

RX Family

Firmware Update Software Development Guide using AWS/Azure QE for OTA

Introduction

This application note describes how to install and use the cloud-based OTA (Over the Air) firmware updates using QE for OTA, a software development support tool for cloud systems.

Target Devices

CK-RX65N (Cloud Kit for RX65N Microcontroller Group) Cellular Version

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1. Overview

1.1 System Overview

QE for OTA is a solution toolkit that runs on the integrated development environment (IDE) e² studio. It is a development tool that enables easy apply Over the Air (OTA) using the AWS or Microsoft Azure cloud service. By operating QE for OTA according to the provided workflow, you can obtain cloud-related information necessary to register with your cloud system to implement OTA, embed security information into the MCU, and execute OTA.

1.2 QE for OTA Structure

QE for OTA consists of two views: the OTA Main (QE) view, which guides the implementation of OTA using the Cloud, and the OTA Manage IoT Device (QE) View, which provides windows for creating firmware, setting OTA, viewing the operating status.

1.2.1 OTA Main (QE) View

This is the main view for QE for OTA. It guides your through the workflow to implement OTA using the Cloud.

- OTA Main (QE) X					°° 🗖 🗖
Cloud	Prepare	О Іот	\rangle \odot	ΟΤΑ	
1.Cloud Settings -	<u>^</u>	Sign-in to Clo	bud		^
✓ Sign-in to Cloud	Cature to size in to Cloud				_
⊘ Cloud resource setting	Setup to sign-in to Cloud				
2.Prepare projects 🔹	1	Cloud		Azure	~
Select projects				Sign-in	Settings
Select provisioning					
3.Manage IoT device -]				
⊘ Manage IoT device	Sign-in to Azure				
⊘ Create initial firmware	Install Azure CLI				
⊘ Write program to IoT devices	Create new Azure acco Sign in to Azuro	unt			
4.0TA •	• <u>Sign-in to Azure</u>				
⊘ Create update firmware	Install Azure CLI				
Execute OTA and check status	1. Download and install th	e Azure CLI from Microsoft we	ebsite.		

Figure 1-1 OTA Main (QE) View

- Cloud settings Setup to sign-in to the Cloud.
 Set up the Cloud resources needed for OTA when with Azure.
- Prepare projects Create OTA projects.
- Manage IoT device

Add, delete, and view information about IoT devices. Also, create the initial firmware and write programs to IoT devices.

OTA

Create update firmware and execute OTA.



1.2.2 OTA Manage IoT Device (QE) View

This view consists of five functions: IoT Device, Initial Firmware, Update Firmware, OTA, and Firmware Log. Switch between functions using the tabs displayed on the right side of the view.

Main (QE)	QE) ×	
devices	IoT Device Initial Firmware Update Firmware OTA Firmware Log	
~ ₩ -	/ Sync Cloud IoT Device Name Symmetri	
azure_demos_ck_rx65n		
	IoT device information	
	5	

Figure 1-2 OTA Manage IoT Device (QE) View

IoT Device

View the device certification, security key and other IoT device information generated when IoT devices are created.

- Initial Firmware Embed information for each IoT device in the source code, create the initial firmware.
- Update Firmware Embed information for each IoT device in the source code and create update firmware.
- OTA Execute OTA.
- Firmware Log View operation log for the target board.



1.3 Operating Environment

The following table shows the operating environment of this application note.

Table 1-1	Operating	Environment
-----------	-----------	-------------

Items	Contents
PC OS	Windows 10, Windows 11 (64-bit version of either)
IDE	Renesas e ² studio 2023-04 version or later
Tool chain	CC-RX V3.04 or later / GCC for Renesas RX 8.3.0.202104 or later
QE	QE for OTA V1.1.0 or later
Target device	RX65N
Evaluation board	CK-RX65N (including RYZ014A PMOD bundled in kit)
SIM card	micro SIM for cellular LTE communications (included with CK-RX65N)
RX Driver Package (RDP)	AWS: V1.34 / Azure: V1.37 (Note 1)
OpenSSL	V3.0.4 Light or later (Note 2)
Renesas Flash Programmer	V3.09 or later (Note 2)
FreeRTOS	v202107.00-rx-1.0.1
Azure RTOS	6.2.1_rel-rx-1.0.1
Azure CLI	V2.49.0 or later (Note 2)

- Note 1. This is the version used by the RTOS utilized in this application note. The version that corresponds to the RTSO used in the target project must be installed.
 - 2. This is not included with e² studio or QE, and it must be installed separately.

In this application note, The sample project using AWS operates with cellular communications using the RYZ014A board. The sample project using Azure operates with Ethernet.

The RYZ014A board's power supply ("USB Cable - Power Supply" in the figure below) can be used with either the power supply from the PC's USB port or the USB power supply connected to the outlet.



Figure 1-3 Operating Environment Connection Diagram for Cellular Communications



The following describes the configuration for connecting a device when using Ethernet. Use an Internetready LAN cable to connect to the Ethernet port on CK-RX65N.



Figure 1-4 Operating Environment Connection Diagram for Ethernet Communications

1.4 Reference Document

- R01UH0590
 - RX65N Group, RX651 Group User's Manual: Hardware
- R20UT5100 RX65N Group Cloud Kit for RX65N Microcontroller Group CK-RX65N v1 User's Manual
- R01AN5549
 - RX Family How to implement FreeRTOS OTA by using Amazon Web Services on RX65N
- R01AN6357
 Creating a Microsoft Azure ADU Environment
- R01AN5548
 Renesas MCU Firmware Update Design Policy
- R19DS0111 RYZ014A LTE Category M1 Module



2. Preparation

The preparations required for OTA installation are as follows.

- Install e² studio
- Apply the following tools to e² studio
 - Toolchain
 - QE for OTA
- Install Renesas Flash Programmer
- Connect to evaluation board
- Create AWS/Azure Account
- Install OpenSSL
- Install Azure CLI (when using Azure)

This chapter describes how to install QE for OTA and how to create an AWS/Azure account.

For details regarding how to install OpenSSL, refer to the OpenSSL website.



2.1 Install QE for OTA

2.1.1 Using Renesas Software Installer

This section explains how to install QE from the Renesas Software Installer in e² studio.

Select Renesas Software Installer from the e² studio menu. After the Renesas Software Installer window appears, select "Renesas QE" and click "Next >".

💽 e2work - e² studio				🕐 Renesas Software Installer	- D X
File Edit Navigate Search Project	Renesas Views Run Window	Help		Renesas Software Installer	
« O =	C/C++	> v on:	-		
	Code Generator	>			
	Debug	>		Renesas QE Tools to assist the development of	embedded systems applications
Project Explorer X	Partner OS	>			
There are no projects in your workspace.	Renesas QE	>			
To add a project:	Smart Configurator	>			
Create a new C or C++ project	Solution Toolkit	<u>,</u>			
Create a project	🗻 Renesas Software Installer				
Magnet projects				O < Back Next >	Finish Cancel

Figure 2-1 Renesas Software Installer

When the "Install Extensions" window appears, check the box in front of "QE for OTA" and click "Finish".

e Renesas Software Installer —	×
Install Extensions Select extensions to install. Press Finish to proceed with installation. Press the information button to see a detailed overview and a link to more	5
Find:	
QE for Motor (v1.2.0) Tools to assist in the configuration of motor middleware and related drivers.	^
QE for OTA (Technical Preview Edition) (v1.1.0) Tools to assist in development work involving OTA update via Cloud.	*
(?) < Back Next > Finish Cancel	I

Figure 2-2 Install Extensions

Check "Renesas QE for OTA" as the item you want to install and click "Next >".

Check to make sure the item to be installed is "Renesas QE for OTA" and click "Finish."

🐮 Install		e	Install		– 🗆 X
Install Check the items that you wish to install.	(6) x	R	stall Details leview the items to be installed.		() m
No pe	Version Id 1.1.0.202305299925 com.renesas.qe.cloud.feature.feature.gro	N	ame 	Version 1.1.0.202305290925	ld com/renesas.ge.cloud.feature
Select All Desent All Details			e: 0 Bytes letails newar 0.6 for 0.114		>
0	< Back Next > Trinsh Cancel			• Back Rent =	inish Cancel

Figure 2-3 Install QE for OTA

For further details, refer to 2.1.3 Installation Procedure (common).

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2.1.2 Download and Install QE from the Web

Select "Help" \rightarrow "Install New Software" menu from the e² studio to open the "Install" dialog.

Next, click "Add..." to open the "Add Repository" dialog.

Click "Archive..." and select the target installation file (zip file) in the file selection dialog, and then click "Open". Click "Add" at the bottom of the "Add Repository" dialog.

👻 Install		- o x
Available Software Select a site or enter the location of a site.		
Work with: type or select a site	~ Add.	. Manage
type riter text	Version	Decelect All
There is no site selected.		
Details		
Show only the latest versions of available software	Hide items that are already installed	
Group items by category	What is already installed?	
Show only software applicable to target environment Contact all update sites during install to find required software		
(?)	< Back Next > Finish	Cancel

Figure 2-4 Download and Install QE from the Web 1

Expand "Renesas QE" displayed in the "Install" dialog, check the box(es) for the displayed software, and then click "Next >". To shorten the installation time, remove the check from for "Contact all update sites during install to find required software".

Confirm that the installation target is correct, and then click "Finish".

💽 Install			C Install	- U X
Available Software Check the items that you wish to install.			Install Details Review the items to be installed.	
Work with: QE for OTA - janfile/ /QE for O	DTA/RenesasQE_ota_V110.zipl/	Add Mar	Name Version Id B. Renesas QE for OTA 1.1.0.202305299925 com.renesas.ge.cloud.feat	ure.feat
type filter text		Sele		
None	Version 1.1.0.20205596925	Dese		
Show only the latest versions of available software Close prevents by category Donow only otherea explicible to target environment Contact all update sites during install to find required software	☐ Hide Rens that are already installed What is <u>already installed</u> ?		Sare Unknown Details	~
0	< Back Next >	Finish Can	(7) (8ack Next> Finite	Cancel

Figure 2-5 Download and Install QE from the Web 2

For further details, refer to 2.1.3 Installation Procedure (common).

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2.1.3 Installation Procedure (common)

If the following dialog appears, set the unsigned content as a trusted tool and the installation will be executed.

Туре	ld/Fingerprint	Name		Validity Dates	
Jnsigned	n/a	Unknown		n/a	
Always trust all	content			Select All De	select All
Always trust all	ld		Version	Select All De	eselect All
Always trust all Classifier osgi.bundle	l content Id com.renesas.c	qe.cloud	Version 1.1.0.20230	Select All De	eselect All

Figure 2-6 Trusted Tool

The installation status of QE for OTA is displayed at the bottom of e^2 studio. Installation is complete when you are asked to restart e^2 studio.

	e Software Updates		×
installing Software: (5%)	Restart e ² studio to apply the software update?	Restart Now 1	No

Figure 2-7 Installation Status



2.2 Create a Cloud Account

This section describes how to create an account for AWS and Azure. For further details, refer to the corresponding service guide.

2.2.1 For AWS

Preparation for using AWS is described below.

- 1. Access the <u>AWS website</u> and created an AWS account.
- Sign-in to the AWS console from your WEB browser and create an IAM user entity to execute OTA. Make sure you add full access permissions (IAMFullAccess) to all IAM services when creating your IAM user entity.
- 3. Open the security credentials in the AWS console and create an access key in the AWS IAM credential information settings. This will generate an access key and a secret access key.

2.2.2 For Azure

Preparation for using Azure is described below.

- 1. Access the <u>Azure website</u> and create an Azure account.
- 2. Sign-in to your Azure account from your WEB browser and confirm your subscription ID.
- 3. Download and install Azure CLI from the Microsoft website.
- After Azure CLI is installed, the first time QE for OTA is started up from your browser, you will be asked to sign into Azure. Input your account information and sign-in.



3. Development Procedure

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By proceeding according to the workflow of QE for OTA, you can create the initial firmware and execute OTA.

	Wo	orkflow				
🚹 🥝 Cloud	⊘ Prepare	\rangle \oslash	IoT	\rangle \odot	ΟΤΑ	
1.Cloud Settings -	$\hat{}$		Sign-in to (Cloud		
✓ Sign-in to Cloud	Catura ta aina in ta Claud					
⊘ Cloud resource setting	Setup to sign-in to Cioud		_			
2.Prepare projects 🔹	1		Cloud		Azure	~
Select projects	-				Sign-	in Settings
Select provisioning	-					
3.Manage IoT device 🔹	1					
⊘ Manage IoT device	Sign-in to Azure					
⊘ Create initial firmware	Install Azure CLI					
⊘ Write program to IoT devices	Create new Azure ad Ciencia to Azure	<u>ccount</u>				
4.0TA -	 <u>Sign-In to Azure</u> 					
🕑 Create update firmware	Install Azure CLI					
Execute OTA and check status	1 Download and instal	ll the Azure CLI f	rom Microsoft	website		

Figure 3-1 OTA Main (QE) View

The items and procedures are listed in the table below.

Table 3-1 QE for OTA Items and Contents

Item		Contents	
Cloud Settings	Sign-in to cloud	Setup to sign-in to cloud, and sign-in	<u>4.3.1</u>
	Cloud resource setting	Set resources (Azure only)	<u>4.3.1</u>
Prepare Projects	Select projects	Create sample project and import	<u>4.4.1</u>
	Select provisioning	Confirm provisioning	<u>4.4.2</u>
Manage IoT device	Manage IoT device	Register and manage IoT device	<u>4.5.1</u>
	Create initial firmware	Create and build initial firmware	<u>4.5.2</u>
	Write program to IoT device	Write initial firmware	<u>4.5.3</u>
OTA	Create update firmware	Create and build firmware to be used	<u>4.6.1</u>
		by OTA	
	Execute OTA and check	Execute OTA and check status	<u>4.6.2</u>
	status		



4. Operation Example

This chapter describes the workflow for executing OTA using QE for OTA.

Although AWS (FreeRTOS) and Azure (Azure RTOS) differ in some areas, unless the difference is major, this description uses AWS as the example. Please apply the contents to Azure accordingly.

The following operations are performed.

- Write the initial firmware and debug firmware V1.0.0 operations.
- After writing the update firmware by executing OTA, switch to V1.1.0 operations using bank swap.





4.1 Preparation

Start e² studio. Prepare the following folders in any location.

- e² studio workspace folder
- RTOS module download folder
- Project folder

This application note uses the following workspace and project folders. Folders not listed here are considered optional folders.

- C:¥workspace (workspace folder)
- C:¥workspace¥freertos (for AWS FreeRTOS)
- C:\u00e4workspace\u00e4azure_demos (for Azure RTOS ADU projects)
- C:¥workspace¥azure_boot_loader (for Azure RTOS bootloader project)
- C:¥afr (FreeRTOS module download folder)

4.2 Start QE for OTA

Select OTA Main (QE) from the e² studio menu to display the OTA Main (QE) view as shown below.

				A OTA Main (Q	e ×						1.
erar Viewr Rup Window	Help			a 📀	Cloud)0	Prepare) ⊙	IoT)© 0	AT
aug	neip			1.Cloud	Settings				Sign-in to Cloud		
C/C++	·			Sign-	in to Cloud	Setu	p to sign-in to Cloud				
ode Generator	> [2.Prepar	re projects	-			Cloud	4/WS	
ebug	> -			 Select 	t projects	_				1410	
artmor OS				Select	t provisioning	_					Sign-in Settings
artilei 05	· · .			3.Manag	e IoT device	-					
Renesas QE	> <u>/</u> 0	Measuring Current Consumption (QE)		Mana	ge IoT device	Sic	un-in to AWS				
mart Configurator	> 🧖	OTA Main (QE)		 Creat 	e initial firmware						
alitatione To allita	_	OTA Manage Ist Druise (OD)		Write	program to IoT device	s ·	Create new IAM user ac	count			
Olution lookit	· · · -	OTA Manage for Device (QE)		4.OTA		-	aginii to Awa				
enesas Software Installer			_	 Creat 	e update firmware	Cre	ate new IAM user accou	int			
				🕑 Execu	te OTA and check stat	JS 1	To use OE for OTA, you i	need an AWS	IAM user account. If y	ou do not have an	IAM user account.

Figure 4-2 Select OTA Main (QE)



4.3 Cloud Settings

This section describes how to sign-in to the cloud. When using Azure, it is also necessary to set resources accordingly.

4.3.1 Sign-in to Cloud

Select "Sign-in to Cloud" from the menu displayed on the left side of the OTA Main QE view.

Select the cloud connection, and then click "Settings" to open the sign-in dialog.



Figure 4-3 Sign-in to Cloud

4.3.1.1 For AWS

Enter your IAM user Access Key ID and Secret Access Key, and then click "Sign-in".

If the IAM user does not have the required permissions to execute OTA, a warning icon will appear next to "Add required permissions for OTA" (right side of dialog). In this case, click "Add required permissions for OTA" and the required permissions will be added automatically.

In the Region box, select the region in which you will be using the AWS services. If the upload region and current region differ, OTA cannot be executed. Make sure you select the same region for both upload and current region.

Access Key ID	****	Display	List of permissions
 Secret Access Key 	******	Display	
User Name			
Account ID			
Region (IoT, S3, Signer)	us-east-1	\checkmark	
Don't have an account?		Sign-in	Add required permissions for OTA
Enter access key ID and secret	access key created on AWS, select the re	gion, and click "Sign-in" b	utton.
			· · · · · · · · · · · · · · · · · · ·

Figure 4-4 Sign-in to Cloud (AWS)



After signing in, make sure that you have received the "Signed in to cloud." Then, click "Close" to close the dialog.

4.3.1.2 For Azure

(1) Sign-in

(a) To create an application

Enter the application name and subscription ID, and then click "Register Application". Take note of the following:

- Subscription owner rights are required.
- An application name that is already registered will be rejected.
- You will not be able to create an application if you have not installed Azure CLI.

Set your Client ID, Client Secret, and Tenant ID, and then click "Sign-in".

If you do not have the required permissions to execute OTA, a warning icon will appear. In this case, click "Add required permissions for OTA" and the required permissions will be added automatically.

After signing in, make sure that you have received the "Signed in to cloud." Then, click "Close" to close the dialog.

e Sign-in to the cloud			x
Application Service Principal Application Name	l Sign-in		Permissions granted to Application List of permissions
 Subscription ID 		Display	
Client ID		Display	
Client Secret		Display	
Tenant ID		Display	
Service Principal ID			
Don't have an account ?	Register Application	Sign-in	Add required permissions for OTA
Enter subscription ID created To use a registered application	on Azure, and click "Register Application" butto n, enter subscription ID, client ID, client secret, ar	n. nd tenant ID, and	l click "Sign-in" button.
			Close

Figure 4-5 Sign-in to Cloud (Azure)



(b) To use a registered application

If you application is already registered, enter your subscription ID, client ID, client secret, and tenant ID, and then click "Sign-in".

After signing in, click "Close" to close the dialog.

e Sign-in to the cloud			×
Application Service Principal Si Application Name	ign-in		Permissions granted to Application List of permissions
1 Subscription ID		Display	
Client ID		Display	
Client Secret		Display	
Tenant ID		Display	
Service Principal ID			
Don't have an account ?	Register Application	Sign-in	Add required permissions for OTA
Enter subscription ID created or To use a registered application,	n Azure, and click "Register Application" bu enter subscription ID, client ID, client secre	itton. t, and tenant ID, and	l click "Sign-in" button.
			Close

Figure 4-6 Sign-in to Cloud Using Registered Application (Azure)



(2) Cloud resource setting

To use Azure, you will need to set cloud resources.

Select "Cloud resource setting" from the menu displayed on the left side of the OTA Main (QE) view.

If you don't see the resource group created by QE on the Azure side (qe_ota_resource_group), click the "Create" button that appears next to the "Setting" button. If there is no "Create", click "Setting".

If "qe_ota_resource_group" has already been created, select it as the resource group.

OTA Main (QE) ×						8 -
Cloud	Prepare	\rangle \odot	ΙοΤ	\rangle \otimes	ΟΤΑ	^
1.Cloud Settings -		C	oud resource	setting		^
⊘ Sign-in to Cloud	Setup the cloud resource	as to use for OT	Δ			
⊘ Cloud resource setting	Setup the cloud resource		A.			
2.Prepare projects 👻]	Reso	urce group	qe_ota_	resource_group	~
⊘ Select projects						Setting
	1	Lo	cation of "Crea	ate" button	< t ₁	

Figure 4-7 Cloud Resource Setting (Azure)



When the "Resource settings" dialog opens, if you do not see resource group "qe_ota_resource_group", click "Create All", and proceed to create new resources.

To set up resources individually, set each item of each resource separately.

Information corresponding to the current settings are displayed in the middle column of the dialog. Check the information here to make sure every resource is set correctly.

Also, if a warning icon is displayed for any of the resources, click "Add required permissions for OTA" to add permissions.

e Resource settings			X
Cature and an and			
Setup resources	(
Setup the cloud resources to	use for OTA.		
[Note] Resources have a cost onc	e you create them. Also, depend	ing on the resource, it may take 10 n	ninutes or more to create or delete.
(1) Select or create resource	group.		
Resource group	5. o		
Resource group		formation	Create New
Resource group		Region 1 Fast US	Name he at recourse group
	`i	State] Succeeded	
	Delete		Region East US 🗸 🗸
			Create
(2) Select or create resource	s.		
IoT			
loT Hub	_ Ir	formation	Create New
	V []	Region] East US	Name qe-iot-hub-20230531163657631
		Host Name]	Region East US V
d required permissions for OTA	issions for OTA Delete		CV11 C1
a required permissions for OTA	13	State] Succeeded	3KU 31 V
			Create
In This Device Hadata		formation	Create New
Ior Hub Device opdate		Region] Southeast Asia	Name ge-adu-20230531163657631
	[SKU] Standard	Pagion East US
Add required perm	issions for OTA Delete	state J Succeeded	
			SKU Standard ~
			Create
In This is Device the date		formation	Create New
Ior Hub Device opdate	instance [3	State] Succeeded	Name ge-adu-instance
		inked IoT Hub]	Crutta
	Delete		Create
Storage			
Storage Account	- In	formation	Create New
Storage Account		Region] Japan East	Name gestor20230531163657631
	[KU] Standard_LRS	Region East US
	Delete	anapolite j	
	1	State] Succeeded	SKU Standard_LRS
	1.	,	Create
Plak Contriner	_ Ir	formation	Create New
Biob Container		State] Available	Name gestor-blob-container
			Contra
	Delete		Create
To create all new resources To setup individually, set wi	at once, press "Create All" butto th item of each resource.	ı.	^
			~
?			Create All Close
-			

Figure 4-8 Resource Settings (Azure)



4.4 **Project Preparation**

4.4.1 **Project Selection**

This section describes how to prepare a sample OTA project. The procedure differs for <u>AWS</u> and <u>Azure</u>.

4.4.1.1 For AWS

(1) Import projects

Select "Select projects" from the menu displayed on the left side of the OTA Main (QE) view and click "Import". When using existing projects, skip the import step and select projects from the dropdown.

- OTA Main (QE) ×					00 D
Cloud	Prepare	Ø IoT	\rangle \odot	ΟΤΑ	
1.Cloud Settings -	<u>^</u>	Select projects			^
⊘ Sign-in to Cloud				-	
2.Prepare projects -				OTA project	Import
⊘ Select projects	Select created projects				
Select provisioning					
		Root London		1.1	

Figure 4-9 Project Selection (AWS)

Click "Browse..." and specify the folder for copying the RTOS (the folder prepared in 4.1).

Next, set the RTOS version.

If a list of versions is displayed, check the setting contents, and then click "Next>" (see Figure 4-12 FreeRTOS Version Selection - Next). If the target version is not listed, click "Check for more version...".

e – C	x c
Renesas GitHub FreeRTOS (with IoT libraries) Project Missing RTOS Version.	
Specify a folder to copy selected RTOS version in order to import the project. Folder: C¥workspace¥freertos	Browse
RTOS version setting Version: Check for more version	v
? < Back Next > Finish C	Cancel

Figure 4-10 FreeRTOS Version Selection



In the next dialog, select the "Module Folder Path" (the folder prepared in <u>4.1</u>) indicating the download version and download location, and then click "Download". The disclaimer dialog with appear. Check the contents and click "Accept".

Select RTOS (with IoT Inbraries) in Select RTOS modules for download	and specify download lo	cation	Ľ
Title FreeRTOS (with IoT libraries) Hold Schub Dollar	Rev. v202107.00-rx-1.0.1 v202107.00-rx-1.0.0 v202012.00-rx-1.0.2 v202012.00-rx-1.0.1 v202012.00-rx-1.0.1 v202012.00-rx-1.0.0 v202012.00-rr8-1.0.0 v202012.00-rr8-1.0.5 iled information of each re	Issue date	Select All Deselect All
Ci¥afr			Browse

Figure 4-11 FreeRTOS Module Download

For details and selection of available revisions, refer to GitHub (<u>Releases · renesas/amazon-freertos</u> (<u>github.com</u>).

Check the setting contents, and then click "Next>".

e ²			—	
Renesas Select R	GitHub FreeRTOS (with	loT libraries) Proj	ect	
Specify	a folder to copy selected RT	OS version in order to	import the project.	
Folder:	C:¥workspace¥freertos			Browse
RTOS v	ersion setting			
Version	v202107.00-rx-1.0.1 Check for more version			~
?	< Back	Next >	Finish	Cancel

Figure 4-12 FreeRTOS Version Selection - Next



Select the projects to be imported from the list. As project selections will differ according to the environment, select the appropriate project for your operating environment.

The figure below is an example of using cellular communications with the RYZ014A board on the CK-RX65N board and with CC-RX selected as the compiler.

After selecting an aws_demos and boot_loader project, each according to the operating environment, click "Finish".

Import Projects Select a directory to search for existing Renesas projects. • Select root directory: C\#workspace\#reertos\#projects\#renesas\kchros5n+ke2studio\#ws_ctemos) sex_demos (C\#workspace\#reertos\#projects\#renesas\kchros5n+ke2studio\#ws_ctemos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n+ke2studio\#ws_ctemos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n+ke2studio\#ws_ctemos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n+ke2studio\#ws_ctemos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n-koud-kit\#e2studio\#ws_demos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n-koud-kit\#e2studio\#ws_demos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n-koud-kit\#e2studio\#ws_demos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n-koud-kit\#e2studio\#ws_demos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n-koud-kit\#e2studio\#ws_demos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n-koud-kit\#e2studio\#ws_demos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n-rs\#e2studio\#ws_demos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n-rs\#e2studio\#ws_demos) ws_demos (C\#workspace\#reertos\#projects\#renesas\%chros5n-rs\#e2studio\#ws_demos) ws_detst (C\#workspace\#reertos\#projects\#renesas\%chros5n-rs\#e2studio\#ws_demos) ws_detst (C\#workspace\#reertos\#projects\#renesas\%chros5n-rs\#e2studio\#ws_demos ws_tests (C\#workspace\#reertos\#projects\#renesas\%chros5n-rs\#e2studio\#ws_demos ws_tests (C\#workspace\#reertos\#projects\#renesas\%chros5n-rs\#e2studio\#ws_detsts) ws_tests (C\#workspace\#reertos\#projects\#renesas\%chros5n-rs\#e2studio\#ws_dets	e	o x
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	Options Search for nested projects Hide projects that already exist in the workspace	
Options Search for nested projects Hide projects that already exist in the workspace	(?) < Back Next> Finish	Cancel

Figure 4-13 Import Project Selection



The following shows examples of project combinations.

- Using RYZ014A (CC-RX compiler): aws_demos (<FreeRTOS destination>¥projects¥renesas¥ck-rx65n-ryz014a¥e2studio¥aws_demos) boot_loader (<FreeRTOS destination>¥projects¥renesas¥ck-rx65n-ryz014a¥e2studio¥boot_loader)
- Using RYZ014A (GCC compiler): aws_demos (<FreeRTOS destination>¥projects¥renesas¥ck-rx65n-ryz014a¥e2studio-gcc¥aws_demos) boot_loader (<FreeRTOS destination>¥projects¥renesas¥ck-rx65n-ryz014a¥e2studio-gcc¥boot_loader)
- Using Ethernet (CC-RX compiler): aws_demos (<FreeRTOS destination>¥projects¥renesas¥ck-rx65n¥e2studio¥aws_demos) boot_loader (<FreeRTOS destination>¥projects¥renesas¥ck-rx65n¥e2studio¥boot_loader)
- Using Ethernet (GCC compiler): aws_demos (<FreeRTOS destination>¥projects¥renesas¥ck-rx65n¥e2studio-gcc¥aws_demos) boot_loader (<FreeRTOS destination>¥projects¥renesas¥ck-rx65n¥e2studio-gcc¥boot_loader)

Project information is automatically selected after the projects are imported, as shown in the following figure.

📥 OTA Main (QE) 🗙				8 - -
Cloud	⊘ Prepare	⊘ IoT	OTA	
1.Cloud Settings	▼ ^	Select proje	ects	· · · · · · · · · · · · · · · · · · ·
🕑 Sign-in to Cloud				_
2.Prepare projects	•		OTA pro	ject Import
 Select projects 	Select created projects			
⊘ Select provisioning				
3.Manage IoT device	•	Boot Loader	boot_loader	
⊘ Manage IoT device		Firmware	aws_demos	~
⊘ Create initial firmware	Information of firmware pro	niect		

Figure 4-14 AWS: After Project Import



To reserve a 256KB-area for the boot_loader project, the aws_demos section settings need to be modified.

(a) Section settings for CC-RX

Select the aws_demos project from the project explorer and right-click to open the properties. Select "Settings", then open "Section setting" from the button at the bottom of the figure.



Figure 4-15 aws_demos Project Section Settings 1 (CC-RX) 1



Section Name				
D D				
R_2				
R				
RPFRAM2				
C_BOOTLOADER				
C_PKCS11_STORA		Add Section		
C_SYSTEM_CONFIG*		Add Section		
В		New Overlay		
B_1		Remove Section		
B_2		Movello		
C_1		Move op		
C_2		Move Down		
C		Import		
C\$*		Export		
D*		Exportin		
W*				
L		Before change		
P*		0xFFFFFF80	EXCEPTVECT	_
EXCEPTVECT		0xFFFFFFFC	RESETVECT	
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Change the addresses of "EXCEPTVECT" and "RESETVECT" and click "OK".

Figure 4-16 aws_demos Project Section Settings 2 (CC-RX)

Click either "Re-Apply" or "Re-Apply and Close" to apply the address changes.



(b) Section settings for GCC

For GCC, edit the "linker_script.ld" file in the aws_demos project from the project explorer.

Double-click the name of the file indicated above and select the "linker_script.ld" tab. Change the addresses of ".exvectors" and ".fvectors" as shown in the following figure.



Figure 4-17 aws_demos Project Section Settings (GCC)

Error messages may appear when editing sections with the linker script editor, but please ignore them.



(2) Changing devices (when using FreeRTOS v202107.00-rx-1.0.x)

This section describes how to change a device. This procedure is necessary for both aws_demos and boot_loader projects, but the description uses the aws_demos project as an example.

Double-click "aws_demos/aws_demos.scfg" in the project explorer to open the Smart Configurator.

Select the "Board" tab to open the board selection dialog.

Г

OTA Main (QE) 💮 aws_demos.scfg 🗙	
Device selection	🔁 📄 Generate Code 🛛 Generate Report
Device selection	è 2
Board: Custom User Board	
verview Board Clocks System Components Pins Interrupts	

Figure 4-18 Device Change 1

Click the Browse button to view a list of target devices.

To use the configuration utilized in this application note, select "R5F565NEDxFB_DUAL" and click "OK". Finally, click "Next >".

ange Device		Device Selection				
elect the new device for aws demos		You can filter devices by regular	expression			
-	E					
urrent Device: R5F565NEDxFB		Search Device				
urrent Board: CKRX65N		Device	RAM	ROM	Pin	-
anat Read		✓ RX65N - 144pin				
ager board.		R5F565N4AxFB	256 KB	512 KB	144	
	Download additional boards	R5F565N4BxFB	256 KB	512 KB	144	
arget Device: R5F565NEDxFB		R5F565N4ExFB	256 KB	512 KB	144	
	Unlock Devices	R5F565N4FxFB	256 KB	512 KB	144	
		R5F565N7AxFB	256 KB	768 KB	144	
		R5F565N7BxFB	256 KB	768 KB	144	
		R5F565N7ExFB	256 KB	768 KB	144	
		R5F565N7FxFB	256 KB	768 KB	144	
		R5F565N9AxFB	256 KB	1 MB	144	
		R5E565N9B×FB	256 KB	1 MB	144	
		R5F565N9ExFB	256 KB	1 MB	144	
		R5F565N9FXEB	256 KB	1 MB	144	
		R5F565NCDxFB	640 KB	1.5 MB	144	
		R5F565NCDxFB_DUA	640 KB	1.5 MB	144	
		R5F565NCHxFB	640 KB	1.5 MB	144	
		R5F565NCH×FB_DUA	L 640 KB	1.5 MB	144	
		RSES65NEDvER	640 B	2 MB	144	
		R5F565NEDxFB_DUA	L 640 KB	2 MB	144	
		R5F565NEHxFB_DUA	L 640 KB	2.MB	144	
			i		<u> </u>	

Figure 4-19 Device Change 2



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When the following dialog appears, click "Next >".

Figure 4-20 Device Change 3

(a) Device change for CC-RX

Select "Build Settings" > "HardwareDebug" > "Toolchain Settings".

Remove the checks from "ROM to RAM mapped section (-rom)" and "Section (-start)".

(When using the boot_loader project for RYZ014A cellular, "Section (-start) will not be listed.) Click "Finish."



Figure 4-21 Device Change 4 (CC-RX)

(b) Device chance for GCC

Select "Project Files".

Remove the check from "src/linker_script.ld".

Click "Finish".

Changes to be performed	<mark>↓</mark>
🗹 🚖 🛛 aws_demos HardwareDebug	^
> 🗹 🔂 Build Settings	
🗸 🗌 🛃 Project Files	
🗌 📥 src/linker_script.ld	
🗹 🍓 Smart Configurator	
	×

Figure 4-22 Device Change 4 (GCC)



(3) RYZ014A setting (when using RYZ014A)

When using RYZ014A, the components need to be configured.

Double-click "aws_demos/aws_demos.scfg" in the project explorer to open the Smart Configurator.

Open the "Component" dialog and select "Middleware/Generic/r_cellular.

Enter the following values in the "Configurations" area. Refer to the SIM card instructions for a description of each value.

- Access point name
- Access point login ID
- Access point password
- SIM card PIN code



Figure 4-23 Cellular Component Configuration

If you add any changes from the Smart Configurator, click "Generate Code" to generate the code.



(4) Wi-Fi setting (when using RYZ014A)

When connecting RYZ014A to CK-RX65N, Wi-Fi will not be available. To work around the execution error (network setup failure), you can use the Wi-Fi SSID and PASSWORD to set up a dummy character string.

Open "aws_demos¥demos¥include¥aws_clientcredential.h" and set the dummy string in the next macro ("a" has been set as an example in the following figure).

- clientcredentialWIFI_SSID
- clientcredentialWIFI_PASSWORD



Figure 4-24 Wi-Fi Network Dummy Setting



4.4.1.2 For Azure

(1) Create projects

This section describes how to create the ADU sample project and the bootloader project. We will start by creating the bootloader project. Except for a few differences, the applies for the ADU sample project as well. The project is created in the project folder described in section 4.1. When using existing projects, skip this step.

Select "File" > "New" > "C/C++ Project" form the e^2 studio menu.

The dialog for creating a new project will open. Select either "Renesas CC-RX C/C++ Executable Project" or "GCC for Renesas RX C/C++ Executable Project", according to the compiler, and then click "Next >". Enter the desired project name, and then click "Next >"

		e	
e ² New C/C++ Project	– D X	New Renesas CC-RX Executable Project New Renesas CC-RX Executable Project	Ď
emplates for New C/C++ Project		Project name <mark>,</mark> azure_boot_loader	
dl Make Aake Aake Aake Aake Access Acce	RX C/C++ Executable Project Project for Renesas RX using the GCC for Renesas RX C/C++ Library Project Exect for Renesas RX using the GCC for Renesas RX Toolchain C++ Executable Project Renesas RX using the Renesas CC-RX toolchain. Exect for Renesas RX using the Renesas CC-RX toolchain. Exect for Renesas RX using the Renesas CC-RX toolchain. Exect for Renesas RX using the Renesas CC-RX toolchain. Exect for Renesas RX using the Renesas CC-RX toolchain. Exect for Renesas RX using the Renesas CC-RX toolchain. Exect for Renesas RX using the Renesas CC-RX toolchain.	✓ Use default location Costion: Cfworkspace¥azure_boot_loader Croose file system: default working sets Working sets Working sets	Browse New V Select

Figure 4-25 Azure Project Creation 1



Select "Azure RTOS" from the "RTOS" combo box.

Select "6.2.1_rel-rx-1.0.1" from the "RTOS Version" combo box. If the combo box is empty, click the link for "Manage RTOS Versions…" below the box to open to the download dialog. From the dialog, specify "Module Folder Path" and download "6.2.1_rel-rx-1.0.1".

After downloading the version, you will be able to select the downloaded version in the "RTOS Versions" combo box.

For details and selection of available revisions, refer to GitHub (Releases · renesas/azure-rtos (github.com)).

Toolchain Settings		RTO Sele	S Module Downlo	bad r download and specify downloa	ad location	Ľ
Language: C C C++ Toolchain: Renesas CC-RX Toolchain Version: V3.05.00 RTOS: RTOS Version: C-2, Trel-rx-1.0.1 Man Device Settings Target Board: CK-RX65N Download	Aanage Toolchains	onfiguration	Title Azure RTOS Azure RTOS Azure RTOS Azure RTOS Azure RTOS Azure RTOS Azure RTOS Azure RTOS	Rev. v6.1.9_rel-rx-1.0.0 6.1.6_rel-rx-1.0.3 6.1.3_rel-rx-1.0.2 6.1.6_rel-rx-1.0.4 v6.1_1_rel-rx-1.0.1 v6.1.6_rel-rx-1.0.6 v6.1.6_rel-rx-1.0.5 v6.2_0_rel-rx-1.0.0	Issue date	Select All Deselect All
Target Device RSF565NEHxF8 Endian: Little Project Type: Default	Create Debug Configuratio RX Simulator Create Release Configuratio Create Release Configuratio	on Pleas	e refer to <u>GitHub</u> for dule Folder Path: <u>Ci¥Users¥user¥.eclip</u>	more detailed information of ea sse¥com.renesas.platform_dowr	iload¥RTOS	Browse

Figure 4-26 Azure Project Creation 2



On the "Target Board", select "CK-RX65N", and then click "Next >".

After the Smart Configurator description appears, click "Next >".

e	
Toolchain Settings Language:	New Kenessa CC-RX Executable Project Setert Coding Assistant settings Use Smart Configurator Use Peripheral Code Generator Configurator which imports, configuration views and prime Smart Configurator which imports, configuration view, interrupt configuration view and prints Smart Configurator which is propheral modules, interrupts and pins occurred in different types of drivers and middleware resources configuration view. Hardware resources conflict in peripheral modules, interrupts and pins occurred in different types of drivers and middleware modules. ISmart Configurator is walable only for the supported device) Optimization view. ISmart Configurator is walable only for the supported device) Middleware Europeant Middleware Europeant Software Components Urbers Using Software Components Using Software Components Understand Software
Inlock Devices Create Debug Configuration Endian: Little Project Type: Default Create Release Configuration	Device Drivers Garcel MCU Hardware Finish Cancel Cancel

Figure 4-27 Azure Project Creation 3

Select "Secure bootloader sample project" in the "Select application area of "Select RTOS Project Settings", and then click "Finish".

New Renesas C	C-RX Executable Project
Select RTOS Pro	ject Settings
Select application	on:
BURNING BURNING	GUIX 16bpp draw 2d sample project
0	This demonstration illustrates GUIX sample project with 16 bits RGB 565 and drawing 2d engine driver
Distance of the	USBX device CDC-ACM Class sample project
0 🔯	This demonstration illustrates the setup and use of USBX device CDC-ACM Class to communicate with the host as a serial device.
Distance of the	USBX Host Mass Storage Class sample project
0 👩	This demonstration illustrates the setup and use of USBX host mass storage class to provide physical access to a data storage device.
0 👩	ThreadX Low Power sample project This demonstration illustrates how to use ThreadX with low power mode
	Azure Device Undate (ADU) sample project
0 👩	This demonstration illustrates OTA firmware update. Note: this project requires bootloader project.
BUILDING OF	Secure bootloader sample project
•	This sample is used together with ADU sample project to provide a secure boot
?	< Back Next > Finish Cancel

Figure 4-28 Azure RTOS Project Selection - Bootloader Sample Project



The "README.md" file is automatically opened when the project is generated. Follow the instructions in the file to configure the project.

Double-click "ProjectName.scfg" in the project explorer to open the Smart Configurator. After that, select the "Board" tab to open the board selection dialog.

Append "_DUAL" to the end of the target device name.

Device selection Device selection Board: Custom User Board \checkmark	toring – C X Device ne new device for azure_boot_loader
Device selection Board: Custom User Board	levice: RSFS6SNEHxFB oard: Custom
Device: RSF565NEHxFB Download more boards Overview Board Clocks System Components Pins Interrupts	Linitada Devices.

Figure 4-29 Azure Project Device Selection 1



Finally, click "Next >" then "Finish" to complete the device change. Please note that when a device is changed, the compiler settings are automatically reset.



Figure 4-30 Azure Project Device Selection 2

If the following dialog appears during the above procedure, click "Yes" and continue.

e' Question	×
Device change detected from "R5F565NEHxFB" to "R5F565NEHxFB_DL Do you want to keep the target board as "CK-RX65N (V1.02)"? Yes	JAL". No

Figure 4-31 Dialog During Azure Project Device Selection



(a) Section Settings for CC-RX

This section describes how to set up sections. Open Properties using the right click. Select "Settings" and open the Section settings using the button as shown below. When the Section Viewer dialog appears, click "Import...".

This will open the Select File dialog. Select and import the "linker_section_sample.esi" file located in the projects src folder. (Note 1)

Note 1. After changing the target device name, the section settings may be changed during the initial firmware creation, and the initial firmware creation may fail. In that case, please try the section settings again.



Figure 4-32 Azure Project Section Settings 1





Next, go to "Section" > "Symbol file", and add "PFRAM2=RPFRAM2".

Figure 4-33 Azure Project Section Settings 2

(b) Section Settings for GCC

To use GCC, you will need to replace the linker setting file.

Original location:

<project folder>/src/linker_script_sample.ld

Location after replacement:

<project folder>/src/linker_script.ld



Figure 4-34 Azure Project Section Settings 3



(2) Create ADU sample project

The next step is to create an ADU sample project. The procedure is the same as that for the bootloader project, but you will need to select "Azure Device Update (ADU) sample project" as the RTOS project setting.

The same exception applies to changing a device or setting a section.



Figure 4-35 Azure RTOS Project Selection - ADU Project

(3) Select projects

Select the created projects.

OTA Main (QE) ×				00
Cloud	⊘ Prepare	О ІОТ	ATO 😒	
.Cloud Settings		Select proje	cts	
Prepare projects	- V		Create a suu OTA president	(
Select projects			create new OTA project	(Telef guid
Select provisioning	Select created projects			
3.Manage IoT device	▼	Boot Loader	azure_boot_loader	```
Manage IoT device		Firmware	azure demos	

Figure 4-36 Select Projects Created for Azure



4.4.1.3 Download Smart Configurator Components

After you have created the sample project and bootloader project, open the Smart Configurator by doubleclicking the "<Project name>.scfg" file in each project using the project explorer.

[Open the "Components" tab. If you see a gray cube icon next to any node, select the node and click the "downloading it" link to download the component.

Software component con	oftware component configuration				
Compone 🚵 🛃 泽 🕒 🕀	Configure		(i)		
 Control Control Control	Component is missing. The issue may be resolved by downloading it or b	y <u>changing the ve</u>	r <u>sion</u> .		
Overview Board Clocks System Co	mponents Pins Interrupts				

Figure 4-37 Download Components



4.4.2 Select Provisioning

As QE for OTA V1.1.0 supports only one provisioning, no settings are necessary.

A 01	TA Main (QE)	×					000	E
	\odot	Cloud	⊘ Prepare	О ІОТ	\rangle \otimes	ΟΤΑ		
1.0	Cloud Se	ttings 👻	<u>^</u>	Select provis	ioning			1
\odot) Sign-in t	to Cloud						
2.1	Prepare	projects 👻	Select a provisioning.					
\odot	Select p	rojects		Provisioning	Source code includes	credentials (asymmetric keys)	~	1
\odot) Select p	rovisioning						1
3.1	Manage 1	IoT device 🔹]					
\odot	Manage	IoT device	Select provisioning(AWS)					
\odot	Create ir	nitial firmware	OF for V1.1.0 supports only 1 pro	ovisonina.				
\odot	Write pr	ogram to IoT devices						
4.0	ΟΤΑ	•	QE Series How to install/uninsta	all How to update FAQ I	<u>license</u>			
\odot	Create u	ipdate firmware						
\odot	Execute	OTA and check status						

Figure 4-38 Provisioning Selection



4.5 Manage IoT Device

Create a new IoT device on the cloud.

4.5.1 Manage IoT Device

Select "Manage IoT device" from the menu displayed on the left side of the OTA Main (QE) view and click "Open view".

OTA Main (QE)	×							8 - E
	Cloud	\rangle	Prepare	\rangle \odot	ΙοΤ	$\rangle \odot$	ΟΤΑ	
1.Cloud S	ettings	▲ <u>^</u>			Manage IoT de	vice		i i i i i i i i i i i i i i i i i i i
2.Prepare	e projects		Let de les te Cleur	d	_			
3.Manage	e IoT device	- Register	101 device to Cloud	and check stati	5.			
🕑 Manag	e IoT device						Manage IoT devi	Open view
🕑 Create	initial firmware							
🕢 Write p	program to IoT devices							

Figure 4-39 Manage IoT Device

The OTA Manage IoT Device view will open.

Г

Click the "Add" icon, then select "Create IoT device".

OTA Main (QE) OTA Manage to T Device (QE) All to 1 devices	IsT Device Initial Firmware Update Firmware OTA Firmware Log
	bT Device Name All IoT devices bT device information Create IoT device Create IoT group
	۰

Figure 4-40 Manage IoT Device - Create IoT Device



Enter the information about the IoT device you are creating and click "Create."

AWS	Create IoT device X	Δτικο	€ Create IoT device X	
AWS	IoT device nam Group nam Create number Polici Create Crea	Azure	IoT device name azure_demos_ Create numbe 1	

Figure 4-41 Create IoT Device Dialog

The contents of each item of IoT device information are shown below.

Table 4-1 Parameters for Creating IoT Device

Item	Contents
IoT device name	Specify the name of the IoT devices. When creating two or more devices, QE automatically adds a sequential number to the IoT device name.
Group name	Specify a group name when required (AWS only).
Create number	Specify the number of devices to create.
Policy	Select a policy. If "Create new policy" is selected QE will automatically create it (AWS only).

Confirm the information for the created IoT device.

The device certification and key will be automatically downloaded and displayed.

Note that the notation for AWS and Azure differ.

	OTA Manage loT Device (O	2E) ×							000	
AI		IoT Device	Initial Firmware	Update Firm	ware OTA	Firmware L	og			
🕂 🕆 🗙 T	Sync Cloud	loT Devic	e Name	Policy	Private Key	Public Key	Device Certificate	Device Certificate ID		
aws_demos_ck_rx	65n	aws_c	lemos_ck_rx65n	0	0			169a718a21ee84ec		_
Δτικο	7									
Azure]									
Azure OTA Main (QE)	OTA Manage loT De	vice (QE) ×								00 -
Azure OTA Main (QE) All IoT devices	OTA Manage loT De	vice (QE) ×	vice Initial Firm	ware Updat	e Firmware	OTA Firm	ware Log			00 – E
Azure OTA Main (QE) All IoT devices + • × × •	OTA Manage loT De Sync Cloue	vice (QE) ×	vice Initial Firm	ware Updat	e Firmware	OTA Firm	ware Log			8 - E
Azure	OTA Manage loT De Sync Cloue s ck rx65n	vice (QE) × loT De	vice Initial Firm Device Name azure_demos_ck_	ware Updat Symr	e Firmware (OTA Firm	ware Log			00 – E
Azure OTA Main (QE) All IoT devices + * * *	OTA Manage loT De Sync Clour s_ck_rx65n	vice (QE) × loT De	vice Initial Firm Device Name azure_demos_ck_	ware Updat Symr rx65n 🕑	e Firmware (DTA Firm	ware Log			
Azure OTA Main (QE) All IoT devices +	OTA Manage IoT De Sync Cloud s_ck_rx65n	d loT	vice Initial Firm Device Name azure_demos_ck_	ware Updat Symr rx65n 🔗	e Firmware (DTA Firm	ware Log			

Figure 4-42 Manage IoT Device - Display After IoT Device Creation



4.5.2 Create Initial Firmware

This section describes the procedure for creating the initial firmware.

4.5.2.1 Confirm Toolchain Version

If the installed toolchain version is not the same as the toolchain versions used by each project, an error will occur during the build.

In this case, you will either need to install the same or later version of the toolchain.

The toolchain version can be confirmed in the property settings of each project.

Properties for aws_demos	— D ×	<
type filter text	Settings $\langle \neg \ \neg \ \neg \ \neg$	000
 > Resource Builders > C/C++ Build Build Variables Environment Logging Settings Stack Analysis Tool Chain Editor > C/C++ General Project Natures Project References Renesas QE Run/Debug Settings 	Configuration: HardwareDebug [Active] Manage Configurations Tool Setting Toolchain Device Build Steps Build Artifact Binary Parsers Error Parsers Image: Configuration Current Toolchain Current Toolchain Colchain: Fenesas CC-RX Version: v3.04.00 Change Toolchain (click Apply before switching tabs) Toolchain: Renesas CC-RX Version: v3.05.00 v v3.05.00 v	*
?	Apply and Close Cancel	

Figure 4-43 Toolchain Version



4.5.2.2 Create Initial Firmware

Create the initial firmware after completing the necessary settings.

Select "Create initial firmware" from the menu displayed on the left side of the OTA Main (QE) view and click "Open view." The "Initial Firmware" tab in the OTA Manage IoT device (QE)" view will open.

						8 - 8
	Cloud	⊘ Prepare	Ø IoT		OTA OTA	× ⊔
1.Cloud Setti	ings 🔺	<u>^</u>	Create init	ial firmware		
2.Prepare pr	ojects 🔺			. .		_
3.Manage Io	T device 👻	Build Boot loader and Firmware to	create program for I	LO I DEVICES.		
🔗 Manage Io	T device				Create initial firmwa	Dpen view
🕝 Create init	ial firmware					
🕑 Write prog	ram to IoT devices	Create initial firmware(AV	VS)			

Figure 4-44 Create Initial Firmware - Open View

Select an IoT device and click "Add". The status will appear on the right side. To register all IoT devices that are displayed, click "Add all.

Next, select the IoT device you want to write from the list of registered devices, specify the version of the initial firmware, and click "Create initial firmware".

This same procedure applies to both AWS and Azure, but the display of registered IoT devices in the upper right of the tab differs.



Figure 4-45 Create Initial Firmware



Clicking "Create initial firmware" opens the Code Signing dialog. If you have already created a code signing certificate, the Certificate Copy dialog with open. (See Figure 4-51 Copy Code Signing Certificate Files Dialog.)

e Code Signing		×
Create Code Signing Cert	ificate	
Create a certificate for code	signing using OpenSSL.	
[Note] Since there is a limit to the signing certificates create created in this dialog stric	e number and number of times code signing certificates can be registered to d by QE are intended to be diverted. Please keep the code signing certificate tly confidential so that you do not lose the file.	cloud, code related file
OpenSSL Exe Path : C:¥Pro	ogram Files¥OpenSSL-Win64¥bin¥openssl.exe	Browse
Stored Location : C:¥Use	ers¥user¥.eclipse¥com.renesas.qe.cloud¥QE-OTA¥codesigning	Browse
Output Location : C:¥wo	rkspace¥freertos¥projects¥renesas¥ck-rx65n-ryz014a¥e2studio¥boot_loader	¥QE-OTA¥codesignir
Certificate Information		
Country Name :	US	
State or Province Name :	Your State	
Locality Name :	Your City	
Organization Name :	Your Company	
Organization Unit Name :	Your Section	
Common Name :	devuser1	
Email Address :	your-address@example.com	
		^
<		>
?	ОК	Cancel

Figure 4-46 Create Code Signing Certificate Dialog

After setting the Open SSL path and entering your certificate information, click "OK". This will automatically create the initial firmware.

Note that since there is a limit to the number and number of times that code signing certificates can be registered to the cloud, code signing certificates created by QE are intended to be diverted. When a certificate diverted, it will no longer be displayed in the code singing dialog. Diverting certificates is explained later in this document (see <u>4.5.2.4 Code Signing Certificate</u>).

When a code signing certificate is created successfully, it will look like the following. This indicates that the initial firmware creation process has completed.

(3) Create initial firmware	
Create initial firmware	
Create firmware is complete.	
	1

Figure 4-47 Create Initial Firmware - Successful Completion

The following dialog may appear during this procedure. In this case, select the target board and click "OK."

e? Sele	Select Board	×
Select ti Board:	ect the board you are using. bard: CK-RX65N	OK Cancel

Figure 4-48 Select Board Dialog



4.5.2.3 Sample Project Firmware

Firmware is generated at the location shown in the figure below with the following contents.

<project folder>¥QE-OTA¥apl¥<version>¥<IoT device name >

- <Project name>.mot
 This is the sample project HEX file in Motorola Format.
- <Project name>.x (CC-RX の場合), <Project name>.elf (for GCC) This is the sample project load module file.
- merged.mot

This is the HEX file of the merged sample and bootloader projects in Motorola Format. Write this file to the IoT device.



Figure 4-49 Locations of Created Initial Firmware (CC-RX)



4.5.2.4 Code Signing Certificate

The created code signing certificates are stored in the following locations in the bootloader project.



Figure 4-50 Code Signing Certificate Locations

Make sure to carefully manage code signing certificate and related files so that you do not lose them. When executing OTA, the code signing certificate generated here are used to create a code signing profile (qe_code_signing), but once the code signing profile is created, it cannot be recreated in QE for OTA. When using a different code signing, use the AWS console to create a code signing profile.

For this reason, certificates created in QE for OTA are intended to be diverted. The following procedure describes how to reuse a certificate.

- 1. Go to the following folder in the project where you created the code signing certificate and copy the codesigning folder.
 - <bootloader project folder>/QE-OTA/codesigning
- 2. Paste the codesigning folder in the same location in the new project.

Note that when certificate is stored in the "Stored location" specified in the "Created Code Signing Certificate" dialog, it may be automatically diverted.

Copy code signing certificate files	×
Required files for code signing are missing in bootloader project. Divert files in stored location ? Yes N	ο

Figure 4-51 Copy Code Signing Certificate Files Dialog



4.5.3 Write Program to IoT Device

Write the initial firmware to the board.

Select "Write program to IoT devices" from the menu displayed on the left side of the OTA Main (QE) view and click "Open view".

♠ ⊘	Cloud	$\rangle \odot$	Prepare	$\rangle \odot$	ΙοΤ	$\rangle \odot$	ΟΤΑ	
1.Cloud Se	ettings			Writ	e program to Io	oT devices		
2.Prepare	projects	•						
3.Manage	IoT device	- Write	program to lot device	S				
🕗 Manage	e IoT device					Write prog	ram to IoT device	Open view
⊘ Create	initial firmware							

Figure 4-52 Write Program to IoT Devices

The Initial Firmware tab will open. Select the IoT device to be written to the board from the list of registered devices and click "Debug".

All loT devices	IoT Device Initial Firmware Update Firmware OTA Firmware Log
🖶 👻 🗶 🖛 Sync Clou	(1) Select IoT devices for which want to create initial firmware
aws_demos_ck_rx65n	Add all IoT Device Name Private Key Public Key Device Certificate
	Add aws_demos_ck_rx65n O O
	Delete
	🗱 Delete all
	Mr. Debug
	A beoug
	(2) Specify version of firmware
	V 1 🗘 0 🗘
	(3) Create initial firmware
	Create initial firmware

Figure 4-53 Debug Button



The Flash Programming dialog for writing the firmware will open.

Connect the board and supply power.

Specify the Renesas Flash Programmer (rfp-cli.exe) path and ID code, as well as the target board and emulator, and then click "Write". When the write is successfully completed, "Operation successful" will be displayed.

To continue to debug programs, click "Debug".

The initial firmware can be run by clicking "Debug".

Flash Programming		
Write the initial firmware device.After connecting button.	e using the Renesas Flash Programmer to the the emulator, check the setting and press the	e Write
[Write] Write the build p [Debug] Download sym	rogram using the Renesas Flash Programme bol information.	r.
To write then debug: Pre To debug without writin	ess the [Write] and then press the [Debug]. g: Press the [Debug].	
Renesas Flash Program	nmer	
RFP CLI exe path: C:¥I	Program Files (x86)¥Renesas Electronics¥ E	rowse
D code: FFF	RX65N	
Emulator: E2 e	emulator Lite V	
Please install Renesas F	lash Programmer.	
	Write Debug (llose
	-	
Operation successful		`
	Write Debug	Close

Figure 4-54 Write Initial Firmware



Immediately after the debug operation is started, it stops by default at the start function break (twice by default).

Operation logs can be monitored in the "Firmware Log" tab of the "OTA Manage IoT Device" view Specify the COM port (or set to "auto") and click "Connect" to display the firmware operation logs.

To check logs, you can display all the logs from the start by connecting to COM during the break.

After connecting to COM, click "Resume" to restart the program.



Figure 4-55 Firmware Dialog Display

When the initial firmware runs successfully, the following contents will appear in the firmware log. Check to make sure there are no error logs and that the displayed version is 1.0.0.

AWS	Azure
55N secure boot program	BOOTLOADER demo version 0.1.1
	FWUP FIT module version 1.06
ecking data flash ROM status.	
ading user code signer public key: not found.	RX65N secure boot program
vision the user code signer public key: OK.	
ecking code flash ROM status.	Checking flash ROM status.
nk 0 status = 0xfc [LIFECYCLE_STATE_INITIAL_FIRM_INSTALLED]	bank 0 status = 0xfc [LIFECYCLE_STATE_INSTALLING]
hk 1 status = 0xff [LIFECYCLE_STATE_BLANK]	bank 1 status = 0xff [LIFECYCLE_STATE_BLANK]
nk into = 1. (start bank = 0)	bank info = 1. (start bank = 0)
rted 10us software timer using CMT channel 0.	Integrity check scheme = sig-shazbo-ecdsa
egrity check scheme = sig-sha256-ecdsa	erase bank1 secure boot mirror area. OK
nk0(execute area) on code flash integrity checkOK	convised and from bank0 to bank1. OK
se bank i secure boot mirror areaOK	iump to user program
by secure boot (part I) from banku to bank IOK	♦ETHERC0 is link up.
by secure boot (partz) from banku to bank IOK	DHCP In Progress
10 ITem Such Write contificate	IP address: 192.168.11.100
40 [Imr Svc] while certificate	Mask: 255.255.255.0
075 [int thread] [INEO][DEMO][2075] STARTING DEMO	Gateway: 192.168.11.1
	DNS Server address: 192.168.11.1
	SNTP Time Sync0.pool.ntp.org
075 [iot_thread] [INFO][INIT][2075] SDK successfully initialized	SNTP Time Sync successfully.
ors [lot_anead] [init o][init1][2075] Solt successibility initialized.	IoTHub Host Name: azure-seminar-iothub-001.azure-devices.net; Device ID: azure_demo
0697 [iot_thread] [INFO][DEMO][10697] Successfully initialized the demo	Connected to Io I Hub.
see he for a see the former to be a second and the denot	IDADK IDTO = 1. (Start bank = (I) [INEO] A DU accept started successfully]
0697 [iot thread] [INEO] OTA over MOTT demo. Application version 1.0.0	[INFO] ADD agent started successfully: Manufactures DENESAS, Models CK, DYSEN, Jactallod Criteria: 10.0

Figure 4-56 Firmware Dialog for Initial Firmware



4.6 OTA

This chapter describes how to create update firmware and how to execute OTA.

4.6.1 Create Update Firmware

Select "Create update firmware" from the menu displayed on the left side of the OTA Main (QE) view and click "Open view". This will open the "Create update firmware" tab in the OTA Manage IoT device (QE) view.

								ŏ
	Cloud	⊘	Prepare	≥ 0	IoT	$\rangle \odot$	ΟΤΑ	
1.Cloud S	Settings			Cı	eate update fii	mware		
2.Prepare	e projects		dt 6	e un determine Claur				
3.Manage	e IoT device	 Create 	e update infinware io	r update via Ciou	1			
4.OTA		-				Creat	e update firmw	e Open view
⊘ Create	update firmware						1	
 Execut 	e OTA and check statu	s						

Figure 4-57 Create Update Firmware

The flow of for creating update firmware is the same as that for creating the initial firmware.

First, update the source file for the updated firmware with feature additions and fixes. This change is omitted in this application note, but make the necessary changes.

Register and select IoT devices, specify the version for the updated firmware, and then click "Create update firmware". If the firmware is successfully created, the "Create firmware is complete" message will appear.

OTA Main (QE)	(QE) ×					8 P E
II IoT devices	IoT Device Initia	I Firmware Update Firmware	OTA Firm	nware Log		
🖶 👻 🗶 🕶 📥 Sync Cl	loud (1) Select IoT de	vices for which want to update	the firmware			
aws_demos_ck_rx65n	🔀 Add all	IoT Device Name	Private Key	Public Key	Device Certificate	
	Add	aws_demos_ck_rx65n 🗮	0	0	Ø	
		1				
	< Delete					
	🔣 Delete all					
	🏇 Debug					
	(2) Specify versi	on of firmware				
	(2) specify version					
	V I 🖵 I					
	(3) Create updat	firmware using latest source				
	Create update f	firmware				
	Create firmware	e is complete.				

Figure 4-58 Update Firmware Creation Procedure



The update firmware is generated at the location shown in the figure below with the following contents.

<project folder>¥QE-OTA¥apl¥<version>¥<IoT device name>

- <Project name>.mot
 This is the sample project HEX file in Motorola Format.
- <Project name>.x (for CC-RX), <Project name>.elf (for GCC) This is the sample project load module file.
- <IoT device name>.rsu This is the update firmware created with the Renesas Secure Flash Programmer. Upload this file to the cloud.
- <loT device name>.importmanifest.json (for Azure)
 This is the import manifest file. Upload this file to the cloud.



Figure 4-59 Location of Update Firmware Creation (CC-RX)



4.6.2 Execute OTA and Check Status

Select "Execute OTA and check status" from the menu displayed on the left side of the OTA Main (QE) view and click "Open view" located next to "Execute OTA". This will open the "OTA" tab in the OTA manage IoT device (QE) view.

- OTA Main (QE) × - OTA Manage IoT Dev	ice (QE)						°° – 🗖
Cloud	\rangle	Prepare	\rangle \otimes	ΙοΤ	\rangle	ΟΤΑ	
1.Cloud Settings	•	<u>^</u>	Exec	ute OTA and	l check status		^
2.Prepare projects		Currente OTA fan a		And sharly C			
3.Manage IoT device	•	Execute OTA for s	elected devices	. And, check C	TA status.		
4.0TA	-					Execute OT	Open view
🕑 Create update firmware							
⊘ Execute OTA and check stat	tus					Check statu	S Open view

Figure 4-60 Execute OTA and Check Status

As with the other tabs, after selecting the IoT device that will execute OTA, click "Add" to register the device.

Select the registered IoT device and specify the version of the created update firmware.

For AWS, specify the role, update location, and code signing profile for the OTA to be executed. If the profile does not appear, select "Create new", and QE for OTA will automatically create the profile when OTA is executed. For Azure, this section does not appear, and settings are not necessary.

Click "Execute OTA" to start running OTA.

- OTA Main (QE) OTA Manage IoT Device (QE) X								8 -
All IoT devices	IoT Device Initial	Firmware Upd	late Firmware OTA	Firmware Log				
🖕 👻 🗶 🖛 Sync Cloud	(1) Select IoT devi	ces for executio	on OTA					
aws_demos_ck_rx65n	🕅 Add all	IoT Device N	ame Policy	OTA Job Sta	atus OT/	A Job Execution Statu	IS	
	Add	aws_dem	os_ck_rx65n 🥝					
	O Delete							
	41 Delete all							
	W belete un							
		OTA Job List	:(0)					
		ID	Creation Date	Status	Execution Status	Reason	Version	Code Signing Profile
	(2) Select version	for update firm	ware					
	v1.1.0 ~							
	(3) Select role, up	load to, code si	gning profile for execu	tion OTA. Not crea	ated with QE, "Create	New" is displayed ar	nd QE crea	ates a new one automatically.
	F	Role .	-	· •				
	Uploa	d to						
	Code signing pro	ofile						
	(4) Execute OTA							
	Execute OTA							
								^
								Ý

Figure 4-61 OTA Settings (AWS)



📤 OTA Main (QE) 🛛 📥 OTA Manage loT Device (Q)E) ×					°° – E
All loT devices	IoT Device Initial F	irmware Update Firmware	OTA	Firmware Log		
🖶 👻 🗶 💌 📥 Sync Cloud	(1) Select IoT devic	es for execution OTA				
azure_demos_ck_rx65n	🔯 Add all	IoT Device Name	OTA J	ob Status	Installed Update	
	Add	azure_demos_ck_rx65n				
	Delete					
	A Delete all		/			
	Wenter					
	(2) Selectiversion f	or update firmware				
	v1.1.0 ~					
	(3) Execute OTA					
	Execute OTA					
						^
						~

Figure 4-62 OTA Settings (Azure)



The OTA execution job is created automatically. For AWS, the OTA job status goes to "IN_PROGRESS", and for Azure, it goes to "InProgress".

When the IoT device (target board) is running in this state and connected to the network, it will detect the update and automatically start the firmware update. If the IoT device is not connected to the network, the firmware update will start after the network is connected.



Figure 4-63 After Executing OTA

You can check the progress in the "Firmware Logs" tab.

Select "Execute OTA and check status" from the menu displayed on the left side of the OTA Main (QE) view and click "Open view" located next to "Check firmware".







After the download is completed, the firmware is checked. If there are no problems, the IoT device will restart and the updated firmware will start running.

Confirm that OTA succeeded by checking the indicated version in the firmware log. Find the version simply by searching the contents in the menu on the left side of the firmware log.

For AWS: [AWS > OTA > Version (x)]

For Azure: [Azure > Version (x)]

The version number will differ before and after OTA execution, indicated that the version has been updated.



Figure 4-65 Firmware Log

After the update is completed, return to the "OTA" tab and check to see that the OTA job is complete on the cloud side.

For AWS			For Azure	
IoT Device Name	Policy	OTA Job Status	IoT Device Name	OTA Job Status
aws_demos_ck_rx65n	0	COMPLETED	azure demos ck. rx65n	Succeeded

Figure 4-66 Job Status after OTA Execution



5. Help Function

You can check the details of the functions of "QE for OTA" from the Help tab in e² studio.



Figure 5-1 Help Function



Revision History

		Description	
Rev.	Date	Page	Summary
1.00	Jun. 30. 23	-	First edition issued



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

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power is supplied until the power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

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

4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable. 6. Voltage application waveform at input pin

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

7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

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

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