This quick start guide explains the process of running the Quick-Connect IoT DA16600 (Wi-Fi BLE) Provisioning demo on an EK-RA6M4. The demo demonstrates provisioning the DA16600 module to a Wi-Fi network using the BLE interface and reading temperature and humidity data from the HS3001 sensor into the RA6M4 microcontroller.

A smartphone application is used to provision the DA16600 module to an existing Wi-Fi network using the BLE interface. A web browser is then used to display the temperature and humidity data read from the HS3001 sensor. Instructions for loading the example project are included at the end of the document as a next step after running the demo.

Target Devices
- RA6M4 MCU (R7FA6M4AF3CFB)
- HS3001 Temperature / Humidity Sensor (HS3001)
- DA16600 Wi-Fi BLE Module (DA16600MOD)

Contents
1. Kit Contents .................................................................................................................................................. 2
   1.1 Hardware Components .......................................................................................................................... 2
   1.2 Software Components .......................................................................................................................... 3
2. Features ......................................................................................................................................................... 3
3. Overview ........................................................................................................................................................ 3
4. Build Environment ........................................................................................................................................ 4
5. Building and Downloading .......................................................................................................................... 4
6. Preparing the Demo ....................................................................................................................................... 5
   6.1 Download the Smartphone Application ............................................................................................... 5
   6.2 Obtain Wi-Fi Network Details ............................................................................................................. 5
   6.3 Status Indication ................................................................................................................................... 5
   6.4 Start the Hardware ................................................................................................................................... 5
7. Running the Demo ........................................................................................................................................ 6
   7.1 Provision Module to Wi-Fi Network ....................................................................................................... 6
   7.1 View Sensor Data ................................................................................................................................... 8
   7.2 Resetting the Demo .............................................................................................................................. 8
8. Starting Development with the Application Project .................................................................................. 8
9. Reference Documents .................................................................................................................................. 9
10. Revision History ........................................................................................................................................ 9
1. Kit Contents

To set up this demo, the following components are needed. Please ensure the Pmod™ boards are connected in the correct order, including on the correct Pmod ports. Connect the micro USB cable between the EK-RA6M4 MCU development board and the Windows PC.

1.1 Hardware Components

- EK-RA6M4 (RTK7EKA6M4S00001BE)
- HS3001 Pmod (US082-HS3001EVZ)
- Pmod Interposer Board (US082-INTERPEVZ)
- DA16600MOD Wi-Fi Bluetooth LE Combo Pmod (US159-DA16600MEVZ)
- Micro USB cable
1.2 Software Components

The following software is required. The demo and application projects are both contained inside the Quick_Connect_IoT_DA16600_Provisioning_Demo.zip file that accompanies this document.

<table>
<thead>
<tr>
<th>Category</th>
<th>Item</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>e² studio project</td>
<td>Quick_Connect_IoT_DA16600_Provisioning_Demo.zip</td>
<td>Project can be directly imported to e² studio and the FSP (v4.5 and higher).</td>
</tr>
<tr>
<td>Mobile App</td>
<td>Renesas Wi-Fi Provisioning Tool for iOS</td>
<td>Apps available globally on Google Play and Apple App Store.</td>
</tr>
<tr>
<td></td>
<td>Renesas Wi-Fi Provisioning Tool for Android</td>
<td></td>
</tr>
</tbody>
</table>

2. Features

- System power supplied by micro USB cable
- RA6M4 MCU reads measured data from HS3001 temperature and humidity sensor
- BLE connectivity provided by DA16600 allows easy provisioning to Wi-Fi networks
- Wi-Fi connectivity allows the web browser to display raw humidity and temperature values

3. Overview

The DA16600 Module contains both Wi-Fi and Bluetooth LE radios. A typical use case for such a module is to use the Bluetooth LE interface to quickly and easily join (provision) the Wi-Fi radio to an existing network. This demonstration uses an app running on a smartphone to provision the DA16600 module to an existing Wi-Fi network by using the Bluetooth LE interface to select the network and enter the password.

After the DA16600 is provisioned to the network, the RA6M4 Microcontroller reads temperature and humidity data via the HS3001 sensor and embeds this information into a simple webpage. This data can be displayed by connecting a PC to the same Wi-Fi network as the DA16600 and then using a web browser to view the webpages served by the RA6M4 Microcontroller.
4. Build Environment

The example application was developed using the following environment.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDE</td>
<td>e² Studio 2023-04</td>
</tr>
<tr>
<td>C Compiler</td>
<td>GCC ARM Embedded 10.3.1.20210824</td>
</tr>
<tr>
<td>FSP</td>
<td>4.5.0</td>
</tr>
<tr>
<td>RTOS</td>
<td>None</td>
</tr>
<tr>
<td>Emulator</td>
<td>On board (J-LINK)</td>
</tr>
</tbody>
</table>

If this environment is not already installed, see the [Official Renesas RA Family Beginner's Guide](#) for complete installation instructions.

5. Building and Downloading

When the build environment is installed, import the project contained within the zip file into e² Studio and build the Debug or Release targets. Then, load the application onto the EK-RA6M4 board using the debugger. If you are not familiar with the build/debug process, see sections 5, 7 and 8 in the [Official Renesas RA Family Beginner's Guide](#).
6. Preparing the Demo

6.1 Download the Smartphone Application

The DA16600 module is provisioned to a Wi-Fi network using a smartphone application that is available on the Apple App and Google Play stores. This app can be downloaded using the following QR code links:

6.2 Obtain Wi-Fi Network Details

You will need to know the SSID and password of the Wi-Fi network to which you want to provision the DA16600 module. When you have this information, keep them at hand because they are required in the next section.

6.3 Status Indication

The red, green, and blue LEDs on the EK-RA6M4 evaluation kit board indicate the status of the demo software as follows:

<table>
<thead>
<tr>
<th>LED State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Device is booting.</td>
</tr>
<tr>
<td></td>
<td>Device is waiting to be provisioned to a Wi-Fi network.</td>
</tr>
<tr>
<td></td>
<td>Device is provisioned and waiting to join a Wi-Fi network.</td>
</tr>
<tr>
<td></td>
<td>Device is provisioned and connected to a Wi-Fi network.</td>
</tr>
<tr>
<td></td>
<td>Device is provisioned, connected to a Wi-Fi network, and a TCP client is connected.</td>
</tr>
<tr>
<td></td>
<td>An error has occurred; check boards are connected correctly and restart.</td>
</tr>
</tbody>
</table>

6.4 Start the Hardware

Apply power to the EK-RA6M4; the red, green, and blue LEDs should illuminate for a few seconds while the device boots. When completed, the red LED should begin to blink indicating the demo is ready to be provisioned to a Wi-Fi network.
7. Running the Demo

7.1 Provision Module to Wi-Fi Network

Open the Wi-Fi Provisioning Tool application on your smartphone and then perform the following steps.

*Note:* The following instructions are based on the use of an iOS device. When using an Android device the interface may appear different.

**Step 1:** Start the Wi-Fi Provisioning Tool and select the **Start DA1600-based** option.

**Step 2:** Press the **Start** button to begin scanning the DA16600 device.

**Step 3:** Devices discovered during the scan are listed in the display.

**Step 4:** When the scan is complete press the **Connect** button next to the DA16600-xxxx device.

**Step 5:** When connected press the **Start Wi-Fi network scan** button to start searching for a Wi-Fi network to join.

**Step 6:** The DA16600 starts searching for available Wi-Fi networks.
Step 7: Select the Wi-Fi network you want the DA16600 to join.

Step 8: Enter the password for the Wi-Fi network then press OK.

Step 9: Connect the DA16600 device to the select Wi-Fi network by pressing the Connect to xxx button.

Step 10: The DA16600 attempts to connect to the select network. This might take up to 1 minute.

Step 11: When connected to the Wi-Fi network, press Complete to finish the process.

Step 12: When provisioning is completed, the red LED on the EK-R4M4 EK turns on. It turns green when the DA16600 has connected to the Wi-Fi network.
7.1 View Sensor Data

Now that the DA16600 Module has been provisioned to a Wi-Fi network, the sensor data can be read using a web browser as follows:

1. Discover the IP Address of the DA16600. To do this, log in to the Wi-Fi AP that the DA16600 joined and determine what IP address it has been assigned. The assigned IP address is also output using the serial debug interface and can be viewed using the Segger J-Link RTT Viewer.

2. Use a web browser to access the sensor data. When the browser has connected to the DA16600, the blue LED on the EK-RA6M4 turns on.

3. Press the S1 button on the EK-RA6M4 and the value displayed in the Button Push Count field increments.

7.2 Resetting the Demo

When provisioned, the DA16600 stores information about the Wi-Fi network it has joined in non-volatile memory, allowing it to re-join the network if it is reset or the power is turned off and on. If you want to provision the DA16600 to a different Wi-Fi network, this information must be erased. This can be achieved using the following procedure:

1. Press and hold button S2 on the EK-RA6M4 board.

2. Press and release the reset button (S3) on the EK-RA6M4 board.

3. Release button S2 on the EK-RA6M4 board. The RED led on the EK-RA6M4 should now be flashing, indicating the DA16600 is not provisioned.

8. Starting Development with the Application Project

The source code used to create the demo project is also included in the zip bundle. This project can be imported into the RA Flexible Software Package (FSP), version 4.5 or higher. The FSP must be downloaded and installed on a Windows or Linux machine. The e2 studio IDE is included as part of the FSP install. For more information on the FSP and how it can be downloaded and installed to your local machine, see the resource links in the following section.
9. Reference Documents

- Renesas Quick-Connect
- Renesas RA6M4 MCU
- EK-RA6M4
- Renesas RA Flexible Software Package (FSP)
- Renesas DA16600MOD
- Renesas HS3001
- Technical Updates / News - The latest information can be downloaded from the Renesas Electronics Website.

Website and Support:

- Renesas Electronics
- Inquiries

10. Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.00</td>
<td>Sep 6, 2023</td>
<td>Updated to be compatible with FSP 4.5.0 and latest version of Wi-Fi Provisioning Tool.</td>
</tr>
<tr>
<td>1.00</td>
<td>Jul 5, 2022</td>
<td>Initial release.</td>
</tr>
</tbody>
</table>
IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers skilled in the art designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only for development of an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising out of your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Disclaimer Rev.1.0 Mar 2020)

Corporate Headquarters
TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact Information
For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/

Trademarks
Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

© 2023 Renesas Electronics Corporation. All rights reserved.
Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.

2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.

3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.

4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.

5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.

6. Renesas Electronics products are classified according to the following two quality grades: “Standard” and “High Quality”. The intended applications for each Renesas Electronics product depend on the product’s quality grade, as indicated below.

   “Standard”: Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliance; machine tools; personal electronic equipment; industrial robots; etc.

   “High Quality”: Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

   Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations, etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user’s manual or other Renesas Electronics document.

7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS EXPRESSLY DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO ANY SECURITY FEATURES, OR ANY OTHER SECURITY RELATED PHASES, WITH REGARD TO COMPANY PRODUCTS AND FACILITIES.

8. When using Renesas Electronics products, refer to the latest product information (data sheets, user’s manuals, application notes, “General Notes for Handling and Using Semiconductor Devices” in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.

9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.

10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.

11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.

12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.

13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.

14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

(Rv.5.0-1 October 2020)

Corporate Headquarters
TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact Information
For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact

Trademarks
Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

© 2023 Renesas Electronics Corporation. All rights reserved.