

## 1. INTRODUCTION

All multi-byte values are Little-Endian unless stated otherwise.  
All reserved bits should be set to zero.

### 1.1. Revision History

| Date       | Version | Changes                        |
|------------|---------|--------------------------------|
| 18/02/2020 | 1.1     | Added Advertising PHY settings |

## 2. CONFIGURING TAGS

Tags may be configured using freely available BLE scanning apps on both Android and iOS devices, or through a customer developed application. After connecting to the device through the DM advertising format, the connection will first need to be authenticated (see [Authentication](#)). After that, parameters can be configured, which will automatically be stored in non-volatile memory. Only one connection is permitted at a time.

## 3. DM SERVICE

|              |                                      |
|--------------|--------------------------------------|
| Service UUID | 8b1c161c-bc0f-4f83-884a-5bf3ae5b5d0d |
|--------------|--------------------------------------|

### 3.1. Advertising

The transmit period is constantly randomized in the range between the max and min advertising periods. The increases tag detection when multiple tags are in the same location.

#### 3.1.1. Minimum Advertising Period

The shortest time between beacon transmissions. This value is checked against the maximum period; if the written value is above the current maximum value, it will be set to the maximum value instead. Valid range is 32 to 65535 (20 ms to 40.96 s). **Note:** if a larger value is set, it may become difficult to connect to the tag, or beacon data may be missed.

|               |                                      |
|---------------|--------------------------------------|
| UUID          | ec2ee336-7764-4a1a-92a5-bfca04efb009 |
| Size          | 2 bytes                              |
| Format        | UInt16. 1 bit = 0.625 ms             |
| Access        | R/W (authenticated)                  |
| Default Value | 1500 (937.5 ms)                      |

### 3.1.2. Maximum Advertising Period

The longest time between beacon transmissions. This value is checked against the minimum period; if the written value is below the current minimum value, it will be set to the minimum value instead. Valid range is 32 to 65535 (20 ms to 40.96 s).

|                      |                                      |
|----------------------|--------------------------------------|
| <b>UUID</b>          | 9755c9a0-0c25-4d0c-af5f-9387d69108dc |
| <b>Size</b>          | 2 bytes                              |
| <b>Format</b>        | UInt16. 1 bit = 0.625 ms             |
| <b>Access</b>        | R/W (authenticated)                  |
| <b>Default Value</b> | 1700 (1062.5 ms)                     |

### 3.1.3. Maximum Transmit Power

Set the transmit power used to transmit beacon data. Valid range is -128 to 109 (-12.8 to 19 dBm). The maximum is 8dBm unless using a high-power Guppy.

|                      |   |
|----------------------|---|
| <b>UUID</b>          | 6654e903-98e8-480c-8b9c-ab9ea93fe418  |
| <b>Size</b>          | 1 byte  |
| <b>Format</b>        | Int8.<br><pre>{   x * 0.1 dBm ,      -128 &lt;= x &lt;= 100   10 + (x-100) dBm , x &gt; 100 }</pre> |
| <b>Access</b>        | R/W (authenticated)   |
| <b>Default Value</b> | 80 (8.0 dBm)  |

### 3.1.4. Advertising PHY

Set the PHY to use for advertising. This is only available for Bluetooth 5 enabled Guppys.

|                      |   |
|----------------------|---|
| <b>UUID</b>          | 5641f840-551e-4a2c-9a3f-9c6f31a6dd81  |
| <b>Size</b>          | 1 byte  |
| <b>Format</b>        | 0: 1M Legacy Advertising<br>1: 1M BLE 5 Advertising<br>4: LE Coded "Long Range" Advertising |
| <b>Access</b>        | R/W (authenticated)   |
| <b>Default Value</b> | 0 (Legacy Advertising)  |

## 3.2. Device Data

### 3.2.1. Battery Voltage

|               |                                      |
|---------------|--------------------------------------|
| <b>UUID</b>   | 81520309-231d-4d17-994e-ec8b0b1008e9 |
| <b>Size</b>   | 1 byte                               |
| <b>Format</b> | Byte. 1 bit = 50mV                   |
| <b>Access</b> | R                                    |

### 3.2.2. Internal Temperature

Internal device temperature. Not to be used for important measurements (accurate to  $\pm 2^{\circ}\text{C}$ ).

|               |                                      |
|---------------|--------------------------------------|
| <b>UUID</b>   | 57f1a202-7c18-467f-967c-554b1dc675b3 |
| <b>Size</b>   | 1 byte                               |
| <b>Format</b> | Int8. $^{\circ}\text{C}$             |
| <b>Access</b> | R                                    |

### 3.2.3. Serial Number

Serial number which is unique across all Digital Matter devices.

|               |                                      |
|---------------|--------------------------------------|
| <b>UUID</b>   | 9b42601b-addr-492a-b0ab-02f85a9d17b9 |
| <b>Size</b>   | 4 bytes                              |
| <b>Format</b> | UInt32                               |
| <b>Access</b> | R                                    |

### 3.2.4. Hardware / Firmware Version

|               |                                      |
|---------------|--------------------------------------|
| <b>UUID</b>   | 5babe726-bf52-481c-90da-09f5bbe92e68 |
| <b>Size</b>   | 4 bytes                              |
| <b>Format</b> | Struct (see below)                   |
| <b>Access</b> | R                                    |

| Offset | Length | Name                   |
|--------|--------|------------------------|
| 0      | 1      | Product ID             |
| 1      | 1      | Hardware Version       |
| 2      | 1      | Firmware Major Version |
| 3      | 1      | Firmware Minor Version |

### 3.2.5. Power on Time

Number of seconds since device reset (battery installation).

|               |                                      |
|---------------|--------------------------------------|
| <b>UUID</b>   | 861183ca-4b9d-4e13-8acf-1a95697e7a17 |
| <b>Size</b>   | 4 bytes                              |
| <b>Format</b> | UInt32. Seconds                      |
| <b>Access</b> | R                                    |

### 3.2.6. LED Control

Can be used to identify a tag by flashing the internal LED. Write any value other than 0 to enable flashing, or a 0 to stop (will automatically stop after disconnecting, or after 30 seconds).

|             |                                      |
|-------------|--------------------------------------|
| <b>UUID</b> | e03b6d08-4e26-44a0-bb32-68319aac2f30 |
| <b>Size</b> | 1 byte                               |

|               |                   |
|---------------|-------------------|
| <b>Format</b> | Byte              |
| <b>Access</b> | W (authenticated) |

### 3.2.7. Device Name

Name used in the DM Guppy format. This will be shown when doing a Bluetooth scan on a phone/computer, etc. **Note:** this is under the “GenericAccess” service, UUID 1800. The maximum length is 10 characters (**do not null terminate**), and sending a 0 length write request will reset to the default value.

|                      |                              |
|----------------------|------------------------------|
| <b>UUID</b>          | 2A00                         |
| <b>Size</b>          | 10 bytes                     |
| <b>Format</b>        | String (not null terminated) |
| <b>Access</b>        | R/W (authenticated)          |
| <b>Default Value</b> | Device Specific              |

## 3.3. Authentication

To be able to write any value to the device, authentication must first be done. This is handled through writing to the pin entry characteristic. By default, this is 4x ascii character ‘0’ (0x30), but can be later changed to any 4 byte values (must be 4 bytes).

### 3.3.1. Pin Entry

When read, returns {0xFF, 0xFF, 0xFF, 0xFF} when unauthenticated, or {0,0,0,0} when authenticated.

|               |                                      |
|---------------|--------------------------------------|
| <b>UUID</b>   | 53771dfc-a724-4a15-af98-142428ed68d6 |
| <b>Size</b>   | 4 bytes                              |
| <b>Format</b> | Byte Array                           |
| <b>Access</b> | R/W                                  |

### 3.3.2. Pin Change

When read, returns the current pin (only after authentication). **Care must be taken when changing a pin code, as there is no way to reset it.**

|               |                                      |
|---------------|--------------------------------------|
| <b>UUID</b>   | ca74066c-858b-4570-9ebe-554b14515d7a |
| <b>Size</b>   | 4 bytes                              |
| <b>Format</b> | Byte array                           |
| <b>Access</b> | R (authenticated) /W (authenticated) |

## 4. APPLE IBEACON SERVICE

|              |                                      |
|--------------|--------------------------------------|
| Service UUID | e78d6874-33f5-4529-8789-e377f2e8f16b |
|--------------|--------------------------------------|

### 4.1. Advertising

#### 4.1.1. Enable

Enable or disable iBeacon transmissions. **Note:** please set up UUID/Major ID/Minor ID before enabling this.

|               |                                      |
|---------------|--------------------------------------|
| UUID          | b80e6ae7-5703-46c7-8902-7f2ae0b4bc1b |
| Size          | 1 byte                               |
| Format        | Boolean (0 = disable, 1 = enabled)   |
| Access        | R/W (authenticated)                  |
| Default Value | 0 (disabled)                         |

#### 4.1.2. Minimum Advertising Period

See [Minimum Advertising Period](#). Applies to iBeacon transmissions only.

|               |                                      |
|---------------|--------------------------------------|
| UUID          | 958baff3-6c2f-487d-98c0-5df566a487f8 |
| Size          | 2 bytes                              |
| Format        | UInt16. 1 bit = 0.625 ms             |
| Access        | R/W (authenticated)                  |
| Default Value | 1500 (937.5 ms)                      |

#### 4.1.1. Maximum Advertising Period

See [Maximum Advertising Period](#). Applies to iBeacon transmissions only.

|               |                                      |
|---------------|--------------------------------------|
| UUID          | 3280020a-2f7d-404c-b439-7ec7e99039b0 |
| Size          | 2 bytes                              |
| Format        | UInt16. 1 bit = 0.625 ms             |
| Access        | R/W (authenticated)                  |
| Default Value | 1700 (1062.5 ms)                     |

#### 4.1.2. TX Power

See [Maximum Transmit Power](#). Applies to iBeacon transmissions only. **Note:** [Calibrated Power](#) must be updated if this value is changed, otherwise distance estimates will be invalid.

|        |  |
|--------|--|
| UUID   | b0e7b41c-981d-430f-9fd5-9d4069146c87   |
| Size   | 1 byte   |
| Format | {<br>$x * 0.1 \text{ dBm}, \quad -128 \leq x \leq 100$<br>$10 + (x - 100) \text{ dBm}, \quad x > 100$<br>} |

|                      |                     |
|----------------------|---------------------|
| <b>Access</b>        | R/W (authenticated) |
| <b>Default Value</b> | 80 (8.0 dBm)        |

### 4.1.3. Advertising PHY

Set the PHY to use for advertising. This is only available for Bluetooth 5 enabled Guppys.

|                      |   |
|----------------------|---|
| <b>UUID</b>          | 7926ba8c-d076-4300-9426-5f9d8e8fdcbc  |
| <b>Size</b>          | 1 byte  |
| <b>Format</b>        | 0: 1M Legacy Advertising<br>1: 1M BLE 5 Advertising<br>4: LE Coded "Long Range" Advertising |
| <b>Access</b>        | R/W (authenticated)   |
| <b>Default Value</b> | 0 (Legacy Advertising)  |

## 4.2. Beacon Data

### 4.2.1. iBeacon UUID

|                      |                                      |
|----------------------|--------------------------------------|
| <b>UUID</b>          | c033b76e-6565-4bde-bb63-42d8eb50d96d |
| <b>Size</b>          | 16 bytes                             |
| <b>Format</b>        | 16 byte UUID                         |
| <b>Access</b>        | R/W (authenticated)                  |
| <b>Default Value</b> | 0000000000000000                     |

### 4.2.2. Major ID

|                      |                                      |
|----------------------|--------------------------------------|
| <b>UUID</b>          | 5ad6c1c2-88c0-4da0-8ef9-c511c0d6ad45 |
| <b>Size</b>          | 2 bytes                              |
| <b>Format</b>        | UInt16                               |
| <b>Access</b>        | R/W (authenticated)                  |
| <b>Default Value</b> | 0                                    |

### 4.2.3. Minor ID

|                      |                                      |
|----------------------|--------------------------------------|
| <b>UUID</b>          | 98337b29-f9a1-4f79-b09e-b5042d1fce6c |
| <b>Size</b>          | 2 bytes                              |
| <b>Format</b>        | UInt16                               |
| <b>Access</b>        | R/W (authenticated)                  |
| <b>Default Value</b> | 0                                    |

#### 4.2.4. Calibrated Power

Calibrated RSSI at 1m. This should be updated if [TX Power](#) is changed from the default value.

|                      |                                      |
|----------------------|--------------------------------------|
| <b>UUID</b>          | 38932bfc-8f16-48a5-bdac-5b286b8eef14 |
| <b>Size</b>          | 1 byte                               |
| <b>Format</b>        | Int8. dBm                            |
| <b>Access</b>        | R/W (authenticated)                  |
| <b>Default Value</b> | -65 (dBm)                            |