GATTBrowser for iOS

Smartphone Application Instruction manual

Introduction

This manual describes about Renesas Bluetooth® Low Energy (hereinafter, "Bluetooth LE") on how to use the Smartphone application known as "GATTBrowser". This application will be used for checking Bluetooth LE behavior during the development of Bluetooth LE products with Renesas microcontrollers.

Checked Devices

Apple inc. iOS devices

Targeted Devices

- IC
  — RX23W Group
  — RA4W1 Group
  — RL78/G1D Group
- Module
  — RX23W Module
  — RY7011 (RL78/G1D mounted)

Related Documents

- RX23W Bluetooth LE Solution & Resource Quick Start Guide (R01QS0067)
- RA4W1 Bluetooth LE Solution & Resource Quick Start Guide (R01QS0066)
- RL78/G1D Bluetooth LE Solution & Resource Quick Start Guide (R01QS0068)
- Bluetooth Core Specification v5.0 (https://www.bluetooth.com/)
- Supplement to the Bluetooth Core Specification CSS (https://www.bluetooth.com/)

Contents

1. Overview

GATTBrowser is a general purpose application that can scan for Bluetooth LE devices which are advertising in the vicinity and can perform the GATT-based communication with the connected Bluetooth LE device. During testing, using its functionalities will expedite the development of Bluetooth LE microcontrollers.

GATTBrowser supports the following features.

● Scan nearby Bluetooth LE devices

● Display the Advertising data

● Display the Received Signal Strength Indication (hereinafter, "RSSI")

● Connect to Renesas Bluetooth LE microcontrollers and other Bluetooth LE devices

● Display the Services and Characteristics information

● Communicate with Bluetooth LE devices

● Support Renesas specific Services and Characteristics

2. Applicability

This manual describes the iOS application, GATTBrowser Version 1.1.6 or later.

3. Restriction

This GATTBrowser application is intended to evaluate the Bluetooth LE software. Accordingly, this GATTBrowser is not applicable to any purpose other than evaluations.

4. Operational Environment

The GATTBrowser runs on the following operating environment.

● Apple Inc. iOS version 12 or later.

● Bluetooth is supported

5.   Installation

To install in iOS devices, open Apple's App Store and search for "GATTBrowser". Then get the application.

It is also possible to install from the following URL.

➢   GATTBrowser

https://apps.apple.com/app/gattbrowser/id1163057977

After successfully installed, the following icon will appear on the screen.

Figure 5-1 GATTBrowser icon

6.   Method of operation

This chapter will describe the operation of the GATTBrowser. For explaining examples, the illustrations are captured by using the iPhone 6 and the iPhone 8 device.

6.1   Application launch

To start GATTBrowser, touch the GATTBrowser icon. After starting, it immediately scans the Bluetooth LE devices that are advertising in the surrounding area. The Figure 6-1 shows the GATTBrowser launch screen.

Figure 6-1 GATTBrowser launch

When Bluetooth Setting is switched off in the iOS device while the application is starting, the GATTBrowser application will notify, "Bluetooth setting are turned OFF. Please turn on the Bluetooth" as shown in Figure 6-2. In order to use this application, Bluetooth must be turned on.

Figure 6-2 Bluetooth OFF the screen

Figure 6-3 shows how to turn ON Bluetooth feature in an iOS device. Bluetooth can be switched on using either the Settings App or Control center. From the Settings, Bluetooth can be turned on by switch as shown in left side of the below figure. Alternatively, swiping up from the bottom of the screen will open control center, tapping the "Bluetooth icon" can switch the Bluetooth ON or OFF. The Control center is shown in right side of the below figure. For more information on how to operate the iOS devices, refer to the respective user guide.
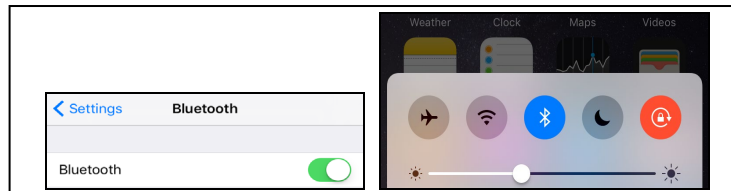

Figure 6-3 Bluetooth ON settings screen

6.2 Bluetooth LE devices scan list

6.2.1 Start scan

When starting the GATTBrowser, the application continuously scans the Bluetooth LE devices that have been advertising in surrounding area. The Bluetooth LE devices found in vicinity are listed on the screen as shown in Figure 6-4. The list is expanding until exhausted due to scanning continuously.

⊙ icons are displayed at the right end of connectable devices. In the case of Non-Connectable devices, ⊗ icon is displayed.

The Bluetooth LE device once scanned continues to be displayed in the list, but for Bluetooth LE devices that could not be detected after advertising for 5 seconds, the antenna displayed at the right end of the Bluetooth LE device name is hidden.

For details, refer to "6.2.5 Bluetooth LE device information in short format".
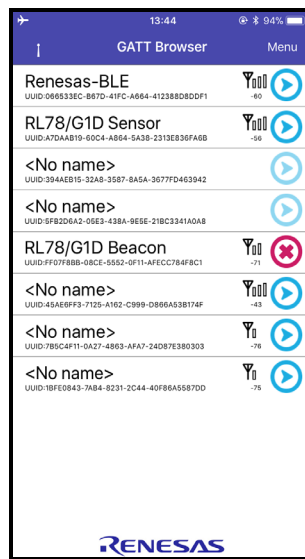

Figure 6-4 List of found Bluetooth LE devices

The antenna icon at the upper left corner of the screen shown in Figure 6-4 indicates the scanning status. While scanning continuously, the animation appears from left to right endlessly illustrated in Figure 6-5. When stop scanning, show the right most icon with no animation.
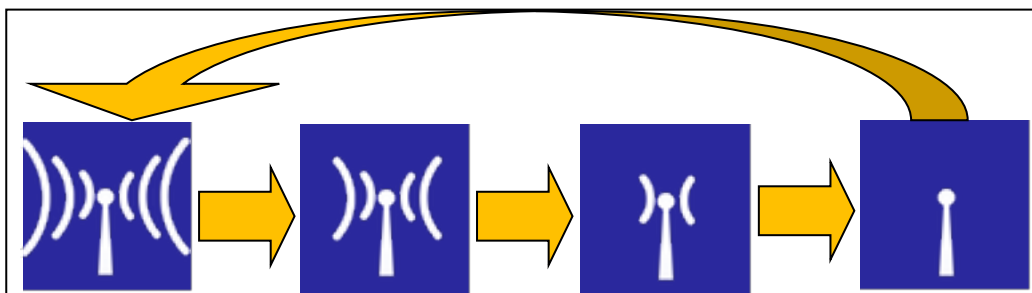

Figure 6-5 Antenna icon

6.2.2   Stop scan

Tapping icon will stop scanning while animating the antenna icon (scanning the advertising Bluetooth LE devices).
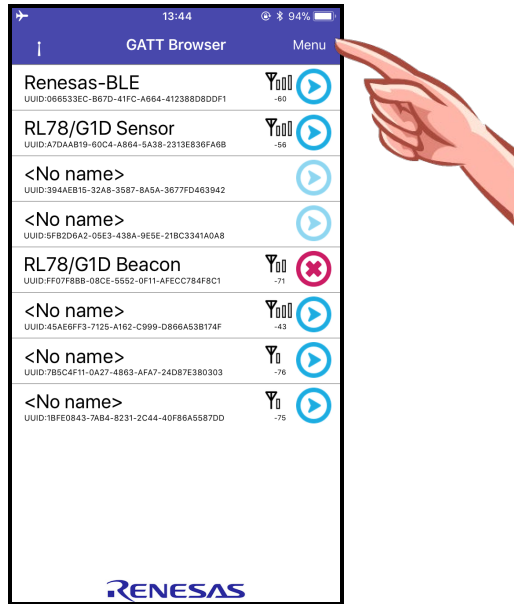

Figure 6-6 Tap on antenna icon

When stopping scan, the list of Advertising Bluetooth LE device is maintained and newly discovered Advertising Bluetooth LE devices won't be added to the list. It also stops updating the RSSI of the respective devices. Thus, RSSI values shown on the screen are the last observed values at stop scanning state.

6.2.3   Rescan

There are three ways on an iPhone and an additional fourth way that is exclusive to iPad type devices to restart scanning. Rescan can be initiated by, swiping down the list as shown in Figure 6-7, tapping the antenna icon as shown in Figure 6-8, by change RSSI filter setting as shown in 6.2.4 Menu button, of in the case of an iPad, by changing orientation of the device. All methods clear the previously scanned list of Bluetooth LE devices and rescan the Advertising Bluetooth LE devices in surrounding area. While rescanning, the newly founded Advertising Bluetooth LE devices will be listed on the screen again.
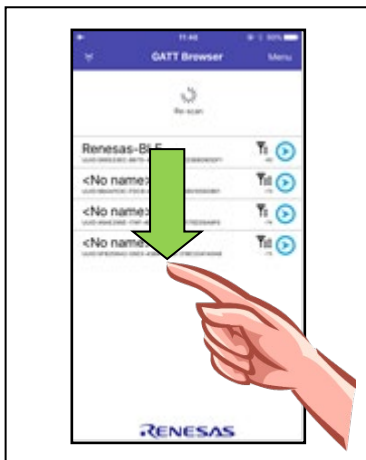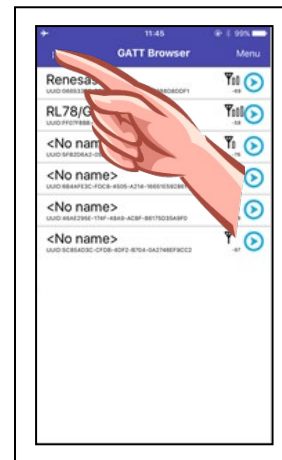

Figure 6-7 Swipe operation

Figure 6-8 Tap again on antenna icon

Note: The antenna icon in Figure 6-7 and Figure 6-8 must be like this ⬛ .

6.2.4 Menu button

Figure 6-9 shows the Menu button that displays in the upper right corner of the screen. Tapping the Menu button will display the menu list: Filter, Sort, Register UUID Name, Edit Saved UUID, System Settings, and Version Information.
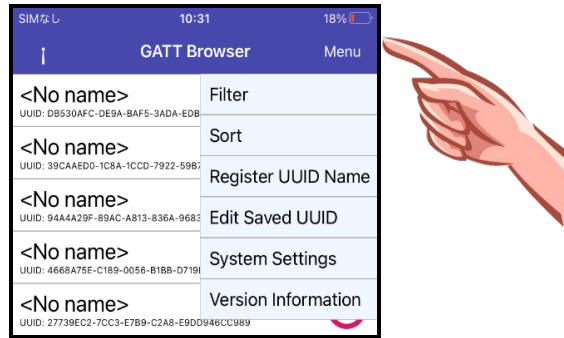
Figure 6-9 Menu button

➤ Filter setting

This setting can filter Bluetooth LE devices found by received RSSI strength.
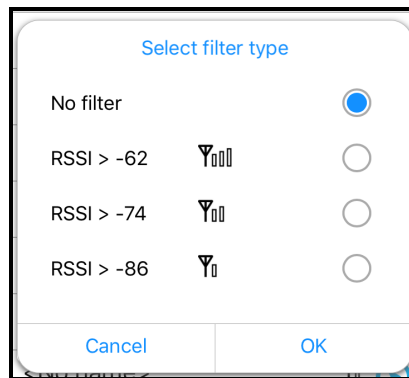
Figure 6-10 Filter setting menu

The configuration of received RSSI strength levels is listed in Table 6-1. By the configuration is set as "No filter". Tap one of the radio buttons to change received RSSI strength level. Pressing OK button changes to new setting or Cancel button does not change the previous setting.

Table 6-1 RSSI filter levels setting

Setting level	Description
No filter	No setting
RSSI > -62	To receive "Excellent" signal strength
RSSI > -74	To receive "Good" signal strength
RSSI > -86	To receive "Fair" signal strength

After changing the RSSI filter level setting, discovered Bluetooth LE devices are not removed from the list. Newly found Bluetooth LE devices will be filtered with respect to the received RSSI strength level and only Bluetooth LE devices met with the Setting level are added to the list.

➢   Sort setting

The discovered Bluetooth LE devices can be sorted in the list by means of received RSSI strength level or Bluetooth LE device name.
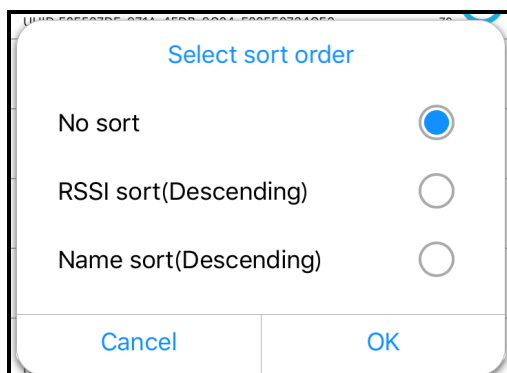
Figure 6-11 Sort setting menu

Table 6-2 shows the Sort setting. By default, "No sort" configuration is selected. To sort the Bluetooth LE device list, tap one of the radio buttons then press the OK button to change the setting. Pressing Cancel button will abort this operation.

Table 6-2 Sort setting

Sort order	Description
No sort	No sort
RSSI sort(Descending)	RSSI level sort (Descending)
Name sort(Descending)	Name sort (Descending)

 After selecting RSSI sort, the application shows a lower number of Bluetooth LE devices in the list with respect to RSSI strength in a decreasing order. When the OK button is tapped with a selection of RSSI sort, the list will be sorted with respect to received strength value on each Bluetooth LE device.

After selecting Name sort, the list will be sorted with respect to Bluetooth LE device name at all times.

➢   Register UUID Name
You can register names for custom UUIDs.
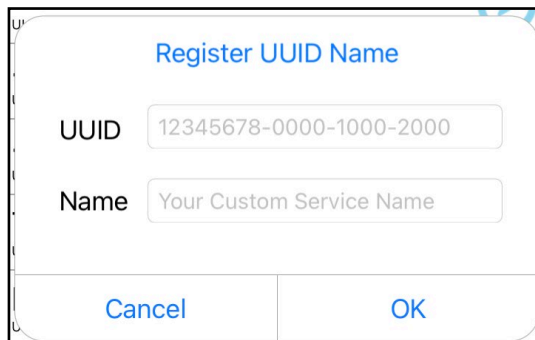
Figure 6-12 Register UUID Name Menu

Details on what can be done are given below. UUID names are registered when the OK button is pressed.

Table 6-3 Details on when can be registered

Field	Descriptions
UUID	Enter UUID Here (This Has to be Uppercase Characters with hyphens and numbers)
Name	Enter Name Here

> ➢ Edit Saved UUIDs
>> You can edit and delete the UUID names registered using the previous feature with this feature.
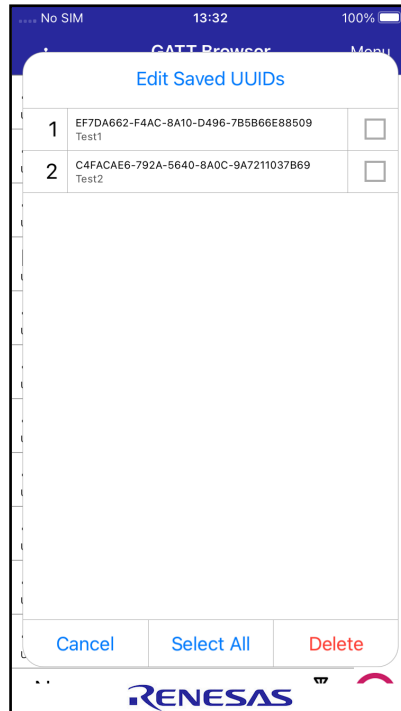
Figure 6-13 Edit saved UUIDs menu

Details on what can be done are given below. Check boxes can be used to select needed UUIDs. Select button used to select all the saved UUIDs. To edit saved UUIDs, select the button between the number and the check box.

Table 6-4 Feature Description

Feature Details	Description
Delete	Delete selected UUID
Edit	Displays the Register UUID Name dialog box

➢   System Settings

This Setting allows you to access the iOS device's Settings directly. Using this menu selection, you can turn Bluetooth ON and OFF or remove the pairing information by going through the Bluetooth option. To return back to GATTBrowser, select the left arrow icon with GATTBrowser text " ◀ GATTBrowser " at the upper left corner of the status bar.
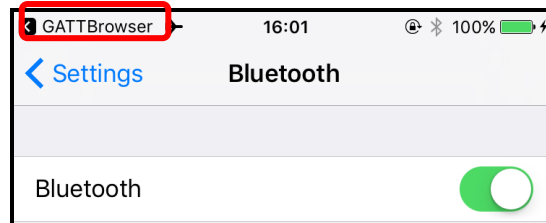
Figure 6-14 iOS device Bluetooth Settings menu

➢   Version Information

This menu is used to view the version information of the GATTBrowser. Pressing the OK button will close this menu.
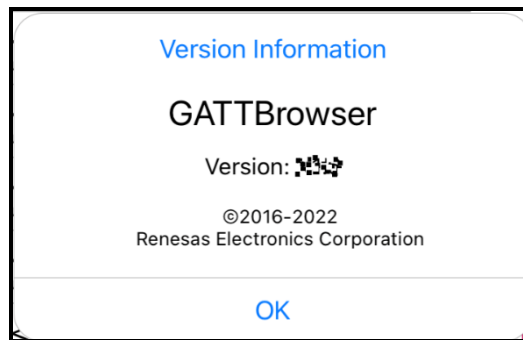
Figure 6-15 Version Information

6.2.5   Bluetooth LE device information in short format

Initially, the list of Advertising Bluetooth LE devices found in surrounding area is shown as short format include only four parameters; (1) Device Name, (2) Device UUID, (3) RSSI and (4) connection button as shown in Figure 6-16. In this format, the detail information of Bluetooth LE device is listed in Table 6-5.

① **Renesas-BLE**
② UUID: C4FACAE6-792A-5640-8A0C-9A7211037B69   ③ [antenna icon] -49   ④ [▶]

Figure 6-16 Bluetooth LE device information in short format

Table 6-5 Bluetooth LE device information

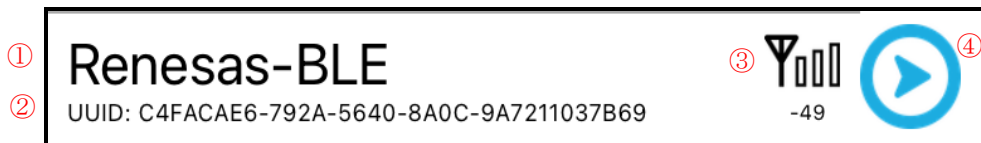| No.	information	description
①	Device Name	Displays the device name for Bluetooth LE device. ➤ If the device is previously connected, it will display the value of the Characteristic GAP Device Name. (*1) ➤ If the device is never connected, it will display the device name in the advertising data. When the advertising data does not contain the device name, the text "<No name>" will be displayed. *1: Since the device information of connected devices is stored in the iOS device's cache, the Device Name will not change if the device is changed in the Advertising Data. If the device's GAP Device Name Characteristic is updated, the Device Name will change on reconnection
②	Device UUID	The Identifier given to a Bluetooth LE device when it is discovered in iOS. Since BD address can't be obtained in an iOS environment, Device UUID is used to identify devices
③	RSSI	RSSI value can be shown in real time for Bluetooth LE device. At scanning, iOS device always gets and displays the RSSI antenna strength, and it keeps updating the parameter value. If the Bluetooth LE device's Advertising stops and 5 seconds have elapsed since the last RSSI acquisition, the antenna display and the RSSI value will be hidden. If Advertising is detected again, it will be redisplayed. When pause the scan operation, the last observed RSSI value will be displayed continuously.
④	Connection Button	This is the button to connect Bluetooth LE devices in the list. Tap this button for connecting to the one of Bluetooth LE devices. If "Is connectable" included in the advertisement information is No, [⊗] icon is displayed, and even if you tap it you cannot connect.

6.2.6   Bluetooth LE device information with Advertising data information

When tapping one of the cells to the Advertising Bluetooth LE devices, expand that cell and display the Advertising data at the bottom of the Bluetooth LE device as shown in Figure 6-17. For detail information about displayed parameters, refer to the online documentation for the Apple Developer Documentation of the Core Bluetooth Framework "Advertisement Data Retrieval Keys".
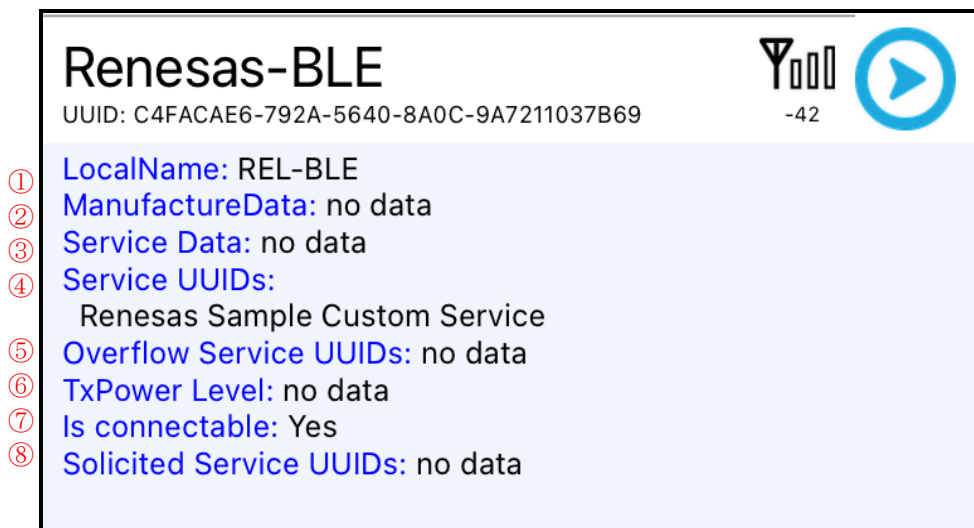
Figure 6-17 Advertising data information

Table 6-6 shows the list of Advertising data information and explain in the description column.

Table 6-6 Advertising data

No.	Information	Description
①	LocalName	The local name for Bluetooth LE device
②	ManufactureData	Bluetooth LE device-specific data
③	Service Data	Services data for Bluetooth LE device
④	Service UUID	Services UUID of Bluetooth LE device
⑤	Overflow Service UUID	If stored as the long in Bluetooth LE device, here shows Service UUID.
⑥	TxPower Level	Bluetooth LE device transmit power
⑦	Is connectable	The Flag indicates whether Bluetooth LE device is connectable or not. When this flag is No, the "④ Connection button" in "Table 6-5 Bluetooth LE device information" becomes ⊗ icon.
⑧	Solicited Service UUIDs	Invitation of whether Bluetooth LE device can operate as a UUID of GATT Client Service to the Server or not.

To display in short format again, tapping to the Bluetooth LE device cell will restore the Advertising information cell display back to short format. To close all cells that are displaying Advertising information, pinch in the opened Advertising information cells as shown in Figure 6-18.
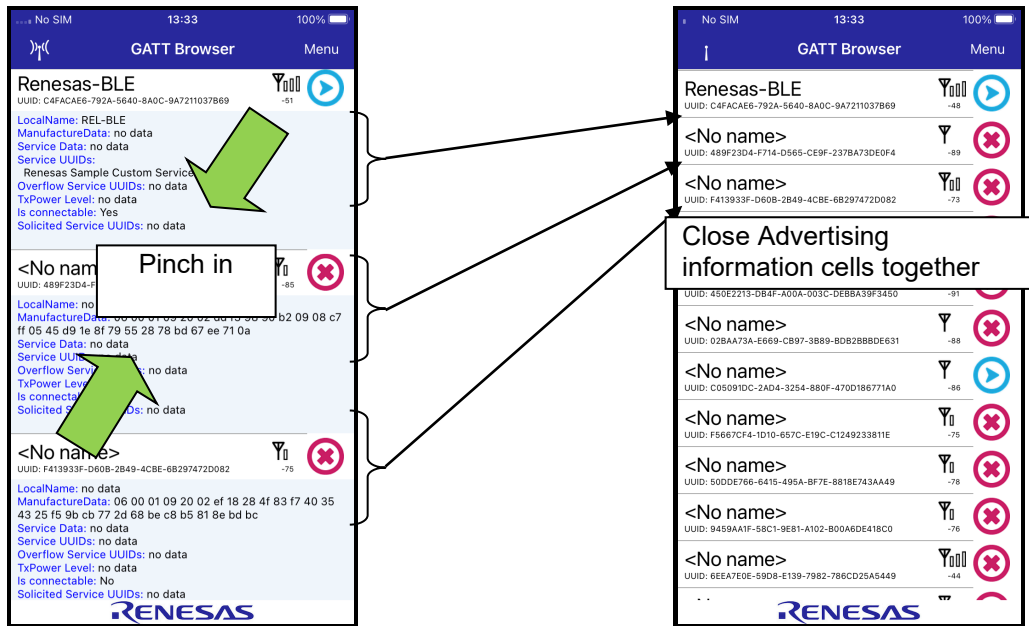
Figure 6-18 Advertising information cell continuous close

6.2.7   Bluetooth LE device connection

When the arrow inside circle mark at the right side of the Bluetooth LE device information display is tapped, as shown in Figure 6-19, the iOS device will connect to that selected peripheral device. After the connection, the display will swift to a new screen that will be explained in section "6.3 Service and Characteristic list".
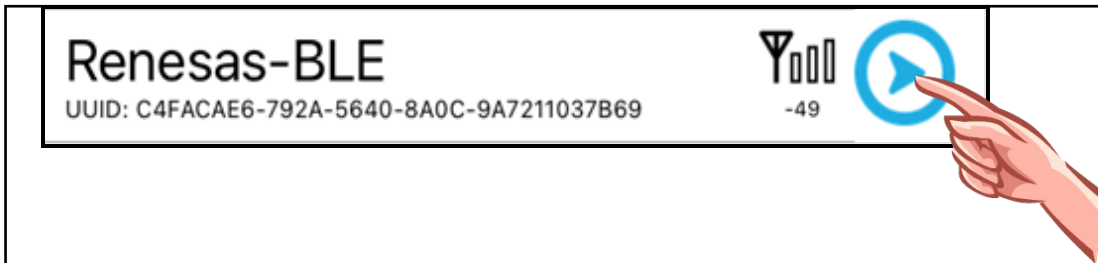
Figure 6-19 Bluetooth LE device connection

By checking the number ⑦ from "Table 6-6 Advertising data", the device can be identified whether it is connectable or not. If the device is connectable, the flag displays "Yes" in Connection Status and connection button is ⊙ icon. If the device is not connectable, the flag displays "No" in Connection Status and connection button is ⊗ icon. Tap does not perform connection processing.

6.3   Service and Characteristic list

After connecting to the Bluetooth LE device, show the list of Service and Characteristic on screen.

The numbered items shown in Figure 6-20 are information and user interaction to connected device. The detail are explained in Table 6-7.
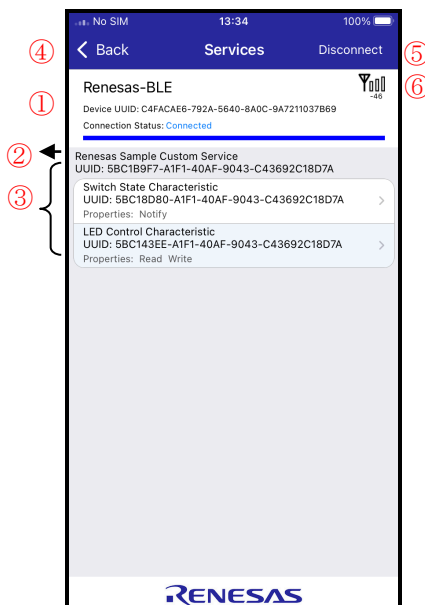
Figure 6-20 Service and Characteristic list

Table 6-7 Service and Characteristic information

No.	Information	Description
①	Device connection information	Display the information of connected Bluetooth LE device. Display the device name and device UUID as well as indication of connection status. UUID can be copied by long pressing the UUID
②	Service name	Display the Service name in the Service Discovery and all included Characteristics. UUID can be copied using a long press
③	Characteristic name	Display the Characteristic name in the Characteristic Discovery. Display each Characteristic found separately for every Service. Display all properties and characteristics, along with Characteristic. UUID can be copied using a long press
④	Back	Return button to disconnect and back to "Bluetooth LE device scan list".
⑤	Disconnect / Connect Button	Disconnect the Bluetooth LE device. When disconnected, "Connect" is switched, and when you tap it you can reconnect to the same Bluetooth LE device.
⑥	RSSI	Display the RSSI received strength and Bluetooth LE devices.

6.3.1 Connection Status

While maintaining the connection with the Bluetooth LE device, display as "Connected" in the connection status, which indicates the "Connection Status". When lost communicating with the Bluetooth LE device, the "Connection Status" displays in red text as "Disconnected". Figure 6-21 and Figure 6-22 are shown in connection and disconnection state respectively.
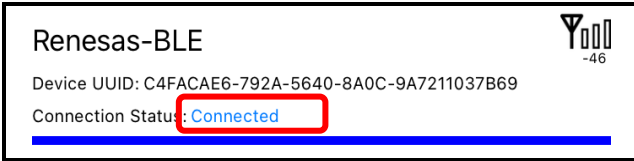
Figure 6-21 Connected
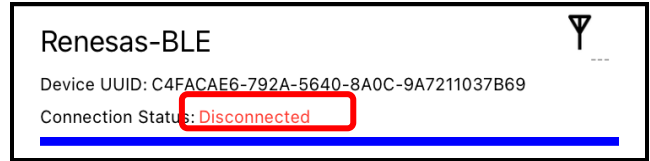
Figure 6-22 Disconnected

6.3.2 Display Service name & Characteristic name

When detect the UUID of Bluetooth SIG, display the Service name (such as Link Loss, Tx Power and Immediate Alert, and etc.) that corresponds to the Service Discovery. As an example, Figure 6-23 shows Service names with respect to Service Discovery. If there are custom UUIDs, the complete UUIDs are also displayed as shown in Figure 6-24.

Figure 6-24 Service names of custom UUID is detected
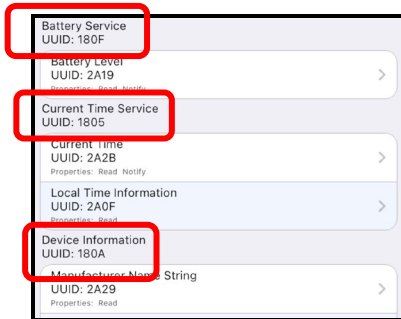
Figure 6-23 Display Service name determined by the Bluetooth SIG, Inc.

To display the Characteristic (such as Alert Level, Tx Power Level, and etc.), it is determined by the Bluetooth SIG or custom UUID as well as the service name, based on the UUID finding in Characteristic Discovery.

Figure 6-26 Characteristic names of custom UUID is detected

Figure 6-25 Display Characteristic name determined by the Bluetooth SIG, Inc.

Figure 6-25and Figure 6-26 show Characteristic names and custom Service respectively. If the detected custom UUID is used in the Renesas sample application of microcontroller device, display the received custom service as its feature name rather than the UUID. For more information, refer to the section "6.5 Display Renesas custom data" later in this document.

6.3.3 Characteristic selection

To open the Characteristic operation screen, tap the Characteristic that you want to perform its operation then can operate one Characteristic at a time for each selection. As an Example, Figure 6-27 shows the selecting of the Characteristic.
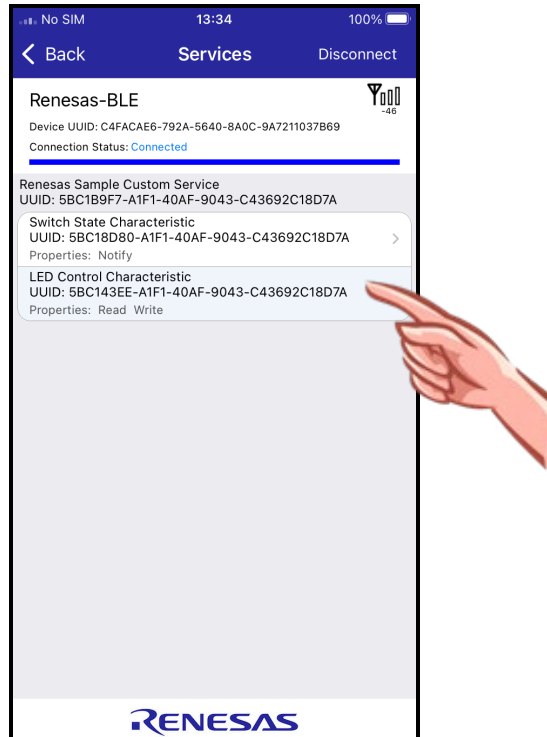
Figure 6-27 Characteristic selection

6.4   Characteristic operation

6.4.1   Characteristic operation screen

After selecting a particular characteristic, Figure 6-28 shows the Characteristics screen with respect to its attributes like read, write, indication and notification. Detail are explained in Table 6-8.
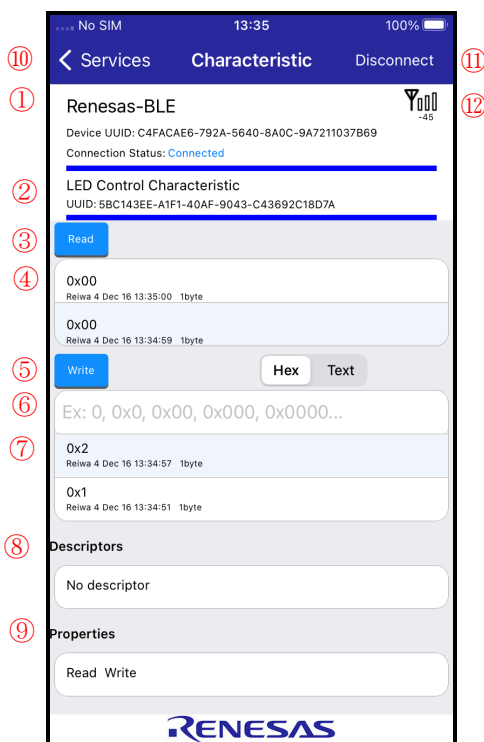
Figure 6-28 Characteristic operation screen

Table 6-8 Characteristic operation information

No.	Information	Description
①	Device connection information	Display the information of connected Bluetooth LE device. Display the device name and device UUID, and connection status indication. UUID can be copied by long pressing the UUID This information is the same as "Service and Characteristic list".
②	Characteristic name	Display information about the Characteristic of operation. Display the Characteristic name and UUID. UUID can be copied by long pressing the UUID
③	Read/Notification/Indication button	Button to receive the characteristic value. Each button is displayed based on the setting of the Characteristic Properties. The Properties settings will not be hidden.
④	History of receive data	Display the received value of the Characteristic Read/Notification/Indication by pressing the buttons. If appear five values in the cell, the displayed top value is the latest data. In one cell, there are three lines: top line: ASCII, middle line: base-16 number display, and bottom line: received time stamp information.
⑤	Write/WriteWithoutResponse button and select button of	Writing a value to the characteristic button. Each button is displayed based on the setting of the

	write data format.	Characteristic Properties. The Properties settings will not be hidden.
		If selecting the write mode selection buttons, treat data as either Hex/Text or other.
⑥	Text field of write data	A text field to enter the value, which to be written to the characteristic. After writing data to Write or WriteWithoutResponse in text field, press button to write the entered data to the target Characteristic.
⑦	History of send data	If operation of Write/WriteWithoutResponse button successfully send, the values will be shown in this cell. If five values appear in one cell, display the top value as the latest data. Fail to send the data also added to the history.
		Display two lines in single cell: send data at the top line and timestamp information at the bottom line after sending.
⑧	Descriptor information	Display the characteristic Descriptor information.
⑨	Properties information	Displays the Properties for the characteristic.
⑩	Back	Return button to Service and Characteristic list
⑪	Disconnect / Connect Button	Disconnect the Bluetooth LE device.
		When disconnected, "Connect" is switched, and when you tap it you can reconnect to the same Bluetooth LE device.
⑫	RSSI	Display the received RSSI strength and Bluetooth LE device.

6.4.2 Connection status

Connection Status: the connection status is similar to section "6.3.1 Connection Status".

6.4.3 Read operation

When Characteristic Properties have Read attributes, Read button is displayed as shown in Figure 6-29. By pressing this Read button, you can read relevant Characteristic value from peer device.

Read data is displayed in received data history as shown in Figure 6-30.

Figure 6-29 Read button

Figure 6-30 After tapping the read button

6.4.4 Notification operation

In the characteristic Properties, Notification attributes are valid when the "Enable Notification" button is displayed in as Figure 6-31 for Client Characteristic Configuration Descriptor (CCCD). You can toggle between "Disable Notification" and "Enable Notification" by pressing this button. To receive a Notification of the relevant Characteristic, pressing the button showing with "Enable Notification" will change to "Disable Notification". After showing with "Disable Notification", it will start receiving notification data. If not switch to this button showing with "Enable Notification", it is disable to notification permission and stop receiving Notification data.

Received Notification data is displayed in the Figure 6-32 as incoming data history after enabling the notification permission.

Figure 6-31 Notification enable button

Figure 6-32 Received notification data after enabling

When Notification data is received on other than the Characteristic operation screen, the Characteristic UUID of the received data and the received Notification data are displayed at the bottom of the screen.
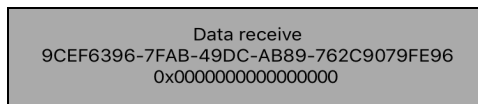
Data receive
9CEF6396-7FAB-49DC-AB89-762C9079FE96
0x0000000000000000

Figure 6-33 Notification data received indication other than Characteristic operation display

6.4.5 Indication operation

Similarly, Indication attributes are valid in the Properties of the characteristic when the "Enable Indication" button is displayed as in Figure 6-34 for Client Characteristic Configuration Descriptor (CCCD). Toggling this button will change between "" and "Enable Indication". To receive an Indication of the Characteristic, press this button while showing with "Enable Indication ". Then, it changes to "Disable Indication" and receives indication data. Not switching to this button showing with "Enable Indication" will disable to indication permission.

Received Indication data is displayed in Figure 6-35 as received data history after enabling the indication permission.
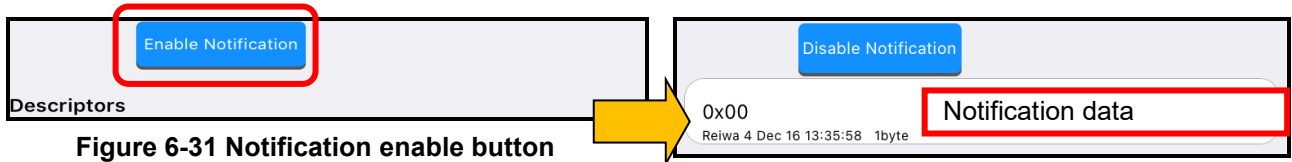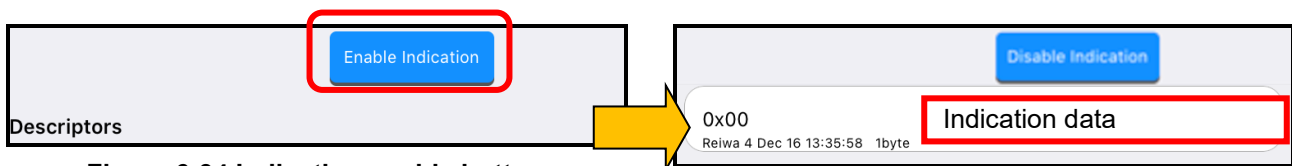

Figure 6-34 Indication enable button

Figure 6-35 Received indication data after enabling

When the Indication data is received on other than Characteristic operation screen, it will be displayed at the bottom of the screen, as shown in "Figure 6-33 Notification data received indication other than Characteristic operation display".

6.4.6 History of received data

Data, which received by the Read/Notification/Indication and time stamp, is displayed in the incoming data history. This history shows maximum five data values and lists the most recent data at the top position and discard the oldest history from the bottom when exceed the maximum limit shown in Figure 6-36. As first in first out action, the history has maintained maximum five Characteristic data for the most recent received data as shown in Figure 6-37.
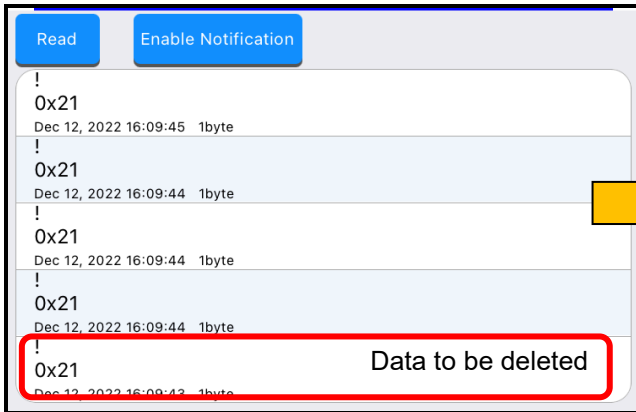
Figure 6-36 Maximum of history data   **Figure 6-37 Overflow the history data**
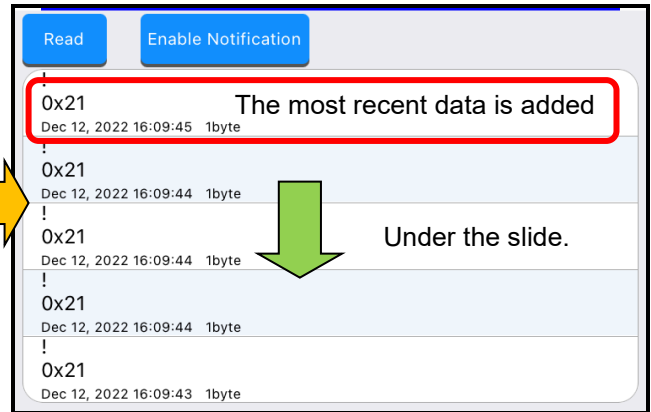
6.4.7   Write operation

Write attributes are valid to set with Write button when Write data in the characteristic Properties, and the text field is displayed. Set the data in the text field and then press the Write button. After pressing the Write button, it is able to write the Characteristic value. In addition to display a button to transmit data, there is write mode switch at the right side of the Write button. Refer to the section "6.4.9 Select write mode operation" for detail.

Succeeded for writing data is displayed in the send data history as shown in Figure 6-39.
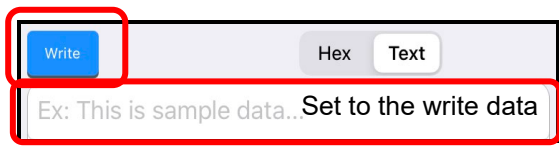
Figure 6-38 Write button, text field, and select button
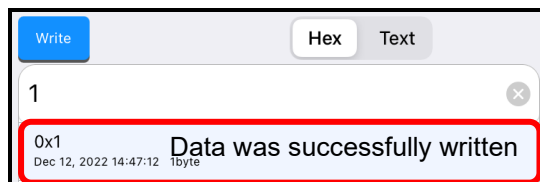
Figure 6-39 Write the Characteristic

6.4.8   Write without response operation

If the text field is displayed, write data "write without response" attributes are valid in the characteristic Properties to set with "Write without resp" button. Writing the data in a text field and pressing the "Write without resp" button will send to "write without response" of the Characteristic. Similarly display a button to transmit data write mode at the right side of "Write without resp" button. Refer to section "6.4.9 Select write mode operation" for detail.

Regardless of the success or failure of the writing, writing data with write without response will be displayed as sending data in history field as shown in Figure 6-41.
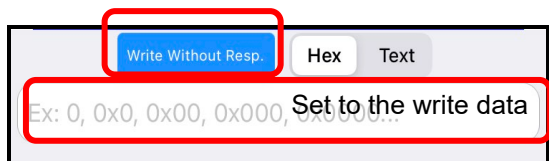
Figure 6-40 "Write without resp" button and select button
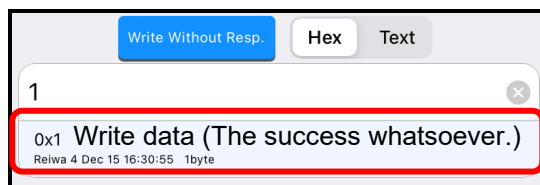
Figure 6-41 Write without response the Characteristic

6.4.9 Select write mode operation

For either "Write" or "Write without resp" button, write mode switching button is displayed. Switching to this button, set data text field as either hexadecimal data or text data. During communication with the Peer Device, switch buttons and connect Characteristic screen hold each switch setting.

For Write data or Write without response in hexadecimal mode, write data is treated as base-16 number. In the following example, handling as hexadecimal data "1" will write to the Characteristic data value "0x1" as shown in Figure 6-42.
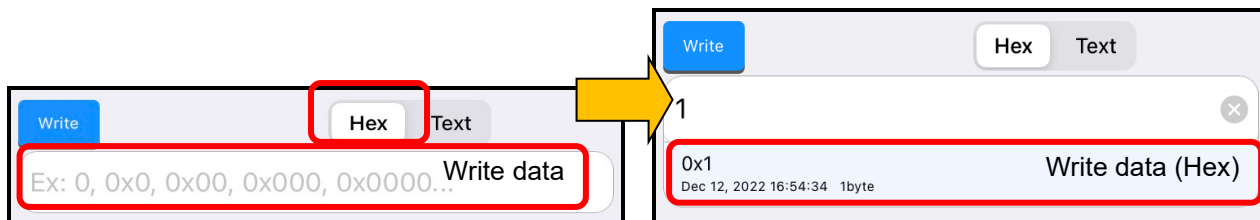
Figure 6-42 Write of Hex format

For Write data or Write without response in text mode, write data is replaced by UTF-8 character code and will be treated as text data. In the following example, handling data "1" will write hexadecimal value "0x31" data to a Characteristic.
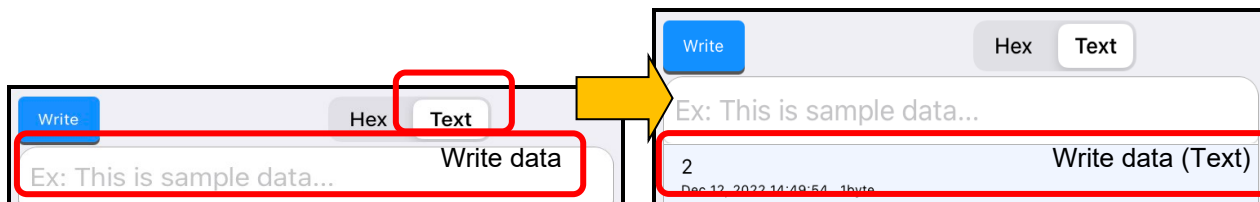
Figure 6-43 Write of Text format

6.4.10 History of sending data

Not only filled with Write/Write without response of incoming data but also the time stamp of the historical data will be displayed in the history of the transmitted data. In this historical list, show maximum five data with the most recent data at the top of the list. When adding the most recent Characteristic data, the oldest data of the list will be discarded from the bottom to maintain five historical data for the most recently submitted data as shown in Figure 6-45.
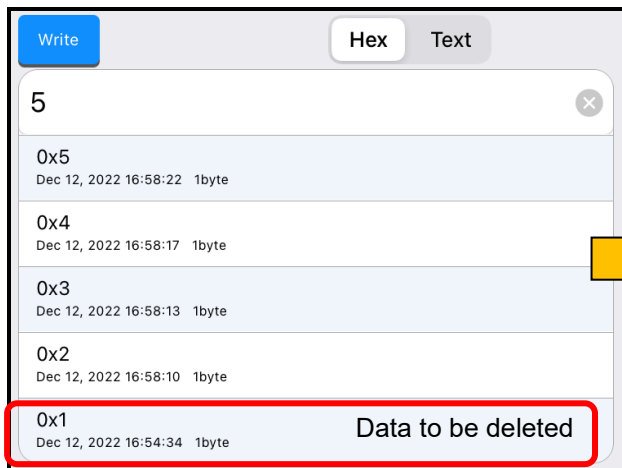
Figure 6-44 Full historical data
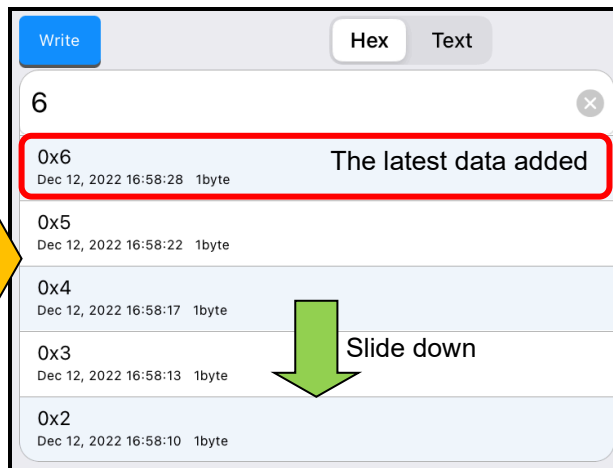
Figure 6-45 History data update

In order to send the hexadecimal data, set the text field to write data as "1". This means that "0x" is prefixed automatically and stored in the history as shown in Figure 6-46. On the other hand, writing text data will be preserved in the history as is. Figure 6-47 shows the writing text data.
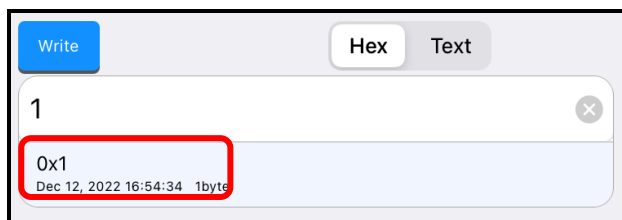
Figure 6-46 Display of historical data (Hex)
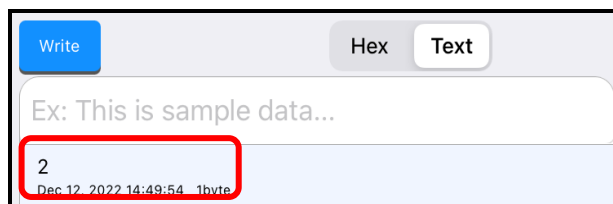
Figure 6-47 Display of historical data (Text)

6.4.11 Copying historical data into the text field.

If the text field of the write data is displayed, tap onto the written historical data or received data history listed in history data field. After tapping, that data has been copied into the text field for sending below

Figure **6-48** shows as an example of copying the historical data when tap to the cell of receiving data in historical section.
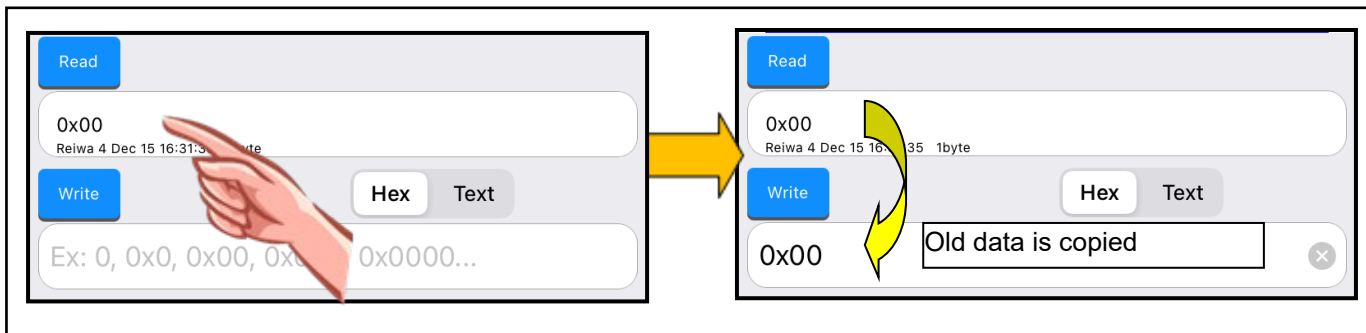
Figure 6-48 Copy historical data into the text field

6.4.12 Update of descriptors

By tapping the permission of Notification or Indication cell in display information, it is possible to re-read the relevant Characteristic Descriptor information intentionally. That descriptor information is updated automatically as shown in Figure 6-49.
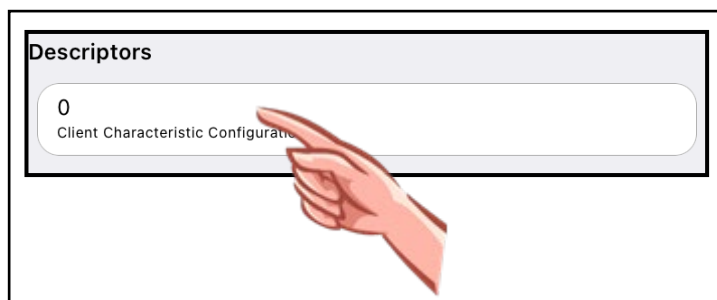
Figure 6-49 Update of descriptors

6.5 Display Renesas custom data

If Bluetooth LE microcontroller custom UUID that has been detected is used in the sample application, you will see the name of the custom services and characteristics instead of the UUID. In addition, a dialog will be displayed for information analysis, but it is a specific characteristic.

6.5.1 Renesas custom Service and Characteristic names display

The Service name used in the below Bluetooth LE microcontroller sample applications are detected and displayed the following Service/Characteristic UUID and Characteristic names.

> Bluetooth LE Virtual UART application (Document No. R01AN3130E)

Table 6-9 UUID of Bluetooth LE Virtual UART application

UUID	Renesas custom Service and Characteristic
D68C0001-A21B-11E5-8CB8-0002A5D5C51B	Renesas Virtual UART Service
D68C0002-A21B-11E5-8CB8-0002A5D5C51B	Indication Characteristic
D68C0003-A21B-11E5-8CB8-0002A5D5C51B	Write Characteristic

> Embedded Configuration Sample application (Document No. R01AN3319E)

Table 6-10 UUID of Embedded Configuration Sample application

UUID	Renesas custom Service and Characteristic
5BC1B9F7-A1F1-40AF-9043-C43692C18D7A	Renesas Sample Custom Service
5BC18D80-A1F1-40AF-9043-C43692C18D7A	Switch State Characteristic
5BC143EE-A1F1-40AF-9043-C43692C18D7A	LED Control Characteristic

> RL78/G1D Beacon Stack Connecting and Updating Beacon Data Sample Program (Document No. R01AN3313E)

Table 6-11 UUID of RL78/G1D Beacon Stack Connecting and Updating Beacon Data Sample Program

UUID	Renesas custom Service and Characteristic
A7660001-4B1E-4D6E-91C4-997BA9B6FC07	Renesas Beacon Updater Service
A7660002-4B1E-4D6E-91C4-997BA9B6FC07	Advertising Information
A7660003-4B1E-4D6E-91C4-997BA9B6FC07	Advertising Data
A7660004-4B1E-4D6E-91C4-997BA9B6FC07	Code Flash Memory Updated Count
A7660005-4B1E-4D6E-91C4-997BA9B6FC07	Data Flash Memory Updated Count
A7660006-4B1E-4D6E-91C4-997BA9B6FC07	Scan Response Data

➢ Other Renesas Custom UUIDs

Table 6-12 Other Renesas Custom UUIDs

UUID	Renesas custom Service and Characteristic
64800001-FAC7-4B08-AFA8-7D89FC4BBB41	Renesas Data Exchange Sample Program Service(Tag)
64800002-FAC7-4B08-AFA8-7D89FC4BBB41	Renesas Data Exchange Sample Program Service(Reader)
D68C0004-A21B-11E5-8CB8-0002A5D5C51B	Simple Connection Notification Characteristic
D68C0005-A21B-11E5-8CB8-0002A5D5C51B	Simple Connection Write Without Response Characteristic
FEACBB7A-DB63-4CA1-8AE2-F611C8269F65	Renesas OTA Reset Service
7753002F-34E9-4A65-904E-5636FBFCEC23	Virtual Reset Button Characteristic
1B7EEA33-19BF-44E0-BA37-3FA621BBB0D7	Project Information Characteristic
AAA509C9-7A50-458C-99DD-DC33E2C2D90C	Version Information Characteristic
9D5998F8-105B-4691-92BE-4B1B4D3EE8BB	Renesas OTA Service
629C8EF7-AA42-4F1E-8330-FE832961B926	Data Control Characteristic
13561280-ECB3-4691-9AB0-33649C7E03DB	Data Transfer Characteristic
9CEF3D10-7FAB-49DC-AB89-762C9079FE96	Renesas Throughput Service
9CEF3D11-7FAB-49DC-AB89-762C9079FE96	Throughput Data 1 Characteristic
9CEF3D12-7FAB-49DC-AB89-762C9079FE96	Throughput Data 2 Characteristic
7DBE3201-F5AB-498A-A012-676FEF22F735	Renesas Data I/O Service
7DBE3202-F5AB-498A-A012-676FEF22F735	Data In Characteristic
7DBE3203-F5AB-498A-A012-676FEF22F735	Data Out Characteristic
58831926-5F05-4267-AB01-B4968E8EFCE0	Renesas LED Switch Service
58837F57-5F05-4267-AB01-B4968E8EFCE0	Switch State Characteristic
5883C32F-5F05-4267-AB01-B4968E8EFCE0	LED Blink Rate Characteristic
908DCB17-7F42-44AC-AB9D-C36F63DCEBD8	Renesas LED Switch Bridge Service
4CC8C6EC-3954-41D1-8CFF-3F2FE5EC0180	Bridged Switch State Characteristic
458B6862-6D2C-4356-8B2E-B88BCE7F0C84	Bridged LED Blink Rate Characteristic

6.5.2 Apple inc. Custom Services and Characteristics UUIDs

Table 6-13 Apple inc. custom UUID list

UUID	Apple custom Service and Characteristic
89D3502B-0F36-433A-8EF4-C502AD55F8DC	Apple Media Service
9B3C81D8-57B1-4A8A-B8DF-0E56F7CA51C2	Remote Command Characteristic
2F7CABCE-808D-411F-9A0C-BB92BA96C102	Entity Update Characteristic
C6B2F38C-23AB-46D8-A6AB-A3A870BBD5D7	Entity Attribute Characteristic
7905F431-B5CE-4E99-A40F-4B1E122D00D0	Apple Notification Center Service
9FBF120D-6301-42D9-8C58-25E699A21DBD	Control Point Characteristic
22EAC6E9-24D6-4BB5-BE44-B36ACE7C7BFB	Data Source Characteristic

6.5.3 Beacon data analysis dialog

The RL78/G1D beacon stack, which can connect for beacon data update, can establish a connection. Then read Characteristic data of Advertising Information and Advertising Data / Scan Response Data included in the sample program. Tapping the historical read data will appear in Analysis dialog. When tapping the historical write data, dedicated Analysis dialog will appear as well.

➢ Advertising information

  To Read or Write data on the advertising Information, tap the Read history data to appear Advertising Information Analysis dialog as shown in Figure 6-50.
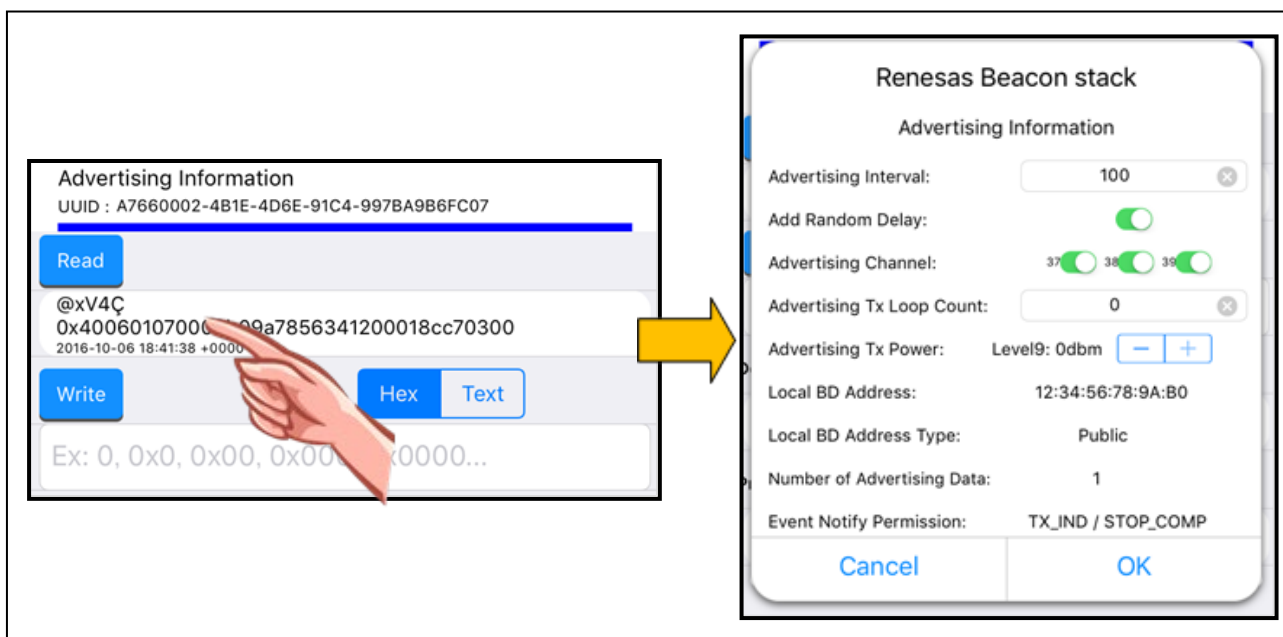
Figure 6-50 Advertising Information Data analysis dialog

  In this dialog box, "Advertising Interval" and "Advertising Tx Power" parameter are allowed for editing. Set the Write data in the text field, and then pressing the OK button in the dialog will change the parameter setting. Press the Write button to write the hexadecimal data in Characteristic data writing mode. Whenever pressing the Cancel button on the Analysis dialog will abort the changes from the text field of the Write data.

  For details of each parameter, refer to "RL78/G1D Beacon Stack Connecting and Updating Beacon Data Sample Program" application note.

➤   Advertising Data / Scan Response Data

When tapping the historical data to either Read or Write on the Advertising Data / Scan Response Data, the "Advertising Data" will appear the Advertising Data Analysis dialog as shown in Figure 6-51.
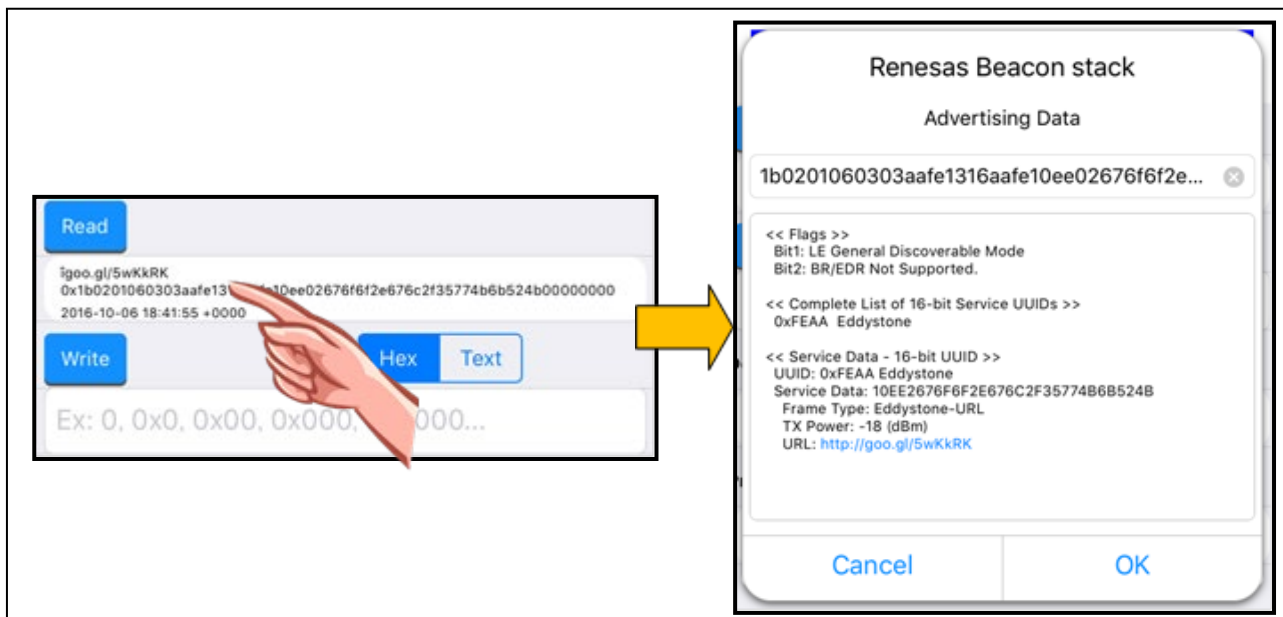
Figure 6-51 Advertising Data analysis dialog

Tapping the text field at the top of the dialog will copy the historical data into the text field, and the analysis data is displayed in the lower text area. Editing the top text field affects the analytical results, which is the bottom text area of analysis data. Then Analysis result will generate a hyperlink with blue letter in Eddystone-URL. Tapping that link on iOS device will open browser (standard Safari Browser) running the Webpage with the URL.

Then set the Write data in the text field, and then press OK button on the dialog to change parameter setting. After that press the Write button at Hex to write Characteristic data write mode. Whenever pressing the Cancel button on the Analysis dialog will abort the changes from the text field of the Write data.

Refer "RL78/G1D Beacon Stack Connecting and Updating Beacon Data Sample Program" application notes for details of each parameter.

7. Appendix

GATTBrowser uses the Bluetooth capabilities of the iOS device. This feature cannot work when Bluetooth is OFF. It shows up the GATTBrowser setting. Do not expect working if you turned OFF the Bluetooth function during the operation.

Revision History

Rev.	Date	Description Page	Summary
1.00	Oct 25, 2016	-	First edition issued
1.10	Mar 16, 2017	-	Rev.1.10 issued "Table 6-1 RSSI filter levels setting" after screen replacement
		P.8	Add "6.2.4 Menu button"
		P.14	"Figure 6-17 Advertising data information" screen replacement (Advertising data show format update)
		P.16	Add description of "⑤ Disconnect" & "⑥ RSSI" to "Figure 6-20 Service and Characteristic list" and "Table 6-7 Service and Characteristic information".
		P.19	Add description of "⑪ Disconnect" & "⑫ RSSI" to "Figure 6-28 Characteristic operation screen" and "Table 6-8 Characteristic operation information".
		P.24	"6.4.9 Select write mode operation" Add to that the settings will be saved.
1.11	Jul 07, 2017	-	Rev.1.11 issued.
		P.3	"2.Applicability" Update applicability version.
		P.12	"Figure 6-15 Version Information" screen replacement. (Replace version display with "X" from number.)
		P.27	"Table 6-11 UUID of RL78/G1D Beacon Stack Connecting and Updating Beacon Data Sample Program" Add description of "Scan Response Data". "Table 6-11 UUID of RL78/G1D Beacon Stack Connecting and Updating Beacon Data Sample Program" screen replacement. (Add information of "Scan Response Data".)
		P.31	"6.5.3 Beacon data analysis dialog" Add description of "Scan Response Data".
1.12	Jan 09, 2018	-	Rev.1.12 issued.
		P.3	"2. Applicability" Update applicability version.
		P.6	"Figure 6-4 List of found Bluetooth LE devices" screen replacement.
		P.7	"Figure 6-6 Tap on antenna icon" screen replacement.
		P.8	Added explanation of "③ RSSI" and "④Connection Button" in "Table 6-5 Bluetooth LE device information ".
		P.14	Added explanation of "⑦ Is connectable" in "Table 6-6 Advertising data".
		P.15	Changed description of device capable of connection described in "6.2.7 Bluetooth LE device connection" below Figure 6-19.
		P.16	Change ⑤ in "Table 6-7 Service and Characteristic information" to "Disconnect / Connect Button".
		P.19	Change ⑪ in "Table 6-8 Characteristic operation information" to "Disconnect / Connect Button".
		P.21	"6.4.4 Notification operation" added "Figure 6-33 Notification data received indication other than Characteristic operation display". In the same way as in Figure. 6-31 in "6.4.5 Indication operation", a description is added when data is received on other than Characteristic operation screen.
1.16	Dec 23, 2022	-	Rev1.16 issued.
		P.3	"2. Applicability" Updated applicability version

"4. Operational Environment" Updated iOS version

P.8   "6.2.4 Menu button" Added description for Register UUID and Edit Saved UUIDs

P.17   "6.3.2 Display Service name & Characteristic name" Added description for long press copy

P.18   "6.3.3 Characteristic selection" Added description for long press copy

P.27   "6.5.1 Renesas custom Service and Characteristic names display" Added more Display UUIDs

P.29   "6.5.2 Apple inc. Custom Services and Characteristics UUIDs" Added Section

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2. Processing at power-on

   The state of the product is undefined at the time 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 time 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 time 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 time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

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5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is 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. Additionally, 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.

6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

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8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of 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.

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