VT-SOM-AH-EVB
Wi-Fi HaLow Evaluation Board

User Manual

Version: 1.4

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Revision History:

No.	Version	Description	Date
1	V1.0	First release	Dec. 21, 2023
2	V1.1	Replaced VT-MOB-AH-EVB with HAP 101 as the Wi-Fi HaLow access point and modified 2.1 access point setup	Jan. 17, 2024
3	V1.2	Modified the method to log in VantronOS for the access point in 2.1	Jan. 20, 2024
4	V1.3	Updated the description of MQTT messaging	Jan. 22, 2024
5	V1.4	Modified the wording regarding the access point setup in 2.1	Jan. 31, 2024

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Foreword

Thank you for purchasing the VT-SOM-AH Wi-Fi HaLow Evaluation Board ("the EVB"). This manual intends to provide instructions on setting up and operating the EVB to facilitate the use of VT-SOM-AH Wi-Fi HaLow Module and reduce the time-to-market of customer products that integrate the module. Please read this manual and make sure you understand the basics of the Wi-Fi HaLow technology before putting the EVB into use.

Intended Users

This manual is intended for:

- Embedded system engineers
- Developers
- Technical support engineers
- Other users

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Disclaimer

While all information contained herein has been carefully checked to assure its accuracy in technical details and typography, Vantron does not assume any responsibility resulting from any error or features of this manual, nor from improper uses of this manual or the software.

It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the product may be changed without notice.

Technical Support and Assistance

Should you have any question about the EVB that is not covered in this manual, contact your sales representative for solution. Please contain the following information in your question:

- Product name and PO number;
- Complete description of the problem;
- Error message you received, if any.

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Regulatory Information

VT-SOM-AH is designed to comply with:

- FCC
- CE
- IC

Please refer to the Appendix for Regulatory Compliance Statement.

Symbology

This manual uses the following signs to prompt users to pay special attention to relevant information.

	Caution for latent damage to system or harm to personnel
	Attention to important information or regulations

General Safety Instructions

The EVB is supposed be installed by knowledgeable, skilled persons familiar with local and/or international electrical codes and regulations. For your safety and prevention of damage to the EVB and other equipment connected to it, please read and observe carefully the following safety instructions prior to installation and operation. Keep this manual well for future reference.

- Do not disassemble or otherwise modify the EVB. Such action may cause heat generation, ignition, electronic shock, or other damages including human injury, and may void your warranty.
- Keep the EVB away from heat source, such as heater, heat dissipater, or engine casing.
- Do not insert foreign materials into any opening of the EVB as it may cause the EVB to malfunction or burn out.
- To ensure proper functioning and prevent overheating of the EVB, do not cover or block the ventilation holes of the EVB.
- Follow the installation instructions with the installation tools provided or recommended.
- The use or placement of the operation tools shall comply with the code of practice of such tools to avoid short circuit of the EVB.
- Cut off the power before inspection of the EVB to avoid human injury or product damage.

Precautions for Power Cables and Accessories

⚠ Use proper power source only. Make sure the supply voltage falls within the specified range.

⚠ Place the cables properly at places without extrusion hazards.

⚠ Use only approved antenna(s). Non-approved antenna(s) may produce spurious or excessive RF transmitting power which may violate FCC limits.

⚠ Cleaning instructions:

- Power off before cleaning the EVB
- Do not use spray detergent
- Clean with a damp cloth
- Do not try to clean exposed electronic components unless with a dust collector

⚠ Power off and contact Vantron technical support engineer in case of the following faults:

- The EVB is damaged
- The temperature is excessively high
- Fault is still not solved after troubleshooting according to this manual

⚠ Do not use in combustible and explosive environment:

- Keep away from combustible and explosive environment
- Keep away from all energized circuits
- Unauthorized removal of the enclosure from the device is not allowed
- Do not replace components unless the power cable is unplugged
- In some cases, the device may still have residual voltage even if the power cable is unplugged. Therefore, it is a must to remove and fully discharge the device before replacement of the components.

CHAPTER 1 INTRODUCTION

1.1 Product Overview

The VT-SOM-AH-EVB evaluation board is intended for programmers or developers who seek to reduce the time-to-market of their embedded products designed based on Vantron VT-SOM-AH Wi-Fi HaLow system-on-module.

VT-SOM-AH-EVB features a VT-SOM-AH Wi-Fi HaLow system-on-module soldered on a carrier board, providing an enhanced platform for better showcasing the performance and capabilities of the VT-SOM-AH Wi-Fi HaLow system-on-module, and allowing for the developers to explore its integration into different applications.

The EVB operates between 850MHz and 950MHz bands and supports 1/2/4/8MHz channel width to provide extended transmission range and faster data rate.

The EVB runs RTOS system, and offers a Micro USB that supports OTG host mode to receive data from USB devices and serial ports (RS232 and RS485) for data transmission.

1.2 Product Features

- Single-stream data rate up to 32.5 Mbps @8MHz or 15 Mbps

  @4MHz channel bandwidth

- Support worldwide Sub-1 GHz frequency bands

  Frequency range: 850MHz~950 MHz

  Channel bandwidth options: 1/2/4/8 MHz

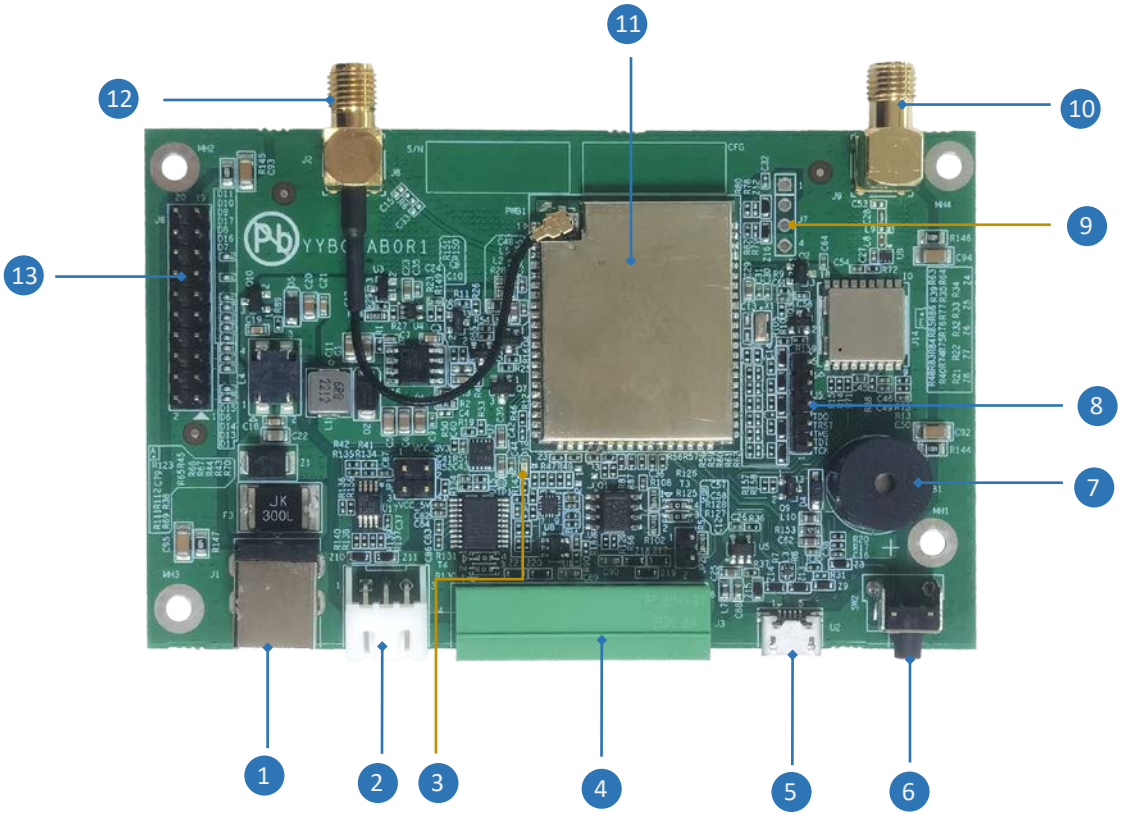
  Support 1 MHz and 2 MHz duplicate modes

- Packet detection & channel equalization

- BPSK & QPSK, 16-QAM & 64-QAM Modulation

- ARM Cortex-M33 MCU & Morse Micro MM6108 SoC
- RTOS system, complete Wi-Fi HaLow solution
- Compact size, self-contained functions
- Easy integration to any embedded device
- I^2C, UART, GPIO for flexible expansion
- Ultra-low-power, reduced cost & time-to-market

1.3 Product Layout

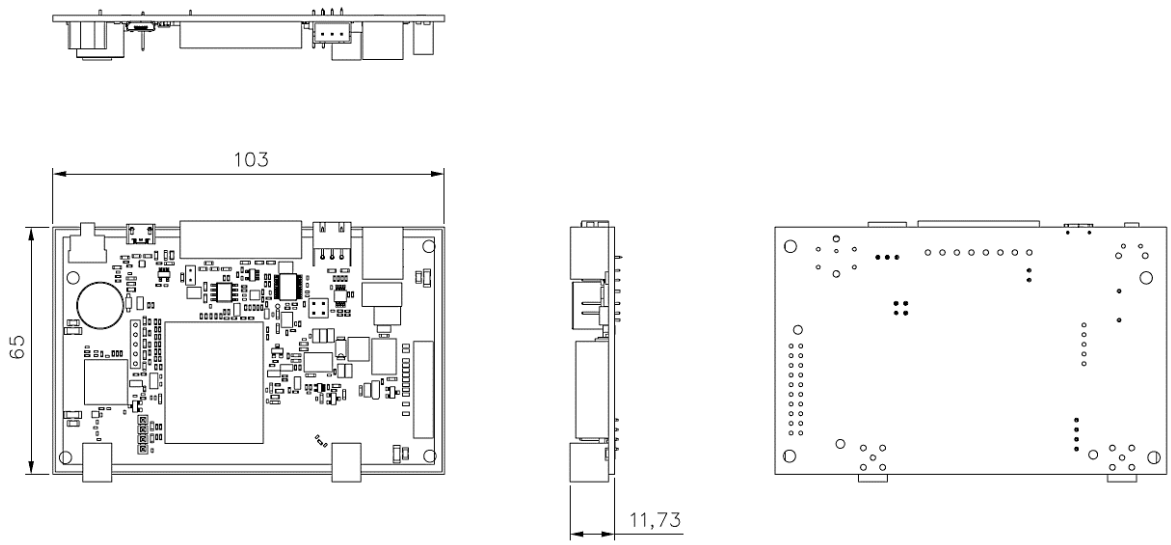


Please refer to the next page for the description of above I/Os.

I/O description:

No.	Name	Description
1	Power jack	Powers up the board via a 12V DC power adapter
2	I^2C	Allows for serial communication between the evaluation board and peripherals, like sensors or other integrated circuits
3	Power indicator	Lights up when the board is powered up
4	RS232 & RS485	Enables serial communication between the evaluation board and the access point for data transfer (115200, 8N1)
5	Micro USB	OTG Host mode supported
6	Reset button	Restarts the board upon a short press
7	Buzzer	Beeps once when the board is powered up Beeps for 2 seconds when an MQTT connection is established
8	JTAG	For firmware flashing
9	Debug UART	For connecting a host PC to debug the board or send AT commands (115200, 8N1)
10	GPS antenna connector	For connecting a GPS antenna to use the GPS function
11	VT-SOM-AH	VT-SOM-AH Wi-Fi HaLow module
12	Wi-Fi HaLow antenna connector	For connecting a Wi-Fi HaLow antenna to enhance the signal strength
13	GPIO	Inputs and outputs for user expansion

1.4 Outlines



1.5 Specifications

VT-SOM-AH-EVB					
System	SoC	Morse Micro MM6108			
	MCU	STM32U			
	SRAM	784KB			
	Flash	2MB			
	EEPROM	2Kb			
RF	GNSS	GPS, Beidou			
I/Os	USB	1 x Micro USB (OTG host mode)			
	GPIO	4 x GPIO (GPIO2, GPIO3, GPIO4, GPIO5) 1 x ADC 1 x FDCAN			
	Expansion	1 x I^2C			
	Serial port	1 x RS232, max. 120kbps (baud rate: 115200, 8N1) 1 x RS485, max. 500kbps (baud rate: 115200, 8N1)			
	Debug	1 x Debug UART			
	JTAG	1 x JTAG (firmware flashing)			
	Antenna	1 x GNSS U.FL antenna 1 x Wi-Fi HaLow U.FL antenna			
WLAN Features	Wi-Fi standard	IEEE 802. 11ah			
	Frequency range (Sub 1 GHz bands)	850MHz ~ 950MHz			
	Channel bandwidth	1 / 2 / 4 /8 MHz			
	Data rate	1 MHz	2 MHz	4 MHz	8 MHz
		3.33Mbps (Max.)	7.22Mbps (Max.)	15Mbps (Max.)	32.5Mbps (Max.)
	Security	AES encryption engine SHA1 and SHA2 hash functions (SHA-256, SHA-384, SHA-512) WPA3 including protected management frames (PMF)			
Software	Operating system	RTOS			
System Control	Button	1 x Reset button (short press to reboot)			
	LED indicator	1 x Power indicator			
	Buzzer	1 x Buzzer (5V)			
Mechanical	Dimensions	103mm x 65mm x 11.73mm			
Power	Input	12V DC 1 x DC jack (Over-current protection, reverse polarity protection)			
Environment Condition	Temperature	Operating: -20℃ ~ +60℃	Storage: -40℃ ~ +85℃		
	Humidity	5%~95%RH (Non-condensing)			

1.6 Unpacking

The EVB has been carefully packed with special attention to quality. However, should you find any component damaged or missing, please contact your sales representative in due time.

The EVB contains the following:

- A VT-SOM-AH system-on-module soldered on a carrier board
- A 12V/1A DC power adapter
- A USB OTG cable (USB-A to Micro USB)

Actual accessories might vary slightly from the list above as the customer order might be different from the standard configuration options.

*The VT-SOM-AH-EVB evaluation board operates in the **station** mode by default, and is designed to be used in combination with a Wi-Fi HaLow access point. We recommend that you use Vantron HAP 101/HAP 103 Wi-Fi HaLow AP for that purpose. Please refer to Appendix A for the specifications of HAP 101.*

1.7 Power Characteristics

VT-SOM-AH-EVB is designed to work with 9V ~ 12V DC power input. It is recommended that a 12V/1A power adapter be used.

Please refer to Chapter 4 for detailed hardware information.

CHAPTER 2 QUICK START

The VT-SOM-AH-EVB evaluation board is supposed to operate in the Wi-Fi HaLow **station mode** and automatically establish a connection to a Wi-Fi HaLow access point using Wi-Fi HaLow technology when properly configured. It is recommended you use Vantron HAP 101/HAP 103, which supports both 2.4GHz Wi-Fi and Wi-Fi HaLow standards, as the access point.

This chapter uses HAP 101 to demonstrate how to connect VT-SOM-AH-EVB to the access point using Wi-Fi HaLow technology.

2.1 Access Point Setup

HAP 101 runs on VantronOS system which is accessible from a host computer via two methods, depending on how the host computer is connected to the Internet.

Option 1— 2.4GHz Wi-Fi connection: Use the wireless IP of the device as the login address.

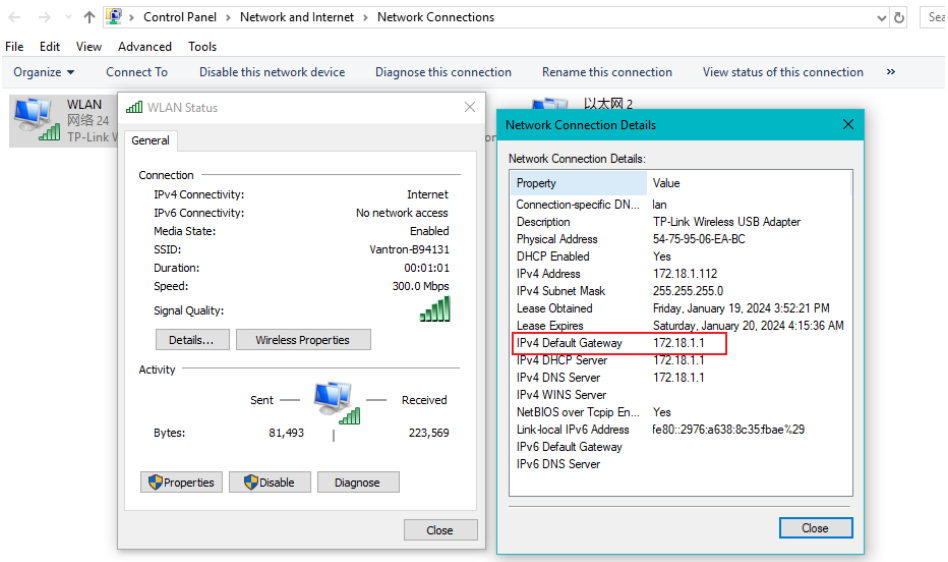
Option 2— Ethernet connection: Use the WAN port IP of the device as the login address.

It is important to note that when logging in to VantronOS for HAP 101, the IP address of the host computer must be on the same network as HAP 101.

Since the Ethernet jack of HAP 101 operates in the WAN area by default, the WAN port IP address of the device cannot be determined without removing the upper cover to debug the device using the debug UART.

Therefore, users need follow the steps below to identify the wireless IP of the device and login to VantronOS first, and then decide on the preferred option for future VantronOS logins.

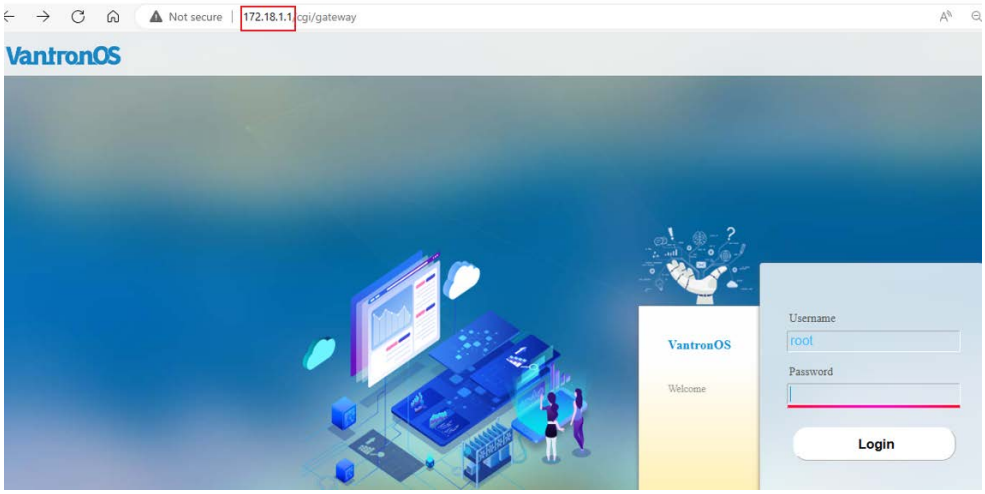
1. Connect the host computer to HAP 101 via 2.4GHz Wi-Fi using the SSID and password provided on the device label;
2. Check the details of the wireless connection on the host computer and identify the gateway IP of the wireless connection;



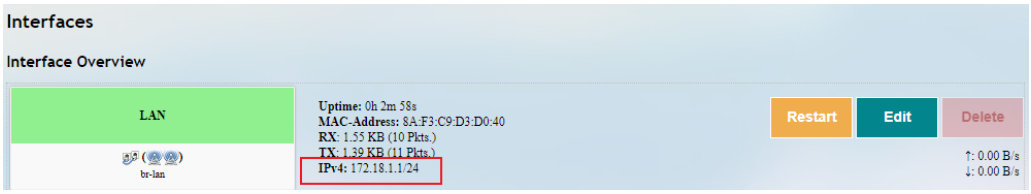
3. Log in VantronOS for HAP 101 using the gateway IP identified in prior step;

   account: root

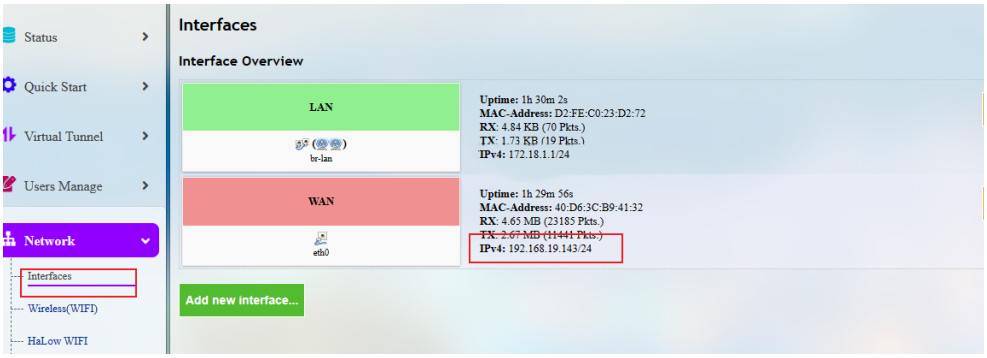
   password: rootpassword



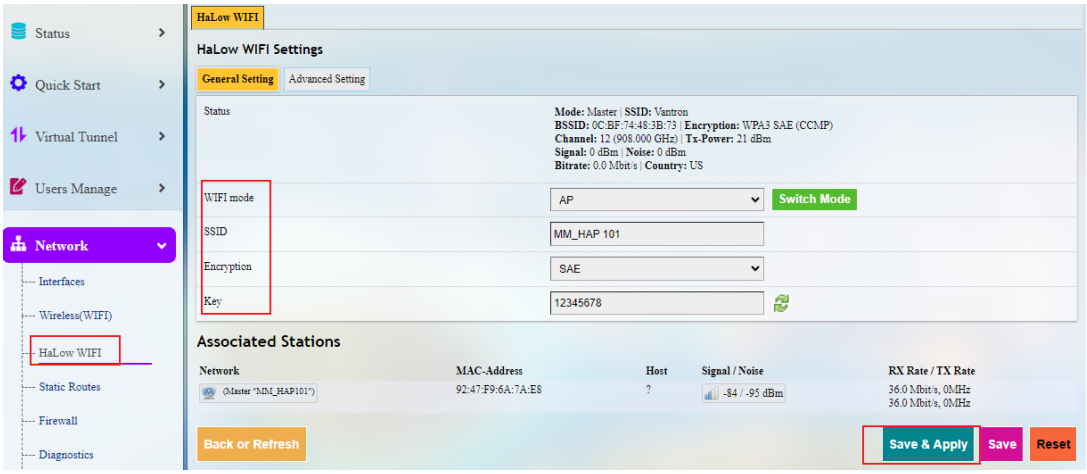
4. Navigate to **Network > Interfaces** to check the interface information of HAP 101 (the LAN port IP (172.18.1.1) is a virtual IP that is used as the host for MQTT messaging);



5. In the following operations, if you connect the host computer to HAP 101 via the 2.4GHz Wi-Fi, you can just proceed with the configurations of HAP 101 using the wireless IP for VantronOS login. If you connect the host computer and HAP 101 separately to a router/switch via an Ethernet cable, you shall login VantronOS for HAP 101 using the WAN port IP displayed behind the WAN port in **Network > Interfaces**;



6. Navigate to **Network > HaLow Wi-Fi;**
7. Set the Wi-Fi mode to AP and configure the SSID, encryption, and password under the **General Setting** tab, then click the **Save & Apply** button;



8. You can then proceed to configure the device under the **Advanced Setting** tab.

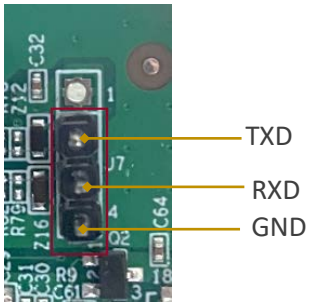
Note: US is the default country code.

2.2 EVB Setup

The VT-SOM-AH-EVB evaluation board is configured using AT commands when connected to a host computer through UART (J7).

2.2.1 Connecting to a host computer

1. Verify the pinout of the debug UART (J7) on the evaluation board, then use three female-to-female DuPont wires to connect the debug UART;



2. Insert the other ends of the DuPont wires into a USB-to-TTL adapter, ensuring that the connections are made as follows: **TXD-RXD, RXD-TXD, GND-GND**;

3. Plug in the USB end of the adapter to a host PC;

4. Power on the evaluation board with 12V DC.

2.2.2 Connecting to a Wi-Fi HaLow access point

After connecting the debug UART of the evaluation board to a host computer, you can proceed with the configuration of the evaluation board via AT commands.

Parameters of the debug UART:

Baud rate	Data bit	Polarity	Stop bit
115200	8	None	1

Use a serial debug program (e.g., SSCOM) to set the parameters of the evaluation board.

When the following parameters are set, the evaluation board will automatically connect to a Wi-Fi HaLow access point and the MQTT Broker of the access point after powering up.

Note: *Please remember to use '\n' as the line break after each command. Every time when you change a parameter, please restart the device to allow the settings to take effect.*

1. Set the DHCP status (AT+DHCP=)

   When DHCP=1 (enabled), there is no need to set up the IP address (IP), subnet mask (MASK), and gateway (GATEWAY), as these parameters will be obtained when the evaluation board connects to the access point.

   When DHCP=0 (disabled), you shall set up the IP, MASK, and GATEWAY, and make sure that the evaluation board is on the same network as the access point.

2. Add the name of the target access point (AT+SSID=)

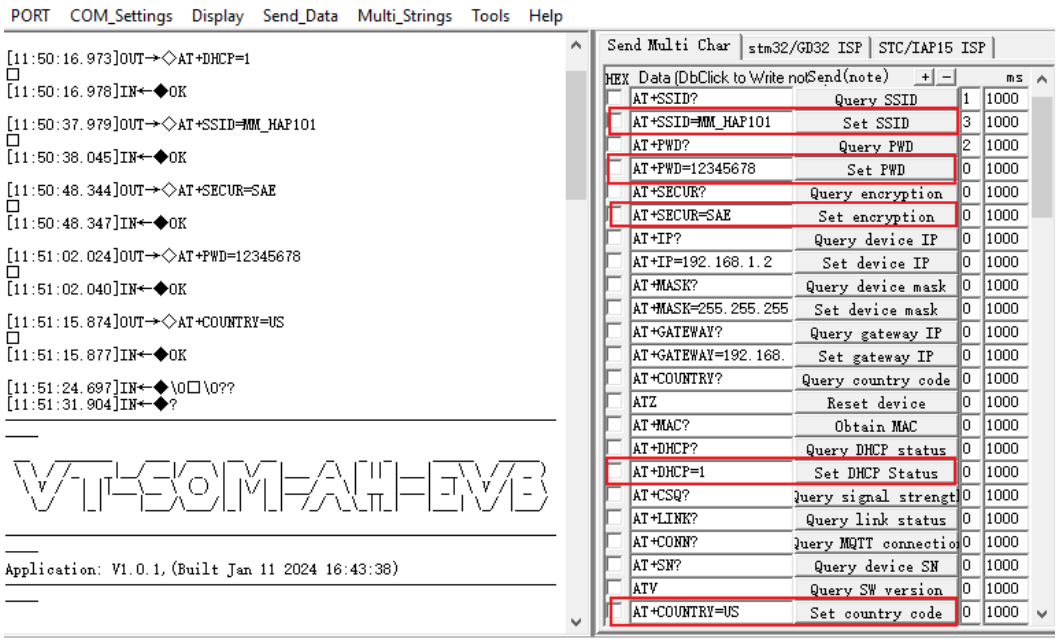
3. Set the encryption method to match that of the access point (AT+SECUR=)

4. Input the password of the access point (AT+PWD=)

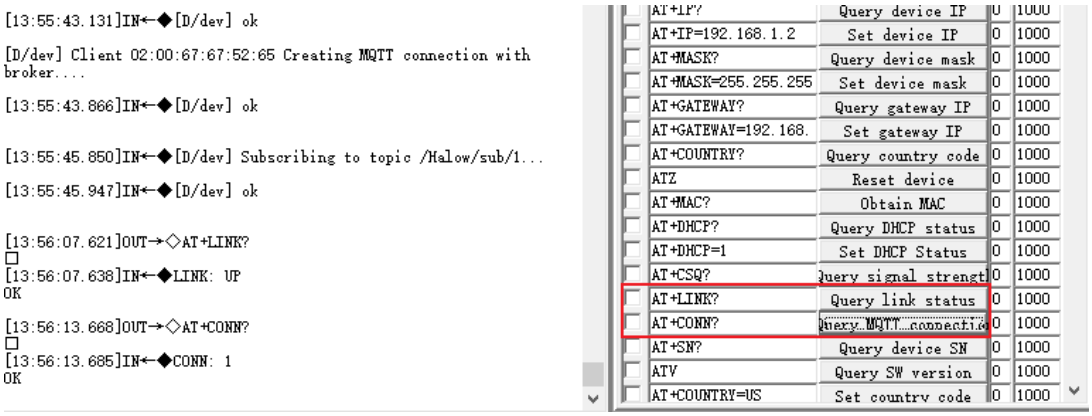
5. Set the country code to that of the access point (AT+COUNTRY=)

6. Restart the evaluation board (ATZ)

Refer to the example screenshot on the next page.



You can then check if the evaluation board is connected to the access point and the MQTT Broker using the command AT+LINK? and AT+CONN?, respectively.



There will be a **2-second beep** upon successful connection of the device to the MQTT Broker.

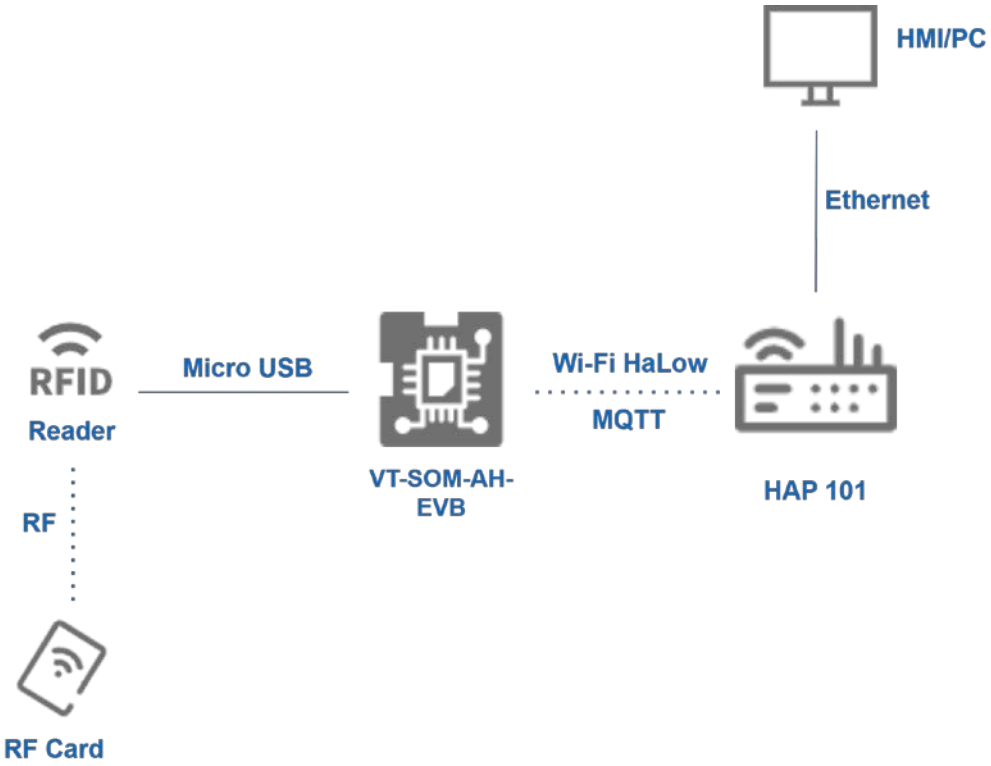
Please refer to Appendix A AT Commands for EVB Configuration for the common AT commands that may be used in configuring the evaluation board.

Section 3.3 provides a process demo for data communication between the EVB and the access point, with data input from the Micro USB port.

CHAPTER 3 DATA COMMUNICATION DEMO

This chapter is going to use VT-SOM-AH-EVB, HAP 101 and an RFID reader (RD905U) to demonstrate the flow of data communication between the devices.

Here is a simplified topology where VT-SOM-AH-EVB is in the station mode and HAP 101 is the access point for the Wi-Fi HaLow connection.



Before getting started, please follow the steps in 2.1 Access point Setup and 2.2 EVB Setup to connect the devices.

Data communication between the EVB and the access point is achieved via MQTT protocol, and data input to the EVB is either from the Micro USB port or the RS232/RS485 serial port.

In this chapter, 3.1 and 3.2 describe the MQTT topics involved in the data communication process. 3.3 demonstrates the process of displaying the Micro USB data on the access point. 3.4 and 3.5 describe the process of sending messages to the access point and EVB, respectively.

3.1 MQTT Message Subscription

Topic	Description
/Halow/sub/ADDR	VT-SOM-AH-EVB subscribes MQTT messages from HAP 101 with this topic, then outputs the messages via RS232/RS485.
	ADDR is the station address of VT-SOM-AH-EVB (1 by default).

Topic	Description
mosquitto_sub -h 172.18.1.1 -t '/Halow/pub/ADDR'	HAP 101 subscribes MQTT messages sent from VT-SOM-AH-EVB with this topic, then prints on the host computer.
	(-h is followed by the MQTT host (HAP 101) to connect to, -t is followed by the MQTT topic to be subscribed by VT-SOM-AH-EVB)

3.2 MQTT Message Publishing

Topic	Description
/Halow/pub/ADDR	VT-SOM-AH-EVB publishes messages with this topic after receiving messages from RS232/RS485/RFID (USB HID).
	ADDR is the station address of (1 by default).

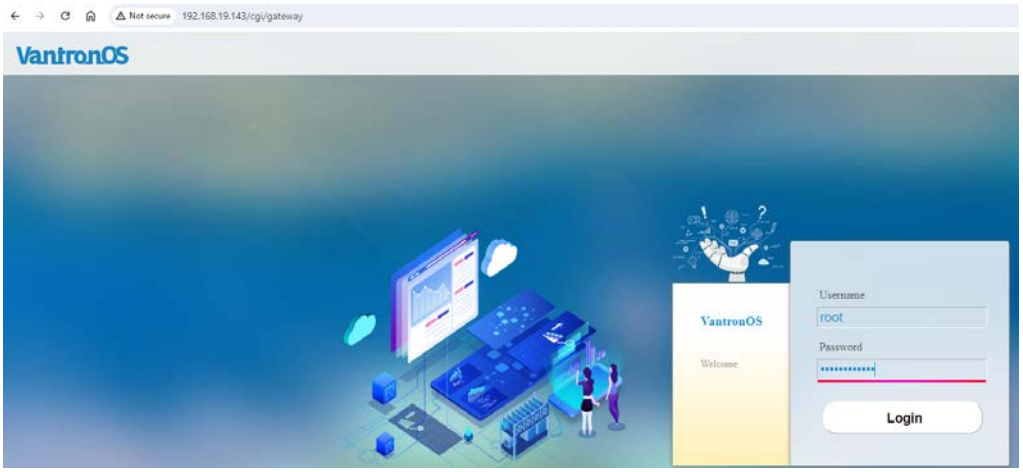
Topic	Description
mosquitto_pub -h 172.18.1.1 -t '/Halow/sub/1' -m xxx	HAP 101 publishes MQTT messages to VT-SOM-AH-EVB with this topic.
	(-h is followed by the MQTT host (HAP 101) to connect to, -t is followed by the MQTT topic to publish to VT-SOM-AH-EVB, -m is followed by the specific message to send)

Note: *ADDR is the station address of VT-SOM-AH-EVB, and it is set to 1 by default. You can use the 'AT+ADDR=' command to change the address.*

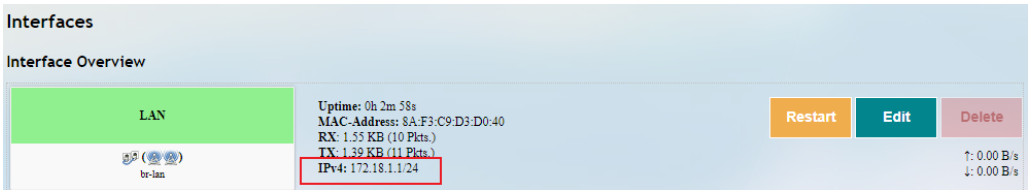
3.3 USB Data from EVB to AP

1. Follow the steps in 2.1 and 2.2 to connect VT-SOM-AH-EVB to HAP 101;
2. Connect the RD905U RFID reader to VT-SOM-AH-EVB using a mini-USB-to-Type-A cable and a USB OTG cable;
3. Use the wireless IP or WAN port IP of HAP 101 to log in VantronOS for HAP 101;

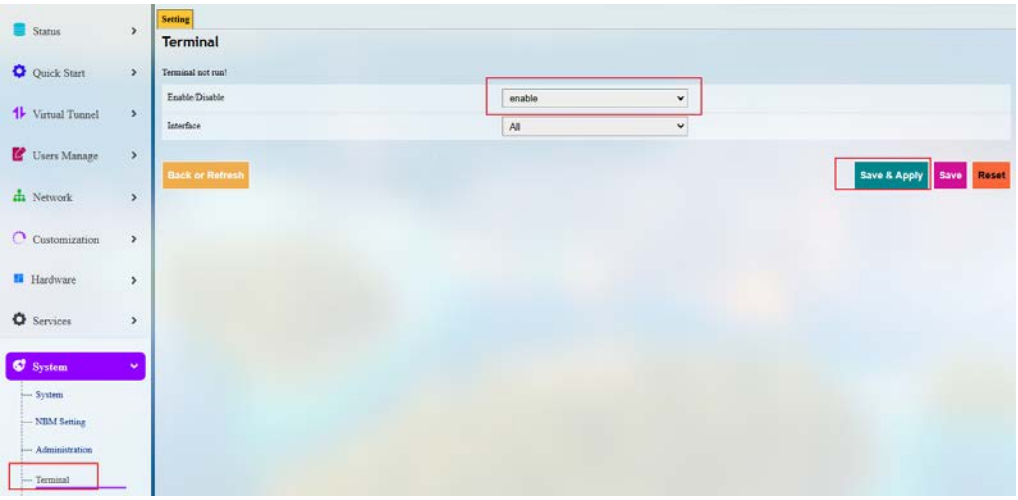
   Username / Password: root / rootpassword



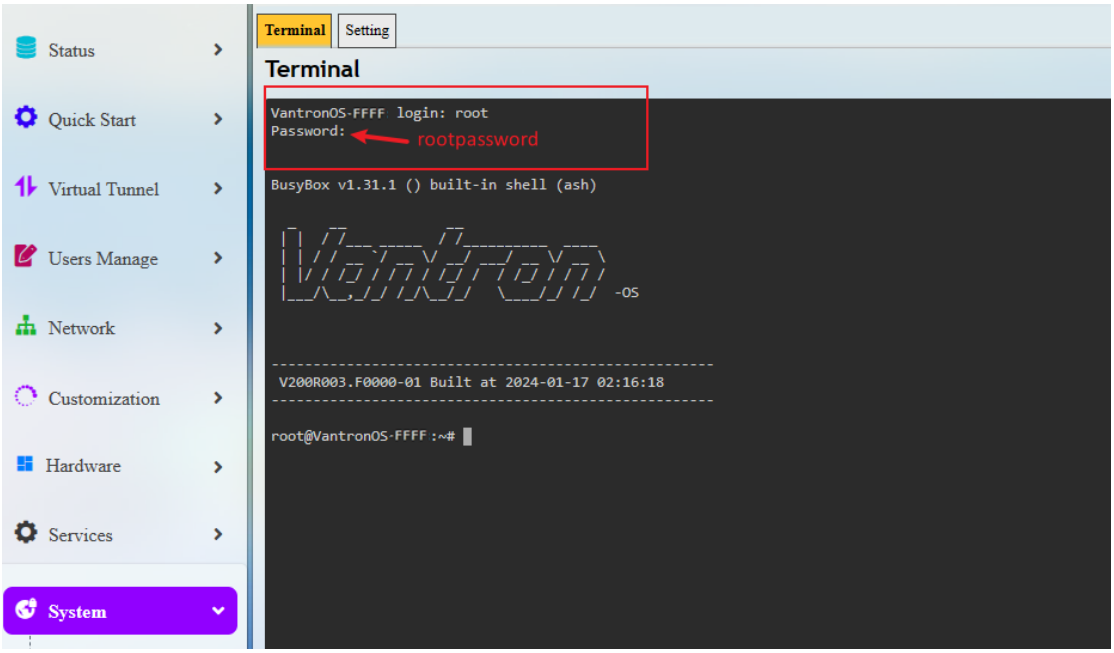
4. Navigate to **Network > Interfaces > LAN** to check the virtual LAN port IP of HAP 101 and it is the IP of the MQTT host;



5. Navigate to **System > Terminal**;
6. Select the **enable** option from the drop-down list and click **Save & Apply** to enable the terminal feature;



7. Click the **Terminal** tab next to the **Setting** tab, and login the shell of HAP 101 with above username and password;



8. Access the directory of the rfid program;

   cd /mnt/USER_SPACE/rfid;

```
root@VantronOS-FFFF:/#
root@VantronOS-FFFF:/#
root@VantronOS-FFFF:/#
root@VantronOS-FFFF:/#
root@VantronOS-FFFF:/# cd /mnt/USER_SPACE/rfid
```

9. Subscribe MQTT messages sent from VT-SOM-AH-EVB;

   mosquitto_sub -h 172.18.1.1 -t '/Halow/pub/1' (refer to 3.1 for details)

```
root@VantronOS-FFFF:/mnt/USER_SPACE/rfid#
root@VantronOS-FFFF:/mnt/USER_SPACE/rfid# mosquitto_sub -h 172.18.1.1 -t '/Halow/pub/1'
```

10. Swipe the card near the RFID reader to check the data printed on the host computer.

```
root@VantronOS-FFFF:/#
root@VantronOS-FFFF:/#
root@VantronOS-FFFF:/# cd /mnt/USER_SPACE/rfid
root@VantronOS-FFFF:/mnt/USER_SPACE/rfid#
root@VantronOS-FFFF:/mnt/USER_SPACE/rfid#
root@VantronOS-FFFF:/mnt/USER_SPACE/rfid# mosquitto_sub -h 172.18.1.1 -t '/Halow/pub/1'


E28068940000502C3B623973

E28068940000502C3B623973

E28068940000502C3B623973

E28068940000502C3B623973

E28068940000502C3B623973
```

3.4 Serial Communication (Message Publishing from EVB)

There is an RS232 and an RS485 ports on VT-SOM-AH-EVB.

Parameters of RS232 & RS485 ports:

Baud rate	Data bit	Polarity	Stop bit
115200	8	None	1

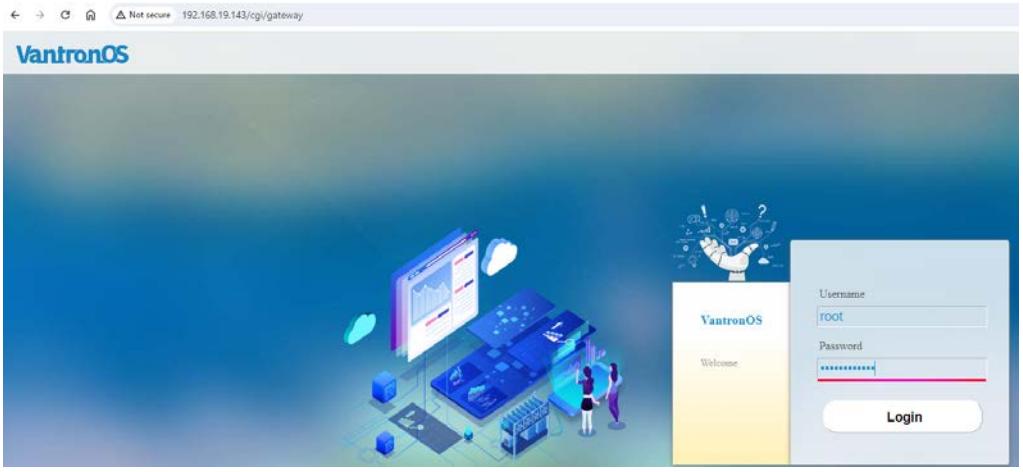
Pinout description of RS232 & RS485 ports:

1. Follow the steps in 2.1 and 2.2 to connect VT-SOM-AH-EVB to HAP 101;
2. Use a USB-to-serial adapter to connect the RS232/RS485 port to the host computer;

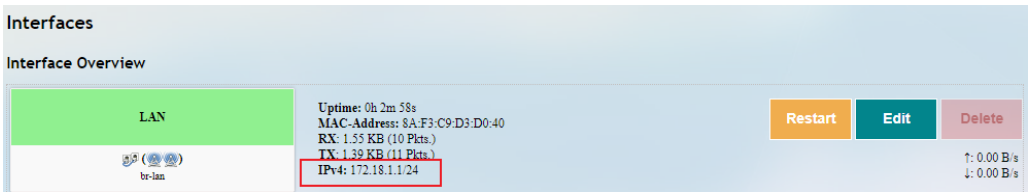
   For RS232 connection: TXD-RXD, RXD-TXD, GND-GND

   For RS485 connection: A-A, B-B, GND-GND
3. Use the wireless IP or WAN port IP of HAP 101 to log in VantronOS for HAP 101;

   Username / Password: root / rootpassword

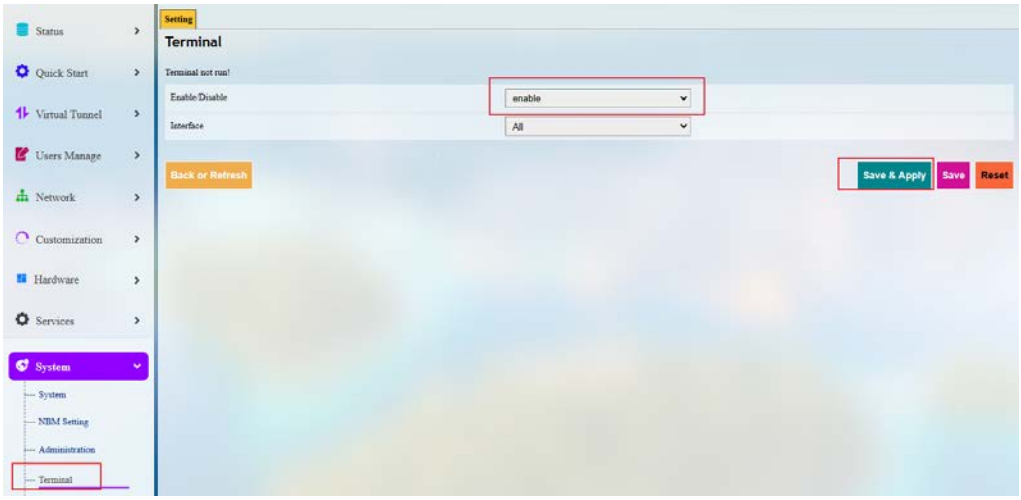


4. Navigate to **Network > Interfaces > LAN** to check the virtual LAN port IP of HAP 101 and it is the IP of the MQTT host;



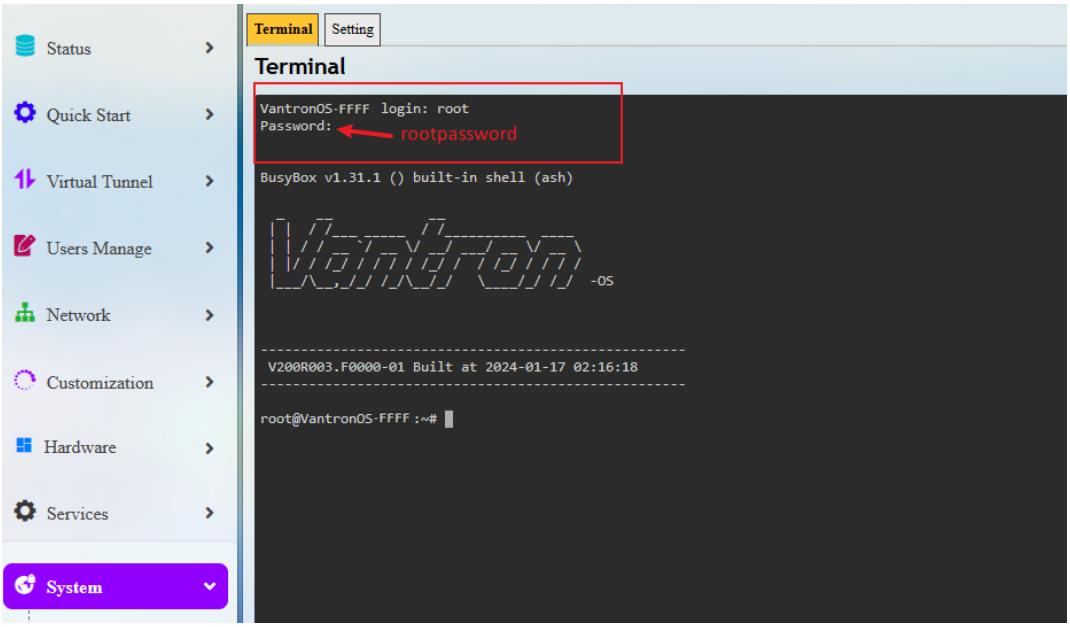
5. Navigate to **System > Terminal**;

6. Select the **enable** option from the drop-down list and click **Save & Apply** to enable the terminal feature;



Note: This step is not necessary if you have previously enabled the Terminal function.

7. Click the **Terminal** tab next to the **Setting** tab, and login the shell of HAP 101 with above username and password;



8. Access the directory of the rfid program;

   cd /mnt/USER_SPACE/rfid;

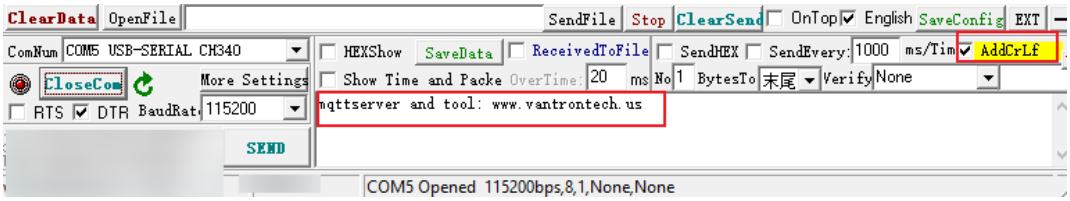
```
root@VantronOS-FFFF:/#
root@VantronOS-FFFF:/#
root@VantronOS-FFFF:/#
root@VantronOS-FFFF:/#
root@VantronOS-FFFF:/# cd /mnt/USER_SPACE/rfid
```

9. Subscribe MQTT messages sent from VT-SOM-AH-EVB;

   mosquitto_sub -h 172.18.1.1 -t '/Halow/pub/1' (refer to 3.1 for details)

```
root@VantronOS-FFFF:/mnt/USER_SPACE/rfid#
root@VantronOS-FFFF:/mnt/USER_SPACE/rfid# mosquitto_sub -h 172.18.1.1 -t '/Halow/pub/1'
```

10. Use the serial debug program used in 2.2.2 to send data via the serial port of VT-SOM-AH-EVB;



11. Check the data printed on the host computer.

```
root@VantronOS-FFFF:/mnt/USER_SPACE/rfid#
root@VantronOS-FFFF:/mnt/USER_SPACE/rfid# mosquitto_sub -h 172.18.1.1 -t '/Halow/pub/1'

mqttserver and tool: www.vantrontech.us
```

3.5 Message Publishing from AP

There is an RS232 and an RS485 ports on VT-SOM-AH-EVB.

Parameters of RS232 & RS485 ports:

Baud rate	Data bit	Polarity	Stop bit
115200	8	None	1

Pinout description of RS232 & RS485 ports:

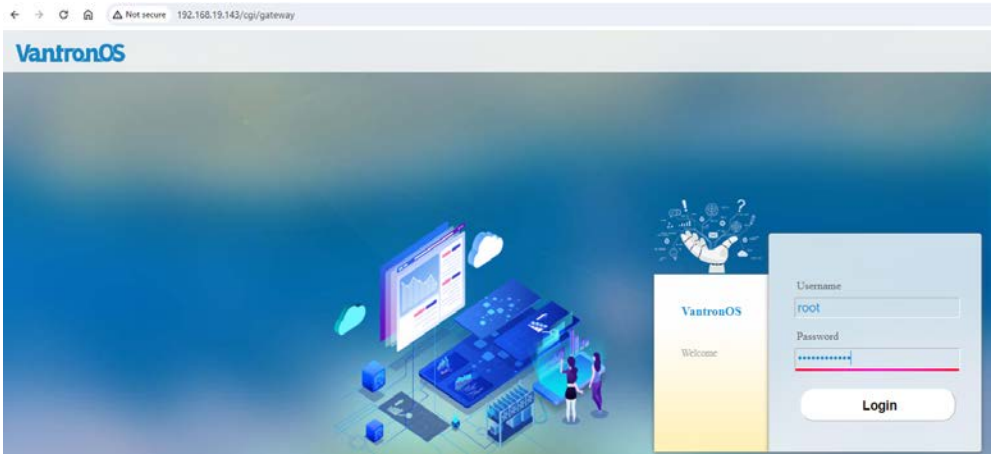
z

1. Follow the steps in 2.1 and 2.2 to connect VT-SOM-AH-EVB to HAP 101;
2. Use a USB-to-serial adapter to connect the RS232/RS485 port to the host computer;

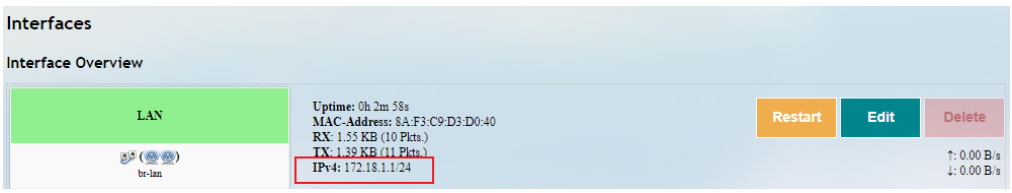
   For RS232 connection: TXD-RXD, RXD-TXD, GND-GND

   For RS485 connection: A-A, B-B, GND-GND
3. Use the wireless IP or WAN port IP of HAP 101 to log in VantronOS for HAP 101;

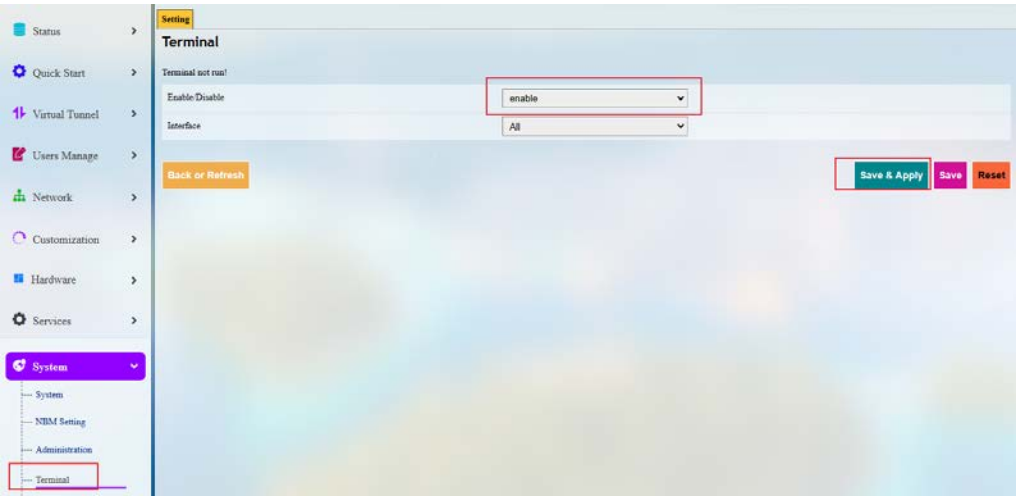
   Username / Password: root / rootpassword



4. Navigate to **Network > Interfaces > LAN** to check the virtual LAN port IP of HAP 101 and it is the IP of the MQTT host;

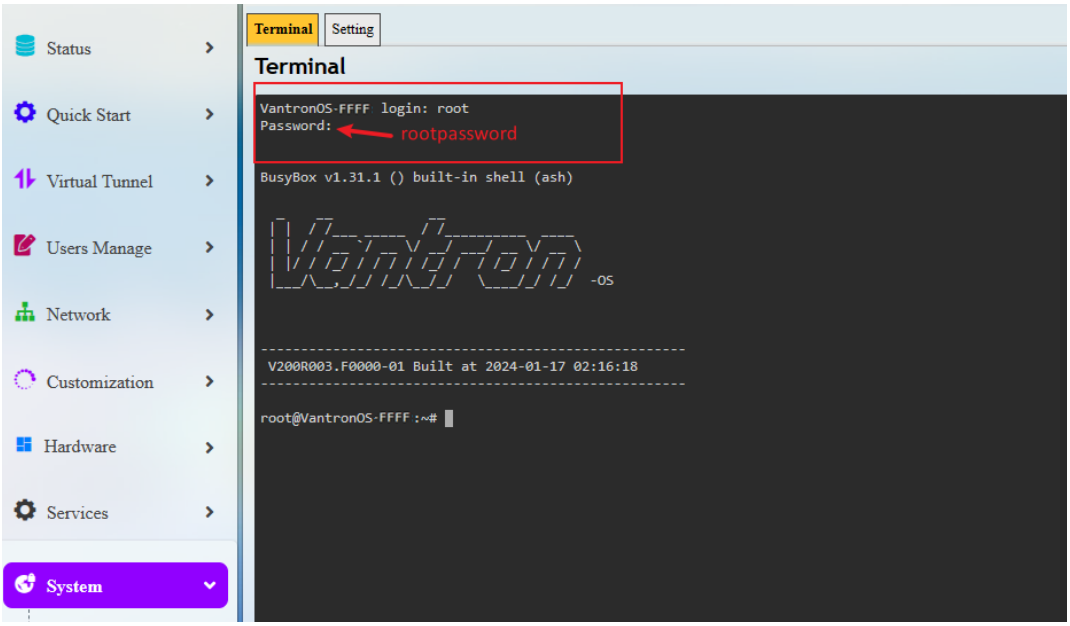


5. Navigate to **System > Terminal**;
6. Select the **enable** option from the drop-down list and click **Save & Apply** to enable the terminal feature;



Note: This step is not necessary if you have previously enabled the Terminal function.

7. Click the **Terminal** tab next to the **Setting** tab, and login the shell of HAP 101 with above username and password;

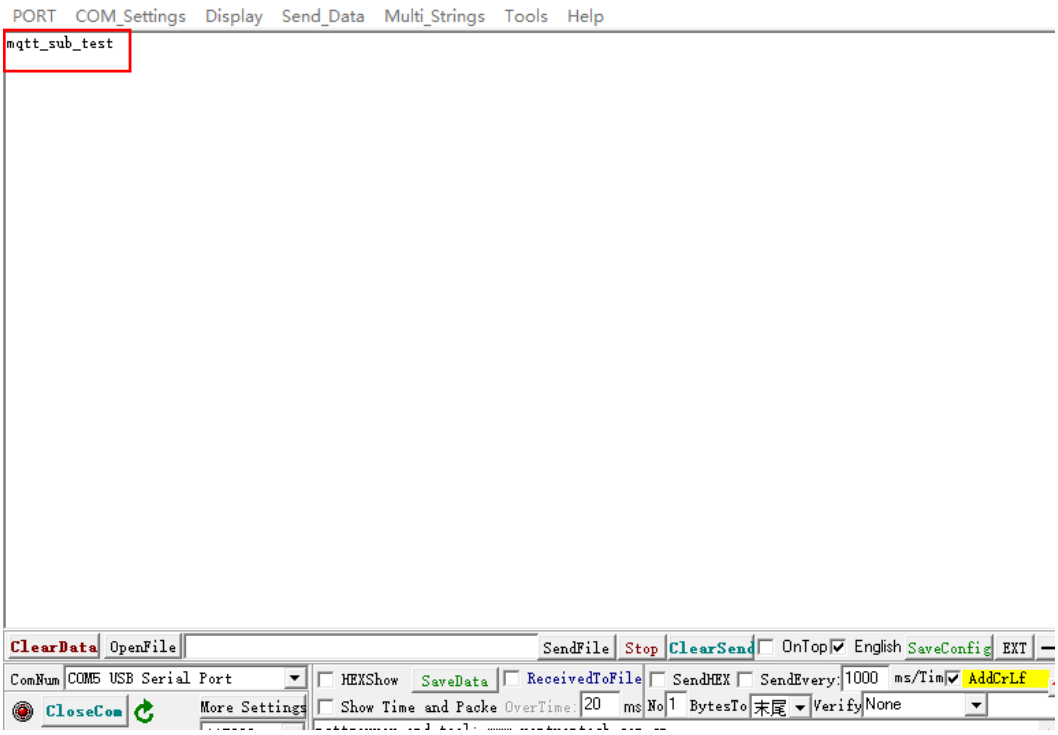


8. Publish an MQTT message from HAP 101 to VT-SOM-AH-EVB with the topic of '/Halow/sub/1';

   `mosquitto_pub -h 172.18.1.1 -t '/Halow/sub/1' -m mqtt_sub_test` (refer to 3.2 for details)

```
root@VantronOS-FFFF:/#
root@VantronOS-FFFF:/# mosquitto_pub -h 172.18.2.1 -t '/Halow/sub/1' -m mqtt_sub_test
```

9. Check the data received by VT-SOM-AH-EVB.



CHAPTER 4 HARDWARE DESCRIPTION

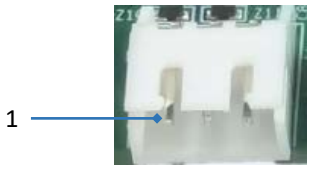
This chapter describes the hardware I/Os on VT-SOM-AH-EVB with respective pinout description or specifications.

4.1 Power Jack

VT-SOM-AH-EVB is designed to work with 9V ~ 12V DC power input with power supplied via the power jack on the board. It is recommended that a 12V/1A power adapter be used.

4.2 I²C

There is an I2C connector on VT-SOM-AH-EVB for connecting peripherals to allow serial communication with external devices.



Pinout description:

Pin	Signal	Description
1	SDA	Serial data
2	SCL	Serial clock
3	GND	Ground

4.3 RS232 & RS485

VT-SOM-AH-EVB offers a non-isolated RS232 connector and a non-isolated RS485 connector for M2M serial communication.

Pinout description of the serial ports:

Pin	Signal	Description
1	GND	Ground
2	RS232_TX	RS232 transmit signal
3	RS232_RX	RS232 receive signal
4	VCC_5V	5V power output (NC)
5	VCC_5V	5V power output (NC)
6	RS485_A	RS485 data A signal
7	RS485_B	RS485 data B signal
8	GND	Ground

4.4 Micro USB

The Micro USB port operates in OTG Host mode. Devices such as RFID readers can be connected to this port for transferring the card swiping information to the board.

4.5 Reset Button

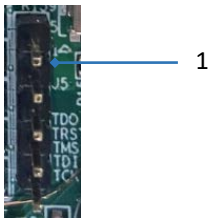
The reset button is designed to restart the board upon a short press.

4.6 Buzzer

The buzzer beeps once when the board is powered on. When the board successfully establishes an MQTT connection with an access point, the buzzer will emit a continuous 2-second beep.

4.7 JTAG (J5)

The JTAG header is for firmware flashing when a new firmware version is available for the board.

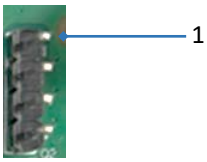


Pinout description:

Pin	Signal	Description
1	TDO	Test data output
2	TRST	JTAG TAP controller reset
3	TMS	Testing/debugging mode select
4	TDI	Test data input
5	TCK	Test data output

4.8 Debug UART (J7)

The board is debugged via this port when connected to a host computer.



Pinout description:

Pin	Signal	Description
1	VCC_3.3V	3.3V power output (NC)
2	TX	Transmit signal
3	RX	Receive signal
4	GND	Ground

4.9 GPIO (J6)

The 20-pin GPIO header provides 4 GPIOs and other signals for connecting peripherals.

Pinout description:

Pin	Signal	Description
1	ADC1_IN15	Analog-to-digital converter_1_input
2	ADC1_IN17	Analog-to-digital converter_1_input
3	NC	
4	NC	
5	NC	
6	NC	
7	SPI2_MOSI	SPI2_Master output slave input
8	GPIO2	General purpose input and output 2
9	GPIO3	General purpose input and output 3
10	GPIO4	General purpose input and output 4
11	GPIO5	General purpose input and output 5
12	NC	

13	FDCAN1_TX	FDCAN1_transmit
14	NC	
15	FDCAN1_RX	FDCAN1_receive
16	NC	
17	NC	
18	NC	
19	GND	Ground
20	GND	Ground

4.10 Antenna

The two antenna connectors are designed for connecting a Wi-Fi HaLow antenna (J2) and a GPS antenna (J9).

CHAPTER 5 DISPOSAL AND WARRANTY

5.1 Disposal

When the device comes to end of life, you are suggested to properly dispose of the device for the sake of the environment and safety.

Before you dispose of the device, please back up your data and erase it from the device.

It is recommended that the device is disassembled prior to disposal in conformity with local regulations. Please ensure that the abandoned batteries are disposed of according to local regulations on waste disposal. Do not throw batteries into fire or put in common waste canister as they are explosive. Products or product packages labeled with the sign of “explosive” should not be disposed of like household waste but delivered to specialized electrical & electronic waste recycling/disposal center.

Proper disposal of this sort of waste helps avoid harm and adverse effect upon surroundings and people’s health. Please contact local organizations or recycling/disposal center for more recycling/disposal methods of related products.

5.2 Warranty

Product warranty

VANTRON warrants to its CUSTOMER that the Product manufactured by VANTRON, or its subcontractors will conform strictly to the mutually agreed specifications and be free from defects in workmanship and materials (except that which is furnished by the CUSTOMER) upon shipment from VANTRON. VANTRON's obligation under this warranty is limited to replacing or repairing at its option of the Product which shall, within **24 months** after shipment, effective from invoice date, be returned to VANTRON's factory with transportation fee paid by the CUSTOMER and which shall, after examination, be disclosed to VANTRON's reasonable satisfaction to be thus defective. VANTRON shall bear the transportation fee for the shipment of the Product to the CUSTOMER.

Out-of-Warranty Repair

VANTRON will furnish the repair services for the Product which are out-of-warranty at VANTRON's then-prevailing rates for such services. At customer's request, VANTRON will provide components to the CUSTOMER for non-warranty repair. VANTRON will provide this service as long as the components are available in the market; and the CUSTOMER is requested to place a purchase order up front. Parts repaired will have an extended warranty of 3 months.

Returned Products

Any Product found to be defective and covered under warranty pursuant to Clause above, shall be returned to VANTRON only upon the CUSTOMER's receipt of and with reference to a VANTRON supplied Returned Materials Authorization (RMA) number. VANTRON shall supply an RMA, when required within three (3) working days of request by the CUSTOMER. VANTRON shall submit a new invoice to the CUSTOMER upon shipping of the returned products to the CUSTOMER. Prior to the return of any products by the CUSTOMER due to rejection or warranty defect, the CUSTOMER shall afford VANTRON the opportunity to inspect such products at the CUSTOMER's location and no Product so inspected shall be returned to VANTRON unless the cause for the rejection or defect is determined to be the responsibility of VANTRON. VANTRON shall in turn provide the CUSTOMER turnaround shipment on defective Product within **fourteen (14) working days** upon its receipt at VANTRON. If such turnaround cannot be provided by VANTRON due to causes beyond the control of VANTRON, VANTRON shall document such instances and notify the CUSTOMER immediately.

Appendix A: AT Commands for EVB Configuration

Here is a collection of the AT commands used to configure the evaluation board.

Please remember to use '\n' as the line break after each command. Every time when you change a parameter, please restart the device to allow the settings to take effect.

1. SSID

The SSID commands are used to query/set the SSID of the access point to which the evaluation board intends to connect.

Action	AT command	Description
Query	AT+SSID?	To query the name of available access point
Set	AT+SSID=xxx	To input the name of the access point (max. 31 characters supported)

2. SECUR

The SECUR commands are used to query/set the encryption method of the access point to which the evaluation board intends to connect. The encryption method shall be kept consistent with that of the access point to ensure successful connection.

Action	AT command	Description
Query	AT+SECUR?	To query the encryption method of available access point
Set	AT+SECUR=xxx	To set the encryption method (Value: SAE (default), OWE, OPEN)

3. PWD

The PWD commands are used to query/set the password of the access point to which the evaluation board intends to connect.

Action	AT command	Description
Query	AT+PWD?	To query the password of available access point
Set	AT+PWD=xxx	To input the password of the access point (max. 100 characters supported)

4. DHCP

The DHCP commands are used to query/set the DHCP state of the evaluation board.

Action	AT command	Description
Query	AT+DHCP?	To query the DHCP state of the evaluation board
Set	AT+DHCP=xxx	To set the DHCP state of the evaluation board (0: disable, 1: enable)

5. IP

The IP commands are used to query/set the IP address of the evaluation board.

Action	AT command	Description
Query	AT+IP?	To query the IP address of the evaluation board
Set	AT+IP=xxx	To set the IP address of the evaluation board (Valid only when DHCP=0)

6. MASK

The MASK commands are used to query/set the subnet mask of the evaluation board.

Action	AT command	Description
Query	AT+MASK?	To query the subnet mask of the evaluation board
Set	AT+MASK=xxx	To set the subnet mask of the evaluation board (Valid only when DHCP=0)

7. GATEWAY

The GATEWAY commands are used to query/set the gateway of the evaluation board.

Action	AT command	Description
Query	AT+GATEWAY?	To query the gateway of the evaluation board
Set	AT+GATEWAY=xxx	To set the gateway of the evaluation board (Valid only when DHCP=0)

8. ADDR

The ADDR commands are used to query/set the station address of the evaluation board.

Action	AT command	Description
Query	AT+ADDR?	To query the station address of the evaluation board
Set	AT+ADDR=xxx	To set the station address of the evaluation board (range: 1~65535)

9. CSQ

The CSQ command is used to query the signal strength.

Action	AT command	Description
Query	AT+CSQ?	To query the Wi-Fi HaLow signal strength

10. LINK

The LINK command is used to query the connection status of the evaluation board to the access point.

Action	AT command	Description
Query	AT+LINK?	Down: connection failed
		Up: connection succeeded

11. CONN

The CONN command is used to query the connection status of the evaluation board to the MQTT Broker.

Action	AT command	Description
Query	AT+CONN?	0: connection failed
		1: connection succeeded

Note: There will be a 2-second beep upon successful connection of the device to the MQTT Broker.

12. COUNTRY

The country code may impact the Wi-Fi frequency band of the device. The COUNTRY commands are used to query/set the country code of the evaluation board to match that of the access point.

Action	AT command	Description
Query	AT+COUNTRY?	To query the country code of the evaluation board
Set	AT+COUNTRY=xxx	To set the country code of the evaluation board (The default code is 'US')

List of country codes (alphabetic order):

Code	Country	Code	Country	Code	Country
AL	Albania	FL	Liechtenstein	MD	Moldova
AT	Austria	FR	France	MK	North Macedonia
AU	Australia	GR	Greece	MT	Malta
BA	Bosnia and Herzegovina	HR	Croatia	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
CH	Switzerland	IN	India	PL	Poland
CY	Cypress	IS	Iceland	PT	Portugal
CZ	Czech Republic	IT	Italy	RO	Romania
DD	Germany	JP	Japan	SE	Sweden
DK	Denmark	KE	Kenya	SG	Singapore
EE	Estonia	KR	South Korea	SI	Slovenia
ES	Spain	LT	Lithuania	SK	Slovakia
EU	EU	LU	Luxembourg	TR	Turkey
FI	Finland	LV	Latvia	UK	United Kingdom
				US	USA

13. SN

The SN command is used to query the serial number of the evaluation board.

Action	AT command	Description
Query	AT+SN?	To query the serial number of the evaluation board

14. GPS

The GPS commands are used to turn on/off the GPS feature. Once turned on, the debug UART will print the geographic information of the evaluation board every second.

Action	AT command	Description
Set	AT+GPS=0	To turn off GPS
	AT+GPS=1	To turn on GPS

15. BAUD

The BAUD commands are used to query/set the baud rate of the serial ports.

Action	AT command	Description
Query	AT+BAUD?	To query the baud rate of the evaluation board
Set	AT+BAUD=mode,ratebaud	Value of mode: 0 for RS232, 1 for RS485 Value of baud rate: 1200, 2400, 4800, 9600, 19200, 38400, 115200

16. AT&

The AT& command is used to reconnect the evaluation board to the access point when the parameters are modified.

Action	AT command	Description
Execute	AT&	To reconnect the evaluation board to the access point

17. ATZ

The ATZ command is used to reset the evaluation board.

Action	AT command	Description
Execute	ATZ	To reset the evaluation board

18. ATV

The ATV command is used to check the firmware version of the evaluation board.

Action	AT command	Description
Execute	ATV	The result is like this: application version: 1.0.1 morse firmware version: rel_1_7_2_2023_Mar_15 morselib version: 1.4.2

Appendix B: Specifications of VT-SOM-AH & HAP 101

VT-SOM-AH					
System	SoC	Morse Micro MM6108			
	MCU	STM32U, 784KB SRAM, 2MB Flash			
RF	GNSS	GPS, Beidou			
I/O	Pin signals	1 x SPI			
		2 x I^2C			
		4 x UART			
		1 x USB			
		1 x CAN			
		3 x ADC			
		7 x GPIO (Min.)			
		JTAG supported			
	Antenna	1 x GNSS U.FL antenna connector			
WLAN Features	Wi-Fi standard	IEEE 802. 11ah			
	Frequency range (Sub 1 GHz bands)	850MHz ~ 950MHz			
	Channel bandwidth	1 / 2 / 4 /8 MHz			
	Data rate	1 MHz	2 MHz	4 MHz	8 MHz
		3.33Mbps (Max.)	7.22Mbps (Max.)	15Mbps (Max.)	32.5Mbps (Max.)
	Security	AES encryption engine SHA1 and SHA2 hash functions (SHA-256, SHA-384, SHA-512) WPA3 including protected management frames (PMF)			
Mechanical	Dimensions	30.5mm x 24.5mm x 2.99mm			
	Voltage	VCC: 3.3V	VDD_FEM: 3.3V	VCC_WIFI: 3.3V	
	Temperature	Operating: -40℃ ~ +85℃	Storage: -40℃ ~ +90℃		
	Humidity	Less than 85% RH (non-condensing)			
	Certification	FCC, IC, CE			

The EVB is designed to be used in combination with a Wi-Fi HaLow access point. The following sheet lists the specification of Vantron HAP 101 Wi-Fi HaLow access point for your reference.

HAP101		
System	CPU	MediaTek 580MHz MIPS® CPU
	Wi-Fi HaLow SoC	Morse Micro MM6108
	Memory	256MB
	Storage	64MB
WLAN Features	2.4GHz Wi-Fi (Optional)	Standard: IEE 802.11 b/g/n
		Frequency range: 2.412GHz ~ 2.484GHz
		Channel bandwidth: 20/40 MHz
		Data rate: up to 150 Mbps
		Antenna: 2T2R
	Wi-Fi HaLow	Standard: IEE 802.11 ah
		Frequency range: 850MHz ~ 950 MHz
		Channel bandwidth: 1/2/4/8 MHz
		Data rate: up to 32.5 Mbps @8MHz or 15 Mbps @4MHz
		Working mode: AP, STA configurable
I/O	Fast Ethernet	1 x RJ45, 10/100 Mbps
	Serial port (Optional)	1 x RS485 (4-pin terminal, 5V output, baud rate: 115200)
	Antenna	1 x Wi-Fi HaLow SMA connector
		2 x 2.4GHz Wi-Fi SMA connector (optional)
System Control	LED indicators	1 x Power indicator 1 x WLAN activity indicator
		1 x Wi-Fi HaLow activity indicator 1 x Error indicator
	Button	1 x Restore button
Mechanical	Dimensions	110mm x 73mm x 28mm (with wall mount)
	Casing material	Plastics (UL94, SP6 compliant)
	Installation	Wall mounting
	Heat dissipation	Fanless
Power	Input	9V ~ 40V DC
	Port	3-pin terminal (Over-current protection, reverse polarity protection)
Software	Operating system	VantronOS
	VPN	OpenVPN, IPSec
	Device management platform	Vantron BlueSphere GWM
	Upgrade	Local upgrade, OTA upgrade
Security	2.4GHz Wi-Fi	64/128-bit WEP, TKIP, WPA, WPA2, AES, WPS
	Wi-Fi HaLow	WPA3
Environment Condition	Temperature	Operating: -20℃ ~ +60℃ Storage: -40℃ ~ +85℃
	Humidity	≤ 95% RH (non-condensing)
	Certificate	FCC, IC

Appendix C: Regulatory Compliance Statement

This product has been determined to be compliant with the applicable standards, regulations, and directives for the countries where the product is marketed.

FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

Note: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate this equipment.

IC Statement

This device complies with ISED's licence-exempt RSSs. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be chosen so that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Le présent appareil est conforme aux CNR d' ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. le dispositif ne doit pas produire de brouillage préjudiciable, et
2. ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radio électrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.