Application Note
AZURE_2CD Example

Version 1.0.0

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1 Introduction

This Application Note covers the implementation of AZURE 2CD on WIZnet's TOE Chip.

2 Github Link

https://github.com/WIZnet-ioNIC/WIZnet-PICO-AZURE-C.git

3 Applicable products

Raspberry Pi Pico & WIZnet Ethernet HAT

W5100S-EVB-Pico

W5500-EVB-Pico

W55RP20-EVB-Pico

W5100S-EVB-Pico2

W5500-EVB-Pico2

4 How to Test AZURE 2CD Example

4.1 Step 1: Prepare software

The following serial terminal program is required for AZURE 2CD example test, download and install from below links.

- **Tera Term**

4.2 Step 2: Prepare hardware

If you are using W5100S-EVB-Pico, W5500-EVB-Pico, W55RP20-EVB-Pico, W5100S-EVB-Pico2 or W5500-EVB-Pico2, you can skip '1. Combine...'

1. Combine WIZnet Ethernet HAT with Raspberry Pi Pico.
2. Connect ethernet cable to WIZnet Ethernet HAT, W5100S-EVB-Pico, W5500-EVB-Pico, W55RP20-EVB-Pico, W5100S-EVB-Pico2 or W5500-EVB-Pico2 ethernet port.
3. Connect Raspberry Pi Pico, W5100S-EVB-Pico or W5500-EVB-Pico to desktop or laptop using 5 pin micro USB cable. W55RP20-EVB-Pico, W5100S-EVB-Pico2 or W5500-EVB-Pico2 require a USB Type-C cable.

4.3 Step 3: Setup AZURE 2CD Example

To test the AZURE 2CD example, minor settings shall be done in code.

1. Setup SPI port and pin in 'w5x00_spi.h' in 'WIZnet-PICO-AZURE-C/port/ioLibrary_Driver/' directory.

Setup the SPI interface you use.

- If you use the W5100S-EVB-Pico, W5500-EVB-Pico, W5100S-EVB-Pico2 or W5500-EVB-Pico2,

```
/* SPI */
#define SPI_PORT spi0

#define PIN_SCK 18
#define PIN_MOSI 19
#define PIN_MISO 16
#define PIN_CS 17
#define PIN_RST 20
```

- If you want to test with the AZURE 2CD example using SPI DMA, uncomment USE_SPI_DMA.

```
/* Use SPI DMA */
//#define USE_SPI_DMA // if you want to use SPI DMA, uncomment.
```

- If you use the W55RP20-EVB-Pico,

```
/* SPI */
#define USE_SPI_PIO

#define PIN_SCK 21
#define PIN_MOSI 23
#define PIN_MISO 22
#define PIN_CS 20
#define PIN_RST 25
```

2. In 'WIZnet-PICO-AZURE-C/examples/main.c', uncomment APP_2CD to choose the sample application.

```
(...)

// The application you wish to use should be uncommented
//
//#define APP_TELEMETRY
#define APP_C2D
//#define APP_CLI_X509
//#define APP_PROV_X509
```

3. Setup network configuration such as IP in ' main.c', which is the AZURE 2CD example in 'WIZnet-PICO-AZURE-C/examples/' directory.

- Setup IP, other network settings to suit your network environment.

```
// The application you wish to use DHCP mode should be uncommented
#define _DHCP
static wiz_NetInfo g_net_info =
    {
        .mac = {0x00, 0x08, 0xDC, 0x12, 0x34, 0x56}, // MAC address
        .ip = {192, 168, 11, 2},                     // IP address
        .sn = {255, 255, 255, 0},                    // Subnet Mask
        .gw = {192, 168, 11, 1},                     // Gateway
        .dns = {8, 8, 8, 8},                         // DNS server
#ifdef _DHCP
        .dhcp = NETINFO_DHCP // DHCP enable/disable
#else
        // this example uses static IP
        .dhcp = NETINFO_STATIC
#endif
};
```

4. Edit the ‘WIZnet-PICO-AZURE-C/exmaples/sample_certs.c’ entering the proper connection string and key value from the Azure Portal:

```
/* Paste in the your iothub connection string  */
const char pico_az_connectionString[] = "[device connection string]";
```

4.4 Step 4: Setup Azure IoT Explorer

In Azure portal, you need to create a device and get the connection string informations as below:

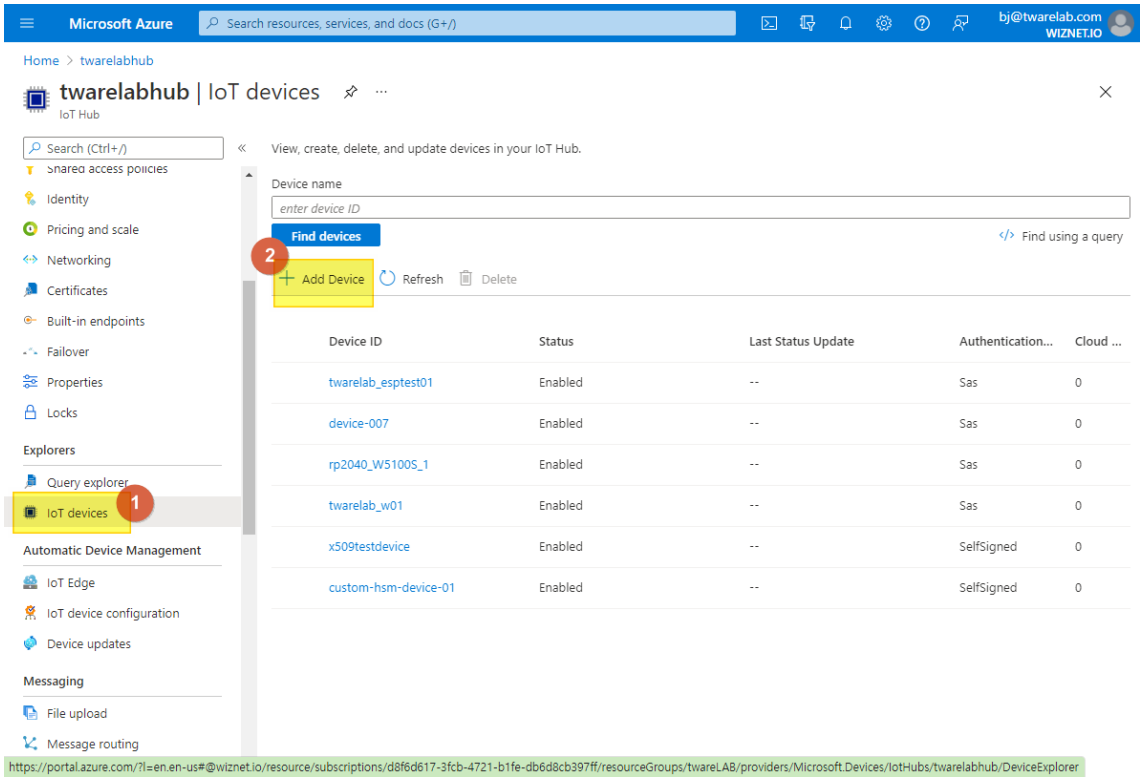

Figure 1. Add IoT devices

This example uses symmetric key

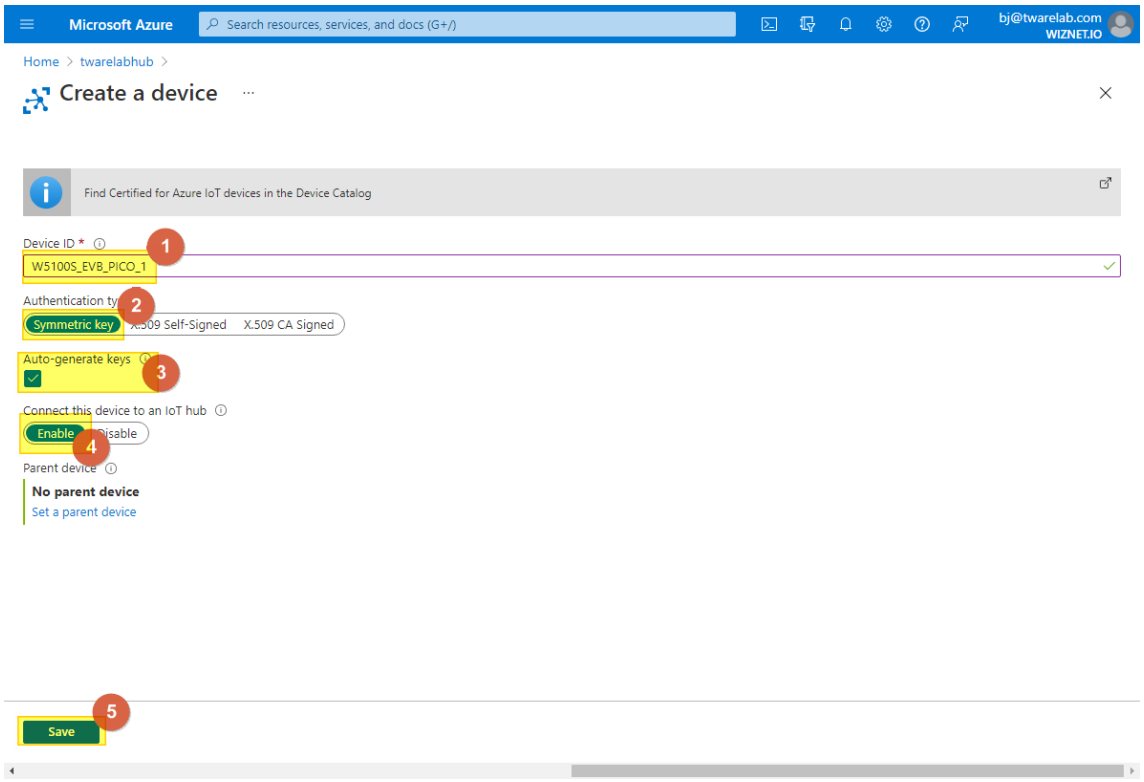

Figure 2. Create a device

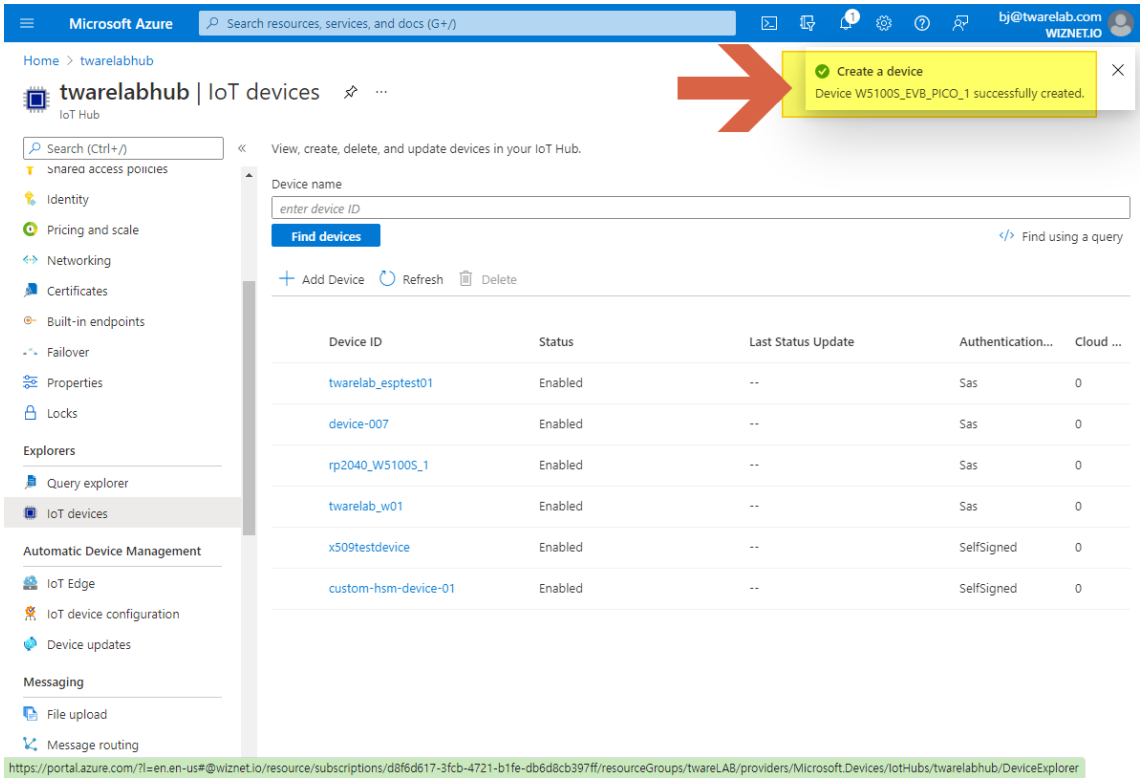

Figure 3. Device successfully created

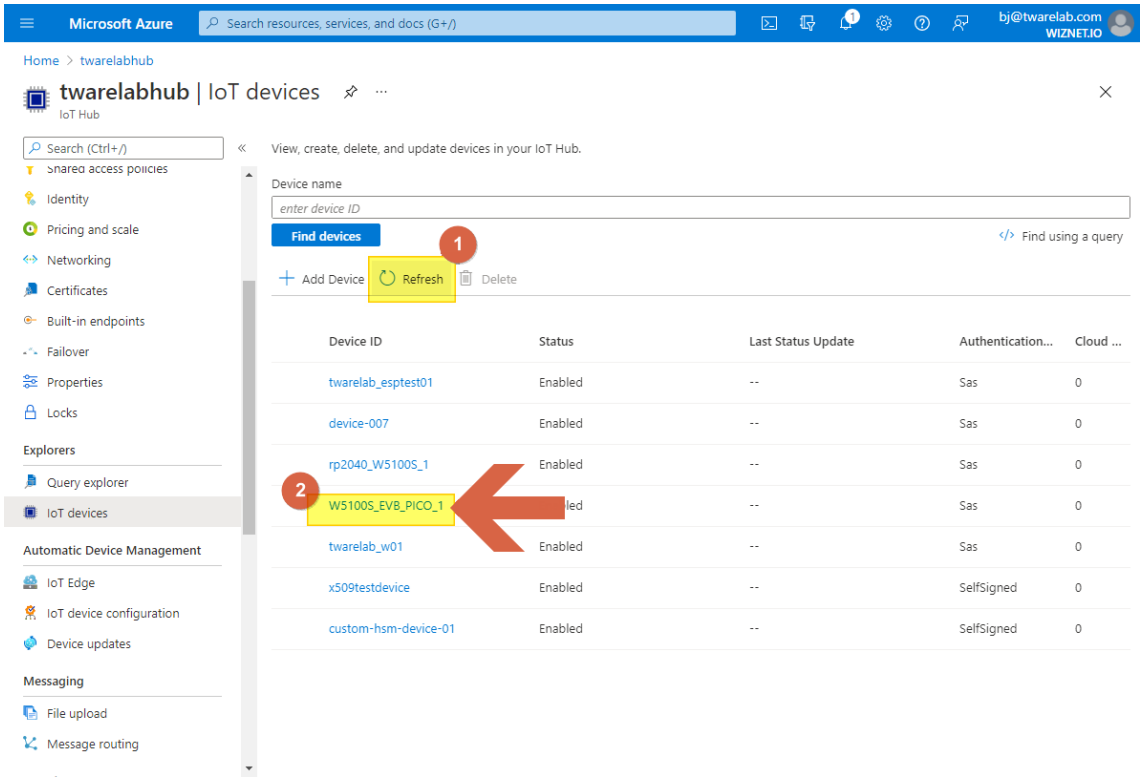

Figure 4. Check the device

You copy the key string, "Primary Connection String" and paste the string into your code as described in next section.

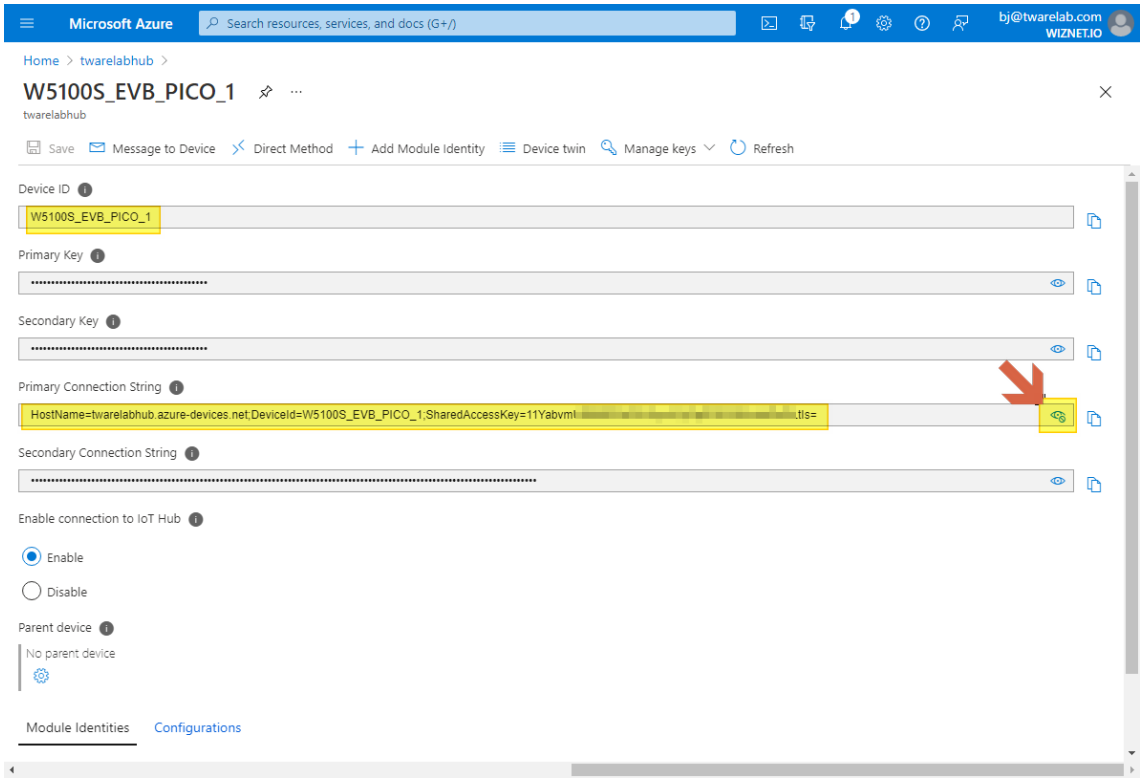

Figure 5. Copy the key string

To see the message from your IoT Device, you need to make a "Azure IoT Explorer" setting as below:

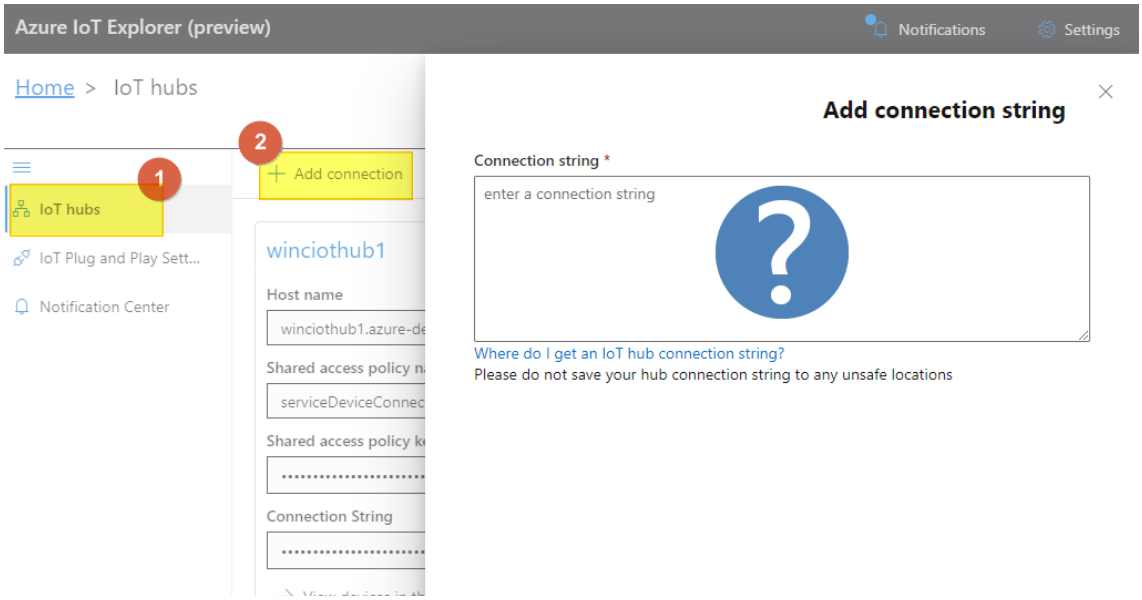

Figure 6. Set up Azure IoT Explorer

1. In Azure portal, you can get the "Connection String" as follows:

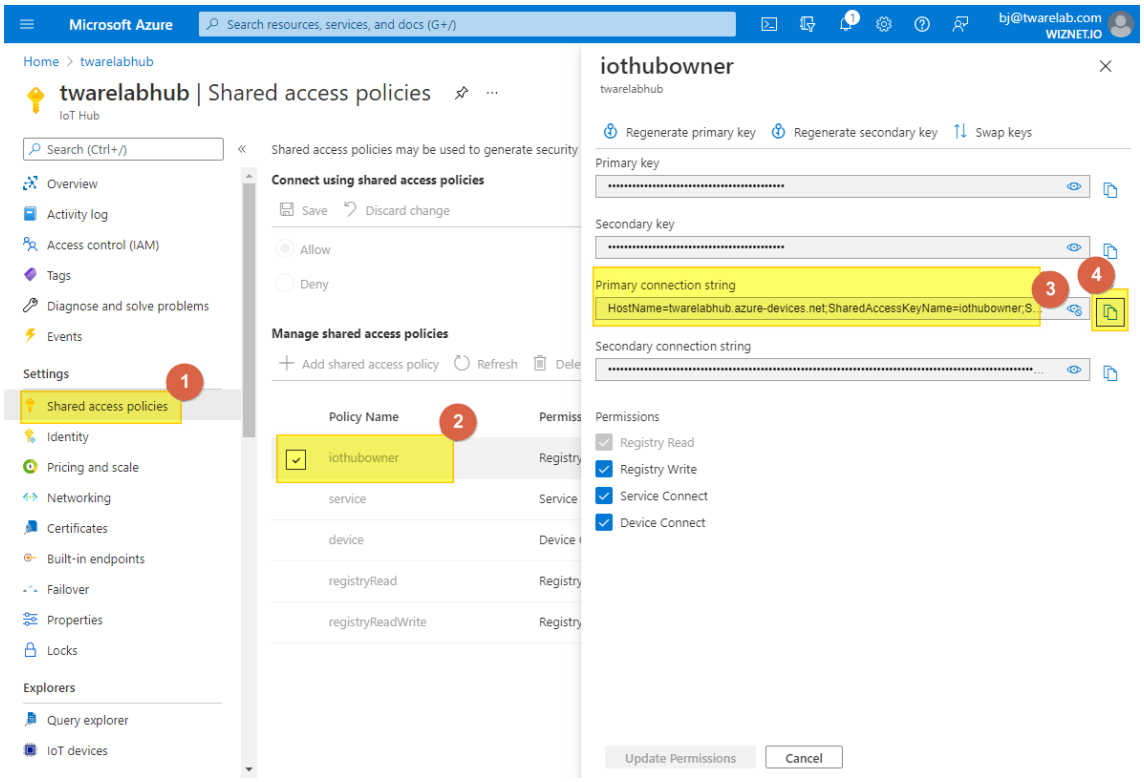

Figure 7. Getting connection string

2. Copy & paste the connection string, and click "Save".

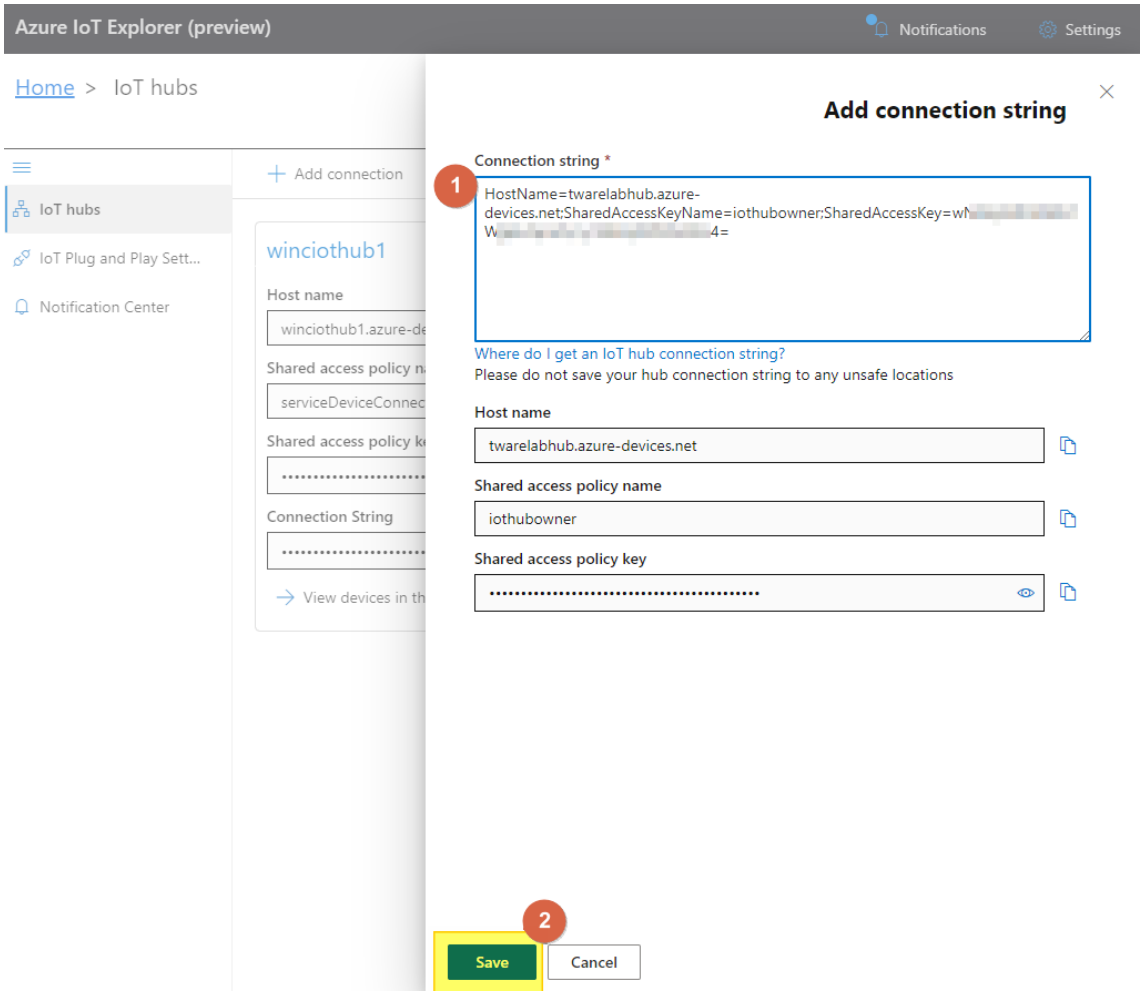

Figure 8. Add connection string

3. Find the device and click name.

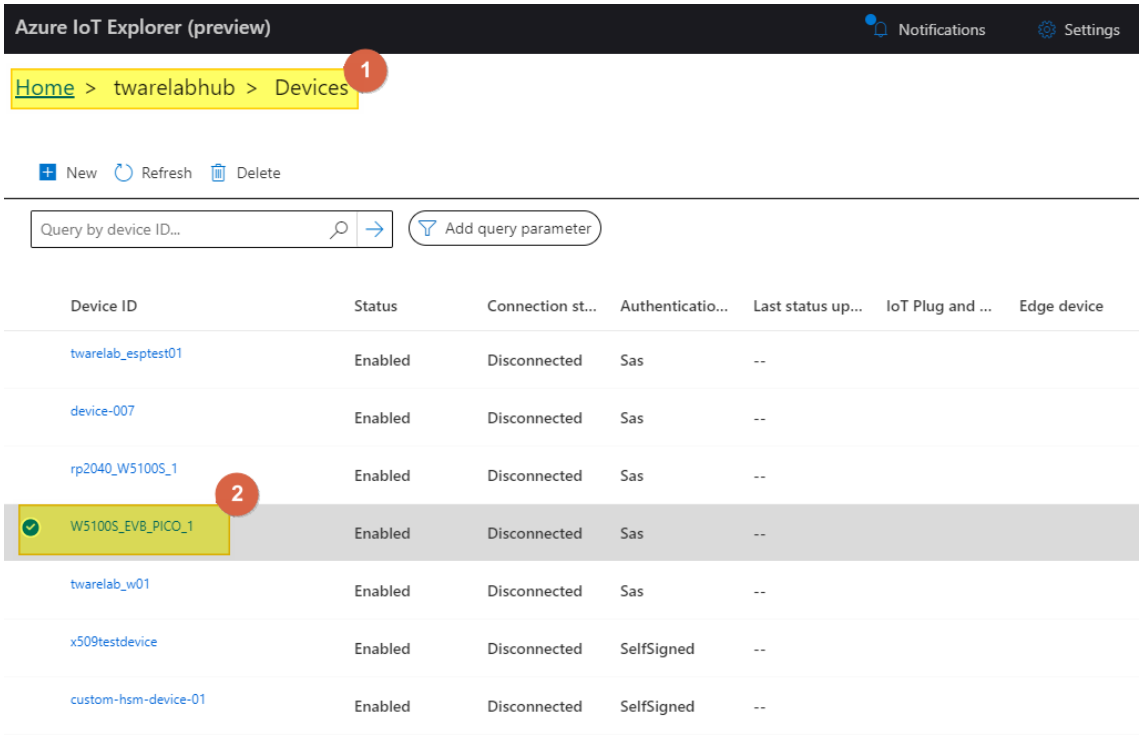

Figure 9. Select the device

4. Go to "Telemetry" menu, and click "Start".

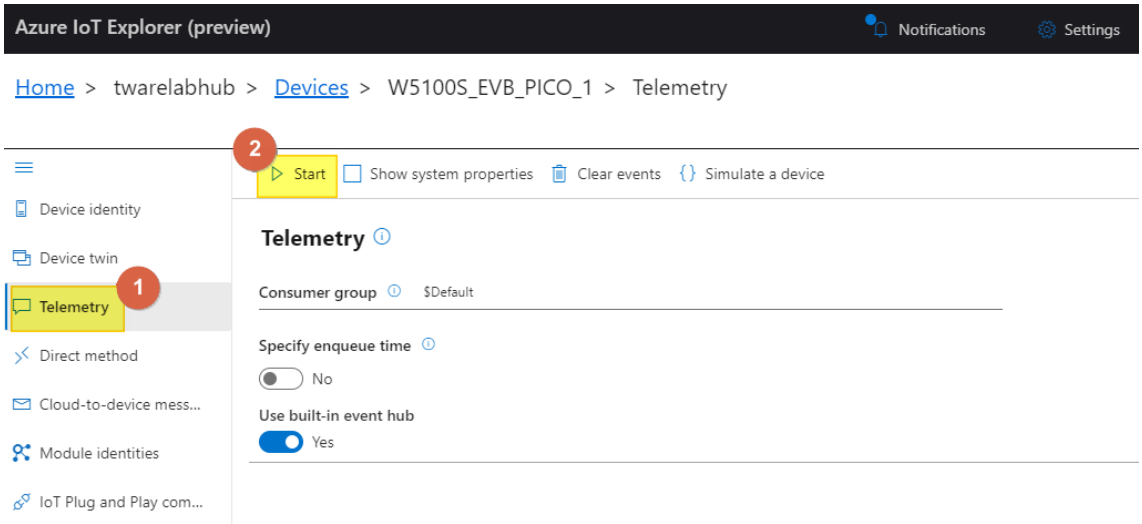

Figure 10. Start Telemetry

5. Wait for incoming message from your IoT device.

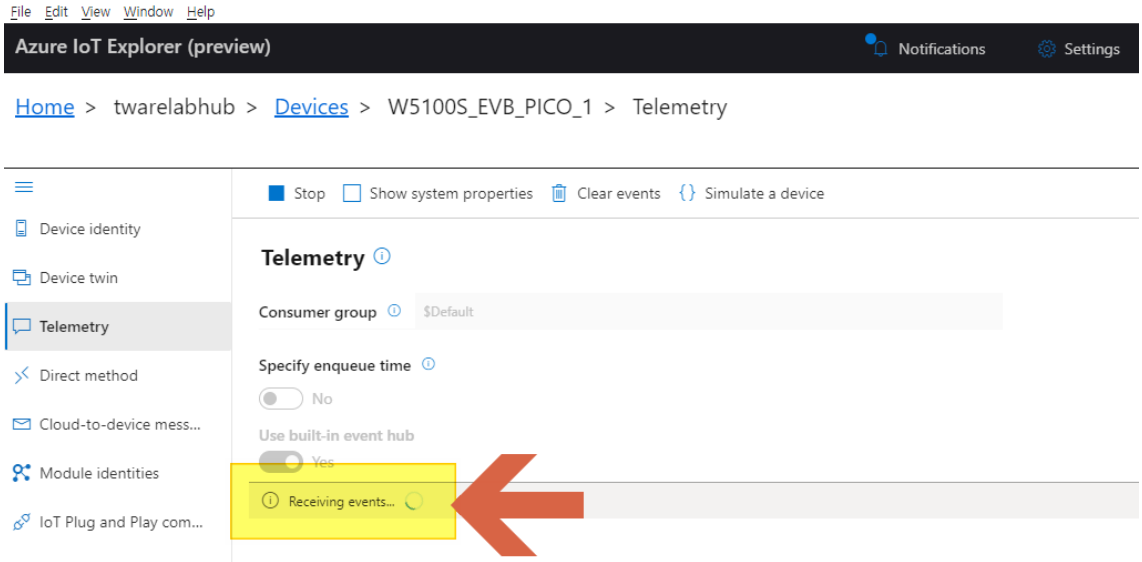

Figure 11. Receiving events

4.5 Step 5: Build

1. After completing the AZURE 2CD example configuration, click 'build' in the status bar at the bottom of Visual Studio Code or press the 'F7' button on the keyboard to build.
2. When the build is completed, 'main.uf2' is generated in 'WIZnet-PICO-AZURE-C/build/examples/' directory.

4.6 Step 6: Upload and Run

1. While pressing the BOOTSEL button of Raspberry Pi Pico, W5100S-EVB-Pico, W5500-EVB-Pico, W55RP20-EVB-Pico, W5100S-EVB-Pico2 or W5500-EVB-Pico2 power on the board, the USB mass storage 'RPI-RP2' is automatically mounted.

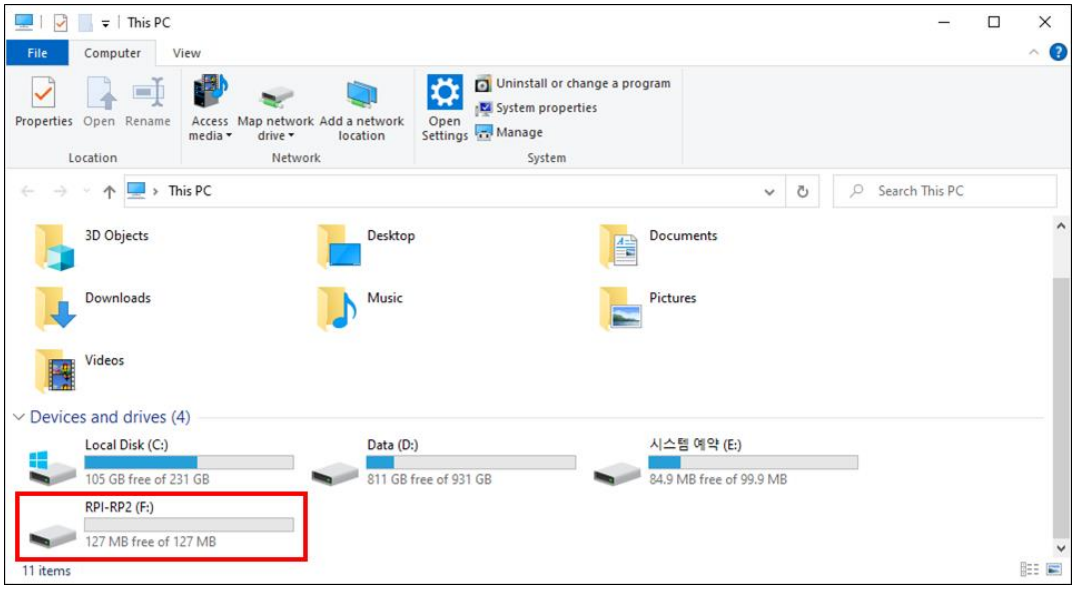

Figure 12. USB mass storage

2. Drag and drop ' main.uf2' onto the USB mass storage device 'RPI-RP2'.
3. Connect to the serial COM port of Raspberry Pi Pico, W5100S-EVB-Pico, W5500-EVB-Pico, W55RP20-EVB-Pico, W5100S-EVB-Pico2 or W5500-EVB-Pico2 with Tera Term.

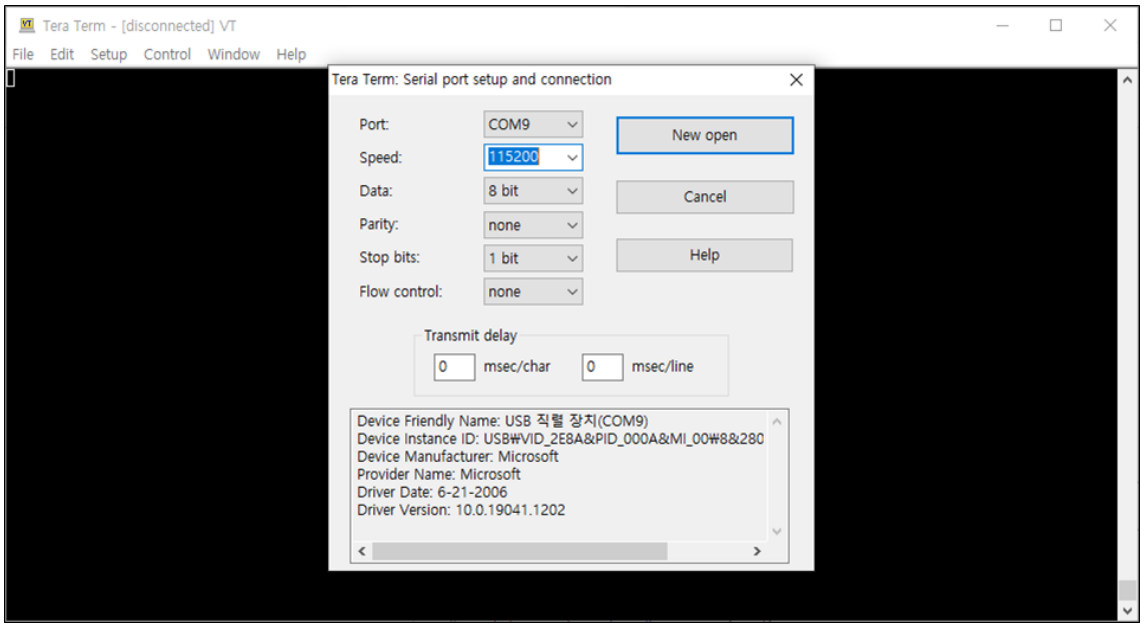

Figure 13. Tera Term

4. Reset your board.

5. If the Azure 2CD example works normally on Raspberry Pi Pico, W5100S-EVB-Pico, W5500-EVB-Pico, W55RP20-EVB-Pico, W5100S-EVB-Pico2 or W5500-EVB-Pico2, you can see the network information of Raspberry Pi Pico, W5100S-EVB-Pico, W5500-EVB-Pico, W55RP20-EVB-Pico, W5100S-EVB-Pico2 or W5500-EVB-Pico2, connecting to the Azure IoT Hub and sending the messages.

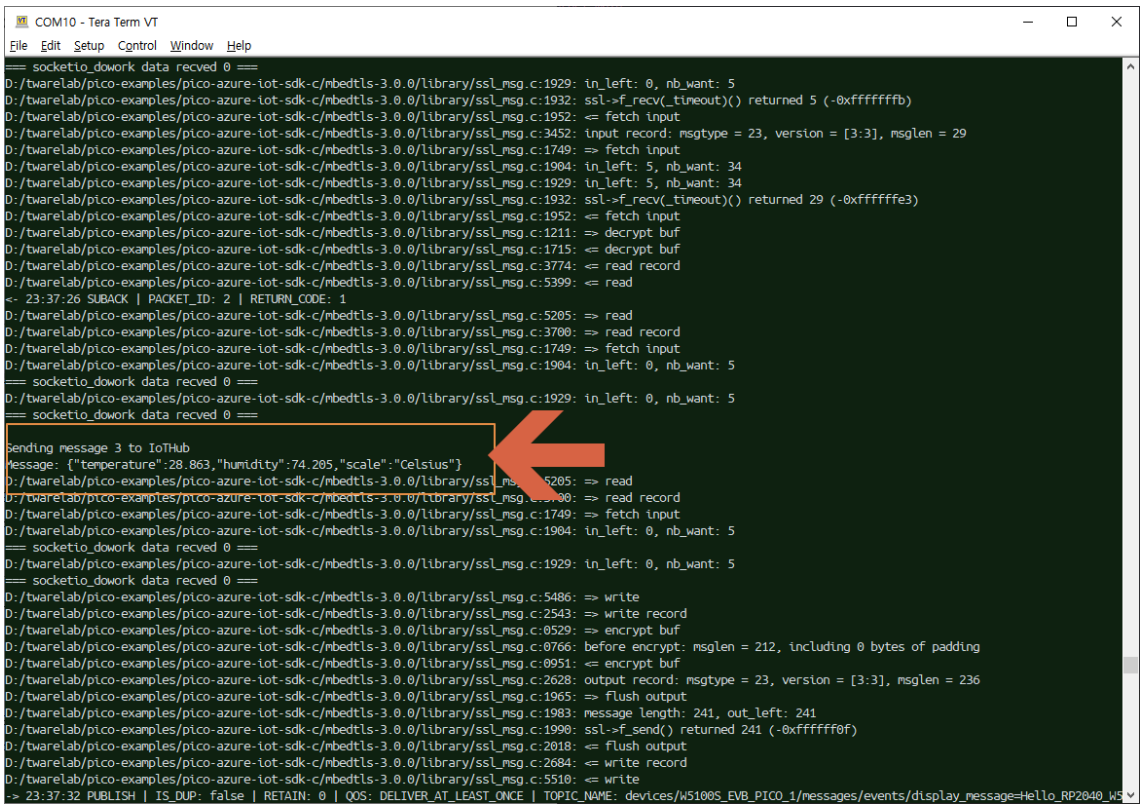

Figure 14. Network Info and connect to Azure IoT Hub

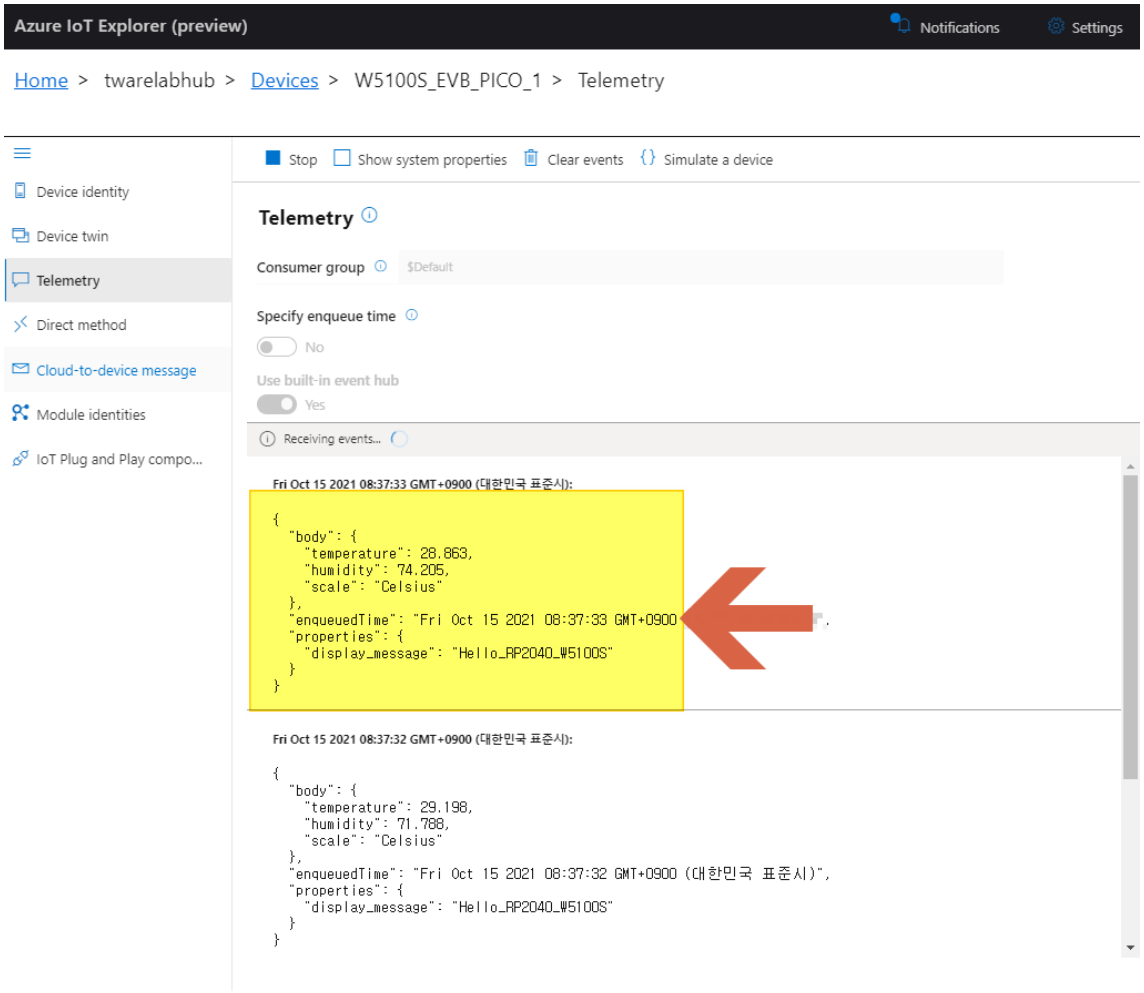

Figure 15. Getting device messages from Azure IoT Hub

6. you can send C2D messages to your device with "Azure IoT Explorer" program as follows:

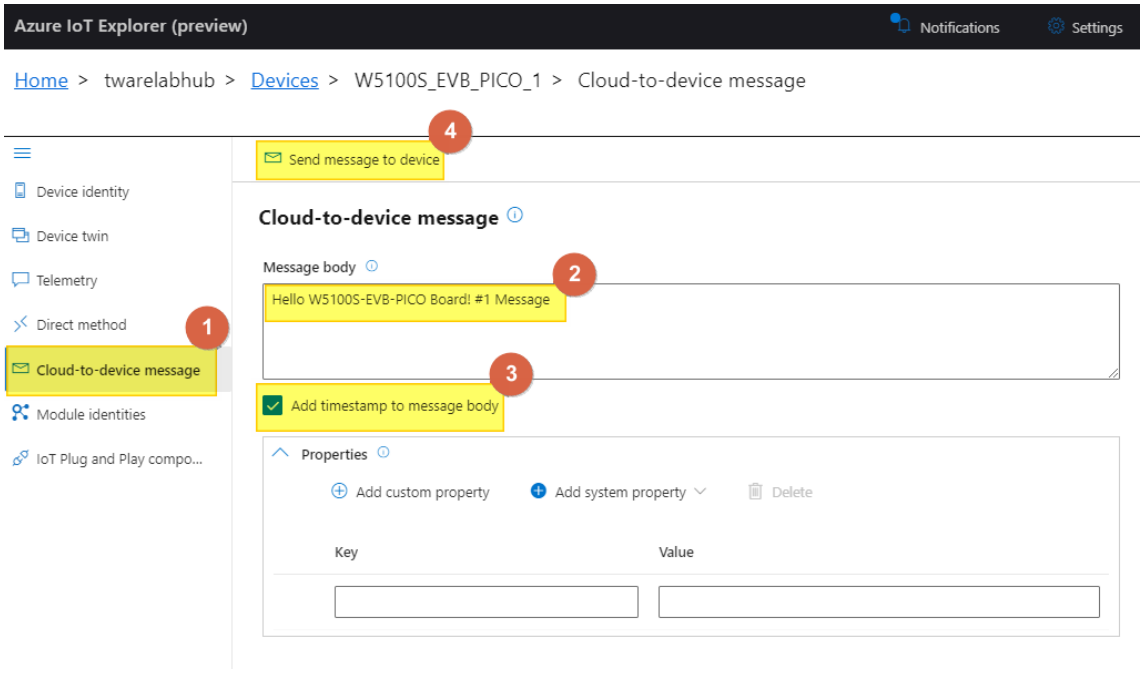

Figure 16. Send Cloud-to-device message

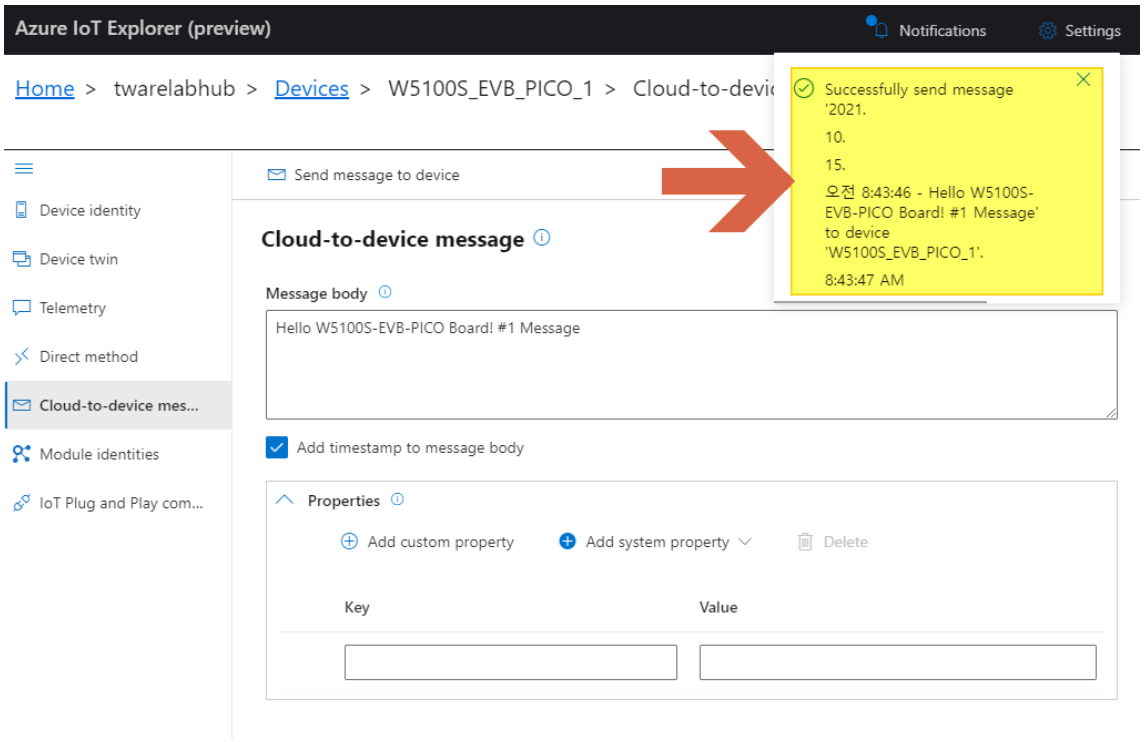

Figure 17. Check the send message

7. Then, you can see the received C2D message through your "Serial Terminal" window as below:

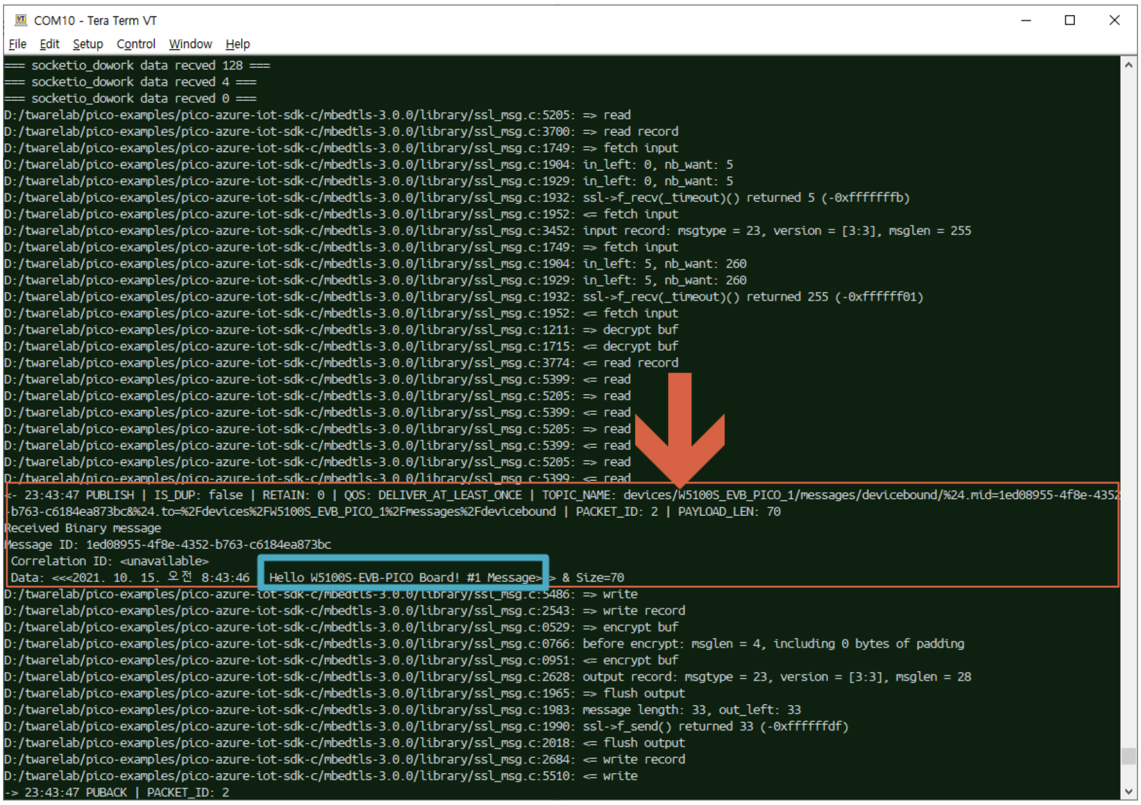

Figure 18. received the C2D message

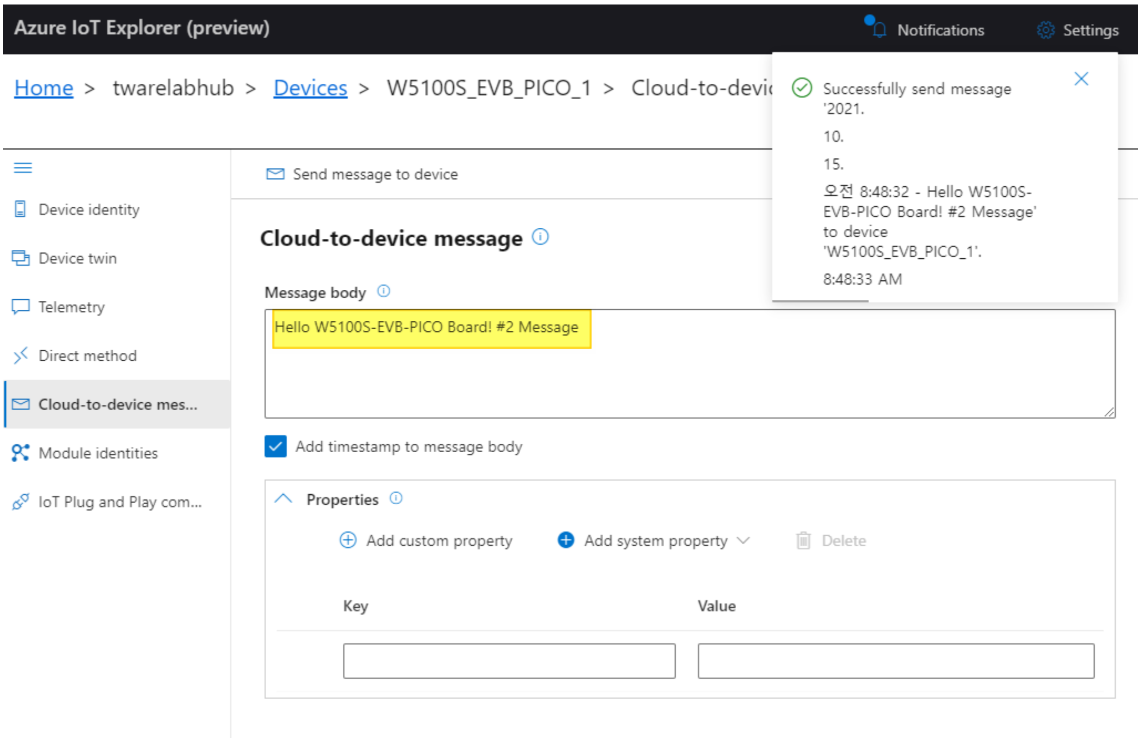

Figure 19. Send Cloud-to-device message 2

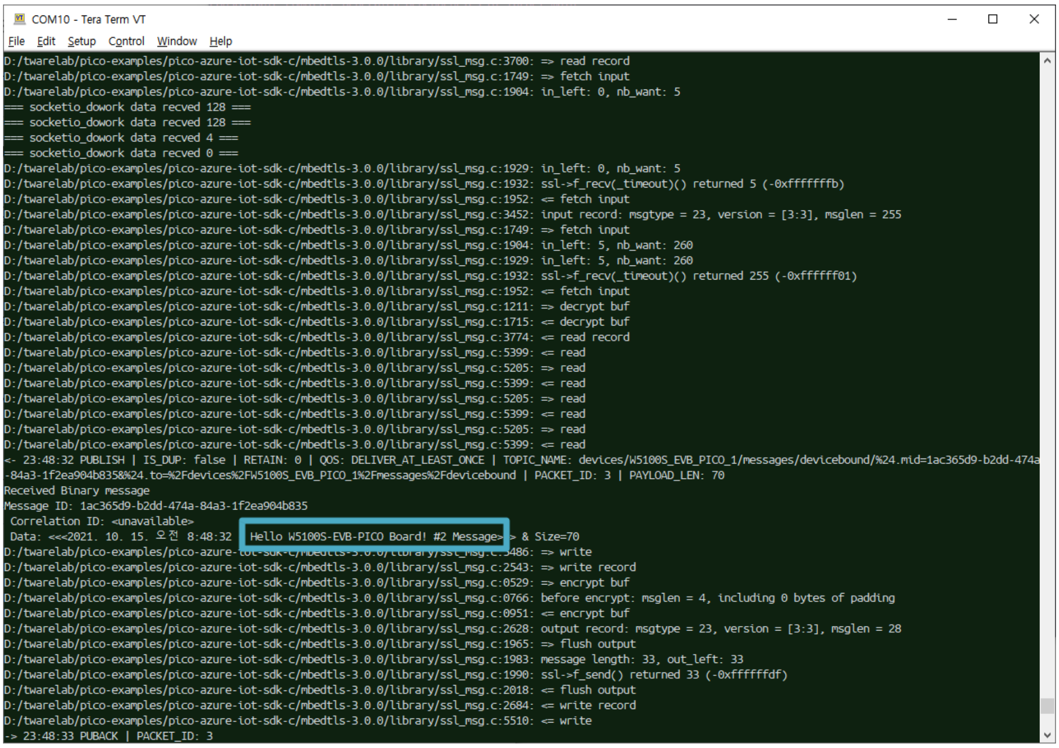

Figure 20. Received the C2D message 2

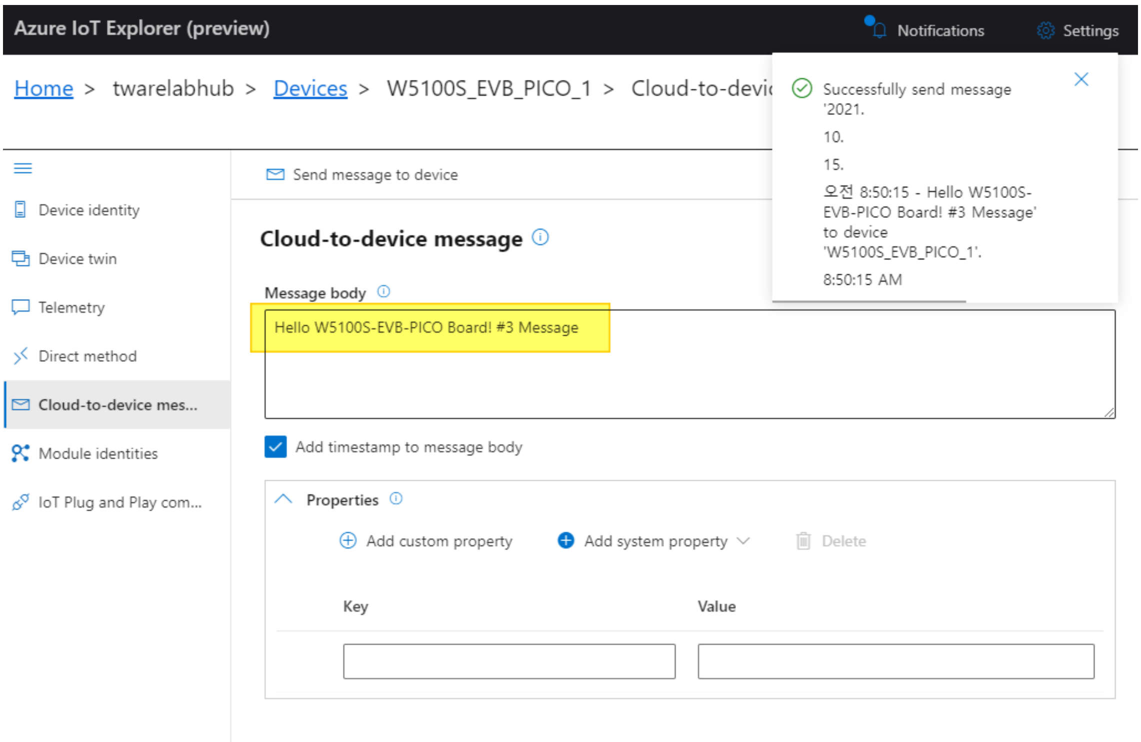

Figure 21. Send Cloud-to-device message 3

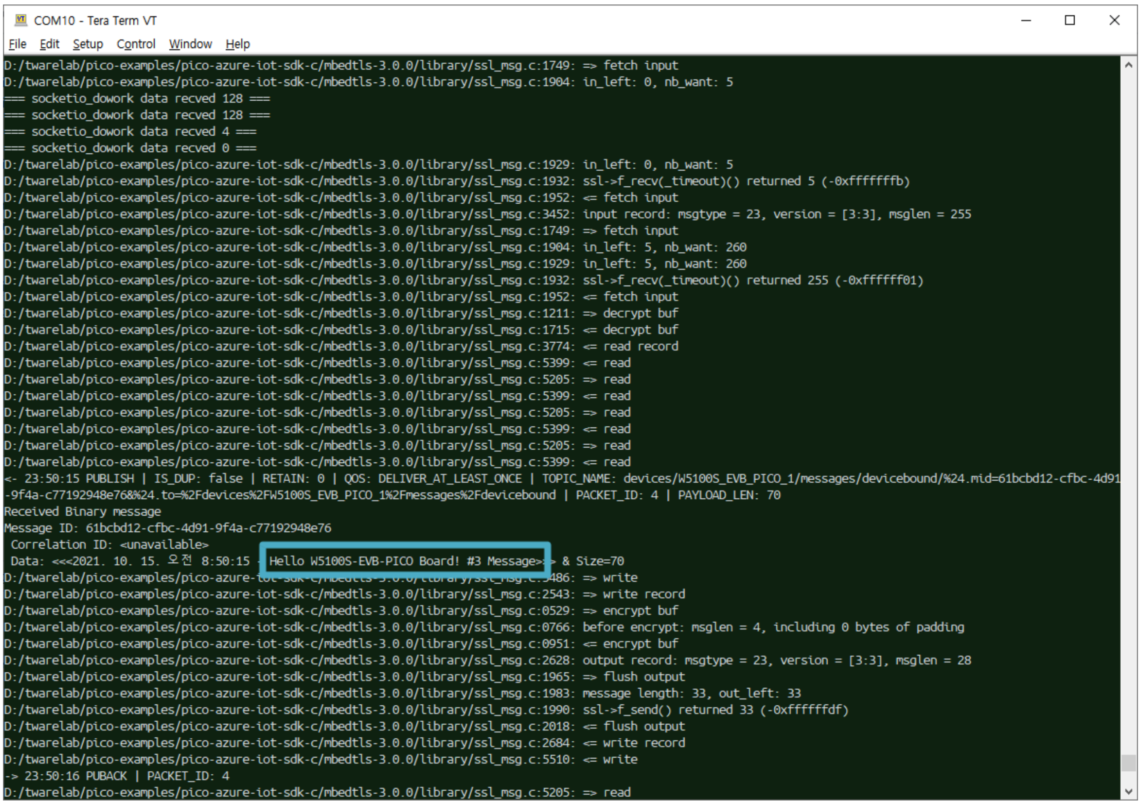

Figure 22. Received the C2D message 3

Revision history

Version	Date	Descriptions
Ver. 1.0.0	Dec, 2024	Initial release.

Table 1. Revision history

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