Using Wi-Fi Provisioning with RAFW Connectivity Devices

This document shows how to use the mobile application to provision the Wi-Fi connection on the RA6W1/RA6W2/RRQ61001/RRQ61051 through SoftAP mode.

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Terms and Definitions

AP	Access Point
EVK	Evaluation Kit
MCU	Microcontroller Unit
RTOS	Real-Time Operating System
SoftAP	Software-Enabled Access Point
SSID	Service Set Identifier
UART	Universal Asynchronous Receiver/Transmitter
Wi-Fi®	Wireless Fidelity
WLAN	Wireless Local Area Network

1. Introduction

The Renesas RA6W1/RA6W2/RRQ61001/RRQ61051 is a Wi-Fi–enabled MCU that is designed for wireless connectivity applications. In this example, Wi-Fi plays the primary role and network provisioning is performed using SoftAP mode. During provisioning, RA6W1/RA6W2 operates as a SoftAP, allowing a mobile application to connect directly to the device. Through this connection, you can configure Wi-Fi parameters such as SSID, password, and server information, which are then stored on the RA6W1/RA6W2 to enable connection to the target Wi-Fi network.

2. System Overview

In SoftAP provisioning mode, the RA6W1/RA6W2 temporarily creates a Wi-Fi access point with a predefined SSID. A user device connects to this access point and accesses a provisioning interface to configure network credentials.
The provisioning flow is as follows:

1. By default, the RA6W1/RA6W2 boots in Station (STA) mode and attempts to connect using previously stored Wi-Fi credentials.
2. If no valid credentials are available, or after a factory reset, the device enters SoftAP mode for provisioning.
3. In SoftAP mode, the RA6W1/RA6W2 broadcasts a temporary Wi-Fi SSID.
4. A mobile provisioning application connects to the RA6W1/RA6W2 SoftAP.
5. The application securely transmits the Wi-Fi network credentials to the device.
6. The RA6W1/RA6W2 stores the received credentials.

Upon successful provisioning, the device switches to STA mode and connects to the configured Wi-Fi network.

2.1 Software Requirements

The following software tools and packages are required to complete the project:

- Renesas Electronics Flexible Software Package (FSP): Version 2.2.0 or later.
- e^2 studio IDE: Version 2026-04.3 or later.
- GCC Arm Embedded Toolchain: Version 13.3.1.arm-13-24.
- Serial Terminal Application: Tera Term or similar tools for logging and monitoring output.

2.2 Hardware Requirements

- Renesas RA6W1/RA6W2 Evaluation Kit (EVK).
- RA6W1/RA6W2 MCUwith ultra-low power consumption.
- USB Type-C Cable: For programming and debugging.
- Jumper Wire (Female to Female): For making proper motherboard configurations for the application.
- Host PC: For running the Mosquitto MQTT broker and test clients.
- Wi-Fi Access Point (AP): With network connectivity.

3. Hardware Setup and Configuration

To connect hardware:

1. Connect the RA6W1/RA6W2 MCU to the Evaluation Kit (EVK) using the extension socket.
2. Connect the USB Debug port on the EVK to the host PC for programming and debugging using a USB Type-C cable.
3. Set up jumpers as following:
   - UART (RX): P0_00
   - UART (TX): P0_01
   - J102: {2-3} [Current Measurement]
   - J105: {2,3} [Voltage Selector]
   - J106: {2,3} [Voltage Selector]
   - J107: {2,3} [Voltage Selector]
   - J210: {1,2} [Reset]
   - SWCLK(c): SWCLK
   - SWDIO(c): SWDIO
4. Enable Soft AP provisioning mode:
   a. Connect BTN1 and P0_11: This configuration is used for the factory reset.
   b. Press and release BTN1: To trigger the device to enter Provisioning mode

4. SoftAP-Based Wi-Fi Provisioning Setup

Before you can do Wi-Fi provisioning using SoftAP mode, you need to set up EVK, flash firmware image, and install mobile application.

4.1 Set up EK-RA6W1/RA6W2

To set up EK-RA6W1/RA6W2 for Wi-Fi provisioning using SoftAP mode, you need:

- An EK-RA6W1/RA6W2
- A mobile phone or PC with Wi-Fi capability to connect to the RA6W1/RA6W2
- An external access point for the final Wi-Fi connectivity

4.2 Flash Firmware Image

In Wi-Fi provisioning example application, the provisioning firmware image is used. The firmware image is generated and flashed to the EK-RA6W1/RA6W2 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 firmware image:

1. Open e^2 studio and connect your EK-RA6W1/RA6W2 board to the PC through USB (using the inbuilt SEGGER J-Link).
2. Go to **Debug Configurations**.
3. On the **Startup tab**, select your `.img.bin` firmware file, and then click **Apply**.
4. Click **Debug**.

e^2 studio automatically flashes the firmware image to the RA6W1/RA6W2. When flashing is completed, the device reboots and starts running the firmware.
For more information, see *RA6W1 Getting Started Guide*.

4.3 Install Mobile Application

For provisioning testing, you need to use a third-party Android phone and install the latest Renesas Wi-Fi Provisioning application version 3.0.2 available on the Play Store or the App Store.



Figure 1. Wi-Fi provisioning application

5. Wi-Fi Provisioning Sequence

Figure 2 shows Wi-Fi provisioning sequence when using mobile application, SoftAP mode, and legacy AP.

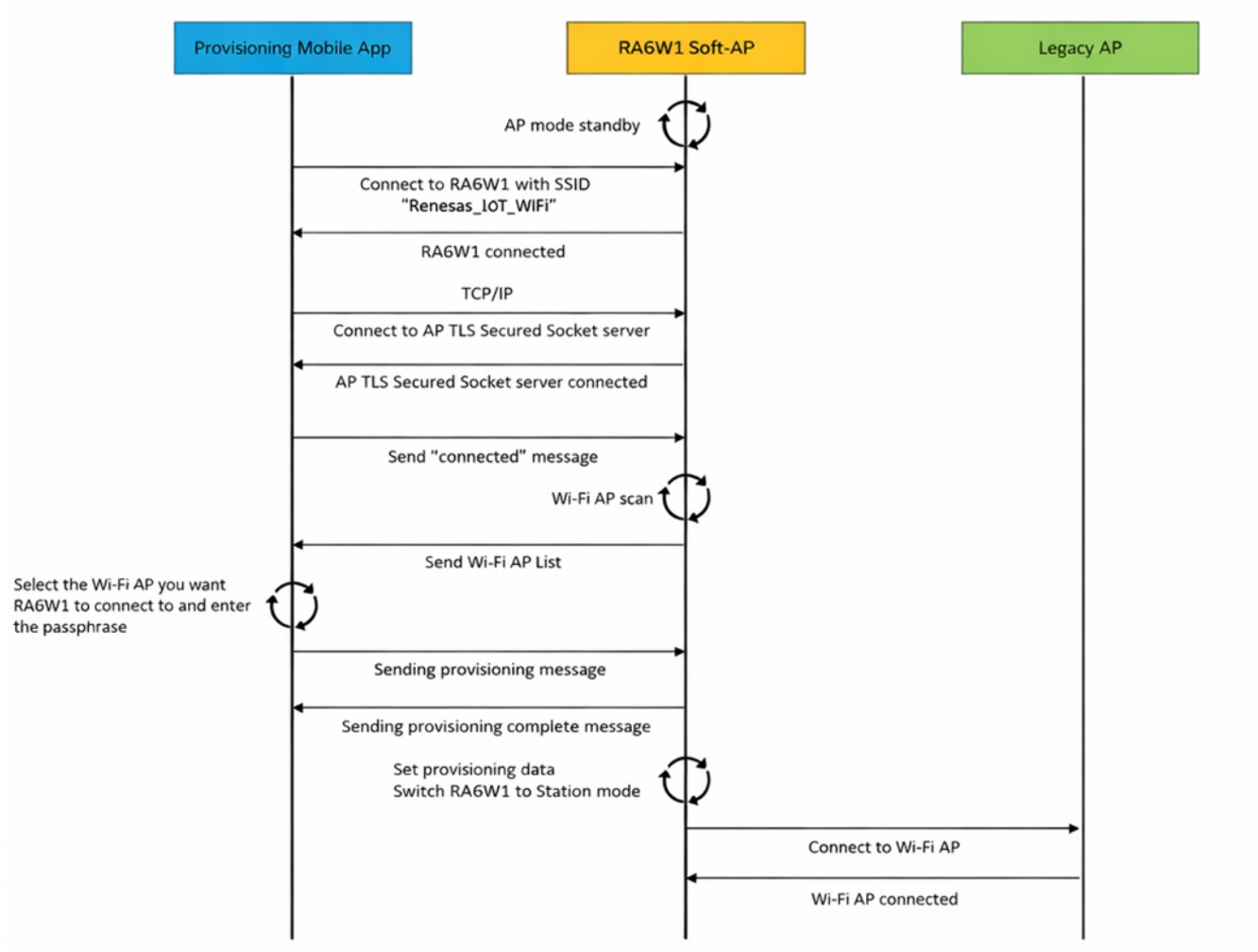


Figure 2. Wi-Fi provisioning sequence

1. Device Power-Up and Provisioning Mode Entry:
   - The RA6W1/RA6W2 device is powered on or reset.
   - Based on the hardware configuration (BTN1 press with P0_11 connected), the device enters Wi-Fi provisioning mode.
   - The device prepares to start the provisioning process.
2. SoftAP Initialization:
   - The RA6W1/RA6W2 device initializes the Wi-Fi stack.
   - The device starts operating as a SoftAP.
   - The SoftAP uses predefined credentials that are hard-coded in the firmware.
     - SSID: Renesas_IoT_WiFi
     - Password:12345678
3. Mobile Application Connection to SoftAP:
   - The user launches the Renesas Wi-Fi Provisioning App on the smartphone (install the latest Renesas WiFiProvisioning application version 3.0.2 available on the Play Store or the App Store).
   - The user selects the option to start provisioning over Wi-Fi.
   - The mobile application connects to the RA6W1 SoftAP using the predefined credentials.

4. Wi-Fi Network Scan Request:
   - The provisioning application initiates a Wi-Fi scan request.
   - The RA6W1/RA6W2 device scans for nearby Wi-Fi networks.
   - The list of available Access Points is sent to the mobile application.
5. Selection of Target Wi-Fi Network:
   - The available Wi-Fi networks are displayed in the mobile application.
   - The user selects the desired target Wi-Fi Access Point from the list.
6. Provisioning of Wi-Fi Credentials:
   - The user enters the password for the selected Wi-Fi network.
   - The provisioning application sends the Wi-Fi credentials to the RA6W1/RA6W2 device.
   - The device stores the received credentials for later use.
7. Device Reboot and Exit from Provisioning Mode:
   - After the credentials are successfully received, the RA6W1/RA6W2 device exits provisioning mode.
   - The device automatically triggers a system reboot.
   - The SoftAP provisioning phase is completed.
8. Connection to Target Wi-Fi Access Point:
   - After reboot, the RA6W1/RA6W2 device switches to Station mode and attempts to connect to the target Wi-Fi network.
   - The device uses the provisioned SSID and password.
   - An IP address is obtained from the network upon successful connection.
9. Provisioning Completion. Successful Wi-Fi connection is indicated by:
   - Serial console log messages or SEGGER RTT logs.
   - Assignment of an IP address.

6. Provision Wi-Fi through SoftAP Mode - Example

When the firmware image is flashed to the RA6W1/RA6W2, the device starts in Station mode. To change the device to Provisioning mode and initiate Wi-Fi provisioning:

NOTE
To enable Wi-Fi Provisioning mode, you must configure the factory reset button by connecting BTN1 to the P0_11 pin on the RA6W1/RA6W2.

1. Connect pins P0_11 and BTN1 together using a jumper wire.
2. To perform Factory Reset, press and hold the factory reset button (configured through the jumper).
   The device performs a factory reset and reboots into SoftAP mode, which is now ready for Wi-Fi provisioning.
3. On the main screen, select **Start provisioning over Wi-Fi** as shown in Figure 3. The mobile application version used is 3.0.2.



Figure 3. Start provisioning over Wi-Fi

4. Wait until the scanning is completed, and then search for the Renesas IoT.

5. Select **Renesas IoT** and wait until it automatically connects as shown in Figure 4.



Figure 4. Connect to RA6W1 with SSID

When the connection is successful, all the buttons become blue as shown in Figure 5.

6. Click **Scan Wi-Fi network** and wait until the scan finishes.



Figure 5. Scan Wi-Fi network

8. Enter the password and click **OK**, see Figure 6.



Figure 6. Enter password



Figure 7. Provisioning is successful

When provisioning is successfully completed, the RA6W1/RA6W2 is assigned an IP address as shown in the console log in Figure 8.



Figure 8. Console log

Figure 9 shows the SEGGER RTT log displaying the connected Access Point details.

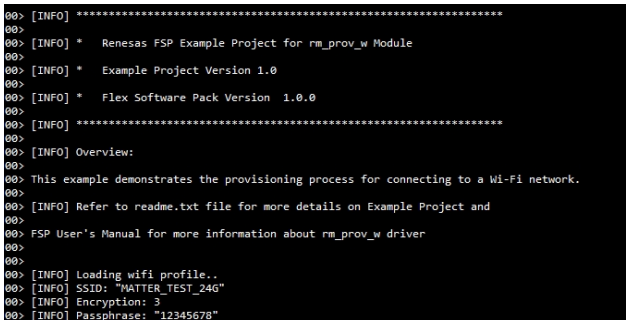


Figure 9. SEGGER RTT log

7. Revision History

Revision	Date	Description
1.02	Sep 21, 2026	Updated the Software requirements section.
1.01	July 21, 2026	Updated software requirements.
1.00	May 22, 2026	First version.

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CorporateHeadquarters

TOYOSU FORESIA, 3-2-24 Toyosu
Koto-ku, Tokyo 135-0061, Japan

www.renesas.com

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