

# BLE Heart Rate Collector Example Project

1.0

## Features

- BLE Heart Rate Profile support in the Client GATT role
- Indication of the Heart Rate data through UART
- LED status indication

## General Description

This example project demonstrates the BLE Heart Rate Collector workflow. The project receives Heart Rate data from any BLE enabled Heart Rate Sensor and indicates that data on any terminal software via UART.

## Development Kit Configuration

Configure your device as follows:

- The UART RX pin is connected to port 1 pin 4.
- The UART TX pin is connected to port 1 pin 5.
- A mechanical button (port 2 pin 7) is used to wake up the device and start re-advertising.
- The red LED (port 2 pin 6) is used to indicate the BLE disconnection state.
- The green LED (port 3 pin 6) is used to indicate the advertising state.
- The blue LED (port 3 pin 7) is used to indicate the battery discharge (low power).

## Project Configuration

The top design schematic is shown in **Figure 1**.

## BLE Heart Rate Collector Example project

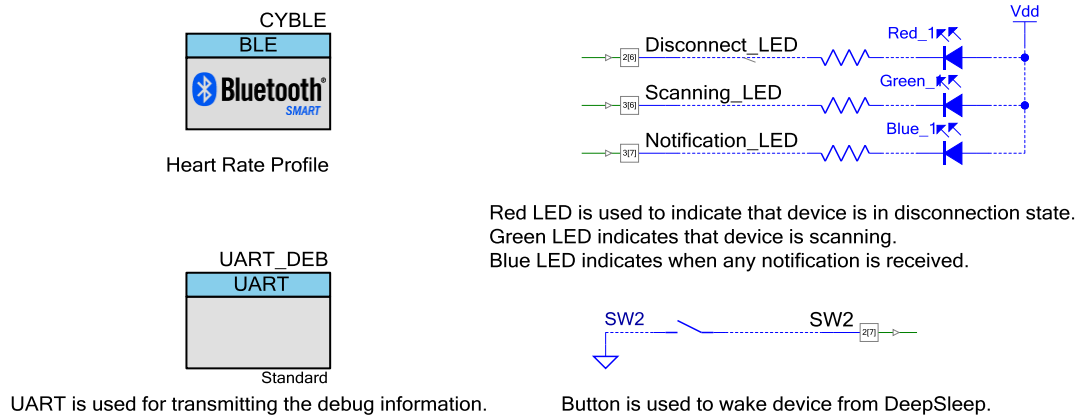


Figure 1. Top design schematic

The BLE component is configured as Heart Rate Collector.

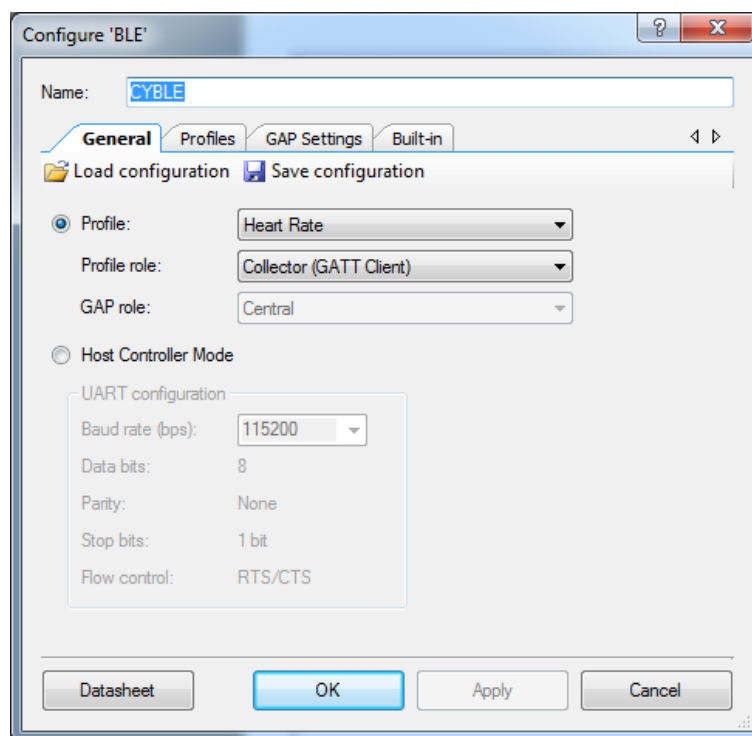


Figure 2. BLE configuration

The GATT settings:

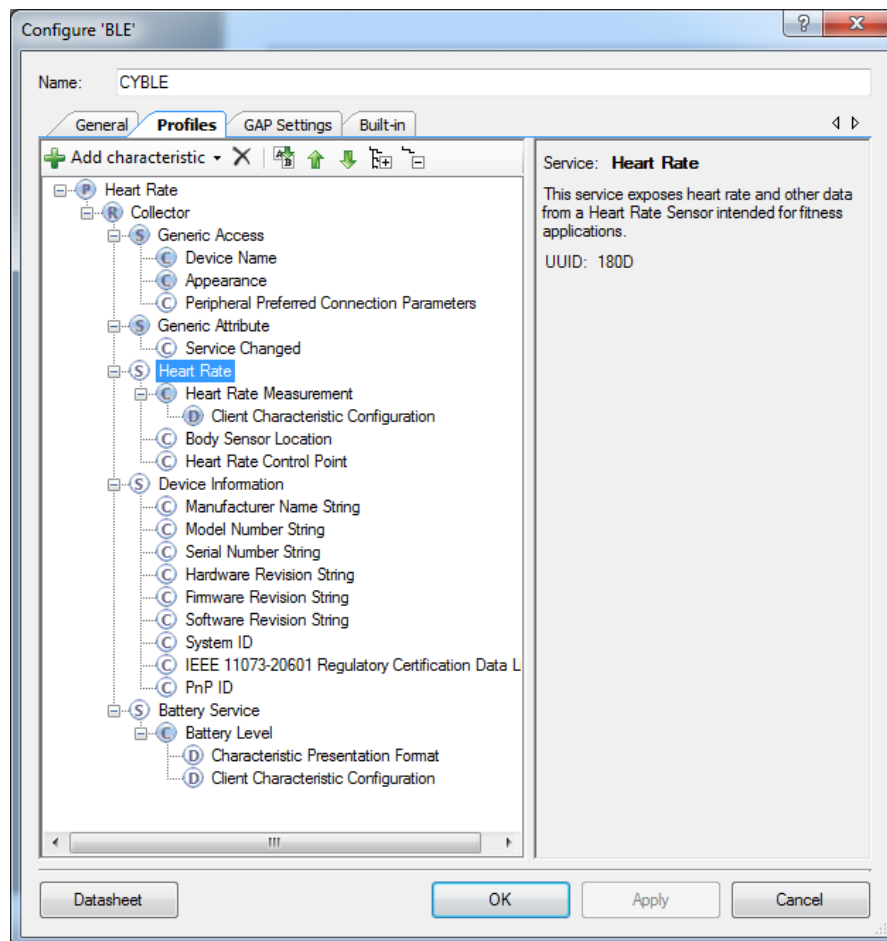


Figure 3. GATT settings

The GAP settings:

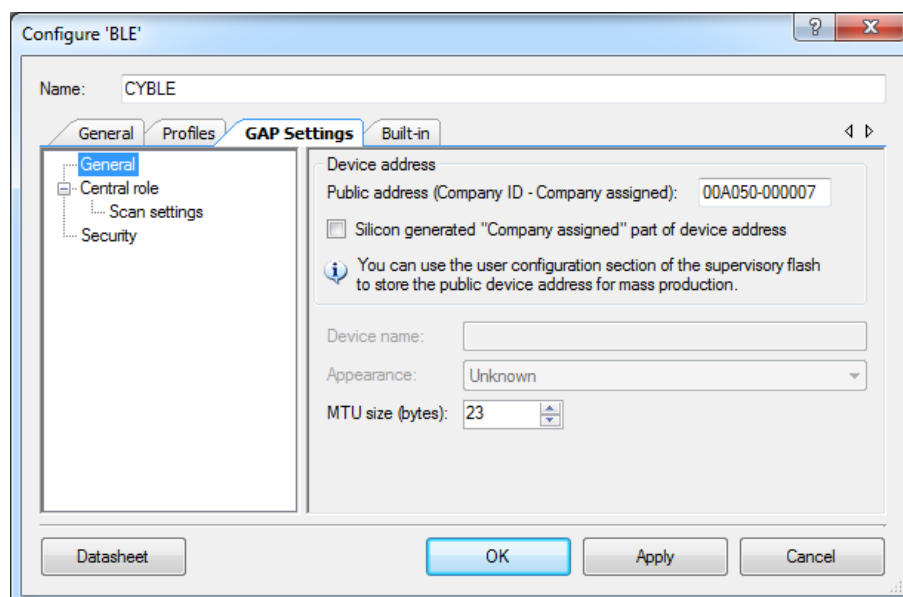


Figure 4. GAP settings

The Scan settings:

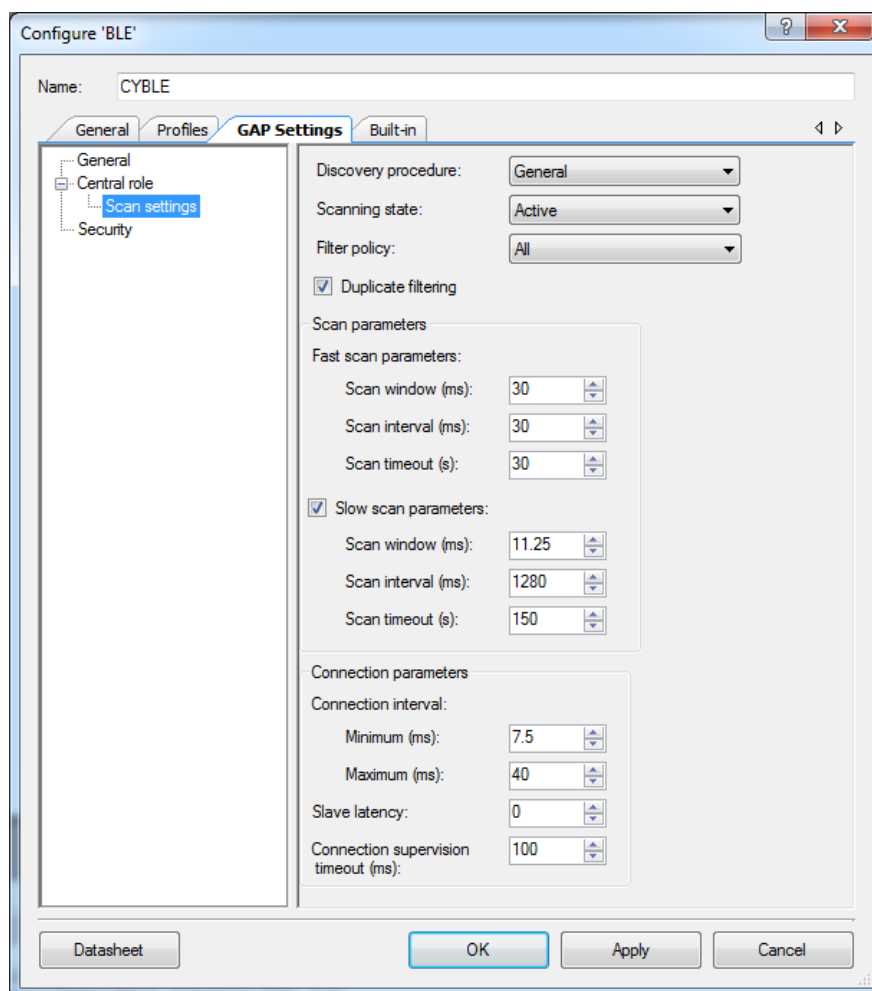


Figure 5. GAP settings->Scan settings

Security settings:

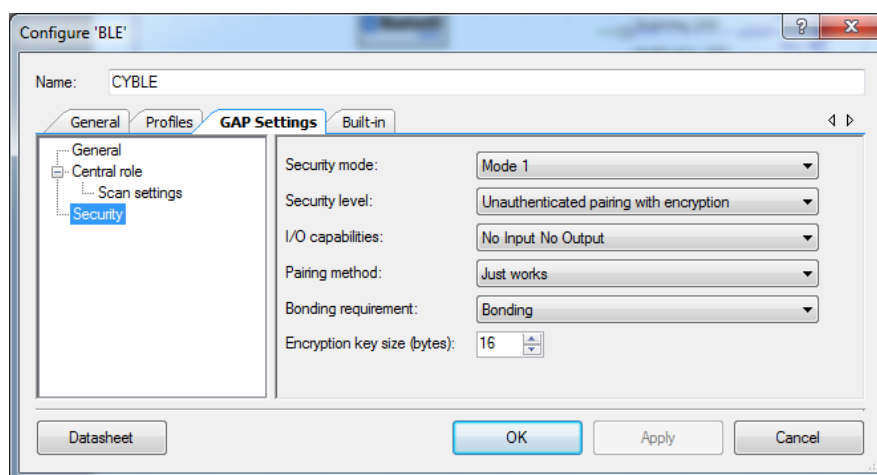


Figure 6. Security settings

## Project Description

The project demonstrates the BLE workflow procedures like scanning, discovering, connecting, writing/reading characteristics/descriptors, receiving notifications etc.

The project is designed so there is no need to initiate any of mentioned actions manually – it automatically starts the BLE stack, then when stack is on (STACK\_ON event is received) the scanning GAP procedure is initiated, then it receives and parses advertisement data. Once it finds out that there is Heart Rate Service UUID in the advertisement packet then it immediately connects to that device and starts to discover all primary services which are supported (configured in the GATT tab): in our case they are: Generic Access (GAP) and Attribute (GATT) services, then Heart Rate (HRS), Battery (BAS) and Device Information Service (DIS). Then the project discovers included services (which may be secondary) and characteristics of each mentioned above primary services. Then it discovers descriptors of each service characteristic which can have descriptors.

After the discovery process (when the DISCOVERY\_COMPLETE event is received) project sends a request to read the Body Sensor Location characteristic and waits for HRSC\_BSL\_READ\_RESPONSE event in the heart rate profile's callback (HeartRateCallBack). In this event project indicates received Body Sensor Location value and enables the Heart Rate Measurement Notification. The notifications come approximately once a second. The project also enables the Battery Level notification, which comes immediately after enabling and then when battery level changes.

## Expected Results

The working project sends the messages through UART.  
The example log is shown below:

```

Heart Rate Client
EVT_STACK_ON
Start Scan
EVT_GAPC_SCANNING
SCAN_PROGRESS_RESULT: peerAddrType - 0, peerBdAddr - 0: 00188c30331a, rssi - -21 dBm, data - 02 01 06 03 03 0d 18 03 19 40 03 02 0a fe 04 09 48 52 4d
This device contains Heart Rate Service
Stop Scanning, Connect to the device 0: 00188c30331a
SCAN_PROGRESS_RESULT: peerAddrType - 0, peerBdAddr - 0: 00188c30331a, rssi - -21 dBm, data -
EVT_GAPC_SCANNING
EVT_GATT_CONNECT_IND: 0
EVT_GAP_DEVICE_CONNECTED: 0
Start Discovery
EVT_GATTC_SRVC_DISCOVERY_COMPLETE
EVT_GATTC_INCL_DISCOVERY_COMPLETE
EVT_GATTC_CHAR_DISCOVERY_COMPLETE
EVT_GATTC_DISCOVERY_COMPLETE
Body Sensor Location: CHEST (1)
HRM CCCD Write Request is sent
Heart Rate Measurement Notification is Enabled
Heart Rate: 60 EnergyExpended: 0 R-R Interval 0: 1024 R-R Interval 1: 4
HRM CCCD Read Request is sent
HRM CCCD Read Response: 0001
Heart Rate: 60 EnergyExpended: 0 R-R Interval 0: 1024 R-R Interval 1: 4
Battery Level CCCD Write Request is sent
Battery Level Notification is Enabled
Battery Level Notification: 8
Heart Rate: 70 EnergyExpended: 0 R-R Interval 0: 877 R-R Interval 1: 3
Heart Rate: 70 EnergyExpended: 0 R-R Interval 0: 868 R-R Interval 1: 3
Heart Rate: 71 EnergyExpended: 0 R-R Interval 0: 857 R-R Interval 1: 3
Heart Rate: 74 EnergyExpended: 0 R-R Interval 0: 839 R-R Interval 1: 801 R-R Interval 2: 3
Heart Rate: 76 EnergyExpended: 0 R-R Interval 0: 800 R-R Interval 1: 3
Heart Rate: 75 EnergyExpended: 0 R-R Interval 0: 813 R-R Interval 1: 3
Heart Rate: 72 EnergyExpended: 0 R-R Interval 0: 849 R-R Interval 1: 3
Heart Rate: 74 EnergyExpended: 1274 R-R Interval 0: 821 R-R Interval 1: 834 R-R Interval 2: 3
Heart Rate Control Point Write Request is sent
CPT Write Response: energy expended counter is reset
Heart Rate: 74 EnergyExpended: 1274 R-R Interval 0: 830 R-R Interval 1: 3
Heart Rate: 73 EnergyExpended: 1274 R-R Interval 0: 833 R-R Interval 1: 3
Heart Rate: 73 EnergyExpended: 1274 R-R Interval 0: 832 R-R Interval 1: 3
Heart Rate: 73 EnergyExpended: 1274 R-R Interval 0: 832 R-R Interval 1: 3
Heart Rate: 73 EnergyExpended: 1274 R-R Interval 0: 836 R-R Interval 1: 839 R-R Interval 2: 3
Heart Rate: 73 EnergyExpended: 1274 R-R Interval 0: 837 R-R Interval 1: 3
Heart Rate: 73 EnergyExpended: 1274 R-R Interval 0: 835 R-R Interval 1: 3
Heart Rate: 73 EnergyExpended: 1274 R-R Interval 0: 836 R-R Interval 1: 3
Heart Rate: 73 EnergyExpended: 1274 R-R Interval 0: 840 R-R Interval 1: 837 R-R Interval 2: 3
Heart Rate: 73 EnergyExpended: 20 R-R Interval 0: 834 R-R Interval 1: 3
Heart Rate: 73 EnergyExpended: 20 R-R Interval 0: 834 R-R Interval 1: 3

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