

## RA6W1 Getting Started Guide

This document is intended to help new or existing developers quickly start evaluating the EVK and using SDK to develop Wi-Fi applications with the RA6W1 chipset.

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## 1. Terms and Definitions

API	Application Program Interface
Arm	Advanced Risk Machine
Bluetooth LE	Bluetooth® Low Energy
COM	Communication Port
CPU	Central Processing Unit
DMP	Dynamic Power Management
EVB	Evaluation Board
EVK	Evaluation Kit
FSP	Flexible Software Package
GCC	GNU Compiler Collection
GPIO	General-Purpose Input/Output
IC	Integrated Circuit
IDE	Integrated Development Environment
MCU	Micro Controller Unit
PMGR	Power Manager
QSPI	Quad Serial Peripheral Interface
RAM	Random Access Memory
ROM	Read Only Memory
RTC	Real Time Clock
RTOS	Real Time Operating System
SD	Secure Digital
SDK	Software Development Kit
SMA	SubMiniature version A
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver/Transmitter
UDP	User Datagram Protocol
WLCSP	Wafer Level Chip Scale Package
WSL	Windows Subsystem for Linux

## 2. Overview

RA6W1 is a highly integrated ultra-low-power Wi-Fi microcontroller unit(MCU) that allows you to develop Wi - Fi solutions using a single chip. This Getting Started Guide provides an overview of setting up the RA6W1 EVK, Programming the released SDK images, instructions for importing and building images with the sample project template using e<sup>2</sup> studio Integrated Development Environment (IDE).

The following are the quick guidelines to start using EVK:

- RA6W1 EVK hardware (see [Section 3 Evaluation Kit](#)).
- Setting up the evaluation board (see [Section 4 Set Up RA6W1 EVK](#)).
- Programming firmware image (see [Section 4.1 Firmware Image Programming](#)).
- Configuring EK- RA6W1 Serial Debug Interface image (see [Section 4.2 Configure RA6W1 EVK Serial Debug Interface](#)).
- Provisioning Wi-Fi (see [Section 4.3 Provision Wi-Fi](#)).

- Evaluating throughput with iPerf (see [Section 5.1 Test Throughput with iPerf Traffic Generator](#)).
- Measuring current consumption (see [Section 5.2 Measure Current Consumption](#)).
- Software Development Kit and Build Setup (see [Section 6 Software Development Kit and Build Setup](#)).

For more resources, go to:

- RA6W1 product page (<https://www.renesas.com/en/products/ra6w1>) – documentation, example projects.
- EK-RA6W1 board page (<https://www.renesas.com/en/design-resources/boards-kits/ek-ra6w1>).

### 3. Evaluation Kit

The RA6W1 EVK is designed to test and develop Wi-Fi applications quickly. The EVK is provided to simplify the process of starting a project with the RA6W1.

The EVK contains:

- Evaluation kit (EVK): made by a motherboard with debugging and power measurement circuitry and a daterboard containing the RA6W1 chip and related needed circuitry.
- USB cable.

#### 3.1 RA6W1 EVK

Figure 1 shows the hardware configuration of the RA6W1 EVK and Table 1 shows EK-RA6W1 components and descriptions.

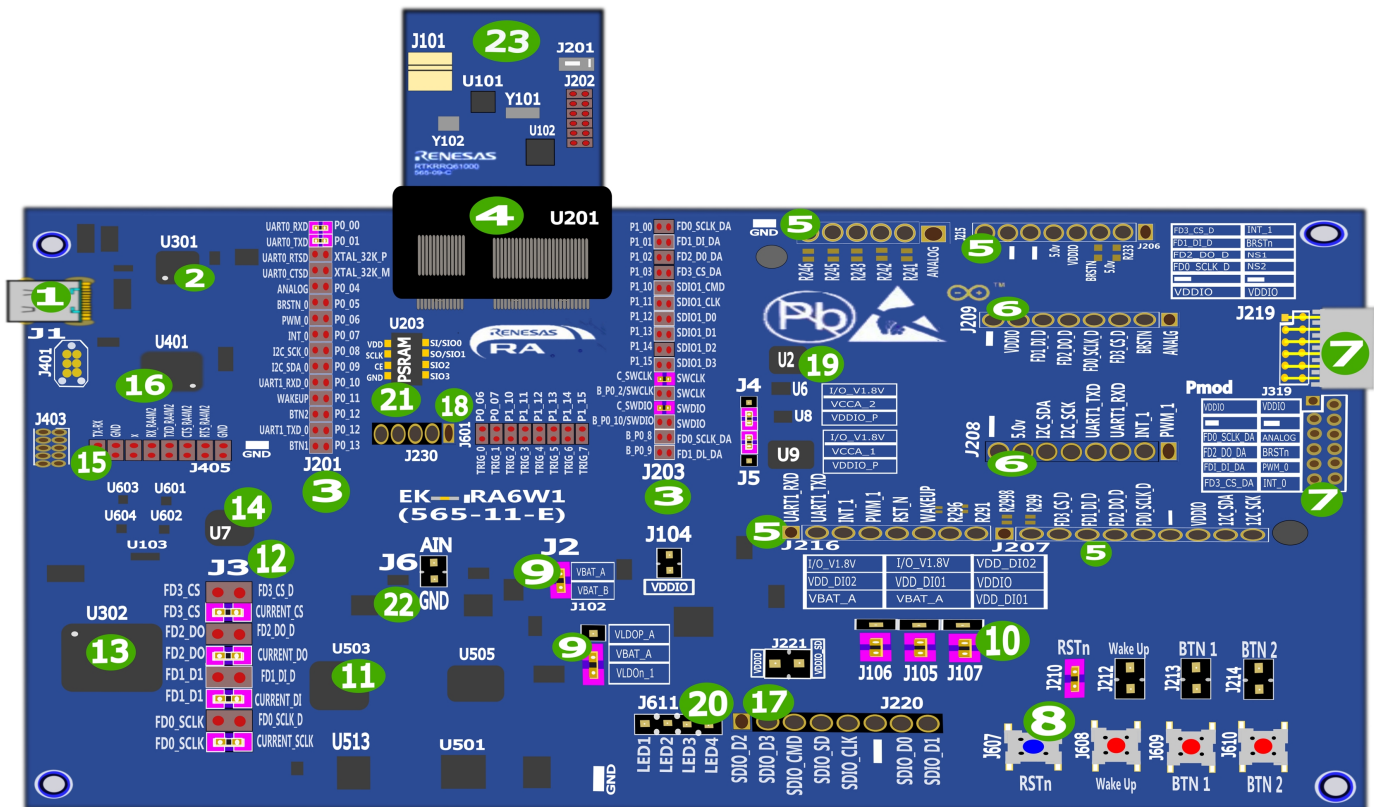


Figure 1. RA6W1 EVK hardware configuration

Table 1. RA6W1 EVK components

No	Name	Description
1	USB302 – USB port	Provides power and data port for the RA6W1 EK.
2	U301 – USB HUB	Connects JTAG and UART interfaces to the PC.
3	J201/J203 – Signal/Power breakout headers	Exposes all the pins of the Daughterboard and Motherboard to allow wiring for custom configurations as well as monitoring of the hardware signals. See Figure 2 and Figure 3.
4	U201- daughterboard connector	The interface mating connector for the Daughterboard.
5	J206/J207/J215/J216 - Arduino sockets	The sockets for plugging in Arduino interface add-on boards. See Figure 9.
6	J208/J209 - MikroBUS™ sockets	Sockets for plugging in MikroBUS™ interface add-on boards. It is multiplexed with PMOD (to be used with DA1453x). See Figure 13.

No	Name	Description
7	J219 - PMOD connectors	The socket for plugging in PMOD interface add-on boards. J319 is a header, No mounted. J219 and J319 share some signals which are multiplexed with MikroBUS™. See <a href="#">Figure 5</a> .
8	J607 - Push-buttons	J607 push-button used to reset Daughterboard, J608/J609/J610 push buttons for general use. See <a href="#">Figure 11</a> .
9	J2/J102 - Power selection	The current sense circuit option. Using this current measurement circuit, you can monitor the current consumption of Daughterboard through Smart Snippets Toolbox software application.
10	J105/J106/J107 - I/O voltage selection	Selects the I/O voltage applied to the Daughterboard (1.8 V, 3.3 V).
11	U503 - Current sense	The current sense circuit.
12	J3 - SPI interface switch	Selects the I/O voltage generated for the Daughterboard board (1.8 V, 3.3 V). See <a href="#">Figure 14</a> .
13	U302 - USB interface IC	Provides communication between Daughterboard UART port and PC. It also transfers the current measurement samples to PC.
14	U7 - Level translators	Transfers the data between Daughterboard and FTDI (U302) in proper voltage level.
15	J405 - External J-link connector	Provides access to Wi-Fi MCU or Bluetooth LE MCU. See <a href="#">Figure 6</a> .
16	U401 – MCU	Place where the SWD implementation of SEGGER applied.
17	J220 - SDIO header	Must be mounted.
18	J601 – Trigger	The trigger signals monitored and presented on Smart Snippets Toolbox. See <a href="#">Figure 12</a> .
19	U2/U6/U8/U9 - Level translators	For the interface section (PMOD, Android and MikroBUS).
20	J611 – LEDs	Four LEDs are connected to this header. To enable an LED, a jumper wire must be connected between a GPIO and one of the pins of J611.
21	U202 - PSRAM	PSRAM. See <a href="#">Figure 4</a> .
22	J6 – AIN GND	AIN is a generic Analog Input which is accessible on J6 header.
23	Daughterboard	

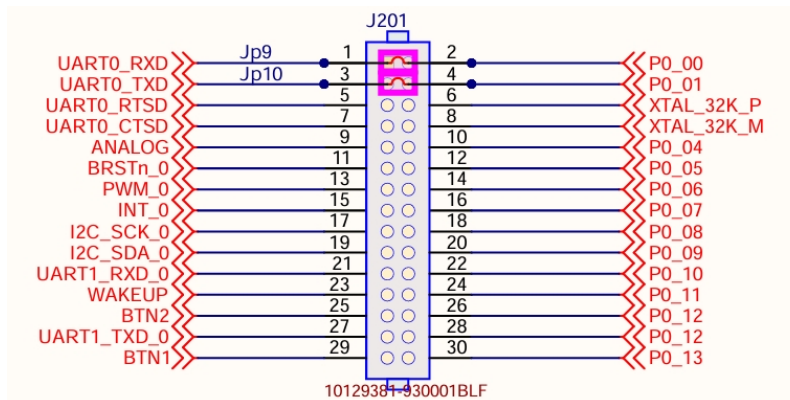


Figure 2. Breakout header J201

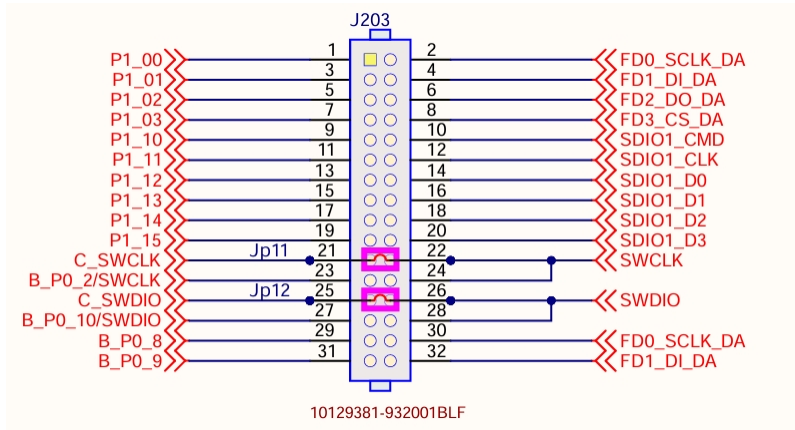


Figure 3. Breakout header J203

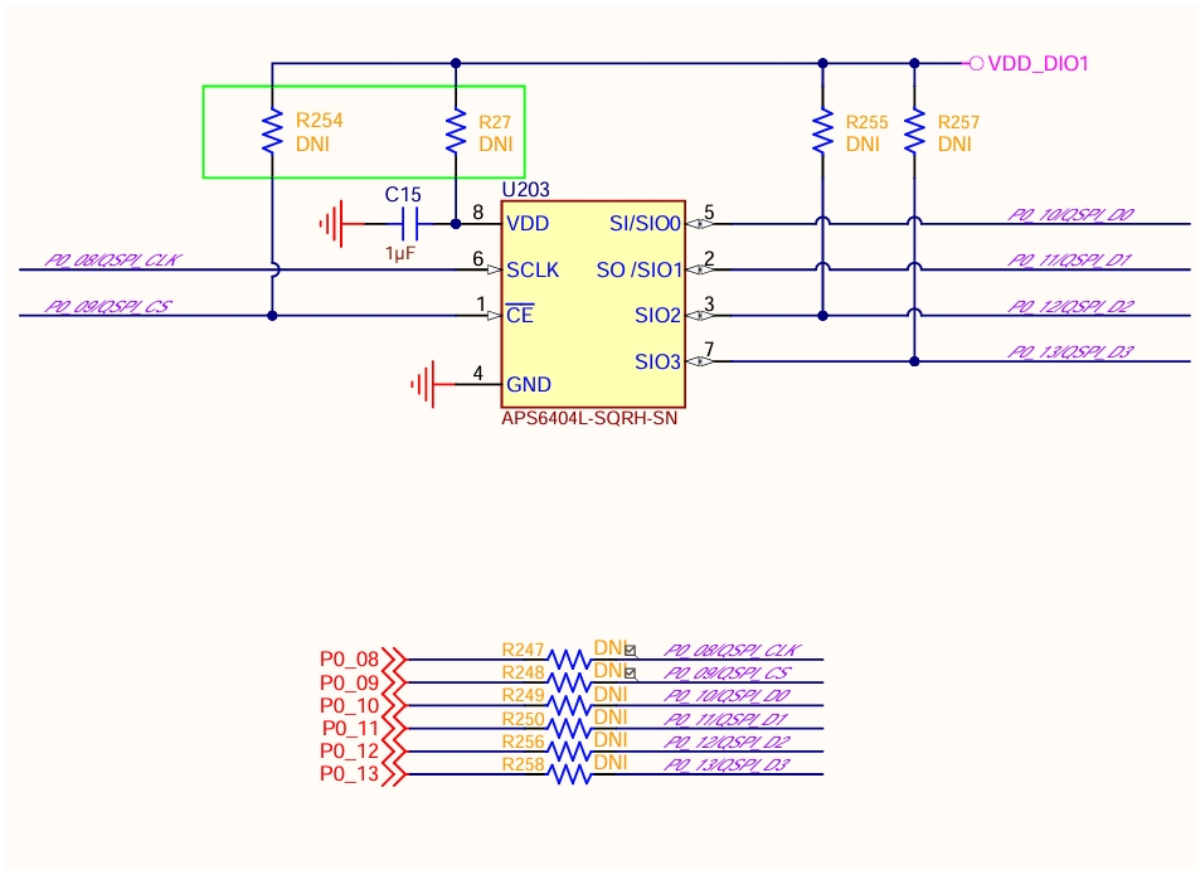


Figure 4. PSRAM

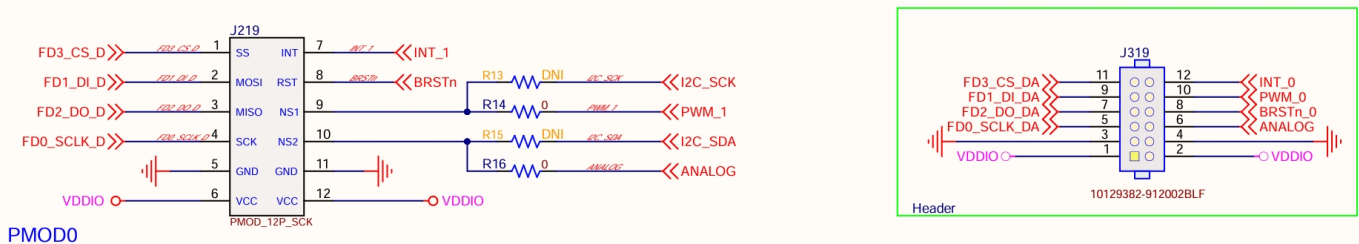


Figure 5. PMOD

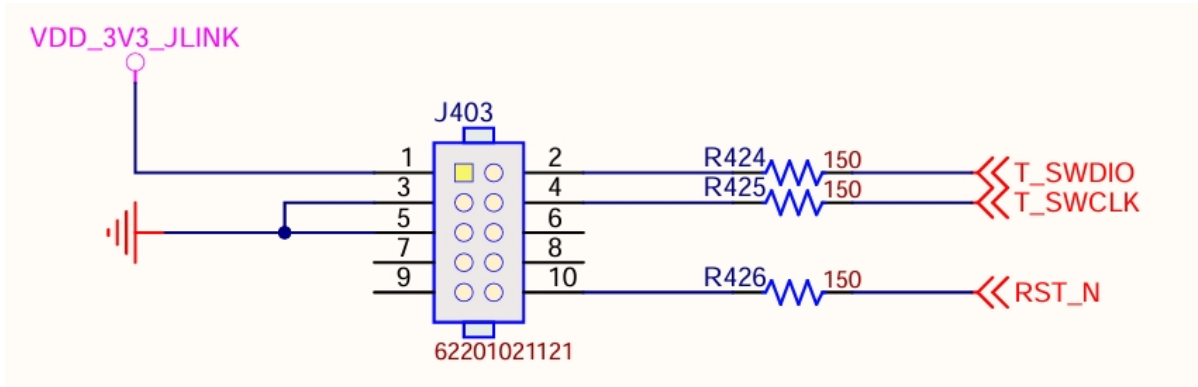


Figure 6. External J-link connector

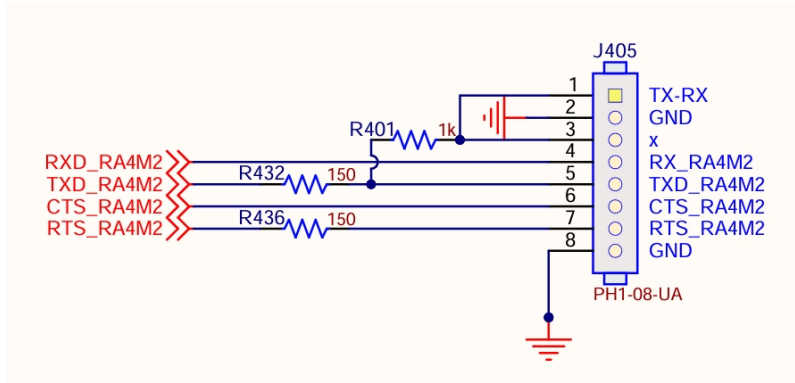


Figure 7. Auxiliary UART

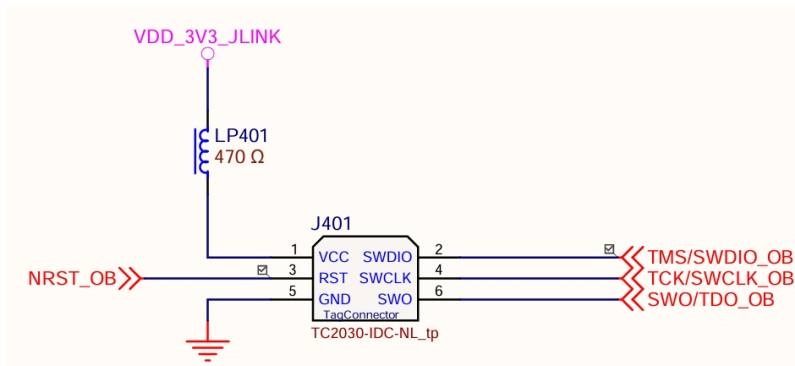


Figure 8. Programming RA4M2

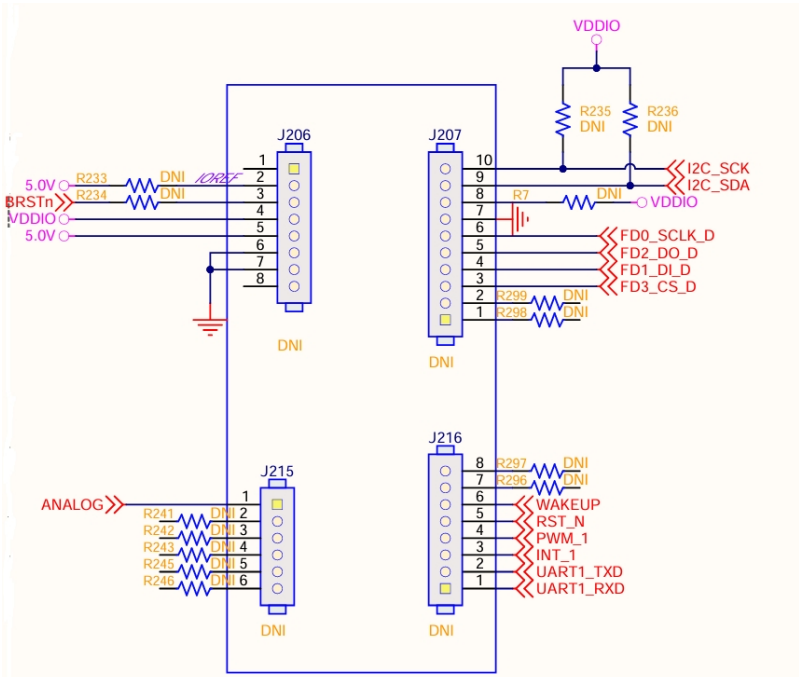
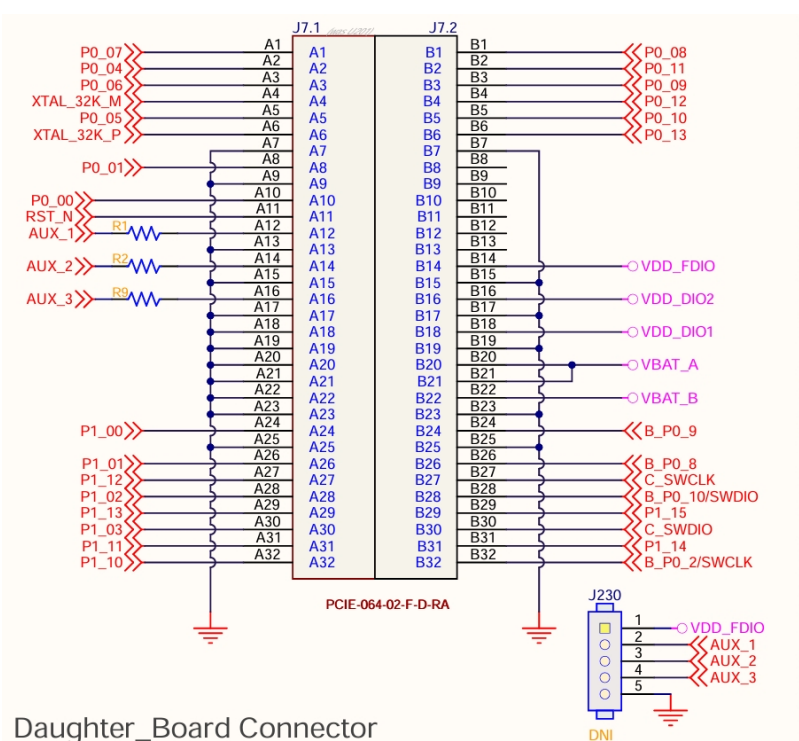


Figure 9. Arduino Interface



Daughter Board Connector

Figure 10. Daughter Board Connector

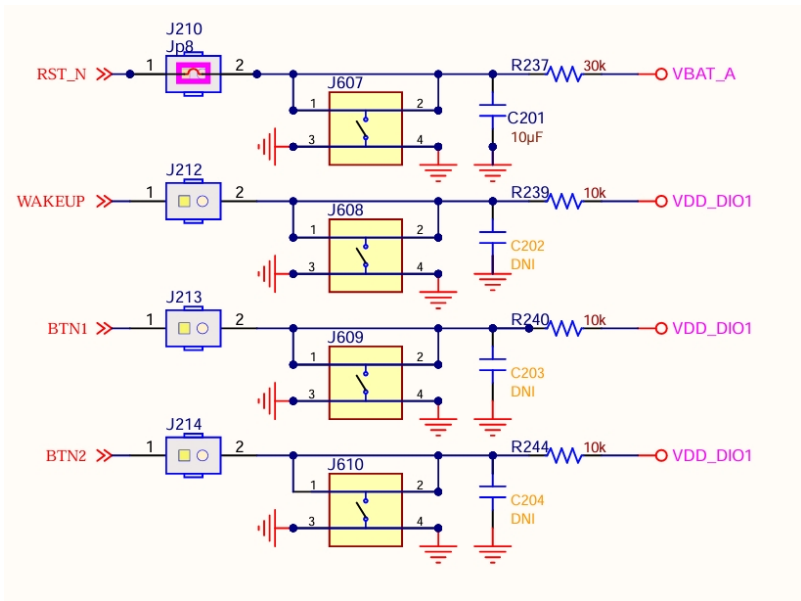


Figure 11. Buttons

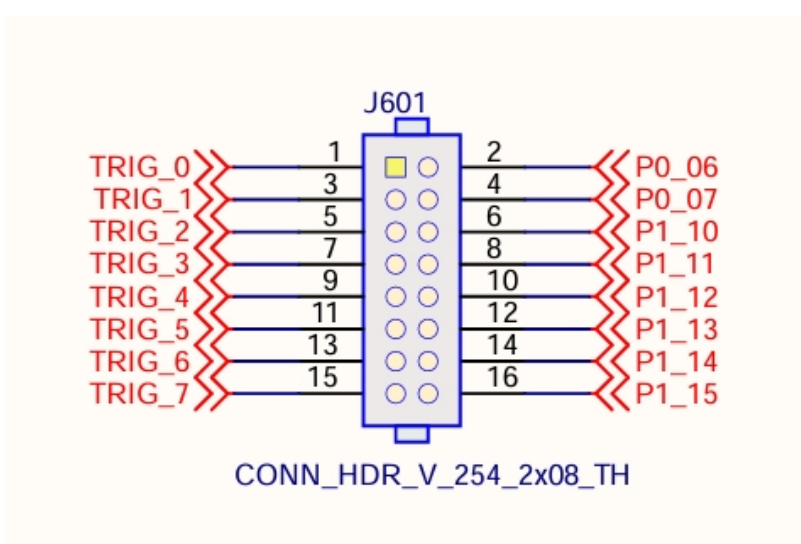


Figure 12. Trigger

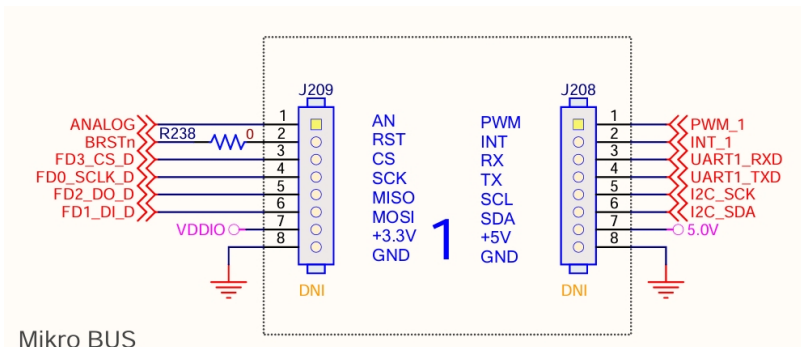


Figure 13. Micro BUS

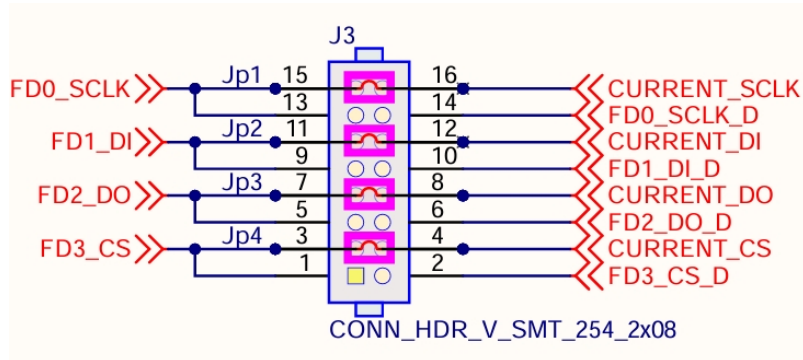


Figure 14. J3

Figure 15 shows the hardware configuration of the daughterboard of RA6W1 EVK.

**NOTE**  
 Renesas recommends using a daughterboard with antenna.

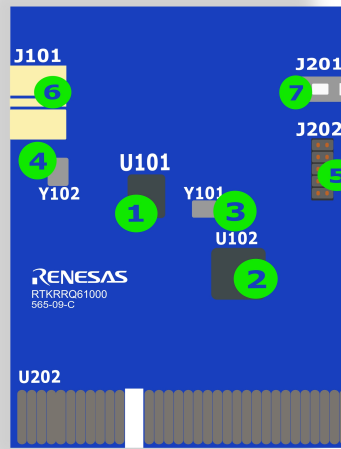


Figure 15. RA6W1 daughterboard

Table 2 shows the components of EK-RA6W1 daughterboard.

Table 2. RA6W1 EVK daughterboard components

No	Name	Description
1	U101 – RA6W1	RA6W1 – WLCSP
2	U102 – Serial flash	Serial flash – AT25SL641
3	Y101 – Crystal	40 MHz crystal
4	Y102 – Crystal	32.768 kHz crystal
5	U202 – J-flash connector	J-link for SPI flash connector
6	J101 – SMA connector	SMA connector for external antenna
7	J201 – Reset switch	Switches to reset the RA6W1

## 4. Set Up RA6W1 EVK

Before setting up ensure that the Evaluation Kit (EVK) and the required software are properly connected and installed. Use the USB cable included in the EVK to connect the host computer and the EVK. When the EVK is connected to the USB port (USB302 on the RA6W1 EVK) USB Serial COM ports are created.

- For Windows, three USB Serial COM ports are displayed in the device manager (see [Figure 16](#)).

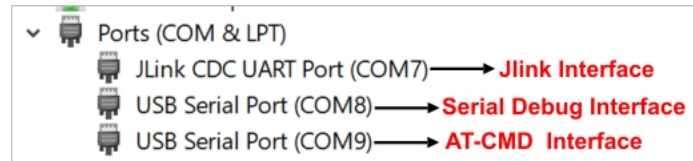


Figure 16. Windows – COM ports

### NOTE

If Windows Device Manager displays **Unknown Device**, the FTDI serial driver is not installed. Download the driver by following the URL and installing it manually: <http://www.ftdichip.com/Drivers/>.

The lower numbered J-Link CDC UART Port (COM7, in this case) is the onboard J-Link. The next USB Serial Port (COM8, in this case) is for the RA6W1 debug interface. The higher numbered USB Serial Port (COM9, in this case) is for the RA6W1 AT command interface or current consumption measurement. A serial terminal application can be used for debugging RA6W1.

The **Tera Term** terminal emulator program is recommended and can be downloaded from <https://github.com/TeraTermProject/teraterm/releases/tag/v5.2>.

- For Linux, two Serial COM ports are created. It can be checked using the following command in Terminal.

```
developer:~$ ls /dev/ttyUSB*
developer:~$ /dev/ttyUSB0 /dev/ttyUSB1
```

The lower numbered USB Serial Port (/dev/ttyUSB0, in this case) is for the RA6W1 debug interface. The higher numbered USB Serial Port (/dev/ttyUSB1, in this case) is for the RA6W1 AT command interface or current consumption measurement. A serial terminal application can be used for debugging RA6W1.

**Minicom** is recommended for Linux and to install minicom on Linux, run this command:

```
developer:~$ sudo apt-get install minicom
```

When the terminal emulation application is installed, connect the USB cable to USB302 on the RA6W1 EVK and start the terminal emulation program. In the terminal emulation program, go to the Serial Port setup and select the preferred COM Port.

### 4.1 Firmware Image Programming

#### 4.1.1 Program Firmware Images for Windows

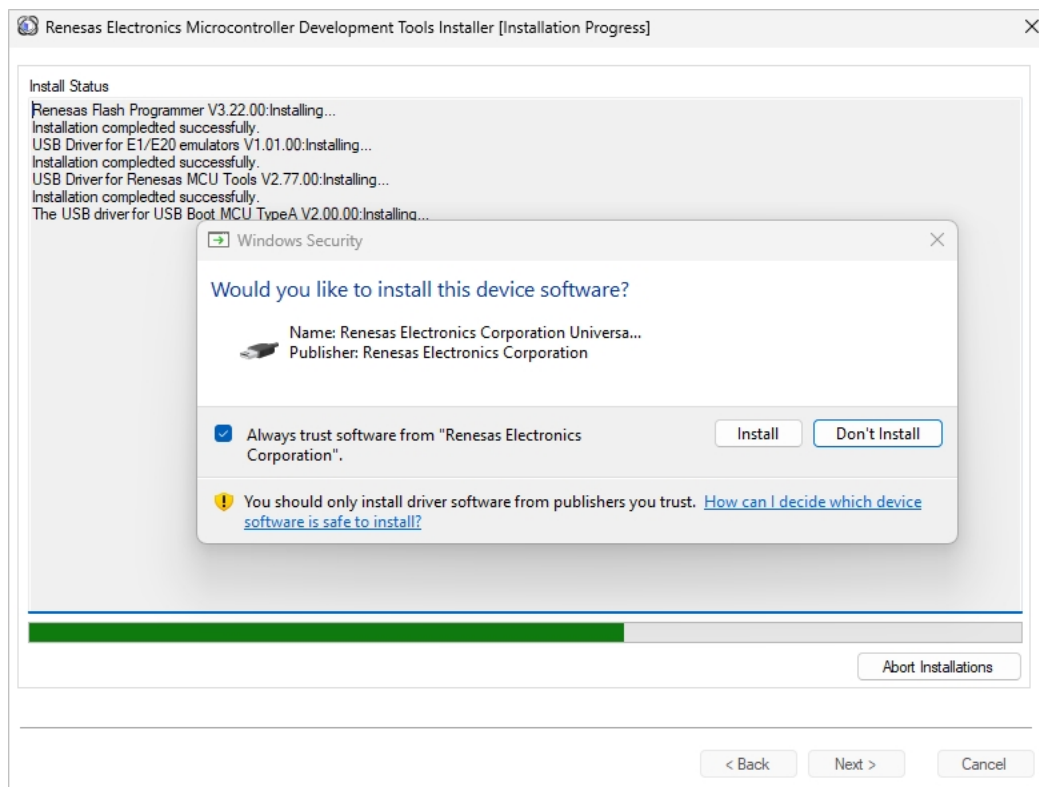
Programming firmware images to the EVK requires the Renesas Flash Programmer (RFP) tool. The RFP provides a graphical interface to flash binary images into the RA6W1 EVK through the on-chip debug interface.

System requirements:

- OS: Windows 11 (64 bit)
- USB drivers (installed along with RFP setup)
- Renesas Flash Programmer V3.22.00 or later
- Hardware: RA6W1 EVK.

To program firmware:

1. Download and launch the Renesas Flash Programmer installer.
2. In the **Software License Agreement** dialog, select **Agree**, then click **Next**.
3. During installation, in the **Windows Security** dialog, to install the Renesas USB driver, select **Always trust software from "Renesas Solutions Corp."**, and click **Install**, and then click **Next**.



**Figure 17. Windows Security prompt for USB driver installation**

4. After installation is completed, to exit the setup, click **Finish**.
5. From the Windows Start menu, launch the Renesas Flash Programmer tool.



- a. In **Microcontroller**, select the **RA6W1, RA6W2** as the target microcontroller.

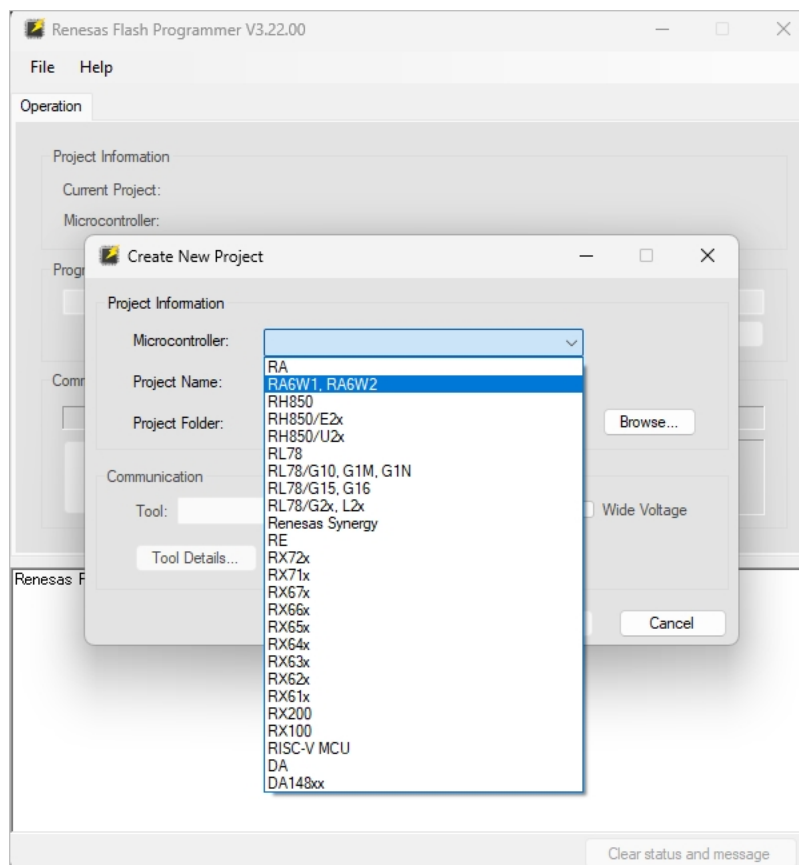
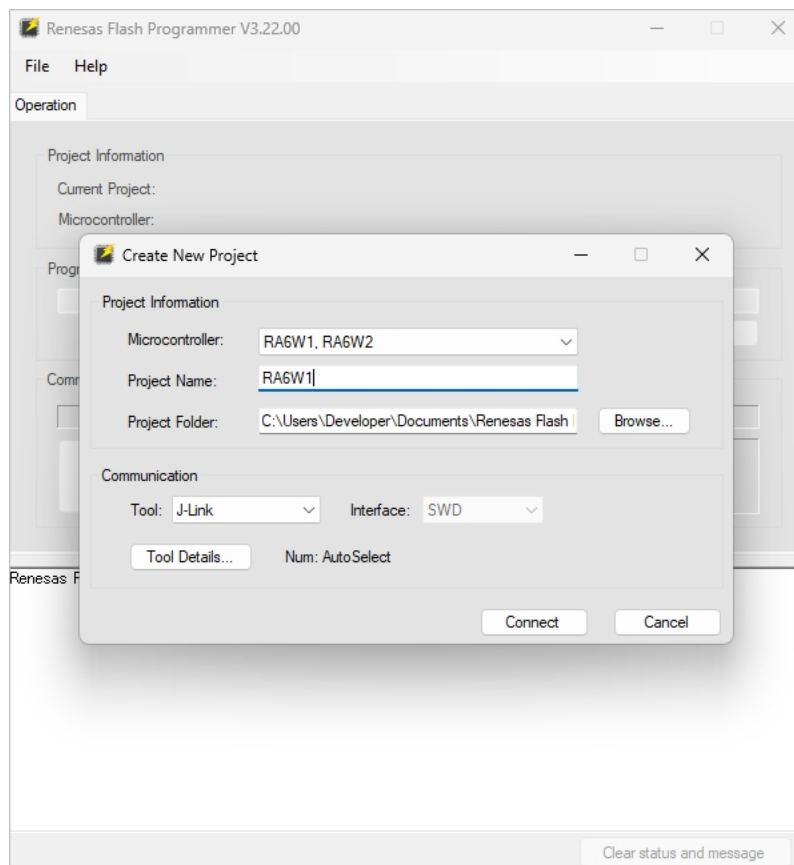


Figure 20. Selecting target microcontroller

- b. In **Project Name**, enter a project name and click **Connect**.



**Figure 21. Connecting RA6W1, RA6W2 EVK**

After the device is connected, the status message displays **Operation completed.**

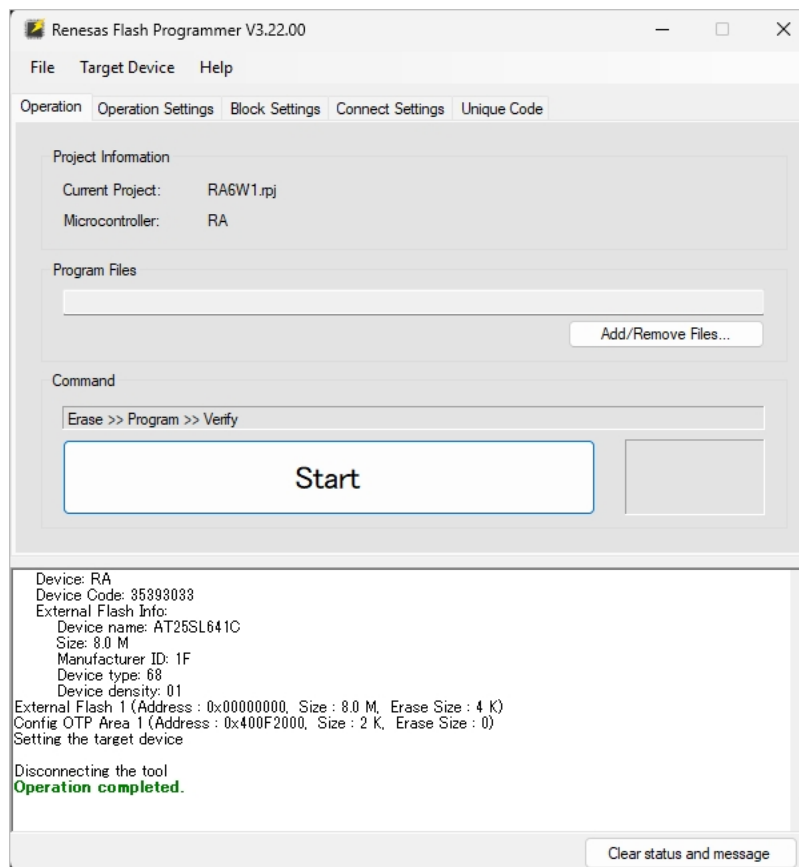


Figure 22. Connection status – operation completed

8. In the **File Details** dialog, to confirm the file selection, click **OK**.

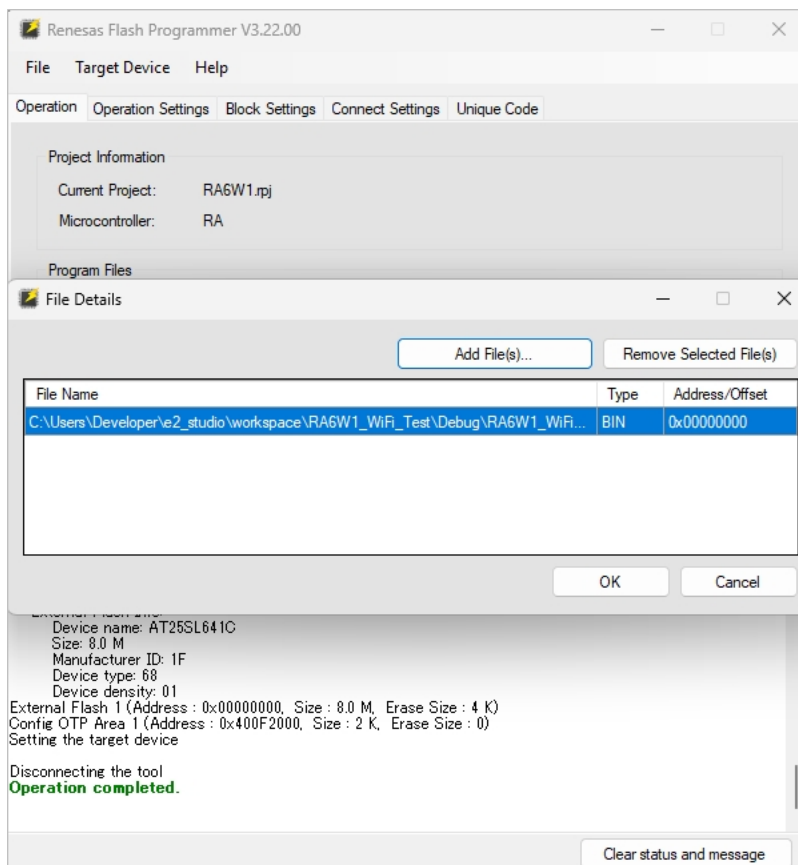


Figure 23. Confirming file selection

9. In **Renesas Flash Programmer**, to flash the image, click **Start**.

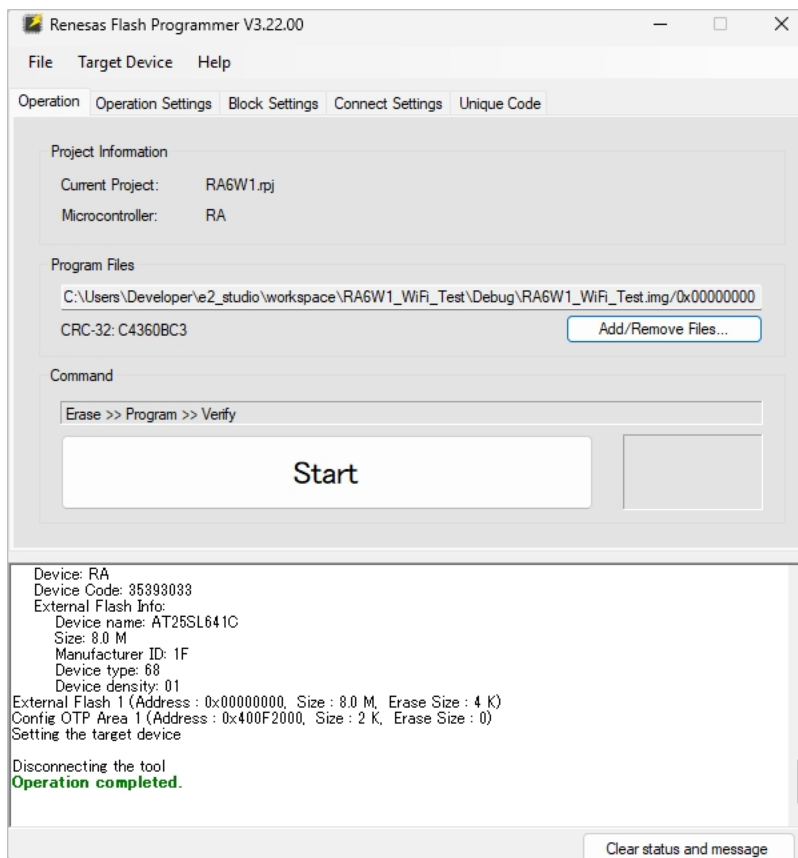
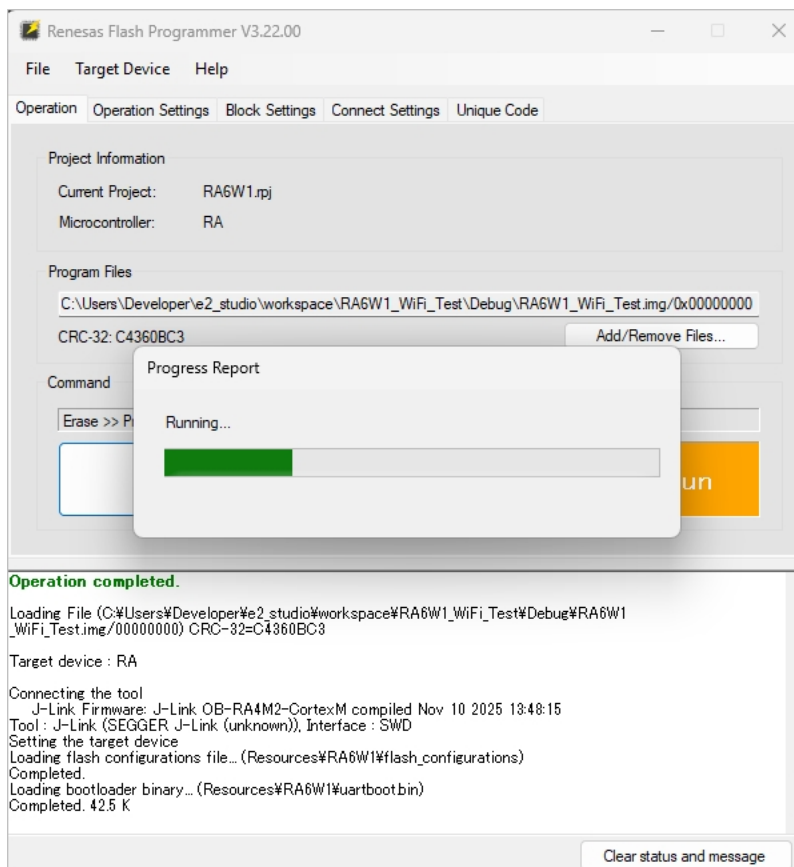


Figure 24. Start programming

The **Progress Report** dialog appears, showing the running progress.



**Figure 25. Progress report**

When the programming is completed, the status window displays "Operation completed", indicating that the firmware image is successfully written to the RA6W1 EVK.

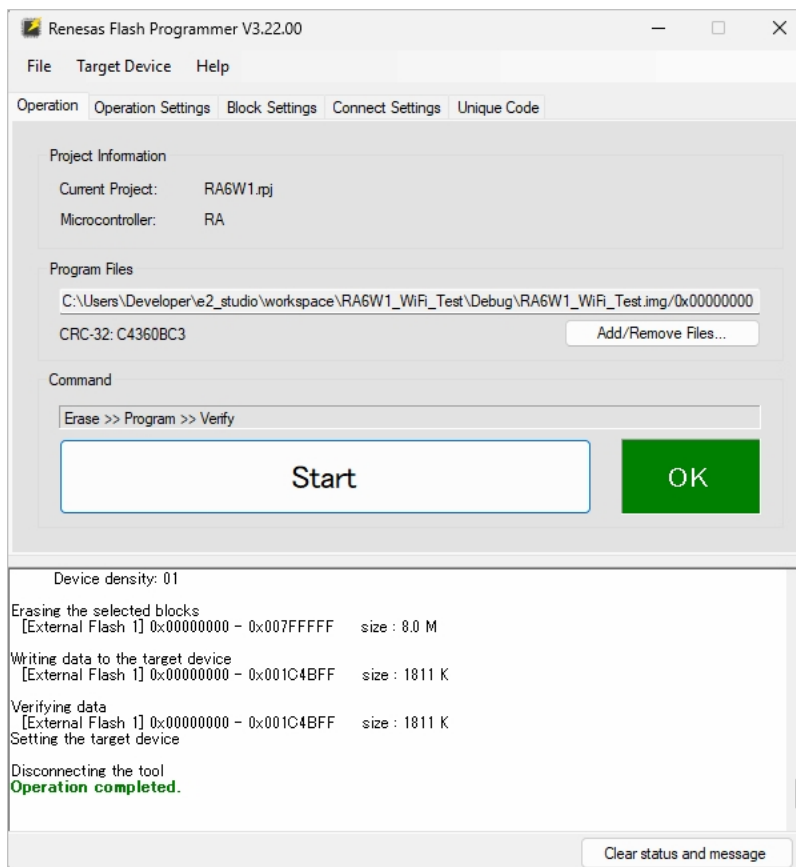


Figure 26. Programming completed successfully

### 4.1.2 Program Firmware Images for Linux

Programming firmware images to EVK in Linux requires the CLI tool of Renesas Flash Downloader. System requirements:

- OS: Ubuntu 22.04.4 LTS or later.
- J-Link Linux driver – J-Link Version 864 or later.
- Renesas Flash Programmer V3.22.00 or later
- Hardware: RA6W1 EVK.

To program the firmware:

1. Extract the RFP\_CLI\_Linux\_V32200\_x64.tgz.

```
tar -xzf RFP_CLI_Linux_V32200_x64.tgz
```

2. Go to the extracted folder and check the J-Link serial number.

```
cd linux-x64/  
./rfp-cli -d RA6W1 -lt
```

3. Program the firmware.

```
./rfp-cli -d RA6W1 -tool jlink:<jlink_serial_no> -if swd -s 25M -auto -bin 0 <path_to_.img  
file>
```

For example of successful operation, see [Figure 27](#).

```
developer@TVMA-WKS0193:~/Downloads/linux-x64$ ./rfp-cli -d RA6W1 -lt  
Renesas Flash Programmer CLI V1.15  
Module Version: V3.22.00.000  
Package Version: V3.22.00 [1 Jan 2026]  
  
[Tool]  
jlink J-Link  
1100009664  
developer@TVMA-WKS0193:~/Downloads/linux-x64$ ./rfp-cli -d RA6W1 -tool jlink:1100009664 -if swd -s 25M -auto -bin 0 /home/developer/Downloads/wifi_test_ek_ra6w1_ep.img  
Renesas Flash Programmer CLI V1.15  
Module Version: V3.22.00.000  
Package Version: V3.22.00 [1 Jan 2026]  
Load: "/home/developer/Downloads/wifi_test_ek_ra6w1_ep.img" (Offset=00000000)  
  
Connecting the tool (J-Link)  
J-Link Firmware: J-Link OB-RA4M2-CortexM compiled Feb 2 2026 09:00:55  
Tool: J-Link (SEGGER J-Link (unknown))  
Interface: SWD  
  
Loading flash configurations file... (Resources/RA6W1/flash_configurations)  
Completed.  
Loading bootloader binary... (Resources/RA6W1/uartboot.bin)  
Completed. 42.5 K  
Read xSPI flash device informations...  
Completed.  
Speed: 25,000,000 Hz  
Connected to RA  
  
Erasing the target device  
[External Flash 1] 00000000 - 007FFFFFFF  
[External Flash 1] 00000000 - 001C5FFF  
Writing data to the target device  
[External Flash 1] 00000000 - 001C5EFF  
Verifying data on the target device  
[External Flash 1] 00000000 - 001C5EFF  
  
Disconnecting the tool  
Operation successful
```

Figure 27. Programming of firmware in Linux

### 4.1.3 Program Firmware Images for macOS

Programming firmware images to EVK in macOS requires the CLI tool of Renesas Flash Downloader.

System requirements:

- OS: Mac OS 14 (Sonoma) or later versions.
- J-Link driver – J-Link Version 864 or later.
- Renesas Flash Programmer V3.22.00 or later
- Hardware: RA6W1 EVK.

To program firmware:

1. Extract the RFP\_CLI\_macOS\_V32200\_arm64.zip.

```
tar -xzf RFP_CLI_macOS_V32200_arm64.zip
```

2. Go to the extracted folder and check the J-Link serial number.

```
cd macos-arm64
./rfp-cli -d RA6W1 -lt
```

3. Program the firmware using this command:

```
./rfp-cli -d RA6W1 -tool jlink:<jlink_serial_number> -if swd -s 25M -auto -bin 0 <path_to_.img file>
```

For example of successful operation, see [Figure 28](#).

```
[thinkpalm@thinkpalms-MacBook-Air macos-arm64 % ./rfp-cli -d RA6W1 -lt
Renesas Flash Programmer CLI V1.15
Module Version: V3.22.00.000
Package Version: V3.22.00 [1 Jan 2026]

[Tool]
jlink J-Link
110009664
[thinkpalm@thinkpalms-MacBook-Air macos-arm64 % ./rfp-cli -d RA6W1 -tool jlink:110009664 -if SWD -s 25M -auto -bin 0 /Users/thinkpalm/Downloads/wifi_test_ek_ra6w1_ep.img
Renesas Flash Programmer CLI V1.15
Module Version: V3.22.00.000
Package Version: V3.22.00 [1 Jan 2026]
Load: "/Users/thinkpalm/Downloads/wifi_test_ek_ra6w1_ep.img" (Offset=00000000)

Connecting the tool (J-Link)
J-Link Firmware: J-Link OB-RA4M2-CortexM compiled Feb 2 2026 09:00:55
Tool: J-Link (SEGGER J-Link (unknown))
Interface: SWD

Loading flash configurations file... (Resources/RA6W1/flash_configurations)
Completed.
Loading bootloader binary... (Resources/RA6W1/uartboot.bin)
Completed. 42.5 K
Read xSPI flash device informations...
Completed.
Speed: 25,000,000 Hz
Connected to RA

Erasing the target device
[External Flash 1] 00000000 - 007FFFFF
[External Flash 1] 00000000 - 001C4FFF
Writing data to the target device
[External Flash 1] 00000000 - 001C4C7F
Verifying data on the target device
[External Flash 1] 00000000 - 001C4C7F

Disconnecting the tool

Operation successful
```

Figure 28. Programming of firmware in macOS

## 4.2 Configure RA6W1 EVK Serial Debug Interface

The RA6W1 provides a command/debug interface on UART0 for performing configuration and diagnostic functions. Connect the USB cable to the USB debug interface on the RA6W1 EVK and start the terminal emulation program.

### 4.2.1 Configure Tera Term Serial Terminal Application for Windows

1. In the Tera Term program, go to the **Serial Port** setup and select the lower numbered COM port (COM8, in this case) and configure it as in [Table 3](#) and [Table 4](#).

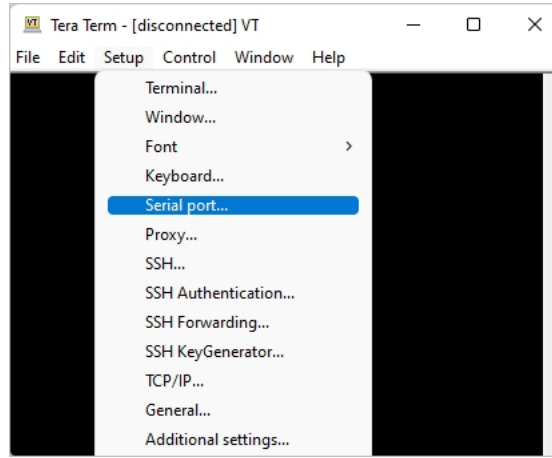


Figure 29. Serial port setup

2. Connect USB cable to RA6W1 EVK and pressing Enter. The following prompt appears in the UART console:  
[ /RA6W1-RRQ61001 ]

Table 3. Serial port configuration values

Settings	Value
Baud Rate	115200
Data Bits	8
Parity	None
Stop Bits	1
Flow Control (Hardware/Software)	None

Table 4. Terminal settings

Settings	Value
Receive	LF
Transmit	CR + LF

### 4.2.2 Configure Minicom for Linux

1. Connect the USB cable to the USB Debug Interface on the RA6W1 EVK and open a terminal for the minicom.
2. Start minicom using the following command:

```
developer:~$ sudo minicom -D /dev/ttyUSB0
```

3. Enter the password.  
After entering the password, minicom terminal view opens, see [Figure 30](#).

**NOTE**  
/dev/ttyUSB0 is for the debug interface and /dev/ttyUSB1 is for the AT command interface

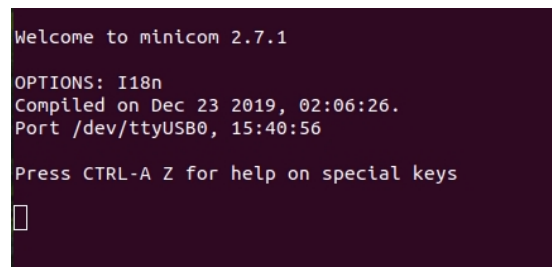


Figure 30. Minicom terminal view

4. To configure minicom, press Ctrl+A followed by Z. It prompts a command summary as shown in [Figure 31](#).







After Factory Reset, the RA6W1 reboots. The Easy Setup Wi-Fi configuration wizard appears automatically.

### 4.3.2 Setup for Station Mode

You can configure the Wi-Fi functions of the RA6W1 by running the Easy Setup Wi-Fi configuration wizard.

**NOTE**

In case of factory reset, the Easy Setup Wi-Fi configuration wizard appears and then follows the following prompts. If reconfiguring, complete the following step.

To configure the RA6W1 for operating in Station mode, open its debug console and run the `setup` command at the `[/RA6W1-RRQ61001]` prompt. To complete the setup, follow the following prompts:

```

[/RA6W1-RRQ61001] # setup //Start the Easy Setup Wizard.

Stop all services for the setting.
Are you sure ? [Yes/No] : Y //Enter Y to stop the services.

[RA6W1-RRQ61001 EASY SETUP - V4]

Country Code List:
AD AE AF AI AL AM AN AR AS AT AU AW AZ BA BB BD BE BF BG BH
BL BM BN BO BR BS BT BY BZ CA CF CH CI CL CN CO CR CU CX CY
CZ DE DK DM DO DZ EC EE EG ES ET EU FI FM FR GA GB GD GE GF
GH GL GP GR GT GU GY HK HN HR HT HU ID IE IL IN IR IS IT JM
JO JP KE KH KN KP KR KW KY KZ LB LC LI LK LS LT LU LV MA MC
MD ME MF MH MK MN MO MP MQ MR MT MU MV MW MX MY NG NI NL NO
NP NZ OM PA PE PF PG PH PK PL PM PR PT PW PY QA RE RO RS RU
RW SA SE SG SI SK SN SR SV SY TC TD TG TH TN TR TT TW TZ UA
UG UK US UY UZ VA VC VE VI VN VU WF WS YE YT ZA ZW ZZ

COUNTRY CODE ? [Quit] (Default KR, ZZ : for debug) : KR // Enter the country code.

SYSMODE(WLAN MODE) ?
1. Station
2. Soft-AP
3. WiFi Direct
4. WiFi Direct P2P GO Fixed
5. Station & Soft-AP
MODE ? [1/2/3/4/5/Quit] (Default Station) : 1 // Enter 1 for Station mode.

BAND ?
1. 2.4 GHz
2. 5 GHz
3. AUTO
BAND ? [1/2/3/Quit] (Default 3. AUTO) : 1 // Choose WiFi Frequency Band.

[ STATION CONFIGURATION ]
=====
[NO] [SSID] [SIGNAL] [CH] [SECURITY]
-----
[ 0] ASUS_TPT_24G -48 1 WPA2
[ 1] ASUS_KEYSGT_24G -50 11 WPA2
[ 2] SK_WiFiGIG_24G -54 6 WPA3
[ 3] ASUS_JIT_EAP_24G -56 6 WPA + WPA2 ENT
[ 4] DIRECT-GM2020 -66 11 WPA2 + WPA3
[ 5] olleh_WiFi_B602 -67 6 WPA2
[ 6] KT_GiGA_2G_Wave2_04A -70 6 WPA2
[ 7] Vantest24g -79 6 OPEN
[ 8] [Hidden] -81 6 WPA2
-----

```

```

[Enter] Rescan
=====

Select SSID ? (0~8/Manual/Quit) : 0 // Enter the SSID NO from the list.

PSK-KEY(ASCII characters 8~63 or Hexadecimal characters 64) ? [Quit]
***** // Enter the password for the AP.

Do you want to set advanced WiFi configuration ? [No/Yes/Quit] (Default No) : N // Enter N to skip this step.
Enable DPM (Dynamic Power Management) ? [Yes/No/Manual/Quit] : N

=====
BAND : 2.4 GHz
SSID : ASUS_TPT_24G
Security : WPA2PSK
ENCRYPTION : AES(CCMP)
Password : *****
PMF : Default
=====
WiFi CONFIGURATION CONFIRM ? [Yes/No/Quit] : Y // Enter Y to confirm the
configuration.

IP Connection Type ? [Automatic IP/Static IP/Quit] : A // Enter A for automatic DHCP IP
address.

IP Connection Type: Automatic IP
IP CONFIGURATION CONFIRM ? [Yes/No/Quit] : Y // Enter Y to confirm the
configuration.

SNTP Client enable ? [Yes/No/Quit] : N // Enter N to disable time sync.

[/RA6W1-RRQ61001] #
Connection COMPLETE to cc:28:aa:7f:02:48

>>> Network Interface (wlan0) : UP
Assigned addr : 192.168.50.130
netmask : 255.255.255.0
gateway : 192.168.50.1
DHCP Server IP : 192.168.50.1
Lease Time : 24h 00m 00s
Renewal Time : 12h 00m 00s

```

The configuration is now completed and stored in NVRAM. For configuring different Wi-Fi modes, see [Appendix 1 Configuration Modes Setup](#) .

## 5. Test Procedures

The following sections describe several tests that verify the proper operation of the RA6W1 and demonstrates its various features.

The tests include:

- **Throughput Test** – demonstrates the Wi-Fi performance of the RA6W1.
- **Current Consumption Measurements** – demonstrates the amount of power used when the RA6W1 is in various Sleep modes or in Operational DPM mode.

### 5.1 Test Throughput with iPerf Traffic Generator

iPerf is a free IP-based a traffic generator tool that can be used for active measurements of the maximum achievable bandwidth on IP networks.

iPerf 2.1.3 (recommended) for Windows and Linux can be downloaded from

<https://sourceforge.net/projects/iperf2/files/>.

There are various test setup types that can be used for Wi-Fi throughput tests:

- **Conducted** – uses RF cables to connect the communicating devices. This effectively eliminates issues caused by the wireless domain.
- **Wireless/Over the Air** – uses antennas connected to the station and access point, as opposed to RF cables, thus introducing additional elements and better replicating real-life usage.
- **Hybrid (Wireless plus Attenuation Control)** – is the same as a wireless test setup, using antennas, but digital attenuators are also introduced as part of the signal path between the AP's RF ports and antennas. This allows for total control over the RSSI, replicating varying distance between the Access Point and Station.

The provided examples work in any of the above scenarios.

#### NOTE

For clean and accurate results, Renesas recommends using an anechoic RF chamber for any of the mentioned tests. Also use a dedicated Access Point for tests. If iPerf does not work and the issue is related to firewall restrictions, contact IT department.

#### 5.1.1 Configure Testbed

To configure the Testbed:

1. Download iPerf 2.1.3 from <https://sourceforge.net/projects/iperf2/files/>.
2. Create a folder called "iperf" in the C:\ directory.
3. Unzip the downloaded iPerf file (if necessary) and move the contents to the "iperf" folder.
4. Rename the downloaded iperf executable file from "iperf-2.1.3-win.exe" to "iperf.exe".
5. To ensure stable iPerf testing, run the Windows Security APP and turn off the network firewall. It is recommended to disable the laptop from all network firewalls before attempting a test.

To set up the Test Environment after setting up the iPerf:

1. Connect your computer to the LAN port of an Access Point (such as the Asus RT-AX88U) through an ethernet cable.
 

The computer should receive an automatic IP address from the Access Points DHCP server. If the Access Point is configured to not provide automatic IP addresses, make sure to manually configure your computer to use a suitable IP address and subnet mask. Make sure that the computer is not connected to any other networks over ethernet or Wi-Fi.
2. Connect EK-RA6W1 EVK wirelessly to the same Access Point SSID (for instructions on how to configure the Wi-Fi connection for the RA6W1, see [Section 4.3.2 Setup for Station Mode](#)).
3. To verify a properly configured connection, ping the RA6W1 from your computer or ping it from the RA6W1 to your computer.

```
net
ping <destination IP address>
```

### 5.1.2 Configure RA6W1 EVK as iPerf Client

The provided UDP uplink iPerf example can be used to primarily evaluate TX throughput speeds.

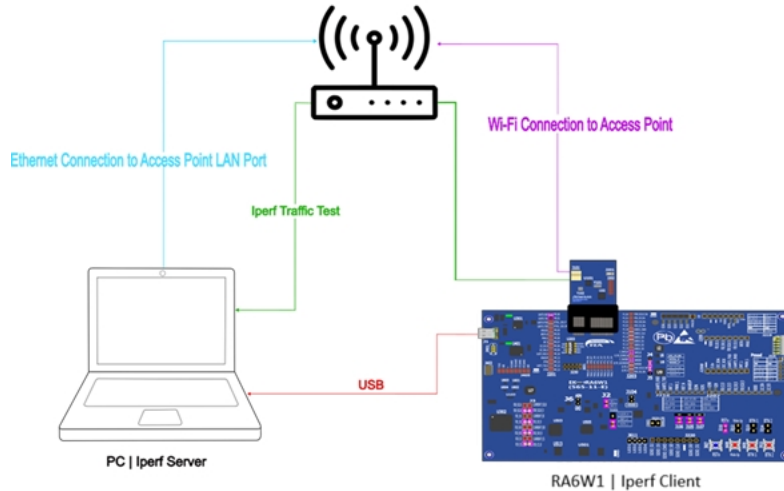


Figure 37. UDP uplink iPerf example

To configure as iPerf server for Windows:

1. Start an iPerf Server on your laptop by opening the command prompt and navigating to the directory in which iPerf is located.
2. Type "ipconfig" in the command prompt to see your laptop's IP address.

```
Ethernet adapter Ethernet:

Connection-specific DNS Suffix . : thinkpalm.lan
Link-local IPv6 Address . . . . . : fe80::343:1650:a9:29f6%14
IPv4 Address. . . . . : 172.27.10.72
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 172.27.10.100
```

Figure 38. IP address

3. Start the UDP server in the Windows command prompt.

```
iperf.exe -s -i1 -u
```

```
C:\Users\itamar.ben.amitai\Downloads\iperf-2.0.10-win>iperf.exe -s -i1 -u
-----
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size: 64.0 KByte (default)
-----
```

Figure 39. Start UDP

To run traffic from the RA6W1 EVK to the iPerf server on the Windows computer:

1. Select the network Command mode, in the **Tera Term** console, by typing the `net` command.
2. Start the UDP client:

```
iperf -I WLAN0 -c <Server IP> -t 10 -i 1 -u
```

3. Read the throughput measurements from the iPerf server window.

```
C:\Users\itamar.ben.amitai\Downloads\iperf-2.0.10-win>iperf.exe -s -i1 -u
-----
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size: 64.0 KByte (default)
-----
[364] local 10.0.0.9 port 5001 connected with 10.0.0.5 port 49297
[ ID] Interval      Transfer    Bandwidth    Jitter    Lost/Total Datagrams
[364] 0.0- 1.0 sec  1021 KBytes  8.36 Mbits/sec  2.360 ms  0/ 711 (0%)
[364] 1.0- 2.0 sec  1.06 MBytes  8.88 Mbits/sec  1.881 ms  4/ 759 (0.53%)
[364] 2.0- 3.0 sec   795 KBytes  6.52 Mbits/sec  1.144 ms  4/ 558 (0.72%)
[364] 3.0- 4.0 sec  1.11 MBytes  9.29 Mbits/sec  3.610 ms  0/ 790 (0%)
[364] 4.0- 5.0 sec  1.23 MBytes  10.3 Mbits/sec  2.575 ms  0/ 878 (0%)
[364] 5.0- 6.0 sec   711 KBytes  5.82 Mbits/sec  3.087 ms  8/ 503 (1.6%)
[364] 6.0- 7.0 sec   991 KBytes  8.11 Mbits/sec  4.242 ms  0/ 690 (0%)
[364] 7.0- 8.0 sec  1.23 MBytes  10.3 Mbits/sec  3.405 ms  0/ 876 (0%)
[364] 8.0- 9.0 sec   712 KBytes  5.83 Mbits/sec  4.903 ms  3/ 499 (0.6%)
[364] 9.0-10.0 sec  1.20 MBytes  10.1 Mbits/sec  2.946 ms  0/ 855 (0%)
[364] 0.0-10.1 sec  10.1 MBytes  8.36 Mbits/sec  9.263 ms  2147469244/2147476436 (1e+002%)
```

Figure 40. Measurements

### 5.1.3 Configure RA6W1 EVK as iPerf Server

The provided UDP downlink iPerf example can be used to primarily evaluate RX throughput speeds.

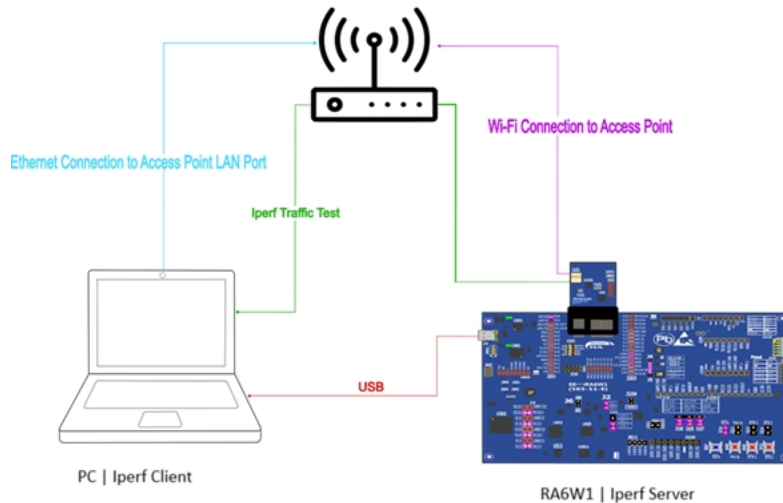


Figure 41. UDP downlink iPerf example

To configure RA6W1 EVK as iPerf Server:

1. Select the network command mode, by typing the net command in the **Tera Term** console.
2. Start the UDP server:

```
iperf -I WLAN0 -s -u -i 1
```

```
[/RA6W1-RRQ61001/net] # iperf -I WLAN0 -s -u -i 1
iPerf Server(UDP): Ready
[/RA6W1-RRQ61001/net] #
```

Figure 42. Start UDP

- Close the existing command prompt on the laptop running the UDP server.
- Open the command prompt and navigate to the directory where iPerf is located.
- Start the UDP client in the Windows command prompt:  
`iperf.exe -c <Server IP> -t 10 -i 1 -u -b100m`

```
C:\Users\itamar.ben.amitai\Downloads\iperf-2.0.10-win>iperf.exe -c 10.0.0.5 -t 10 -i 1 -u
-----
Client connecting to 10.0.0.5, UDP port 5001
Sending 1470 byte datagrams, IPG target: 11215.21 us (kalman adjust)
UDP buffer size: 64.0 KByte (default)
-----
[360] local 10.0.0.9 port 50756 connected with 10.0.0.5 port 5001
[ ID] Interval      Transfer      Bandwidth
```

Figure 43. Start UDP client

## 5.2 Measure Current Consumption

### NOTE

Current consumption measurement through Smart snippet is possible with the latest Evaluation Kit.

There are numerous available methods to measure current consumption to evaluate the power save performance of different sleep and DPM configurations.

The following instructions explain how to perform such measurements using the SmartSnippets Toolbox ([Section 5.2.2 Measure with SmartSnippets](#)) or a standard power analyzer ([Section 5.2.3 Measure with Power Analyzer](#)) and focus measuring current consumption in forced Sleep modes and DPM mode.

### 5.2.1 PMGR Sleep Mode CLI Commands

RA6W1 can be configured to temporarily enter Power Manager (PMGR) Sleep modes 2 to Sleep mode 3 for a 5 second duration through CLI commands (custom durations are not yet supported):

```
[/RA6W1-RRQ61001/pmgr] # pmgr force
- Usage: force [lld_states: PMGR_LLD_POWER_MODE_SLEEP2, PMGR_LLD_POWER_MODE_SLEEP3, PMGR_LLD_POWER_
MODE_SLEEP4, PMGR_LLD_POWER_MODE_DPM, PMGR_LLD_POWER_MODE_CPU_WFI, PMGR_LLD_POWER_MODE_AUTO]
[/RA6W1-RRQ61001/pmgr] #
```

Example:

```
pmgr force PMGR_LLD_POWER_MODE_SLEEP3
```

To prepare SmartSnippets Toolbox:

- Download and install the latest version of the SmartSnippets Toolbox for current measurement from the Renesas Product webpage or from the provided evaluation Software package.

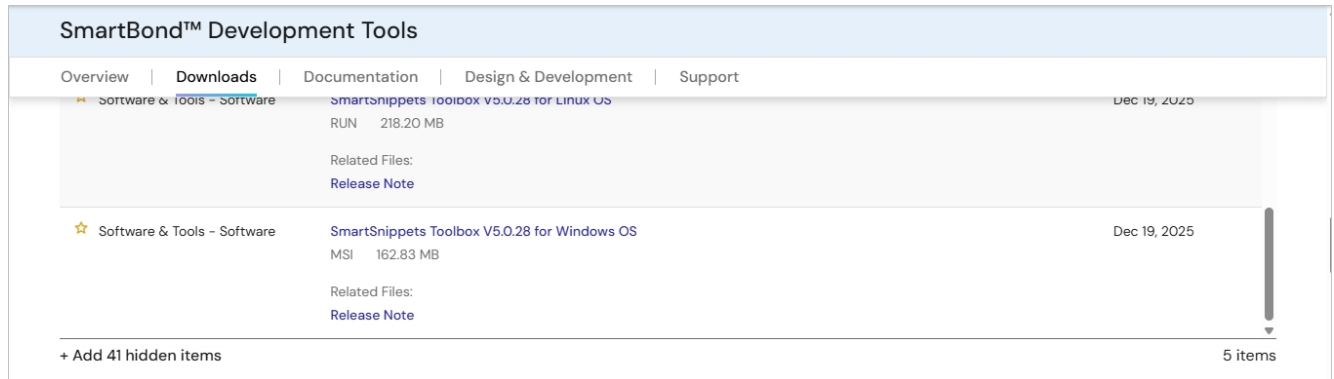
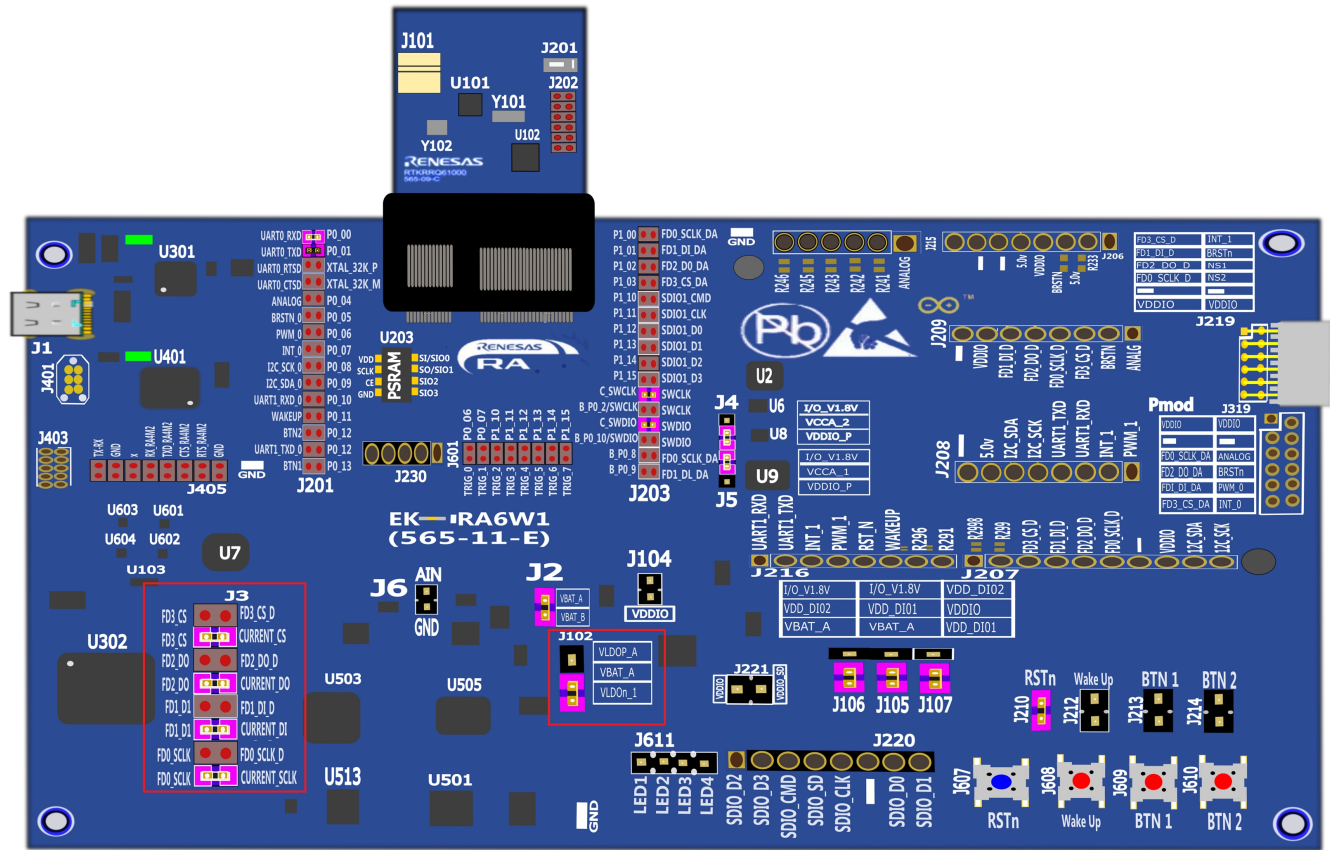


Figure 44. SmartSnippets toolbox

2. Connect jumpers between the pins highlighted in red in Figure 45. LED light turns on when jumper J102 is set.



## 5.2.2 Measure with SmartSnippets

To measure the current consumption with SmartSnippets:

1. Disassemble the RA6W1 daughterboard from the motherboard and power up the EVK through USB to your computer.
2. Close any open instances of the UART COM port.
3. Open SmartSnippets Toolbox on your computer.
4. Select **Board > Device > RA6W1**.

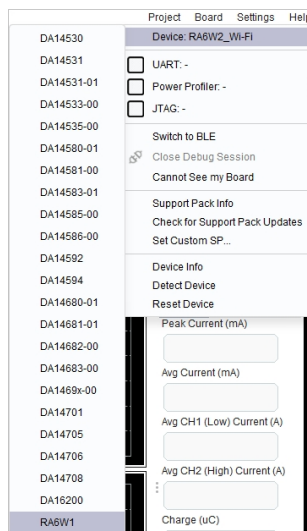


Figure 46. RA6W1

5. On the **Chart View** tab, select **VBAT\_WI-FI** and **CH1/CH2 Charge** checkboxes.

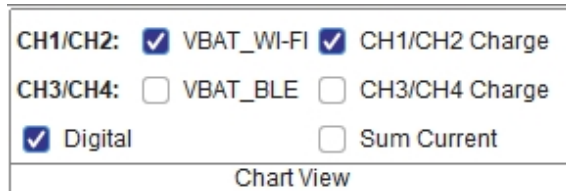


Figure 47. Chart View tab

You should see the VBAT Wi-Fi – CH1/CH2 current measurement window.

6. Identify the RA6W1 EVK -related COM ports through the Windows Device Manager.
7. Based on the identified pair of COM ports belonging to the RA6W1 EVK (in this case COM21 and COM22), select the following configurations:
  - a. Select **Board > PowerProfiler >** (Higher-numbered COM port).

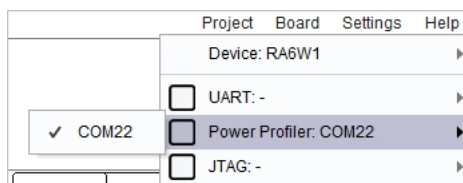


Figure 48. Power profiler port

- b. Select **OffsetCalibration > CH1/CH2** in SmartSnippets.

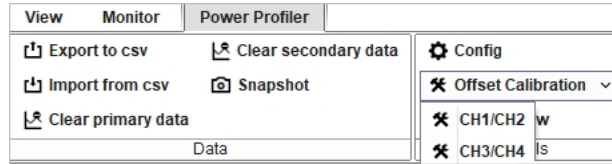
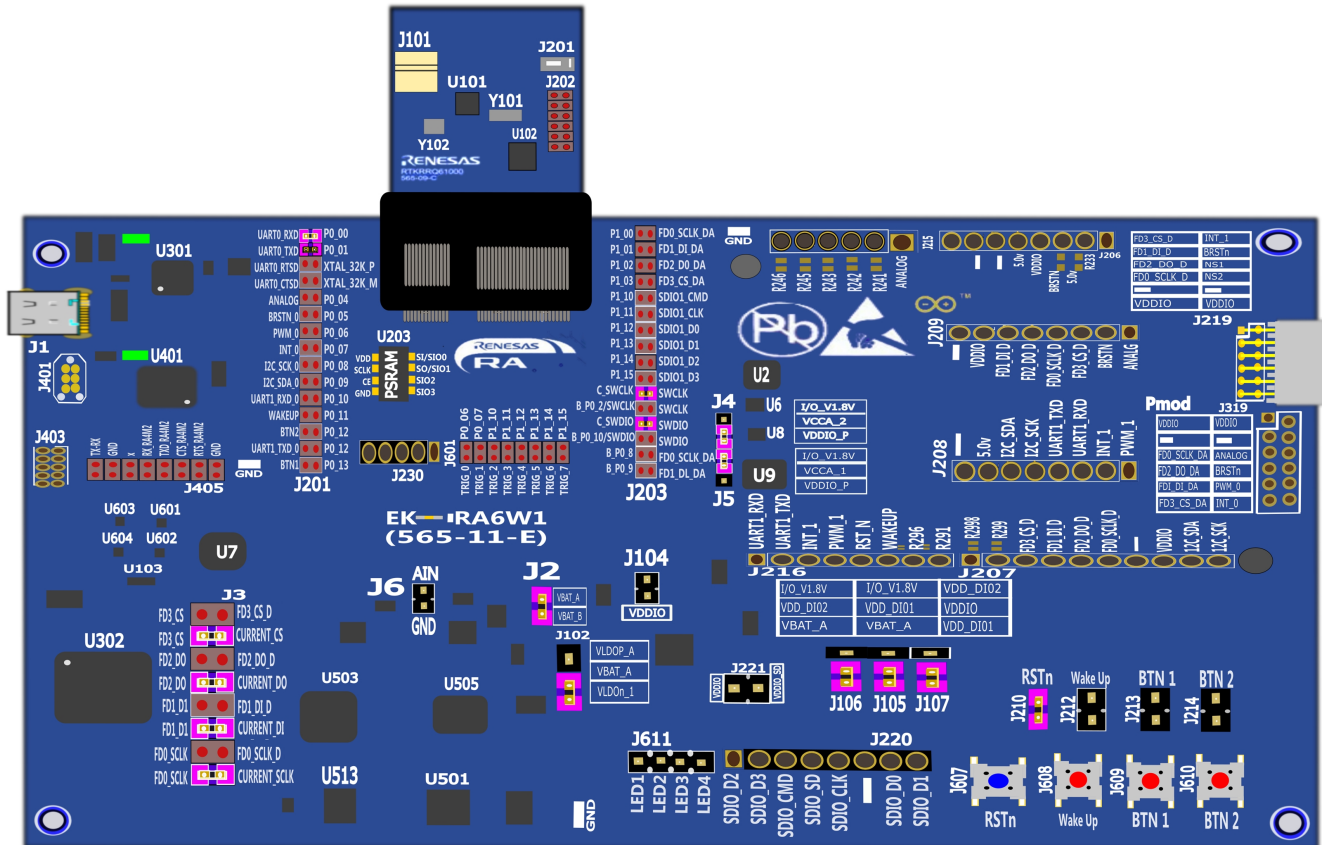


Figure 49. Offset calibration

**NOTE**

Offset calibration is required to find the current consumption values of motherboard before inserting daughterboard. This way the measurement of daughterboard is accurate. Calibration takes 10 seconds, and the values are saved in the configuration.

- Connect the RA6W1 EVK daughterboard to the motherboard.



10. In SmartSnippets, select **Start**.
11. Connect to the console through UART using Tera Term, see [Section 4.2 Configure RA6W1 EVK Serial Debug Interface](#).
12. In the UART console, select the needed configuration:  
 Example:  
 Configure the RA6W1 as in **Station + DPM mode** (see [Appendix A.2 Set up EVK for Station plus Soft AP Mode](#)).  
 //OR//  
 Enter **forced sleep modes (2 or 3)** by using the following command syntax: "pmgr force <mode>"  

```
pmgr force PMGR_LLD_POWER_MODE_SLEEP3
```
13. In SmartSnippets, select **Stop**.
14. To measure the average current consumption over a selected period, on the **Tools** tab, click **Measure**.
15. Click and drag the measurement cursor over the section that you want measure in the top screen (CH1/CH2 Current – VBAT) and read the "lav" measurement for the average current between the selected measurement points.

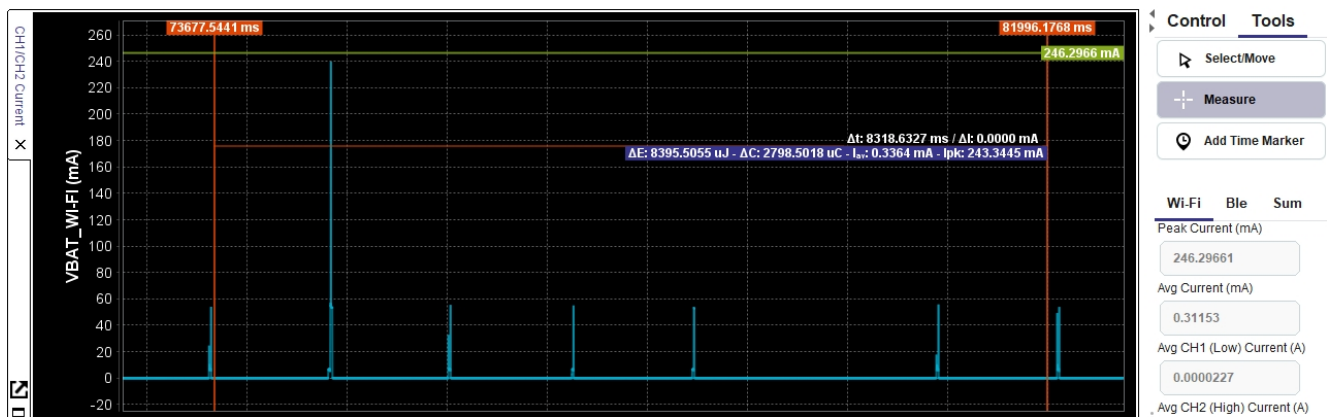


Figure 52. Measurement points

### 5.2.3 Measure with Power Analyzer

To measure the current consumption with Power Analyzer:

1. On the Power Analyzer, select the current measurement mode.
2. Connect jumpers between the pins and connect the current measurement points to the power analyzer, see [Figure 53](#).

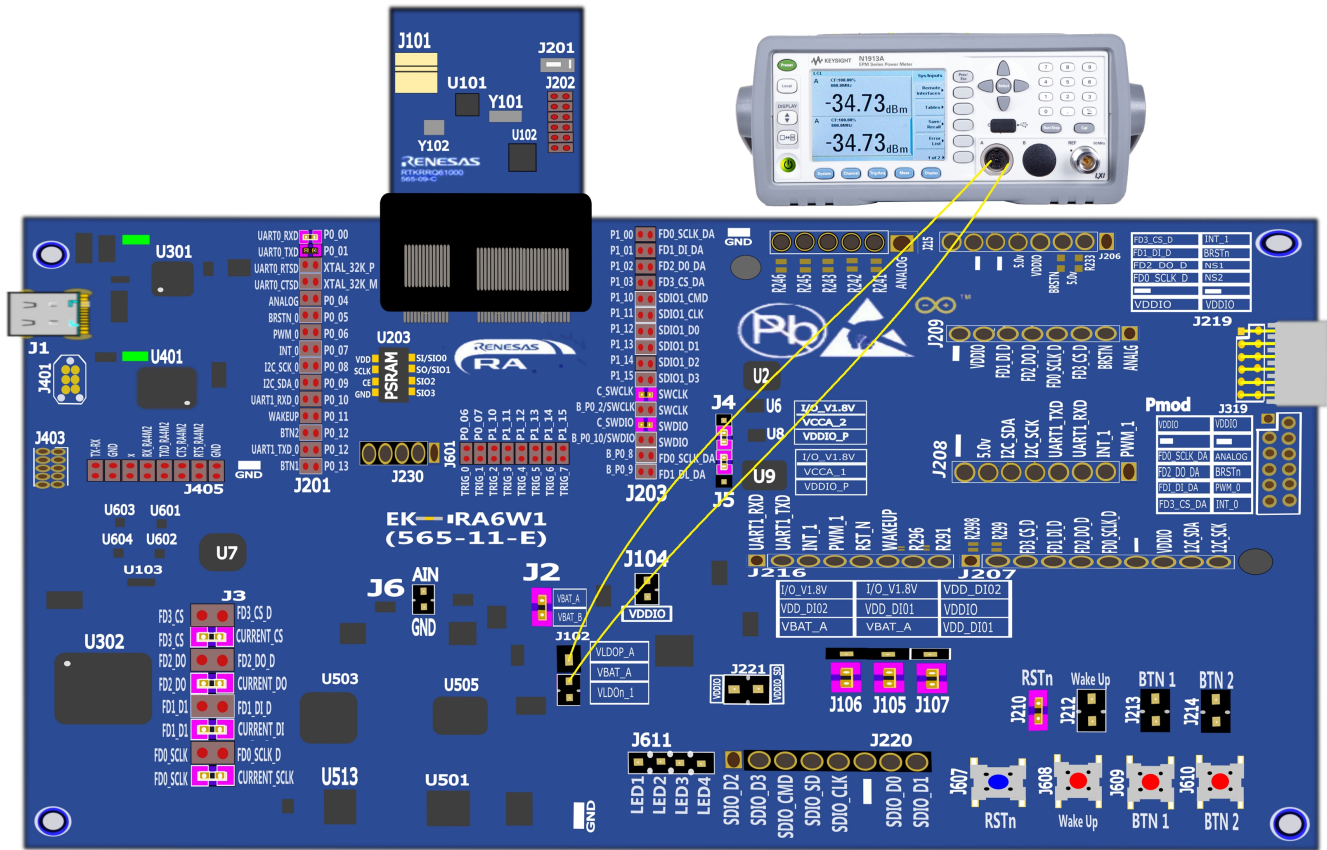


Figure 53. Jumper connections between pins

3. Assemble the daughterboard to the motherboard and turn on the EVK by connecting it to your computer through USB C.
4. Connect to the console through UART using Tera Term, see [Section 4.2 Configure RA6W1 EVK Serial Debug Interface](#).
5. In the UART console, select the needed configuration:
 

Example:

Configure the RA6W1 as in **Station + DPM mode** (see [Appendix A.3 Set up Station Mode with DPM Enabled](#)).  
 //OR//

Enter forced Sleep modes (2 or 3) by using the following command syntax: "pmgr force <mode>"  
 pmgr force PMGR\_LLD\_POWER\_MODE\_SLEEP\_2
6. Perform measurements with the power analyzer:

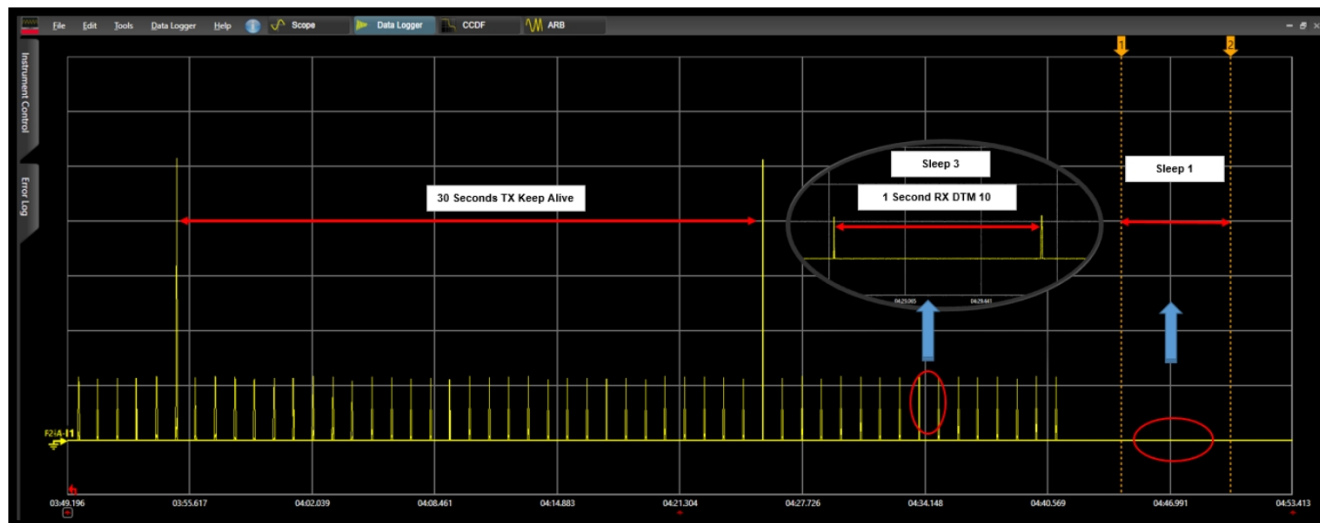


Figure 54. Measurements

### 5.2.4 Measure Sleep 1 Current Consumption

To measure the current consumption for Sleep 1 follow the same process as in [Section 4.3.2 Setup for Station Mode](#) and [Appendix A.1 Set up Soft AP Mode](#), you do not need any configuration in the CLI.

The following modifications are needed in the test setup to force the device to Sleep 1 Mode:

1. Remove the pull-up on the RST of the daughterboard.

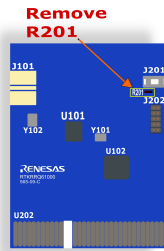


Figure 55. Remove resistor

2. Remove the J210 jumper on the motherboard.
3. Connecting a jumper between the GND and J210 RST\_N pins.

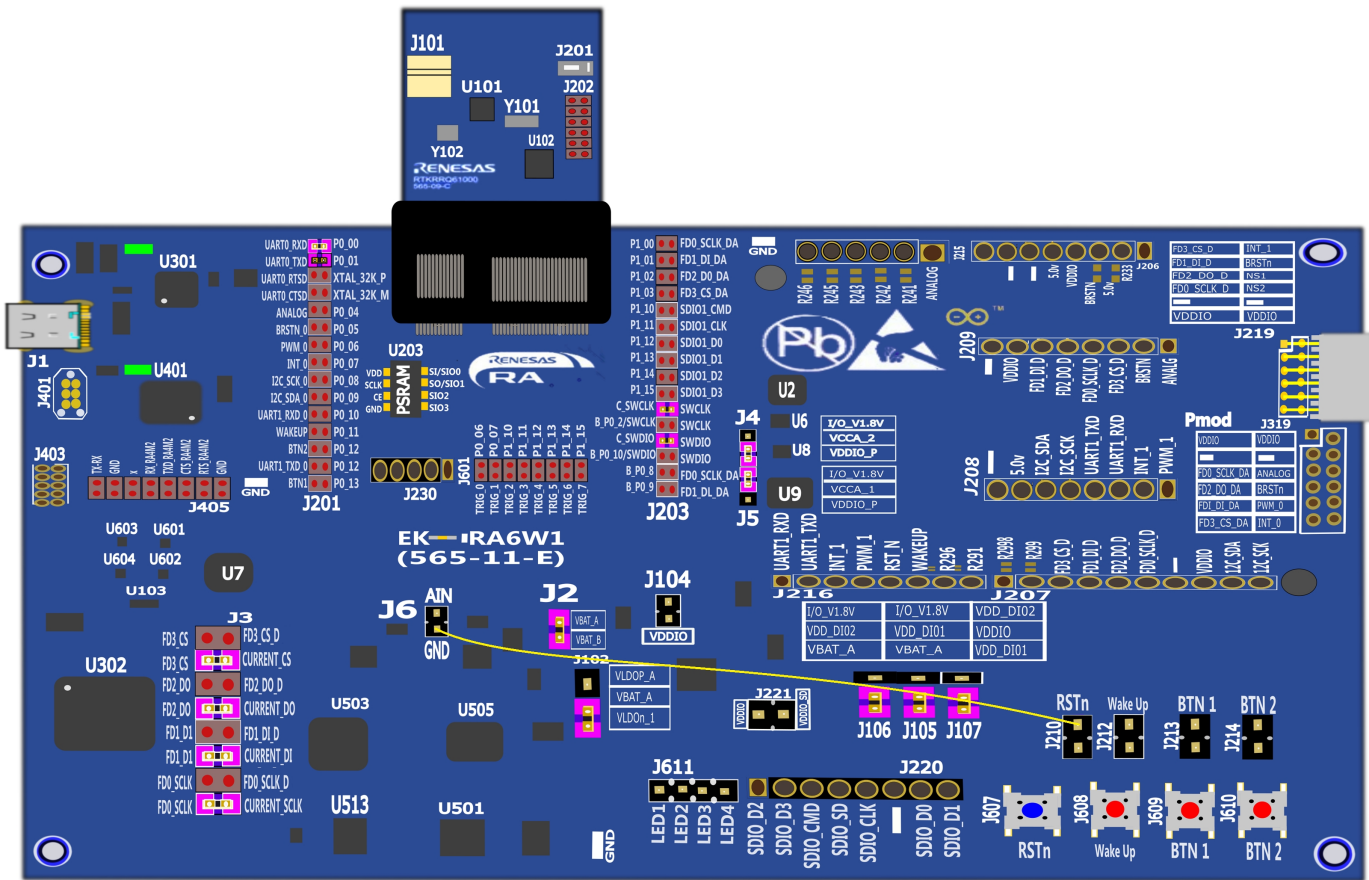


Figure 56. Connecting jumper between pins

## 6. Software Development Kit and Build Setup

Wi-Fi applications can be developed for the RA6W1 using the RA6W1 FreeRTOS Software Development Kit (SDK) and the Renesas e<sup>2</sup> studio IDE on either a Windows 10, Linux or macOS based development system.

To start developing applications for the RA6W1, complete the following steps:

1. Install and configure the e<sup>2</sup> studio IDE.
2. Import the RA6W1 SDK into the e<sup>2</sup> studio IDE and build an application.
3. Download and test the application.
4. Use J-Link debugger to debug the application.

Figure 57 shows the typical e<sup>2</sup> studio project for the RA6W1 FSP.

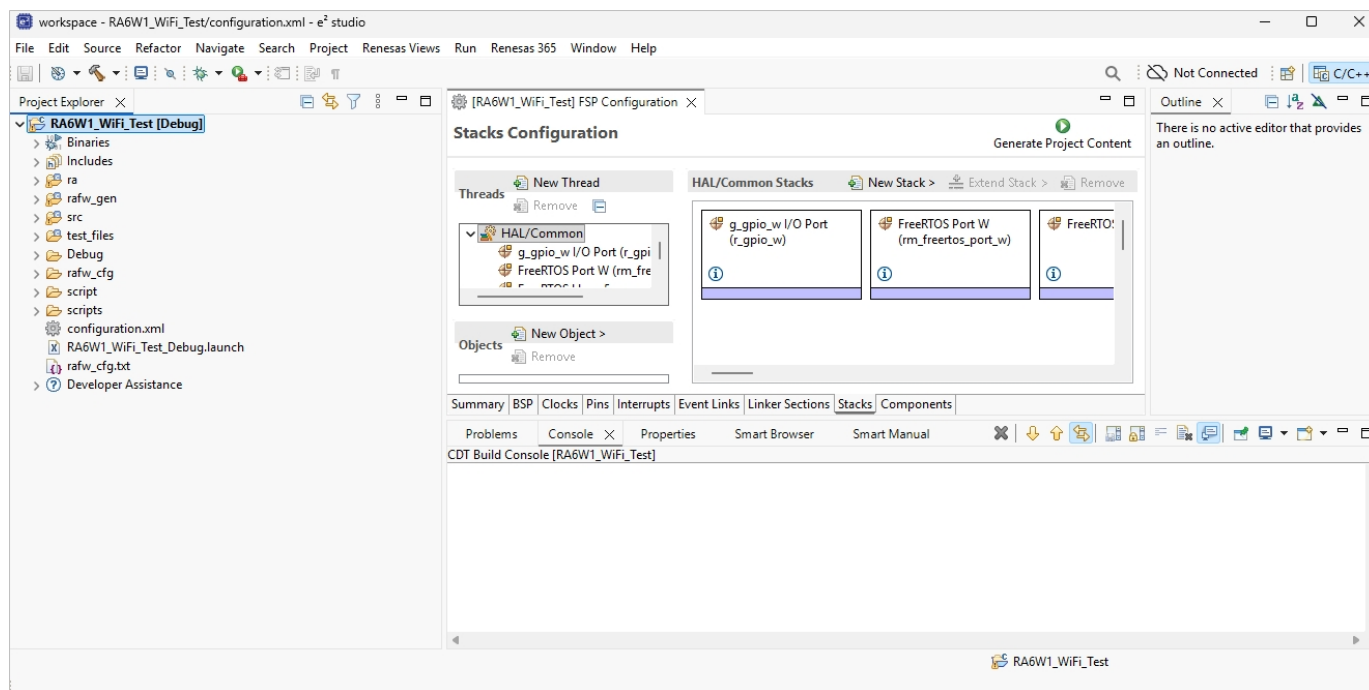


Figure 57. Project view

### System requirements:

- Windows 10 64 bit or later versions
- Ubuntu 22.04 LTS or later versions
- macOS 14 (Sonoma) or later versions
- e<sup>2</sup> studio installer-2025-12 or later versions.

### 6.1 Install e<sup>2</sup> studio IDE for Windows

The following files are required for installation in Windows and can be found in the Software and Tools section of RA6W1 product page:

- e<sup>2</sup> studio installer – e2studio\_installer-2025-12\_windows\_host.exe.
- RA6W1 FSP pack – RAFW\_FSP\_Packs\_2.0.1.
- Sample project template – wifi\_test\_ek\_ra6w1\_ep.zip.

To install e<sup>2</sup> studio IDE for Windows:

1. Run the installer, in the e<sup>2</sup>studio setup wizard, select **Standard Install**, and then select **Next**.

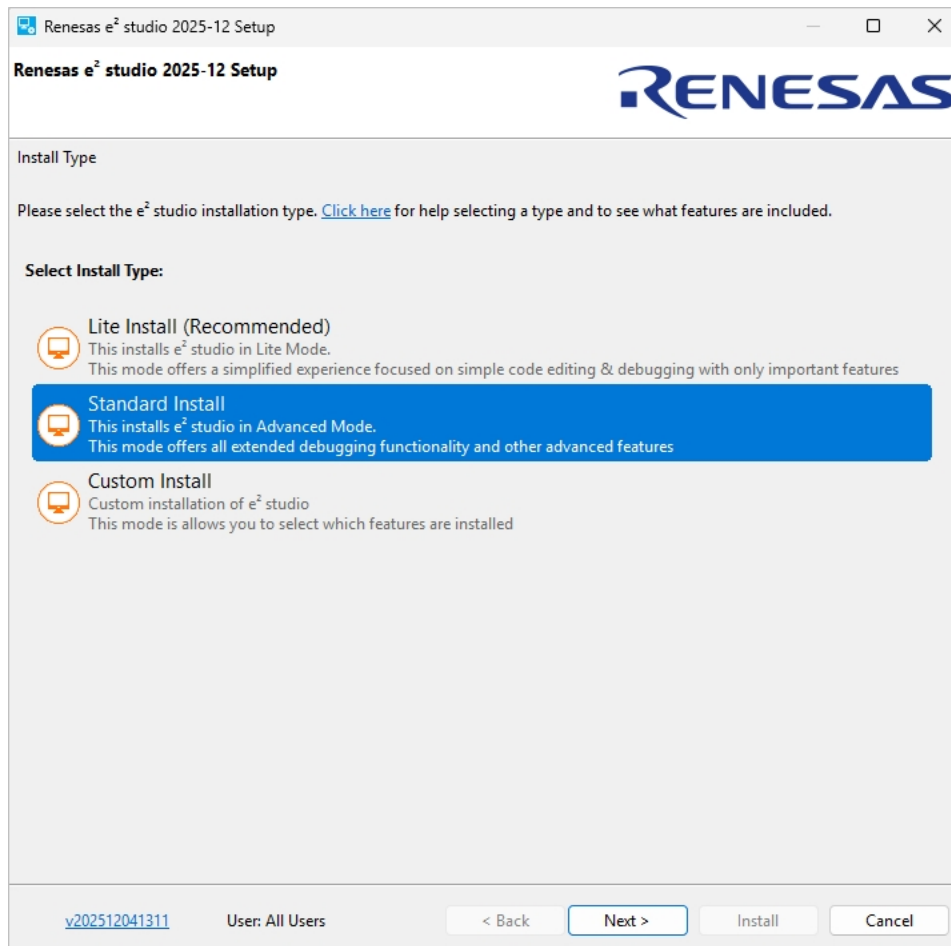


Figure 58. Standard installation

2. On the **Device Families** step, select **RA for Wireless**.

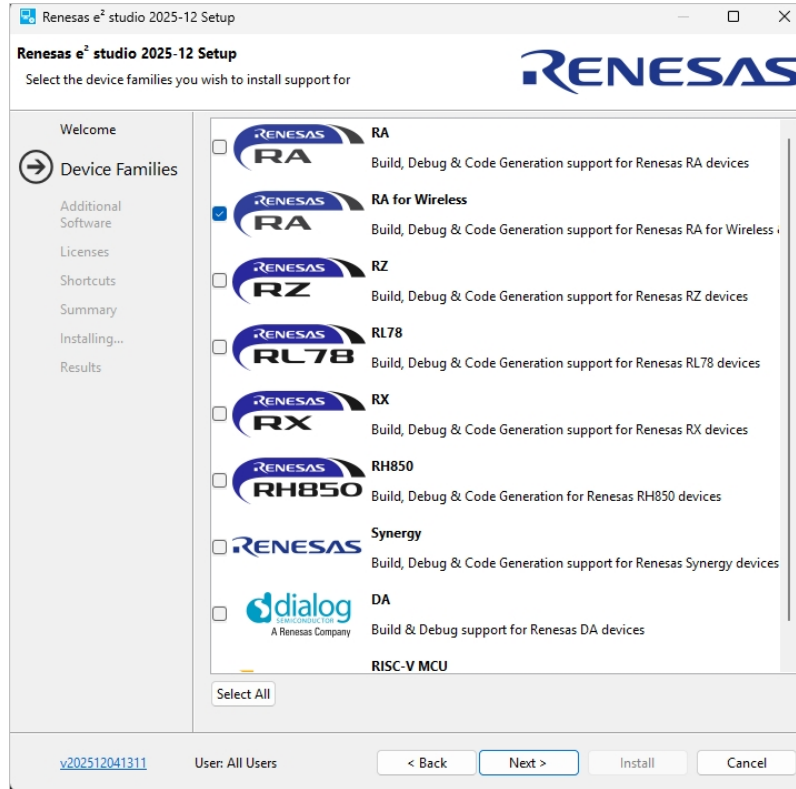


Figure 59. Device families

- On the **Additional Software** step, expand **GCC Toolchains and Utilities**, select the **GNU ARM Embedded 13.3** checkbox, and click **Next**.

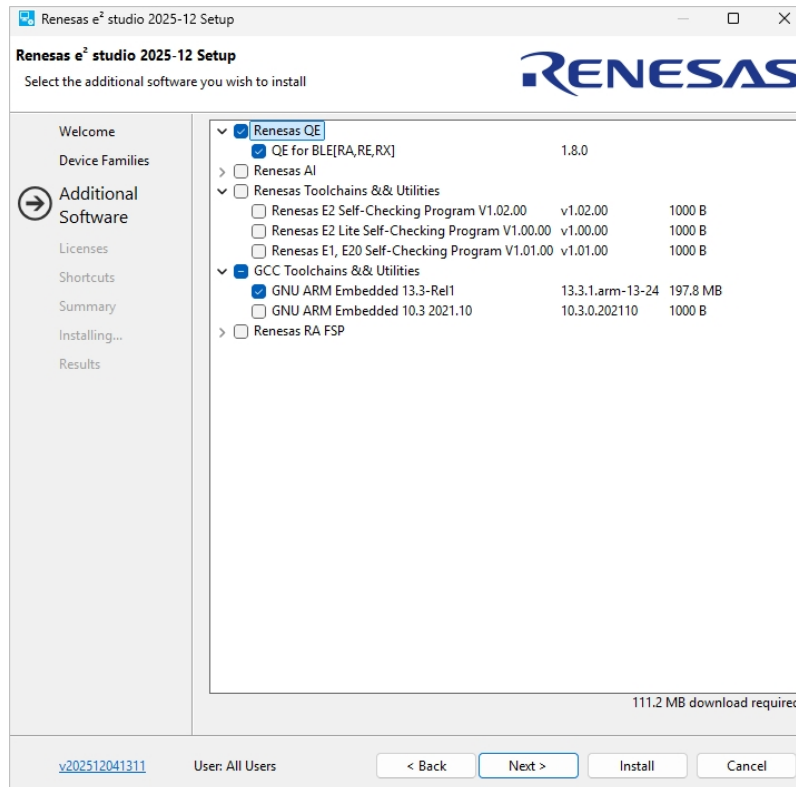


Figure 60. Additional software

- 4. On the **Licenses** step, accept the terms of the software agreement by selecting the checkbox, and click **Next**.
- 5. On the **Shortcuts** step, click **Next**.

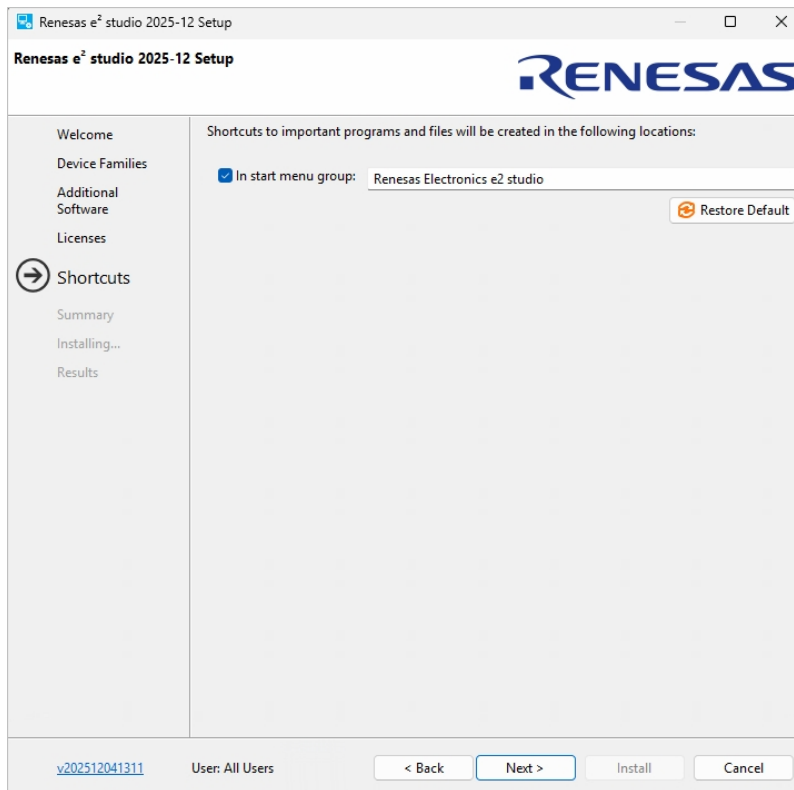


Figure 61. Shortcuts

- 6. On the **Summary** step, click **Install**.

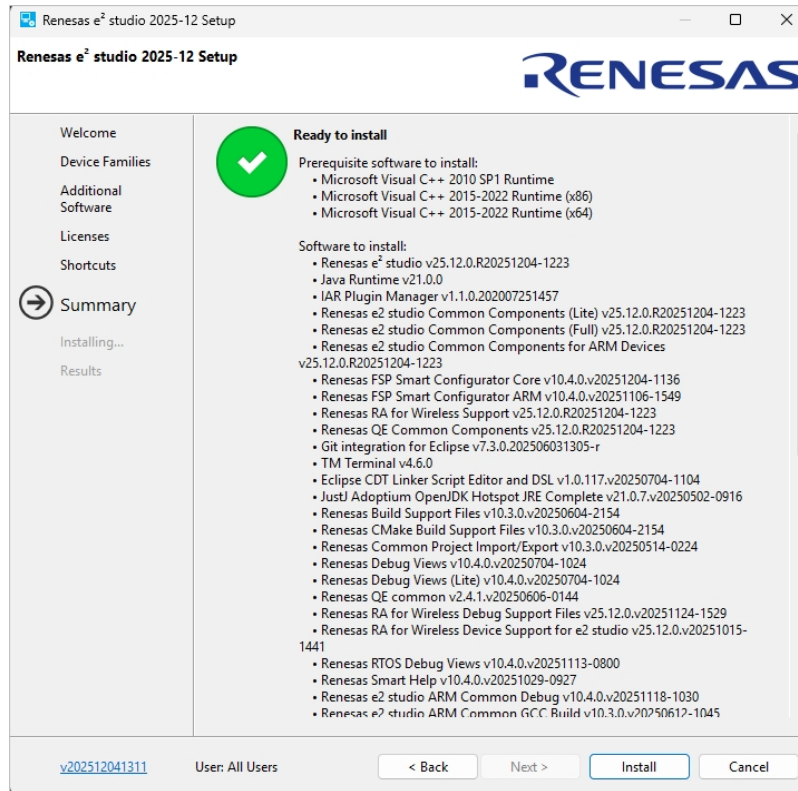


Figure 62. Ready to install

7. While installing e² studio, GNU Arm® Embedded 13.3 toolchain installation initializes.

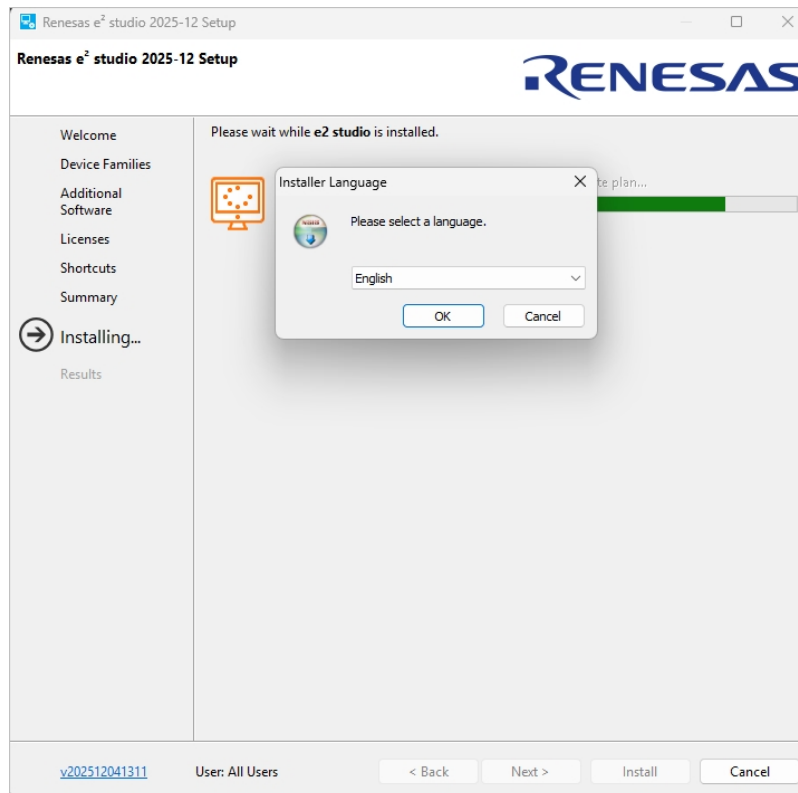


Figure 63. Toolchain installation

8. Complete the toolchain installation.

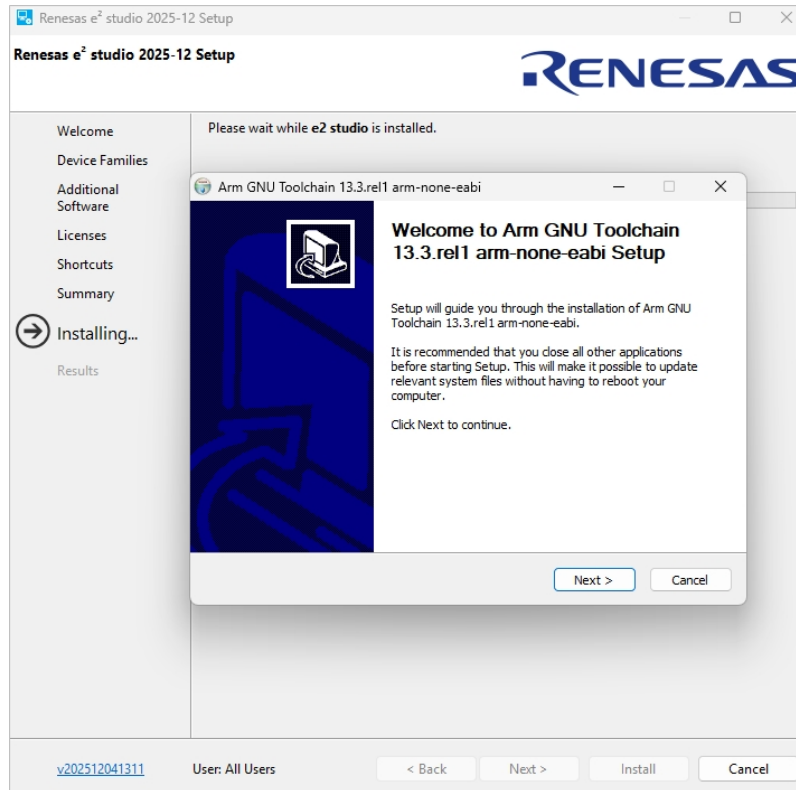


Figure 64. Toolchain setup wizard

- 9. When the e<sup>2</sup> studio is installed, select the **Launch e<sup>2</sup> studio** checkbox and click **OK**.
- 10. Open e<sup>2</sup> studio and continue with installing the RA6W1 FSP pack.

See [Section 6.4 Install RA6W1 FSP Pack](#).

## 6.2 Install e<sup>2</sup> studio IDE for Linux

The following files are required for installation in Linux and can be found in the Software and Tools section of RA6W1 product page:

- e<sup>2</sup> studio installer – e2studio\_installer-2025-12\_linux\_host.run.
- RA6W1 FSP pack – RAFW\_FSP\_Packs\_2.0.1.
- Sample project template – wifi\_test\_ek\_ra6w1\_ep.zip.

To install e<sup>2</sup> studio IDE for Linux:

- 1. Give the execution permissions to the e<sup>2</sup> studio installer and run installer, see [Figure 65](#).

```
developer@TVMA-WKS0193:~/Downloads$ chmod +x e2studio_installer-2025-12_linux_host.run
developer@TVMA-WKS0193:~/Downloads$ ./e2studio_installer-2025-12_linux_host.run
Verifying archive integrity... 100% MD5 checksums are OK. All good.
```

Figure 65. Installer

- 2. In the e<sup>2</sup>studio setup wizard, select **Standard Install**, and select **Next**.

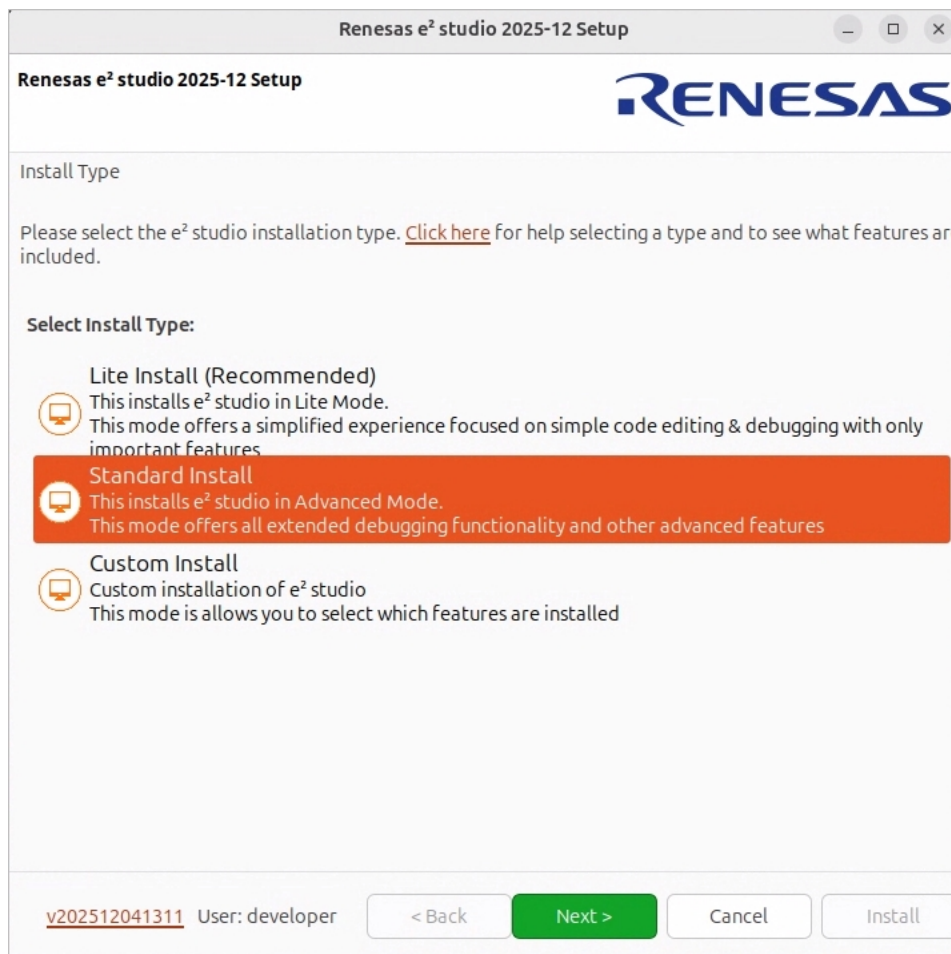


Figure 66. Standard installation

3. On the **Device Families** step, select **RA for Wireless**.

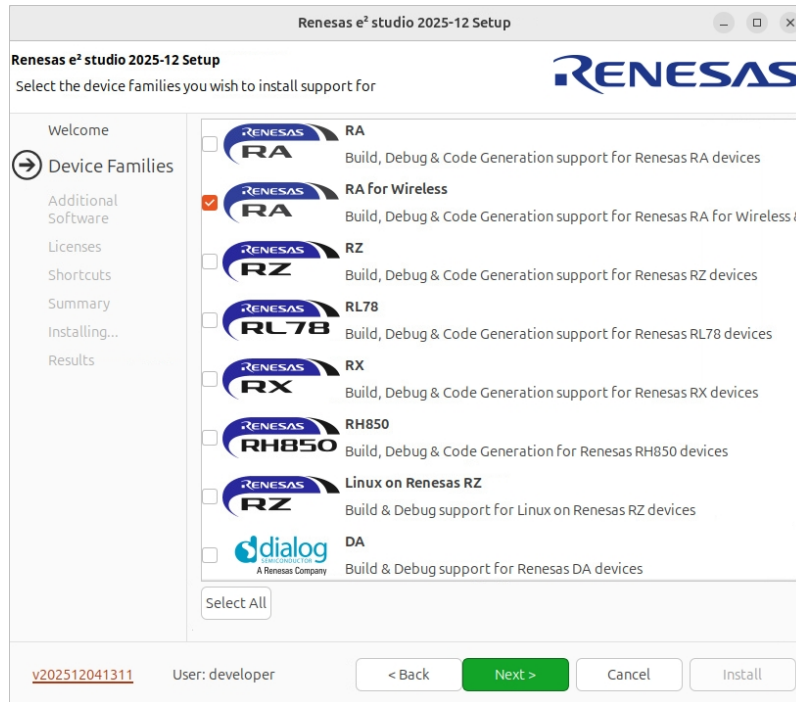


Figure 67. Device families

- On the **Additional Software** step, expand **GCC Toolchains and Utilities**, select the **GNU ARM Embedded 13.3** checkbox, click **Next > Install**, see [Figure 68](#).

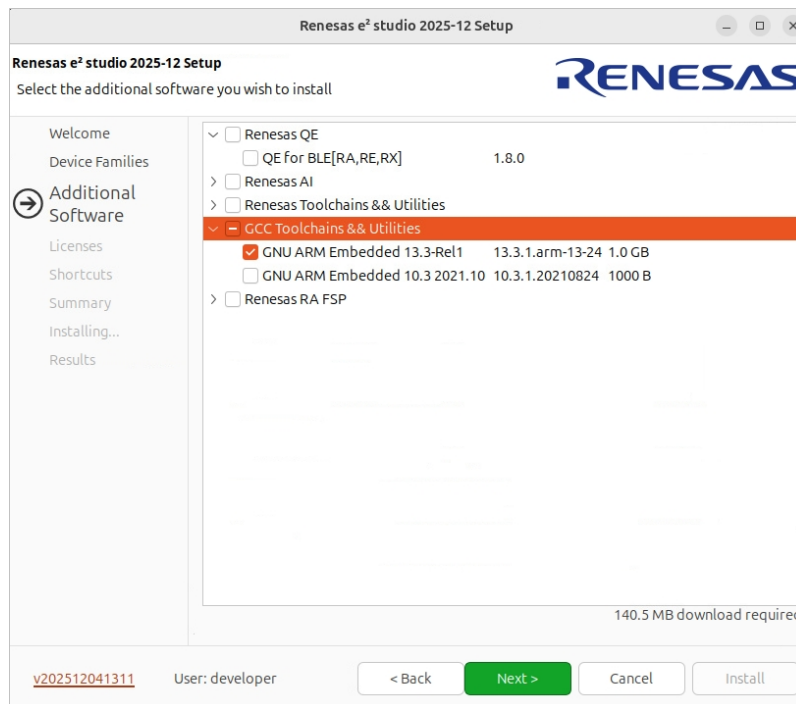


Figure 68. Device families

- After completing e² studio installation, open e² studio and continue with installing the RA6W1 FSP pack. See [Section 6.4 Install RA6W1 FSP Pack](#)).

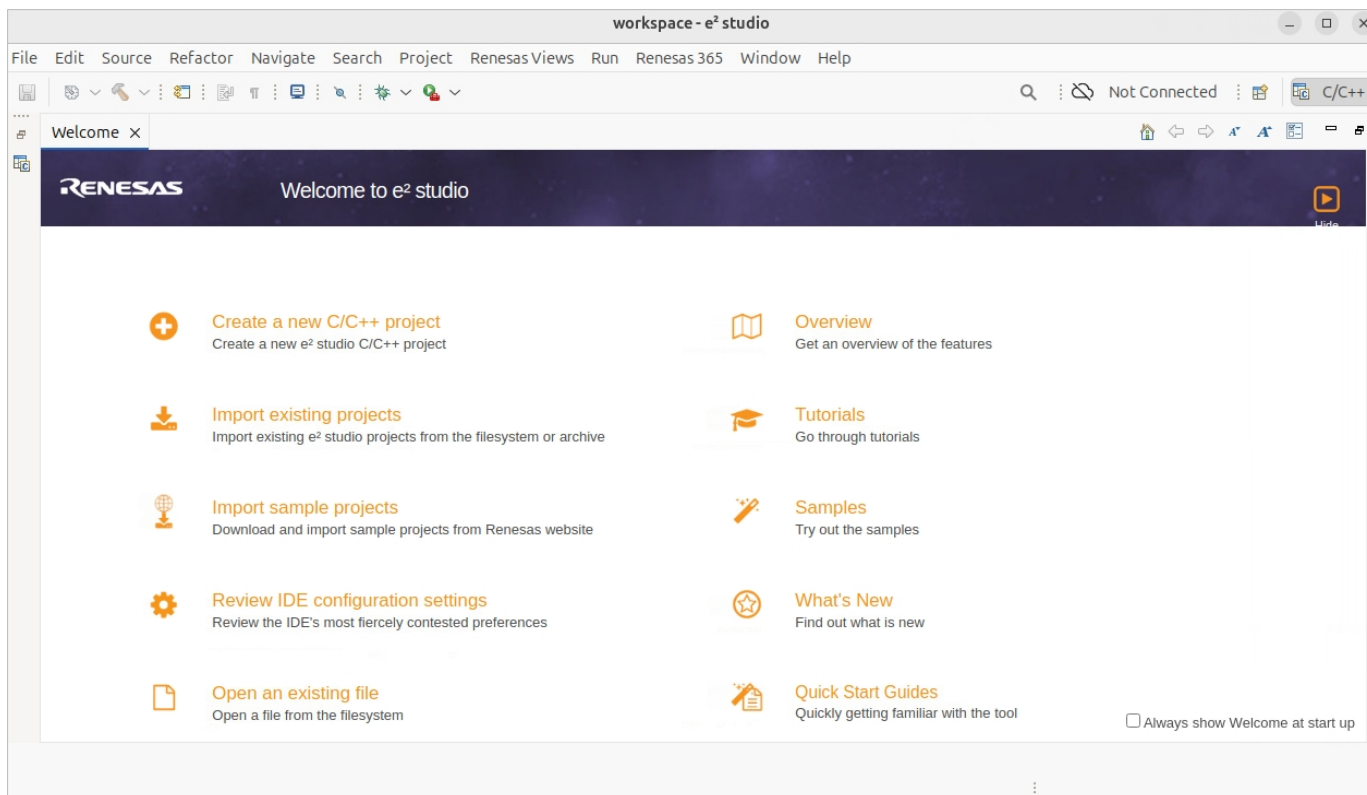


Figure 69. e2 studio

### 6.3 Install e2 studio IDE for macOS

The following files are required for installation in macOS and can be found in the Software and Tools section of RA6W1 product page:

- e2 studio installer – e2studio\_installer-2025-12\_macosx\_host.txz.
- RA6W1 FSP pack – RAFW\_FSP\_Packs\_2.0.1.
- Sample project template – wifi\_test\_ek\_ra6w1\_ep.zip.
- Toolchain Installer – arm-gnu-toolchain-13.3.rel1-darwin-arm64-arm-none-eabi.pkg.
- Python 3 Installer – python-3.13.6-macos11.pkg.

To install e2 studio IDE for macOS:

1. In the downloaded archive, extract the E2studio.app file and move it to the application folder.
2. In the application folder, double-click E2studio.app to start the e2 studio.

If the ["E2studio.ap" is damaged and can't be opened. You should move it to the Trash.] error message appears when the e2 studio is started, open the terminal window and run the following command:

```
xattr -d com.apple.quarantine /Applications/E2studio.app
```

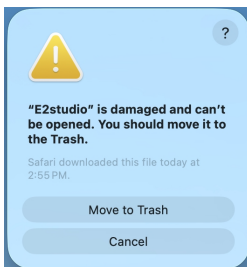


Figure 70. Error in Starting the e<sup>2</sup> studio

3. Install the Toolchain by double-clicking the installer.

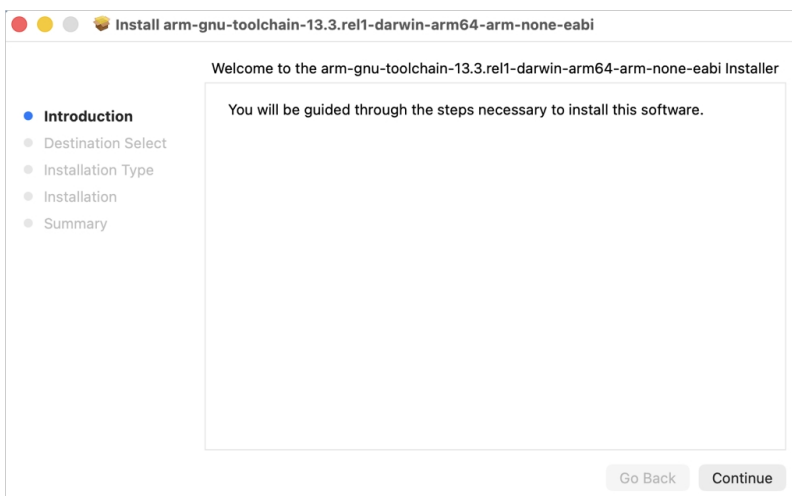


Figure 71. Toolchain Installer

4. After Toolchain Installation is successfully completed, in e<sup>2</sup> studio, go to **Help > Add Renesas Toolchains**.

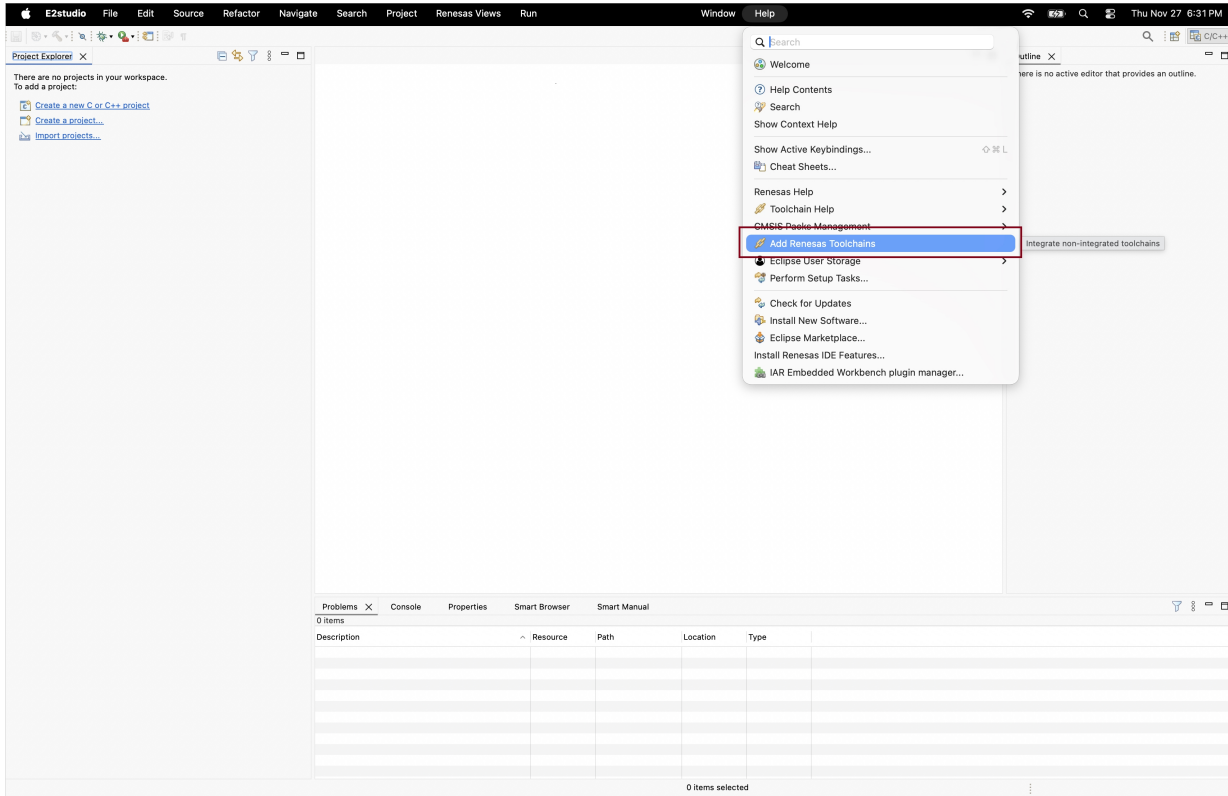


Figure 72. Add Renesas Toolchains

5. In the **Renesas Toolchain Management** dialog, click **Add**.

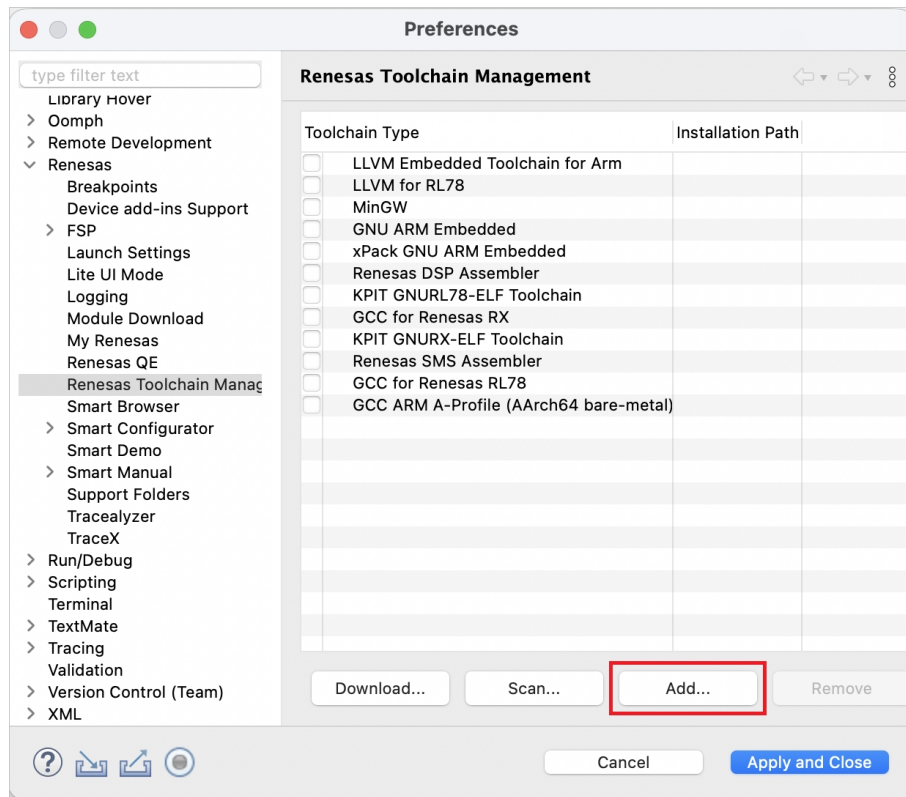


Figure 73. Renesas Toolchain Management

- 6. In the **Add New Toolchain** dialog, click **Browse**.
- 7. Go to **Applications > ArmGNUToolchain > 13.3.rel1>arm-none-eabi**, and click **Open**.

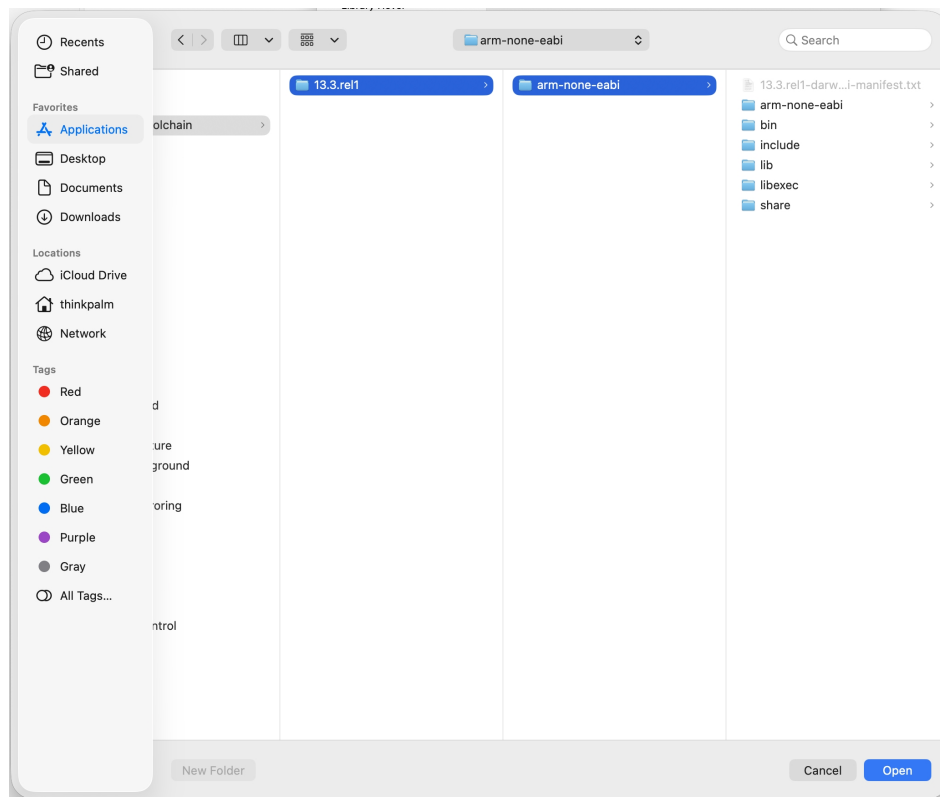


Figure 74. Choose the Installed Toolchain

- 8. In the **Add New Toolchain** dialog, click **OK**.
- 9. In the **Renesas Toolchain Management** dialog, click **Apply and Close**.

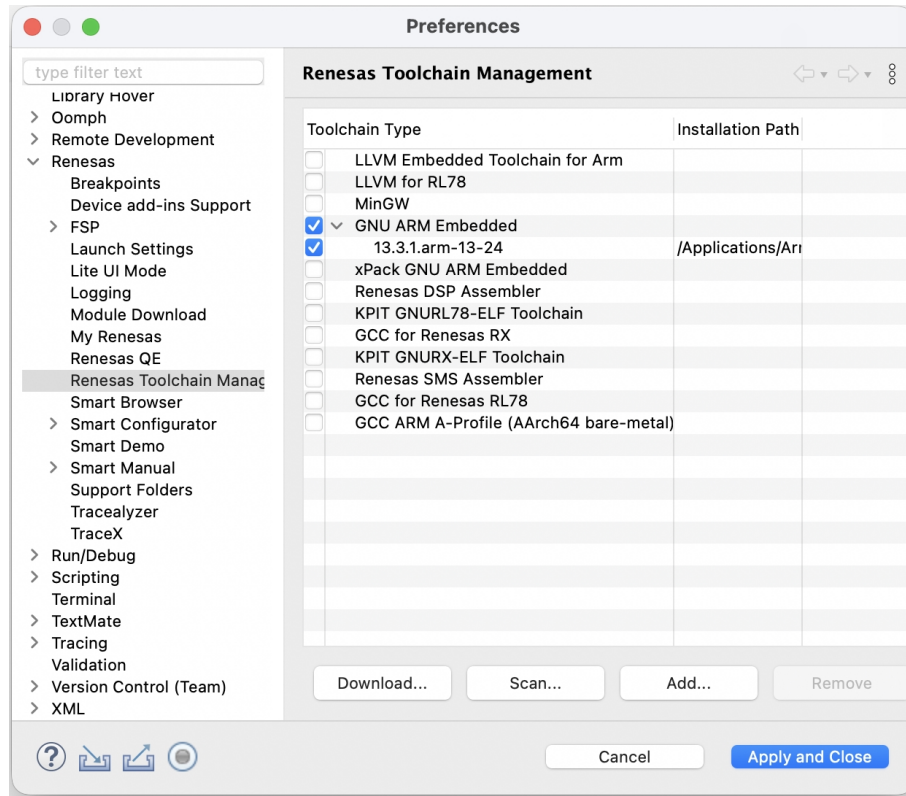


Figure 75. Finalize Toolchain Settings

10. Install Python3 by double-clicking Installer – python-3.13.6-macos11.pkg.

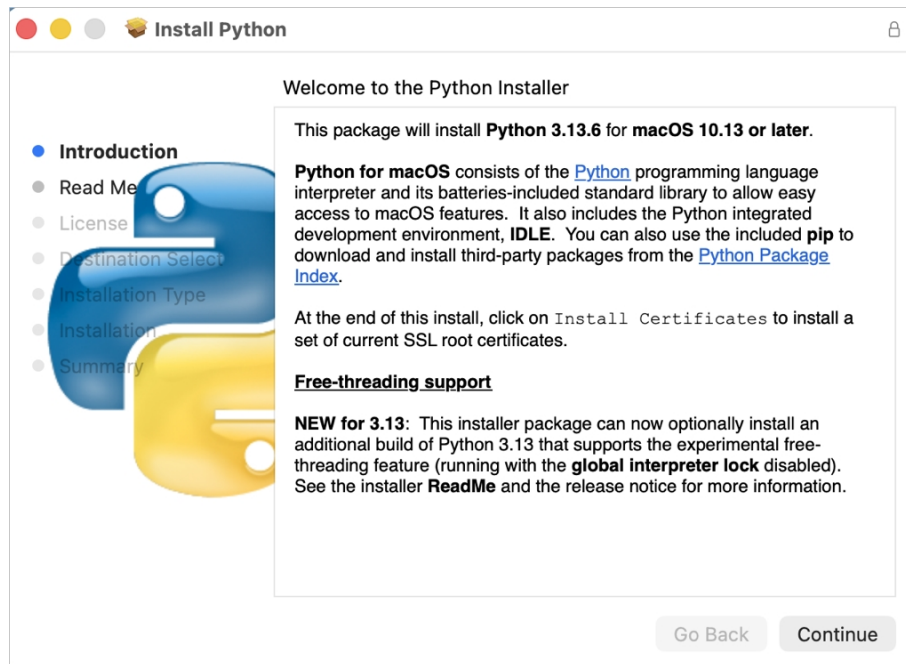


Figure 76. Python3 Installer

11. After Python3 installation is completed successfully, restart e<sup>2</sup> studio using **File >Restart**.

## 6.4 Install RA6W1 FSP Pack

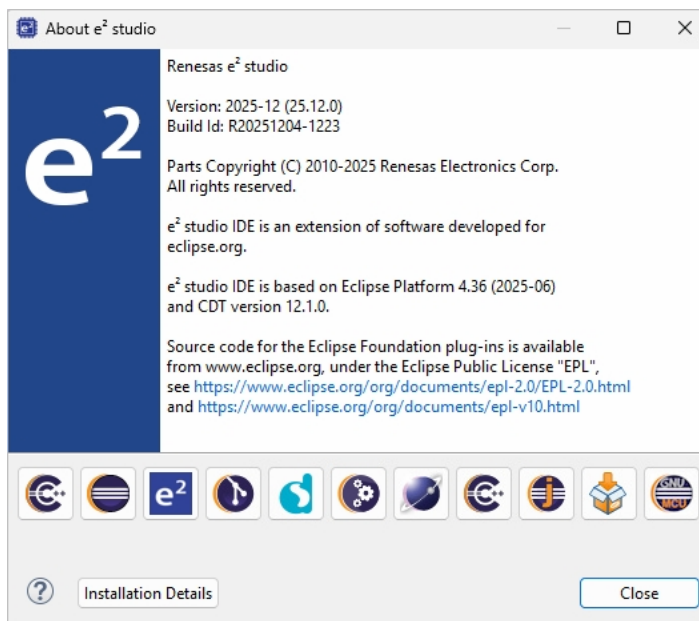
To build the SDK, install the RA6W1 FSP pack:

**NOTE**

The same procedure applies to both Windows OS, Linux and macOS.

To install the latest **RA6W1 FSP Release package**:

1. Unzip the `RAFW_FSP_Packs_2.0.1.zip` to the **e<sup>2</sup> studio** install directory.
2. To find the exact **e<sup>2</sup> studio** install directory, click **Help > About e<sup>2</sup> studio**. For macOS, click **e2studio > About e2studio**.
3. In the **About e2studio** dialog, click **Installation Details**.



**Figure 77. e<sup>2</sup> studio details**

4. In the **e<sup>2</sup> studio Installation Details** dialog, select the **Support Folders** tab.

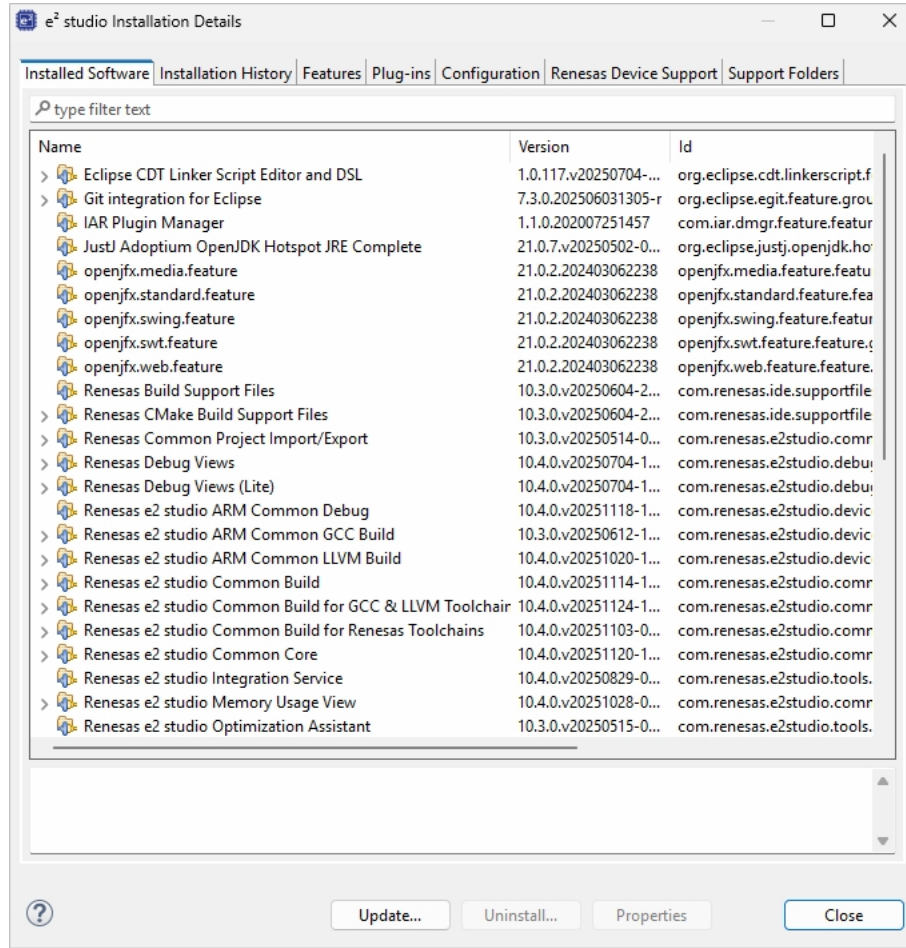


Figure 78. e<sup>2</sup> studio installation details

- To open the system file manager in the directory that corresponds to e<sup>2</sup> studio install directory, click the e<sup>2</sup> studio support area link.

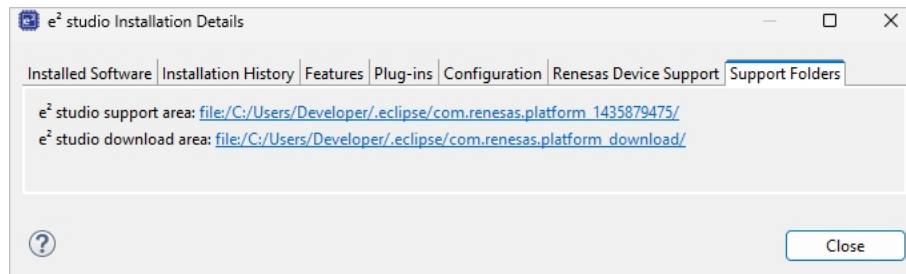


Figure 79. Support folders

- Extract the RAFW\_FSP\_Packs\_2.0.1.zip file.
- Copy and paste the **Internal folder** to the **e<sup>2</sup> studio support** folder.  
In MacOS, select the **Merge** option when copying the internal folder.
- To restart e<sup>2</sup> studio, click **File > Restart**.

**NOTE**

For updating/re-installing the RA6W1\_FSP\_Packs, delete the following folders in the e<sup>2</sup> studio support folder first.

- DebugComp\rrq\
- internal\cmsis\data\rrq\
- internal\devassist\rafw\_fsp\
- internal\projectgen\rafw\_fsp\.

Then follow Step 5 and Step 8.

To see the module information in e<sup>2</sup> studio, you need to integrate FSP API documentation into e<sup>2</sup> studio. Do the following:

**Note**  
This section becomes obsolete when Platform installer for RAFW is released.

1. On the RA6W1 product page, go to the **Softwares & Tools** section and download **Renesas RAFW FSP <version> User Manual**.
2. Unzip and rename the folder to **fsp\_documentation**.
3. Copy the renamed folder to e<sup>2</sup> studio support area.  
For details on opening e<sup>2</sup> studio support area, see step 2-5 of installation procedure for RA6W1 FSP Release package ([Section 6.4 Install RA6W1 FSP Pack](#)).
4. Restart e<sup>2</sup> studio.

Now module information can be viewed by clicking the module resource page icon (i).

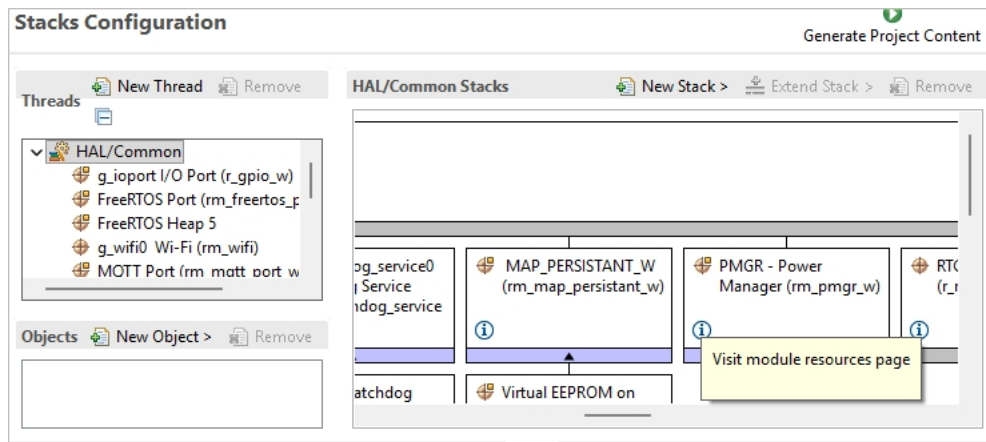


Figure 80. Visit Module resource page button

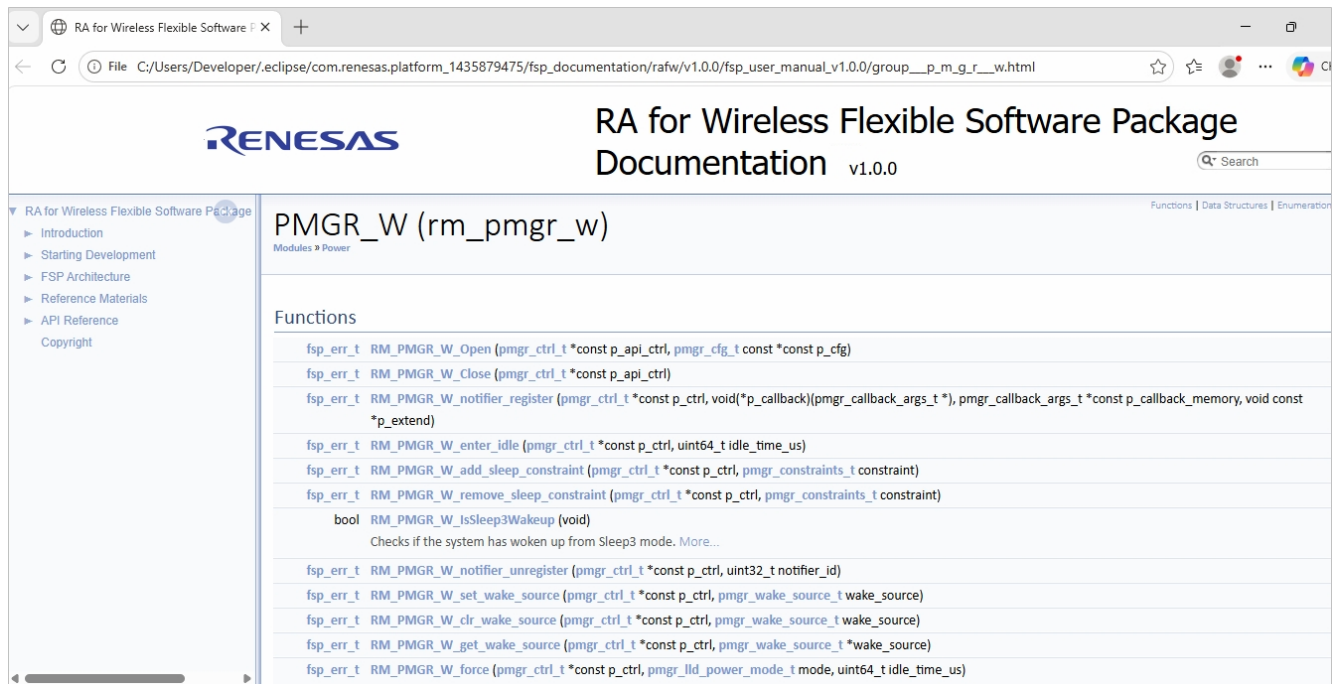


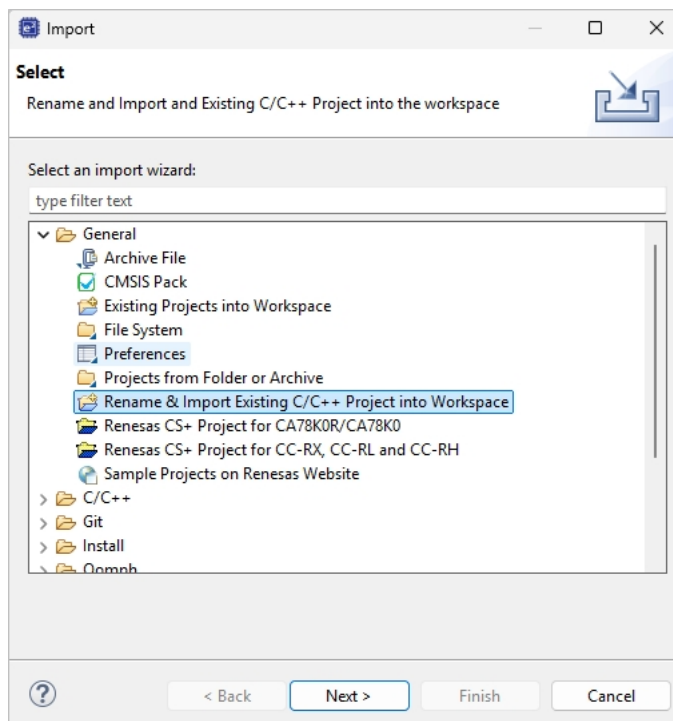
Figure 81. Module resource page

## 6.5 Load Project Template in e<sup>2</sup> studio

**wifi\_test\_ek\_ra6w1\_ep.zip** is a project template to create the default Wi-Fi image of the released version.

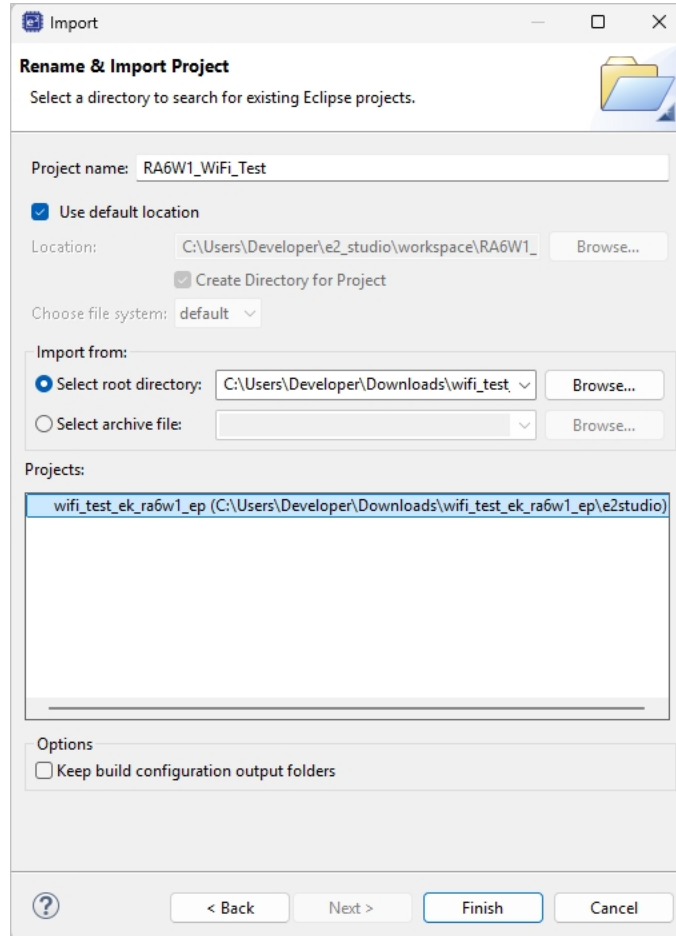
To load the project template:

1. Extract the **wifi\_test\_ek\_ra6w1\_ep.zip** project template to a directory.
2. To import project template, click **File > Import**.
3. Under **General**, select **Rename & Import Existing C/C++ Project into Workspace**.



**Figure 82. Rename and import**

4. Go to the project template directory (unzip **wifi\_test\_ek\_ra6w1\_ep.zip**), and in the **Project name** field, enter the name and click **Finish**.
5. In the **Project name** field, enter the name and click **Finish**, see [Figure 83](#).



**Figure 83. Finish import**

6. After import finishes, install python using the following steps in Windows:
  - a. Right-click the project, click **Show in Local Terminal > Terminal**.
  - b. In console, enter "python3".

**NOTE**  
 For Windows, if Python 3 is installed already and above terminal appears, for python Integration, see [Appendix D Python Integration in e2 studio Windows](#).

- c. Microsoft store appears and to install Python 3, click **Get**.

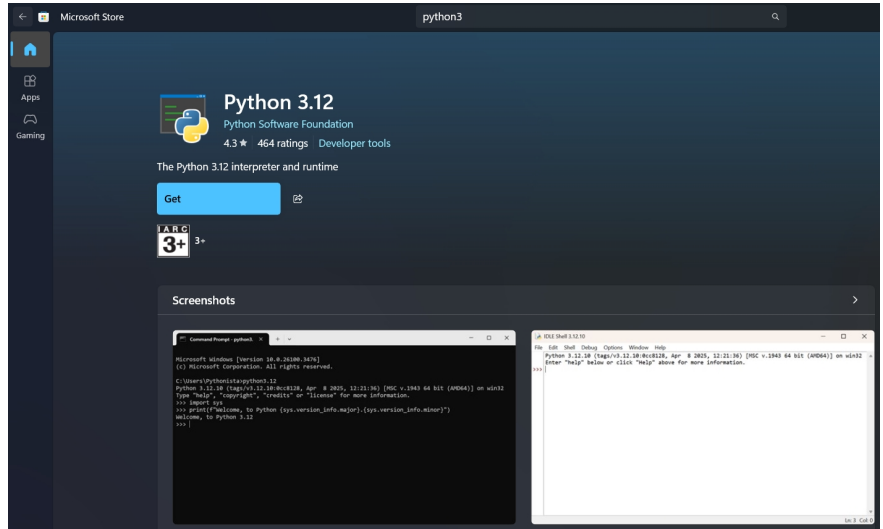


Figure 84. Install Python 3

7. Go to **configuration.xml** and click **Generate Project Content**.

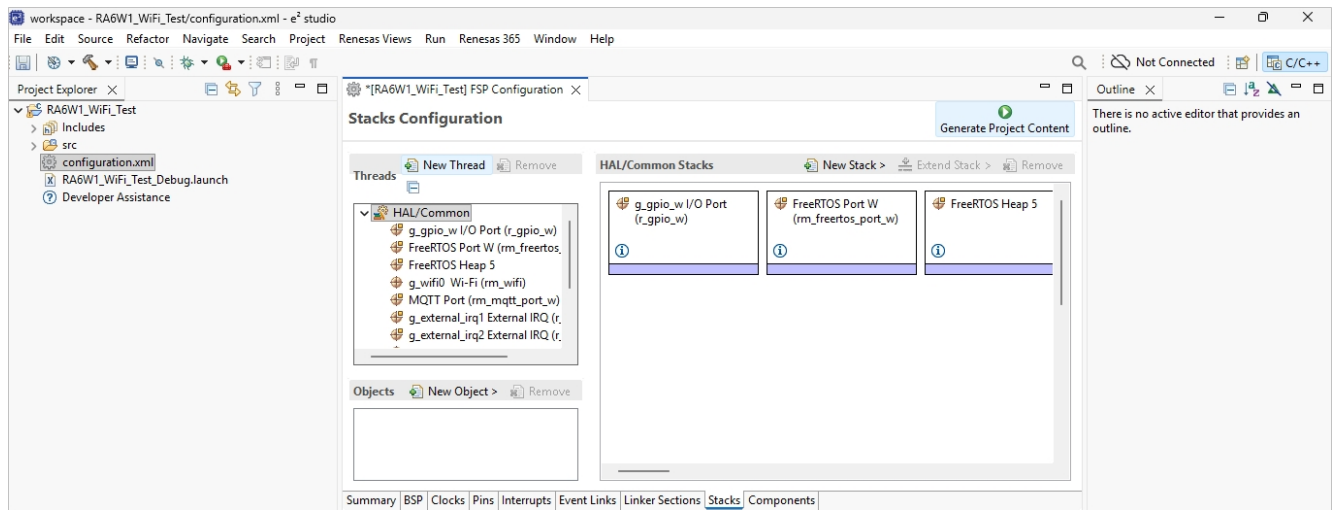


Figure 85. Configuration and generate project contents

- 8. To build the project, right-click the project and click **Build Project**.
- 9. To see the build progress, open the console window.

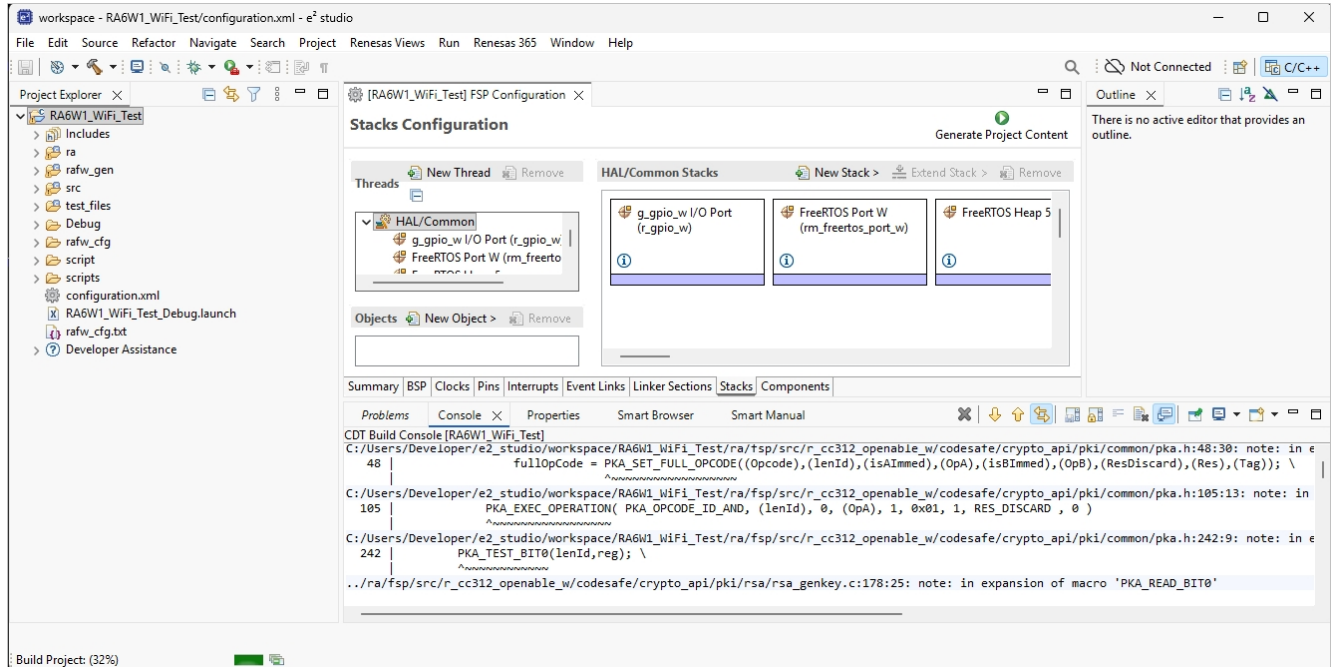


Figure 86. Console window

Figure 87 shows the successful build.

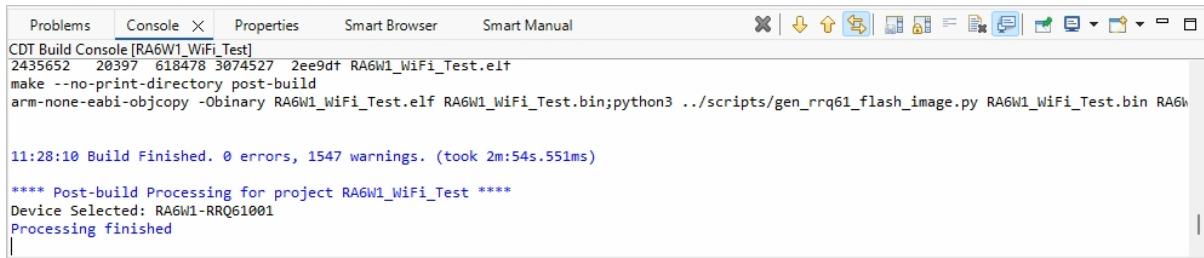


Figure 87. Successful build

10. If there is no .img.bin file generated on Windows and Python 3 command does not show any error in console, follow the step 6.

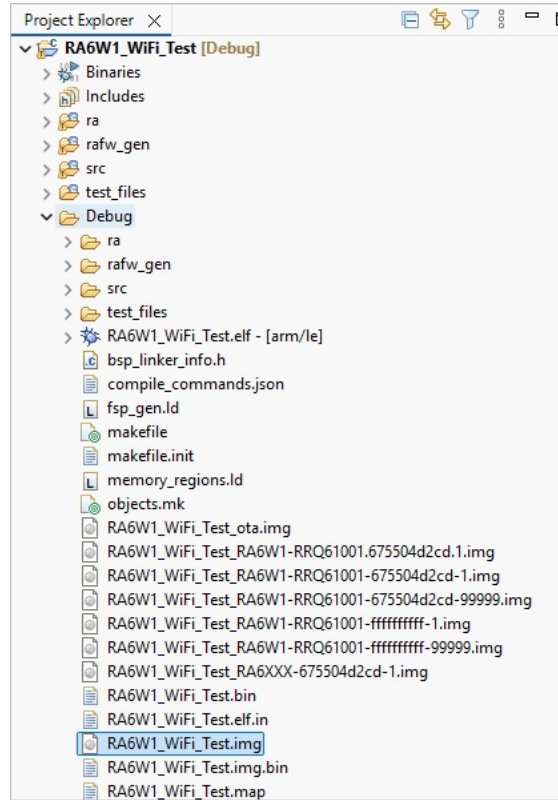


Figure 88. Image in Project Explorer tab

11. To program the firmware images, see [Section 4.1 Firmware Image Programming](#) .

## 6.6 Flash and Debug using e<sup>2</sup> studio

You can flash and debug in e<sup>2</sup> studio using J-Link.

System Requirements:

- e<sup>2</sup> studio installer-2025-12 or later versions
- Segger J-Link V878 or later.

To flash and debug in e<sup>2</sup> studio:

1. Install RA6W1 FSP Pack and Load Project Template in e<sup>2</sup> studio.
2. Build Debug for RA6W1.
3. Go to **Debug > Debug New\_configuration**.

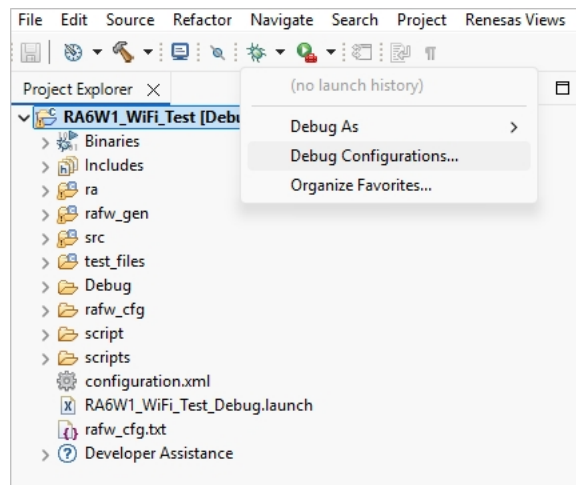


Figure 89. Debug Configuration in e<sup>2</sup> studio

- In **Debug Configurations**, select **Renesas GDB Hardware Debugging**, and then select **Launch Configuration**.

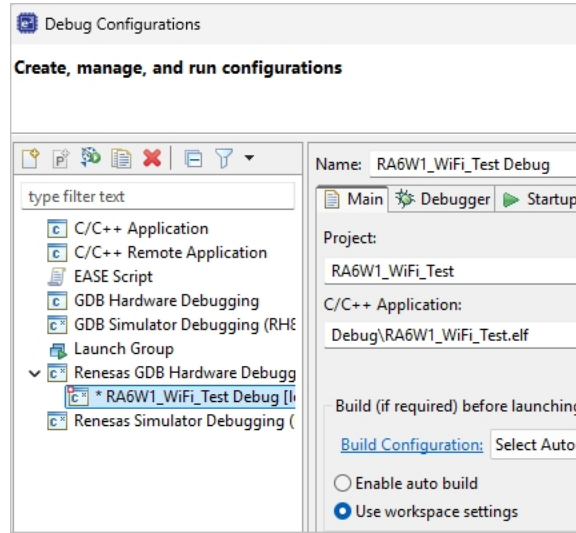


Figure 90. Debug Configuration page

- On the **Debugger** tab, set up the target device as follows:

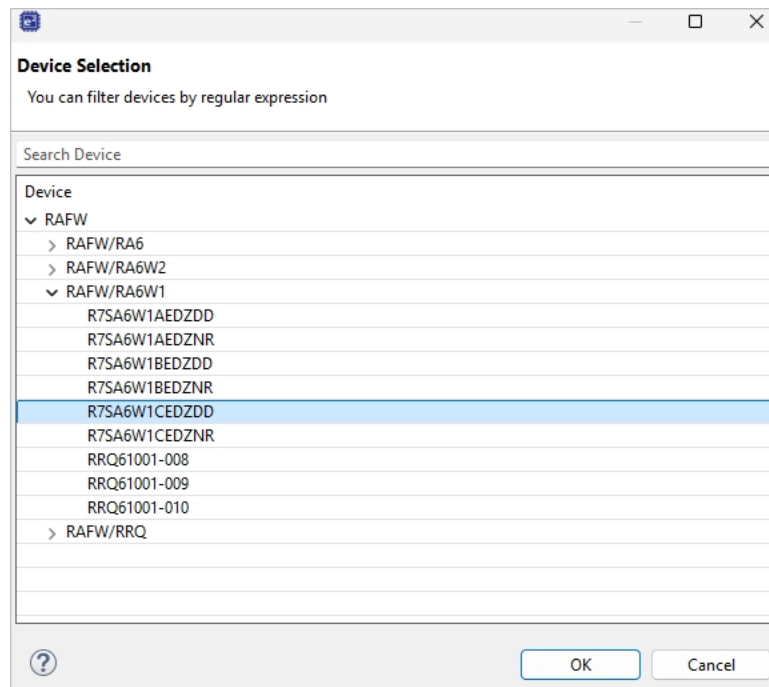


Figure 91. Device selection in Debugger

- On the **Startup** tab, and change load type of **Program Binary** to **Symbols Only**.

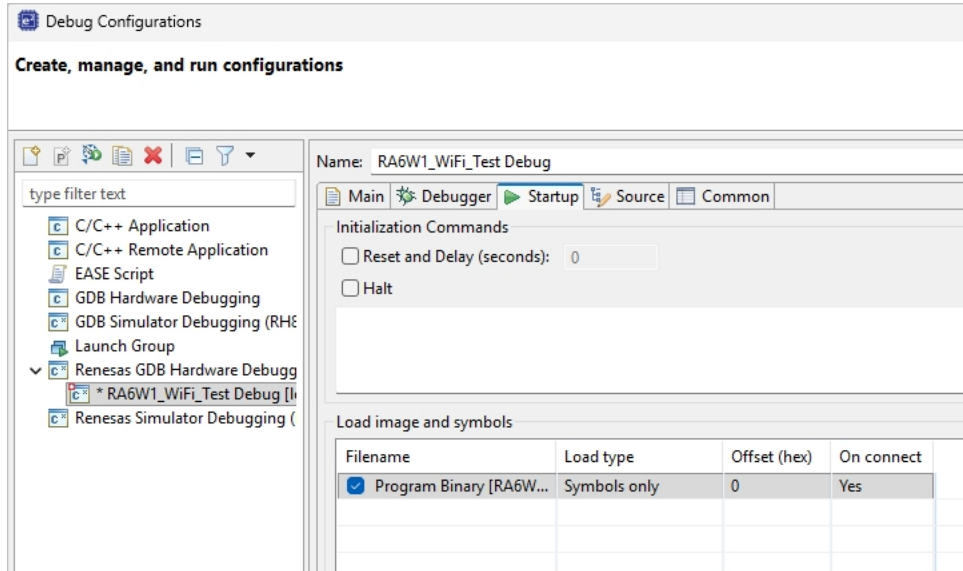


Figure 92. Symbols only

- To add **Download Module (.img.bin)** from Debug, go to **Add > Workspace > Project File > Debug > test\_files > .img.bin**.

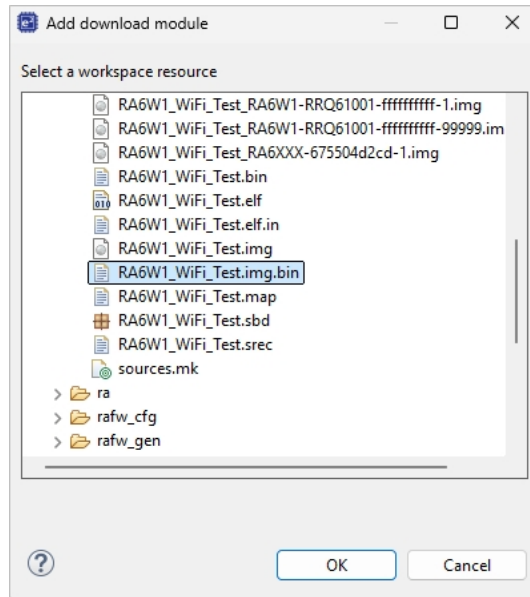


Figure 93. Add Download Module

- Change Load Type of `.img.bin` into **Raw Binary** and **Offset** as `a000000`. Then click **Apply > Debug**.

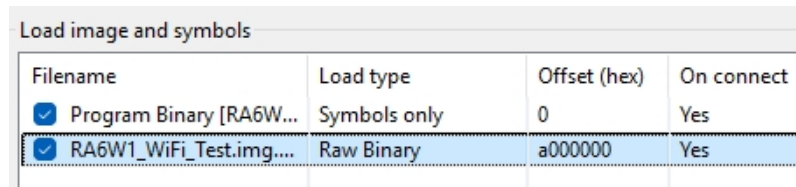


Figure 94. Change Load type and Offset

- Click **Switch**.

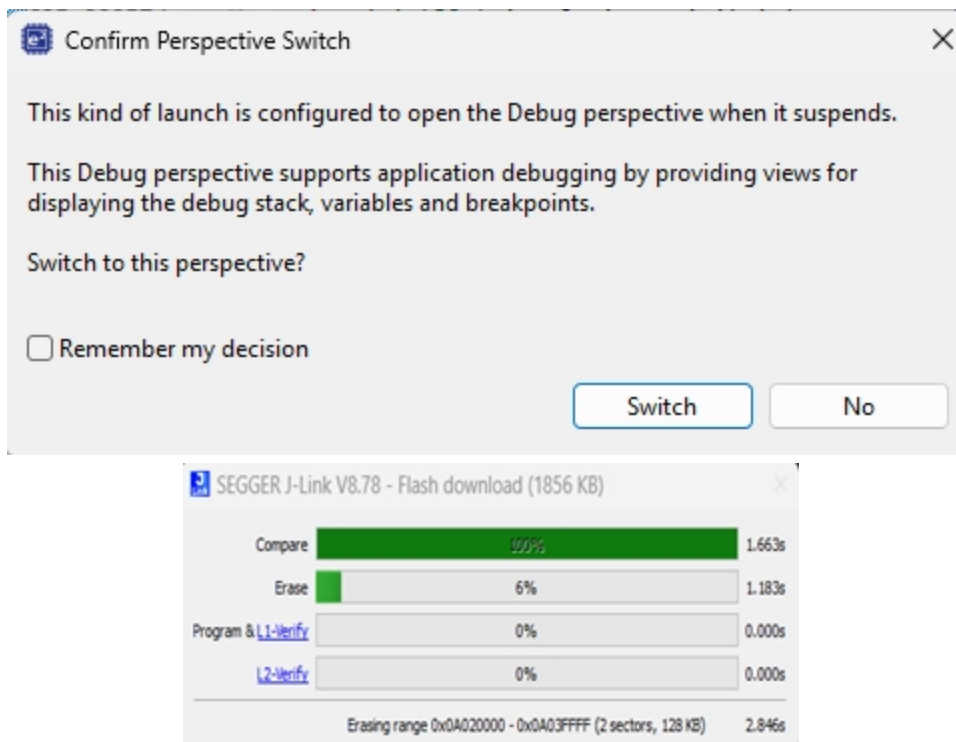


Figure 95. Confirm Perspective Switch and Segger J-Link

10. On **Debug** page, click **Play**.

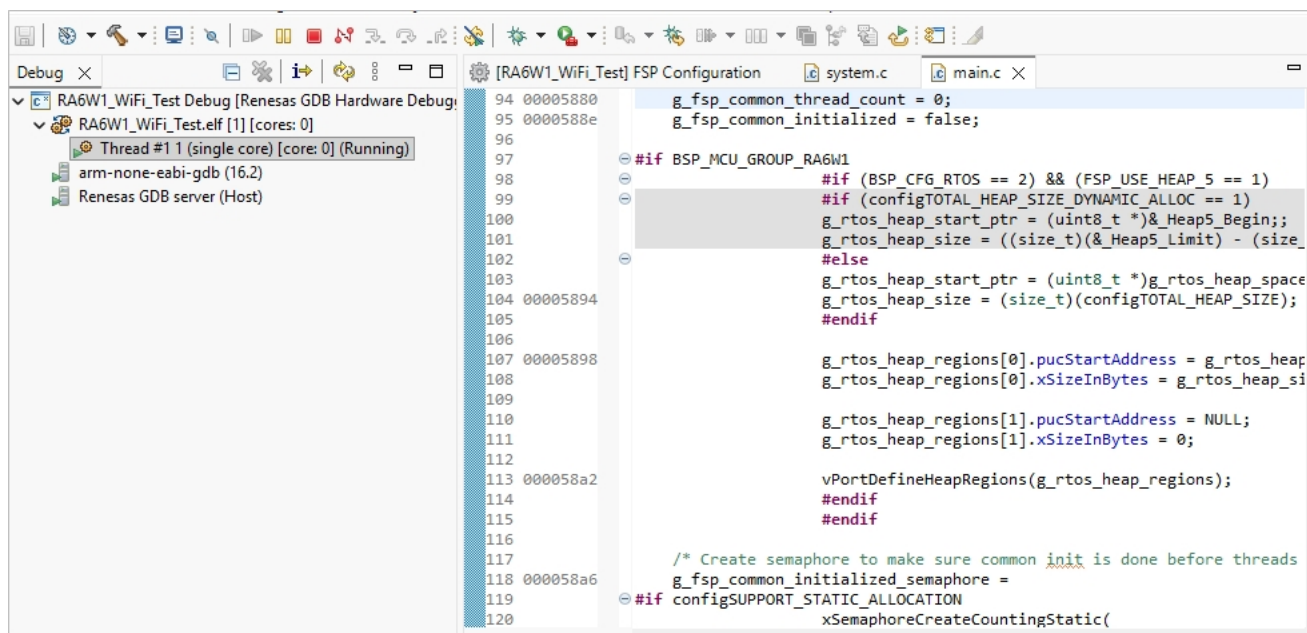


Figure 96. Debug Page

11. By putting a breakpoint in a file you can debug normally using debug interface. Go to C/C++ > Choose a breakpoint > Debug > Resume button.

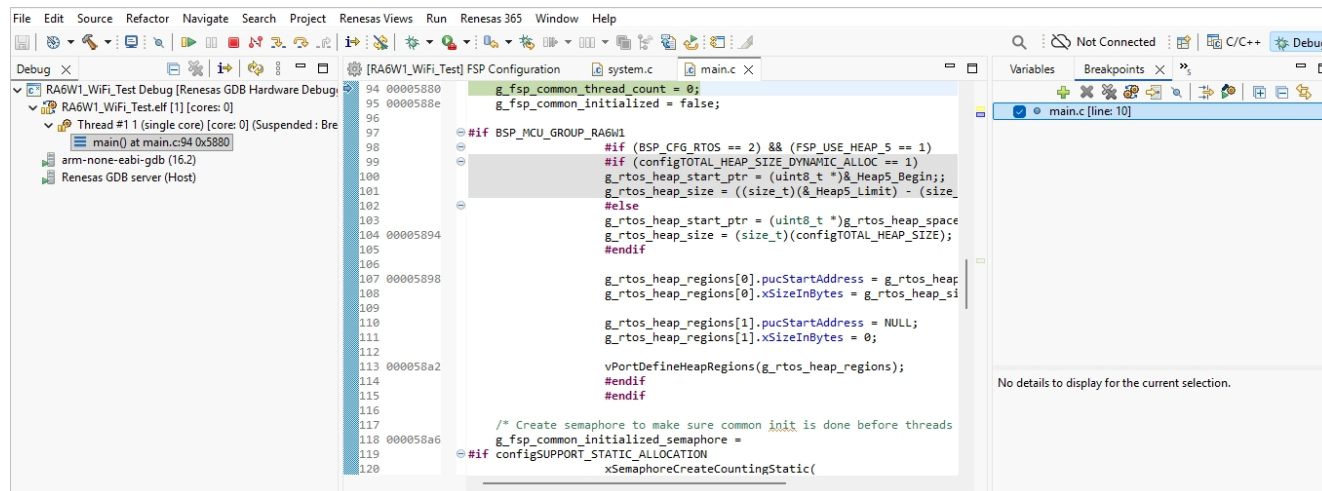


Figure 97. Debug by setting breakpoint

For more details about debugging in e<sup>2</sup> studio, see *JTAG Manual*.

After flashing successfully, for test procedures, see [Section 5 Test Procedures](#).

## 7. Example Projects

Renesas provides several example projects that demonstrate different capabilities of the RAFW MCUs. These example projects can be a good starting point for you to develop custom applications.

Example projects (source code and project files) for RA6W1 are available in the RAFW FSP Examples GitHub. The link to GitHub is available on the Software and Tools section of RA6W1 web page

(<https://www.renesas.com/en/products/ra6w1>):

- Download and extract the example projects bundle (xxxxxxxxxxxxxxxx-ek-ra6w1-exampleprojects.zip) to a local directory on the host PC.
- Go to the desired example project (for example: adc\_ek\_ra6w1\_ep) in the example projects bundle (xxxxxxxxxxxxxxxx-ek-ra6w1-exampleprojects\ek\_ra6w1-exampleprojects\example\_projects\ek\_ra6w1\adc\_ek\_ra6w1\_ep).
- For help on using example projects, see readme file with project.
- The archived versions of the source code of the example projects are available in the example project repository.

## Appendix A Configuration Modes Setup

### A.1 Set up Soft AP Mode

Soft AP mode allows you to provision the RA6W1 through the Wi-Fi interface using a mobile application and configure it by running the Easy Setup Wi-Fi configuration wizard.

To configure the RA6W1 for operating in Soft AP mode:

1. Open the RA6W1 debug console and run the `setup` command in the `[/RA6W1-RRQ61001] #` prompt.
2. To complete the setup, complete the following prompts:

```

[/RA6W1-RRQ61001] #setup // Start the Easy Setup Wizard.

Stop all services for the setting.
Are you sure ? [Yes/No] : Y // Enter Y to stop the running services.

[RA6W1 -RRQ61001 EASY SETUP - V4]

Country Code List:
AD AE AF AI AL AM AR AS AT AU AW AZ BA BB BD BE BF BG BH BL
BM BN BO BR BS BT BY BZ CA CF CH CI CL CN CO CR CU CX CY CZ
DE DK DM DO DZ EC EE EG ES ET EU FI FM FR GA GB GD GE GF GH
GL GP GR GT GU GY HK HN HR HT HU ID IE IL IN IR IS IT JM JO
JP KE KH KN KP KR KW KY KZ LB LC LI LK LS LT LU LV MA MC MD
ME MF MH MK MN MO MP MQ MR MT MU MV MW MX MY NG NI NL NO NP
NZ OM PA PE PF PG PH PK PL PM PR PT PW PY QA RE RO RS RU RW
SA SE SG SI SK SN SR SV SY TC TD TG TH TN TR TT TW TZ UA UG
UK US UY UZ VA VC VE VI VN VU WF WS YE YT ZA ZW ALL

COUNTRY CODE ? [Quit] (Default KR) : US // Enter the country code.

SYSMODE(WLAN MODE) ?
  1. Station
  2. Soft-AP
  3. WiFi Direct
  4. WiFi Direct P2P GO Fixed
  5. Station & Soft-AP
MODE ? [1/2/3/4/5/Quit] (Default Station) : 2 // Enter 2 for Soft-AP mode.
BAND ?
  1. 2.4 GHz
  2. 5 GHz
MODE ? [1/2/Quit] (Default 1. 2.4 GHz) : 1 // Enter 1 for 2.4 Band.
[ SOFT-AP CONFIGURATION ]

SSID ? (Default RA6W1-RRQ61001_B0A977) : TEST_AP // Enter the SSID name.

CHANNEL ? [1~11, Auto:0/Quit] (Default Auto) : // Enter to select Auto channel selection.

AUTHENTICATION ?
  1. OPEN // No authentication or encryption; any
device can connect
  2. WEP(Unsupported) // Legacy and insecure encryption; not
recommended
  3. WPA-PSK // Uses shared password; better than WEP
but outdated
  4. WPA2-PSK // Strong AES-based security with shared
password
  5. WPA/WPA2-PSK // Mixed mode for WPA and WPA2 client
compatibility
  6. WPA3-SAE (WPA3-Personal) // Modern secure authentication; resistant

```

```
to brute-force
    7. WPA2-PSK+WPA3-SAE (Recommend)           // Mixed mode for WPA2 and WPA3
compatibility
    8. WPA3-OWE                               // Encrypted open network without password
(OWE)

AUTHENTICATION ? [1/3/4/5/6/7/8/Quit] : 4      // Enter 4 to select WPA2-PSK authentication.

PSK-KEY(ASCII characters 8~63 or Hexadecimal characters 64) ? [Quit]
12345678                                     // Enter the password for the AP.

Do you want to set advanced WiFi configuration ? [No/Yes/Quit] (Default No) : N // Enter N to
skip this step.

=====
BAND      : 2.4 GHz
SSID      : TEST_AP
CHANNEL   : AUTO(ACS)
Security  : WPA2PSK
ENCRYPTION : AES(CCMP)
Password  : 12345678
WIFI MODE : 11b/g/n (2.4 GHz)
PMF       : Default
WIFI CONFIGURATION CONFIRM ? [Yes/No/Quit] : Y // Enter Y to confirm the WIFI
configuration.

IP ADDRESS ? [Quit] (Default 10.0.0.1) :      // Enter to select the default IP Address. An
IP address is a unique identifier assigned to a device so it can communicate on a network.

SUBNET ? [Quit] (Default 255.255.255.0) :     // Enter to select the default Subnet. A
subnet is a smaller division of a network used to organize and manage IP addresses efficiently.

GATEWAY ? [Quit] (Default 10.0.0.1) :         // Enter to select the default Gateway. A
gateway is a device that connects a local network to other networks, such as the internet.
=====
[WLAN1]
IP ADDRESS: 10.0.0.1
SUBNET    : 255.255.255.0
GATEWAY   : 10.0.0.1
=====
IP CONFIGURATION CONFIRM ? [Yes/No/Quit] : Y // Enter Y to confirm the IP
configuration.

DHCP SERVER CONFIGURATION ? [Yes/No/Quit] : Y // Enter Y to confirm the DHCP Server
configuration. DHCP automatically assigns IP addresses and network settings to devices on a
network.

DHCP SERVER LEASE IP Count(MAX 10) ? [Quit] (Default 10) :
// Enter to select the default Lease Count.

DHCP SERVER LEASE TIME(60 ~ 86400 SEC) ? [Quit] (Default 1800) :
// Enter to select the default Lease Time.
=====
[DHCP SERVER]
Start IP  : 10.0.0.2
END IP    : 10.0.0.11
LEASE TIME: 1800
=====
```

```

DHCP SERVER CONFIGURATION CONFIRM ? [Yes/No/Quit] : Y //Enter Y to confirm the configuration.

[/RA6W1-RRQ61001] # >>> wpa_supplicant_deinit ...
[wpa_supplicant_deinit_iface] CTRL-EVENT-TERMINATING
>>> Request Supplicant start
>>> Renesas RA6W1-RRQ61001 wpa_supplicant 2.10 - Sep/2023
>>> Add SoftAP Interface (softap1) ...
>>> MAC address (softap1) : 74:90:50:b0:a9:77
[init_net_ifaces]: Switching WiFi mode to: Soft-AP
[init_net_ifaces]: Setting up AP (wlan1)
Stop DHCP Server

INFO: DHCP Server is not running.
Start DHCP Server
>>> AP Operating Channel: AUTO

>>> DHCP Server Started

Soft-AP is Ready (74:90:50:b0:a9:77)

```

When all settings are completed, the configuration is saved, and the system reboots. Then, the **Soft AP mode started successfully** message appears.

When a station gets connected successfully, **AP-STA-CONNECTED** with M address of station message is printed.

```

AP-STA-CONNECTED fa:87:d8:62:3d:a1

```

## A.2 Set up EVK for Station plus Soft AP Mode

To configure the RA6W1 for operating in Station + Soft AP mode:

1. Open the RA6W1 debug console and run the setup command in the [/RA6W1-RRQ61001Y] prompt.
2. To complete the setup, complete the following prompts:

```

[/RA6W1 -RRQ61001] # setup

Stop all services for the setting.
Are you sure ? [Yes/No] : y

[RA6W1 -RRQ61001 EASY SETUP - V4]

Country Code List:
AD AE AF AI AL AM AN AR AS AT AU AW AZ BA BB BD BE BF BG BH
BL BM BN BO BR BS BT BY BZ CA CF CH CI CL CN CO CR CU CX CY
CZ DE DK DM DO DZ EC EE EG ES ET EU FI FM FR GA GB GD GE GF
GH GL GP GR GT GU GY HK HN HR HT HU ID IE IL IN IR IS IT JM
JO JP KE KH KN KP KR KW KY KZ LB LC LI LK LS LT LU LV MA MC
MD ME MF MH MK MN MO MP MQ MR MT MU MV MW MX MY NG NI NL NO
NP NZ OM PA PE PF PG PH PK PL PM PR PY QA RE RO RS RU
RW SA SE SG SI SK SN SR SV SY TC TD TG TH TN TR TT TW TZ UA
UG UK US UY UZ VA VC VE VI VN VU WF WS YE YT ZA ZW ZZ

COUNTRY CODE ? [Quit] (Default KR, ZZ : for debug) : us

SYSMODE(WLAN MODE) ?

```

```

1. Station
2. Soft-AP
3. WiFi Direct
4. WiFi Direct P2P GO Fixed
5. Station & Soft-AP
MODE ? [1/2/3/4/5/Quit] (Default Station) : 5
BAND ?
1. 2.4 GHz
2. 5 GHz
3. AUTO
MODE ? [1/2/3/Quit] (Default 3. AUTO) : 1
[ STATION CONFIGURATION ]
=====
[NO] [SSID] [SIGNAL] [CH] [SECURITY]
-----
[ 0] WiFi_Net_2.4G -26 6 WPA2-ENT
[ 1] RenesasMatter -26 10 WPA2
[ 2] REL-GLOBAL -27 6 WPA2-ENT
[ 3] NETGEAR81 -36 3 WPA2
[ 4] GGG_AP_2G -36 11 WPA2
-----
[Enter] Rescan
=====
Select SSID ? (1~5/M1~M5/Manual/Quit) : 1

PSK-KEY(ASCII characters 8~63 or Hexadecimal characters 64) ? [Quit]
[123456789|123456789|123456789|123456789|123456789|123456789|1234]
:*****

Do you want to set advanced WiFi configuration ? [No/Yes/Quit] (Default No) : n

BAND : 2.4 GHz
SSID : RenesasMatter
Security : WAP2PSK
ENCRYPTION : TKIP/AES(CCMP)
Password :*****
PMF : Default
=====
WIFI CONFIGURATION CONFIRM ? [Yes/No/Quit] : y

IP Connection Type ? [Automatic IP/Static IP/Quit] : a
IP Connection Type: Automatic IP

IP CONFIGURATION CONFIRM ? [Yes/No/Quit] : y

SNTP Client enable ? [Yes/No/Quit] : n

[ SOFT-AP CONFIGURATION ]

SSID ? (Default RA6W1 -RRQ61001_B0A977) : TEST_AP // Enter the SSID name.

AUTHENTICATION ?
1. OPEN // No authentication or encryption; any
device can connect
2. WEP(Unsupported) // Legacy and insecure encryption; not
recommended
3. WPA-PSK // Uses shared password; better than WEP
but outdated
4. WPA2-PSK // Strong AES-based security with shared

```

```

password
    5. WPA/WPA2-PSK // Mixed mode for WPA and WPA2 client
compatibility
    6. WPA3-SAE (WPA3-Personal) // Modern secure authentication; resistant
to brute-force
    7. WPA2-PSK+WPA3-SAE (Recommend) // Mixed mode for WPA2 and WPA3
compatibility
    8. WPA3-OWE // Encrypted open network without password
(OWE)
AUTHENTICATION ? [1/3/4/5/6/7/8/Quit] : 4 // Enter 4 to select WPA2-PSK authentication.

PSK-KEY(ASCII characters 8~63 or Hexadecimal characters 64) ? [Quit]
12345678 // Enter the password for the AP.

Do you want to set advanced WiFi configuration ? [No/Yes/Quit] (Default No) : N
// Enter N to skip this step.
=====
BAND : 2.4 GHz
SSID : TEST_AP
Security : WPA2PSK
ENCRYPTION : AES(CCMP)
Password : 12345678
PMF : Default
WIFI CONFIGURATION CONFIRM ? [Yes/No/Quit] : Y // Enter Y to confirm the WIFI
configuration.

IP ADDRESS ? [Quit] (Default 10.0.0.1) : // Enter to select the default IP Address.

SUBNET ? [Quit] (Default 255.255.255.0) : // Enter to select the default Subnet.

GATEWAY ? [Quit] (Default 10.0.0.1) : // Enter to select the default Gateway.
=====
[WLAN1]
IP ADDRESS: 10.0.0.1
SUBNET : 255.255.255.0
GATEWAY : 10.0.0.1
=====
IP CONFIGURATION CONFIRM ? [Yes/No/Quit] : Y // Enter Y to confirm the IP
configuration.

DHCP SERVER CONFIGURATION ? [Yes/No/Quit] : Y // Enter Y to confirm the DHCP Server
configuration.

DHCP SERVER LEASE IP Count(MAX 10) ? [Quit] (Default 10) :
// Enter to select the default Lease Count.

DHCP SERVER LEASE TIME(60 ~ 86400 SEC) ? [Quit] (Default 1800) :
// Enter to select the default Lease Time.
=====
[DHCP SERVER]
Start IP : 10.0.0.2
END IP : 10.0.0.11
LEASE TIME: 1800
=====

DHCP SERVER CONFIGURATION CONFIRM ? [Yes/No/Quit] : Y // Enter Y to confirm the
configuration.

[/RA6W1-RRQ61001] # >>> wpa_supplicant_deinit ...

```

```

[wpasupplicant_deinit_iface] CTRL-EVENT-TERMINATING
>>> Request Supplicant start
>>> Renesas RA6W1-RRQ61001 wpasupplicant 2.10 - Sep/2023
>>> MAC address (sta0) : 74:90:50:b0:a9:76
>>> Add SoftAP Interface (softap1) ...
>>> MAC address (softap1) : 74:90:50:b0:a9:77

>>> Start STA & SOFT-AP Concurrent mode...
[init_net_ifaces]: Switching WiFi mode to: Station & Soft-AP
[init_net_ifaces]: Setting up Concurrent mode (AP + STA)
Stop DHCP Server

INFO: DHCP Server is not running.
Start DHCP Server
>>> AP Operating Channel: 11(2462)

Soft-AP is Ready (74:90:50:b0:a9:77)

>>> DHCP Server Started

Connection COMPLETE to 34:0a:33:78:e5:68

>>> Network Interface (wlan0) : UP
    Assigned addr   : 192.168.0.104
    netmask         : 255.255.255.0
    gateway         : 192.168.0.1
    DHCP Server IP  : 192.168.0.1
    Lease Time      : 08h 00m 00s
    Renewal Time    : 04h 00m 00s

```

When all settings are completed, the configuration is saved, and the **"Start STA & SOFT-AP Concurrent mode"** message appears.

### A.3 Set up Station Mode with DPM Enabled

Dynamic Power Management (DPM) is a synthesis of breakthrough in ultra-low-power technologies that enable extremely low-power operation of the RA6W1. DPM shuts down all microelements on the chip when not in use, which allows a near zero level of power consumption when not actively transmitting or receiving data. DPM also enables Ultra-low-power Transmit and Receive modes when the MCU needs to be awake to exchange information with other devices. Advanced algorithms enable the device to stay asleep until the exact required moment to wake up to Transmit or Receive mode.

For more details about DPM, see *PMGR DPM Application Note*.

By default, the DPM functionality is enabled upon the device's connection to an Access Point. This can be reconfigured by running the Easy Setup Wi-Fi configuration wizard. DPM allows for considerably reduced power consumption by periodically entering various sleep modes when full functionality is not required.

To configure the RA6W1 for operating in Station + DPM mode:

1. Open the RA6W1 debug console and run the setup command in the `[/RA6W1-RRQ61001]` prompt.
2. To complete the setup, complete the following prompts:

```

[/RA6W1 -RRQ61001/dpm] # setup

Stop all services for the setting.
Are you sure ? [Yes/No] : y

```

[ RA6W1 -RRQ61001 EASY SETUP - V4 ]

Country Code List:

AD AE AF AI AL AM AN AR AS AT AU AW AZ BA BB BD BE BF BG BH  
 BL BM BN BO BR BS BT BY BZ CA CF CH CI CL CN CO CR CU CX CY  
 CZ DE DK DM DO DZ EC EE EG ES ET EU FI FM FR GA GB GD GE GF  
 GH GL GP GR GT GU GY HK HN HR HT HU ID IE IL IN IR IS IT JM  
 JO JP KE KH KN KP KR KW KY KZ LB LC LI LK LS LT LU LV MA MC  
 MD ME MF MH MK MN MO MP MQ MR MT MU MV MW MX MY NG NI NL NO  
 NP NZ OM PA PE PF PG PH PK PL PM PR PT PW PY QA RE RO RS RU  
 RW SA SE SG SI SK SN SR SV SY TC TD TG TH TN TR TT TW TZ UA  
 UG UK US UY UZ VA VC VE VI VN VU WF WS YE YT ZA ZW ZZ

COUNTRY CODE ? [Quit] (Default KR, ZZ : for debug) : us

SYSMODE(WLAN MODE) ?

- 1. Station
- 2. Soft-AP
- 3. WiFi Direct
- 4. WiFi Direct P2P GO Fixed
- 5. Station & Soft-AP

MODE ? [1/2/3/Quit] (Default Station) : 1

BAND ?

- 1. 2.4 GHz
- 2. 5 GHz
- 3. AUTO

BAND ? [1/2/3/Quit] (Default 3. AUTO) : 1

[ STATION CONFIGURATION ]

[NO]	[SSID]	[SIGNAL]	[CH]	[SECURITY]
[ 0]	REL-GLOBAL_2.4G	-21	6	WPA2-ENT
[ 1]	WiFi_Net_2.4G	-22	6	WPA2-ENT
[ 2]	REL-GLOBAL	-22	6	WPA2-ENT
[ 3]	WiFi_Public_2.4G	-23	6	WPA2
[ 4]	RenesasMatter	-27	10	WPA2

[Enter] Rescan

Select SSID ? (1~5/M1~M5/Manual/Quit) : 5

PSK-KEY(ASCII characters 8~63 or Hexadecimal characters 64) ? [Quit]  
 :\*\*\*\*\*

Do you want to set advanced WiFi configuration ? [No/Yes/Quit] (Default No) : n

Enable DPM (Dynamic Power Management) ? [Yes/No/Quit] : y

DPM factors : Defaults ? [Yes/No/Quit] : y

```

=====
DPM MODE           : Enable
Keep Alive Time    : 30000 ms
User Wakeup Time   : 0 ms
TIM Wakeup Count   : 10 dtim
=====
    
```

DPM CONFIGURATION CONFIRM ? [Yes/No/Quit] : y

```

=====
BAND      : 2.4 GHz
SSID      : RenesasMatter
Security  : WAP2-PSK
ENCRYPTION : TKIP/AES(CCMP)
Password  : *****
PMF       : Default
=====
WIFI CONFIGURATION CONFIRM ? [Yes/No/Quit] : y

IP Connection Type ? [Automatic IP/Static IP/Quit] : a

IP Connection Type: Automatic IP

IP CONFIGURATION CONFIRM ? [Yes/No/Quit] : y

SNTP Client enable ? [Yes/No/Quit] : n

[/RA6W1-RRQ61001/dpm] #
Connection COMPLETE to 34:0a:33:78:e5:68

>>> Network Interface (wlan0) : UP
    Assigned addr   : 192.168.0.104
       netmask      : 255.255.255.0
       gateway      : 192.168.0.1
    DHCP Server IP  : 192.168.0.1
    Lease Time      : 08h 00m 00s
    Renewal Time    : 06h 40m 00s

>>> Start DPM Power-Down !!!

```

When the RA6W1 is in DPM Sleep mode, user input is not accepted by the debug terminal. To re-enable the input, see [Appendix A.4 Disable DPM Mode](#).

### A.4 Disable DPM Mode

When RA6W1 enters DPM Sleep mode, the debug terminal does not accept the input because the UART interfaces are powered down. To exit this state and restart the setup process, complete the following steps:

1. Copy the string `pmgr add_constraint PMGR_CONSTRAINT_SLEEP_PROHIBITED` to the clipboard. For example, open Notepad, type `pmgr add_constraint PMGR_CONSTRAINT_SLEEP_PROHIBITED`, and then copy (Ctrl+C) the command string.
2. To restart the EVK, use the **RST\_N** button.
3. After restarting, before the message **>>> Start DPM Power-Down !!!** appears on the console, paste the `pmgr add_constraint PMGR_CONSTRAINT_SLEEP_PROHIBITED` string in the terminal window, and press Enter.

When this procedure is done successfully, the UART console responds as normal. If DPM mode does not stop successfully, try the process again:

```

Wakeup source is 0x4

*****
*          RA6W1-RRQ61001 SDK Information
* -----

```

```

*
* - CHIP Name       : RA6W1-RRQ61001 (D3095B)
* - SKU Type       : 0x20, Dual Band (2.4 + 5 GHz) WI-FI 6
* - CPU Type       : Cortex-M33 (160MHz)
* - Kernel Version  : FreeRTOS V11.1.0
* - SFLASH Type    : 8 MB (Renesas AT25SL)
* - SDK Version    : V8.0.3.0.4
* - F/W Version    : RA6W1-RRQ61001-79a76003d0-1
* - Boot Index     : 0
*
*****

```

```

System Mode : Station Only (0)
Network init...OK
>>> Renesas RA6W1-RRQ61001 wpa_supplicant 2.10 - Sep/2023
>>> MAC address (sta0) : 74:90:50:b0:b5:b6
>>> Start STA mode...
pmgr add_constraint PMGR_CONSTRAINT_SLEEP_PROHIBITED //pmgr command
to disable DPM

Connection COMPLETE to 10:7c:61:9a:ca:58

[/RA6W1-RRQ61001/pmgr] #          Assigned addr   : 192.168.50.78
          netmask      : 255.255.255.0
          gateway      : 192.168.50.1
          DHCP Server IP : 192.168.50.1
          Lease Time    : 24h 00m 00s
          Renewal Time  : 20h 00m 00s

```

DPM can be restarted at any time with the `pmgr remove_constraint PMGR_CONSTRAINT_SLEEP_PROHIBITED` command.

## Appendix B AT Command Wi-Fi Provisioning

You can provision the Wi-Fi connection using AT commands through the AT command terminal. For AT command interface configuration, see Section [Section 4.2.3 Configure RA6W1 EVK AT Command Interface](#). To provision a Wi-Fi connection, complete the following steps:

1. To see nearby apps, enable echo output and then initiate a Wi-Fi scan.

```
ATE
```

```
AT+WFSCAN
```

2. Configure the desired Wi-Fi connection with the following command:

- AT+WFJAP=<SSID>,<Security>,<Encryption>,<Passphrase>
  - <SSID>: AP SSID
  - <Security>: Security protocol.  
0 (OPEN), 1 (WEP), 2 (WPA), 3 (WPA2), 4 (WPA+WPA2), 5 (WPA3 OWE), 6 (WPA3 SAE), 7 (WPA2 RSN and WPA3 SAE)
  - <Encryption>:  
0 (TKIP), 1 (AES), 2 (TKIP+AES)
  - <Key>: Passphrase. 8 ~ 63 characters are allowed

Example:

If selecting Dlink\_AP\_24G\_FZ, the configuration selected should be as follows:

- <SSID>: Dlink\_AP\_24G\_FZ
- <Security>: 4 for WPA+WPA2 Security protocol.
- <Encryption>: 2 for TKIP+AES encryption.
- <Key>: 12345678 (password of AP).

The example of the command: AT+WFJAP=Dlink\_AP\_24G\_FZ,4,2,12345678

The RA6W1 reboots and connects to the given SSID, with DPM enabled by default.

The procedure is similar for a 5 GHz connection. In this example, the only changes are to <Security> (changed to WPA3), and <Encryption> (changed to AES).

```
AT+WFJAP=R15-5G,6,1,12345678
```

The additional useful commands for Wi-Fi configuration:

```
AT+WFSTAT // for getting the Wi-Fi configuration.
ATF // for factory reset
```

## Appendix C Flash Using flash\_img\_downloader Script

Programming firmware images to the EVK requires the flash downloader. The flash downloader (flash\_img\_downloader.zip) is provided with binary images (see [Figure 98](#)).

Name	Date modified	Type
binaries	4/15/2024 2:27 PM	File folder
flash_img_downloader_jtag.bat	4/15/2024 11:09 AM	Windows Batch F
flash_img_downloader_jtag_ble.bat	4/15/2024 11:09 AM	Windows Batch F
flash_img_downloader_uart.bat	4/15/2024 11:09 AM	Windows Batch F
flash_img_downloader_uart.sh	4/15/2024 11:09 AM	Shell Script
flash_img_downloader_uart_ble.bat	4/15/2024 11:09 AM	Windows Batch F
flash_img_downloader_uart_ble.sh	4/15/2024 11:09 AM	Shell Script
readme.txt	4/15/2024 11:09 AM	Text Document

Figure 98. Flash downloader

### System requirements:

- OS (Windows 10 64 bit/Ubuntu 20.04 LTS 64 bit).
- Python 3.12.x and pycryptodome package.

### NOTE

Install mandatory python library.

pycryptodome

- For Windows  
Open a Windows command prompt and enter the following commands:  
`python -m pip install pycryptodome`
- For Linux OS  
Open a terminal window and enter the following commands:  
`python -m pip install pycryptodome`

Check python version using `python -version`

Python 3.1.X

To program the firmware image through the UART, you have the following options:

- For Windows, use `flash_img_downloader_uart.bat` batch file.
- For Linux, use `flash_img_downloader_uart.sh` shell script file.
- Hardware: RA6W1 EVK, see [Figure 99](#).



The script finishes programming the firmware image through UART.

```

Writing to address: 0x00000000 offset: 0x001c7000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001c8000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001c9000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001ca000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001cb000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001cc000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001cd000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001ce000 chunk size: 0x00000bf4
done.
end
.....
.. FINISHED
.....

```

Figure 103. Finished programming a firmware image with UART

4. After firmware programming is completed, open the Terminal Emulator and configure Tera Term Serial Terminal Application for Windows, see [Section 4.2.1 Configure Tera Term Serial Terminal Application for Windows](#).
5. Press the Reset button on the EVK.
6. Check the booting status through UART.

## C.1 Program Firmware Images for Windows

```

Wakeup source is 0x4

*****
* RA6W1-RRQ61001 SDK Information
* -----
* - CHIP Name      : RA6W1-RRQ61001 (D3095B)
* - SKU Type      : 0x20, Dual Band (2.4 + 5 GHz) WI-FI 6
* - CPU Type      : Cortex-M33 (160MHz)
* - Kernel Version : FreeRTOS V11.1.0
* - SFLASH Type   : 8 MB (Renesas AT25SL)
* - SDK Version   : V8.0.3.0.4
* - F/W Version   : RA6W1-RRQ61001-79a76003d0-1
* - Boot Index    : 0
*
*****

System Mode : Station Only (0)
Network init..OK
>>> Renesas RA6W1-RRQ61001 wpa_supplicant 2.10 - Sep/2023
>>> MAC address (sta0) : 74:90:50:b0:b5:b6
>>> Start STA mode...

```

Figure 104. Flash boot with downloaded image

## C.2 Program Firmware Images for Linux

To program the firmware image using Linux:

1. Execute the Shell script in the Terminal.

Usage: flash\_img\_downloader\_uart.sh [img full path]

Example: flash\_img\_downloader\_uart.sh <full\_path>/wifi\_test\_ek\_ra6w1\_ep.img

```

developer@TVMA-WKS0193:~/Downloads/flash_img_downloader$ ./flash_img_downloader_uart.sh /home/developer/Downloads/wifi_test_ek_ra6w1_ep.img

```

Figure 105. Run flash downloader with UART

<b>NOTE</b>
While programming, make sure the port of RA6W1 interface should be /dev/ttyUSB0. Also close any other minicom instances of this port to make sure of port availability.

2. If prompted, to start programming the firmware, press the RST\_N (Reset) button on the RA6W1 EVK.

```
Setting serial port baud rate to 115200.
Connecting to device...
Press RESET.
```

Figure 106. Reset RA6W1 EVK

The script finishes programming the firmware image through UART.

```
Writing to address: 0x00000000 offset: 0x001cb000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001cc000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001cd000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001ce000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001cf000 chunk size: 0x00001000
Writing to address: 0x00000000 offset: 0x001d0000 chunk size: 0x000001cc
done.
end
.....
..
.. FINISHED!
..
.....
```

Figure 107. Finished programming a firmware image with UART

3. After firmware programming completes, open the Terminal Emulator and configure as in [Section 4.2.2 Configure Minicom for Linux](#).
4. On the EVK, press the **Reset** button.
5. Check the booting status through UART.

```
Wakeup source is 0x4

*****
* RA6W1-RRQ61001 SDK Information
* -----
*
* - CHIP Name      : RA6W1-RRQ61001 (D3095B)
* - SKU Type       : 0x20, Dual Band (2.4 + 5 GHz) WI-FI 6
* - CPU Type       : Cortex-M33 (160MHz)
* - Kernel Version : FreeRTOS V11.1.0
* - SFLASH Type    : 8 MB (Renesas AT25SL)
* - SDK Version    : V8.0.3.0.4
* - F/W Version    : RA6W1-RRQ61001-79a76003d0-1
* - Boot Index     : 0
*
*****

System Mode : Station Only (0)
Network init...OK
>>> Renesas RA6W1-RRQ61001 wpa_supplicant 2.10 - Sep/2023
>>> MAC address (sta0) : 74:90:50:b0:b5:b6
>>> Start STA mode...
```

Figure 108. Flash boot with downloaded image

## Appendix D Python Integration in e<sup>2</sup> studio Windows

If Python 3 is already installed and it is not showing in the e<sup>2</sup> studio terminal, follow the steps:

1. In Windows, go to **Apps > Advanced app settings > App execution aliases > python3.exe**.

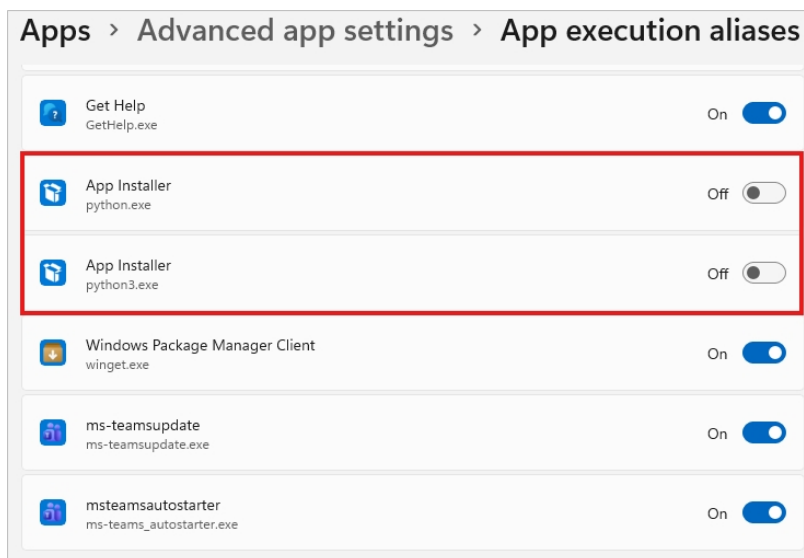


Figure 109. Application execution aliases

2. Create a `python3.bat` file with the following script.

```
@echo off  
python %*
```

3. Copy the `python3.bat` file to the already existing python3 installation location.

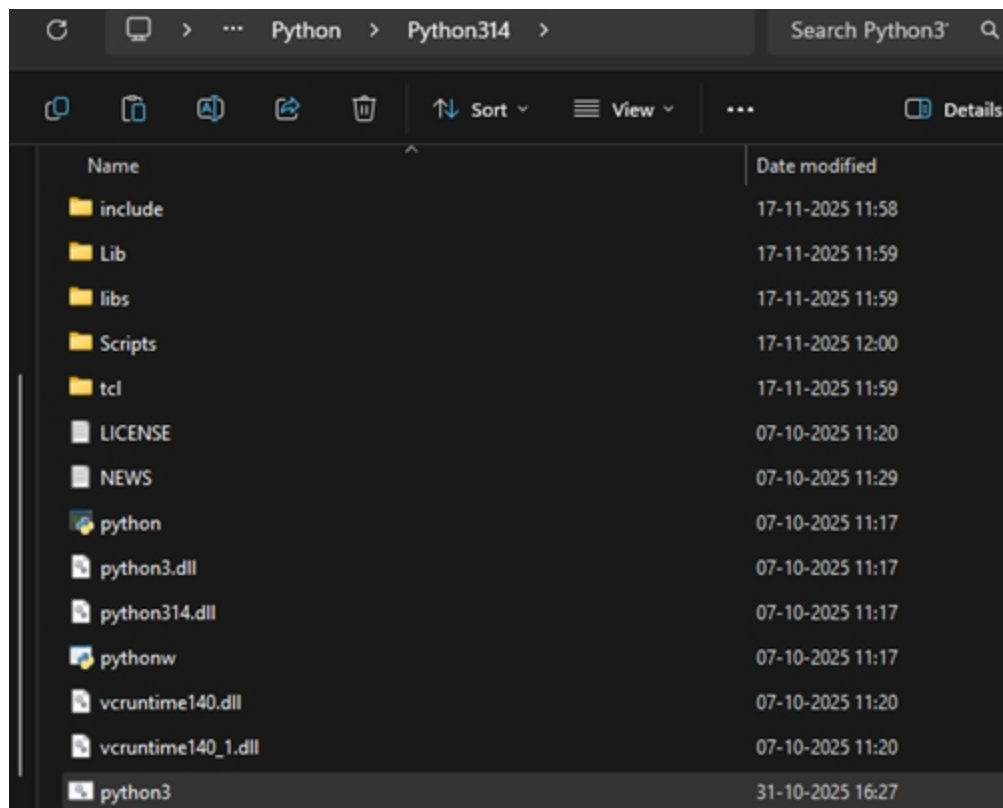


Figure 110. Python3 Installation folder

- Restart e<sup>2</sup> studio and check if Python 3 is properly integrated using the below command.

```
python3 --version
```

## Appendix E SFlash Memory Maps

This section describes the memory maps for the external SFlash device and how to change the SFlash device memory map used in the SDK.

### NOTE

The RA6W1 SDK currently supports the following SFlash types:

- **8-MB SFlash**

- Renesas - AT25SL641

To use a different type of SFlash with the RA6W1, contact Renesas Electronics to confirm compatibility.

The RA6W1 SDK supports 8-MB SFlash.

**Table 5. 8-MB SFlash map for RA6W1**

Address	Name	Description	Size (kB)
0x0000_0000	Product Header		4
0x0000_1000	Product Header - Backup		4
0x0000_2000	RTOS #0	(64*1024 * 40)	2560
0x0028_2000	Reserved	RTOS binary size – Expandable area	508
0x0030_0000	NVRAM	NVRAM VEE Segment #1	40
0x0030_A000	NVRAM	Backup (Multiplier 8)	280
0x0035_0000	TLS_Cert_Base		704
0x0035_0000	TLS Certificate WPA_Enterprise	CA	4 or Unused
0x0035_1000		Cert	4 or Unused
0x0035_2000		Private key	4 or Unused
0x0035_3000		Diffie-Hellmann key	4 or Unused
0x0035_4000	TLS Certificate OTA_Update	CA	4 or Unused
0x0035_5000		Cert	4 or Unused
0x0035_6000		Private key	4 or Unused
0x0035_7000		Diffie-Hellmann key	4 or Unused
0x0035_8000	TLS Certificate HTTPs Client	Cert	4 or Unused
0x0035_9000		Private key	4 or Unused
0x0035_A000		Diffie-Hellmann key	4 or Unused
0x0035_B000		CA	4 or Unused
0x0035_C000	TLS Certificate HTTPs Server	Cert	4 or Unused
0x0035_D000		Private key	4 or Unused
0x0035_E000		Diffie-Hellmann key	4 or Unused
0x0035_F000		Cert	4 or Unused
0x0036_0000	TLS Certificate MQTTs Client	Cert	4 or Unused
0x0036_1000		Private key	4 or Unused
0x0036_2000		Diffie-Hellmann key	4 or Unused
0x0036_3000		CA	4 or Unused
0x0036_4000	TLS Certificate AT-CMD #0 ~ #15	AT command TLS Certificate Key #0 ~ #15	64 or Unused
0x0037_4000	TLS Certificate AWS		20 or Unused
0x0037_9000	TLS Certificate Matter		20 or Unused
0x0037_E000	TLS Certificate MISC1		20 or Unused
0x0038_3000	TLS Certificate MISC2		20 or Unused

Address	Name	Description	Size (kB)
0x0038_8000	TLS Certificate MISC3		20 or Unused
0x0038_D000	TLS Certificate MISC4		20 or Unused
0x0039_2000	TLS Certificate MISC5		20 or Unused
0x0039_7000	TLS Certificate MISC6		20 or Unused
0x0039_C000	TLS Certificate MISC7		20 or Unused
0x003A_1000	TLS Certificate MISC8		20 or Unused
0x003F_E000	Secure Asset Product Area		4 or Unused
0x0040_0000	RTOS #1	(64*1024 * 40)	2560
0x0068_0000	Reserved	RTOS binary size – Expandable area	512
0x0070_0000	User Area #1		1020
0x007F_F000	Partition Table		4

## 8. Revision History

Revision	Date	Description
1.05	Apr 28, 2026	<ul style="list-style-type: none"> <li>■ Updated e<sup>2</sup>studio installation steps for 2025-12 version.</li> <li>■ Updated RFP version to 3.22.</li> <li>■ Updated SFlash memory maps.</li> </ul>
1.04	Mar 26, 2026	Updated the AT Command Jumper Configuration section.
1.03	Nov 28, 2025	Updated Mother-Board to RevE. Updated sections about EVK and its setup, test procedures, SDK and build setup. Added appendix about Python integration.
1.02	Aug 31, 2025	Updated sections about programming firmware images, station mode, SDK and bild setup, and flash_img_downloader.
1.01	May 30, 2025	<ul style="list-style-type: none"> <li>■ Updated sections about measuring Sleep 1 current consumption and SFlash memory maps.</li> <li>■ Changed the chip name from RRQ61000 to RA6W1.</li> </ul>
1.00	Mar 13, 2025	First release.

### Status Definitions

Status	Definition
DRAFT	The content of this document is under review and subject to formal approval, which may result in modifications or additions.
APPROVED or unmarked	The content of this document has been approved for publication.

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#### Corporate Headquarters

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

[www.renesas.com](http://www.renesas.com)

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