**Title:** Low Power ECG App Communication Protocol and steps

**Date:** 3/17/2021

**Revision:** X01

BLE GATT Database:

Configuration Service: CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:D4:8C:AD:8A

-Settings Characteristic: 06:0D:00:CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:AA:46:AD:8A

Data type: uint8\_t [10]

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bluetooth Header | Module | Sub Message #1 | Sub Message #2 | Sub Message #3 | Sub Message #4 | Sub Message #5 | Sub Message #6 | Sub Message #7 | Bluetooth Footer |

-Response Characteristic: 12:0F:00:CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:AB:46:AD:8A

Data type: uint8\_t [4]

|  |  |  |  |
| --- | --- | --- | --- |
| Response #1 | Response #2 | Response #3 | Response #4 |

Temperature Service: CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:D5:8C:AD:8A

-Instant Temp Characteristic: 12:1D:00:CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:AF:46:AD:8A

Data type: uint8\_t [2]

|  |  |
| --- | --- |
| Temperature [0] | Temperature [1] |

ECG Service: CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:D6:8C:AD:8A

-Instant ECG Characteristic: 12:1D:00:CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:B1:46:AD:8A

Data type: uint8\_t [64]

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ECG V1 [0] | ECG V1 [1] | ECG V2 [0] | ECG V2 [1] | ECG V3 [0] | ECG V3 [1] | ECG V4  [0] | ECG V4  [1] | ECG  V5 [0] | ECG  V5 [1] | … | ECG  V32  [0] | ECG V32 [1] |

1. Connect to Device.
   1. Device name: LP\_ECG-X01
   2. Manufacturer name: GT-BITNG
2. Discover all attributes and services.
3. Enable all characteristic notifications.
4. Write the following command to the SETTINGS CHARACTERISTIC
   1. Enable Bluetooth Advertising after disconnection.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | BLUETOOTH MODULE | BLUETOOTH ENABLE ADVERTISING AFTER DISCONNECTION COMMAND | 0 | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X06 | 0X18 | 0 | 0 | 0 | 0 | 0 | 0 | 0XBB |

* 1. The Response Characteristic should read the following after the previous command:

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x01 |

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Start Instant Temperature Data Collection Command

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | TMP117 MODULE | TMP117 START DATA COLLECTION COMMAND | 0 | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X02 | 0X0B | 0 | 0 | 0 | 0 | 0 | 0 | 0XBB |

* 1. The Response Characteristic should read the following after the previous command:

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x01 |

* 1. Start the internal timer to control the sampling rate for the temperature sensor:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | NRF52 MODULE | NRF52 RTC CLOCK COMMAND | NRF52 RTC SENSOR START | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X01 | 0X04 | 0X09 | 0 | 0 | 0 | 0 | 0 | 0XBB |

* 1. The response characteristic should read the following after the previous command:

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x01 |

The previous command will be implemented. After implementation the following command, the response will be sent to indicate that the temperature data collection has started.

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x05 |

Data is written to the instant temperature characteristic above at the desired sampling rate. After data is written to the characteristic, a notification is sent to the BLE Client to show that the characteristic value is updated.

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Start Instant ECG Data Recording Command

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | MAX30003 MODULE | MAX30003 START DATA COLLECTION COMMAND | 0 | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X04 | 0X0E | 0 | 0 | 0 | 0 | 0 | 0 | 0XBB |

* 1. The response characteristic should read the following after the previous command:

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x01 |

The previous command will be implemented. After implementation the following command, the response will be sent to indicate that the temperature data collection has started.

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x03 |

Data is written to the instant temperature characteristic above at the desired sampling rate. After data is written to the characteristic, a notification is sent to the BLE Client to inform the BLE Client to read the data in the characteristic and save it to internal memory.

**To stop data transfer of pressure, send the following commands:**

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Stop instant ECG data recording.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | MAX30003 MODULE | MAX30003 STOP DATA COLLECTION COMMAND | 0 | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X04 | 0X0F | 0 | 0 | 0 | 0 | 0 | 0 | 0XBB |

* 1. The Response Characteristic should read the following after the previous command:

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x01 |

The previous command will be implemented. After implementation the following command, the response will be sent to indicate that the temperature data collection has started.

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x04 |

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Stop instant TEMP data recording session.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | TMP117 MODULE | TMP117 STOP DATA COLLECTION COMMAND | 0 | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X02 | 0X0C | 0 | 0 | 0 | 0 | 0 | 0 | 0XBB |

* 1. The response characteristic should read the following after the previous command:

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x01 |

The previous command will be implemented. After implementation the following command, the response will be sent to indicate that the temperature data collection has finished.

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x06 |

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Stop the internal clock to stop sampling the temperature sampling.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | NRF52 MODULE | NRF52 RTC CLOCK COMMAND | NRF52 RTC SENSOR STOP | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X01 | 0X04 | 0X10 | 0 | 0 | 0 | 0 | 0 | 0XBB |

\* Only call this function once to stop all timer enabled sensor data collection.

* 1. The response characteristic should read the following after the previous command:

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x01 |

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Shutdown patch.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | NRF52 MODULE | NRF52 COMMON COMMAND | NRF52 VCC LDO DISABLE | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X01 | 0X06 | 0X07 | 0 | 0 | 0 | 0 | 0 | 0XBB |

* 1. The response characteristic should read the following after the previous command:

|  |  |  |  |
| --- | --- | --- | --- |
| 0x00 | 0x00 | 0x00 | 0x01 |