User's Manual

# Bluetooth® Low Energy Protocol Stack

## API Reference Manual: FMP

Renesas MCU

Target Device

RL78/G1D



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## General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Handling of Unused Pins

   Handle unused pins in accordance with the directions given under Handling of Unused Pins in the manual.

   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment when power is supplied.

   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

   — When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

   — The characteristics of an MPU or MCU in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

# How to Use This Manual

## 1. Purpose and Target Readers

This manual describes the API (Application Program Interface) of the Find Me profile (FMP) of the Bluetooth Low Energy protocol stack (BLE software), which is used to develop Bluetooth applications that incorporate the Renesas Bluetooth low energy microcontroller RL78/G1D. It is intended for users designing application systems incorporating this software. A basic knowledge of microcontrollers and Bluetooth low energy is necessary in order to use this manual.

**Related documents**

The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

| Document Name | Document No. |
|---|---|
| Bluetooth Low Energy Protocol Stack | |
| User's Manual | R01UW0095E |
| API Reference Manual: Basics | R01UW0088E |
| API Reference Manual: FMP | This manual |
| API Reference Manual: PXP | R01UW0090E |
| API Reference Manual: HTP | R01UW0091E |
| API Reference Manual: BLP | R01UW0092E |
| API Reference Manual: HOGP | R01UW0093E |
| API Reference Manual: ScPP | R01UW0094E |
| API Reference Manual: HRP | R01UW0097E |
| API Reference Manual: CSCP | R01UW0098E |
| API Reference Manual: CPP | R01UW0099E |
| API Reference Manual: GLP | R01UW0103E |
| API Reference Manual: TIP | R01UW0106E |
| API Reference Manual: RSCP | R01UW0107E |
| API Reference Manual: ANP | R01UW0108E |
| API Reference Manual: PASP | R01UW0109E |
| API Reference Manual: LNP | R01UW0113E |
| Application Note: Sample Program | R01AN1375E |
| Application Note: rBLE Command Specification | R01AN1376E |

List of Abbreviations and Acronyms

| Abbreviation | Full Form | Remark |
|---|---|---|
| ANP | Alert Notification Profile | |
| ANS | Alert Notification Service | |
| API | Application Programming Interface | |
| ATT | Attribute Protocol | |
| BAS | Battery Service | |
| BB | Base Band | |
| BD_ADDR | Bluetooth Device Address | |
| BLE | Bluetooth low energy | |
| BLP | Blood Pressure Profile | |
| BLS | Blood Pressure Service | |
| CPP | Cycling Power Profile | |
| CPS | Cycling Power Service | |
| CSCP | Cycling Speed and Cadence Profile | |
| CSCS | Cycling Speed and Cadence Service | |
| CSRK | Connection Signature Resolving Key | |
| CTS | Current Time Service | |
| DIS | Device Information Service | |
| EDIV | Encrypted Diversifier | |
| FMP | Find Me Profile | |
| GAP | Generic Access Profile | |
| GATT | Generic Attribute Profile | |
| GLP | Glucose Profile | |
| GLS | Glucose Service | |
| HCI | Host Controller Interface | |
| HID | Human Interface Device | |
| HIDS | HID Service | |
| HOGP | HID over GATT Profile | |
| HRP | Heart Rate Profile | |
| HRS | Heart Rate Service | |
| HTP | Health Thermometer Profile | |
| HTS | Health Thermometer Service | |
| IAS | Immediate Alert Service | |
| IRK | Identity Resolving Key | |
| L2CAP | Logical Link Control and Adaptation Protocol | |
| LE | Low Energy | |

| Abbreviation | Full Form | Remark |
|---|---|---|
| LL | Link Layer | |
| LLS | Link Loss Service | |
| LNP | Location and Navigation Profile | |
| LNS | Location and Navigation Service | |
| LTK | Long Term Key | |
| MCU | Micro Controller Unit | |
| MITM | Man-in-the-middle | |
| MTU | Maximum Transmission Unit | |
| NDCS | Next DST Change Service | |
| OOB | Out of Band | |
| OS | Operating System | |
| PASP | Phone Alert Status Profile | |
| PASS | Phone Alert Status Service | |
| PXP | Proximity Profile | |
| RF | Radio Frequency | |
| RSCP | Running Speed and Cadence Profile | |
| RSCS | Running Speed and Cadence Service | |
| RSSI | Received Signal Strength Indication | |
| RTUS | Reference Time Update Service | |
| ScPP | Scan Parameters Profile | |
| ScPS | Scan Parameters Service | |
| SM | Security Manager | |
| SMP | Security Manager Protocol | |
| STK | Short Term Key | |
| TIP | Time Profile | |
| TK | Temporary Key | |
| TPS | Tx Power Service | |
| UART | Universal Asynchronous Receiver Transmitter | |
| UUID | Universal Unique Identifier | |

| Abbreviation | Full Form | Remark |
|---|---|---|
| APP | Application | |
| CSI | Clocked Serial Interface | |
| IIC | Inter-Integrated Circuit | |
| RSCIP | Renesas Serial Communication Interface Protocol | |
| VS | Vendor Specific | |

# Contents

# 1. Overview

This manual describes the API (Application Program Interface) of the Find Me profile (FMP) of the Bluetooth Low Energy protocol stack (BLE software), which is used to develop Bluetooth applications that incorporate Renesas Bluetooth low energy microcontroller RL78/G1D.

For details about the organization and features of BLE software, see the Bluetooth Low Energy Protocol Stack User's Manual.

# 2. Common Definitions

This section describes the definitions common to the API of each profile.

## 2.1 Service Definitions

This section describes the common definitions of services used by the API of multiple profiles.

- Declaration of enumerated type for alert level

```
enum RBLE_SVC_ALT_LVL_enum {
   RBLE_SVC_ALERT_NONE = 0x00,            No alert
   RBLE_SVC_ALERT_MILD,                   Mild alert
   RBLE_SVC_ALERT_HIGH                    High alert
};
```

- Declaration of enumerated type for PnP ID characteristic vendor ID field

```
enum RBLE_SVC_PNP_VENDOR_ID_enum {
   RBLE_SVC_SIG_ASSIGNED_ID = 0x01,       Vendor ID assigned by Bluetooth SIG
   RBLE_SVC_USB_ASSIGNED_ID               Vendor ID assigned by USB Implementer's
                                          Forum
};
```

- Declaration of enumerated type for Name Space field of Characteristic Presentation Format descriptor

```
enum RBLE_SVC_PRESEN_NAMESPASE_enum {
   RBLE_SVC_NAMESPACE_SIG = 0x01,         Defined by Bluetooth SIG
};
```

- Declaration of enumerated type for security level of Service

```
enum RBLE_SVC_SEC_LVL_enum {
   RBLE_SVC_SEC_NONE = 0x01,              No security
   RBLE_SVC_SEC_UNAUTH = 0x02,            Require unauthenticated pairing
   RBLE_SVC_SEC_AUTH = 0x04,              Require authenticated pairing
   RBLE_SVC_SEC_AUTZ = 0x08,              Require authorization
   RBLE_SVC_SEC_ENC = 0x10                Require encryption
};
```

- Declaration of enumerated type for connection types

```
enum RBLE_PRF_CON_enum {
    RBLE_PRF_CON_DISCOVERY = 0x00,        Configuration connection performed
                                          when connecting for the first time
    RBLE_PRF_CON_NORMAL                   Normal connection performed when
                                          connecting for the second and
                                          subsequent times
};
```

- Declaration of enumerated type for client configuration characteristic value

```
enum RBLE_PRF_CLIENT_CONFIG_enum {
    RBLE_PRF_STOP_NTFIND = 0x00,            Stop notification or indication of
                                            characteristic value.
    RBLE_PRF_START_NTF,                     Start notification of
                                            characteristic value.
    RBLE_PRF_START_IND                      Start indication of
                                            characteristic value.
};
```

- Declaration of enumerated type for server configuration characteristic value

```
enum RBLE_PRF_SERVER_CONFIG_enum {
    RBLE_PRF_STOP_BRD = 0x00,               Stop broadcast of characteristic value.
    RBLE_PRF_START_BRD                      Start broadcast of characteristic value.
};
```

## 2.2 Status Definitions

This section describes the status definitions used by the API of each profile.

- Declaration of enumerated type for rBLE status

```
enum RBLE_STATUS_enum {
    RBLE_OK = 0x00,                          Normal operation
    RBLE_PRF_ERR_INVALID_PARAM = 0x90,       Invalid parameter specified for
                                             setting or acquiring a characteristic
                                             value
    RBLE_PRF_ERR_INEXISTENT_HDL,             Invalid handle specified for setting
                                             or acquiring a characteristic value
    RBLE_PRF_ERR_STOP_DISC_CHAR_MISSING,     The characteristic value is missing.
    RBLE_PRF_ERR_MULTIPLE_IAS,               Multiple IASs exist.
    RBLE_PRF_ERR_INCORRECT_PROP,             Incorrect property
    RBLE_PRF_ERR_MULTIPLE_CHAR,              Multiple characteristic values exist.
    RBLE_PRF_ERR_NOT_WRITABLE,               Writing is not permitted.
    RBLE_PRF_ERR_NOT_READABLE,               Reading is not permitted.
    RBLE_PRF_ERR_REQ_DISALLOWED,             Requesting is not permitted.
    RBLE_PRF_ERR_NTF_DISABLED,               Notification is disabled.
    RBLE_PRF_ERR_IND_DISABLED,               Indication is disabled.
    RBLE_PRF_ERR_ATT_NOT_SUPPORTED,          The characteristic value is not
                                             supported.
};
```

Note: Statuses other than the above are described in *API Reference Manual: Basics*.

# 3. Find Me Profile

This section describes the API of the Find Me profile. The Find Me profile allows a host to find a peer device within a specified communication range, by using means such as alerts.

## 3.1 Definitions

This section describes the definitions used by the API of the Find Me profile.

- Declaration of enumerated type for FMP event types

```
enum RBLE_FMP_EVENT_TYPE_enum {
   RBLE_FMP_EVENT_TARGET_ENABLE_COMP = 0x01,          Target enable completion event
                                                      (Parameter: target_enable)
   RBLE_FMP_EVENT_TARGET_DISABLE_COMP,                Target disable completion event
                                                      (Parameter: target_disable)
   RBLE_FMP_EVENT_TARGET_ALERT_IND,                   Target alert indication event
                                                      (Parameter: target_alert_ind)
   RBLE_FMP_EVENT_TARGET_COMMAND_DISALLOWED_IND,      Target command disallowed
                                                      indication event
                                                      (Parameter: cmd_disallowed_ind)
   RBLE_FMP_EVENT_LOCATOR_ENABLE_COMP = 0x81,         Locator enable completion event
                                                      (Parameter: locator_enable)
   RBLE_FMP_EVENT_LOCATOR_DISABLE_COMP,               Locator disable completion
                                                      event
                                                      (Parameter: locator_disable)
   RBLE_FMP_EVENT_LOCATOR_ERROR_IND,                  Locator error indication event
                                                      (Parameter: locator_error_ind)
   RBLE_FMP_EVENT_LOCATOR_COMMAND_DISALLOWED_IND      Locator command disallowed
                                                      indication event
                                                      (Parameter: cmd_disallowed_ind)
};
```

- Declaration of data type for FMP event types

```
typedef uint8_t RBLE_FMP_EVENT_TYPE;
```

- Declaration of data type for FMP Target event callback function

```
typedef void ( *RBLE_FMPT_EVENT_HANDLER )( RBLE_FMPT_EVENT *event );
```

- Declaration of data type for FMP Locator event callback function

```
typedef void ( *RBLE_FMPL_EVENT_HANDLER )( RBLE_FMPL_EVENT *event );
```

- Immediate alert service content structures

```
typedef struct RBLE_FMP_IAS_CONTENT_t {
    uint16_t     shdl;                                 IAS start handle
    uint16_t     ehdl;                                 IAS end handle
    uint16_t     alert_char_hdl;                       Alert level characteristic
                                                       handle
```

```
    uint16_t     alert_val_hdl;                    Alert level characteristic
                                                   value handle
    uint8_t      alert_char_prop;                  Alert level characteristic
                                                   property
    uint8_t      reserved;                         Reserved
}RBLE_FMP_IAS_CONTENT;
```

- FMP Target event parameter structures

```
typedef struct RBLE_FMPT_EVENT_t {
    RBLE_FMP_EVENT_TYPE      type;                 FMP event type
    uint8_t                  reserved;             Reserved
    union Event_Fmt_Parameter_u {
        Target enable completion event
        struct RBLE_FMP_Target_Enable_t{
            RBLE_STATUS      status;               Status
            uint8_t          reserved;             Reserved
            uint16_t         conhdl;               Connection handle
        }target_enable;

        Target disable completion event
        struct RBLE_FMP_Target_Disable_t{
            RBLE_STATUS      status;               Status
            uint8_t          reserved;             Reserved
            uint16_t         conhdl;               Connection handle
        }target_disable;

        Target alert indication event
        struct RBLE_FMP_Target_Alert_Ind_t{
            uint16_t         conhdl;               Connection handle
            uint8_t          alert_lvl;            Alert level
            uint8_t          reserved;             Reserved
        }target_alert_ind;

        Target command disallowed indication event
        struct RBLE_FMP_Target_Command_Disallowed_Ind_t{
            RBLE_STATUS      status;               Status
            uint8_t          reserved;             Reserved
            uint16_t         opcode;               Opcode
        }cmd_disallowed_ind;
    } param;
} RBLE_FMPT_EVENT;
```

- FMP Locator event parameter structures

```
typedef struct RBLE_FMPL_EVENT_t {
    RBLE_FMP_EVENT_TYPE      type;                  FMP event type
    uint8_t                  reserved;              Reserved
    union Event_Fml_Parameter_u {
        Generic event
        RBLE_STATUS          status;                Status

        Locator enable completion event
        struct RBLE_FMP_Locator_Enable_t{
            RBLE_STATUS              status;        Status
            uint8_t                  reserved;      Reserved
            uint16_t                 conhdl;        Connection handle
            RBLE_FMP_IAS_CONTENT     ias;           Immediate alert service
                                                    information
        }locator_enable;

        Locator disable completion event
        struct RBLE_FMP_Locator_Disable_t{
            RBLE_STATUS      status;                Status
            uint8_t          reserved;              Reserved
            uint16_t         conhdl;                Connection handle
        }locator_disable;

        Locator error indication event
        struct RBLE_FMP_Locator_Error_Ind_t{
            RBLE_STATUS      status;                Status
            uint8_t          reserved;              Reserved
            uint16_t         conhdl;                Connection handle
        }locator_error_ind;

        Locator command disallowed indication event
        struct RBLE_FMP_Locator_Command_Disallowed_Ind_t{
            RBLE_STATUS      status;                Status
            uint8_t          reserved;              Reserved
            uint16_t         opcode;                Opcode
        }cmd_disallowed_ind;
    } param;
} RBLE_FMPL_EVENT;
```

## 3.2 Functions

The following table shows the API functions defined for the FMP of rBLE and the following sections describe the API functions in detail.

Table 3-1 API Functions Used by the FMP

| | |
|---|---|
| RBLE_FMP_Target_Enable | Enables the Find Me Target role. |
| RBLE_FMP_Target_Disable | Disables the Find Me Target role. |
| RBLE_FMP_Locator_Enable | Enables the Find Me Locator role. |
| RBLE_FMP_Locator_Disable | Disables the Find Me Locator role. |
| RBLE_FMP_Locator_Set_Alert | Specifies the alert level value. |

### 3.2.1 RBLE_FMP_Target_Enable

| RBLE_STATUS RBLE_FMP_Target_Enable(uint16_t conhdl, uint8_t sec_lvl, RBLE_FMPT_EVENT_HANDLER call_back) | | |
|---|---|---|
| This function enables the Find Me Target role.<br>The result is reported by using the Target role enable completion event RBLE_FMP_EVENT_TARGET_ENABLE_COMP. | | |
| Parameters: | | |
| | *conhdl* | Connection handle |
| | *sec_lvl* | Security level |
| | *call_back* | Specify the callback function that reports the FMP event. |
| Return: | | |
| | *RBLE_OK* | Success |
| | *RBLE_ERR* | Failed to allocate the area for the callback function. |
| | *RBLE_PARAM_ERR* | Invalid parameter |
| | *RBLE_STATUS_ERROR* | Not executable because the rBLE mode is other than RBLE_MODE_ACTIVE. |

### 3.2.2 RBLE_FMP_Target_Disable

| RBLE_STATUS RBLE_FMP_Target_Disable(uint16_t conhdl) | | |
|---|---|---|
| This function disables the Find Me Target role.<br>The result is reported by using the Target role disable completion event RBLE_FMP_EVENT_TARGET_DISABLE_COMP. | | |
| Parameters: | | |
| | *conhdl* | Connection handle |
| Return: | | |
| | *RBLE_OK* | Success |
| | *RBLE_STATUS_ERROR* | Not executable because the rBLE mode is other than RBLE_MODE_ACTIVE. |

### 3.2.3 RBLE_FMP_Locator_Enable

RBLE_STATUS RBLE_FMP_Locator_Enable(uint16_t conhdl, uint8_t con_type,
RBLE_FMP_IAS_CONTENT *ias, RBLE_FMPL_EVENT_HANDLER call_back)

This function enables the Find Me Locator role and starts access to the services exposed by the Find Me Target.
The result is reported by using the Locator role enable completion event RBLE_FMP_EVENT_LOCATOR_ENABLE_COMP.
When starting access to the service exposed by a Find Me Target to be connected for the first time, set 0 to the parameter of the service to configure the connection and to discover the service for the Target. If the handle information about the discovered service is saved and is used when the Target is connected normally for a second or subsequent time, detecting the service is skipped, which enables a high-speed access to the service.
While the Locator role is enabled, the service exposed by only one Find Me Target is accessible. To connect to more than one Target at the same time and access the services exposed by each Target, repeat enable/disable of the Find Me Locator role in order to switch access to them. At that time, perform normal connection by using the connection handle (which was obtained when connecting to each Target) and the handle information (which was saved when starting access to the service for the first time) as parameters.

Parameters:

| | | | |
|---|---|---|---|
| *conhdl* | Connection handle | | |
| *con_type* | RBLE_PRF_CON_DISCOVERY | | Configuration connection performed when connecting for the first time |
| | RBLE_PRF_CON_NORMAL | | Normal connection performed when connecting for the second and subsequent times |
| *ias | shdl | | Immediate alert service start handle |
| | ehdl | | Immediate alert service end handle |
| | alert_char_hdl | | Alert level characteristic handle |
| | alert_val_hdl | | Alert level characteristic value handle |
| | alert_char_prop | | Alert level characteristic property |
| *call_back* | Specify the callback function that reports completion of enabling the Locator role. | | |

Return:

| | |
|---|---|
| *RBLE_OK* | Success |
| *RBLE_ERR* | Error occurred |
| *RBLE_PARAM_ERR* | Invalid parameter |
| *RBLE_STATUS_ERROR* | Not executable because the rBLE mode is other than RBLE_MODE_ACTIVE. |

### 3.2.4 RBLE_FMP_Locator_Disable

RBLE_STATUS RBLE_FMP_Locator_Disable(uint16_t conhdl)

This function disables the Find Me Locator role and terminates access to the service exposed by the Find Me Target.
The result is reported by using the Locator role disable completion event RBLE_FMP_EVENT_LOCATOR_DISABLE_COMP.

Parameters:

| | |
|---|---|
| *conhdl* | Connection handle |

Return:

| | |
|---|---|
| *RBLE_OK* | Success |
| *RBLE_STATUS_ERROR* | Not executable because the rBLE mode is other than RBLE_MODE_ACTIVE. |

### 3.2.5 RBLE_FMP_Locator_Set_Alert

| RBLE_STATUS RBLE_FMP_Locator_Set_Alert(uint16_t conhdl, uint8_t alert_lvl) | | |
|---|---|---|
| This function specifies the alert level indicated by the immediate alert service. | | |
| Parameters: | | |
| *conhdl* | Connection handle | |
| *alert_lvl* | RBLE_SVC_ALERT_NONE | No alert |
| | RBLE_SVC_ALERT_MILD | Mild alert |
| | RBLE_SVC_ALERT_HIGH | High alert |
| Return: | | |
| *RBLE_OK* | Success | |
| *RBLE_STATUS_ERROR* | Not executable because the rBLE mode is other than RBLE_MODE_ACTIVE. | |

## 3.3 Events

The following table shows the events defined for the FMP of rBLE and the following sections describe the events in detail.

Table 3-2 Events Defined for the FMP

| | |
|---|---|
| RBLE_FMP_EVENT_TARGET_ENABLE_COMP | Target role enable completion event |
| RBLE_FMP_EVENT_TARGET_DISABLE_COMP | Target role disable completion event |
| RBLE_FMP_EVENT_TARGET_ALERT_IND | Target alert indication event |
| RBLE_FMP_EVENT_TARGET_COMMAND_DISALLOWED_IND | Target role command disallowed indication event |
| RBLE_FMP_EVENT_LOCATOR_ENABLE_COMP | Locator role enable completion event |
| RBLE_FMP_EVENT_LOCATOR_DISABLE_COMP | Locator role disable completion event |
| RBLE_FMP_EVENT_LOCATOR_ERROR_IND | Locator role error indication event |
| RBLE_FMP_EVENT_LOCATOR_COMMAND_DISALLOWED_IND | Locator role command disallowed indication event |

### 3.3.1 RBLE_FMP_EVENT_TARGET_ENABLE_COMP

| RBLE_FMP_EVENT_TARGET_ENABLE_COMP | | |
|---|---|---|
| This event reports the result of enabling the Target role (RBLE_FMP_Target_ Enable). | | |
| Parameters: | | |
| *status* | Result of enabling the Target role<br>(See *2.2* and *Bluetooth Low Energy Protocol Stack API Reference Manual: Basics*, *3.2, Declaration of enumerated type for rBLE status*.) | |
| *conhdl* | Connection handle | |

### 3.3.2 RBLE_FMP_EVENT_TARGET_DISABLE_COMP

| RBLE_FMP_EVENT_TARGET_DISABLE_COMP | | |
|---|---|---|
| This event reports the result of disabling the Target role (RBLE_FMP_Target_ Disable). | | |
| Parameters: | | |
| *status* | Result of disabling the Target role<br>(See *2.2* and *Bluetooth Low Energy Protocol Stack API Reference Manual: Basics*, *3.2, Declaration of enumerated type for rBLE status*.) | |
| *conhdl* | Connection handle | |

### 3.3.3 RBLE_FMP_EVENT_TARGET_ALERT_IND

| RBLE_FMP_EVENT_TARGET_ALERT_IND | | |
|---|---|---|
| This event indicates the alert level value received from the immediate alert service sent from the Locator. | | |
| Parameters: | | |
| *conhdl* | Connection handle | |
| *alert_lvl* | RBLE_SVC_ALERT_NONE | No alert |
| | RBLE_SVC_ALERT_MILD | Mild alert |
| | RBLE_SVC_ALERT_HIGH | High alert |

### 3.3.4 RBLE_FMP_EVENT_TARGET_COMMAND_DISALLOWED_IND

| RBLE_FMP_EVENT_TARGET_COMMAND_DISALLOWED_IND | | |
|---|---|---|
| This event indicates the error that occurs when a command executed by the Target role cannot be accepted. | | |
| Parameters: | | |
| *status* | Result of command execution<br>(See *2.2* and *Bluetooth Low Energy Protocol Stack API Reference Manual: Basics*, *3.2, Declaration of enumerated type for rBLE status*.) | |
| *opcode* | RBLE_CMD_FMP_TARGET_ENABLE | Target role enable command |
| | RBLE_CMD_FMP_TARGET_DISABLE | Target role disable command |

### 3.3.5 RBLE_FMP_EVENT_LOCATOR_ENABLE_COMP

| RBLE_FMP_EVENT_LOCATOR_ENABLE_COMP | | | |
|---|---|---|---|
| This event reports the result of enabling the Locator role (RBLE_FMP_Locator_Enable).<br>Save the obtained handle information about the discovered service, to enable a high-speed access to the service without service detection when restarting access to the service. | | | |
| Parameters: | | | |
| | *status* | Result of enabling the Locator role<br>(See *2.2* and *Bluetooth Low Energy Protocol Stack API Reference Manual: Basics*, *3.2, Declaration of enumerated type for rBLE status*.) | |
| | *conhdl* | Connection handle | |
| | *ias* | *shdl* | Immediate alert service start handle |
| | | *ehdl* | Immediate alert service end handle |
| | | *alert_char_hdl* | Alert level characteristic handle |
| | | *alert_val_hdl* | Alert level characteristic value handle |
| | | *alert_char_prop* | Alert level characteristic property |

### 3.3.6 RBLE_FMP_EVENT_LOCATOR_DISABLE_COMP

| RBLE_FMP_EVENT_LOCATOR_DISABLE_COMP | | |
|---|---|---|
| This event reports the result of disabling the Locator role (RBLE_FMP_Locator_Disable). | | |
| Parameters: | | |
| | *status* | Result of disabling the Locator role<br>(See *2.2* and *Bluetooth Low Energy Protocol Stack API Reference Manual: Basics*, *3.2, Declaration of enumerated type for rBLE status*.) |
| | *conhdl* | Connection handle |

### 3.3.7 RBLE_FMP_EVENT_LOCATOR_ERROR_IND

| RBLE_FMP_EVENT_LOCATOR_ERROR_IND | | |
|---|---|---|
| This event indicates an error code unique to the Locator role. | | |
| Parameters: | | |
| | *status* | Error code<br>(See *2.2* and *Bluetooth Low Energy Protocol Stack API Reference Manual: Basics*, *3.2, Declaration of enumerated type for rBLE status*.) |
| | *conhdl* | Connection handle |

### 3.3.8 RBLE_FMP_EVENT_LOCATOR_COMMAND_DISALLOWED_IND

| RBLE_FMP_EVENT_LOCATOR_COMMAND_DISALLOWED_IND | | | |
|---|---|---|---|
| This event indicates the error that occurs when a command executed by the Locator role cannot be accepted. | | | |
| Parameters: | | | |
| | *status* | Result of command execution<br>(See *2.2* and *Bluetooth Low Energy Protocol Stack API Reference Manual: Basics*, *3.2, Declaration of enumerated type for rBLE status*.) | |
| | *opcode* | RBLE_CMD_FMP_LOCATOR_ENABLE | Target role enable command |
| | | RBLE_CMD_FMP_LOCATOR_DISABLE | Target role disable command |
| | | RBLE_CMD_FMP_LOCATOR_SET_ALERT | Alert setup command |

## 3.4 Message Sequence Chart

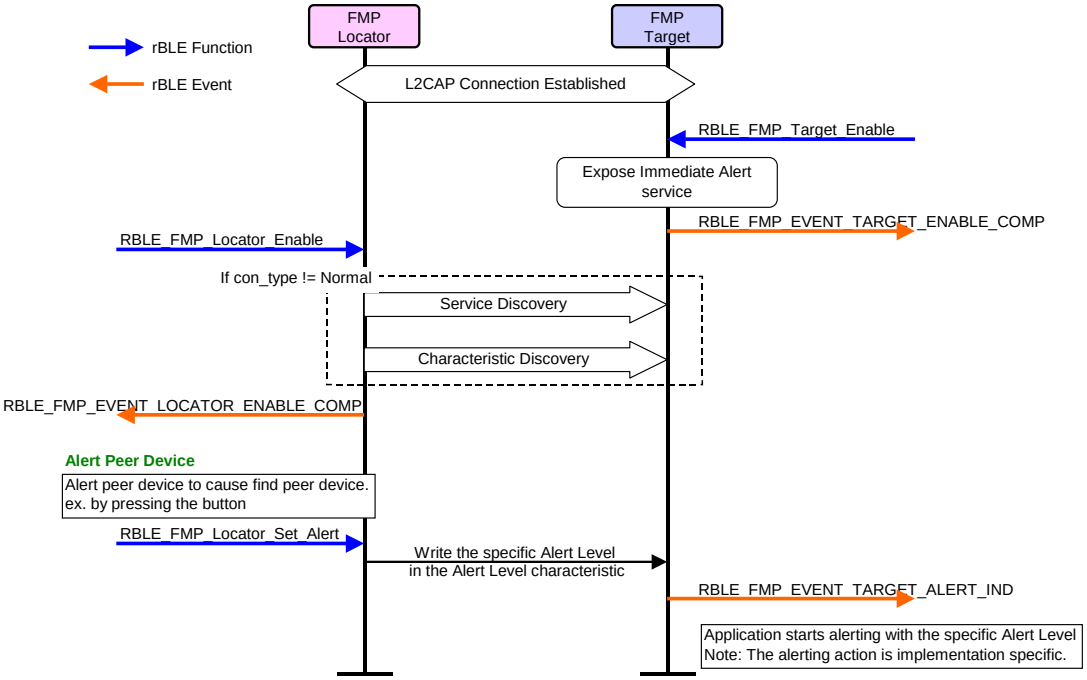


Figure 3-1 Example of Use Case in which FMP Is Implemented by Using rBLE API

# 4. Notes

# Appendix A How to Read Definition Tables

This section shows how to read the tables that describes the rBLE API functions and events shown in this document.

## A.1 How to Read Function Definition Tables

The following contents are included in the function definition tables:

The Parameters area describes the parameters specified for the function.
The italicized character strings on the left are the parameters of the function.
The meaning of each parameter is described on the far right following the variables.

The italicized character string(s) next to each parameter indicate the member(s) of the parameter (structure).

The values that can be specified for the parameter might be described between the parameter name and its description.

<table>
<tr><td colspan="5">The function definition is shown at the top of the table in the row with the light green background. This area shows the function prototype.</td></tr>
<tr><td colspan="5">The operation of the function and the event reported after executing the function are described in this area.</td></tr>
<tr><td colspan="5">Parameters:</td></tr>
<tr><td></td><td>Parameter 1</td><td colspan="3">Description of parameter 1</td></tr>
<tr><td></td><td rowspan="3">Parameter 2</td><td rowspan="2">Member 1</td><td>Value 1 that can be specified for member 1</td><td>Description of value 1 that can be specified for member 1</td></tr>
<tr><td>Value 1 that can be specified for member 2</td><td>Description of value 1 that can be specified for member 2</td></tr>
<tr><td>Member 2</td><td colspan="2">Description of member 2</td></tr>
<tr><td colspan="5">Return:</td></tr>
<tr><td></td><td colspan="2">Value 1 that might be returned</td><td colspan="2">Description of value 1 that might be returned</td></tr>
<tr><td></td><td colspan="2">Value 2 that might be returned</td><td colspan="2">Description of value 2 that might be returned</td></tr>
</table>

The Return area describes the values returned for the function.
The leftmost row shows the value that might be returned, and the next row describes the return value.

## A.2 How to Read Event Definition Tables

The following contents are included in the event definition tables:

The Parameters area describes the parameters specified for the event.
The italicized character strings on the left show the parameters of the event parameter structure. The meaning of each parameter is described on the far right.

The italicized character string(s) next to each parameter indicate the member(s) of the parameter (structure).

| The event definition is shown at the top of the table in the row with the orange background. This area shows the event type. | | | |
|---|---|---|---|
| The information reported by the event is described in this area. | | | |
| Parameters: | | | |
| | *Parameter 1* | Description of parameter 1 | |
| | *Parameter 2* | *Member 1* | Description of member 1 |
| | | *Member 2* | Description of member 2 |
| | | *Member 3* | Description of member 3 |
| | *Parameter 3* | Value 1 that can be specified for parameter 3 | Description of value 1 that can be specified for parameter 3 |
| | | Value 2 that can be specified for parameter 3 | Description of value 2 that can be specified for parameter 3 |

The values that can be specified for the parameter might be shown between the parameter name and its description.

# Appendix B Referenced Documents


1. Bluetooth Core Specification v4.0, Bluetooth SIG
2. Find Me Profile Specification v1.0, Bluetooth SIG
3. Immediate Alert Service Specification v1.0, Bluetooth SIG
4. Proximity Profile Specification v1.0, Bluetooth SIG
5. Link Loss Service Specification v1.0, Bluetooth SIG
6. Tx Power Service Specification v1.0, Bluetooth SIG
7. Health Thermometer Profile Specification v1.0, Bluetooth SIG
8. Health Thermometer Service Specification v1.0, Bluetooth SIG
9. Device Information Service Specification v1.1, Bluetooth SIG
10. Blood Pressure Profile Specification v1.0, Bluetooth SIG
11. Blood Pressure Service Specification v1.0, Bluetooth SIG
12. HID over GATT Profile Specification v1.0, Bluetooth SIG
13. HID Service Specification v1.0, Bluetooth SIG
14. Battery Service Specification v1.0, Bluetooth SIG
15. Scan Parameters Profile Specification v1.0, Bluetooth SIG
16. Scan Parameters Service Specification v1.0, Bluetooth SIG
17. Bluetooth SIG Assigned Numbers https://www.bluetooth.org/Technical/AssignedNumbers/home.htm
18. Services & Characteristics UUID http://developer.bluetooth.org/gatt/Pages/default.aspx
19. Personal Health Devices Transcoding White Paper v1.2, Bluetooth SIG

# Appendix C Terminology

| Term | Description |
|---|---|
| Service | A service is provided from a GATT server to a GATT client. The GATT server exposes some characteristics as the interface.<br>The service prescribes how to access the exposed characteristics. |
| Profile | A profile enables implementation of a use case by using one or more services. The services used are defined in the specifications of each profile. |
| Characteristic | A characteristic is a value used to identify services. The characteristics to be exposed and their formats are defined by each service. |
| Role | Each device takes the role prescribed by the profile or service in order to implement the specified use case. |
| Client Characteristic Configuration Descriptor | A descriptor is used to control notifications or indications of characteristic values that include the client characteristic configuration descriptor sent from the GATT server. |
| Connection Handle | The handle determined by the controller stack and is used to identify connection with a remote device. The valid handle range is between 0x0000 and 0x0EFF. |

| REVISION HISTORY | Bluetooth Low Energy Protocol Stack API Reference Manual: FMP |
|---|---|

| Rev. | Date | Description | |
|---|---|---|---|
| | | Page | Summary |
| 1.00 | Feb 15, 2013 | --- | First Edition issued |
| 1.01 | Mar 27, 2013 | --- | The description about the high-speed access to the service for a second or subsequent time is added. |
| 1.02 | Jun 28, 2013 | --- | Bookmark is added. |
| 1.03 | Sep 19, 2014 | 2<br>5<br>--- | The common definitions of profile are added.<br>A definition of connection type is deleted.<br>Parameter description is changed to use the common definitions of profile. |
| 1.04 | Apr 17, 2015 | 2 | The service definitions are updated. |

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