1. BLE Specifications

This document provides the different characteristics available in the EV – Battery service in a device. If a device claims conformance to this service, all capabilities indicated as mandatory for this service shall be supported.

1.1. Service Dependency

This service has no dependencies on other GATT-based services

1.2. Byte Transmission Order

All Characteristics used with this service shall be transmitted with the least significant octet first (i.e. little endian)

1.3. Service Declaration

The service UUID shall be set as per the standards. Custom services, characteristics and descriptors preferably should have 128-bit UUID.

1.4. Service Characteristics

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **EV-Battery Service- UUID** | | | | | **a377860c-0594-4377-9843-ede2281d3cbc** | | | | |
| **Characteristics Of above EV-Battery Service** | | | | | | | | | |
| **#** | **Characteristic** | **Description** | **UUID** | **Mandatory / Optional** | **Read** | **Write** | **Notify** | **Indicate** | **Remarks**  **(Size in bytes)** |
| 1 | Available Energy | Available energy in battery | b6060cf1-e288-4d85-855f-77162e8a4a47 | O | Y | X | X | X | (4) |
| 2 | BIN | Battery Identification Number | 7837a8a3-936d-4009-b666-f2e9033e4ac6 | O | Y | X | X | X | (20) |
| 3 | VIN | Vehicle Identification Number | 70d6e5bd-1289-4ff1-9eca-b20922eeb906 | O | Y | X | X | X | (17) |
| 4 | Lock-smart Mode | Lock-smart mode : Drive Mode/Charge mode | 323c818f-28f0-4c5e-8cf8-d112a52ae7e1 | M | Y | X | X | X | Lock-smart Mode (1) |
| 5 | Consumed energy | Consumed energy in w-hr | 407709de-fc3e-41d9-b926-  bbbb27cb5c10 | M | Y | X | X | X | Consumed energy (2) |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6 | Protocol Version | Protocol version | 0b9eec83-16b7-451b-9dc3-16d2a8ee7aa0 | | | M | Y | X | X | X | Protocol version (3) |
| 7 | Error Codes | Error Codes stored in battery | ef7f78b2-6835-423f-9b5c-71e340cc68cf | | | O | Y | X | X | X | (40) |
| 8 | EV- Battery statistics | Packet to read the statistics from the battery | 0cc59d16-be17-408a-bcb1-ed81ebca6f85 | | | M | Y | X | X | X | Available Energy (2)  Consumed Energy(2) BIN(20) VIN(17)(Will be all 0s if not associated with a vehicle) Smart-lock Mode(1)  Unique-id for drive from CMS (UFD)(16)  Geo-fence status (1)-Will be 1 i.e in-fence by default. Refer Section 7.1. for more details.  Discharge status (1) |
| 9 | EV-Charged Battery VIN Association | Packet to program charged battery | dfa75d76-4078-47d3-9a03-b73495c52cb2 | | | M | X | Y | X | X | Smart-lock Mode(1) VIN(17)  Unique-id For Drive (UFD)\*(16)  IsTrackingEnabled(1). True indicates the presence of tracking module in vehicle |
| 10 | Temperature | Battery temperature | 0b9eec83-16b7-451b-9dc3-16d2a8ee7aa0 | | | M | Y | X | X | X | Battery temperature in degree Centigrade(2) |
| 11 | Lock battery | Lock battery using passcode provided from server on vehicle submission (in case of leased vehicles) | | fef069ff-dc80-40b8-9760-a289db7ec23b | M | | X | Y | X | X | Passcode(4)  Discharge status-off(1) |
| 12 | Unlock battery | Unlock battery using passcode provided from server on vehicle undertaking (in case of leased vehicles) | | b5f209a1-05ff-4944-941c-29c677cb03fb | M | | X | Y | X | X | Passcode(4)  Discharge status-on(1) |

\*UFD- Unique-Id for Drive obtained from CMS

**TWO WHEELER Extended characteristics(UPDATED)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EV-Battery Service- UUID | | | a377860c-0594-4377-9843-ede2281d3cbc | | | | | | |
| Characteristics Of above EV-Battery Service | | | | | | | |  |  |
| # | Characteristic | Description | UUID | Mandatory /Optional | Read | Write | Notify | Indicate | Remarks (Size in bytes) |
| 1 | EV-Battery statistics (Two-Wheeler) | Packet to  Read the statistics from the battery | 41f26170-6c37-4c12-9d54-f9fef216d6a1 | M | Y | X | X | X | Available Energy (2) Consumed Energy (2) BIN (20) VIN (17) (Will be all 0s if not associated with a vehicle) Smart-lock Mode(1) Unique-id for drive from CMS (UFD) (16) Geo-fence status (1) - Will be 1 i.e. in-fence by default. Refer Section 7.1. for more details.    Discharge status (1)    Tyre diameter (centi-inches) (4)    Distance travelled in Km (4)    Extended Distance (4). |
| 2 | EV-Charged Battery        VIN Association (Two-Wheeler) | Packet to program charged battery | 276cc58a-8853-478b-bbf3-21363c69029b | M | X | Y | X | X | Smart-lock Mode (1) VIN (17) UFD (16) IsTrackingEnabled(1). True indicates the presence of tracking module in vehicle  Tyre diameter (centi-inches) (4)  Distance allowed in Km (4). |
| 3 | Extend range | Packet to extend the allocated range | 3035bac0-ef11-43e7-bb7b-405f4523ffa4 | M | X | Y | X | X | UFD (16)  New Distance allowed in Km (4). |

2. BLE – BMS COMMUNICATION

* When BLE gets connected with application it sends a message as “0x7B” and when disconnected it sends a message “0x7D”.
* Led within the ble module keeps on blinking when advertising and remains turned ON when connected to the application

The communication between the BLE and the BMS involves the following data transfers.

* Updating of values when the BLE module is connected to the mobile application
* When application changes the value of any characteristics /Attribute modified

2.1 UPDATING WHEN CONNECTED

When the BLE module gets connected to the mobile application, all values are updated in sequence

* Message 1 :: BLE request BMS FIRMWARE VERSION

|  |  |  |
| --- | --- | --- |
| START SEGMENT(BYTE 1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) |
| 0X7E | 0X04 | 0X03 |

* Message 2:: BMS sends BMS FIRMWARE VERSION

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | | DATA BYTE 3 | DATA BYTE 4 |
| 0X7E | 0X04 | 0X07 | 0X00 | 0X00 | | 0X00 | | 0X00 |

* Message 3: : BLE request BIN NUMBER

|  |  |  |
| --- | --- | --- |
| START SEGMENT | PACKET ID | LENGTH OF PACKET |
| 0X7E | 0X05 | 0X03 |

* Message 4: : BMS sends BIN NUMBER

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | | ……… | DATA BYTE20 |
| 0X7E | 0X05 | 0X17 | 0X00 | 0X00 | | ……… | | 0X00 |

* Message 5: : BLE request VIN NUMBER

|  |  |  |
| --- | --- | --- |
| START SEGMENT | PACKET ID | LENGTH OF PACKET |
| 0X7E | 0X03 | 0X03 |

* Message 6: : BMS sends VIN NUMBER

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | | ……… | DATA BYTE17 |
| 0X7E | 0X01 | 0X14 | 0X00 | 0X00 | | ……… | | 0X00 |

* Message 7: : BLE request SMARTLOCK

|  |  |  |
| --- | --- | --- |
| START SEGMENT | PACKET ID | LENGTH OF PACKET |
| 0X7E | 0X02 | 0X03 |

* Message 8: : BMS sends SMARTLOCK

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | |
| 0X7E | 0X02 | 0X04 | 0X00 |

* Message 9: : BLE request TEMPERATURE

|  |  |  |
| --- | --- | --- |
| START SEGMENT | PACKET ID | LENGTH OF PACKET |
| 0X7E | 0X08 | 0X03 |

* Message 10: : BMS sends TEMPERATURE

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | |
| 0X7E | 0X08 | 0X05 | 0X00 | 0X00 | |

* Message 11: : BLE request CONSUMED ENERGY

|  |  |  |
| --- | --- | --- |
| START SEGMENT | PACKET ID | LENGTH OF PACKET |
| 0X7E | 0X0C | 0X03 |

* Message 12: : BMS sends CONSUMED

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | |
| 0X7E | 0X0C | 0X05 | 0X00 | 0X00 | |

* Message 13: : BLE request ERROR CODE

|  |  |  |
| --- | --- | --- |
| START SEGMENT | PACKET ID | LENGTH OF PACKET |
| 0X7E | 0X06 | 0X03 |

* Message14: : BMS sends ERROR CODE

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | |
| 0X7E | 0X06 | 0X05 | 0X00 | 0X00 | |

* Message 13: : BLE request DISCHARGE STATISTICS

|  |  |  |
| --- | --- | --- |
| START SEGMENT | PACKET ID | LENGTH OF PACKET |
| 0X7E | 0X07 | 0X03 |

* Message14: : BMS sends DISCHARGE STATISTICS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | | ……… | DATA BYTE 60 |
| 0X7E | 0X07 | 0X3F | 0X00 | 0X00 | | ……… | | 0X00 |

**2.2 UPDATING WHEN ATRIBUTE MODIFIED**

Only the following attributes are with write enable and can be updated & When updated BLE **module sends the following message to BMS**

* **EV-Charged Battery VIN Association**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | | ……… | DATA BYTE 35 |
| 0X7E | 0X07 | 0X26 | 0X00 | 0X00 | | ……… | | 0X00 |

* Smartlock

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | |
| 0X7E | 0X02 | 0X04 | 0X00 |

* LockPass

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | | ……… | DATA BYTE5 |
| 0X7E | 0X09 | 0X08 | 0X00 | 0X00 | | ……… | | 0X00 |

* UnlockPass

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | | ……… | DATA BYTE5 |
| 0X7E | 0X0b | 0X08 | 0X00 | 0X00 | | ……… | | 0X00 |

**When all these packets are requested by BLE module the BMS always send back the DISCHARGE STATISTICS PACKET**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | | ……… | DATA BYTE 60 |
| 0X7E | 0X07 | 0X3F | 0X00 | 0X00 | | ……… | | 0X00 |

**TWO WHEELER Extended characteristics(UPDATED)**

* **EV-Charged Battery VIN Association** ( 2W)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | | ……… | DATA BYTE43 |
| 0X7E | 0X0D | 0X2E | 0X00 | 0X00 | | ……… | | 0X00 |

* Extend range

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE 2 | | ……… | | DATA BYTE 20 |
| 0X7E | 0X0E | 0X017 | 0X00 | 0x00 | | ……… | | 0x00 | |

**When these two packets are requested by BLE module the BMS always send back the BATTERY STATISTICS PACKET(2W)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | | ……… | DATA BYTE 72 |
| 0X7E | 0X0D | 0x4B | 0X00 | 0X00 | | ……… | | 0X00 |

**2.3 WHEN A CHARACTERISTICS IS READ (UPDATED)**

**When the** EV-Battery statistics (Two-Wheeler) is requested by the Mobile Application

**Request to bms from ble**

|  |  |  |
| --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) |
| 0X7E | 0X0D | 0x3 |

**Response from bms to ble**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | DATA BYTE 1 | | DATA BYTE2 | | ……… | DATA BYTE 72 |
| 0X7E | 0X0D | 0x4B | 0X00 | 0X00 | | ……… | | 0X00 |

**2.4 MAC modification**

* Accessibility to change the MAC address of the device through using the following command.

1. MAC SET COMMAND FROM BMS TO BLE

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| COMMAND BYTE 1 | COMMAND BYTE 2 | COMMAND BYTE 3 | MAC BYTE 1 | MAC BYTE 2 | MAC BYTE 3 | MAC BYTE 4 | MAC BYTE 5 | MAC BYTE 6 |
| ‘A’ | ‘T’ | ‘M’ | 0X00 | 0X00 | 0X00 | 0X00 | 0X00 | 0X00 |

Note – The Received MAC is stored in non-volatile memory.

1. RECEIVE REQUEST OF BLE MAC FROM BMS

|  |  |  |
| --- | --- | --- |
| COMMAND BYTE 1 | COMMAND BYTE 2 | COMMAND BYTE 3 |
| ‘A’ | ‘T’ | ‘B’ |

RESPONSE FROM BLE TO BMS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| START SEGMENT(BYTE1) | PACKET ID (BYTE 2) | LENGTH OF PACKET (BYTE3) | MAC BYTE 1 | MAC BYTE 2 | MAC BYTE 3 | MAC BYTE 4 | MAC BYTE 5 | MAC BYTE 6 |
| 0X7E | 0X0A | 0X09 | 0X00 | 0X00 | 0X00 | 0X00 | 0X00 | 0X00 |