RX Family

How to Implement FreeRTOS OTA Using Amazon Web Services (202406-LTS Version)

Introduction

This application note explains the procedures for using an OTA demo application under FreeRTOS with IoT Libraries.

Note: The procedures described in this application note are compatible with v202406.01-LTS-rx-1.1.0 and later versions of iot-reference-rx, a FreeRTOS reference project for RX microcontrollers.
When using v202210.01 or an earlier version of FreeRTOS, refer to *How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)* (*R01AN7037*).

Note: The examples of implementations this application note describes are based on the CK-RX65N v2 board with Ethernet communications as the operating environment, but the examples can also be used with combinations of other boards and communications control modules, such as the RYZ014A PMOD module.
For the combinations of boards and communications control modules, refer to the page at the following link.
[GitHub] https://github.com/renesas/iot-reference-rx/blob/main/Getting_Started_Guide.md#getting-started-guide

Note: Renesas has announced discontinuation of production of the existing LTE module with the part number RYZ014A, and has announced the cessation of shipment of the product.
Accompanying cessation of shipment of the RYZ014A, the CK-RX65N v1 board will also no longer be shipped.
If the RYZ014A is in use for a current design or item in production, replace it with the Sequans product GM01Q, which has pin and functional compatibility with the RYZ014A.

The EOL notice for the RYZ014A is given at the following link.
[Link] https://www.renesas.com/document/eln/plc-240004-end-life-eol-process-select-part-numbers?r=1503996
[Product page] https://www.renesas.com/products/wireless-connectivity/cellular-iot-modules/ryz014a-lte-cat-m1-cellular-iot-module

Target Devices

RX65N and RX651 groups

Hardware

CK-RX65N v2

Contents

1. Overview

1.1 Overview of the System

This section outlines the operations for implementing OTA updates by using the RX65N microcontroller that is mounted on the CK-RX65N v2 board and supports the dual-bank function.

In a microcontroller with the dual-bank function, the ROM area can be divided into an execution area and a temporary area. By dynamically swapping the execution area and temporary area, the updated firmware can be written to the temporary area while the existing version of firmware continues to run in the execution area.

The following figures show memory allocation and how the memory areas are switched by bank swapping with the dual-bank function during an OTA update.

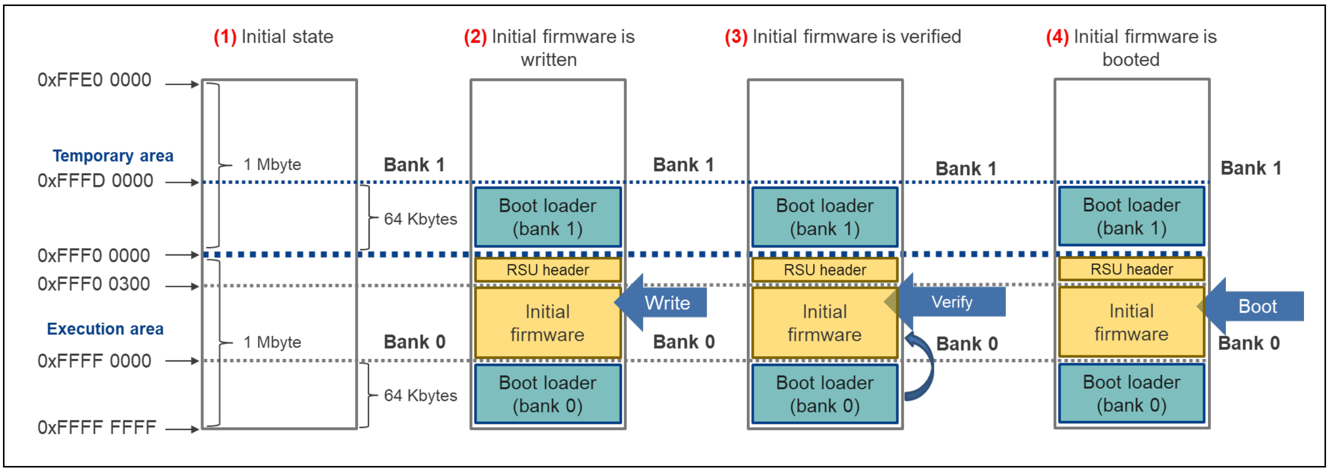


Figure 1.1 Overview of an OTA Update (1)

(1) In this state, all data have been erased (blank state) by the Renesas Flash Programmer.

(2) In this state, the data[Note] obtained by combining the boot loader and initial firmware in the Renesas Flash Programmer are written.

Note: This refers to the data obtained by combining the boot loader (in bank 0), initial firmware, RSU header, and boot loader (in bank 1). For details on the RSU header, refer to “5.2 Image File” in *RX Family Firmware Update Module Using Firmware Integration Technology Application Note (R01AN6850)*.

(3) After release from the reset state, the boot loader (in bank 0) verifies the initial firmware.

(4) The initial firmware is booted up.

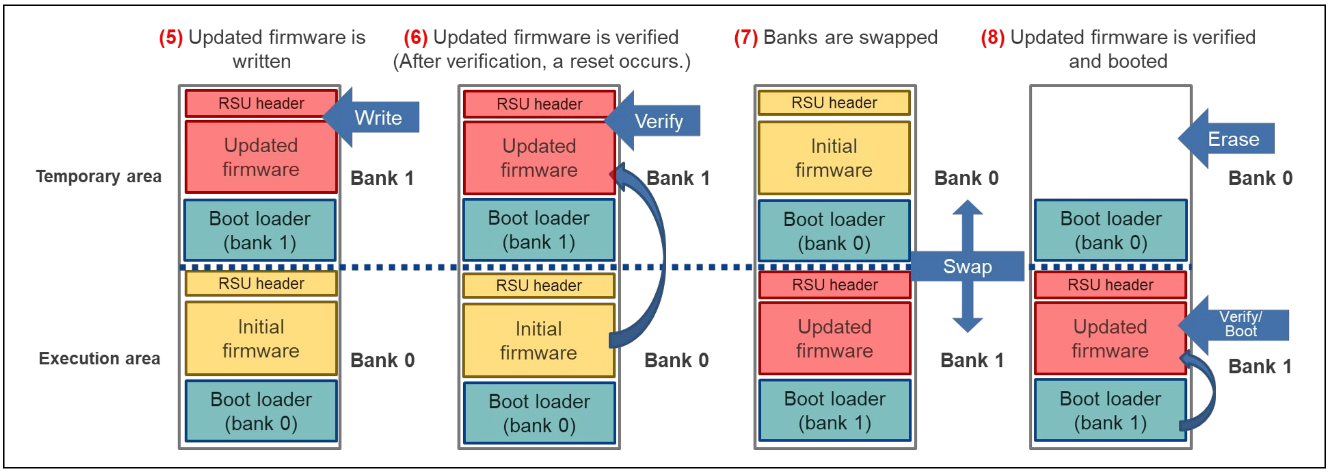


Figure 1.2 Overview of an OTA Update (2)

(5) Upon receiving the updated firmware from Amazon Web Services (AWS), the updated firmware is written to bank 1.

While this writing to bank 1 is in progress, operations by the initial firmware are executed through the BGO function.

(6) The updated firmware is verified by the initial firmware.

(7) Bank 0 and bank 1 are swapped (bank swap), and bank 1 is designated as the execution area.

(8) The updated firmware is verified by the boot loader (in bank 1).

If verification fails, control is returned to the previous firmware and the previous firmware is booted up.

If verification succeeds, the updated firmware that was written to bank 1 is booted up.

After the updated firmware has been executed, a self-test proceeds. If the result of the self-test is a pass, the initial firmware in bank 0 is erased.

If the result of the self-test is not a pass, control is returned to the previous firmware and a reset is executed.

1.2 Hardware Environment for Confirming Operation

The hardware environment for confirming operation of the demo project is indicated in the table below.

Table 1.1 Hardware Environment for Confirming Operation

Item	Product
Board	CK-RX65N v2 (Ethernet)

1.3 Software Environment for Confirming Operation

The elements of the software environment for confirming operation of the demo project are listed in the table below.

Table 1.2 Software Environment for Confirming Operation

Item	Product
Integrated Development Environment (IDE)	e^2 studio 2025-04
Compiler	Renesas CC-RX v3.07.00 GCC for Renesas RX v8.3.0.202405
FreeRTOS	v202406.01-LTS-rx-1.1.0
Log monitoring tool	Tera Term v4.108
Python	Python 3.11.0
Keygen tool	Win64 OpenSSL v3.4.1
Flash memory programming tool	Renesas Flash Programmer V3.19.00
Renesas Image Generator	Version 3.03 (supplied with Firmware Update Module Rev.2.04)
AWS command line interface (CLI)	AWS Command Line Interface version 2

2. Preparations in Advance

2.1 Installing Tera Term

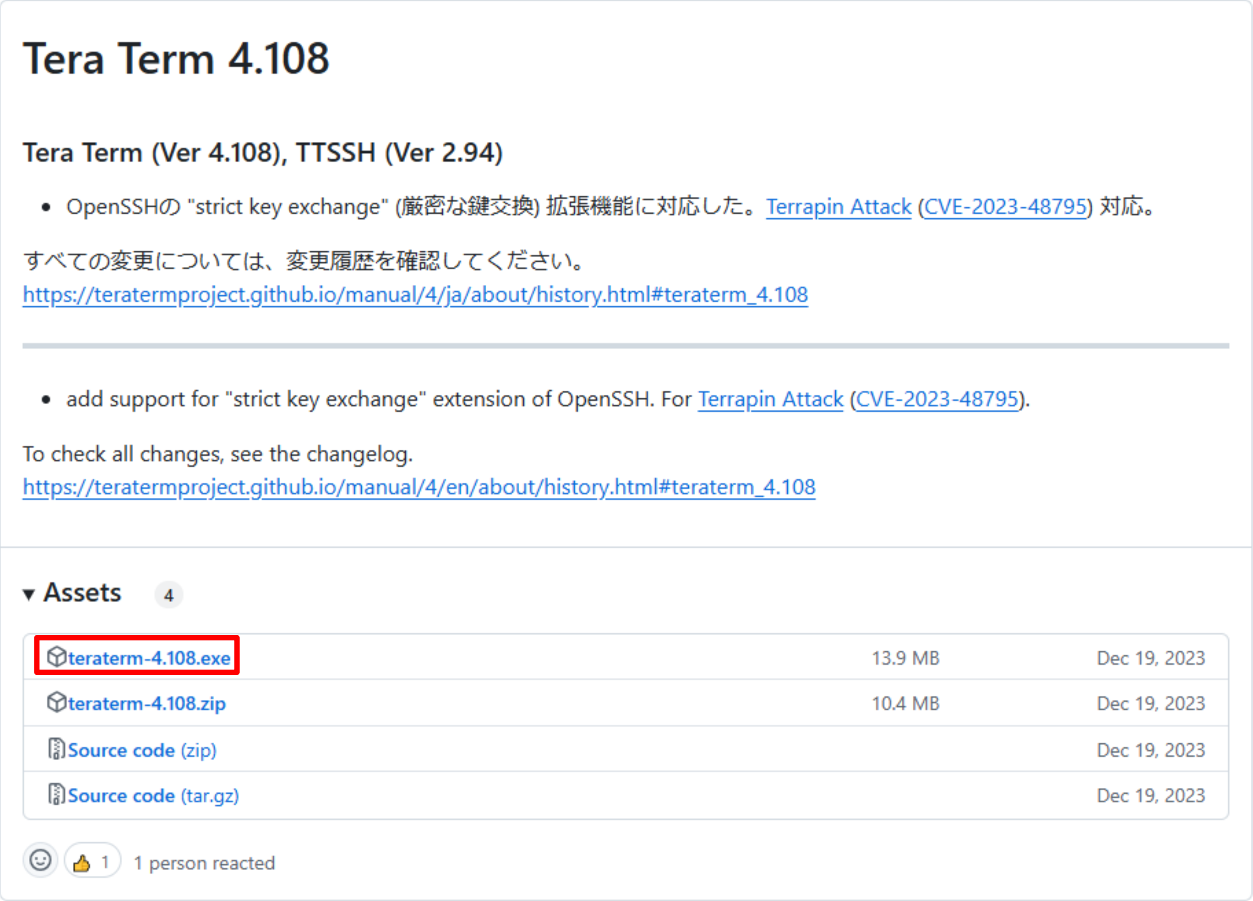
(1) Access the Tera Term download site.

Access the Tera Term download site at the following link.

Tera Term download site (GitHub)

(2) Download the Tera Term installer.

Specify a version of Tera Term 4.xxx and download the Tera Term installer.



Tera Term 4.108

Tera Term (Ver 4.108), TTSSH (Ver 2.94)

- OpenSSHの "strict key exchange" (厳密な鍵交換) 拡張機能に対応した。Terrapin Attack (CVE-2023-48795) 対応。

すべての変更については、変更履歴を確認してください。
https://teratermproject.github.io/manual/4/ja/about/history.html#teraterm_4.108

- add support for "strict key exchange" extension of OpenSSH. For Terrapin Attack (CVE-2023-48795).

To check all changes, see the changelog.
https://teratermproject.github.io/manual/4/en/about/history.html#teraterm_4.108

▾ Assets 4

teraterm-4.108.exe	13.9 MB	Dec 19, 2023
teraterm-4.108.zip	10.4 MB	Dec 19, 2023
Source code (zip)		Dec 19, 2023
Source code (tar.gz)		Dec 19, 2023

Note: Tera Term v5.xxx cannot be used because it does not support some functions of the demo project described in this application note.

(3) Run the installer.

Run the installer and follow the prompts to install Tera Term.
Execute the installer with administrative permissions.

(4) Confirm that Tera Term starts up.

Click on the Tera Term icon in the Start menu and confirm that Tera Term starts.

2.2 Installing Python

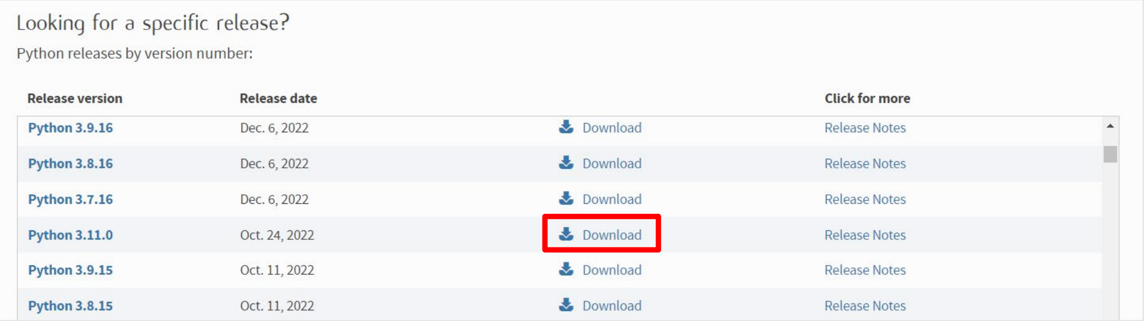
(1) Access the Python download site.

Access the Python download site at the following link.

Python download site

(2) Download the Python installer.

Click on the “Download” link for Python 3.11.0 in the version list.

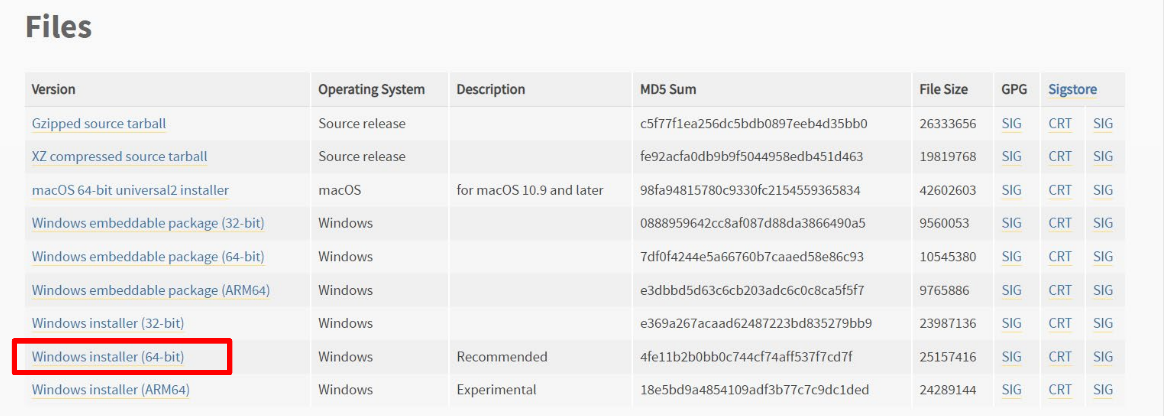


Looking for a specific release?

Python releases by version number:

Release version	Release date		Click for more
Python 3.9.16	Dec. 6, 2022	Download	Release Notes
Python 3.8.16	Dec. 6, 2022	Download	Release Notes
Python 3.7.16	Dec. 6, 2022	Download	Release Notes
Python 3.11.0	Oct. 24, 2022	Download	Release Notes
Python 3.9.15	Oct. 11, 2022	Download	Release Notes
Python 3.8.15	Oct. 11, 2022	Download	Release Notes

Download the installer for the OS you are using.

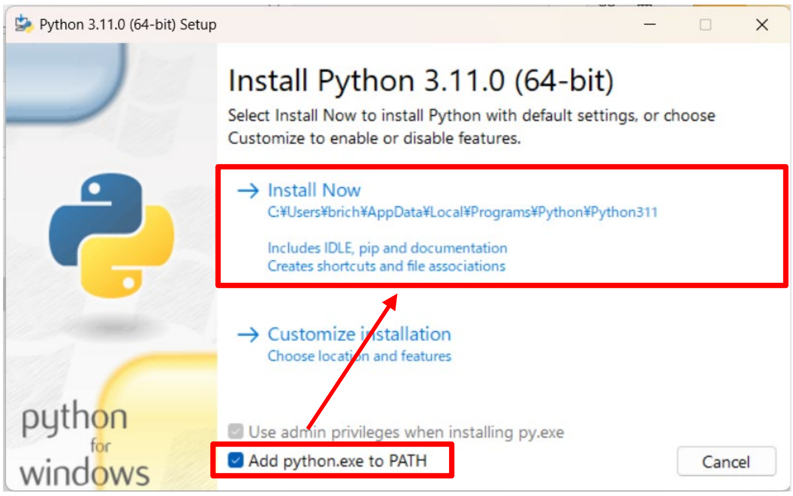


Files

Version	Operating System	Description	MD5 Sum	File Size	GPG	Sigstore	
Gzipped source tarball	Source release		c5f77f1ea256dc5bdb0897eeb4d35bb0	26333656	SIG	CRT	SIG
XZ compressed source tarball	Source release		fe92acfa0db9b9f5044958edb451d463	19819768	SIG	CRT	SIG
macOS 64-bit universal2 installer	macOS	for macOS 10.9 and later	98fa94815780c9330fc2154559365834	42602603	SIG	CRT	SIG
Windows embeddable package (32-bit)	Windows		0888959642cc8af087d88da3866490a5	9560053	SIG	CRT	SIG
Windows embeddable package (64-bit)	Windows		7df0f4244e5a66760b7caaed58e86c93	10545380	SIG	CRT	SIG
Windows embeddable package (ARM64)	Windows		e3dbbd5d63c6cb203adc6c0c8ca5f5f7	9765886	SIG	CRT	SIG
Windows installer (32-bit)	Windows		e369a267acaad62487223bd835279bb9	23987136	SIG	CRT	SIG
Windows installer (64-bit)	Windows	Recommended	4fe11b2b0bb0c744cf74aff537f7cd7f	25157416	SIG	CRT	SIG
Windows installer (ARM64)	Windows	Experimental	18e5bd9a4854109adf3b77c7c9dc1ded	24289144	SIG	CRT	SIG

(3) Install Python.

Run the installer and follow the prompts to install Python.
In the installation window, tick the [Add python.exe to PATH] checkbox.



Python 3.11.0 (64-bit) Setup

Install Python 3.11.0 (64-bit)

Select Install Now to install Python with default settings, or choose Customize to enable or disable features.

→ Install Now
C:¥Users¥brich¥AppData¥Local¥Programs¥Python¥Python311

Includes IDLE, pip and documentation
Creates shortcuts and file associations

→ Customize installation
Choose location and features

☐ Use admin privileges when installing py.exe

☑ Add python.exe to PATH

Cancel

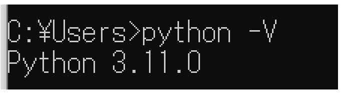
(4) Confirm the installation of Python.

Open the command prompt window, and confirm that Python 3.11.0 is installed.
Execute the following command and confirm that the version information is displayed.

```
> python -V
```

Note: "V" must be entered as a capital letter.

After the command has been executed, the display in the window will be as shown below.



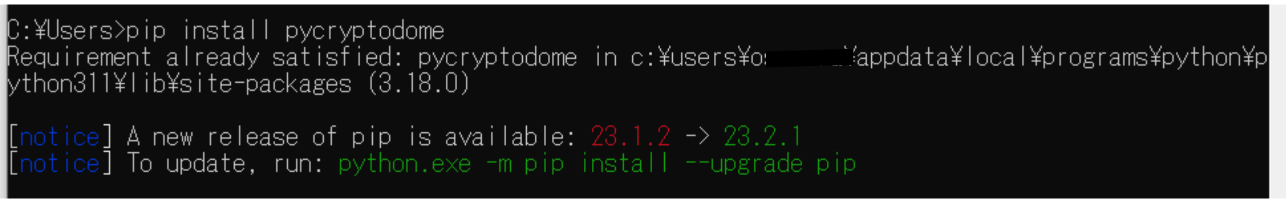
```
C:¥Users>python -V
Python 3.11.0
```

(5) Install an encryption library for Python.

Install the encryption library "pycryptodome" for Python.
Execute the following command to install the encryption library.

```
> pip install pycryptodome
```

After the command has been executed, the display in the window will be as shown below.



```
C:¥Users>pip install pycryptodome
Requirement already satisfied: pycryptodome in c:¥users¥o[redacted]¥appdata¥local¥programs¥python¥p
ython311¥lib¥site-packages (3.18.0)

[notice] A new release of pip is available: 23.1.2 -> 23.2.1
[notice] To update, run: python.exe -m pip install --upgrade pip
```

2.3 Installing OpenSSL

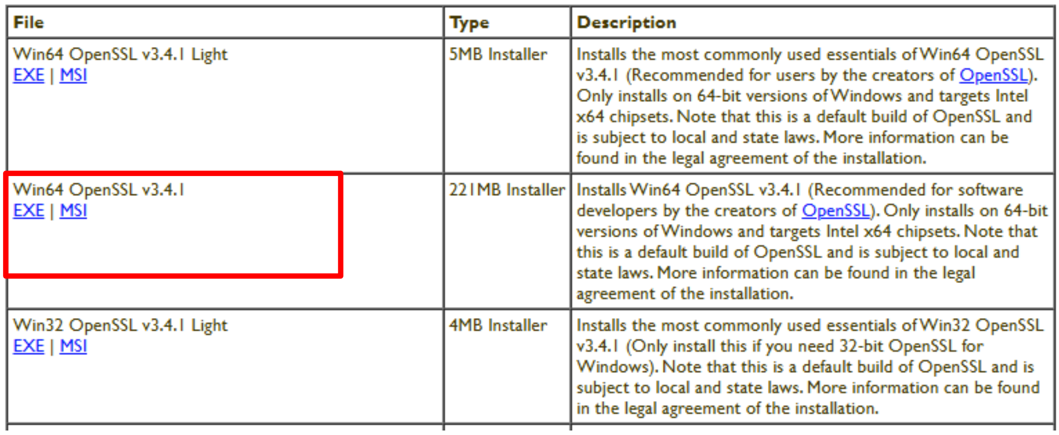
(1) Access the OpenSSL download site.

Access the Win32/Win64 OpenSSL download site at the following link.

(Win32/Win64 OpenSSL Installer for Windows - Shining Light Productions (slproweb.com))

(2) Download the OpenSSL installer.

Download the OpenSSL installer.
Download the installer for the OS you are using.



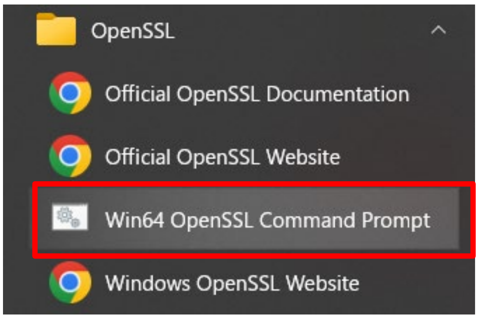
File	Type	Description
Win64 OpenSSL v3.4.1 Light EXE | MSI	5MB Installer	Installs the most commonly used essentials of Win64 OpenSSL v3.4.1 (Recommended for users by the creators of OpenSSL). Only installs on 64-bit versions of Windows and targets Intel x64 chipsets. Note that this is a default build of OpenSSL and is subject to local and state laws. More information can be found in the legal agreement of the installation.
Win64 OpenSSL v3.4.1 EXE | MSI	221MB Installer	Installs Win64 OpenSSL v3.4.1 (Recommended for software developers by the creators of OpenSSL). Only installs on 64-bit versions of Windows and targets Intel x64 chipsets. Note that this is a default build of OpenSSL and is subject to local and state laws. More information can be found in the legal agreement of the installation.
Win32 OpenSSL v3.4.1 Light EXE | MSI	4MB Installer	Installs the most commonly used essentials of Win32 OpenSSL v3.4.1 (Only install this if you need 32-bit OpenSSL for Windows). Note that this is a default build of OpenSSL and is subject to local and state laws. More information can be found in the legal agreement of the installation.

(3) Run the OpenSSL installer.

Run the installer and follow the prompts to install OpenSSL.
Select [The OpenSSL binaries directory] as the location to save the OpenSSL DLLs.

(4) Open the OpenSLL command prompt window.

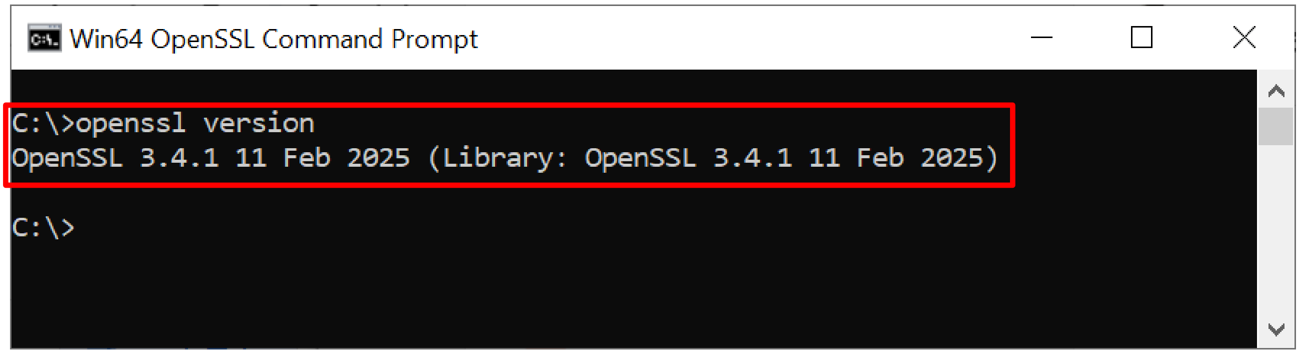
Select [Win64 OpenSSL Command Prompt] in the Start menu.



(5) Confirm the execution of OpenSSL.

Confirm that the openssl command can be executed at the command prompt.
Execute the following command and confirm that the version information is displayed.

```
> openssl version
```



```
C:\>openssl version
OpenSSL 3.4.1 11 Feb 2025 (Library: OpenSSL 3.4.1 11 Feb 2025)

C:\>
```

2.4 Installing the Renesas Image Generator

The Renesas Image Generator is a utility tool for creating firmware images to be used by the firmware update module. The Renesas Image Generator can generate the following types of images for use by the module.

- Initial image: An image file (name extension: mot) containing the boot loader and application program. It is programmed with a flash programmer at the time of initially setting up the system.
- Update image: An image file (name extension: rsu) containing the updated firmware.

Note: Firmware Update Module Rev.2.00 and later versions only support the generation of firmware images by using Python scripts.

The Renesas Image Generator is supplied as part of Firmware Update Module Rev.2.04. The Renesas Image Generator can be obtained through the following steps.

(1) Open the Renesas Image Generator installation folder.

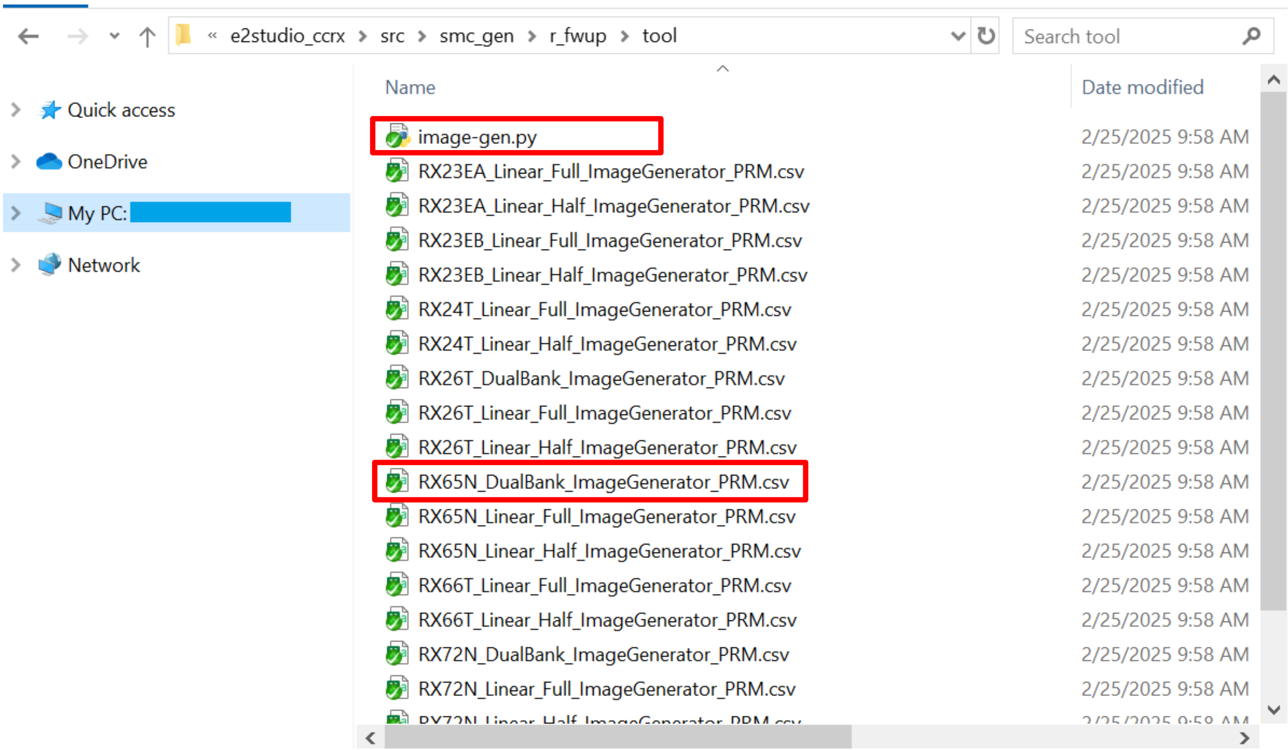
After importing the sample project, open the following folder.
For the procedure for importing the sample project, see 4.2.1.

```
\iot-reference-rx\Projects\aws_ether_ck_rx65n_v2\e2studio_ccrx\src\smc_gen\r_fwup\tool
```

The above pathname consists of the folder and project names for the example of a case of importing the project given in 4.2.1.

(2) Confirm the Renesas Image Generator folder.

The “tool” folder contains the Renesas Image Generator script file (image-gen.py) and parameter files (*_ImageGenerator_PRM.csv) for the various device types, as shown below.



Name	Date modified
image-gen.py	2/25/2025 9:58 AM
RX23EA_Linear_Full_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX23EA_Linear_Half_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX23EB_Linear_Full_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX23EB_Linear_Half_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX24T_Linear_Full_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX24T_Linear_Half_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX26T_DualBank_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX26T_Linear_Full_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX26T_Linear_Half_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX65N_DualBank_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX65N_Linear_Full_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX65N_Linear_Half_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX66T_Linear_Full_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX66T_Linear_Half_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX72N_DualBank_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX72N_Linear_Full_ImageGenerator_PRM.csv	2/25/2025 9:58 AM
RX72N_Linear_Half_ImageGenerator_PRM.csv	2/25/2025 9:58 AM

(3) Confirm the files to be used.

Confirm the files to be used in the Renesas Image Generator.
The following files are used in this application note.

- image-gen.py: Renesas Image Generator script file
- RX65N_DualBank_ImageGenerator_PRM.csv: Parameter file for the RX65N dual-bank function

Create a folder with the name “Renesas Image Generator” in a desired folder, and copy the above files to that folder.

2.5 Installing the AWS Command Line Interface (CLI)

The AWS command line interface (CLI) is a tool for managing and operating the various Amazon Web Services with the use of commands from a command line shell.

This application note provides guidance on making AWS settings with operations through the AWS CLI.

Note: AWS CLI version 1 and AWS CLI version 2 are not compatible with each other. Be sure to install version 2.
If version 1 has already been installed, update it to version 2 with reference to the following Web page:
[Migration from AWS CLI version 1 to AWS CLI version 2]

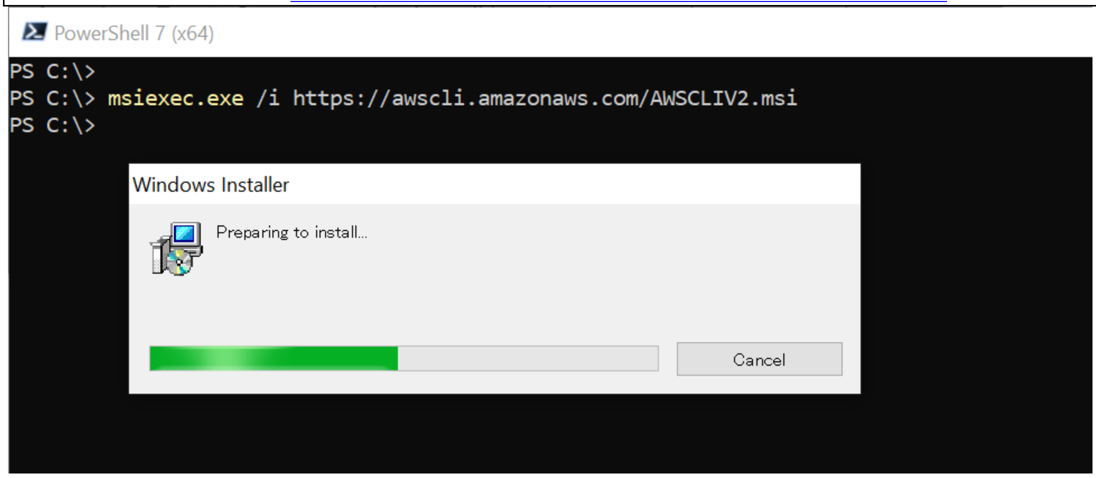
(1) Execute the command line shell.

Execute the Windows PowerShell or Windows command prompt. The PowerShell is used for the display examples explained in this application note.
The command line shell is referred to as the command prompt in this application note.

(2) Install the AWS CLI.

Enter the following command at the command prompt. This leads to the automatic downloading and execution of the AWS CLI v2 installer.

```
> msiexec.exe /i https://awscli.amazonaws.com/AWSCLIV2.msi
```



```
PS C:\>
PS C:\> msiexec.exe /i https://awscli.amazonaws.com/AWSCLIV2.msi
PS C:\>
```

Windows Installer

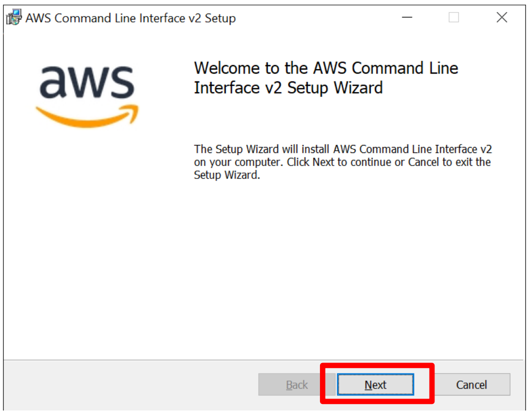
Preparing to install...

The steps for download and installation can be referred to on the following Web page.

[AWS CLI install and update instructions]

(3) Run the installer.

Run the installer and wait for a while until the [Next] button becomes selectable.
After clicking on the [Next] button, follow the prompts to install the AWS CLI.
After you have finished the installation, restart the command prompt window.


AWS Command Line Interface v2 Setup

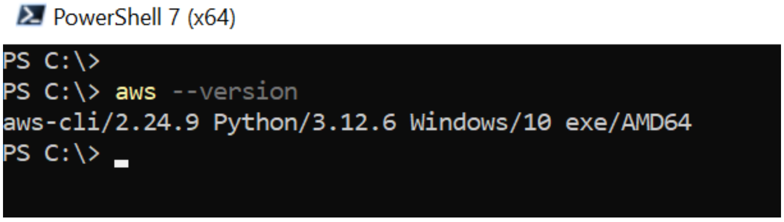
Welcome to the AWS Command Line Interface v2 Setup Wizard

The Setup Wizard will install AWS Command Line Interface v2 on your computer. Click Next to continue or Cancel to exit the Setup Wizard.

(4) Confirm the installation.

After installation is completed, enter the following command at the command prompt. The version of the installed AWS CLI is displayed.

```
> aws --version
```



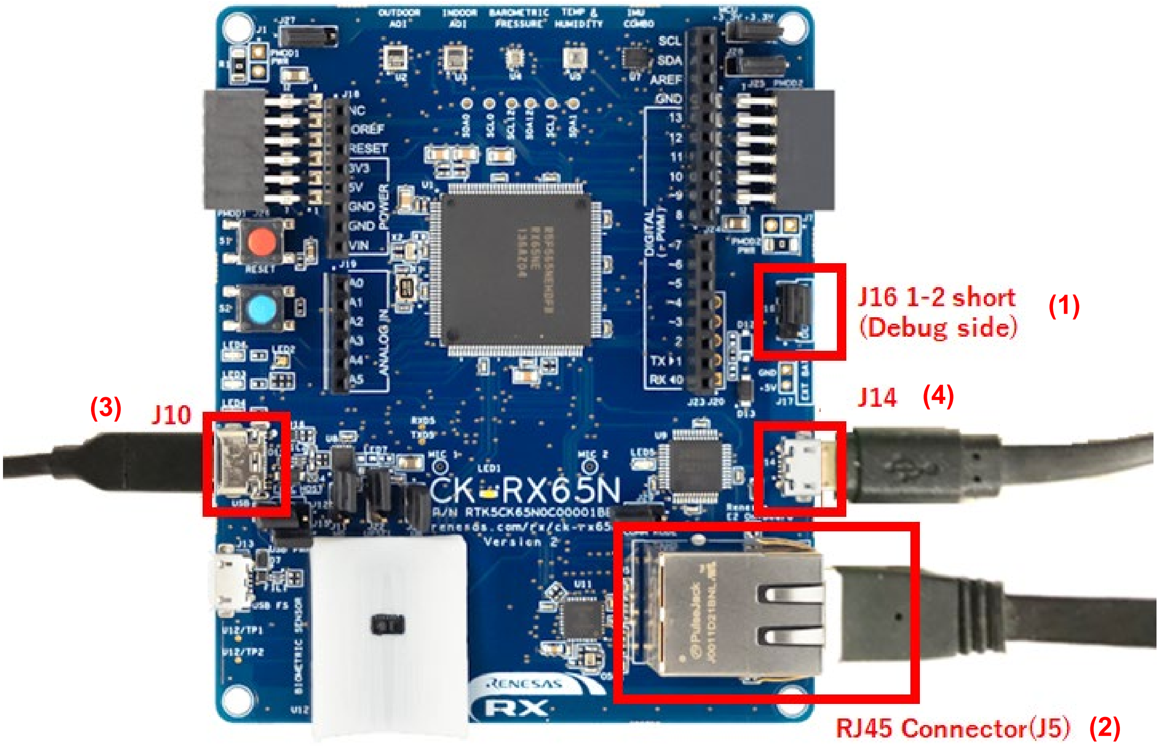
```
PS C:\>
PS C:\> aws --version
aws-cli/2.24.9 Python/3.12.6 Windows/10 exe/AMD64
PS C:\>
```

After you have confirmed that the installed version is 2.xx.x, the installation procedure is complete.

2.6 Connecting the CK-RX65N v2

(1) For Ethernet connection

Connect the base board and set the jumper blocks.

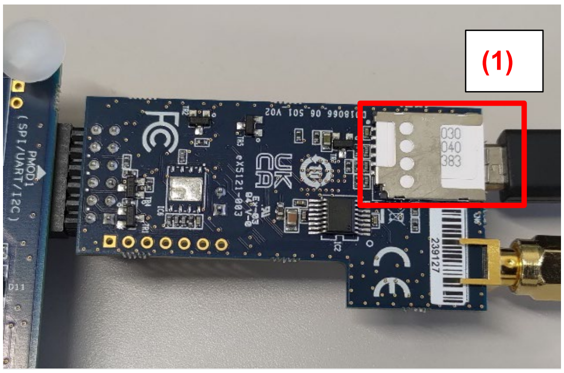


CK-RX65N v2 Base Board

(1) Close pins 1-2 of jumper block J16 on the base board (enables debugging).
(2) Connect a LAN cable to the RJ45 connector (J5) on the base board (Ethernet connection).
(3) Connect J10 on the base board to a PC via a USB cable (USB serial connection).
(4) Connect J14 on the base board to a PC via a USB cable (debugger connection).

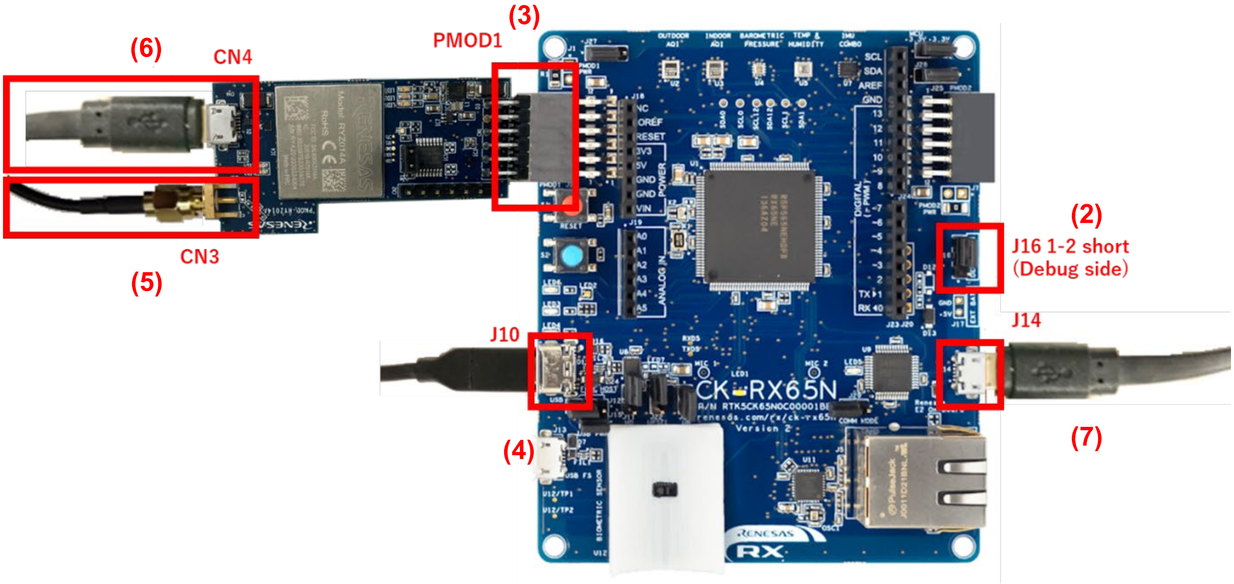
(2) For cellular connection (RYZ014A)

For cellular communications with the use of the RYZ014A, refer to the following connections.



Back of the RYZ014A PMOD Module

(1) Insert a SIM card into the CN6 slot on the RYZ014A PMOD module.



Top Surfaces of the Base Board and RYZ014A PMOD Module

(2) Close pins 1-2 of jumper block J16 on the base board (enables debugging).
(3) Connect the RYZ014A PMOD module to PMOD1 on the base board.
(4) Connect J10 on the base board to a PC via a USB cable (USB serial connection).
(5) Connect an antenna to CN3 of the RYZ014A PMOD module.
(6) Supply power by connecting a USB cable to CN4 of the RYZ014A PMOD module.
(7) Connect J14 on the base board to a PC via a USB cable (debugger connection).

Note: Perform step (6) if you have a spare USB cable.
If power is not directly supplied to the RYZ014A PMOD module, communications might become unstable.

3. Setting Up AWS

This chapter describes the procedure for setting up AWS to execute a FreeRTOS demo project.

A procedure for using the AWS command line interface (CLI) with the single sign-on (SSO) technique as an IAM Identity Center user (workforce user) is explained.

Note that accounts are managed differently for workforce users of the IAM Identity Center and for IAM users.

For details on the AWS CLI commands, refer to the following AWS document.

AWS CLI command examples - AWS Command Line Interface

3.1 Setting Up an Environment for Signing In to AWS

Follow the steps below to sign in to AWS, create a workforce user of the IAM Identity Center, and set up an environment for signing in to AWS.

3.1.1 Signing In to the AWS Management Console

Create a root user (management) account of AWS and sign in to the AWS management console.

(1) Obtain a sign-in account.

An AWS account is required for signing in to AWS.
Create an AWS account with reference to the following document for AWS.

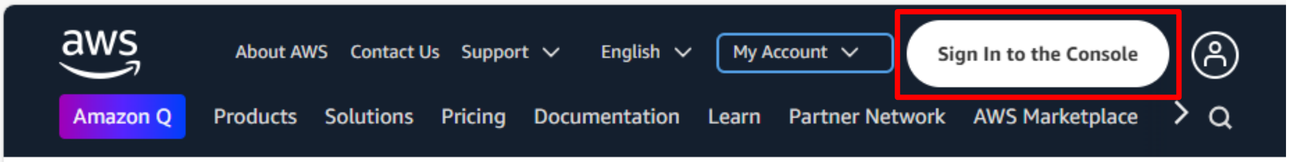
- Set up AWS account - AWS IoT Core

(2) Sign in to the AWS console.

Sign in to the AWS management console with the AWS (management) account that you created.

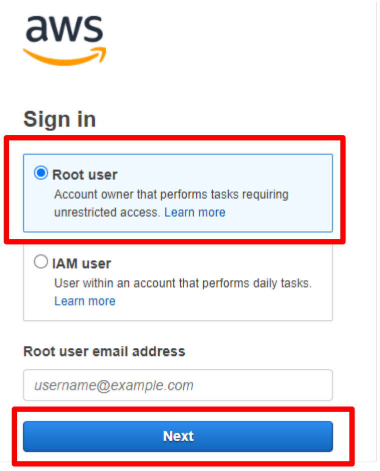
(a) Sign in to the AWS management console.

Access AWS (https://aws.amazon.com/) and click on [Sign In to the Console].



(b) Enter your email address.

Tick the [Root user] checkbox, enter the email address for the root user, and click on the [Next] button. You may be able to skip this step after having already signed in.
Sign in as the root user because IAM Identity Center services can only be created with a management account.



Sign in

● Root user
Account owner that performs tasks requiring unrestricted access. Learn more

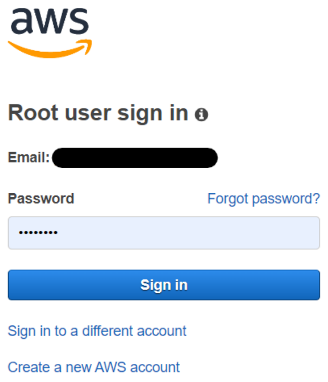
○ IAM user
User within an account that performs daily tasks. Learn more

Root user email address

username@example.com

(c) Enter your password.

Enter your password and then click on [Sign in].



Root user sign in

Email: [redacted]

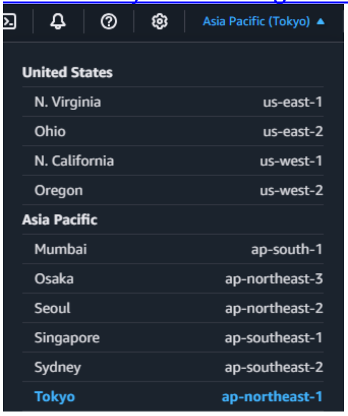
Password

••••••••

3.1.2 Setting Your Region in AWS

After logging in to the AWS management console, select your region in the top right of the window.
Since the regions usable in the IAM Identity Center are pre-determined, select the appropriate region. For the usable regions, see the figure below.

[IAM Identity Center Region data storage and operations]



United States	
N. Virginia	us-east-1
Ohio	us-east-2
N. California	us-west-1
Oregon	us-west-2
Asia Pacific	
Mumbai	ap-south-1
Osaka	ap-northeast-3
Seoul	ap-northeast-2
Singapore	ap-southeast-1
Sydney	ap-southeast-2
Tokyo	ap-northeast-1

3.1.3 Creating a Workforce User of the IAM Identity Center

After obtaining an AWS account, sign in to the AWS management console with the management account. Then, create a workforce user with IAM Identity Center services and set up an environment for performing SSO to AWS.

By following the procedures below, start by creating instances of the IAM Identity Center, then create users, and finally assign the necessary permission sets to users or groups.

(1) Enable the IAM Identity Center.

Enable the IAM Identity Center with reference to the following Web page. After the IAM Identity Center is enabled, instances for use by the management account will be generated.
Enable IAM Identity Center - AWS IAM Identity Center
Management by the user is only possible through IAM Identity Center instances that were created with the management account.

(2) Create a workforce user.

Create a user of the IAM Identity Center with reference to the following Web page. The user created here will become the account of the workforce user.
Add users to your Identity Center directory - AWS IAM Identity Center
When a user has been created, AWS sends authentication mail to the mail address of the created user. Register a password and set multi-factor authentication (MFA), as directed by the contents of the mail.

(3) Create groups.

Create groups to which users belong as required with reference to the following Web page.
Add groups to your Identity Center directory - AWS IAM Identity Center
When a group has been created, users can be added to the created group.

(4) Create permission sets.

Create permission sets to be assigned to users or groups with reference to the following Web page.
Create, manage, and delete permission sets - AWS IAM Identity Center
Normally, the creation of AdministratorAccess would be satisfactory. However, when setting a permission set other than AdministratorAccess according to organization policies, the following permission sets need to be assigned to users for executing OTA updates.

- AWSIoTFullAccess
- AmazonFreeRTOSOTAUpdate
- AWSIoTDeviceTesterForFreeRTOSFullAccess

Note: The AdministratorAccess permission set includes the above permission sets.

(5) Assign the users and groups to access the AWS account.

Assign the created users and groups to the AWS management account and grant permission with reference to the following Web page.
Assign user access to AWS accounts - AWS IAM Identity Center
This will enable the workforce user to sign in to AWS.

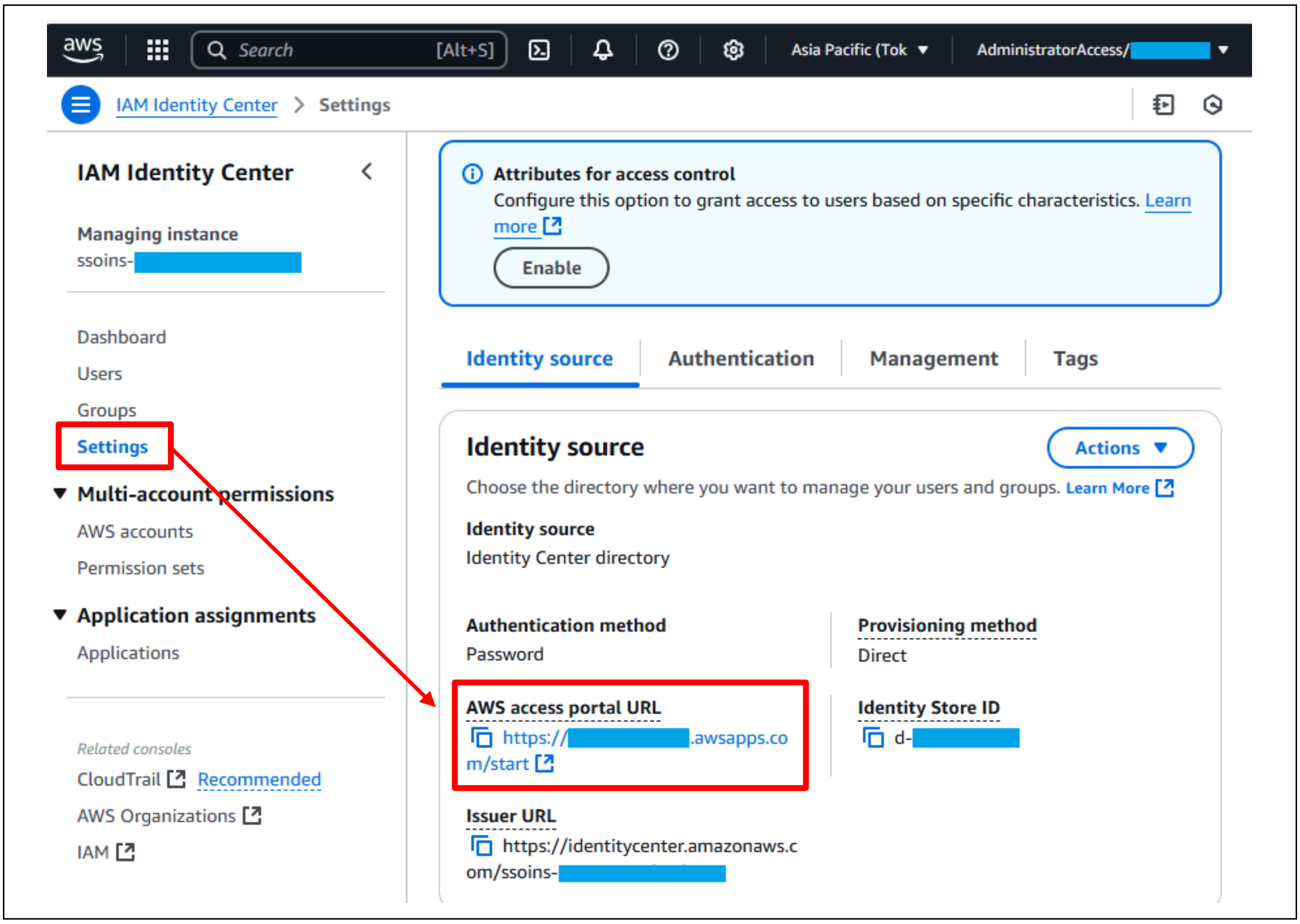
Note: The AWS CLI can be used even in a sign-in by an IAM user with the use of the access key. In this case, the access key can be obtained by proceeding with reference to the following Web page.
Manage access keys for IAM users - AWS Identity and Access Management

3.1.4 Preparing for an AWS CLI Sign-In

Create a profile for signing in to the AWS CLI as a workforce user of the IAM Identity Center. Since a profile is reusable, it only has to be created once.

(1) Obtain the URL of the AWS access portal.

Sign in to the AWS management portal as a root user, click on [Settings] in the IAM Identity Center menu, and make a note of [AWS access portal URL] in the [Identity source] field.
When signing in as a root user is not possible, ask the account administrator about the AWS access portal URL.



Managing instance
ssoins-[redacted]

Attributes for access control
Configure this option to grant access to users based on specific characteristics. Learn more

Identity source
Choose the directory where you want to manage your users and groups. Learn More

Identity source
Identity Center directory

Authentication method
Password

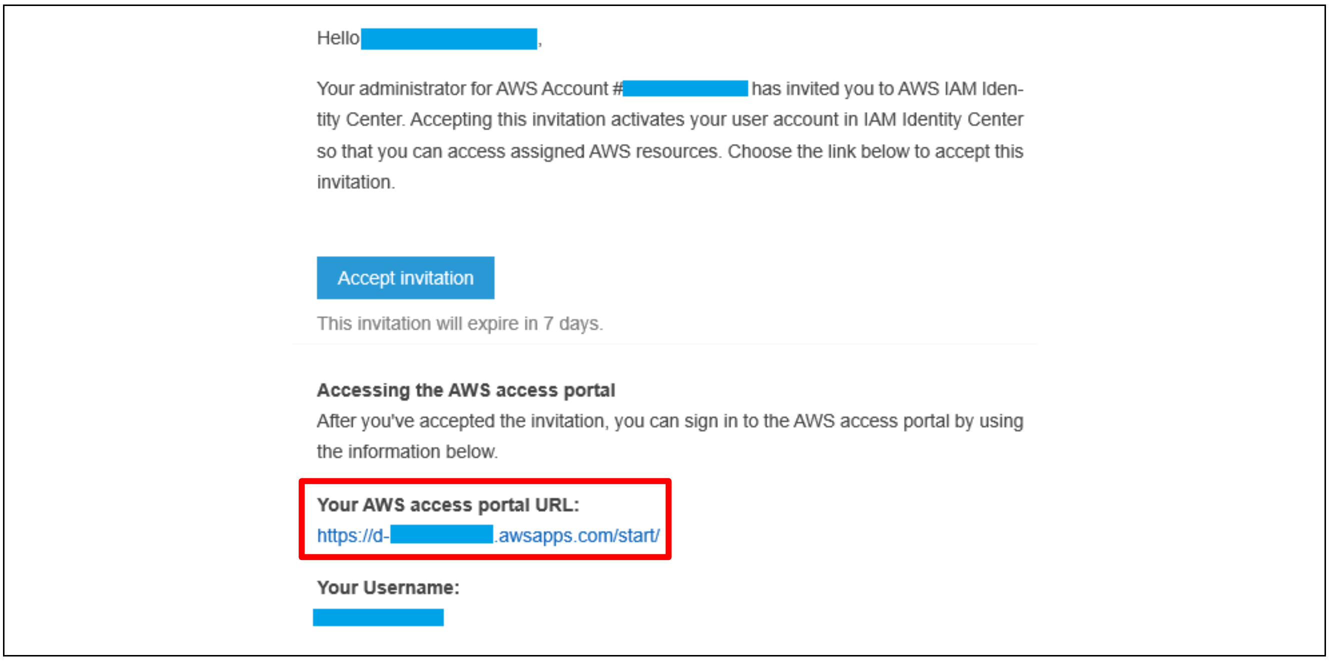
Provisioning method
Direct

AWS access portal URL
https://[redacted].awsapps.com/start

Identity Store ID
d-[redacted]

Issuer URL
https://identitycenter.amazonaws.com/ssoins-[redacted]

The AWS access portal URL is in the email you will have received to guide you in authentication as a workforce user for the first time.



Hello [redacted],

Your administrator for AWS Account #[redacted] has invited you to AWS IAM Identity Center. Accepting this invitation activates your user account in IAM Identity Center so that you can access assigned AWS resources. Choose the link below to accept this invitation.

This invitation will expire in 7 days.

Accessing the AWS access portal

After you've accepted the invitation, you can sign in to the AWS access portal by using the information below.

Your AWS access portal URL:

https://d-[redacted].awsapps.com/start/

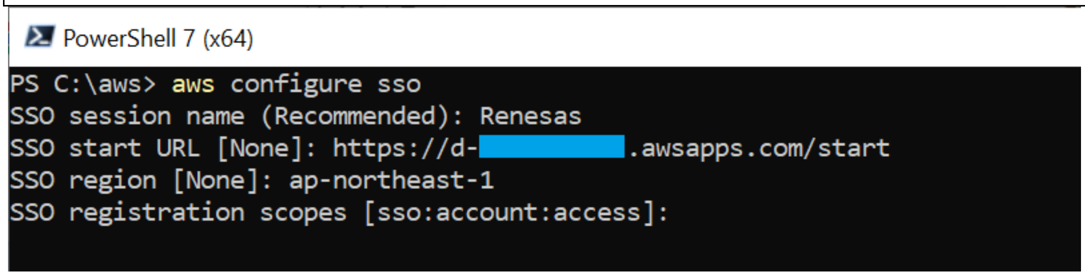
Your Username:

[redacted]

(2) Create an SSO profile.

Open the command prompt window and execute the following command.

```
> aws configure sso
```



```
PS C:\aws> aws configure sso
SSO session name (Recommended): Renesas
SSO start URL [None]: https://d-[redacted].awsapps.com/start
SSO region [None]: ap-northeast-1
SSO registration scopes [sso:account:access]:
```

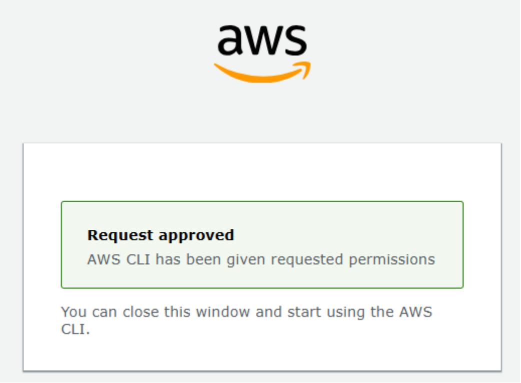
Following execution of the command, you will be requested to enter the following four items. Enter the contents to be set for each item.

Item	Description	Contents to be Set
SSO session name	Session name	This is the session name for use in registration of the SSO profile. Enter a desired character string.
SSO start URL	URL for starting SSO	The URL for starting with an SSO is registered here. Enter the URL of the AWS access portal, which was obtained in step (1).
SSO region	Region name	The region in which the SSO is to be used is entered here. Enter the character string for the region in which the IAM Identity Center instance was created.
SSO registration scopes	Scopes of access permission	Simply press the Enter key without entering anything. This will set the initial value “sso:account:access”.

After you have pressed the Enter key in response to the “SSO registration scopes” item, a Web browser will open and display the AWS sign-in window. Log in with the account for the workforce user.

If signing in is successful, the display in the window will be as shown below.

Note: If the information from having completed signed in is still in place, the window may display “Request approved” instead of making the transition to the sign-in window.

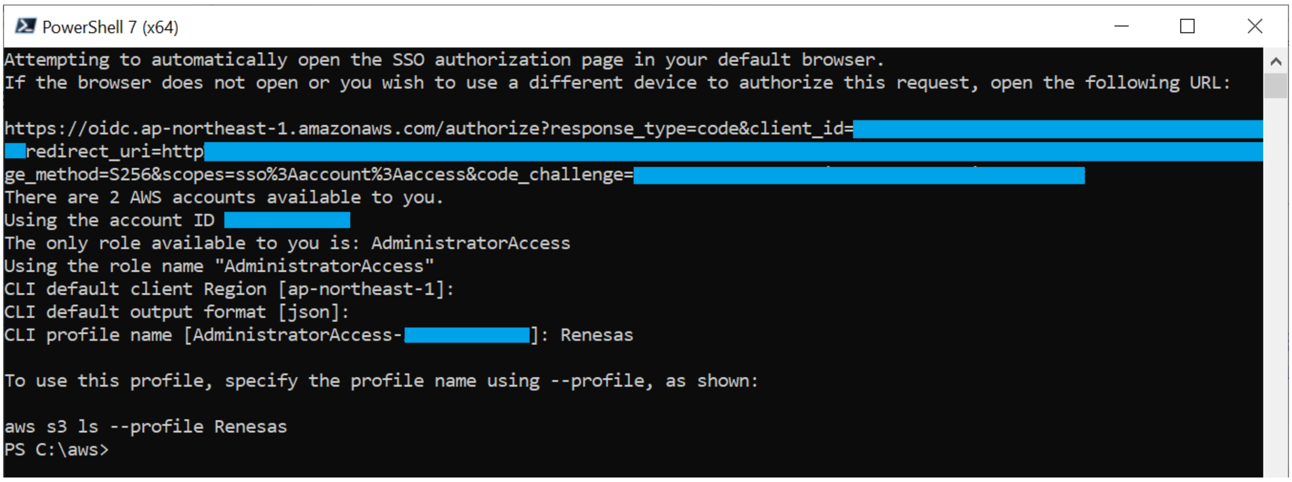


Request approved

AWS CLI has been given requested permissions

You can close this window and start using the AWS CLI.

Once the account and permission sets have been authenticated, the following will be displayed in the command prompt window.



```
Attempting to automatically open the SSO authorization page in your default browser.
If the browser does not open or you wish to use a different device to authorize this request, open the following URL:

https://oidc.ap-northeast-1.amazonaws.com/authorize?response_type=code&client_id=[redacted]
[redacted]redirect_uri=http[redacted]
ge_method=S256&scopes=sso%3Aaccount%3Aaccess&code_challenge=[redacted]
There are 2 AWS accounts available to you.
Using the account ID [redacted]
The only role available to you is: AdministratorAccess
Using the role name "AdministratorAccess"
CLI default client Region [ap-northeast-1]:
CLI default output format [json]:
CLI profile name [AdministratorAccess-[redacted]]: Renesas

To use this profile, specify the profile name using --profile, as shown:

aws s3 ls --profile Renesas
PS C:\aws>
```

You will be requested to enter the following three items. Enter the contents to be set for each item.

Item	Description	Contents to be Set
CLI default client Region	Region of the CLI	Enter the region where the CLI is to be used. Basically, do not change the region from the one that was set the first time.
CLI default output format	Format for output from the CLI	Enter “json”.
CLI profile name	Profile name for the CLI	The character string of a desired profile name can be entered. This profile name is to be specified when entering CLI commands.

The creation of a profile is now complete.

When entering a CLI command, add “--profile *PROFILE_NAME*” to the end of the command to specify a profile.

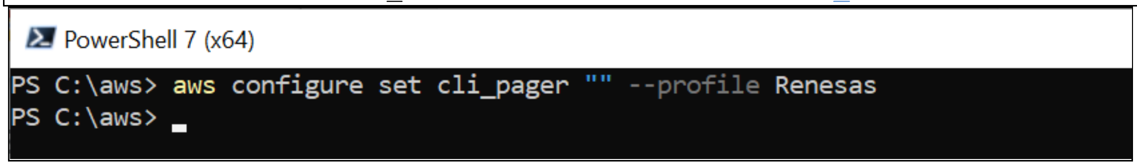
The profile name set in this step should be specified as “PROFILE_NAME”.

The display examples used for explanations in this application note have the profile name setting “Renesas”.

(3) Add a setting to the profile.

Make an additional setting to the profile for operating the CLI.
This setting will cancel the function of temporarily halting display when the result of a CLI command does not fit in one command prompt window.
Since the display of JSON data often involves showing a large amount of information, this setting was made in creating this application note.
Enter the following command.

```
> aws configure set cli_pager "" --profile <PROFILE_NAME>
```



```
PS C:\aws> aws configure set cli_pager "" --profile Renesas
PS C:\aws> _
```

(4) Confirm the login to AWS through the CLI.

Log in to AWS with the created profile. Enter the following command.

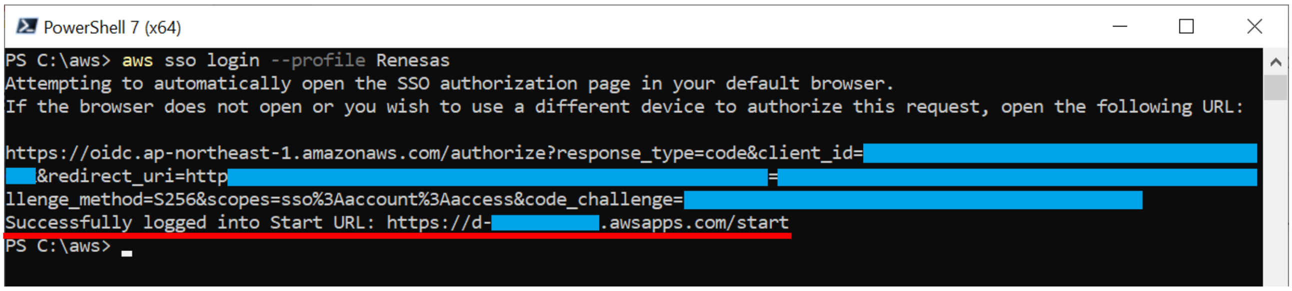
```
> aws sso login --profile <PROFILE_NAME>
```

After the command has been executed, a Web browser will open and display the AWS sign-in window. Sign in with the account for the workforce user.

Note: If the information from having completed signed in is still in place, the window may display “Request approved” instead of making the transition to the sign-in window.

After the login to AWS through the CLI has finished, the following will be displayed in the command prompt window.

The login is successful if “Successfully logged into Start URL: ~”, as in the underlined part in the figure below, is displayed.



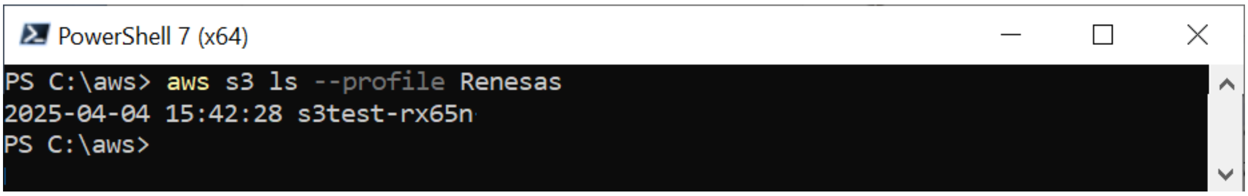
```
PS C:\aws> aws sso login --profile Renesas
Attempting to automatically open the SSO authorization page in your default browser.
If the browser does not open or you wish to use a different device to authorize this request, open the following URL:

https://oidc.ap-northeast-1.amazonaws.com/authorize?response_type=code&client_id=[redacted]
&redirect_uri=http[redacted]=[redacted]
llenge_method=S256&scopes=sso%3Aaccount%3Aaccess&code_challenge=[redacted]
Successfully logged into Start URL: https://d-[redacted].awsapps.com/start
PS C:\aws> _
```

(5) Check the operation of the CLI.

After an SSO login succeeds, enter the following command for obtaining a list of S3 buckets to confirm whether the CLI is operating normally.
If no error occurs, the CLI command has been accepted normally.
If S3 buckets are available with your account, a list of buckets is displayed.

```
> aws s3 ls --profile <PROFILE_NAME>
```

After the command has been executed, the display in the window will be as shown below.
The following window shows an example in which the existing bucket (s3test-rx65n) is available.

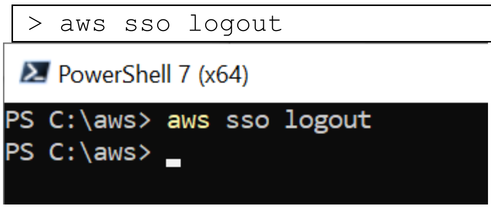


```
PS C:\aws> aws s3 ls --profile Renesas
2025-04-04 15:42:28 s3test-rx65n
PS C:\aws>
```

(6) Log out from AWS.

Enter the following command at the command prompt.

```
> aws sso logout
```



```
PS C:\aws> aws sso logout
PS C:\aws>
```

3.1.5 Creating a Work Folder

Create a desired folder for performing steps with the AWS CLI. The configuration files and other files to be used in CLI commands are to be stored in this folder.

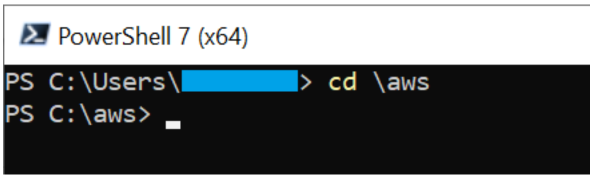
The work folder is created as “C:\aws” in the display examples used for explanations in this application note.

3.2 SSO Login to AWS through the CLI

Log in to AWS with the use of the AWS CLI.

(1) Jump to the work folder.

Start the command prompt and change the current directory to the work folder that was created in 3.1.5.



```
PS C:\Users\[redacted]> cd \aws
PS C:\aws> _
```

(2) Log in to AWS.

Enter the following command at the command prompt.

```
> aws sso login --profile <PROFILE_NAME>
```

Enter the profile name that was created in “3.1.4(2)” into *<PROFILE_NAME>*.
The specification of the profile name has to be entered at the end of all CLI commands explained from this point.

For details on the SSO login process, see 3.1.4(4).

3.3 Registering a Device with AWS

Create a device and assign the necessary permissions.

3.3.1 Setting Policies

Use AWS IoT Core services to set permissions (policies) for granting access to AWS resources in the device to be connected.

Set the following policies for the device to be connected according to this application note.

- iot:Connect: Connects to AWS IoT
- iot:Publish: Publishes (transmits) a topic
- iot:Subscribe: Subscribes to (receives) a topic
- iot:Receive: Receives messages from AWS IoT

(1) Create a json file in which policies are set.

Create a configuration file of policies.
With a text editor, create a file with the name “policy.json” in the work folder that was created in 3.1.5 and enter the following code.

- policy.json

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "iot:Connect",
            "Resource": "*"
        },
        {
            "Effect": "Allow",
            "Action": "iot:Publish",
            "Resource": "*"
        },
        {
            "Effect": "Allow",
            "Action": "iot:Subscribe",
            "Resource": "*"
        },
        {
            "Effect": "Allow",
            "Action": "iot:Receive",
            "Resource": "*"
        }
    ]
}
```

The text strings in blue are the names of access permissions to be assigned.

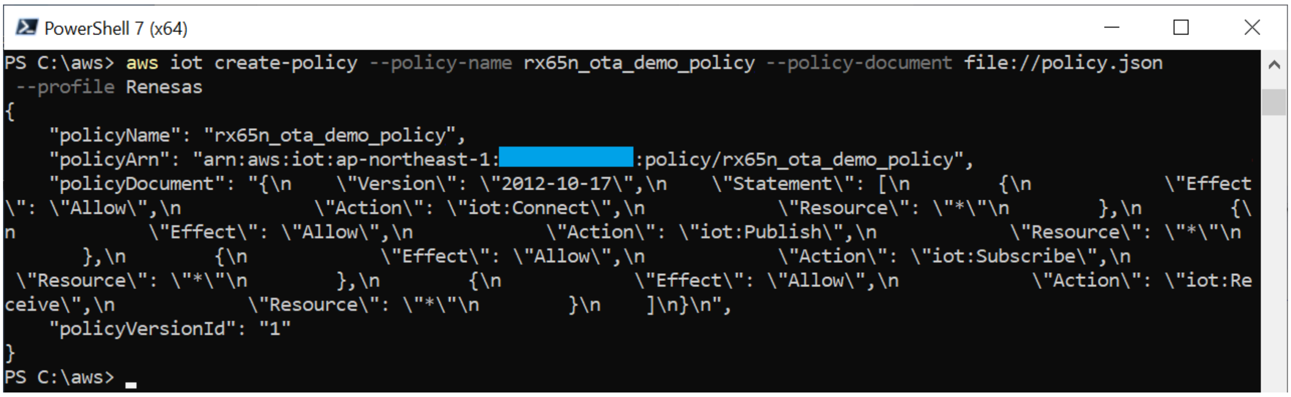
(2) Create a policy.

Enter the following command and create a policy.

```
> aws iot create-policy --policy-name <POLICY_NAME> --policy-document
file://policy.json --profile <PROFILE_NAME>
```

- A desired policy name can be entered into *<POLICY_NAME>* (example: rx65n_ota_demo_policy).

After the command has been executed, the display in the window will be as shown below.



```
PS C:\aws> aws iot create-policy --policy-name rx65n_ota_demo_policy --policy-document file://policy.json
 --profile Renesas
{
    "policyName": "rx65n_ota_demo_policy",
    "policyArn": "arn:aws:iot:ap-northeast-1:[redacted]:policy/rx65n_ota_demo_policy",
    "policyDocument": "{\n    \"Version\": \"2012-10-17\",\n    \"Statement\": [\n        {\n            \"Effect
\": \"Allow\",\n            \"Action\": \"iot:Connect\",\n            \"Resource\": \"*\"\n        },\n        {\
n            \"Effect\": \"Allow\",\n            \"Action\": \"iot:Publish\",\n            \"Resource\": \"*\"\n
        },\n        {\n            \"Effect\": \"Allow\",\n            \"Action\": \"iot:Subscribe\",\n
 \"Resource\": \"*\"\n        },\n        {\n            \"Effect\": \"Allow\",\n            \"Action\": \"iot:Re
ceive\",\n            \"Resource\": \"*\"\n        }\n    ]\n}\n",
    "policyVersionId": "1"
}
PS C:\aws> _
```

Make a note of the policy name that was created. You will need it in a later process.

3.3.2 Creating an Amazon S3 Bucket

Amazon S3 is an online storage Web service used to store the firmware for use in updating.

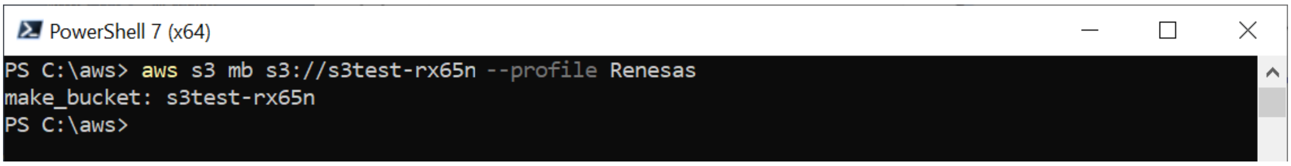
(1) Create an S3 bucket.

Enter the following command.

```
> aws s3 mb s3://<BUCKET_NAME> --profile <PROFILE_NAME>
```

- A desired bucket name can be entered into *<BUCKET_NAME>* (example: s3test-rx65n).

After the command has been executed, the display in the window will be as shown below.



```
PS C:\aws> aws s3 mb s3://s3test-rx65n --profile Renesas
make_bucket: s3test-rx65n
PS C:\aws>
```

Make a note of the bucket name that was entered. You will need it in a later process.

Note 1. The bucket name must be globally unique. The following error message appears if the bucket name is already in use. In this case, use another name.

```
make_bucket failed: s3://s3test-rx65n An error occurred
(BucketAlreadyExists) when calling the CreateBucket operation: The
requested bucket name is not available. The bucket namespace is shared
by all users of the system. Please select a different name and try
again.
```

Note 2. Only lowercase letters, numerals, periods (.), and hyphens (-) can be used in a bucket name.

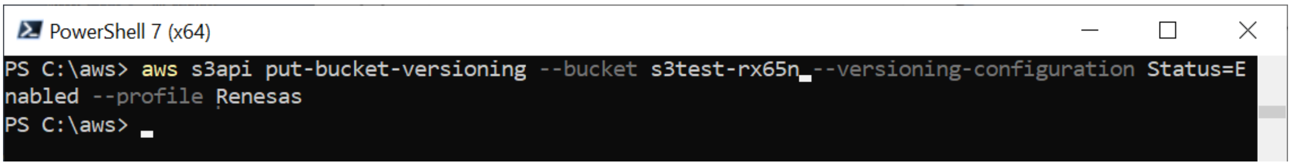
(2) Enable version control for the S3 bucket.

Enable this function to manage the versions of the files to be stored in the created bucket.
Enter the following command.

```
> aws s3api put-bucket-versioning --bucket <BUCKET_NAME> --versioning-
configuration Status=Enabled --profile <PROFILE_NAME>
```

- Enter the bucket name that was created in step (1) into *<BUCKET_NAME>*.

After the command has been executed, the display in the window will be as shown below (no part of the execution result is displayed).



```
PS C:\aws> aws s3api put-bucket-versioning --bucket s3test-rx65n --versioning-configuration Status=E
nabled --profile Renesas
PS C:\aws>
```

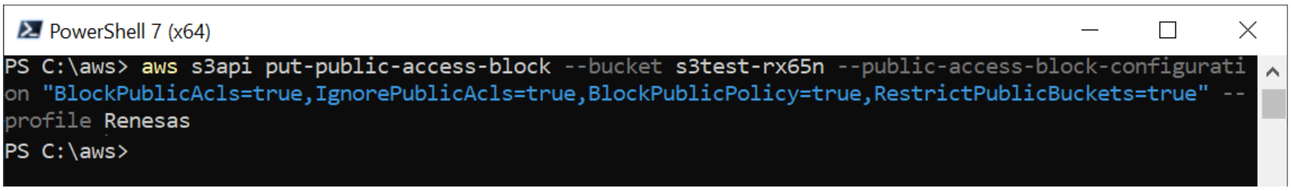
(3) Make a setting to block public access to the S3 bucket.

This setting is for restricting public access to the created bucket.
Enter the following command.

```
> aws s3api put-public-access-block --bucket <BUCKET_NAME> --public-access-block-configuration "BlockPublicAcls=true,IgnorePublicAcls=true,BlockPublicPolicy=true,RestrictPublicBuckets=true" --profile <PROFILE_NAME>
```

- Enter the bucket name that was created in step (1) into *<BUCKET_NAME>*.

After the command has been executed, the display in the window will be as shown below (no part of the execution result is displayed).



```
PS C:\aws> aws s3api put-public-access-block --bucket s3test-rx65n --public-access-block-configuration "BlockPublicAcls=true,IgnorePublicAcls=true,BlockPublicPolicy=true,RestrictPublicBuckets=true" --profile Renesas
PS C:\aws>
```

3.3.3 Allocating Permission for OTA Execution to an IAM User

Use AWS IAM services to create a role and assign it the appropriate access permissions for creating OTA update jobs.

(1) Create a json file in which the permission for OTA execution is set.

Create a configuration file of the permission for OTA execution.
With a text editor, create a file with the name “Test-Role-Trust-Policy.json” in the work folder that was created in 3.1.5 and enter the following code.

- Test-Role-Trust-Policy.json

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "",
            "Effect": "Allow",
            "Principal": {
                "Service": "iot.amazonaws.com"
            },
            "Action": "sts:AssumeRole"
        }
    ]
}
```

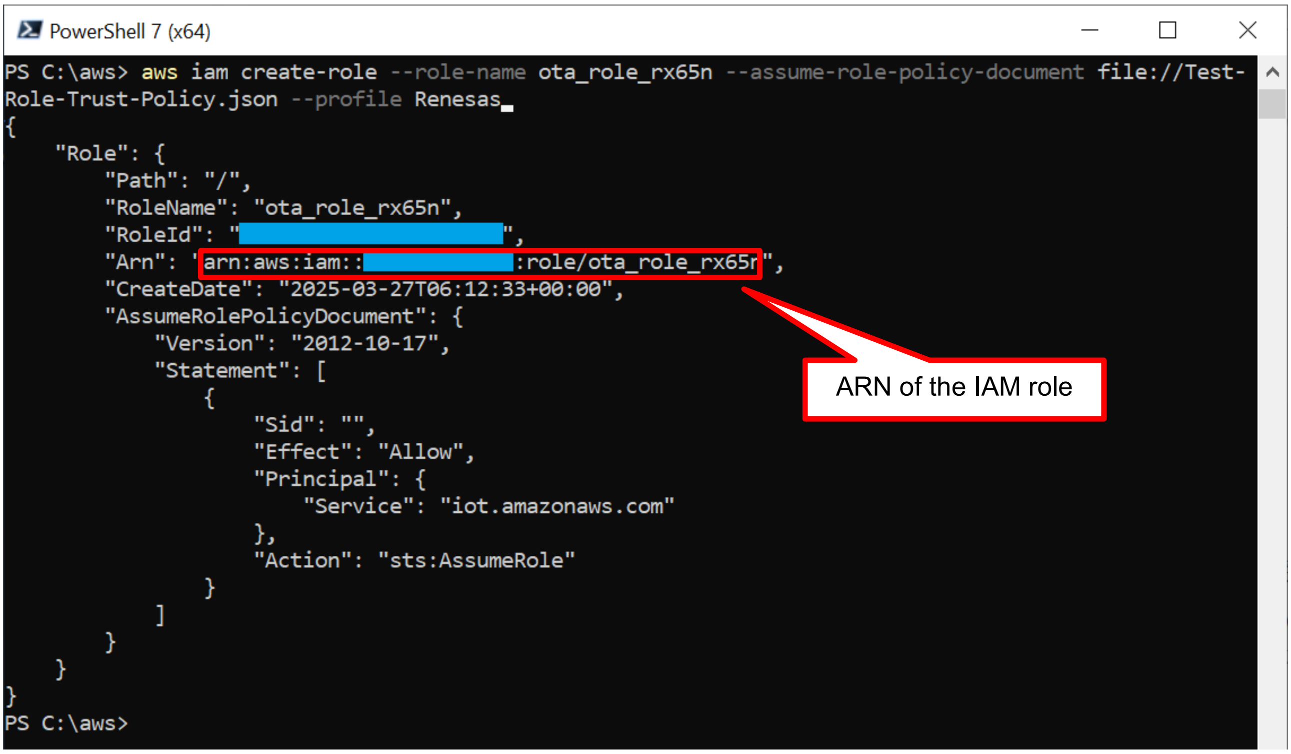
(2) Create an IAM role.

Create an IAM role for use in OTA updates.
Enter the following command.

```
> aws iam create-role --role-name <ROLE_NAME> --assume-role-policy-document
file://Test-Role-Trust-Policy.json --profile <PROFILE_NAME>
```

- A desired role name can be entered into <ROLE_NAME> (example: ota_role_rx65n).

After the command has been executed, the display in the window will be as shown below.



```
PS C:\aws> aws iam create-role --role-name ota_role_rx65n --assume-role-policy-document file://Test-
Role-Trust-Policy.json --profile Renesas
{
    "Role": {
        "Path": "/",
        "RoleName": "ota_role_rx65n",
        "RoleId": "[redacted]",
        "Arn": "arn:aws:iam::[redacted]:role/ota_role_rx65n",
        "CreateDate": "2025-03-27T06:12:33+00:00",
        "AssumeRolePolicyDocument": {
            "Version": "2012-10-17",
            "Statement": [
                {
                    "Sid": "",
                    "Effect": "Allow",
                    "Principal": {
                        "Service": "iot.amazonaws.com"
                    },
                    "Action": "sts:AssumeRole"
                }
            ]
        }
    }
}
PS C:\aws>
```

Make a note of the role name entered here and the Amazon Resource Name (ARN) of the IAM role (Arn: text inside the red frame in the above figure) which is displayed. You will need them in a later process.

(3) Attach managed policies to the IAM role.

Attach the AWS IoT and FreeRTOS OTA managed policies to the IAM role.
Attach the following four managed policies to the IAM role.

- AWSIoTThingsRegistration
- AWSIoTRuleActions
- AWSIoTLogging
- AmazonFreeRTOSOTAUpdate

Enter the following four commands in order.

```
> aws iam attach-role-policy --role-name <ROLE_NAME> --policy-arn
arn:aws:iam::aws:policy/service-role/AWSIoTThingsRegistration --profile
<PROFILE_NAME>
```

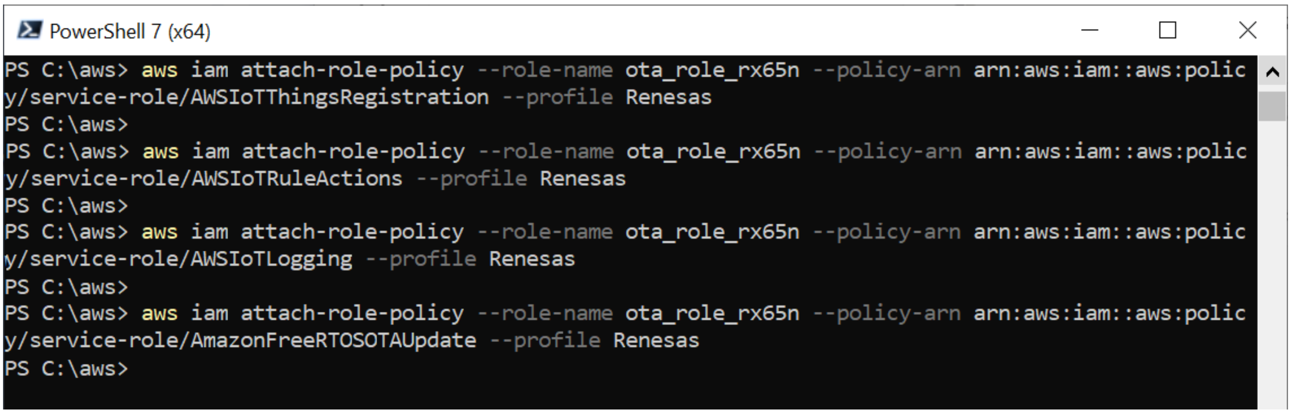
```
> aws iam attach-role-policy --role-name <ROLE_NAME> --policy-arn
arn:aws:iam::aws:policy/service-role/AWSIoTRuleActions --profile
<PROFILE_NAME>
```

```
> aws iam attach-role-policy --role-name <ROLE_NAME> --policy-arn
arn:aws:iam::aws:policy/service-role/AWSIoTLogging --profile <PROFILE_NAME>
```

```
> aws iam attach-role-policy --role-name <ROLE_NAME> --policy-arn
arn:aws:iam::aws:policy/service-role/AmazonFreeRTOSOTAUpdate --profile
<PROFILE_NAME>
```

- Enter the IAM role name that was created in step (2) into *<ROLE_NAME>*.

After the commands have been executed, the display in the window will be as shown below (no part of any execution result is displayed).



```
PS C:\aws> aws iam attach-role-policy --role-name ota_role_rx65n --policy-arn arn:aws:iam::aws:polic
y/service-role/AWSIoTThingsRegistration --profile Renesas
PS C:\aws>
PS C:\aws> aws iam attach-role-policy --role-name ota_role_rx65n --policy-arn arn:aws:iam::aws:polic
y/service-role/AWSIoTRuleActions --profile Renesas
PS C:\aws>
PS C:\aws> aws iam attach-role-policy --role-name ota_role_rx65n --policy-arn arn:aws:iam::aws:polic
y/service-role/AWSIoTLogging --profile Renesas
PS C:\aws>
PS C:\aws> aws iam attach-role-policy --role-name ota_role_rx65n --policy-arn arn:aws:iam::aws:polic
y/service-role/AmazonFreeRTOSOTAUpdate --profile Renesas
PS C:\aws>
```

(4) Make a permission setting for passing the IAM role to AWS services.

Use an inline policy to make a permission setting for passing the IAM role to AWS services.

(a) Create a json file in which the inline policy is set.

Create a file containing an inline policy to which an access permission is set.
With a text editor, create a file with the name “inline-policy1.json” in the work folder that was created in 3.1.5 and enter the following code.

- inline-policy1.json

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "iam:GetRole",
                "iam:PassRole"
            ],
            "Resource": "*"
        }
    ]
}
```

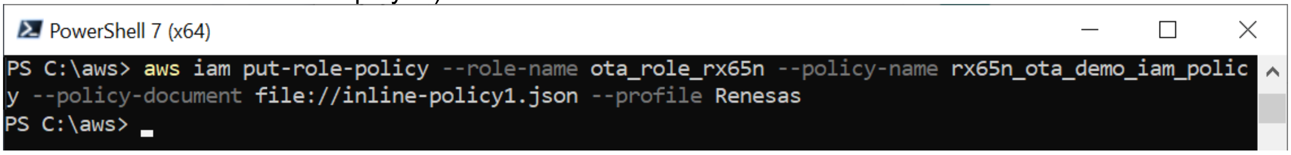
(b) Attach the inline policy to the IAM role.

Attach the inline policy to the IAM role.
Enter the following command.

```
> aws iam put-role-policy --role-name <ROLE_NAME> --policy-name <POLICY_NAME>
--policy-document file://inline-policy1.json --profile <PROFILE_NAME>
```

- Enter the IAM role name that was created in step (2) into *<ROLE_NAME>*.
- A desired policy name can be entered into *<POLICY_NAME>* (example: rx65n_ota_demo_iam_policy).

After the command has been executed, the display in the window will be as shown below (no part of the execution result is displayed).



```
PS C:\aws> aws iam put-role-policy --role-name ota_role_rx65n --policy-name rx65n_ota_demo_iam_polic
y --policy-document file://inline-policy1.json --profile Renesas
PS C:\aws> _
```

(5) Assign permission for granting access to Amazon S3 to the IAM role.

Use an inline policy to add permission for access by the IAM role to Amazon S3, where the updated firmware is to be stored.

(a) Create a json file in which an inline policy is set.

Create a file containing an inline policy to which an access permission is set.
With a text editor, create a file with the name “inline-policy2.json” in the work folder that was created in 3.1.5 and enter the following code.

- inline-policy2.json

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "s3:GetObjectVersion",
                "s3:GetObject",
                "s3:PutObject"
            ],
            "Resource": [
                "*"
            ]
        }
    ]
}
```

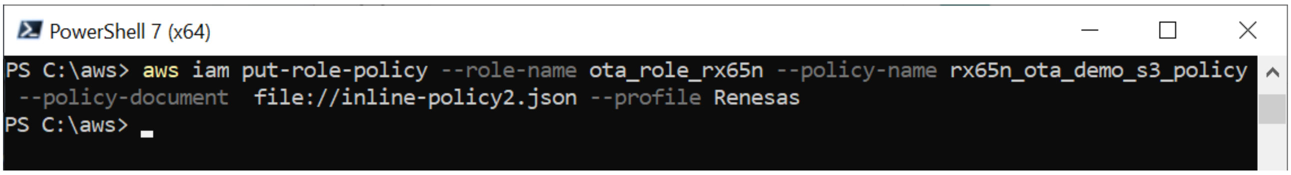
(b) Attach the inline policy (Amazon S3) to the IAM role.

Attach the inline policy to the IAM role.
Enter the following command.

```
> aws iam put-role-policy --role-name <ROLE_NAME> --policy-name <POLICY_NAME>
--policy-document  file://inline-policy2.json --profile <PROFILE_NAME>
```

- Enter the IAM role name that was created in step (2) into *<ROLE_NAME>*.
- A desired policy name can be entered into *<POLICY_NAME>* (example: rx65n_ota_demo_s3_policy).

After the command has been executed, the display in the window will be as shown below (no part of the execution result is displayed).



```
PS C:\aws> aws iam put-role-policy --role-name ota_role_rx65n --policy-name rx65n_ota_demo_s3_policy
 --policy-document  file://inline-policy2.json --profile Renesas
PS C:\aws> _
```

3.3.4 Registering a Device as a Thing in AWS IoT

Use AWS IoT Core services to create a device (“thing”) and certificate for the AWS IoT Core to be connected.

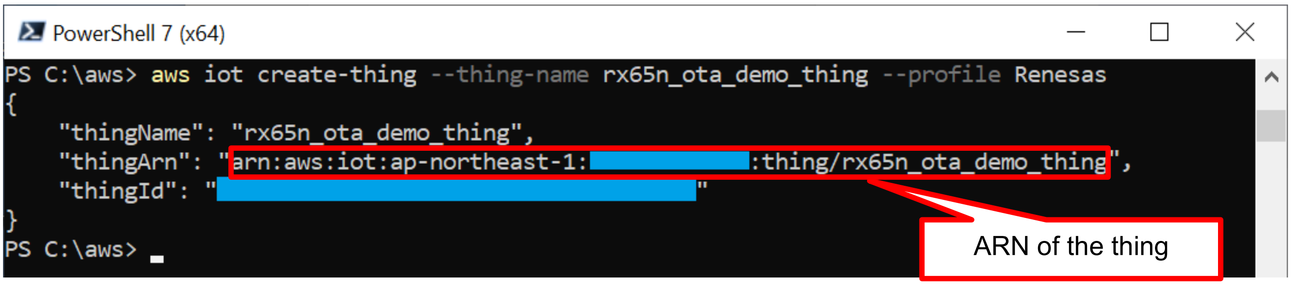
(1) Create a device (thing).

Enter the following command and create a thing.

```
> aws iot create-thing --thing-name <THING_NAME> --profile <PROFILE_NAME>
```

- A desired thing name can be entered into *<THING_NAME>* (example: rx65n_ota_demo_thing).

After the command has been executed, the display in the window will be as shown below.



```
PS C:\aws> aws iot create-thing --thing-name rx65n_ota_demo_thing --profile Renesas
{
    "thingName": "rx65n_ota_demo_thing",
    "thingArn": "arn:aws:iot:ap-northeast-1:[redacted]:thing/rx65n_ota_demo_thing",
    "thingId": "[redacted]"
}
PS C:\aws>
```

ARN of the thing

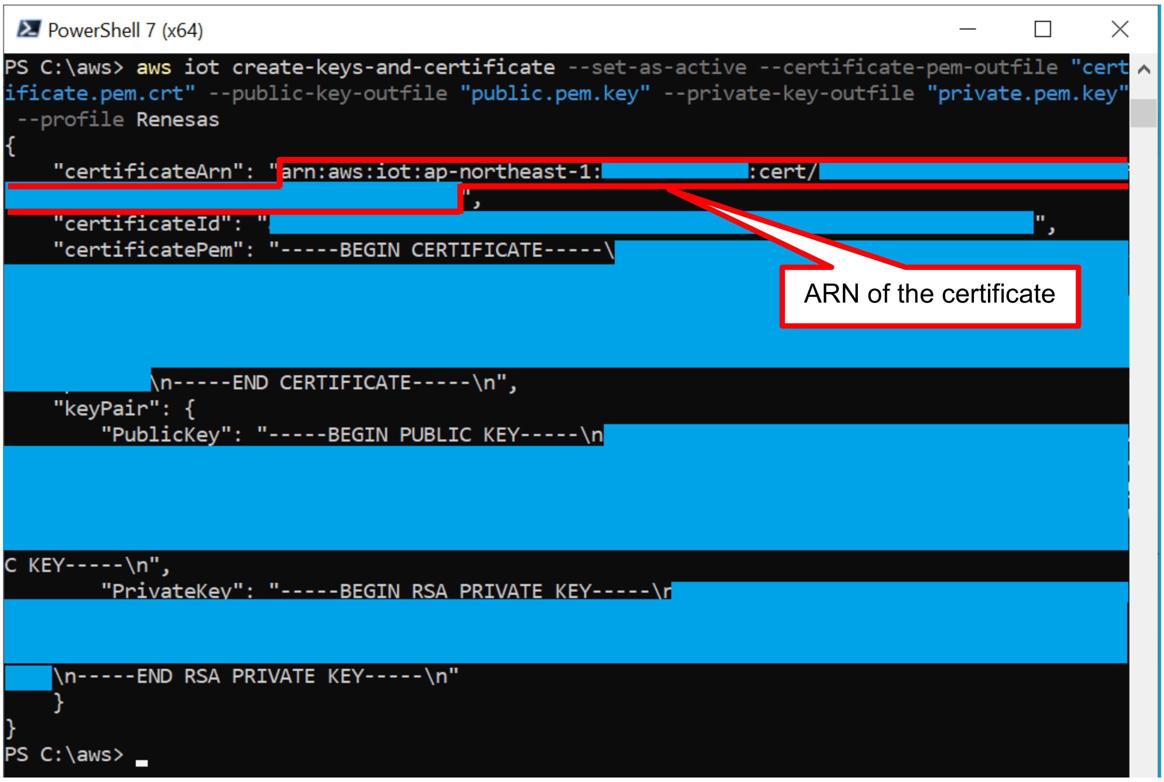
Make a note of the thing name entered here and the ARN of the thing (thingArn: text inside the red frame in the above figure) which is displayed. You will need them in a later process.

(2) Create a device certificate.

Create a device certificate and make it active, then download the device certificate, public key, and private key files.
Enter the following command.

```
> aws iot create-keys-and-certificate --set-as-active --certificate-pem-
outfile "certificate.pem.crt" --public-key-outfile "public.pem.key" --private-
key-outfile "private.pem.key" --profile <PROFILE_NAME>
```

Execution of the command leads to creation of the device certificate and keys and the display in the window will be as shown below (the lengths of the character strings in the example of the display are abbreviated).



```
PS C:\aws> aws iot create-keys-and-certificate --set-as-active --certificate-pem-outfile "cert
ificate.pem.crt" --public-key-outfile "public.pem.key" --private-key-outfile "private.pem.key"
 --profile Renesas
{
    "certificateArn": "arn:aws:iot:ap-northeast-1:[redacted]:cert/[redacted]
",
    "certificateId": "[redacted]",
    "certificatePem": "-----BEGIN CERTIFICATE-----\[redacted]
\n-----END CERTIFICATE-----\n",
    "keyPair": {
        "PublicKey": "-----BEGIN PUBLIC KEY-----\n[redacted]
C KEY-----\n",
        "PrivateKey": "-----BEGIN RSA PRIVATE KEY-----\n[redacted]
\n-----END RSA PRIVATE KEY-----\n"
    }
}
PS C:\aws> _
```

Make a note of the ARN of the device certificate (certificateArn: text inside the red frame in the above figure) which is displayed. You will need it in a later process.

After execution of the command for creating a certificate, the following three files are downloaded to the work folder that was created in 3.1.5.

File Name	Description
certificate.pem.crt	Device certificate that is registered in the thing
public.pem.key	Public key that is registered in the thing
private.pem.key	Private key that is registered in the thing

The certificate and private key are equivalent to passwords for the device (thing). Registering a certificate and private key in the device allows their use in establishing connection between the device and AWS.

Note: The device certificate, public key, and private key can only be downloaded at the time the certificate is created.
These files should be stored in a safe location to prevent leakage of the information.

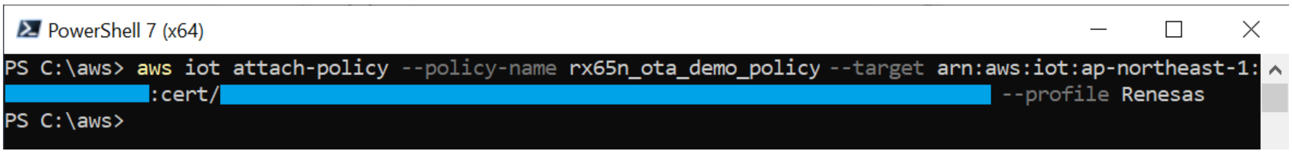
(3) Attach a policy to the device certificate.

Attach a policy to the created device certificate.
Enter the following command.

```
> aws iot attach-policy --policy-name <POLICY_NAME> --target <CERTIFICATE_ARN>
--profile <PROFILE_NAME>
```

- Enter the policy name that was created in 3.3.1(2) into <POLICY_NAME>.
- Enter the ARN of the device certificate that was created in step (2) into <CERTIFICATE_ARN>.

After the command has been executed, the display in the window will be as shown below (no part of the execution result is displayed).



```
PS C:\aws> aws iot attach-policy --policy-name rx65n_ota_demo_policy --target arn:aws:iot:ap-northeast-1:
[redacted]:cert/[redacted] --profile Renesas
PS C:\aws>
```

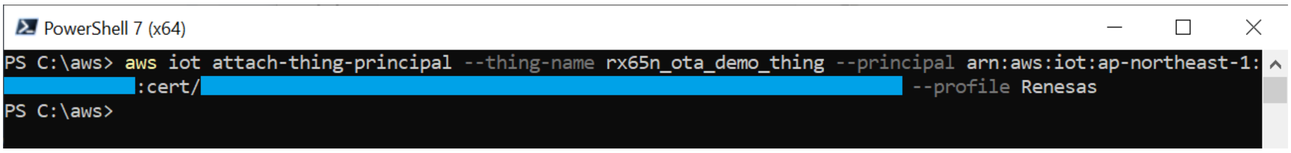
(4) Attach the device certificate to the thing.

Attach the device certificate to the created thing.
Enter the following command.

```
> aws iot attach-thing-principal --thing-name <THING_NAME> --principal
<CERTIFICATE_ARN> --profile <PROFILE_NAME>
```

- Enter the thing name that was created in step (1) into <THING_NAME>.
- Enter the ARN of the device certificate that was created in step (2) into <CERTIFICATE_ARN>.

After the command has been executed, the display in the window will be as shown below (no part of the execution result is displayed).



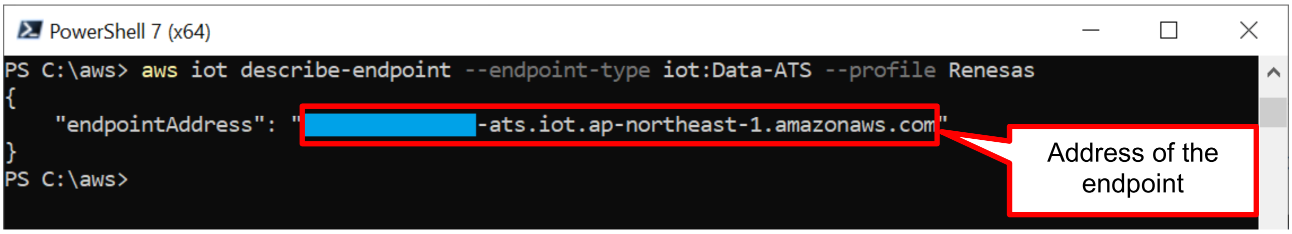
```
PS C:\aws> aws iot attach-thing-principal --thing-name rx65n_ota_demo_thing --principal arn:aws:iot:ap-northeast-1:
[redacted]:cert/[redacted] --profile Renesas
PS C:\aws>
```

(5) Check the endpoint (domain).

The endpoint is equivalent to the destination (URL) for connection of the device (thing). Registering the endpoint in the device will lead to connection of the device with the specified endpoint.
Enter the following command.

```
> aws iot describe-endpoint --endpoint-type iot:Data-ATS --profile
<PROFILE_NAME>
```

After the command has been executed, the display in the window will be as shown below.



```
PS C:\aws> aws iot describe-endpoint --endpoint-type iot:Data-ATS --profile Renesas
{
    "endpointAddress": "[redacted]-ats.iot.ap-northeast-1.amazonaws.com"
}
PS C:\aws>
```

Address of the endpoint

Make a note of the address of the endpoint (endpointAddress: text inside the red frame in the above figure) which is displayed. You will need it in a later process.

4. Setting Up a Device

Create a certificate for use in code signing verification of the firmware during the execution of an OTA update.

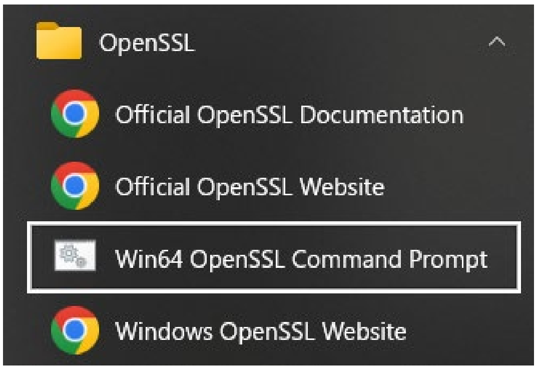
Create the certificate through the following steps.

Note: The certificate that is created here is different from that created in 3.3.4(2).

4.1 Generating a Key Pair and Certificate

(1) Start the Win64 OpenSSL Command Prompt.

From the Start menu, open the Win64 OpenSSL Command Prompt.

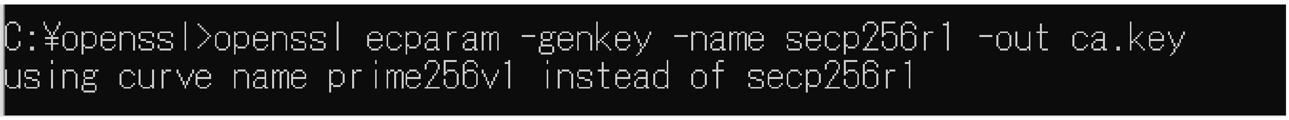


(2) Create an ECDSA CA private key.

Issue an OpenSSL command to create an elliptic curve digital signature algorithm (ECDSA) certificate authority (CA) private key.
Execute the following command.

```
> openssl ecparam -genkey -name secp256r1 -out ca.key
```

After the command has been executed, the display in the window will be as shown below.



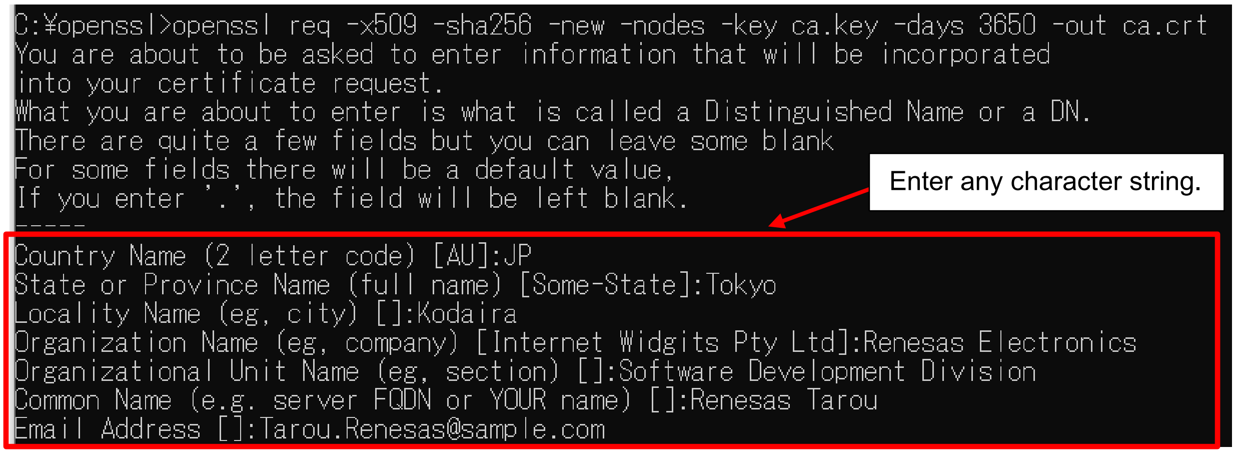
```
C:¥openssl>openssl ecparam -genkey -name secp256r1 -out ca.key
using curve name prime256v1 instead of secp256r1
```

(3) Create a CA certificate.

Create a CA certificate from the CA private key created in the previous step.
Execute the following command. Desired character strings can be entered into the fields from “Country Name” onward.

```
> openssl req -x509 -sha256 -new -nodes -key ca.key -days 3650 -out ca.crt
```

After the command has been executed, the display in the window will be as shown below.



```
C:¥openssl>openssl req -x509 -sha256 -new -nodes -key ca.key -days 3650 -out ca.crt
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:JP
State or Province Name (full name) [Some-State]:Tokyo
Locality Name (eg, city) []:Kodaira
Organization Name (eg, company) [Internet Widgits Pty Ltd]:Renesas Electronics
Organizational Unit Name (eg, section) []:Software Development Division
Common Name (e.g. server FQDN or YOUR name) []:Renesas Tarou
Email Address []:Tarou.Renesas@sample.com
```

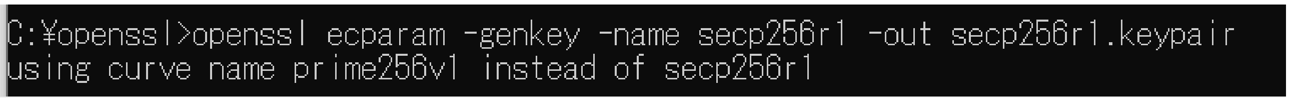
Enter any character string.

(4) Create an ECDSA key pair.

Create an ECDSA key pair.
Execute the following command.

```
> openssl ecparam -genkey -name secp256r1 -out secp256r1.keypair
```

After the command has been executed, the display in the window will be as shown below.



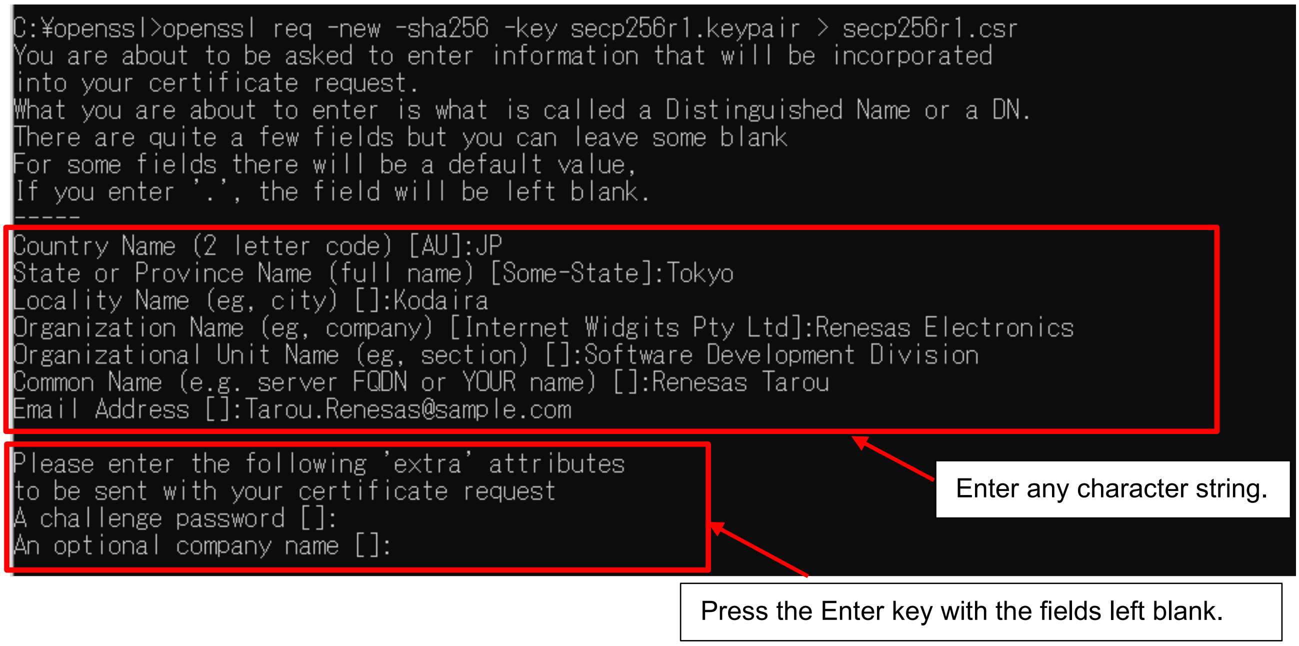
```
C:¥openssl>openssl ecparam -genkey -name secp256r1 -out secp256r1.keypair
using curve name prime256v1 instead of secp256r1
```

(5) Create a certificate request from the ECDSA key pair.

Create a certificate request from the ECDSA key pair created in the previous step.
Execute the following command.
Desired character strings can be entered into the fields from “Country Name” onward. For the last two lines, press the Enter key with the fields left blank.

```
> openssl req -new -sha256 -key secp256r1.keypair > secp256r1.csr
```

After the command has been executed, the display in the window will be as shown below.



```
C:¥openssl>openssl req -new -sha256 -key secp256r1.keypair > secp256r1.csr
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:JP
State or Province Name (full name) [Some-State]:Tokyo
Locality Name (eg, city) []:Kodaira
Organization Name (eg, company) [Internet Widgits Pty Ltd]:Renesas Electronics
Organizational Unit Name (eg, section) []:Software Development Division
Common Name (e.g. server FQDN or YOUR name) []:Renesas Tarou
Email Address []:Tarou.Renesas@sample.com

Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:
An optional company name []:
```

Enter any character string.

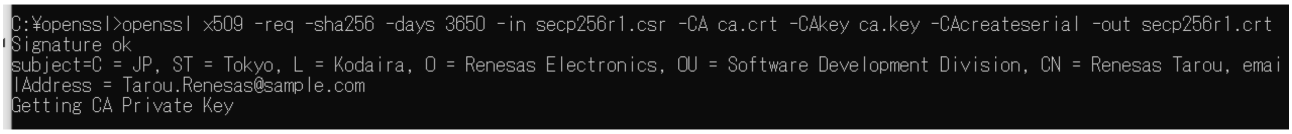
Press the Enter key with the fields left blank.

(6) Create a certificate.

Create a certificate from the certificate request, CA certificate, and CA private key created so far.
Execute the following command.

```
> openssl x509 -req -sha256 -days 3650 -in secp256r1.csr -CA ca.crt -CAkey
ca.key -CAcreateserial -out secp256r1.crt
```

After the command has been executed, the display in the window will be as shown below.



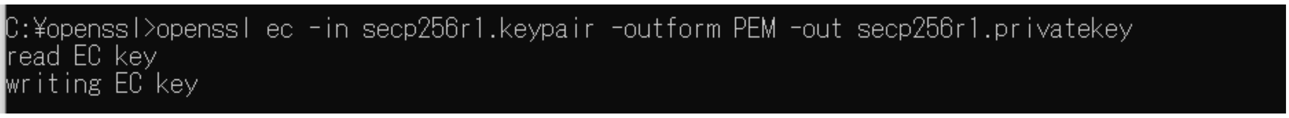
```
C:¥openssl>openssl x509 -req -sha256 -days 3650 -in secp256r1.csr -CA ca.crt -CAkey ca.key -CAcreateserial -out secp256r1.crt
Signature ok
subject=C = JP, ST = Tokyo, L = Kodaira, O = Renesas Electronics, OU = Software Development Division, CN = Renesas Tarou, emai
lAddress = Tarou.Renesas@sample.com
Getting CA Private Key
```

(7) Extract the private key from the ECDSA key pair.

Extract the private key from the ECDSA key pair.
Execute the following command.

```
> openssl ec -in secp256r1.keypair -outform PEM -out secp256r1.privatekey
```

After the command has been executed, the display in the window will be as shown below.



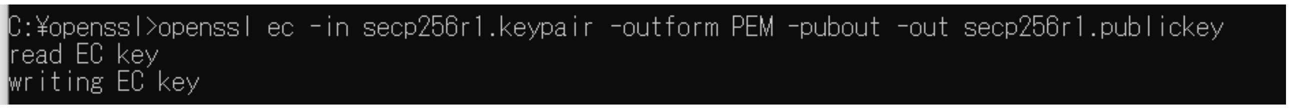
```
C:¥openssl>openssl ec -in secp256r1.keypair -outform PEM -out secp256r1.privatekey
read EC key
writing EC key
```

(8) Extract the public key from the ECDSA key pair.

Extract the public key from the ECDSA key pair.
Execute the following command.

```
> openssl ec -in secp256r1.keypair -outform PEM -pubout -out
secp256r1.publickey
```

After the command has been executed, the display in the window will be as shown below.



```
C:¥openssl>openssl ec -in secp256r1.keypair -outform PEM -pubout -out secp256r1.publickey
read EC key
writing EC key
```

(9) Confirm the generated files.

Following the procedure in this section will lead to creation of the four files listed below.

• ECDSA public key:	secp256r1.publickey
• ECDSA private key:	secp256r1.privatekey
• ECDSA certificate (key pair certificate):	secp256r1.crt
• ECDSA certificate chain:	ca.crt

The above files created by this point are used for making settings at the times of creating projects and creating OTA jobs in AWS.

4.2 Creating the Initial Version of the Firmware

This section describes how to create the initial version of the firmware.

4.2.1 Importing Projects

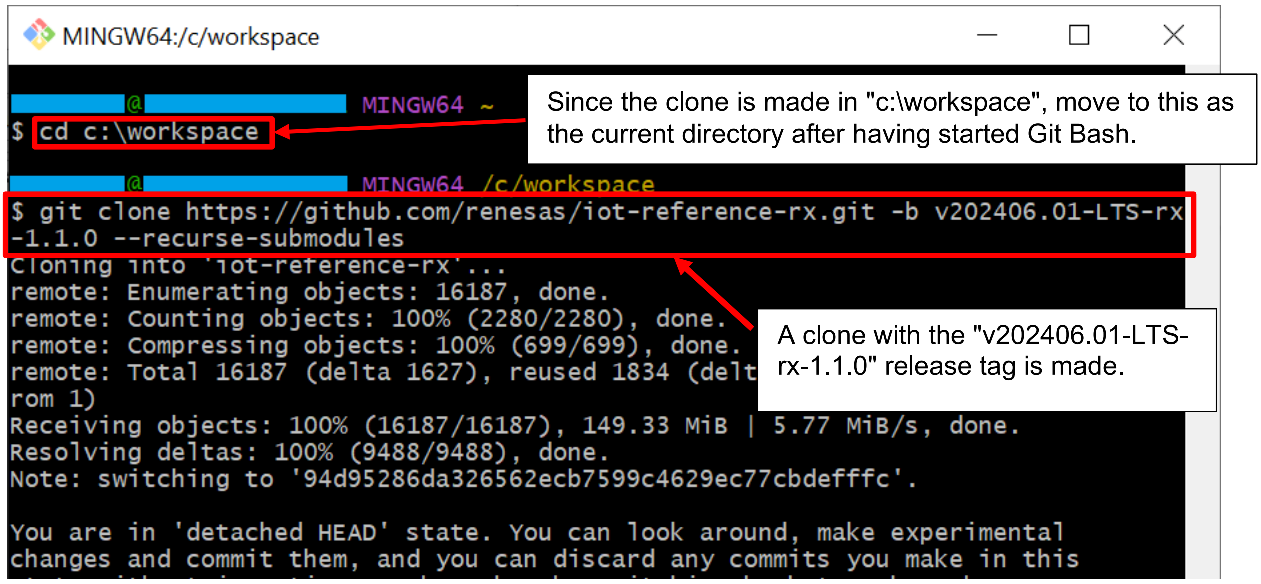
(1) Clone the demo project.

Download the demo project from GitHub (https://github.com/renesas/iot-reference-rx) to make a clone of it in a desired folder. This application note explains how to make a clone when using Git for Windows. Refer to the above link and install Git for Windows before continuing with the procedure.

Start Git Bash and enter the following command.
In the following example, the clone is made in "c:\workspace".

```
> cd c:\workspace
> git clone https://github.com/renesas/iot-reference-rx.git -b v202406.01-LTS-
rx-1.1.0 --recurse-submodules
```

After the command has been executed, the display in the window will be as shown below.



```
[redacted]@[redacted] MINGW64 ~
$ cd c:\workspace

[redacted]@[redacted] MINGW64 /c/workspace
$ git clone https://github.com/renesas/iot-reference-rx.git -b v202406.01-LTS-rx
-1.1.0 --recurse-submodules
Cloning into 'iot-reference-rx'...
remote: Enumerating objects: 16187, done.
remote: Counting objects: 100% (2280/2280), done.
remote: Compressing objects: 100% (699/699), done.
remote: Total 16187 (delta 1627), reused 1834 (delt
rom 1)
Receiving objects: 100% (16187/16187), 149.33 MiB | 5.77 MiB/s, done.
Resolving deltas: 100% (9488/9488), done.
Note: switching to '94d95286da326562ecb7599c4629ec77cbdefffc'.

You are in 'detached HEAD' state. You can look around, make experimental
changes and commit them, and you can discard any commits you make in this
```

Since the clone is made in "c:\workspace", move to this as the current directory after having started Git Bash.

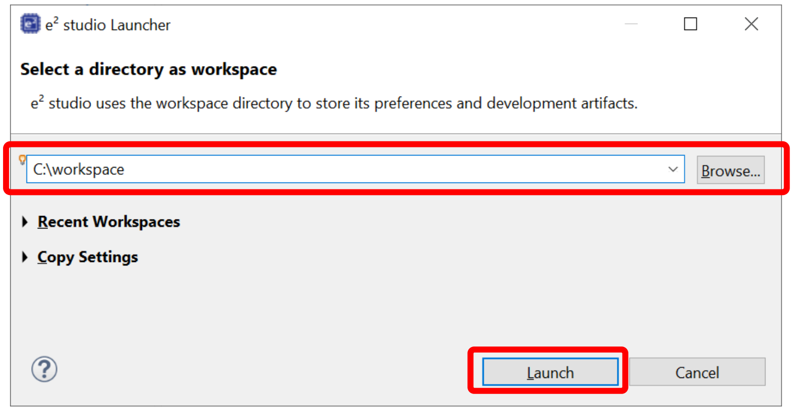
A clone with the "v202406.01-LTS-rx-1.1.0" release tag is made.

Note 1. Check for the latest version of "iot-reference-rx" at the GitHub download site.

Note 2. The path length (including the desired folder name) of the destination for cloning must be within 35 characters due to a limitation imposed by the e^2 studio. If 36 or more characters are specified, attempting to build the project will lead to an error.
An error may also occur if the path contains Japanese characters. Therefore, make sure to enter a name that only has alphanumeric characters.

(2) Create an e^2 studio workspace.

Launch the e^2 studio and create a new workspace.
Specify the folder containing the demo project that was cloned in step (1) as the workspace.



e^2 studio Launcher

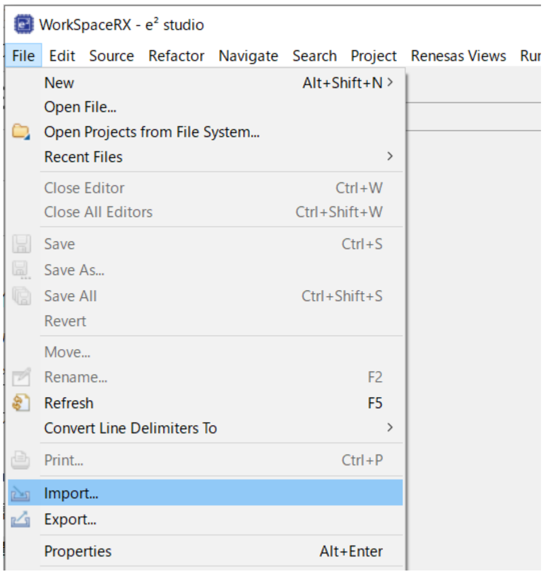
Select a directory as workspace

e^2 studio uses the workspace directory to store its preferences and development artifacts.

C:\workspace

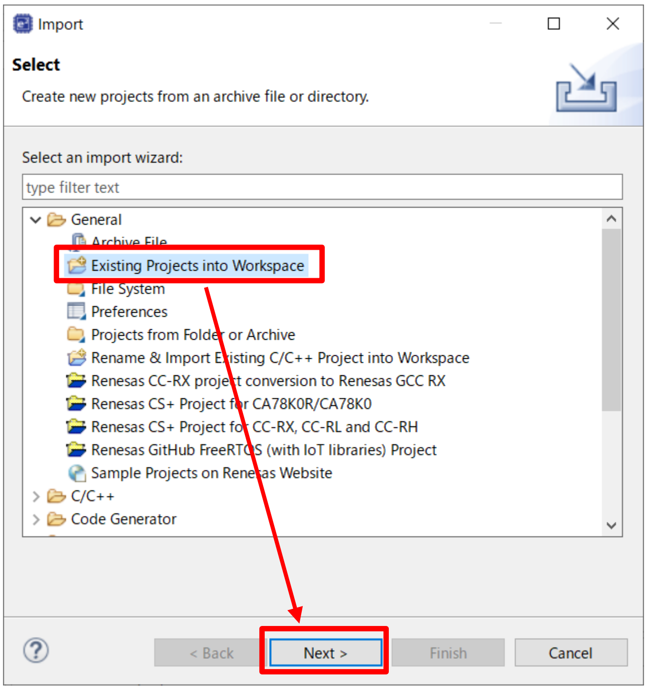
(3) Import files.

Select [File] → [Import].



(4) Select the import method.

Select [Existing Projects into Workspace] and click on the [Next] button.

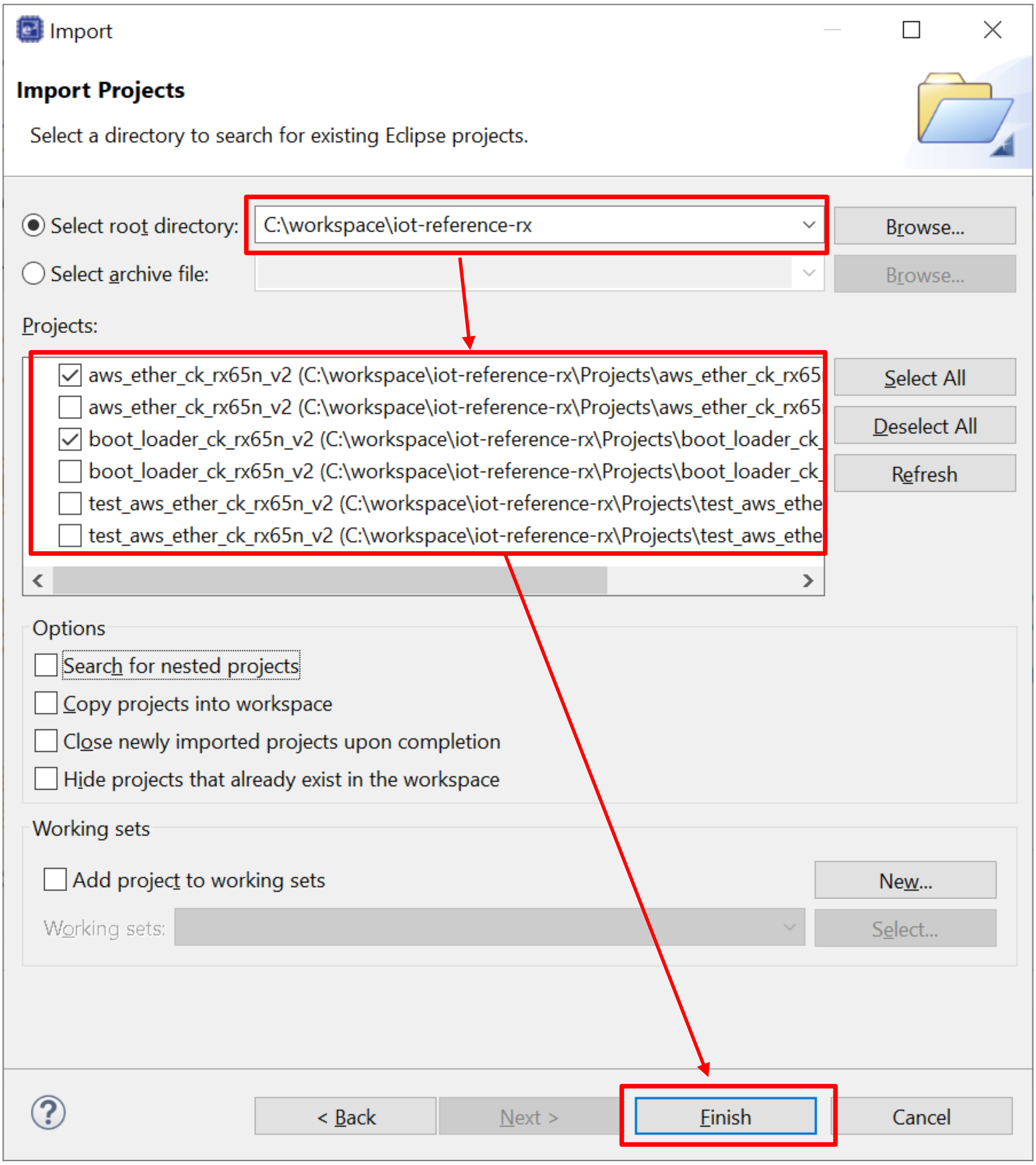

Import
Select
Create new projects from an archive file or directory.
Select an import wizard:
type filter text
General
Archive File
Existing Projects into Workspace
File System
Preferences
Projects from Folder or Archive
Rename & Import Existing C/C++ Project into Workspace
Renesas CC-RX project conversion to Renesas GCC RX
Renesas CS+ Project for CA78K0R/CA78K0
Renesas CS+ Project for CC-RX, CC-RL and CC-RH
Renesas GitHub FreeRTOS (with IoT libraries) Project
Sample Projects on Renesas Website
C/C++
Code Generator
< Back
Next >
Finish
Cancel

(5) Select the projects to be imported.

Select the folder that was created by cloning in step (1) in [Select root directory], tick the checkboxes for the following projects, and click on [Finish].
Confirm the compiler in the path names in parentheses when selecting the projects.

- aws_ether_ck_rx65n_v2 (CC-RX)
- boot_loader_ck_rx65n_v2 (CC-RX)

This application note explains the steps for an Ethernet-connected CC-RX compiler project as an example.



Import

Import Projects

Select a directory to search for existing Eclipse projects.

● Select root directory: C:\workspace\iot-reference-rx

○ Select archive file:

Projects:

☑ aws_ether_ck_rx65n_v2 (C:\workspace\iot-reference-rx\Projects\aws_ether_ck_rx65
☐ aws_ether_ck_rx65n_v2 (C:\workspace\iot-reference-rx\Projects\aws_ether_ck_rx65
☑ boot_loader_ck_rx65n_v2 (C:\workspace\iot-reference-rx\Projects\boot_loader_ck_
☐ boot_loader_ck_rx65n_v2 (C:\workspace\iot-reference-rx\Projects\boot_loader_ck_
☐ test_aws_ether_ck_rx65n_v2 (C:\workspace\iot-reference-rx\Projects\test_aws_ethe
☐ test_aws_ether_ck_rx65n_v2 (C:\workspace\iot-reference-rx\Projects\test_aws_ethe

Options

☐ Search for nested projects
☐ Copy projects into workspace
☐ Close newly imported projects upon completion
☐ Hide projects that already exist in the workspace

Working sets

☐ Add project to working sets

Working sets:

The table below is a list of projects that can be imported.
You can select a project with the desired connectivity and compiler.

Path	Project	Compiler
C:\workspace\iot-reference-rx\Projects\aws_ether_ck_rx65n_v2\e2studio_ccrx	Demo project: Ethernet	CC-RX
C:\workspace\iot-reference-rx\Projects\aws_ether_ck_rx65n_v2\e2studio_gcc		GCC
C:\workspace\iot-reference-rx\Projects\aws_ryz014a _ck_rx65n_v2\e2studio_ccrx	Demo project: Cellular (RYZ014A)	CC-RX
C:\workspace\iot-reference-rx\Projects\aws_ryz014a _ck_rx65n_v2\e2studio_gcc		GCC
C:\workspace\iot-reference-rx\Projects\aws_da16600_ck_rx65n_v2\e2studio_ccrx	Demo project: Wi-Fi（DA16600）	CC-RX
C:\workspace\iot-reference-rx\Projects\aws_da16600_ck_rx65n_v2\e2studio_gcc		GCC
C:\workspace\iot-reference-rx\Projects\boot_loader_ck_rx65n_v2\e2studio_ccrx	Boot loader project	CC-RX
C:\workspace\iot-reference-rx\Projects\boot_loader_ck_rx65n_v2\e2studio_gcc		GCC

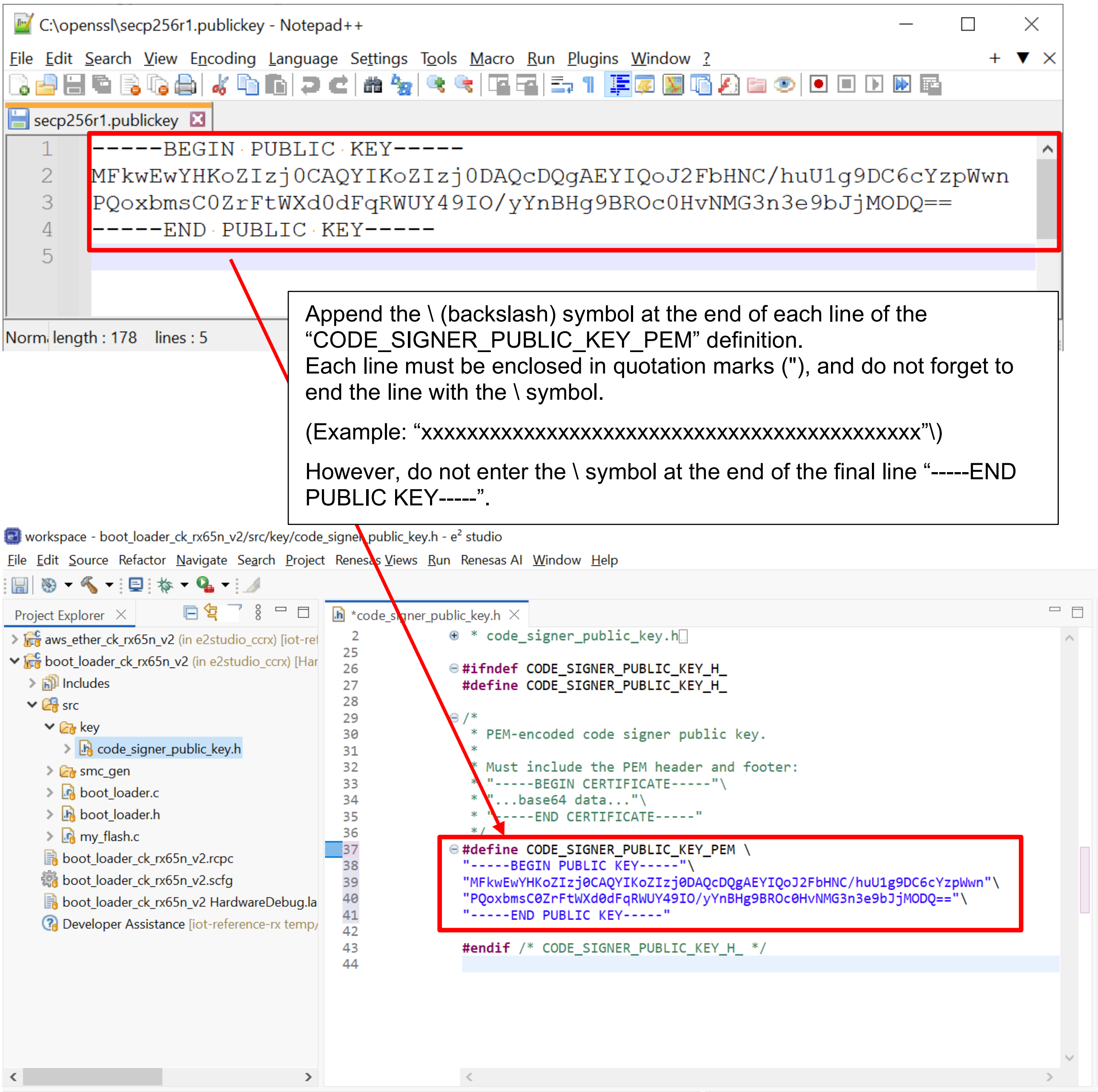
Note: The projects with names having the prefix “test_” are for validation tests and will not normally be used.

4.2.2 Setting Up Projects

(1) Assign a public key to the boot_loader_ck_rx65n_v2 project.

Assign a public key to the boot loader project.
Copy the contents of the secp256r1.publickey file that was created in 4.1(8), and paste the public key to the "CODE_SIGNENR_PUBLIC_KEY_PEM" definition in whichever of the following files matches the compiler in use.

- CC-RX: \boot_loader_ck_rx65n_v2\e2studio_ccrx\src\key\code_signer_public_key.h
- GCC: \boot_loader_ck_rx65n_v2\e2studio_gcc\src\key\code_signer_public_key.h


C:\openssl\secp256r1.publickey - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
secp256r1.publickey
Norm. length : 178 lines : 5
workspace - boot_loader_ck_rx65n_v2/src/key/code_signer_public_key.h - e² studio
File Edit Source Refactor Navigate Search Project Renesas Views Run Renesas AI Window Help
Project Explorer
aws_ether_ck_rx65n_v2 (in e2studio_ccrx) [iot-ref
boot_loader_ck_rx65n_v2 (in e2studio_ccrx) [Har
Includes
src
key
code_signer_public_key.h
smc_gen
boot_loader.c
boot_loader.h
my_flash.c
boot_loader_ck_rx65n_v2.rcpc
boot_loader_ck_rx65n_v2.scfg
boot_loader_ck_rx65n_v2 HardwareDebug.la
Developer Assistance [iot-reference-rx temp/
*code_signer_public_key.h

```
-----BEGIN PUBLIC KEY-----
MFkwEwYHKoZIzj0CAQYIKoZIzj0DAQcDQgAEYIQoJ2FbHNC/huU1g9DC6cYzpWwn
PQoxbmsC0ZrFtWXd0dFqRWUY49IO/yYnBHg9BROc0HvNMG3n3e9bJjMODQ==
-----END PUBLIC KEY-----
```

Append the \ (backslash) symbol at the end of each line of the "CODE_SIGNER_PUBLIC_KEY_PEM" definition.
Each line must be enclosed in quotation marks ("), and do not forget to end the line with the \ symbol.

(Example: "xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx"\)

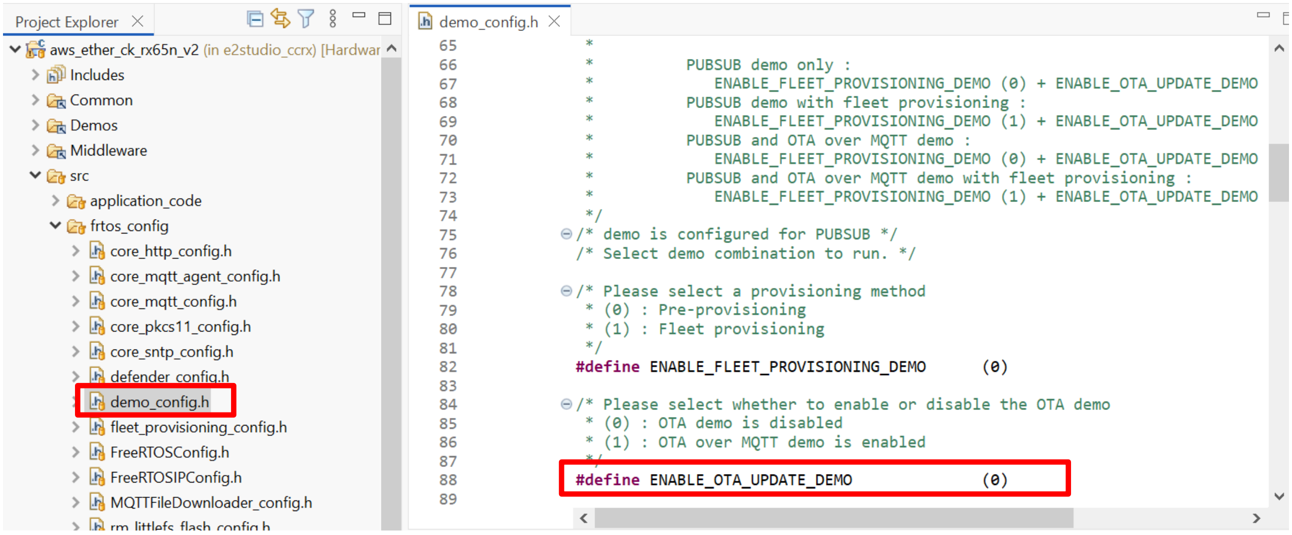
However, do not enter the \ symbol at the end of the final line "-----END PUBLIC KEY-----".

```
 * code_signer_public_key.h

#ifndef CODE_SIGNER_PUBLIC_KEY_H_
#define CODE_SIGNER_PUBLIC_KEY_H_

/*
 * PEM-encoded code signer public key.
 *
 * Must include the PEM header and footer:
 * "-----BEGIN CERTIFICATE-----"\
 * "...base64 data..."\
 * "-----END CERTIFICATE-----"
 */
#define CODE_SIGNER_PUBLIC_KEY_PEM \
"-----BEGIN PUBLIC KEY-----"\
"MFkwEwYHKoZIzj0CAQYIKoZIzj0DAQcDQgAEYIQoJ2FbHNC/huU1g9DC6cYzpWwn"\
"PQoxbmsC0ZrFtWXd0dFqRWUY49IO/yYnBHg9BROc0HvNMG3n3e9bJjMODQ=="\
"-----END PUBLIC KEY-----"

#endif /* CODE_SIGNER_PUBLIC_KEY_H_ */
```

(2) Set the definition for the OTA update demo to “Enable”.

Make a setting so that the project runs on the OTA update demo.
Set the ENABLE_OTA_UPDATE_DEMO definition to 1 (Enable) in whichever of the following files matches the compiler in use (the default value is 0).

- CC-RX: \aws_ether_ck_rx65n_v2\e2studio_ccrx\src\frtos_config\demo_config.h
- GCC: \aws_ether_ck_rx65n_v2\e2studio_gcc\src\frtos_config\demo_config.h



```
 *
 *         PUBSUB demo only :
 *            ENABLE_FLEET_PROVISIONING_DEMO (0) + ENABLE_OTA_UPDATE_DEMO
 *         PUBSUB demo with fleet provisioning :
 *            ENABLE_FLEET_PROVISIONING_DEMO (1) + ENABLE_OTA_UPDATE_DEMO
 *         PUBSUB and OTA over MQTT demo :
 *            ENABLE_FLEET_PROVISIONING_DEMO (0) + ENABLE_OTA_UPDATE_DEMO
 *         PUBSUB and OTA over MQTT demo with fleet provisioning :
 *            ENABLE_FLEET_PROVISIONING_DEMO (1) + ENABLE_OTA_UPDATE_DEMO
 */
/* demo is configured for PUBSUB */
/* Select demo combination to run. */

/* Please select a provisioning method
 * (0) : Pre-provisioning
 * (1) : Fleet provisioning
 */
#define ENABLE_FLEET_PROVISIONING_DEMO      (0)

/* Please select whether to enable or disable the OTA demo
 * (0) : OTA demo is disabled
 * (1) : OTA over MQTT demo is enabled
 */
#define ENABLE_OTA_UPDATE_DEMO              (0)
```

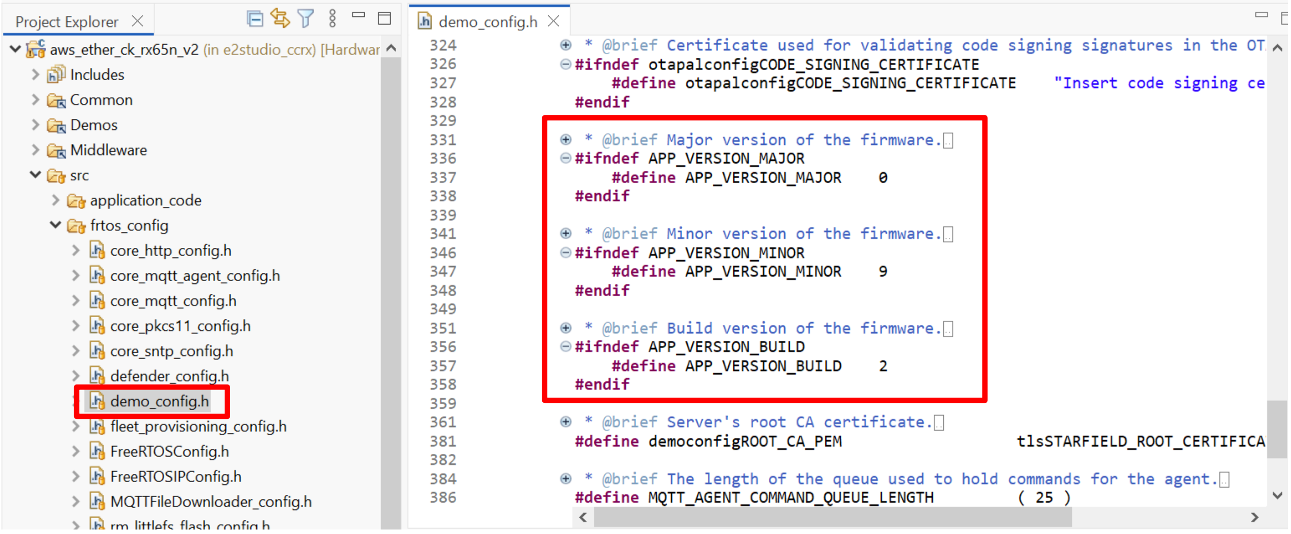
(3) Confirm the initial version of the project.

Confirm that the initial version of the project is 0.92.
Open the following file that matches the compiler in use and confirm the version.

- CC-RX: \aws_ether_ck_rx65n_v2\e2studio_ccrx\src\frtos_config\demo_config.h
- GCC: \aws_ether_ck_rx65n_v2\e2studio_gcc\src\frtos_config\demo_config.h

Confirm that the version definitions are set as follows:

APP_VERSION_MAJOR:	0
APP_VERSION_MINOR:	9
APP_VERSION_BUILD:	2

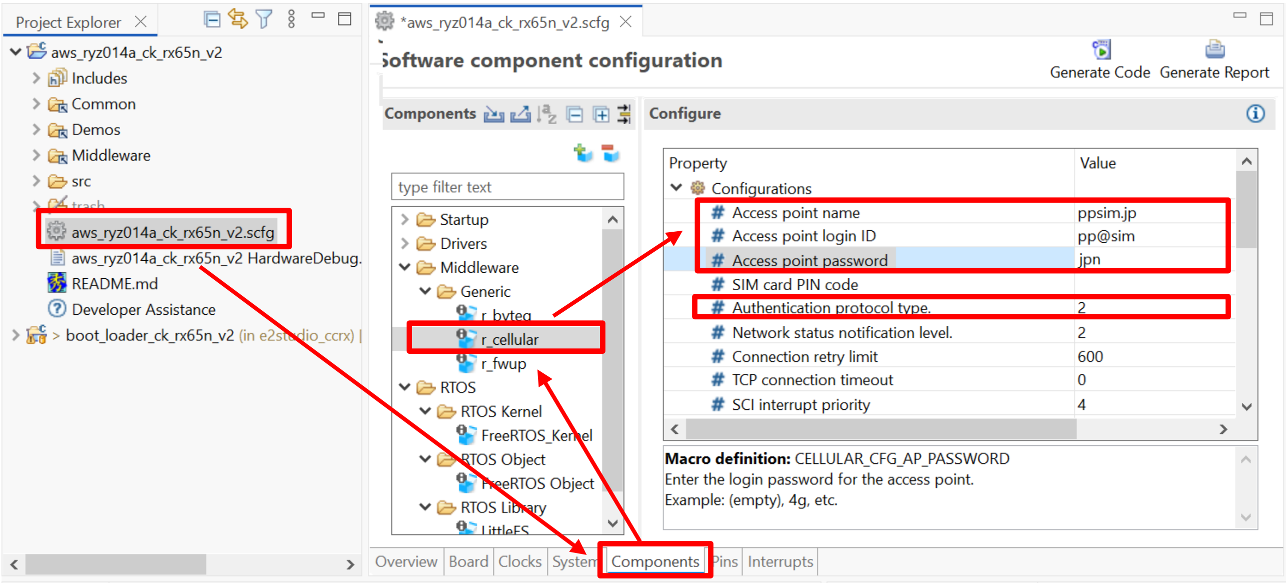


```
 * @brief Certificate used for validating code signing signatures in the OT
#ifndef otapalconfigCODE_SIGNING_CERTIFICATE
    #define otapalconfigCODE_SIGNING_CERTIFICATE    "Insert code signing ce
#endif

 * @brief Major version of the firmware.
#ifndef APP_VERSION_MAJOR
    #define APP_VERSION_MAJOR    0
#endif

 * @brief Minor version of the firmware.
#ifndef APP_VERSION_MINOR
    #define APP_VERSION_MINOR    9
#endif

 * @brief Build version of the firmware.
#ifndef APP_VERSION_BUILD
    #define APP_VERSION_BUILD    2
#endif

 * @brief Server's root CA certificate.
#define democonfigROOT_CA_PEM                   tlsSTARFIELD_ROOT_CERTIFICA

 * @brief The length of the queue used to hold commands for the agent.
#define MQTT_AGENT_COMMAND_QUEUE_LENGTH         ( 25 )
```

(4) Set up the RYZ014A cellular module.

When a cellular module is to be used for the AWS connection, set up the RYZ014A cellular module control module using FIT (r_cellular).

Open “aws_ryz014a_ck_rx65n_v2.scfg” and click on the [Components] tab. For the [r_cellular] component, set [Access point name], [Access point login ID], [Access point password], and [Authentication protocol type] to match the settings of the SIM card.



Property	Value
Configurations	
Access point name	ppsim.jp
Access point login ID	pp@sim
Access point password	jpn
SIM card PIN code	
Authentication protocol type.	2
Network status notification level.	2
Connection retry limit	600
TCP connection timeout	0
SCI interrupt priority	4

Macro definition: CELLULAR_CFG_AP_PASSWORD
Enter the login password for the access point.
Example: (empty), 4g, etc.

Note: For the method of setting up a Wi-Fi network with the use of the DA16600 Wi-Fi module, refer to GitHub "Settings of Wi-Fi network". For the settings of the country code and GMT timezone, refer to "Settings of Country code and GMT timezone".

4.2.3 Creating the Initial Firmware

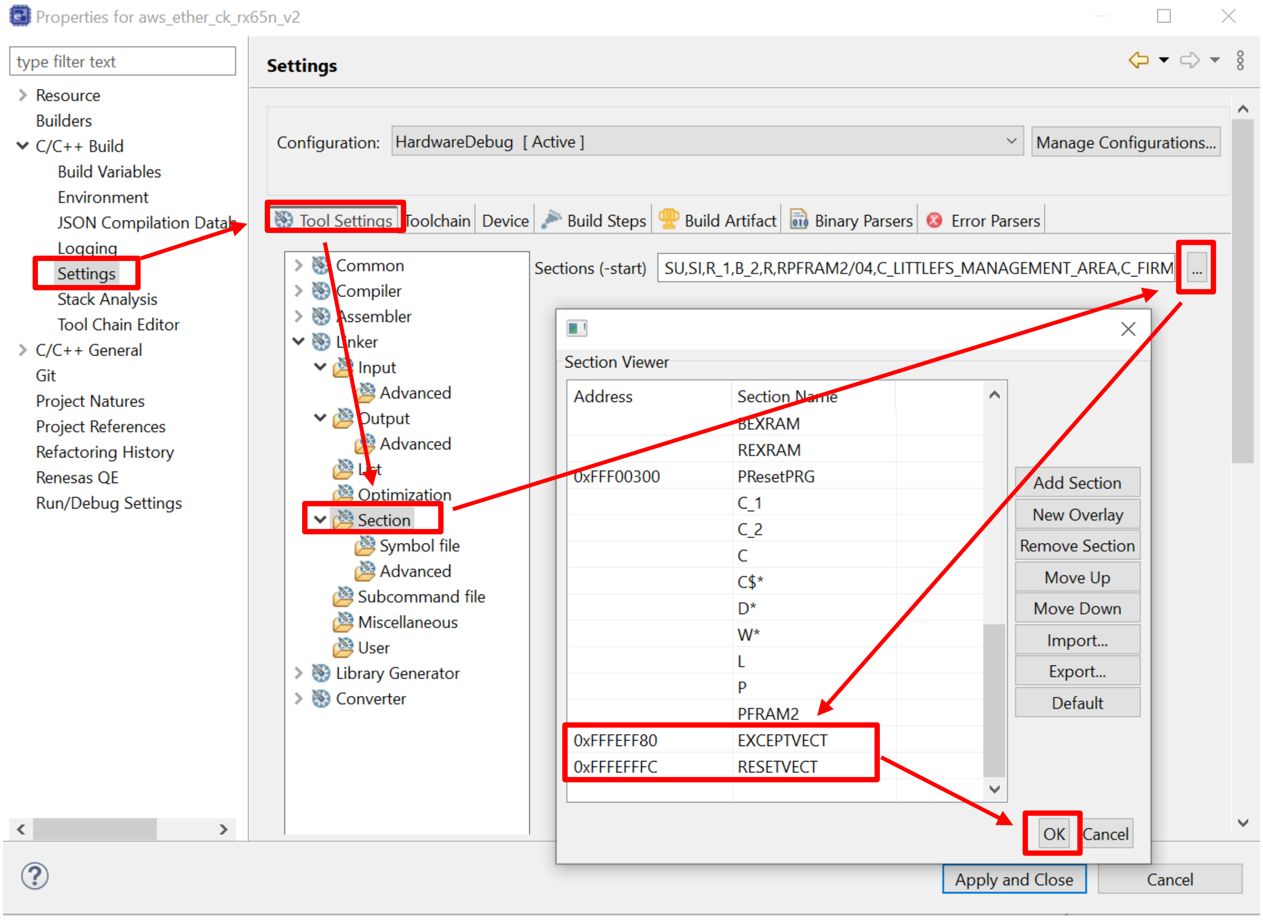
This section explains how to create the initial firmware by combining the boot loader (boot_loader_ck_rx65n_v2) and firmware (aws_ether_ck_rx65n_v2).

(1) Change the vectors of the firmware (aws_ether_ck_rx65n_v2) and build the firmware.

Confirm the changes to the vectors in the firmware and then build the firmware.
Open the aws_ether_ck_rx65n_v2 project, and select [Project] → [Properties].

Select [Settings] in the C/C++ Build menu. On the [Tool Settings] tabbed page, select [Linker] → [Section] → [Section Viewer]. Allocate the addresses below to the respective sections.

- EXCEPTVECT: 0xFFFEFF80
- RESETVECT: 0xFFFEFFFC



Configuration: HardwareDebug [Active]

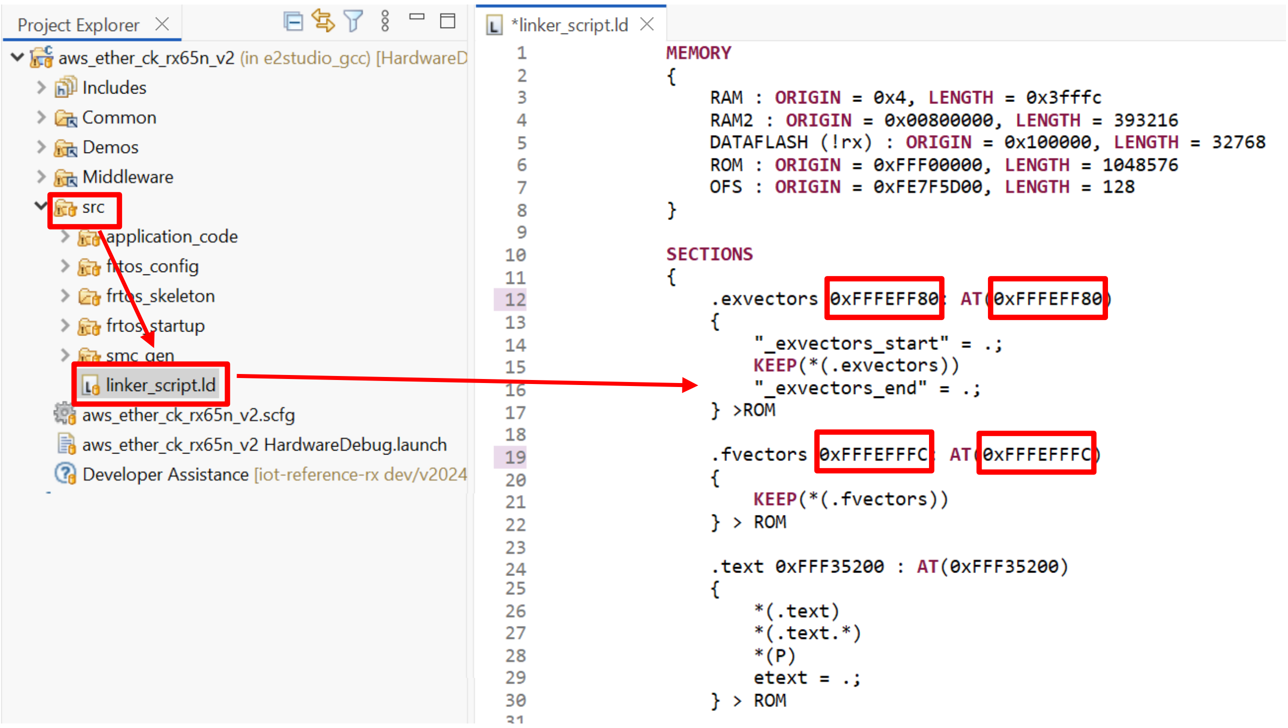
Sections (-start) SU,SI,R_1,B_2,R,RPFRAM2/04,C_LITTLEFS_MANAGEMENT_AREA,C_FIRM

Address	Section Name
	BEXRAM
	REXRAM
0xFFF00300	PResetPRG
	C_1
	C_2
	C
	C$*
	D*
	W*
	L
	P
	PFRAM2
0xFFFEFF80	EXCEPTVECT
0xFFFEFFFC	RESETVECT

After the vector setting is complete, build the aws_ether_ck_rx65n_v2 project in the e^2 studio to create the firmware.

When creating a GCC project, the method for changing the vector setting is different.
In Project Explorer, open the “src\linker_script.ld” file and change the following addresses.

- .exvectors: 0xFFFEFF80 (2 places)
- .fvectors: 0xFFFEFFFC (2 places)


Project Explorer
aws_ether_ck_rx65n_v2 (in e2studio_gcc) [HardwareD
Includes
Common
Demos
Middleware
src
application_code
frtos_config
frtos_skeleton
frtos_startup
smc_gen
linker_script.ld
aws_ether_ck_rx65n_v2.scfg
aws_ether_ck_rx65n_v2 HardwareDebug.launch
Developer Assistance [iot-reference-rx dev/v2024
*linker_script.ld

```
MEMORY
{
    RAM : ORIGIN = 0x4, LENGTH = 0x3fffc
    RAM2 : ORIGIN = 0x00800000, LENGTH = 393216
    DATAFLASH (!rx) : ORIGIN = 0x100000, LENGTH = 32768
    ROM : ORIGIN = 0xFFF00000, LENGTH = 1048576
    OFS : ORIGIN = 0xFE7F5D00, LENGTH = 128
}

SECTIONS
{
    .exvectors 0xFFFEFF80 : AT(0xFFFEFF80)
    {
        "_exvectors_start" = .;
        KEEP(*(.exvectors))
        "_exvectors_end" = .;
    } >ROM

    .fvectors 0xFFFEFFFC : AT(0xFFFEFFFC)
    {
        KEEP(*(.fvectors))
    } > ROM

    .text 0xFFF35200 : AT(0xFFF35200)
    {
        *(.text)
        *(.text.*)
        *(P)
        etext = .;
    } > ROM
```

After the vector setting is complete, build the aws_ether_ck_rx65n_v2 project in the e^2 studio to create the firmware.

(2) Create the boot loader.

Build a boot loader project to create the boot loader.

(3) Use the Renesas Image Generator to generate the initial firmware.

Use the Renesas Image Generator to generate the initial firmware.
Start by placing the following files in the Renesas Image Generator folder.

• Results of the build process in 4.2.3(1):	aws_ether_ck_rx65n_v2.mot
• Results of the build process in 4.2.3(2):	boot_loader_ck_rx65n_v2.mot
• Private key created in 4.1(7):	secp256r1.privatekey

Open the command prompt window, navigate to the Renesas Image Generator folder, and execute the following command to generate the userprog.mot file.
As several minutes may elapse from the execution of a command to the creation of a file, wait for the required time.

```
python image-gen.py -iup aws_ether_ck_rx65n_v2.mot -ip RX65N_DualBank_ImageGenerator_PRM.csv -o userprog
-ibp boot_loader_ck_rx65n_v2.mot -key secp256r1.privatekey -vt ecdsa -ff RTOS
```

(4) Install the flash programming tool (Renesas Flash Programmer).

Access the download site of the flash programming tool, and download and install “Renesas Flash Programmer V3.19.00 Windows”.

(5) Connect the PC to the CK-RX65N v2 board.

Follow the instructions on how to connect the CK-RX65N v2 board in “2.6 Connecting the CK-RX65N v2” to connect the PC to the CK-RX65N v2 board.

(6) Open the erase project in the Renesas Flash Programmer.

In the Renesas Flash Programmer, select [Open Project] in the File menu, and open the “erase.rpj” project.
The erase project can be found in a subfolder of the sample program.

```
\Projects\aws_ether_ck_rx65n_v2\flash_project\erase_from_bank1
```

(7) Erase the device.

Click on the [Start] button to commence erasing the device.
Erasure is complete when the message “Operation completed” is displayed.

Note: If the message “Error (E3000107): This device does not match the connection parameters.” is output, proceed to step (8) because this indicates that the device information has already been initialized.

(8) Open the flash programming project in the Renesas Flash Programmer.

In the Renesas Flash Programmer, select [Open Project] in the File menu, and open the "flash_project.rpj" project.
The flash programming project can be found in a subfolder of the sample program.

```
\Projects\aws_ether_ck_rx65n_v2\flash_project
```

(9) Select the initial firmware.

Next, click on [Add/Remove Files], then click on the [Add File(s)] button.

In the [File Details] dialog box, select the initial firmware (userprog.mot) that was created in 4.2.3(3).

(10) Write the initial firmware.

Click on the [Start] button to write the initial firmware.
Writing of the initial firmware is complete when the message "Operation completed" is displayed.

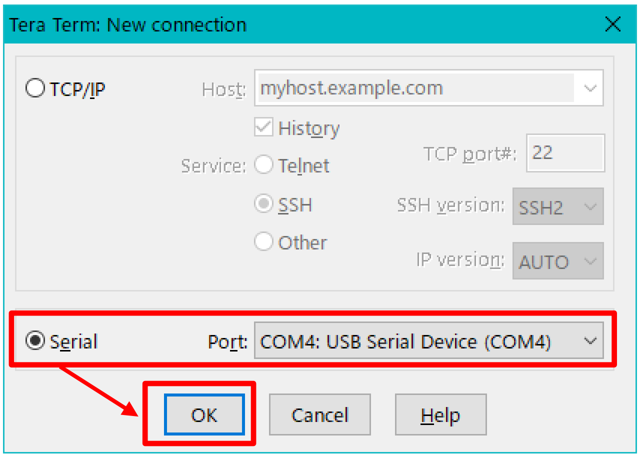
Note: If the message "Error (E3000107): This device does not match the connection parameters." is output, perform the erasure processing in step (7) because this indicates that the device information has not been initialized.

4.2.4 Registering AWS IoT Information

This section explains how to set AWS IoT information in Tera Term by running the aws_ether_ck_rx65n_v2 project. The information set through this process is written to data flash memory.

(1) Start Tera Term and set the serial port.

Start Tera Term and set the serial port to be connected to the target board. Select [New Connection] in the File menu. In the [New Connection] dialog box thus produced, tick the [Serial] checkbox, then click on [OK].



Tera Term: New connection

○ TCP/IP Host: myhost.example.com

☑ History

Service: ○ Telnet TCP port#: 22

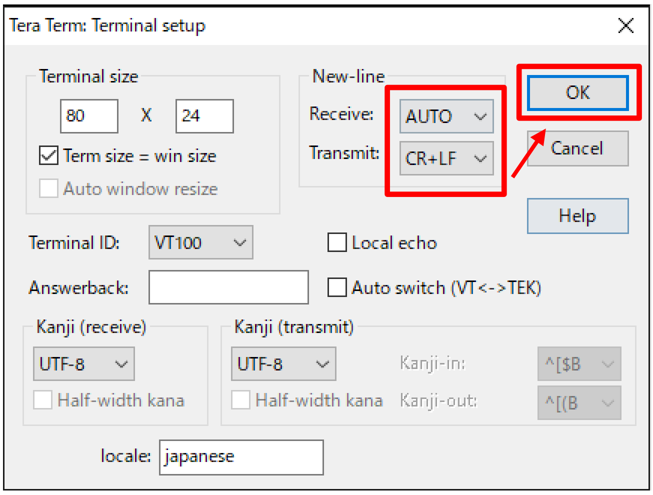
● SSH SSH version: SSH2

○ Other IP version: AUTO

● Serial Port: COM4: USB Serial Device (COM4)

(2) Set the new-line code.

Set the new-line code for use in transmission and reception through the serial port.
Select [Terminal] in the Setup menu. In the [New-line] field of the dialog box that appears, select "Auto" for [Receive] and "CR+LF" for [Transmit], then click on [OK].



Tera Term: Terminal setup

Terminal size: 80 X 24

☑ Term size = win size

□ Auto window resize

New-line

Receive: AUTO

Transmit: CR+LF

Terminal ID: VT100

□ Local echo

Answerback:

□ Auto switch (VT<->TEK)

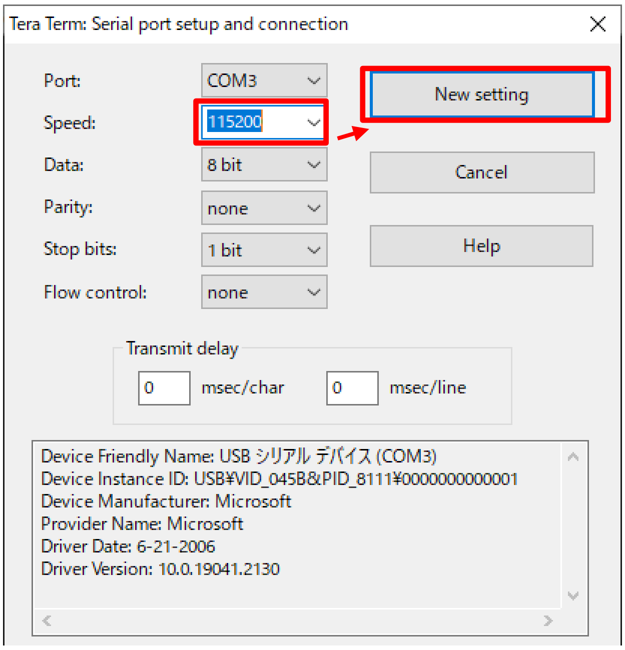
Kanji (receive): UTF-8 □ Half-width kana

Kanji (transmit): UTF-8 □ Half-width kana Kanji-in: ^[$B Kanji-out: ^[(B

locale: japanese

(3) Set the serial communications speed.

Select [Serial port…] in the Setup menu. In the dialog box that appears, select “115200” for [Speed], then click on [New setting].



Tera Term: Serial port setup and connection

Port: COM3

Speed: 115200

Data: 8 bit

Parity: none

Stop bits: 1 bit

Flow control: none

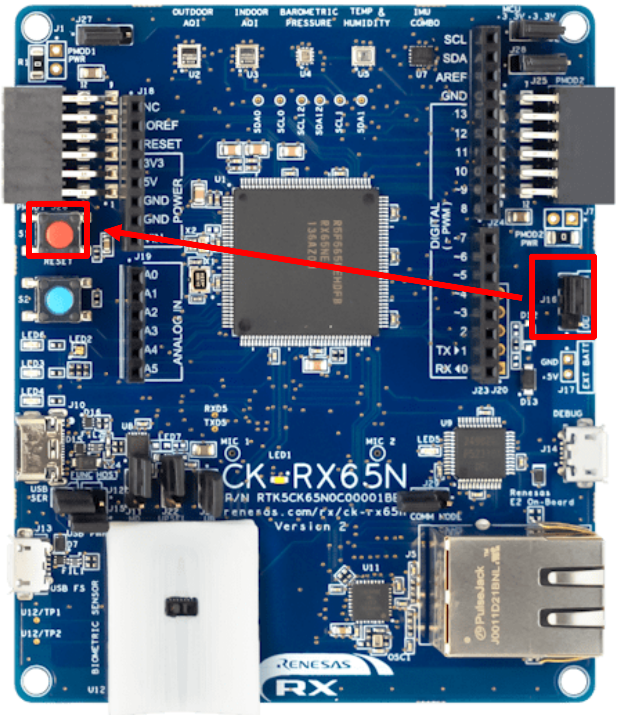
Transmit delay

0 msec/char 0 msec/line

Device Friendly Name: USB シリアル デバイス (COM3)
Device Instance ID: USB¥VID_045B&PID_8111¥0000000000001
Device Manufacturer: Microsoft
Provider Name: Microsoft
Driver Date: 6-21-2006
Driver Version: 10.0.19041.2130

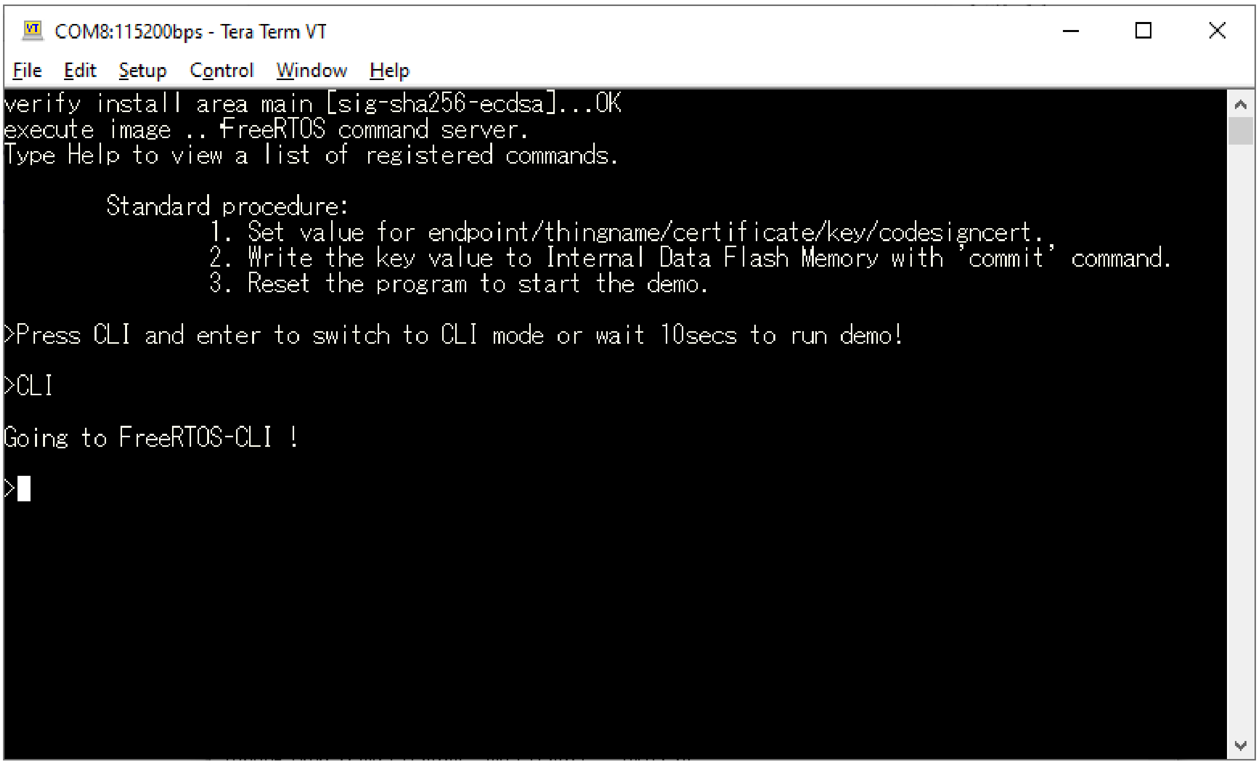
(4) Reset the target board and execute the firmware.

Set jumper block J16 on the CK-RX65N v2 board to the RUN side, and then press the RESET switch. The initial firmware will start running.



(5) Display the CLI menu.

Execution of the initial firmware produces a menu in the Tera Term window. Within 10 seconds of this, enter “CLI” and press the Enter key.

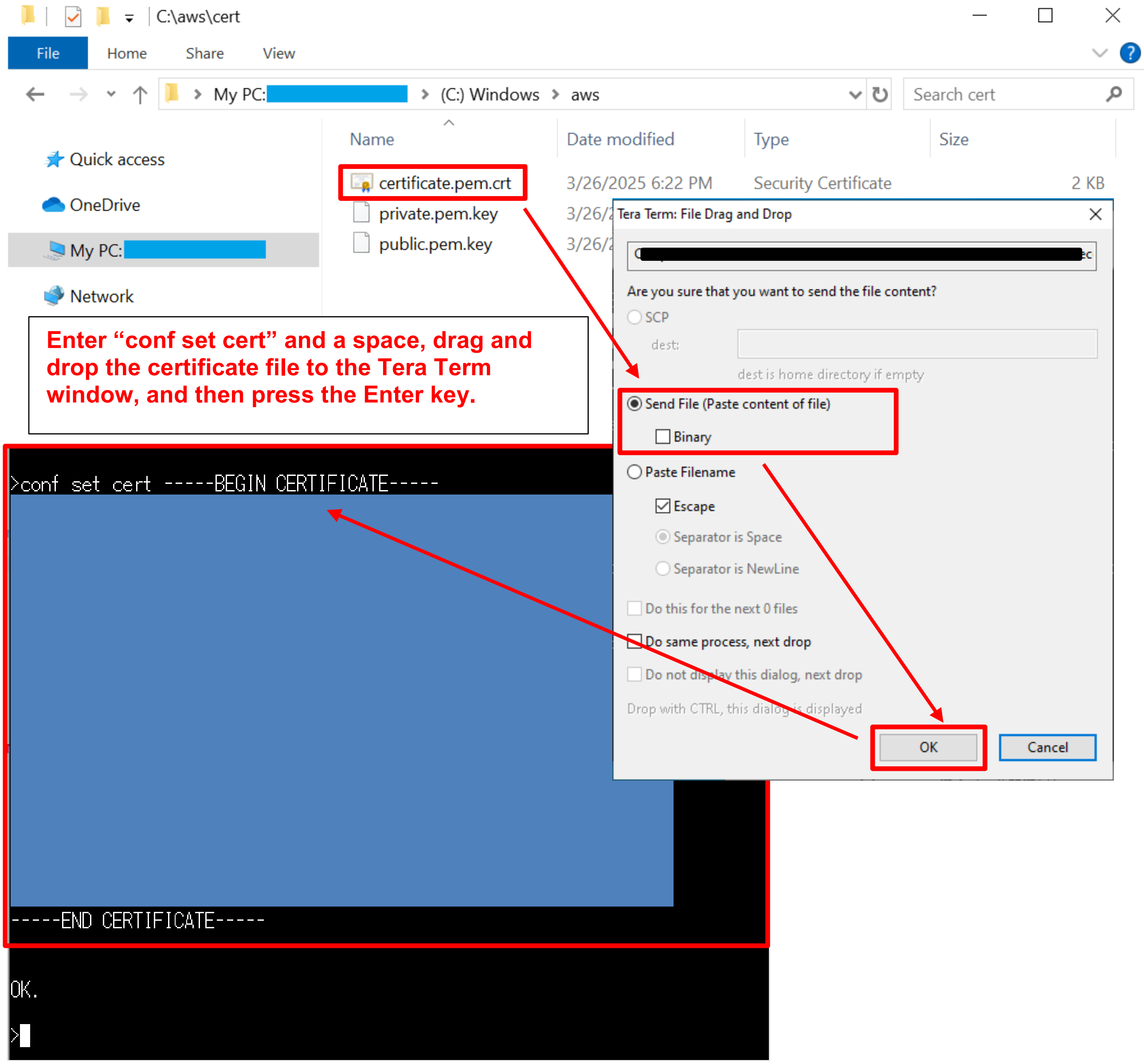

COM8:115200bps - Tera Term VT
File Edit Setup Control Window Help

```
verify install area main [sig-sha256-ecdsa]...OK
execute image .. FreeRTOS command server.
Type Help to view a list of registered commands.

        Standard procedure:
                1. Set value for endpoint/thingname/certificate/key/codesigncert.
                2. Write the key value to Internal Data Flash Memory with 'commit' command.
                3. Reset the program to start the demo.

>Press CLI and enter to switch to CLI mode or wait 10secs to run demo!

>CLI

Going to FreeRTOS-CLI !

>
```

(6) Register the device certificate.

Register the certificate that was downloaded in 3.3.4(2) to the target board.
Enter “`conf set cert`” in Tera Term, then drag and drop the certificate file (certificate.pem.crt) to the Tera Term window to send the file. Finally, press the Enter key in the Tera Term window.

Note: Change the linefeed code of the certificate file to LF with a text editor, etc. before dragging and dropping the file.



Name	Date modified	Type	Size
certificate.pem.crt	3/26/2025 6:22 PM	Security Certificate	2 KB
private.pem.key	3/26/2		
public.pem.key	3/26/2		

Enter “conf set cert” and a space, drag and drop the certificate file to the Tera Term window, and then press the Enter key.

Tera Term: File Drag and Drop

[redacted]

Are you sure that you want to send the file content?

○ SCP

dest:

dest is home directory if empty

● Send File (Paste content of file)

□ Binary

○ Paste Filename

☑ Escape

○ Separator is Space

○ Separator is NewLine

□ Do this for the next 0 files

□ Do same process, next drop

□ Do not display this dialog, next drop

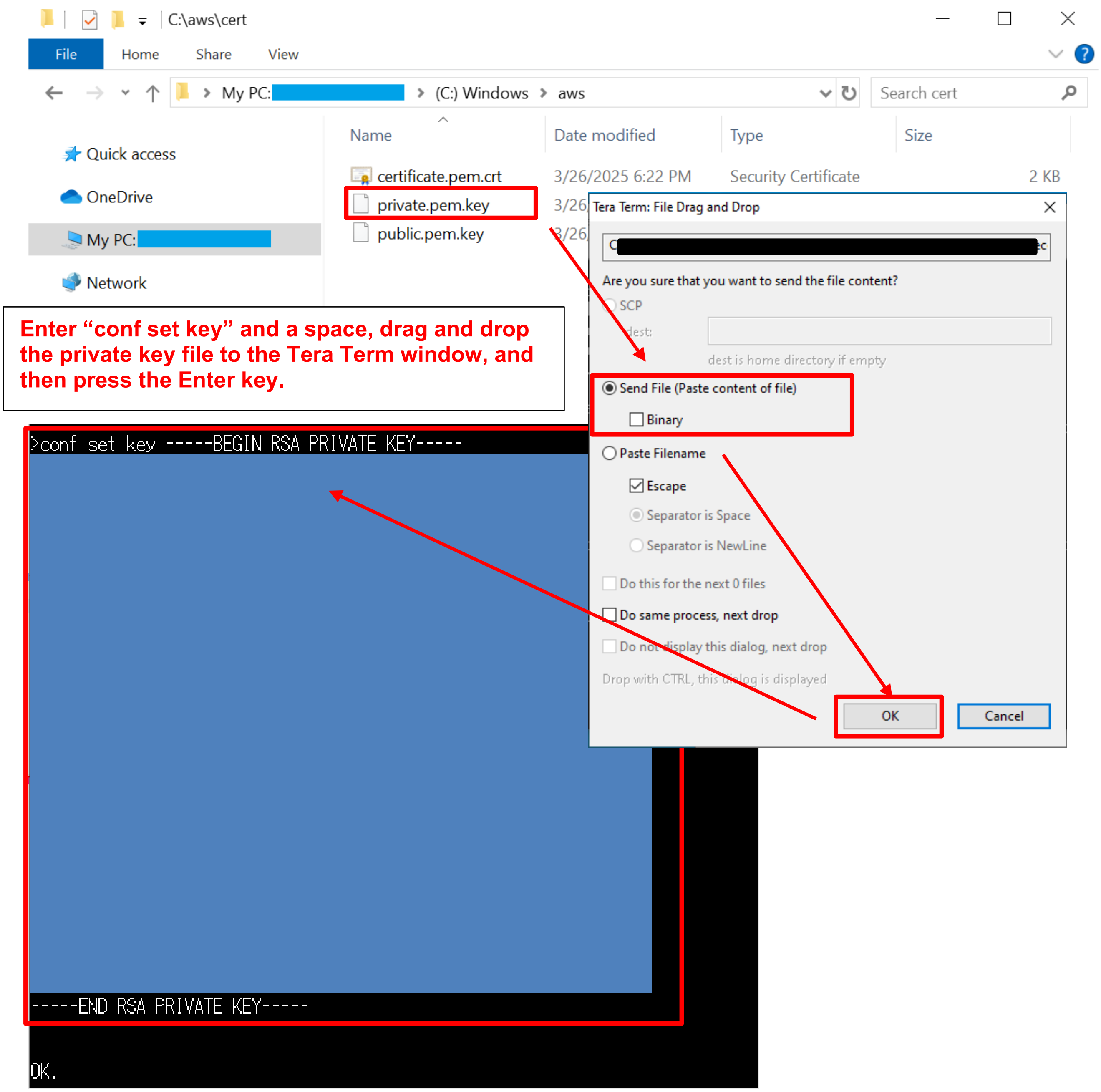
Drop with CTRL, this dialog is displayed

```
>conf set cert -----BEGIN CERTIFICATE-----
[redacted]
-----END CERTIFICATE-----

OK.

>
```

(7) Register the private key.

Register the private key that was downloaded in 3.3.4(2) to the target board.
Enter "`conf set key`" in Tera Term, then drag and drop the private key file (private.pem.crt) to the Tera Term window to send the file. Finally, press the Enter key in the Tera Term window.

Note: Change the linefeed code of the private key file to LF with a text editor, etc. before dragging and dropping the file.



Name	Date modified	Type	Size
certificate.pem.crt	3/26/2025 6:22 PM	Security Certificate	2 KB
private.pem.key	3/26		
public.pem.key	3/26		

Enter "conf set key" and a space, drag and drop the private key file to the Tera Term window, and then press the Enter key.

Tera Term: File Drag and Drop

[redacted]

Are you sure that you want to send the file content?

○ SCP

dest:

dest is home directory if empty

● Send File (Paste content of file)

□ Binary

○ Paste Filename

☑ Escape

○ Separator is Space

○ Separator is NewLine

□ Do this for the next 0 files

□ Do same process, next drop

□ Do not display this dialog, next drop

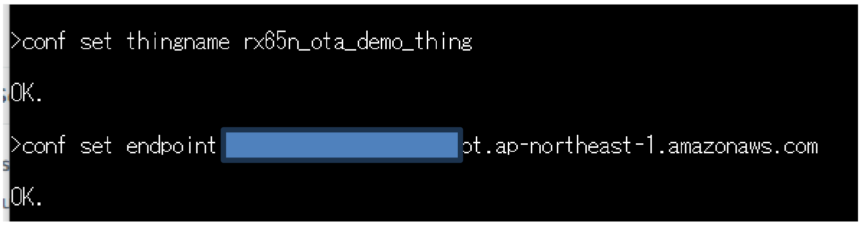
Drop with CTRL, this dialog is displayed

```
>conf set key -----BEGIN RSA PRIVATE KEY-----

-----END RSA PRIVATE KEY-----

OK.
```

(8) Register the endpoint.

Register the thing name that was set in 3.3.4(1) and the endpoint that you made a note in 3.3.4(5) to the target board.
Execute the following commands in Tera Term.

- `conf set thingname <thing name>`
- `conf set endpoint <endpoint name>`

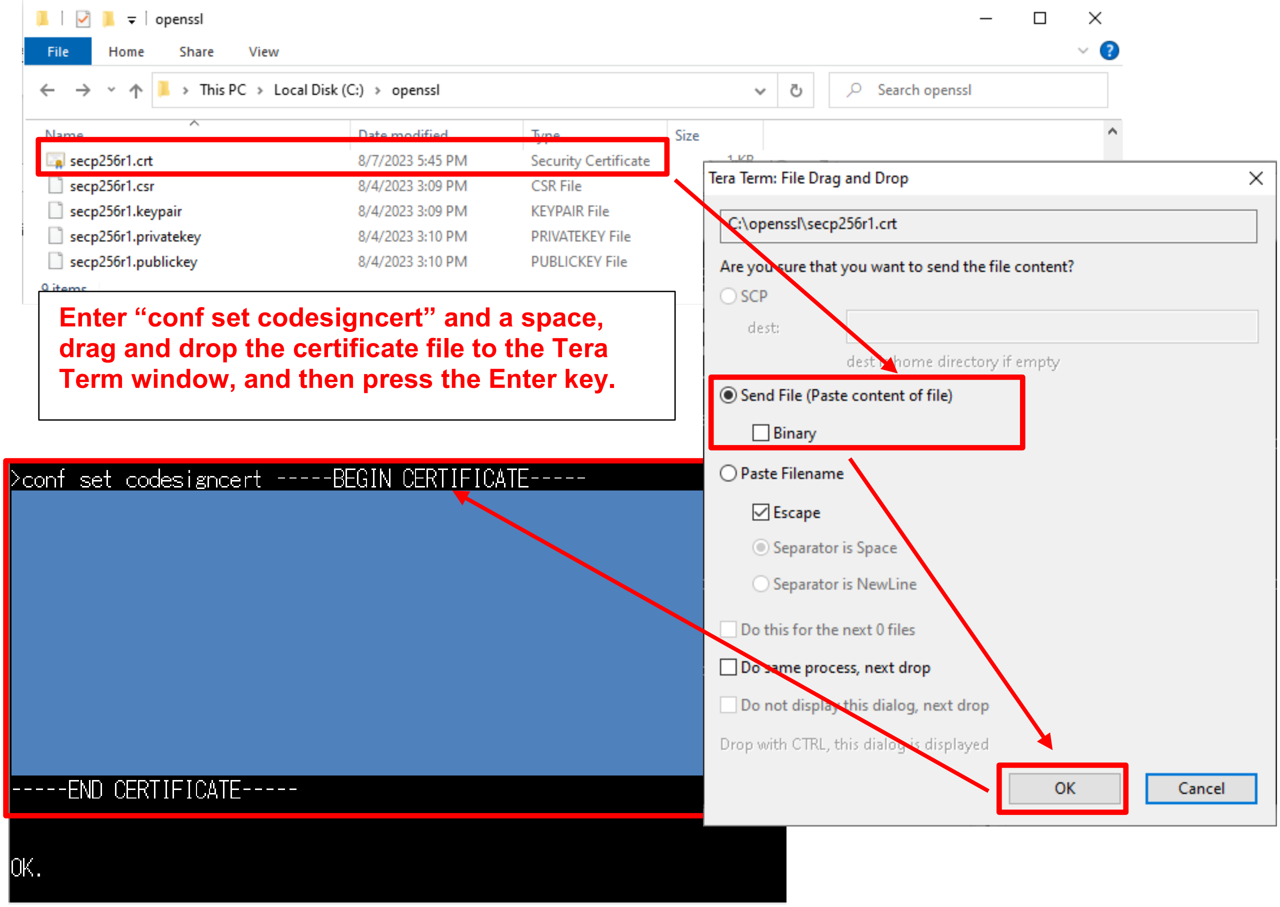


```
>conf set thingname rx65n_ota_demo_thing
OK.
>conf set endpoint [redacted]ot.ap-northeast-1.amazonaws.com
OK.
```

(9) Register the certificate for code signing verification.

Register the key pair certificate (secp256r1.crt) that was generated in 4.1(6) to the target board. Enter "`conf set codesigncert`" in Tera Term, then drag and drop the key pair certificate file (secp256r1.crt) to the Tera Term window to send the file. Finally, press the Enter key in the Tera Term window.

Note: Change the linefeed code of the certificate file to LF with a text editor, etc. before dragging and dropping the file.



Name	Date modified	Type
secp256r1.crt	8/7/2023 5:45 PM	Security Certificate
secp256r1.csr	8/4/2023 3:09 PM	CSR File
secp256r1.keypair	8/4/2023 3:09 PM	KEYPAIR File
secp256r1.privatekey	8/4/2023 3:10 PM	PRIVATEKEY File
secp256r1.publickey	8/4/2023 3:10 PM	PUBLICKEY File

Enter "conf set codesigncert" and a space, drag and drop the certificate file to the Tera Term window, and then press the Enter key.

Tera Term: File Drag and Drop

C:\openssl\secp256r1.crt

Are you sure that you want to send the file content?

○ SCP

dest:

dest: home directory if empty

● Send File (Paste content of file)

□ Binary

○ Paste Filename

☑ Escape

○ Separator is Space

○ Separator is NewLine

□ Do this for the next 0 files

□ Do same process, next drop

□ Do not display this dialog, next drop

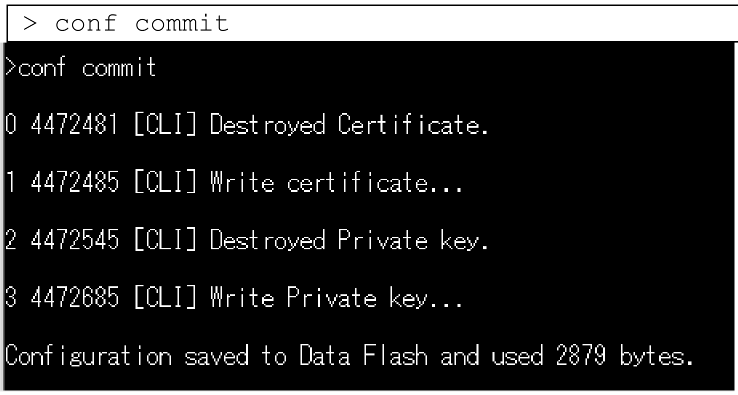
Drop with CTRL, this dialog is displayed

```
>conf set codesigncert -----BEGIN CERTIFICATE-----
[redacted]
-----END CERTIFICATE-----

OK.
```

(10) Write the settings to data flash memory.

Commit the AWS IoT settings (write the settings to data flash memory).
Execute the following command in Tera Term.

```
> conf commit
```



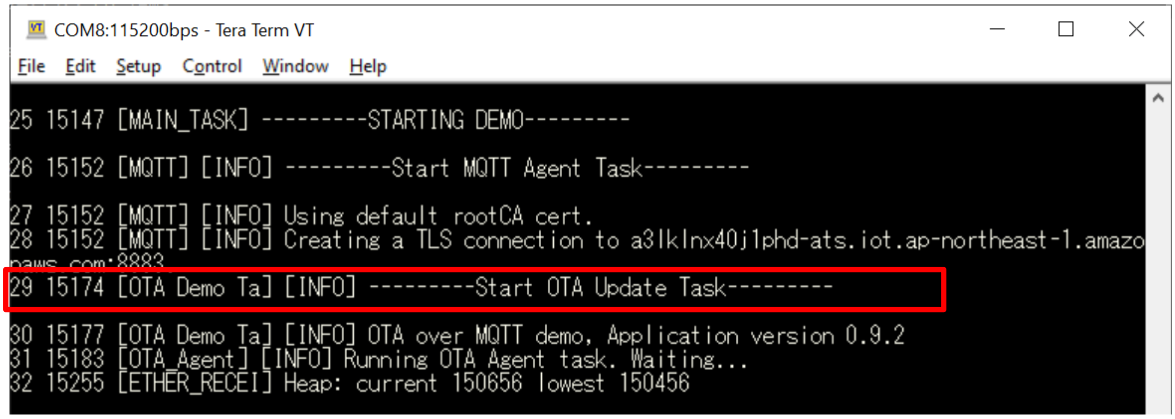
```
>conf commit

0 4472481 [CLI] Destroyed Certificate.

1 4472485 [CLI] Write certificate...

2 4472545 [CLI] Destroyed Private key.

3 4472685 [CLI] Write Private key...

Configuration saved to Data Flash and used 2879 bytes.
```

(11) Execute a reset.

Restart the firmware by executing a software reset. That is, execute the following command in Tera Term.

```
> reset
```

After the reset processing is complete, confirm that Tera Term displays a communications log, OTA tasks are executed, and the application then waits for OTA jobs.


COM8:115200bps - Tera Term VT
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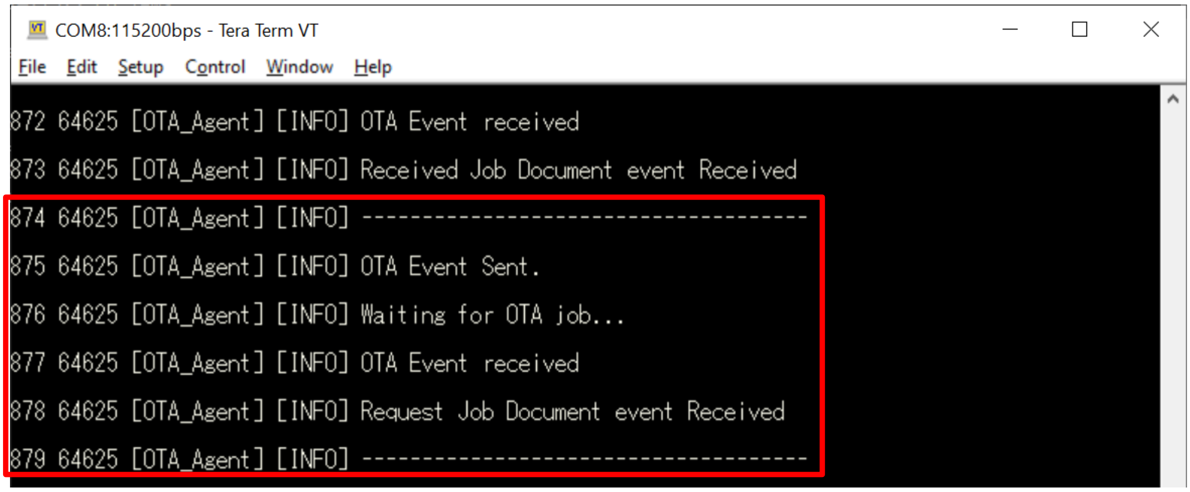
```
25 15147 [MAIN_TASK] ---------STARTING DEMO---------

26 15152 [MQTT] [INFO] ---------Start MQTT Agent Task---------

27 15152 [MQTT] [INFO] Using default rootCA cert.
28 15152 [MQTT] [INFO] Creating a TLS connection to a3lklnx40j1phd-ats.iot.ap-northeast-1.amazo
naws.com:8883
29 15174 [OTA Demo Ta] [INFO] ---------Start OTA Update Task---------

30 15177 [OTA Demo Ta] [INFO] OTA over MQTT demo, Application version 0.9.2
31 15183 [OTA_Agent] [INFO] Running OTA Agent task. Waiting...
32 15255 [ETHER_RECEI] Heap: current 150656 lowest 150456
```


COM8:115200bps - Tera Term VT
File Edit Setup Control Window Help

```
872 64625 [OTA_Agent] [INFO] OTA Event received

873 64625 [OTA_Agent] [INFO] Received Job Document event Received

874 64625 [OTA_Agent] [INFO] ------------------------------------

875 64625 [OTA_Agent] [INFO] OTA Event Sent.

876 64625 [OTA_Agent] [INFO] Waiting for OTA job...

877 64625 [OTA_Agent] [INFO] OTA Event received

878 64625 [OTA_Agent] [INFO] Request Job Document event Received

879 64625 [OTA_Agent] [INFO] ------------------------------------
```

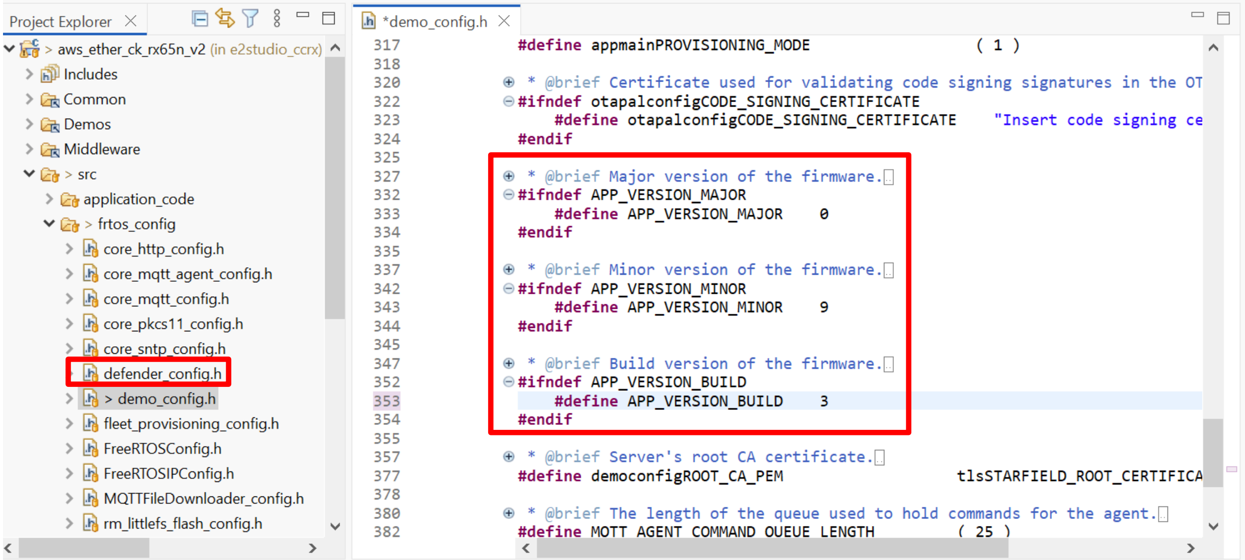
5. Updating the Firmware

5.1 Creating the Updated Firmware

5.1.1 Changing the Firmware Version

(1) Change the firmware version.

Change the version of the updated firmware to “v0.9.3”.
Repeat the build process, this time with “3” specified for the APP_VERSION_BUILD definition in \aws_ether_ck_rx65n_v2\src\frtos_config\ demo_config.h.



```
#define appmainPROVISIONING_MODE                          ( 1 )

 * @brief Certificate used for validating code signing signatures in the OT
#ifndef otapalconfigCODE_SIGNING_CERTIFICATE
    #define otapalconfigCODE_SIGNING_CERTIFICATE    "Insert code signing ce
#endif

 * @brief Major version of the firmware.
#ifndef APP_VERSION_MAJOR
    #define APP_VERSION_MAJOR    0
#endif

 * @brief Minor version of the firmware.
#ifndef APP_VERSION_MINOR
    #define APP_VERSION_MINOR    9
#endif

 * @brief Build version of the firmware.
#ifndef APP_VERSION_BUILD
    #define APP_VERSION_BUILD    3
#endif

 * @brief Server's root CA certificate.
#define democonfigROOT_CA_PEM                   tlsSTARFIELD_ROOT_CERTIFICA

 * @brief The length of the queue used to hold commands for the agent.
#define MQTT_AGENT_COMMAND_QUEUE_LENGTH         ( 25 )
```

(2) Use the Renesas Image Generator to generate the updated firmware.

Overwrite the file in the Renesas Image Generator folder with the firmware (aws_ether_ck_rx65n_v2.mot) that was rebuilt in 5.1.1(1), then execute the following command at the command prompt.

As several minutes may elapse from the execution of a command to the creation of a file, wait for the required time.

python image-gen.py -iup *aws_ether_ck_rx65n_v2.mot* -ip *RX65N_DualBank_ImageGenerator_PRM.csv* -o *user_093* -key *secp256r1.privatekey* -vt ecdsa -ff RTOS

This command will generate the user_093.rsu file.

5.2 Updating the Firmware

In AWS, upload the updated firmware and create an OTA update job to update the firmware.

Use the AWS CLI to perform the following steps. In preparation for doing so, with reference to 3.2, use the AWS CLI at the command prompt, log in to AWS, and change the current directory to the work folder that was created in 3.1.5.

5.2.1 Uploading the Updated Firmware to AWS

Upload the updated firmware to the S3 bucket of AWS.

(1) Copy the firmware to the work folder.

Copy the updated firmware (user_093.rsu) that was created in 5.1.1(2) to the work folder that was created in 3.1.5.

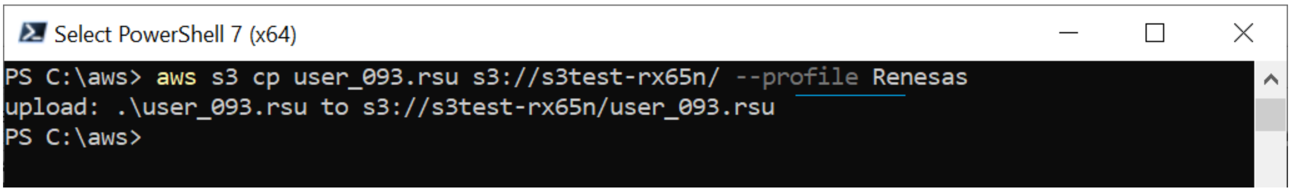
(2) Upload the firmware to the S3 bucket.

Upload the created firmware to the S3 bucket.
Enter the following command.

```
> aws s3 cp <FIRMWARE_NAME> s3://<BUCKET_NAME>/ --profile <PROFILE_NAME>
```

- Enter the file name of the updated firmware into *<FIRMWARE_NAME>*.
- Enter the bucket name that was created in 3.3.2(1) into *<BUCKET_NAME>*.

After the command has been executed, the display in the window will be as shown below.



```
PS C:\aws> aws s3 cp user_093.rsu s3://s3test-rx65n/ --profile Renesas
upload: .\user_093.rsu to s3://s3test-rx65n/user_093.rsu
PS C:\aws>
```

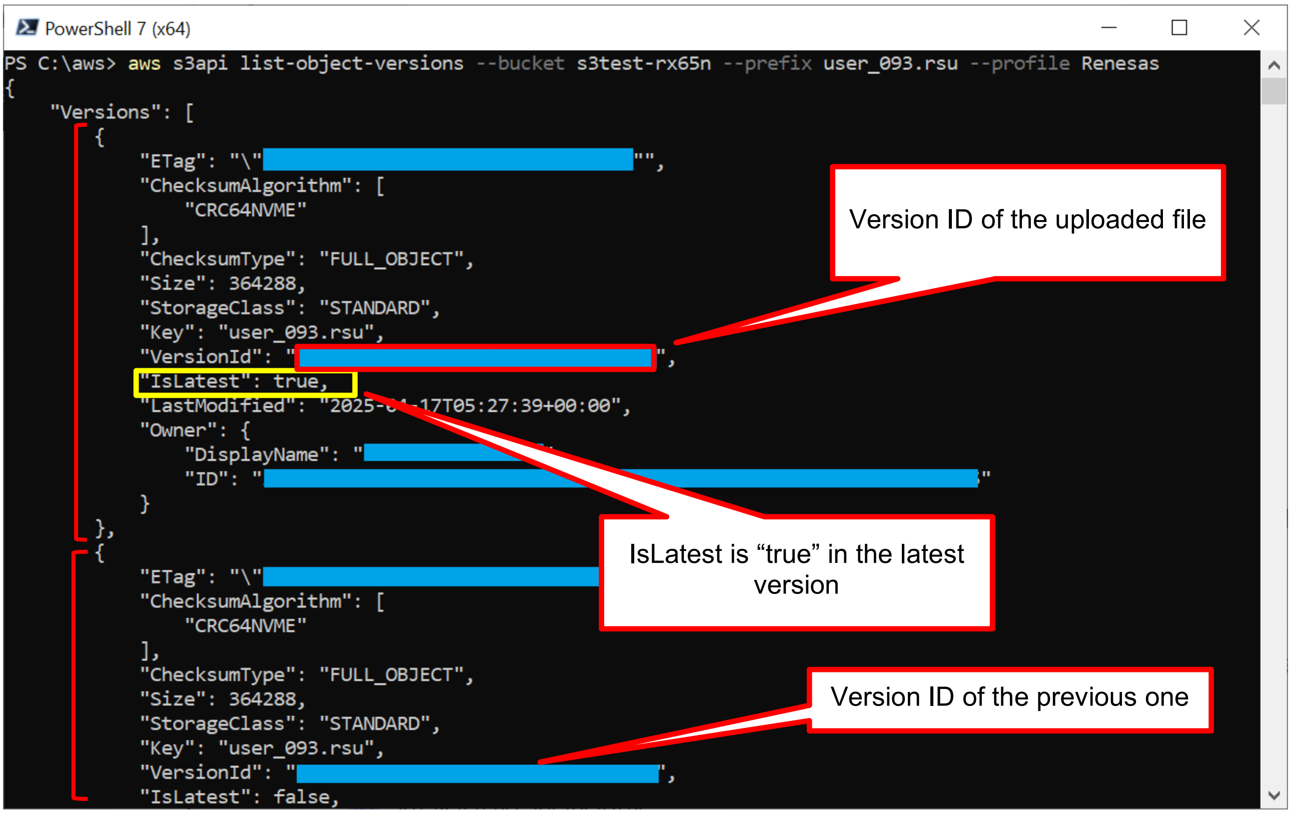
(3) Confirm the version ID.

Confirm the version ID of the updated firmware that was uploaded.
Enter the following command.

```
> aws s3api list-object-versions --bucket <BUCKET_NAME> --prefix
<FIRMWARE_NAME> --profile <PROFILE_NAME>
```

- Enter the S3 bucket name that was uploaded in step (2) into *<BUCKET_NAME>*.
- Enter the file name of the updated firmware into *<FIRMWARE_NAME>*.

After the command has been executed, the display in the window will be as shown below.



```
PS C:\aws> aws s3api list-object-versions --bucket s3test-rx65n --prefix user_093.rsu --profile Renesas
{
    "Versions": [
        {
            "ETag": "\"[redacted]"",
            "ChecksumAlgorithm": [
                "CRC64NVME"
            ],
            "ChecksumType": "FULL_OBJECT",
            "Size": 364288,
            "StorageClass": "STANDARD",
            "Key": "user_093.rsu",
            "VersionId": "[redacted]",
            "IsLatest": true,
            "LastModified": "2025-04-17T05:27:39+00:00",
            "Owner": {
                "DisplayName": "[redacted]",
                "ID": "[redacted]"
            }
        },
        {
            "ETag": "\"[redacted]
            "ChecksumAlgorithm": [
                "CRC64NVME"
            ],
            "ChecksumType": "FULL_OBJECT",
            "Size": 364288,
            "StorageClass": "STANDARD",
            "Key": "user_093.rsu",
            "VersionId": "[redacted]",
            "IsLatest": false,
```

Version ID of the uploaded file

IsLatest is “true” in the latest version

Version ID of the previous one

Make a note of the version ID of the updated firmware file (VersionId: text inside the red frame in the above figure) which is displayed. You will need it in a later process.
Read the VersionId field of the latest version, i.e., that for which “true” is displayed in the “IsLatest” field (within the yellow frame) one line below. When a file with the same name has been uploaded multiple times, multiple entries will appear under the “Versions” field in the above figure.

5.2.2 Creating a Code Signing Certificate and Profile

Create a code signing certificate for guaranteeing the reliability of the updated firmware that was uploaded in an OTA update.

The procedure in this section can be skipped if a code signing certificate was uploaded and a profile was created in the past. Write the profile name created in this section to the json file when creating an OTA job.

(1) Prepare the certificate and key files.

Copy the following three files that were created in 4.1(9) to the work folder that was created in 3.1.5.

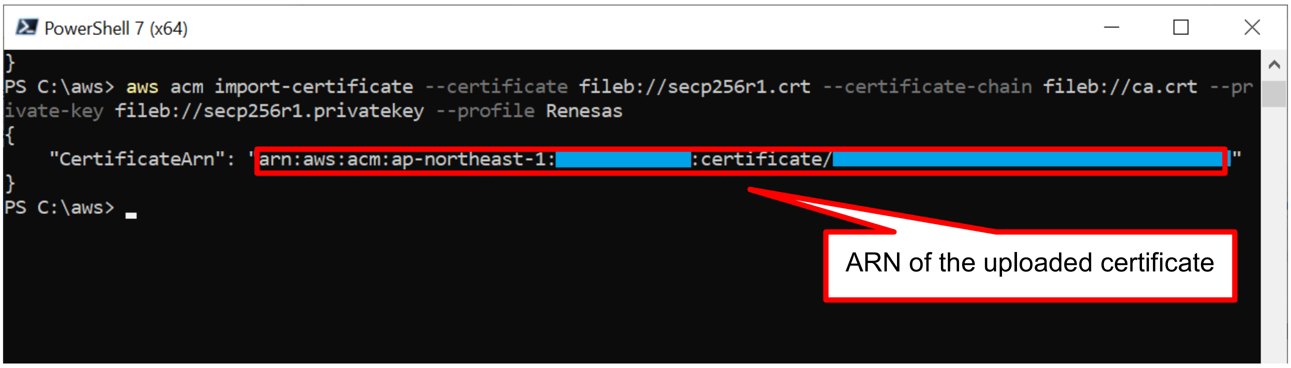
- ECDSA certificate: secp256r1.crt
- ECDSA private key: secp256r1.privatekey
- ECDSA certificate chain: ca.crt

(2) Import a new code signing certificate.

Import the files prepared in step (1) for the code signing certificate to AWS.
Enter the following command.

```
> aws acm import-certificate --certificate fileb://secp256r1.crt --
certificate-chain fileb://ca.crt --private-key fileb://secp256r1.privatekey --
profile <PROFILE_NAME>
```

After the command has been executed, the display in the window will be as shown below.



```
}
PS C:\aws> aws acm import-certificate --certificate fileb://secp256r1.crt --certificate-chain fileb://ca.crt --pr
ivate-key fileb://secp256r1.privatekey --profile Renesas
{
    "CertificateArn": "arn:aws:acm:ap-northeast-1:[redacted]:certificate/[redacted]"
}
PS C:\aws> _
```

Make a note of the ARN of the code signing certificate (CertificateArn: text inside the red frame in the above figure) which is displayed. You will need it in a later process.

(3) Create a profile for the code signing certificate.

(a) Create a json file containing a profile.

Create a configuration file of the code signing certificate profile.
With a text editor, create a file with the name “profile.json” in the work folder that was created in 3.1.5 and enter the following code.

- profile.json

```
{
    "profileName": "rx65n_ota_demo_profile",
    "signingMaterial": {
        "certificateArn": "arn:aws:acm:ap-northeast-1:x
xxxxxxxxxxxx:certificate/yyyyyyyy-yyy-yyyy-yyyy-yyyyyyyyyyyy"
    },
    "platformId": "AmazonFreeRTOS-Default",
    "signingParameters": {
        "certname": "dummy"
    }
}
```

Profile name

ARN of the certificate

Enter the following information into the fields underlined in red in the above json file.

Item	Description	Contents to be Set
profileName	Profile name	A desired profile name can be entered (example: rx65n_ota_demo_profile).
certificateArn	ARN of the certificate	Enter the ARN of the code signing certificate that was imported in step (2).

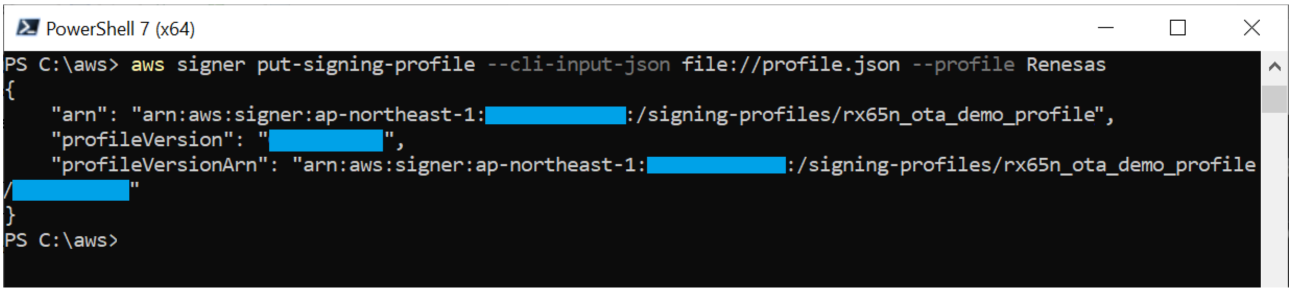
Make a note of the profile name (profileName) that was set here. You will need it in a later process.

(b) Create a code signing certificate profile.

Create a profile using the json file that was created in step (a).
Enter the following command.

```
> aws signer put-signing-profile --cli-input-json file://profile.json --
profile <PROFILE_NAME>
```

After the command has been executed, the display in the window will be as shown below.



```
PS C:\aws> aws signer put-signing-profile --cli-input-json file://profile.json --profile Renesas
{
    "arn": "arn:aws:signer:ap-northeast-1:[redacted]:/signing-profiles/rx65n_ota_demo_profile",
    "profileVersion": "[redacted]",
    "profileVersionArn": "arn:aws:signer:ap-northeast-1:[redacted]:/signing-profiles/rx65n_ota_demo_profile
/[redacted]"
}
PS C:\aws>
```

5.2.3 Executing an OTA Job

Create an OTA job and execute an OTA update.

(1) Create a json file in which details of the OTA job are set.

Create a configuration file of the OTA job.
With a text editor, create a file with the name “create-ota-update.json” in the work folder that was created in 3.1.5 and enter the following code.

- create-ota-update.json

```
{
    "otaUpdateId": "rx65n_ota_demo_job",
    "targets": [
        "arn:aws:iot:ap-northeast-1:xxxxxxxxxxxx:thing/rx65n_ota_demo_thing"
    ],
    "protocols": [
        "MQTT"
    ],
    "targetSelection": "SNAPSHOT",
    "awsJobExecutionsRolloutConfig": {
        "maximumPerMinute": 1000
    },
    "files": [
        {
            "fileName": "/device/updates",
            "fileLocation": {
                "s3Location": {
                    "bucket": "s3test-rx65n",
                    "key": "user_093.rsu",
                    "version": "xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx"
                }
            },
            "codeSigning": {
                "startSigningJobParameter": {
                    "destination": {
                        "s3Destination": {
                            "bucket": "s3test-rx65n",
                            "prefix": "SignedImages/"
                        }
                    },
                    "signingProfileName": "rx65n_ota_demo_profile"
                }
            }
        }
    ],
    "roleArn": "arn:aws:iam::xxxxxxxxxxxx:role/ota_role_rx65n"
}
```

Enter the following information into the fields underlined in red in the above json file.

Item	Description	Contents to be Set
otaUpdateId	OTA update ID	This is the name of the OTA job to be executed. Enter a desired job name (example: rx65n_ota_demo_job). Note: The name set must be different from any job names used in the past because the duplication of an OTA job name is not allowed.
targets	Target ARN	Enter the ARN of the thing (device) for which the OTA update is to be executed. Enter the ARN of the thing that was set in 3.3.4(1).
bucket (files→fileLocation→s3Location)	S3 bucket	Enter the bucket name to which the updated firmware was uploaded. Enter the bucket name that was set in 3.3.2(1).
key (files→fileLocation→s3Location)	S3 key	Specify the file name of the updated firmware. Enter the name of the file that was uploaded in 5.2.1(2).
version (files→fileLocation→s3Location)	Version of the S3 bucket	Enter the version ID of the updated firmware. Enter the version ID of the uploaded file that was confirmed in 5.2.1(3).
bucket (files→codeSigning→ startSigningJobParameter→ destination→s3Destination)	Bucket used in code signing	Enter the S3 bucket name for which code signing is performed. Enter the bucket name that was set in 3.3.2(1).
signingProfileName (files→codeSigning→ startSigningJobParameter)	Profile name used in code signing	Enter the profile name used in code signing. Enter the profile name that was set in 5.2.2(3)(a).
roleArn	Role ARN	Enter the ARN of the IAM role used in the OTA update. Enter the ARN of the IAM role that was created in 3.3.3(2).

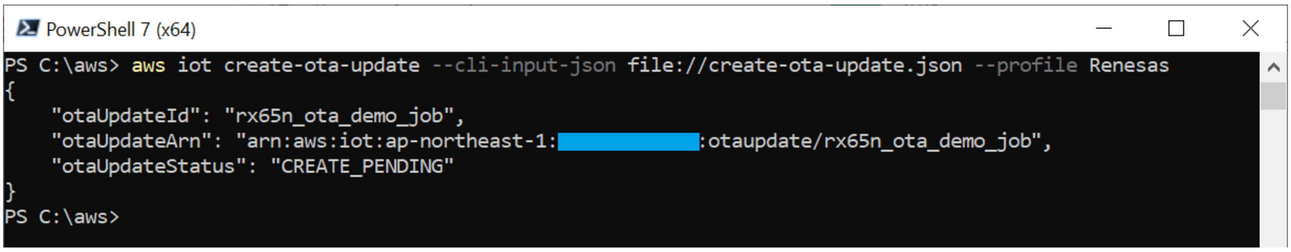
Make a note of the OTA update ID (otaUpdateId) that was set here. You will need it in a later process.

(2) Execute the OTA job.

Before running the job, execute the initial firmware in the CK-RX65N v2 board and confirm that it reaches the state of waiting for the execution of an OTA job (see 4.2.4(11)).
Execute the OTA job by using the json file that was created in step (1).
Enter the following command.

```
> aws iot create-ota-update --cli-input-json file://create-ota-update.json --
profile <PROFILE_NAME>
```

After the command has been executed, the display in the window will be as shown below.
If execution of the job proceeded normally, downloading of the updated firmware to the target board will start.



```
PS C:\aws> aws iot create-ota-update --cli-input-json file://create-ota-update.json --profile Renesas
{
    "otaUpdateId": "rx65n_ota_demo_job",
    "otaUpdateArn": "arn:aws:iot:ap-northeast-1:[redacted]:otaupdate/rx65n_ota_demo_job",
    "otaUpdateStatus": "CREATE_PENDING"
}
PS C:\aws>
```

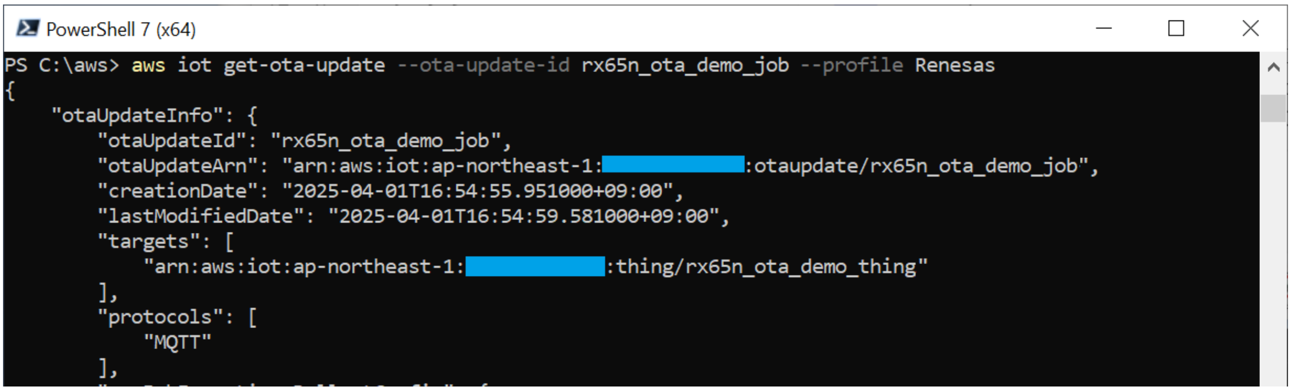
(3) Confirm the execution status of the OTA job.

Confirm the status after the OTA job has been executed.
Enter the following command.

```
> aws iot get-ota-update --ota-update-id <JOB_NAME> --profile <PROFILE_NAME>
```

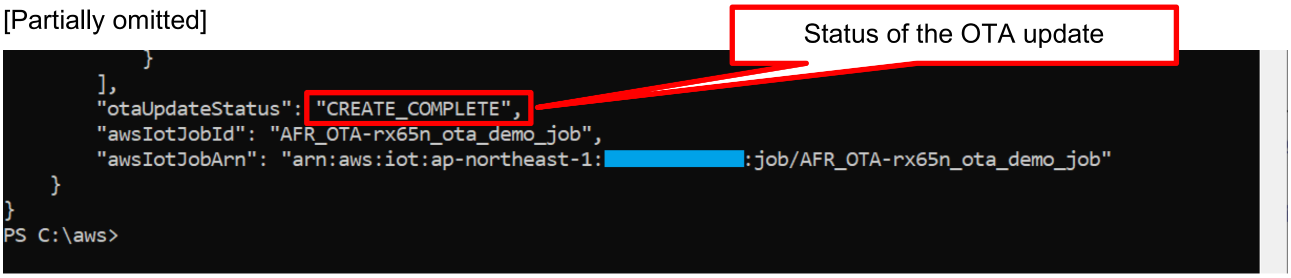
- Enter the OTA job name (OTA update ID) that was set in step (1) into *<JOB_NAME>*.

After the command has been executed, the display in the window will be as shown below.



```
PS C:\aws> aws iot get-ota-update --ota-update-id rx65n_ota_demo_job --profile Renesas
{
    "otaUpdateInfo": {
        "otaUpdateId": "rx65n_ota_demo_job",
        "otaUpdateArn": "arn:aws:iot:ap-northeast-1:[redacted]:otaupdate/rx65n_ota_demo_job",
        "creationDate": "2025-04-01T16:54:55.951000+09:00",
        "lastModifiedDate": "2025-04-01T16:54:59.581000+09:00",
        "targets": [
            "arn:aws:iot:ap-northeast-1:[redacted]:thing/rx65n_ota_demo_thing"
        ],
        "protocols": [
            "MQTT"
        ],
```

[Partially omitted]



Status of the OTA update

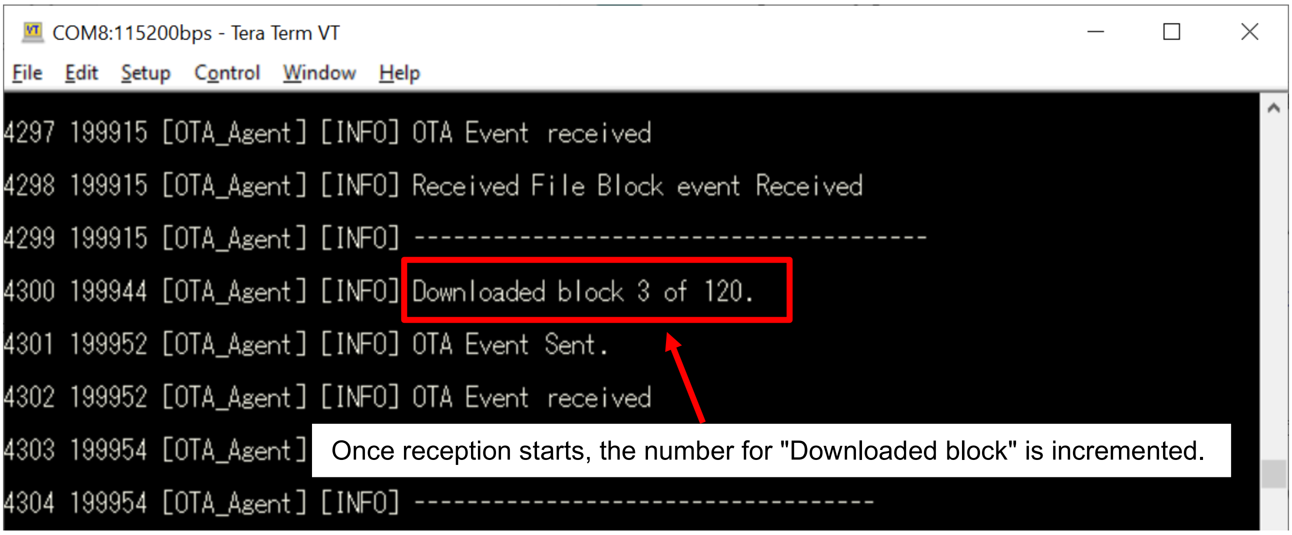
```
            }
        ],
        "otaUpdateStatus": "CREATE_COMPLETE",
        "awsIotJobId": "AFR_OTA-rx65n_ota_demo_job",
        "awsIotJobArn": "arn:aws:iot:ap-northeast-1:[redacted]:job/AFR_OTA-rx65n_ota_demo_job"
    }
}
PS C:\aws>
```

If “CREATE_COMPLETE” is displayed as the status of the OTA update (otaUpdateStatus: text inside the red frame in the above figure), the OTA job was executed successfully.

If the OTA job ends in an error due to an incorrect setting or some other factor, a message such as “CREATE_FAILED” will be displayed.

(4) Wait until the reception of the firmware is completed.

When the OTA job is started, the reception and writing of the firmware proceed.


COM8:115200bps - Tera Term VT
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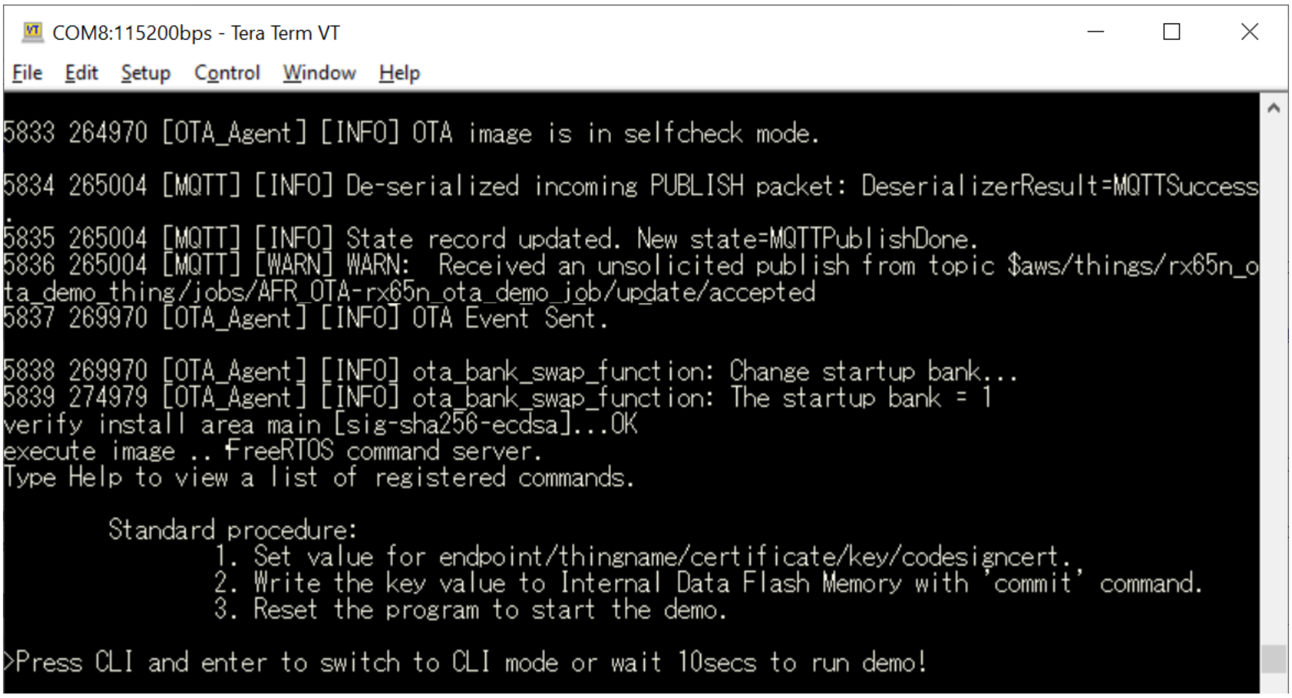
```
4297 199915 [OTA_Agent] [INFO] OTA Event received
4298 199915 [OTA_Agent] [INFO] Received File Block event Received
4299 199915 [OTA_Agent] [INFO] -----------------------------------
4300 199944 [OTA_Agent] [INFO] Downloaded block 3 of 120.
4301 199952 [OTA_Agent] [INFO] OTA Event Sent.
4302 199952 [OTA_Agent] [INFO] OTA Event received
4303 199954 [OTA_Agent]
4304 199954 [OTA_Agent] [INFO] ---------------------------------
```

Once reception starts, the number for "Downloaded block" is incremented.

When updating is completed and code signing verification has succeeded, the updated firmware is executed following a CPU reset, and the first messages are displayed as shown below.


COM8:115200bps - Tera Term VT
File Edit Setup Control Window Help

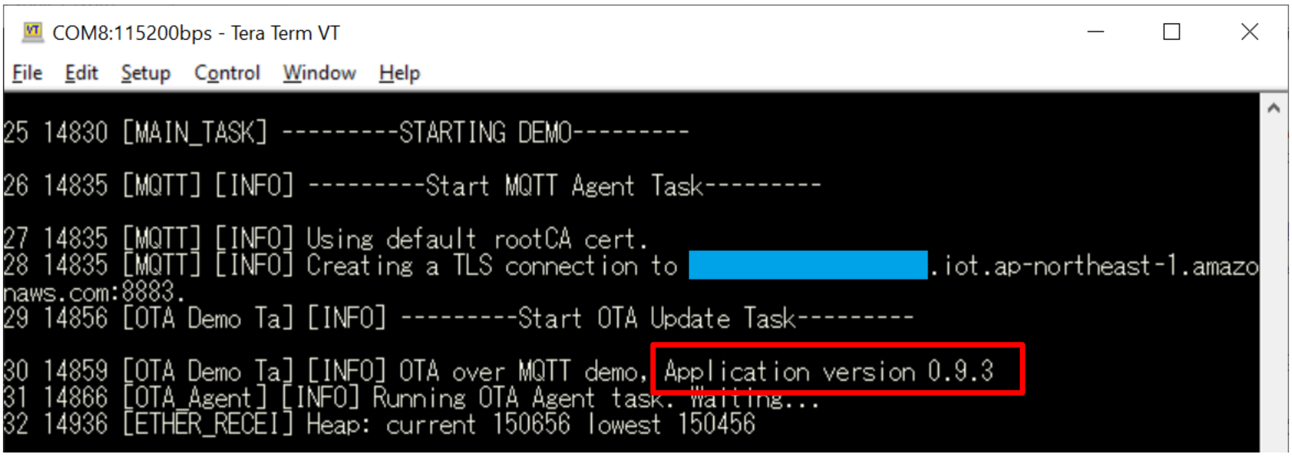
```
5833 264970 [OTA_Agent] [INFO] OTA image is in selfcheck mode.
5834 265004 [MQTT] [INFO] De-serialized incoming PUBLISH packet: DeserializerResult=MQTTSuccess
.
5835 265004 [MQTT] [INFO] State record updated. New state=MQTTPublishDone.
5836 265004 [MQTT] [WARN] WARN:  Received an unsolicited publish from topic $aws/things/rx65n_o
ta_demo_thing/jobs/AFR_OTA-rx65n_ota_demo_job/update/accepted
5837 269970 [OTA_Agent] [INFO] OTA Event Sent.

5838 269970 [OTA_Agent] [INFO] ota_bank_swap_function: Change startup bank...
5839 274979 [OTA_Agent] [INFO] ota_bank_swap_function: The startup bank = 1
verify install area main [sig-sha256-ecdsa]...OK
execute image .. FreeRTOS command server.
Type Help to view a list of registered commands.

        Standard procedure:
                1. Set value for endpoint/thingname/certificate/key/codesigncert.
                2. Write the key value to Internal Data Flash Memory with 'commit' command.
                3. Reset the program to start the demo.

>Press CLI and enter to switch to CLI mode or wait 10secs to run demo!
```

(5) Confirm that the firmware version has become “version 0.9.3” after the reset.


COM8:115200bps - Tera Term VT
File Edit Setup Control Window Help

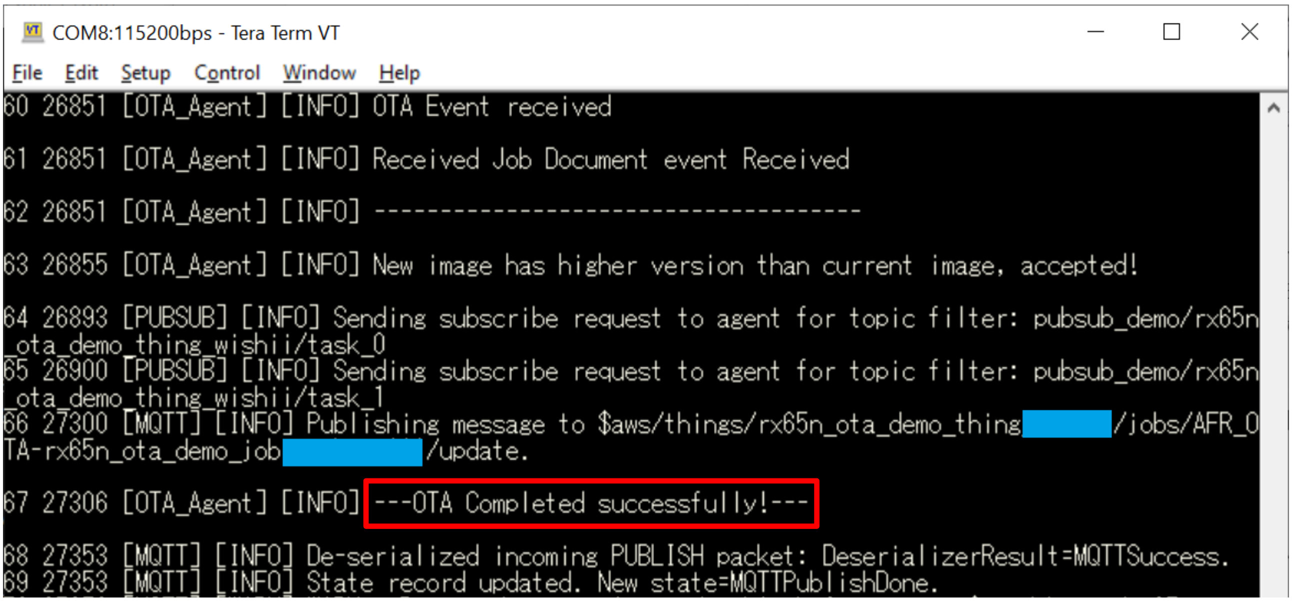
```
25 14830 [MAIN_TASK] ---------STARTING DEMO---------

26 14835 [MQTT] [INFO] ---------Start MQTT Agent Task---------

27 14835 [MQTT] [INFO] Using default rootCA cert.
28 14835 [MQTT] [INFO] Creating a TLS connection to [redacted].iot.ap-northeast-1.amazo
naws.com:8883.
29 14856 [OTA Demo Ta] [INFO] ---------Start OTA Update Task---------

30 14859 [OTA Demo Ta] [INFO] OTA over MQTT demo, Application version 0.9.3
31 14866 [OTA_Agent] [INFO] Running OTA Agent task. Waiting...
32 14936 [ETHER_RECEI] Heap: current 150656 lowest 150456
```

When the OTA job is completed normally, “OTA Completed successfully!” is displayed as shown below.


COM8:115200bps - Tera Term VT
File Edit Setup Control Window Help

```
60 26851 [OTA_Agent] [INFO] OTA Event received

61 26851 [OTA_Agent] [INFO] Received Job Document event Received

62 26851 [OTA_Agent] [INFO] -------------------------------------

63 26855 [OTA_Agent] [INFO] New image has higher version than current image, accepted!

64 26893 [PUBSUB] [INFO] Sending subscribe request to agent for topic filter: pubsub_demo/rx65n
_ota_demo_thing_wishii/task_0
65 26900 [PUBSUB] [INFO] Sending subscribe request to agent for topic filter: pubsub_demo/rx65n
_ota_demo_thing_wishii/task_1
66 27300 [MQTT] [INFO] Publishing message to $aws/things/rx65n_ota_demo_thing[redacted]/jobs/AFR_O
TA-rx65n_ota_demo_job[redacted]/update.

67 27306 [OTA_Agent] [INFO] ---OTA Completed successfully!---

68 27353 [MQTT] [INFO] De-serialized incoming PUBLISH packet: DeserializerResult=MQTTSuccess.
69 27353 [MQTT] [INFO] State record updated. New state=MQTTPublishDone.
```

6. Appendix

6.1 Points to Keep in Mind when Operating Multiple Devices within the Same LAN Environment

Addresses assigned from the vendor ID of Renesas Electronics Corporation are used as the MAC addresses in the sample code.

When using the sample program to operate multiple devices at the same time within the same LAN environment, the MAC addresses must be changed to avoid duplication.

The sample program may not operate properly if the same MAC addresses are duplicated among multiple devices.

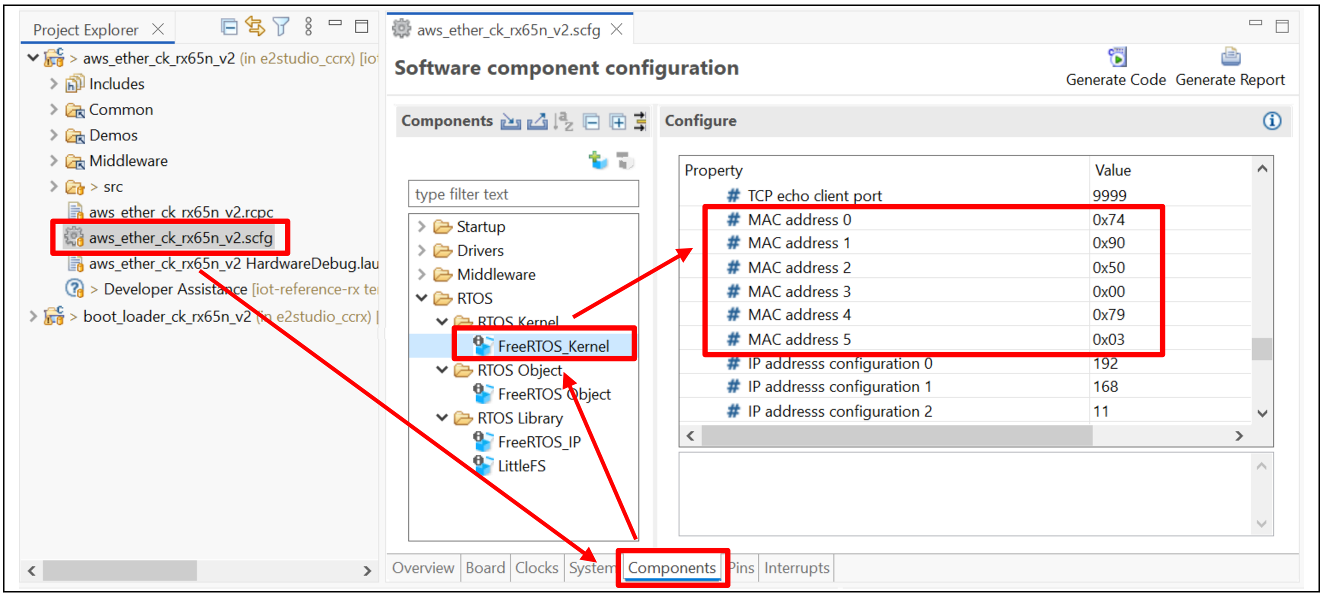
The procedure for changing the MAC addresses is described below.

Open “aws_ether_ck_rx65n_v2.scfg” in the Smart Configurator, and select the [Components] tab.

In the tree, select [RTOS] → [RTOS Kernel] → [FreeRTOS_Kernel], then under [Property] set hexadecimal values of your choice as “Value” for “MAC address 0” to “MAC address 5”.

Enter values in the format 0xXX (where XX represents a hexadecimal value of your choice).

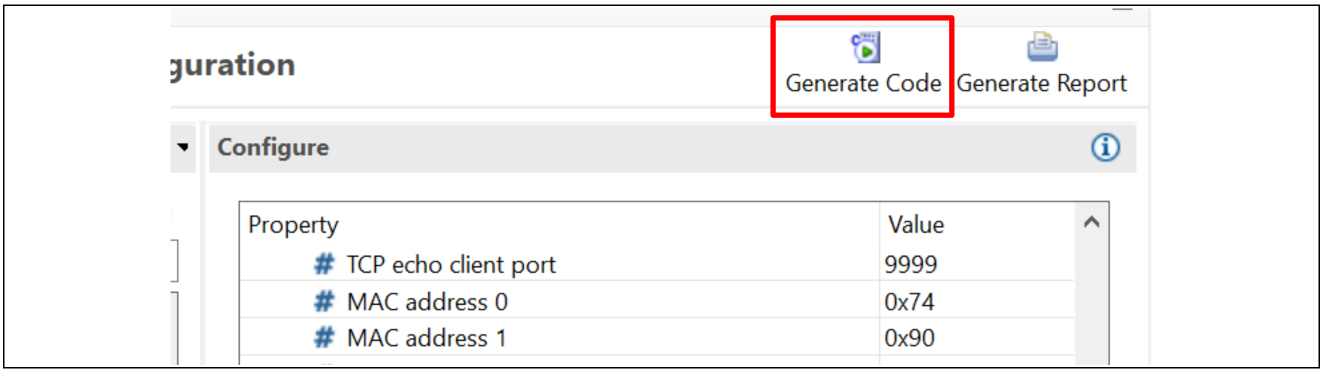
When creating commercial products for sale, be sure to use MAC addresses that have been submitted to the IEEE.



Project Explorer
aws_ether_ck_rx65n_v2 (in e2studio_ccrx) [io
Includes
Common
Demos
Middleware
src
aws_ether_ck_rx65n_v2.rcpc
aws_ether_ck_rx65n_v2.scfg
aws_ether_ck_rx65n_v2 HardwareDebug.lau
Developer Assistance [iot-reference-rx te
boot_loader_ck_rx65n_v2 (in e2studio_ccrx) [
aws_ether_ck_rx65n_v2.scfg
Software component configuration
Generate Code
Generate Report
Components
Configure
type filter text
Startup
Drivers
Middleware
RTOS
RTOS Kernel
FreeRTOS_Kernel
RTOS Object
FreeRTOS Object
RTOS Library
FreeRTOS_IP
LittleFS
Overview
Board
Clocks
System
Components
Pins
Interrupts

Property	Value
TCP echo client port	9999
MAC address 0	0x74
MAC address 1	0x90
MAC address 2	0x50
MAC address 3	0x00
MAC address 4	0x79
MAC address 5	0x03
IP address configuration 0	192
IP address configuration 1	168
IP address configuration 2	11

After making the above changes, click the [Generate Code] button in the upper-right corner of the window to have the code reflect the changes made in the Smart Configurator.



Property	Value
TCP echo client port	9999
MAC address 0	0x74
MAC address 1	0x90

7. Troubleshooting

The following table lists problems that might arise when executing the sample program, and how to resolve them.

Table 7-1 Troubleshooting

No.	Issue	Reason	Solution	Refer to
1	The command to create the initial firmware fails.	The Python installation folder is not set correctly in the path of the environment variable.	Reinstall Python. Also, make sure that the [Add python.exe to PATH] checkbox is selected when performing step 2.2(3).	2.2
2		The encryption library is not installed.	Install the encryption library.	2.2(5)
3	The initial firmware cannot be written.	J16 on the CK-RX65N v2 board is not set to the DEBUG side.	Make sure that pins 1-2 of J16 on the CK-RX65N v2 board are closed (DEBUG).	2.6
4	The initial firmware does not start.	J16 on the CK-RX65N v2 board is not set to the RUN side.	Make sure that pins 2-3 of J16 on the CK-RX65N v2 board are closed (RUN).	4.2.4(4)
5	Cellular communication cannot start.	The RYZ014A PMOD module is not connected properly.	Check the connection of the RYZ014A PMOD module.	2.6
6		A SIM card is not inserted.	Insert a SIM card.	2.6
7		The SIM card is configured incorrectly.	Review the configuration settings for the r_cellular module.	4.2.2(4)
8		The SIM card supplied with the CK-RX65N v1 board is in use but is not activated.	Activate the SIM card.	4.2.2(4)
9	An error occurs during cellular communications.	The communications environment is poor.	Connect an antenna and power supply to the RYZ014A PMOD module. Also, place the antenna in a location with good reception, such as near a window.	2.6
10	An error occurs when connecting to AWS.	The AWS IoT information is not set or is set incorrectly.	Set the AWS IoT information again.	4.2.4

11	The firmware does not start after the boot loader is started.	The public key is not correctly set in the boot loader.
		The version ID of the firmware is registered incorrectly.
			Review the public key setting in the boot loader.
			Confirm the version of the uploaded firmware.
				4.2.2(1)
				5.2.1(3)

12	The firmware does not start after an OTA update.	The project is not set correctly.	Review the settings of the firmware and boot loader.	4.2.2 4.2.3(1)
13	An error occurs when an OTA job is re-executed.	The OTA job name is a duplicate.	OTA job names cannot be reused. Set a different name.	5.2.3(1)

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Jun.20.25	—	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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(Rev.5.0-1 October 2020)

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