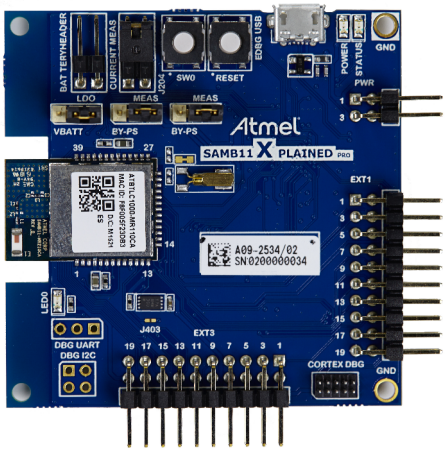
ATSAMB11 BluSDK SMART

OTAU Profile – Getting Started Guide

USER GUIDE

Overview



The OTAU profile enables firmware upgrade over the Bluetooth Low Energy (BLE) protocol stack using Generic Attribute Profile (GATT). The Atmel BLE OTAU protocol defines the communication between the OTAU target and OTAU manager. The OTAU manager, which could be a mobile (iOS/Android) device or any BLE Device that implements the OTAU manager GATT client protocol is the one that transfers the upgrade firmware to the OTAU target. The OTAU target implements the OTAU GATT Server protocol in order to receive the new firmware image or resume an interrupted downloaded image. This user guide covers the steps to generate a factory new image and an upgrade image.

Features

The OTAU application provides the following features:

- Advertisement
- Pairing
- Services: OTAU Service and Battery Service.
- OTAU Target Mode

Table of Contents

1. Introduction

This getting started guide describes the steps to bring-up and execute the BLE Over-the-Air upgrade (BLE OTAU) application that is available as part of the BluSDK SMART in the Atmel® | SMART SAM B11 Xplained Pro evaluation board.

This getting started guide enables the users to include the Atmel OTAU service in their application to provide in-field Over-the-Air upgrade capability to their Atmel BLE based products.

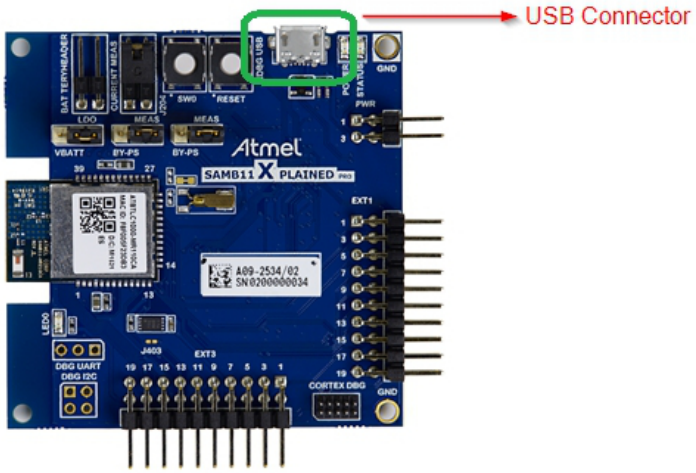
2. Block Diagram

The following diagram shows the functional components involved in the OTAU process.

3. Hardware Setup

Connect the Atmel SAMB11 Xplained Pro Evaluation Board with the host PC using a Micro-USB cable.

Figure 3-1. Atmel SAMB11 Xplained Pro Evaluation Board



4. Software Setup

4.1. Installation Steps

1. Install the latest Atmel Studio 7.0 (build 629 or later)
   http://www.atmel.com/tools/atmelstudio.aspx
2. Install the latest Atmel Software Framework through **Tools>Extensions and Updates** tab in Atmel Studio.
3. Install SAMB11-DFP-2.1.157 or later version from **Tools** > **Device Pack Manager** to support BLE OTAU.

The Atmel Software Framework package will install the following example application within the Atmel Studio environment.

OTAU Application for ATSAMB11 - This application generates the image files for both, factory version and the upgraded version. The `OtauImageCreator` command line tool is used to generate both the factory format .img file and the OTAU format binary file. This tool is available as part of the SDK package.

4.2. Build Procedure

This OTAU demo requires two different firmware images to be generated from the example project. They are

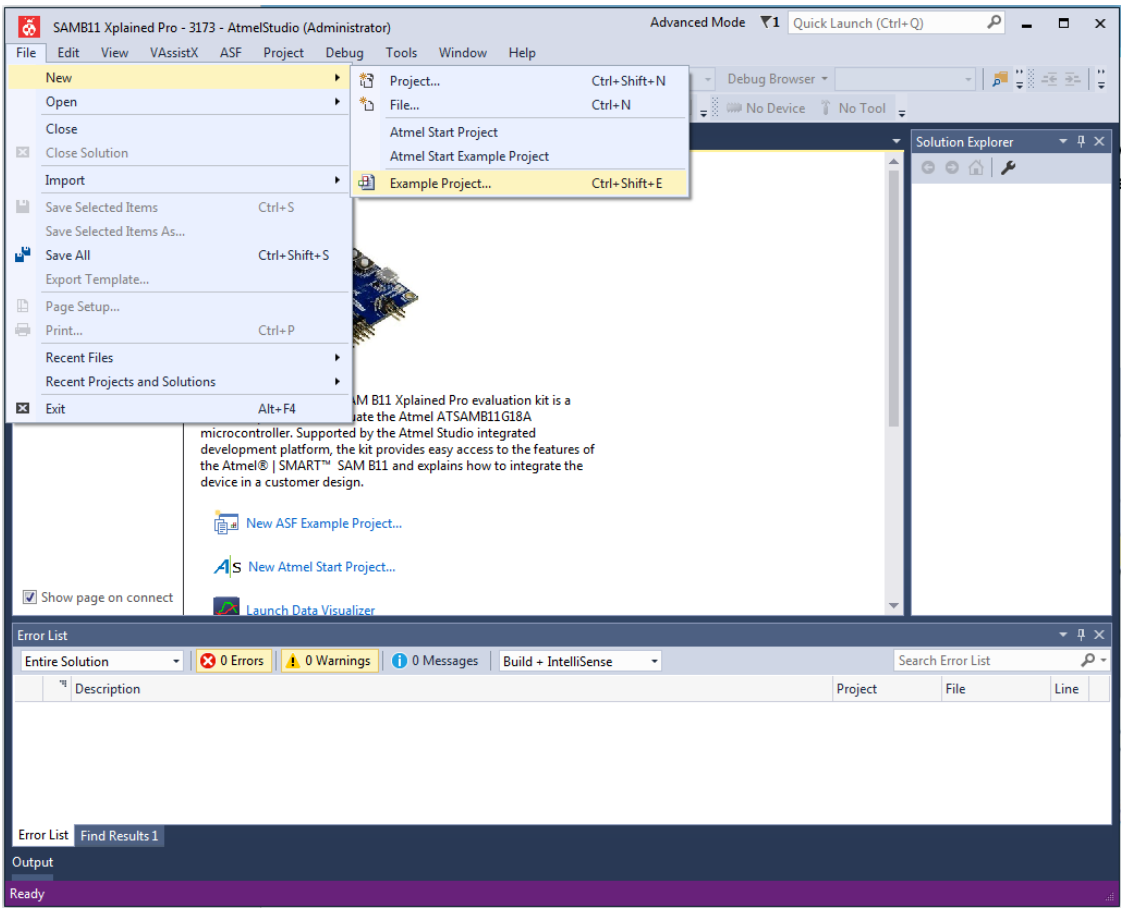
1. an initial/factory version - Image flashed on to the SAM B11 device.
2. a new/upgrade version - Image used by OTAU manager(mobile application) for upgrade.

The OTAU example project is generated and built in the Atmel Studio IDE by performing the following steps.

4.2.1. Build the Initial Factory Version

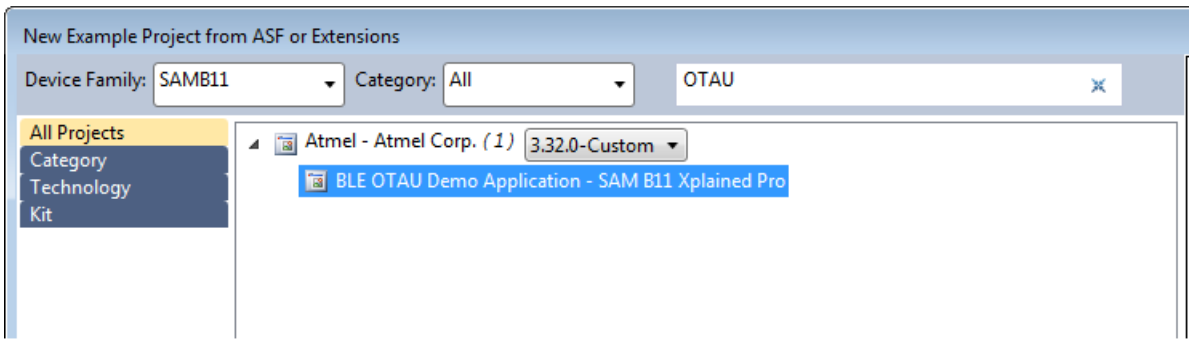
1. Select **New Example Project**.

Figure 4-1. Creating a New Project



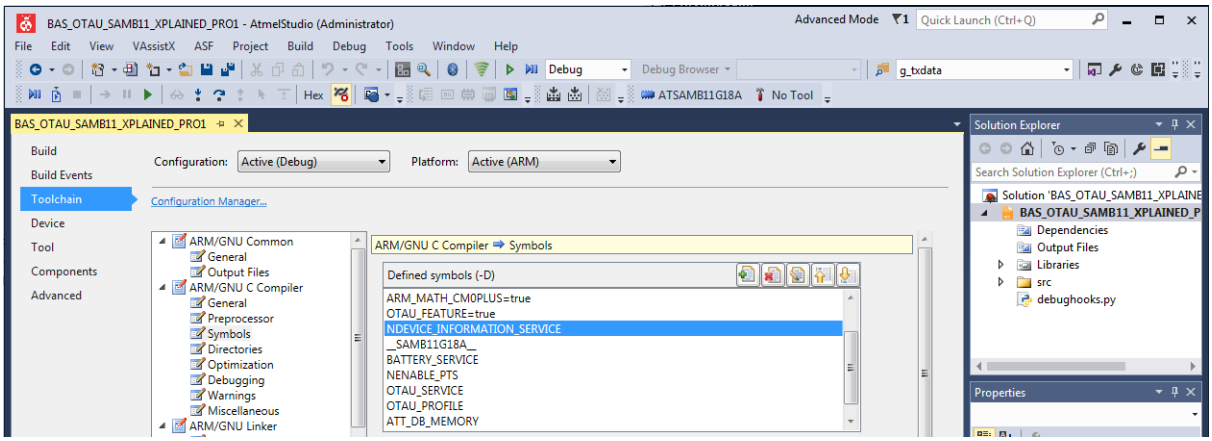
2. Select **SAMB11** in device family, enter `OTAU` in the search window and expand Atmel Corp Projects. The BLE OTAU application is displayed as shown in the following figure. Select the application and specify the required **Location** and **Name** of the project in the respective fields at the bottom of the window. Click **OK**.

Figure 4-2. Selecting OTAU Application from Example Projects



3. **Accept** the license Agreement. Atmel Studio will generate the OTAU application project for ATSAMB11.
4. Go to **Project Properties** >**Toolchain** > **Symbols**.
   Ensure the symbol `NDEVICE_INFORMATION_SERVICE` is defined as shown in following figure:

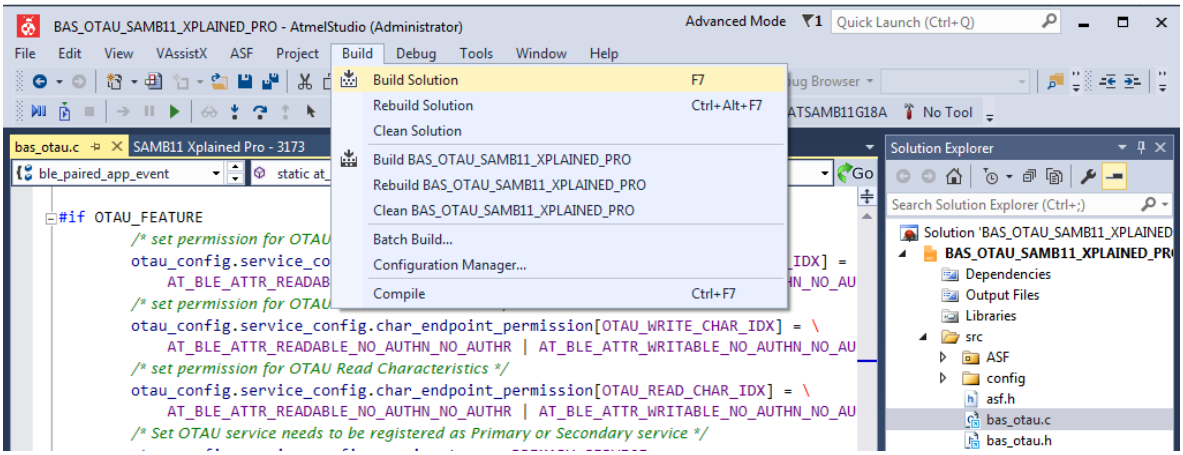
Figure 4-3. Symbol Value for Factory Version



Note: The starting letter of the symbol '**N**' denote the exclusion of device information service in the initial/factory version of the application.

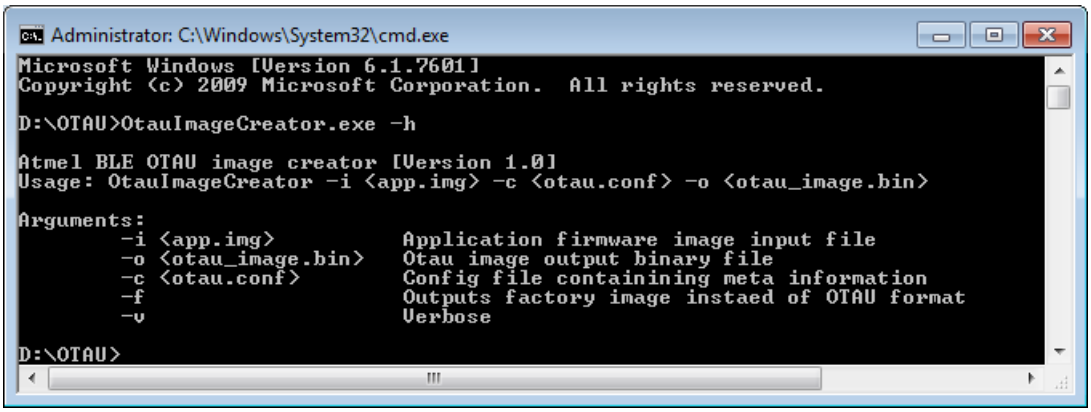
5. The solution can be compiled and linked using **Build->Build Solution** option or by pressing **F7**.

Figure 4-4. Building the OTAU Application



6. When the project is built, an application firmware executable file with .img extension is created in the "Debug" or respective project configuration folder.
   Note: The executable file for SAMB11 device is a custom '.img' format (custom format) and not hex or bin format.
7. The command line tool `OtauImageCreator.exe`, available in the SDK package is used to create the factory format firmware image from the application executable file. The metadata corresponding to the application firmware such as firmware version, vendor and product identification, hardware revision are provided in `otau.conf` configuration file. The template of the `otau.conf` file is provided along with **OtauImageCreator** tool. The following figure shows the help content available in the OtauImageCreator tool.

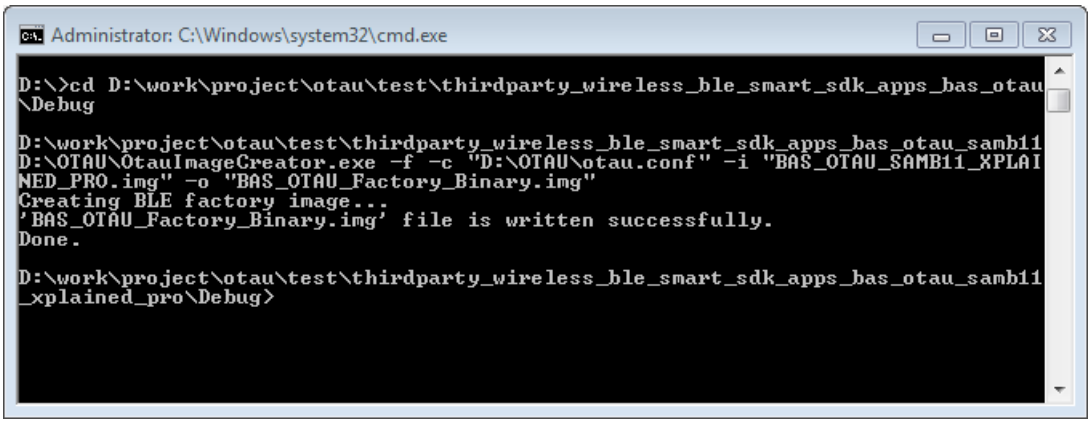
Figure 4-5. OtauImageCreator Usage Options



8. Edit the `otau.conf` file to modify the information such as the Vendor ID, Product ID, and the version of the application firmware (Initial/Factory version).
9. In the command prompt, navigate to the directory/folder which contains the firmware executable .img file and invoke the following command:

```
<tool path>\OtauImageCreator.exe -f -c "<conf file path>\otau.conf" -i
"BAS_OTAU_SAMB11_XPLAINED_PRO.img" -o "BAS_OTAU_Factory_Binary.img"
```

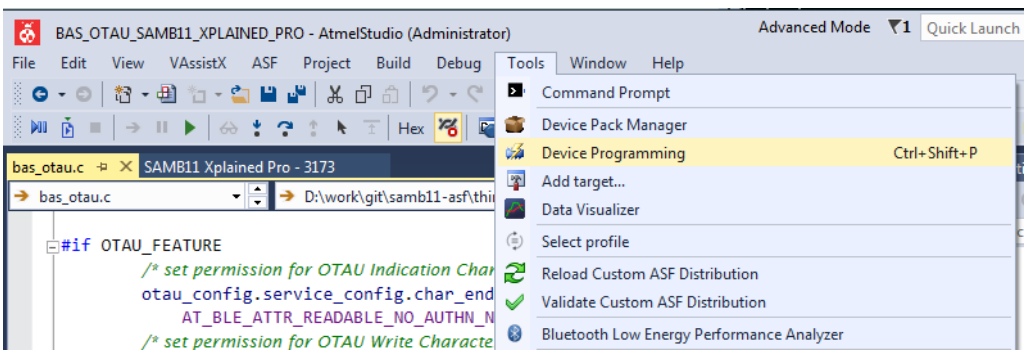
Figure 4-6. Generate Factory Version of the Firmware Binary



The `-o` option in the above command determines the output file (factory format) to be generated.

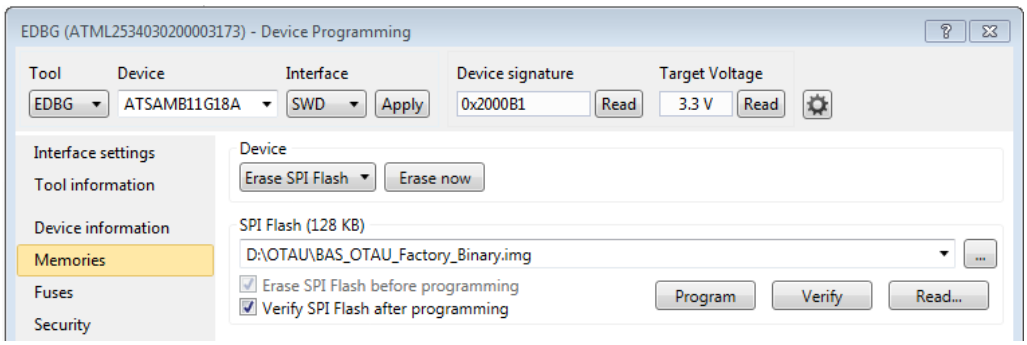
10. On executing the above command, the factory format binary file (`BAS_OTAU_Factory_Binary.img`) is generated. This binary file is downloaded to ATSAMB11 Xplained Pro board using the Tools >Device Programming option as shown.

Figure 4-7. Selecting Device Programming Option



11. Inside the **Device Programming** window, select the appropriate EDBG tool and connect to the ATSAMB11 Xplained Pro board. Select **Memories** tab and browse to the factory format .img file in the **SPI Flash** field. Click **Program** to load the factory image to the SAM B11 device as shown in the following image. The size of factory image is greater than 240KB and it might take a few minutes to complete writing this image into the flash.

Figure 4-8. Flashing the Application on Atmel MCU



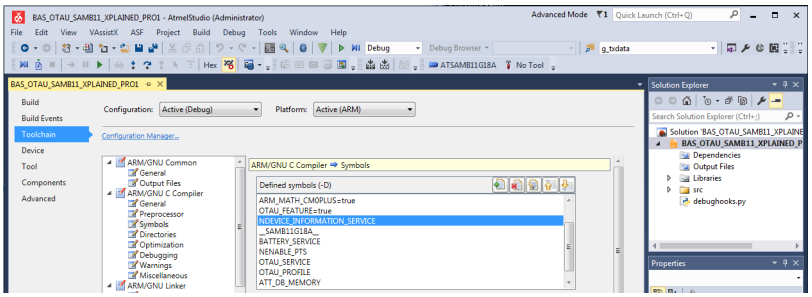
4.2.2. Build the Upgrade Version

The upgrade application is generated using the same example project. But, using a different symbol definition in order to include a feature. This feature differentiates the upgrade version from the factory version.

The following section explains the steps to generate the upgrade image in OTAU format.

1. In the **OTAU application**, Go to **Project Properties->Toolchain->Symbols** and set the device information service symbol to `DEVICE_INFORMATION_SERVICE`. This symbol excludes the initial letter 'N' mentioned in the previous section. The definition of this symbol includes device information service in the application. Use **Build->Build Solution** option or **F7** button to compile and link the application; this creates the .img output file.

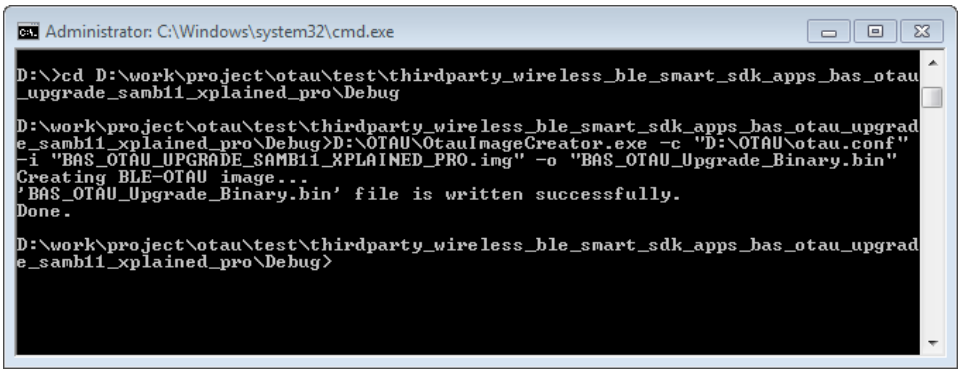
Figure 4-9. Symbol Value for Upgrade Version



2. The OtauImageCreator tool is also used to generate the firmware binary in OTAU format which is a custom format required by the OTAU manager (Mobile application). Edit the `otau.conf` file and change the Firmware version to a value greater than the factory version used in the previous section.
3. Open the command prompt and navigate to the directory/folder that contains the executable .img file for the upgrade application. Invoke the following command to generate the binary file corresponding to the upgrade firmware in OTAU format.

```
 <tool path>\OtauImageCreator.exe -c "<conf file path>\otau.conf" -i
"BAS_OTAU_UPGRADE_SAMB11_XPLAINED_PRO.img" -o "BAS_OTAU_Upgrade_Binary.bin"
```

Figure 4-10. Generate Upgrade Version Binary in OTAU Format



4. The upgrade binary image generated in the previous step will be used by the Mobile application to upgrade the current firmware in the ATSAMB11 Xplained Pro board.

5. Mobile Application

Atmel provides a mobile application called ‘Atmel SmartConnect’ to evaluate all the BLE example applications supplied with the SDK release. This application is supported on both iOS and Android, and it can be downloaded from the link provided in the SDK release package. Atmel SmartConnect application implements the OTAU manager protocol and it is used to demonstrate this Over-The-Air Upgrade (OTAU) feature.

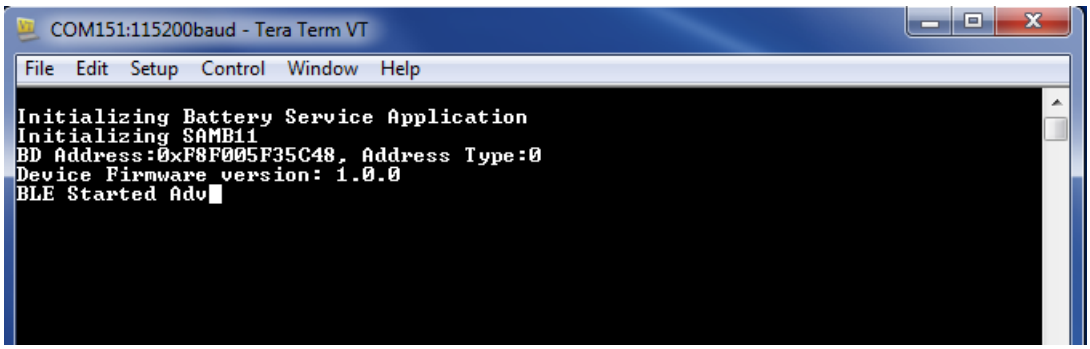
6. Console Logging

Facility for logging to a serial console is available for debugging. The logging interface utilizes the same COM port that connects to ATSAMB11 Xplained Pro board. A serial port monitor application such as TeraTerm can be used to open the EDBG COM port enumerated by the board on the host PC.

7. Running the Demo

1. Power ON the ATSAMB11 Xplained Pro board by connecting the USB cable.
2. Ensure that the factory version of the firmware binary is flashed on to the board as described in the Build the Initial/Factory version section.
3. Open a serial terminal monitor application such as TeraTerm. Select the appropriate COM Port (Settings: Baudrate 115200, None Parity, one Stop bit, one Start bit, no Hardware Handshake.) and connect to the board to view the logs.
4. Press the **Reset** button on the ATSAMB11 board.
5. The device is in advertising mode and the firmware version is displayed as 1.0.0 (the factory firmware).

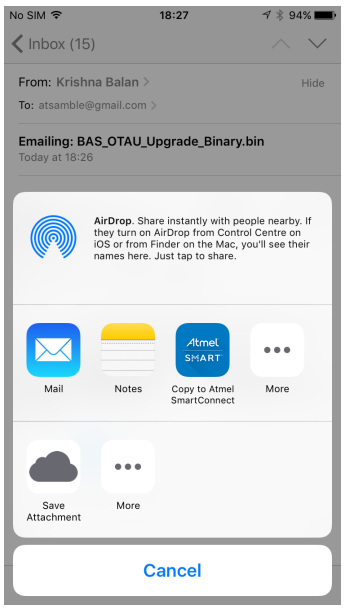
Figure 7-1. OTAU Device in Advertising Mode



6. The upgrade firmware binary file generated in the section Build the Upgrade Version is transferred to the mobile application in the following ways.

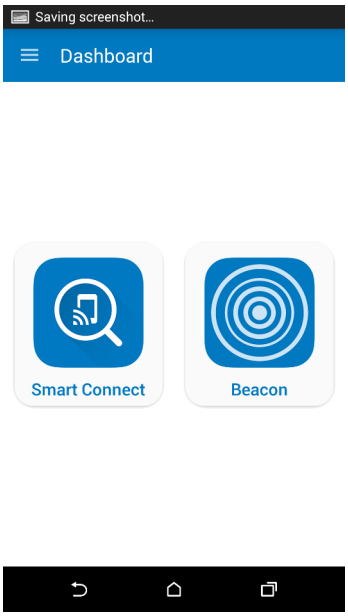
6.1. In case of iOS, the binary file is sent to a mail client available in the iOS device. When the mail with binary file is received in the mobile device, the binary is downloaded and copied to the Atmel SmartConnect application as shown below.

Figure 7-2. Transfer Upgrade Firmware Binary to Atmel SmartConnect App in iOS

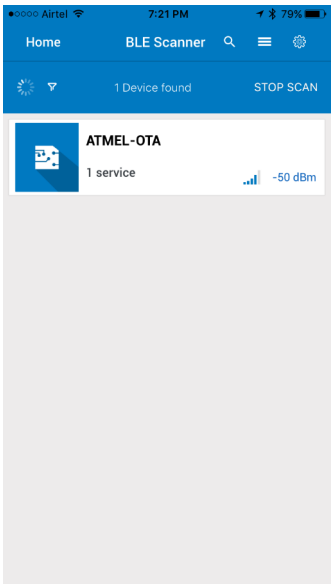


6.2. In case of Android devices, the upgrade firmware binary is placed in `Atmel` folder. The folder named 'Atmel' would be created when the Atmel SmartConnect application is installed in the mobile device.

7. Open the Atmel Smart Connect App from the mobile device (Android/IOS). From Dashboard page select **Smart Connect** navigation pane.

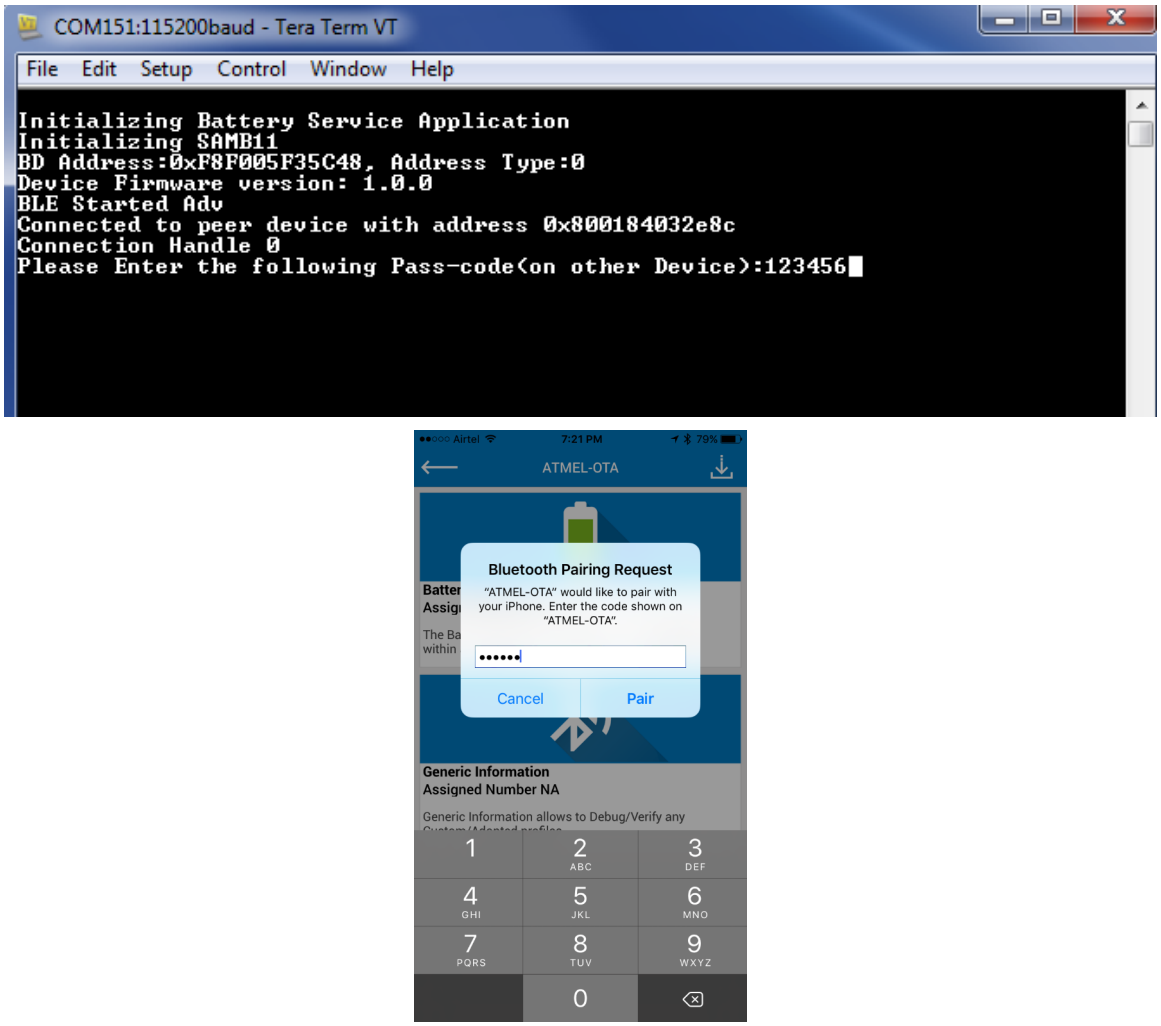


8. Press **START SCAN** to view the available BLE devices in the vicinity. ‘ATMEL-OTA’ service will be discovered and displayed. Click on **ATMEL-OTA** to establish connection.



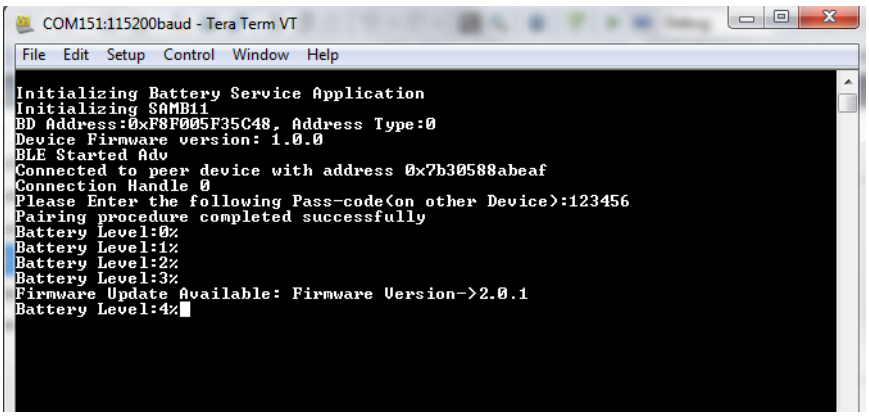
9. Enter the pass key from mobile (123456) as shown in the terminal and pair with the OTA application running in the SAM B11 device.

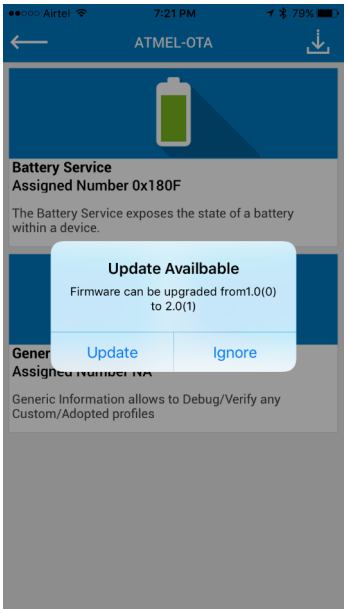
Figure 7-3. Pairing Process



10. When the connection is successfully established, the Battery service offered by the device will be displayed. At the background, the mobile application compares the available upgrade firmware version against the firmware version of the device. A firmware upgrade popup window will be displayed to notify the user about the latest firmware version.

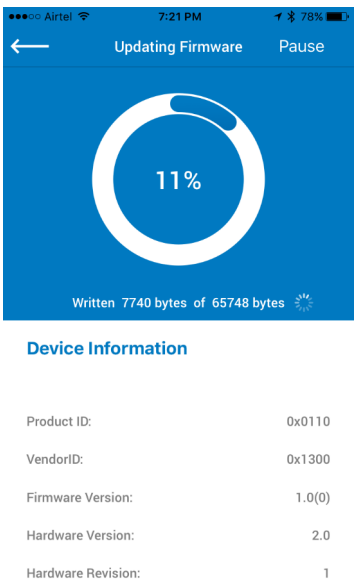
Figure 7-4. Firmware Upgrade Notification

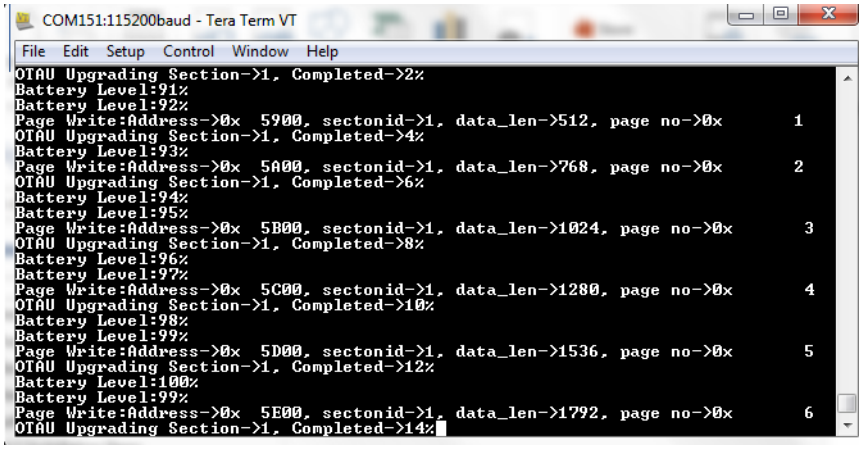




11. Start the firmware upgrade by pressing the **Update** button on the popup window. The status of the upgrade process is displayed.

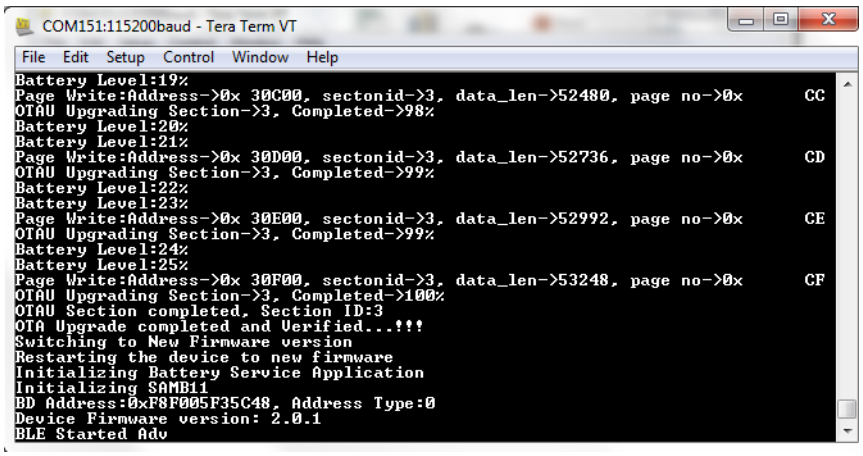
Figure 7-5. Over-The-Air Upgrade Status





12. When the firmware upgrade is completed, the mobile application will disconnect from the OTA application and the SAMB11 device reboots with the upgraded firmware. The latest firmware version of the device (2.0.1) will be displayed in the command window.

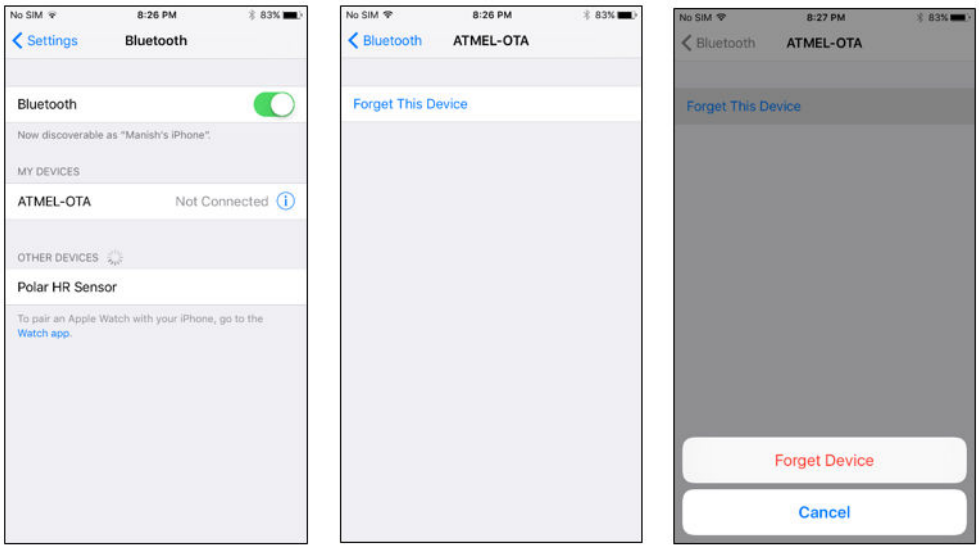
Figure 7-6. Firmware Upgrade Completion



13. In the mobile device, the Bluetooth cache needs to be cleared to discover the upgraded services and it is done by performing following steps.

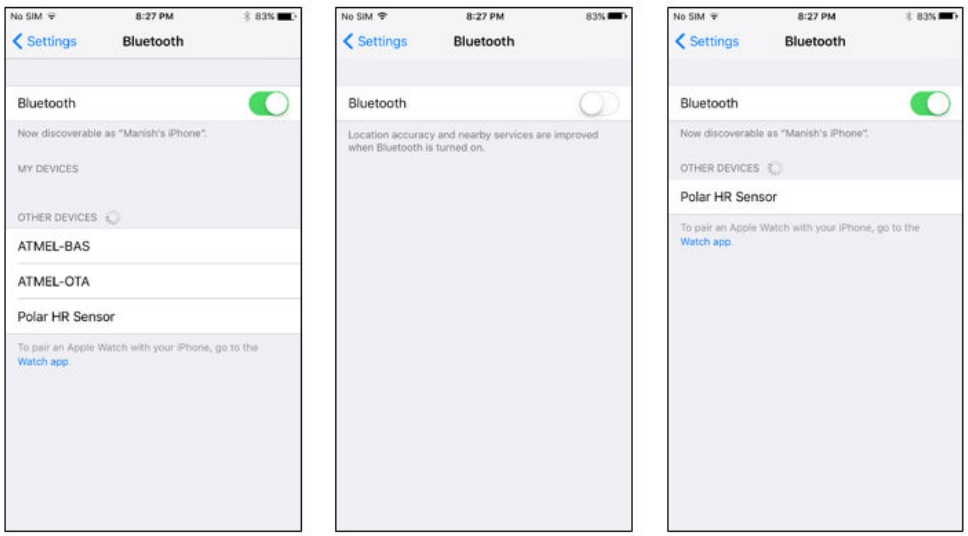
    13.1. Go to **Settings** and select **Forget This Device** for ATMEL-OTA

Figure 7-7. Remove ATMEL-OTA from Mobile Cache



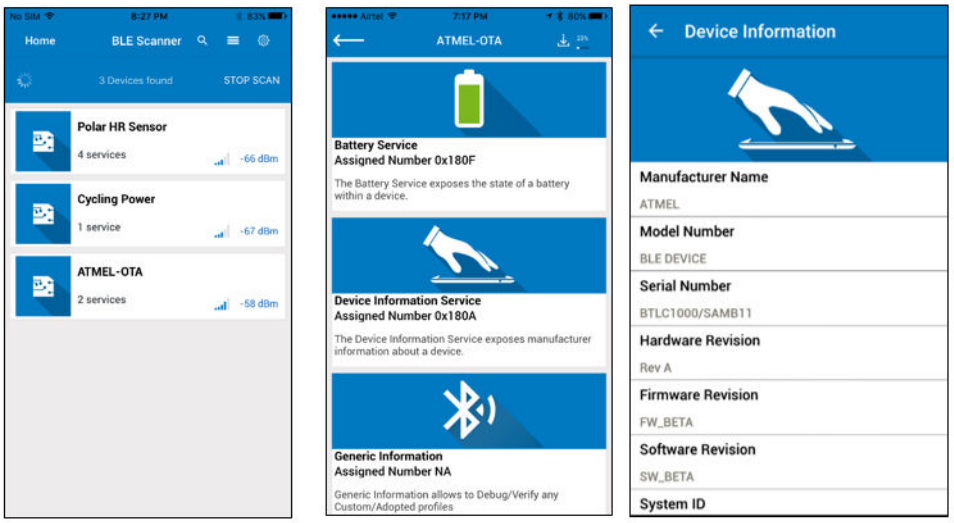
13.2. Disable and Enable the Bluetooth.

Figure 7-8. Power Cycle Bluetooth Radio



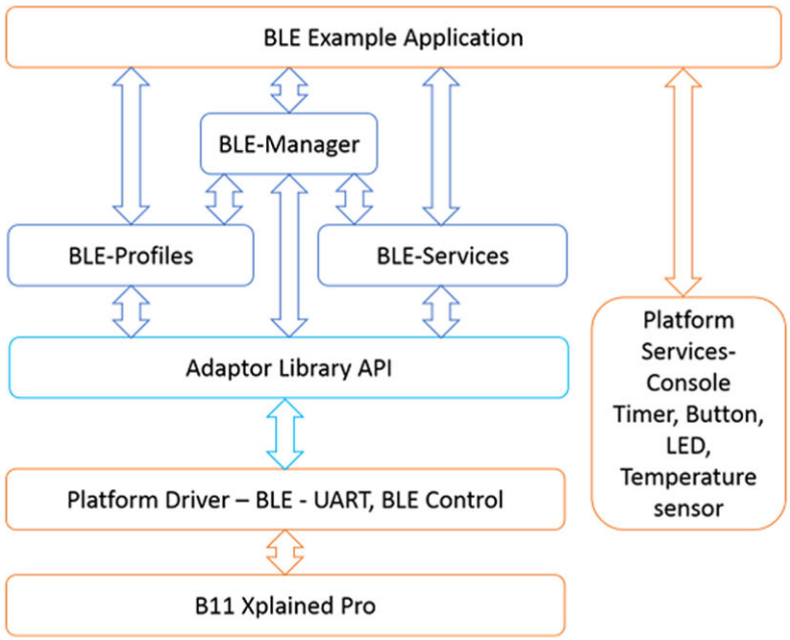
14. Once again scan and reconnect to ‘ATMEL-OTA’ from the mobile application. A new ‘Device Information Service’ will be displayed in addition to the Battery service shown before. The Device Information Service is present in the upgraded firmware version. Click on the Device Information Service to view detailed information of the device.

Figure 7-9. BLE Device Scanning and Service Pages



8. BluSDK SMART Software Architecture

The following diagram illustrates the top level diagram for the ATSAMB11 configuration.



9. ATMEL EVALUATION BOARD/KIT IMPORTANT NOTICE AND DISCLAIMER

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10. Revision History

Doc.Rev.	Date	Comments
42746A	07/2016	Initial document release

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