User Manual

DA16200 AT GUI Tool

UM-WI-004

Contents

Figures

1 Terms and Definitions

AP	Access Point
AT	Attention
CoAP	Constrained Application Protocol
DHCP	Dynamic Host Configuration Protocol
EVK	Evaluation Kit
GUI	Graphical User Interface
HTTP	Hypertext Transfer Protocol
MFC	Microsoft Foundation Class
MQTT	Message Queuing Telemetry Transport
OTP	One-Time Programmable
PC	Personal Computer
QFN	Quad Flat No-Lead
SDK	Software Development Kit
SSID	Service Set Identifier
STA	Station
TCP	Transmission Control Protocol
TLS	Transport Layer Security
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

3 Introduction

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

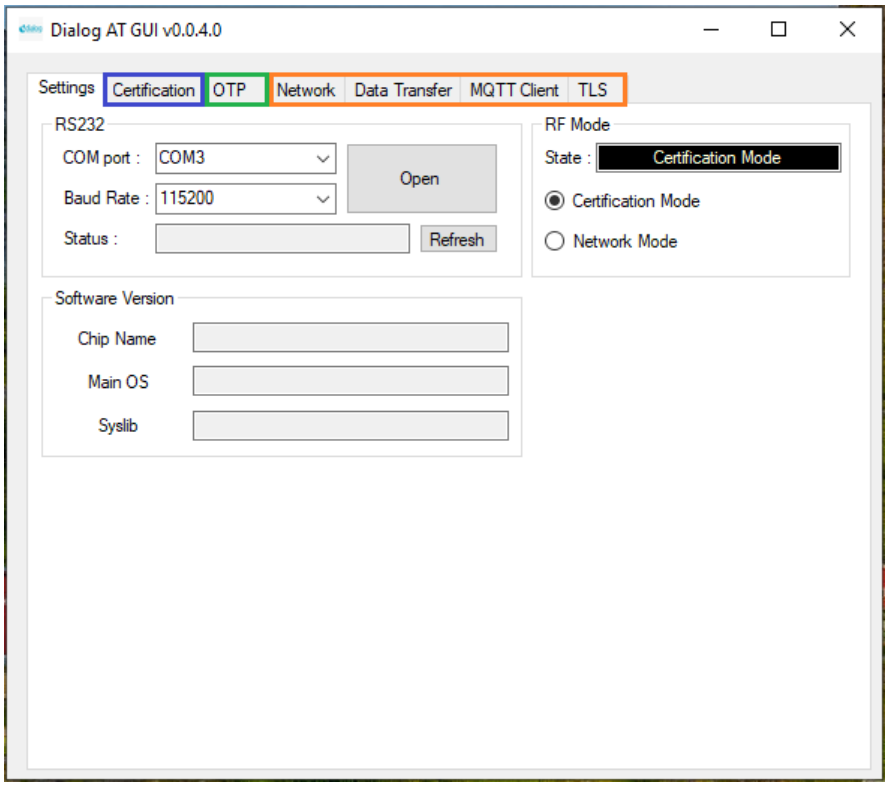


Figure 1: DA16200 EVK GUI

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 is 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, the developer 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 How to Connect

4.1 USB to Serial Driver

The DA16200 evaluation board supports USB to serial interface. Connect DA16200 EVK with a desktop through a micro-USB cable and then two COM ports will be 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.

- Required the FT232 Driver installation for Windows
  - In most cases, it will be installed automatically

The FTDI driver for the FT2232 FTDI chip used on DA16200 EVK is available for download at the following link: http://www.ftdichip.com/Drivers/CDM/CDM21224_Setup.zip

- See Ref. [3] to find the detailed information about the UART1 port. AT GUI tool uses UART1 port

To update with a new DA16200 firmware, see Ref. [3].

5 DA16200 SDK or Firmware Selection

There are several types of SDK and firmware for DA16200 such as Generic and Manufacture that can be found in DA16200 SDK/Image packages. Consider the kinds of tests you plan to determine which SDK or firmware should be picked up.

- Certification or OTP Mode:
  - SDK: DA16200_SDK_Manufacture_QFN_xxx.zip
  - Firmware: DA16200_IMG_Manufacture_QFN
- Network Mode:
  - SDK: DA16200_SDK_Generic_QFN xxx.zip
    - The __SUPPORT_ATCMD__ where can be found in config_generic_sdk.h file should be enabled.

```
[\apps\da16200\get_started\inc\config_generic_sdk.h]


  // AT-CMD features
  #define     __SUPPORT_ATCMD__                  // Support AT-CMD
```

  - Firmware: ATCMD firmware should be picked such as DA16200_IMG_Generic_QFN_ATCMD, DA16200_IMG_Generic_FcCSP_LP_ATCMD or DA16200_IMG_Generic_FcCSP_NP_ATCMD depending on SoC package type

6 How to Run GUI with DA16200 EVK

6.1 Connection and Running

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 to the host PC as shown in Figure 2.

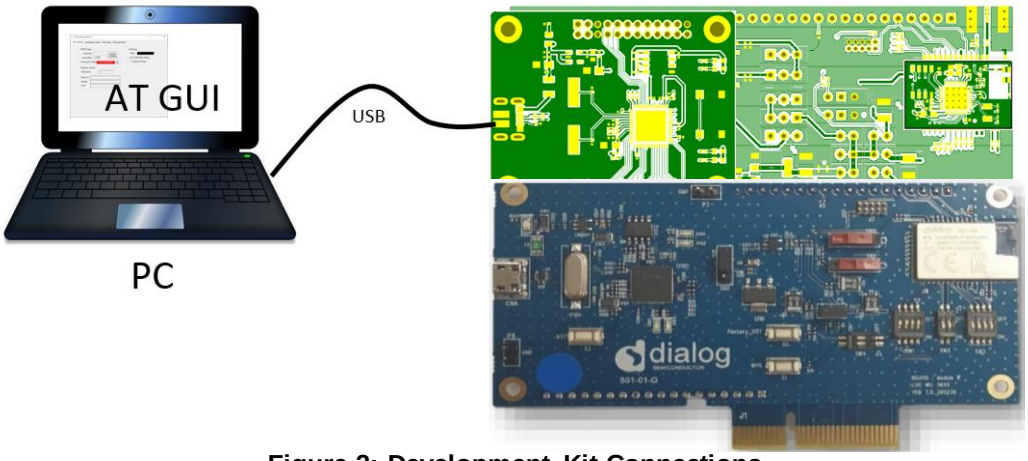


Figure 2: Development Kit Connections

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

2. Start the AT GUI program.

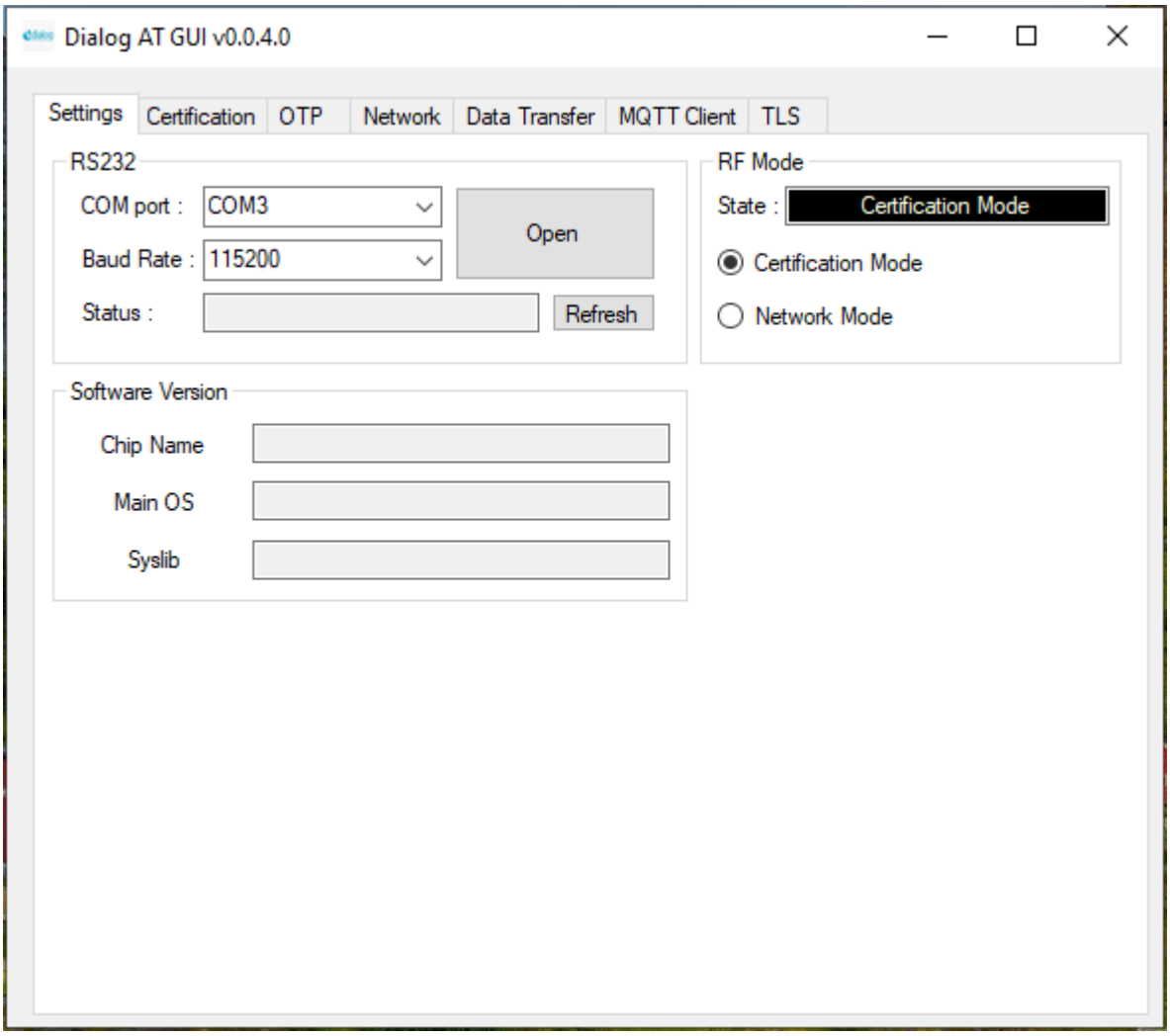


Figure 3: AT GUI

6.2 COM Port and Baud Rate Configuration

1. When the AT GUI program runs, 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.

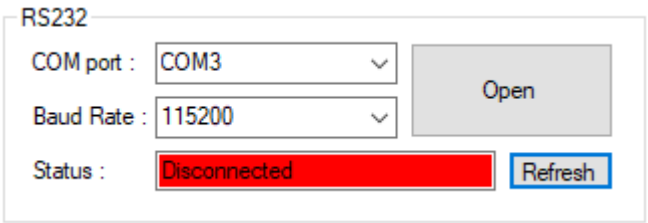


Figure 4: RS232 Setup – Disconnected

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 will soon change to a green color and the **Connection Status** field shows “Connected” in a green color. This means that communication is OK

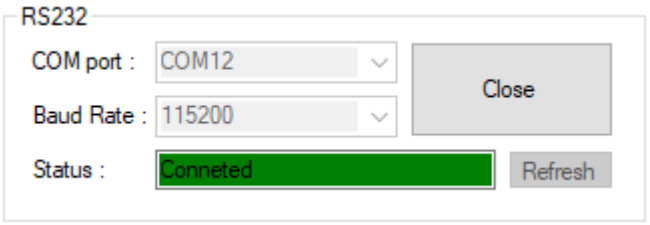


Figure 5: RS232 Setup – Connected

- In the **Debug Console** window (in the black box), the message “`Echo on`” is shown

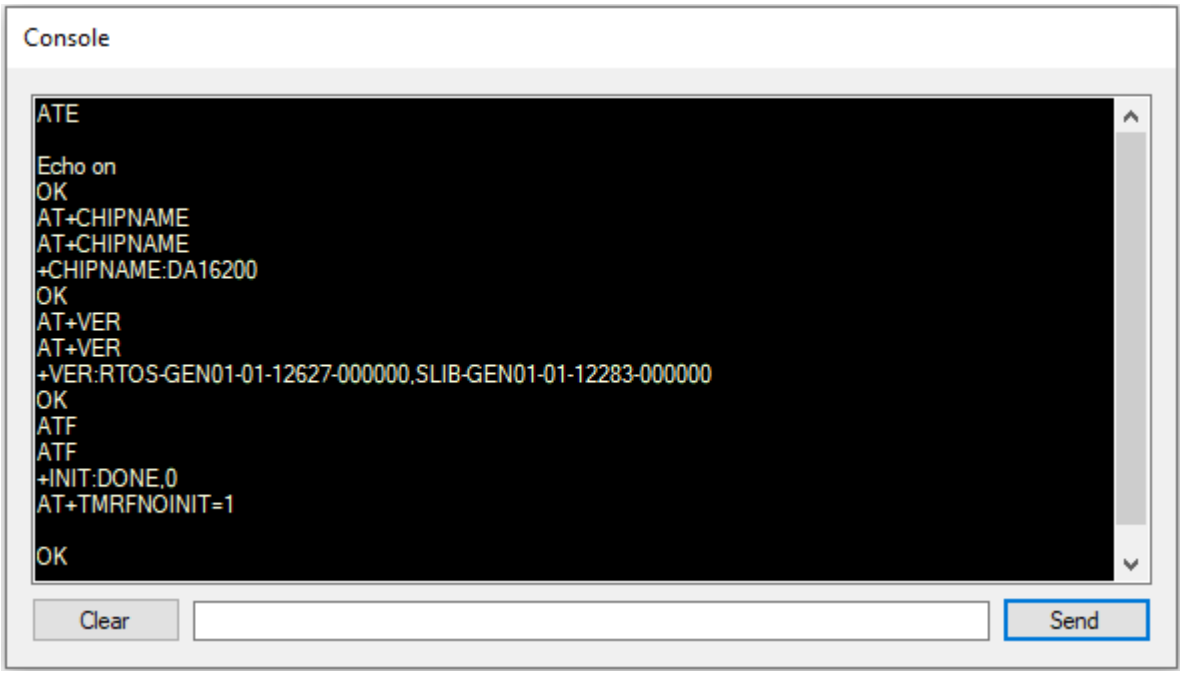


Figure 6: Debug Console – Connected

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.

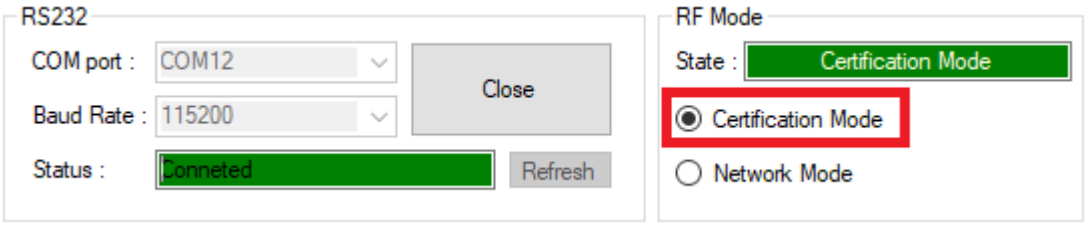


Figure 7: Certification Mode Configuration

6.4 TX Test Mode

1. Open the **Certification Mode** tab. See Figure 8.

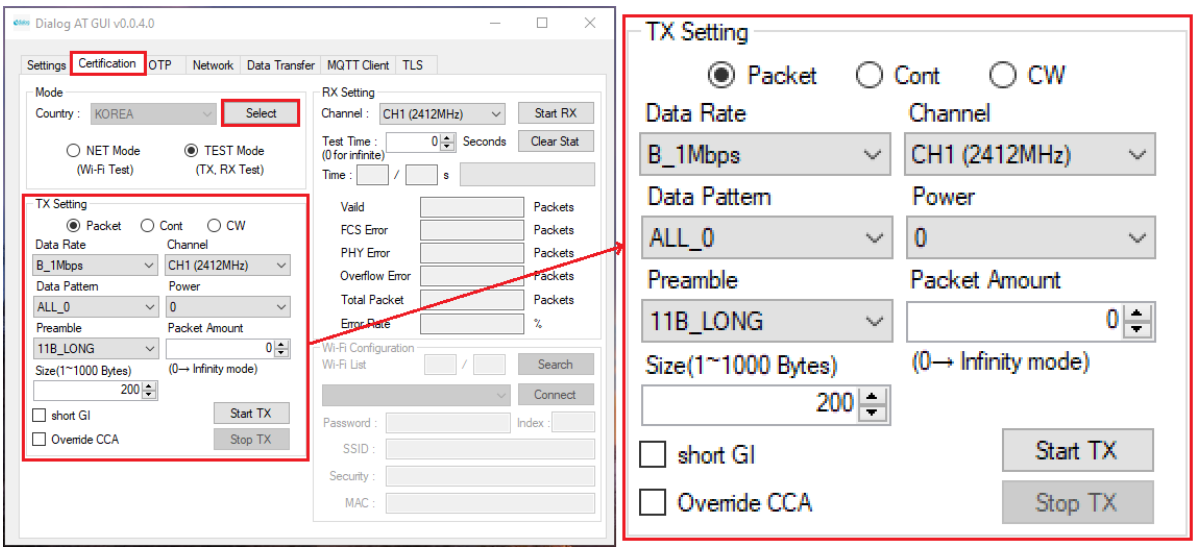


Figure 8: Tx Test Mode Configuration

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

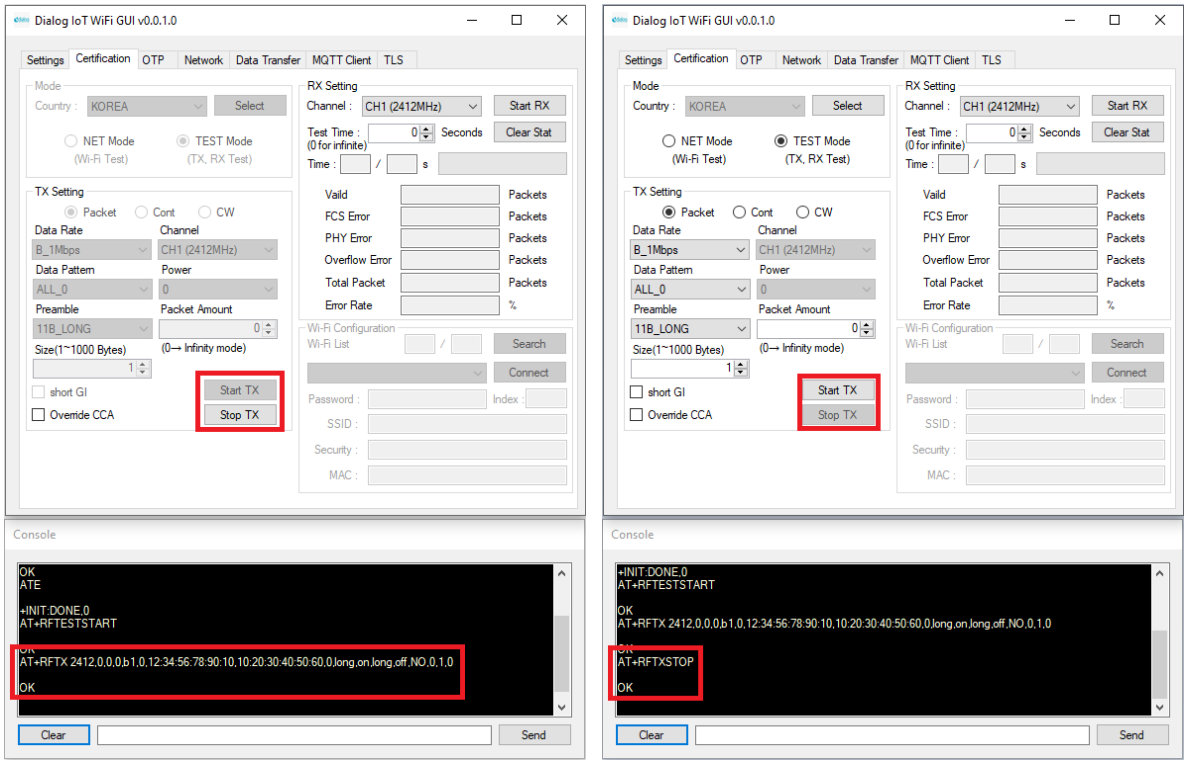
Figure 9: Debug Console – TX Mode

3. Select the **Data Rate**, **Channel**, and **Power** for the purpose of the test.
   - **Packet mode**: this is the normal test mode with packet generation mode. Offers the possibility to adjust duty of RF Burst at time domain
   - **Cont mode**: Continuous TX out mode. This mode is for TX power test. In this mode, TX packet is generated continuously over 95% duty cycle
   - **CW mode**: Only single sinewave tone out mode. This mode is for frequency error check
   - **Data Rate**: Choose 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/1step

- **Size**: You can adjust the duty rate with this number. However, the size is not linear as the number, so to set the exact number you need equipment like a spectrum analyzer to check the value. (Equipment setting is set to zero span setting or burst mode setting)

To do 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 is started



Start TX Stop TX

Figure 10: Start and Stop TX

For example: there is a test setting with 802.11n MCS7, channel 1, 100 bytes packet and power grade 0.

- When the **Start TX** button is clicked, messages as shown in Figure 11 will be shown

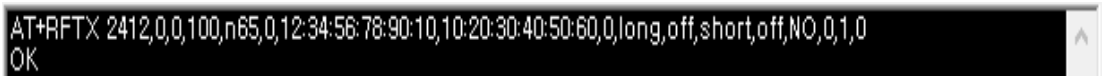


Figure 11: Debug Console – Start TX

- When you click the **Stop TX** button, messages as shown in Figure 12 will be shown

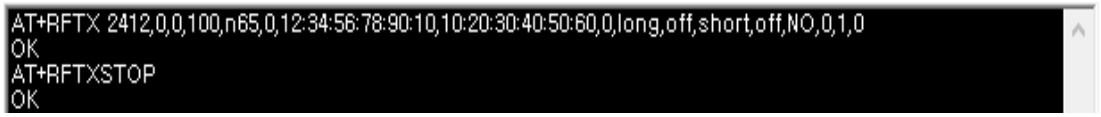


Figure 12: Debug Console – Stop TX

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)

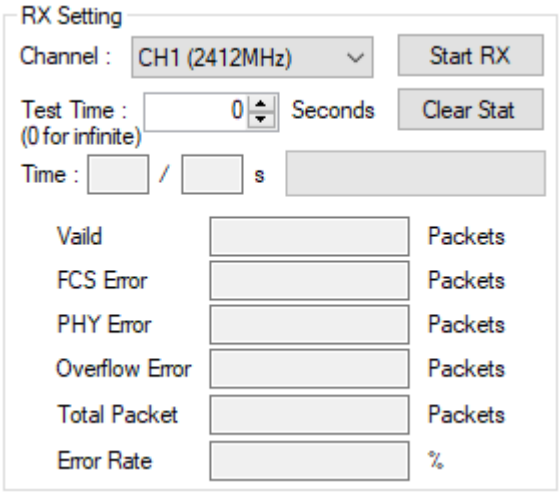


Figure 13: Rx Configuration

- 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.

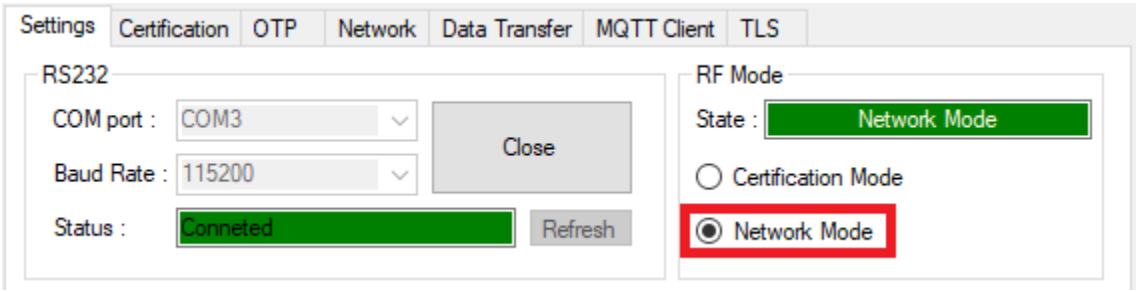


Figure 14: Network Mode Configuration

7.1 Station Mode

1. In the **Mode Select:** field, select **Station Mode**.
   - The network mode is changed. Next, DA16200 reboots and the station mode setup window opens. See Figure 15

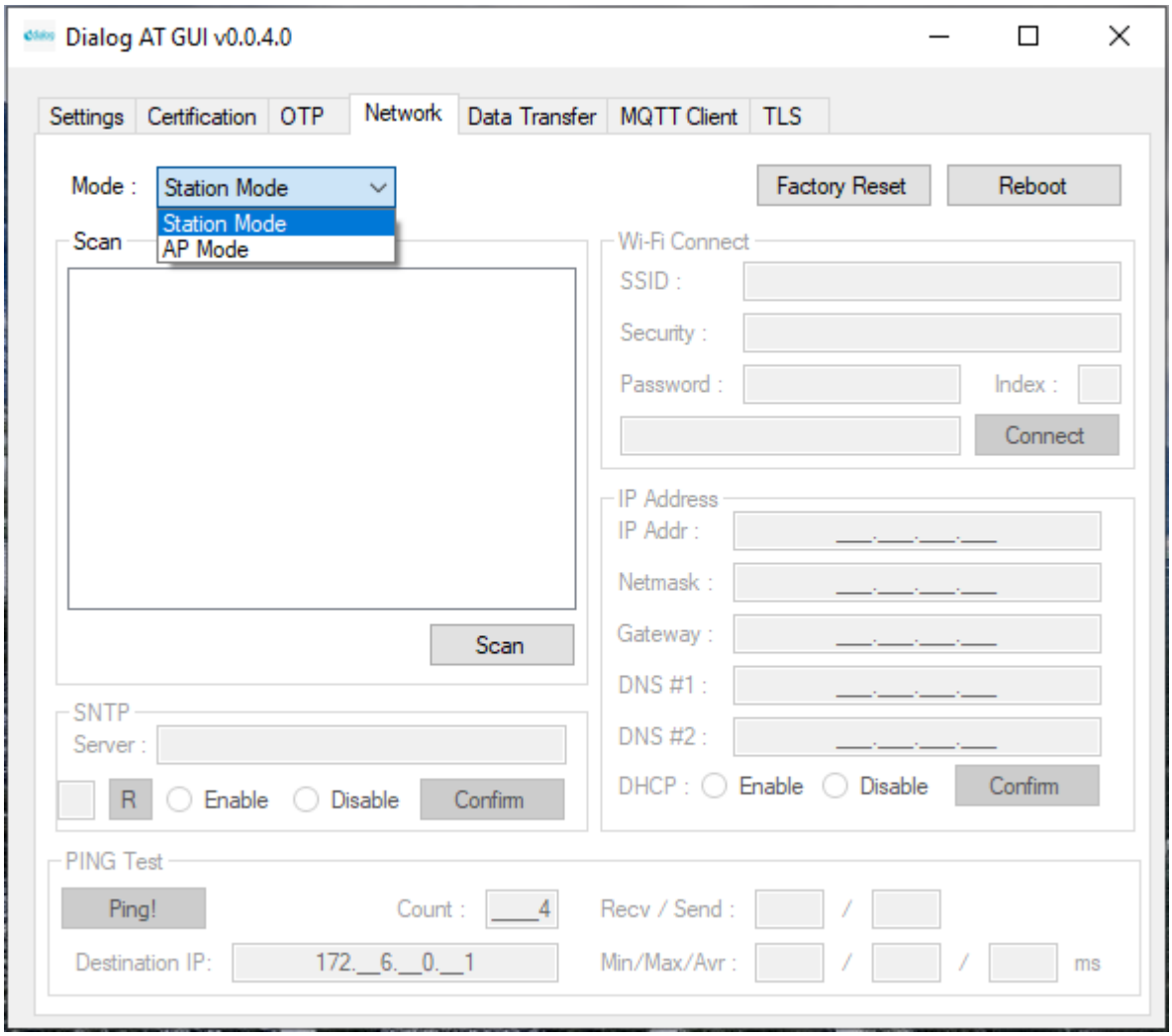


Figure 15: Setup Window – Station Mode

2. Click the **Scan** button to scan APs. See Figure 16.

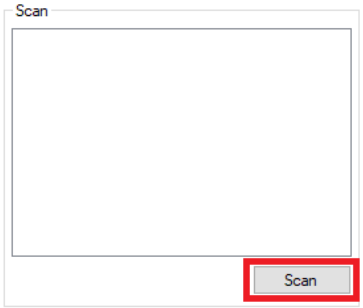


Figure 16: Station Mode – SCAN

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

Figure 17: Station Mode – Choose AP and Connect

Figure 18: Debug Console – Connect to AP

7.2 AP Mode

1. In the **Mode Select** field, select **AP Mode**.
   - The network mode changes, DA16200 reboots and the AP Mode setup window opens. See Figure 19

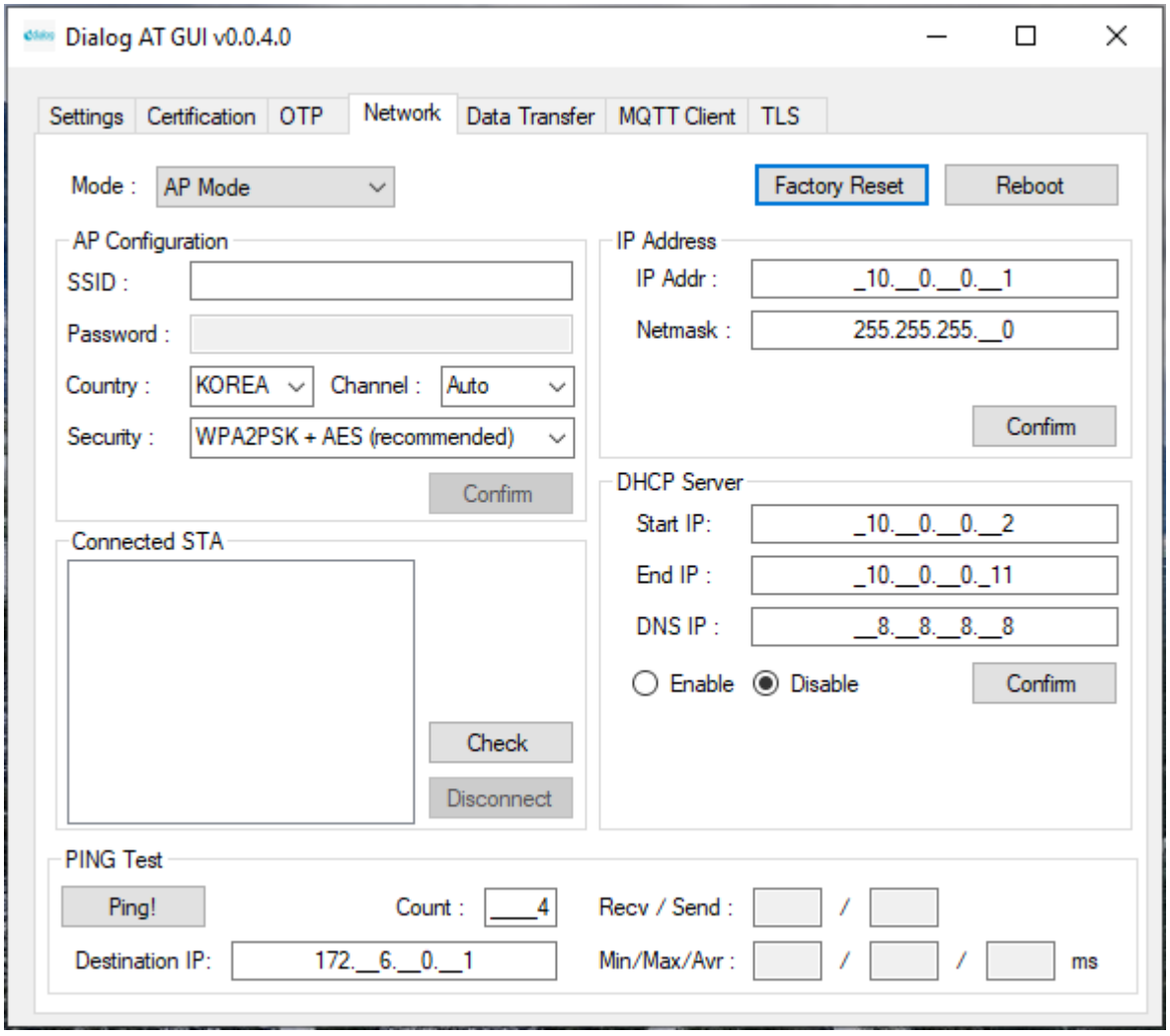


Figure 19: Setup Window – AP Mode

2. Set the fields SSID, Password, Country, Channel, and Security mode. See Figure 20.
3. Click the **Confirm** button.

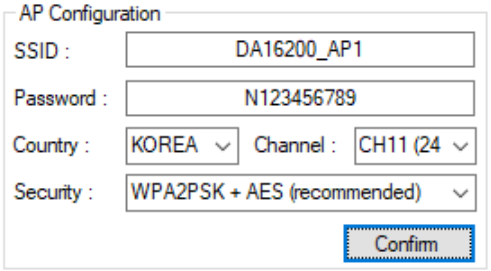


Figure 20: AP Configuration

- The Debug Console window messages appears as shown in Figure 21

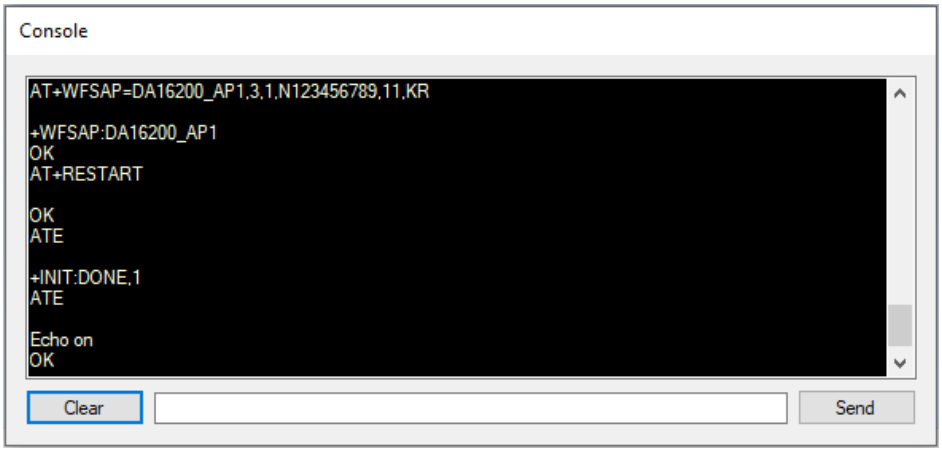


Figure 21: Debug Console – AP Configuration

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 will be shown as in Figure 23

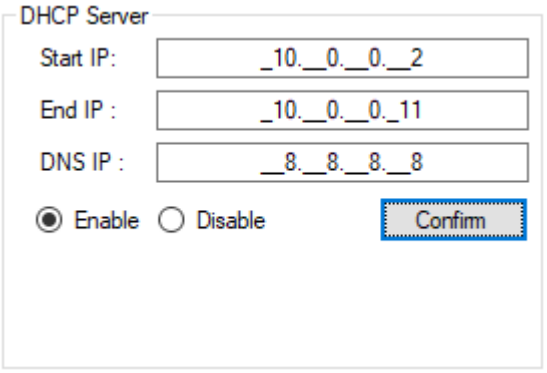


Figure 22: DHCP Configuration

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 DA16200 succeeds connecting with an AP, the IP address will be filled in. See Figure 24.

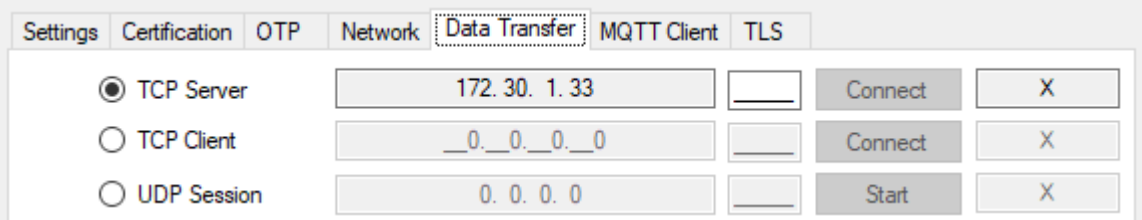


Figure 24: Data Transfer Tab

The DA16200 provides three kinds of sessions: TCP server, TCP client, and UDP session. Developers 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 a server is opened, the **X** will change to **O**. See Figure 25.

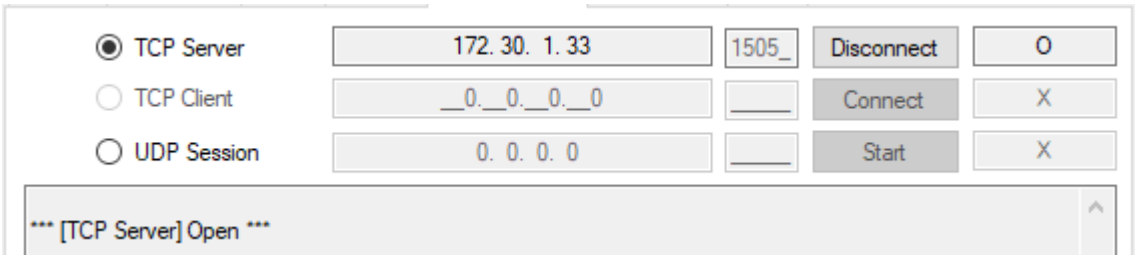


Figure 25: TCP Server Open

The developer can connect the DA16200 TCP server with tools for data exchange like the IO Ninja. When a client connects successfully, its information will be shown as in Figure 26. The DA16200 TCP server can accept up to eight client sessions.

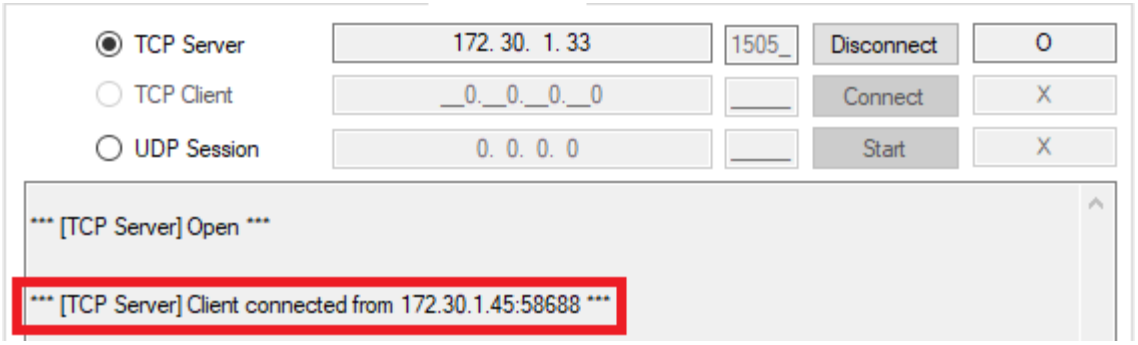


Figure 26: TCP Server Connection with Client

7.3.2 TCP Client

To connect a TCP server, fill in the IP address and port number of the server and click the **Connect** button on the **TCP Client** line. When the DA16200 TCP client succeeds to connect, the **X** will change to **O**. See Figure 27.

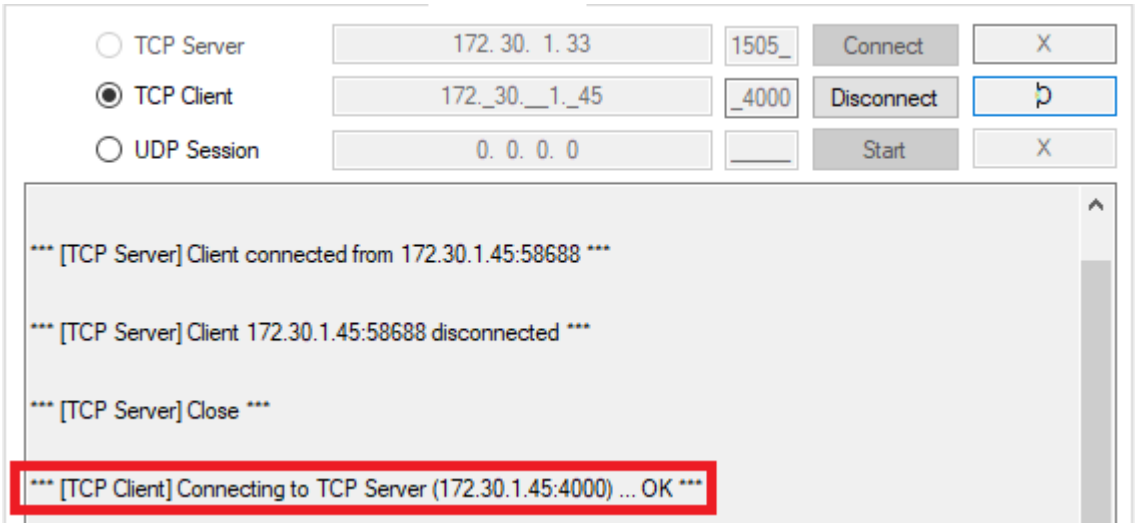


Figure 27: TCP Client Connection to Server

7.3.3 UDP Session

To open a UDP session, enter a port number and click the **Start** button. When the DA16200 TCP client succeeds to connect, the **X** will change to **O**. See Figure 28. TODO:

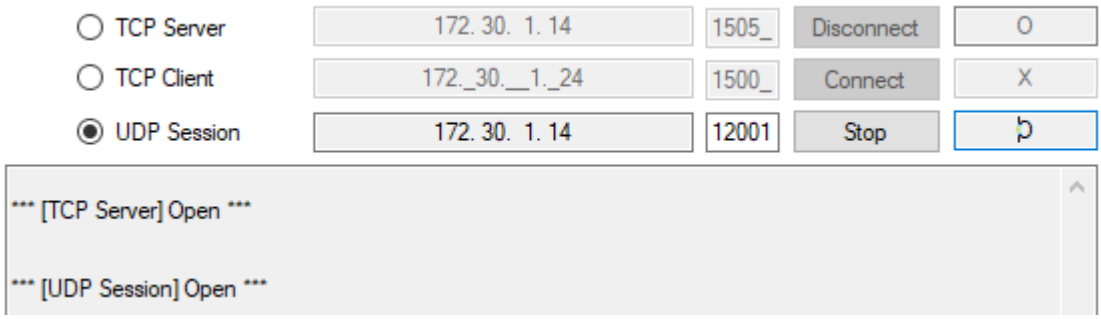


Figure 28: UDP Session Open

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**: Select the **TCP Server** checkbox > Select the destination IP in the drop-down list > Type a message > Click the **Send** button (see Figure 29)

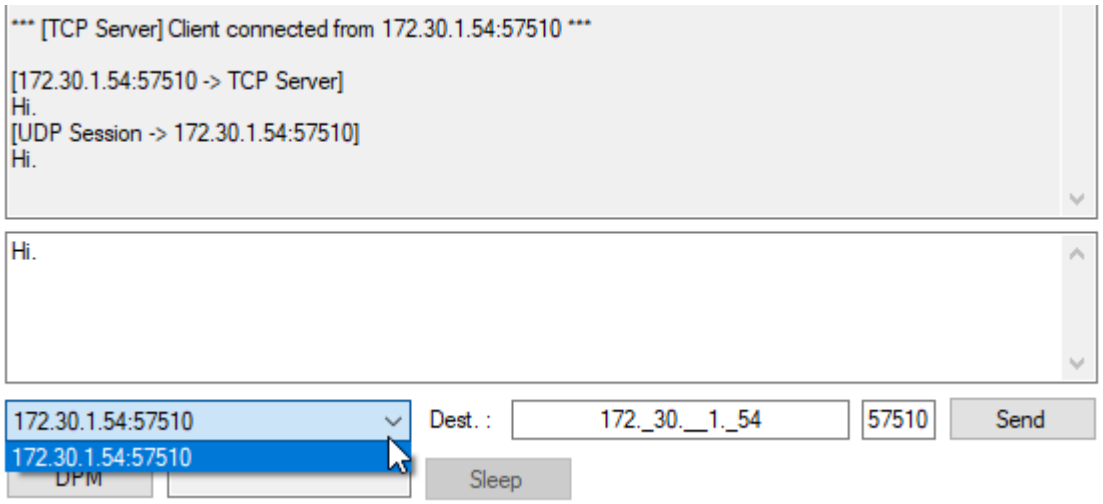


Figure 29: TCP Server Data Transfer

- **TCP Client**: Select the **TCP Client** checkbox > Type a message > Click the **Send** button (see Figure 30)

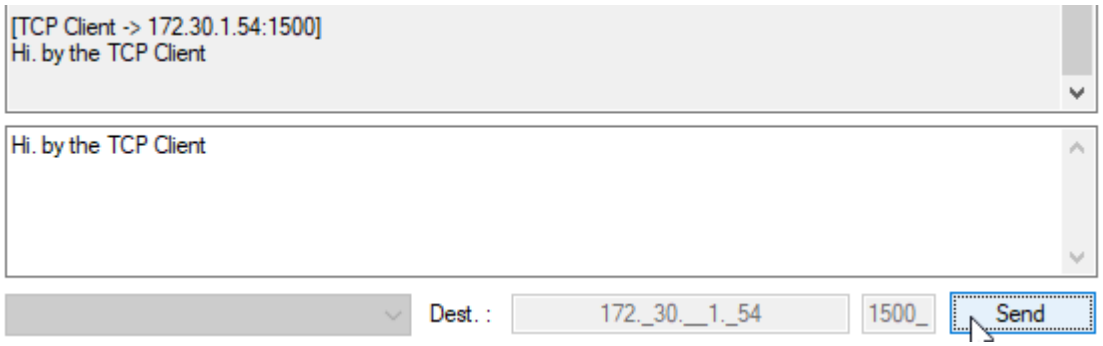


Figure 30: TCP Client Data Transfer

- **UDP Session**: Select the **UDP Session** checkbox > Enter the destination IP and port number > Type a message > Click the **Send** button (see Figure 31)

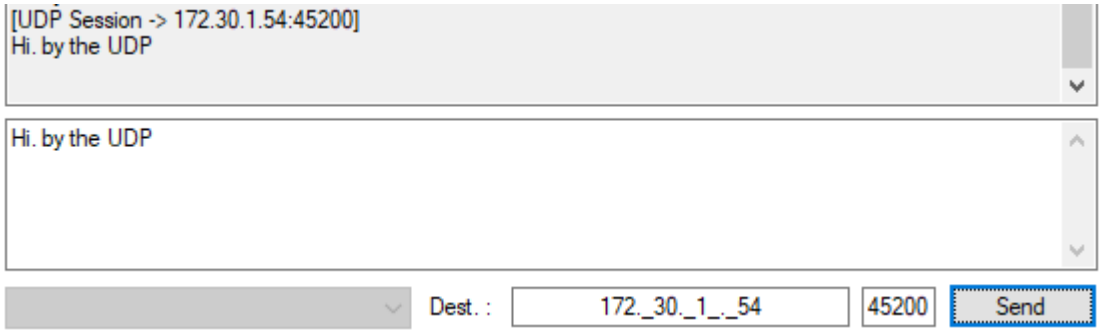


Figure 31: UDP Session Data Transfer

When a session receives a message from a peer, the message is shown in the message window. See Figure 32.

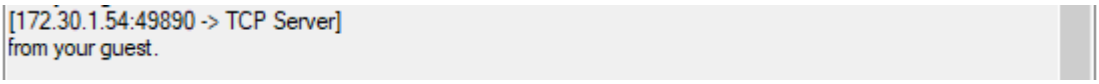


Figure 32: TCP/UDP Data Reception

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

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

When DA16200 in DPM sleep state receives a TCP or UDP messages from a peer, it is shown in the message window like in Figure 32.

2. To send a message in DPM Sleep status:
   a. Wake up DA16200 with the switch. The **DPM_STATUS** will change 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** will change to "DPM sleep".

1. To exit DPM mode:
   a. Wake up DA16200 with the switch. The **DPM_STATUS** will change to "DPM Wake-up".
   b. Click the **Sleep** button. The **DPM_STATUS** will change 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 a connection is made to an MQTT broker, set the required fields for the connection information. See Figure 34.

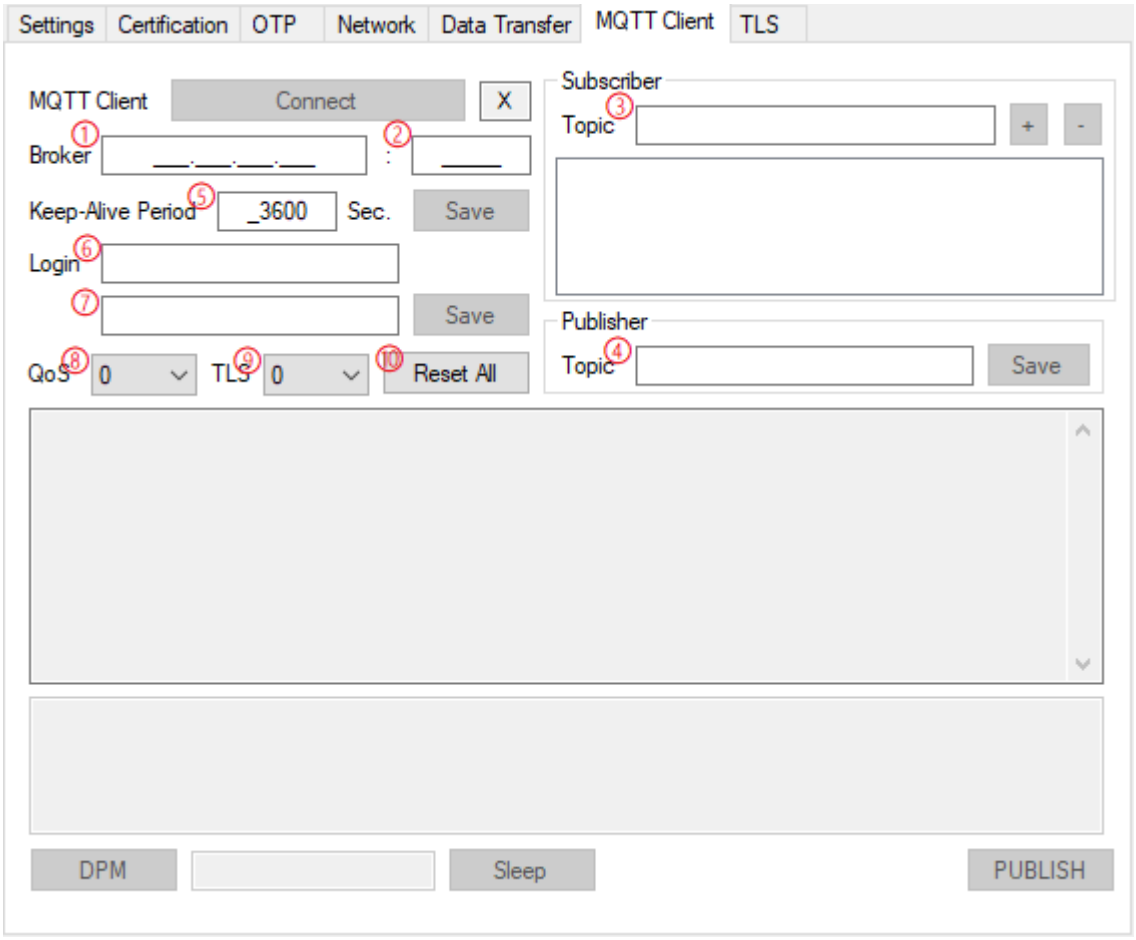


Figure 34: MQTT Client Tab

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** will change to **O**. Moreover, the developer 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.

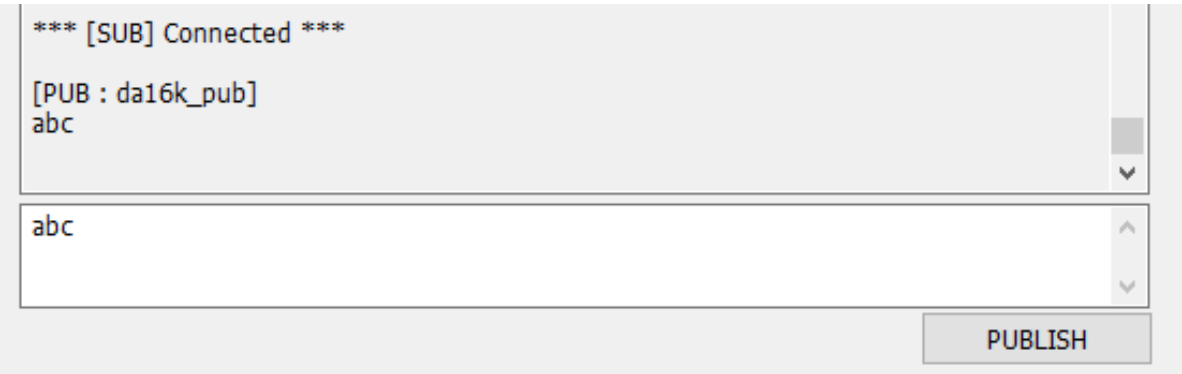


Figure 35: MQTT PUBLISH Transfer

When the client receives a message from the broker, the message is displayed in the message window. See Figure 36.

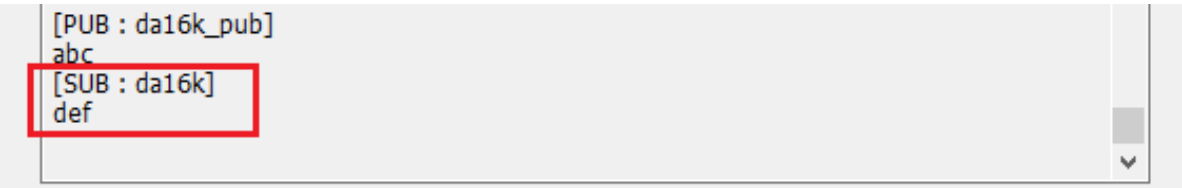


Figure 36: MQTT PUBLISH Reception

7.4.3 MQTT on DPM Mode

The DA16200 GUI provides MQTT client operation in DPM mode. There is the DPM mode setting as shown in Figure 33 in MQTT Client tab.

1. To initiate MQTT client in DPM mode:
   a. After setting up, connect to a MQTT Broker.
   b. Click the **DPM** button to start DPM mode.
   c. After the MQTT client session is ready in DPM mode, the **DPM_STATUS** will change to "DPM sleep".

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

2. To send a message in DPM Sleep status:
   a. Wake up DA16200 with the switch. The **DPM_STATUS** will change to "DPM wake-up".
   b. Type a message and click the **PUBLISH** button.

c. After sending messages, click the **Sleep** button. The DPM_STATUS will change to "DPM sleep".

3. And to exit DPM mode:
   a. Wake up DA16200 with the switch. The **DPM_STATUS** will change to "DPM Wake-up".
   b. Click the **Sleep** button. The **DPM_STATUS** will change to "Disabled".

7.5 TLS Setting

Developers can store a TLS certificate that is set with this tool for MQTT, HTTPs, and CoAPs. There are three kinds of items: Root CA, Client Certificate, and Private Key.

DA16200 can only process Privacy Enhanced Mail type (pem). 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>` will appear in the window. See Figure 37.

If the developer has TLS certificate files with PEM type, click **File Search** and select the file. The text will be loaded in the window.

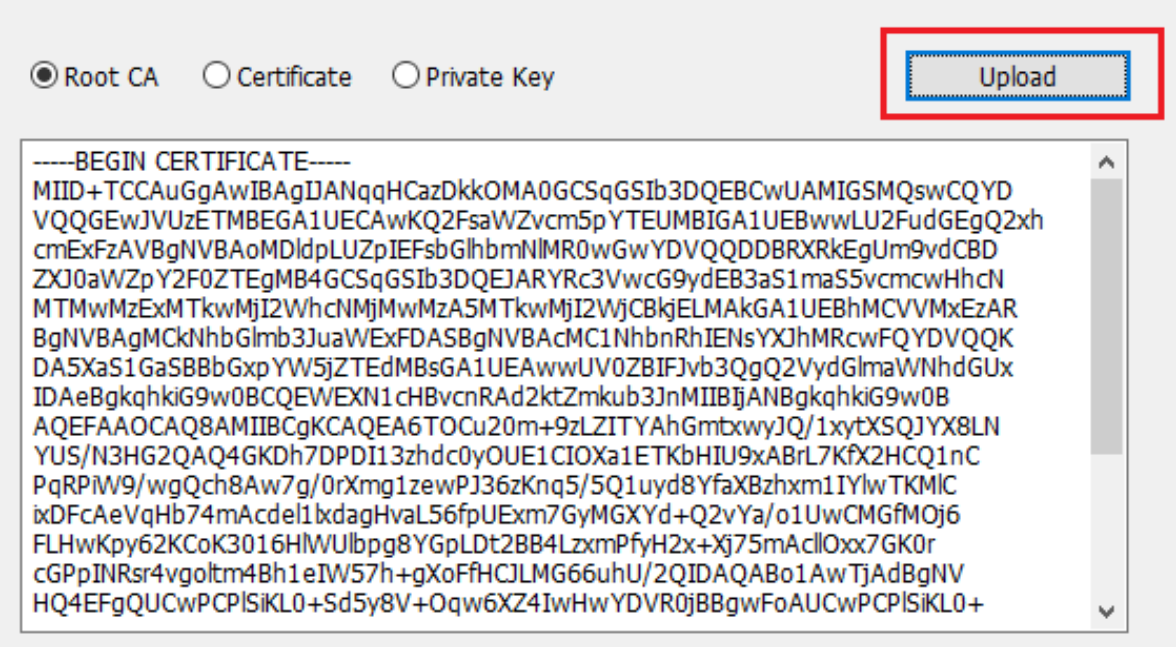


Figure 37: TLS Setting Tab

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

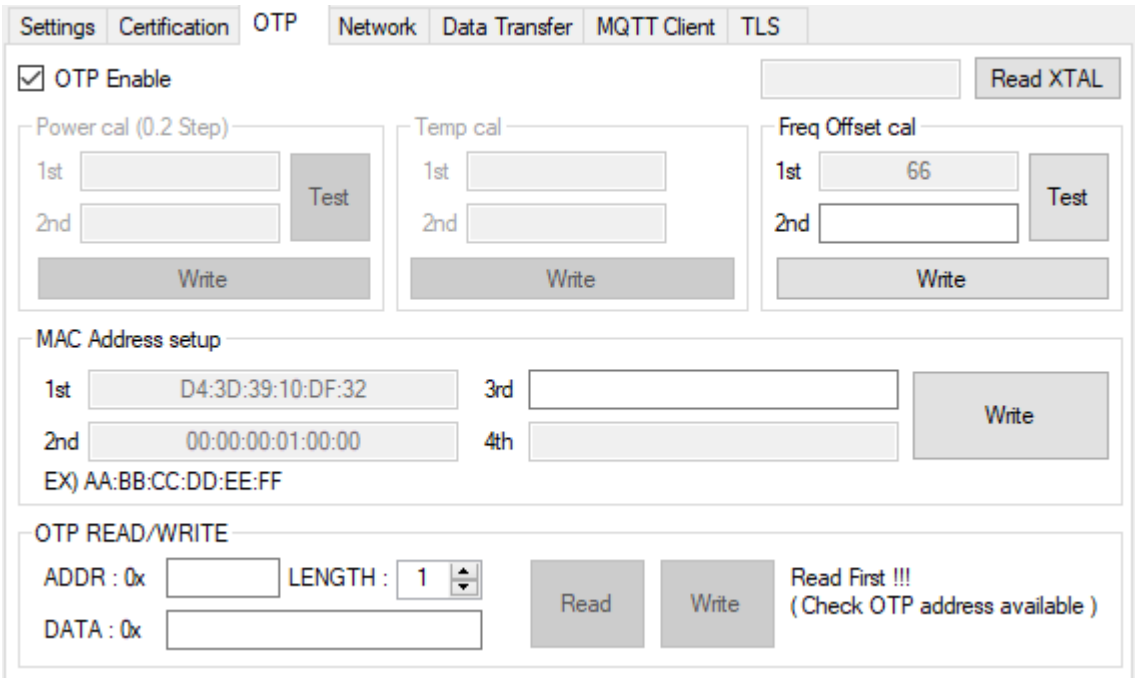


Figure 38: OTP Mode

Power calibration and **temperature calibration** has been completed for the chipset by Renesas Electronics and it may not need to be done by the customer.

Freq Offset cal: the range of frequency offset calibration is 0x0 ~ 0x7F.

MAC Address Setup

DA16200 has 4 slots to store MAC addresses. The 1st slot is written by Renesas Electronics. The developer can use 3 slots to write their 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 a MAC address in the first empty slot and click the **Write** button, then the new address substitutes for the previous address.

Revision History

Revision	Date	Description
1.8	30-Jun-2023	Updated the reference section
1.7	28-Mar-2022	Updated logo, disclaimer, and copyright
1.6	19-Aug-2021	Applied changes to SDK folder hierarchy
1.5	06-Jan-2021	Revised as the user interface changes of the tool.
1.4	21-Aug-2020	4.3.5 Data Transfer on DPM Mode Modification 4.4.3 MQTT on DPM Mode Modification Figure 36: MQTT Client Tab Change Figure 45: Solution Explorer Tab
1.3	06-Apr-2020	TCP/UDP, MQTT, and TLS added, GUI Build added
1.2	31-Oct-2019	Finalized for publication
1.1	15-Oct-2019	Editorial review
1.0	03-Jul-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.

RoHS Compliance

Renesas Electronics' suppliers certify that its products are in compliance with the requirements of Directive 2011/65/EU of the European Parliament on the restriction of the use of certain hazardous substances in electrical and electronic equipment. RoHS certificates from our suppliers are available on request.

Important Notice and Disclaimer

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:

https://www.renesas.com/contact/