IBEACON SAMPLE APP

Application Note **v1.0**

INTRODUCTION

The goal of this document includes the following:

- Explain how to setup the BL600 to function as a configurable iBeacon.
- Detail how to test the BL600 for iBeacon functionality.

OVERVIEW

An iBeacon consists of a BLE-enabled device that sends out an Apple, Inc. Manufacturer Specific Advertising Record, which will be henceforth referred to in this document as an AMSAD, formatted specifically to be interpreted by a receiving BLE device.

The Bluetooth specification requires that the AMSAD consists of 4 or more octets. The first octet is the overall length, the second octet shall always be 0xFF, the third and fourth octets are the manufacturer assigned Company ID for Apple Inc, and the rest is the iBeacon data. Apple has specified the rest of the octets to be grouped as: [Datatype] [Length] [UUID] [Major] [Minor] [Calibration Power], where the UUID is 16 octets long, Major and Minor are 2 octets long and the rest all single octets as shown in Figure 1:

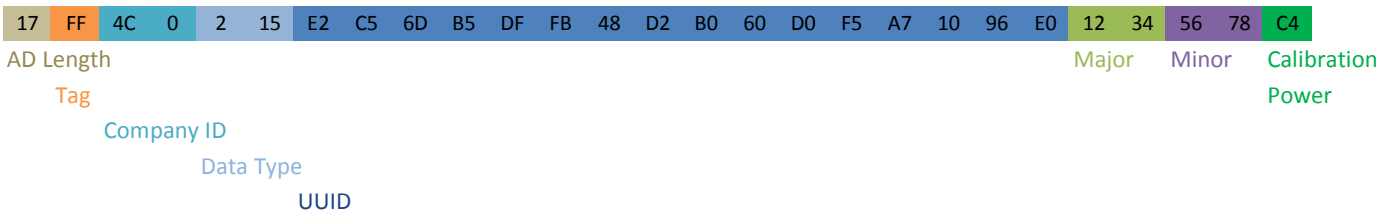

Figure 1: AMSAD Graphical Representation

The iBeacon smartBASIC sample app allows you to remotely configure the following parameters:

- UUID
- Major
- Minor
- Calibration Power
- Advertising Interval
- Advertising Timeout
- Time to remain connectable
- Actual Transmit Power Value

When not in a connection, the BL600 advertises with the AMSAD.

REQUIREMENTS

The following equipment and utilities are required:

- BL600 Devkit (firmware 1.2.54.0 or newer)
- Windows PC
- UwTerminal (Laird's terminal emulation utility)
- Android or iOS device with BLE capability
- App for Android or iOS device for detecting iBeacons
    - For Android, apps B-BLE or nRF Master Control, and iBeacon Locate (Google Play Store)
    - For iOS, apps LightBlue & Locate for iBeacon (Apple App Store)

Note: To download UWTerminal, use the following link: UWTerminal. It is also available from the Bluetooth product page (www.lairdtech.com/bluetooth) > Product Information tab.

This application note assumes you are familiar and with downloading *smart*BASIC applications into the BL600 using UWTerminal. If not, please refer to the module's user guide. All BL600 documentation is available from the Laird BL600 product page (http://www.lairdtech.com/Products/Embedded-Wireless-Solutions/Bluetooth-Radio-Modules/BL600-Series/).

CHECKING FIRMWARE VERSION

To check the firmware version, attach the BL600 devkit to a USB port on your PC and run UWTerminal. Once the module is running, type **AT I 3** to display the firmware version. See Figure 2.

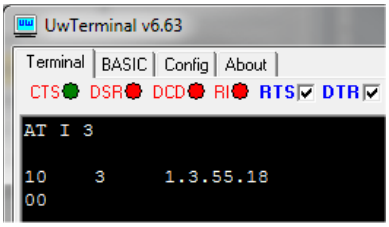

Figure 2: AT I 3 command returning the firmware version number

If the firmware version is older than 1.2.54.0, then you must upload new firmware. Please contact a Laird representative for the latest engineering or production firmware.

BL600 DEVKIT SETUP

This smartBASIC sample app is supplied as an autorun application, so the devkit must be configured if you want the application to run on startup.

To enable Autorun mode while connected to UwTerminal:

1. On the BL600 devkit, close DIP switch 2-6 on CON12. See Figure 3.
2. In UwTerminal, ensure that the DTR checkbox is ticked to enable autorun on startup. See Figure 4.

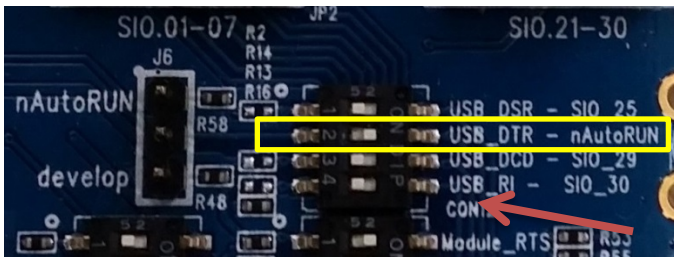

Figure 3: Closing DIP switch 2-6

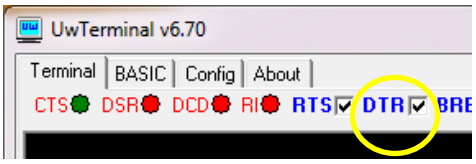

Figure 4: Asserting DTR line in UwTerminal

To enable Autorun mode when not connected to UwTerminal:

1. On the BL600 devkit, place a jumper on the nAutoRun pin and the pin under it. See Figure 5.
2. Ensure that SW4 is in the "DC" position and SW5 is in the "3V3" position. If powering from a coin cell battery, ensure that SW6 is in the "CR2032" position. See Figure 6.

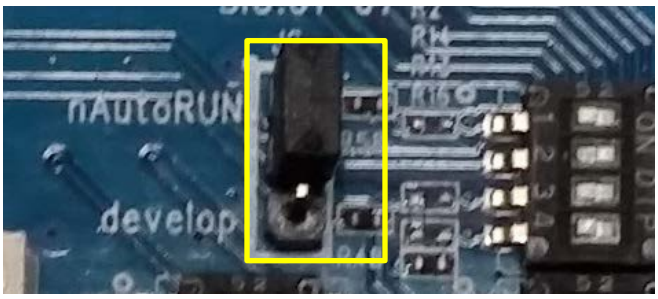

Figure 5: Jumper position for Autorun mode

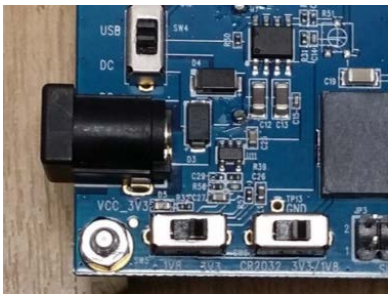

Figure 6: Setting SW4 SW5 and SW6

CALIBRATION

Some iBeacon apps give the option of displaying the **approximate** distance of your Android/iOS device from the iBeacon which is derived from the RSSI. You can calibrate the iBeacon for more accurate distance as follows:

1. Download the sample smartBASIC application *$autorun$.iBeacon.Firmware_v1_3_57_19_or_Older.sb* or *$autorun$.iBeacon.Firmware_v1_3_57_20_or_Newer.sb* depending the firmware version you checked above and check the file exists in the module's file system by entering the command **AT+DIR** in UwTerminal. It will be listed as a file called "$autorun$" (Only characters up to the first '.' Are used to name the file in the module's file system).
   If you get a compile error during the download process you will have selected the wrong file.
2. Reset the BL600 module. The iBeacon application should run and start advertising.
3. Open "iBeacon Locate" on your Android device, or "Locate for iBeacon" on your iOS device.
4. Tap "Locate iBeacons".
5. Select your device from the list of Visible iBeacons.
6. Tap "Calibrate iBeacon" and follow the instructions.
7. When it is finished, note down the 8-bit signed RSSI seen next to "Tx Power value" (See Figure 7) and convert it to **Hexadecimal** (See Lookup Table at Appendix A).
8. Proceed to Configuring the iBeacon below.

CONFIGURING THE IBEACON

The custom iBeacon service used in this application allows the user to configure iBeacon and advertising parameters remotely via any BLE device that can read and write to characteristics. We will now use this service to change the Calibrated Measured RSSI value.

These are the steps to change the value of **any** of the characteristics:

1. Reset the module – it will remain connectable for 20 seconds*
2. Open B-BLE or nRF Master Control Panel (Android), or LightBlue (iOS) and connect to the iBeacon
3. Select the iBeacon service by tapping its UUID (569a**1900**-b87f-490c-92cb-11ba5ea5167c)
4. Select the desired characteristic by tapping its UUID (In this case, the Measured RSSI Value characteristic UUID is 569a**2017**-b87f-490c-92cb-11ba5ea5167c).
5. Supply a Hex value**, which in this case was obtained in step 7 of the calibration process. See Figure 8.
6. Disconnect from the BL600 to update the iBeacon service.

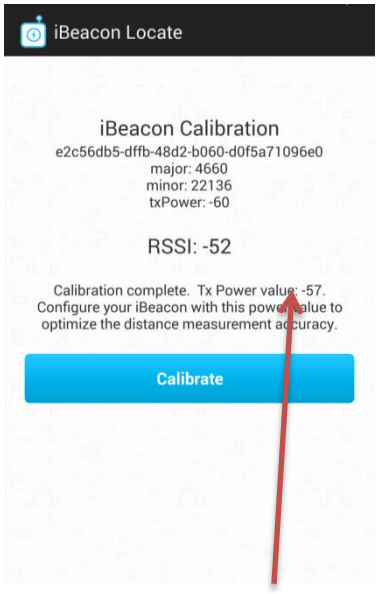

Figure 7: iBeacon Calibration

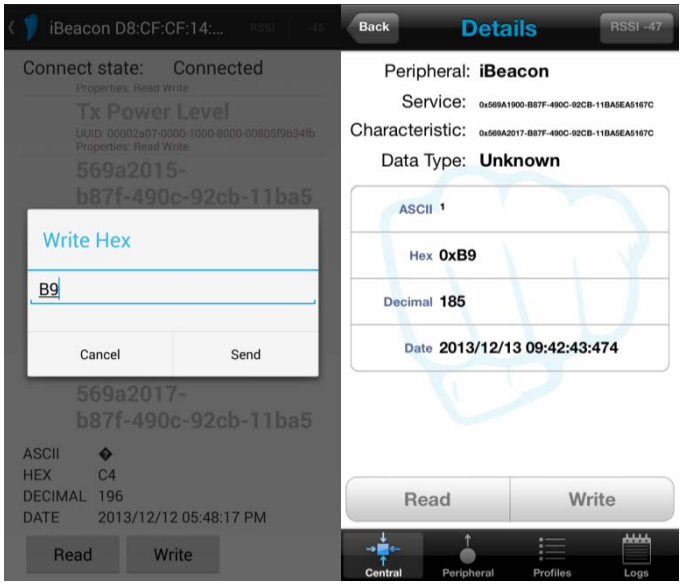

Figure 8: Writing to Calibrated RSSI Value characteristic via B-BLE on Android (Left) and LightBlue on iOS (Right)

Note: When a characteristic is written to, its new value, if valid is saved in non-volatile memory once disconnected from the module.

*The value of the Remain Connectable Time characteristic determines how long the module will advertise with type 0 – Connectable. After this time, adverts are restarted with type 2 – Not connectable. The value can be changed by following the steps in the section Configuring the iBeacon. The UUID of this characteristic is 569a2018-b87f-490c-92cb-11ba5ea5167c.

**With the exception of the Device Name characteristic (569a2010-b87f-490c-92cb-11ba5ea5167c) where a value can be supplied in Hex or ASCII, all characteristic values shall be supplied in Hex. A lookup table for converting an 8 bit Signed Integer value into a 1 byte Hex value can be found at Appendix A

TESTING IBEACON FUNCTIONALITY

When this application is running and the BL600 advertises with the iBeacon AMSAD, the Android app "iBeacon Locate" its iOS equivalent, "Locate for iBeacon" will identify the BL600 as an iBeacon and display it's UUID, major and minor values, the RSSI and an approximate distance from the iBeacon. See Figure 9.

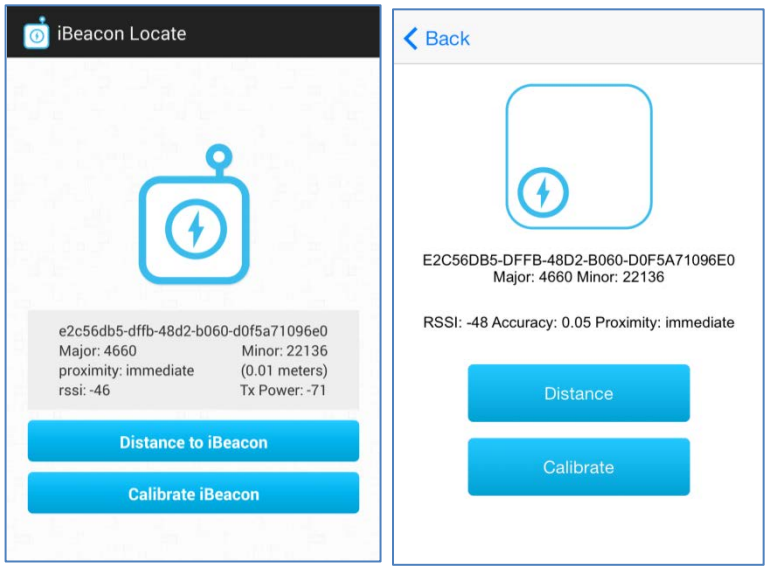

Figure 9: iBeacon Locate (Left) and Locate for iBeacon (Right)

Note: These apps recognise iBeacons with any of the following Apple defined UUIDs:

```
e2c56db5-dffb-48d2-b060-d0f5a71096e0
5a4bcfce-174e-4bac-a814-092e77f6b7e5
74278bda-b644-4520-8f0c-720eaf059935
```

Further Information

For more information on the characteristics and their UUIDs, see the $autorun$.iBEacon.sblib file. Further information relating to firmware and the use of UWTerminal is available from the Laird website at http://www.lairdtech.com/Products/Embedded-Wireless-Solutions/Bluetooth-Radio-Modules/BL600-Series

APPENDIX

Appendix A: 8-bit Signed Integer to 1 byte Hex Lookup Table

8-bit int	Hex	8-bit int	Hex	8-bit int	Hex	8-bit int	Hex	8-bit int	Hex
-30	0xE2	-40	0xD8	-50	0xCE	-60	0xC4	-70	0xBA
-31	0xE1	-41	0xD7	-51	0xCD	-61	0xC3	-71	0xB9
-32	0xE0	-42	0xD6	-52	0xCC	-62	0xC2	-72	0xB8
-33	0xDF	-43	0xD5	-53	0xCB	-63	0xC1	-73	0xB7
-34	0xDE	-44	0xD4	-54	0xCA	-64	0xC0	-74	0xB6
-35	0xDD	-45	0xD3	-55	0xC9	-65	0xBF	-75	0xB5
-36	0xDC	-46	0xD2	-56	0xC8	-66	0xBE	-76	0xB4
-37	0xDB	-47	0xD1	-57	0xC7	-67	0xBD	-77	0xB3
-38	0xDA	-48	0xD0	-58	0xC6	-68	0xBC	-78	0xB2
-39	0xD9	-49	0xCF	-59	0xC5	-69	0xBB	-79	0xB1