BLE Blood Pressure Sensor

1.0

Features

- BLE Blood Pressure Service in GATT Server role
- Low Power mode
- Report the workflow status through UART
- LED status indication

General Description

This example project demonstrates the BLE Blood Pressure Sensor application workflow. The Blood Pressure Sensor application utilizes the BLE Blood Pressure profile to report blood pressure measurement records to the Client. Also the Blood Pressure Sensor application utilizes the Battery Service to notify the battery level and the Device Information Service to assert the Device Name, etc.

Development Kit Configuration

Default CY8CKIT-042 BLE Pioneer Kit configuration,

Connect J2 pin P3[0] to J3 pin VREF.

Project Configuration

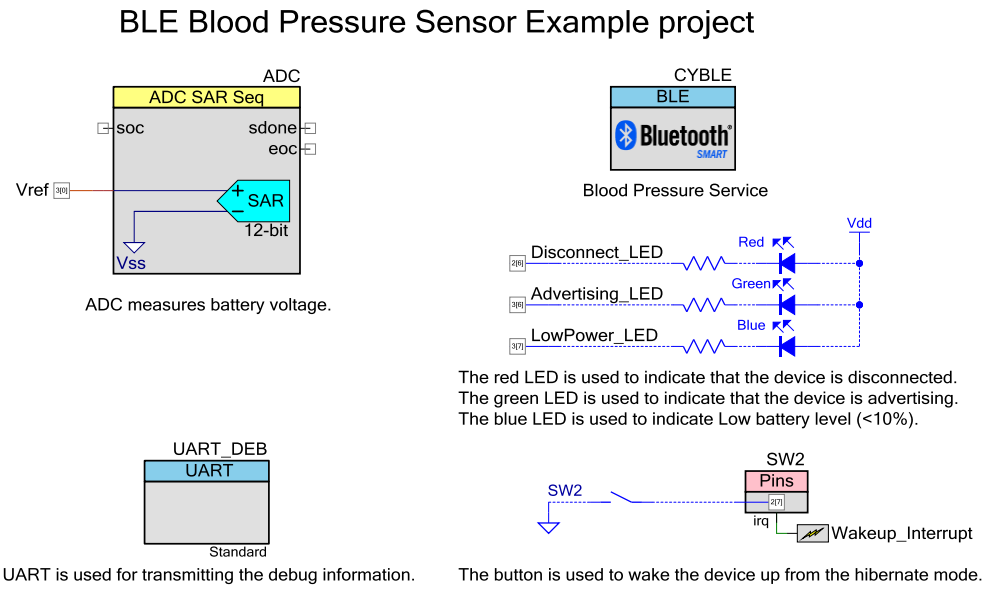


Figure 1. Top design schematic

The BLE component is configured as Blood Pressure Server in the GAP Peripheral role. Also BAS and DIS services are included.

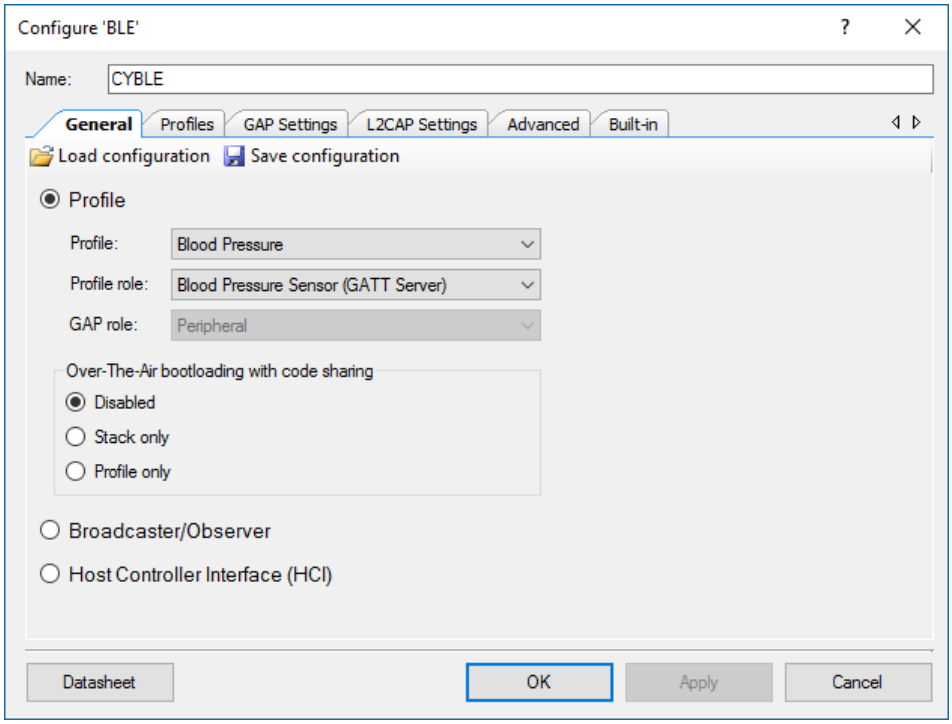


Figure 2. General settings

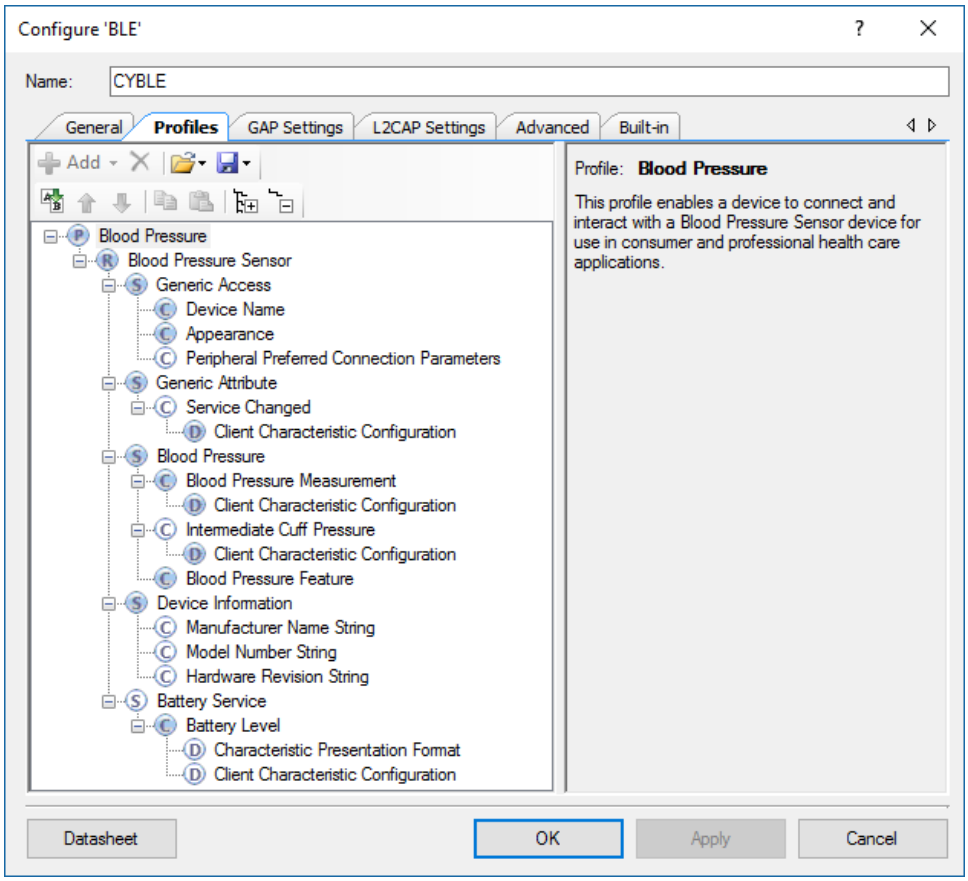


Figure 3. GATT settings

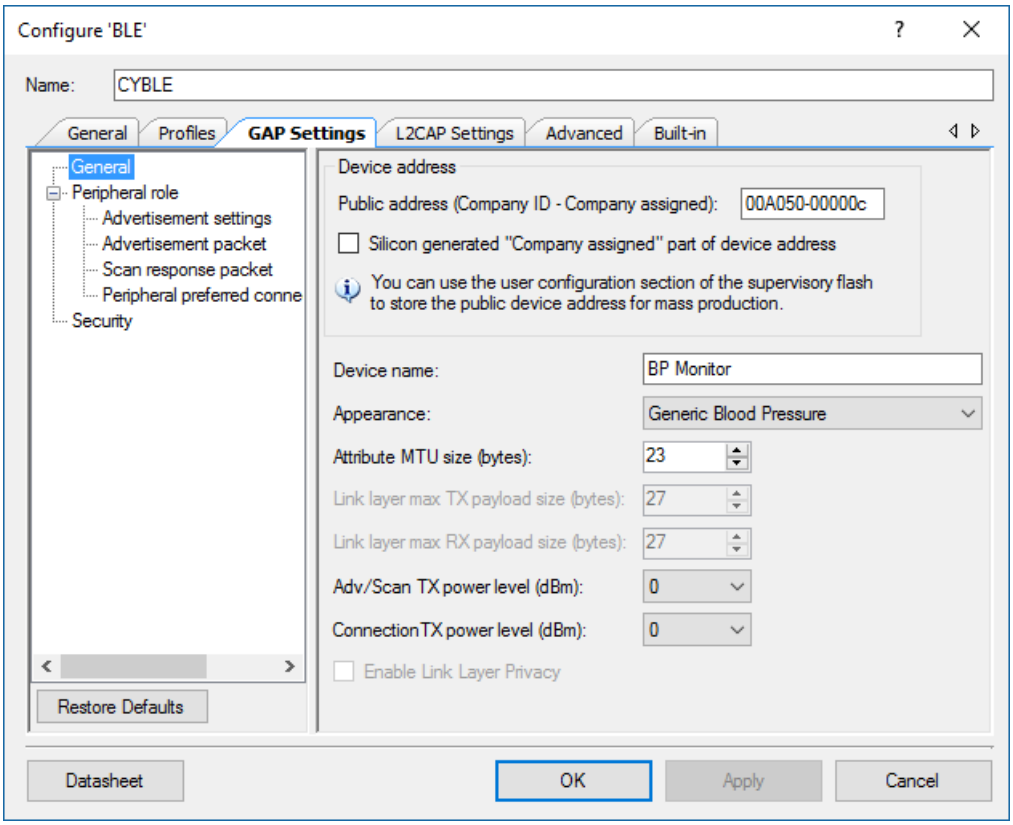


Figure 4. GAP settings

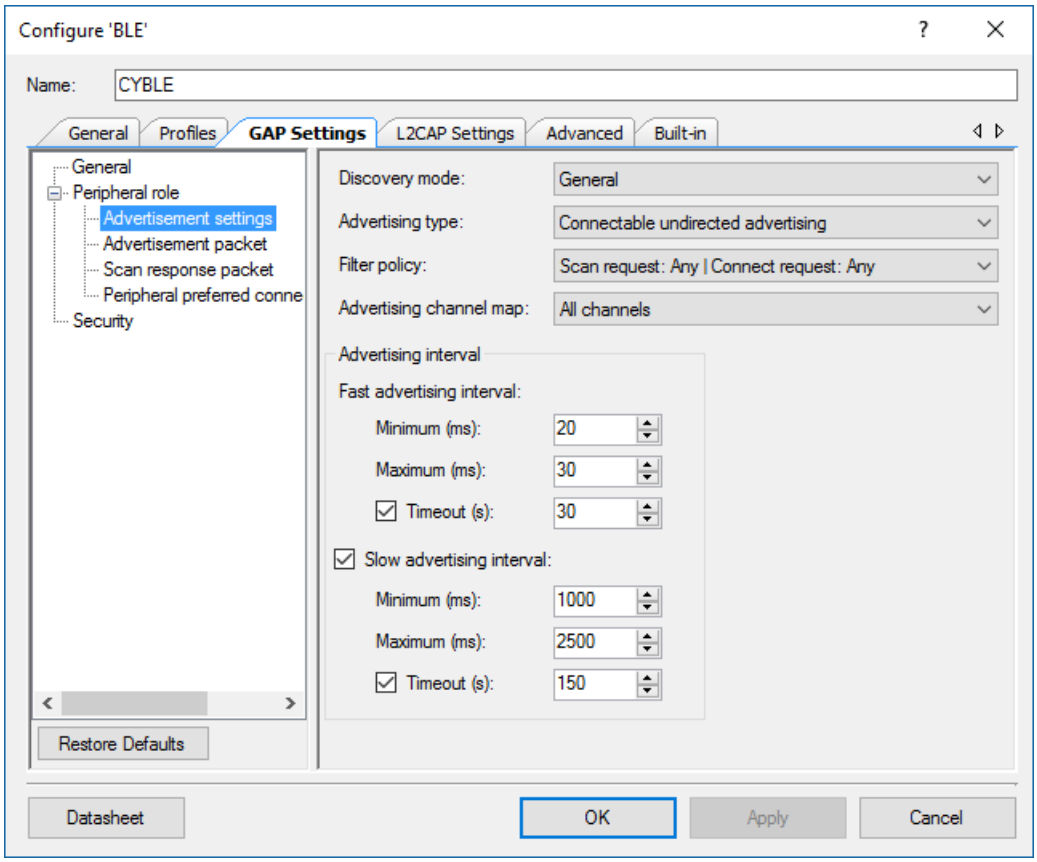


Figure 5. GAP settings -> Advertisement settings

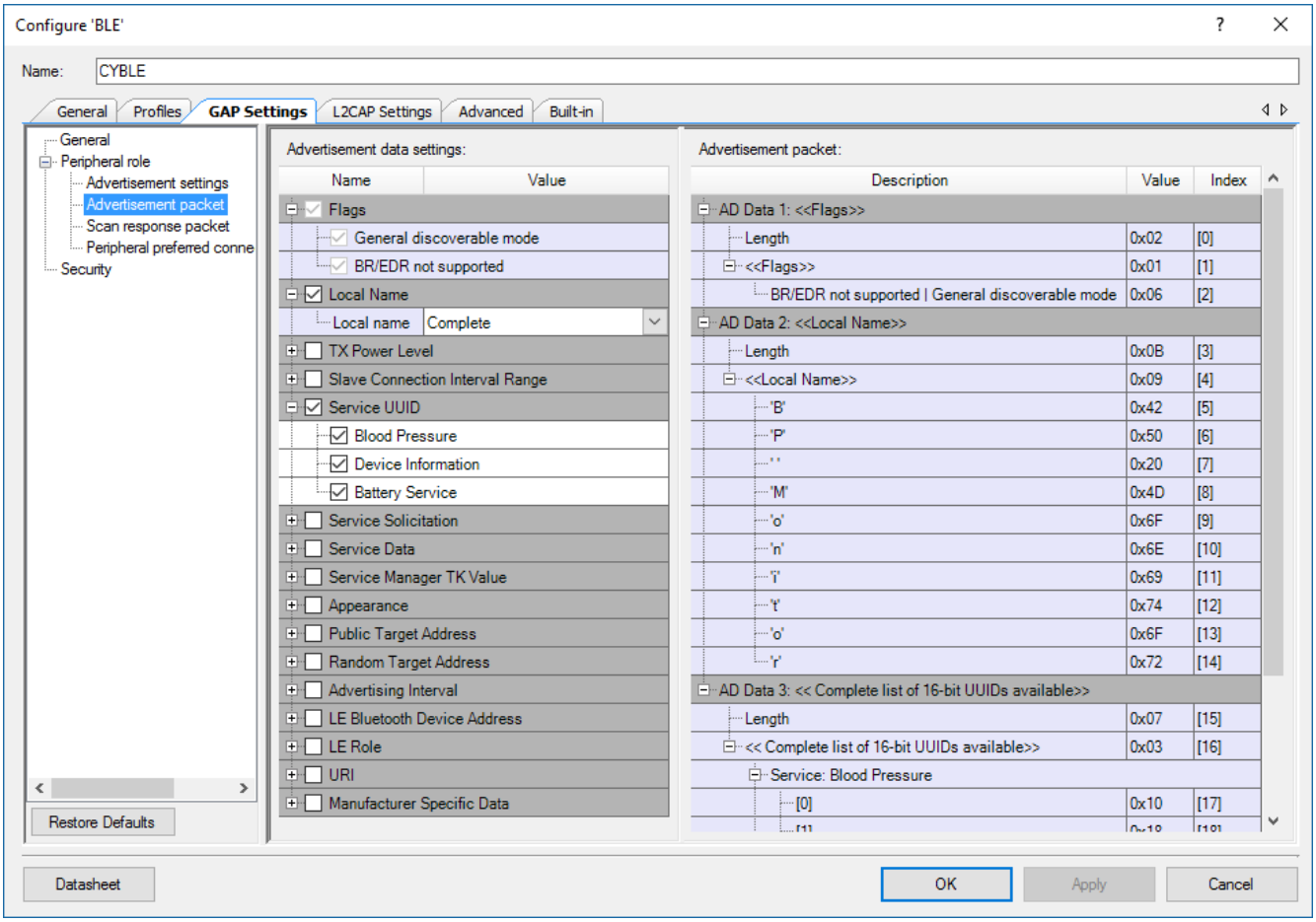


Figure 6. GAP Settings -> Advertisement packet

The Scan response packet settings are also configured to include the Local Name and all the service UUIDs into the Scan response packet.

The pin assignment is the next:

- The UART RX is connected to P1[4].
- The UART TX is connected to P1[5].
- A mechanical button is connected to P2[7].
- The red LED is connected to P2[6].
- The green LED is connected to P3[6].
- The blue LED is connected to P3[7].
- The VREF (J3) is connected to P3[0]

Project Description

The project demonstrates the core functionality of the BLE component configured as a Blood Pressure Server.
Right after startup the device performs BLE component initialization. In this project three callback functions are required for the BLE operation. One callback function (AppCallBack()) is required to receive generic events from BLE Stack and the service specific callbacks BasCallBack() and BlsCallBack() for Battery and Blood Pressure service-specific events accordingly. The CYBLE_EVT_STACK_ON event indicates a successful initialization of BLE Stack. After this event is received the component starts advertising with the packet structure as configured in BLE component customizer (see **Figure 6**). The BLE component stops advertising once 180 seconds advertising period expires.

The Blood Pressure Sensor device can be connected with any BLE (4.0 or later) compatible device configured as GAP Central role and GATT Client which supports Blood Pressure Profile. Also the Battery and Device Information Services may be optionally used. To connect to the Blood Pressure Sensor device, just send a connection request to the device while the device is advertising. The green LED is blinking while the device is advertising. The red LED is turned on after disconnection to indicate that no Client is connected to the device. When the client connects successfully, both red and green LEDs are turned off. If the Client is connected to the Blood Pressure Sensor and the Blood Pressure Measurement (BPM) characteristic indication and/or the Intermediate Cuff pressure (ICF, if it is supported by client) characteristic notifications is/are enabled then the device is simulating blood pressure measurement process continuously and periodically (once a second) sends the ICF notification and/or BPM indication. The WDT is used to timing the blood pressure measurement simulations, battery level measurement and LED blinking.
While connected to a Client and between connection intervals, the device is put into Sleep Mode.

Expected Results

The project sends the Blood Pressure Service characteristic's notifications/indications and Battery Level notifications to the Central Client device which can show them for user. LEDs are blinking as described in Project Description section.

The project is intended to work in pair with any BLE-compatible device (e.g. phone, tablet). Appropriate software with Blood Pressure Profile support should be installed on client OS. CySmart mobile app (available for Android and iOS) can act as a client for Blood Pressure Service.

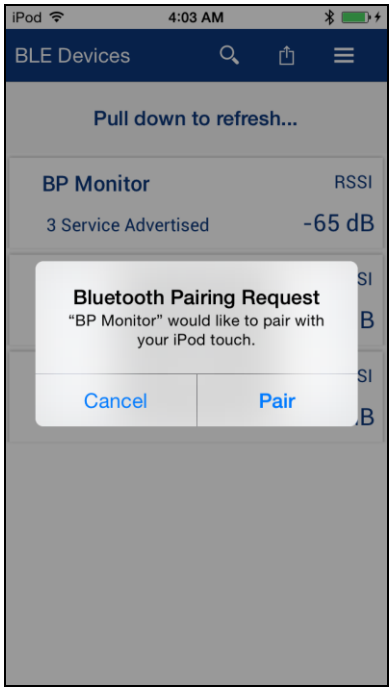


Figure 7. CySmart iOS app pairs with Blood Pressure Sensor Service

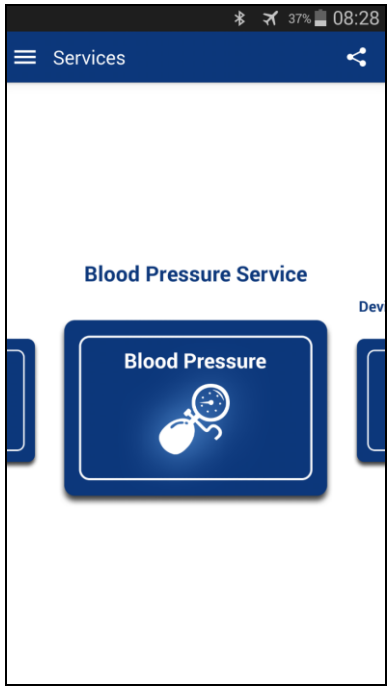


Figure 8. CySmart Android app recognized Blood Pressure Sensor Profile

You can observe simulated values of Blood Pressure with CySmart mobile app:

Figure 9. CySmart app on iOS displays simulated Blood Pressure values

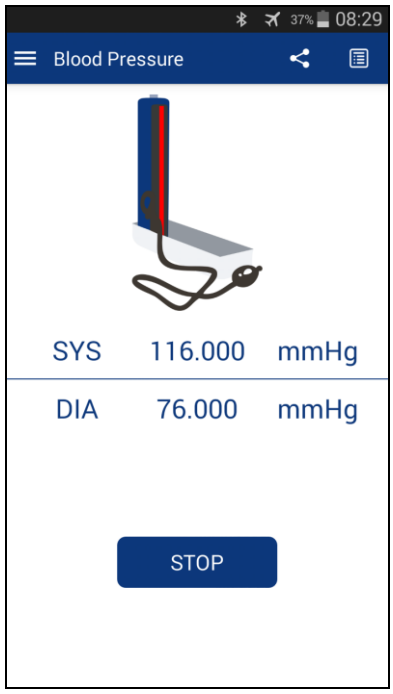
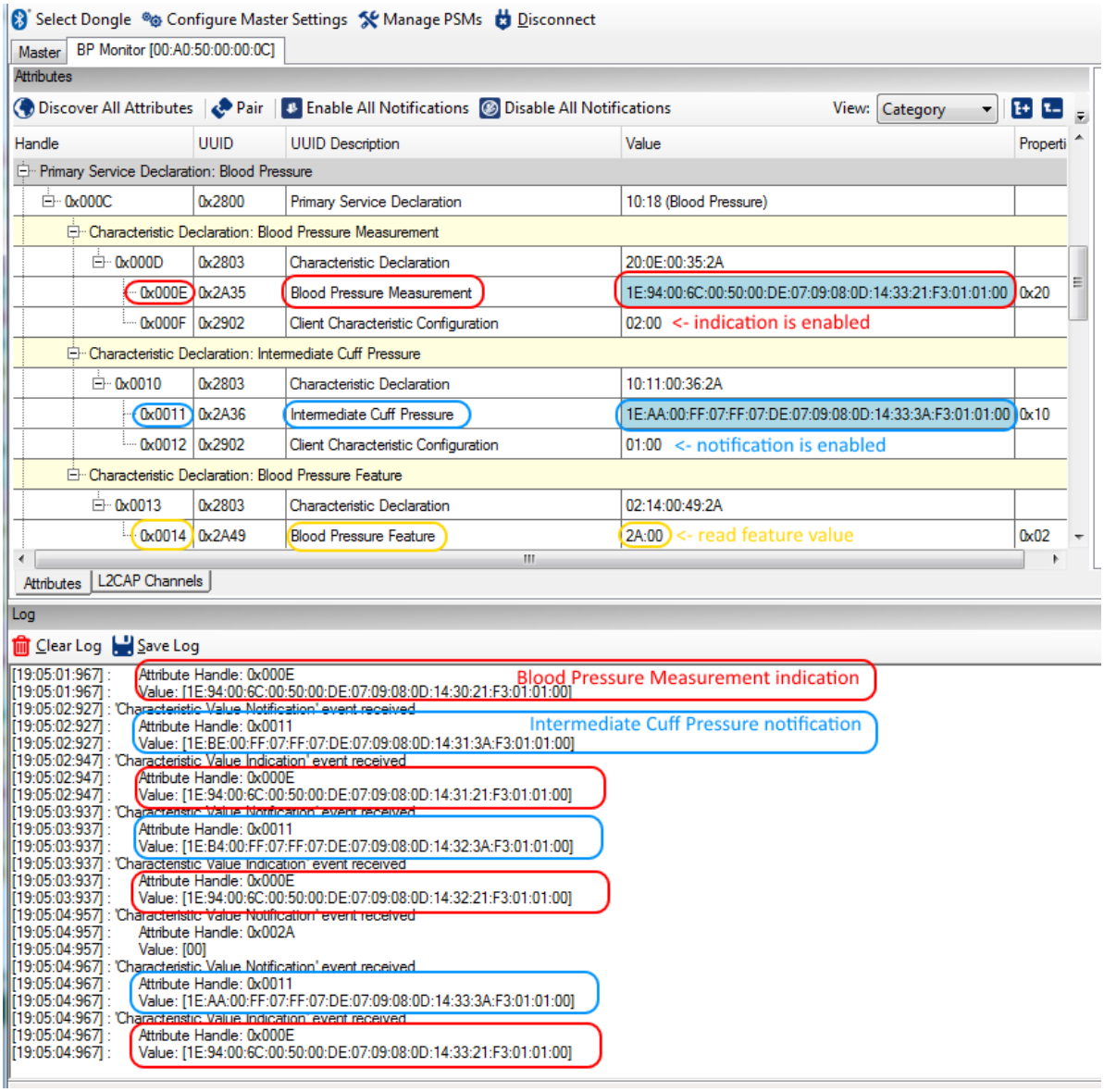


Figure 10. CySmart app on Android displays Blood Pressure values

Also, the Blood Pressure Sensor can be used together with CySmart app for Windows. It is required to match the security settings between Blood Pressure Sensor and CySmart Client and perform pairing (bonding) before any writing (enabling notifications etc.) into Server's GATT database. For further instructions on how to use CySmart application, see CySmart User Guide.

The simple example how to use CySmart Windows application as Blood Pressure Service client is the next:

- Connect the CySmart BLE dongle to a USB port on the PC.
- Launch CySmart app and select connected dongle in the dialog window.
- Reset the development kit to start advertising by pressing SW1 button.
- Click **Start Scan** button to discover available devices.
- Select **BP Sensor** in the list of available devices and connect to it.
- Click **Pair**, then **Discover All Attributes**, and **Enable All Notifications** in CySmart app.
- Observe the Blood Pressure Measurement and Intermediate Cuff Pressure characteristics indications/notifications with simulated data:



The details about the Blood Pressure Service characteristic data structures are in the BLS Specification.