



# **Multilink—Central Demo User's Guide**

# Multilink\_Central\_Demo\_User's\_Guide

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## 1. Overview

This document explains how to setup an Multilink-Central demo using SAML21 Xplained Pro, BM71-XPro. This document briefly talks about setting up hardware, building application, programming firmware and running a demo.

This demo application showcases a Proof-of-Concept example of using **ble\_host\_sdk** to setup BM71 as Multilink-Central where it can connect with up to four GAP-Peripheral devices. This demo application scan for suitable GAP-Peripheral device and connects with it. Once connected it discovers device orientation service and characteristics in remote device and enable notifications to get accelerometer and gyroscope sensor data from remote device. Upon receiving data from remote GAP-Peripheral device, the Multilink-Central demo prints them on serial console.

The following table provides the list of expected BLE services and Characteristics in this application.

Name	UUID	Properties	Size (bytes)
Device Orientation Service (Custom)	0xF05ABAC1393611E587A60002A5D5C51B	-	-
Accelerometer Position Characteristic	0x1BC5D5A50200A687E5113639D7BA5AF0	Notify, Read	6
Gyroscope Position Characteristic	0x1BC5D5A50200A687E5113639D4BA5AF0	Notify, Read	6

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## 1.1. Hardware Setup

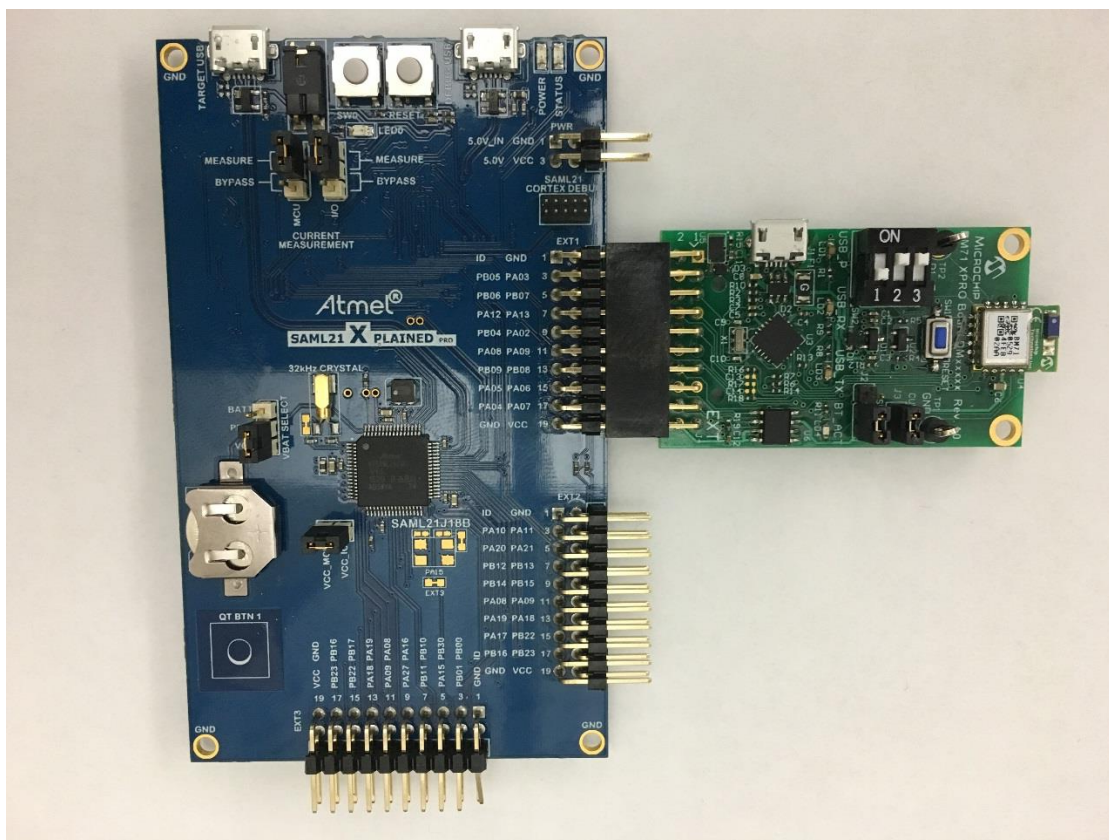


Figure 1: SAML21 Xplained Pro with BM71-XPro

1. Plug in the BM71-XPro board into EXT1 of SAML21 Xplained Pro board as shown in Figure 1.
2. Connect the SAML21 Xplained Pro board to the host PC using micro USB cable.

## 1.2. Console

The Multilink-Central demo application uses the Universal Asynchronous Receiver/Transmitter (UART) interface on SAML21 Xplained Pro to send the status messages like Scanning, Connected, Disconnected and the sensor data from remote device. Any serial application (ex: TeraTerm) can be used to interact with SAML21 Xplained Pro.

Use the following serial port configuration to interact with BM70.

<b>Baud rate</b>	115200
<b>Data</b>	8 bits
<b>Parity</b>	none
<b>Stop</b>	1 bit
<b>Flow control</b>	none

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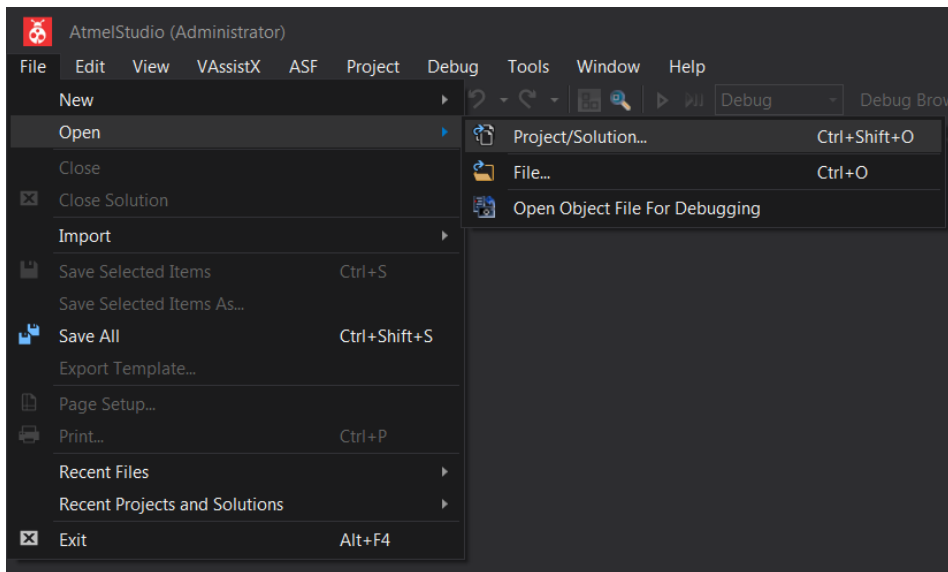
## 2. Build Procedure

This section describes the build procedure of Multilink-Central demo application on Atmel Studio 7.

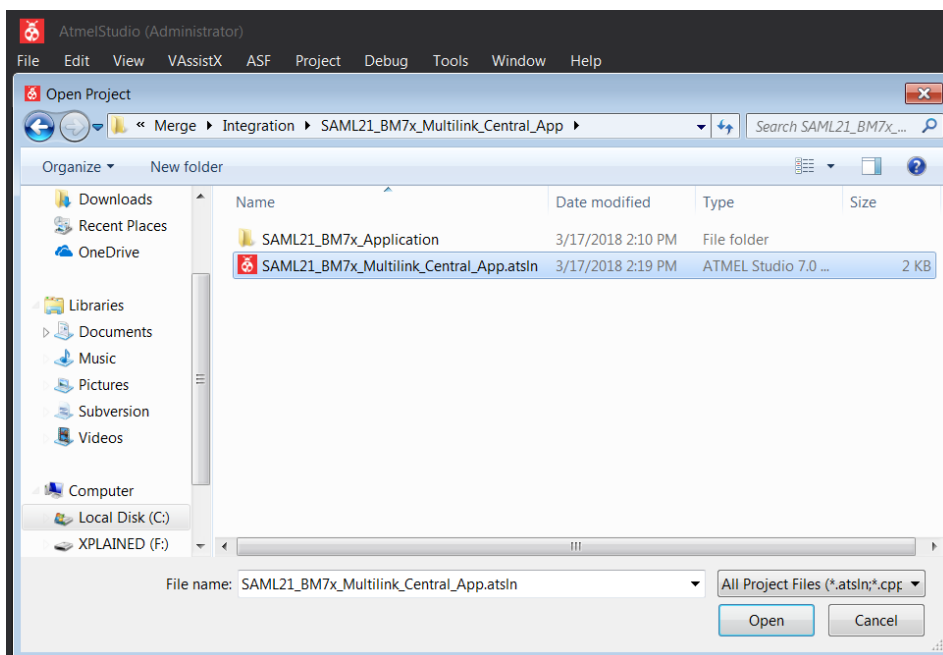
### 2.1. Open Atmel Studio 7

### 2.2. Open GAP-Central Demo Application

1. Go to menu **File → Open → Project/Solution.**



2. Select “SAML21\_BM7x\_Multilink\_Central\_App.atsln” and press **Open.**



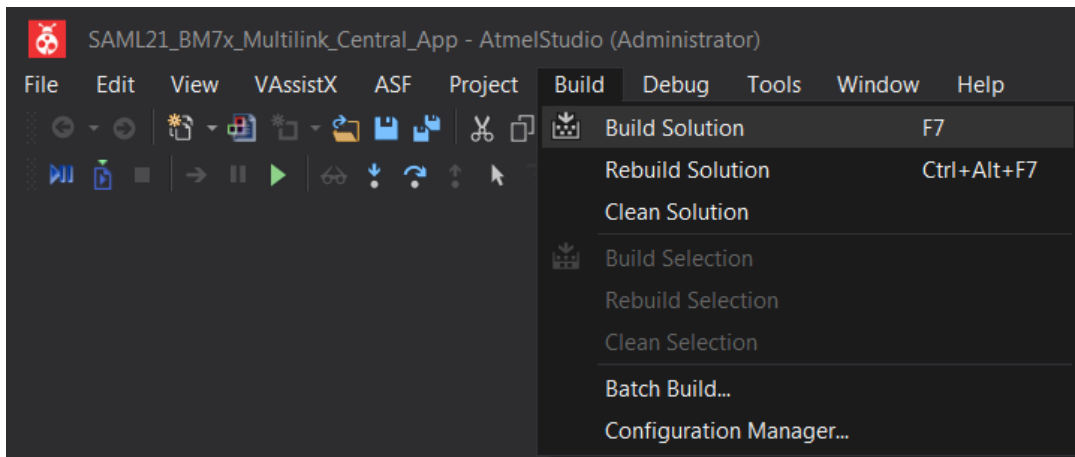
3. Once the project is opened, you can see the files attached to this project in Solution Explorer Window

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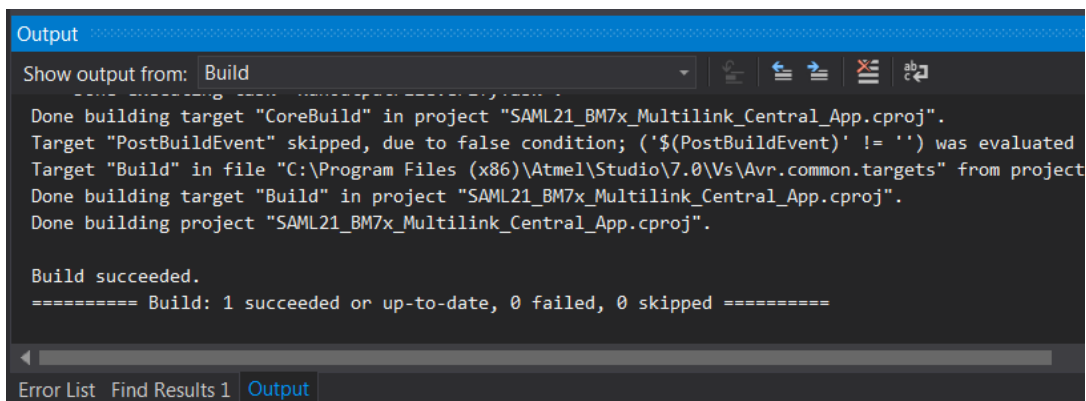
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## 2.3. Build Multilink-Central Demo Application

1. Go to menu **Build** → **Build Solution** or Press **F7**



2. Build status can be checked in **Output** window



3. You can find the Hex images in “..\SAML21\_BM7x\_Application\Debug”.

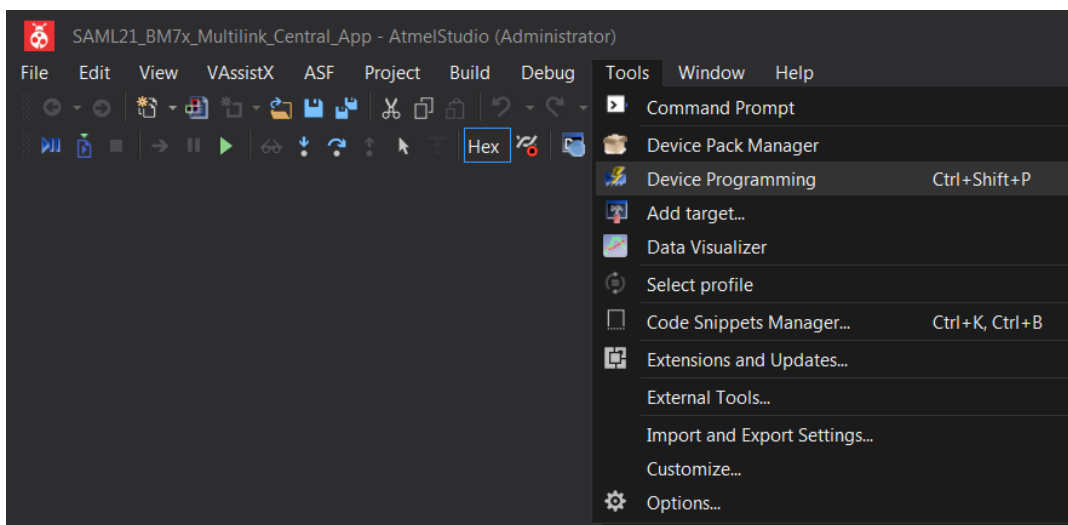
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## 3. Programming Firmware

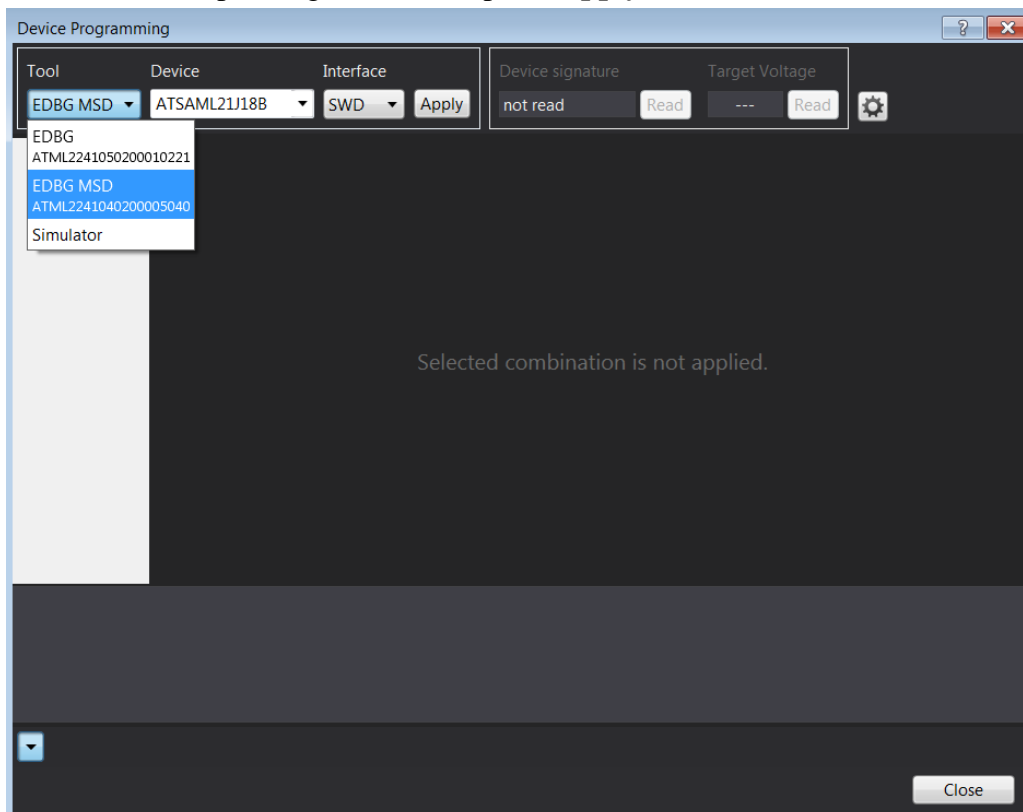
This section describes the procedure to program Multilink-Central demo firmware on SAML21 Xplained Pro board.

1. Connect the SAML21 Xplained Pro board to the host PC using micro USB cable. Perform the following steps:
  - a. Verify that the virtual COM port is enumerated on the host PC.
  - b. Make sure that POWER LED (green) is solid ON.
2. To program the HEX files into the SAML21, go to menu **Tools → Device Programming** or Press **Ctrl + Shift + P**.

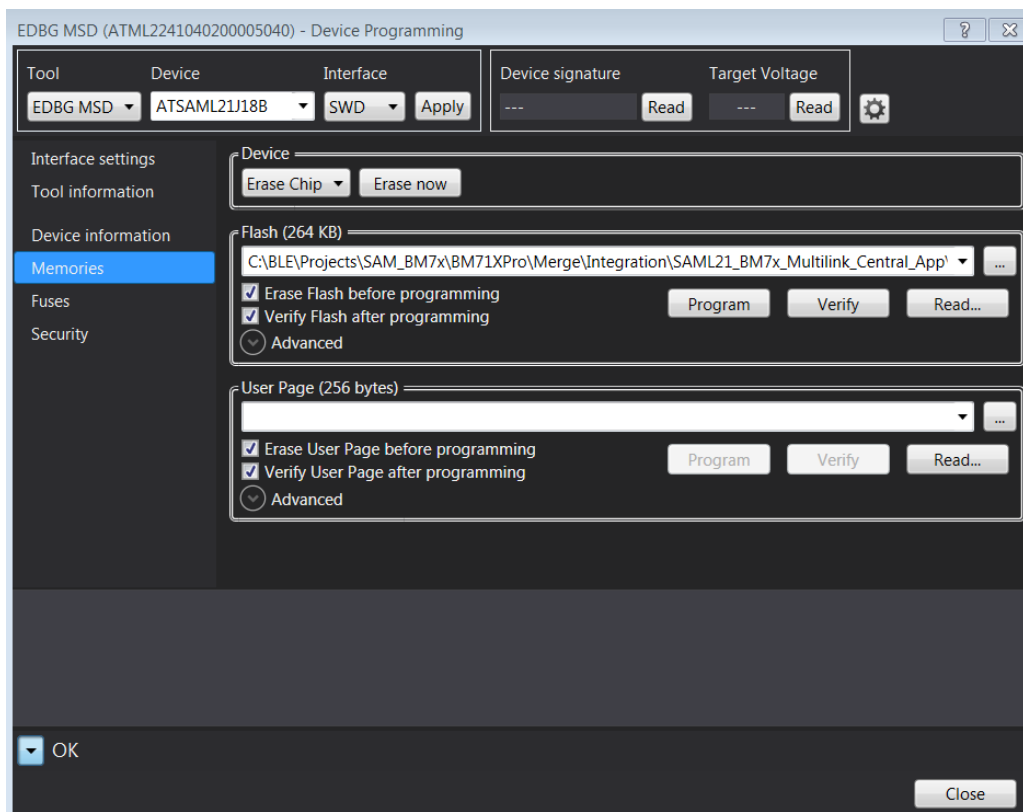


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3. Select the corresponding **EDBG** and press **Apply**.



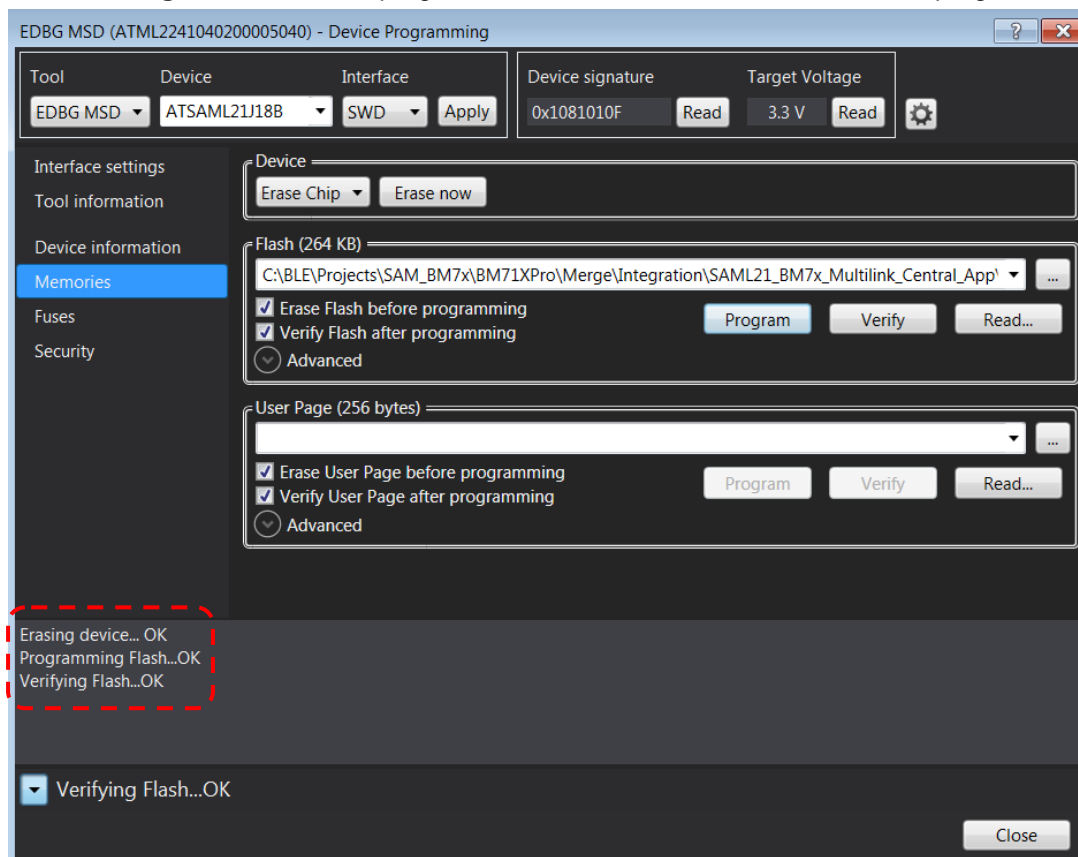
4. Go to **Memories** Tab and select Hex file.





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5. Press **Program**, the tool will program SAML21. You can check the status of programming.



6. Once programming is done, close the Device Programming window.

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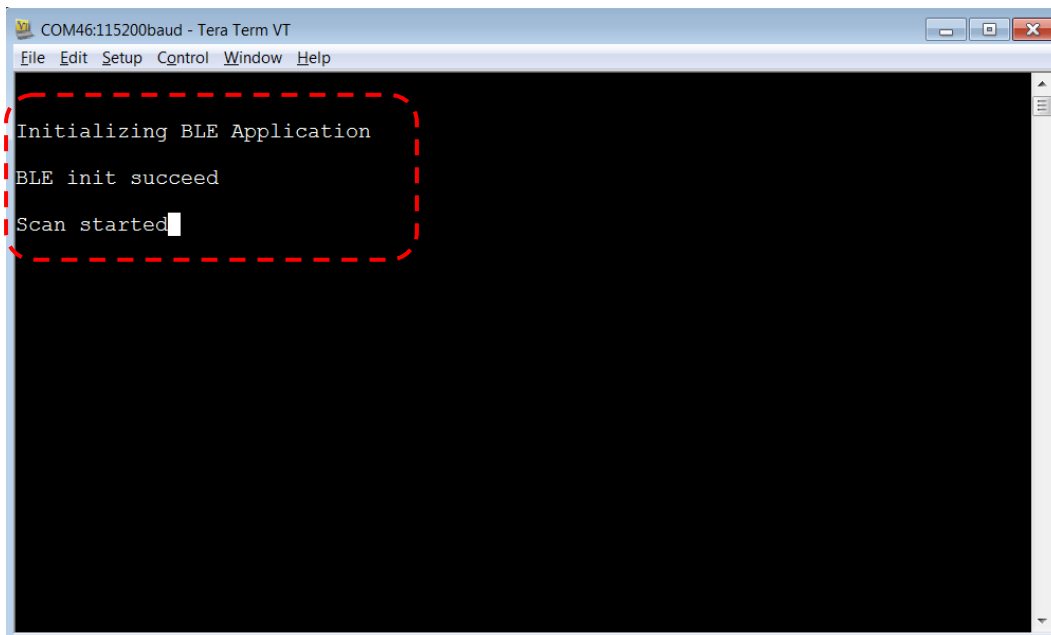
## 4. Running Multilink-Central Demo

This section describes the Multilink-Central Demo application procedures to work with four GAP-Peripheral devices.

1. Connect BM71-XPro on EXT1 of SAML21 Xplained Pro board (Multilink-Central device).
2. Connect the Multilink-Central device to the host PC using micro USB cable. Perform the following steps:
  - a. Verify that the virtual COM port is enumerated on the host PC.
  - b. Open the enumerated COM port on a serial console application like TeraTerm with the following settings:

<b>Baudrate</b>	115200
<b>Data</b>	8 bits
<b>Parity</b>	none
<b>Stop</b>	1 bit
<b>Flow control</b>	none

- c. Make sure that POWER LED (green) on SAML21 Xplained Pro board is solid ON.
  - d. Press Reset button on SAML21 Xplained Pro board and verify that LD4 (blue) on BM71-XPro is blinking at a regular interval.
3. Ensure that the Multilink-Central device is up and running and start scanning. Check status on a serial console application.

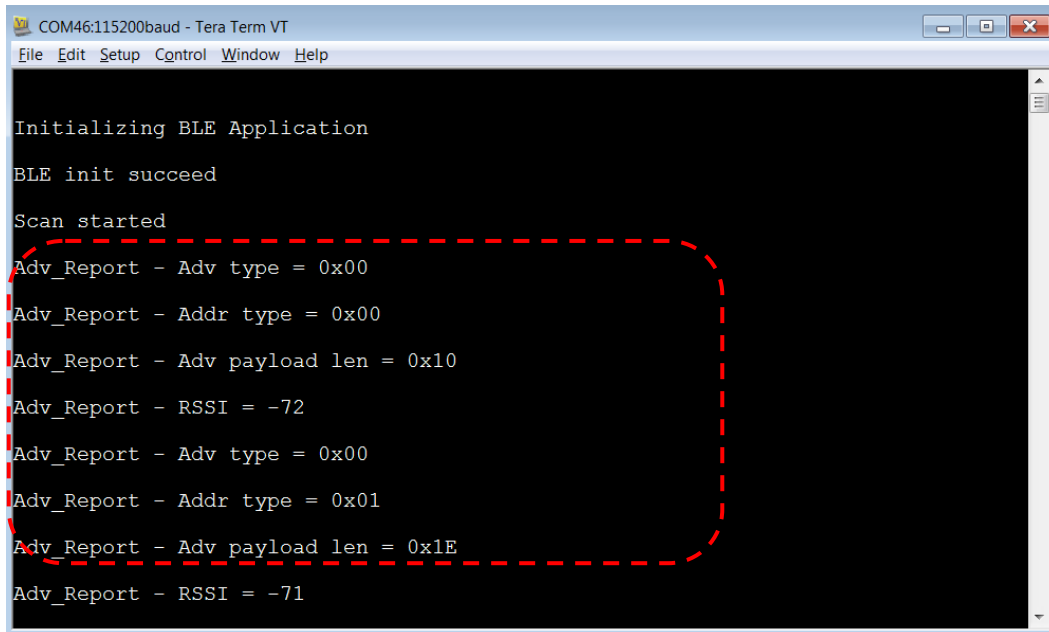


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  4. Prepare four GAP-Peripheral devices to connect with Multilink-Central device (Refer GAP\_Peripheral\_Demo\_Getting\_Started\_Guide.doc).

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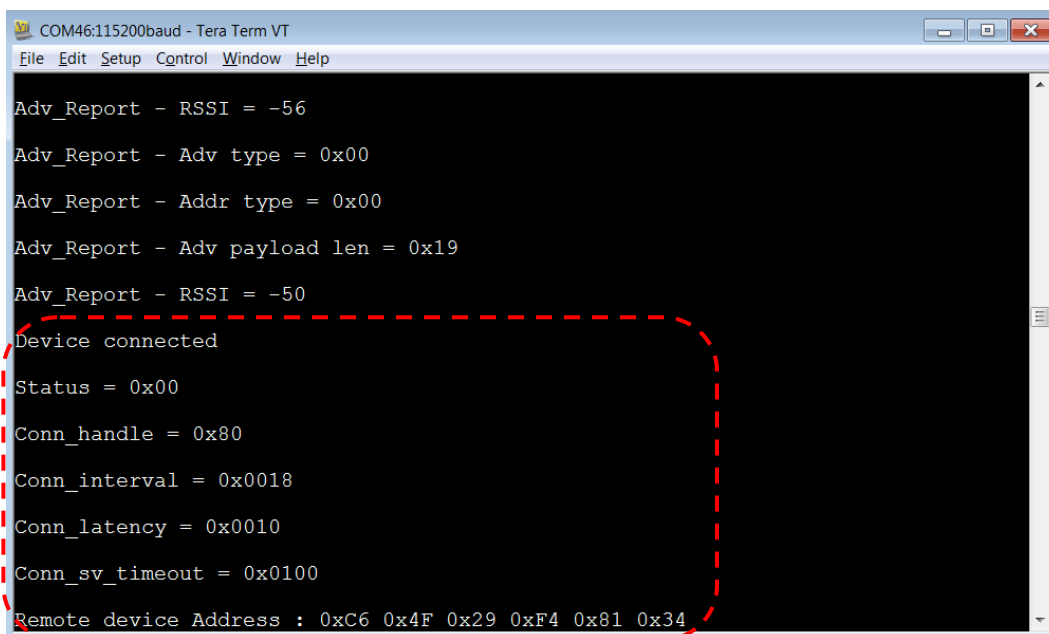
5. Power on first GAP-Peripheral device.
6. As Multilink-Central device when it receives advertisements from devices in vicinity, it prints the advertisement report in serial console.



```
COM46:115200baud - Tera Term VT
File Edit Setup Control Window Help

Initializing BLE Application
BLE init succeed
Scan started
Adv_Report - Adv type = 0x00
Adv_Report - Addr type = 0x00
Adv_Report - Adv payload len = 0x10
Adv_Report - RSSI = -72
Adv_Report - Adv type = 0x00
Adv_Report - Addr type = 0x01
Adv_Report - Adv payload len = 0x1E
Adv_Report - RSSI = -71
```

7. Multilink-Central device finds the GAP-Peripheral device based on the advertisement payload and initiates a connection.
8. Once connected the Multilink-Central device prints the GAP-Peripheral device address and connection parameters in serial console.



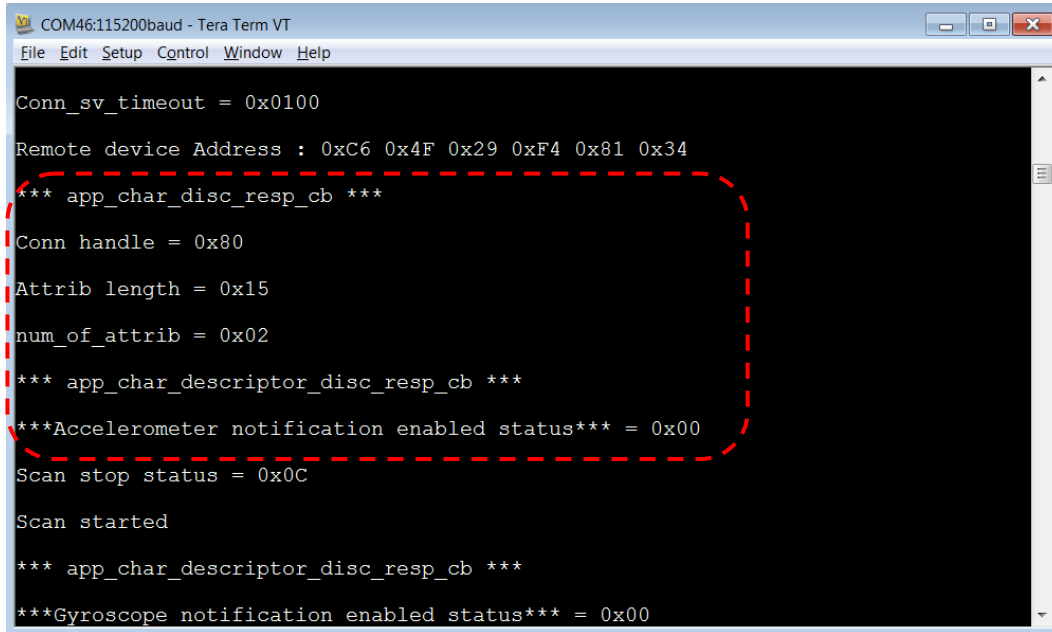
```
COM46:115200baud - Tera Term VT
File Edit Setup Control Window Help

Adv_Report - RSSI = -56
Adv_Report - Adv type = 0x00
Adv_Report - Addr type = 0x00
Adv_Report - Adv payload len = 0x19
Adv_Report - RSSI = -50
Device connected
Status = 0x00
Conn_handle = 0x80
Conn_interval = 0x0018
Conn_latency = 0x0010
Conn_sv_timeout = 0x0100
Remote device Address : 0xC6 0x4F 0x29 0xF4 0x81 0x34
```

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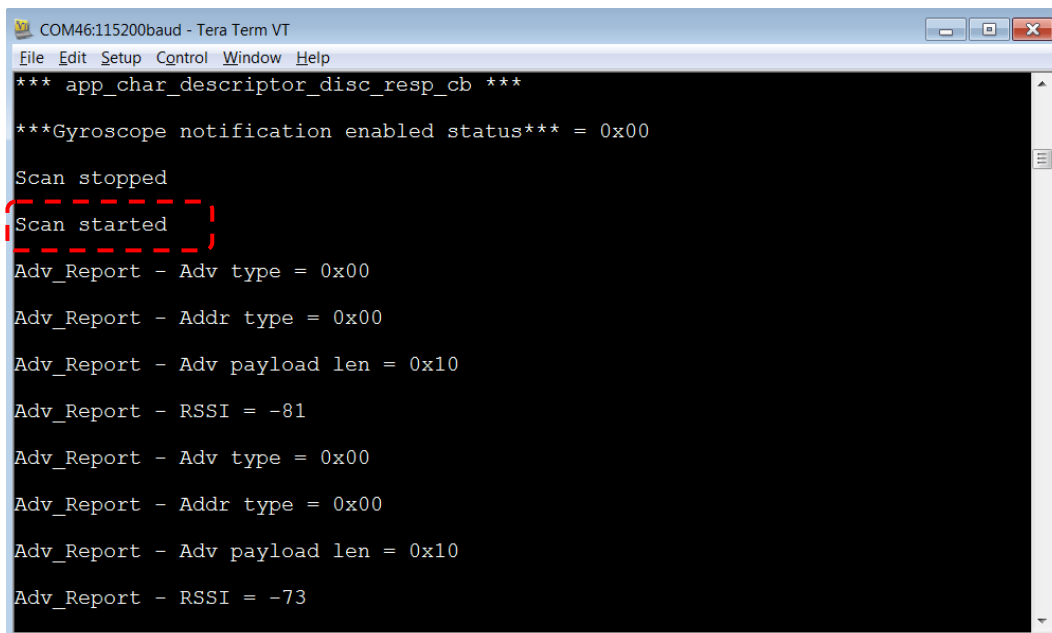
9. Once connected, Multilink-Central device discovers the device orientation service and characteristics in remote device based on the UUID.
10. It also discovers the Client Characteristic Configuration Descriptors (CCCD) of accelerometer and gyroscope sensor characteristics and enabled them to receive notifications.



```
COM46:115200baud - Tera Term VT
File Edit Setup Control Window Help

Conn_sv_timeout = 0x0100
Remote device Address : 0xC6 0x4F 0x29 0xF4 0x81 0x34
*** app_char_disc_resp_cb ***
Conn handle = 0x80
Attrib length = 0x15
num_of_attrib = 0x02
*** app_char_descriptor_disc_resp_cb ***
***Accelerometer notification enabled status*** = 0x00
Scan stop status = 0x0C
Scan started
*** app_char_descriptor_disc_resp_cb ***
***Gyroscope notification enabled status*** = 0x00
```

11. Once enable the accelerometer and gyroscope sensor data notifications, Multilink-Central device start scan to find next GAP-Peripheral device.



```
COM46:115200baud - Tera Term VT
File Edit Setup Control Window Help

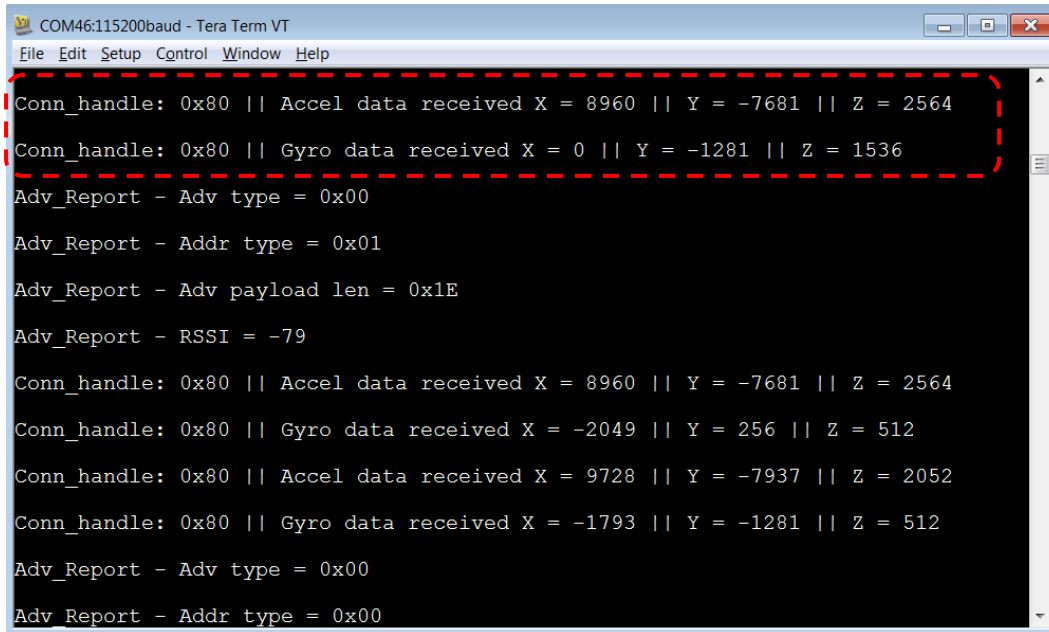
*** app_char_descriptor_disc_resp_cb ***
***Gyroscope notification enabled status*** = 0x00
Scan stopped
Scan started
Adv_Report - Adv type = 0x00
Adv_Report - Addr type = 0x00
Adv_Report - Adv payload len = 0x10
Adv_Report - RSSI = -81
Adv_Report - Adv type = 0x00
Adv_Report - Addr type = 0x00
Adv_Report - Adv payload len = 0x10
Adv_Report - RSSI = -73
```

12. Upon notification enabled by Multilink-Central device, GAP-Peripheral device start notifies the accelerometer and gyroscope sensor data to Multilink-Central device.

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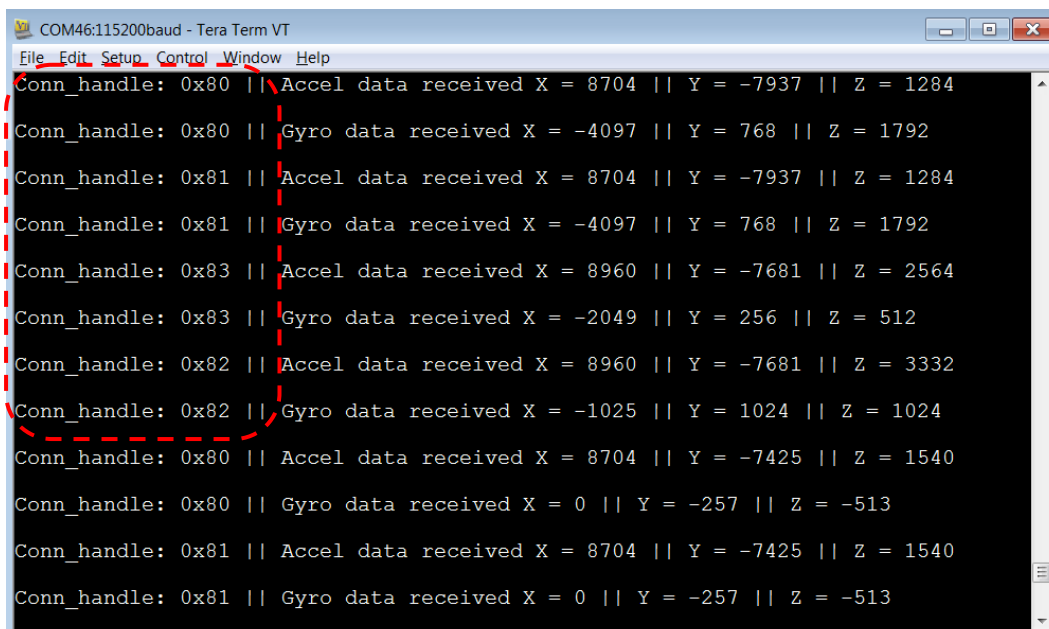
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13. Multilink-Central devices receive sensor data notifications and print them on serial console along with connection handle.



```
COM46:115200baud - Tera Term VT
File Edit Setup Control Window Help
Conn_handle: 0x80 || Accel data received X = 8960 || Y = -7681 || Z = 2564
Conn_handle: 0x80 || Gyro data received X = 0 || Y = -1281 || Z = 1536
Adv_Report - Adv type = 0x00
Adv_Report - Addr type = 0x01
Adv_Report - Adv payload len = 0x1E
Adv_Report - RSSI = -79
Conn_handle: 0x80 || Accel data received X = 8960 || Y = -7681 || Z = 2564
Conn_handle: 0x80 || Gyro data received X = -2049 || Y = 256 || Z = 512
Conn_handle: 0x80 || Accel data received X = 9728 || Y = -7937 || Z = 2052
Conn_handle: 0x80 || Gyro data received X = -1793 || Y = -1281 || Z = 512
Adv_Report - Adv type = 0x00
Adv_Report - Addr type = 0x00
```

14. Similarly, power on GAP-Peripheral devices 2, 3 and 4.
15. The Multilink-Central device will find other GAP-Peripheral devices and connect with them. It also discovers the device orientation service and characteristics in remote devices and enable notifications.
16. Finally, Multilink-Central device start receiving data from all four GAP-Peripheral devices and print them on serial console along with connection handles.



```
COM46:115200baud - Tera Term VT
File Edit Setup Control Window Help
Conn_handle: 0x80 || Accel data received X = 8704 || Y = -7937 || Z = 1284
Conn_handle: 0x80 || Gyro data received X = -4097 || Y = 768 || Z = 1792
Conn_handle: 0x81 || Accel data received X = 8704 || Y = -7937 || Z = 1284
Conn_handle: 0x81 || Gyro data received X = -4097 || Y = 768 || Z = 1792
Conn_handle: 0x83 || Accel data received X = 8960 || Y = -7681 || Z = 2564
Conn_handle: 0x83 || Gyro data received X = -2049 || Y = 256 || Z = 512
Conn_handle: 0x82 || Accel data received X = 8960 || Y = -7681 || Z = 3332
Conn_handle: 0x82 || Gyro data received X = -1025 || Y = 1024 || Z = 1024
Conn_handle: 0x80 || Accel data received X = 8704 || Y = -7425 || Z = 1540
Conn_handle: 0x80 || Gyro data received X = 0 || Y = -257 || Z = -513
Conn_handle: 0x81 || Accel data received X = 8704 || Y = -7425 || Z = 1540
Conn_handle: 0x81 || Gyro data received X = 0 || Y = -257 || Z = -513
```

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