RX Family

QE for BLE [RX]: Sample Projects and Dedicated Programs for the R_BLE Scripts

Introduction

The Renesas Solution Kit QE for BLE [RX] is among the QE (Quick and Effective Tool Solution) development assistance products for various applications. QE for BLE [RX] makes it easy to test the communications features of the RX23W (Bluetooth® low energy MCU), thus reducing development periods up to the point where a product reaches the market.

This document describes the usage of this tool with examples. Refer to the help system of QE for BLE [RX] and the related documents for detailed information on individual functions.

Target Device

RX23W

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1. Configuration of a System

The configuration of a system for using QE for BLE [RX] is shown below.

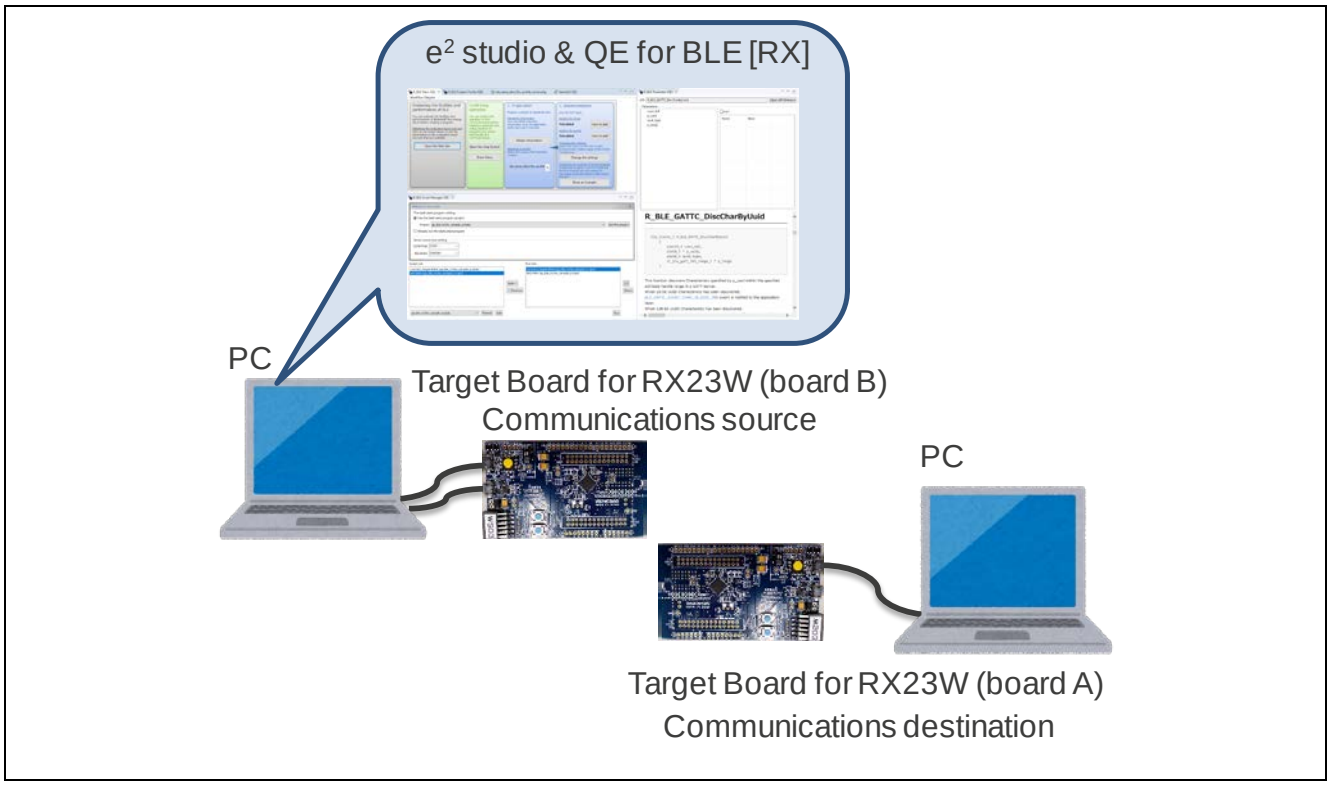


Figure 1-1 Configuration of a System

Operating Environment

- Host OS
  Windows 7, 8.1, 10 (Japanese or English, 32-/64-bit)
- Environment for execution
  V7.6.0 or a later version of the e² studio integrated development environment
  V1.0.0 of QE for BLE [RX] (development assistance tool for Bluetooth® low energy)
- Library
  RX23W group BLE module Firmware Integration Technology V1.00
- Applicable board
  Target Board for RX23W: Two
  - Board A: For writing the sample project for the BLE protocol stack
  - Board B: For writing a mot file to the Target Board for RX23W
- Cables
  USB (Micro B) cables: Three
  - For supplying power to board A
  - For downloading programs to board B
  - For serial communications with board B

2. Advance Preparation

2.1 Downloading and Installing

This section describes how to obtain the software required to use QE for BLE [RX]. Download and install the software according to the procedures described on the download pages.

Table 2-1 List of the Required Software and URLs of the Download Pages

Software	URL	Description
e^2 studio V7.6.0	https://www.renesas.com/e2studio	Builds and downloads programs. Install the software according to the procedure described on the download page.
QE for BLE [RX] V1.0.0	https://www.renesas.com/qe-ble	Runs the R_BLE script. Install the software according to the procedure described on the download page.
RX23W group BLE module Firmware Integration Technology V1.0.0	https://www.renesas.com/search/keyword-search.html#q=r01an4860	Enables the use of the demonstration program included with the sample project as a program in the communications destination.

3. Structure of the Project

The following shows the structure of the file system that includes the sample project for the R_BLE scripts (file name: qe_ble_rx23w_sample_scripts.zip). Details of files that are automatically generated by the FIT module or integrated development environment are omitted.

Table 3-1 Structure of a Folder

```
TOP                                                    : TOP folder
│
│   ble_demo_tbrx23w_uart_hci.mot                     : mot file for a Target Board for RX23W
│   connect_target.rble5                               : R_BLE script for connection
│   led.rble5                                          : R_BLE script for making an LED blink
│   qe_ble_rx23w_sample_scripts HardwareDebug.launch   : File for a debugging structure
│
├─generate                                             : Source files for use in creating the project
│       dbsct.c
│       hwsetup.c
│       intprg.c
│       iodefine.h
│       resetprg.c
│       sbrk.c
│       sbrk.h
│       stacksct.h
│       typedefine.h
│       vect.h
│       vecttbl.h
└─src
        qe_ble_rx23w_sample_scripts.c                  : Source files for use in creating the project
```

4. Running the R_BLE scripts

In this chapter, the R_BLE script function of QE for BLE [RX] is used to make an LED blink in response to communications from board B to board A via Bluetooth® Low Energy communications.

4.1 Preparing the Communications Destination

This section describes preparation of the communications destination to check the operation of the R_BLE scripts.

4.1.1 Connecting the Target Board for RX23W

Connect the PC to the Target Board for RX23W with the USB cable. Do so through the following steps.

1. Turn on side 2 of the ESW1 switch (1) of the Target Board for RX23W. This enables debugging.
2. Connect the USB cable to ECN1 (2).

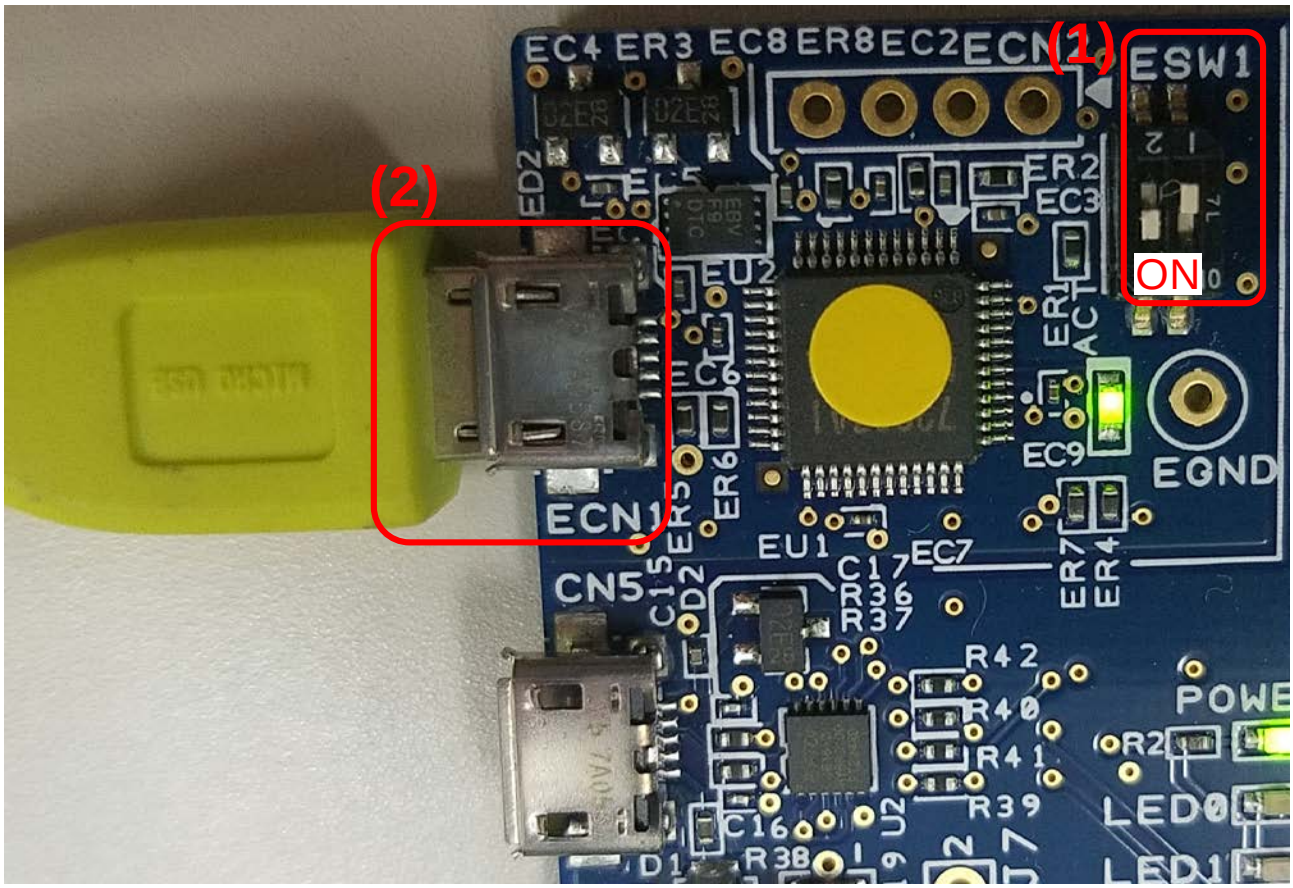


Figure 4-1 Connecting the Target Board for RX23W in the Communications Destination

4.1.2 Running the Program in the Communications Destination

4.1.2.1 Activating the e² studio

Select “e² studio” from the shortcut menu in the start menu of Windows, or activate “e2studio.exe” which is in the folder where it was installed (or under “C:¥Renesas¥e2_studio¥eclipse” by default).

4.1.2.2 Importing the Demonstration Project for the Target Board for RX23W to Run as a GATT Server

Import the demonstration project which is included in the RX23W group BLE module Firmware Integration Technology (R01AN4860xx0100) package.

Import the demonstration project for the Target Board for RX23W to run as a GATT server (file name: ble_demo_tbrx23w_profile_server.zip) in the [FITDemos] folder under [r01an4860xx0100-rx23w-ble] through the following steps.

1. Select the [Import] menu from [File].
2. In the [Import] dialog box, select [Existing Projects into Workspace] from [General] and click on the [Next] button.
3. Select the [Select archive file] radio button and click on the [Browse] button.
4. In the dialog box for selecting files, select “ble_demo_tbrx23w_profile_server.zip” and click on the [Open] button.
5. “ble_demo_tbrx23w_profile_server(ble_demo_tbrx23w_profile_server/)” is added to the [Projects] list. Check that the checkboxes have been selected and click on the [Finish] button.

4.1.2.3 Building and Running the Program

Build the imported project and download the demonstration program to place the Target Board for RX23W in the state where it can run the program.

1. In the [Project Explorer] view, right-click on the “ble_demo_tbrx23w_profile_server” project and select [Build Project] in the pop-up menu.
2. After building is completed, right-click on the “ble_demo_tbrx23w_profile_server” project and select [Renesas GDB Hardware Debugging] from [Debug] in the pop-up menu.
3. After downloading is completed, select the [Resume] menu from [Run As] to set the demonstration program as executable.
4. The program is stopped at the start of the main function. Select the [Resume] menu from [Run As] again to get the demonstration program into the state to be run.

This is the end of preparing the destination board.

4.2 Preparing the Communications Source

This section describes preparation of the communications source to check the operation of the R_BLE scripts.

4.2.1 Connecting the Target Board for RX23W

Connect the PC to the Target Board for RX23W with the USB cable. Use the following steps.

1. Turn on side 2 of the ESW1 switch (1) of the Target Board for RX23W. This enables debugging.
2. Connect the USB cable (for downloading programs to board B) to ECN1 (2).
3. Connect the USB cable (for serial communications with board B) to CN5 (3).

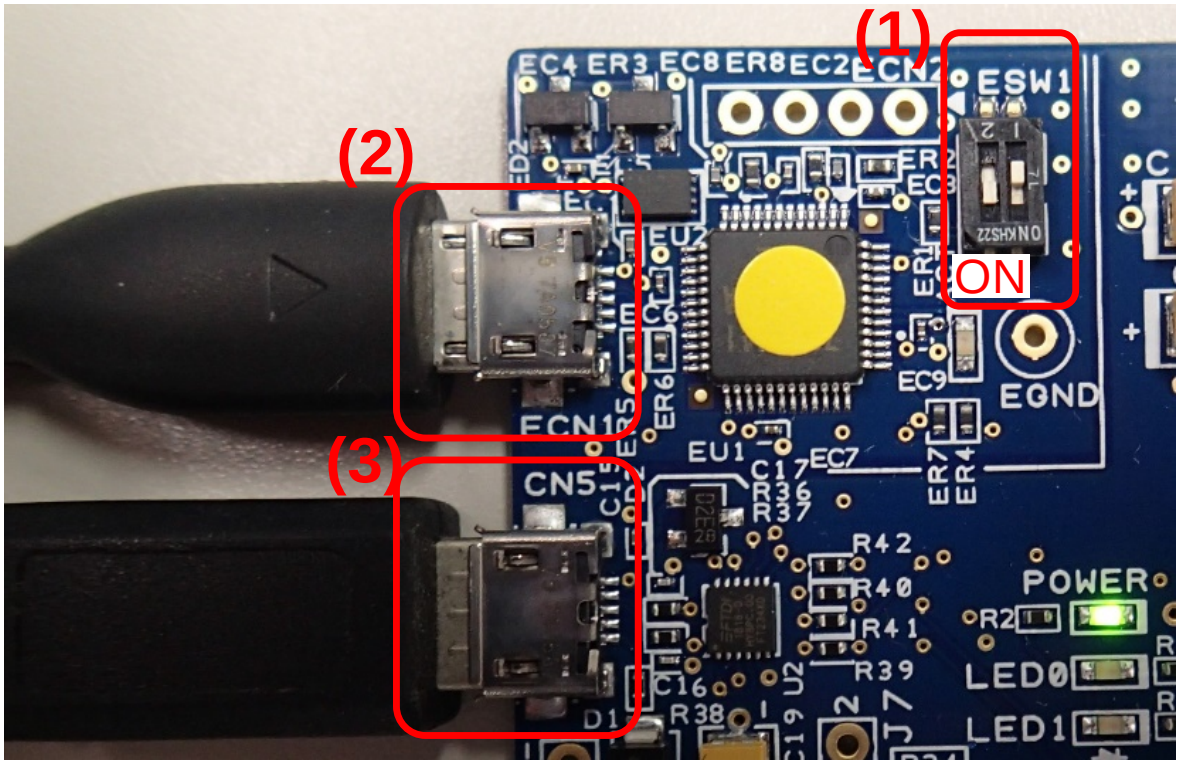


Figure 4-2 Connecting the Target Board for RX23W for Running the R_BLE Scripts

4.2.2 Preparing the Environment for Running the R_BLE Scripts

4.2.2.1 Activating the e² studio

Select “e² studio” from the shortcut menu in the start menu of Windows, or activate “e2studio.exe” which is in the folder where it was installed (or under “C:¥Renesas¥e2_studio¥eclipse” by default).

4.2.2.2 Importing the Sample Project for the R_BLE Scripts

Import the project which is provided with this application note. You can use the Smart Browser to do this.

1. Open the [R_BLE Script Manager (QE)] view.
2. Select the [Use the dedicated program project] radio button in [Settings to run script].
3. Click on the [Get the project] button.
4. The [Smart Browser] view appears with this application note shown in the list. Select the line for this application note and select [Sample Code (import projects)] from the pop-up menu.
5. The [Save As] dialog box appears. Specify the desired directory for saving the zip file and click on the [Save] button.
6. When the [End User License Agreement (Sample Code)] dialog box is displayed, click on the [Agree] button.
7. The [Import] dialog box appears. Select the [qe_ble_rx23w_sample_scripts] checkbox in the [Projects] list and click on the [Finish] button.

4.2.2.3 Opening the [R_BLE Script Manager (QE)] View

Select the [R_BLE Main (QE)] menu from [Renesas QE] in [Renesas Views] to open the [R_BLE Main (QE)] view. Clicking on the [Show Views] button on the [R_BLE Main (QE)] view opens the [R_BLE5 Script] perspective.

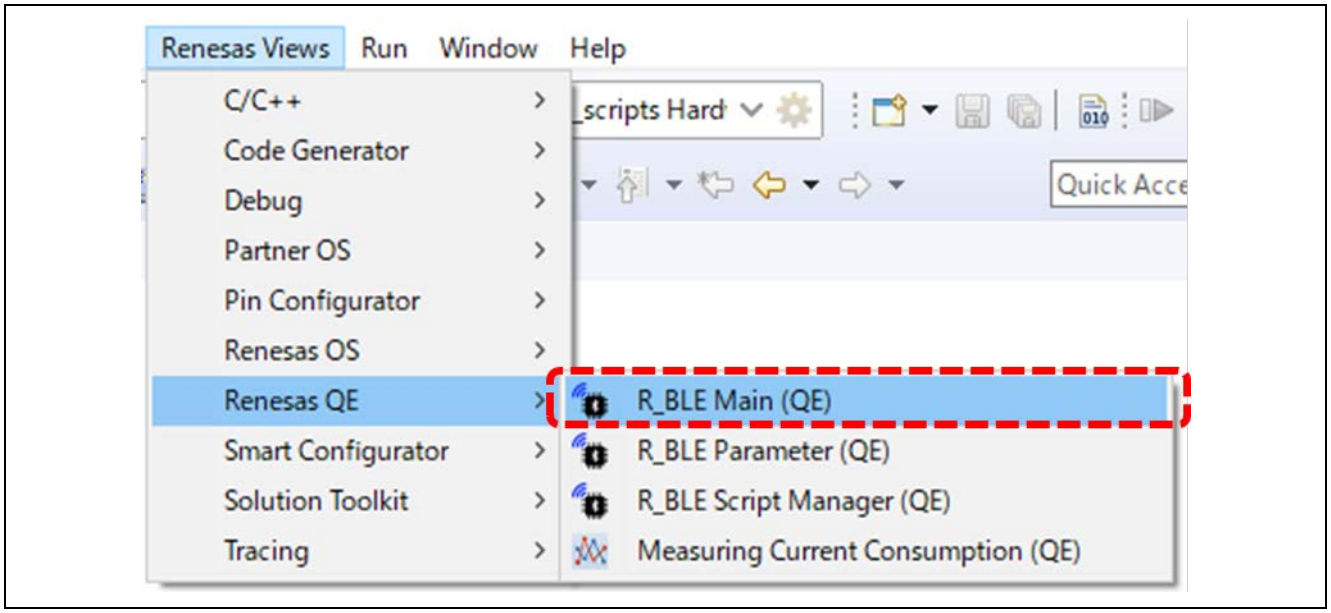


Figure 4-3 Opening the [R_BLE Main (QE)] View of QE for BLE [RX]

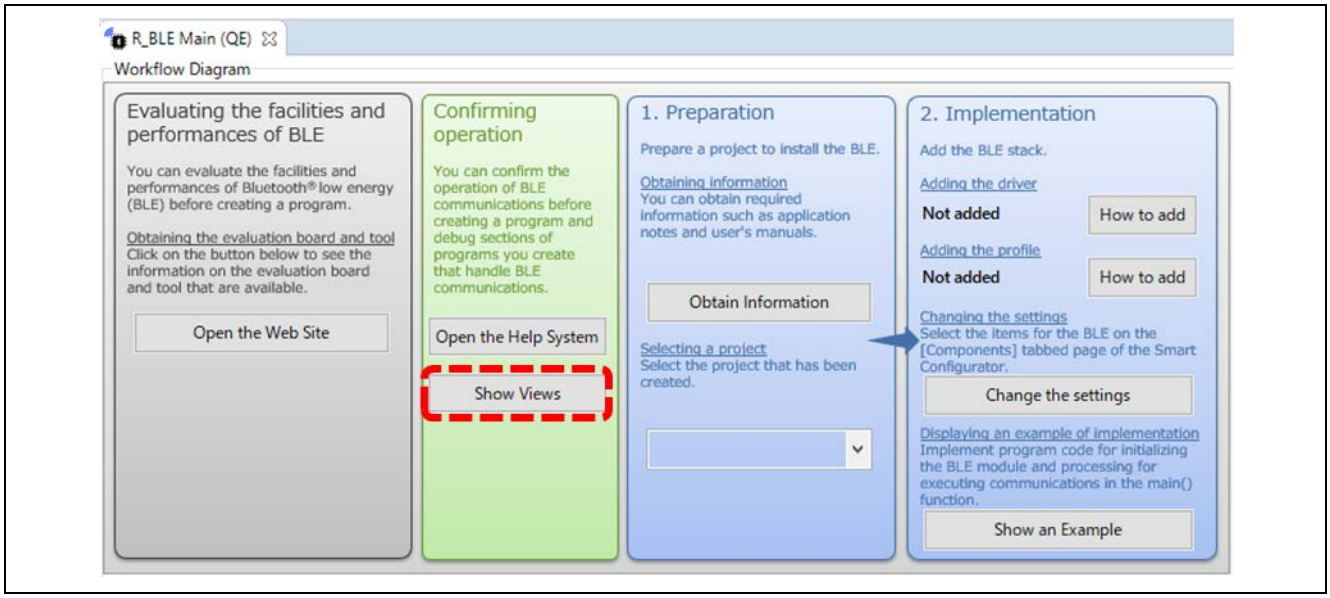


Figure 4-4 [R_BLE Main (QE)] View

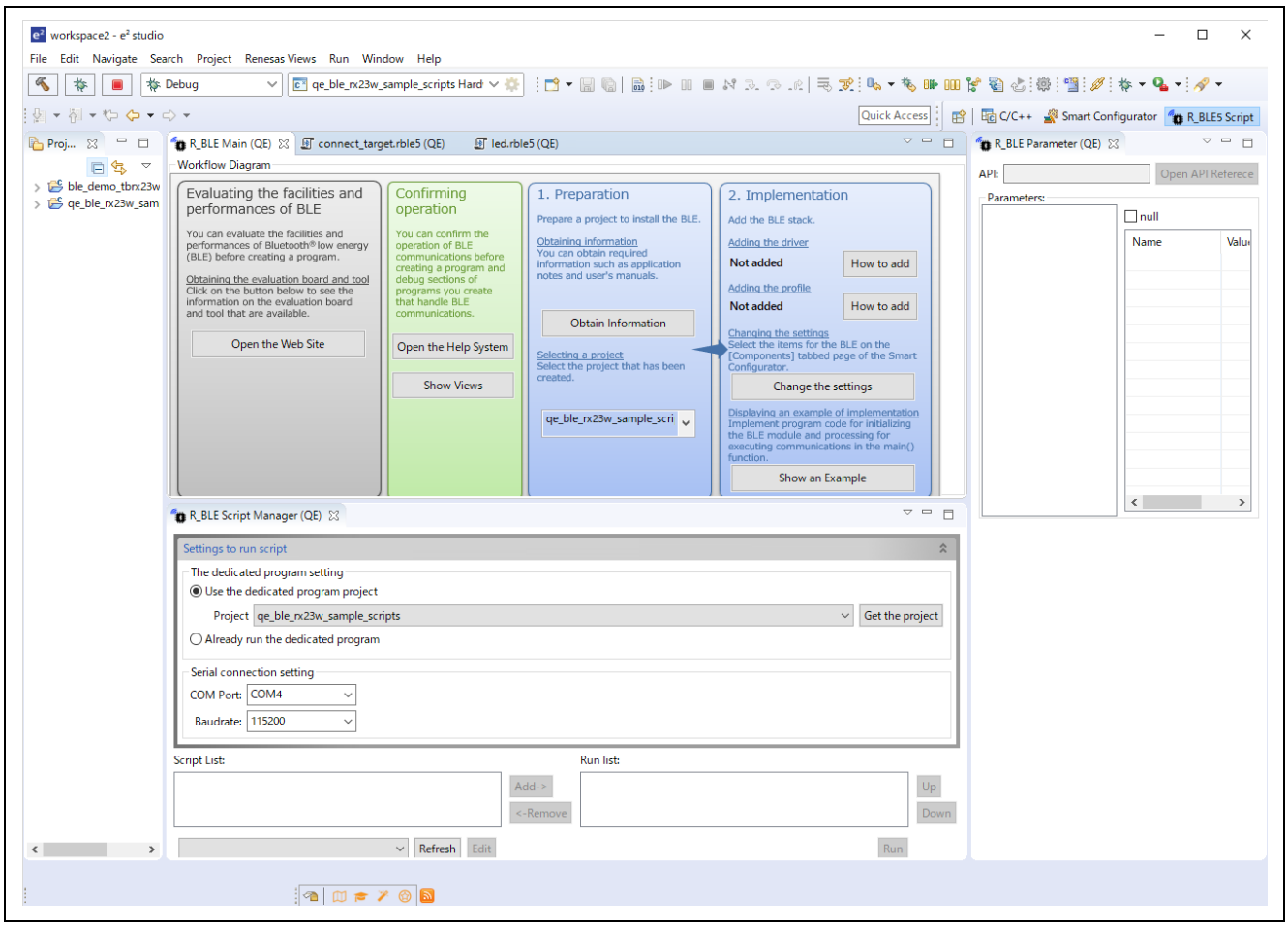


Figure 4-5 [R_BLE5 Script] Perspective

4.2.3 Operating the Sample Project for the R_BLE Scripts

4.2.3.1 Setting the [R_BLE Script Manager (QE)] View

To run the sample scripts in the [R_BLE Script Manager (QE)] view, proceed through the following steps.

1. Select the [Use the dedicated program project] radio button.
2. Select [qe_ble_rx23w_sample_scripts] from the [Project] combo box.
3. Select the COM port for serial communications with board B from the [COM Port:] combo box.
   *If you do not know which COM port to select, select that which was added to the list of choices in the [COM Port:] combo box when the USB cable for serial communications was inserted. If the list of choices for the COM port has not changed, remove the focus from the [COM Port:] combo box by clicking on the [Baudrate:] combo box or another place to shift the focus.
4. Select [115200] from the [Baudrate:] combo box.

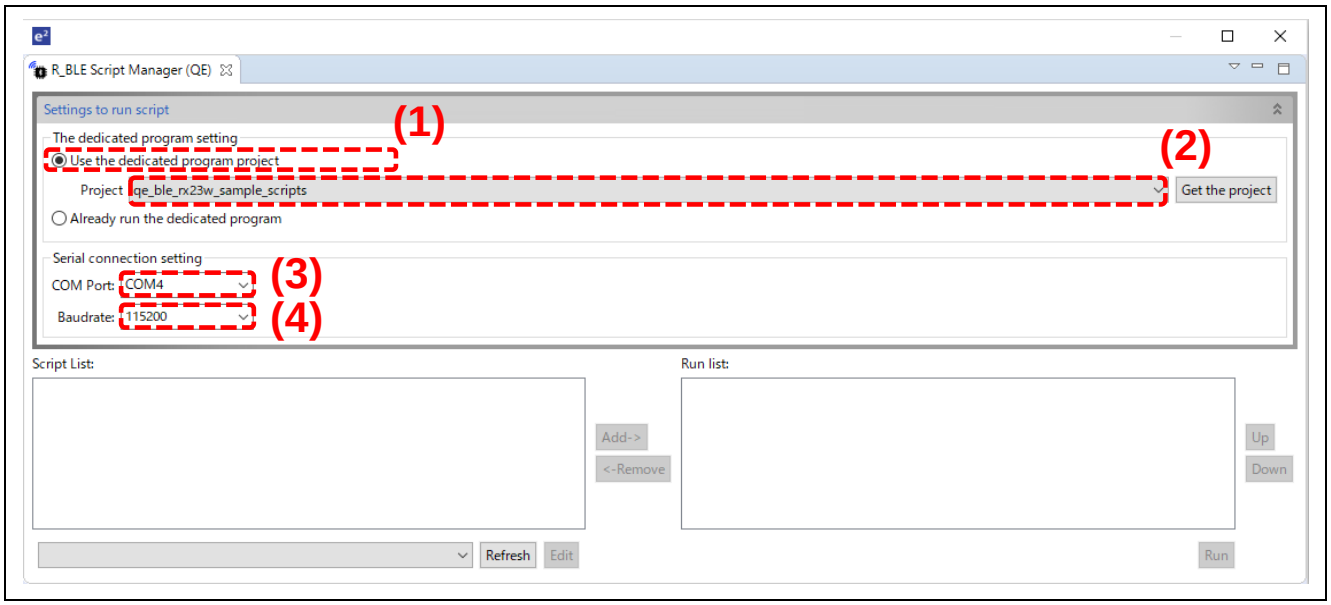


Figure 4-6 Setting the Script to be Run

Add the two R_BLE script files (connect_target.rble5 and led.rble5) to [Run list:] in the [R_BLE Script Manager (QE)] view through the following steps.

1. Click on the [Refresh] button or select the [qe_ble_rx23w_sample_scripts] project from the combo box which is to the left of the [Refresh] button.
2. Select [connect_target.rble5 (qe_ble_rx23w_sample_scripts)] from [Script List:] and click on the [Add] button to add this to [Run list:].
3. Similarly, select [led.rble5 (qe_ble_rx23w_sample_scripts)] from [Script List:] and click on the [Add] button to add this to [Run list:].

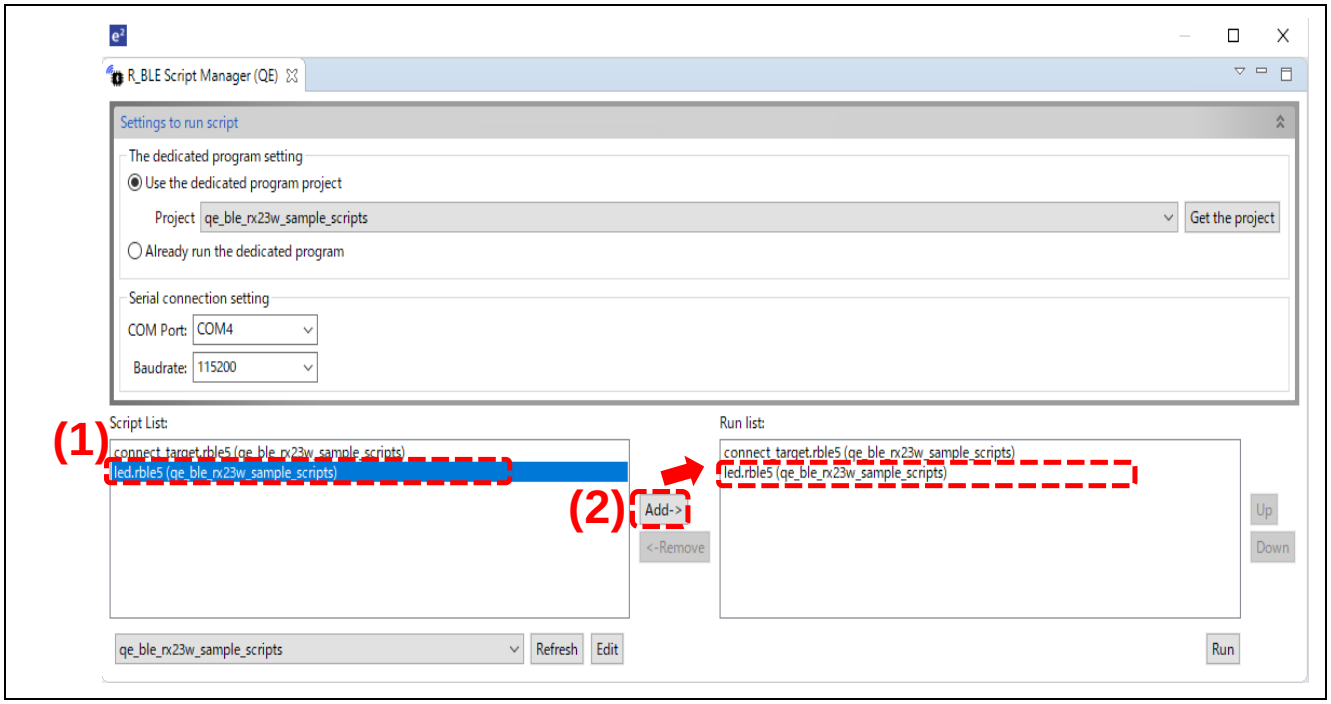


Figure 4-7 Selecting the R_BLE Scripts to be Run

4.2.3.2 Running the R_BLE Scripts

Clicking on the [Run] button in the [R_BLE Script Manager (QE)] view runs the R_BLE script which was added to [Run list:]. After the R_BLE scripts have been run, the LED on board A starts blinking. Proceed through the following steps to check the operation.

1. Click on the [Run] button.
2. The states of running the R_BLE script are output to the console.
3. After board A has been connected, the R_BLE script enters communications that vary the interval for making the LED on board A blink.
4. The LED on board A blinks.
5. After a few seconds have passed, the R_BLE script ends and the LED stops blinking.

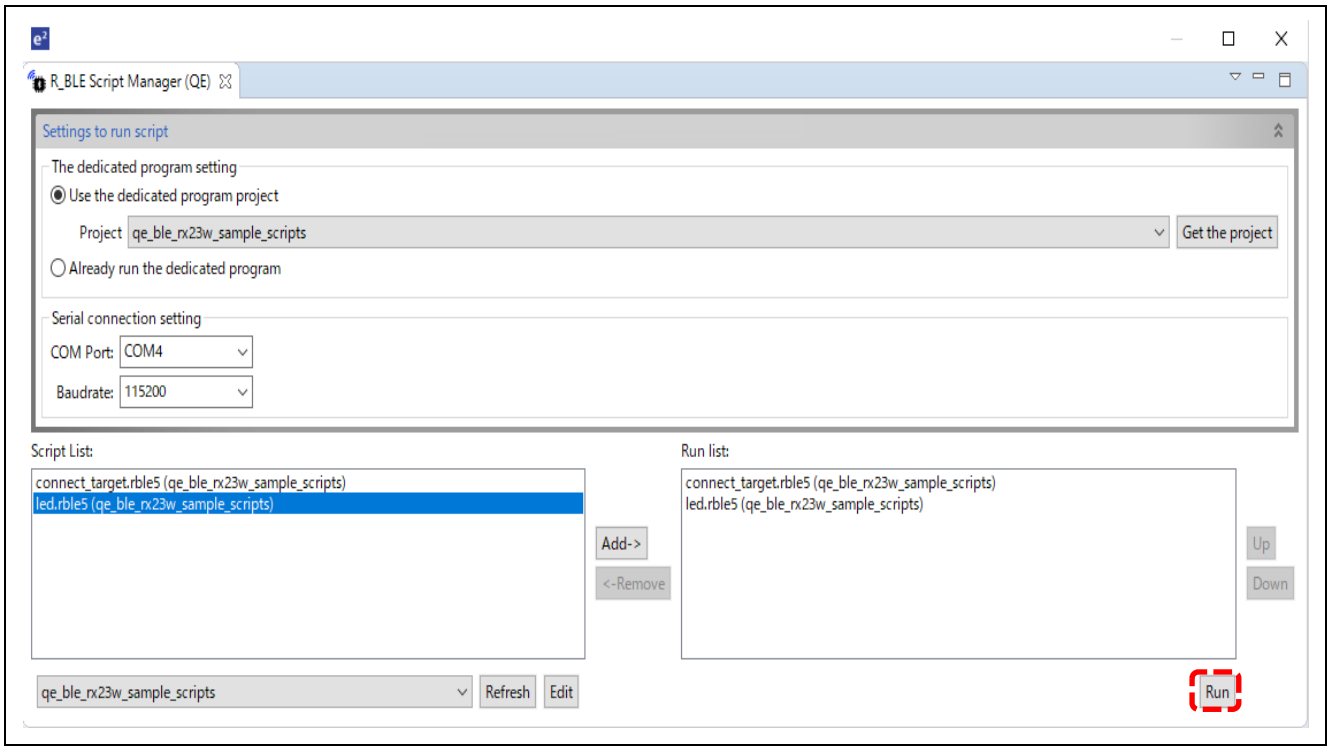


Figure 4-8 Running the R_BLE Scripts

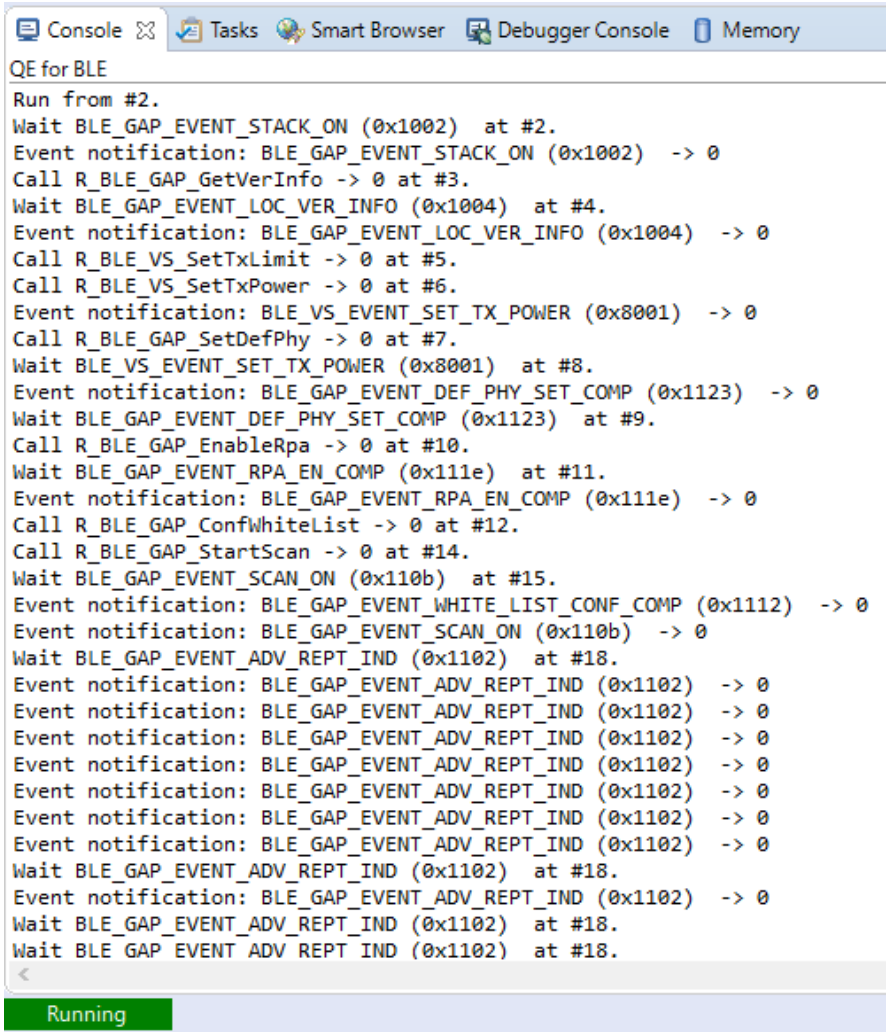


Figure 4-9 States of Running the R_BLE Scripts

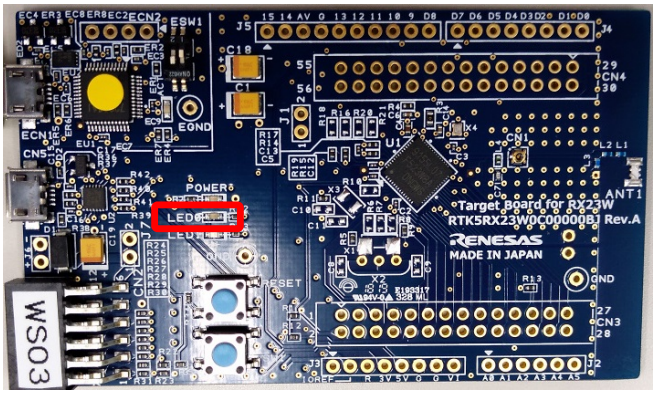


Figure 4-10 Position of the LED that Blinks on Board A

5. Note on Usage

5.1 Programming the Target Board for RX23W

If the address of the Target Board for RX23W (board A), which is used for downloading the demonstration project for the Target Board for RX23W, has been changed, communications will not be possible. Write the current address to the return value of R_BLE_GAP_CreateConn on the 28th line in the R_BLE script file (connect_target.rble5(QE)) of the sample project for the R_BLE scripts. You can use the GATT browser to confirm the current address. Download the GATT browser by access to the links on the page at the following URL. For the usage of that browser, refer to the user's manual.

- Download page: https://www.renesas.com/solutions/bluetooth

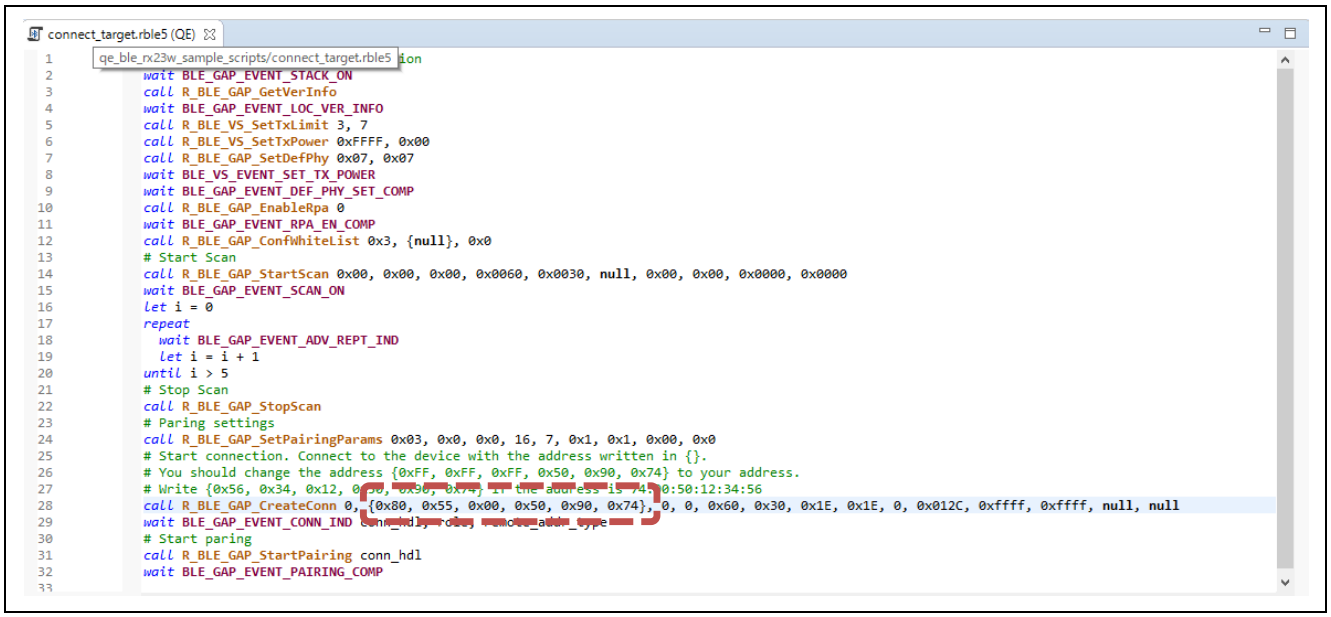


Figure 5-1 Changing the Address

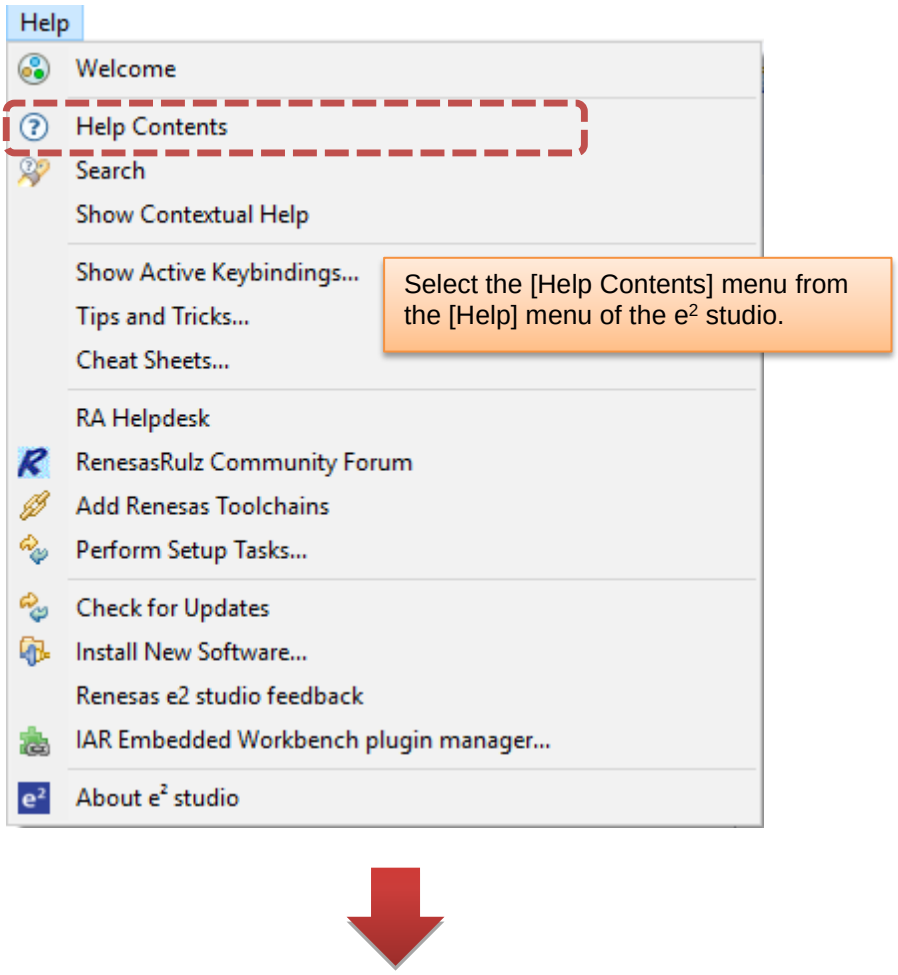
6. Other Points

6.1 How to Use the Respective Views and Write the R_BLE Scripts

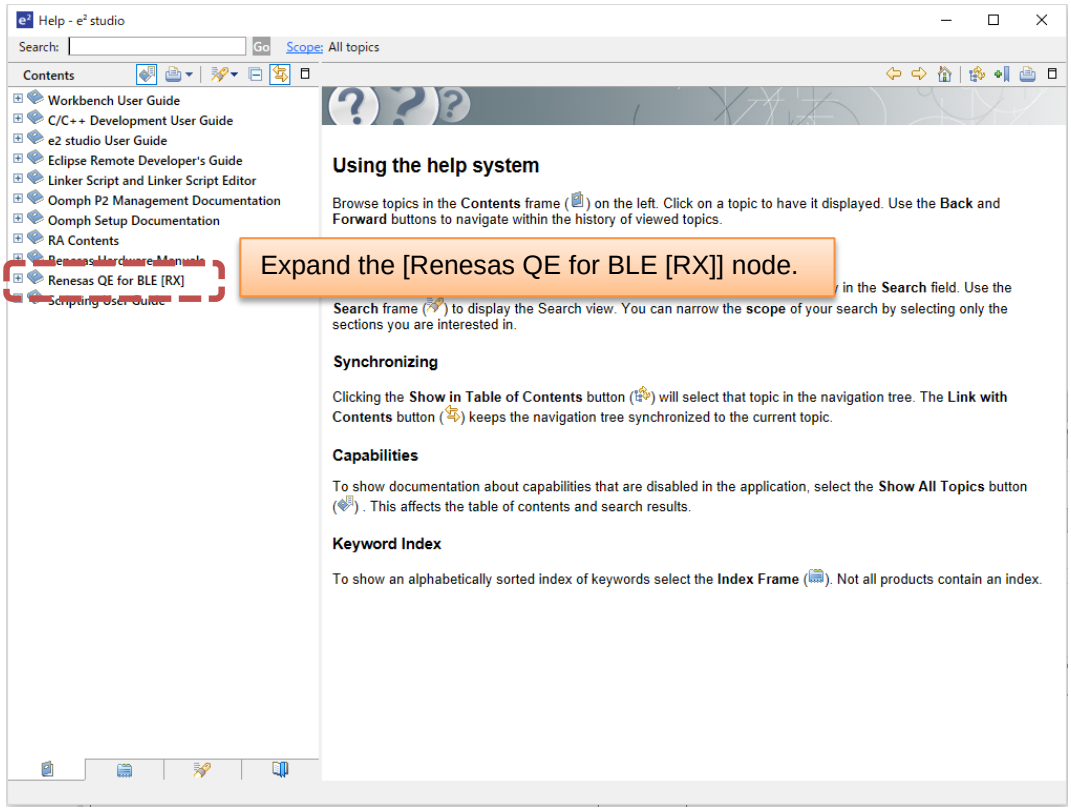
Refer to the help system through the following steps for details on using the [R_BLE Script Manager (QE)] and [R_BLE Parameter Edit (QE)] views and writing the R_BLE scripts.

1. Select [Help Contents] from the [Help] menu, then open the [Help] dialog box.
2. Open the [Renesas QE for BLE [RX]] node from the tree of the [Help] dialog box.
3. Click on the child node for the [Renesas QE for BLE [RX]] node for reference to the help system.

Step 1



Step 2



Step 3

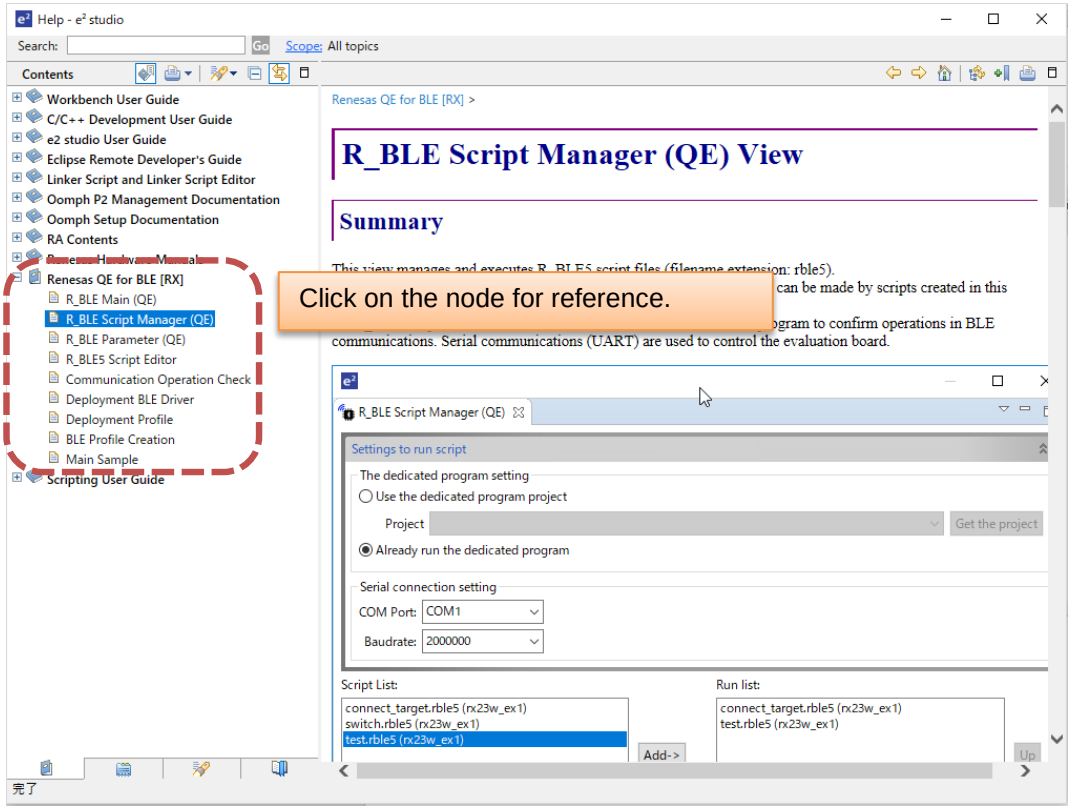


Figure 6-1 Referring to the Help System for QE for BLE [RX]

6.2 Sample Projects for the Host Controller Interface (HCI) Mode

The sample projects for the HCI mode are firmware for use in evaluating the RF characteristics and the Bluetooth® Trial Tool Suite (BTTS: R01AN4554) that sends HCI commands to the RX23W MCU from a host device such as a PC, which is connected via a serial interface. The sample projects for the HCI mode are “ble_demo_tbrx23w_uart_hci.zip” for the Target Board for RX23W and “ble_demo_rsskrx23w_uart_hci.zip” for RSSK in the [FITDemos] folder under [r01an4860xx0100-rx23w-ble]. For details, refer to chapter 6 in the Bluetooth® Low Energy Protocol Stack Basic Package User’s Manual (R01UW0205EJ0100), which can be obtained from the following URL.

- Download page: https://www.renesas.com/search/keyword-search.html#q=r01uw0205

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Dec.4.19	All	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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