DA16200 DA16600 AT GUI Tool

This document provides instructions on how to control the DA16200 and DA16600 EVBs in GUI environment.

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1. Terms and Definitions

AP	Access Point
AT	Attention
CoAP	Constrained Application Protocol
Devkit	Development Kit
DHCP	Dynamic Host Configuration Protocol
EVB	Evaluation Board
EVK	Evaluation Kit
GUI	Graphical User Interface
HTTP	Hypertext Transfer Protocol
MFC	Microsoft Foundation Class
MQTT	Message Queuing Telemetry Transport
OTP	One-Time Programmable
PEM	Privacy Enhanced Mail
QFN	Quad Flat No-Lead
RX	Receive
SDK	Software Development Kit
SSID	Service Set Identifier
STA	Station
TCP	Transmission Control Protocol
TLS	Transport Layer Security
TX	Transmit
UART	Universal Asynchronous Receiver Transmitter
UDP	User Datagram Protocol
USB	Universal Serial Bus

2. References

[1] DA16200, Datasheet, Renesas Electronics.

[2] UM-WI-046, DA16200 DA16600, FreeRTOS SDK Programmer Guide, User Manual, Renesas Electronics.

[3] UM-WI-056,DA16200 DA16600, FreeRTOS Getting Started Guide, User Manual, Renesas Electronics.

[4] UM-WI-003, DA16200 DA16600, Host Interface and AT Command, User Manual, Renesas Electronics.

Note 1 References are for the latest published version, unless otherwise indicated.

3. Introduction

The DA16200/DA16600 GUI tool allows you to control the DA16200/DA16600 EVBs in a GUI environment. There are three modes of operation: Certification mode, Network mode, and OTP mode (see Figure 1).

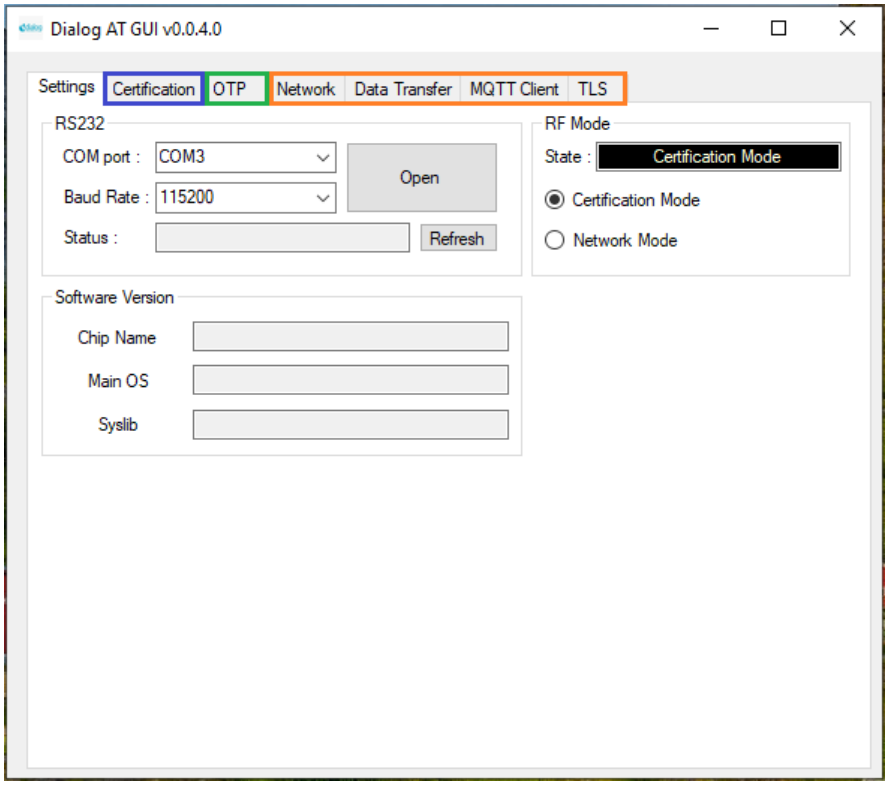


Figure 1. DA16200 EVB GUI

NOTE
This document also covers the DA16600.

3.1 Certification Mode

This mode is for Wi-Fi RF test (TX power, RX sensitivity) also known as "TEST Mode".

3.2 Network Mode

With Network mode, the Station or AP mode of the DA16200 can be tested.

- **AP mode**: Soft AP test with configurable parameters like SSID, security, and DHCP Server.
- **Station mode**: STA test to search and connect to an Access Point and check/test the STA function.

After the network mode is set, you can test the TCP/UDP or the MQTT and manage the TLS certificates.

- **Data Transfer**: message exchange through the TCP Server/Client, and UDP session.
- **MQTT Client**: message exchange through the MQTT protocol.
- **TLS Setting**: management of TLS certificate that is set (for example, Root CA, Client Certificate, Client Private Key).

3.3 OTP Mode

This mode is for **power calibration** and **temperature calibration with OTP memory location.**

4. DA16200/DA16600 EVB Setup

The DA16200 evaluation board supports USB to serial interface. Connect DA16200 EVB with a desktop through a micro-USB cable and then two COM ports are detected automatically.

One (UART0) is for console command and the other (UART1) is for AT command. Normally, the higher number COM port is for AT commands and the lower number COM port is for the console.

- See Ref. [3] on how to set up DA16200 and DA16600.

5. DA16200/DA16600 Firmware for AT Commands

The official pre-built image package (DA16200 DA16600 FreeRTOS SDK Image vX.X.X.X) contains the firmware supporting AT command for DA16200 and DA16600. These images can be used with the AT GUI tool.

In the package, the images for using the AT GUI tool are as follows:

- For DA16200 EVB: DA16200_IMG_FreeRTOS_ATCMD_UART1_EVK_vX.X.X.X_4MB.zip
- For DA16600 EVB: DA16600_IMG_FreeRTOS_ATCMD_UART2_EVK_vX.X.X.X_4MB.zip

Alternatively, the firmware image can be created using the DA16200 DA16600 SDK.

To use AT commands, the following change is required to the `config_generic_sdk.h`:

```
// AT command features
      #define   __SUPPORT_ATCMD__                              // Support AT commands
```

The `config_generic_sdk.h` files are in the following directory path in the DA16200 DA16600 SDK.

- For DA16200: <sdk_root>/apps/da16200/get_started/include/user_main/config_generic_sdk.h
- For DA16600: <sdk_root>/apps/da16600/get_started/include/user_main/config_generic_sdk.h

To program this image into the EVB, see the Programming Firmware Image section in Ref. [3].

6. Run GUI with DA16200 EVB

6.1 Connection and Running

The DA16200 AT GUI program is a single executable file.

NOTE
If "a DLL file (for example, vcruntime140.dll or mfc1400u.dll) is missing" message appears, install Microsoft Visual Studio redistributable package (https://www.microsoft.com/en-us/download/details.aspx?id=48145) or copy the `.dll` file into the Windows system folder (C:\Windows\System32 or C:\Windows\SysWOW64).

The program setup sequence is:

1. Connect the DA16200 Development Kit (Devkit) to the host computer as shown in Figure 2.

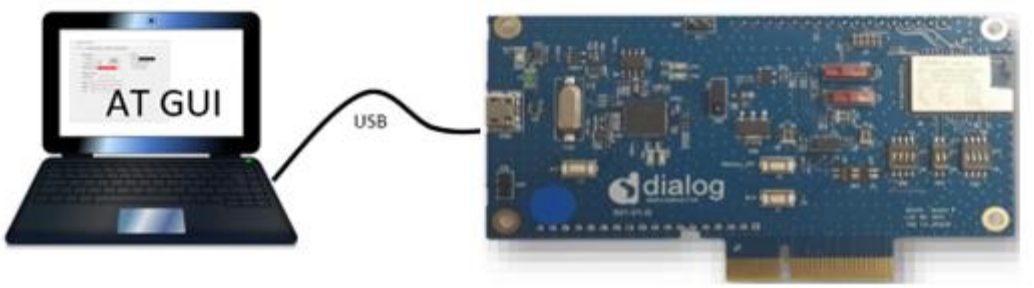


Figure 2. Devkit connections

NOTE
See Ref. [3] to see which port to use.

2. Start the AT GUI program.

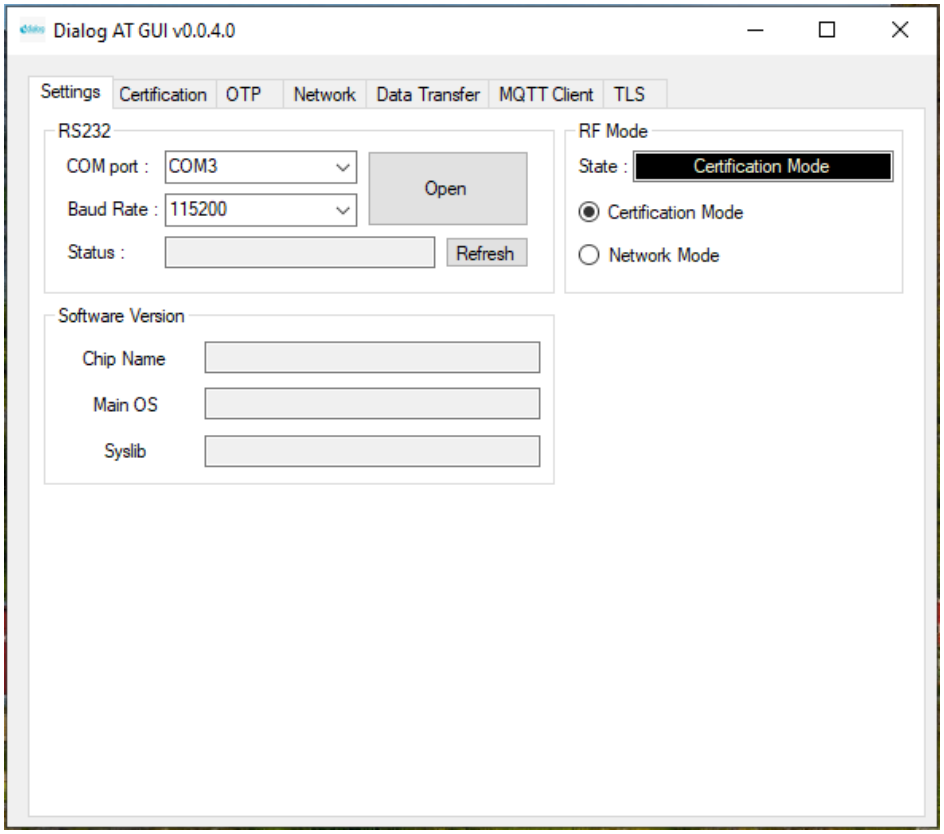


Figure 3. AT GUI

6.2 COM Port and Baud Rate Configuration

1. When running the AT GUI program, the connection status is red (not connected). If the program does not detect any COM port, click the **Refresh** button to refresh the COM port, see Figure 4.

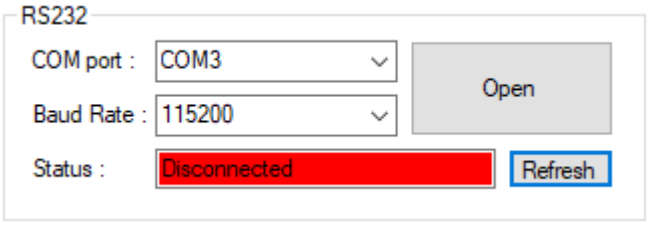


Figure 4. RS232 setup – disconnected

2. Select a COM port and click the **OPEN** button and wait for a few seconds, see Figure 5 and Figure 6.

- The connection status soon changes to a green color and shows "Connected". This means that communication is OK.

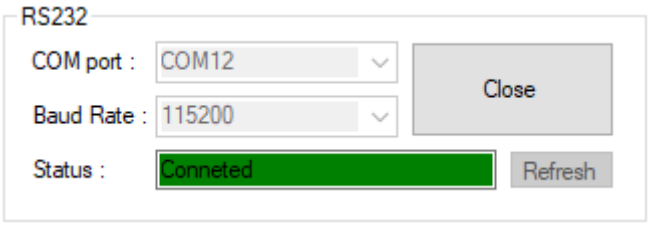


Figure 5. RS232 setup – connected

- In the **Console** window (see Figure 6), when it is connected, the message "`Echo on`" is shown.

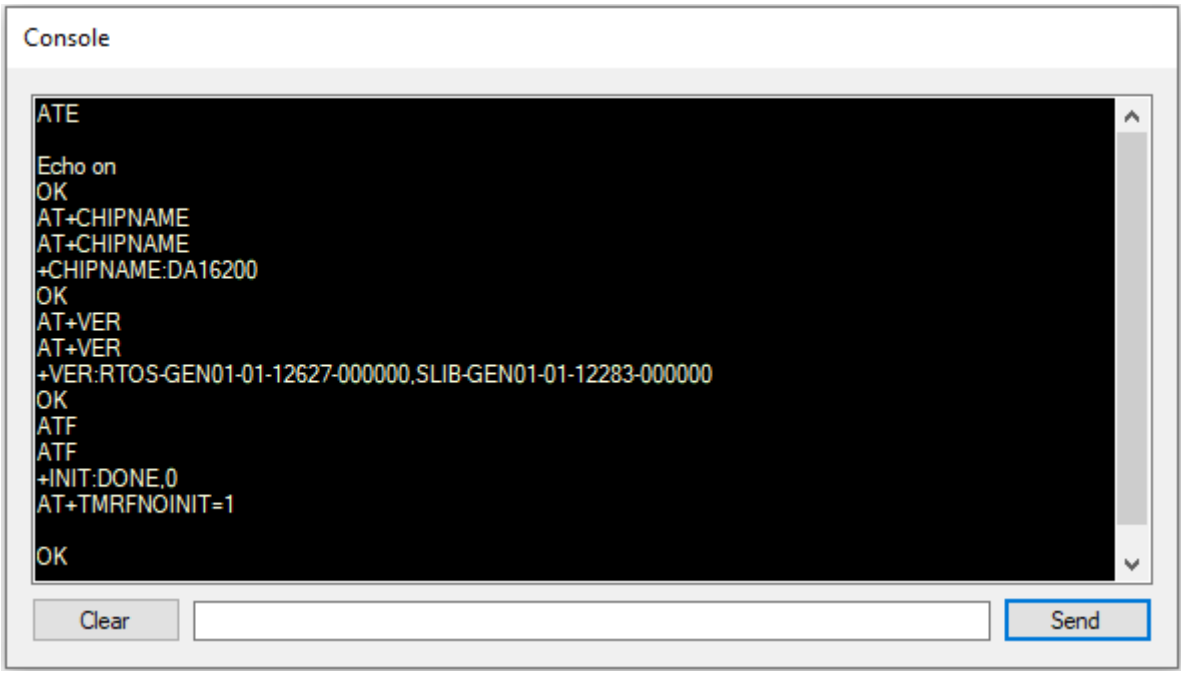


Figure 6: Debug console – connected

6.3 RF Certification Mode

To enable certification mode:

1. Open the **Settings** tab, see Figure 7.
2. In the **RF Mode** area, select the **Certification Mode** check box.

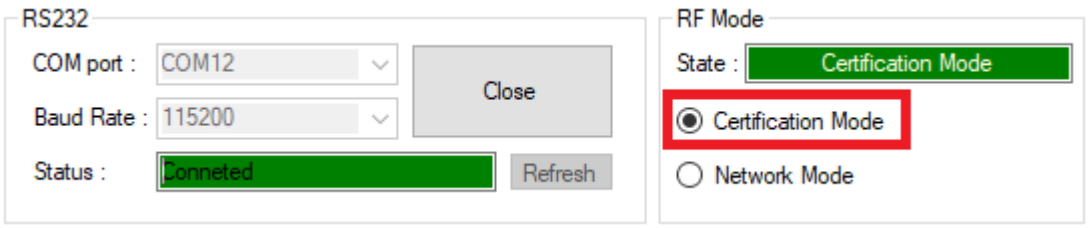


Figure 7. Configuring certification mode

6.4 TX Test Mode

1. Open the **Certification Mode,** see Figure 8.

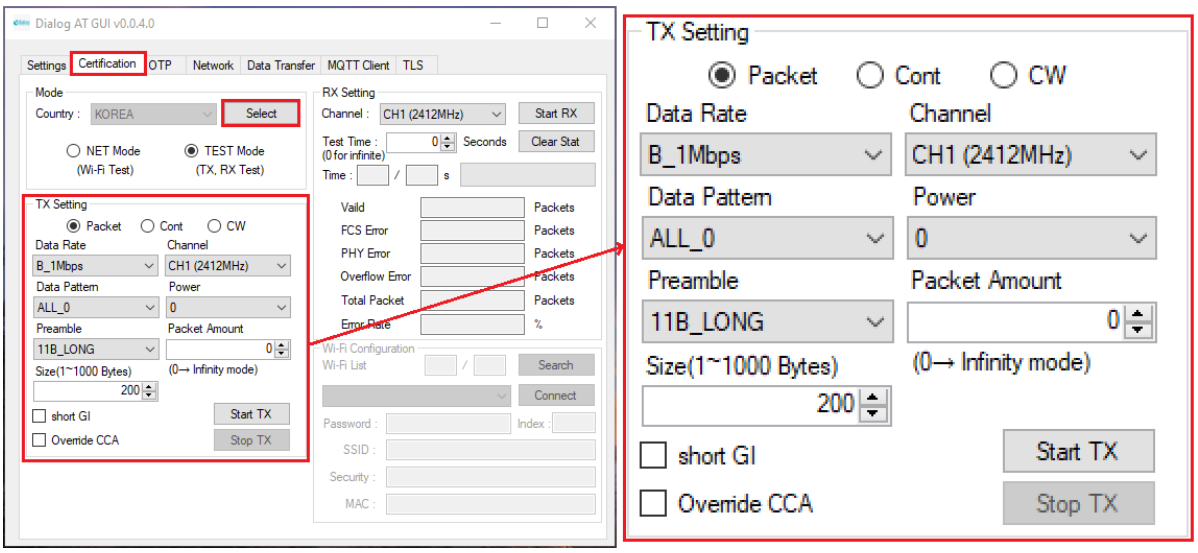


Figure 8. TX setting

2. Click the **Select** button under **Mode** (see Figure 8). A confirmation message is shown, see Figure 9. This is a normal state.

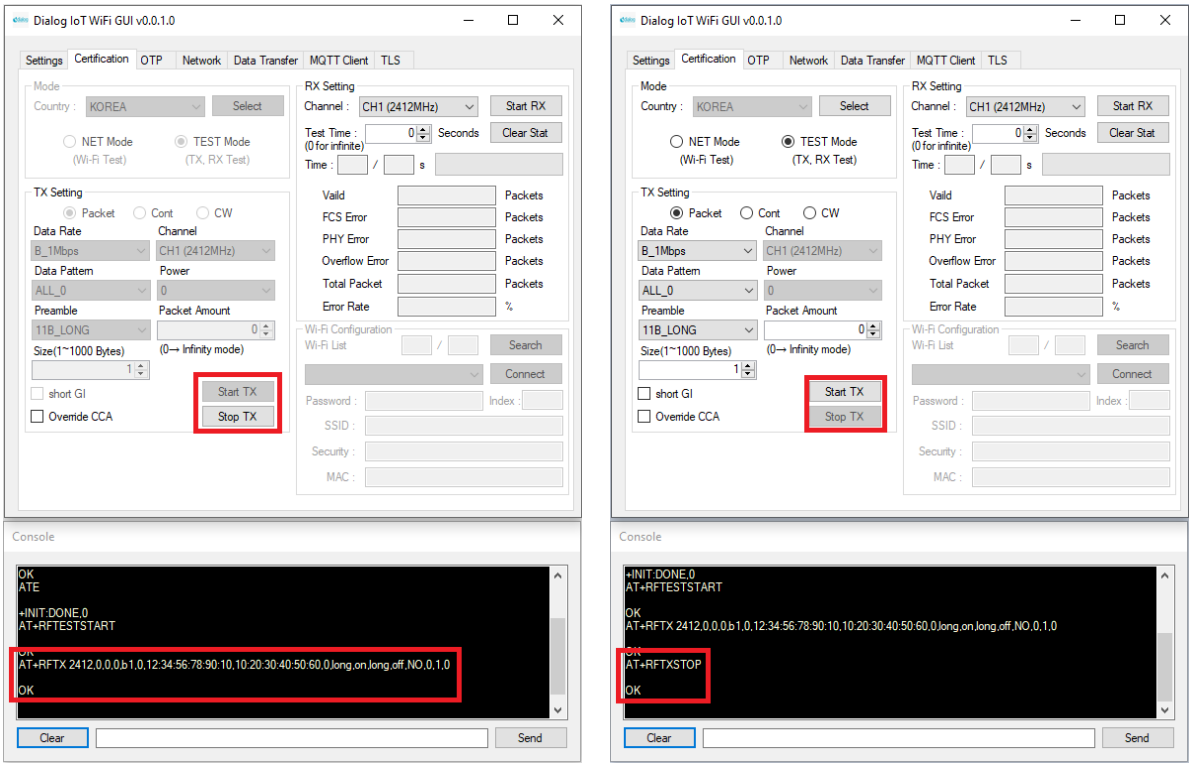
Figure 9. Debug console – TX mode

3. Select the **Data Rate**, **Channel**, and **Power** for the purpose of the test.

- **Packet mode**: Packet generation TX mode. Packets of a fixed size are sent according to the modulation.
- **Cont mode**: Continuous TX mode. TX packet is generated continuously over 95% duty cycle. This mode is for TX power test.
- **CW mode**: Single tone TX mode. Continuous wave signal with a single frequency, which is unmodulated and does not carry information. This mode is for frequency error check.
- **Data rate**: Select a modulation type to test.
- **Power**: Select or tune the power level. ("0" step is maximum). The difference between power steps is about 0.8~1 dB/1 step.
- **Size**: You can adjust the duty rate. However, the size is not linear as the number, so set the exact number you need with equipment like a spectrum analyzer to check the value. Equipment setting is set to zero span setting or burst mode setting.

For TX packet generation:

- To start and stop TX packet generation, use the **Start TX** button and the **Stop TX** button. If you want to make changes for another condition, click **Stop TX** before a new test starts.



Start TX **Stop TX**

Figure 10. Start and stop TX

For example, assume that you have a test setting with 802.11n MCS7, channel 1, 100 bytes packet, and power grade 0.

- When you click the **Start TX** button, the message appears as shown in Figure 11.

Figure 11. Debug console – Start TX

- When you click the **Stop TX** button, the message appears as shown in Figure 12.

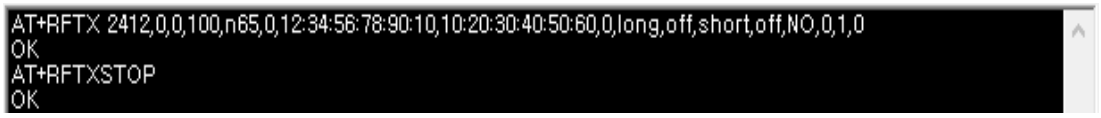


Figure 12. Debug console – Stop TX

6.5 RX Test Mode

The settings are made in the **RX Setting** area. See Figure 13.

- **Channel**: Support CH1 ~ CH13
- **Test Time**: Maximum 3600 s (Duration is 1 second fixed)

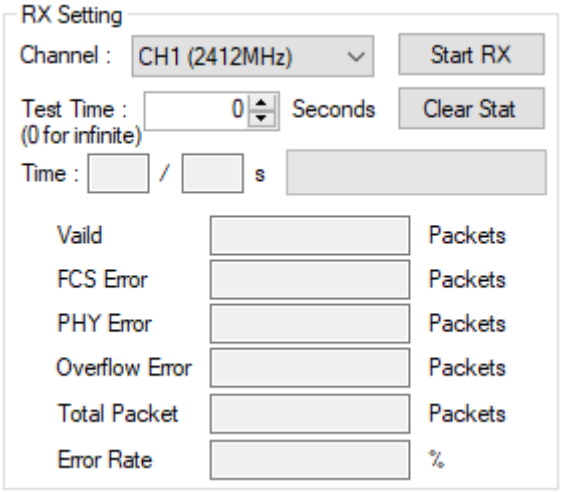


Figure 13. RX configuration

- **RX Packet Rate:** FCS + PHY + Overflow packet/Total packet = Error rate

7. Network Mode

To enable network mode:

1. Open the **Settings** tab.
2. Select the **Network Mode** checkbox, see Figure 14.

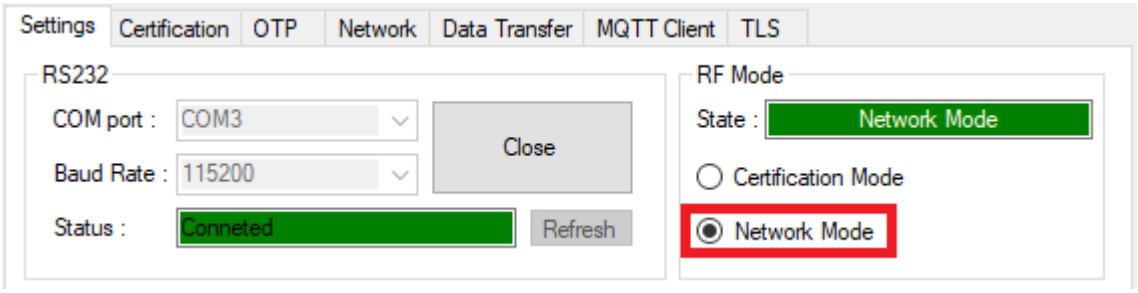


Figure 14. Network mode configuration

7.1 Station Mode

1. In the **Mode** field, select **Station Mode**.

   The mode is changed to Network mode. Then, the DA16200 reboots, and the station mode setup window opens, see Figure 15.

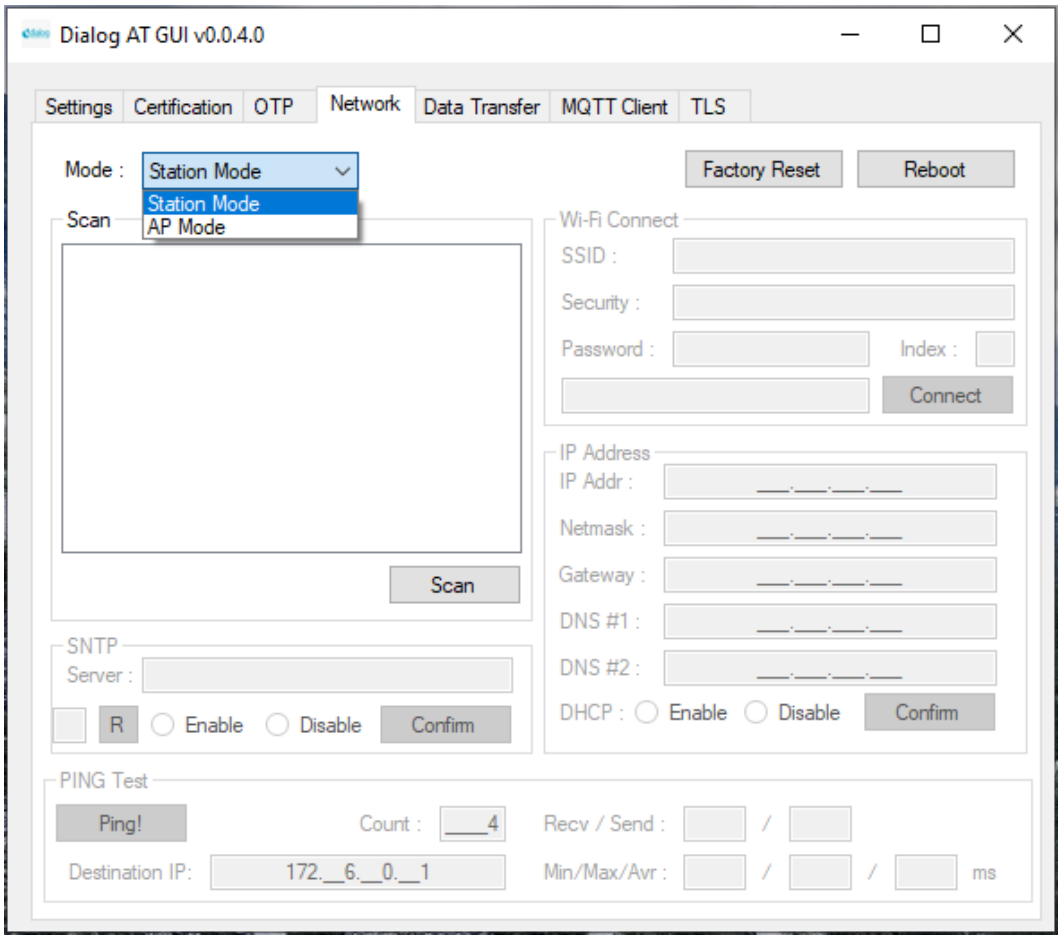


Figure 15. Setup – Station Mode

2. Click the **Scan** button to scan Aps, see Figure 16.

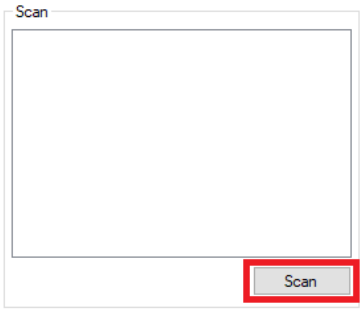


Figure 16. Station mode – Scan

3. When scanning is finished, select one AP in the list, see Figure 17.
4. Click the **Connect** button.
5. If required by the security mode of the AP, enter a password or key index.

Figure 17. Station mode – select AP and connect

Figure 18. Debug console – connect to AP

7.2 AP Mode

1. In the **Mode** field, select **AP Mode**.

   The mode is changed to Network mode. Then, the DA16200 reboots, and the AP Mode setup window opens, see Figure 19.

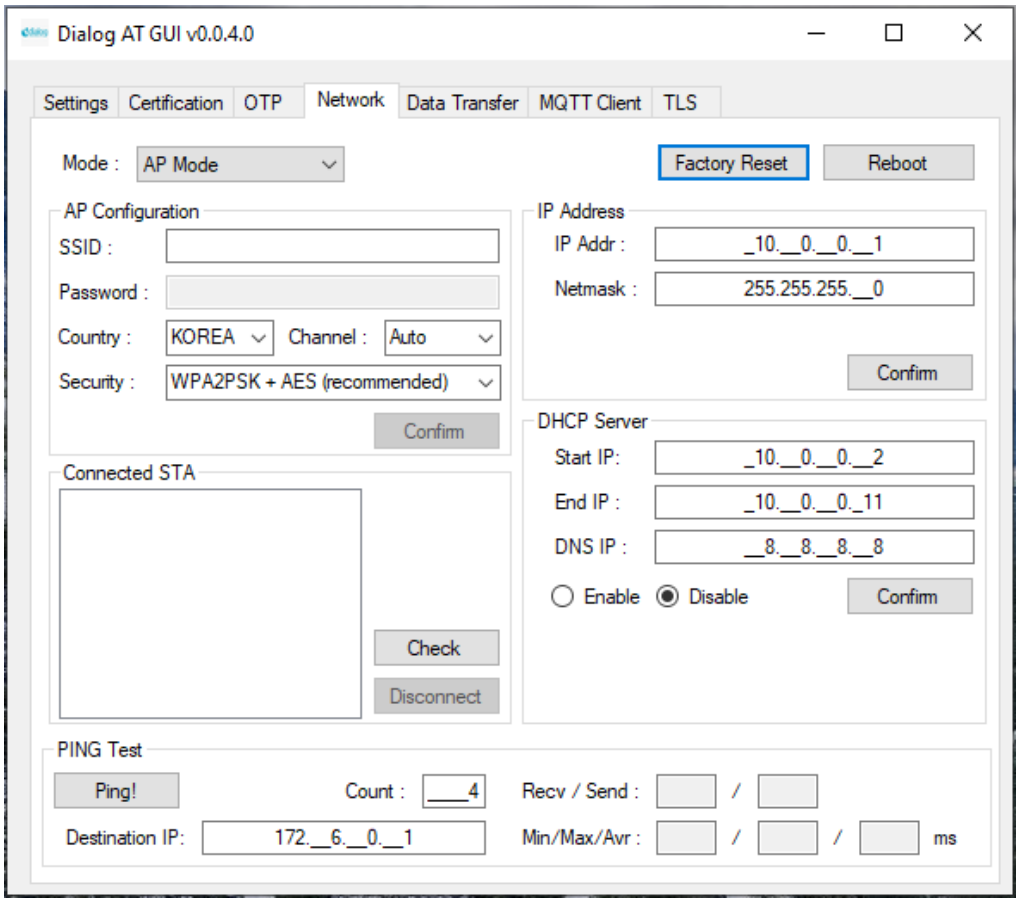


Figure 19. Setup – AP Mode

2. Set the fields of **SSID**, **Password**, **Country**, **Channe**l, and **Security** mode**,** see Figure 20.
3. Click the **Confirm** button.

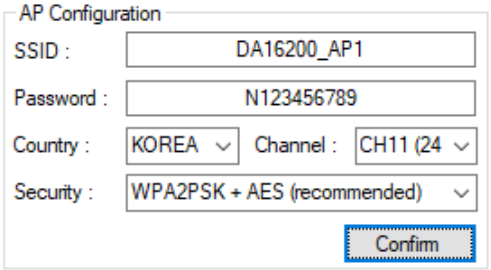


Figure 20. AP configuration

The message appears in the Debug console as shown in Figure 21.

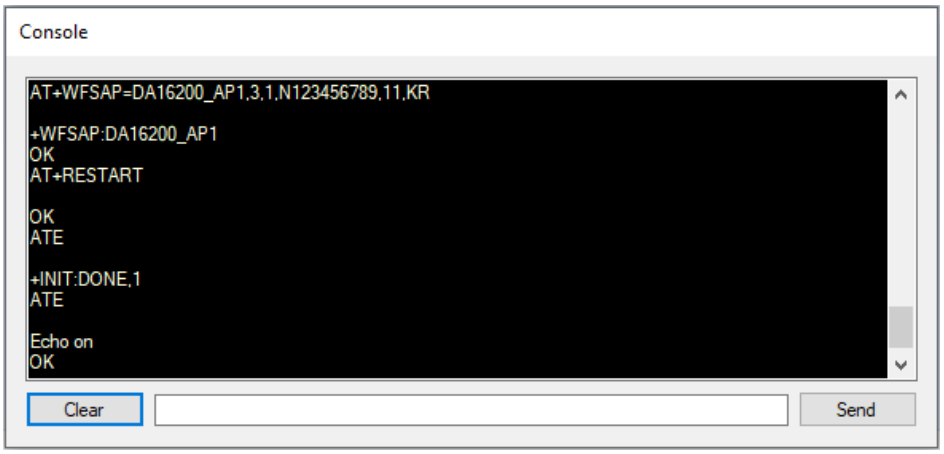


Figure 21. Debug console – AP configuration

4. In the **DHCP Server** area, make the required settings for the IP addresses and click the **Confirm** button, see Figure 22.

   When a client is connected, the MAC address appears as shown in Figure 23.

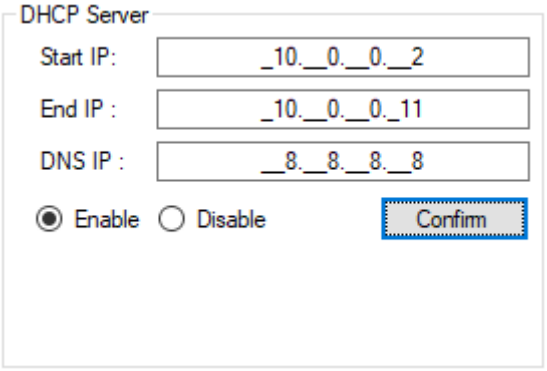


Figure 22. DHCP configuration

Figure 23. Debug console – DHCP configuration

7.3 Data Transfer (TCP/UDP)

The DA16200 GUI tool provides data transfer functions with TCP/UDP. Before messages are sent with this tool, connect the DA16200 to an access point as shown in Section 7.1. Then, click the **Data Transfer** tab. If the DA16200 successfully connects with an AP, the IP address is automatically populated, see Figure 24.

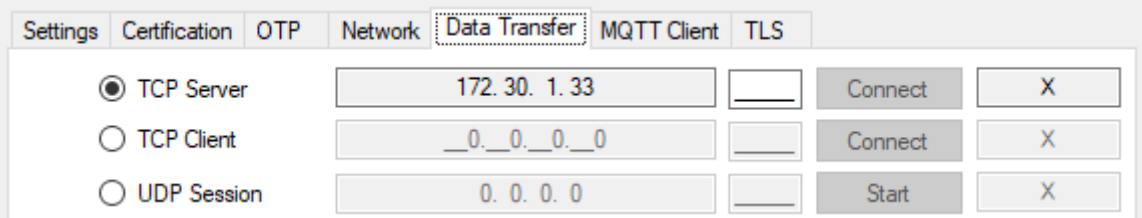


Figure 24. Data transfer tab

The DA16200 provides three sessions: **TCP Server**, **TCP Client**, and **UDP Session**. You can use the three sessions simultaneously.

7.3.1 TCP Server

To use TCP server, fill in a port number and click the **Connect** button on the **TCP Server** line. When the server is opened, the **X** changes to **O**, see Figure 25.

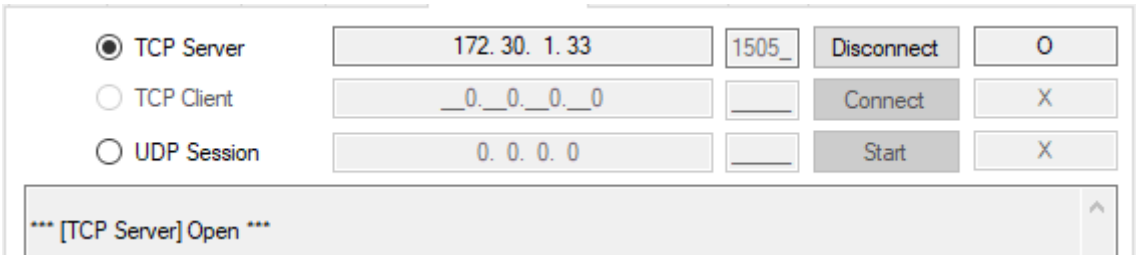


Figure 25. TCP server open

You can connect to the DA16200 TCP server with tools for data exchange like the IO Ninja. When a client is connected successfully, the information is shown in Figure 26. The DA16200 TCP server can accept up to eight client sessions.

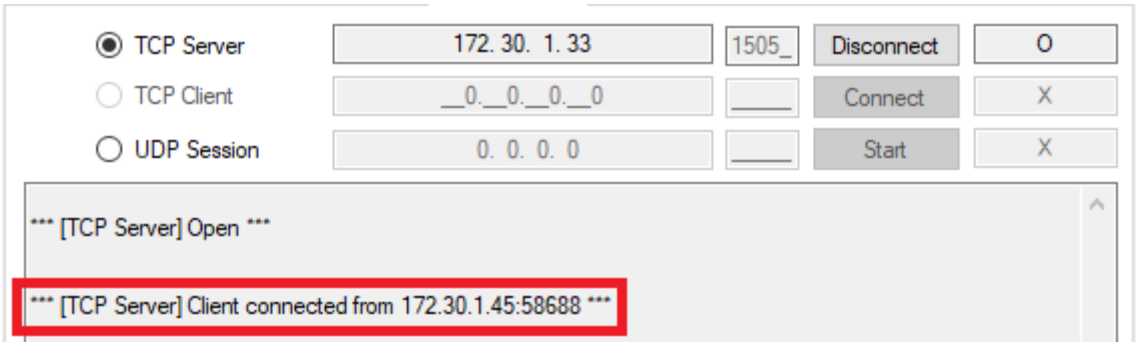


Figure 26. TCP server connection with client

7.3.2 TCP Client

To connect to a TCP server, fill in the IP address and port number of the server and click the **Connect** button on the **TCP Client** line, see Figure 27. When the DA16200 TCP client is successfully connected, the **X** changes to **O.**

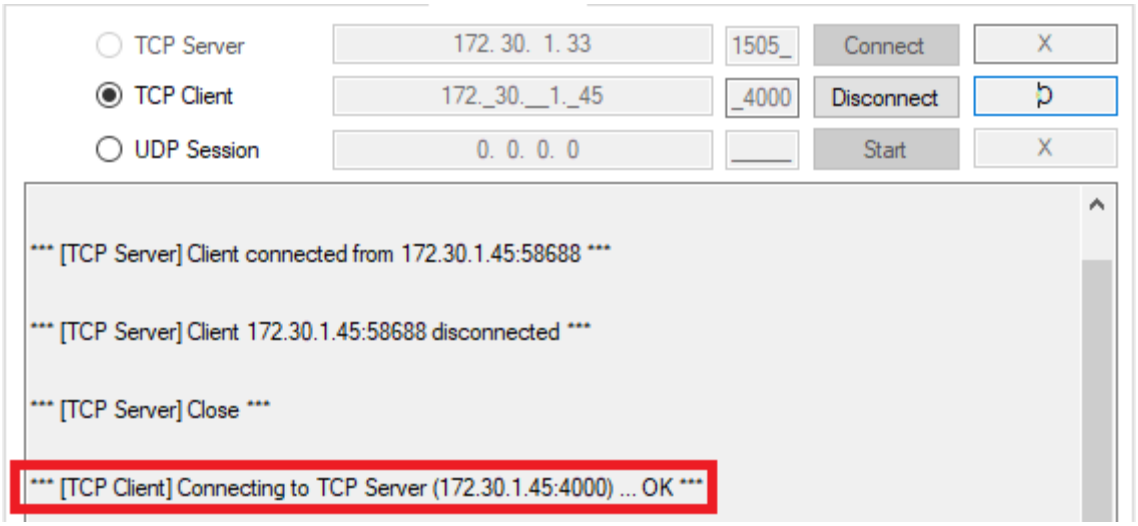


Figure 27. TCP client connection to server

7.3.3 UDP Session

To open a UDP session, enter a port number and click the **Start** button. When the DA16200 TCP client is successfully connected, the **X** changes to **O,** see Figure 28.

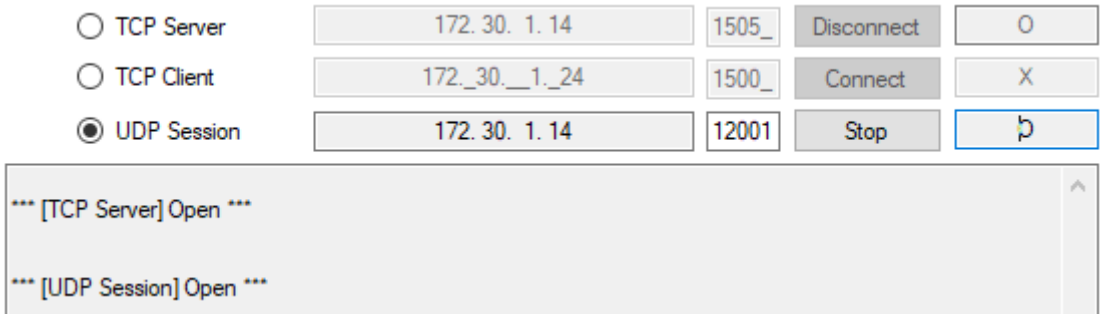


Figure 28. UDP session open

7.3.4 Data Exchange

To send a message to a peer, select a session first. Each session is slightly different in method.

- **TCP Server**:

1. Select the **TCP Server** checkbox.
2. Select the destination IP in the drop-down list.
3. Type a message.
4. Click the **Send** button (see Figure 29).

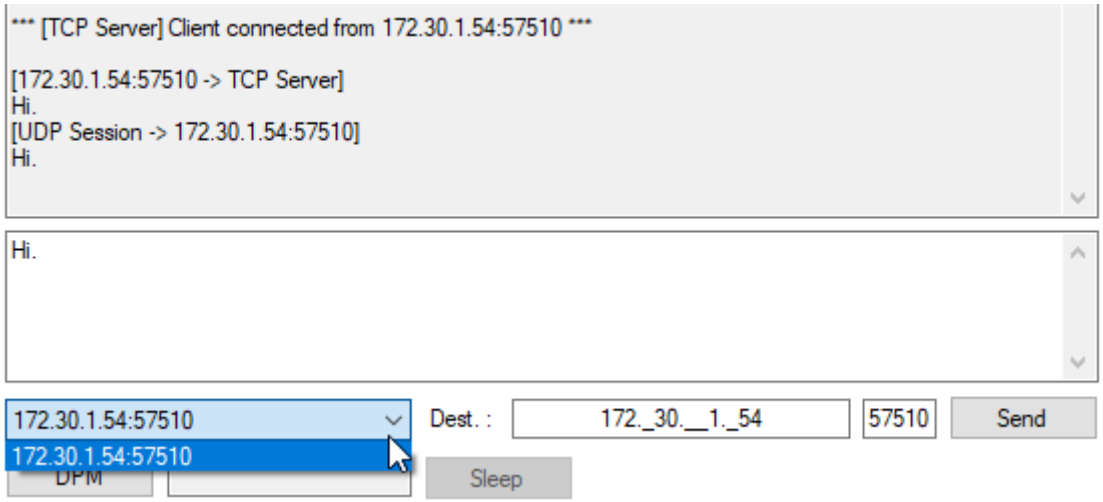


Figure 29. TCP server data transfer

- **TCP Client**:

1. Select the **TCP Client** checkbox.
2. Type a message.
3. Click the **Send** button (see Figure 30).

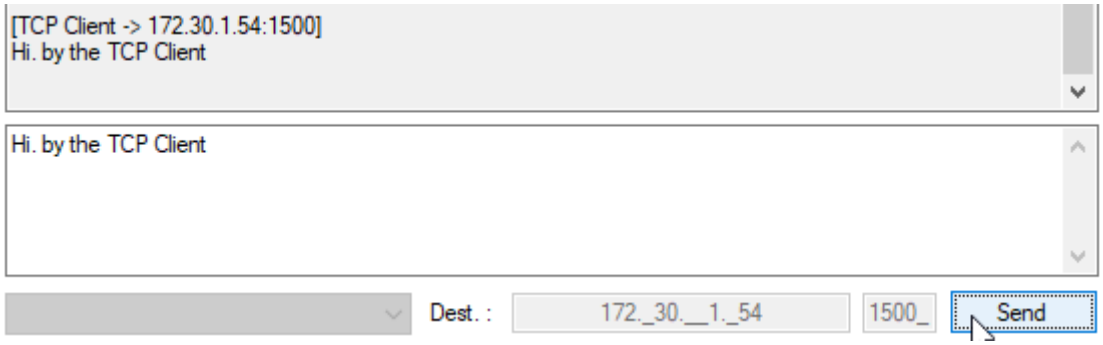


Figure 30. TCP client data transfer

- **UDP Session**:

1. Select the **UDP Session** checkbox.
2. Enter the destination IP and port number.
3. Type a message.
4. Click the **Send** button (see Figure 31).

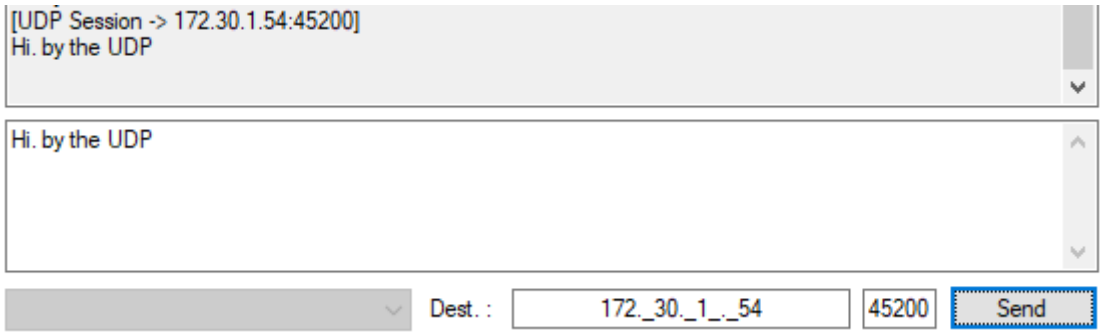


Figure 31. UDP session data transfer

When a session receives a message from a peer, the message is shown, see Figure 32.

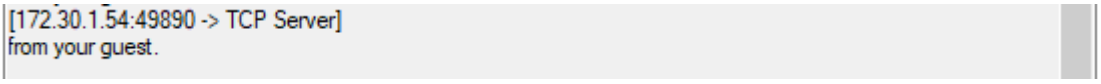


Figure 32. TCP/UDP data reception

7.3.5 Data Transfer on DPM Mode

The DA16200 GUI provides TCP/UDP sockets operation in DPM (DA16200 power-save) mode. See Figure 33.

Figure 33. DPM mode setting

- **DPM Button**: Start or end the DPM mode.
- **DPM_STATUS**: DPM state (Disabled/DPM init…/DPM Sleep/DPM wake-up).
- **Sleep Button**: The DA16200 returns to DPM sleep state (only available DPM wake-up state).

1. To initiate TCP/UDP sockets in DPM mode:
   a. Open the desired socket.
   b. Click the DPM button to start DPM mode.
   c. After all sockets are ready in DPM mode, the DPM_STATUS changes to **DPM sleep**.

When the DA16200 in DPM sleep state receives a TCP or UDP messages from a peer, the message appears, see Figure 32.

2. To send a message in DPM Sleep status:
   a. Wake up the DA16200 with the switch. The **DPM_STATUS** changes to **DPM wake-up**.
   b. Select the session to send, type a message, and click the **Send** button.
   c. After sending messages, click the **Sleep** button. The **DPM_STATUS** changes to **DPM sleep**.
3. To exit DPM mode:
   a. Wake up the DA16200 with the switch. The **DPM_STATUS** change to **DPM Wake-up**.
   b. Click the **Sleep** button. The **DPM_STATUS** changes to **Disabled**.

7.4 MQTT Client

The DA16200 GUI tool provides data transfer functions with MQTT protocol. Before messages are sent with this tool, connect the DA16200 to an access point as shown in Section 7.1. Click the **MQTT Client** tab.

7.4.1 Configuration

Before connecting to an MQTT broker, set the required fields for the connection information. See Figure 34.

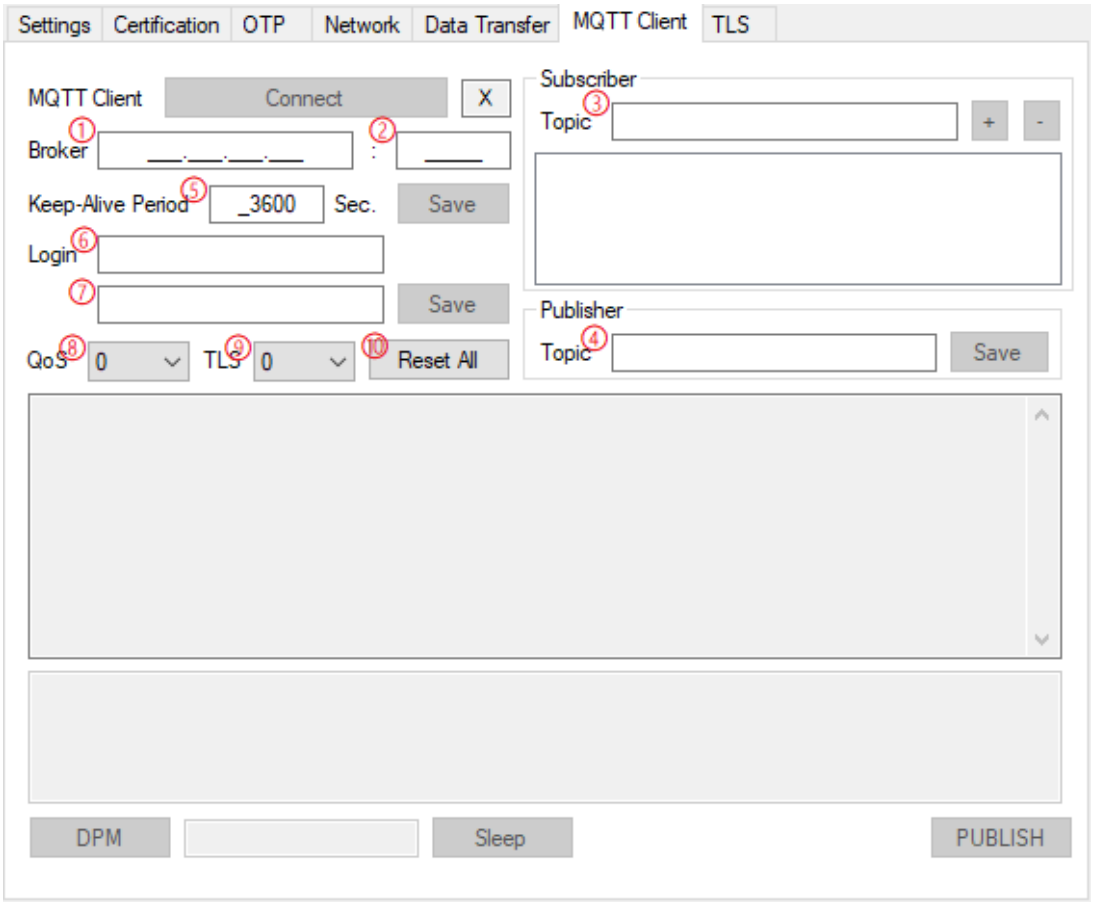


Figure 34. MQTT client tab

1. Broker IP address
2. Broker port number
3. Subscriber topics (up to 4)
4. Publisher topic
5. Sending PINGREQ cycle (second)
6. Login ID
7. Login password
8. MQTT QoS (0~2)
9. TLS use (0 or 1)
10. Reset all configuration to default

When the DA16200 MQTT client succeeds to connect, the letter **X** changes to **O**. Moreover, you can send a PUBLISH message to the broker or receive a message.

7.4.2 Data Exchange

To exchange a message with the broker, connect the MQTT Client. To send a PUBLISH, type the message, and click the **PUBLISH** button. See Figure 35.

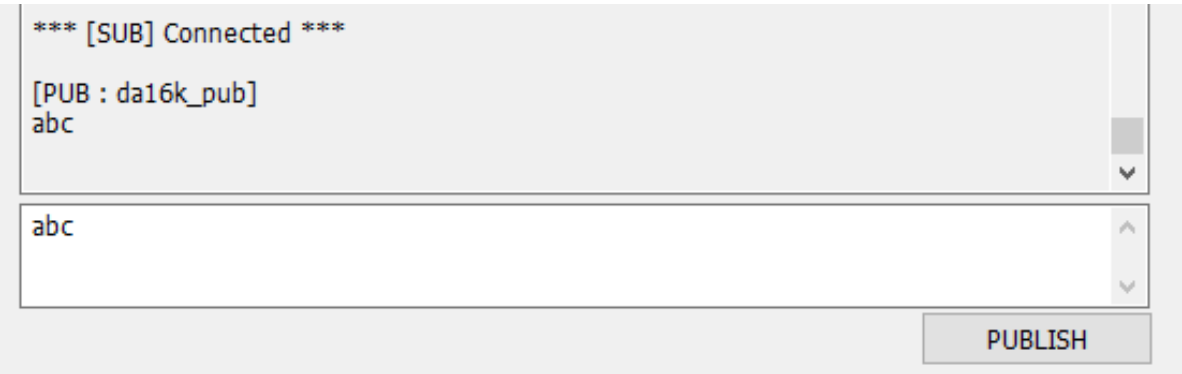


Figure 35. MQTT PUBLISH transfer

When the client receives a message from the broker, the message is displayed as shown in Figure 36.

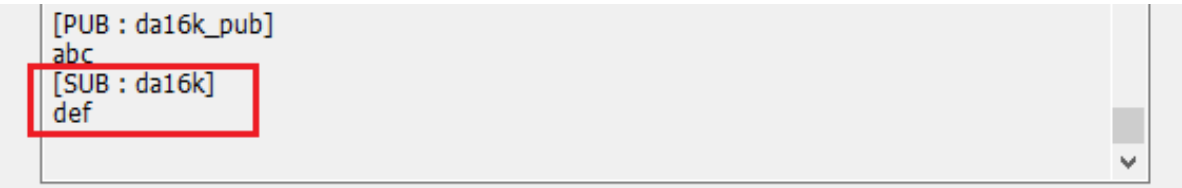


Figure 36. MQTT PUBLISH reception

7.4.3 MQTT in DPM Mode

The DA16200 GUI provides MQTT client operation in DPM mode. Figure 33 shows the DPM mode setting under the MQTT Client tab.

To initiate MQTT client in DPM mode:

1. After setting up, connect to an MQTT Broker.
2. Click the **DPM** button to start DPM mode.
3. After the MQTT client session is ready in DPM mode, the **DPM_STATUS** changes to **DPM sleep**.

When the DA16200 in DPM sleep state receives a PUBLISH from the broker, it is shown in the message window like Figure 36.

To send a message in DPM Sleep status:

1. Wake up the DA16200 with the switch. The **DPM_STATUS** changes to **DPM wake-up**.
2. Type a message and click the **PUBLISH** button.
3. After sending messages, click the **Sleep** button. The DPM_STATUS changes to **DPM sleep**.

To exit DPM mode:

1. Wake up the DA16200 with the switch. The **DPM_STATUS** changes to **DPM Wake-up**.
2. Click the **Sleep** button. The **DPM_STATUS** changes to **Disabled**.

7.5 TLS Setting

You can store a TLS certificate that is set with this tool for MQTT, HTTPs, and CoAPs. The certificate has Root CA, Client Certificate, and Private Key.

The DA16200 can only process Privacy Enhanced Mail (PEM) type. To enter the certificates directly, input the text and click the **Upload** button with the TLS item selection. If this is done successfully, `<Content exists>` appears in the window, see Figure 37.

If you have TLS certificate files with PEM type, click **File Search** and select the file and then the text should be loaded.

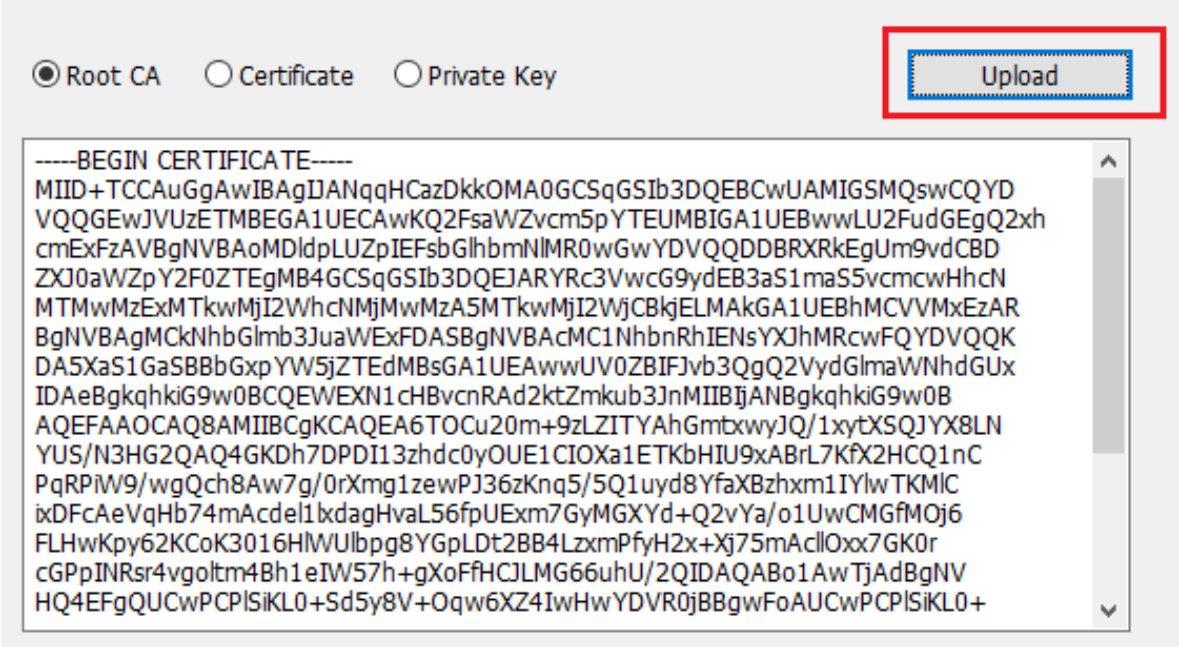


Figure 37: TLS setting tab

8. OTP Mode Setup

To enable OTP mode:

1. Open the **OTP Mode** tab.
2. Click the **OPT Enable** checkbox.
   The current OTP data is as shown in Figure 38.

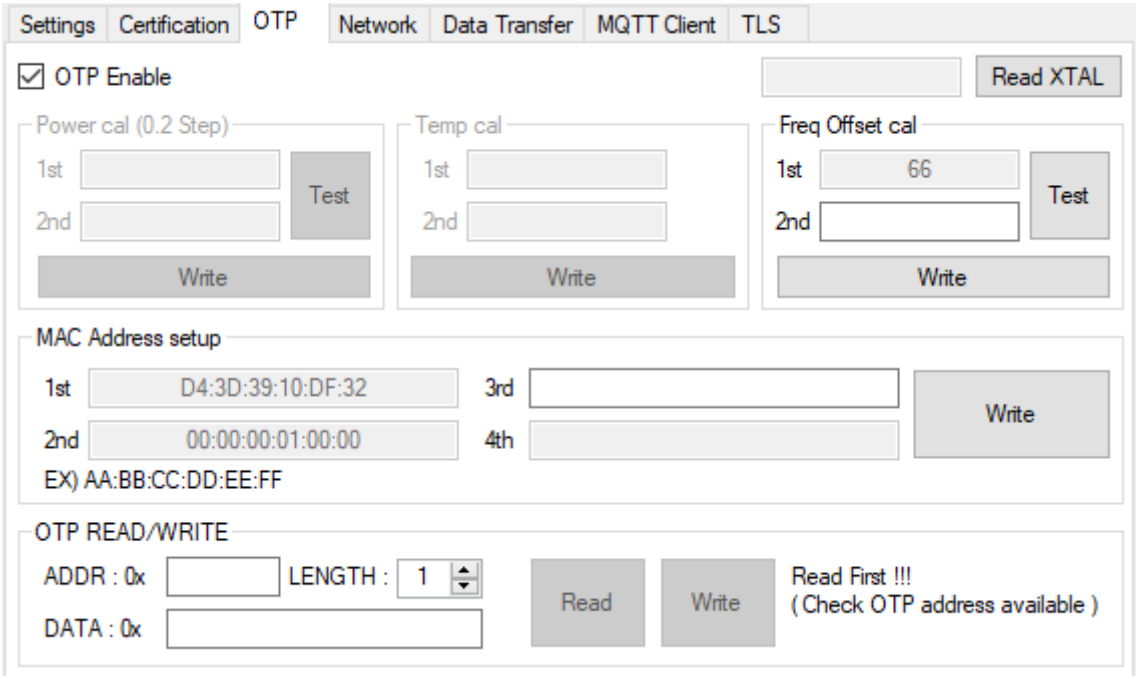


Figure 38. OTP mode

- **Power calibration** and **temperature calibration** are completed for the chipset by Renesas Electronics, so you may not need to do it.
- **Freq Offset cal:** the range of frequency offset calibration is 0x0 ~ 0x7F.
- **MAC Address Setup:**
  The DA16200 has 4 slots to store MAC addresses. The 1st slot is written by Renesas Electronics. You can use 3 slots to write your own MAC address. The MAC address written in the OTP must be an even number. It is used for WLAN0 MAC address (for STA interface), and the next number is automatically used for WLAN1 MAC address (for Soft AP interface).
  To write the MAC address, give the MAC address in the first empty slot and click the **Write** button, then the new address substitutes for the previous address.

9. Revision History

Revision	Date	Description
1.9	Apr 23, 2025	Converted into Renesas template.
1.8	June 30, 2023	Updated the reference section.
1.7	Mar 28, 2022	Updated logo, disclaimer, and copyright.
1.6	Aug 19, 2021	Applied changes to SDK folder hierarchy.
1.5	Jan 6, 2021	Revised as the user interface changes of the tool.
1.4	Aug 21, 2020	Added: Section 7.3.5, Section 7.4.3, and Figure 34.
1.3	Apr 6, 2020	Added TCP/UDP, MQTT, TLS, and GUI Build.
1.2	Oct 31, 2019	Finalized for publication.
1.1	Oct 15, 2019	Editorial review.
1.0	July 3, 2019	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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