

RX Family

How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

Preface

This application note explains how to use the OTA demo application on FreeRTOS (with IoT Libraries). For details about security, see the Renesas MCU Firmware Update Design Policy ([R01AN5548](#))

Note : The procedures described in this application note apply to v202210.01-LTS-rx-1.1.3 and later of *iot-reference-rx*, a FreeRTOS reference project for RX MCUs. For earlier versions, see *How to implement FreeRTOS OTA by using Amazon Web Services on RX65N* ([R01AN5549](#)).

Note : This application note shows an implementation example based on the operating environment of the CK-RX65N v1 board and the RYZ014A PMOD module, but it can also be utilized with other boards and communication control combinations. For each board and communication control combination, please see:

[GitHub] [iot-reference-rx/Getting_Started_Guide.md at main · renesas/iot-reference-rx \(github.com\)](#)

Note : Renesas announces to discontinue the existing Sequans-sourced LTE module known as the part number RYZ014A and will no longer be shipping this product. With the discontinuation of RYZ014A, the CK-RX65N v1 board will also be discontinued. If you are using RYZ014A in a current design or production, the Sequans part numbers, GM01Q is a pin and functionally compatible replacement for RYZ014A.

Below Cellular driver of RX family works the below alternate product combination.
- RYZ014A Cellular Module Control Module : Sequans GM01Q is the compatible module.

Regarding EOL notice of the RYZ014A, please see :
[The link] <https://www.renesas.com/document/elc/plc-240004-end-life-eol-process-select-part-numbers?r=1503996>
[The 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

Related Documents

Renesas MCU Firmware Update Design Policy ([R01AN5548](#))

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1. Overview

1.1 System Overview

This section shows an overview of implementing OTA using a RX65N microcontroller that supports the dual bank function and has the CK-RX65N cloud kit installed.

The dual bank function divides the ROM of the microcontroller into an execution area and a temporary area. By dynamically swapping the execution area and the temporary area, updated firmware can be written to ROM while the existing software continues to run in the execution area.

The following explains how memory is allocated during OTA updates, and what happens when memory banks are swapped using the dual bank function.

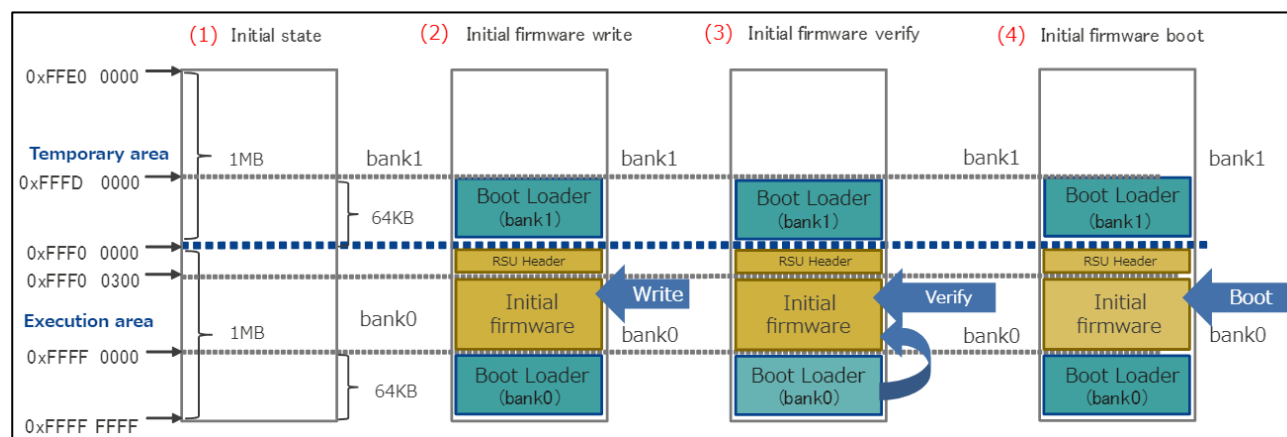


Figure 1.1 Overview of OTA Operation (1)

- (1) The state that erased all the data by Renesas Flash Programmer.
- (2) Memory state after writing combined bootloader and initial firmware data* in Renesas Flash Programmer.

* It refers to the data that Boot Loader(bank0) + Initial firmware + RSU Header + BootLoader(bank1) are combined. For details of RSU Header, please refer to 4.2 image file of RX Family Firmware Update module Using Firmware Integration Technology Application Notes([R01AN6850](#)).

- (3) After reset, bootloader (bank0) verifies Initial firmware.
- (4) Initial firmware is booted.

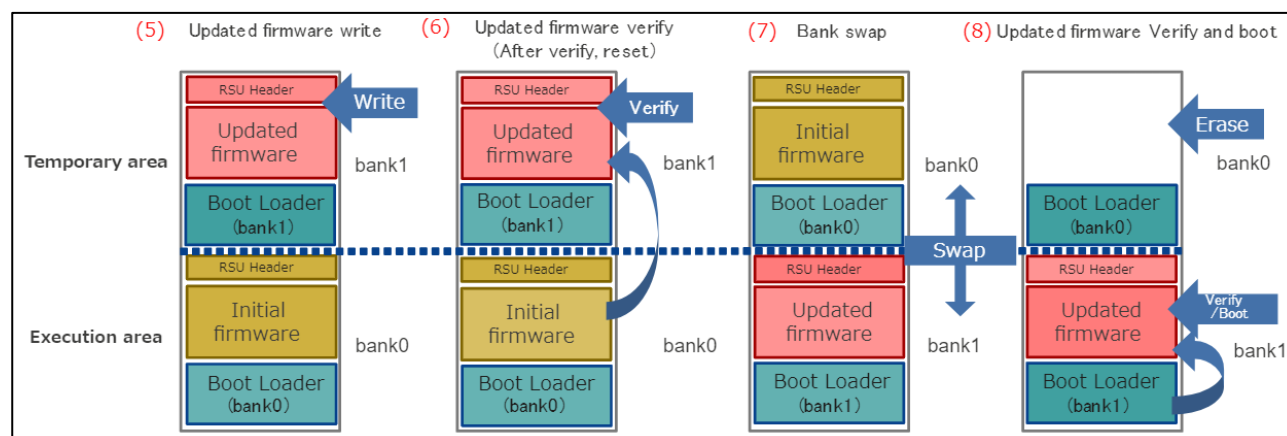


Figure 1.2 Overview of OTA Operation (2)

- (5) When new firmware is received from AWS, it is written to bank1.
Initial firmware operation is executed by BGO function while writing to bank1.

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- (6) Updated firmware is verified by the initial firmware.
 - (7) Bank0 and bank1 are swapped, and bank1 is designated as the execution area.
 - (8) Updated firmware is verified by bootloader.
- Erase Initial firmware in bank0 and execute Updated firmware written to bank1.

1.2 Operation Verification Environment for Hardware

The operation verification environment (hardware) for the demo project is listed below.

Table 1.1 Operation Verification Environment for Hardware

| Item | |
|-----------------|------------------------------------------|
| Board | CK-RX65N (Cellular/Ethernet) *1 |
| Cellular module | RYZ014A (incorporated into CK-RX65N) |
| SIM | LTE Cat-M1-compatible SIM (micro-SIM) *2 |

Notes: 1. Cellular communication is used in this sample.

2. To use the SIM card supplied with the CK-RX65N kit, activate the SIM card by following the procedure in *4.1.5 Activating SIM card* in the following application note:

[SIM activation, Creating the trial account and using Dashboard with RYZ014A or Ethernet Application for AWS - Getting Started Guide \(R01QS0064\)](#)

1.3 Operation Verification Environment for Software

The operation verification environment (software) for the demo project is listed below.

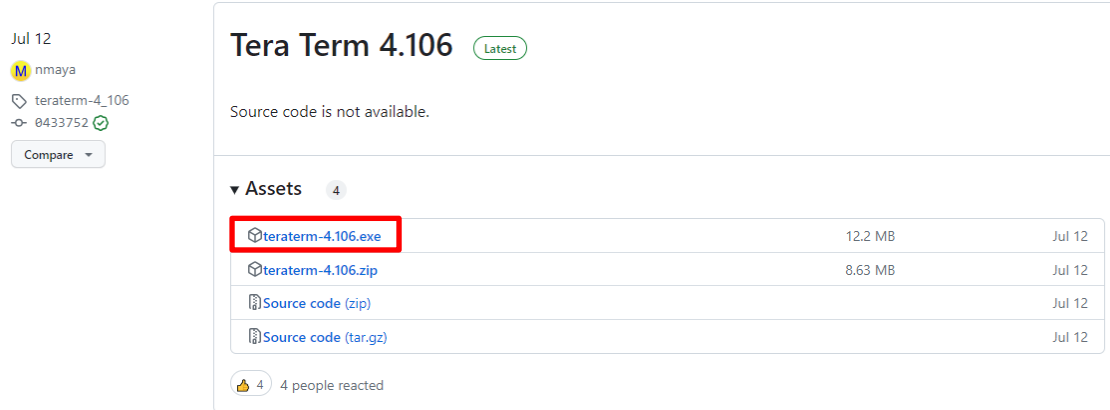
Table 1.2 Operation Verification Environment for Software

| Item | |
|------------------------------------|--------------------------------------------------------------|
| Integrated development environment | e ² studio 2024-04 |
| Compiler | Renesas CC-RX v3.05.00 |
| FreeRTOS | v202210.01-LTS-rx-1.2.1 |
| Log monitoring tool | Tera Term v4.106 |
| Python | Python 3.11.0 |
| Keygen tool | Win64 OpenSSL v3.0.12 |
| Flash programming tool | Renesas Flash Programmer V3.12.00 |
| Renesas Image Generator | Version 3.02 (supplied with Firmware Update module Rev.2.01) |

2. Prerequisites

2.1 Installing Tera Term

- (1) Access the Tera Term download site.
[Tera Term download web site \(GitHub\)](#)
- (2) Download the Tera Term installer.



- (3) Run the installer and follow the prompts to install Tera Term.
- (4) Confirm that Tera Term starts when you click the Tera Term icon in the Start menu.

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2.2 Installing Python

- (1) Access the Python download web site.

[Python download web site](#)

- (2) Download the Python 3.11.0 installer.

Click the **Download** link for Python 3.11.0.

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 |

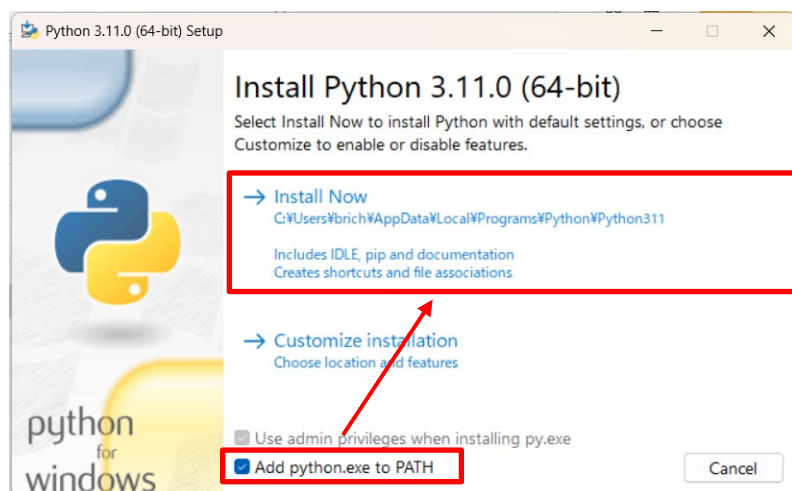
Download the installer for the operating system you are using.

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) Run the installer and follow the prompts to install Python.

On the installation screen, select the **Add python.exe to PATH** check box.



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- (4) Open a command prompt, and confirm that Python 3.11.0 is installed.

Execute the following command and confirm that information appears.

```
python -V
```

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

- (5) Install the Python encryption library (pycryptodome).

Install the encryption library by executing the following command:

```
pip install pycryptodome
```

```
C:\Users>pip install pycryptodome
Requirement already satisfied: pycryptodome in c:\users\os: \_ppdata\local\programs\python\python311\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 Win32/Win64 download web site for OpenSSL.

[Win32/Win64 OpenSSL Installer for Windows - Shining Light Productions \(slproweb.com\)](https://slproweb.com/products/Win32OpenSSL.html)

- (2) Download the OpenSSL installer.

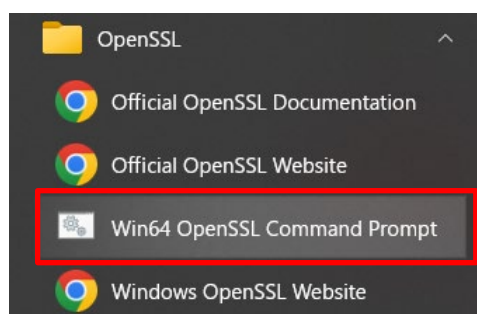
Download the installer for the operating system you are using.

| | | |
|--------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Win64 OpenSSL v3.0.12 Light EXE MSI | 5MB Installer | Installs the most commonly used essentials of Win64 C by the creators of OpenSSL . Only installs on 64-bit ve chipsets. Note that this is a default build of OpenSSL a information can be found in the legal agreement of the |
| Win64 OpenSSL v3.0.12 EXE MSI | 140MB Installer | Installs Win64 OpenSSL v3.0.12 (Recommended for sc OpenSSL). Only installs on 64-bit versions of Windows this is a default build of OpenSSL and is subject to loca found in the legal agreement of the installation. |
| Win32 OpenSSL v3.0.12 Light EXE MSI | 4MB Installer | Installs the most commonly used essentials of Win32 C 32-bit OpenSSL for Windows. Note that this is a defau and state laws. More information can be found in the le |
| Win32 OpenSSL v3.0.12 | 116MB Installer | Installs Win32 OpenSSL v3.0.12 (Only install this if you |

- (3) Run the installer and follow the prompts to install OpenSSL.

Select the option to copy the OpenSSL DLLs to the OpenSSL binaries directory.

- (4) From the Start menu, open the Win64 OpenSSL Command Prompt.

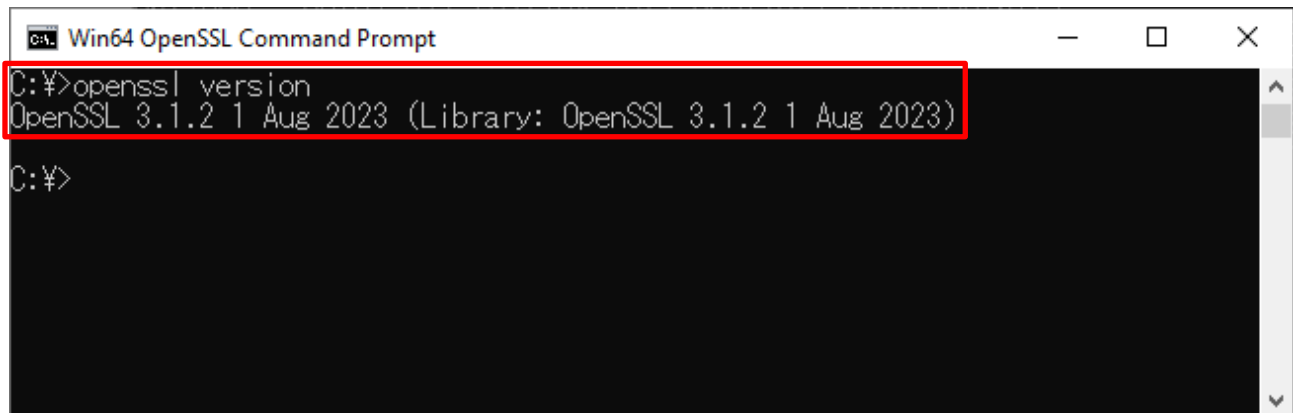


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- (5) Confirm that you can run the openssl command from the command prompt.

Execute the following command and confirm that version information appears.

openssl version



```
C:\>openssl version
OpenSSL 3.1.2 1 Aug 2023 (Library: OpenSSL 3.1.2 1 Aug 2023)
C:\>
```

2.4 Installing Renesas Image Generator

Renesas Image Generator is a tool that generates the firmware images used by the firmware update module. Renesas Image Generator can generate the following images for use by the firmware update module:

- Initial image: An image file containing the bootloader and application program written by flash writer during initial system configuration (extension: mot)
- Update image: An image file containing the updated firmware (extension: rsu)

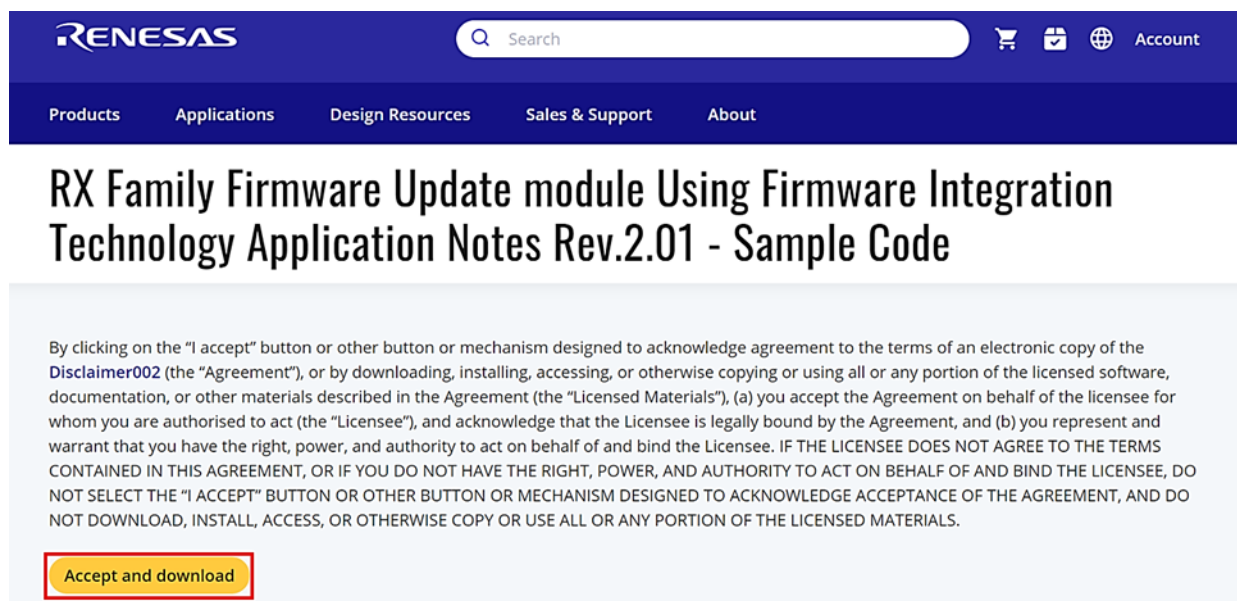
Renesas Image Generator is provided as part of the Firmware Update FIT module.

Note: Version Rev.2.00 and later of the Firmware Update module only support firmware generation using Python scripts.

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- (1) Download the firmware update module from the page linked to below.

[RX Family Firmware Update module Using Firmware Integration Technology Application Notes Rev.2.03 - Sample Code | Renesas](#)



Alternatively, download the firmware update module from the GitHub repository linked to below.

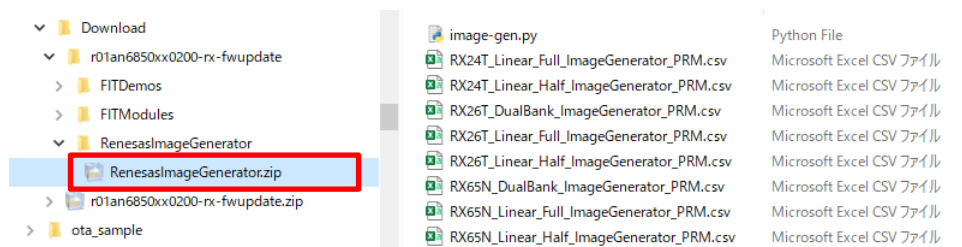
<https://github.com/renesas/renesas-image-generator>

- (2) Extract the firmware update module from the downloaded archive file.



- (3) Extract Renesas Image Generator.

Extract the file RenesasImageGenerator.zip in the firmware update module. The RenesasImageGenerator folder contains the Renesas Image Generator script file (image-gen.py) and the parameter files for various devices (*_ImageGenerator_PRM.csv).



2.5 Connecting the CK-RX65N

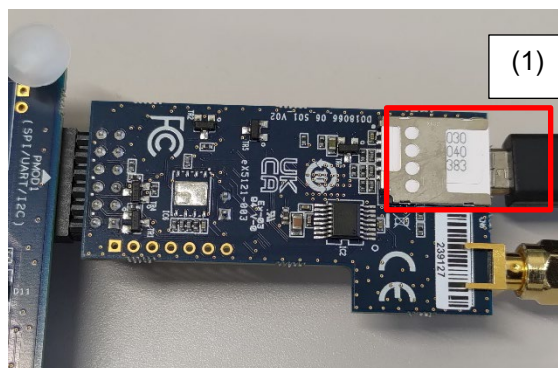


Figure 2.1 Back of RYZ014A PMOD

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

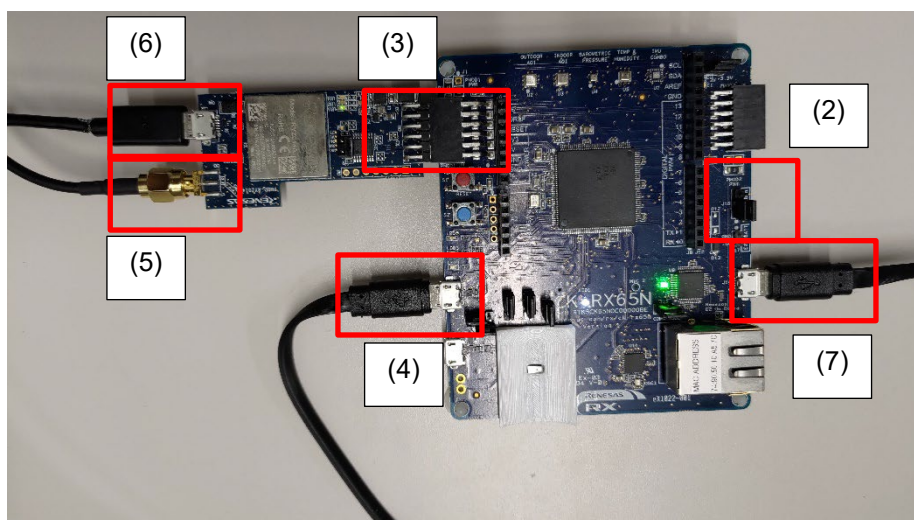


Figure 2.2 Front of Base Board and RYZ014A PMOD

- (2) On the base board, position the jumper on pins 1-2 of J16 to enable debugging mode.
(3) Connect the RYZ014A PMOD to PMOD1 on the base board.
(4) Connect J20 on the base board to a PC using a USB cable (USB serial connection).
(5) Connect an antenna to CN3 of the RYZ014A PMOD.
(6) Supply power by connecting a USB cable to CN4 of the RYZ014A PMOD.
(7) Connect J14 on the base board to a PC using a USB cable (debugger connection).

Note: Perform step (6) if you have a spare USB cable available.

If you do not supply power to the RYZ014A PMOD, communication might become unstable.

3. Setting Up AWS

To run the FreeRTOS demo, you must have an AWS account (the root user, or an IAM user with permissions to access AWS IoT and FreeRTOS cloud services).

For details on how to sign up for an AWS account and add permissions to users, see

<https://docs.aws.amazon.com/freertos/latest/userguide/freertos-prereqs.html>.

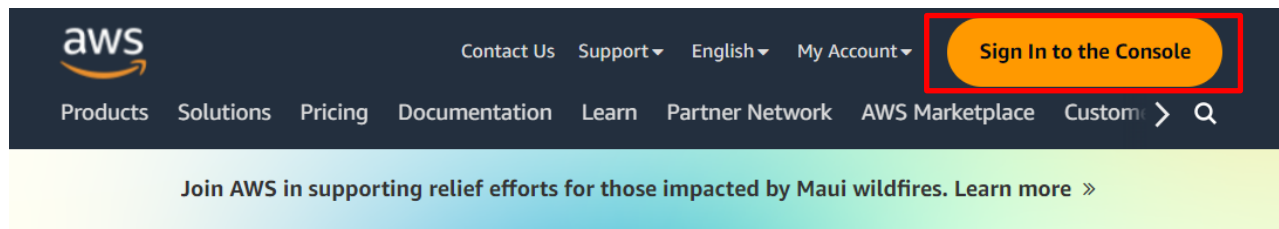
For details on how to set up OTA updates, see <https://docs.aws.amazon.com/freertos/latest/userguide/ota-prereqs.html>.

You must also configure the source code as explained in 4.2 to allow the demo to communicate with AWS.

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3.1 Signing In to the AWS Console

- (1) Access the AWS web site (<https://aws.amazon.com/>) and click **Sign In to the Console**.



- (2) Enter your email address or account ID, and then click **Next**.

If the account you are using to sign in is the root user, enter the root user email address. If the account is an IAM user, enter the account ID. (You might skip this step if you have already signed in.)



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

Next

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- (3) Enter your password and then click **Sign in**.

For root users



Root user sign in ⓘ

Email:

Password

[Forgot password?](#)

.....

Sign in

[Sign in to a different account](#)

[Create a new AWS account](#)

For IAM users



Sign in as IAM user

Account ID (12 digits) or account alias

IAM user name

Password

☐ Remember this account

Sign in

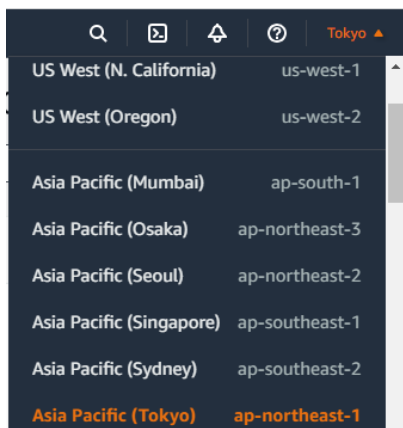
[Sign in using root user email](#)

[Forgot password?](#)

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3.2 Setting Your Region in AWS

After logging in to AWS, select your region in the top right of the screen.



3.3 Registering Your Device in AWS

The following explains the preparations necessary to run the demo project in AWS. Set up AWS by referring to the following tutorial.

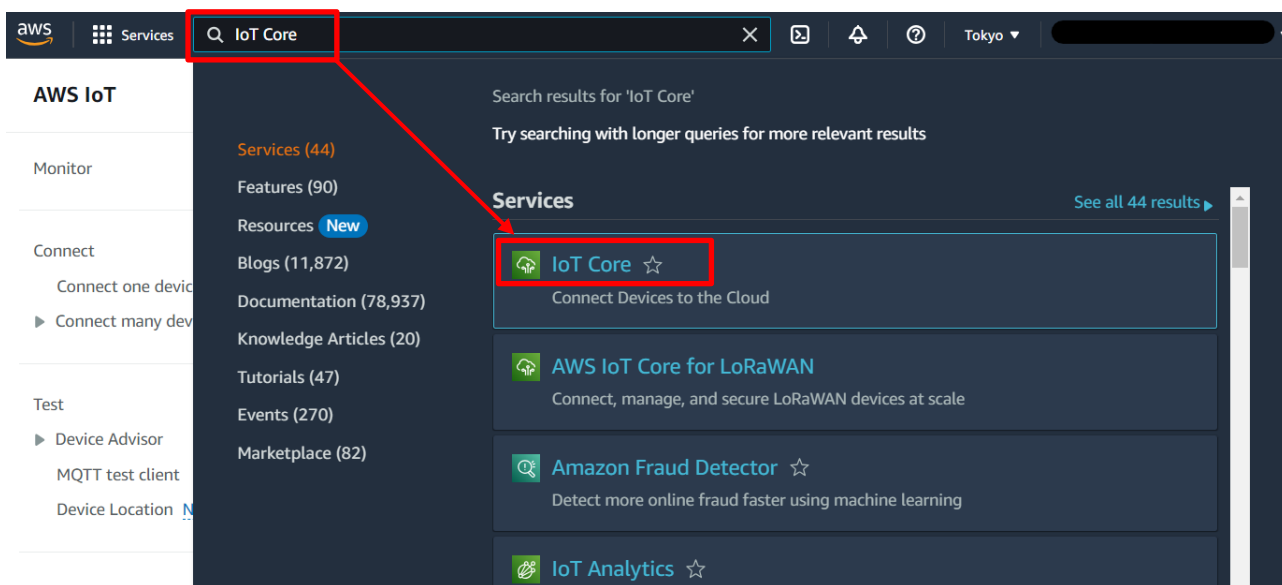
3.3.1 Setting Policies

Assign access permissions (policies) for AWS and other resources to the device you want to connect to AWS.

Assign the following policies to the device connected in this application note:

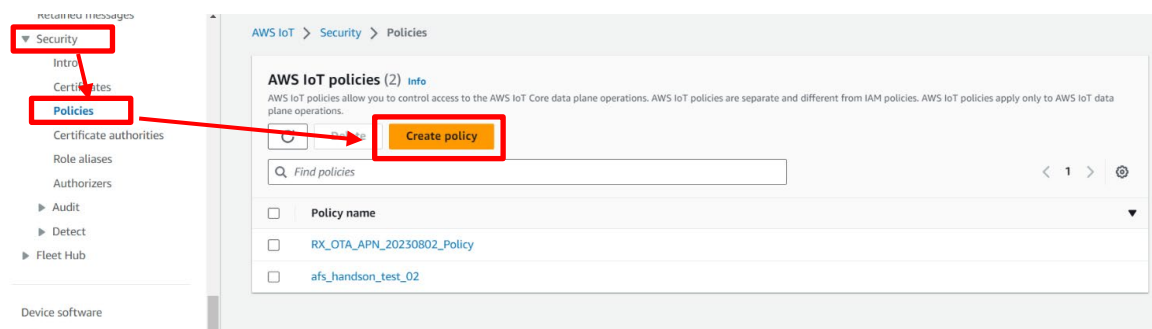
- **iot:Connect:** Connects to AWS IoT
- **iot:Publish:** Publishes a topic
- **iot:Subscribe:** Subscribes to a topic
- **iot:Receive:** Receives messages from AWS IoT

(1) Enter IoT Core in the search box at the top of the screen, and click **IoT Core** in the search results.



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- (2) In the menu, click **Security** and then **Policies**, and then click the **Create policy** button.



- (3) Enter a policy name (for example: rx65n_ota_demo_policy).

Create policy [Info](#)

AWS IoT Core policies allow you to manage access to the AWS IoT Core data plane operations.

Policy properties

AWS IoT Core supports named policies so that many identities can reference the same policy document.

Policy name

A policy name is an alphanumeric string that can also contain period (.), comma (,), hyphen(-), underscore (_), plus sign (+), equal sign (=), and at sign (@) characters, but no spaces.

► Tags - optional

- (4) Click the **Policy statements** tab, and in the **Policy document** area, click **Builder**. Enter the policy settings as shown in the following figure, and then click **Create**.

Because the policy initially contains only one statement, you must add more statements by clicking the **Add new statement** button.

Policy statements | Policy examples

Policy document [Info](#)

An AWS IoT policy contains one or more policy statements. Each policy statement contains actions, resources, and an effect that grants or denies the actions by the resources.

Builder | JSON

| Policy effect | Policy action | Policy resource | |
|---------------|---------------|-----------------|--------|
| Allow | iot:Connect | * | Remove |
| Allow | iot:Publish | * | Remove |
| Allow | iot:Receive | * | Remove |
| Allow | iot:Subscribe | * | Remove |

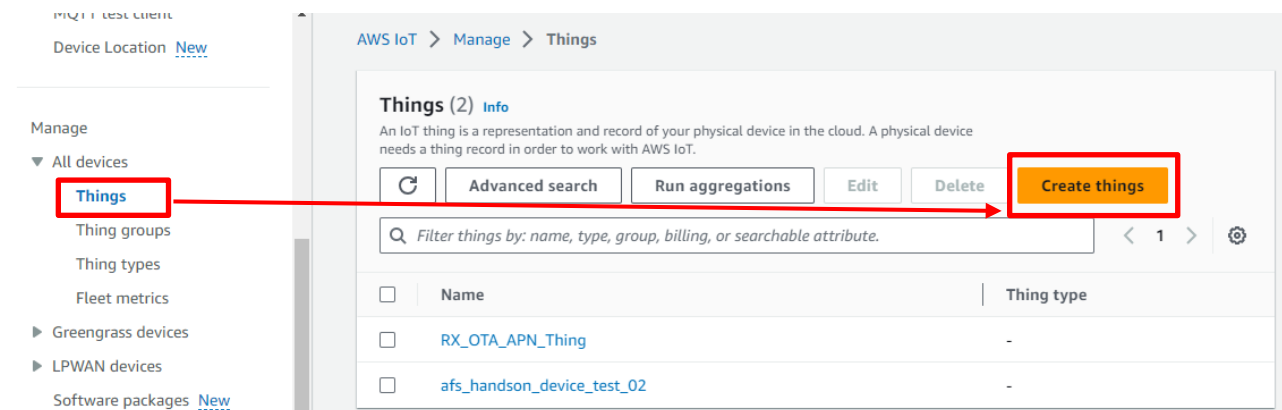
Add new statement

Cancel **Create**

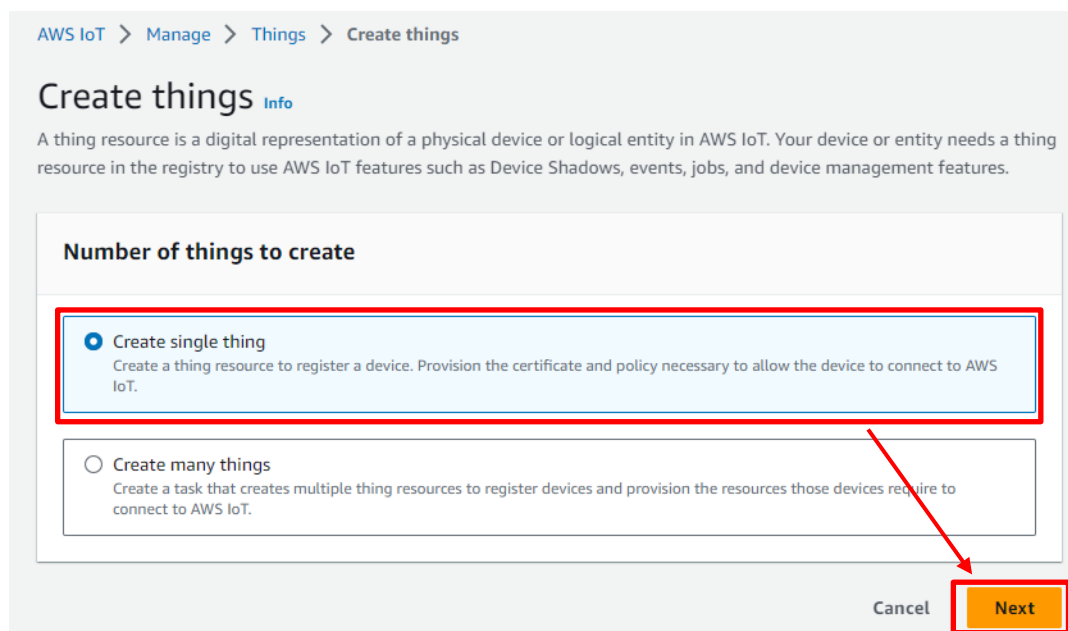
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3.3.2 Registering Your Device as a *Thing* in AWS IoT

(1) In the menu, click **Manage**, **All devices**, and **Things**, and then click the **Create things** button.



(2) Select **Create single thing** and then click **Next**.



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(3) Enter a thing name (example: rx65n_ota_demo_thing), and then click **Next**.

Make a note of the thing name you entered. You will need it in a later process.

AWS IoT > Manage > Things > Create things > Create single thing

Step 1
Specify thing properties

Step 2 - optional
Configure device certificate

Step 3 - optional
Attach policies to certificate

Specify thing properties [Info](#)

A thing resource is a digital representation of a physical device or logical entity in AWS IoT. Your device or entity needs a thing resource in the registry to use AWS IoT features such as Device Shadows, events, jobs, and device management features.

Thing properties [Info](#)

Thing name

rx65n_ota_demo_thing

Enter a unique name containing only: letters, numbers, hyphens, colons, or underscores. A thing name can't contain any spaces.

Additional configurations

You can use these configurations to add detail that can help you to organize, manage, and search your things.

Device Shadow [Info](#)

Device Shadows allow connected devices to sync states with AWS. You can also get, update, or delete the state information of this thing's shadow using either HTTPs or MQTT topics.

☒ No shadow

☐ Named shadow
Create multiple shadows with different names to manage access to properties, and logically group your devices properties.

☐ Unnamed shadow (classic)
A thing can have only one unnamed shadow.

Cancel **Next**

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(4) In the Device certificate area, select **Auto-generate a new certificate** and then click **Next**.

Step 1
Specify thing properties

Step 2 - optional
Configure device certificate

Step 3 - optional
Attach policies to certificate

Configure device certificate - optional [Info](#)

A device requires a certificate to connect to AWS IoT. You can choose how to register a certificate for your device now, or you can create and register a certificate for your device later. Your device won't be able to connect to AWS IoT until it has an active certificate with an appropriate policy.

Device certificate

☒ **Auto-generate a new certificate (recommended)**
Generate a certificate, public key, and private key using AWS IoT's certificate authority.

☐ **Use my certificate**
Use a certificate signed by your own certificate authority.

☐ **Upload CSR**
Register your CA and use your own certificates on one or many devices.

☐ **Skip creating a certificate at this time**
You can create a certificate for this thing and attach a policy to the certificate at a later time.

Cancel Previous **Next**

(5) Attach the policy to the certificate.

Select the policy you created in 3.3.1 Setting policies, and then click the **Create thing** button.

Step 1
Specify thing properties

Step 2 - optional
Configure device certificate

Step 3 - optional
Attach policies to certificate

Attach policies to certificate - optional [Info](#)

AWS IoT policies grant or deny access to AWS IoT resources. Attaching policies to the device certificate applies this access to the device.

Policies (1/3) [Refresh](#) [Create policy](#)

Select up to 10 policies to attach to this certificate.

| <input type="checkbox"/> | Name |
|-------------------------------------|-----------------------|
| <input checked="" type="checkbox"/> | rx65n_ota_demo_policy |
| <input type="checkbox"/> | af... |
| <input type="checkbox"/> | RX... |

Cancel Previous **Create thing**

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(6) Download the certificate and key files.

The certificate and private key are equivalent to a password for the device (thing). When you register a certificate and private key on a device, the device can use this certificate and private key to connect to AWS.

You must download the certificate, public key, and private key now. You will not have another opportunity to download them.

Download certificates and keys

×

Download certificate and key files to install on your device so that it can connect to AWS.

Device certificate

You can activate the certificate now, or later. The certificate must be active for a device to connect to AWS IoT.

Device certificate
[REDACTED].pem.crt

Deactivate certificate

Download

Key files

The key files are unique to this certificate and can't be downloaded after you leave this page. Download them now and save them in a secure place.

⚠ This is the only time you can download the key files for this certificate.

Public key file
[REDACTED]-public.pem.key

Download

Private key file
[REDACTED]-private.pem.key

Download

Root CA certificates

Download the root CA certificate file that corresponds to the type of data endpoint and cipher suite you're using. You can also download the root CA certificates later.

Amazon trust services endpoint
RSA 2048 bit key: Amazon Root CA 1

Download

Amazon trust services endpoint
ECC 256 bit key: Amazon Root CA 3

Download

If you don't see the root CA certificate that you need here, AWS IoT supports additional root CA certificates. These root CA certificates and others are available in our developer

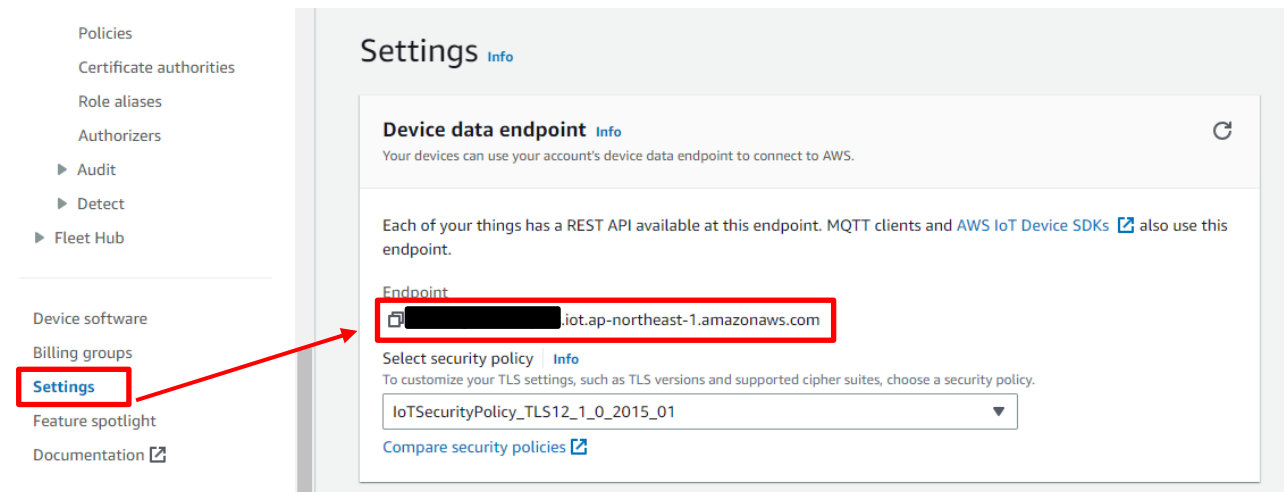
Done

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

3.3.3 Checking the Endpoint

The endpoint is equivalent to a connection destination (URL) for the device (thing). The device will connect to the endpoint registered for the device.

- (1) In the menu, click **Settings** and make a note of the endpoint.

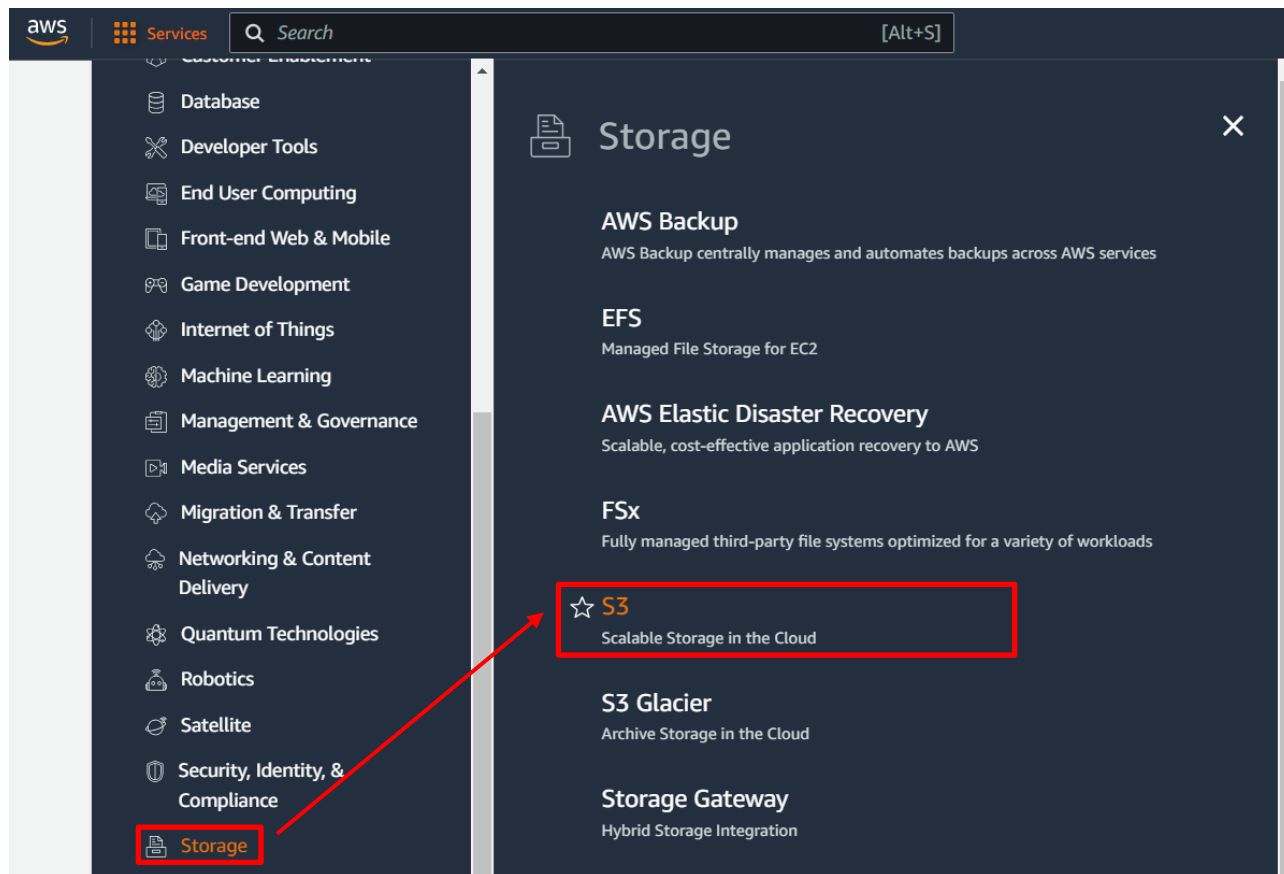


RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

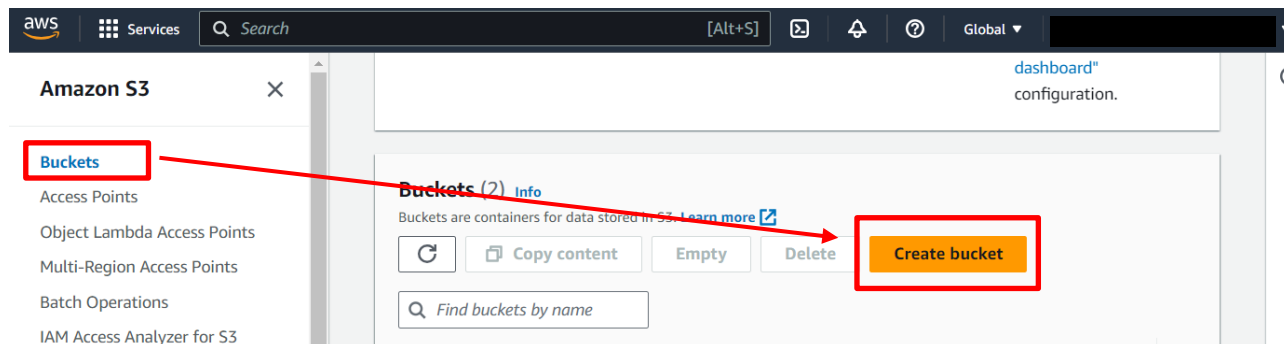
3.4 Creating an Amazon S3 Bucket

Amazon S3 is an online storage web service used to store the firmware with which the device will be updated.

(1) From the **Services** menu, select **Storage** and then **S3**.



(2) On the **Buckets** page, click the **Create bucket** button.



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(3) Enter a bucket name. (example: s3test-rx65n)

[Amazon S3](#) > [Buckets](#) > Create bucket

Create bucket [Info](#)

Buckets are containers for data stored in S3. [Learn more](#)

General configuration

AWS Region

US East (N. Virginia) us-east-1

Bucket type [Info](#)

☒ **General purpose**
Recommended for most use cases and access patterns. General purpose buckets are the original S3 bucket type. They allow a mix of storage classes that redundantly store objects across multiple Availability Zones.

☐ **Directory - New**
Recommended for low-latency use cases. These buckets use only the S3 Express One Zone storage class, which provides faster processing of data within a single Availability Zone.

Bucket name [Info](#)

s3test-rx65nv2

Bucket name must be unique within the global namespace and follow the bucket naming rules. [See rules for bucket naming](#)

Copy settings from existing bucket - *optional*
Only the bucket settings in the following configuration are copied.

[Choose bucket](#)

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.

Bucket name

s3test

 Bucket with the same name already exists

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(4) Create the bucket.

Enter the settings as follows, and then click the **Create bucket** button.

- **Block Public Access setting for this bucket: Block all public access**
- **Bucket Versioning: Enable**

Block Public Access settings for this bucket

Public access is granted to buckets and objects through access control lists (ACLs), bucket policies, access point policies, or all. In order to ensure that public access to this bucket and its objects is blocked, turn on Block all public access. These settings apply only to this bucket and its access points. AWS recommends that you turn on Block all public access, but before applying any of these settings, ensure that your applications will work correctly without public access. If you require some level of public access to this bucket or objects within, you can customize the individual settings below to suit your specific storage use cases. [Learn more](#)

☒ **Block all public access**
Turning this setting on is the same as turning on all four settings below. Each of the following settings are independent of one another.

- ☒ **Block public access to buckets and objects granted through *new* access control lists (ACLs)**
S3 will block public access permissions applied to newly added buckets or objects, and prevent the creation of new public access ACLs for existing buckets and objects. This setting doesn't change any existing permissions that allow public access to S3 resources using ACLs.
- ☒ **Block public access to buckets and objects granted through *any* access control lists (ACLs)**
S3 will ignore all ACLs that grant public access to buckets and objects.
- ☒ **Block public access to buckets and objects granted through *new* public bucket or access point policies**
S3 will block new bucket and access point policies that grant public access to buckets and objects. This setting doesn't change any existing policies that allow public access to S3 resources.
- ☒ **Block public and cross-account access to buckets and objects through *any* public bucket or access point policies**
S3 will ignore public and cross-account access for buckets or access points with policies that grant public access to buckets and objects.

Bucket Versioning

Versioning is a means of keeping multiple variants of an object in the same bucket. You can use versioning to preserve, retrieve, and restore every version of every object stored in your Amazon S3 bucket. With versioning, you can easily recover from both unintended user actions and application failures. [Learn more](#)

Bucket Versioning
☐ Disable
☒ Enable

► **Advanced settings**

After creating the bucket, you can upload files and folders to the bucket, and configure additional bucket settings.

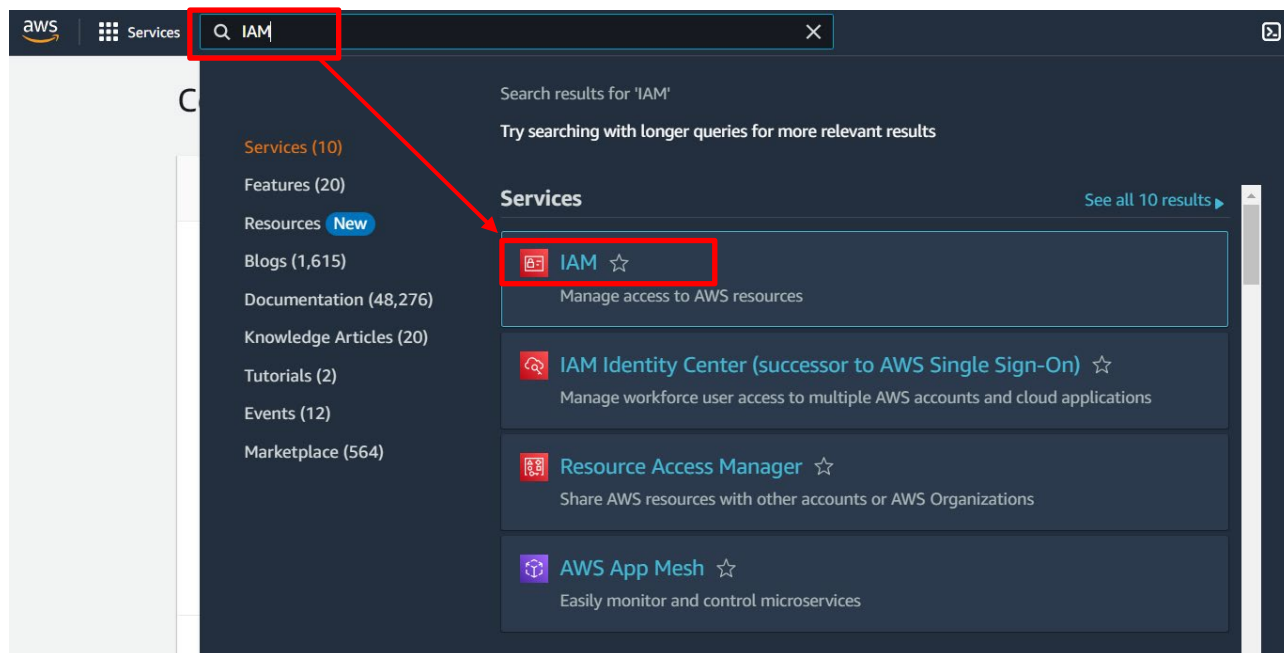
Cancel **Create bucket**

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

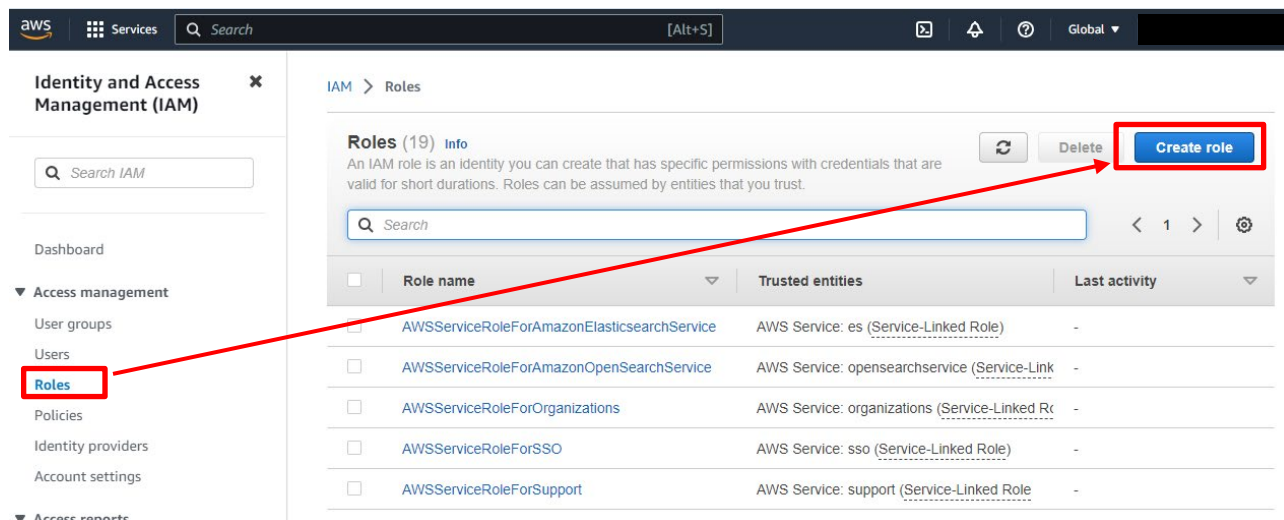
3.5 Allocating OTA Execution Permission to IAM Users

Create a role with the appropriate access permissions to create OTA update jobs.

(1) Enter IAM in the search box at the top of the screen, and click **IAM** in the search results.



(2) In the menu, click **Roles** and then click the **Create role** button.



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(3) Under **Select trusted entity**, enter the following settings and then click **Next**:

- Under **Trusted entity type**, select **AWS service**.
- Under **Use cases for other AWS services**, select **IoT**.
- Select the **IoT** option button.

IAM > Roles > Create role

Step 1
Select trusted entity

Step 2
Add permissions

Step 3
Name, review, and create

Select trusted entity [Info](#)

Trusted entity type

☒ **AWS service**
Allow AWS services like EC2, Lambda, or others to perform actions in this account.

☐ **AWS account**
Allow entities in other AWS accounts belonging to you or a 3rd party to perform actions in this account.

☐ **Web identity**
Allows users federated by the specified external web identity provider to assume this role to perform actions in this account.

☐ **SAML 2.0 federation**
Allow users federated with SAML 2.0 from a corporate directory to perform actions in this account.

☐ **Custom trust policy**
Create a custom trust policy to enable others to perform actions in this account.

Use case

☒ **IoT**
Allows IoT to call AWS services on your behalf.

☐ **IoT - Device Defender Audit**
Provides AWS IoT Device Defender read access to IoT and related resources.

☐ **IoT - Device Defender Mitigation Actions**
Provides AWS IoT Device Defender write access to IoT and related resources for execution of Mitigation Actions.

[Cancel](#) [Next](#)

(4) Click **Next** on the **Add permissions** page without making any changes.

Add permissions [Info](#)

Permissions policies (3) [Info](#)

The type of role that you selected requires the following policy.

| Policy name ↗ | Type | Attached entities |
|-------------------------------------|----------|-------------------|
| AWSIoTRuleActions | AWS m... | 1 |
| AWSIoTLogging | AWS m... | 1 |
| AWSIoTThingsRegi... | AWS m... | 1 |

► **Set permissions boundary - optional** [Info](#)

Set a permissions boundary to control the maximum permissions this role can have. This is not a common setting, but you can use it to delegate permission management to others.

[Cancel](#) [Previous](#) [Next](#)

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(5) Enter a role name (example: ota_role_rx65n), and then click the **Create role** button.

Name, review, and create

Role details

Role name

Enter a meaningful name to identify this role.

ota_role_rx65n

Maximum 64 characters. Use alphanumeric and '+', '@', '-' characters.

Description

Add a short explanation for this role.

Allows IoT to call AWS services on your behalf.

Maximum 1000 characters. Use alphanumeric and '+', '@', '-' characters.

Add tags - optional [Info](#)

Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources.

No tags associated with the resource.

Add tag

You can add up to 50 more tags.

Cancel

Previous

Create role

(6) Click the role you created.

Identity and Access Management (IAM)

Search IAM

Dashboard

▼ Access management

User groups

Users

Roles

Policies

Identity providers

Account settings

▼ Access reports

Access analyzer

Archive rules

Analyzers

Settings

Credential report

IAM > Roles

Roles (20) [Info](#)

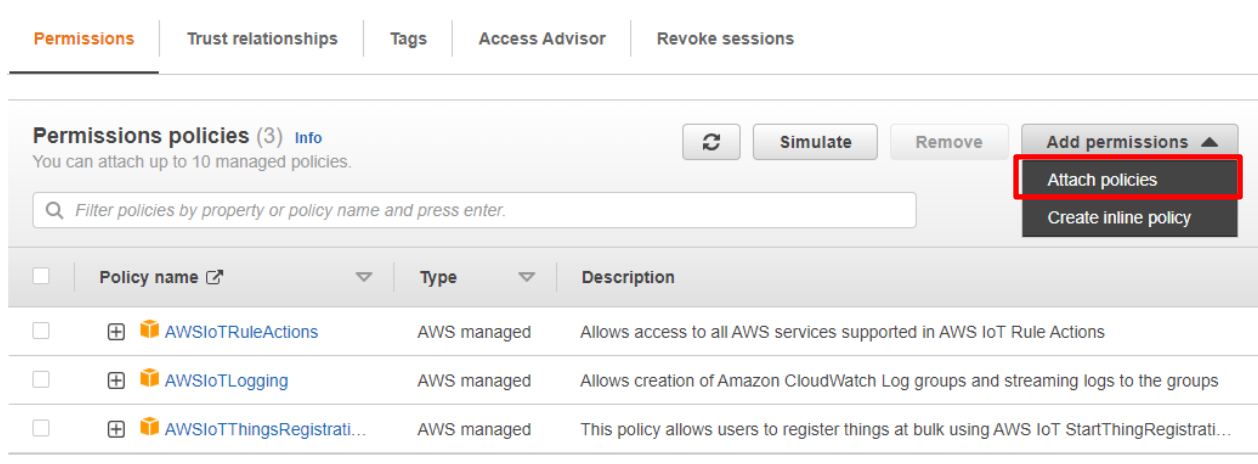
An IAM role is an identity you can create that has specific permissions with credentials that are valid for short durations. Roles can be assumed by entities that you trust.

Search

| <input type="checkbox"/> | Role name | Trusted entities |
|--------------------------|-------------------------------------------------------------|--------------------------------|
| <input type="checkbox"/> | AWSServiceRoleForAmazonElasticsearchService | AWS Service: es (Service) |
| <input type="checkbox"/> | AWSServiceRoleForAmazonOpenSearchService | AWS Service: opensearch |
| <input type="checkbox"/> | AWSServiceRoleForOrganizations | AWS Service: organizations |
| <input type="checkbox"/> | AWSServiceRoleForSSO | AWS Service: sso (Service) |
| <input type="checkbox"/> | AWSServiceRoleForSupport | AWS Service: support (Service) |
| <input type="checkbox"/> | AWSServiceRoleForTrustedAdvisor | AWS Service: trustedadvisor |
| <input type="checkbox"/> | | AWS Service: iot |
| <input type="checkbox"/> | | AWS Service: iot |
| <input type="checkbox"/> | ota_role_rx65n | AWS Service: iot |
| <input type="checkbox"/> | | AWS Service: iot |

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(7) Select **Attach policies**.



Permissions policies (3) Info

You can attach up to 10 managed policies.

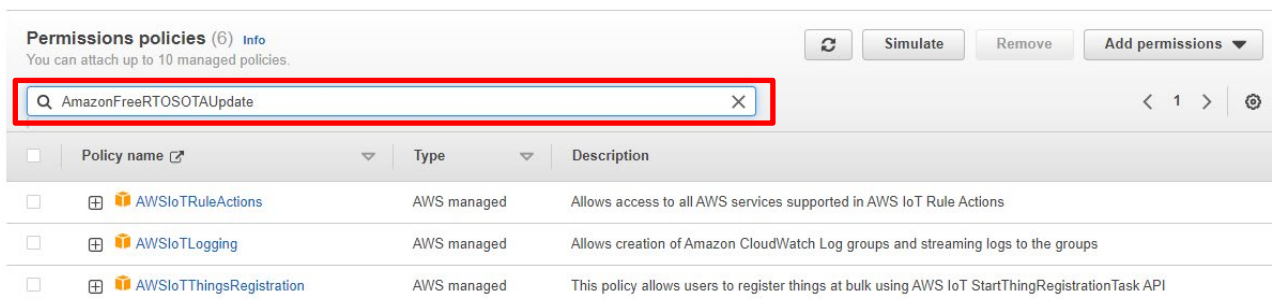
Filter policies by property or policy name and press enter.

Buttons: Refresh, Simulate, Remove, Add permissions (dropdown)

Dropdown options: Attach policies (highlighted), Create inline policy

| <input type="checkbox"/> | Policy name | Type | Description |
|--------------------------|---------------------------|-------------|-------------------------------------------------------------------------------------------|
| <input type="checkbox"/> | AWSIoTRuleActions | AWS managed | Allows access to all AWS services supported in AWS IoT Rule Actions |
| <input type="checkbox"/> | AWSIoTLogging | AWS managed | Allows creation of Amazon CloudWatch Log groups and streaming logs to the groups |
| <input type="checkbox"/> | AWSIoTThingsRegistrati... | AWS managed | This policy allows users to register things at bulk using AWS IoT StartThingRegistrati... |

(8) Enter AmazonFreeRTOSOTAUpdate in the **Permissions policies** search box, and then press the **Enter** key.



Permissions policies (6) Info

You can attach up to 10 managed policies.

Search box: AmazonFreeRTOSOTAUpdate (highlighted)

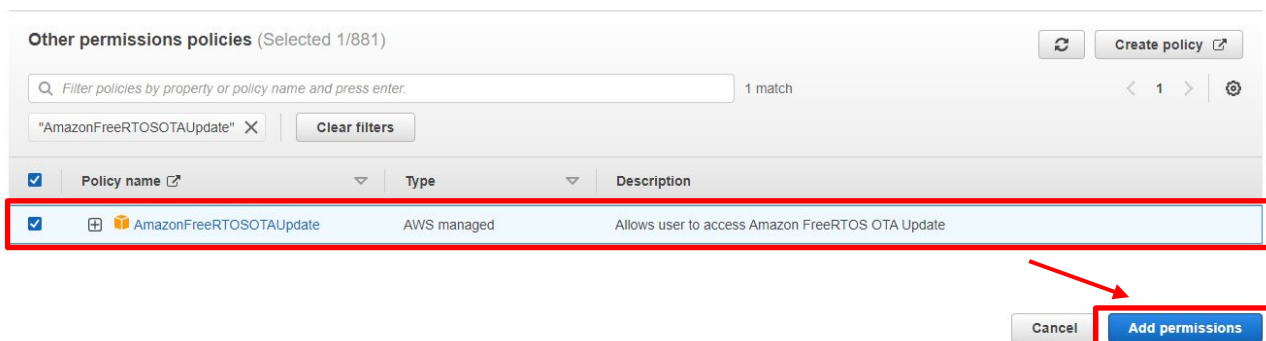
Buttons: Refresh, Simulate, Remove, Add permissions (dropdown)

| <input type="checkbox"/> | Policy name | Type | Description |
|--------------------------|--------------------------|-------------|--------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> | AWSIoTRuleActions | AWS managed | Allows access to all AWS services supported in AWS IoT Rule Actions |
| <input type="checkbox"/> | AWSIoTLogging | AWS managed | Allows creation of Amazon CloudWatch Log groups and streaming logs to the groups |
| <input type="checkbox"/> | AWSIoTThingsRegistration | AWS managed | This policy allows users to register things at bulk using AWS IoT StartThingRegistrationTask API |

(9) Select the check box beside the AmazonFreeRTOSOTAUpdate policy, and then click the **Add permissions** button.

Attach policy to ota_role_rx65n

► Current permissions policies (3)



Other permissions policies (Selected 1/881)

Filter policies by property or policy name and press enter. 1 match

Search box: "AmazonFreeRTOSOTAUpdate" (highlighted)

Buttons: Refresh, Create policy

| <input checked="" type="checkbox"/> | Policy name | Type | Description |
|-------------------------------------|-------------------------|-------------|--------------------------------------------------|
| <input checked="" type="checkbox"/> | AmazonFreeRTOSOTAUpdate | AWS managed | Allows user to access Amazon FreeRTOS OTA Update |

Buttons: Cancel, Add permissions (highlighted)

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(10) From the **Add permissions** drop-down list, select **Create inline policy**.

PermissionsTrust relationshipsTagsAccess AdvisorRevoke sessions

Permissions policies (4) Info

You can attach up to 10 managed policies.

Filter policies by property or policy name and press enter.

Refresh

Simulate

Remove

Add permissions ▲

Attach policiesCreate inline policy

| | Policy name | Type | Description |
|--------------------------|--------------------------|-------------|----------------------------------------------------------------------------------------|
| <input type="checkbox"/> | AWSIoTRuleActions | AWS managed | Allows access to all AWS services supported in AWS IoT Rule Actions |
| <input type="checkbox"/> | AWSIoTLogging | AWS managed | Allows creation of Amazon CloudWatch Log groups and streaming logs to the gro... |
| <input type="checkbox"/> | AWSIoTThingsRegistration | AWS managed | This policy allows users to register things at bulk using AWS IoT StartThingRegistr... |
| <input type="checkbox"/> | AmazonFreeRTOSOTAUpd... | AWS managed | Allows user to access Amazon FreeRTOS OTA Update |

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(11) Click **JSON**, paste the following code, and then click **Next**.

This code grants permission to pass the IAM role to AWS services.

Code to paste:

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

Specify permissions [Info](#)

Add permissions by selecting services, actions, resources, and conditions. Build permission statements using the JSON editor.

Policy editor

```
1 {
2   "Version": "2012-10-17",
3   "Statement": [
4     {
5       "Effect": "Allow",
6       "Action": [
7         "iam:GetRole",
8         "iam:PassRole"
9       ],
10      "Resource": "*"
11    }
12  ]
13 }
14
```

Visual

JSON

Actions ▼

Edit statement

Select a statement

Select an existing statement in the policy or add a new statement.

[+ Add new statement](#)

JSON Ln 14, Col 0

10128 of 10240 characters remaining

Security: 1 Errors: 0 Warnings: 0 Suggestions: 0

Cancel

Next

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(12) Enter a policy name (example: rx65n_ota_demo_iam_policy), and then click the **Create policy** button.

Review and create

Review the permissions, specify details, and tags.

Policy details

Policy name

Enter a meaningful name to identify this policy.

rx65n_ota_demo_iam_policy

Maximum 128 characters. Use alphanumeric and '+', '@', '-' characters.

Permissions defined in this policy [Info](#)

Permissions in the policy document specify which actions are allowed or denied.

Search

Allow (1 of 384 services)

Show remaining 383 services

Service

Access level

Resource

Request condition

IAM

Limited: Read, Write

All resources

None

Cancel

Previous

Create policy

(13) Again, from the **Add permissions** drop-down list, select **Create inline policy**.

Permissions

Trust relationships

Tags

Access Advisor

Revoke sessions

Permissions policies (4) [Info](#)

You can attach up to 10 managed policies.

Filter policies by property or policy name and press enter.



Simulate

Remove

Add permissions

Attach policies

Create inline policy



Policy name



Type

Description



AWSIoTRuleActions

AWS managed

Allows access to all AWS services supported in AWS IoT Rule Actions



AWSIoTLogging

AWS managed

Allows creation of Amazon CloudWatch Log groups and streaming logs to the gro...



AWSIoTThingsRegistration

AWS managed

This policy allows users to register things at bulk using AWS IoT StartThingRegist...



AmazonFreeRTOSOTAUpd...

AWS managed

Allows user to access Amazon FreeRTOS OTA Update

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(14) Click **JSON**, paste the following code, and then click **Next**.

This code allows access to Amazon S3 where the updated firmware is stored.

Code to paste:

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

Specify permissions [Info](#)

Add permissions by selecting services, actions, resources, and conditions. Build permission statements using the JSON editor.

Policy editor

Visual **JSON** Actions ▼

Edit statement

Select a statement

Select an existing statement in the policy or add a new statement.

[+ Add new statement](#)

JSON Ln 17, Col 0 999 of 10128 characters remaining

Security: 0 Errors: 0 Warnings: 0 Suggestions: 0

Cancel **Next**

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(15) Enter a policy name (example: rx65n_ota_demo_s3_policy), and then click the **Create policy** button.

Review and create

Review the permissions, specify details, and tags.

Policy details

Policy name

Enter a meaningful name to identify this policy.

rx65n_ota_demo_s3_policy

Maximum 128 characters. Use alphanumeric and '+', '@', '-' characters.

Permissions defined in this policy [Info](#)

Edit

Permissions in the policy document specify which actions are allowed or denied.

Q Search

Allow (1 of 384 services)

Show remaining 383 services

| Service | Access level | Resource | Request condition |
|---------|----------------------|---------------|-------------------|
| S3 | Limited: Read, Write | All resources | None |

Cancel

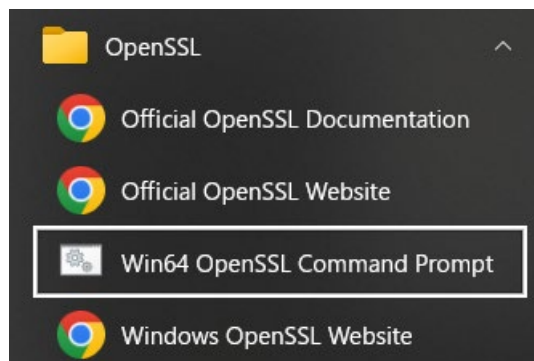
Previous

Create policy

4. Setting Up the Device

4.1 Generating Key Pairs and Certificates

- (1) From the **Start** menu, open the **Win64 OpenSSL Command Prompt**.



- (2) Execute the command to create a CA private key using ECDSA.

Execute the following command:

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

Execution results:

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

- (3) Execute the command to create a CA certificate from the CA private key you created.

Execute the following command: You can enter any character string for **Country Name** onward.

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

```
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 for these attributes.

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

- (4) Execute the command to create an ECDSA key pair.

Execute the following command:

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

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

- (5) Execute the command to create a certificate signing request from the ECDSA key pair you created.

Execute the following command: You can enter any character string for **Country Name** onward. For the last two lines, press **Enter** without entering anything.

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

```
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 for these attributes.

Press **Enter** without entering anything.

- (6) Execute the command to create a certificate from the certificate signing request, CA certificate, and CA private key you created.

Execute the following command:

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

```
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, email
Address = Tarou.Renesas@sample.com
Getting CA Private Key
```

- (7) Execute the command to extract the private key from the ECDSA key pair.

Execute the following command:

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

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

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

- (8) Execute the command to extract the public key from the ECDSA key pair.

Execute the following command:

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

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

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

4.2 Creating the Initial Version of the Firmware

The following explains how to create the initial version of the firmware.

4.2.1 Creating the Sample Projects

Follow the procedure below to create the OTA sample project and Secure Bootloader sample project needed to implement OTA using Amazon Web Services, as described in 4.2.2.

If you wish to use the import function to run the demo project, refer to the instructions in [Getting Started Guide](#).

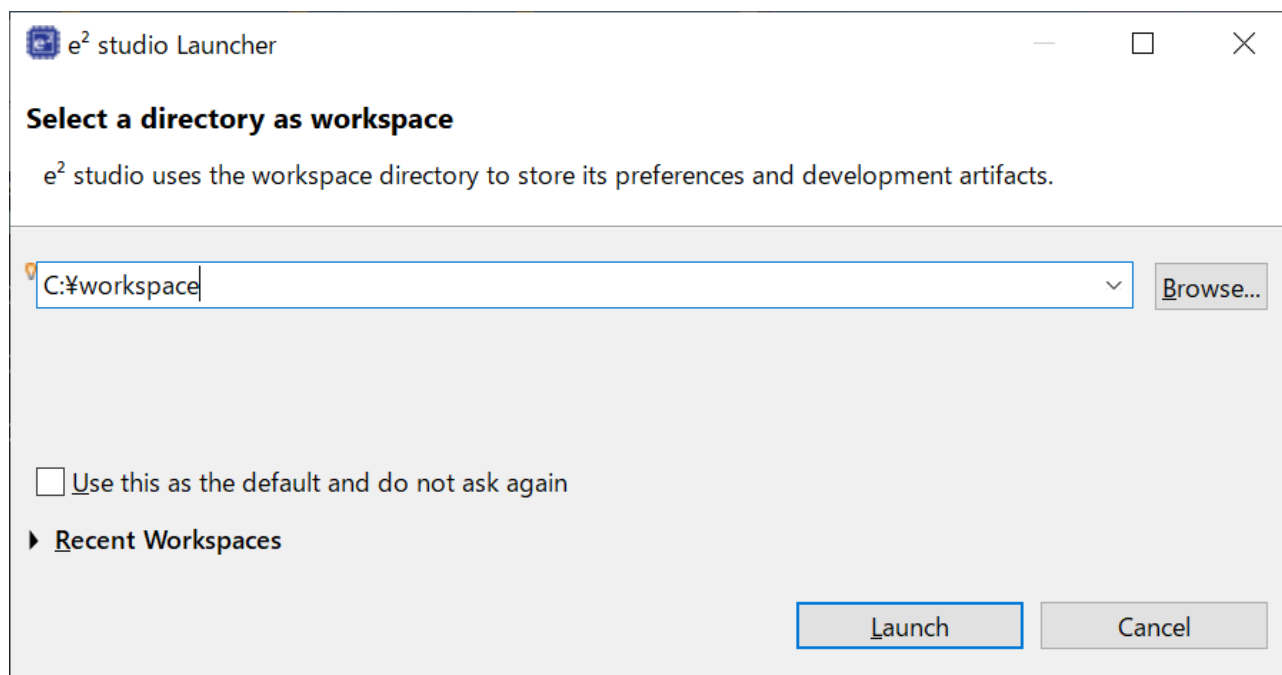
- (1) Create a workspace in e² studio.

Launch e² studio and create a new workspace.

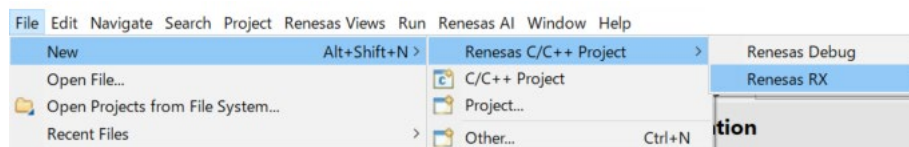
Keep the names of the workspace and the project files as short as possible. If the full path to the files at the lowest level of the directory structure exceeds 256 bytes, an error will occur when you build the project.

Errors may also occur if the file path contains Japanese characters, so make sure the name you enter contains only alphanumeric characters.

Example: Creating a workspace in location **C:\workspace**



After launching e² studio, from the **File** menu select **New > Renesas C/C++ Project > Renesas RX** to display the **New C/C++ Project** dialog box.

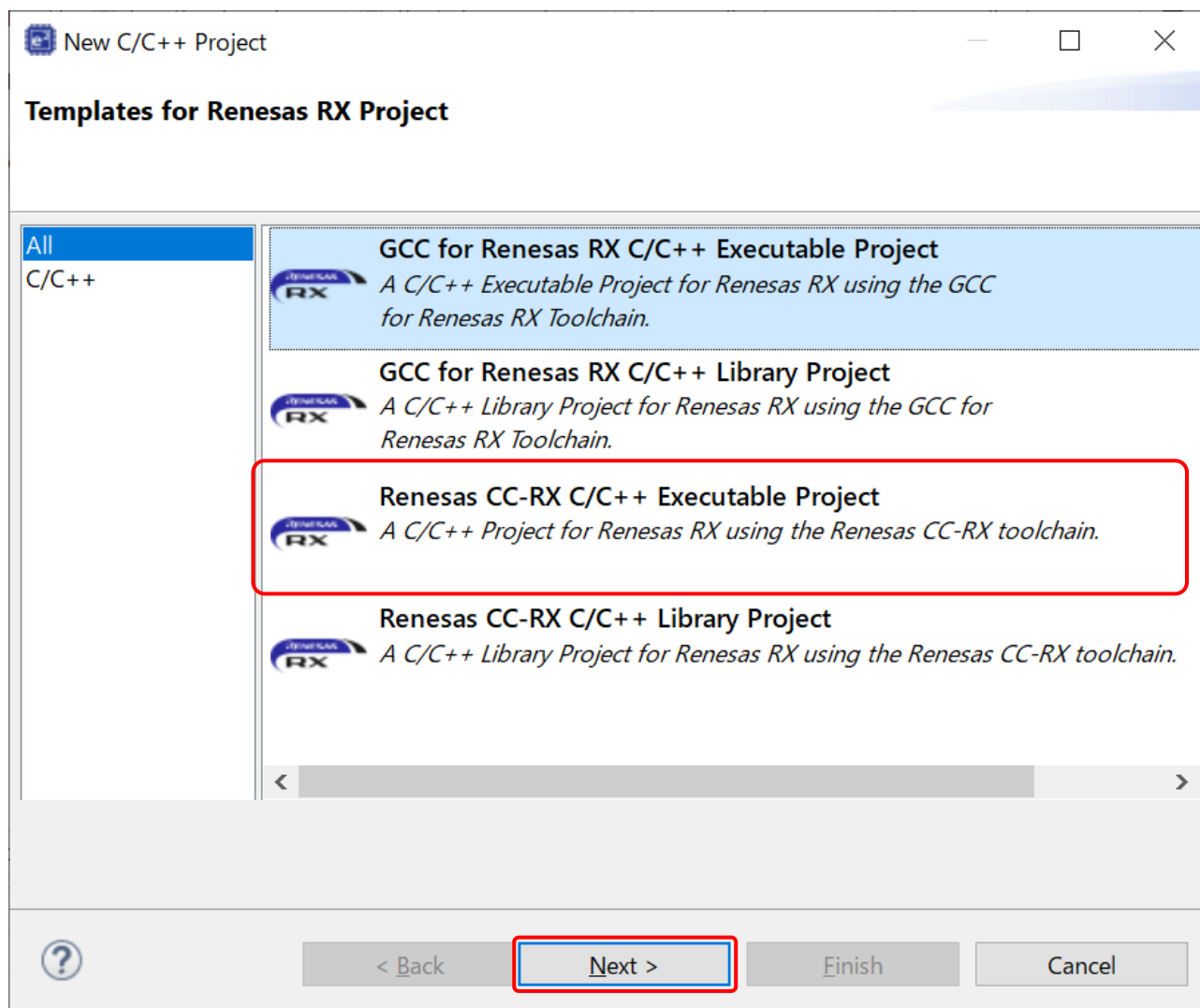


RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

In the **New C/C++ Project** dialog box, select the type of project to be created. In this case, select **All**, then select **Renesas CC-RX C/C++ Executable Project** and click the **Next** button.

Selecting the project type opens the **New Renesas CC-RX Executable Project** dialog box.

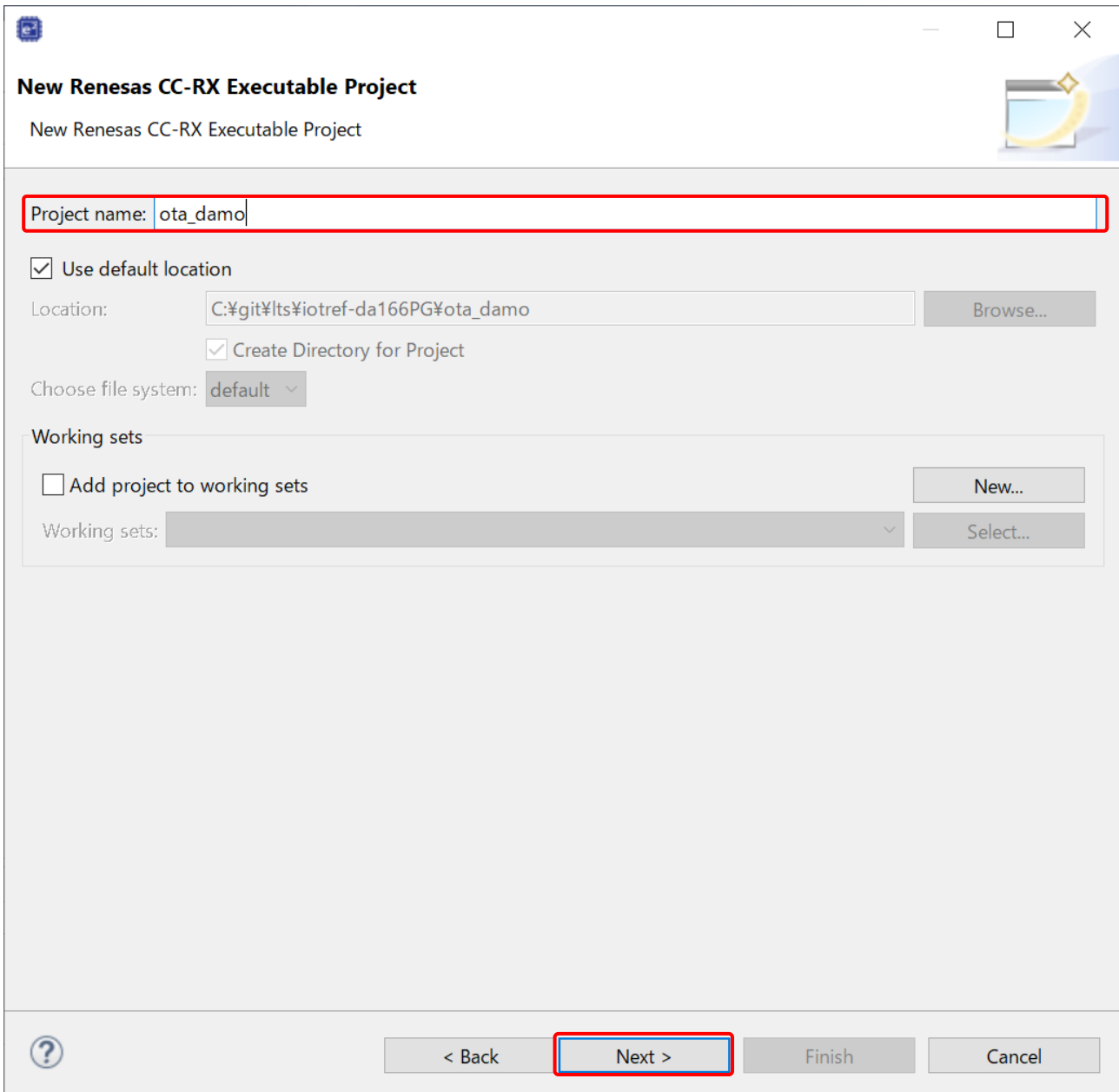
To use GCC, select **GCC for Renesas RX C/C++ Executable Project** as the project type.



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(2) Create the OTA sample project.

Here you will specify the project name. Enter **ota_demo** as the project name and click the **Next** button. The **Select toolchain, device & debug settings** dialog box opens.



New Renesas CC-RX Executable Project

New Renesas CC-RX Executable Project

Project name:

☒ Use default location

Location:

☒ Create Directory for Project

Choose file system:

Working sets

☐ Add project to working sets

Working sets:

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

Configure the toolchain, device, and debug settings to use for the project.

The setting for **Toolchain** is pre-selected based on the type of project. To change the toolchain version, select the version of your choice from the drop-down list next to **Toolchain Version**.

For RTOS, select **Free RTOS (with IoT libraries)**, and for **RTOS Version** select **202210.01-LTS-rx-1.2.1**. If you are running e² studio for the first time or if the desired version does not appear in the list, click **Manage RTOS Versions...** to display the **RTOS Module Download** dialog box, check the box next to the desired version, and click the **Download** button to download it.

For **Target Board**, select **CK-RX65N**. (The setting for **Target Device** is selected automatically.)

For **Bank Mode**, select **Dual Bank**. To implement OTA, it is necessary to select the dual bank mode setting in which the code flash memory of the device is treated as two banks.

After all the settings have been configured, click the **Next** button.

New Renesas CC-RX Executable Project

Select toolchain, device & debug settings

Toolchain Settings

Language: ☒ C ☐ C++

Toolchain: Renesas CC-RX

Toolchain Version: v3.05.00

[Manage Toolchains...](#)

RTOS: FreeRTOS (with IoT libraries)

RTOS Version: 202210.01-LTS-rx-1.2.1

[Manage RTOS Versions...](#)

Device Settings

Target Board: CK-RX65N

Target Device: R5F565NEHxFB

[Unlock Devices...](#)

Endian: Little

Bank Mode: Dual Bank

Configurations

☒ Create Hardware Debug Configuration

E2 Lite (RX)

☐ Create Debug Configuration

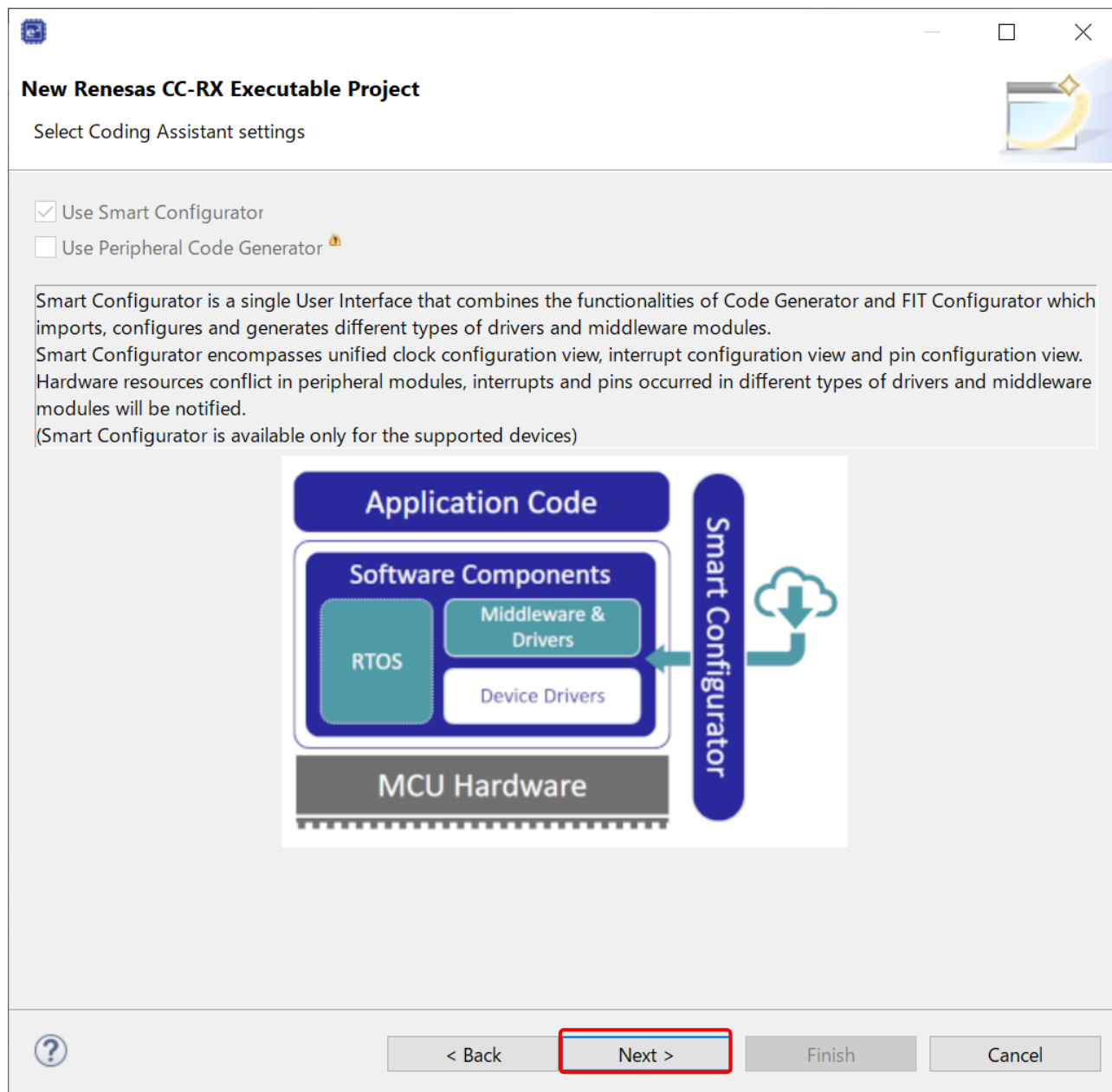
RX Simulator

☐ Create Release Configuration

[?](#) < Back **Next >** Finish Cancel

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

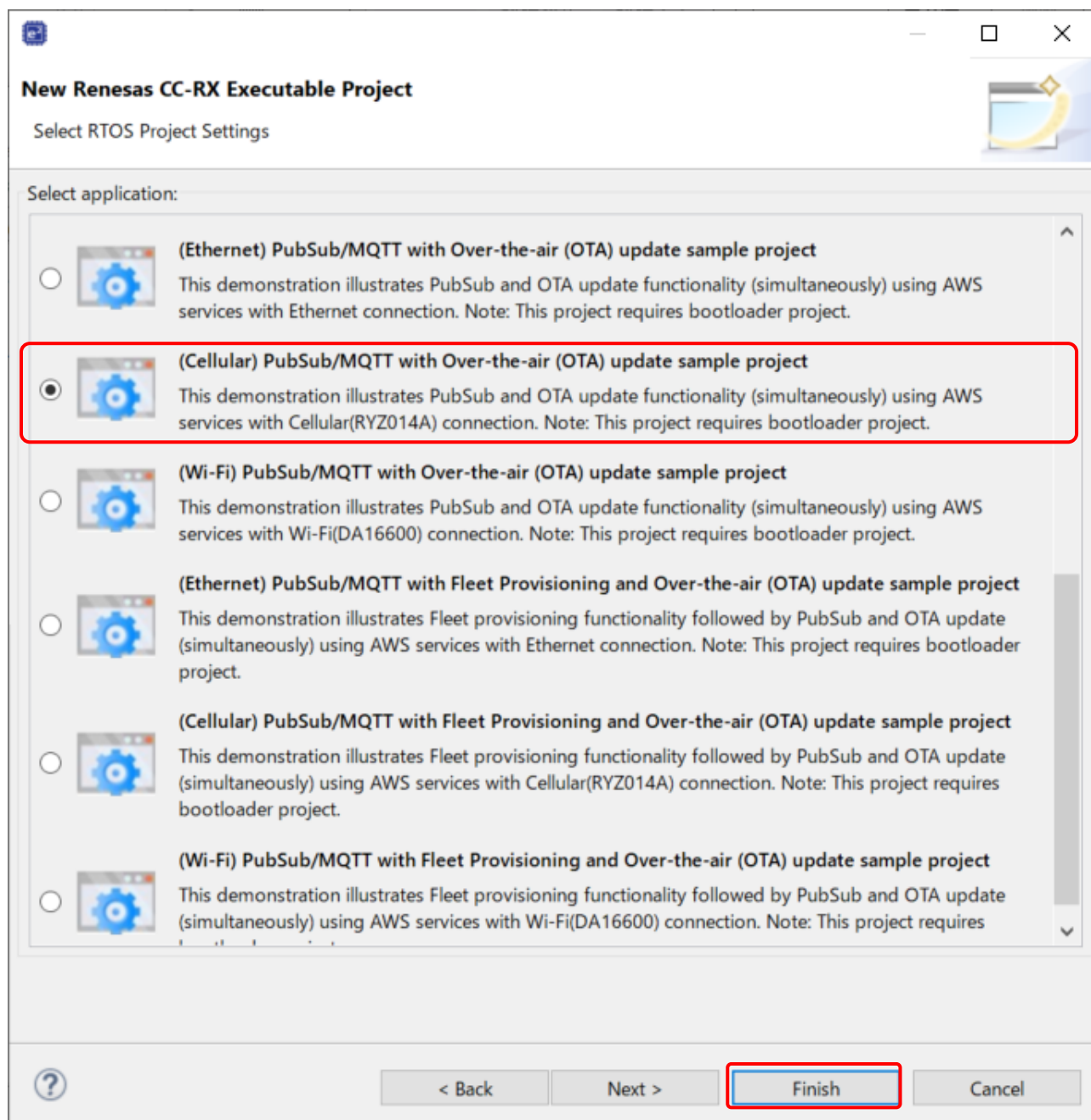
When the **Select Coding Assistant settings** dialog box appears, click the **Next** button without changing any settings.



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

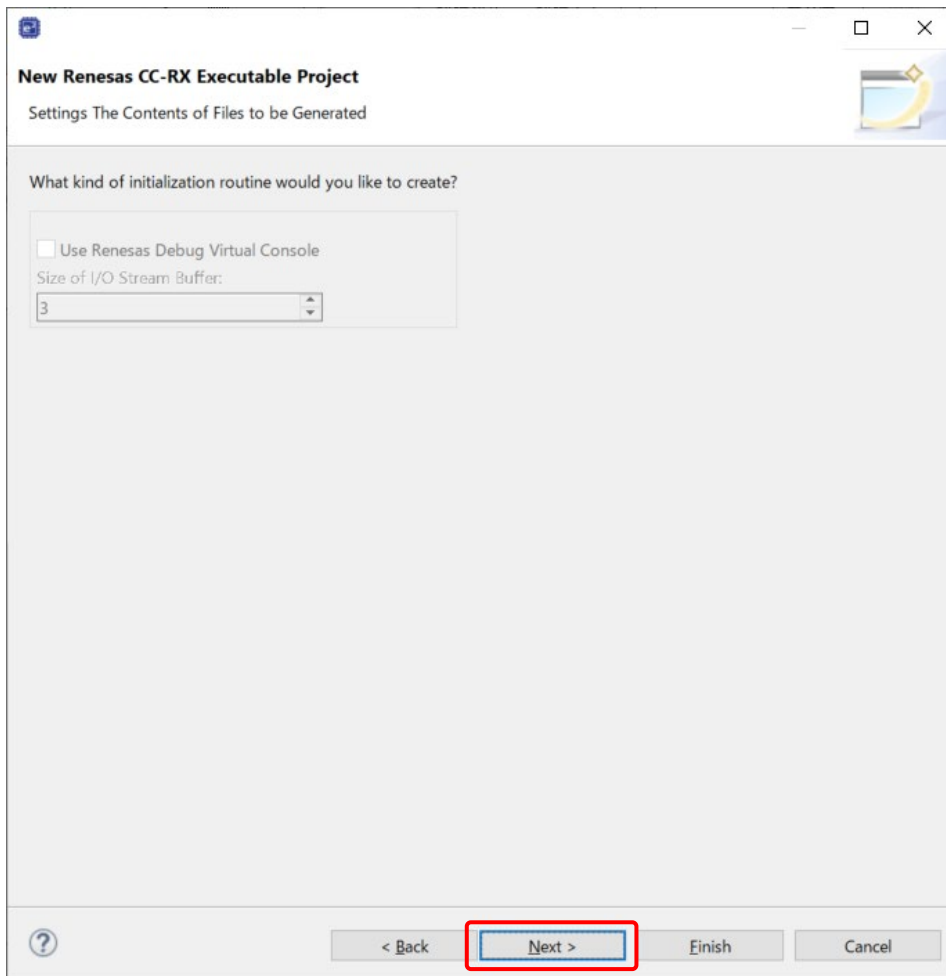
A list of sample projects is displayed in the **Select RTOS Project Settings** dialog box.

Use the scroll bar to scroll down the list, select **(Cellular) PubSub/MQTT with Over-the-air (OTA) update sample project**, and click the **Next** button.



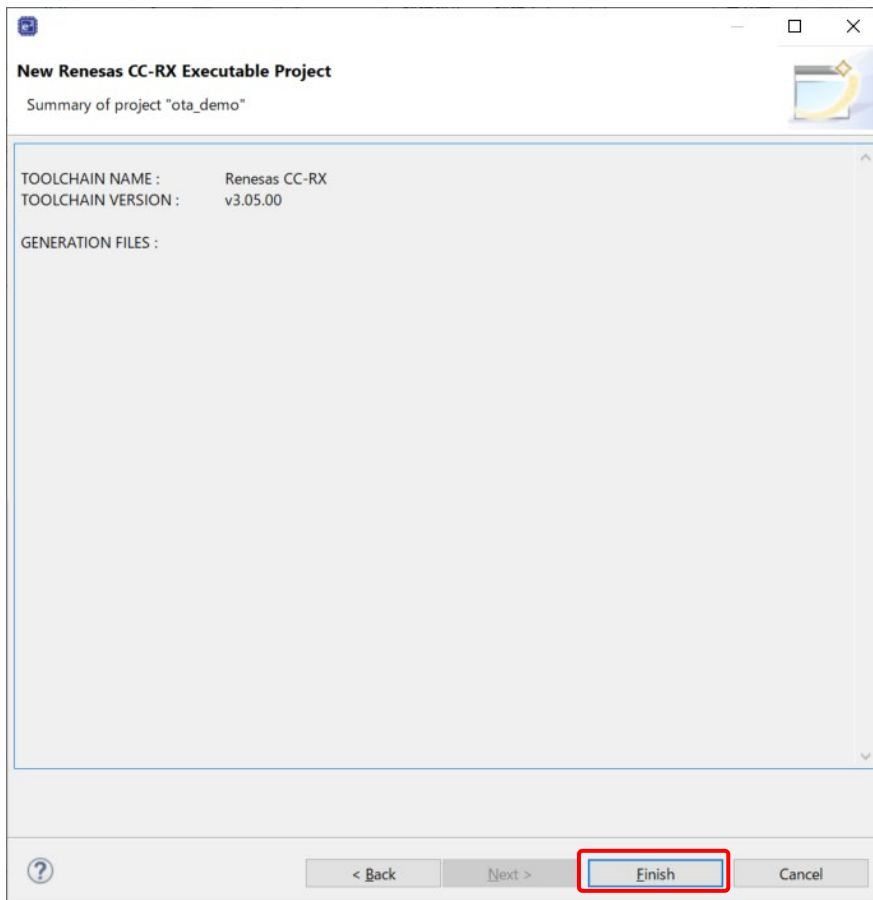
RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

When the **Settings The Contents of Files to be Generated** dialog box appears, click the **Next** button without changing any settings.

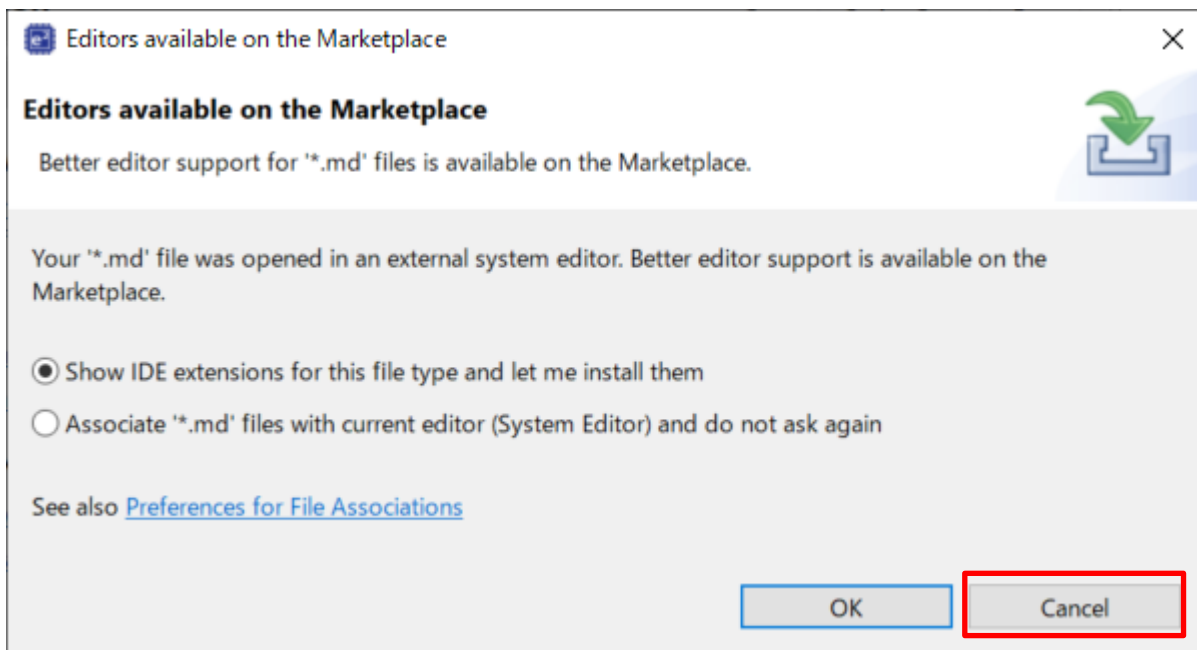


RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

A dialog box appears indicating that the project has been created. If everything appears to be in order, click the **Finish** button.



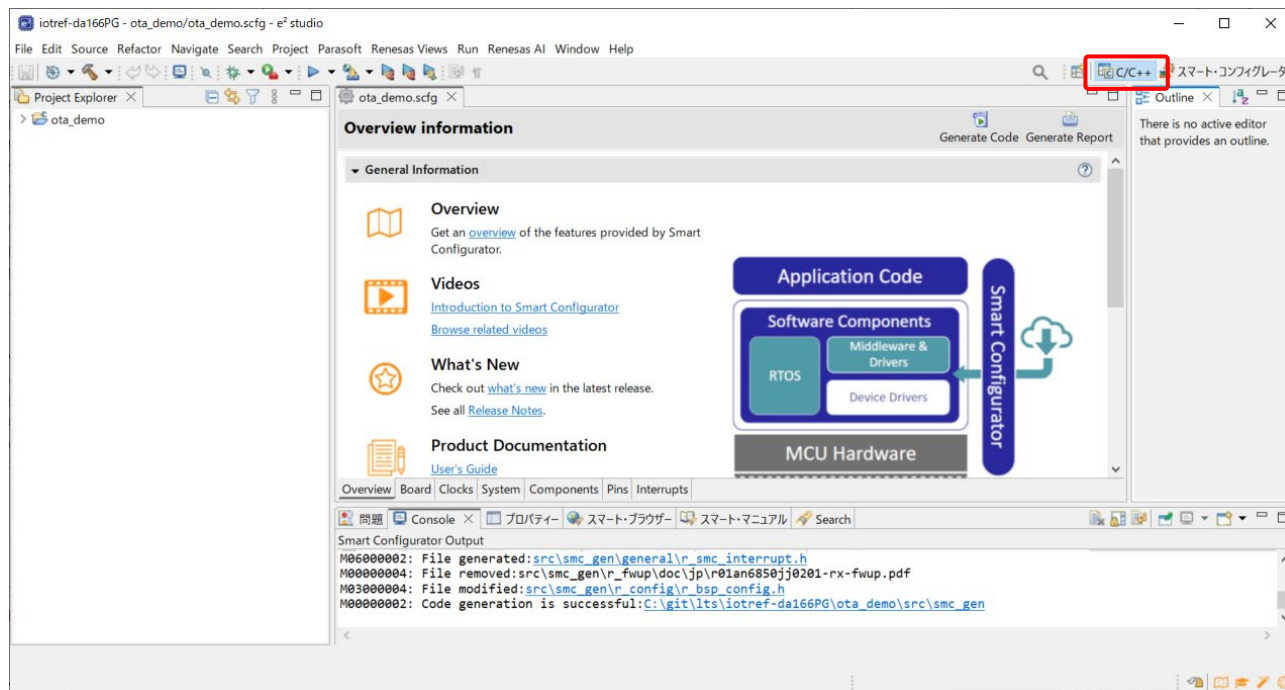
When the **Editors available on the Marketplace** dialog box appears, click the **Cancel** button to close it.



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

This completes the procedure for creating the project in e² studio.

If Project Explorer is not visible, click the button for the **C/C++** perspective in the upper right corner of the window, then select **Window > Show View > Project Explorer**.



In the discussion that follows, replace the project name **aws_ryz014a_ck_rx65n** with **ota_demo** as appropriate.

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(3) Create the Secure Bootloader sample project.

Create the Secure Bootloader sample project in the same manner as the OTA sample project. The procedure involved is basically the same as that used to create the OTA sample project.

Enter **bootloader** as the project name.

New Renesas CC-RX Executable Project

New Renesas CC-RX Executable Project

Project name:

☒ Use default location

Location:

☒ Create Directory for Project

Choose file system:

Working sets

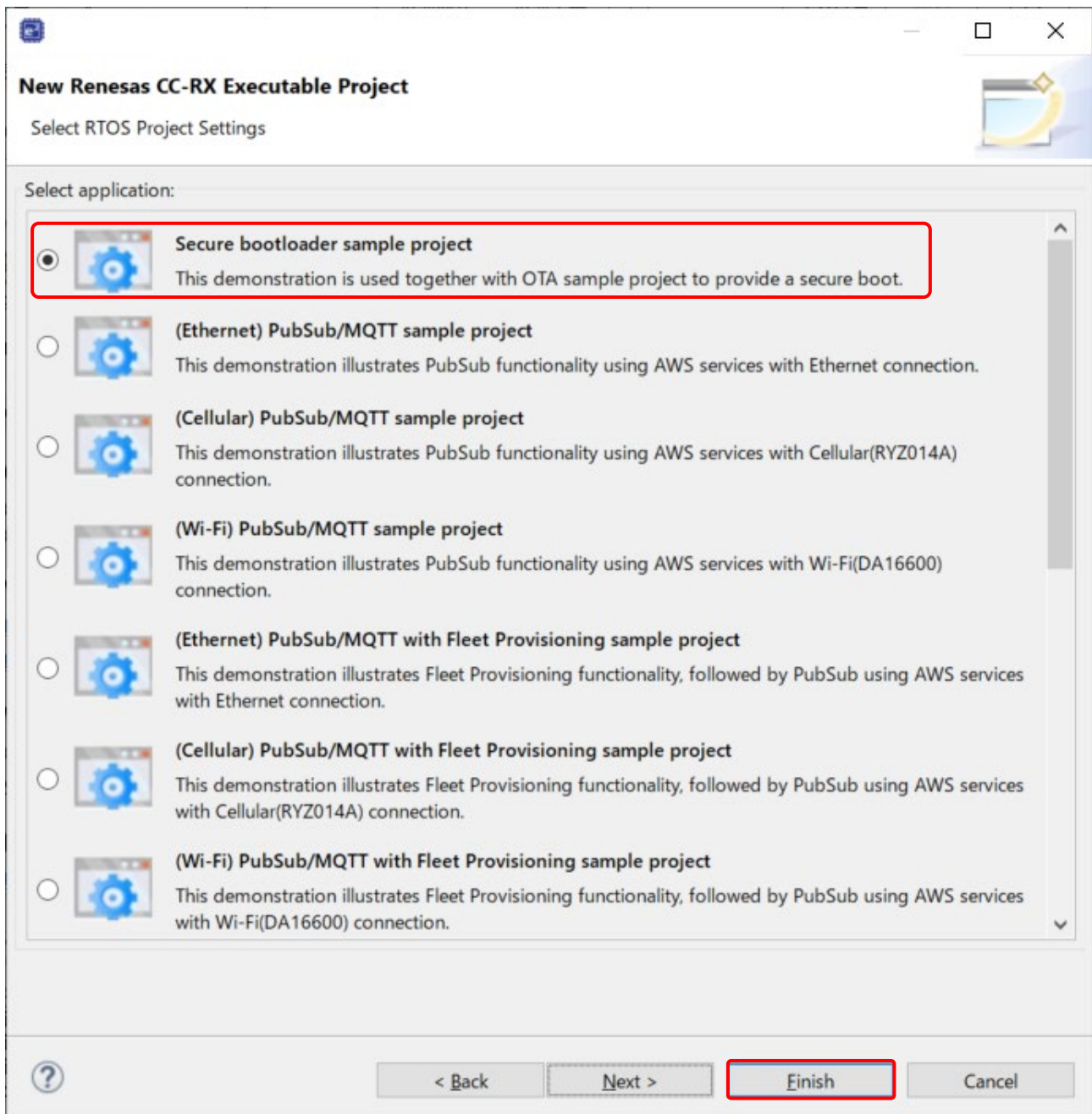
☐ Add project to working sets

Working sets:

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

Next, select **Secure bootloader sample project** in the **Select RTOS Project Settings** dialog box.

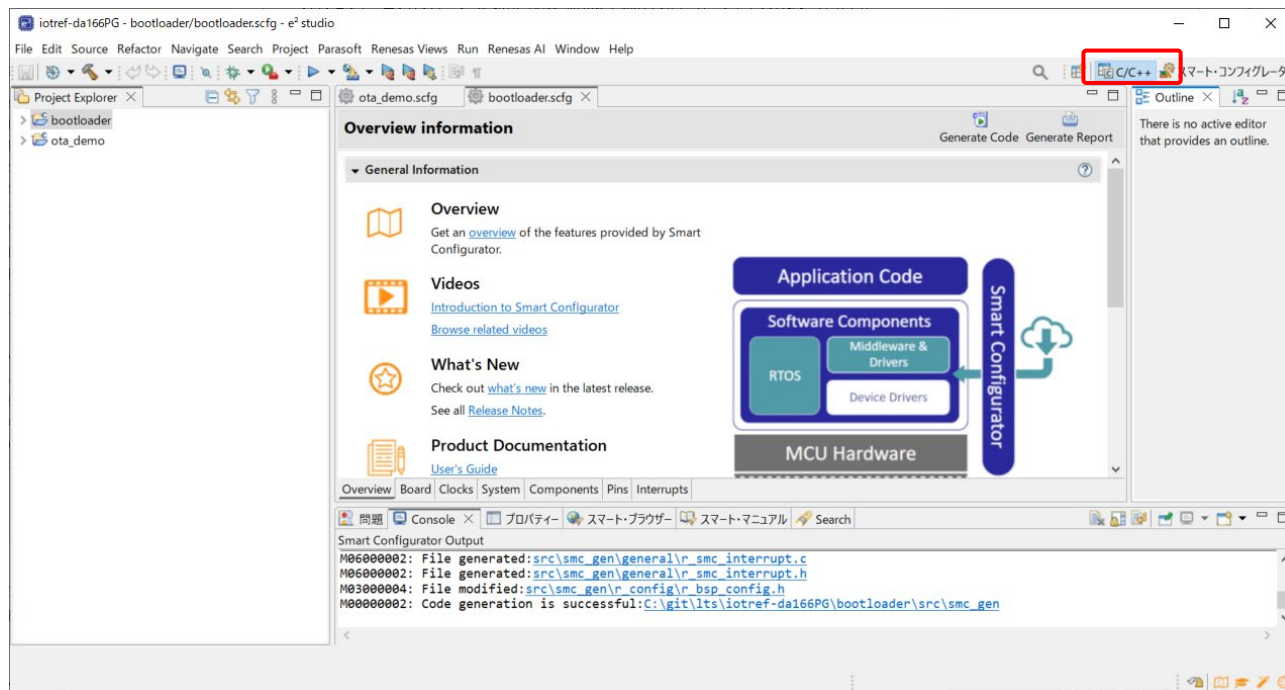
The other settings are the same as those used when creating the OTA sample project.



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

The projects appear in e² studio as shown below.

If Project Explorer is not visible, click the button for the **C/C++** perspective in the upper right corner of the window, then select **Window > Show View > Project Explorer**.

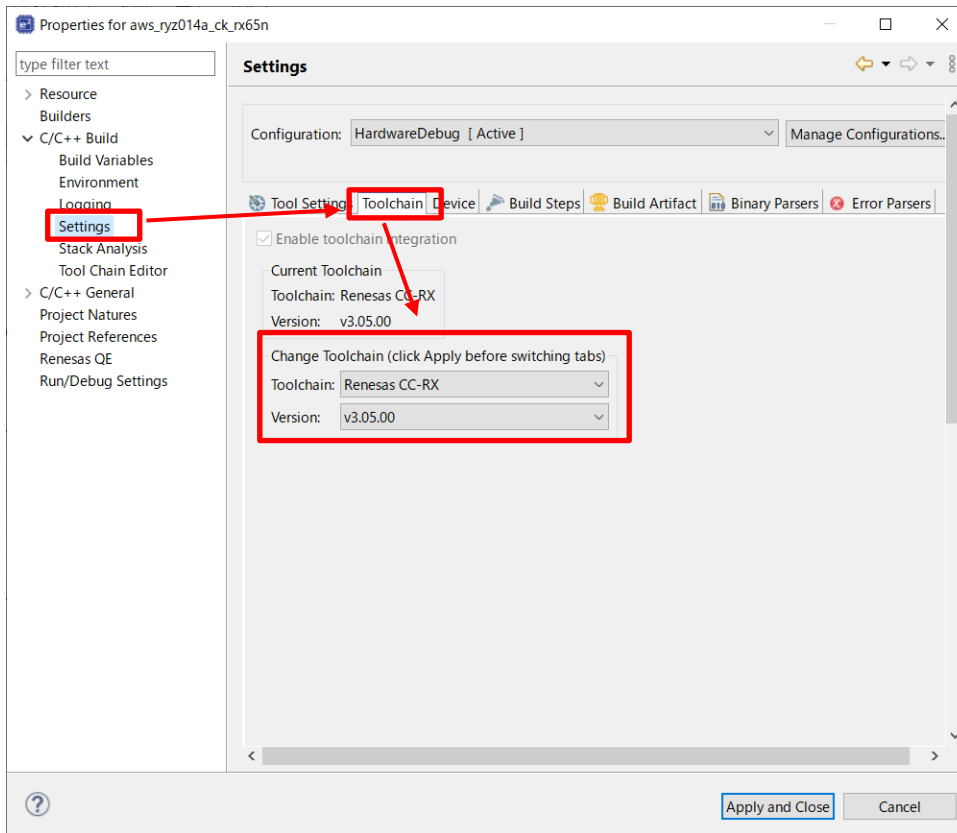


In the discussion that follows, replace the project name **boot_loader_ck_rx65n** with **bootloader** as appropriate.

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

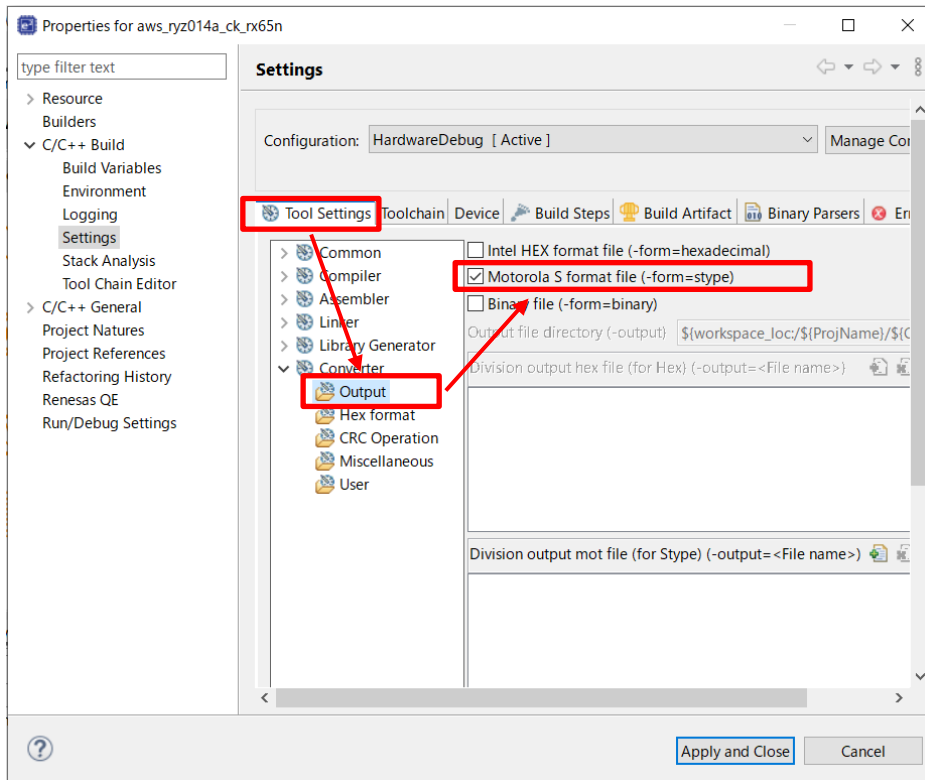
4.2.2 Checking the Project Environment Settings

- (1) For both projects, from the **Projects** menu, select **Properties**, expand the **C/C++ Build** menu, and click **Settings**. On the **Toolchain** tab, confirm that the toolchain is **Renesas CC-RX**.



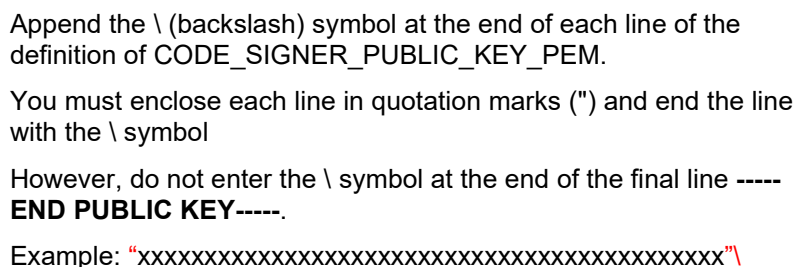
RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

- (2) For both projects, select the **Tool Settings** tab, expand the **Converter** menu, select **Output**, and confirm that the box next to **Motorola S format file** is checked.



4.2.3 Setting Up Projects

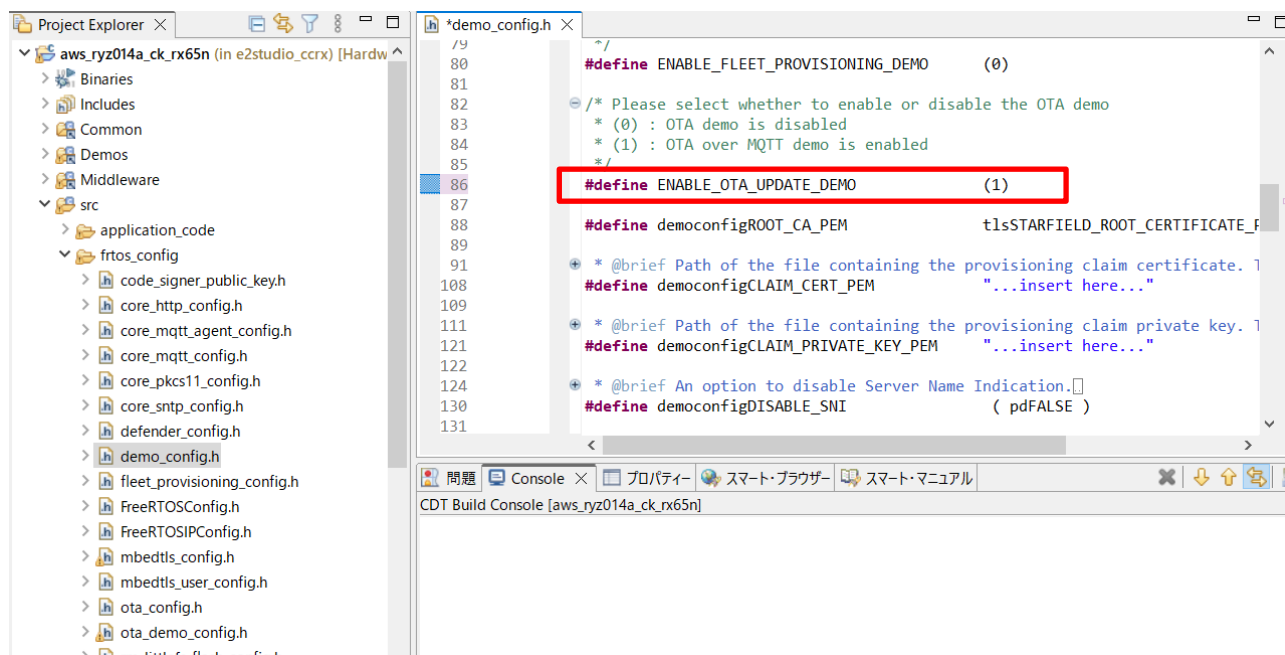
- Copy the contents of the `secp256r1.publickey` file you created in 4.1(8), and paste the value into the definition of `CODE_SIGNENR_PUBLIC_KEY_PEM` in boot loader `ck rx65n\src\key\code signer public key.h`.



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

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

Set `ENABLE_OTA_UPDATE_DEMO` to 1 (Enable) in `aws_ryz014a_ck_rx65n\src\frtos_conf\demo_config.h`. (The default is 0)

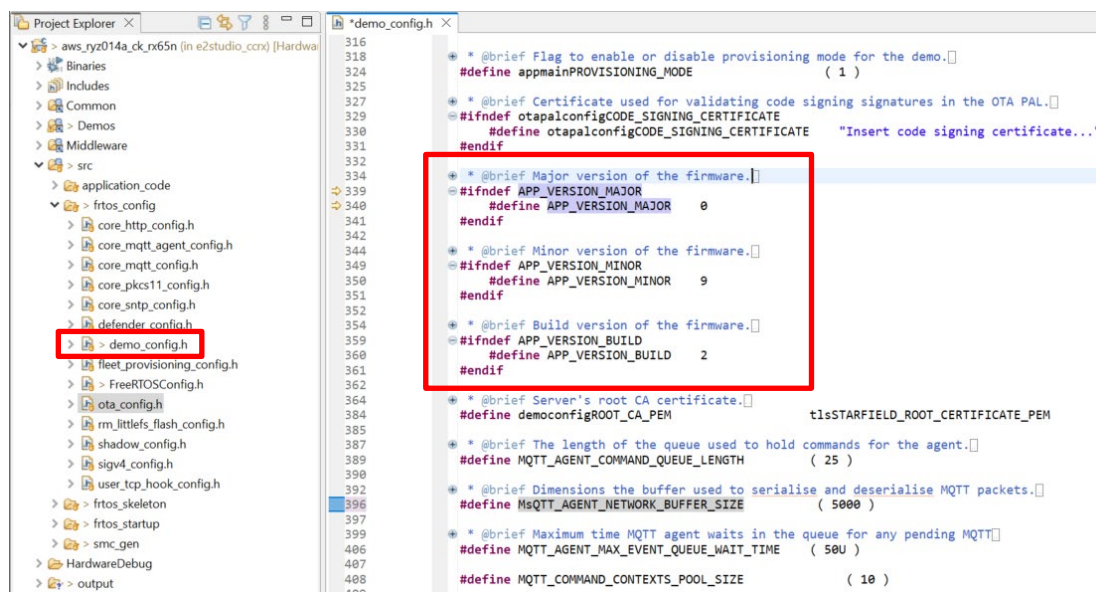


RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(3) Confirm that the initial project version is 0.92.

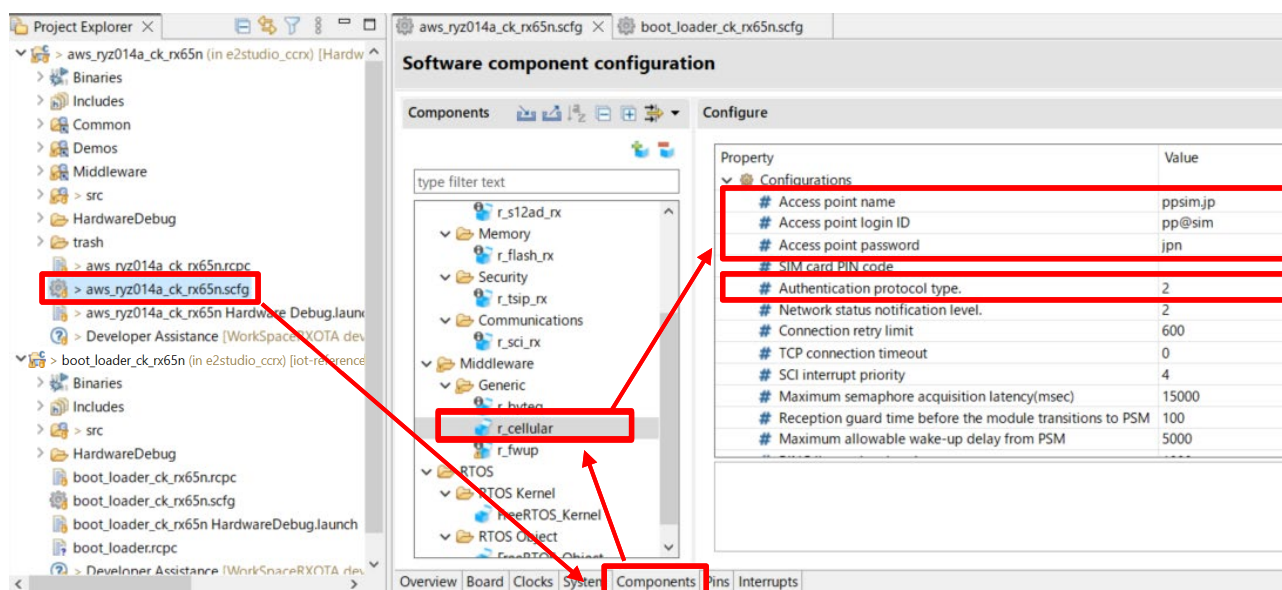
Confirm that the version definitions in `aws_ryz014a_ck_rx65n\src\rtos_config\demo_config.h` are as follows:

- APP_VERSION_MAJOR 0
- APP_VERSION_MINOR 9
- APP_VERSION_BUILD 2



(4) Configure the RYZ014A Cellular Module Control FIT module (`r_cellular`).

Open the file `aws_ryz014a_ck_rx65n.scfg`, and click the **Components** tab. For the `r_cellular` component, set **Access point name**, **Access point login ID**, **Access point password**, and **Authentication protocol type** according to your SIM card.



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

To use the SIM card supplied with the CK-RX65N kit, activate the SIM card by following the procedure in 4.1.5 *Activating SIM card* in the following application note:

[SIM activation, Creating the trial account and using Dashboard with RYZ014A or Ethernet Application for AWS - Getting Started Guide \(R01QS0064\)](#)

Note: About the setting of Wi-Fi network with DA16600 module, please refer to the [GitHub 「Settings of Wi-Fi network \(Only using Wi-Fi\)」](#). And regarding setting of country code and GMT timezone, please refer to the [Settings of Country code and GMT timezone \(Only using Wi-Fi\)](#) as needed.

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

4.2.4 Creating the Initial Firmware

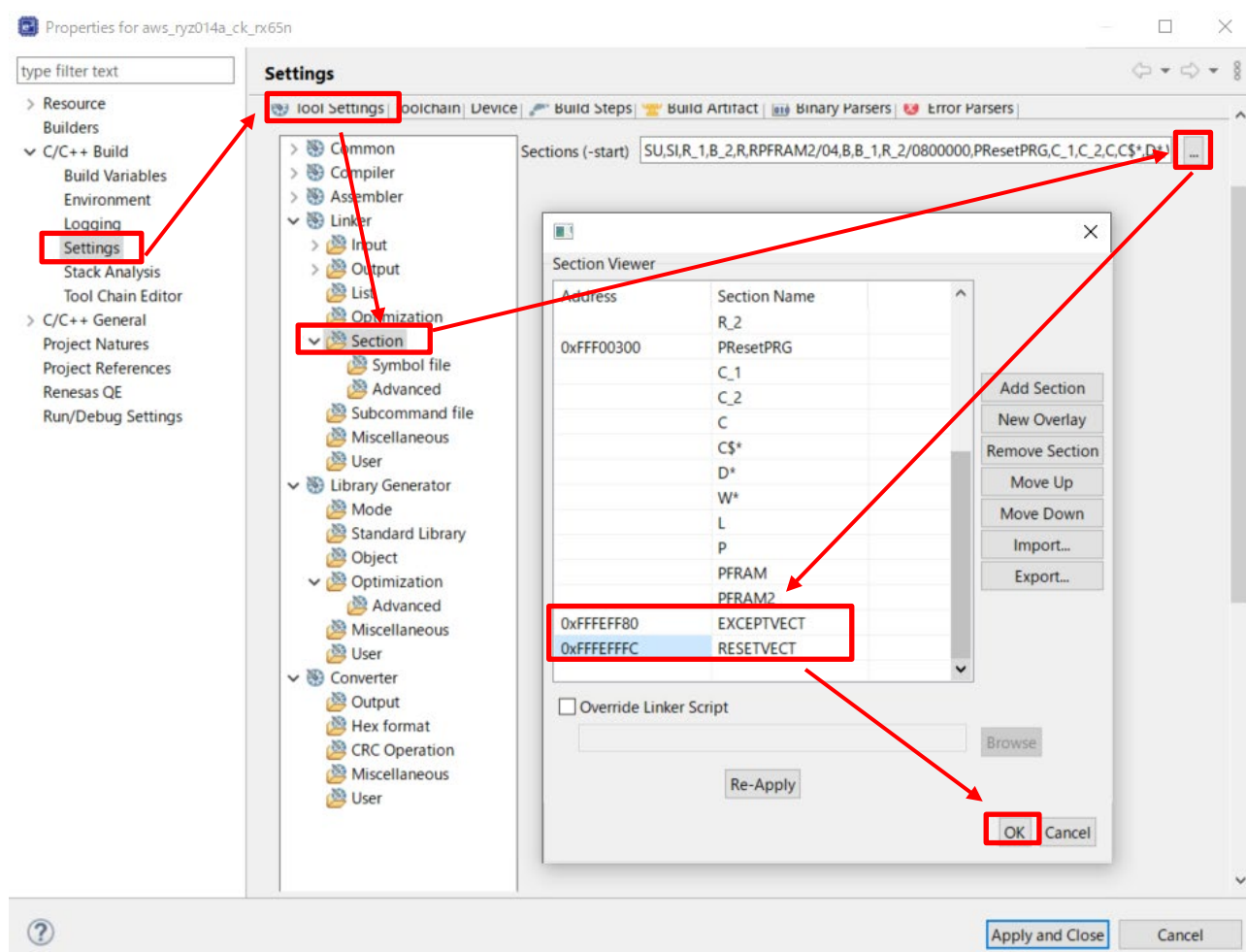
The following explains how to create the initial firmware that combines the boot loader (boot_loader_ck_rx65n) and the firmware (aws_ryz014a_ck_rx65n).

- (1) Change the firmware (aws_ryz014a_ck_rx65n) vector and build the firmware.

Open the aws_ryz014a_ck_rx65n project, and select **Project** and then **Properties**.

Expand the **C/C++ Build** menu, and click **Settings**. In the menu tree on the **Tool Settings** tab, expand the **Linker** menu and click **Section**, and open the Section Viewer. Allocate EXCEPTVECT to 0xFFFFE080 and RESETVECT to 0xFFFFE0FC.

After this, build the aws_ryz014a_ck_rx65n project to create the firmware.



- (2) Create the bootloader (boot_loader_ck_rx65n).

Build the boot_loader_ck_rx65n project to create the bootloader.

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

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

Place the following files in the Renesas Image Generator folder:

- The results of the build process in 4.2.4(1): aws_ryz014a_ck_rx65n.mot
- The results of the build process in 4.2.4(2): boot_loader_ck_rx65n .mot
- The private key created in 4.1(7): secp256r1.privatekey

Open a command prompt, navigate to the Renesas Image Generator folder, and execute the following command to generate the file userprog.mot.

```
python image-gen.py -iup aws_ryz014a_ck_rx65n.mot -ip RX65N_DualBank_ImageGenerator_PRM.csv -o userprog -ibp boot_loader_ck_rx65n.mot -key secp256r1.privatekey -vt ecdsa -ff RTOS
```

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

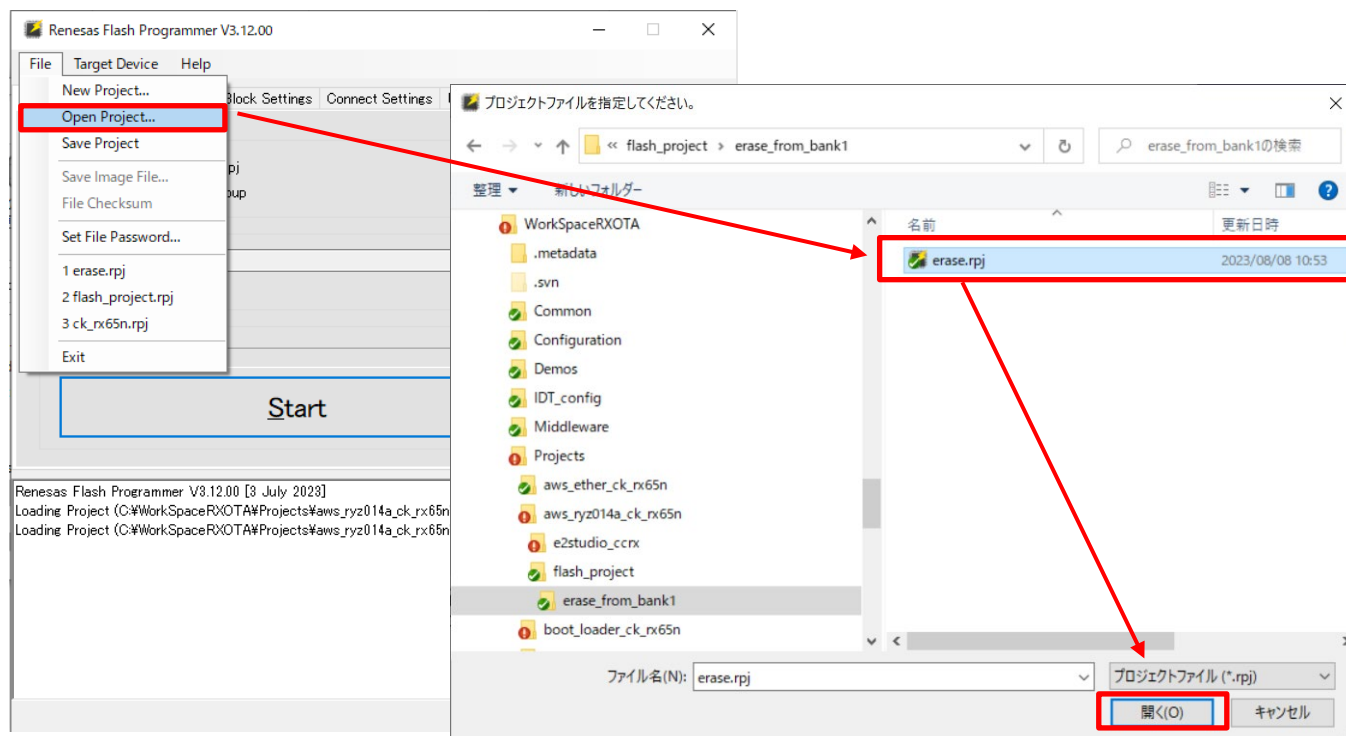
Access the [download site](#) of the flash programming tool, and download and install **Renesas Flash Programmer V3.11.02 Windows**.

- (5) Follow the instructions in 2.5, Connecting the CK-RX65N, to connect the PC to the CK-RX65N.

- (6) Launch Renesas Flash Programmer, and open the erase.rpj project.

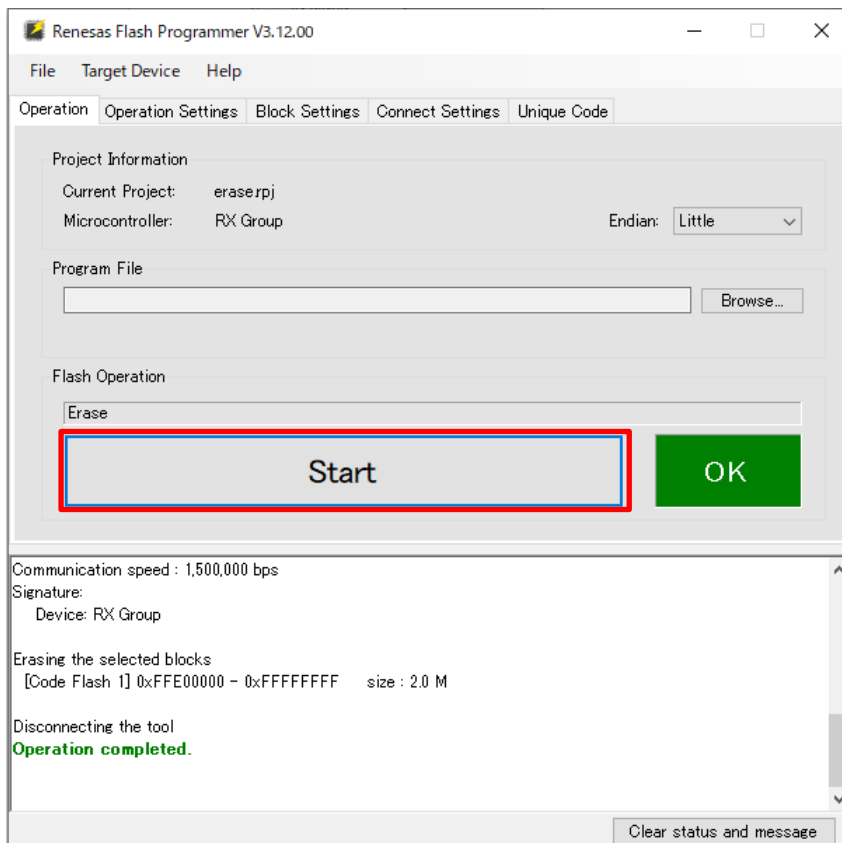
The erase.rpj project can be found either in a subfolder of the sample program or in a subfolder of FreeRTOS, which you downloaded when creating a new project.

\\Projects\\aws_ryz014a_ck_rx65n\\flash_project\\erase_from_bank1



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(7) Click **Start** to erase the device.



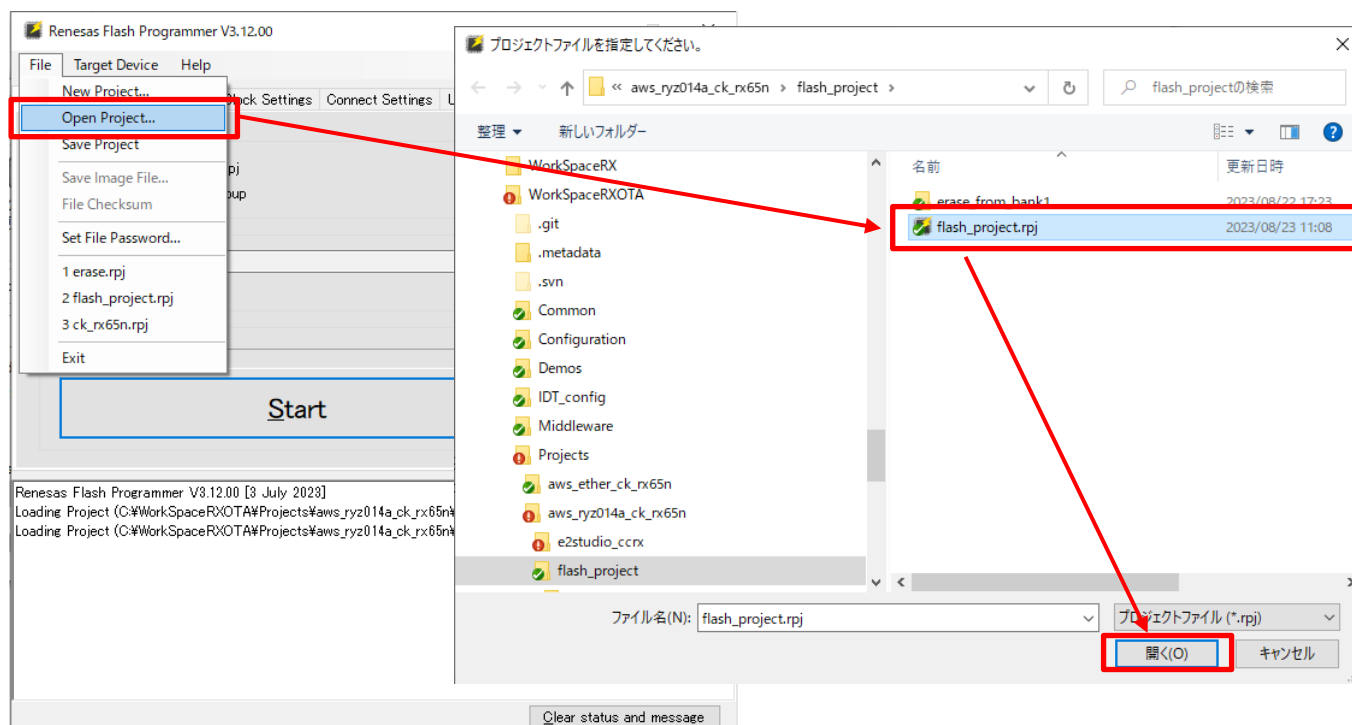
If the message **Error (E3000107): Device connection information does not match** is output, proceed with step (8).

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

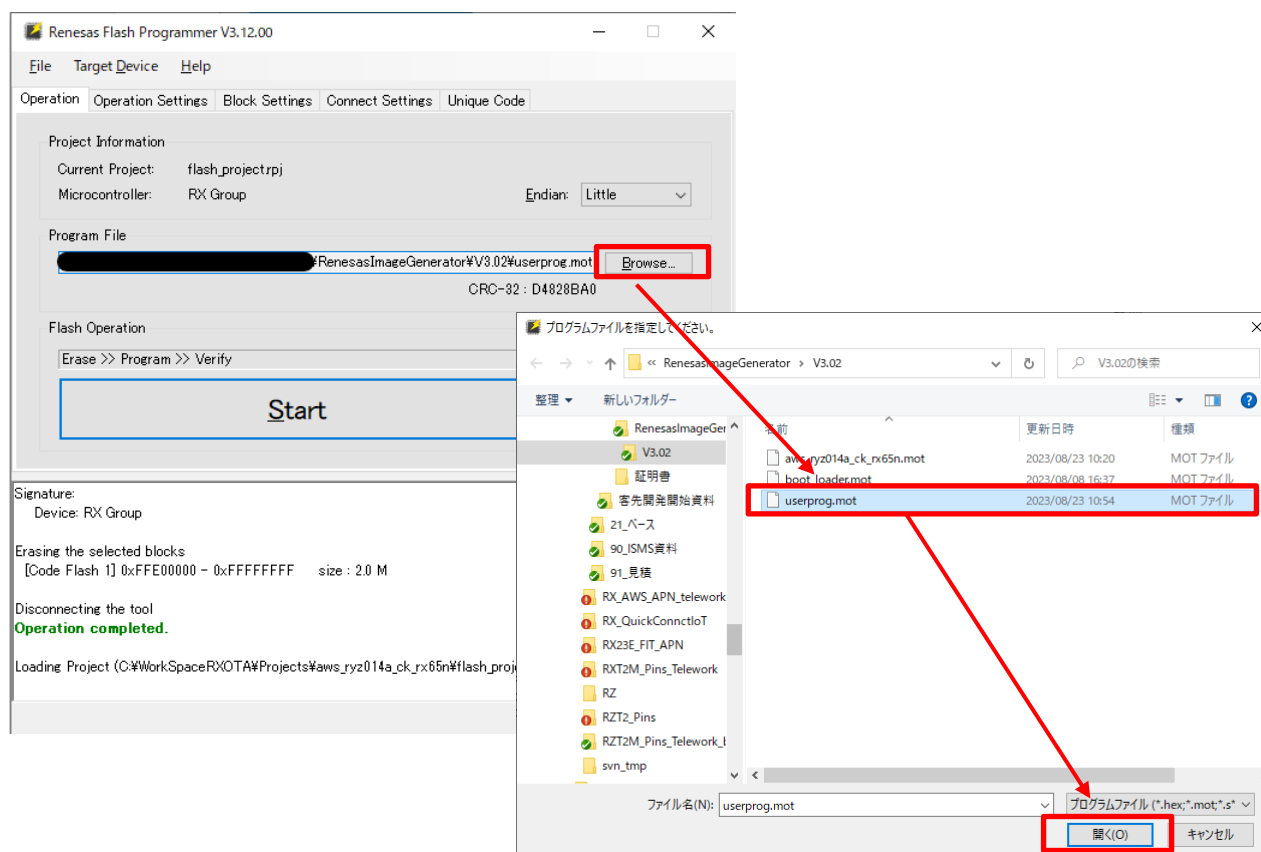
(8) Open the flash_project.rpj project.

The flash_project.rpj project can be found either in a subfolder of the sample program or in a subfolder of FreeRTOS, which you downloaded when creating a new project.

\\Projects\\aws_ryz014a_ck_rx65n\\flash_project\\

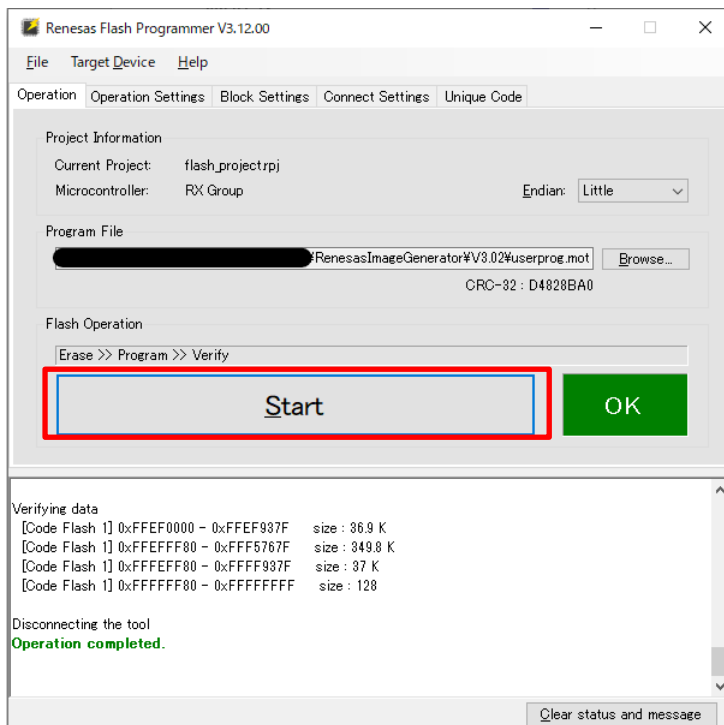


(9) Select the initial firmware (userprog.mot) created in 4.2.4(2).



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(10) Write the firmware.

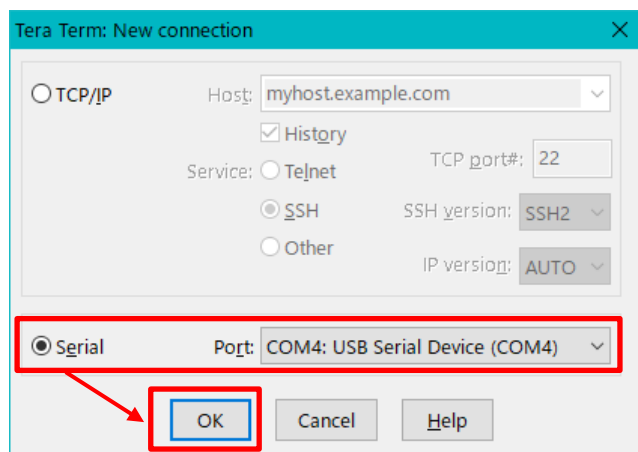


RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

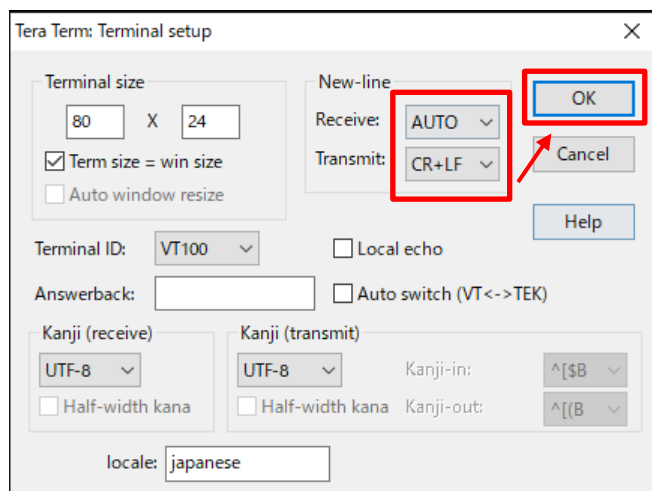
4.2.5 Registering AWS IoT Information

The following explains how to set AWS IoT information in Tera Term by running the aws_ryz014a_ck_rx65n project. The information set by this process is written to data flash memory.

- (1) Open Tera Term, and from the **File** menu, select **New Connection**. In the dialog box that appears, select **Serial** and then click **OK**.

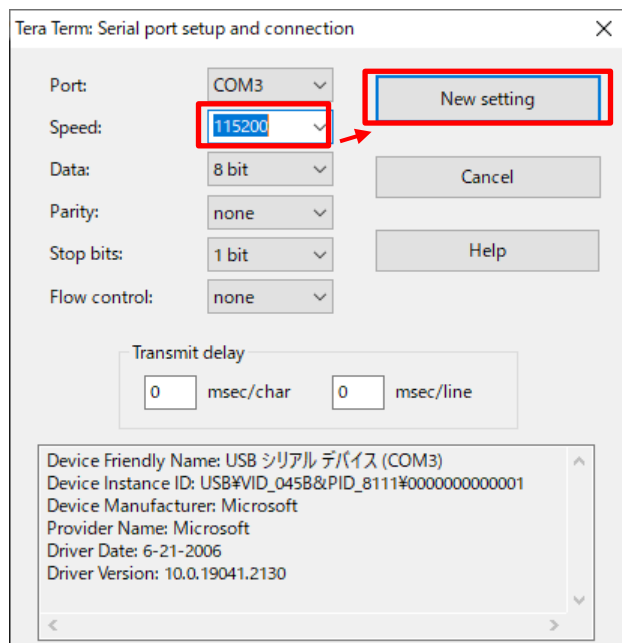


- (2) From the **Setup** menu, select **Terminal**. In the **New-line** area of the dialog box that appears, select **AUTO** for **Receive** and **CR+LF** for **Transmit**.

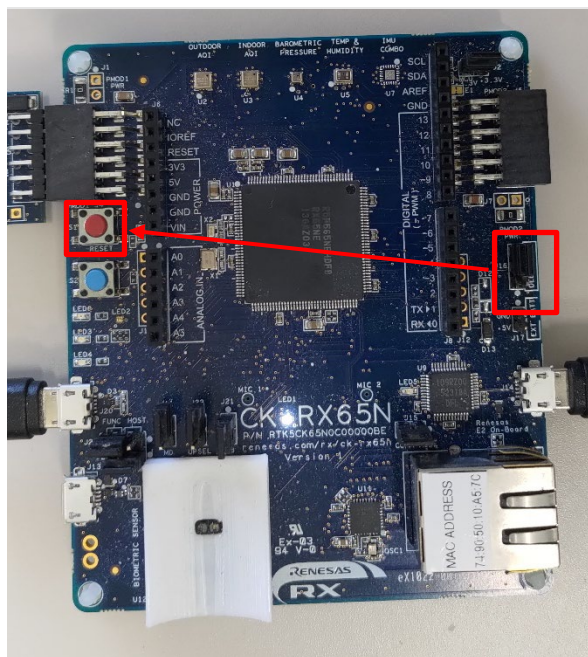


RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

- (3) From the **Setup** menu, select **Serial port**. In the dialog box that appears, set **Speed** to 115200 and then click **New setting**.



- (4) Move the jumper on J16 of the CK-RX65N board to the RUN setting, and then press the RESET switch.



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(5) Enter CLI and press the **Enter** key within 10 seconds of the menu appearing in the Tera Term window.

```
==== RX65N : BootLoader [dual bank] ====
verify install area 0 [sig-sha256-ecdsa]...OK
execute new 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 'commi
        t' 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 !
```

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(6) Register the certificate you downloaded in 3.3.2(6).

Enter conf set cert in Tera Term, and then drag and drop the certificate file (xxxx-certificate.pem.crt) to the Tera Term window to send the file. Finally, press **Enter** in the Tera Term window.

Enter conf set cert, drag and drop the certificate file to the Tera Term window, and then press Enter.

The screenshot shows a Windows File Explorer window with the path `This PC > Local Disk (C:) > openssl > Cert`. It lists three files: `ec1-certificate.pem.crt` (Security Certificate, 2 KB), `ec1-private.pem.key` (KEY File, 2 KB), and `ec1-public.pem.key` (KEY File, 1 KB). The file `ec1-certificate.pem.crt` is highlighted with a red box.

The Tera Term window shows the command `>conf set cert -----BEGIN CERTIFICATE-----` followed by a long base64-encoded certificate string, and `-----END CERTIFICATE-----`. The command is highlighted with a red box.

The 'Tera Term: File Drag and Drop' dialog box is open, showing the file `ec1-certificate.pem.crt` being dragged. The dialog asks 'Are you sure that you want to send the file content?' and offers two options:
- ☒ Send File (Paste content of file)
- ☐ Paste Filename
The 'Send File' option is selected and highlighted with a red box. Below it, there are checkboxes for 'Binary', 'Escape', 'Separator is Space', and 'Separator is NewLine'. At the bottom, there are checkboxes for 'Do this for the next 0 files', 'Do same process, next drop', and 'Do not display this dialog, next drop'. The 'OK' button is highlighted with a red box.

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(7) Register the private key you downloaded in 3.3.2(6).

Enter conf set key in Tera Term, and then drag and drop the private key file (xxxx- private.pem.key) to the Tera Term window to send the file. Finally, press **Enter** in the Tera Term window.

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

File Explorer window showing the selection of the private key file:

| Name | Date modified | Type | Size |
|-------------------------|-------------------|----------------------|------|
| ec1-certificate.pem.crt | 8/7/2023 12:09 PM | Security Certificate | 2 KB |
| ec1-private.pem.key | 8/7/2023 12:09 PM | KEY File | 2 KB |
| ec1-public.pem.key | 8/7/2023 12:09 PM | KEY File | 1 KB |

Tera Term window showing the command to set the key:

```
>conf set key -----BEGIN RSA PRIVATE KEY-----
MIIEpAIBAAKCAQEA1nT60e3u4T1RRdyjBu8PaEchuaXtzkoFJGM25fD8/Z
M5VuCPH9F7P1fn8d20GlvswmXwScWAcyng40I/nCdE1aPpCBLKr6i8ivJ9
wi1Wkh1Ho91g4UpeXkAWrDxj0FI6vvBUx32k/8IBmcu1I1HbA+07H1g5q
FIq1th0QDeL4Y0AB3W0nv4Nbpj0uAxeMfPm9T61Mb1aJq1uRoGRM6BoC10
XUVmeJ3out6MJxGdTpjLnwYooBE3Mm88h+SqHNHogCne1bii0wrVprCAZh
G9vM4xctSA5GuLji1EktBAvrNnWRjpnqSwfFGsQIDAQABAAIBAEFK0kZx62
rE7jH8y+w10hQZqp3JDsh/1P9qZ76mVUwWDTIPImQskhgB+AM1Xb+PcmDp
dn+s6CRRDUv9dPIRY5Km56sBSZqW/uvjsza+zCJmObaBIwrUapDfCGG17S
pmYr2bPLVLUmWv8s1JyphJULWvHVX478WYE8QvIzyKm8iyaCU8Fh7fHFN1
lnhkUZh49nwEgtQgEA7tfvRDGYE84j+RVWjdHmptxRpAKEo/KYnT7s1s5X
oNOB9VVU1mw8VoVewC6B19F1cT6v8bSWy1Cv6jviH360y4VCj1ZXmsQDCo
scSLP0ECgYEA/C2Z19PNu9ZHV+/uvEdK90tCNaG0nc9Q3IL+G3rsp5ztaZ
tMhMQ3zQkfW8sFTwFQLascUdWln+zG5MDjY2sMHEaNAwNGAg+FPzr1igRI
LDbqnGp0vEmCTbAo2b202Be6yxcX2P1swcMjQC1tRaV3Lx1BMCyC9akCgY
f0pWf6J+tPRA3ukKgx0vJLkVWAAtVqoRxxUVL8JiQPNGnD5qvHzBe/THvdx
26EhQfePFdh2yYyCiXnL6DgV2IDENEuzsB06Q0tEZTg6w6HUWSBWeEgN+xQ
watCKDuomkakUJIfJWcPQKS5Sap5UcAoA0AjgXckCgYEAyb1QTGsY/1CA8U
1jT6WXxkYOIdhMckDUdfVxSotP0xKZJwLvqRLHrBVbVARhwk94comdS+716w86R
+CxVwz68bjsi1EKxHPPK0IDKowS6GwN076Fe0pDNoHAM06g+hS7D1riYqyx13yJm
ZPh7kjLEXhnmJLj6S1bQy0ECgYEAvaq6XzQG34+78tU8fz2QNE4oBTyHwe1jYIzQ
ZFhtctDa+jkPXC44E100zyFPXxN8DF106rSkwRCEYziKiGgj5y0hdUaxc0ULEVX/
kEUmyuAAjoi1TJFHk2irYNFo1EBjVnliT1jazwu41SsrOZ1P590D0bSyhh7kU8G8
vL4ZamkCgYAHIDoyaOPP9PuX5K8IKb7Sgpg7Zy3tTsCKtDASWnB3vLiLlWMnQ9B
YN56j1BcRcBIRQcXE5bfAg2uyogrnvhf5/VoYocnUZ7/qFkBgP1ar1Vh26V9jSrP
Iqkj19SEp+kJ01xCRLLVh8++pDmgpFbdgpn/1DndDAwHJfJxfxRvoA==
-----END RSA PRIVATE KEY-----
```

Tera Term: File Drag and Drop dialog box showing the file being sent:

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

OK Cancel

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

- (8) Register the thing name you set in 3.3.2(3) and the endpoint you made a note of in 3.3.3(1).

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 a1k[REDACTED]ap-northeast-1.amazonaws.com
OK.
```

- (9) Register the key pair certificate (secp256r1.crt) generated in 4.1(6).

Enter `conf set codesigncert` in Tera Term, and then drag and drop the key pair certificate (secp256r1.crt) to the Tera Term window to send the file. Then press the **Enter** key in Tera Term.

Note: Change the linefeed code of the certificate file to LF before pasting the file contents

Enter `conf set codesigncert`, drag and drop the key pair certificate to the Tera Term window, and then press **Enter**.

```
>conf set codesigncert -----BEGIN CERTIFICATE-----
MIIB/zCCAaUCFAST434WX7IKrUKZEhX2aP9+jdtMAoGCCqGSM49BAMCMIGB
CQYDVQQGEwJKUDEOMAwGA1UECAwFT3Nha2ExDjAMBgNVBAcMBU9zYWthMREw
VQOQDAhQaXN5c3R1bTELMaKGA1UECwwCUOUxEDAQBgNVBAMMD29zYW11cmEx
BgkqhkiG9w0BCQEW9zYW11cmFAcG1zLmNvLmpwMB4XDTEzMDgwMDA2MTAz
DTMzMDgwMTA2MTAzMFowYExCzAJBgNVBAYTAkpQM04wDAYDVQQIDAVFPC2Fr
MAwGA1UEBwwFT3Nha2ExETAPBgNVBAoMCFBpc3IzdGVtMQswCQYDVQQLEAJT
MA4GA1UEAwwHb3NhbXV5YTEgMB4GCScqGSIb3DQEJARYRb3NhbXV5YUBwaXMu
anAwWTATBgghkijOPQIBBgghkijOPQMBBwNCAASMTXh+GipwxAixlhHPH1JQ
I2HeZKgfgsJwXfAP5Rrward1gqkkrKXTyU299MP46gH401VsEgDLTiIPR1
CCqGSM49BAMCA0gAMEUCIDy6Bd/v8eNHZlbrmi3dI+fNvyK1Uuc6NQ7hPGjv
AiEA8X6t1y22ZuK8GC7cFTf18F6Ej9p20VzKIZQoIr6qBX0=
-----END CERTIFICATE-----
OK.
```

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(10) Commit the AWS IoT settings (write the settings to data flash memory).

Execute the following commands in Tera Term:

conf commit

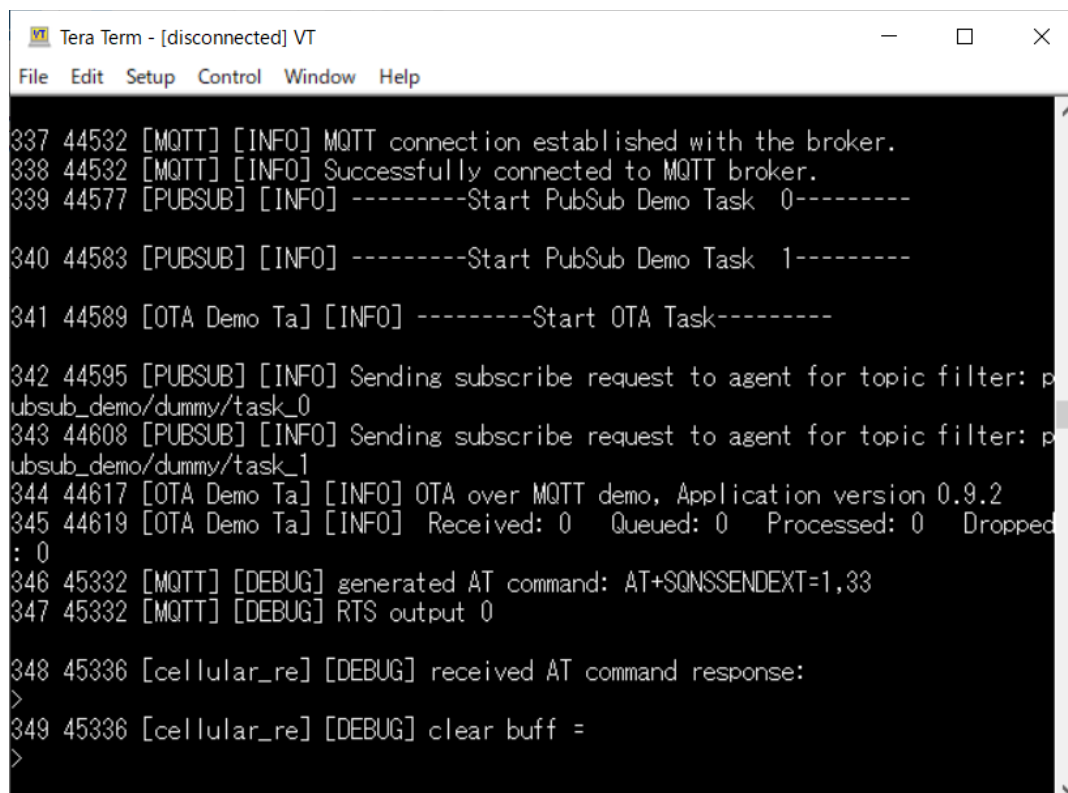
```
>conf commit
0 4472481 [CLI] Destroyed Certificate.
1 4472485 [CLI] Write certificate...
2 4472545 [CLI] Destroyed Private key.
3 4472685 [CLI] Write Private key...
Configuration saved to Data Flash and used 2879 bytes.
```

(11) Perform a reset.

Execute the following commands in Tera Term:

reset

After the reset process is complete, confirm that Tera Term displays a communication log and the application is waiting for OTA jobs.

A screenshot of a Tera Term window titled "Tera Term - [disconnected] VT". The window has a menu bar with "File", "Edit", "Setup", "Control", "Window", and "Help". The main area displays a log of system messages. The messages include MQTT connection status, PubSub task initialization, and OTA task initialization. The log shows the application version 0.9.2 and the current state of the OTA process (Received: 0, Queued: 0, Processed: 0, Dropped: 0). The log ends with a "clear buff =" message.

```
Tera Term - [disconnected] VT
File Edit Setup Control Window Help
337 44532 [MQTT] [INFO] MQTT connection established with the broker.
338 44532 [MQTT] [INFO] Successfully connected to MQTT broker.
339 44577 [PUBSUB] [INFO] -----Start PubSub Demo Task 0-----
340 44583 [PUBSUB] [INFO] -----Start PubSub Demo Task 1-----
341 44589 [OTA Demo Ta] [INFO] -----Start OTA Task-----
342 44595 [PUBSUB] [INFO] Sending subscribe request to agent for topic filter: p
ubsub_demo/dummy/task_0
343 44608 [PUBSUB] [INFO] Sending subscribe request to agent for topic filter: p
ubsub_demo/dummy/task_1
344 44617 [OTA Demo Ta] [INFO] OTA over MQTT demo, Application version 0.9.2
345 44619 [OTA Demo Ta] [INFO] Received: 0 Queued: 0 Processed: 0 Dropped
: 0
346 45332 [MQTT] [DEBUG] generated AT command: AT+SQNSSENDEXT=1,33
347 45332 [MQTT] [DEBUG] RTS output 0
348 45336 [cellular_re] [DEBUG] received AT command response:
>
349 45336 [cellular_re] [DEBUG] clear buff =
>
```

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

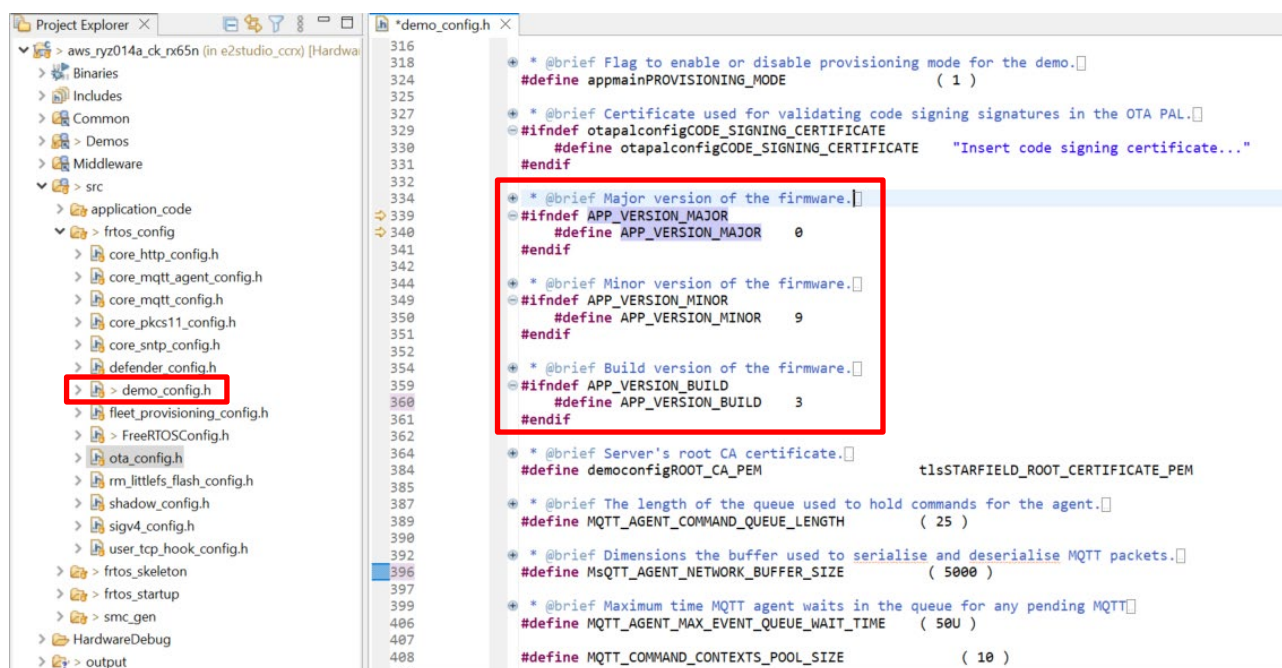
5. Updating the Firmware

5.1 Creating the Updated Firmware

5.1.1 Changing the Firmware Version

- (1) Change the firmware version to v0.9.3.

Repeat the build process, this time with 3 specified for the APP_VERSION_BUILD definition in aws_ryz014a_ck_rx65n\src\rtos_config\demo_config.h.



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

Overwrite the file in the Renesas Image Generator folder with the firmware you rebuilt in 5.1.1(1) (aws_ryz014a_ck_rx65n.mot), and then execute the following command at the command prompt:

```
python image-gen.py -iup aws_ryz014a_ck_rx65n.mot -ip RX65N_DualBank_ImageGenerator_PRM.csv -o user_093 -key secp256r1.privatekey -vt ecdsa -ff RTOS
```

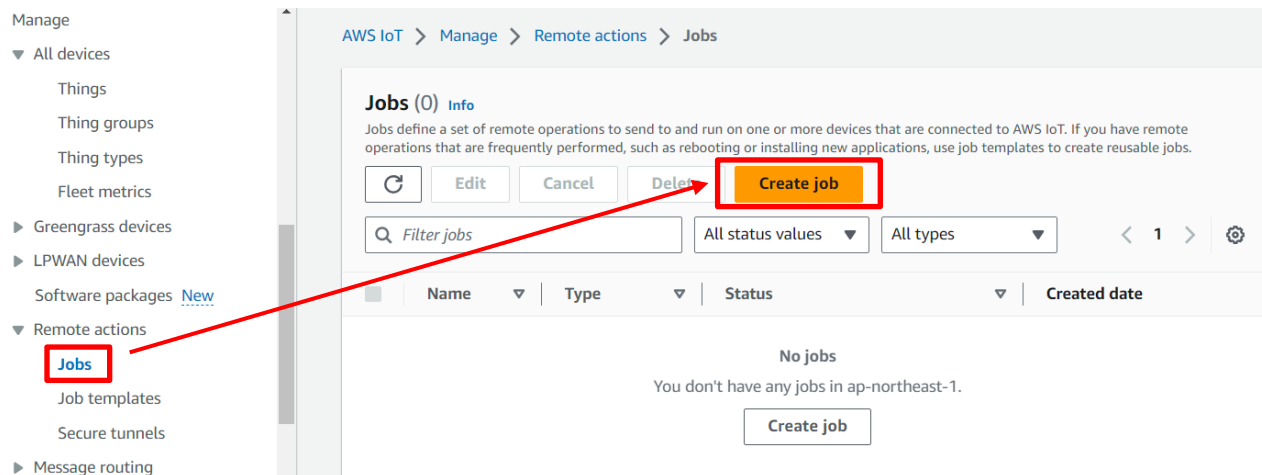
This command generates a file named user_093.rsu.

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

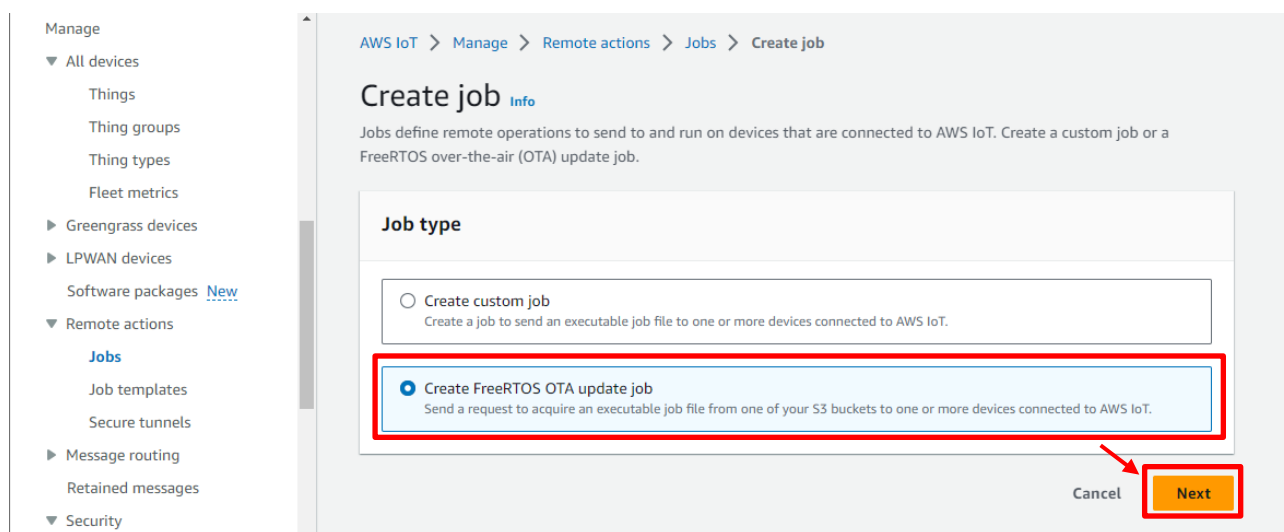
5.2 Updating the Firmware

In AWS, create an OTA update job that will update the firmware.

- (1) In the IOT Core menu, select **Manage**, **Remote actions**, and **Jobs**, and then click the **Create job** button.



- (2) Select **Create FreeRTOS OTA update job** and then click **Next**.



RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(3) Enter a job name (example: rx65n_ota_demo_job) and then click **Next**.

AWS IoT > Jobs > Create job > OTA job

Step 1
OTA job properties

Step 2
OTA file configuration

Step 3
OTA job configuration

OTA job properties [Info](#)

Job properties

Job name

rx65n_ota_demo_job

Enter a unique name without spaces. Valid characters: a-z, A-Z, 0-9, - (hyphen), and _ (underscore)

Description - optional

Enter job description

Tags - optional

Cancel **Next**

(4) Click the **Devices to update** drop-down list and select the device to update.

OTA file configuration [Info](#)

Devices [Info](#)

This OTA update job will send your file securely over MQTT or HTTP to the FreeRTOS-based things and/or the thing groups that you choose.

Devices to update

Choose things and/or thing groups

Thing groups

Things

☒ rx65n_ota_demo_thing

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(5) Click **Create new profile**.

The screenshot shows the 'Sign and choose your file' step in the AWS IoT Code Signing console. It includes three radio button options: 'Sign a new file for me.' (selected), 'Choose a previously signed file.', and 'Use my custom signed file.'. Below these is the 'Code signing profile' section with a description. At the bottom, there is a dropdown menu labeled 'Existing code signing profile' with the text 'Choose existing code signing profile' and a 'Create new profile' button, which is highlighted with a red rectangle.

You can skip steps (5) to (9) if you have already created a profile. Click **Choose existing code signing profile** and select the profile you created from the drop-down list.

The screenshot shows the 'Existing code signing profile' dropdown menu. The dropdown is open, showing a list of profiles. The 'rx65n_ota_demo_profile' is selected and highlighted with a red rectangle. A red arrow points to the selected profile. The 'Create new profile' button is also visible.

| Existing code signing profile |
|------------------------------------------------|
| Choose existing code signing profile ▲ |
| Q |
| rx65n_ota_demo_profile2 /dummy SHA256 ECDSA |
| rx65n_ota_demo_profile dummy SHA256 ECDSA |

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(6) Create a profile (1): Profile name and device hardware platform.

- Enter the profile name (example: rx65n_ota_demo_profile)
- Select **Windows Simulator** as the device hardware platform

Create a code signing profile

Profile name
rx65n_ota_demo_profile
Enter a unique name without spaces. Valid characters: a-z, A-Z, 0-9, and _ (underscore)

Device hardware platform
Windows Simulator

(7) Create a profile (2): Import a certificate.

- In the **Code signing certificate** area, click **Import new code signing certificate**.
- In **Certificate body**, select the file secp256r1.crt you created in 4.1(6).
- In **Certificate private key**, select the file secp256r1.privatekey you created in 4.1.
- In **Certificate chain**, select the file ca.crt you created in 4.1(3).
- Click **Import**.

Create a code signing profile

Code signing certificate
AWS Certificate Manager (ACM) handles the complexity of creating, managing, or importing SSL/TLS certificates. You can use ACM to create an ACM Certificate or import a third-party certificate that you use for signing. You must have a certificate to sign code.

☒ Import new code signing certificate ☐ Select an existing certificate

Certificates

| | |
|------------------------------|-----------------------------------------------|
| Certificate body | secp256r1.crt 753 bytes Uploaded |
| Certificate private key | secp256r1.privatekey 232 bytes Uploaded |
| Certificate chain - optional | ca.crt 890 bytes Uploaded |

Import

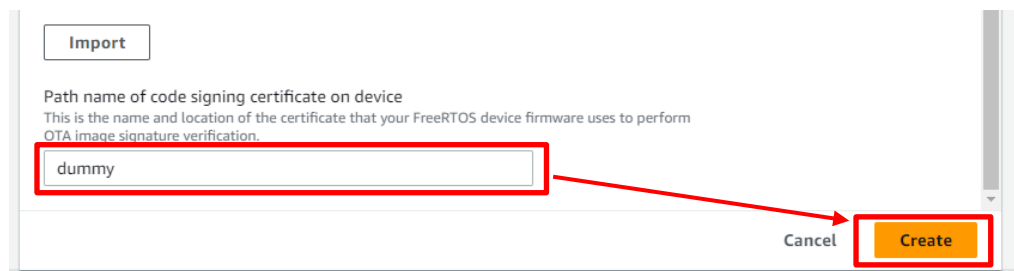
Path name of code signing certificate on device
This is the name and location of the certificate that your FreeRTOS device firmware uses to perform OTA image signature verification.

Cancel Create

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

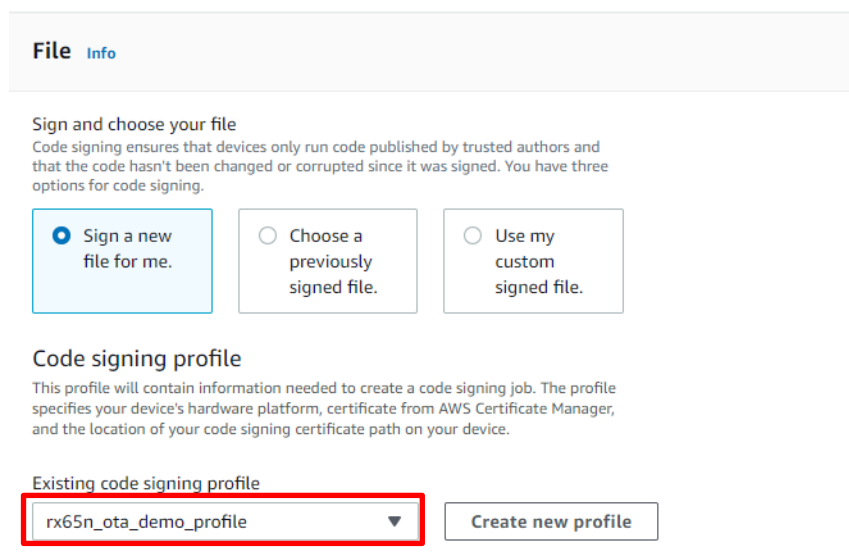
- (8) Create a profile (3): Enter the path of the code signing certificate of the device and then click **Create**.

You can enter any path. (Example: dummy)



The screenshot shows a dialog box with an 'Import' button at the top left. Below it, the text reads: 'Path name of code signing certificate on device' and 'This is the name and location of the certificate that your FreeRTOS device firmware uses to perform OTA image signature verification.' A text input field contains the word 'dummy'. A red rectangle highlights this input field, and a red arrow points from it to the 'Create' button at the bottom right. The 'Create' button is also highlighted with a red rectangle. A 'Cancel' button is located to the left of the 'Create' button.

- (9) Confirm that the name of the profile you created earlier is selected in the **Existing code signing profile** drop-down list.



The screenshot shows the 'File' tab in the AWS IoT console. It has a 'File' tab and an 'Info' tab. The main heading is 'Sign and choose your file'. Below it, there is a paragraph explaining code signing. There are three radio button options: 'Sign a new file for me.' (selected), 'Choose a previously signed file.', and 'Use my custom signed file.' Below these options is the 'Code signing profile' section. It contains a paragraph explaining the profile. At the bottom, there is a drop-down menu labeled 'Existing code signing profile' with 'rx65n_ota_demo_profile' selected. A red rectangle highlights this drop-down menu. To the right of the drop-down menu is a 'Create new profile' button.

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(10) Update the firmware.

- Select **Upload a new file**.
- In **File to upload**, select the file `usr093.rsu` you created in 5.1.1(2).
- Click **Browse S3** and select the S3 bucket you created in 3.4.
- Enter a path name in **Path name of file on device**. (You can enter any path name. Example: `/device/updates`)

The screenshot shows the 'File upload' section of the AWS IoT console. It includes two radio buttons: 'Upload a new file.' (selected) and 'Select an existing file.'. Below is the 'File to upload' section with a 'Choose file' button and a list showing 'usr093.rsu' (357888 bytes). The 'File upload location in S3' section contains an 'S3 URL' field with 's3://s3test-rx65n', a 'Browse S3' button, and a 'Create S3 bucket' button. The 'Path name of file on device' field contains '/device/updates'. A 'File type - optional' dropdown is at the bottom.

(11) In the **Role** drop-down list, select the role you created in 3.5(5) and then click **Next**.

The screenshot shows the 'IAM role' page in the AWS IAM console. The 'Role' dropdown menu is set to 'ota_role_rx65n'. At the bottom, there are 'Cancel', 'Back', and 'Next' buttons. The 'Next' button is highlighted with a red box and an arrow pointing to it from the role dropdown.

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

(12) Click **Create job**.

OTA job configuration [Info](#)

Job run type
Choose how to run this job.

☒ Your job will complete after deploying to the devices and groups that you chose (snapshot)

☐ Your job will continue to deploy to any devices added to the groups that you chose (continuous)

► **Job start rollout configuration - optional**
Specify how quickly devices will be notified when a pending job starts.

► **Job stop configuration - optional**
These configurations define when to automatically stop the job. The job stops if a percentage of devices fail the deployment after a minimum number have deployed. The job cancels if any of the criteria are met after the job starts.

► **Job run timeout configuration - optional**
Specify how long the job will run.

[Cancel](#) [Back](#) [Create job](#)

(13) Wait until firmware reception is complete.

When the job starts, the job receives and writes the firmware.

```
COM3 - Tera Term VT
File Edit Setup Control Window KanjiCode Help

4049 186594 [cellular_re] [DEBUG] clear buff =
OK

4050 186663 [OTA Demo Ta] [INFO] Received: 11 Queued: 11 Processed: 11 Dr
opped: 0

4051 187230 [cellular_re] [DEBUG] URC =
+SQNSRING: 1,1024

4052 187231 [MQTT] [DEBUG] generated AT command: AT+SQNSRECV=1,5

4053 187231 [MQTT] [DEBUG] RTS output

4054 187236 [cellular_re] [DEBUG] URC =
+SQNSRECV: 1,5

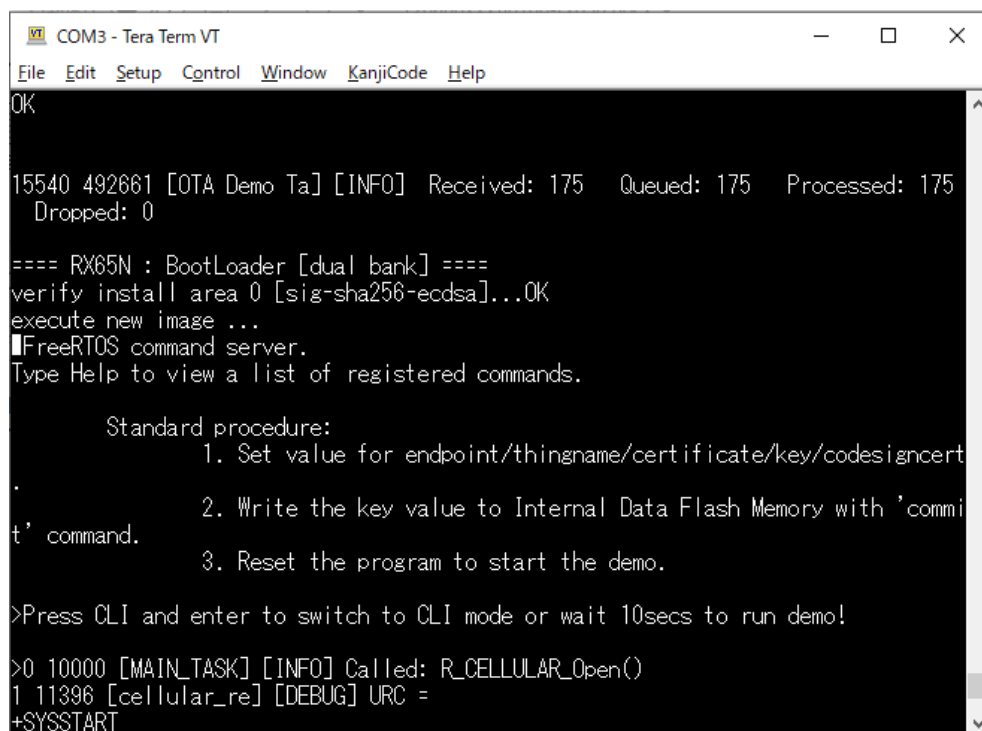
4055 187238 [cellular_re] [DEBUG] received AT command response:
OK

4056 187238 [cellular_re] [DEBUG] clear buff =
OK
```

The **Received** counter is incremented when reception starts.

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

When the update process is complete, the device resets and the initial menu appears.



```
COM3 - Tera Term VT
File Edit Setup Control Window KanjiCode Help
OK
15540 492661 [OTA Demo Ta] [INFO] Received: 175   Queued: 175   Processed: 175
      Dropped: 0

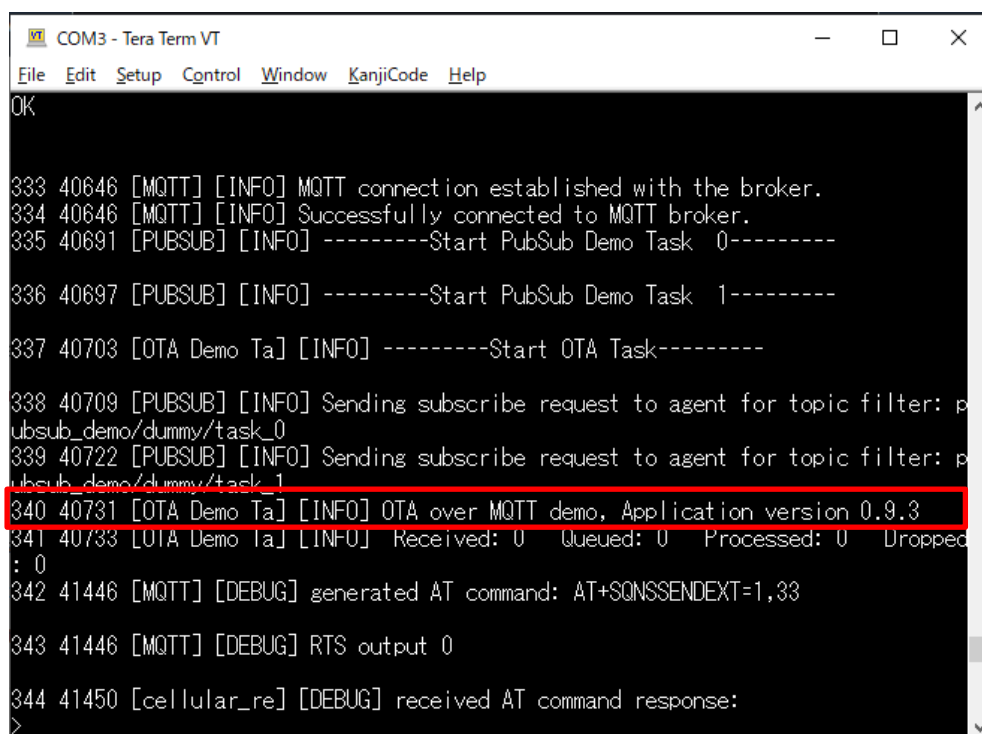
==== RX65N : BootLoader [dual bank] ====
verify install area 0 [sig-sha256-ecdsa]...OK
execute new image ...
FreeRTOS command server.
Type Help to view a list of registered commands.

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

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

>0 10000 [MAIN_TASK] [INFO] Called: R_CELLULAR_Open()
1 11396 [cellular_re] [DEBUG] URC =
+SYSSTART
```

(14) Confirm that the firmware version is Ver. 0.9.3.



```
COM3 - Tera Term VT
File Edit Setup Control Window KanjiCode Help
OK
333 40646 [MQTT] [INFO] MQTT connection established with the broker.
334 40646 [MQTT] [INFO] Successfully connected to MQTT broker.
335 40691 [PUBSUB] [INFO] -----Start PubSub Demo Task 0-----
336 40697 [PUBSUB] [INFO] -----Start PubSub Demo Task 1-----
337 40703 [OTA Demo Ta] [INFO] -----Start OTA Task-----
338 40709 [PUBSUB] [INFO] Sending subscribe request to agent for topic filter: p
ubsub_demo/dummy/task_0
339 40722 [PUBSUB] [INFO] Sending subscribe request to agent for topic filter: p
ubsub_demo/dummy/task_1
340 40731 [OTA Demo Ta] [INFO] OTA over MQTT demo, Application version 0.9.3
341 40733 [OTA Demo Ta] [INFO] Received: 0   Queued: 0   Processed: 0   Dropped
: 0
342 41446 [MQTT] [DEBUG] generated AT command: AT+SQNSENDEXT=1,33
343 41446 [MQTT] [DEBUG] RTS output 0
344 41450 [cellular_re] [DEBUG] received AT command response:
>
```

RX Family How to implement FreeRTOS OTA using Amazon Web Services in RX65N (for v202210.01-LTS-rx-1.1.3 or later)

6. Appendix

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

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

When using the sample program to operate multiple devices within the same LAN environment, it is necessary to change the MAC addresses to avoid duplication.

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

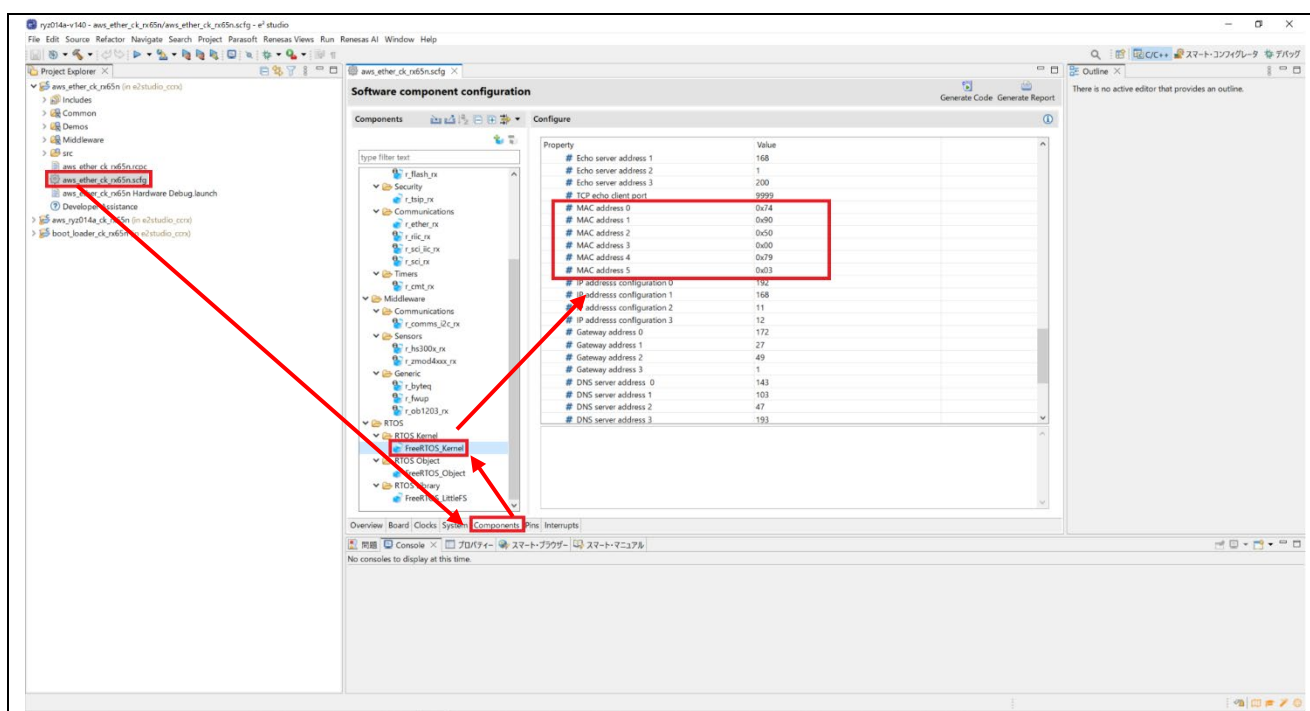
The procedure for changing the MAC addresses is described below.

Open **aws_ether_ck_rx65n.scfg** in Smart Configurator, and select the **Components** tag.

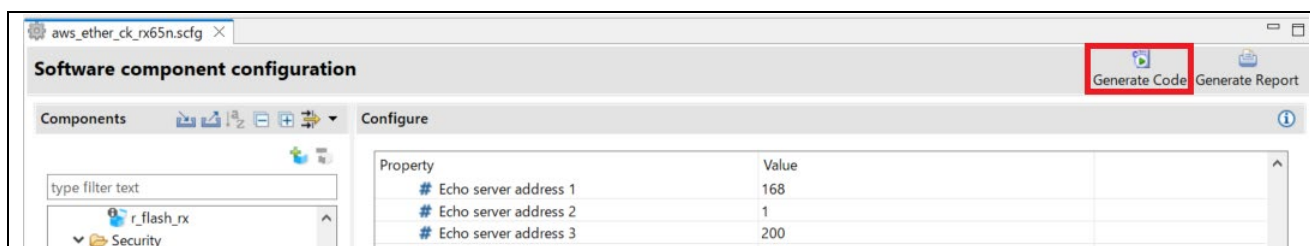
In the tree, select **RTOS** → **RTOS Kernel** → **FreeRTOS_Kernel**, then under **Property** set **Value** for **MAC address 0** to **MAC address 5** to hexadecimal values of your choice.

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

When commercializing a product for sale, make sure to apply to the IEEE to obtain the MAC addresses eventually used.



After making the above changes, click the **Generate Code** button in the upper right corner of the window to apply the changes made in Smart Configurator to the code.



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7. Troubleshooting

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

Table 7.1 Troubleshooting

| No. | Issue | Cause | Solution | Refer to |
|-----|------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 1 | The command to create the initial firmware fails | The Python installation folder is not set correctly in the Path variable | Reinstall python. Also, make sure that the Add python.exe to PATH check box is selected when you perform the steps in 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 | The CK-RX65N kit is not in debug mode | Make sure that the jumper on J16 of the CK-RX65N board is on pins 1-2 (debug mode). | 2.5 |
| 4 | The initial firmware does not start | The CK-RX65N kit is not in RUN mode | Make sure that the jumper on J16 of the CK-RX65N board is on pins 2-3 (RUN mode). | 4.2.5(4) |
| 5 | Cellular communication cannot start | The RYZ014A PMOD board is not connected properly | Check the connection of the RYZ014A PMOD board. | 2.5 |
| 6 | | No SIM card is inserted | Insert the SIM card. | 2.5 |
| 7 | | The SIM card is configured incorrectly | Revise the configuration of the r_cellular module. | 4.2.3(4) |
| 8 | | You are using the SIM card supplied with the CK-RX65N kit but the SIM card is not activated | Activate the SIM card. | 4.2.3(4) |
| 9 | An error occurs during cellular communication | The communication environment is poor | Connect an antenna and power supply to the RYZ014A PMOD board. Also, place the antenna in an area with good reception such as near a window. | 2.5 |
| 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. | 4.2.5 |
| 11 | The firmware does not start after starting the boot loader | The public key is not correctly set in the boot loader | Review the public key setting in the boot loader. | 4.2.3(1) |
| 12 | The firmware does not start after an OTA update | The public key is not correctly set in the firmware | Review the public key setting in the firmware. | 4.2.3(1) |
| 13 | | Device selection is incorrect | Review the device setting in the firmware and the boot loader. | 4.2.3(5) to 4.2.3(9) |

Revision History

| Rev. | Date issued | Details | |
|------|---------------|---------|--------------------------------------------------------------------------|
| | | Page | Nature of revision |
| 1.00 | Sep. 15, 2023 | — | Initial publication |
| 1.10 | Jun. 14, 2024 | — | Partial revisions to sections 2.1, 2.4, and 4.2 Addition of section 6 |

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

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8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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