GATTBrowser for Windows

Windows Application Instruction manual

Introduction

This application note describes how to use the Windows® 10 application "GATTBrowser" that can wirelessly communicate with an evaluation board equipped with a Renesas Electronics Bluetooth® Low Energy technology compatible microcomputer or module.

The GATTBrowser can be used to check the operation of Bluetooth LE when developing Bluetooth LE application products.

Target Device

Target Board for RX23W

Target Board for RX23W module

EK-RA4W1

EB-RE01B

RL78/G1D Evaluation Board (RTK0EN0001D01001BZ)

Related Documents

RX23W Group

- RX23W Group Target Board for RX23W Quick Start Guide (R20QS0014)
- RX23W Group Target Board for RX23W User's Manual (R20UT4634)
- RX23W Group Target Board for RX23W module Quick Start Guide (R20QS0022)
- RX23W Group Target Board for RX23W module User's Manual (R20UT4890)

RA4W1 Group

- RA4W1 Group Evaluation Kit for RA4W1 Microcontroller Group EK-RA4W1 Quick Start Guide (R20QS0015)
- RA4W1 Group EK-RA4W1 User's Manual (R20UT4683)

RE01B Group

- EB-RE01B Hardware Manual (TS-TUM09734) (TESSERA TECHNOLOGY INC.)
- RE01B Group Bluetooth Low Energy Sample code (using CMSIS Driver Package) (R01AN5606)

RL78/G1D Group

- Bluetooth® Low Energy Protocol Stack Virtual UART Application (R01AN3130)
- Bluetooth® Low Energy Protocol Stack Quick Start Guide (R01AN2767)
- RL78/G1D Evaluation Board User's Manual (R30UZ0048)

Contents

1. Overview

The GATTBrowser is general purpose application that can scan Bluetooth LE devices operating in the vicinity and connect to those devices for GATT based communication. By using this application, we can support the development of Bluetooth LE application products.

GATTBrowser supports the following features.

- Scanning Bluetooth LE devices sending advertising.
- Displaying advertising data.
- Display of RSSI (Received Signal Strength Indicator).
- Connection with Bluetooth LE device.
- Display services and characteristic published by connected devices.
- Manipulating Characteristic values of connected devices and displaying acquired data.

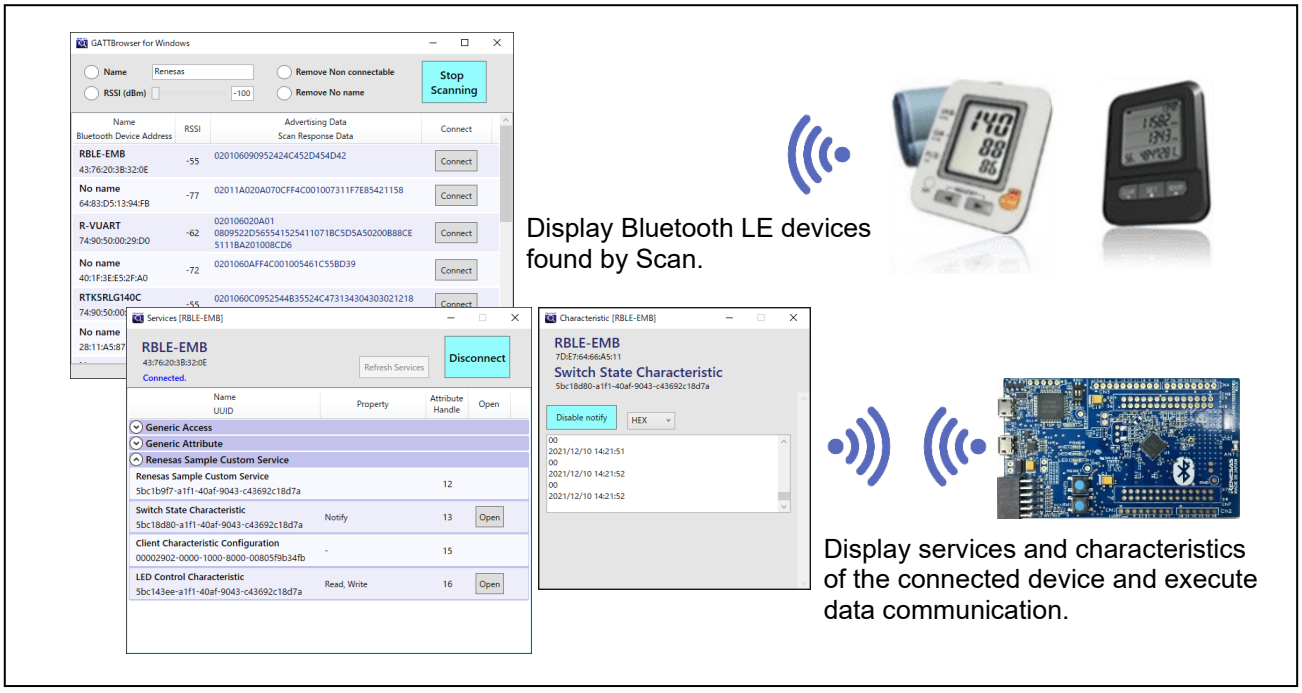


Figure 1-1 GATTBrowser overview

2. Operating Environment

The GATTBrowser can be used in the following environments.

- Windows 10 PC with Bluetooth LE function.

3. Installation

Copy the executable file included in this application note to any folder on your PC.

Table 3-1 GATTBrowser executable file

Folder name	Executable file name
r01an6230xxXXXX-gattbrowser-win\bin (Note1	GATTBrowser.exe

Note1: Please the replace "XXXX" with revision number.

4. Method of Operation

This chapter explains how to operate GATTBrowser.

4.1 Enable Bluetooth function

Enable Bluetooth function of your PC to use the GATTBrowser.

Select [Settings]-[Devices]-[Bluetooth & other devices] from the Windows Start menu to turn on the Bluetooth function.

(1) Click [Start menu]  of Windows.

(2) Click [Settings]  in Start menu.

(3) Click [Devices] in Windows settings.

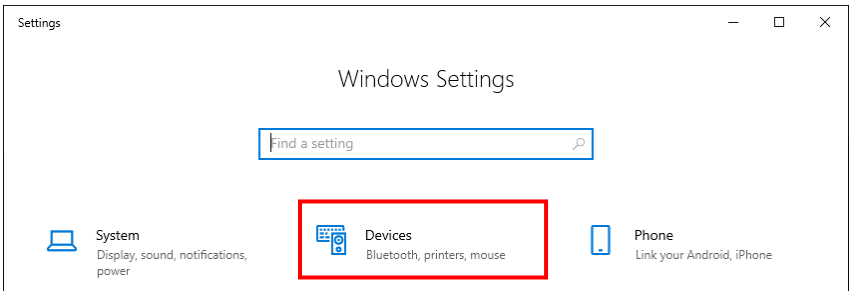


Figure 4-1 Settings of windows

(4) Click the "Bluetooth" toggle switch in Bluetooth & other devices to turn it on.

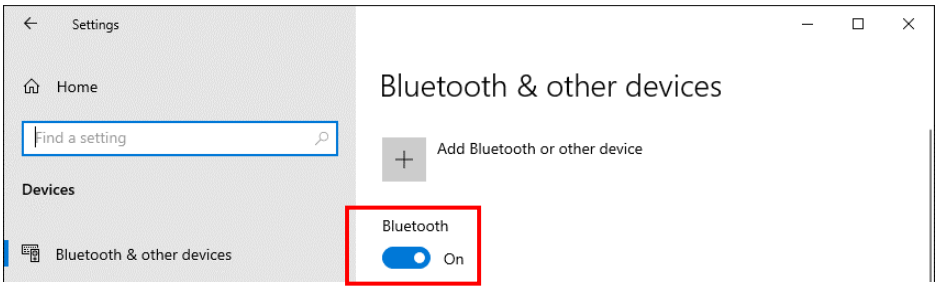


Figure 4-2 Bluetooth & other devices

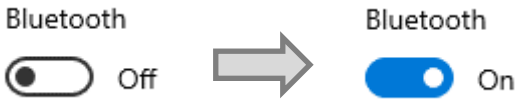
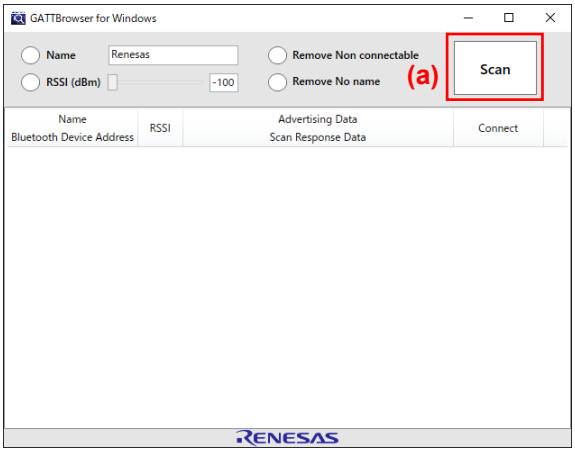


Figure 4-3 Enable Bluetooth function

4.2 Basic operation

This section describes the basic operation of the GATTBrowser. For the function of each window, refer to "4.3 Feature Description".

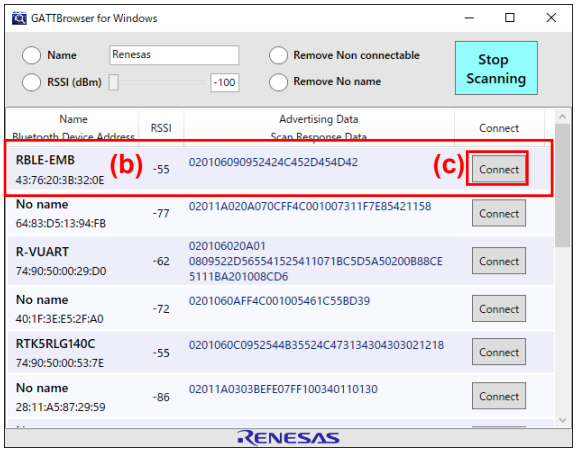
(1) Start-up



(4.3.1 Scan window)

Click (a)

(2) Scan

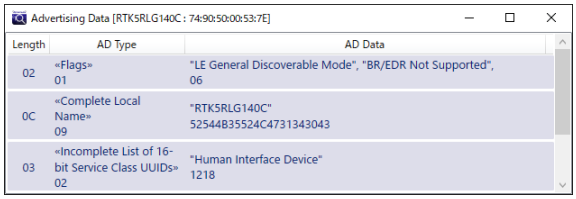


(4.3.1 Scan window)

Double click (b)

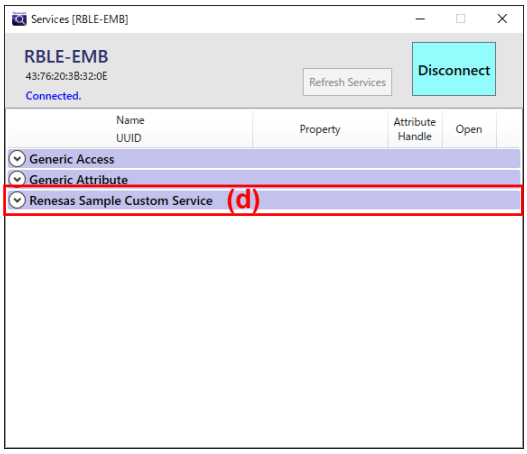
Click (c)

(3) Displaying advertising data



(4.3.2 Advertising data window)

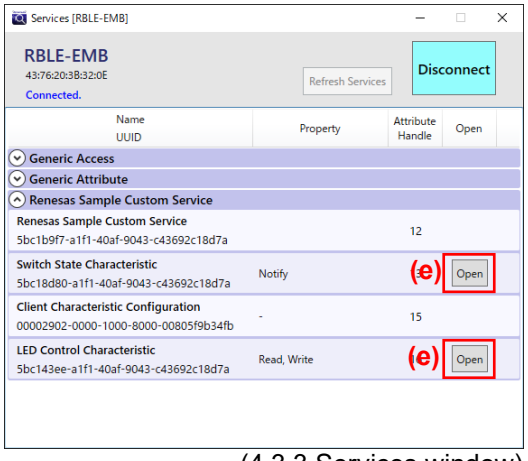
(4) Connection



(4.3.3 Services window)

Click (d)

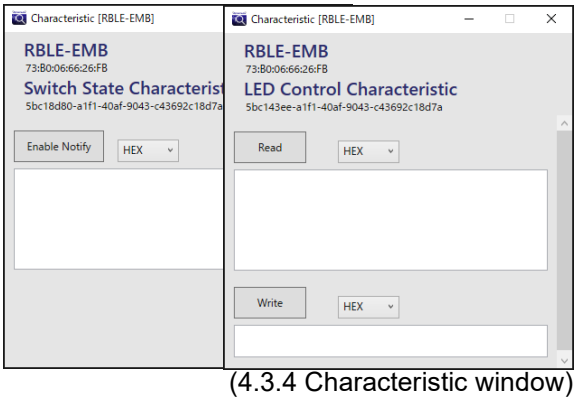
(5) Displaying services and characteristics



(4.3.3 Services window)

Click (e)

(6) Data communication



(4.3.4 Characteristic window)

Figure 4-4 Basic operation

(1) Start-up

Double-click executable file (GATTBrowser.exe) to start the Scan window.

(4.3.1 Scan window)

(2) Scan

Click the "Scan button" at the top right of the scan window to start scanning and display the list of Bluetooth LE devices that are advertising in the surrounding area.

(4.3.1 Scan window)

(3) Displaying advertising data

Double-click the displayed "Bluetooth LE device row" to display the advertising data window that analyzes advertising data for each AD Type.

(4.3.2 Advertising data window)

(4) Connection

Click the "Connect button" on the right side of the Bluetooth LE device list to connect. The services window opens, displaying a list of services owned by the connected Bluetooth LE device.

(4.3.3 Services window)

(5) Displaying services and characteristics

Click the displayed "Service name" to display a list of Characteristic that the service has.

(4.3.3 Services window)

(6) Data communication

Click the "Open button" on the right side of the characteristic list to open the characteristic window corresponding to the characteristic Property. You can perform data communication with the connected Bluetooth LE device.

(4.3.4 Characteristic window)

4.3 Feature Description

This section describes the functions of each window displayed by the GATTBrowser.

4.3.1 Scan window

The window that appears when you start the GATTBrowser has the following main functions.

- Run a scan to display a list of Bluetooth LE devices that are advertised around PC.
- Filtering of Bluetooth LE devices to display with Scan.
- Connection with Bluetooth LE devices.
- Displaying the advertising data window.

When connected to a Bluetooth LE device, you can close the scan window while staying connected. To display the scan window again, select "Show scan window." from the system menu of the services window. For details, refer to "4.3.3 - (5) Show scan window menu".

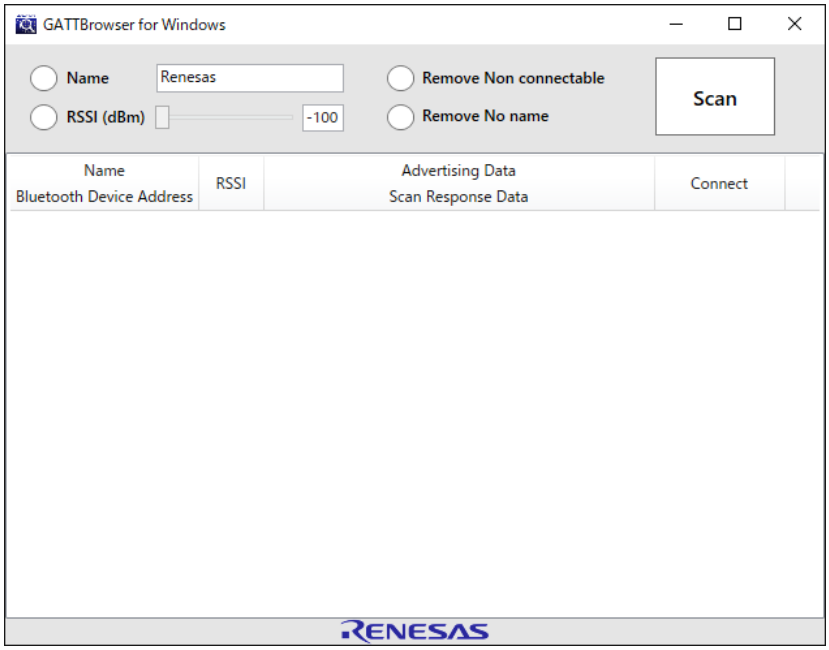


Figure 4-5 Scan window

(1) Scan button

It can start and stop Scan.

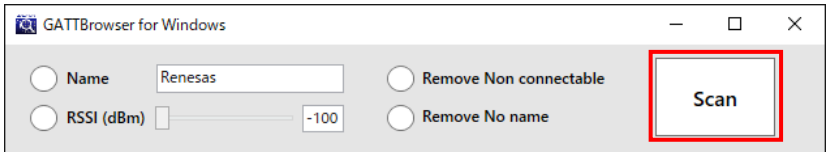


Figure 4-6 Scan button

When you click the button, the button changes as follows.

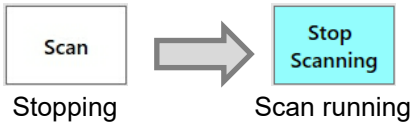


Figure 4-7 Scan button

(2) Scan filter

Only Advertising that matches the filter conditions can be displayed.

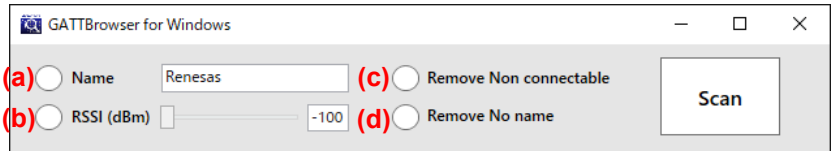


Figure 4-8 Scan filter

Click the button to enable the filter and the button will change as follows.

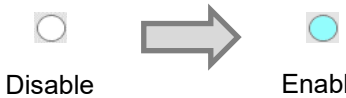


Figure 4-9 Filter disable and filter enable

(a) Name filter.
Displays advertising with a Local Name that matches the specified character.

(b) RSSI filter.
Displays advertising that is greater than or equal to the specified RSSI value.

(c) Remove Non connectable filter.
Does not display advertising that cannot be connected.

(d) Remove No name filter.
Does not display advertising that does not contain Local Name in advertising data.

(3) Bluetooth LE device list

Lists the Bluetooth LE devices found by Scan.

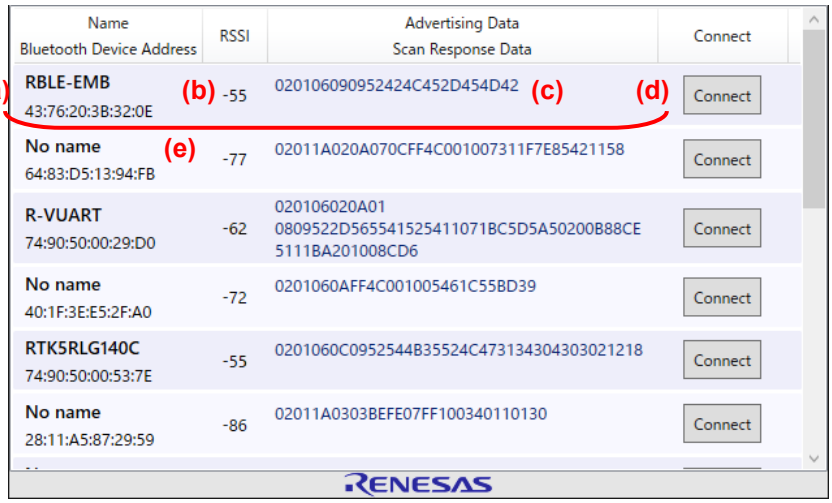


Figure 4-10 Bluetooth LE device list

(a) Displays the Local Name and Bluetooth Device Address.

(b) Display RSSI.

(c) Displays advertising data and scan response data.

(d) Click the connect button to connect to the Bluetooth LE device.

(e) Double-click the row on the Bluetooth LE device to display the advertising data window.

(4) Version information

If you select "About GATTBrowser..." from the system menu of the scan window, the about window will be displayed and you can check the version information.

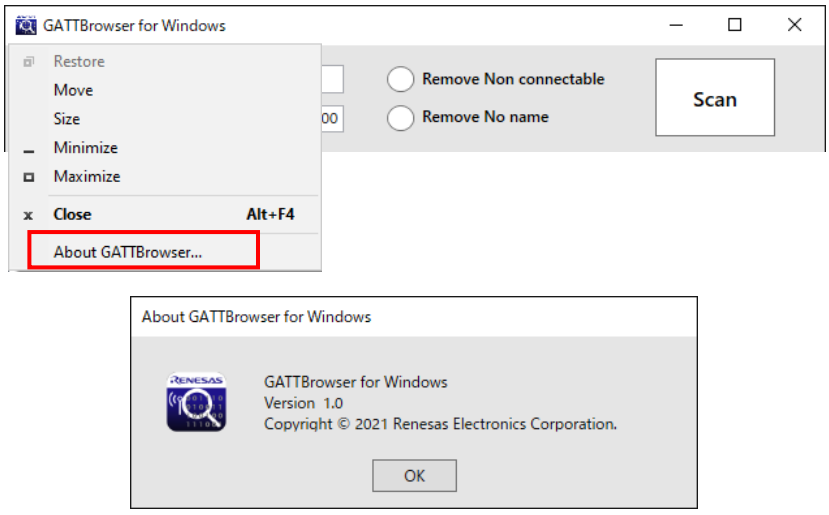


Figure 4-11 Version information

4.3.2 Advertising data window

This window analyzes and displays the advertising data of the Bluetooth LE device received by scan for each Advertising Data Type (AD Type).

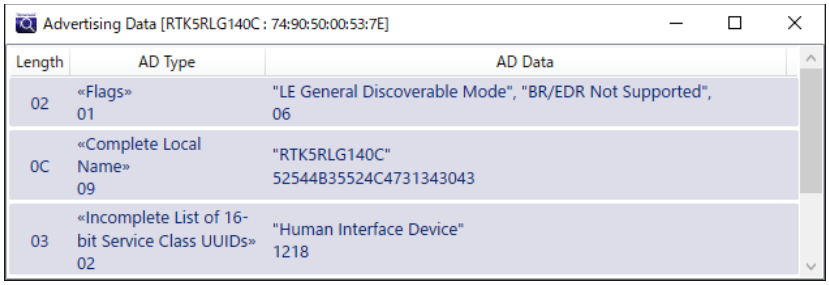


Figure 4-12 Advertising data window

(1) Advertising data information

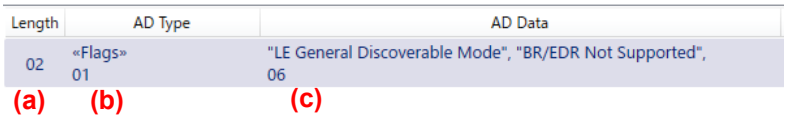


Figure 4-13 Advertising data information

(a) Data length that is the sum of AD Type and AD Data.

(b) AD Type analysis result.

(c) AD Data analysis result.

(2) Close all advertising data windows

You can open multiple Advertising Data windows. You can close all advertising data windows at once by selecting "Close all advertising data windows." from the system menu.

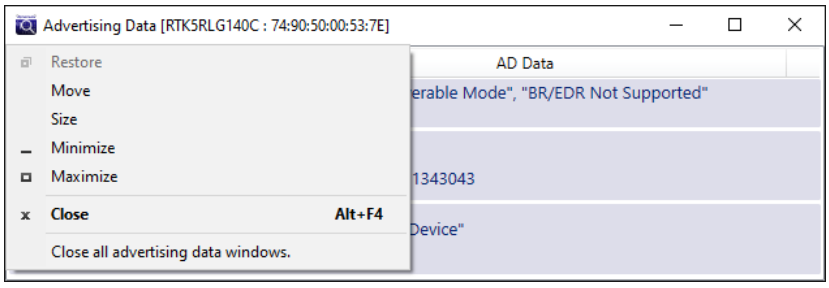


Figure 4-14 Close all advertising data windows menu

4.3.3 Services window

This window is displayed when you connect by pressing the connect button of the Bluetooth LE device found in the scan window. Closing the services window disconnects from the connected Bluetooth LE device.

Shows the main functions of the services window.

- A list of services and characteristic of the connected Bluetooth LE device is displayed.
- Disconnecting or reconnecting with a Bluetooth LE device.
- Search for service again.
- Displaying the characteristic window.

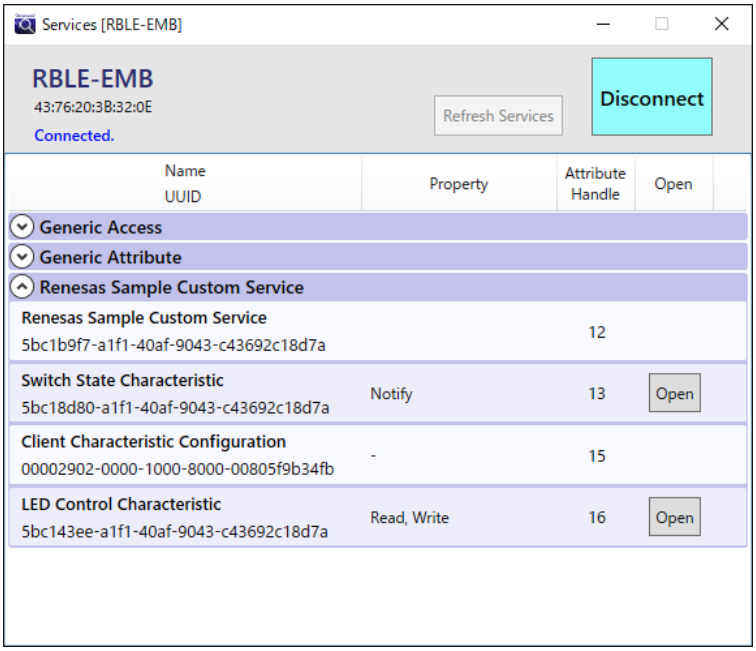


Figure 4-15 Services window

(1) Connect/Disconnect button

This button can be connected and disconnected with a Bluetooth LE device.

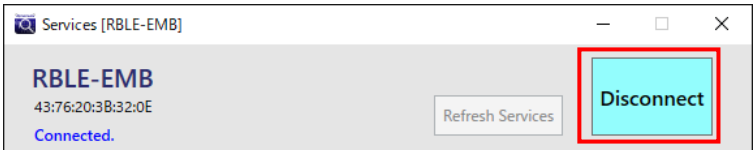


Figure 4-16 Connect/Disconnect button

When you click the button, the button changes as follows depending on the connection status with the Bluetooth LE device.

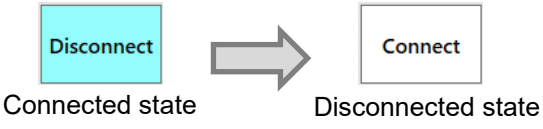


Figure 4-17 State of connect/disconnect button

(2) Refresh Service button

This button can search for service again when it receives a service changed indication from the connected Bluetooth LE device.

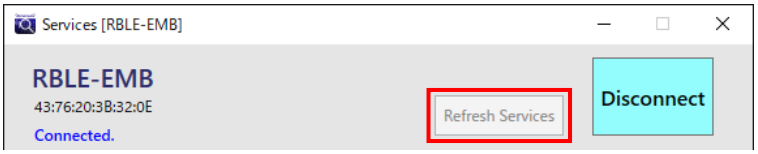
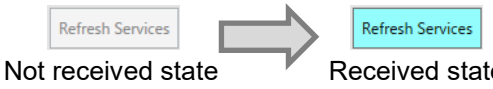


Figure 4-18 Refresh services button

The button changes as follows depending on the reception status of service changed indication. When a Windows PC receives the service changed indication, you can click the button to search for the Service again.



Not received state Received state

Figure 4-19 State of refresh service button

(3) Connection information

Displays connection information with the connected Bluetooth LE device.

Figure 4-20 Connection information

(a) Local Name and Bluetooth Device Address of the connected Bluetooth LE device.

(b) Connection status information.

(4) Service, Characteristic list

Lists the services and characteristics of the connected Bluetooth LE device.

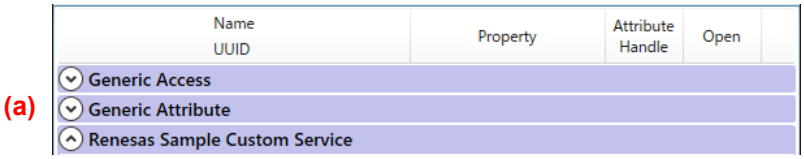


Figure 4-21 Services list

(a) Service list of connected Bluetooth LE devices.
Click the service name to display the characteristic list of the service.

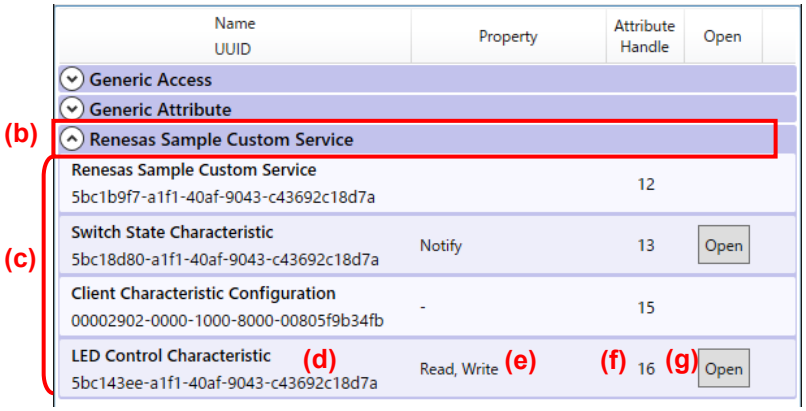


Figure 4-22 Characteristics list

(b) Service name.

(c) Characteristic list of service.

(d) Characteristic name and UUID.

(e) Characteristic property.

(f) Attribute handle number.

(g) Characteristic window open button.

(5) Show scan window menu

Redisplays the closed scan window. Select "Show scan window." from the system menu of the services window.

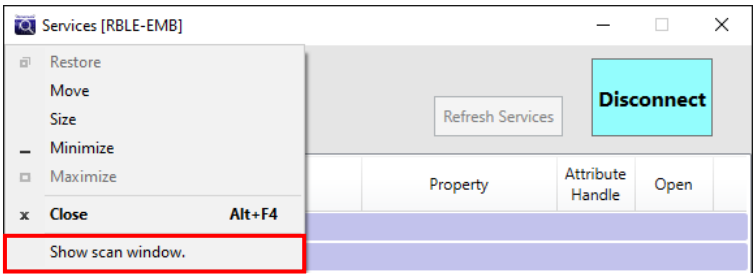


Figure 4-23 Show scan window menu

4.3.4 Characteristic window

This window is used for data communication with the connected Bluetooth LE device. The main functions are as follows.

- Set enable/disable notify and indicate for connected Bluetooth LE devices.
- Request read or write from the connected Bluetooth LE device.
- Display data received from the connected Bluetooth LE device as hexadecimal character data or ASCII text data.
- Send data in hexadecimal binary data or ASCII text to the connected Bluetooth LE device.

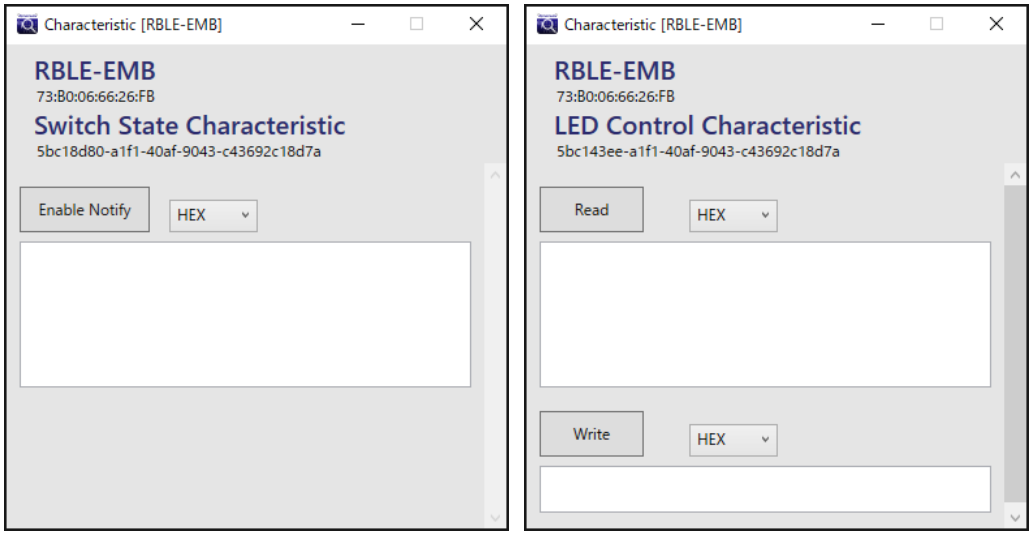


Figure 4-24 Characteristic window

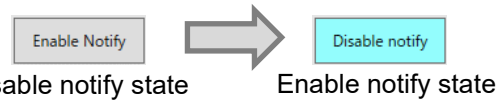
(1) Notify, Indicate

This button sets Notify and Indicate to the connected Bluetooth LE device. It also displays Notify and Indicate from Bluetooth LE devices in the text box.

Here, Notify is used as an example.

Figure 4-25 Notify enable/disable button

When the button is clicked, the button changes as follows depending on the status of Notify.



Disable notify state Enable notify state

Figure 4-26 State of notify button

Displays Notify from the Bluetooth LE device in the text box. Select HEX or TEXT in the combo box to change the display format.

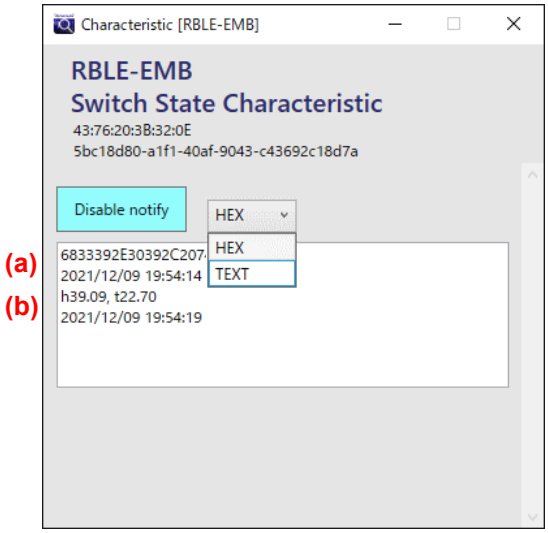


Figure 4-27 Notify

(a) When HEX is selected in the combo box, the text data of hexadecimal characters and the time when Notify was received are displayed.

(b) When TEXT is selected in the combo box, ASCII character text data and the time when Notify was received are displayed.

(2) Read

Click the Read button to read the data from the connected Bluetooth LE device and display it in the text box. Select HEX or TEXT in the combo box to change the display format.

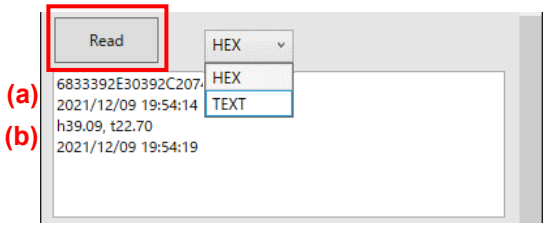


Figure 4-28 Read

(a) When HEX is selected in the combo box, the text data of hexadecimal characters and the time when the data was received are displayed.

(b) When TEXT is selected in the combo box, the text data of ASCII characters and the time when the data was received are displayed.

(3) Write button

Click the Write button to send the data entered in the text box to the connected Bluetooth LE device.

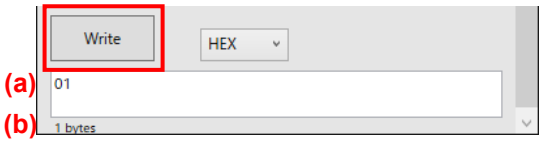


Figure 4-29 Write

(a) Enter the data to send to the connected Bluetooth LE device.

(b) Displays the entered data size.

If you select HEX in the combo box, enter hexadecimal characters in the text box. The entered hexadecimal character is sent as hexadecimal binary data.

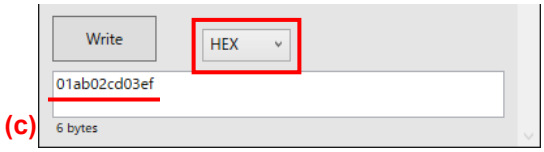


Figure 4-30 Write button – HEX

(c) Displays the length of data to be sent.

If you select TEXT in the combo box, enter ASCII characters in the text box. The entered ASCII characters are sent as ASCII text data.

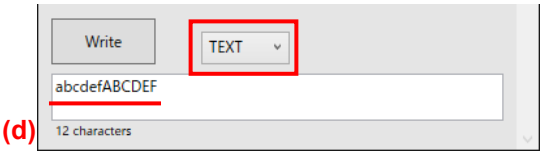


Figure 4-31 Write - TEXT

(d) Displays the number of characters to be sent.

(4) Characteristic information

Displays Characteristic connection information.

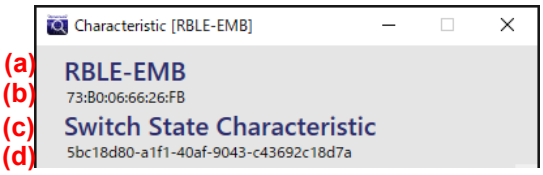


Figure 4-32 Characteristic information

(a) Displays the Local Name.

(b) Displays the Bluetooth Device Address.

(c) Displays the Characteristic name.

(d) Displays the UUID of the Characteristic.

4.4 Pairing

When connecting to a Bluetooth LE device that requires pairing, perform pairing in the Windows "Settings" before connecting.

(1) Click [Start menu]  of Windows.

(2) Click [Settings]  in Start menu.

(3) Click [Devices] in Windows settings.

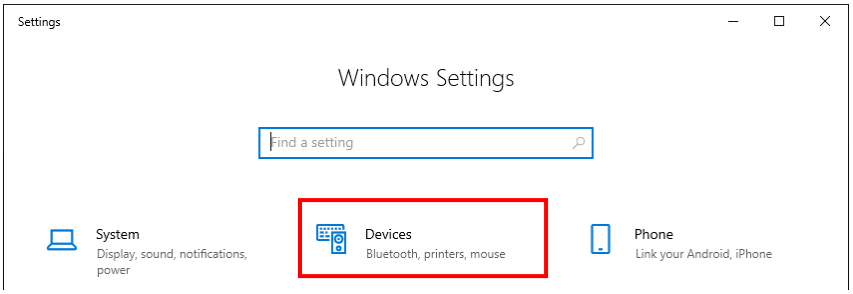


Figure 4-33 Settings of windows

(4) Click the "Add Bluetooth or other device" toggle switch in Bluetooth & other devices to turn it on.

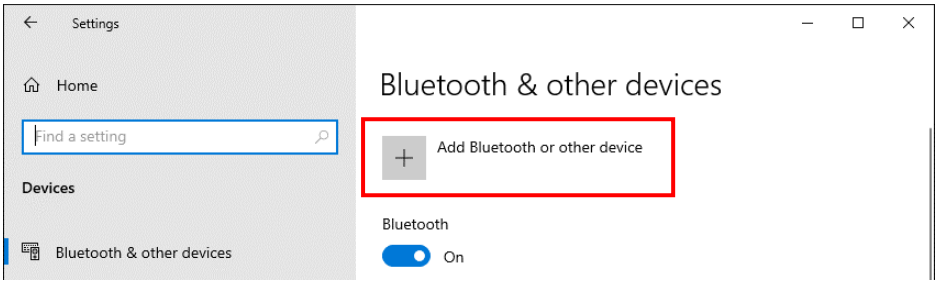


Figure 4-34 Bluetooth & other devices

(5) Click "Bluetooth" to add a device.

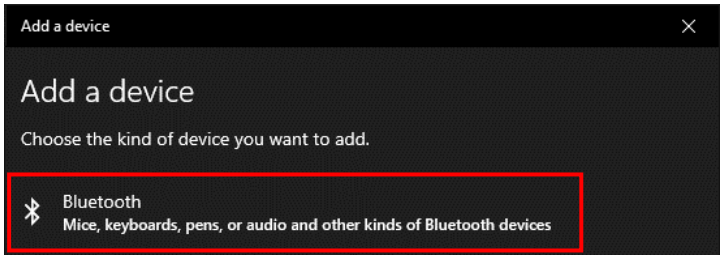


Figure 4-35 Add a device

(6) Click "Devices to connect to" displayed in Add device.

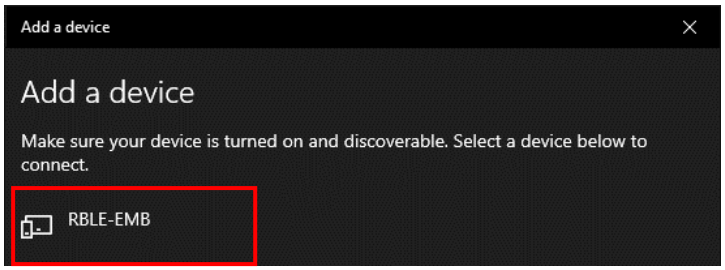


Figure 4-36 Add a device – Device to connect

(7) Confirm that the device to be connected is "Paired" and click "Done".

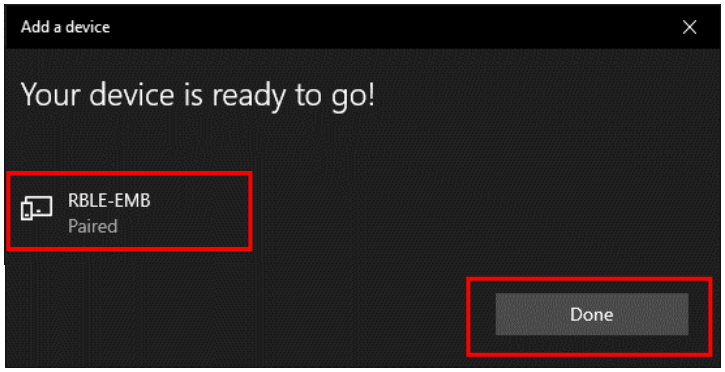


Figure 4-37 Add a device – Paired

4.5 Error number

Table 4-1 Error number

Error number	Error message	Description
0x80000013	The object has been closed.	The instance with the connected device has been lost. Please restart the GATTBrowser.
0x80070005	Access is denied.	The version of Windows 10 may be old. Please upgrade Windows 10. Or use another Windows 10 PC.
0x80070057	The parameter is incorrect.	The version of Windows 10 may be old. Please upgrade Windows 10. Or use another Windows 10 PC.
0x800710DF	The device is not ready for use.	The Bluetooth function is turned off. Please turn on the Bluetooth function.
0x80131537	Could not find any recognizable digits.	Write the correct data.
	Additional non-parsable characters are at the end of the string.	
0x80650003	The attribute cannot be written.	The version of Windows 10 may be old. Please upgrade Windows 10. Or use another Windows 10 PC.
0x80650005	The attribute requires authentication before it can be read or written.	Refer to "4.4 Pairing" to pair the device to be connected with Windows 10.
0x8065000D	The attribute value length is invalid for the operation.	Please specify the correct size data.

Revision History

Rev.	Date	Description	
		Page	Summary
1.0	Dec.27.2021	-	First edition, issued

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit 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. Precaution against Electrostatic Discharge (ESD)
   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
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
   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 the 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.
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.).
7. Prohibition of access to reserved addresses
   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
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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