# Wi-Fi MQTT Client Simple Demo

Quick Start Guide of MQTT Client Simple Demo

Rev.1.00
Mar, 2022

## Introduction

This quick start guide describes the setup and use of MQTT client running on DA16200 Wi-Fi module. This guide mainly focuses on describing how to make Wi-Fi module as MQTT client by AT command for connecting MQTT broker, and how to publish a message to MQTT server. Meanwhile, a simplest button pressed operation will be recorded by MQTT server through publishing a message by MQTT client.

Through this guide and related demo, you can easily start your development on DA16200, a Wi-Fi module, using AT command and EK-RA6M4, an evaluation kit for RA6M4 MCU group.

## Target Device

EK-RA6M4 (R7FA6M4AF3CFB)

DA16200 PMOD

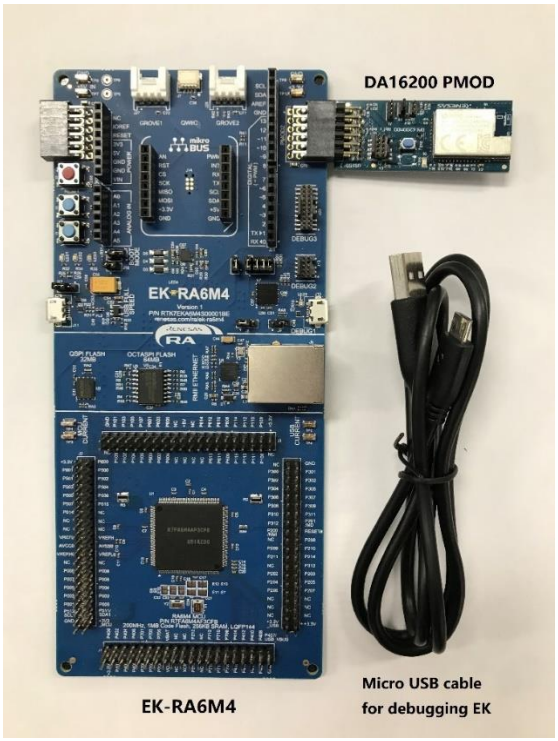
## Contents

# 1. Kit Contents

To set up this demo, the following components are needed.

## 1.1 Hardware components

- EK-RA6M4
- DA16200 PMOD (US159-DA16200MEVZ)
- Micro USB cable
- A UART-USB bridge cable (if possible and optional for AT command observation)




## 1.2 Software components

Below software components are needed:

| Category | Item | Remark |
|---|---|---|
| Firmware | RA6M4_DA16200_MQTT_CLIENT.zip | Compressed project file |
| | RA6M4_DA16200_MQTT_CLIENT.mot | Motorola S-record file for programming RA6M4 chip |
| Software | e2 studio 2021-10, SSP v3.5.0 | A GUI and related software package for RA6M4 development |
| | SEGGER J-Link V7.52a | A flash programmer for downloading file to RA6M4, meanwhile a tool using J-Link RTT function to observe the state of the system. |
| | mosquitto-2.0.14-install-windows-x64.exe | An open source (EPL/EDL licensed) message broker that implements the MQTT protocol versions 5.0, 3.1.1 and 3.1. |

## 2. Features

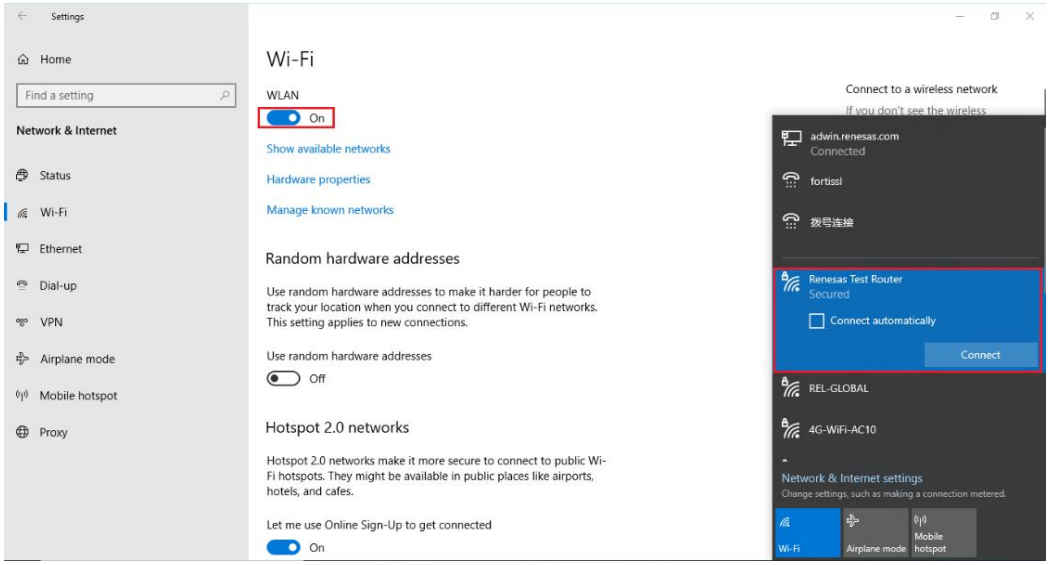
- Supply power to the kit by micro-USB cable
- Set the necessary modules of RA6M4 to establish connection between EK and DA16200 PMOD
- Use Mosquitto software, a message broker implementing the MQTT protocol on PC, to make a laptop a MQTT Server
- Initialize and control Wi-Fi module (DA16200) by AT command to act as a MQTT client
- The topic of button with message is published to MQTT Server when the button (S1) on EK board is pressed
- Make a smartphone a MQTT client subscribing button topic, getting the status of button from MQTT Server.

## 3. Set Up the Demo

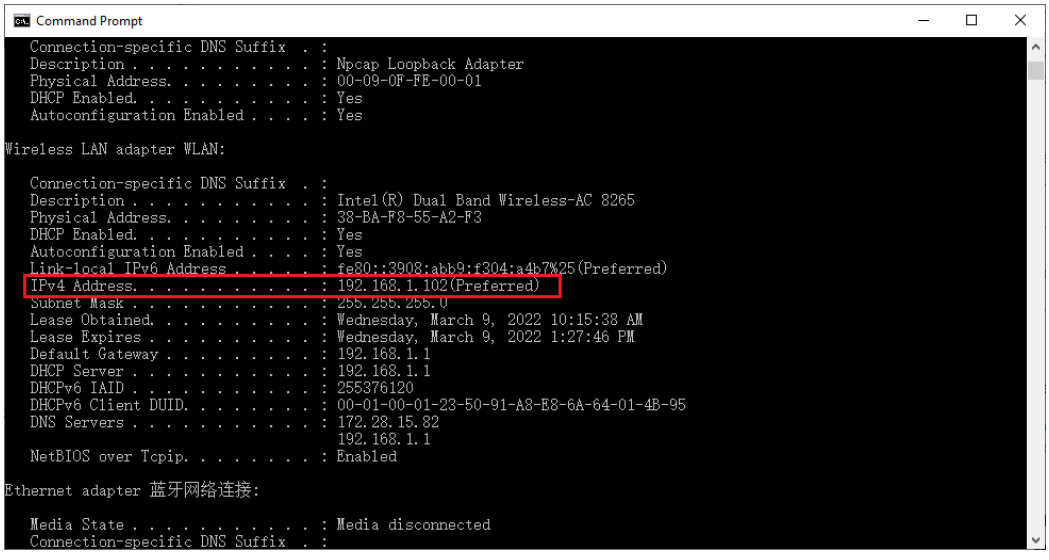
### 3.1 Prerequisite

Step 1. Connect your PC (set as a MQTT Server later) to a Wi-Fi Router.

Open Windows Settings, click Network & Internet, go to WLAN. Set it to ON, click “show available networks” and select “Renesas Test Router” as an example. Here a password of “12345678” is assigned to this router.




Step 2. Confirm the IP address of PC which is distributed by Wi-Fi Router.



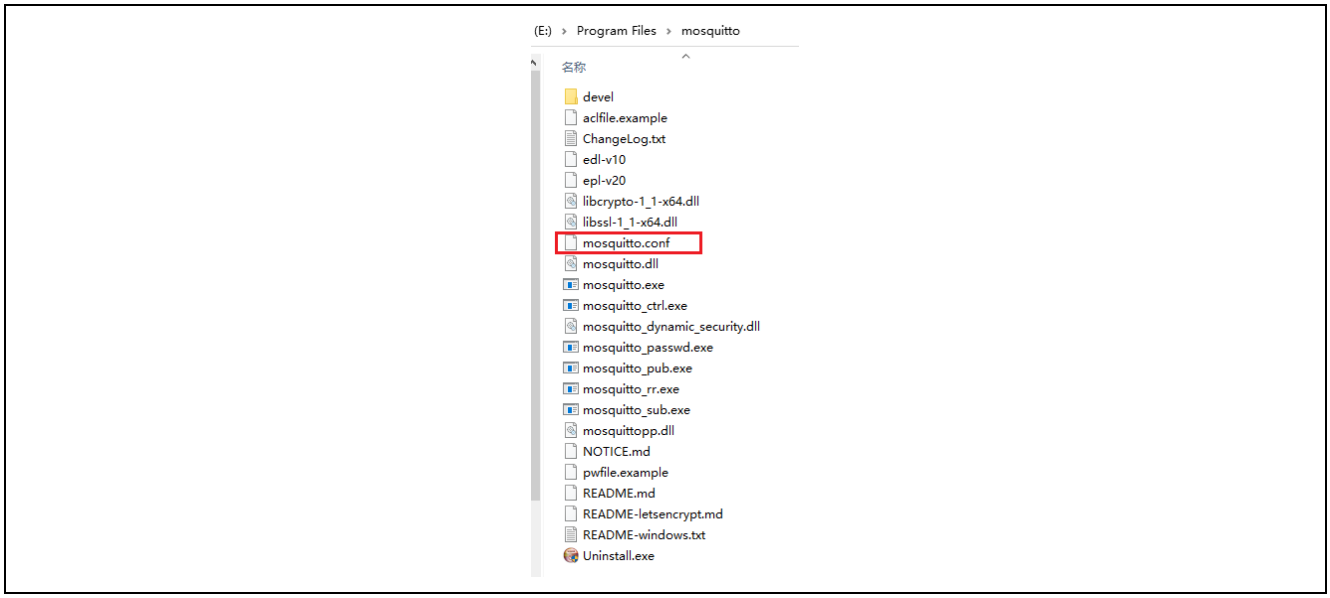
Step 3. Setup a MQTT Server on PC.

Download Eclipse Mosquitto software that can run on your PC system and install it.The URL of Mosquitto downloading is show below.
https://mosquitto.org/download/

Here use Mosquitto installed on windows 64-bit system as an example. mosquitto-2.0.14-install-windows-x64.exe

Then modify some information in the configuration file.

Find out file of mosquitto.conf and open it.

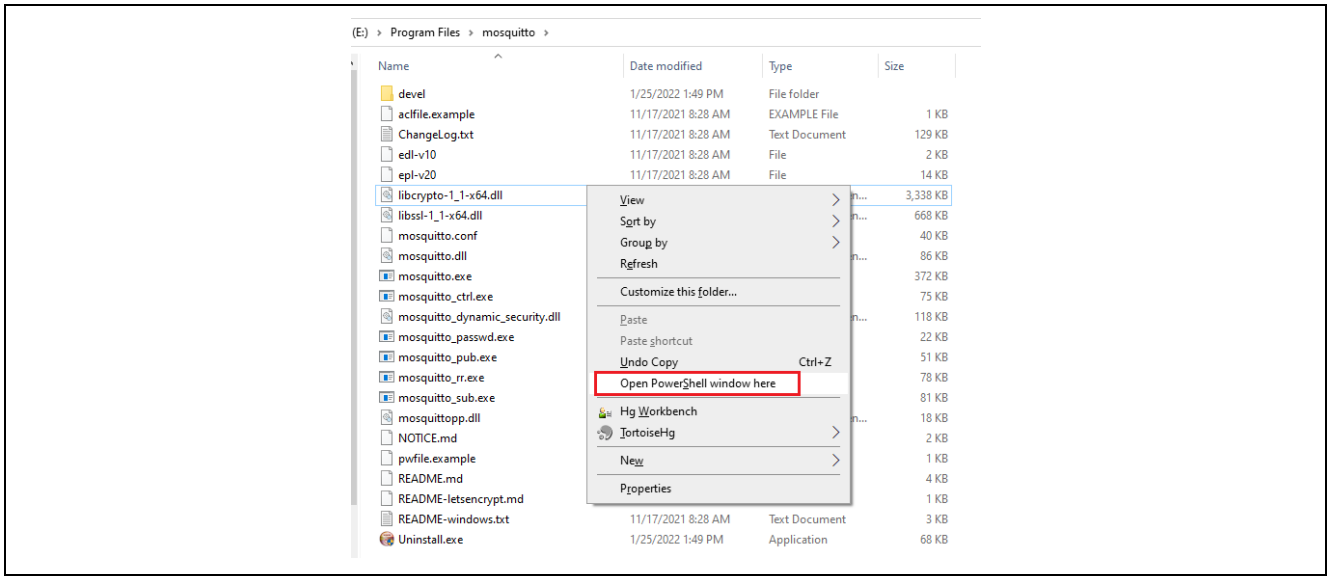



Search “# listener port-number [ip address/host name/unix socket path]”, add line of “listener 1883” below it, signifying that the listening port number is 1883.

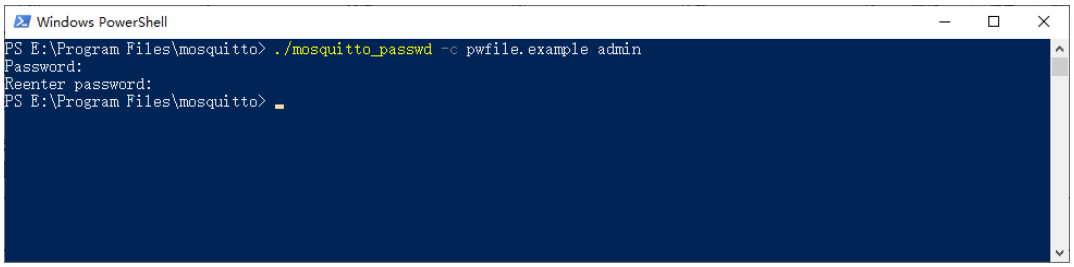
Search “# allow_anonymous false”, delete “#” to not allow anonymous logins.

Search “# password_file”, change it to “password_file pwfile.example”, setting the file location which involving account name and log in password.

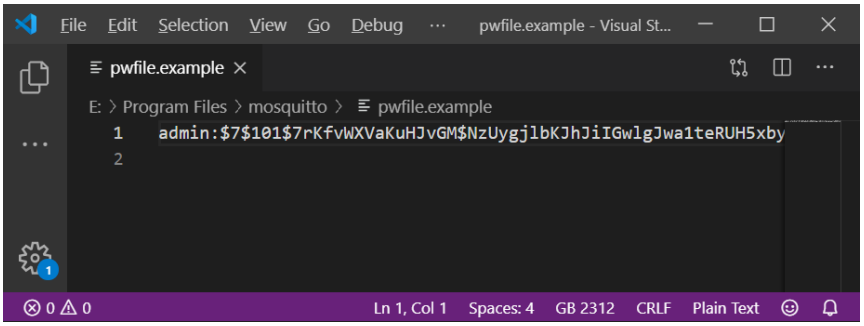
Then set users name and password. In the installation path, right click mouse when holding down “Shift”, select “Open PowerShell window here” from the pop-up menu.



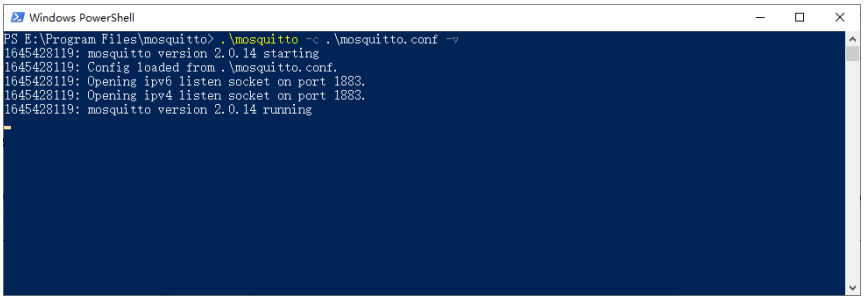

Input “./mosquitto_passwd -c pwfile.example admin”. This command is to add an account named admin. Input password twice to confirm this setting, then the count is created successfully. Here use “Renesas” as the password.




File of “pwfile.example” can be opened for confirming this setting. Close this PowerShell window means the setting has been finished.



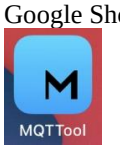

Reopen a PowerShell window following the previous step, input command “.\mosquitto -c .\mosquitto.conf -v” to run this tool using mosquitto.conf as a configuration file, while enabling detailed log mode.




At this point, the MQTT broker (MQTT server) setup on PC is running.

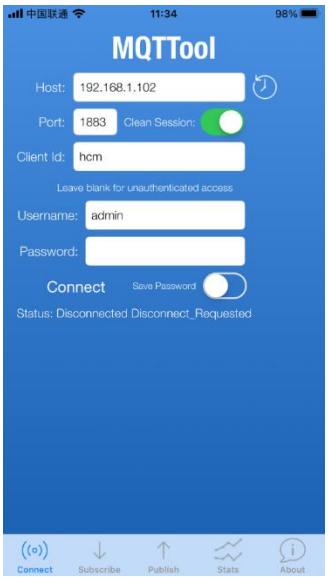
Note: The MQTT message send by client cannot be displayed on the MQTT Server entirely, so a smartphone is necessary to subscribe this message for monitoring the entire information.

Step 4. Download MQTTool from App Store, which is a MQTT client software on Iphone, or something like this from Google Shop. Here use MQTTool running on Iphone as an example.

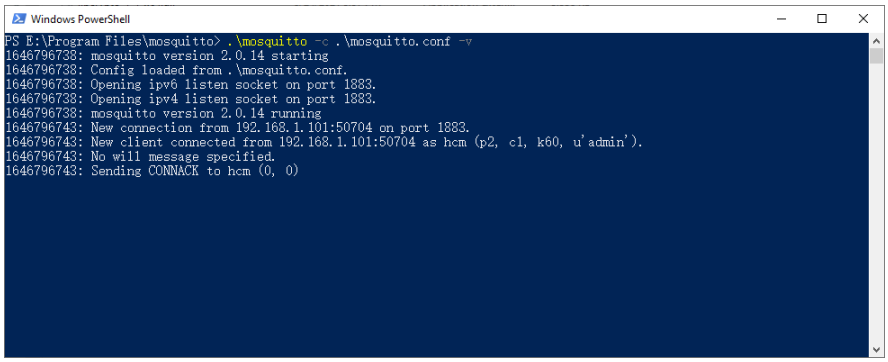



Firstly, open “settings” in Iphone, select “WLAN” and choose the name of AP which is projected a Wi-Fi signal by Wi-Fi Router. After connecting successfully, the bridge between PC and the smartphone is established.

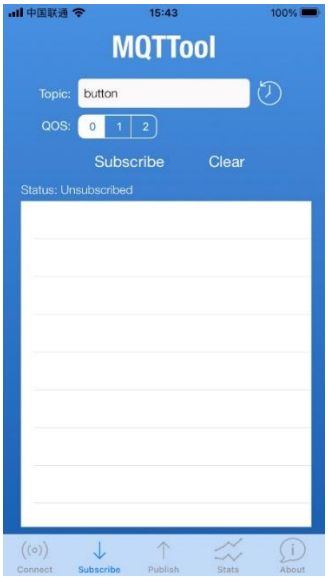
Then open MQTTool, input IP address of MQTT Server (Host) and select Port number 1883, define a Client Id, input Username and Password to log in MQTT Server. The username and password for logging in MQTT Server has been set by step3 through mosquitto.conf file. Click “Connect” to realize connection with MQTT Server.




After click “Connect” button, Mosquitto receives connecting command and displays that a new connection from smartphone has been established.




Click “Subscribe” tab, input “button” in topic blank, which is designed by sample code, click “subscribe” to subscribe to message based on this topic. All message based on this topic sent by MQTT server will be received by MQTTool.



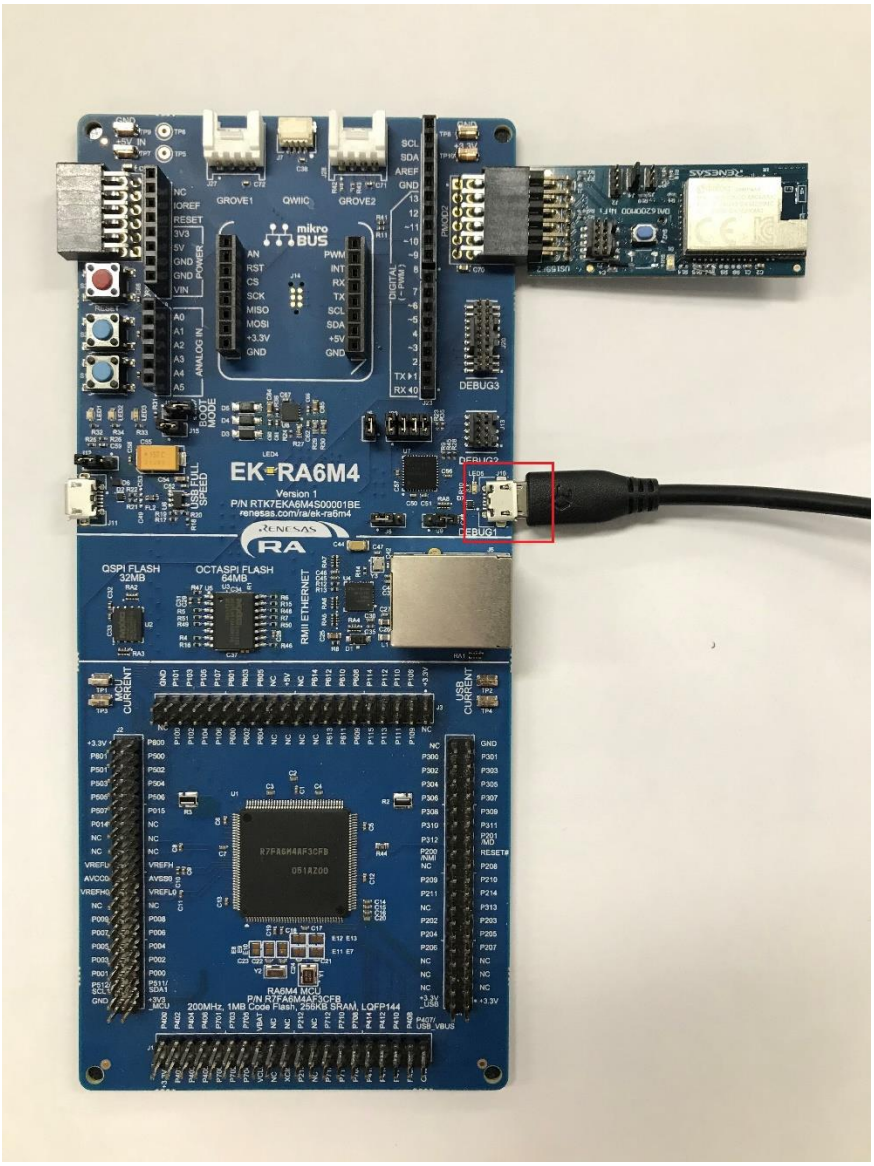
## 3.2 Connect the solution kit

Power off the solution kit, insert DA16200 PMOD board into J25 (PMOD2 on EK), establishing the whole system just as the picture at chapter 1.1.

## 3.3 Debug and download code to EK-RA6M4

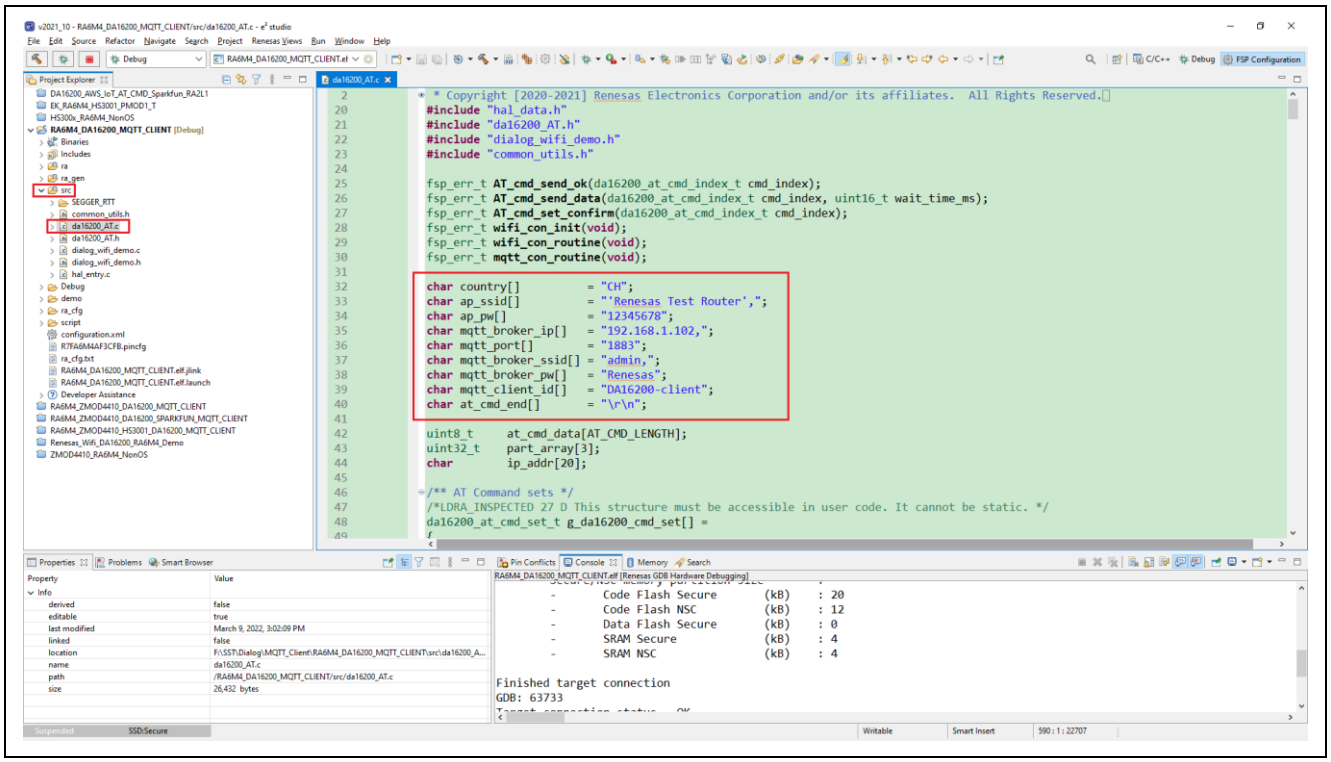
The EK-RA6M4 features a SEGGER J-Link On-Board debugger, using Renesas S124 Debug MCU and SEGGER J-Link® firmware to provide the on-board debug functionality, so all the customer needs for debugging is a Micro USB cable.

Step 1. Insert Micro USB cable into Debug USB Micro-B connector (J10), establishing a debug channel.

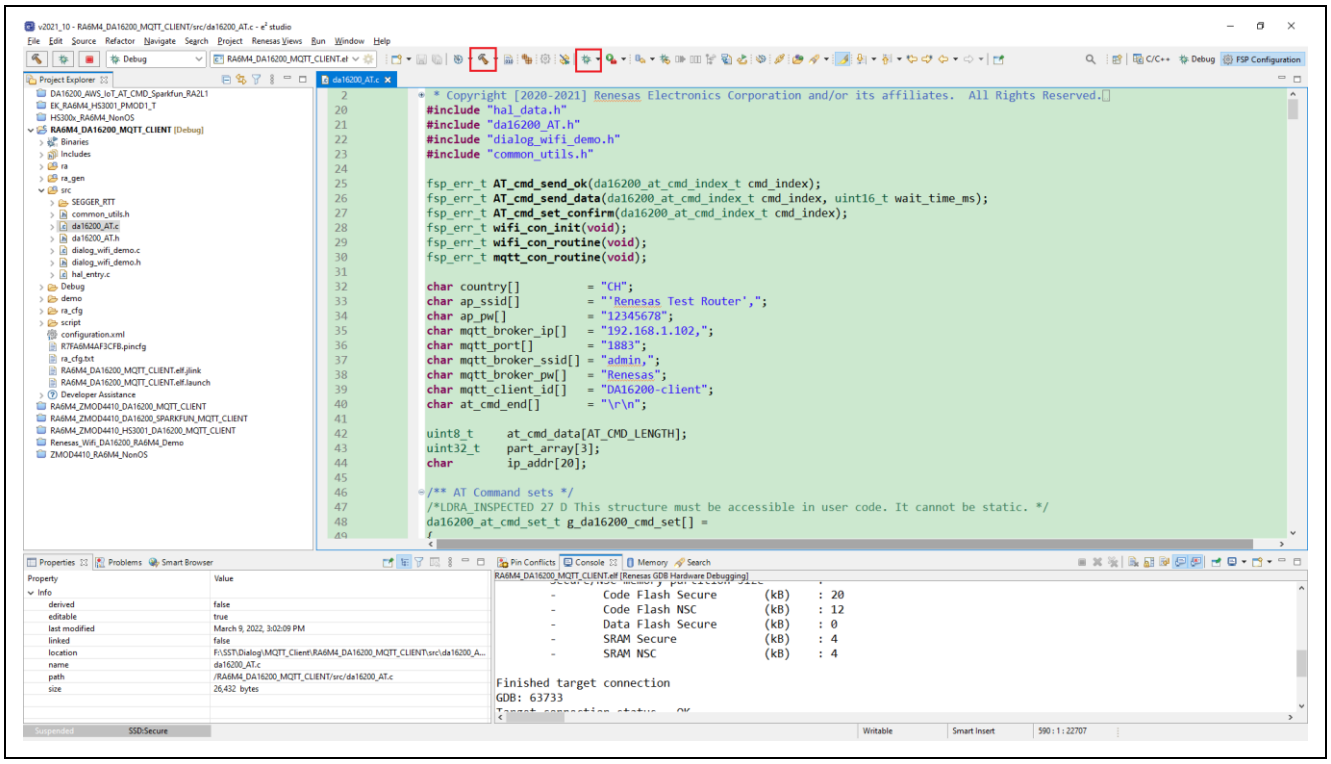



Step 2. Modify the project according to the actual internet environment.

Import project into e2 studio, open project->src->da16200_AT.c, find the array variables associated with the internet environment, such as the current country, ssid and password of Wi-Fi Router, IP address of MQTT Broker and ssid and password for logging in.



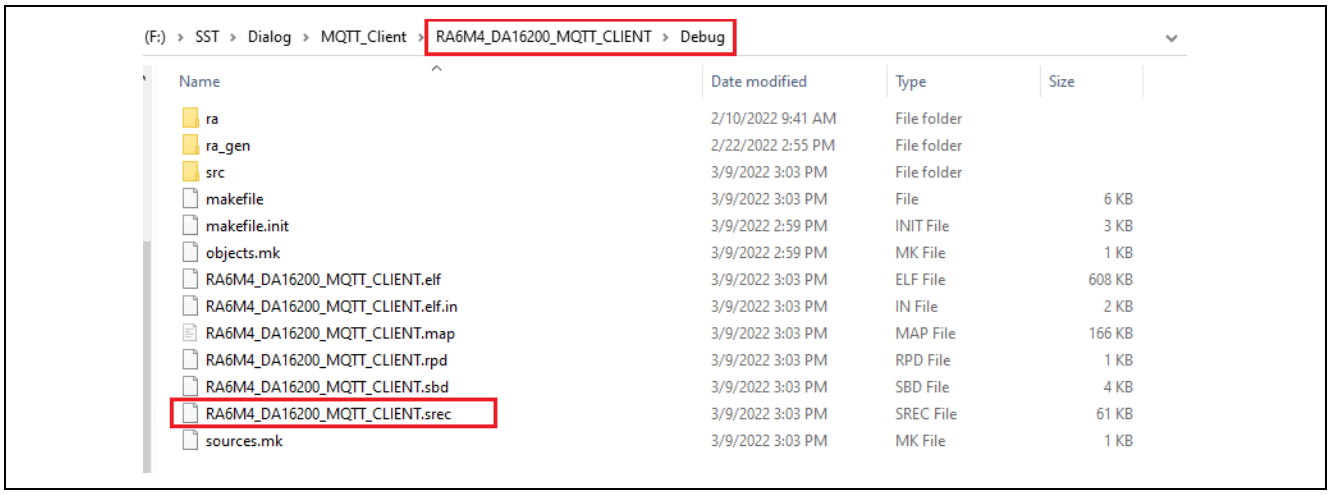
Compile the project to get the object file which can be downloaded to the chip. Then use debug function to test the sample code.



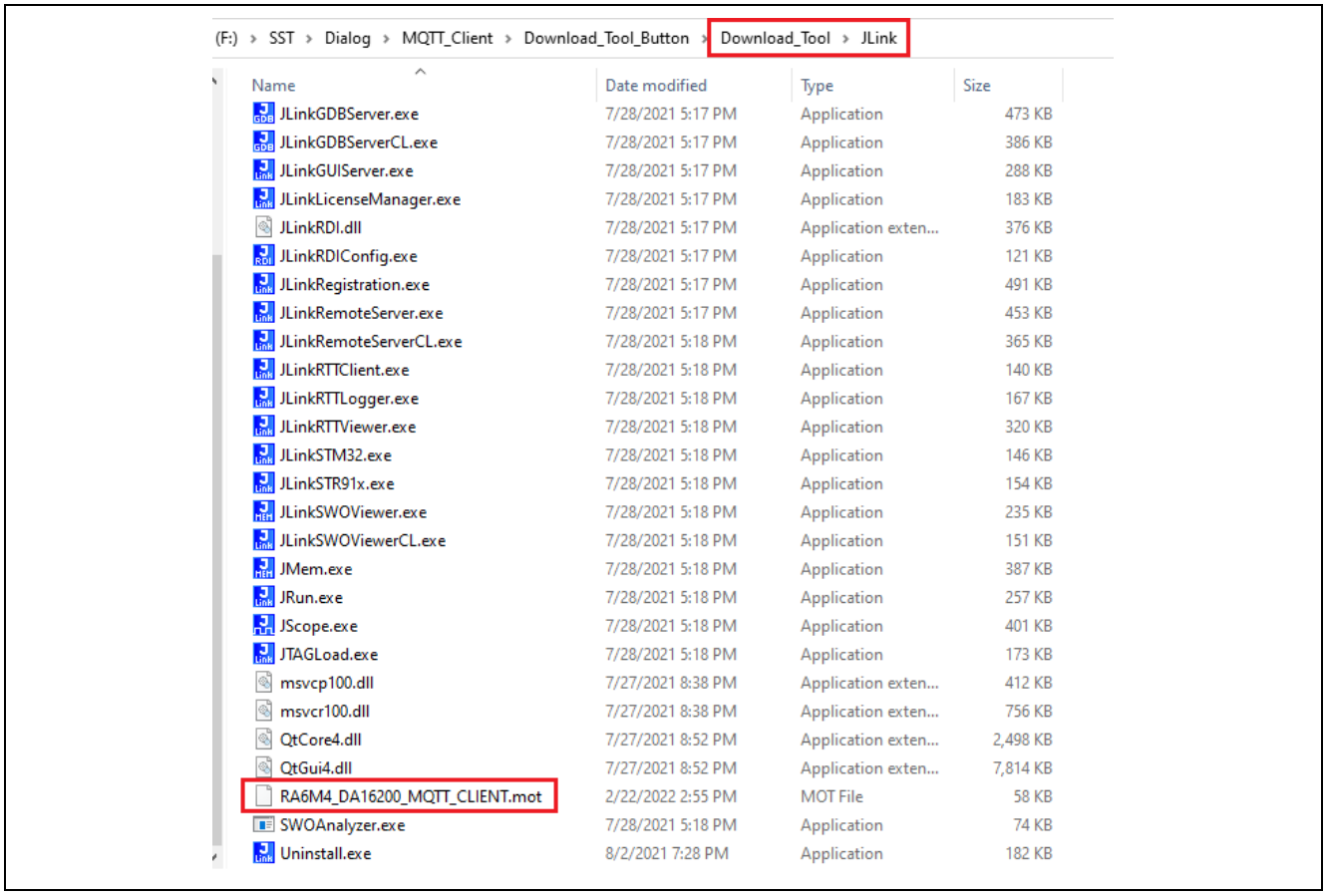
Note: about how to use e2studio and import the project, you can refer to “5. Customizing the Quick Start Example Project” chapter of EK-RA6M4 Quick Start Guide.

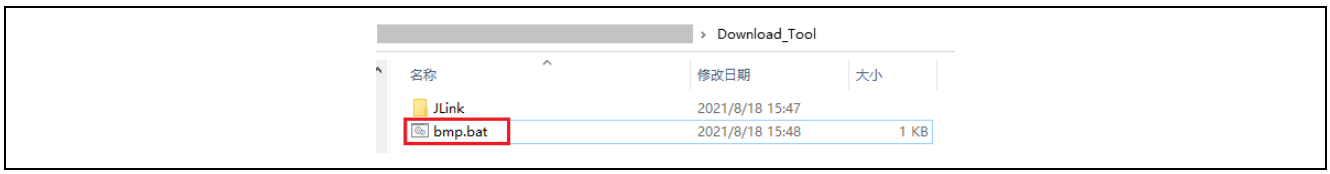
https://www.renesas.com/jp/zh/document/qsg/ek-ra6m4-quick-start-guide?language=en

If the project doesn’t need to be modified, or it has been updated and only needs to be downloaded to the target MCU, please find the “*.srec” file in the debug folder under the project and modify the suffix to “mot” to get the type of file that can be downloaded to target MCU by SEGGER J-Link.

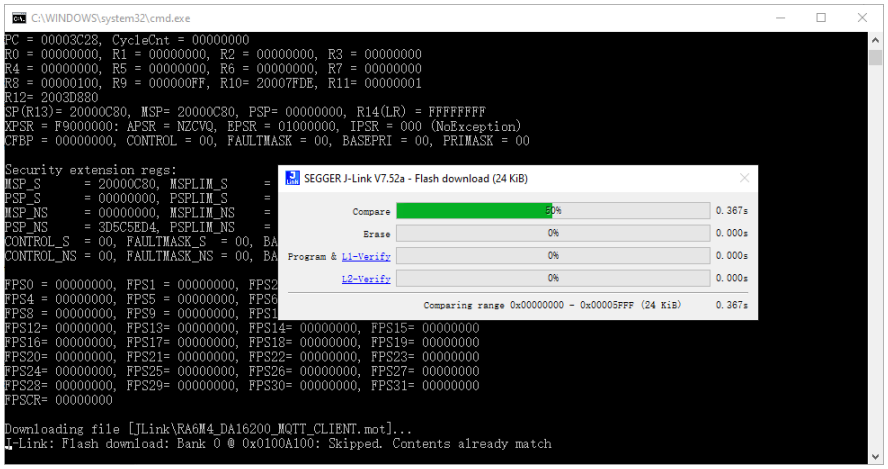



Unzip “Download_Tool.zip” file, replace the file of the same name under JLink folder with this file. Back to Download_Tool folder and click “bmp.bat” file to program MCU. This folder combines the version of J-Link v7.52a in JLink folder, involving all files at software installation and realizing all J-Link operations.




Once programming begins, “Flash download” interface appears, like the picture below.



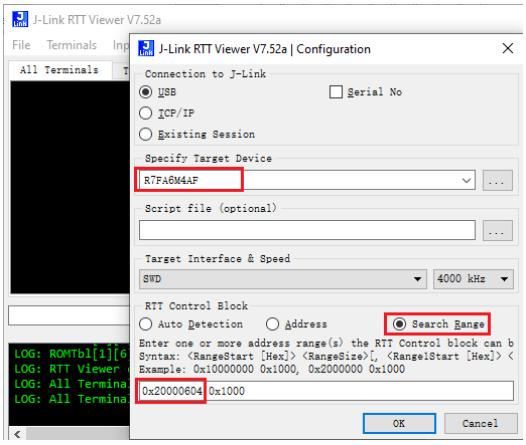

After programming, J-Link operation interface will exit automatically.

(Note: If you want the latest SEGGER J-Link version, please download from link below: https://www.segger.com/downloads/jlink)

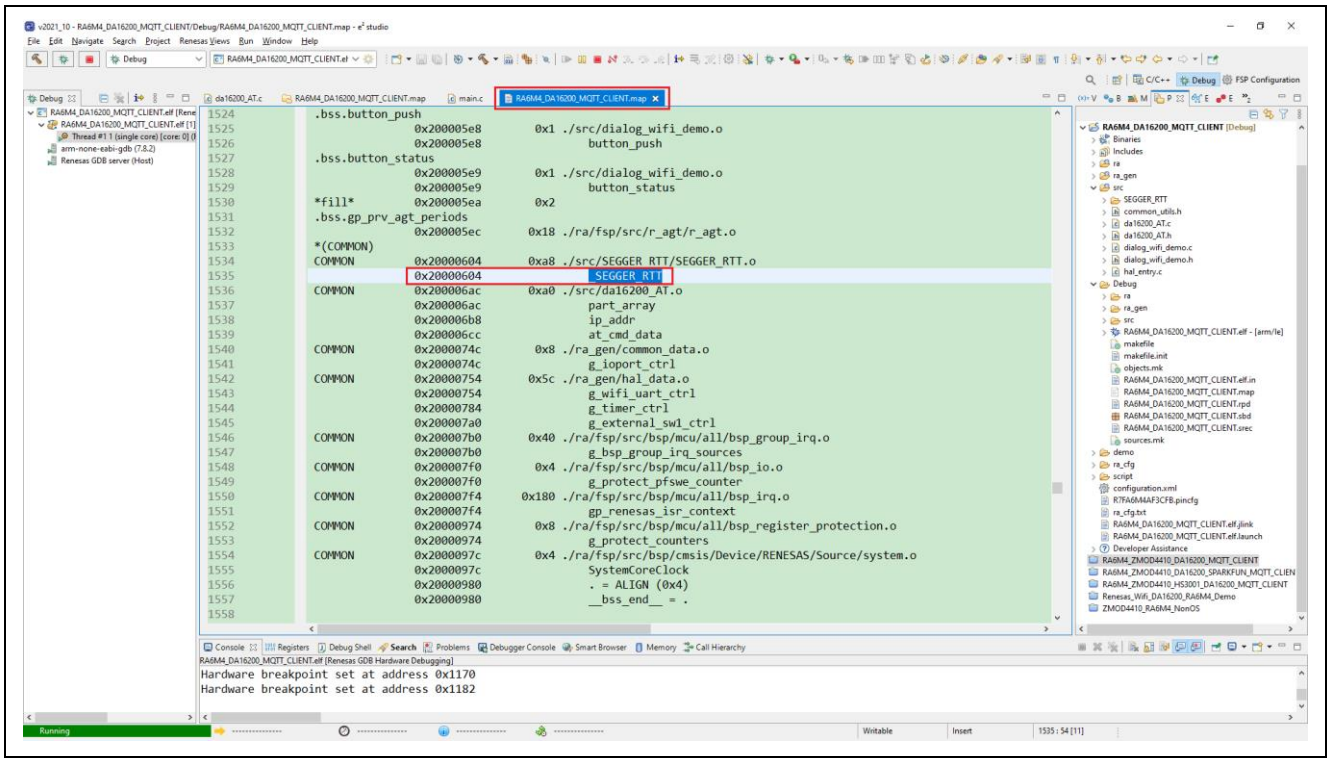
## 3.4 Run the solution

Step 1. Restart the system by pressing RESET button (S3) on EK-RA6M4 or powering off and on the system, causing the program to run again. While under debugging, restart the program is necessary.

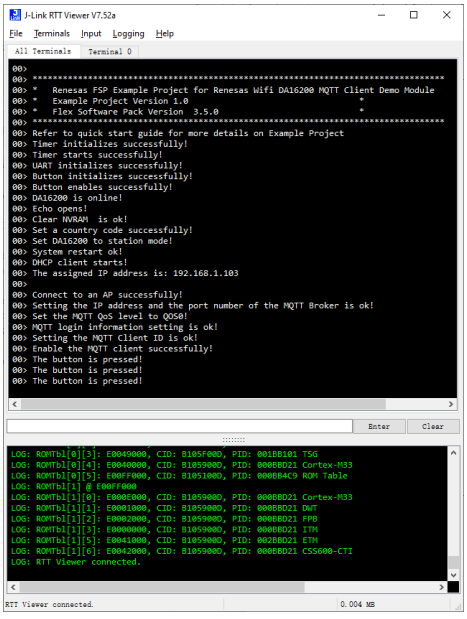
Step 2. Open “JLinkRTTViewer.exe” in JLink folder, which is unzipped at chapter 3.3 step 2, specify target device as R7FA6M4AF, change RTT Control Block from “Auto Detection” to “Search Range” and input “0x20000604 0x1000” to the blank block shown below.




The first address of “Search Range” can be found in “*.map” file after the demo code is built. Please open “*.map” file and search “_SEGGER_RTT”, then copy the address assigned by compiler to this place.



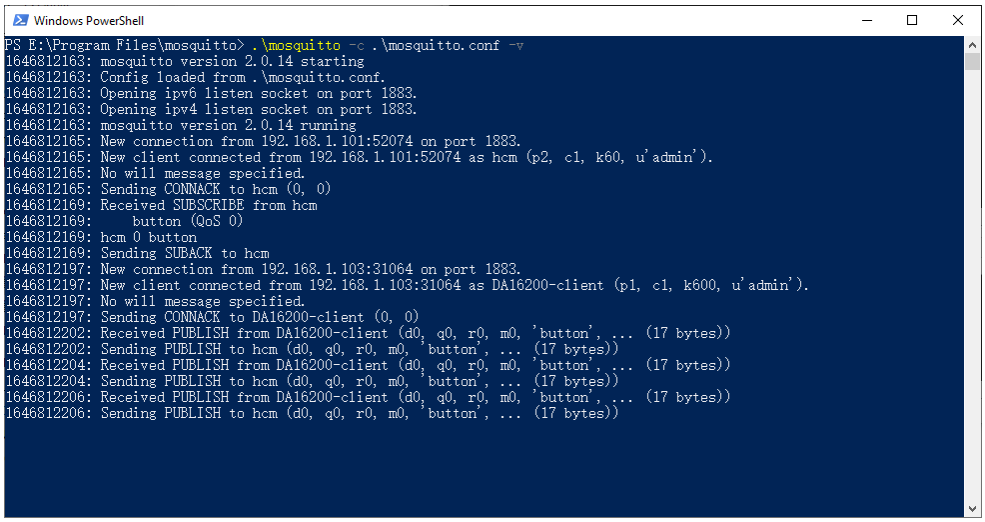

J-Link RTT Viewer serves as a tool to monitor the state of the system, especially the current stage of Wi-Fi and MQTT operation.



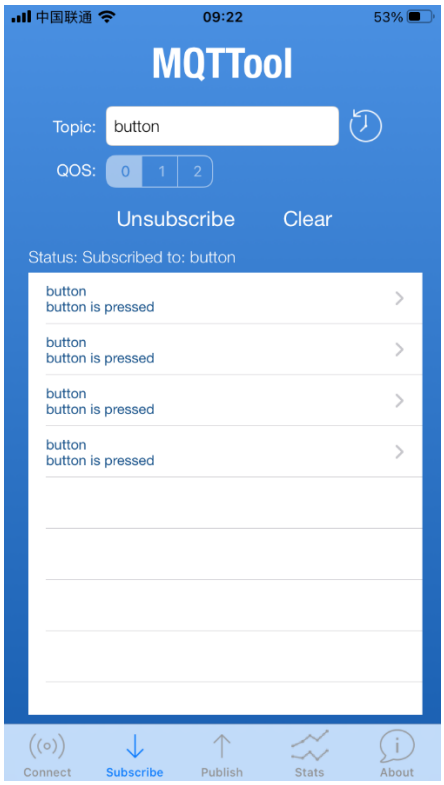

After MQTT connection finished, Green Led on EK-RA6M4 lights.

Press S1 on EK-RA6M4 publishes a message of “button is pressed” with topic of button to MQTT Server, any subscribers subscribing this topic will receive this information, smartphones are no exception.

Mosquitto software updates the current Wi-Fi and MQTT connection state and message received from MQTT client.




The subscribed message from MQTT Server displays on MQTTool on smartphone.




Meanwhile, the Blue Led on EK-RA6M4 turns on and off by turns when button is pressed.

If you want to observe AT Command, use a UART to USB bridge and connect RXD of UART part to P410 pin on EK-RA6M4 board, open serial tool such as Tera Term, and set the baud rate to 115200. Then AT command will pop up. It's an auxiliary way to debug the program and of course as an option.

Summarize: All described above is a simplest demo for a beginner. If you want a more complex example, please refer to other samples.

## 4. Reference Documents

Renesas RA6M4 MCU

RA6M4 - 200MHz Arm® Cortex®-M33 TrustZone®, High Integration with Ethernet and OctaSPI | Renesas

EK-RA6M4

EK-RA6M4 - Evaluation Kit for RA6M4 MCU Group | Renesas

DA16200

DA16200 | Dialog (dialog-semiconductor.com)

DA16200MOD

DA16200 Modules | Dialog (dialog-semiconductor.com)

Technical Updates/Technical News

(The latest information can be downloaded from the Renesas Electronics Website.)

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Renesas Electronics Website
http://www.renesas.com/

Inquiries
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## Revision History

| | | Description | |
|---|---|---|---|
| **Rev.** | **Date** | **Page** | **Summary** |
| 1.00 | Feb. 22, 2022 | — | First edition issued |

# General Precautions in the Handling of Micro processing Unit and Microcontroller Unit Products

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

1. Precaution against Electrostatic Discharge (ESD)

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

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

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

   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced near 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 micro processing 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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## Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
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