

RX65N-2MB Group

RYZ024A PMOD LTE Connectivity with
RX65N MCU
Quick Start Guide

Renesas RX Family
RX600 Series

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1. Precaution against Electrostatic Discharge (ESD)

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

2. Processing at power-on

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

3. Input of signal during power-off state

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

4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

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Precautions

This Starter Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area, or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.

The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

- Ensure attached cables do not lie across the equipment.
- Reorient the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that which the receiver is connected.
- Power down the equipment when not in use.
- Consult the dealer or an experienced radio/TV technician for help.

Note: It is recommended that wherever possible shielded interface cables are used.

The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

- The user is advised that mobile phones should not be used within 10 m of the product when in use.
- The user is advised to take ESD precautions when handling the equipment.

The Starter Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

Renesas RX Family

RYZ024A PMOD with RSK-RX65N-2MB
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1. Introduction

This Quick Start Guide (QSG) provides:

- An overview of the RYZ024A PMOD example project for the RSK-RX65N-2MB board.
- Instructions for running the RYZ024A PMOD example project on the RSK-RX65N-2MB board.
- Instructions for flashing the RYZ024A PMOD example project code using Renesas Flash Programmer.

1.1 Assumptions and Advisory Notes

1. Tool experience: It is assumed that the user has prior experience in using a serial terminal emulation program such as Tera Term.
2. Subject knowledge: It is assumed that the user has basic knowledge about microcontrollers, embedded systems, LTE communication and AT commands.
3. The screen shots provided throughout this document are for reference. The actual screen content may differ depending on the version of software and development tools used.

2. Kit Contents

The following components are required:

1. RYZ024A PMOD board with external antenna ([RTKYZ024A0B00000BE](#))
2. RSK-RX65N-2MB board ([RX65N-2MB-Starter-Kit-Plus](#))
3. E2 Lite Debugger ([RX5N-2MB-Starter-Kit-Plus](#))
4. 5VDC power supply ([RX65N-2MB-Starter-Kit-Plus](#))
5. 2x USB device cables (type-A male to mini-B male)
6. 1x USB cable (type-A male to micro-B)
7. Truphone SIM card ([RTKYZ024A0B00000BE](#))

3. RSK-RX65N-2MB Kit Setup

First, disconnect the 5VDC power from the board. The RYZ024A PMOD board should be connected to PMOD1 with the external antenna attached (Figure 1). The included SIM card must be inserted in the card slot on the underside of the RYZ024A PMOD board. Connect the micro USB cable to RYZ024A PMOD board (connector CN4) for external powering of PMOD and the other end of cable to a PC USB port. You may now reconnect the 5VDC power cable.

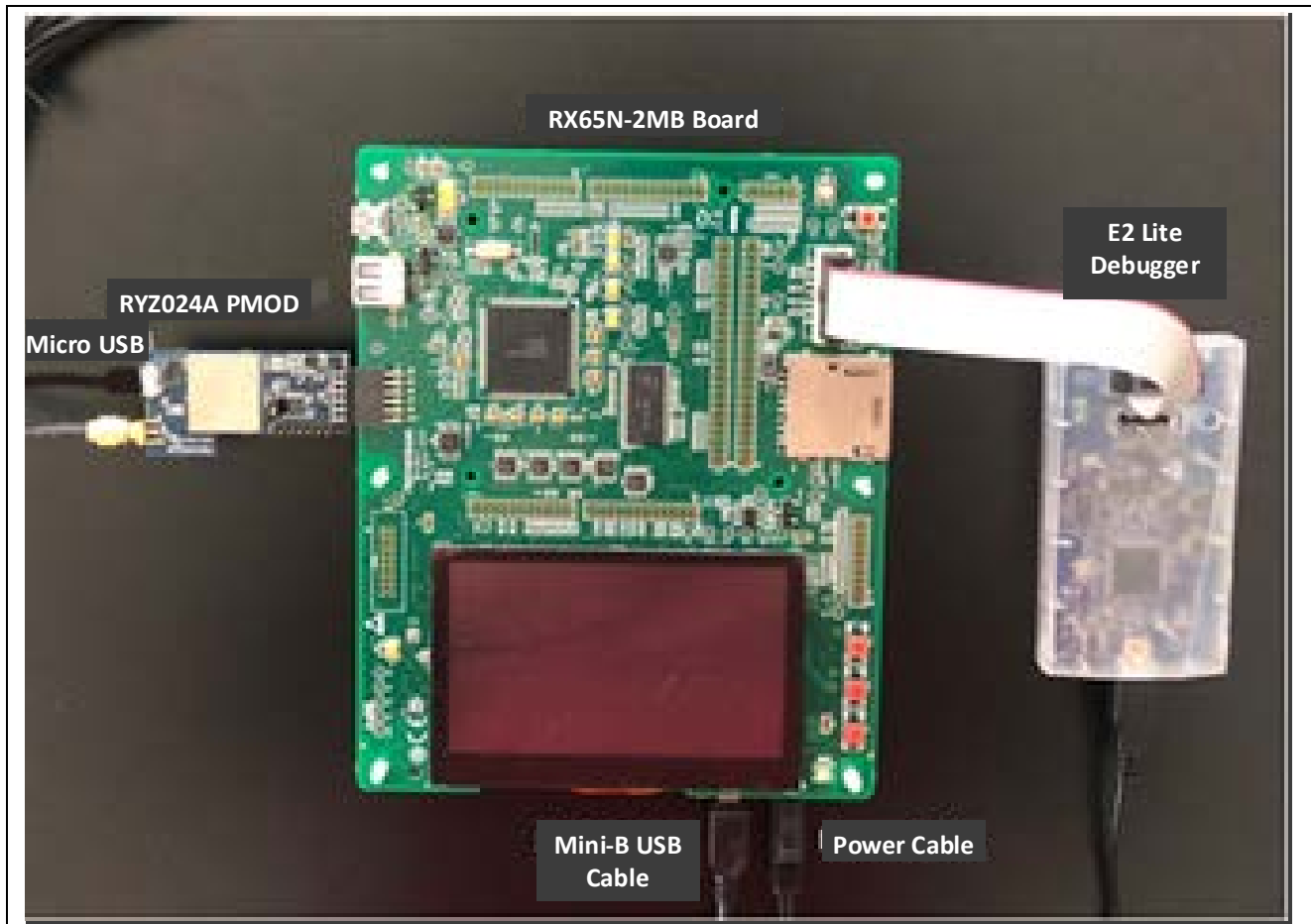


Figure 1. RSK-RX65N-2MB Setup with RYZ024A PMOD Board Connected

4. Overview of the RYZ024A PMOD Example Project

The RYZ024A PMOD example project allows the user to activate, enable and test the RYZ024A PMOD board and SIM card connectivity through a serial terminal menu.

When the RSK-RX65N-2MB board is running the RYZ024A PMOD example project and is connected to a host PC via the serial port, the kit and RYZ024A PMOD information can be viewed, and the included SIM card activation can be validated.

5. Running the RYZ024A PMOD Example Project

This section lists the requirements and instructions to power up the RSK-RX65N-2MB board, flash the RSK-RX65N-2MB board and run the RYZ024A PMOD example project.

Hardware Requirements

- RSK-RX65N-2MB board
- 2x Mini-B USB device cables
- 1x Micro-B USB device cable
- A PC with at least two USB ports
- RYZ024A PMOD board with external antenna

Software Requirements

- Windows® 10 operating system
- Tera Term (or similar) serial terminal console application V4.106 or later
- Renesas Flash Programmer V3.10.00 or later
- RYZ024A PMOD example project Hex File (located in `r21qs0009euxxxx-ryz024a-rsk-rx65n-2mb.zip > ryz024a_quickstart_rx65n_2mb/ ryz024a_quickstart_rx65n_2mb.hex`).

5.1 Flashing the Example Program on the RSK-RX65N-2MB Board

1. Connect the Mini-B connector of the USB device cable to the USB mini-B port (G1USB0) of the RSK-RX65N-2MB board. Next, connect the USB-A end of the device cable to the host PC.
2. Connect the E2 Lite ribbon cable between the E2 Lite Debugger and the RSK-RX65N-2MB board E1/E2 Lite connector. Connect the Mini-B end of the second USB device cable to the E2 Lite Debugger and the Type-A end to the host PC.
3. Connect the power cable from the AC adapter to the power jack on the RSK-RX65N-2MB board (PWR).
4. Open Renesas Flash Programmer and create a new project by using the **File** menu and selecting **New Project**.
5. In the Create a New Project window, select the **RX65x** from the Microcontroller drop-down menu. Next, enter a desired project name and select **E2 emulator Lite** for the Communication Tool and Interface as **2 wire UART**. Click **Connect**.

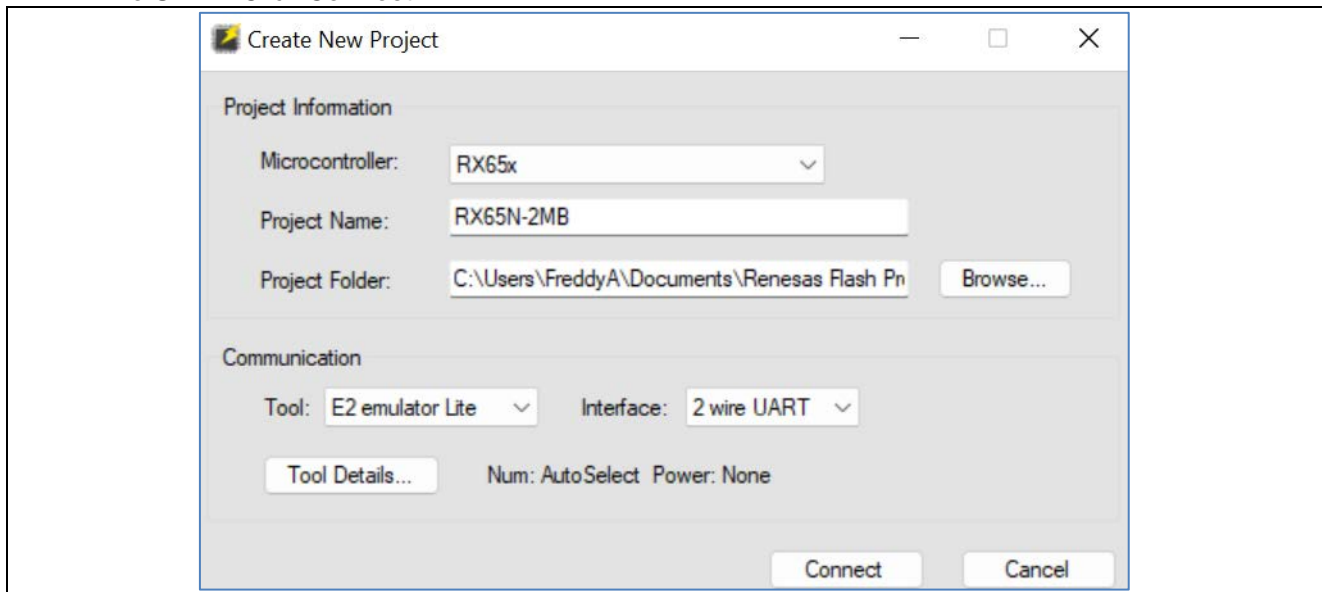


Figure 2. Creating a New Project on Renesas Flash Programmer

6. An authentication window should appear. Then, enable **Auto Authentication** and click **OK**.

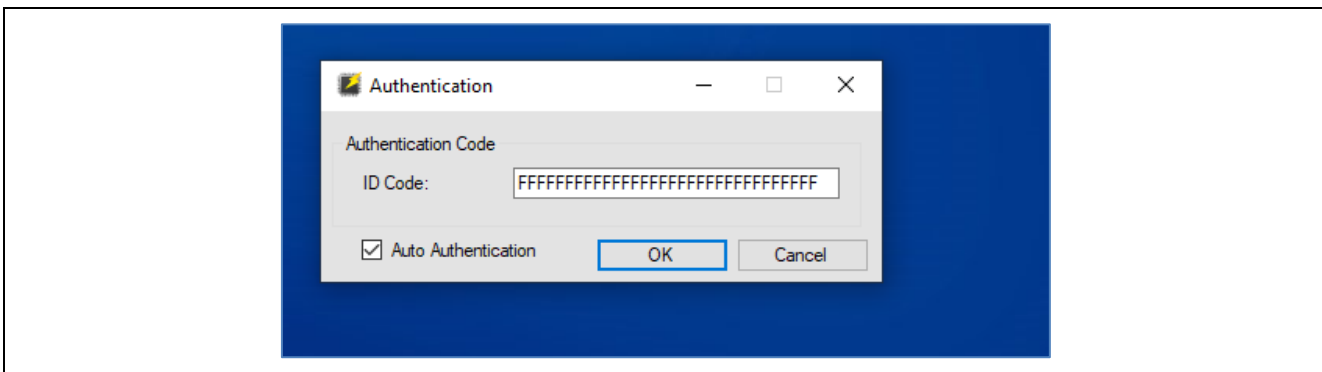


Figure 3. Enabling Auto Authentication

7. Verify that the message **Operation Completed** is printed in the main window. Under Program File, click **Browse** to choose to the program file that will be flashed onto the board (Figure 4). Using the file explorer window, navigate to the example project's **Hex File** (located in `r21qs0009euxxxx-ryz024a-rsk-rx65n-2mb.zip > ryz024a_quickstart_rx65n_2mb/ryz024a_quickstart_rx65n_2mb.hex`) and click **Open**.

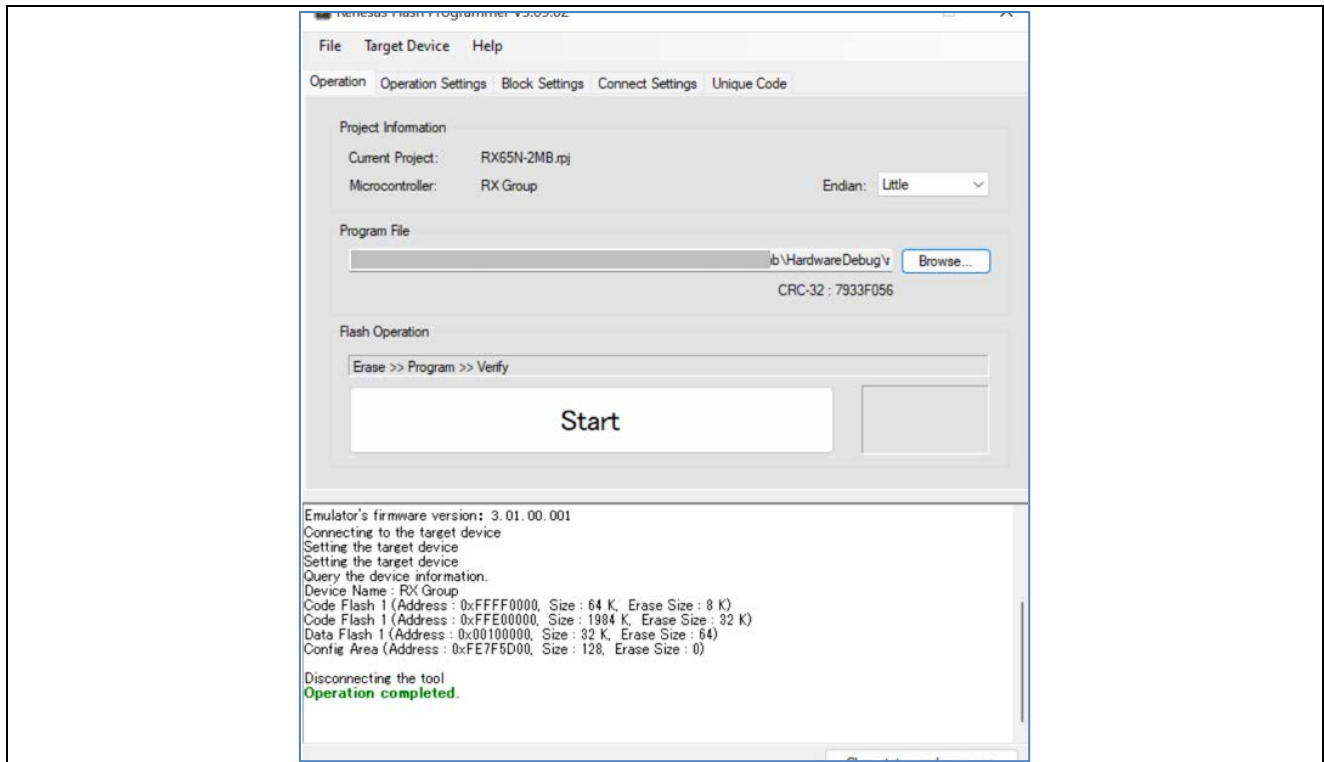


Figure 4. Main Window of Renesas Flash Programmer After Creating a New Project

8. Click **Start** to begin flashing the example project code onto the board. Once completed, the message **Operation completed** should be printed and the status **OK** should be displayed next to the start button.
9. Disconnect the 5VDC power cable from the RSK-RX65N-2MB board.
10. Disconnect the E2 Lite Emulator ribbon cable from the E2 Lite connector of the RSK-RX65N-2MB board.

5.2 Connecting and Powering Up the RSK-RX65N-2MB Board

1. Connect the RYZ024A PMOD board (with attached external antenna) to PMOD1 connector labeled on the board.
2. Connect the Micro-B USB cable to RYZ024A (connector CN4) for external powering of PMOD and the type-A USB end of cable to a PC USB port.
3. Connect the Mini-B connector end of the USB device cable to the USB Mini-B port (G1CUSB0) of the RSK-RX65N-2MB board and connect the type-A USB end of the cable to the USB port of the host PC.
4. Connect the power cable to the RSK-RX65N-2MB power jack (PWR). 5V_PWR and 3V3_PWR LEDs should be turned on.



Figure 5. Connections to the RX65N-2MB Board After Flashing

5.3 Running the RYZ024A PMOD Example Project

To run the RYZ024A PMOD example project, use the following instructions:

1. On the host PC, open Windows Device Manager. Expand **Ports (COM & LPT)**, locate **USB Serial Device (COMxx)** and note the COM port number for reference in the next step.

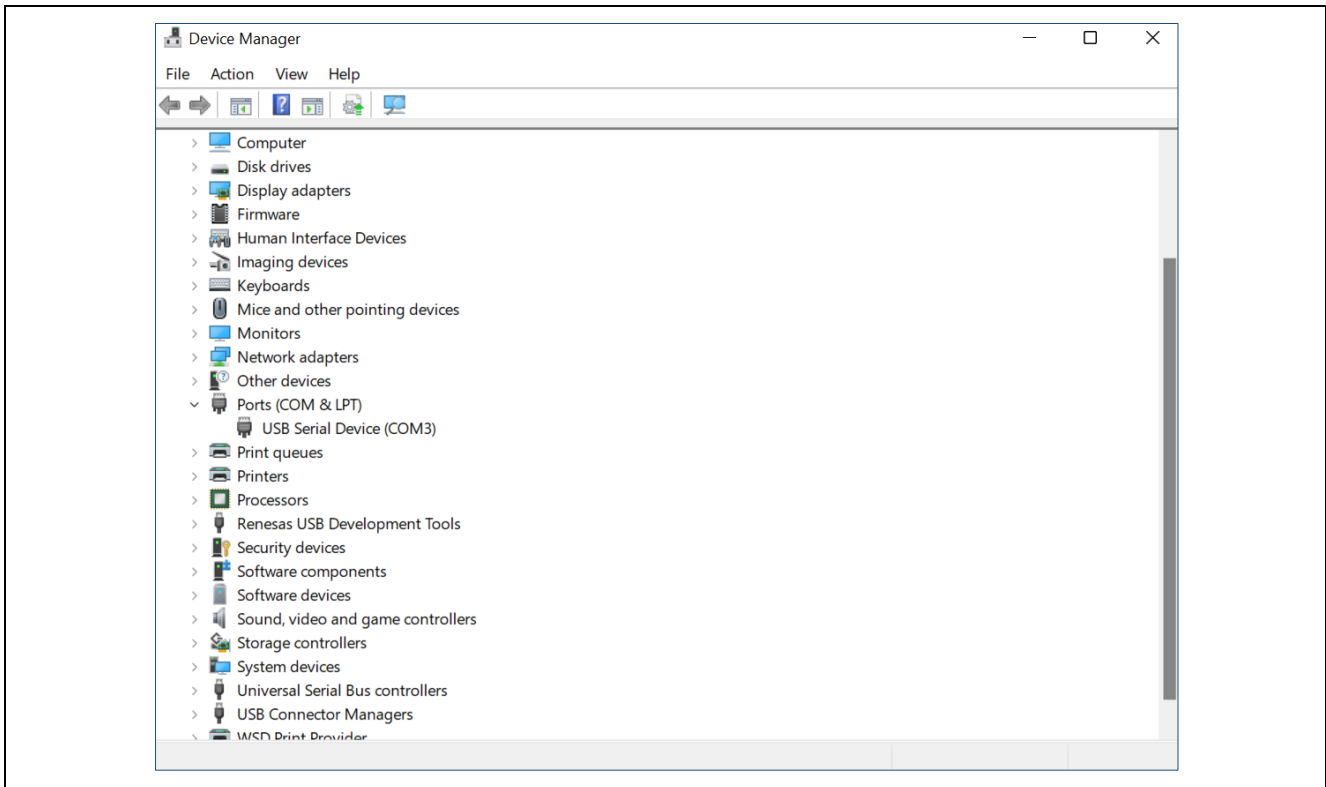


Figure 6. USB Serial Device in Windows Device Manager

2. Open Tera Term, select **Serial** and **COMxx: USB Serial Device (COMxx)** and click **OK**.

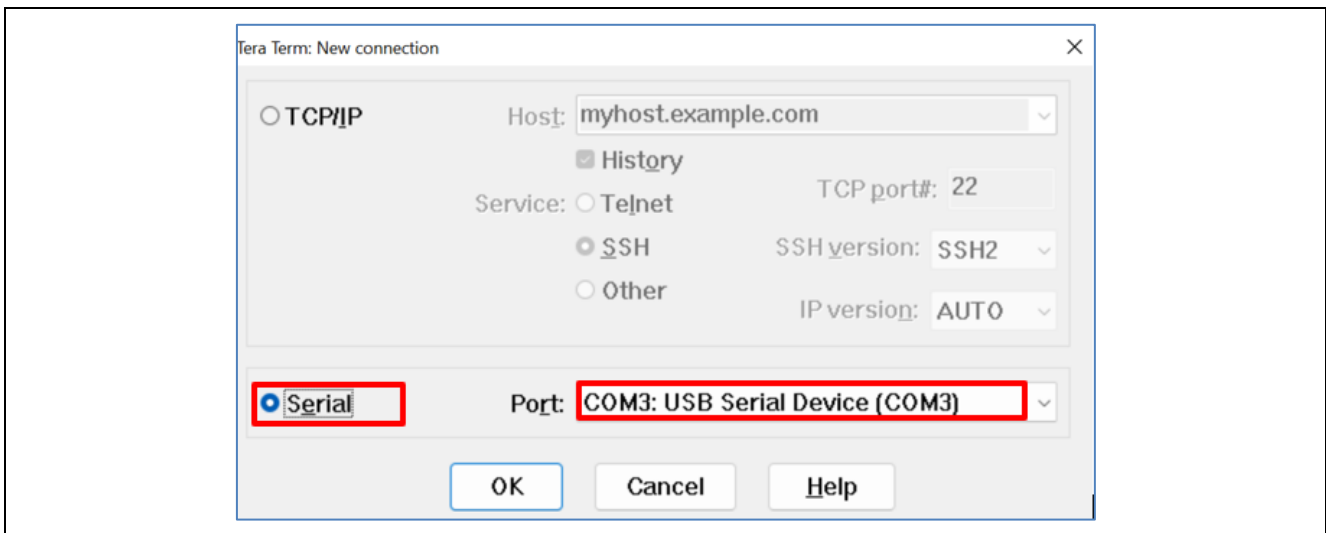


Figure 7. Selecting the Serial Port on Tera Term

- Using the **Setup** menu pull-down, select **Serial port...** and ensure that the speed is set to **115200**, as shown in Figure 8. Click **New setting**.

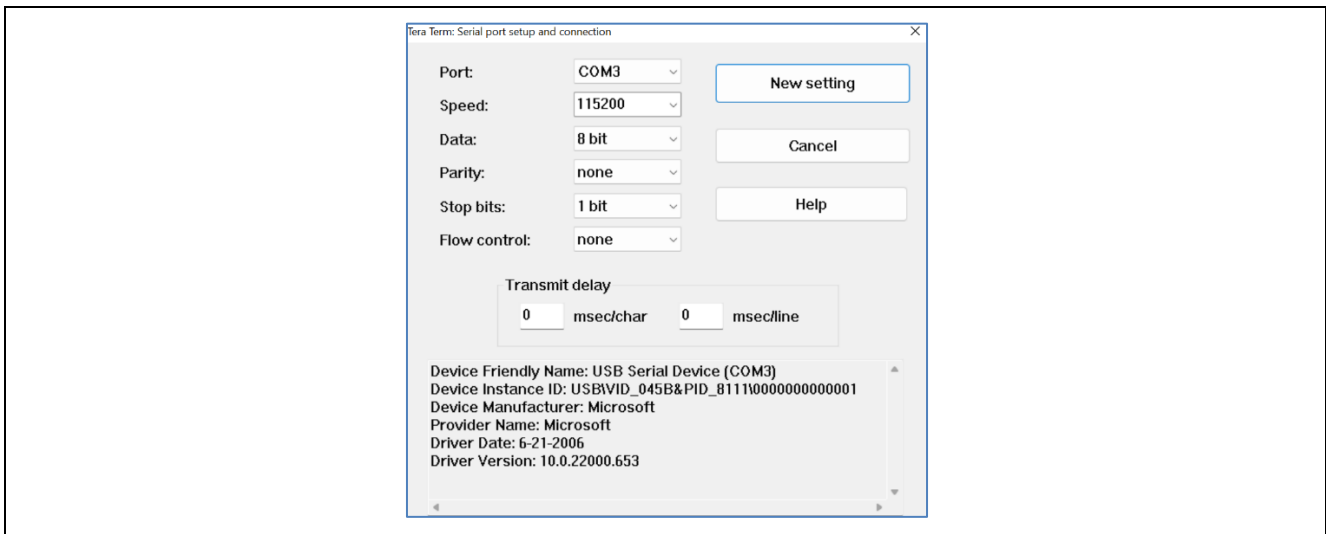


Figure 8. Selecting 115200 on the Speed Pulldown

- Complete the connection. The ‘Welcome and Main Menu’ screen will be displayed as shown in Figure 9.

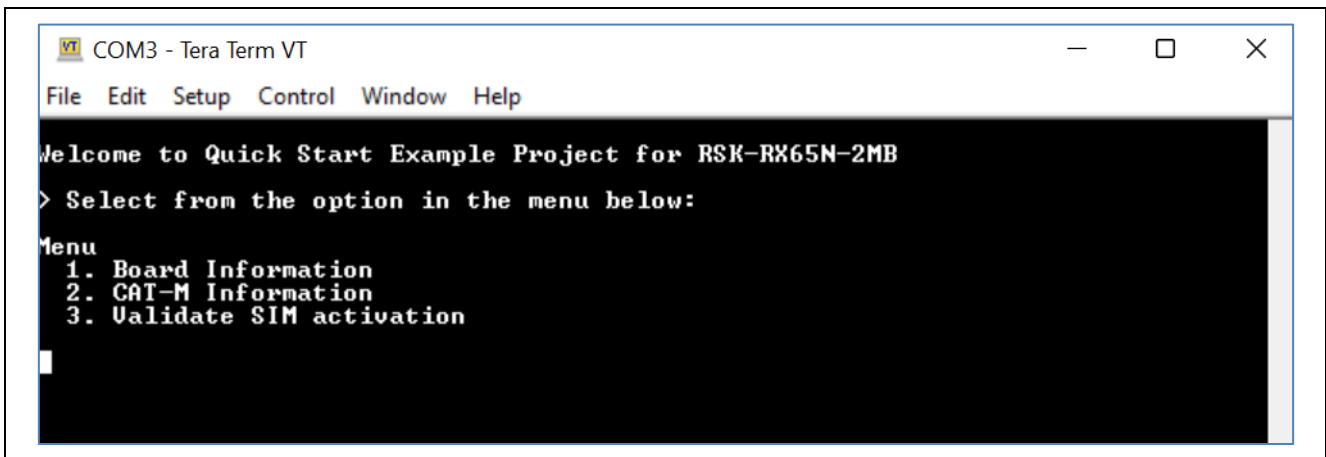


Figure 9. Welcome and Main Menu

- Press **1** to display the **Board Information** including the kit name, and part number.

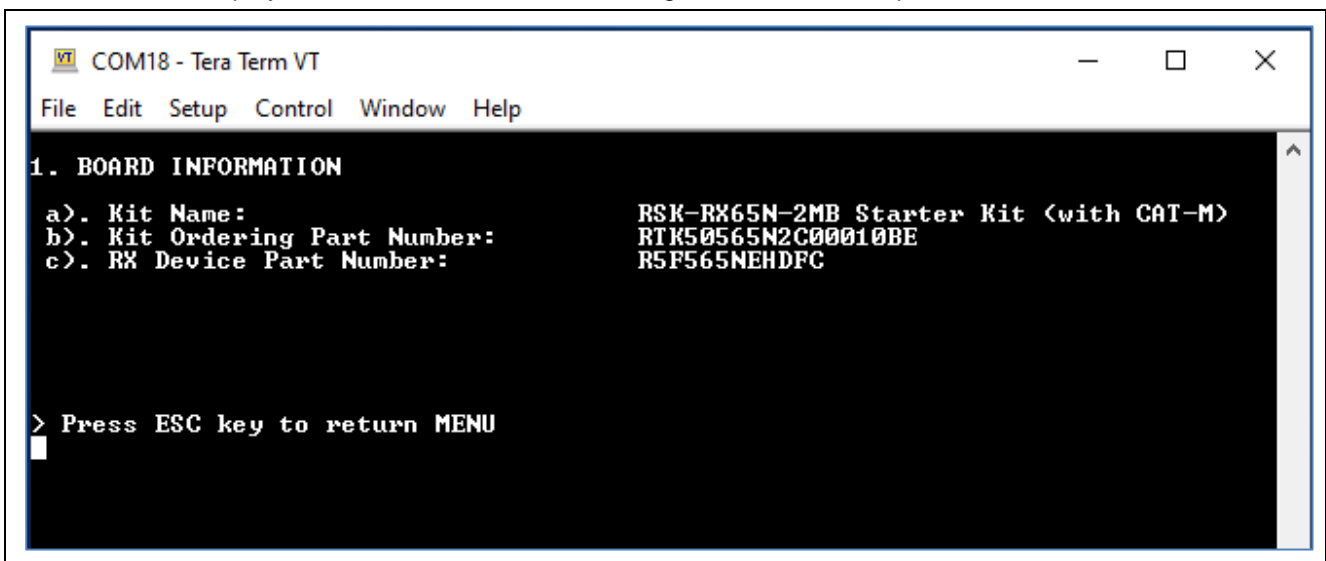
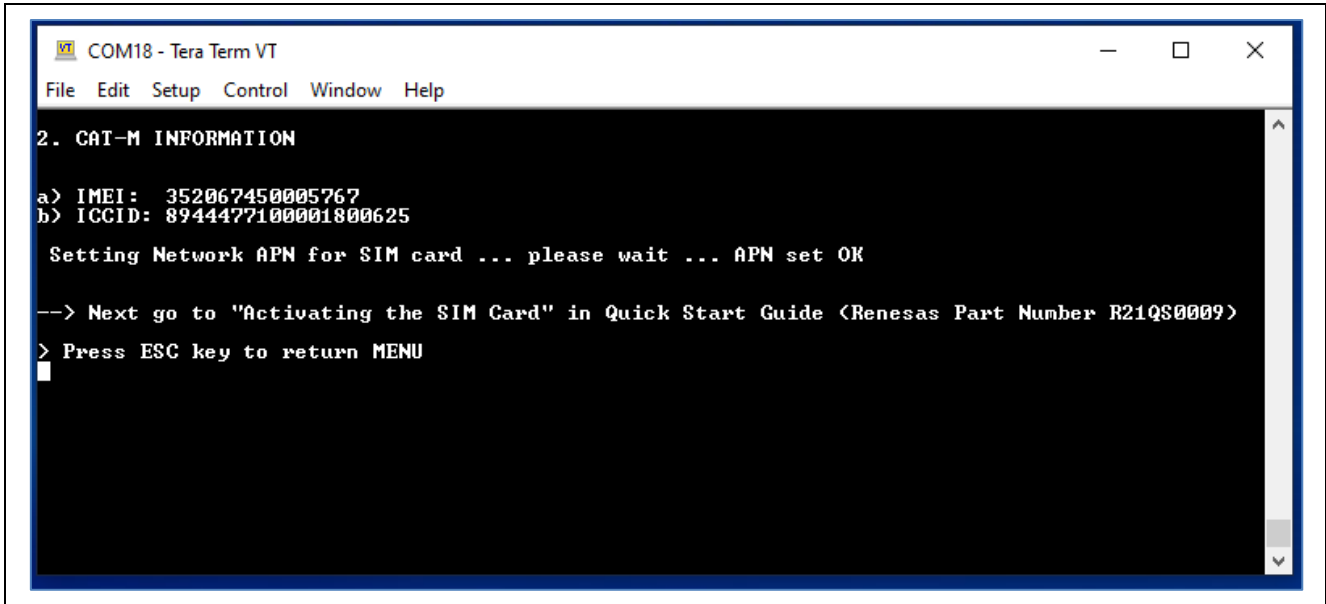


Figure 10. Board Information

6. Press **ESC** to return to the 'Welcome and Main Menu' screen.
7. Press **2** to display **CAT-M Information**. This menu will communicate with the RYZ024A PMOD module to obtain the ICCID value needed for activating the SIM card. Upon success, the IMEI and ICCID values will be displayed on the terminal screen. The program will continue to attempt to communicate with the RYZ024A PMOD module until it has successfully connected or timed out. After obtaining the ICCID value, go to Truphone truphone.com/connectit to activate the SIM card (see section **Activating the SIM card**).

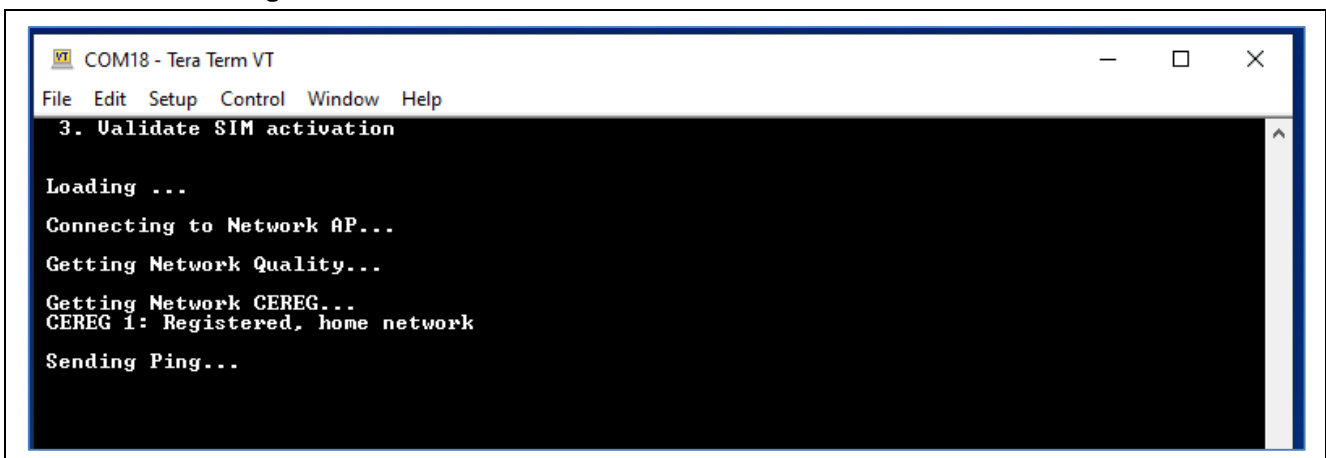
A screenshot of a terminal window titled 'COM18 - Tera Term VT'. The window has a menu bar with 'File', 'Edit', 'Setup', 'Control', 'Window', and 'Help'. The terminal content shows the following text:

```
2. CAT-M INFORMATION
a) IMEI: 352067450005767
b) ICCID: 8944477100001800625
Setting Network APN for SIM card ... please wait ... APN set OK
--> Next go to "Activating the SIM Card" in Quick Start Guide <Renesas Part Number R21QS0009>
> Press ESC key to return MENU
```

Figure 11. RYZ024A PMOD Information

8. Press **ESC** to return to the 'Welcome and Main Menu' screen.

Press **3** to enter the **Validate SIM activation** screen. The program will attempt to ping the Quad9 server (IP address 9.9.9.9) for a response to determine whether the SIM card has been activated. The steps of a successful SIM validation are shown in Figure 12. Upon success, the text "*** SIM card active! ***" will be displayed on the terminal screen (see Figure 13). If SIM card validation fails, follow the **Troubleshooting** section.

A screenshot of a terminal window titled 'COM18 - Tera Term VT'. The window has a menu bar with 'File', 'Edit', 'Setup', 'Control', 'Window', and 'Help'. The terminal content shows the following text:

```
3. Validate SIM activation
Loading ...
Connecting to Network AP...
Getting Network Quality...
Getting Network CERE...
CEREG 1: Registered, home network
Sending Ping...
```

Figure 12. Validation Steps of SIM Activation

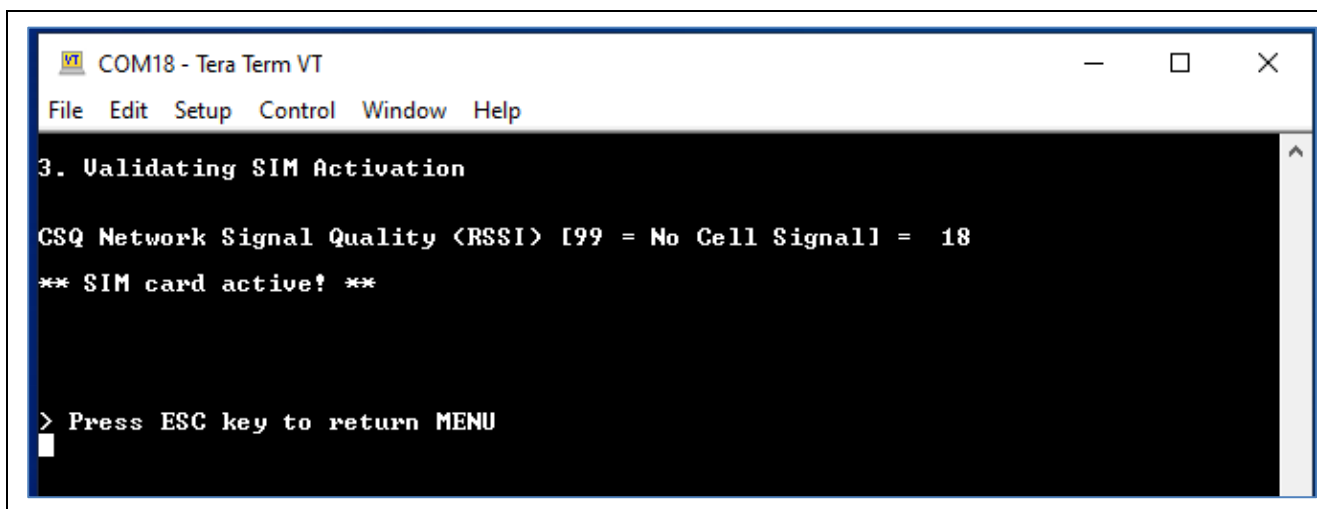


Figure 13. Validating SIM Activation – SIM Card Active

9. Press **ESC** to return to the 'Welcome and Main Menu' screen.

6. Activating the SIM Card

To activate the included SIM card, please visit the Truphone SIM Activation platform at truphone.com/connectit and use the following steps:

1. On the Business page, click **Start activation** button under **IoT SIM Activation**.

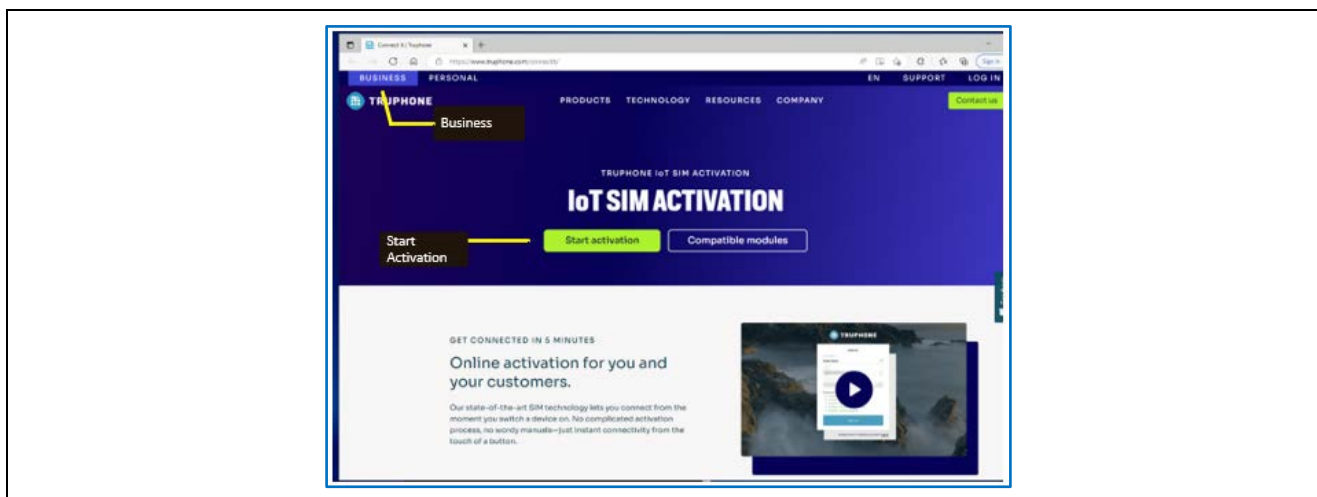


Figure 14. Activating the SIM Card

2. Create a new Truphone Account by selecting **Sign up** (next to **Don't have an account yet?**) and fill-in your full name, Email, and a password. Then click **Sign up** to create a new account.
3. Select **Personal** as the account type.
4. Select **Get Started**.
5. Verify your email by entering the activation code sent to your email account.
6. Complete the **Profile information** form – then select **Create account**.
7. Select **Activate SIMS** to activate your individual SIM by **ICCID**.
8. Enter the **ICCID** value obtained from the **Running the RYZ024A PMOD example project** section. See the **ICCID** value in Figure 11, RYZ024A PMOD Information. Fill other fields as needed.
9. You will receive email confirmation when the SIM card activation is complete.
10. Insert the SIM card in the RYZ024A PMOD. Follow **Running the RYZ024A PMOD example project** section step 8 by using **Menu 3 Validate SIM activation** to verify that the SIM card is activated. The SIM card should be activated on the Truphone SIM Activation platform after 15 minutes and can be validated on the Tera Term terminal as shown in Figure 12. The time for the SIM Card to be activated by Truphone can vary depending on their system demand. In most cases, if PING Response fails, wait a few more minutes and repeat **Menu 3 Validate SIM activation**.

Disclaimer

The activation steps above are provided by SIM Provider Truphone. They are the most current at the time of publishing this application note. If you need help activating your SIM card, contact Truphone support iot.truphone.com or [Contact Support | Truphone](#).

If you have a SIM card from any other provider then contact the technical support for that provider.

For any other issue that cannot be resolved please contact Renesas Support at [Technical Support](#).

Note: The SIM card provider for the Quick Start Guide example project is Truphone. If you use any other SIM card provider you must change the Access Point Name required for the SIM card provider in your global region. Failure to do so could result in the RYZ024A not connecting to the cellular network.

To set the Access Point Name (APN) for SIM Card provider other than Truphone

The APN is set in the example project in `/src/r_cellular/r_cellular_config.h`

```
See #define CELLULAR_CFG_AP_NAME iot.truphone.com /* APN : Truphone SIM Card */
```

7. Troubleshooting

This section includes a common set of issues and how to resolve them. The two types of issues that you may encounter are due to the hardware setup or SIM activation. The steps that follow will help to resolve those types of issues. For any other issue that cannot be resolved please contact Renesas support at [Technical Support](#).

7.1 Hardware Setup

A first step for any general issue is to verify that the proper connections are made. For example, Executing Menu 2 **CAT-M Information** results in `** RYZ024A init FAILED **`. Refer to Figure 5.

- The power cable is plugged into the power jack of the RSK-RX65N-2MB board.
- The RYZ024A external antenna cable is plugged into the RYZ024A PMOD board.
- The RYZ024A PMOD board is connected to the PMOD1 port of the RX65N-2MB board.
- The mini-B USB device cable is connected to the serial port (G1CUSB0) of the RSK-RX65N-2MB board. The Type-A end of the device cable is connected to the host PC.
- The micro-USB cable is plugged into the RYZ024A PMOD connector (CN4).
- E2 Lite Debugger is disconnected when trying to run the code.
- Check to see that the SIM card is fully inserted in the SIM slot (on the underside of the RYZ024A PMOD module). Check for proper SIM card orientation in the slot.

7.2 SIM Card Activation Problem

- If the SIM activation fails, verify that the ICCID number and PUK numbers are correctly entered when activating the SIM card on Truphone IoT SIM activation platform truphone.com/connectit
- If **Menu 3 Validate SIM activation** PING response returns a Ping Failed condition, it can take up to 15 minutes or longer for the card to be activated after performing **Activating the SIM Card** to obtain LTE Network access. In this case, wait at least 15 minutes (or longer) and repeat **Menu 3 Validate SIM activation**.
- SIM cards cannot be activated more than once. To verify whether the SIM card has already been activated, please monitor and manage your SIMs on the Truphone IoT Connectivity Management Platform or contact Truphone support through iot.truphone.com by logging into your account.
- If **Menu 3 Validate SIM activation** PING response continues to return Ping Failed condition, first check the external antenna is connected securely to the RYZ024A PMOD and try again. The CSQ Network Signal Quality (RSSI) could be too low to connect. If the RSSI is 99 then check external antenna is connected or no Cell Network Signal could be detected in your area. An RSSI reading with RSSI = 15 or less indicates marginal or poor reception.

CSQ Network Signal Quality (RSSI) [99 = No Cell Signal] = 15, Marginal Signal Quality

It may be necessary to move the RSK-RX65N-2MB with PMOD to a different location to improve the Network Signal Quality (RSSI) to get an RSSI value in the range of 16 to 98.

- If **Menu 3 Validate SIM activation** continues to fail, verify that the APN is set for the Global Region where the RYZ024A PMOD is trying to connect. The APN setting and LTE Band List depends on your Global Region and the SIM card provider.

The APN is set in the example project in `/src/r_cellular/r_cellular_config.h`

```
See #define CELLULAR_CFG_AP_NAME iot.truphone.com /* Access Point Name : Truphone  
SIM Card */
```

- For all other SIM card issues that cannot be resolved with these troubleshooting steps, contact Truphone support through iot.truphone.com by logging into your account.

7.3 Illegible/No Terminal Output (Tera Term)

This could be caused by the setup of the terminal connection and/or having the E2 Lite Debugger connected after flashing the example code. To fix this, use the following instructions:

- Open Tera Term and on the file menu, go to **Setup > Serial port...** Please make sure the following settings in the setup of the serial connection are set up as such:
 - Speed: 115200
 - Data: 8 bit
 - Parity: None
 - Stop bits: 1 bit
 - Flow Control: None
- Make sure the E2 Lite Debugger ribbon cable is disconnected from the board if the hex file has been flashed onto the board already. Otherwise, follow the same steps in section 5.1, Flashing the Example Program on the RSK-RX65N-2MB board.

7.4 Unable to Read RYZ024A Board Information

If there is a failure to read the RYZ024A PMOD board and SIM information (IMEI and ICCID), check to confirm the following:

- SIM card is fully inserted in the SIM card slot on the underside of the RYZ024A PMOD board.
- RYZ024A PMOD board is plugged into the PMOD1 port of the RX65N-2MB board.
- A micro-USB cable is plugged into the RYZ024A PMOD connector (CN4) and PC.

7.5 Contact Renesas Support

For Starter Kit and RYZ024A PMOD related issues that cannot be resolved with these troubleshooting steps, please contact Renesas Support at renesas.com/support for more help.

8. Next Steps

- RYZ024A PMOD Module
renesas.com/RTKYZ024A0B00000BE
- RYZ024A Module
renesas.com/RYZ024A
- RX65N-2MB
[rx65n-32-bit-microcontrollers-rxv2-core-large-capacity-ram-and-enhanced-security-connectivity-and-hmi](http://renesas.com/rx65n-32-bit-microcontrollers-rxv2-core-large-capacity-ram-and-enhanced-security-connectivity-and-hmi)

9. Website and Support

Visit the following URLs to learn about the kit and the RX family of microcontrollers, download tools and documentation, and get support.

RSK-RX65N-2MB Resources	renesas.com/rx/rsk-rx65n-2mb
RX Product Information	renesas.com/rx
RX Product Support Forum	community.renesas.com/mcu-mpu/rx
Renesas Support	renesas.com/support

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