Getting Started with the Renesas RZ/A2M Evaluation Board Kit

Required Resources
To build and run the RZ/A2M Evaluation Board Kit example, you will need following resources:

Development tools & software

- e²studio IDE v7.6.0 (e²studio download)
- GNU ARM Embedded 6-2016q2-update (bundled in e²studio v7.6.0)

Hardware

- Renesas RZ/A2M Evaluation Board Kit, P/N: RTK7921053S00000BE#WS (https://www.renesas.com/products/software-tools/boards-and-kits/eval-kits/rz-a2m-evaluation-board-kit.html)
- PC running Windows 7 or 10; the Tera Term console, or similar application; and an installed web browser (Google Chrome, Internet Explorer, Microsoft Edge, or Mozilla Firefox).
- Ethernet LAN internet access

Before you begin, see Prerequisites.

If you do not have an RZ/A2M Evaluation Board Kit, you can order one from Renesas.

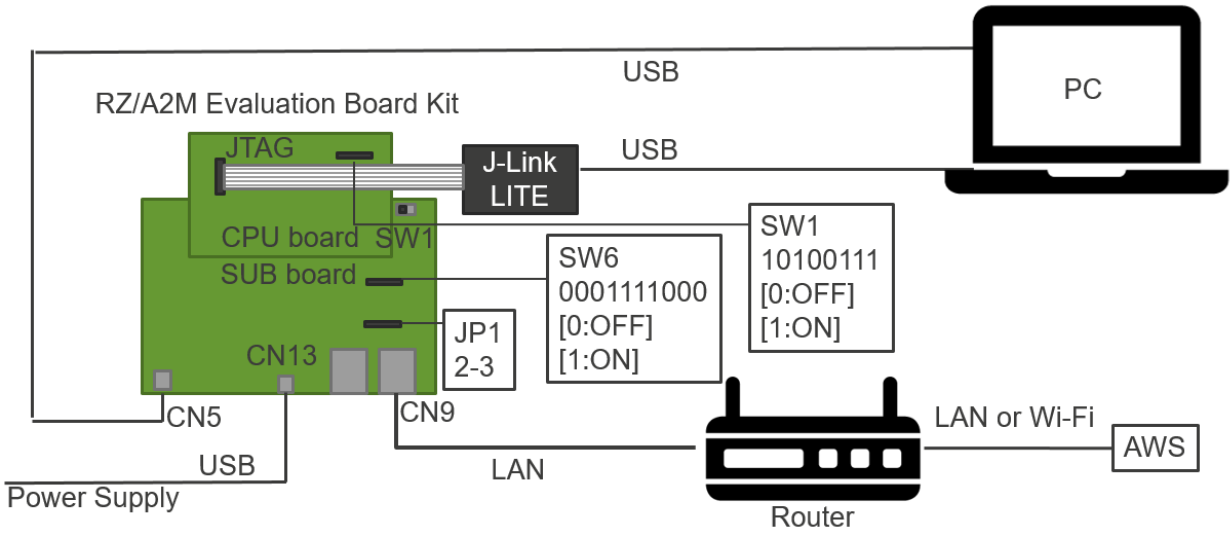
Setting Up Your Environment

FreeRTOS for the RZ/A2M Evaluation Board Kit uses e²studio IDE and GNU ARM Embedded compiler. Before you begin, install the IDE and compiler to your machine:

To install e²studio:

1. Browse to e²studio and choose **Download Software. Make sure to use** e²studio version 7.6.0 or later.
2. Unzip and run the installer. Follow the prompts for the section 2.1 and 2.2 of the e²studio Getting Started Guide.

Connecting a Debugger



1. Confirm Power switch (SW1) on SUB board is ON (left).
2. Connect CPU board and SUB board.
3. Set SW1 on CPU board to 10100111.
4. Set SW6 on SUB board to 0001111000.
5. Connect pin 2 and pin 3 of JP1 on SUB board.
6. Connect J-Link LITE to JTAG connector on CPU board.
7. Connect USB cable from J-Link LITE to a spare USB port on your PC.
8. Connect USB cable form CN5 on SUB board to a spare USB port on your PC.
9. Connect LAN cable from CN9 on SUB board to a router can access AWS.

Download and Build FreeRTOS

After your environment is set up, you can download 'Renesas RZ/A2M Evaluation Board Kit Application Example' and run the demo code.

Download FreeRTOS

1. Browse to the GitHub Page and download the code.
2. Unzip the downloaded file to a folder and make a note of the folder path. In this tutorial, this folder is referred to as `BASE_FOLDER`.

Note: The e²studio doesn't support long path names. To accommodate the files in the FreeRTOS projects, make sure the path to the directory is less than 260 characters and does not contain spaces or special characters.

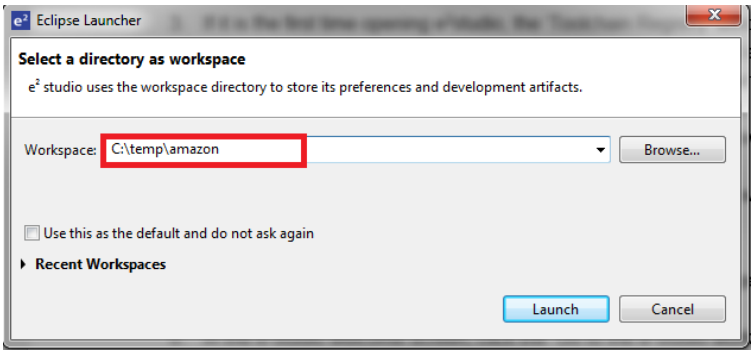
Import the FreeRTOS Demo Code into Your IDE

To import the FreeRTOS demo code into e²studio IDE

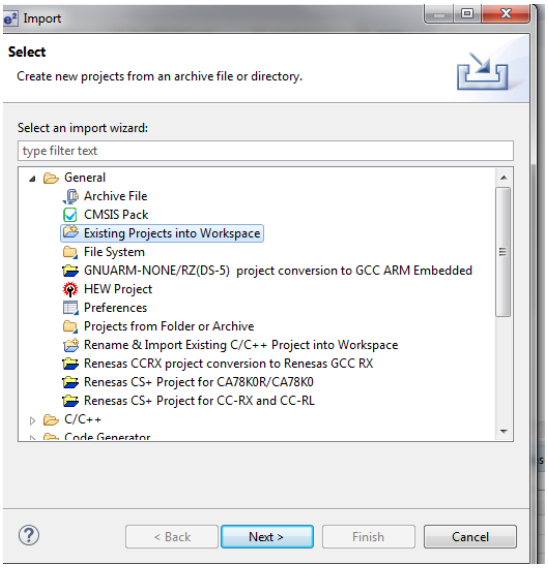
1. e²studio integrates various tools such as compiler, an assembler, debugger and an editor into a common graphical user interface. Start e²studio:

   ```
   Windows™ 7: Start Menu>All Programs>Renesas Electronics e2studio>e2studio
   Windows™ 10: Start Menu>All Apps> Renesas Electronics e2studio>e2studio
   ```

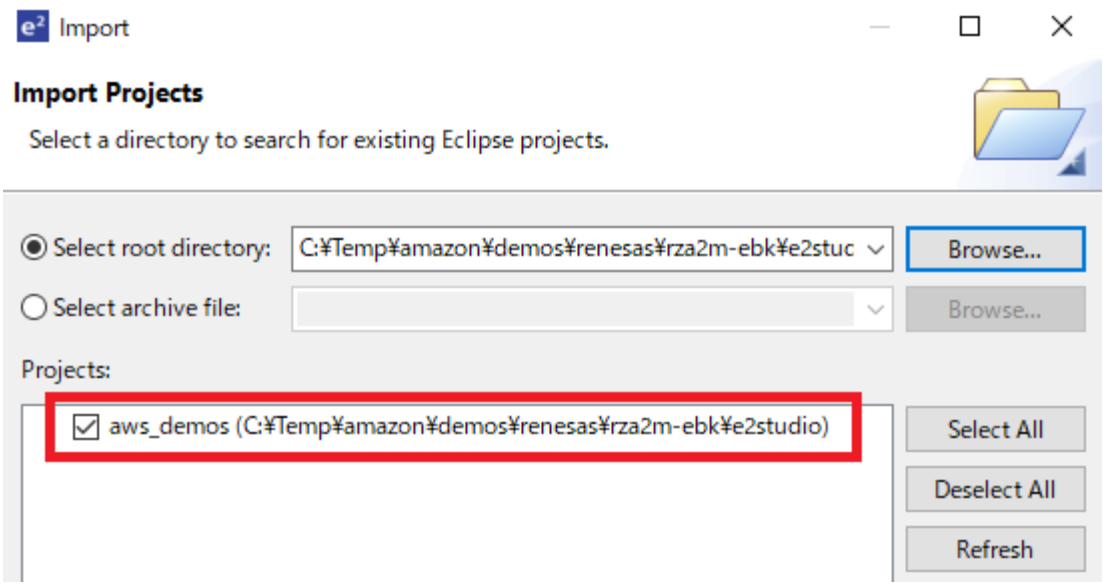
2. In the 'Select a workspace' folder that appears, browse to the folder "…`BASE_FOLDER`\amazon". Click 'OK' to continue.



3. If it is the first time opening e^{2}studio, the ‘Toolchain Registry’ window will open. In the ‘Toolchain Registry’ dialog select GCC ARM Embedded and ensure that ‘6.3.1.20170620’ is selected. Click ‘Register’. A dialog will appear "Selected Toolchains were successfully integrated with e^{2}studio ". Click ‘OK’.
4. In the ‘Code Generator Registration’ dialog click ‘OK’. This window opens up first time only after installation.
5. A ‘Code Generator COM component register’ dialog will pop-up with the text “Please restart e^{2}studio to use Code Generator”. Click ‘OK’.
6. In the ‘Restart e^{2}studio dialog, click ‘OK’.
7. Once e^{2}studio is restarted, then ‘Select a workspace’ window appears again with the folder path selected in step 2. Click ‘OK’.
8. In the e^{2}studio welcome screen, click ‘Go to the e^{2}studio workbench’ arrow icon, on the far right.
9. Right click in the Project Explorer window, and select ‘Import’.
10. In the import wizard, select General > Existing Projects into Workspace, and click ‘Next’.



11. Click the ‘Browse’ button, and locate the following directory ‘*<BASE_FOLDER>*\amazon\demos\renesas\rza2m-ebk\e2studio'.



12. Click “Finish”.
13. In the **Project** menu, choose **Project->Build All**. The project should build with no errors.

Configure Your Project

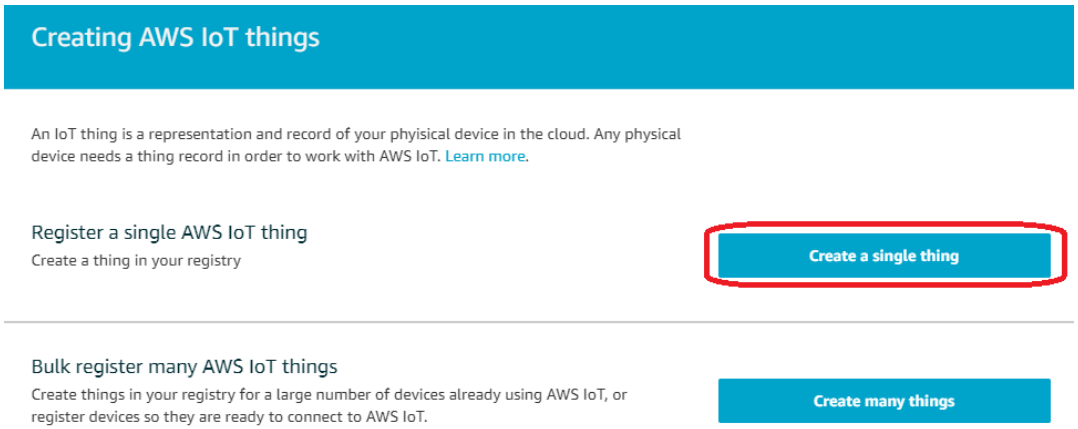
To configure your project, you need to know your AWS IoT endpoint and Thing name that represents your board.

Configure AWS IoT endpoint

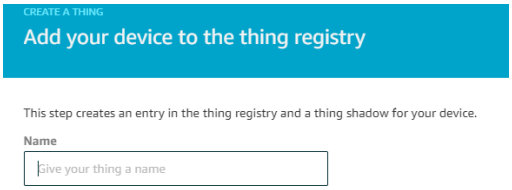
1. Login to aws account and Click on IoT Core services.
2. In the left navigation pane, choose **Settings**.
3. Copy your AWS IoT endpoint from the **Endpoint** text box. It should look like `<1234567890123>.iot.<us-east-1>.amazonaws.com`.
4. Open `aws_demos/application_code/common_demos/include/aws_clientcredential.h` and set `clientcredentialMQTT_BROKER_ENDPOINT` to your AWS IoT endpoint.

   static const char clientcredentialMQTT_BROKER_ENDPOINT[] = "Paste AWS IoT Broker endpoint here.";

5. In the left navigation pane, Click on Manage-> Things, and then Click on 'Create" to create a new Thing.
6. In the next window, click on "Create a single thing".



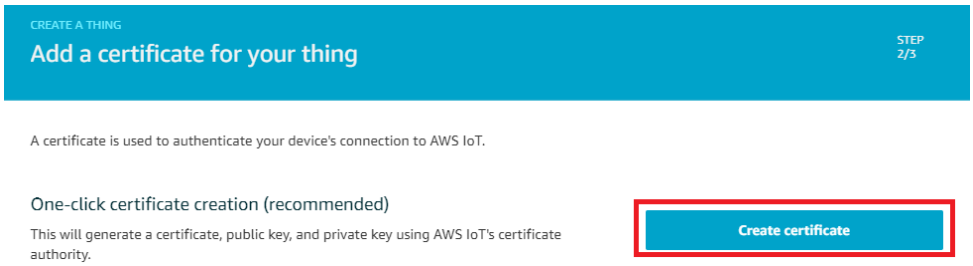
7. Enter thing Name for your IoT board.



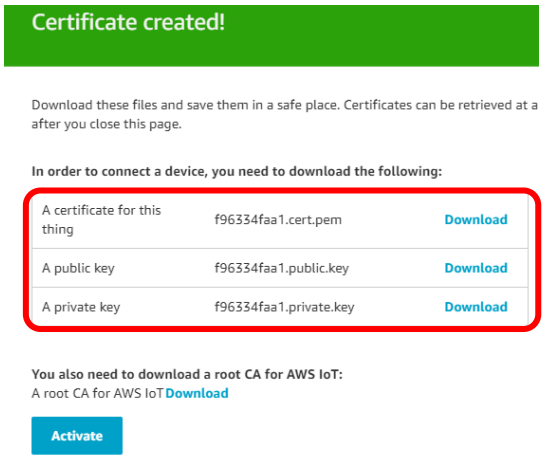
8. Open `aws_demos\application_code\common_demos\include\aws_clientcredential.h`. Specify AWS IoT thing for your board in the following `#define` constants from **Thing** pane in AWS IoT console.

```
#define clientcredentialIOT_THING_NAME "Paste AWS IoT Thing name here."
```

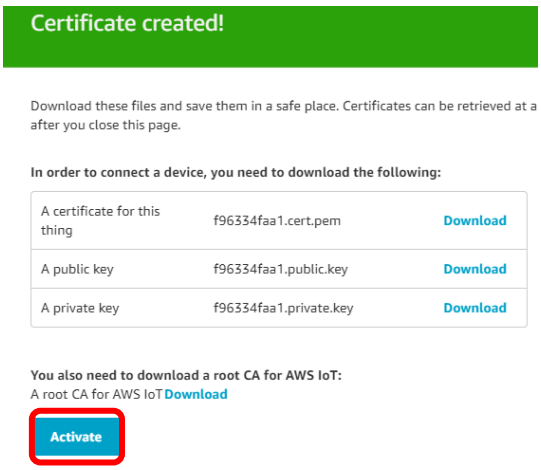
9. Click next. In next window click on “Create Certificate”



10. Download the certificate.

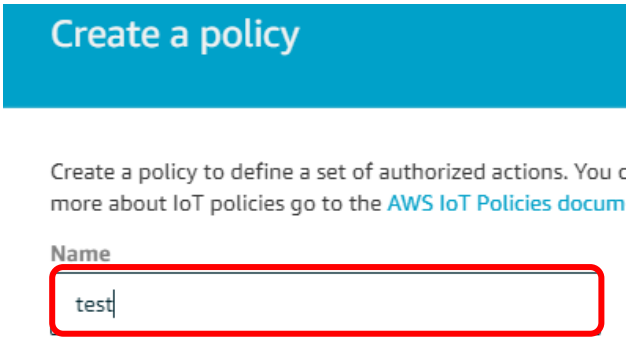


11. Activate the certificate.

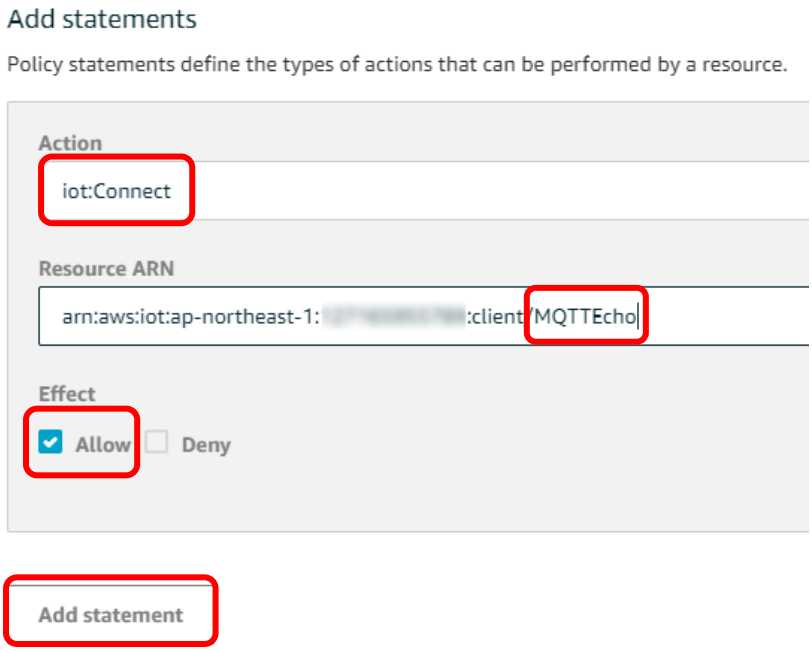


Create AWS IoT policy

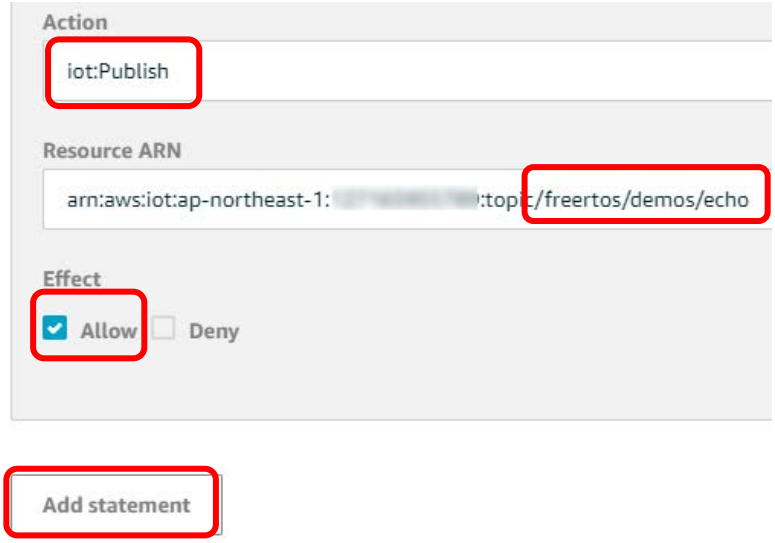
1. In the left navigation pane, Click on **Secure**-> **Policies**, and then Click on "**Create a policy**" or "**Create**" to create a new policy.
2. Enter Policy name for your test



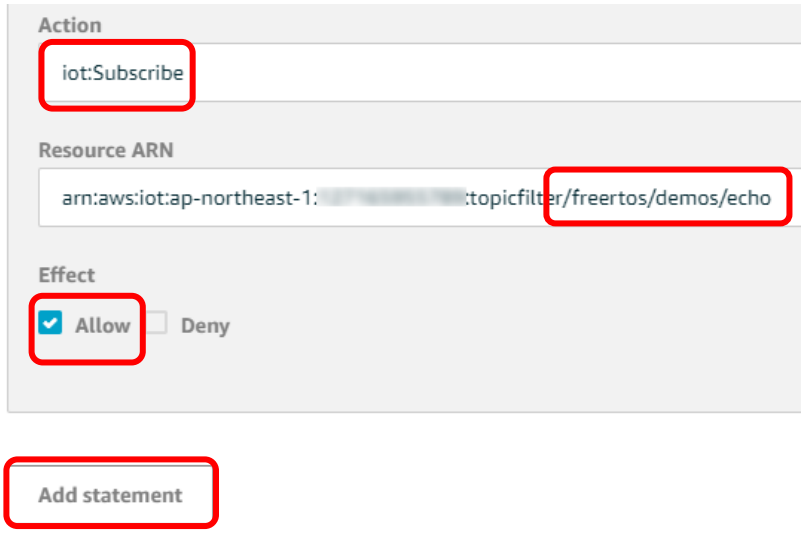
3. Enter **iot:Connect** in Action box, replace replaceWithAClientId with **MQTTEcho** in Resource ARN box, check **Allow** in Effect, and click on **Add statement**.



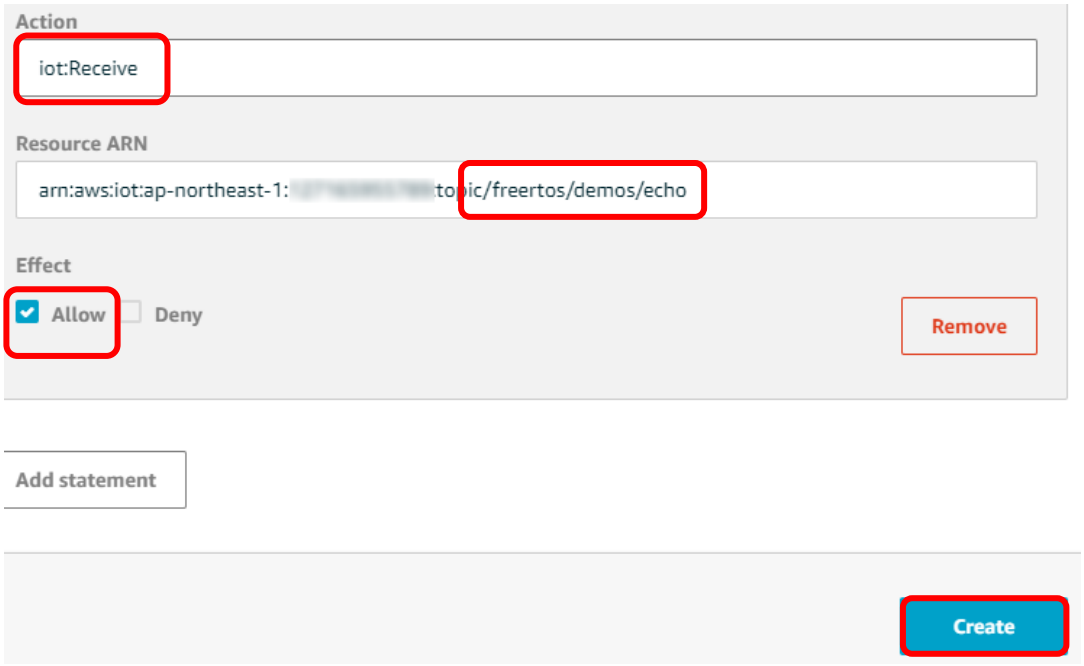
4. Enter **iot:Publish** in Action box, replace replaceWithATopic with **freertos/demos/echo** in Resource ARN box, check **Allow** in Effect, and click on **Add statement**.



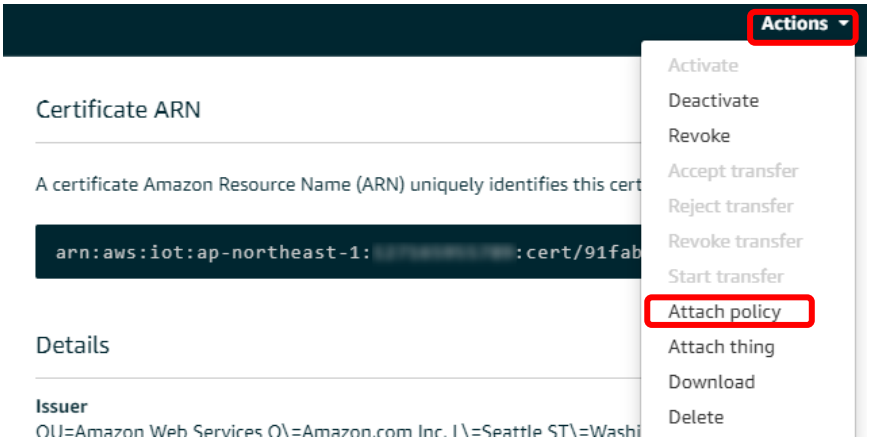
5. Enter **iot:Subscribe** in Action box, replace replaceWithATopicFilter with **freertos/demos/echo** in Resource ARN box, check **Allow** in Effect, and click on **Add statement**.



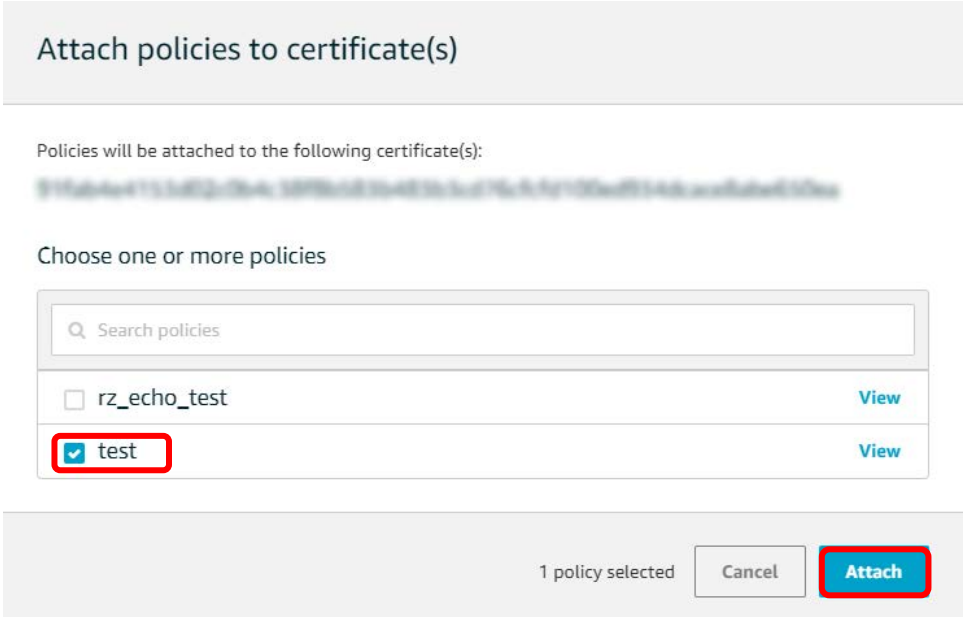
6. Enter **iot:Receive** in Action box, replace replaceWithATopic with **freertos/demos/echo** in Resource ARN box, check **Allow** in Effect, and click on **Create**.



7. In the left navigation pane, Click on **Secure**-> **Certificates**, and then Click on certificate created in the sequence 10 of **Configure AWS IoT endpoint** section above.
8. Click on Actions and select **Attach policy**.



9. Check the policy you created, then click on **Attach**.

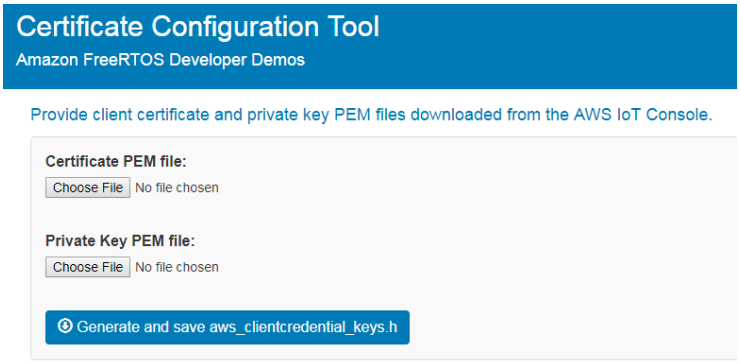


Configure certificate and private key

The certificate and private key must be hard-coded into the FreeRTOS demo code. This is for demo purposes only. Production level applications should store these files in a secure location. FreeRTOS is a C language project, and the certificate and private key must be specially formatted to be added to the project.

To format your certificate and private key

1. In a browser window, open certificate configuration tool from project `<BASE_FOLDER>\tools\certificate_configuration\CertificateConfigurator.html`.



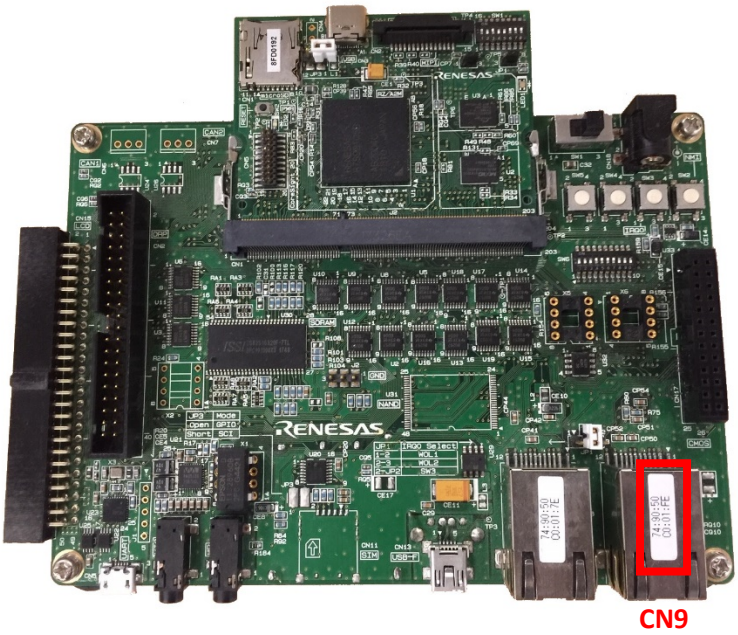
2. Under **Certificate PEM file**, choose `certificate.pem.crt` you downloaded from the AWS IoT console in previous step.
3. Under **Private Key PEM file**, choose `private.pem.key` you downloaded from the AWS IoT console in previous step.
4. Choose **Generate and save aws_clientcredential_keys.h**, and then save the file in`<BASE_FOLDER>\demos\common\include`. This overwrites the file aws_clientcredential_keys.h in the directory.

Configure MAC address

MAC address is NOT stored in the storage memory on the board. Therefore, you need to set MAC address to your project.

1. Get your MAC address

   You can find your MAC address on CN9 of the board.



2. Set MAC address in your code

   Edit **configMAC_ADDR**N (N=0, 1, ... ,5) macros defined in **FreeRTOSConfig.h** to the MAC address printed on CN9. Ethernet driver is configured to use CN9.

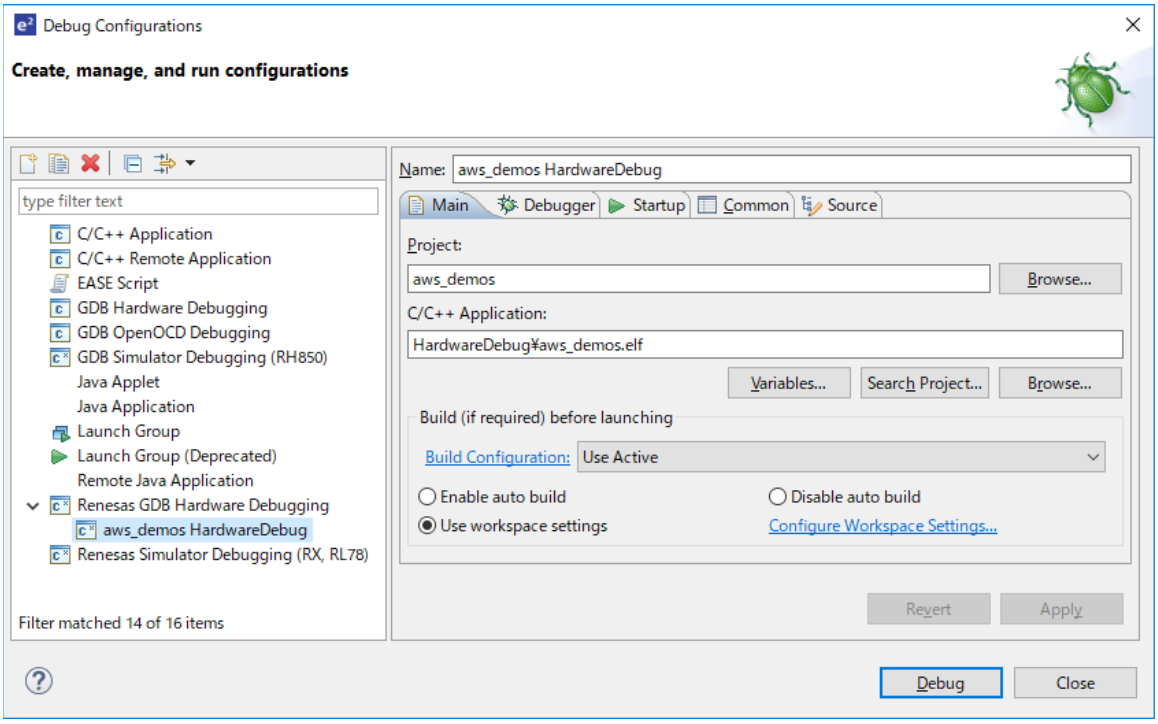
   In the case your MAC address is 01:23:45:67:89:AB, set macros as follows:

```
#define configMAC_ADDR0                 0x01
#define configMAC_ADDR1                 0x23
#define configMAC_ADDR2                 0x45
#define configMAC_ADDR3                 0x67
#define configMAC_ADDR4                 0x89
#define configMAC_ADDR5                 0xAB
```

Run the FreeRTOS Demo

To run the FreeRTOS demos on the RZ/A2M Evaluation Board Kit:

1. Sign in to the AWS IoT console.
2. In the left navigation pane, choose **Test** to open the MQTT client.
3. In the **Subscription topic** text box, type '**freertos/demos/echo**', and then choose **Subscribe to topic**.
4. Rebuild the project, "**Project->Build All**".
5. Connect USB cable from J-Link LITE to a spare USB port on your PC.
6. Connect USB cable from CN13 on SUB board to a power supply.
7. The debugging can be started by clicking the 'Run-> Debug Configuration'. Click the symbol **"aws_demos HardwareDebug"** under 'Renesas GDB Hardware Debugging' by expanding the list.



8. Click the '**Debug**' button to download the code to the target board to begin debugging. A firewall warning may be displayed for 'e2-server-gdb.exe'. Select the check-box for 'Private networks, such as my home or work network', and click 'Allow access'.
9. e^{2}studio may ask you to change to the 'Renesas Debug Perspective'. Click 'Yes'.
10. Once the code has been downloaded, click the 'Resume' button to run the code up to the first line of the main function. Click 'Resume' button again to run the target through the rest of the code.

In the AWS IOT console MQTT client, you should see the MQTT messages sent by your device.

Note:

Please visit the following GitHub repository to get the latest projects (prototype), but not yet certified for other Renesas devices, compilers, and target boards.

https://github.com/renesas-rz/amazon-freertos

Troubleshooting

If no messages appear in the AWS IoT console, try the following:

1. Check that your network credentials are valid.
2. Verify the switch settings on your board.