

## Getting started with the Renesas Starter Kit+ for RX671

This tutorial provides instructions for getting started with the Renesas Starter Kit+ for RX671. If you do not have the Renesas Starter Kit+ for RX671, visit the [AWS Partner Device Catalog](#), and purchase one from our partners.

This document explains how to configure AWS IoT Core and FreeRTOS to connect your device to the AWS Cloud.

### Overview

This tutorial contains instructions for the following getting started steps:

- A Hardware Requirement.**
- B Installing tool and software on the host machine for developing.**
- C Creating Policy for Device**
- D Device on AWS IoT Core**
- E Set up the Renesas Starter Kit+ for RX671 (Wi-Fi).**
- F Cross compiling a FreeRTOS demo application to a binary image.**
- G Loading the application binary image to your board, and then running the application.**
- H Monitoring MQTT messages on the cloud.**

### A. Hardware Requirement

1. Renesas Starter Kit+ for RX671 (**RTK55671EHC00000BE**)  
<https://www.renesas.com/products/microcontrollers-microprocessors/rx-32-bit-performance- efficiency-mcus/rx671-starter-kit-plus-renesas-starter-kit-rx671>
2. Mini-B USB cables x1  
 These cables can be used to connect the PC to the Renesas Starter Kit+ for RX671
3. E2 Lite Emulator (required)  
<https://www.renesas.com/us/en/software-tool/e2-emulator-lite-rte0t0002lkce00000r>.
4. Wi-Fi Pmod Expansion Board (**RTK00WFMX0B00000BE**)
5. +5V power adapter

Go to Troubleshooting section to solve any issues.

### B. Installing software and tool on the host machine for developing

*Note: Host machine running Windows 8.1 or 10.*

#### To download and install e<sup>2</sup>studio

1. Go to the [Renesas e<sup>2</sup>studio installer](#) download page and download the offline installer.
2. You are directed to a Renesas Login page.

If you have an account with Renesas, enter your username and password and then choose **Login**.

If you do not have an account, choose **Register now**, and follow the first registration steps. You should receive an email with a link to activate your Renesas account. Follow this link to complete your registration with Renesas, and then login to Renesas.

3. After you log in, download the e<sup>2</sup>studio installer to your computer.
4. Open the installer and follow the steps to completion.

For more information, see the [e<sup>2</sup>studio](#) on the Renesas website.  
Note: Linux and MacOS are not supported.

### To download and install the RX Family C/C++ V3.03.00 Compiler Package

1. Download [RX Family C/C++ V3.03.00 Compiler Package](#).
2. Open the executable and install the compiler.

### To download and install the GCC for Renesas 8.3.0.202004-GNURX Toolchain Package

3. Download [GCC for Renesas 8.3.0.202004-GNURX Toolchain](#).
4. Open the executable and install the compiler.

### To download Tera Term

Go to <https://ttssh2.osdn.jp/index.html.en> to download the software.

## C. Create a Policy for a Device

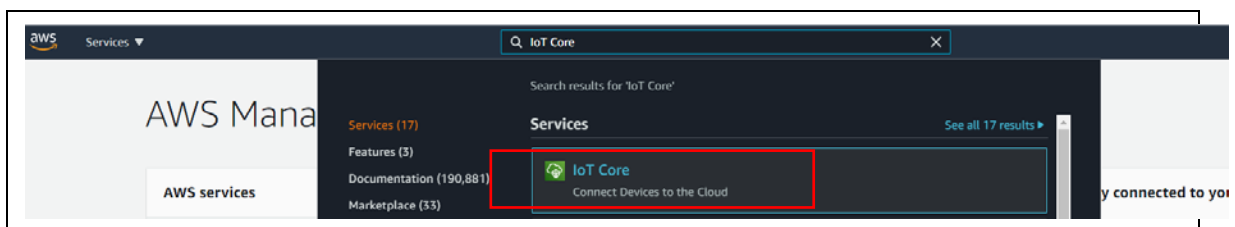
User needs to create AWS account. Refer to the instructions at [Set up your AWS Account](#). Follow the steps outlined in these sections to create your account and a user and get started:

- Sign up for an AWS account.
- Create a user and grant permissions.
- Open the AWS IoT console.

Pay special attention to the Notes.

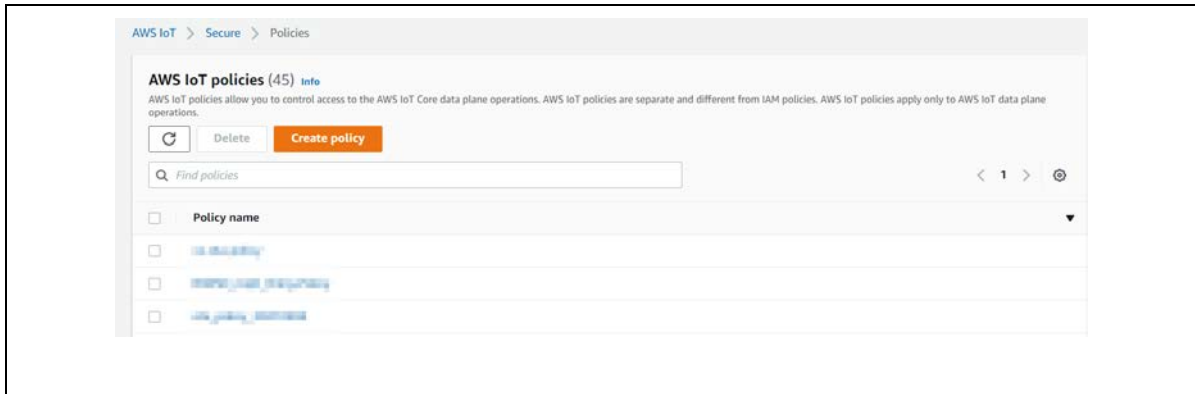
If user created AWS account already in the past, please skip this step.

1. Type IoT Core in search bar and click **IoT Core**



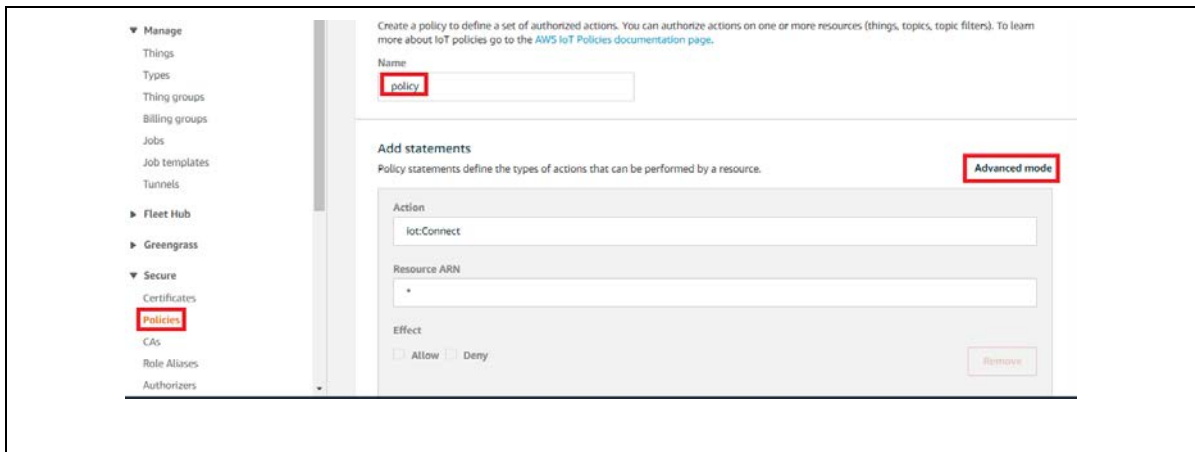
**AWS IoT Core Selection**

2. Go to Secure→Policies  
Click on **Create policy** to create a policy



### Create a policy

In the **Name** field, enter a name for the policy.  
Then, change to **Advanced mode**.



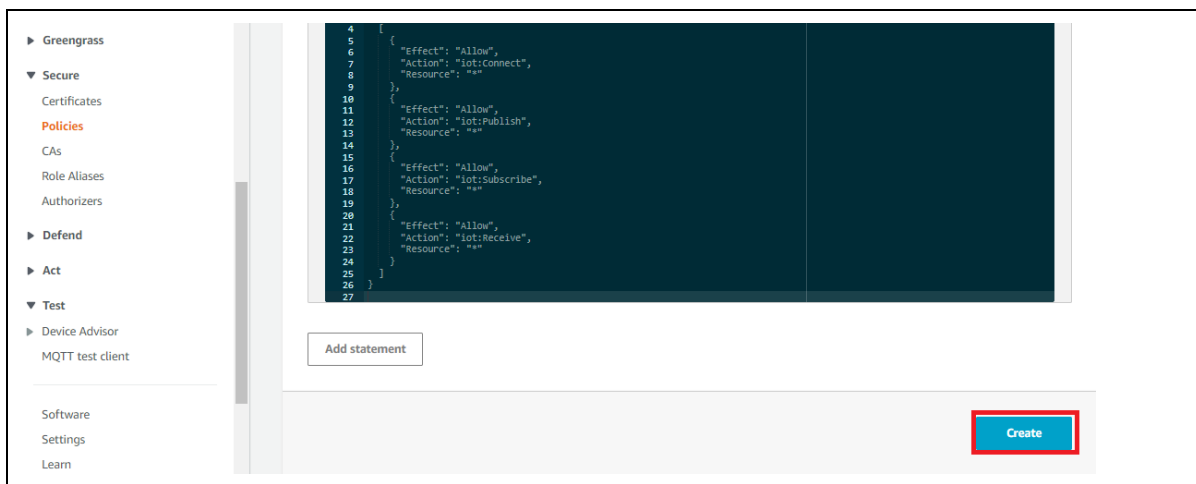
### Give a policy name

Add following text to **Advanced mode**

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

### Add statements for policy

### 3. Create a policy



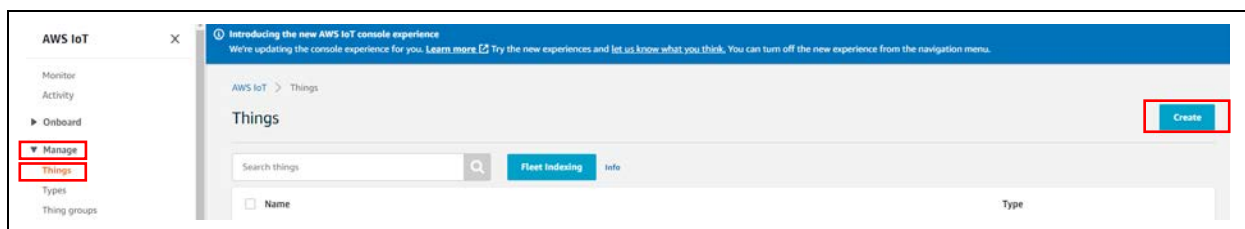
#### Create a policy

*Note: The examples in this document are intended only for dev environments. All devices in your fleet must have credentials with privileges that authorize only intended actions on specific resources. The specific permission policies can vary for your use case. Identify the permission policies that best meet your business and security requirements. For more information, refer to [Example policies](#) and [Security Best practices](#).*

## D. Creating Device on AWS IoT Core

### 4. Create a Thing

Select **Manage** → **Things** → **Create** to create a thing



#### Create a thing

## 5. Select the **Create a single thing**

AWS IoT > Things > Create things

### Creating AWS IoT things

An IoT thing is a representation and record of your physical device in the cloud. Any physical device needs a thing record in order to work with AWS IoT. [Learn more.](#)

**Register a single AWS IoT thing**  
Create a thing in your registry

**Create a single thing**

**Bulk register many AWS IoT things**  
Create things in your registry for a large number of devices already using AWS IoT, or register devices so they are ready to connect to AWS IoT.

**Create many things**

Cancel **Create a single thing**

### Create a single thing

## 6. Add name to thing and **Next**

AWS IoT > Things > Create things > Add your device to the thing registry

### CREATE A THING

#### Add your device to the thing registry

STEP 1/3

This step creates an entry in the thing registry and a thing shadow for your device.

**Name**  
Thing

**Apply a type to this thing**  
Using a thing type simplifies device management by providing consistent registry data for things that share a type. Types provide things with a common set of attributes, which describe the identity and capabilities of your device, and a description.

**Thing Type**  
No type selected **Create a type**

Groups / **Create group** **Change**

**Set searchable thing attributes (optional)**  
Enter a value for one or more of these attributes so that you can search for your things in the registry.

Attribute key	Value	
Provide an attribute key, e.g. Manufacturer	Provide an attribute value, e.g. Acme-Corporation	<b>Clear</b>

**Add another**

**Show thing shadow** ▾

Cancel **Back** **Next**

### Add name to a single thing

## 7. Add a certificate for thing

AWS IoT > Things > Create things > Add your device to the thing registry > Add certificate

CREATE A THING STEP 2/3

### Add a certificate for your thing

A certificate is used to authenticate your device's connection to AWS IoT.

**One-click certificate creation (recommended)**  
This will generate a certificate, public key, and private key using AWS IoT's certificate authority.

**Create certificate**

**Create with CSR**  
Upload your own certificate signing request (CSR) based on a private key you own.

**Create with CSR**

**Use my certificate**  
Register your CA certificate and use your own certificates for one or many devices.

**Get started**

**Skip certificate and create thing**  
You will need to add a certificate to your thing later before your device can connect to AWS IoT.

**Create thing without certificate**

**Create a certificate for thing**

## 8. Attach a policy to thing

- Click the **Download** button next to each of the certificates, keys and save in local PC or host machine.
- Click the **Activate** button to activate the certificate.
- Select **Attach a policy** and choose the policy you created in section C.

**Certificate created!**

Download these files and save them in a safe place. Certificates can be retrieved at any time, but the private and public keys cannot be retrieved after you close this page.

In order to connect a device, you need to download the following:

A certificate for this thing	cert.pem	<b>Download</b>
A public key	public.key	<b>Download</b>
A private key	private.key	<b>Download</b>

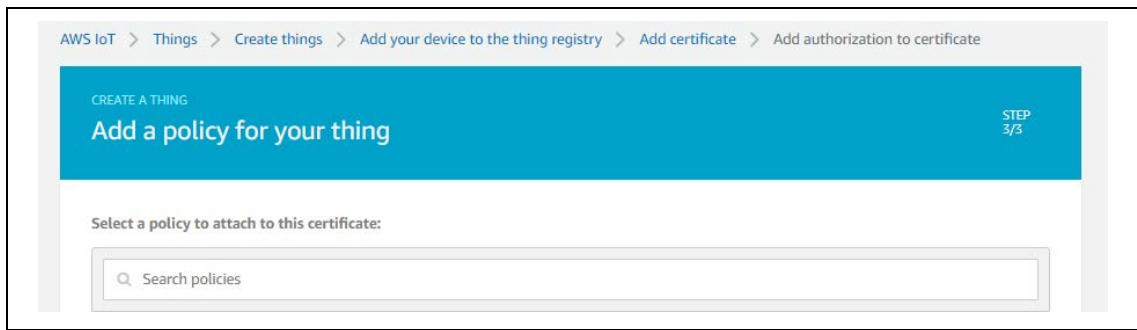
You also need to download a root CA for AWS IoT:  
A root CA for AWS IoT [Download](#)

**Activate**

Cancel Done **Attach a policy**

**Attach a policy**

## 9. Register policy to thing

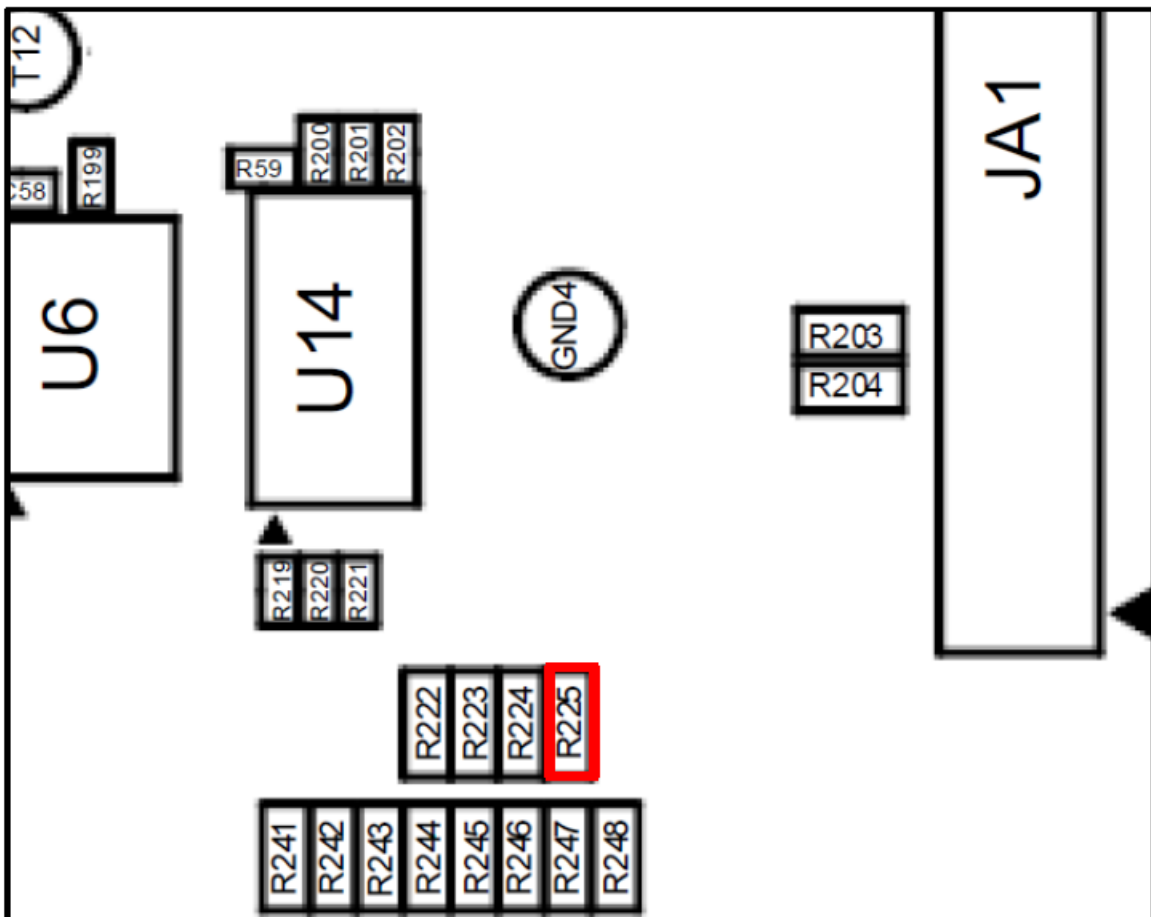
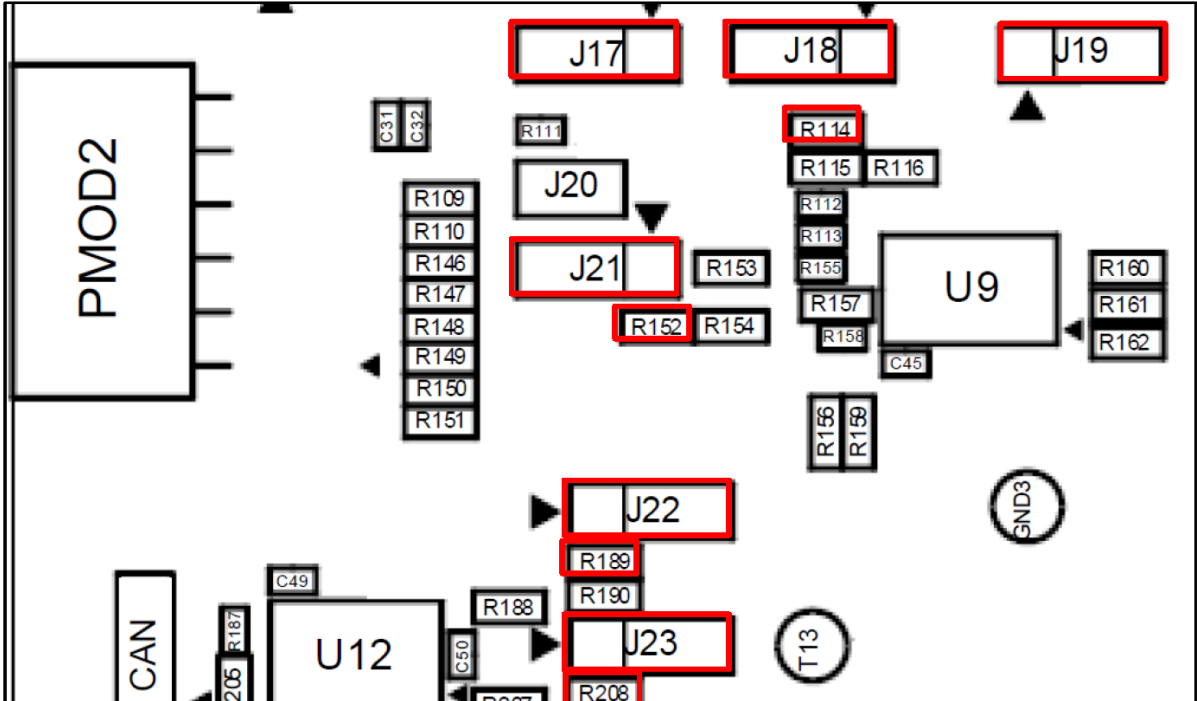
**Register policy to thing****E. Set up the Renesas Starter Kit+ for RX671****To confirm functionality on Renesas Starter Kit+ for RX671**

It is necessary to modify the Renesas Starter Kit+ for RX671 board to connect the Wi-Fi module to PMOD2.

Required modifications are as follows:

Signal name	Signal	Jumper/Resistor	Short pins/Remove Resistor
P12	PMOD2-IO2_MISO_RXD_SCL	J21	Pin2-3 short
		R152	Remove
P13	PMOD2-IO1_MOSI_TXD	J17	Pin1-2 short
		J18	Pin2-3 short
		R114	Remove
P32	PMOD2-IO6_CS1_WIFITXD	J23	Pin2-3 short
		R208	Remove
P33	PMOD2-IO7_CS2_WIFIRXD	J22	Pin2-3 short
		R189	Remove
P51	PMOD2-IO3_SCK_RTS	J19	Pin1-2 short
		R225	Remove

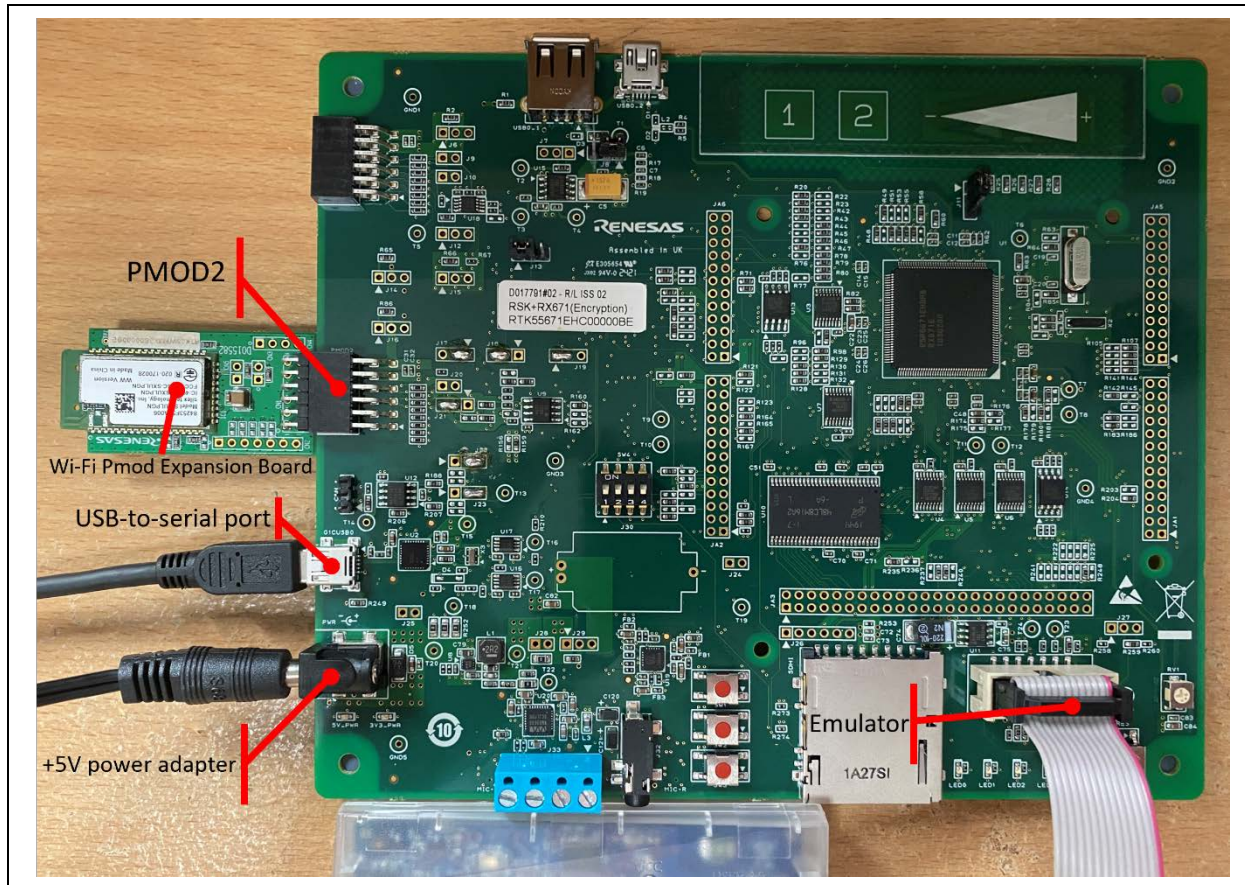
Mounting locations of each component are shown below:





After completing board modification described above:

- Connect the positive +5V power adapter to the PWR connector on the RSK+ for RX671.
- Connect your computer to the USB-to-serial port on the RSK+ for RX671.
- Connect Wi-Fi Pmod Expansion Board to PMOD2



**Connect Renesas Starter Kit+ for RX671 to power PC**

#### To set up the E2 Lite Debugger module

- Use the 14-pin ribbon cable to connect the E2 Lite Debugger module to the 'E1/E2 Lite' port on the RSK+ for 671.
- Use a USB cable to connect the E2 Lite debugger module to your host machine. When the E2 Lite debugger is connected to both the board and your computer, a green 'ACT' LED on the debugger flashes.
- After the debugger is connected to your host machine and RSK+ for RX671, the E2 Lite debugger drivers begin installing.

*Note that administrator privileges are required to install the drivers.*

## F. Cross compiling a FreeRTOS demo application to a binary image

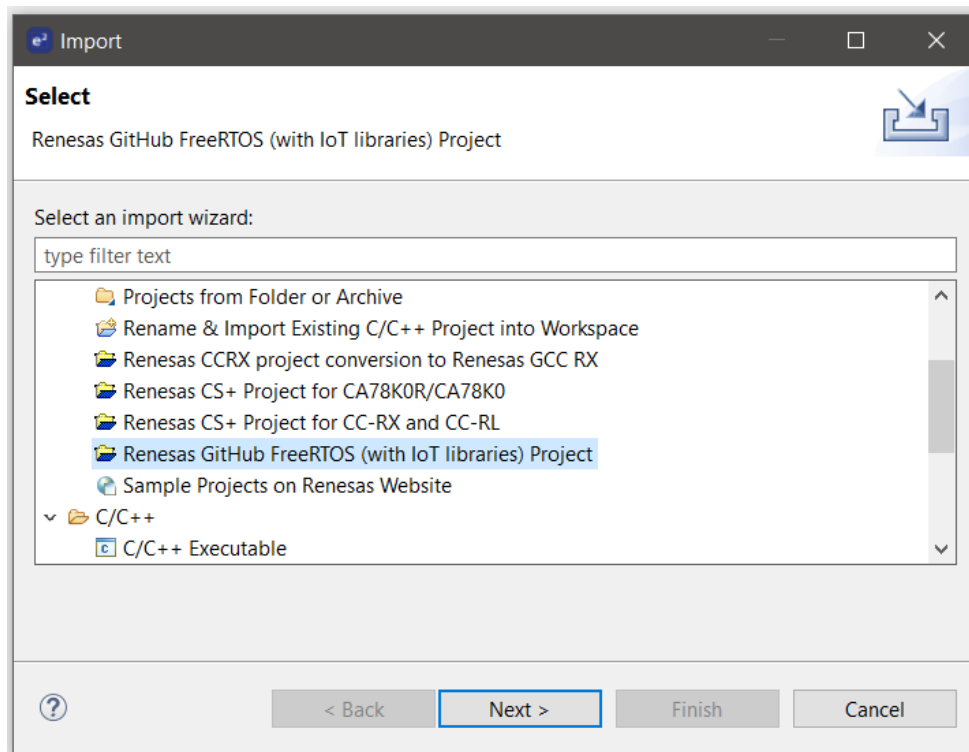
Now that you have configured your board, you are ready to build and run the project on your board.

## Build the FreeRTOS Demo in e<sup>2</sup>studio

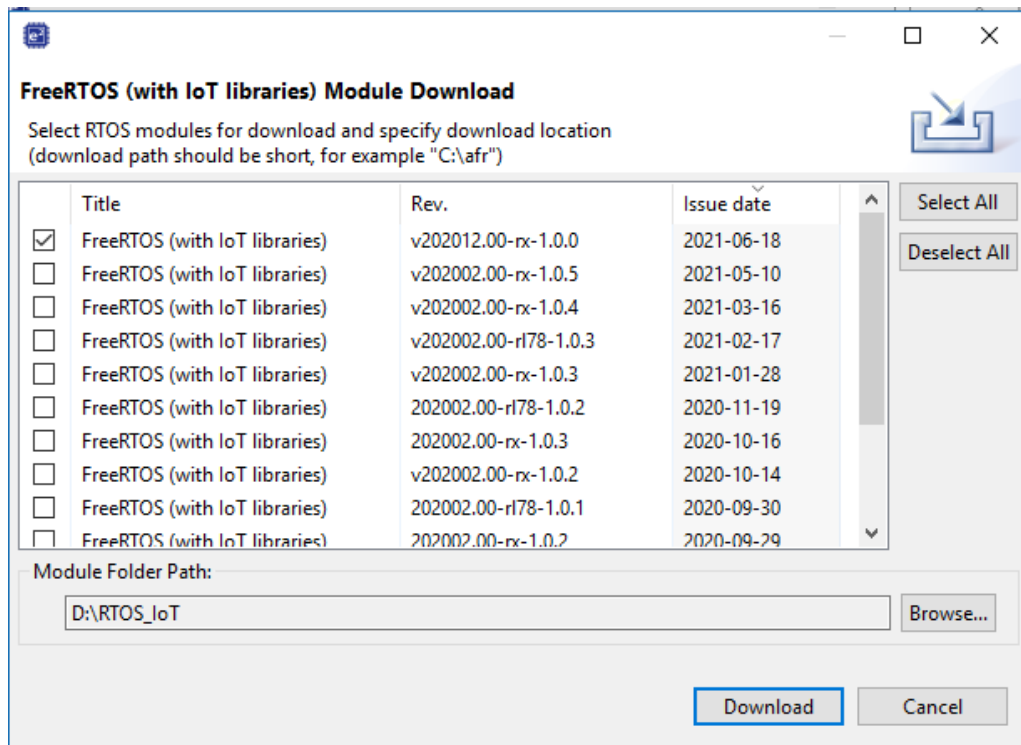
### To download and build the demo in e<sup>2</sup>studio

In this tutorial, the path to the FreeRTOS download directory is referred to as `freertos`.

1. Launch e<sup>2</sup>studio from the Start menu.
2. On the **Select a directory as a workspace** window, browse to the folder that you want to work in, and choose **Launch**.
3. The first time you open e<sup>2</sup>studio, the **Toolchain Registry** window opens. Choose **Renesas Toolchains** and confirm that **CC-RX v3.03.00** or **GCC for Renesas 8.3.0.202004-GNURX** is selected. Choose **Register**, and then choose **OK**.
4. If you are opening e<sup>2</sup>studio for the first time, the **Code Generator Registration** window appears. Choose **OK**.
5. The **Code Generator COM component register** window appears. Under **Please restart e<sup>2</sup>studio to use Code Generator**, choose **OK**.
6. The **Restart e<sup>2</sup>studio** window appears. Choose **OK**.
7. e<sup>2</sup>studio restarts. On the **Select a directory as a workspace** window, choose **Launch**.
8. On the e<sup>2</sup>studio welcome screen, choose the **Go to the e<sup>2</sup>studio workbench** arrow icon.
9. Right-click the **Project Explorer** window and choose **Import**.
10. In the import wizard, choose **General, Renesas GitHub FreeRTOS (with IoT libraries) Project**, and the choose **Next**.



11. Choose **Browse** to specify a folder to copy downloaded RTOS content in order to import project.
12. In RTOS version setting, choose **Check for more version...** to see a list of all supported RTOS version. On the **FreeRTOS (with IoT libraries) Module Download** window, select the FreeRTOS version (recommended: v202012.00-rx-1.0.0 ) you want to work on by clicking the checkbox, then choose **Download**.



13. Once download is completed, choose **Next** in the **Renesas GitHub FreeRTOS (with IoT libraries) Project** window.
14. If you are *not* using an empty folder, the **Copy Resources** warning message appears. Choose **Yes**.
15. Choose the project to import:
  - To import CC-RX demo project, choose `${freertos}/projects/renesas/rx671-rsk/e2studio/aws_demos`, then choose **Finish**.
  - To import GNURX demo project, choose `${freertos}/projects/renesas/rx671-rsk/e2studio-gcc/aws_demos`, then choose **Finish**.
16. From **Project** menu, choose **Build All**.

The build console issues a warning message that the License Manager is not installed. You can ignore this message unless you have a license key for the CC-RX compiler. To install the License Manager, see the [License Manager](#) download page.

## G. Loading the application binary image to your board, and then running the application

### To run the project in e<sup>2</sup>studio

1. Confirm that you have connected your computer to the USB-to-serial port on Renesas Starter Kit+ for RX671.
2. From the top menu, choose **Run, Debug Configurations...**
3. Expand **Renesas GDB Hardware Debugging** and choose **aws\_demos HardwareDebug**.
4. Choose the **Debugger** tab, and then choose the **Connection Settings** tab. Confirm that your connection settings are correct.
5. Choose **Debug** to download the code to your board and begin debugging.

You might be prompted by a firewall warning for `e2-server-gdb.exe`. Check **Private networks, such as my home or work network**, and then choose **Allow access**.

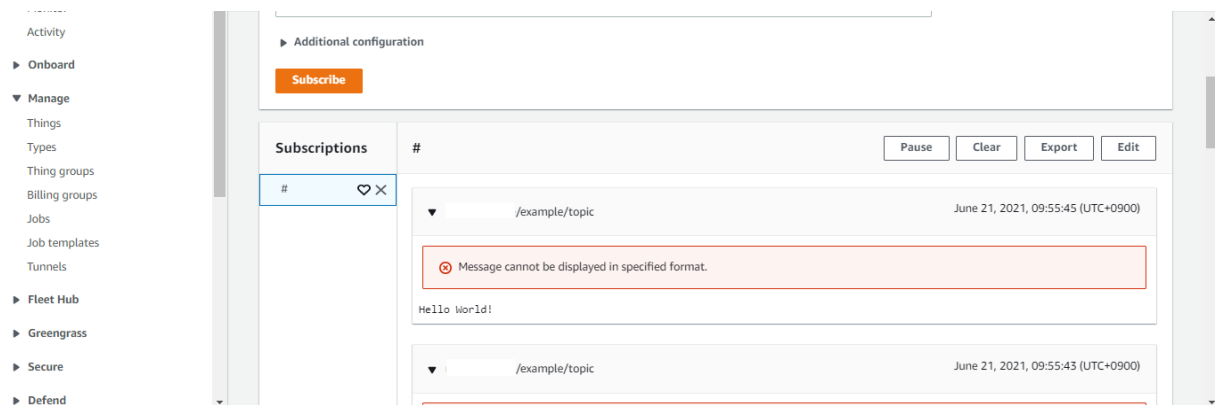
- e2studio might ask to change to **Renesas Debug Perspective**. Choose **Yes**.
- After the code is downloaded to the board, choose **Resume** to run the code up to the first line of the main function. Choose **Resume** again to run the rest of the code.

## H. Monitoring MQTT messages on the cloud

You can use the MQTT client in the AWS IoT console to monitor the messages that your device sends to the AWS Cloud.

### To subscribe to the MQTT topic with the AWS IoT MQTT client

- Sign in to the [AWS IoT console](#).
- In the navigation pane, choose **Test** to open the MQTT test client.
- In **Subscription topic**, enter `#`, and then choose **Subscribe to topic**.
- Successful demo run looks like following the picture



For the latest projects released by Renesas, see the `renesas` fork of the `amazon-freertos` repository on [GitHub](#).

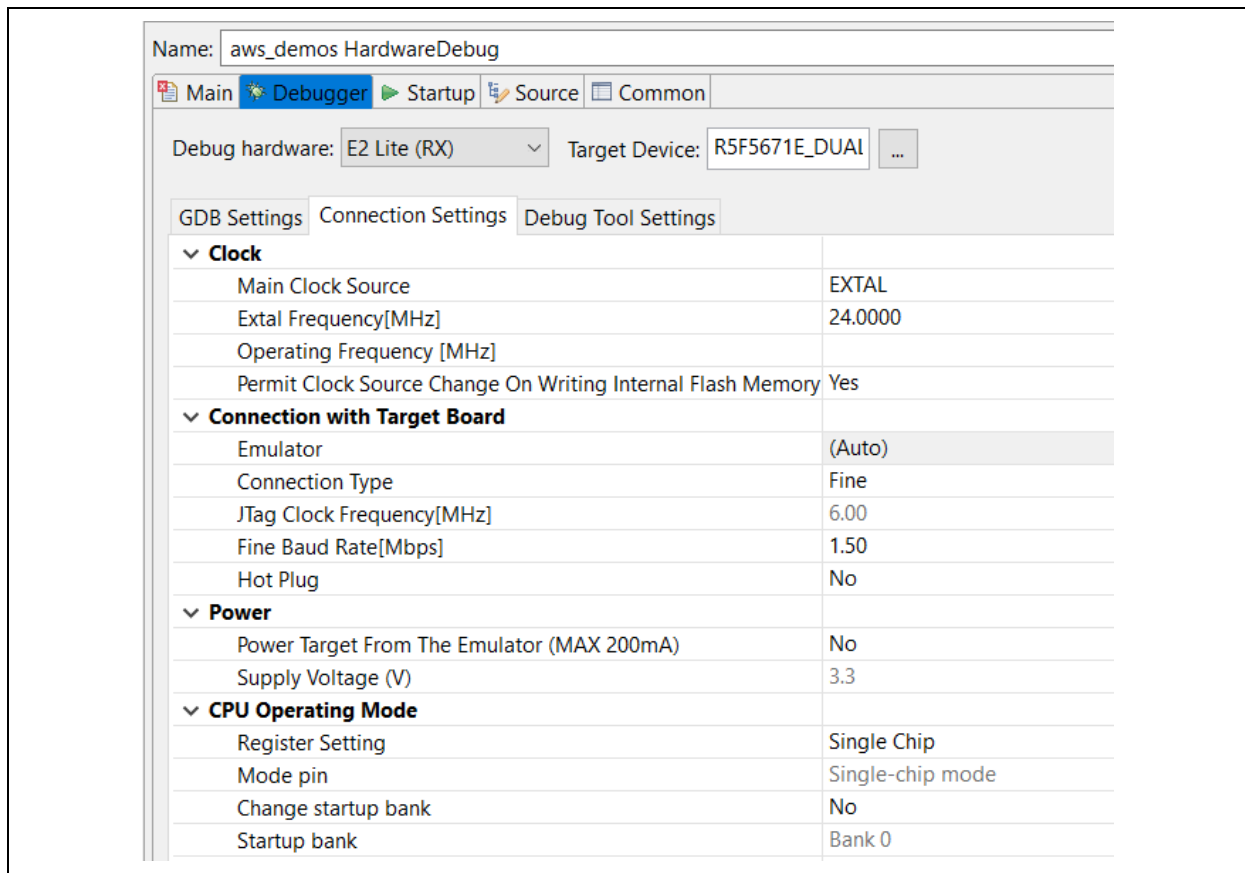
## Troubleshooting

For general troubleshooting information about Getting Started with FreeRTOS, see [Troubleshooting getting started](#).

The following information is for debugging if any troubles.

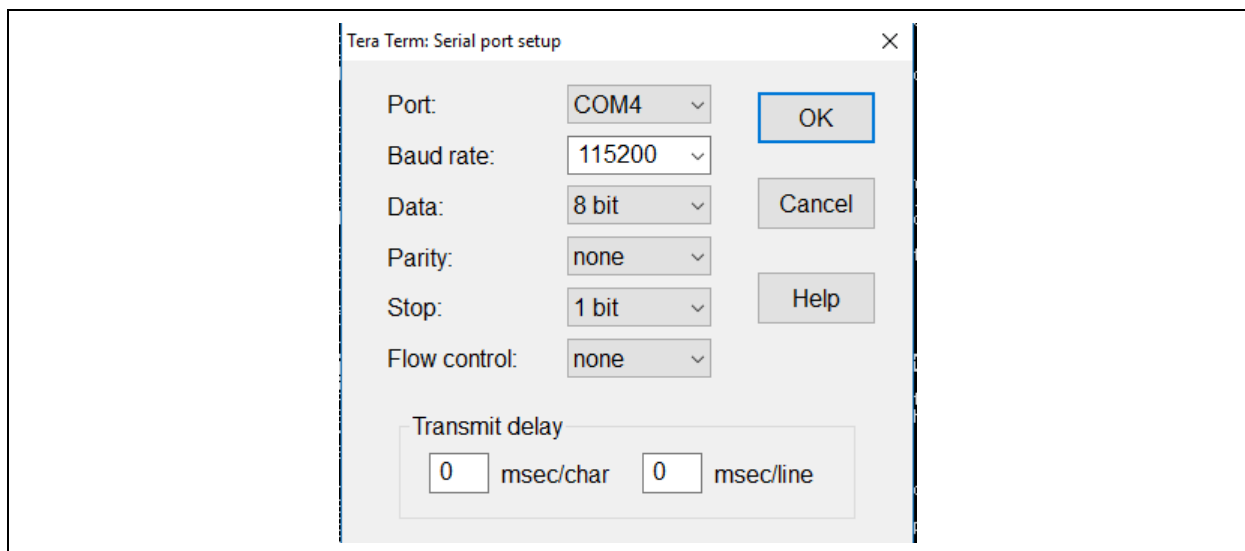
### 1. Open e2studio to debug

Make sure that debug configuration is same as the following setting.



## 2. Tera term

Open tera term to check port, baud rate, Data, Parity, Stop and Flow control.



## 3. The Build errors

- Make sure that v202012.00-rx-1.0.0 is located to C: or D: drive or etc. Windows has a path length limitation of 260 characters. The path structure of FreeRTOS is many levels deep, so if you are using Windows, keep your file paths under the 260-character limit. The build will be passed if file paths under the 260-character.

#### 4. Can not connect to AWS IoT Core

- Check `aws_demos/demos/include/aws_clientcredential.h` and confirm 4 settings:
  - `clientcredentialMQTT_BROKER_ENDPOINT`
  - `clientcredentialIOT_THING_NAME`
  - `clientcredentialWIFI_SSID`
  - `clientcredentialWIFI_PASSWORD`

For “`clientcredentialIOT_THING_NAME`”, input name of the thing you created in section D.

```

⊕ * FreeRTOS V202002.00
⊖ #ifndef __AWS_CLIENTCREDENTIAL_H__
#   define __AWS_CLIENTCREDENTIAL_H__
⊕ * @brief MQTT Broker endpoint.
#   define clientcredentialMQTT_BROKER_ENDPOINT ""
⊕ * @brief Host name.
#   define clientcredentialIOT_THING_NAME ""
⊕ * @brief Port number the MQTT broker is using.
#   define clientcredentialMQTT_BROKER_PORT 8883
⊕ * @brief Port number the Green Grass Discovery use for JSON retrieval from cloud is using.
#   define clientcredentialGREENGRASS_DISCOVERY_PORT 8443
⊕ * @brief Wi-Fi network to join.
#   define clientcredentialWIFI_SSID ""
⊕ * @brief Password needed to join Wi-Fi network.
#   define clientcredentialWIFI_PASSWORD ""

```

#### `aws_clientcredential.h`

To find the endpoint for your account, use the AWS IoT console at [console.aws.amazon.com/iot](https://console.aws.amazon.com/iot). In the left panel, choose Settings. The endpoint is listed under Custom endpoint as following snapshot:

The screenshot shows the AWS IoT console interface. On the left, the 'Settings' menu item is highlighted with a red box. The main content area shows the 'Custom endpoint' settings, which are 'ENABLED'. The 'Endpoint' field is highlighted with a red box and contains the value 'amazonaws.com'. Below this, there are sections for 'Logs' (DISABLED) and 'Event-based messages' (DISABLED).

The endpoint in AWS IoT

## Revision History

Rev.	Date	Description	
		Page	Summary
1.00	2021/8/25	-	First edition issued
2.00	2022/3/25	7,8,9	MP board used; updated board modification steps