Using Matter Door Lock Reference Application with AT Commands in RAFW Connectivity Devices

This application note provides guidance on importing, compiling, flashing, and testing the Matter Door Lock reference application with AT Support on RA6W1.

Contents

1. Introduction **3**
2. Hardware Setup **3**
3. Software Setup **4**
3.1 Install e2 Studio IDE 4
3.2 Download Reference Door Lock Template 4
3.3 Load Matter Application Project Template in e2 Studio 4
3.4 Flash Firmware to Hardware 6
4. Configure the Google Nest Hub on Home Application **8**
5. Testing Procedures **10**
5.1 Access Serial Console of RA6W1 10
5.2 Configure Tera Term for RA6W1 Serial Console 10
5.3 Test Provisioning over Wi-Fi in RA6W1 12
5.3.1 Connect to Wi-Fi Using AT Command 13
5.3.2 Add Device in Google Home App 17
5.3.3 Testing the Application 24
6. Revision History **27**

Figures

Figure 1. Basic elements of Matter network 3
Figure 2. Build project 5
Figure 3. Console window 5
Figure 4. Build successfully 6
Figure 5. Debug folder 6
Figure 6. Google Nest Hub configuration flow 9
Figure 7. Serial port selection 10
Figure 8. Configurations for Tera Term 11
Figure 9. Serial baud rate setup 11
Figure 10. Factory reset action 12
Figure 11. Choosing AT port 13
Figure 12. Configurations for Terminal setup 13
Figure 13. Serial baud rate setup 14
Figure 14. AT console 15
Figure 15. Configuration setting using AT 16
Figure 16. App task started 17
Figure 17. Configuring Google Nest Hub 18
Figure 18. Configurations continue 18
Figure 19. Starting setup process 19
Figure 20. Setup anyway screen 20

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Figure 21. Setup anyway confirmation prints 20
Figure 22. Generating Matter credentials 21
Figure 23. Successful connection of device to Nest Hub 22
Figure 24. Generation of QR code 23
Figure 25. Scanning QR code 23
Figure 26. Unlock action 25
Figure 27. Lock action 26

Tables

Table 1. Software download links 4
Table 2. +MSTATUS possible values 24
Table 3. AT+MATTR parameters 24

Terms and Definitions

AP	Access Point
Bluetooth LE	Bluetooth® Low Energy
DPM	Dynamic Power Management
EVB	Evaluation Board
FSP	Flexible Software Package
IDE	Integrated Development Environment

1. Introduction

Matter is a unified, open-source application-layer connectivity standard built to enable developers and device manufacturers to connect and build reliable, and secure ecosystems and increase compatibility among connected home devices.
This document provides a comprehensive overview of the Matter Door Lock application developed on the RA6W1 platform with AT support. It describes the use of Easy Setup for initial provisioning and details the complete workflow for importing, compiling, flashing, and testing the Door Lock reference application with AT support within the Matter environment.

2. Hardware Setup

Figure 1 shows the basic element of Matter network (Hub, Device, and Controller) and how the network is linked together remotely. Matter accessory applications (lights and door locks) can be tested and developed on the device, RA6W1 Evaluation Board (EVB). To find out more about setting up the RA6W1 EVB for the Matter application, see the Documentation section on the RA6W1 product page.



Figure 1. Basic elements of Matter network

- Hub: Matter smart hubs such as Apple HomePod mini, Google Nest Hub, and Amazon Echo Dot
- Controller: Mobile apps such as Apple Home, Google Home, and Amazon Alexa
- Device: RA6W1 EVB.

3. Software Setup

To develop Matter applications on the RA6W1 using the Matter module, install and set up the Renesas Electronics e^2 studio IDE.
To set up the development environments:

1. Install and configure the e^2 studio IDE: Version 2026-04.3.
2. Use GCC Arm Embedded Toolchain: Version 13.3.1 arm-13-24.
3. Download the RAFW FSP version 2.2.0 or later from the Renesas Electronics website.
4. Load the Matter Application project template in e^2 studio.
5. Change the Matter Application in the reference project.
6. Build the application project.
7. Program the firmware image.

3.1 Install e^2 Studio IDE

To install e² studio, download and run the e² studio platform installer for your operating system (Windows, Linux, or macOS). For detailed installation instructions, refer to the Install e² studio IDE for Windows, Linux, and macOS sections in the *RA6W1/RRQ61001 Application Development Guide*.

Table 1. Software download links

File	Download
Platform installer: `setup_rafwfsp_v2_1_0_e2s_v2026-04.2.exe`	From the RAFW FSP GitHub Releases page: `https://github.com/renesas/rafw-fsp/releases`
GNU Arm embedded toolchain: `gnu-toolchain-13.3.rel1-mingw-w64-i686-arm-none-eabi.zip`	From the official Arm GNU Toolchain website: `https://developer.arm.com/tools-and-software/gnu-toolchain`

3.2 Download Reference Door Lock Template

1. Download the example templates and FSP pack files from the RA6W1 product page on the Renesas website.
2. Download the RAFW FSP Examples (2.2.0 or later) package from the Renesas website:
   - > Software & Tools > Software Downloads > RAFW FSP Examples (2.2.0 or later).
3. Access the RAFW FSP Examples from the RA6W1 Software & Tools page.
4. Download the `RAFW_FSP_Packs_(v2.2.0 or later)` pack from the Renesas website:
   - > Software & Tools > Software Downloads > RAFW Flexible Software Package.
5. Click **RAFW Flexible Software Package** to navigate to the download page for `RAFW_FSP_Packs_(v2.2.0` or later)
6. Download `RAFW_FSP_Packs_(v2.21.0` or later) directly from the website (https://www.renesas.com/en/products/ra6w1?tab=software-tools)
   - Sample project template – `matter_wifi_at_lock_ek_ra6w1.zip` is available in `application_projects/r19an0437/Matter_AT_Application/` in the downloaded `RAFW FSP Examples (2.2.0 or later)` folder.

3.3 Load Matter Application Project Template in e^2 Studio

1. Extract the project template from `matter_wifi_at_lock_ek_ra6w1.zip` and launch e^2 studio.
2. To import project template, go to **File** > **Import**.
3. Under **General option**, select **Rename and Import Existing C/C++ Project into Workspace**.
4. Browse to the project template directory, unzip `matter_wifi_at_lock_test_app.zip`, and enter the project name.
5. The ZAP tool integrated into e² studio generates the zap-generated files, which includes the cluster and endpoint features. Renesas provides the Renesas QE tool for the Matter application to generate zap files. For details on adding and using the Renesas QE tool for the Matter application to generate the zap-generated files for lock application, see the Renesas QE for Matter section in *Wi-Fi Matter Quick Start Guide*.

6. To build the project, right-click the project, and then select **Build Project**.

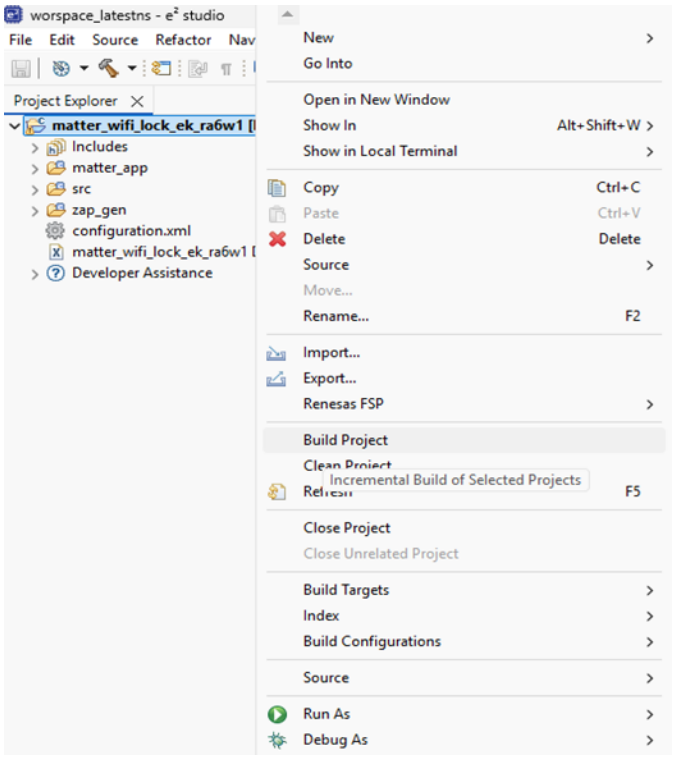


Figure 2. Build project

7. Check the console window to see if the build is proceeding.

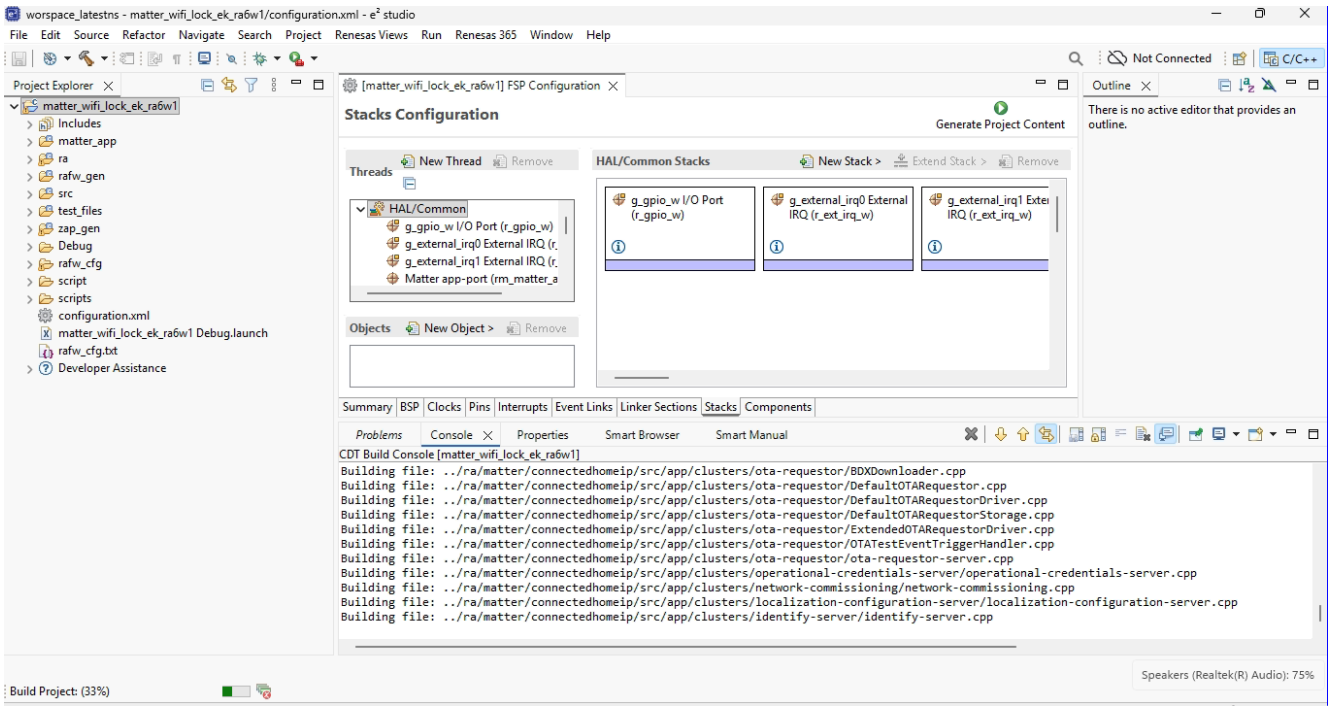


Figure 3. Console window

Figure 4 shows a successfully completed build.

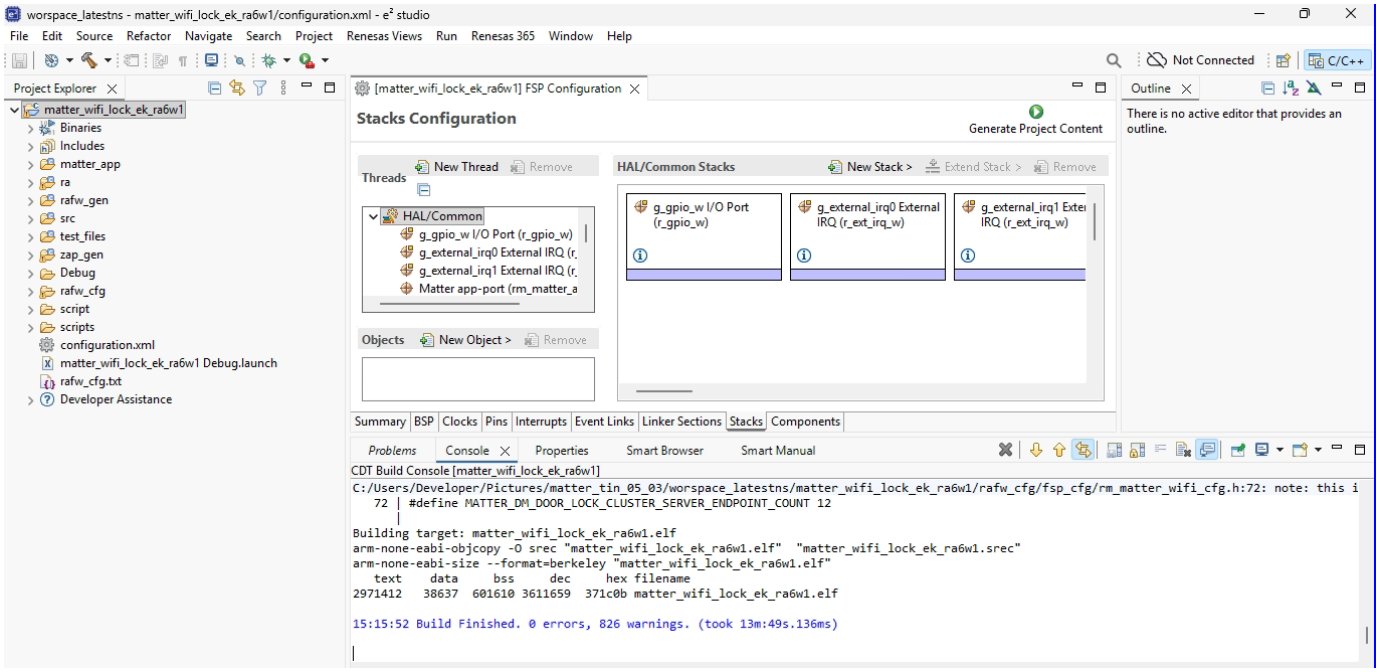


Figure 4. Build successfully

3.4 Flash Firmware to Hardware

After compilation, the `.img.bin` file can be found in the **Debug** folder, as shown in Figure 5.

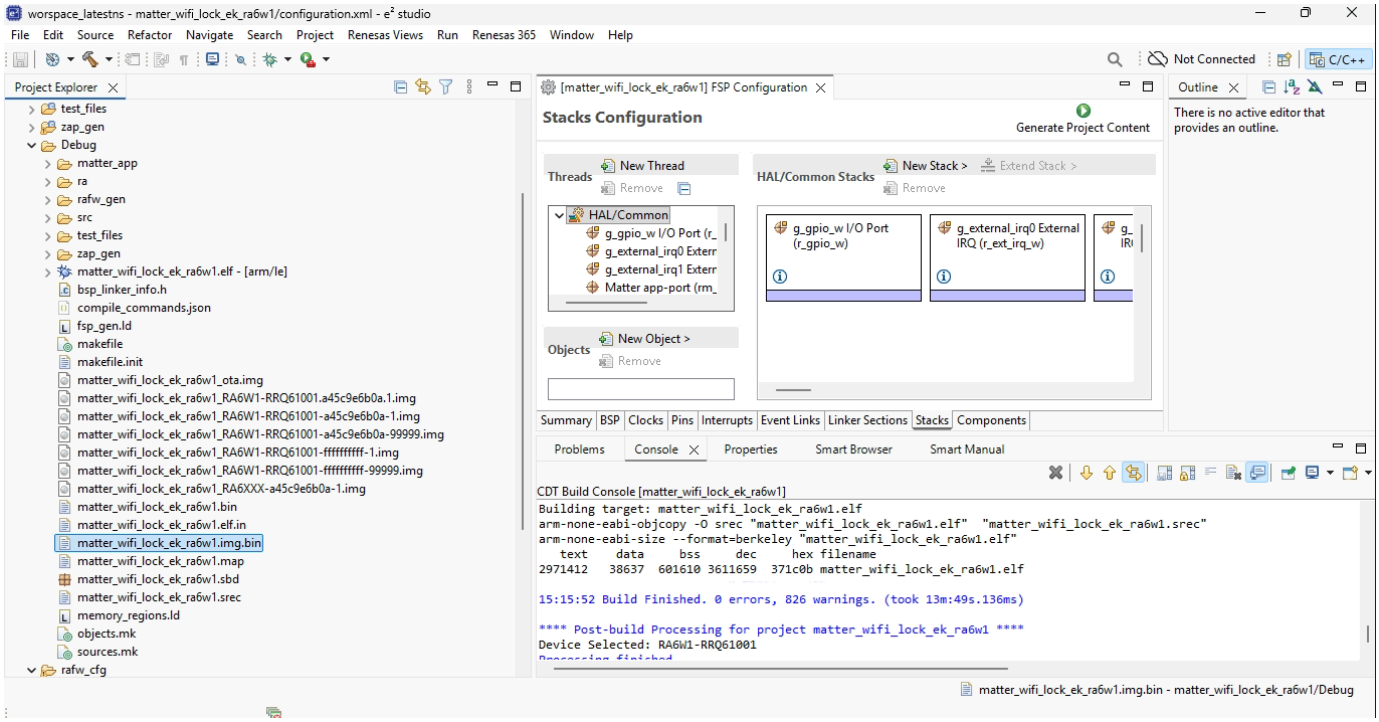


Figure 5. Debug folder

The firmware image is generated and flashed onto the EK-RA6W1 using e^2 studio with J-Link support. e^2 studio provides an integrated build and flash environment, eliminating the need for external flash programming scripts.

To flash the firmware image:

1. Open e^2 studio and connect your EK-RA6W1 board to the PC through USB (using the inbuilt SEGGER J-Link).
2. Go to **Debug Configurations**, on the **Startup** tab, select your `.img.bin` firmware file, and click **Apply**, then **Debug**.

The e^2 studio automatically flashes the firmware image to the RA6W1.

4. Configure the Google Nest Hub on Home Application

To integrate a Google Nest device with the Google Home application, do the following:

1. Install the Google Home application from the Google Play Store (Home Application) or Apple App (Home Application), depending on the mobile device being used.
2. Power on the Google Nest device and ensure that it is in Setup mode.
3. Connect the mobile device to the Wi-Fi network that will be used for the Nest device.
4. Open the Google Home application and select the **Add Device** option.
5. Choose **Set up device** and then select **New device** to initiate the discovery process.
6. The application automatically searches for nearby compatible devices. When the Nest device is detected, proceed with the on-screen instructions.
7. Confirm the device identification code if prompted and select the appropriate Wi-Fi network.
8. Complete the setup by assigning the device to a specific room and finalizing the configuration.

Upon successful completion of these steps, the Google Nest device is connected to the Google Home application and is available for control and management through the application interface.

For more information on setting up the Google Nest Hub, see the following videos:

- Google Nest Hub: How to Update/Change WiFi Password & Network Name (SSID)
- How to Add Google Nest Hub to the Google Home App – First Connection Guide

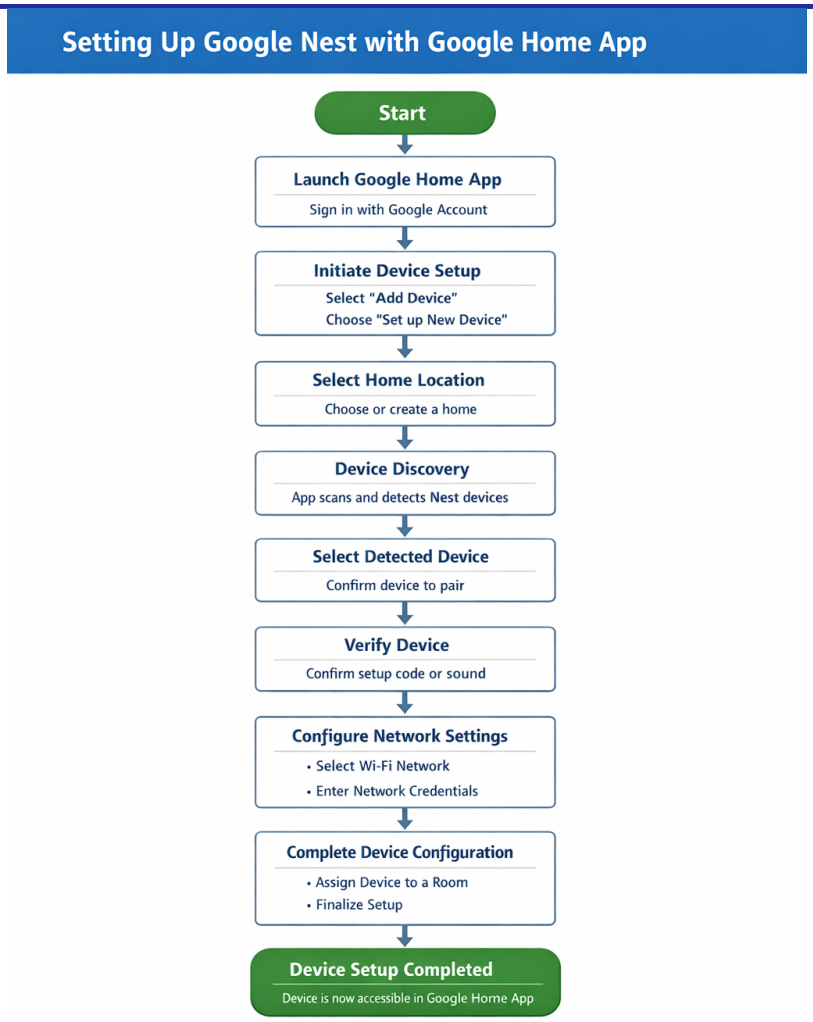


Figure 6. Google Nest Hub configuration flow

5. Testing Procedures

This section provides an overview of testing the Matter Door Lock reference application on RA6W1 with AT support.

5.1 Access Serial Console of RA6W1

You can access the serial console of the RA6W1 using terminal applications such as Tera Term on Windows and Minicom on Linux systems.

- For Windows (using Tera Term):
  a. Download Tera Term from the official release page.
  b. For a 64-bit Windows PC, you can directly download the installer. Install the application and launch Tera Term.
  c. To open the serial console, select the appropriate COM port corresponding to the RA6W1 device.
- For Linux (using Minicom):
  a. Download Minicom from https://linux.softpedia.com/get/Communications/Telephony/minicom-753.shtml. Alternatively, install Minicom using the package manager: `sudo apt install minicom`.
  b. Configure Minicom using `sudo minicom -s`.
  c. Set the correct serial device (for example, `/dev/ttyUSB0`) and baud rate as required.
  d. Start Minicom to access the RA6W1 serial console.

5.2 Configure Tera Term for RA6W1 Serial Console

1. Open the Tera Term application on the Windows system.
2. In the initial dialog box, select the appropriate serial (COM) port corresponding to the RA6W1 device (shown in Figure 7) and click **OK**. See the Set Up RA6W2 EVK section in the *RA6W1/RRQ61001 Application Development Guide*.

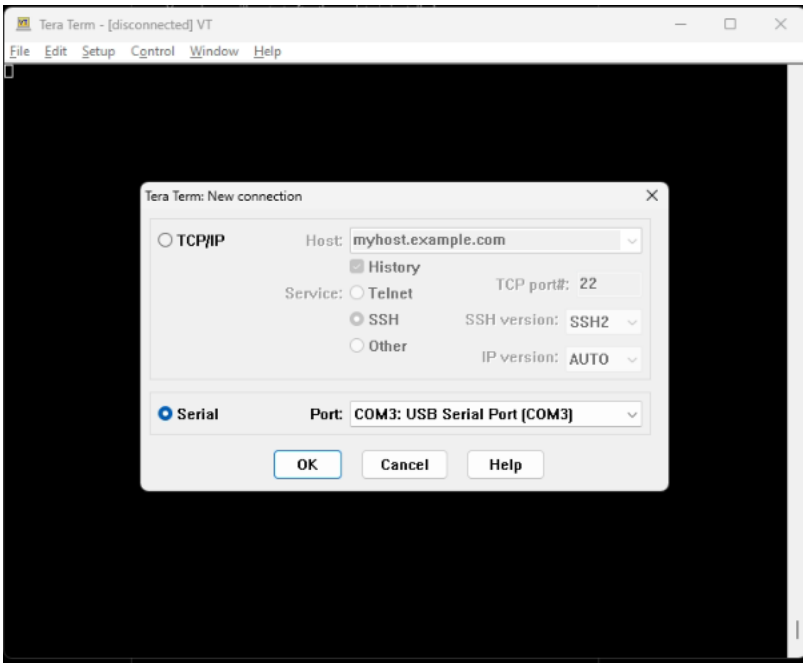


Figure 7. Serial port selection

3. To configure terminal settings, go to **Setup** > **Terminal**, and set **Receive** to **AUTO** and **Transmit** to **CR+LF**, then click **OK**.

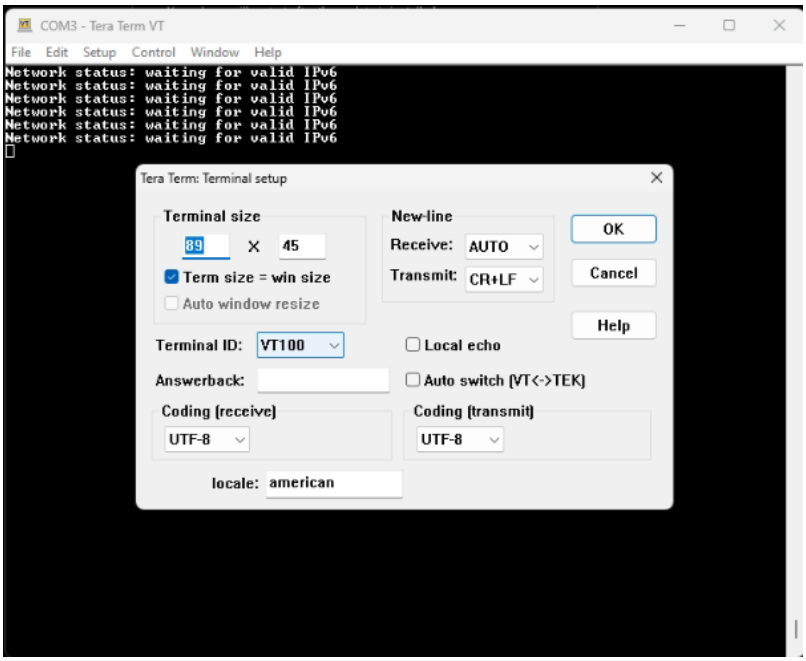


Figure 8. Configurations for Tera Term

4. To set the Baud Rate, go to **Setup** > **Serial Port**, and set the Baud rate **Speed** to **115200**, and ensure other serial parameters are configured correctly, as shown in Figure 9.

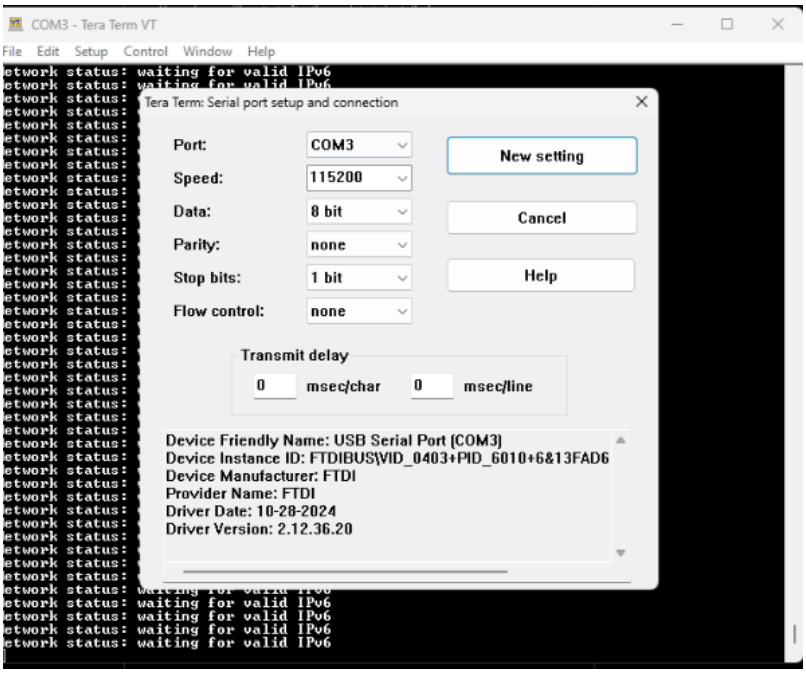


Figure 9. Serial baud rate setup

5.3 Test Provisioning over Wi-Fi in RA6W1

1. After flashing, press the **Reset** button on RA6W1 EVK to start execution.
2. If the RA6W1/RA6W2 device has already been commissioned and paired with a Nest Hub, perform a factory reset to clear the existing commissioning data before proceeding. Use the factory reset command from the console of RA6W1 if the device is already connected to a hub.
3. Execute the `factory` command on the RA6W1/RA6W2 console, as shown in Figure 10.
4. Confirm the factory reset operation and verify that the **Start Factory-Reset** action is displayed in the console window.



Figure 10. Factory reset action

After the factory reset, the RA6W1/RA6W2device loses Wi-Fi connectivity and must be reconnected to the Wi-Fi network.

5.3.1 Connect to Wi-Fi Using AT Command

5.3.1.1 Accessing the AT Console of RA6W1 Using Tera Term

1. Open Tera Term application on your system.
2. In the initial dialog box, select the appropriate serial (COM) port corresponding to the AT console, as shown in Figure 11 and click **OK**. See the Set Up RA6W1 EVK section in *RA6W1/RRQ61001Application Development Guide*.

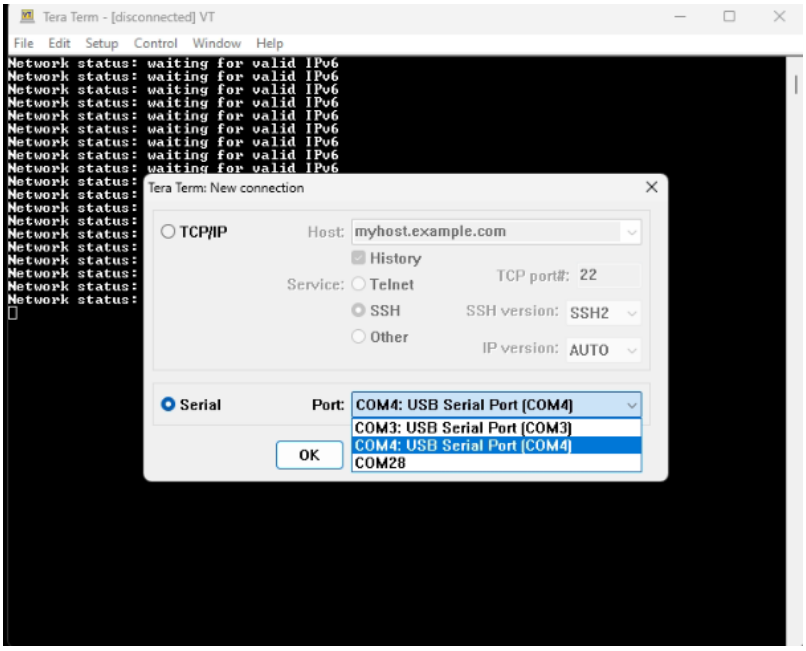


Figure 11. Choosing AT port

3. To configure terminal settings, go to **Setup** > **Terminal** and apply the required configurations as shown in the Figure 8.

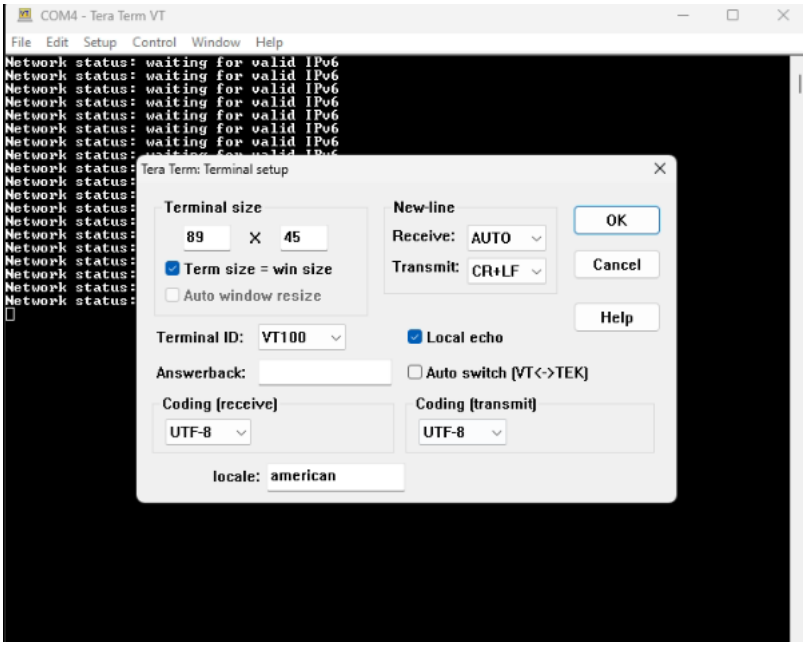


Figure 12. Configurations for Terminal setup

4. To set the Baud Rate, go to **Setup** > **Serial Port** and set the Baud rate **Speed** to **115200**.

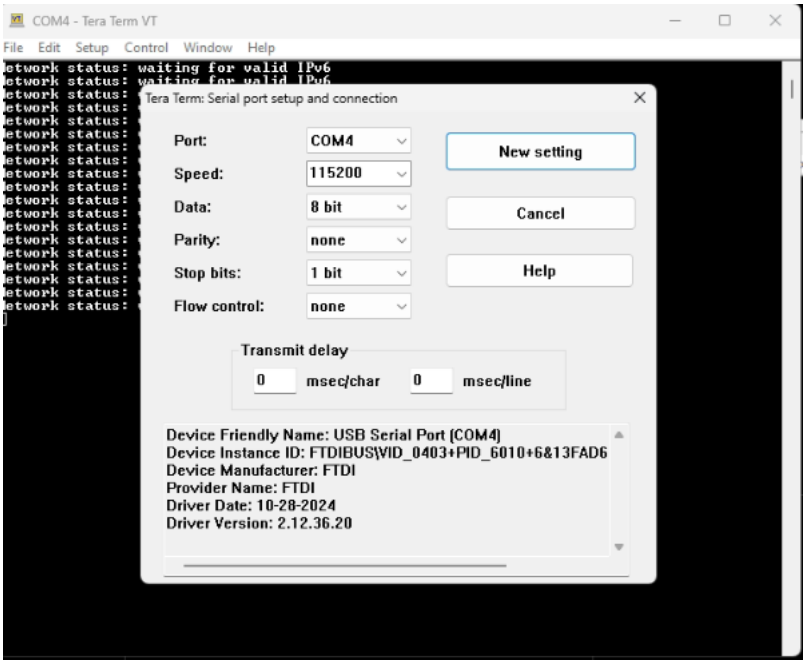


Figure 13. Serial baud rate setup

5.3.1.2 Execute the Wi-Fi Join Command

The RA6W1 must be connected to the same Wi-Fi network as the Matter Hub before starting the commissioning process. You can perform provisioning using the `AT+WFJAP` command on the AT console by specifying the SSID, password, and security type.
Executing this command also enables DPM. For more details regarding `AT+WFJAP`, see the AT Commands for DPM Setup section in *Getting Started with Matter* and *AT Commands Manual*.

1. To connect the device to the Wi-Fi network, enter the following AT command:

```
AT+WFJAP=<SSID>,<SECURITY>,<PASSKEY>
```

Example Command:

```
AT+WFJAP=RenesasMatter1,3,1,Matter2023
```

where:

- SSID: Name of the Wi-Fi network
- SECURITY: Security type (for example, 3 for WPA2/WPA3, depending on configuration)
- PASSKEY: Wi-Fi password

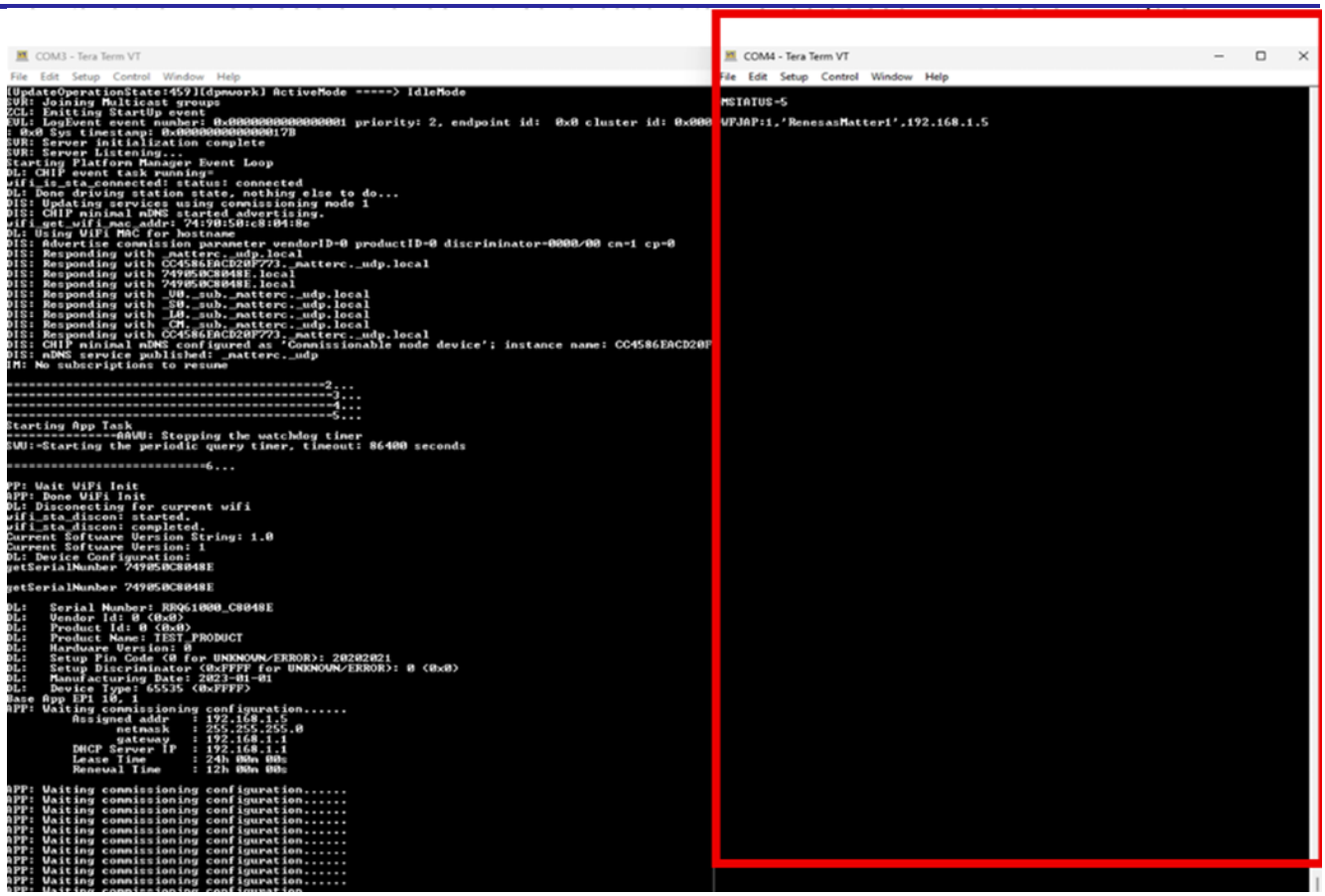


Figure 14. AT console

2. Configure the device by applying the following settings using the corresponding AT commands.

```
AT+MCONFIG=DISC,3840
AT+MCONFIG=VID,5474
AT+MCONFIG=PID,5
AT+MCONFIG=HWVER,1
AT+MCONFIG=SPKPCNT,1000
AT+MCONFIG=SPKPSALT,U1BBS0UyUCBLZXkgU2FsdA==
AT+MCONFIG=SPKPVF,uWFwqugDNGiEck/po7KHwwMwwqZgN10XuyBajPGuyzUEV/
iree4lOrao5GuwnlQ65CJzbeUB49s31EH+NEkg0JVI5MGCQGMMT/SRPFNRODm3wH/MBiehuFc6FJ/NH6Rmzw==
AT+MCONFIG=PINCODE,20202021
AT+MCONFIG=DEVTYPE,10
```

3. Apply the commands as shown in Figure 15. Look for an "OK" message when applying each configuration from step 2 on the AT console.

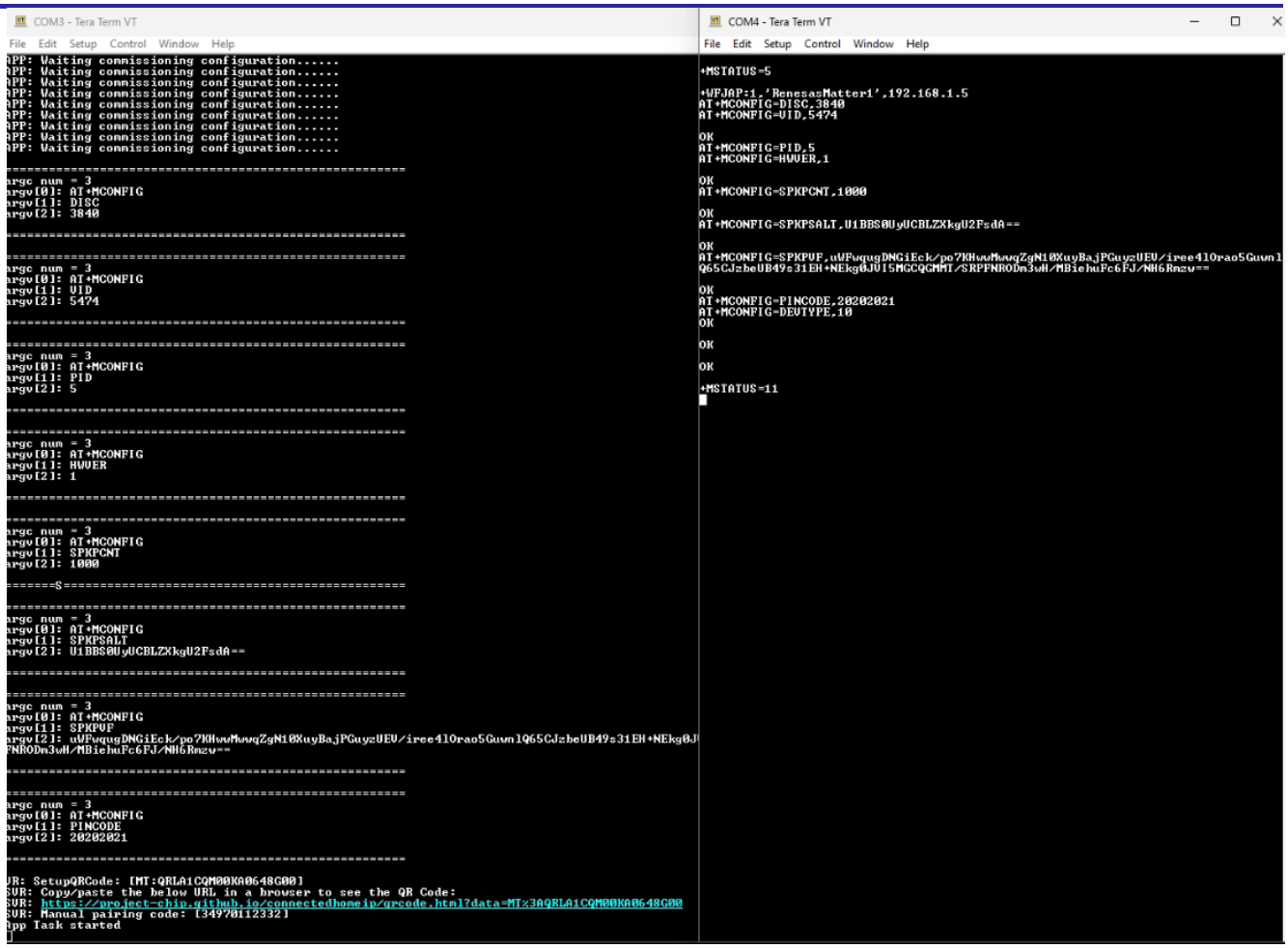


Figure 15. Configuration setting using AT

4. Reboot the device by executing the `AT+RESTART` command in the AT console.

   After the reboot, ensure that the display matches the screen shown in Figure 16, then proceed to Section 5.3.2 Add Device in Google Home App.

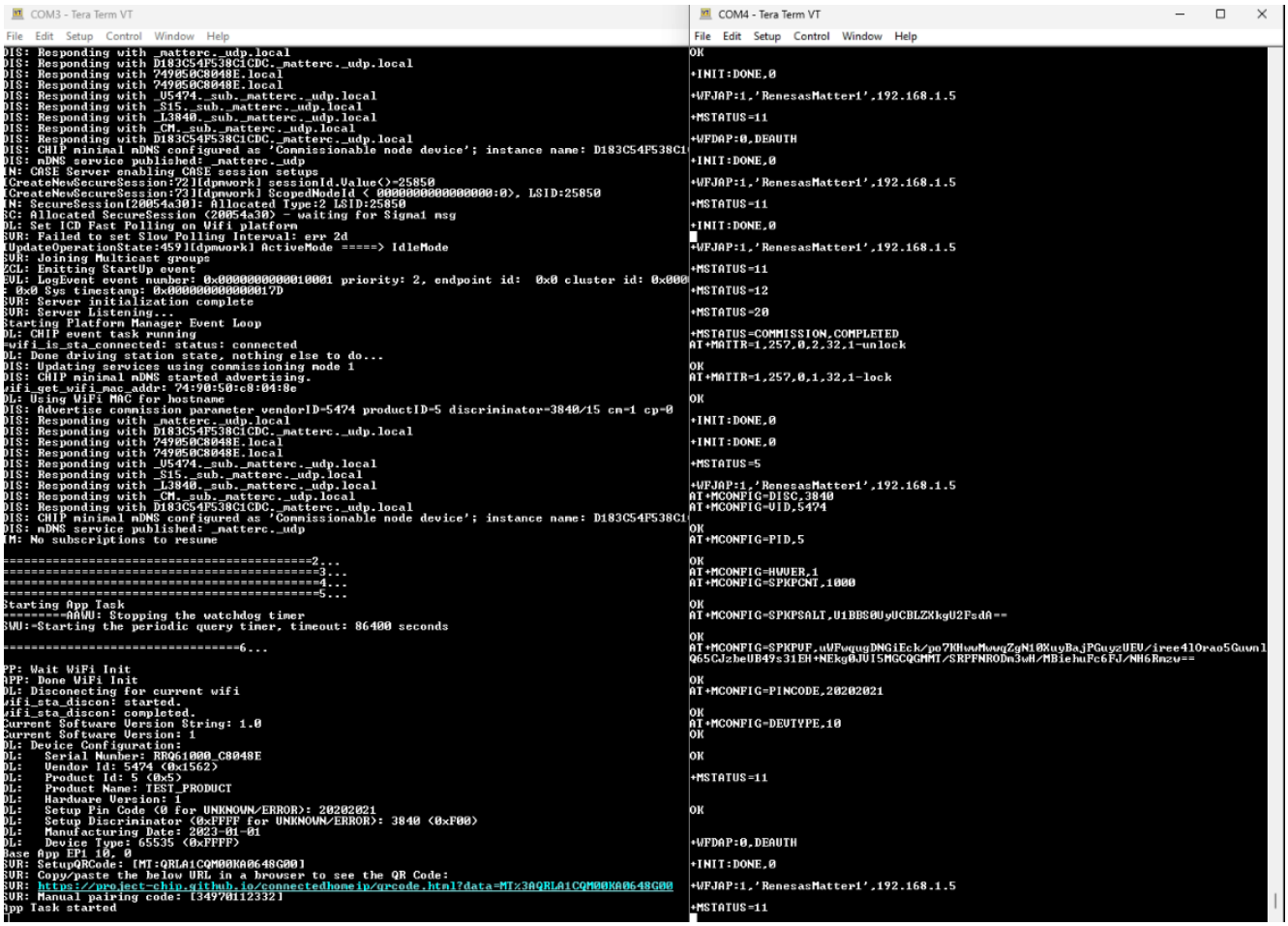


Figure 16. App task started

5.3.2 Add Device in Google Home App

You can add Door lock on RA6W1 to Google Nest Hub using pairing code or by scanning the QR code of the device.

5.3.2.1 Add the Device using Pairing Code

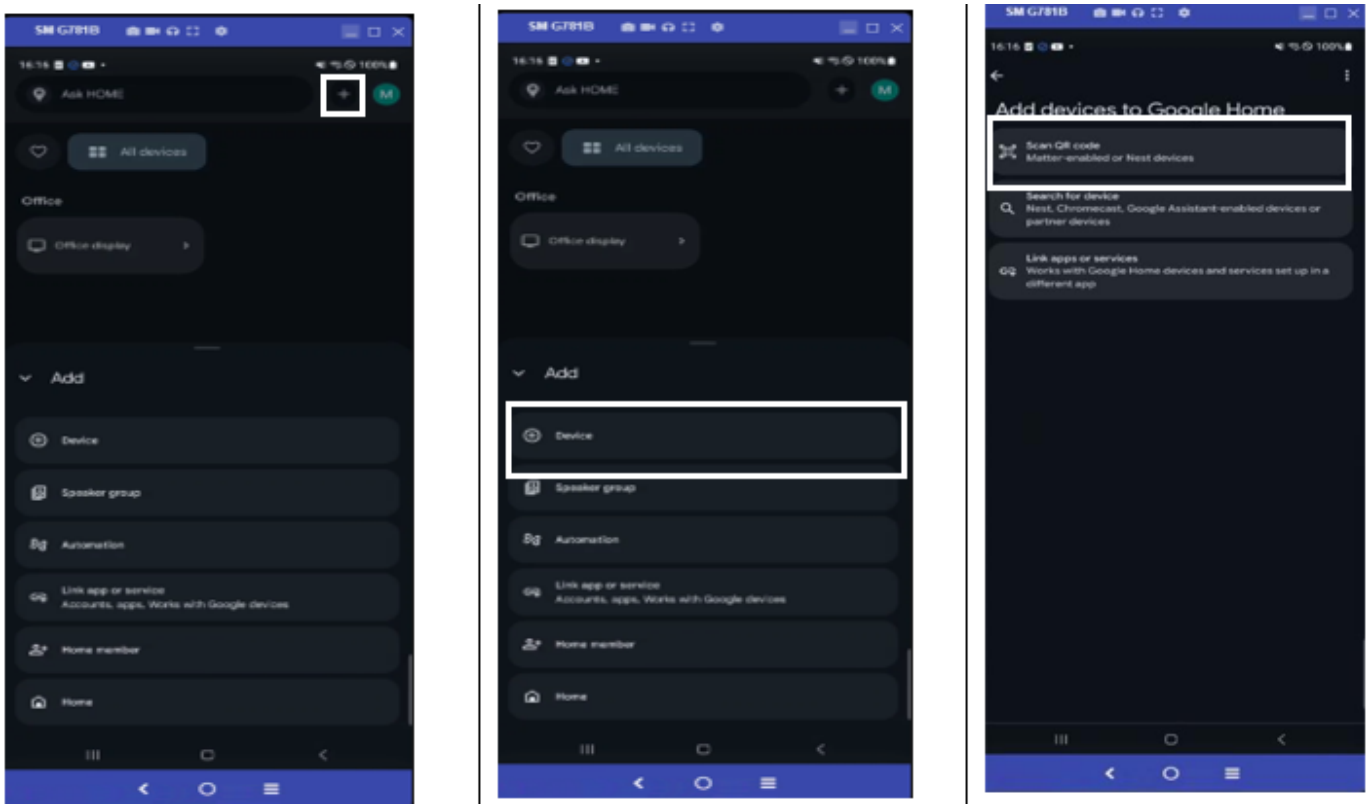


Figure 17. Configuring Google Nest Hub

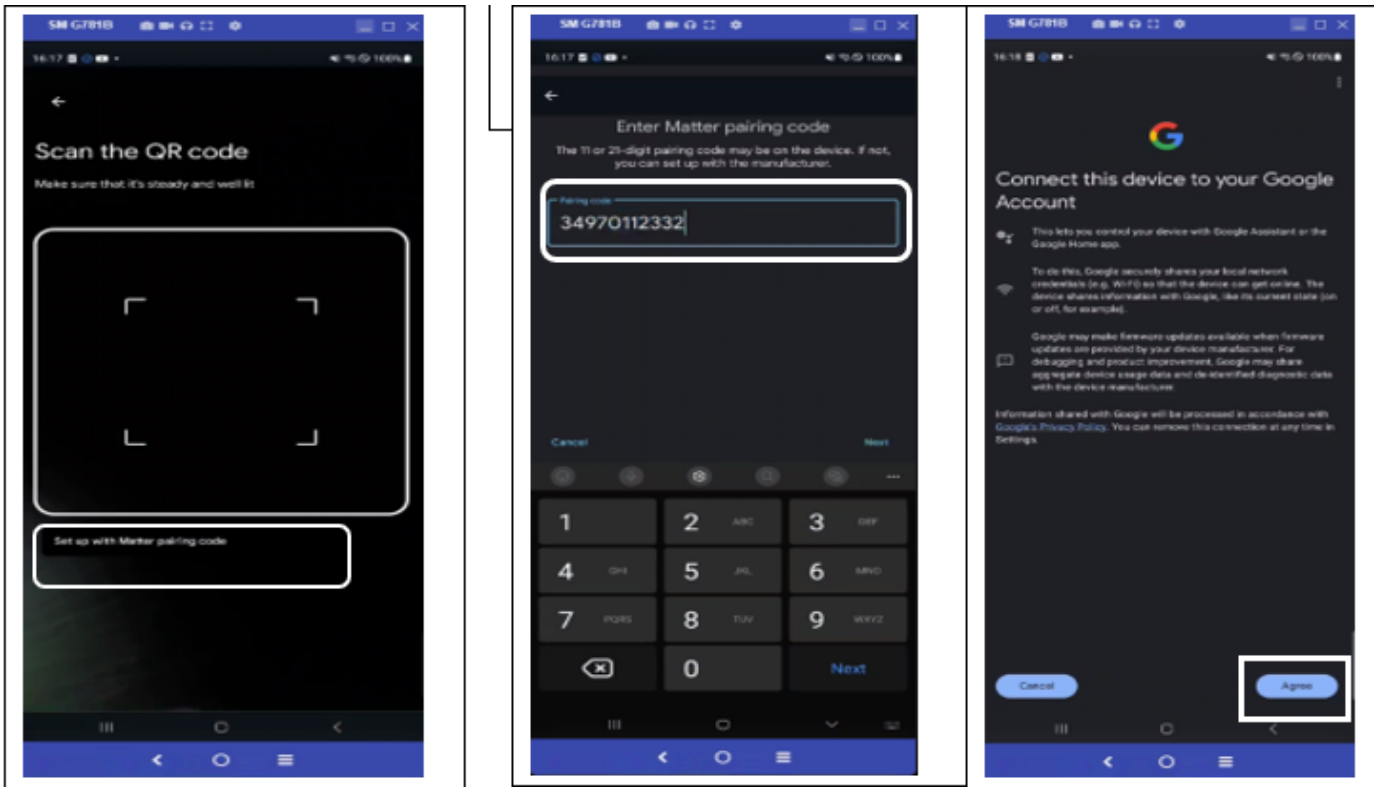


Figure 18. Configurations continue

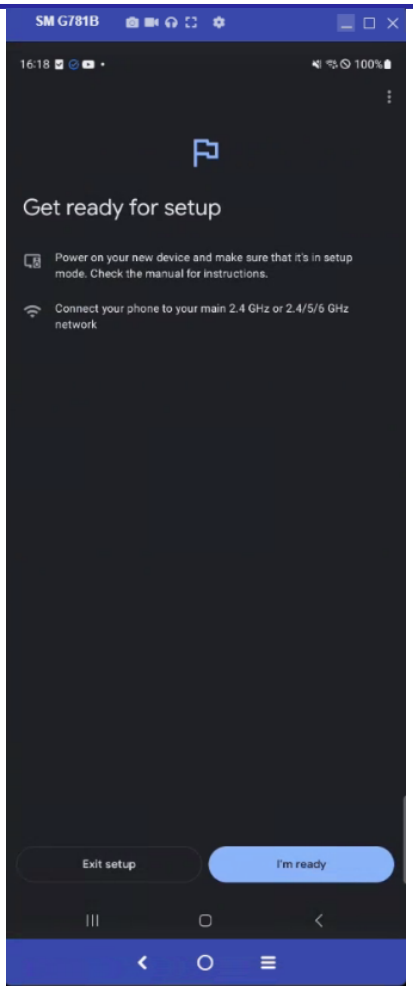


Figure 19. Starting setup process

NOTE
Before proceeding with the Set Up Anyway step shown in Figure 20 you must wait for the device to reboot and confirm that the App Task started message appears on the RA6W1 console, as shown in Figure 21. This step is mandatory; otherwise, the Matter commissioning process will fail.

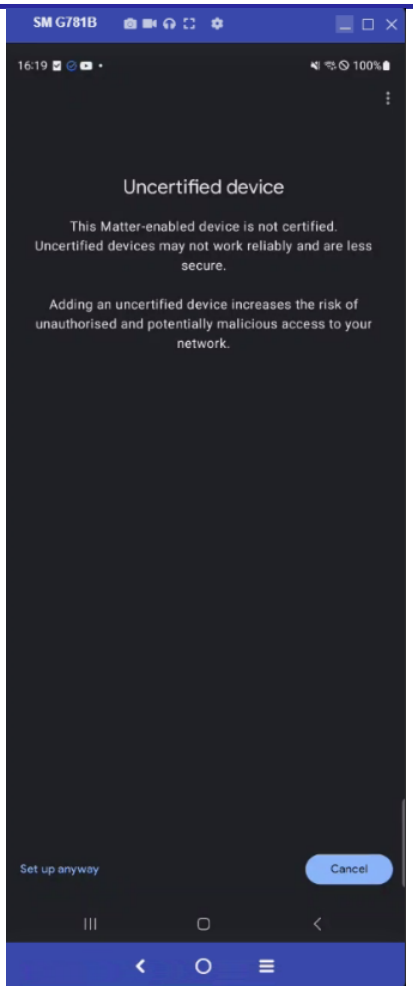


Figure 20. Setup anyway screen

```
P: Wait WiFi Init
PP: Done WiFi Init
L: Disconecting for current wifi
ifi_sta_discon: started.
ifi_sta_discon: completed.
urrent Software Version String: 1.0
urrent Software Version: 1
L: Device Configuration:
L:    Serial Number: RRQ61000_C8048E
L:    Vendor Id: 65521 (0xFFF1)
L:    Product Id: 32774 (0x8006)
L:    Product Name: TEST_PRODUCT
L:    Hardware Version: 1
L:    Setup Pin Code (0 for UNKNOWN/ERROR): 20202021
L:    Setup Discriminator (0xFFFF for UNKNOWN/ERROR): 3840 (0xF00)
L:    Manufacturing Date: 2023-01-01
L:    Device Type: 65535 (0xFFFF)
VR: SetupQRCode: [MT:8IXS1AFN00KA0648G00]
VR: Copy/paste the below URL in a browser to see the QR Code:
VR: https://project-chip.github.io/connectedhomeip/qrcode.html?data=MT%3A8IXS1AFN00KA0648G00
VR: Manual pairing code: [34970112332]
L: CD: SFlash read failed Address: 0x00379000
L: [AppTask.cpp:ReadAllCredentialsAndUpdateSizes:250] kConfigKey_Creds_CD_Size failed
L: DAC: SFlash read failed Address: 0x0037A000
L: [AppTask.cpp:ReadAllCredentialsAndUpdateSizes:256] kConfigKey_Creds_DAC_Size failed
L: PAI: SFlash read failed Address: 0x0037B000
L: [AppTask.cpp:ReadAllCredentialsAndUpdateSizes:262] kConfigKey_Creds_PAI_Size failed
L: DAC Priv Key: SFlash read failed Address: 0x0037C000
L: [AppTask.cpp:ReadAllCredentialsAndUpdateSizes:268] kConfigKey_Creds_DAC_Priv_Size failed
L: DAC Pub Key: SFlash read failed Address: 0x0037D000
L: [AppTask.cpp:ReadAllCredentialsAndUpdateSizes:274] kConfigKey_Creds_DAC_Pub_Size failed
pp Task started
M_PMGR_W_dpm_is_enabled
```

Figure 21. Setup anyway confirmation prints

Continue with the commissioning process, as shown in Figure 22.

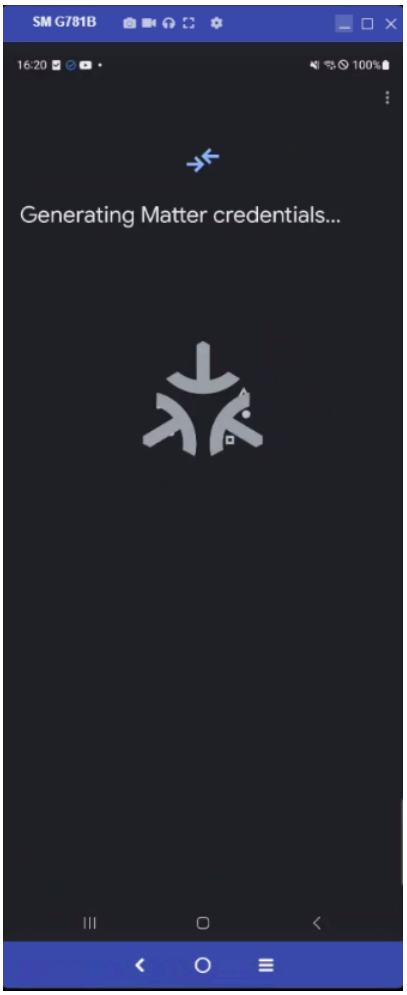


Figure 22. Generating Matter credentials

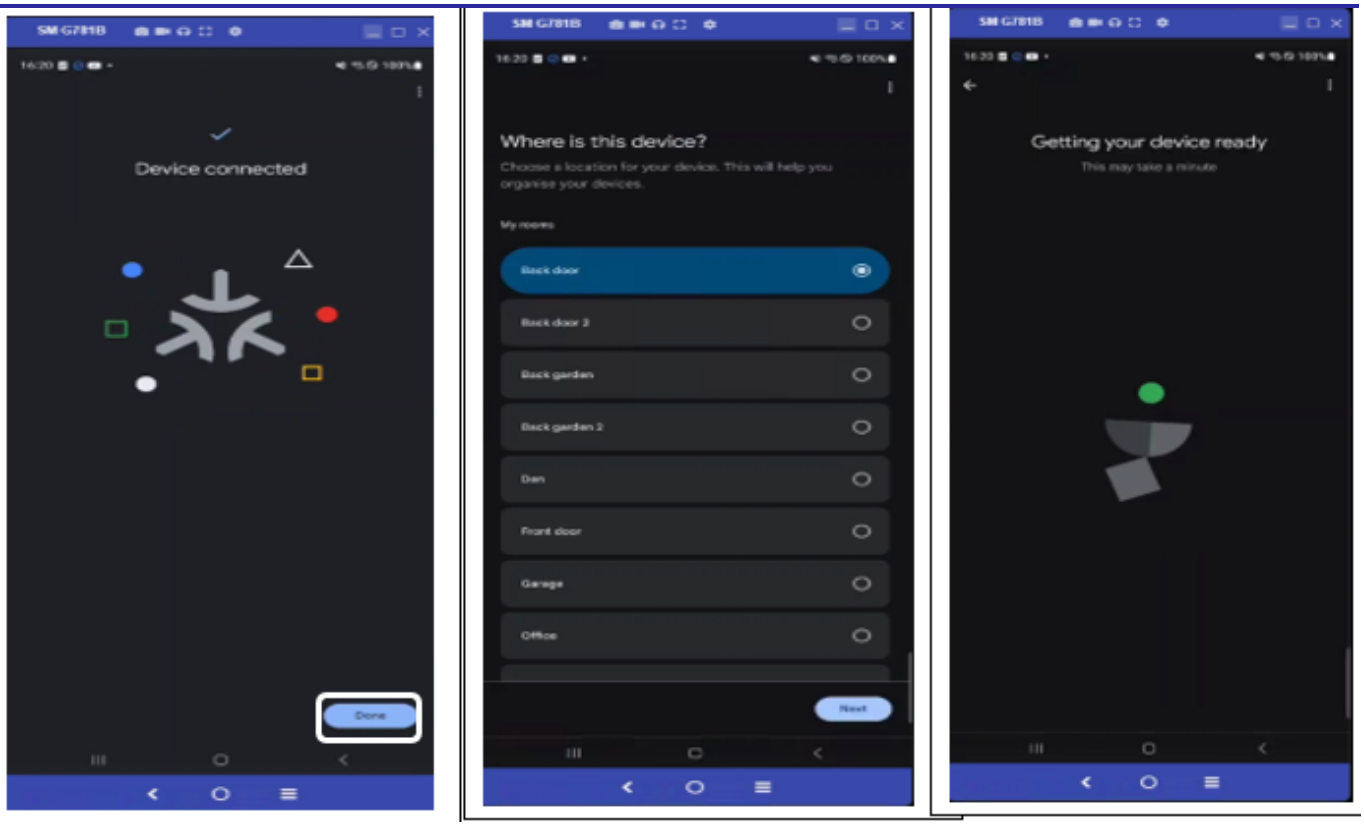


Figure 23. Successful connection of device to Nest Hub

On the AT console, the logs `+MSTATUS=11`, `+MSTATUS=12`, and `+MSTATUS=20` can be observed during the commissioning process. When commissioning is completed, the log `+MSTATUS=COMMISSION,COMPLETED` is displayed on the AT console.

5.3.2.2 Add the Device by Scanning the QR Code of Matter Enabled Device

After the device is successfully connected to the access point (network), as described in Section 5.3.1 Connect to Wi-Fi Using AT Command, a URL is displayed on the serial console, as shown in Figure 24.

1. Copy and paste this URL into any web browser to access the commissioning page. A specific QR code is generated, as shownin Figure 22.

2. Use the Google Home application and select the Scan QR Code option (see Figure 25) to scan the generated QR code and proceed with the commissioning process.

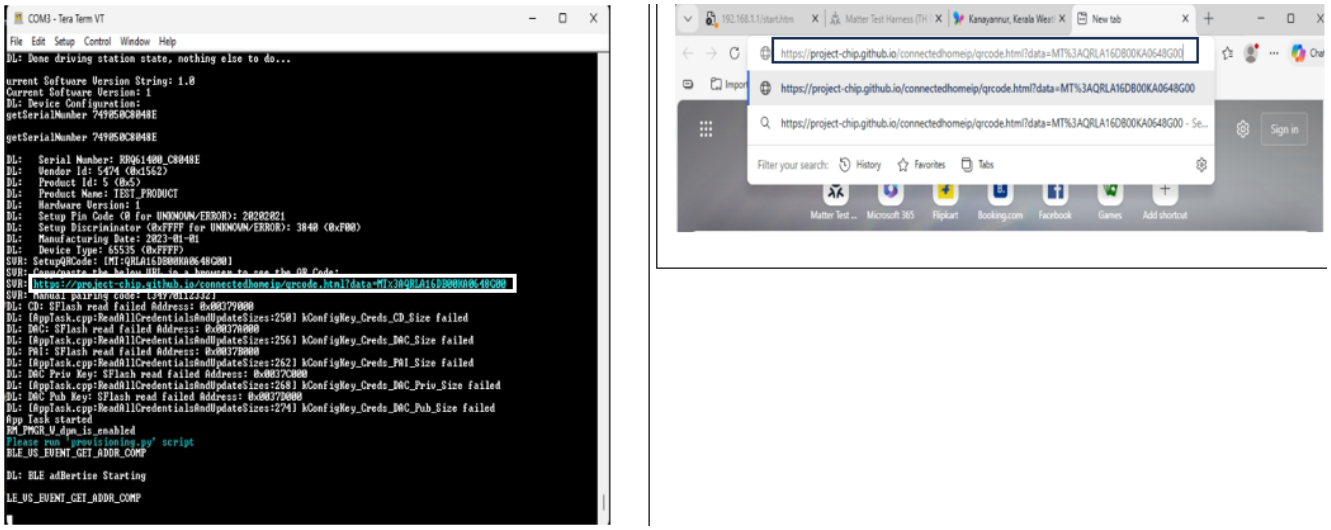


Figure 24. Generation of QR code

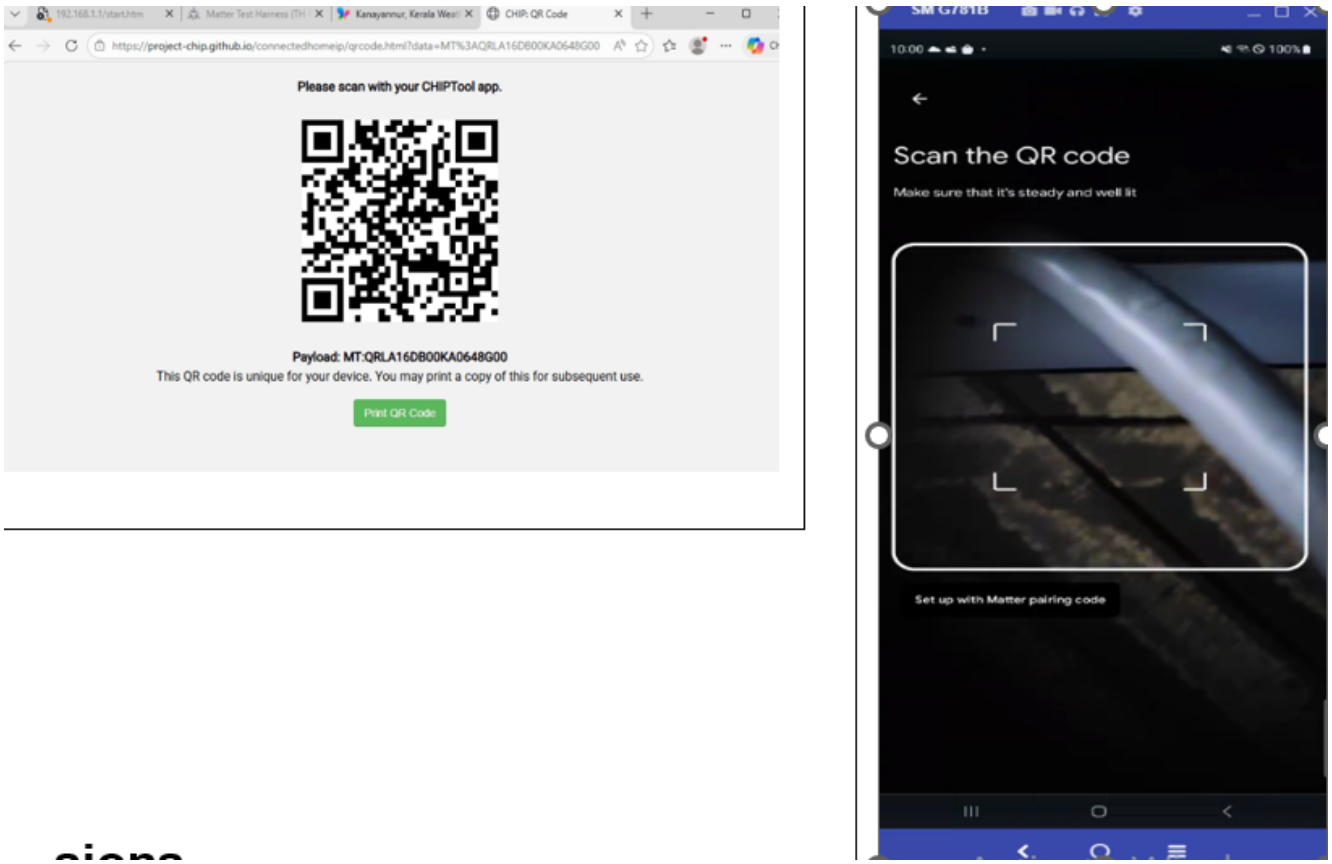


Figure 25. Scanning QR code

5.3.3 Testing the Application

5.3.3.1 Responses in AT Console

On the AT console, the logs `+MSTATUS=11`, `+MSTATUS=12`, and `+MSTATUS=20` can be observed during the commissioning process. Whencommissioning is completed, the log “+MSTATUS=COMMISSION,COMPLETED” is displayed on the AT console. The possible values of `+MSTATUS` are in Table 2.

Table 2. +MSTATUS possible values

Value	AT Message	Description
0	+MSTATUS=0	Factory reset completed.
1	+MSTATUS=1	Device boot-up ready.
5	+MSTATUS=5	Device requires configuration. The discriminator is not yet set, and the device continues looping until a valid discriminator is provided using AT+MCONFIG.
10	+MSTATUS=10	Access Point (AP) mode started.
11	+MSTATUS=11	Commissioning mode started. The device is advertising and waiting for a Matter commissioner.
12	+MSTATUS=12	Commissioning mode completed. The commissioner has finished the pairing process.
15	+MSTATUS=15	Network connectivity established successfully.
16	+MSTATUS=16	Network failure occurred. This status is also reported when the commissioning fail-safe timer expires.
20	+MSTATUS=20	Wi-Fi STA mode started; device joined the network.
25	+MSTATUS=25	Wi-Fi STA mode completed.
30	+MSTATUS=30	MCU OTA firmware update is in progress.

5.3.3.2 Unlock Action

To perform the unlock operation, execute the following AT command in the device AT console:

```
AT+MATTR=1,257,0,2,32,1 // Unlock
```

The format of the command is the following:

```
AT+MATTR=<endpoint-id>,<cluster-id>,<attribute-id>,<attribute-data>,<data-type>,<write(1)/read(0)>
```

Table 3. `AT+MATTR` parameters

Parameter	Value	Meaning
endpoint-id	1	Endpoint 1
cluster-id	257 (0x0101)	Door Lock cluster
attribute-id	0 (0x0000)	LockState attribute
attribute-data	2	Value 2 = Unlocked
data-type	32 (0x20)	ZCL uint8
write/read	1	Write

This command sets the LockState attribute of the Door Lock cluster on endpoint 1 to the Unlocked state.
After executing this command, the change is reflected in both the Home application and the device console, as shown in Figure 26. The message “Unlock Action has been completed” is displayed on the device console.
Similarly, when the device is unlocked through the Home application, the message “Unlock Action has been completed” is displayed on the console. While performing the unlock operation through the AT console, you can see the “OK” message on the AT console.

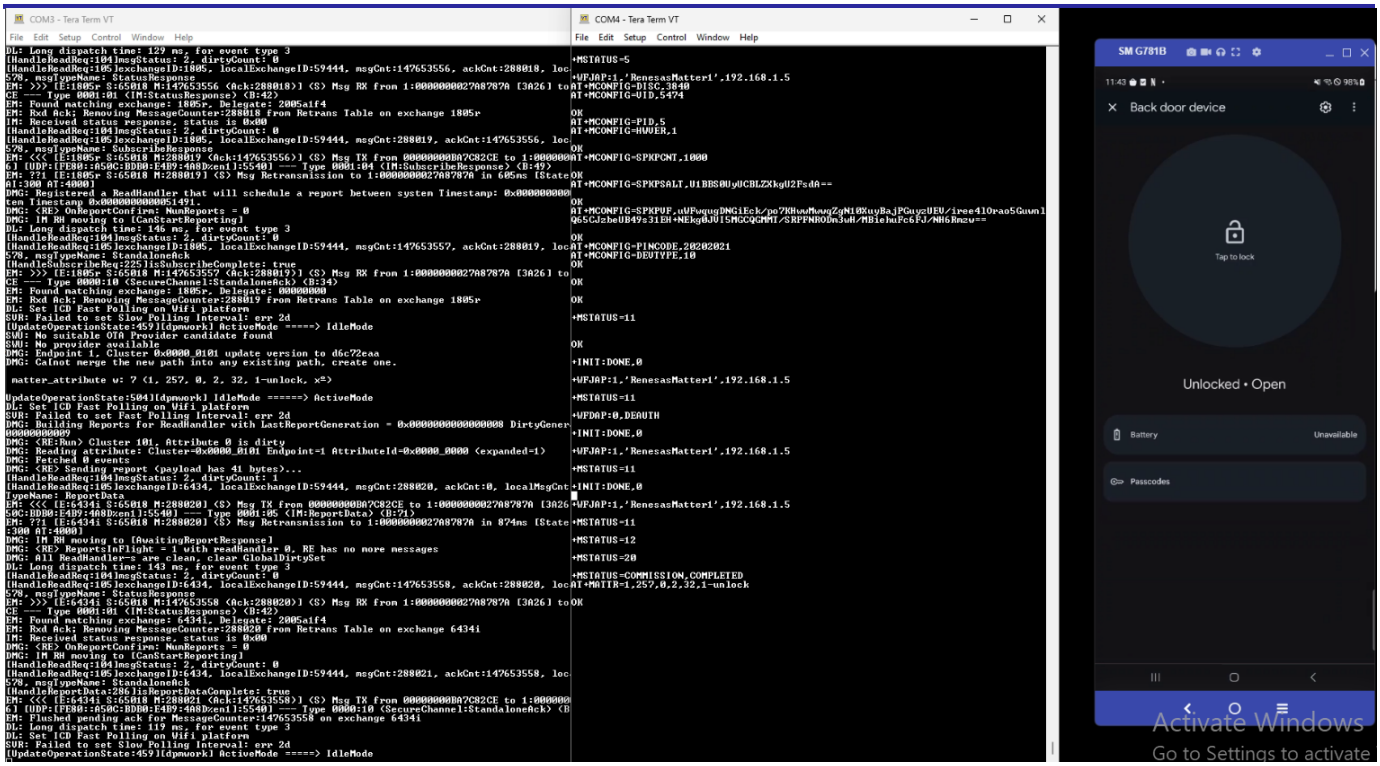


Figure 26. Unlock action

5.3.3.3 Lock Action

To perform the lock operation, execute the following AT command in the device's AT console:

```
AT+MATTR=1,257,0,1,32,1    // Lock
```

In the above command, the attribute-data value is set to 1 to perform the lock operation.
After executing this command, the change is reflected in both the Home application and the device console, as shown in Figure 27. The message "Lock Action has been completed" is displayed on the device console.
While unlocking the device through Home application, the message "Lock Action has been completed" is displayed on the console. you can see the "OK" message on the AT console while performing lock action on AT console.

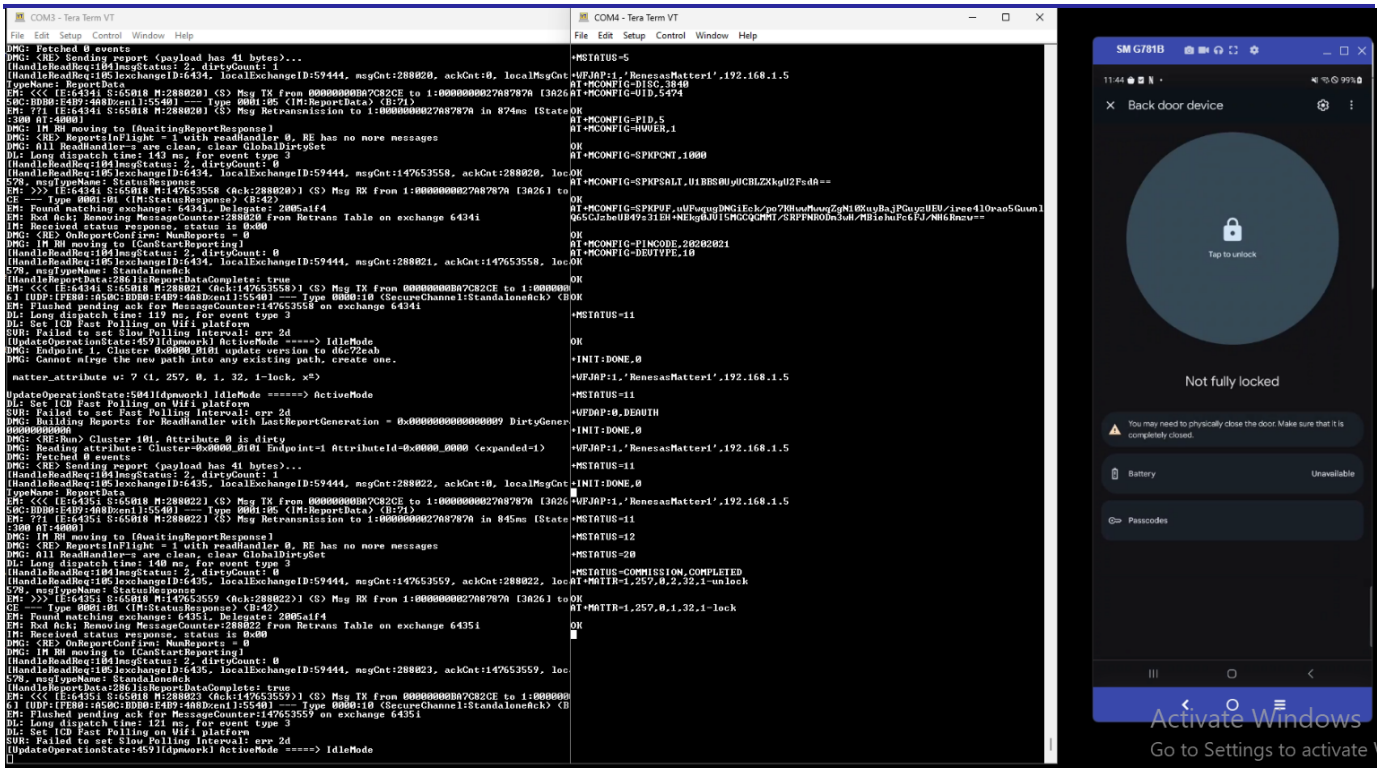


Figure 27. Lock action

6. Revision History

Revision	Date	Description
1.02	Sep 21, 2026	Updated the ZAP file generation workflow to use the Renesas QE for Matter tool. Refreshed the pack version and e² studio installer details for the FSP 2.2.0 release.
1.01	July 21, 2026	Updated the FSP application version to align with the FSP 2.1.0 APPS release. Revised the required e^2 studio version to ensure compatibility with the FSP 2.1.0 APPS release.
1.00	June 2, 2026	Initial release.

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