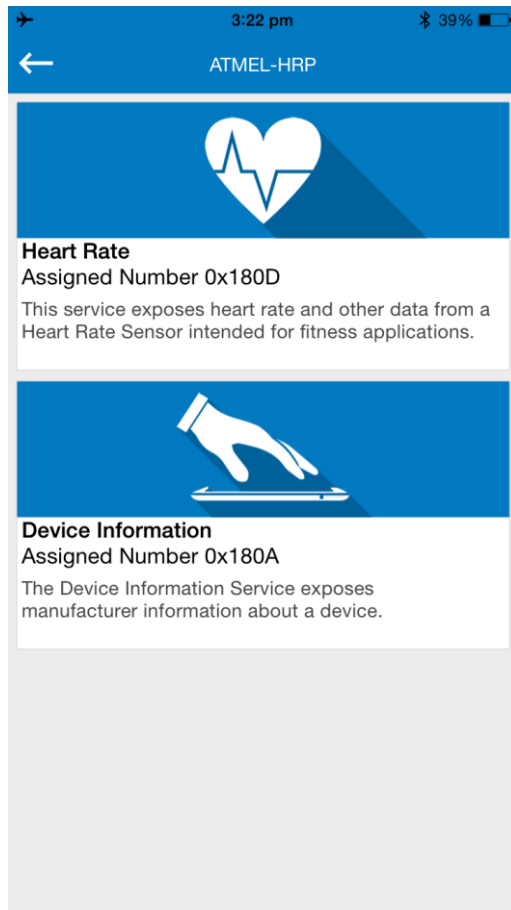
6. Once connected, the client side will request for pairing procedure with iPhone. The console log provides a guidance for the user to enter the pass-key on iPhone.
7. On the iPhone side, a pop-up screen prompting the user to enter the pass-key will appear. Enter '123456' in the text box and click on 'Pair'.

Figure 7-3. Pairing Request Pop-up in Mobile App



8. Once the device is connected, the supported services Heart Rate and Device Information will be displayed as shown.

Figure 7-4. Service Page when Connected to Heart Rate Sensor



9. Once the notifications are enabled the HRM values are displayed as shown in the console and the corresponding mobile app. LED on SAML21 board will start blinking while sending notifications.

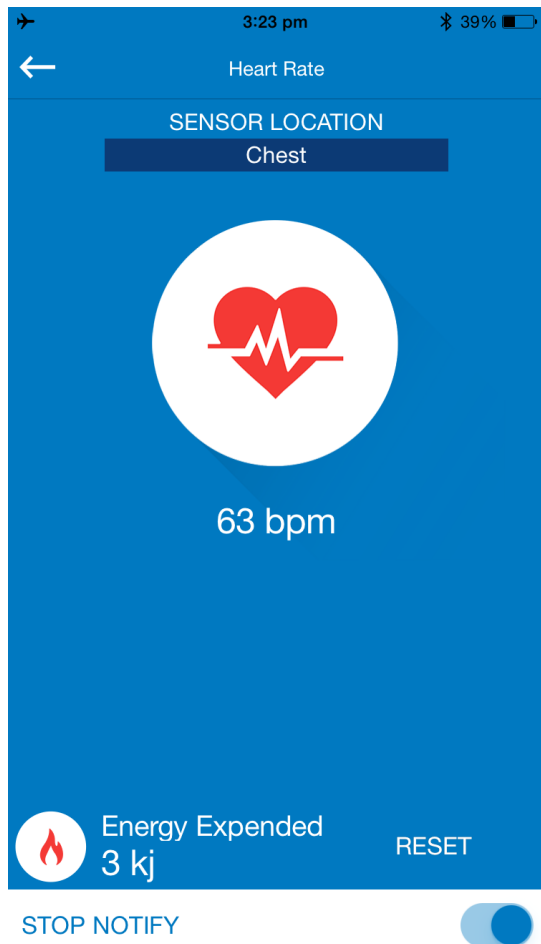
Figure 7-5. Console Log when Notifications are Enabled

```

COM129:115200baud - Tera Term VT
File Edit Setup Control Window Help

Initializing Heart Rate Sensor Application
Initializing BTLC1000
BD Address:0xF8F005F35254, Address Type:0
Press the button to start advertisement
Bluetooth device is in Advertising Mode
Connected to peer device with address 0x599f5abe5817
Connection Handle 0
Enable the notification in app to listen heart rate or press the button to disconnect
Please Enter the following Pass-code(on other Device):123456
Pairing procedure completed successfully
Notification Enabled
Heart Rate: 50 bpm      RR Values:(100,300)msec User Status:Idle
Heart Rate: 51 bpm      RR Values:(500,700)msec User Status:Idle
Heart Rate: 52 bpm      RR Values:(900,1100)msec User Status:Idle
Heart Rate: 53 bpm      RR Values:(100,300)msec User Status:Idle
Heart Rate: 54 bpm      RR Values:(500,700)msec User Status:Idle
Heart Rate: 55 bpm      RR Values:(900,1100)msec User Status:Idle
Heart Rate: 56 bpm      RR Values:(100,300)msec User Status:Idle
Heart Rate: 57 bpm      RR Values:(500,700)msec User Status:Idle
Heart Rate: 58 bpm      RR Values:(900,1100)msec User Status:Idle
Heart Rate: 59 bpm      RR Values:(100,300)msec User Status:Idle
Energy Expended :3 KJ
  
```

Figure 7-6. Mobile Screen when Displaying Heart Rate Measurements



10. Once the user clicks on Stop Notify, the notifications are displayed as shown in the console logs.

Figure 7-7. Console Log when Notifications are Disabled

```
Heart Rate: 53 bpm      RR Values:(500,700)msec User Status:Idle
Heart Rate: 52 bpm      RR Values:(900,1100)msec User Status:Idle
Heart Rate: 71 bpm      RR Values:(100,300)msec User Status:Walking
Energy Expended :12 KJ

Heart Rate: 72 bpm      RR Values:(500,700)msec User Status:Walking
Heart Rate: 73 bpm      RR Values:(900,1100)msec User Status:Walking
Heart Rate: 74 bpm      RR Values:(100,300)msec User Status:Walking
Heart Rate: 75 bpm      RR Values:(500,700)msec User Status:Walking
Heart Rate: 76 bpm      RR Values:(900,1100)msec User Status:Walking
Heart Rate: 77 bpm      RR Values:(100,300)msec User Status:Walking
Heart Rate: 78 bpm      RR Values:(500,700)msec User Status:Walking
Heart Rate: 79 bpm      RR Values:(900,1100)msec User Status:Walking
Heart Rate: 80 bpm      RR Values:(100,300)msec User Status:Walking
Heart Rate: 81 bpm      RR Values:(500,700)msec User Status:Walking
Energy Expended :22 KJ

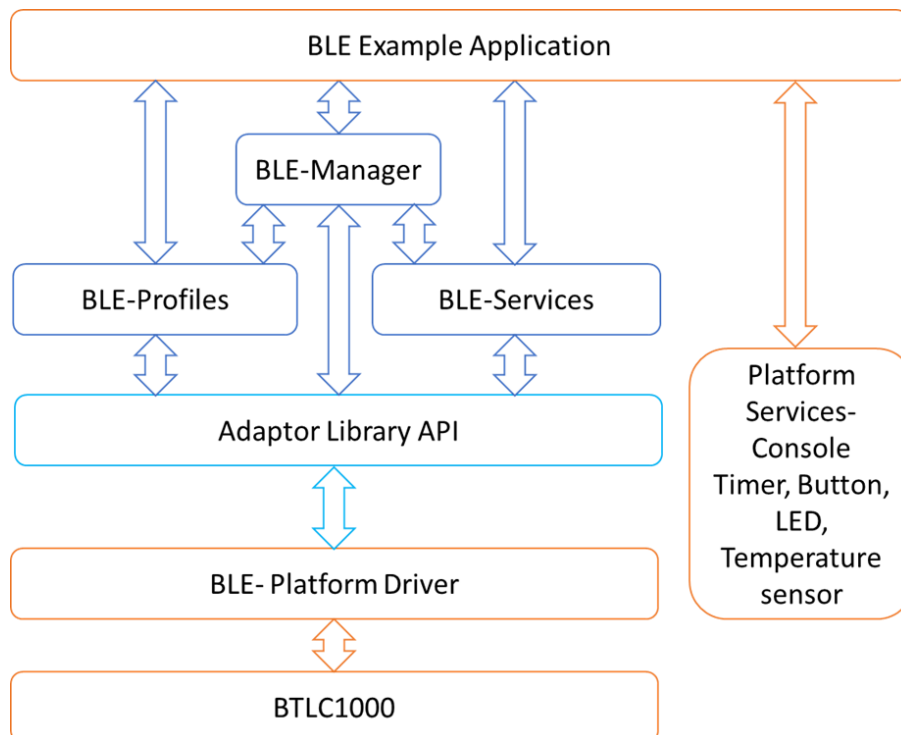
Heart Rate: 82 bpm      RR Values:(900,1100)msec User Status:Walking
Heart Rate: 83 bpm      RR Values:(100,300)msec User Status:Walking
Heart Rate: 84 bpm      RR Values:(500,700)msec User Status:Walking
Heart Rate: 85 bpm      RR Values:(900,1100)msec User Status:Walking
Heart Rate: 86 bpm      RR Values:(100,300)msec User Status:Walking
Notification Disabled
```

11. During the connection, SW0 button is used to disconnect the connection. If no connection exists SW0 button is used to start advertisement.

8 BluSDK Software Architecture

Figure 8-1 illustrates the various layers in the BLE subsystem for the ATBTLC1000 configuration. The External host can be supported platform. The application in this example is Heart Rate Profile example.

Figure 8-1. BluSDK Software Architecture



9 **ATMEL EVALUATION BOARD/KIT IMPORTANT NOTICE AND DISCLAIMER**

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10 Revision History

Doc Rev.	Date	Comments
42541C	02/2016	Table 2.1 is updated with SAM4S hardware support. Figure 3.4 is updated with SAM4S Xplained Pro Image. Section 5.1 Installation Steps are updated.
42541B	11/2015	Figure 3-1 is updated. The screenshots in Chapter 5 are updated.
42541A	09/2015	Initial document release.



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