MeiG 5G EVB User Guide

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Revision History

Revision	Date	Author	Description
V1.0	2020-03-05	Shuang Yang	Initial
V1.1	2020-06-28	Shuang Yang	Modify Antenna Definition
V1.2	2020-07-16	Kangyu Fan	Add EVB environment construction and operation procedures Illustration

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1 Introduction

1.1 Safety Information

Observing the following safety information can keep you safe and protect the product and its working environment from potential damage.

	Driving safety first! When you drive, do not use handheld mobile terminal device unless it has a hands-free function. Please stop the car before calling!
	Please turn off the mobile terminal device before boarding. The wireless function of mobile terminal shall not be turned on in the aircraft to prevent interference with the aircraft communication system. Ignoring this reminder may affect flying safety or even violate the law.
	In hospitals or health care facilities, pay attention to whether there are restrictions on the use of mobile terminal device. RF interference will cause medical equipment to be abnormal, so mobile terminal device may need to be turned off.
	Mobile terminal device cannot always be effectively connected, for example, if the mobile device has no expense or the SIM is invalid. When you encounter the above situations in an emergency, please make an emergency call, meanwhile, ensure that your device is turned on and in an area with sufficient signal strength.
	Your mobile terminal device will receive and transmit radio frequency signals when it is turned on. There will be radio frequency interference when it is close to TV, radio, computer or other electronic equipment.
	Please keep mobile device away from inflammable gases. Please turn off the mobile terminal device when you are near a fueling station, oil depot, chemical plant or explosion site. There will be potential safety hazards when operating electronic equipment in any place with potential explosion hazard.

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1.2 Purpose

This document describes the basic functions and main features of 5G EVB development board, hardware interface and methods of use, structural characteristics and electrical characteristics, and gives users a guidance of using 5G EVB development board to evaluate and test 5G LGA module and M.2 module products.

1.3 Overview

This user manual is consisted of three chapters below:

- Chapter 1, safety information, purpose and overview;
- Chapter 2, the basic functions and main features of 5G EVB development board;
- Chapter 3, the functions, features and usage of 5G EVB development board.
- Chapter 4, EVB environment construction and operation procedures Illustration.

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2 Product Introduction

2.1 Basic Information

5G EVB development board is a powerful brand-new development board that our company provides customers and designers with application and verification functions based on 5G LGA module, M.2 5G module and M.2 Wi-Fi module. It is mainly applicable to the following module products.

The table below describes 5G EVB features in detail:

Table 1 Features List

Features	Description
Adaptor	DC: +12V/2A
Module Type	5G LGA Module, M.2 5G Module, M.2 Wi-Fi Module
Ethernet Interface	AR8035
SD Interface	Support SD
(U) SIM Card	Support dual (U) SIM:2.95V and 1.8V
Audio Interface	Support NAU8810 CODEC, Audio Interface: SPK, earphone connector
RJ11	Support SI82135 SLIC, 1*RJ11
Serial Port Interface	Support one UART connector with USB interface compatible 3.3V industrial serial port
USB Interface	USB 3.1 or USB 2.0
Signal Indicator	10 groups of signal indicators available
Key & Switch	Power Key, Reset Key, Switch
Physical Features	Dimension: 173mm×150mm

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Table 2 EVB Accessories List

Items	Does EVB Kit contain	Description
5G EVB	include	The development board is used to debug and evaluate the functions of the 5G series modules
Micro USB cable	include	Micro USB3.0 A/B cable
Antennas	include	4/5G antennas 8pcs antennas GPS antennas 1pcs
5G Module	include	Only includes 5G LGA Module
DC power adapter	include	DC power adapter 12V/2A
USB-AF cable	exclude	USB Type-A to Type-A cable
SIM/USIM card	exclude	Standard NANO SIM card
Driver file	Supplied separately	The driver supports the following operating systems: Windows 7/8/8.1/10 Linux/Android

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2.2 Interface Introduction

Figure 1 shows the 5G EVB interfaces positions.

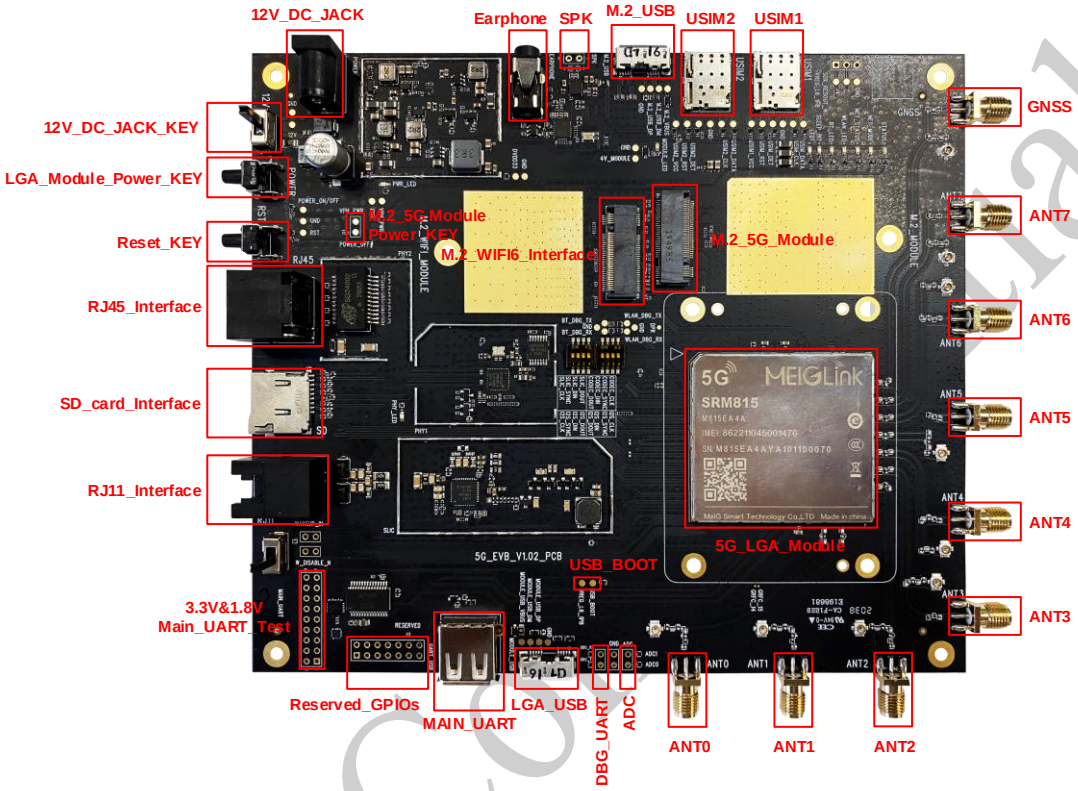

Figure 1 Interfaces Positions

Table 3 EVB Interfaces Introduction

Functions	Component No.	Description
Adaptor	J100	Typical adaptor model 12V/2A
Power Switch	J101	Switch on, EVB development board 12V circuit turn-on Switch off, EVB development board 12V circuit turn-off
POWER_KEY	J500	5G LGA Module power key
POWER_OFF#	J1001	M.2 5G Module power-on shorting cap. Power on when connected
RESET_KEY	J501	Reset key can be used to reset 5G LGA module or M.2 5G Module
Network Interface	J600	Module RGMII input voltage 1.8V; AR8035 Ethernet chipset
SD Interface	J900	Support SD card interface

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(U)SIM1	J901	(U)SIM1 Slot, support 1.8V/3V
(U)SIM2	J902	(U)SIM2 Slot, support 1.8V/3V
Audio Interface	J401	Audio earphone connector
	J402	Audio speaker
RJ11 Interface	J800	Telephone SLIC interface
Serial Port Interface	J700	Main serial port 1.8V/3.3V Pin header interface
	J702	Main serial port converts to USB interface
USB Interface	J704	5G LGA module USB3.1/USB2.0 device interface
	J705	M.2 5G Module USB3.1/USB2.0 device interface
DBG_UART	J701	Debug serial port, Pin interface mode
ADC	J2000	Two-way ADC interface, Pin interface mode
Power Indicator Light	LED504	Module power indicator: PWR_LED
	LED508	System 4V Power supply indicator: MODULE_LED
Signal Indicator	LED500	Module status indicator: SLEEP_INT
	LED501	Module network operation status indicator: NET_STATUS
	LED502	Module network registration status indicator: NET_MODE
	LED503	Network port status indicator: PHY_LED
	LED504	System 4V power indicator: PWR_LED
	LED505	WI-FI operation status indicator: WLEN_LED
	LED506	Module power-on status indicator: STATUS
	LED507	Bluetooth operation status indicator: BT_LED
	LED508	Module power supply indicator: MODULE_LED
	LED510	Reserved Indicator verification for sink current capacity: LED1
RESERVED	J2001	
Antenna Interface	J300	LMHB TRX n41 TRX1 n79_DRX1
	J301	LMHB DRX n41_DRX1 n79_TRX1
	J307	n79_DRX0
	J304	n79_TRX0

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J306	MHB PRX_MIMO n77/78 TRX0 UHB TRX
J303	n77/78 TRX1 n41 TRX0 UHB TRX1
J302	MHB DRX_MIMO n77/78 DRX0 n41 DRX0 UHB DRX
J305	n77/78 DRX1 UHB DRX1
J308	GNSS

2.3 EVB Top View and Bottom View

The top view and bottom view of the EVB development board are respectively shown in Figure 2 and Figure 3. The single side of the development board is embedded with devices and various interfaces. If you need to debug, you can connect the corresponding modules, which is very convenient for development and debugging.



Figure 2 EVB Top View

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Figure 3 EVB Bottom View

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3 Interface Applications

This chapter mainly introduces the interface function and usage.

- Power Interface
- Module Interfaces
- Keys
- RGMII Function
- SLIC Function
- CODEC Circuit
- USB Interface
- UART Interface
- SIM Card Interface
- SD Card Interface
- ADC Interface
- USB_BOOT Interface
- Antenna
- M.2 Wi-Fi 6 Module

3.1 Power Interface

After the external 12V power jack is input, connect the step-down conversion IC, which can provide the power supply voltage (including VBAT) required for running the circuit on the EVB. The power block diagram of the EVB board is shown in Figure 4, and the external power interface is shown in Figure 5.

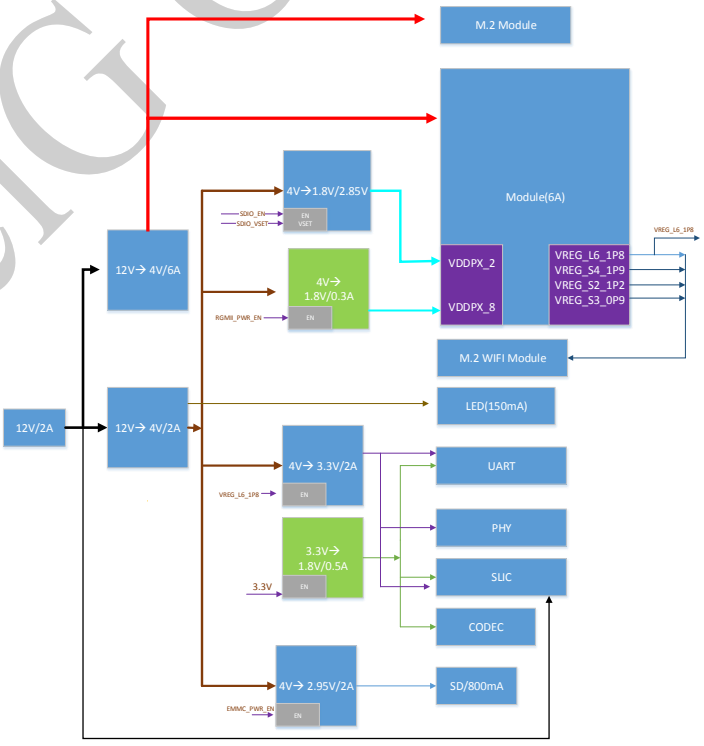

Figure 4 Simplified Principle Block Diagram of Power Interface

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After connecting the power adapter, move the power dial switch to the direction as shown in Figure 5 to supply power to the EVB.

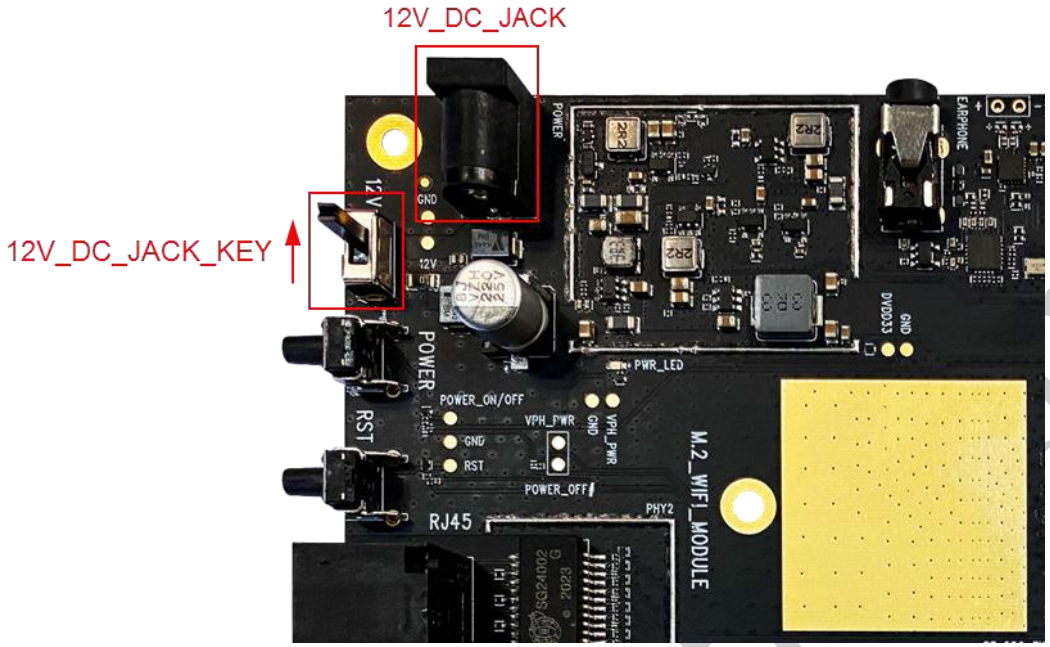

Figure 5 External Power Interface

Note:

Before connecting the power supply, the user must confirm to use the matching DC power adapter to power the development board.

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3.2 Module Interfaces

The core module interface of 5G EVB development board is mainly applicable to our 5G modules, including LGA and M.2 packaging forms.

Please refer to the corresponding hardware design manual for detailed module parameter.

5G LGA dimension is 44mm x 41mm x 2.8mm. The location of the bottom plate of the LGA pad is shown in Figure 6.

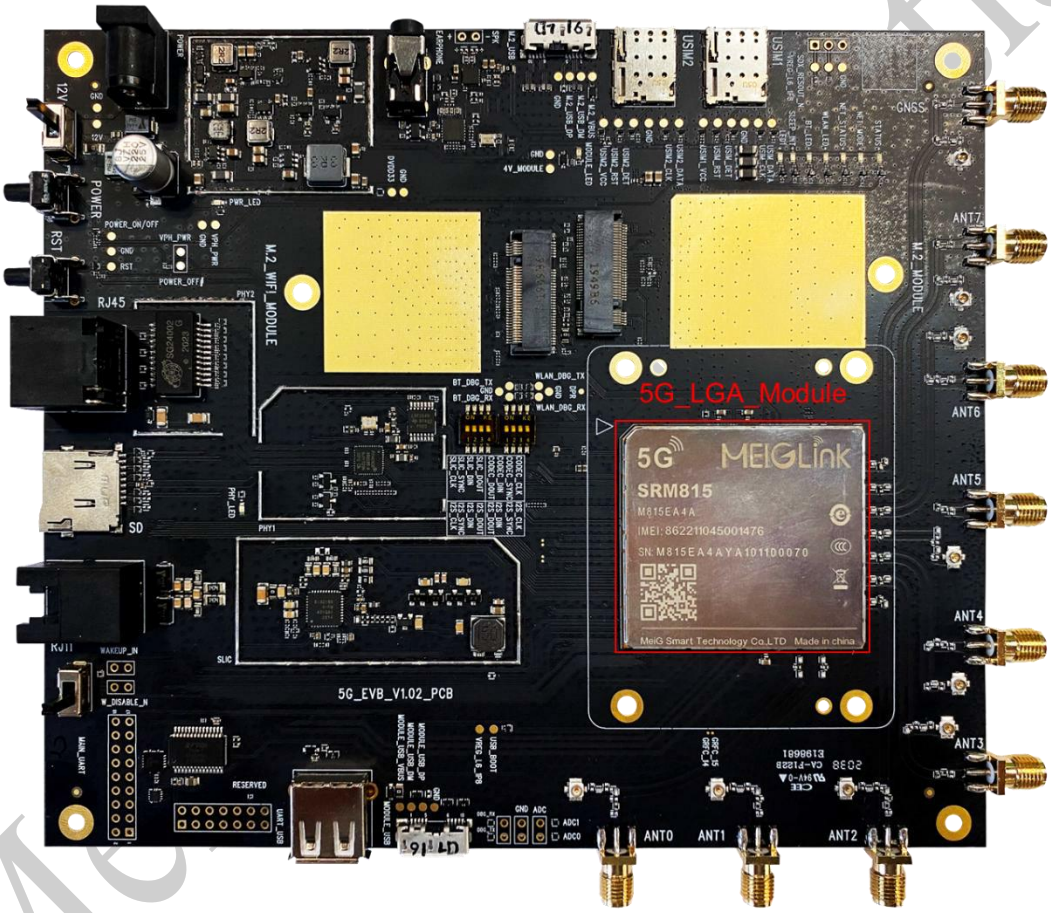

Figure 6 5G LGA Interface

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M.2 module dimension 52mm x 30mm. Standard gold finger interface is used. The plug position on EVB is shown in Figure 7.

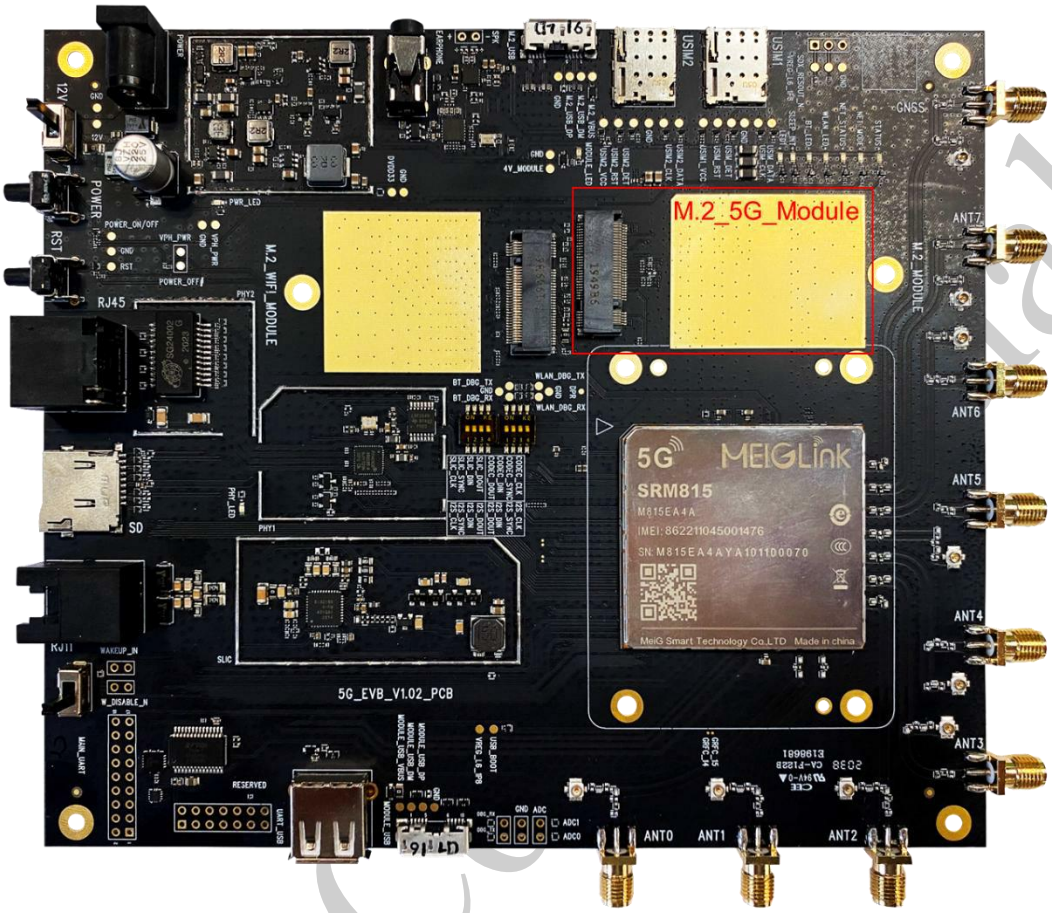

Figure 7 M.2 5G Module Interface

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3.3 Keys

Two keys are on the EVB development board, J500 power-on key and J501 reset key respectively.

Power-on key: J500 is 5G LGA module power-on key and supports module switch; J1001 pin header is M.2 5G Module. When it is short-circuited with jumper cap, M.2 5G module is started. When the jumper cap is plugged out, M.2 5G module is turned off.

Reset key: reset function works for both 5G LGA module and M.2 5G Module.

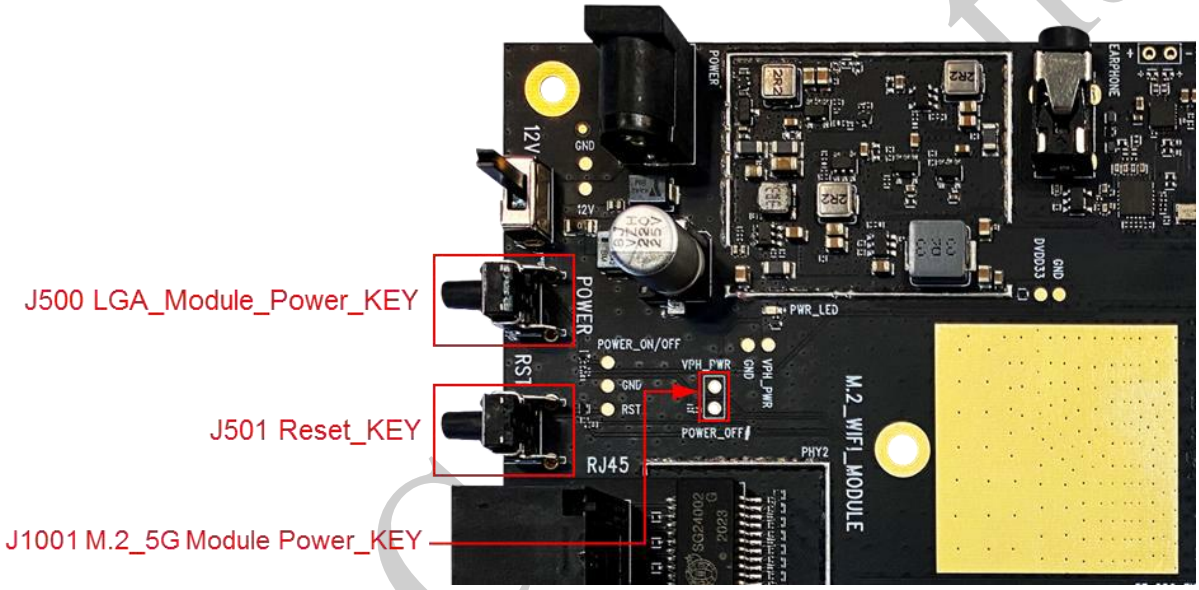

Figure 8 Keys

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3.4 RGMII Function

The 5G EVB development board is equipped with a single network port, which adopts AR8035 solution. Only 5G LGA module supports RGMII function.

5G EVB + 5G LGA module + RJ45 network cable are required to realize the function.

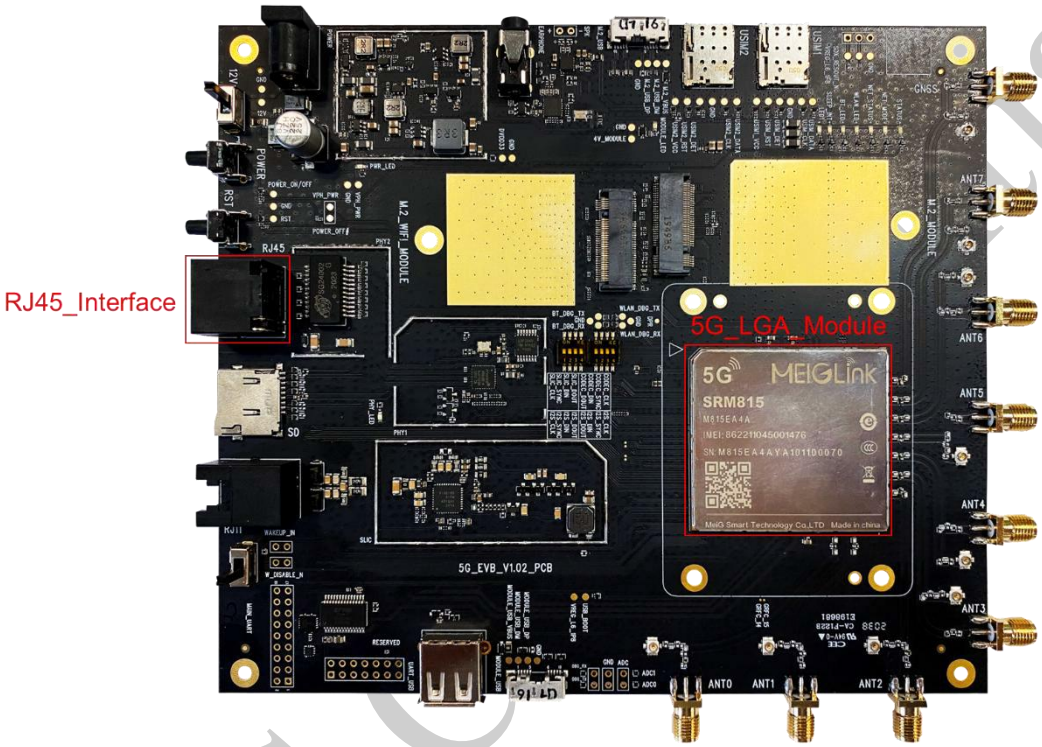

Figure 9 Network Interface

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3.5 SLIC Function

5G EVB development board is equipped with on-board SLIC circuit. SLIC adopts Si32184/5 solution. Only 5G LGA module supports this function.

5G EVB + 5G LGA module + RJ11 telephone interface are required to realize this function. Move U1101 dial switch to the top of EVB, as shown in Figure 10.

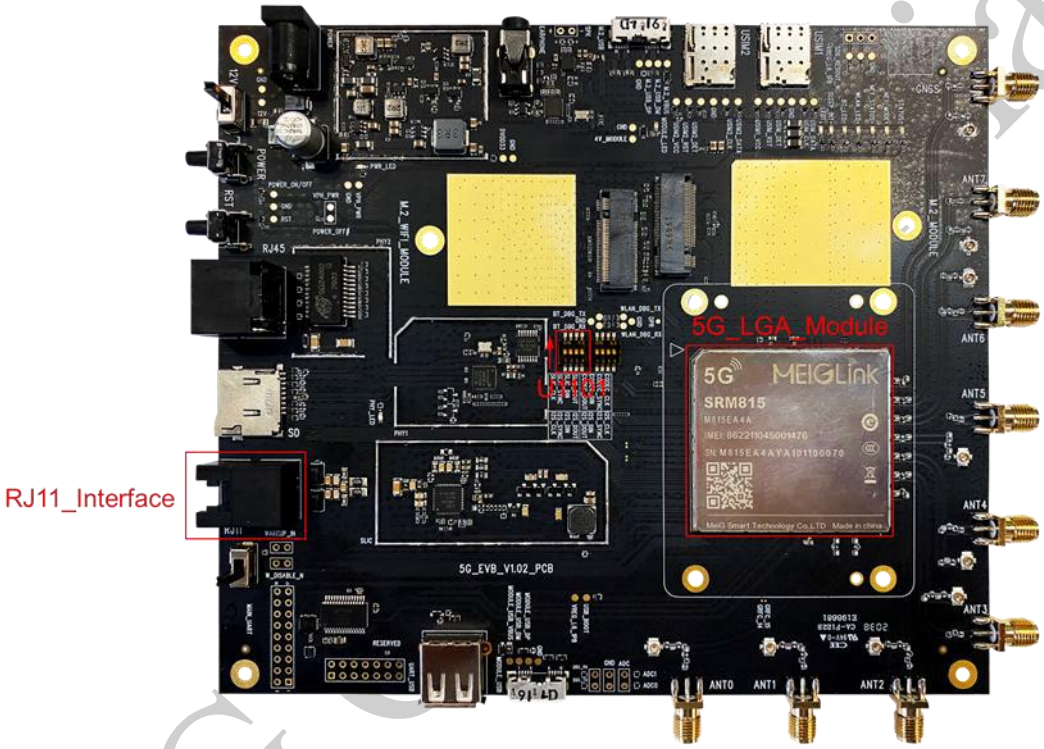

Figure 10 SLIC Function

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3.6 CODEC Circuit

5G EVB development board has CODEC circuit on board. CODEC supports earphone connector and loudspeaker. It adopts NAU8810 solution, and the loudspeaker adopts AW8735 audio power amplifier.

Move U1100 dial switch to the top of EVB, as shown in Figure 11.

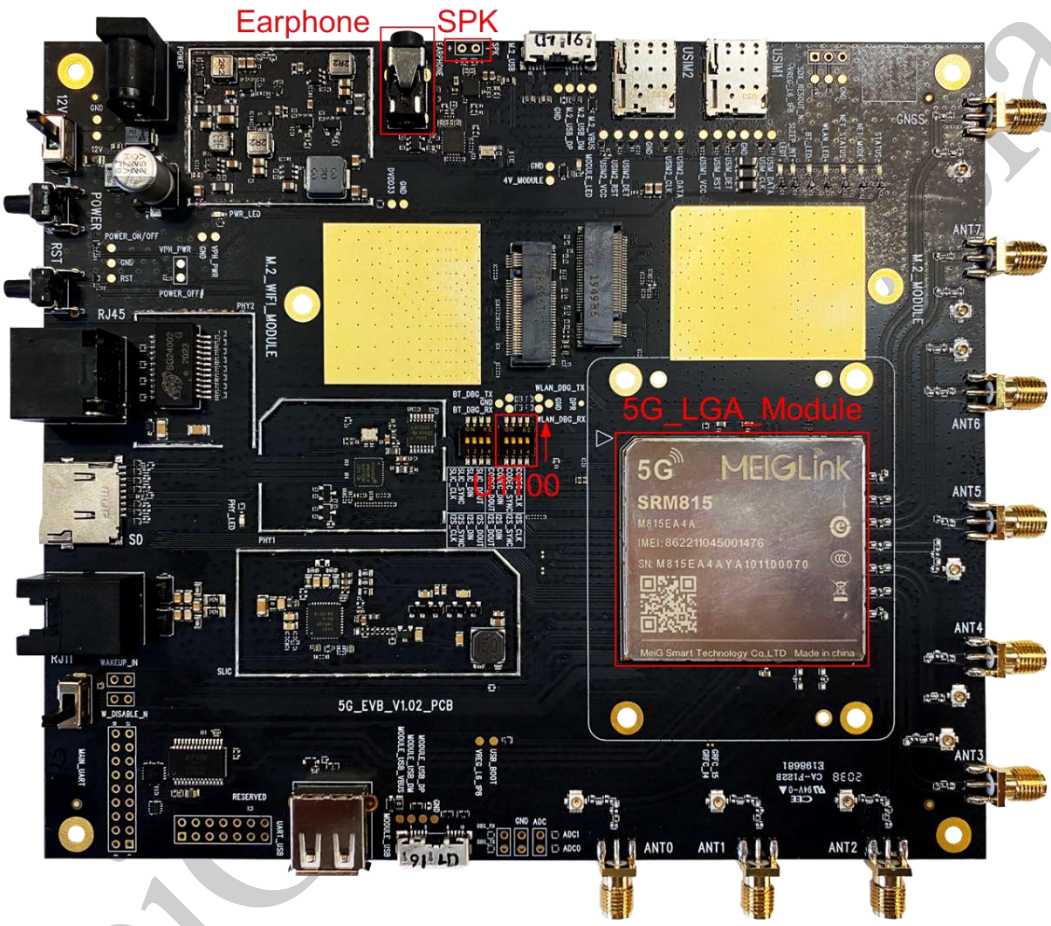

Figure 11 CODEC Function

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3.7 USB Interface

The development board has three USB interfaces, namely, USB AF and Micro USB 3.0*2, as shown in Figure 12.

USB AF, which is converted from 2-wire main serial port to USB interface through conversion chip, can be used to send AT commands, etc., only supported with 5g LGA module.

Micro USB3.0*2 only supports slave mode. J704 is the USB interface of 5G LGA module. J705 is the USB interface of M.2 5G module.

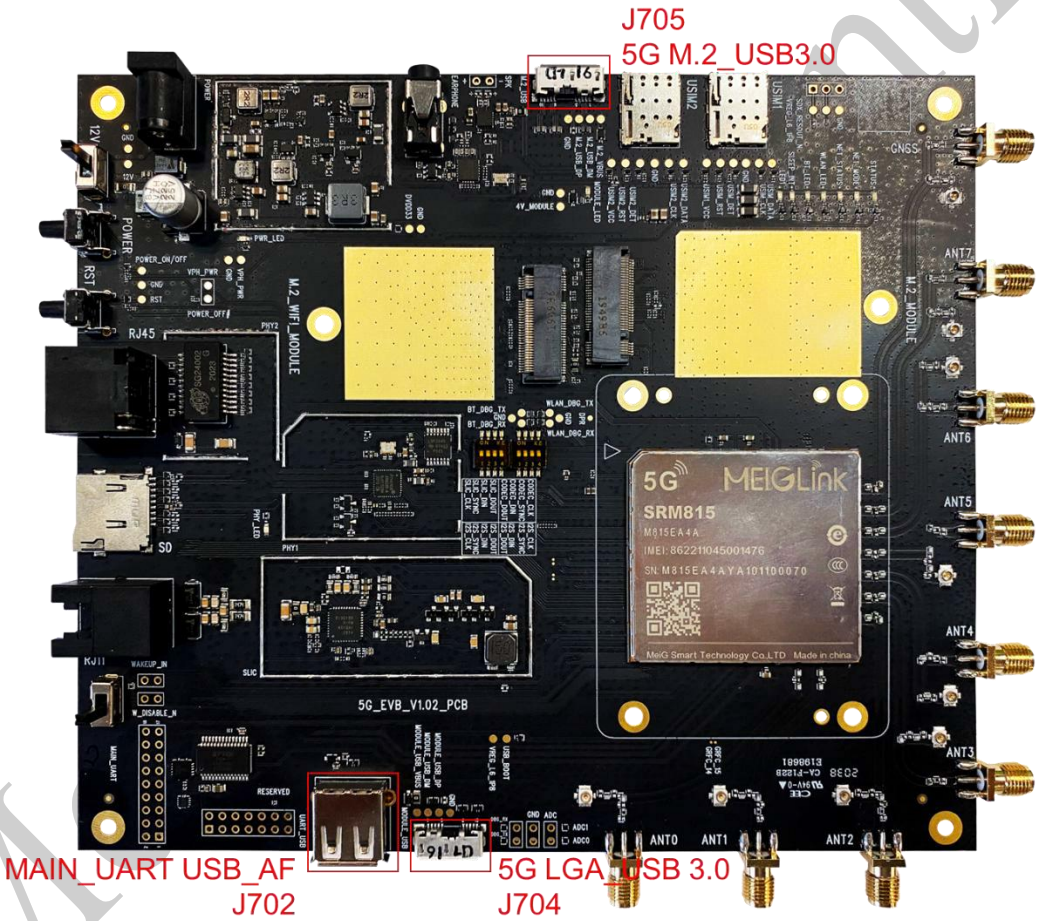

Figure 12 USB Interface

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3.8 UART Interface

The development board provides three UART interfaces: main serial port UART1, BT_UART and Debug UART, as shown in Figure 13. The main features of these three interfaces are described below.

- Main serial port UART1 and BT_UART 9600, 19200, 38400, 57600, 115200, 230400, 460800 and baud rate. The default baud rate is 115200bps, which is used for data transmission and AT command transmission.
- Debug UART supports 115200bps baud rate for module debugging and log output.
- BT_UART is applied to Bluetooth serial port communication in M.2 WI-FI Module. Direct connection is used in EVB development board.
- There are two ways to use UART1 as the main serial port for external application. One is to convert its TXD and RXD into the external USB interface through the conversion chip, which is the USB AF described in Chapter 3.7 above; the other is the reserved pin header interface. One row is 1.8V power domain UART and the other row is the 3.3V power source domain serial port signal line from level conversion.
- The main serial port UART1 and BT_UART only work in 5G LGA module environment.

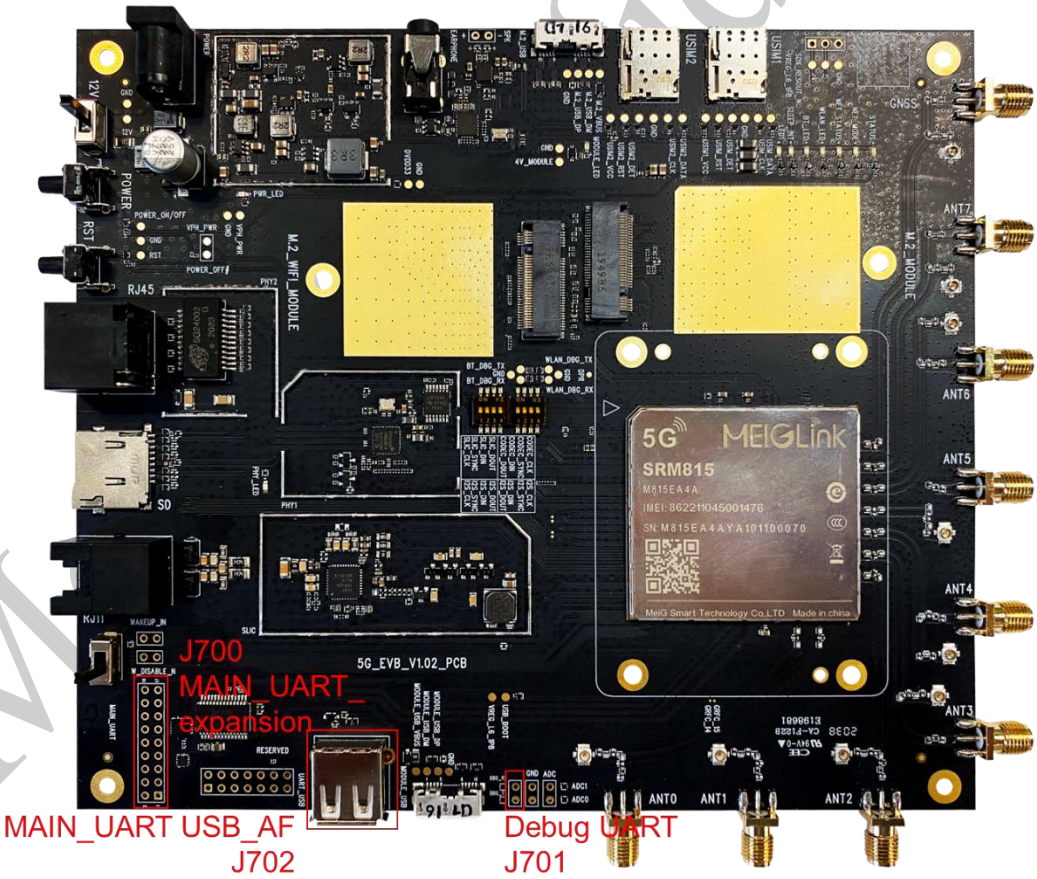

Figure 13 UART DB9 Interface

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3.9 SIM Card Interface

The development board provides two SIM card holders (SIM1 and SIM2) and supports SIM_DET hot plugging function. It supports automatic matching of 1.8V/3.0V voltage. 5G LGA module and M.2 5G module share two SIM cards. Both modules support dual SIM cards. The locations of SIM card holders is shown in Figure 14.

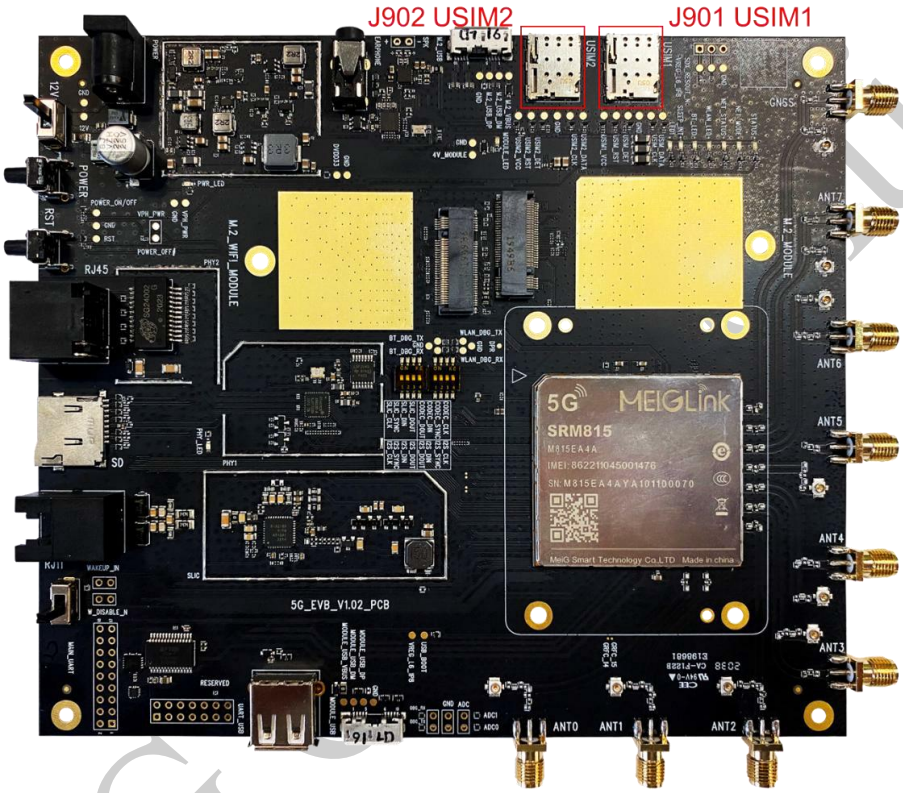

Figure 14 SIM Card Interface

Note:

The 2-way (U) SIM card on the EVB development board works under 5G LGA module state by default. If M.2 5G module is used, the resistance values of R911, R913, R921, R919 need to be changed to NC and R912, R915, R922, R920 need to be changed to 0R.

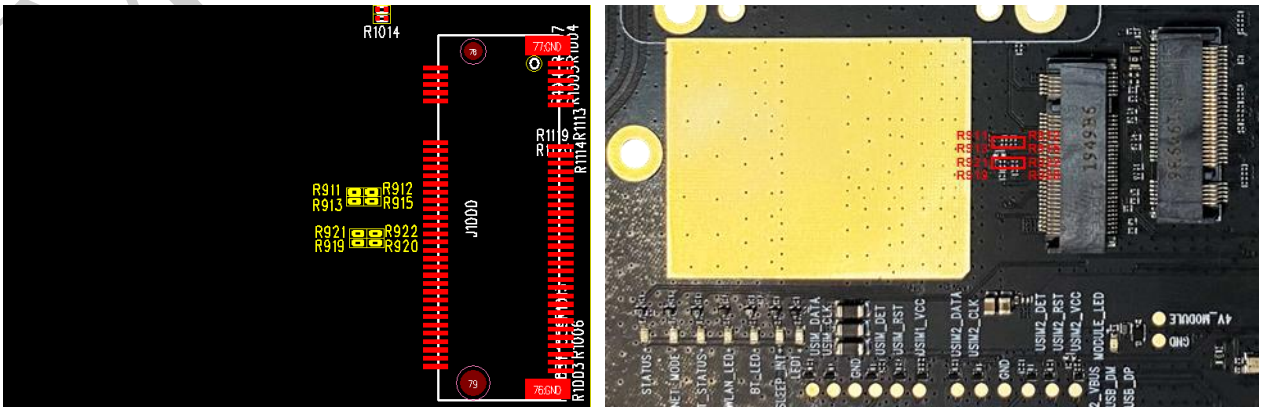

Figure 15 Position of the Sim Card Resistance

3.10 SD Card Interface

The development board provides a standard SD card signal, as shown in Figure 16. In addition, the SD card supports hot plugging. With the help of the SD card interface, customers can easily increase the storage capacity of module products. However, only 5G LGA module supports SD card function.

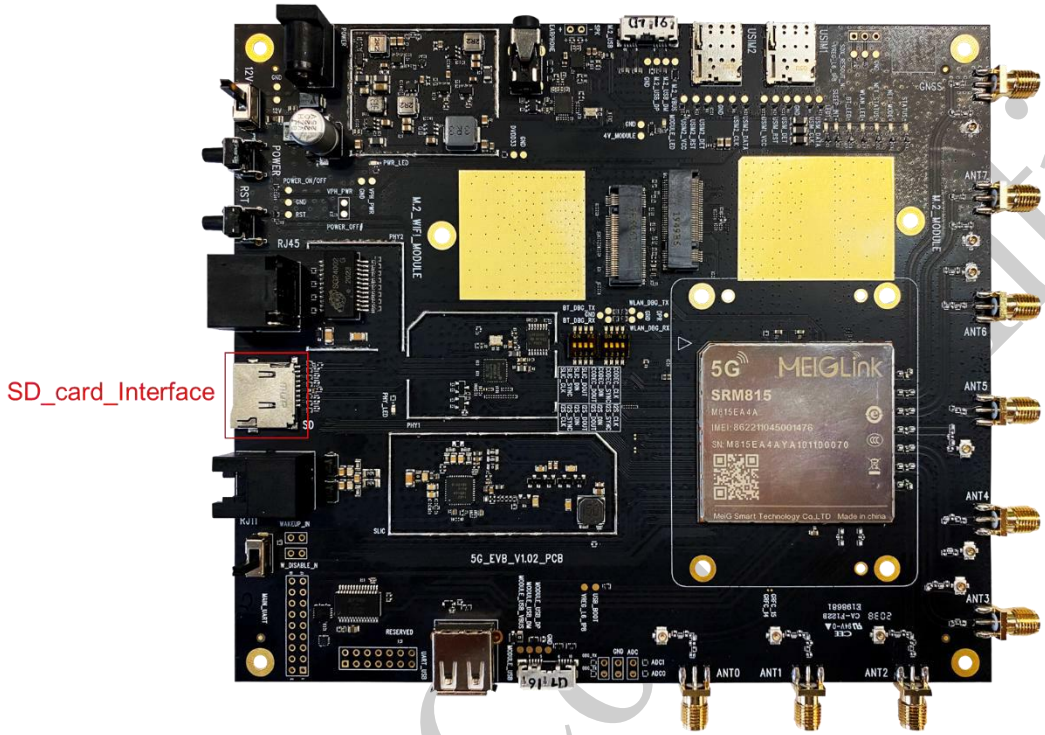

Figure 16 SD Card Interface

3.11 ADC Interface

Two ADC pin header interfaces are reserved on the EVB development board. Only 5G LGA module is used to verify the use of AT commands or real-time ADC sampling. The voltage range is 0~1.825V. The position of ADC pin headers is shown in Figure 17.

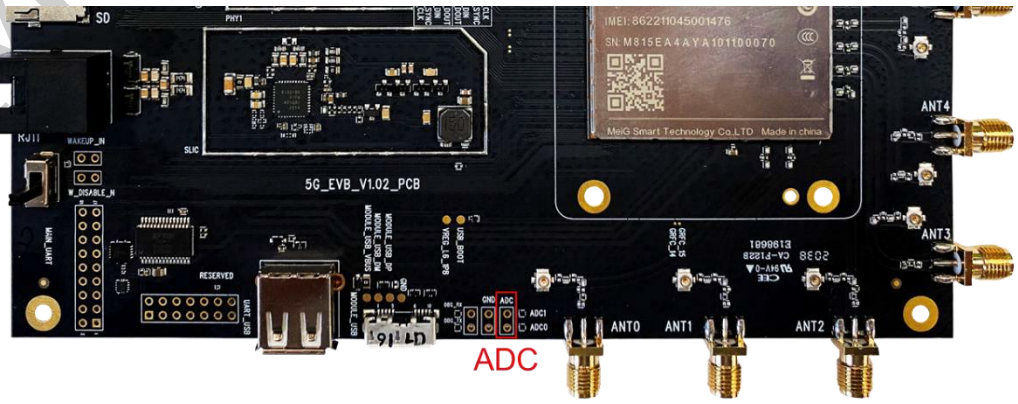

Figure 17 ADC Interface

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3.12 USB_BOOT Interface

The EVB board has reserved emergency download test point (USB_BOOT), it can be used for SW download or update for 5G LGA module.

First connected the EVB and PC through Micro USB cable, and connected the two pins of USB_BOOT test point with a wire, then power on the EVB board, the 5G LGA module will enter into the emergency download mode and you can see 9008 port on PC as figure 19, we can disconnect the two pins of USB_BOOT test point now.

The USB_BOOT test point of the M.2 module is on the M.2 module, not EVB board.

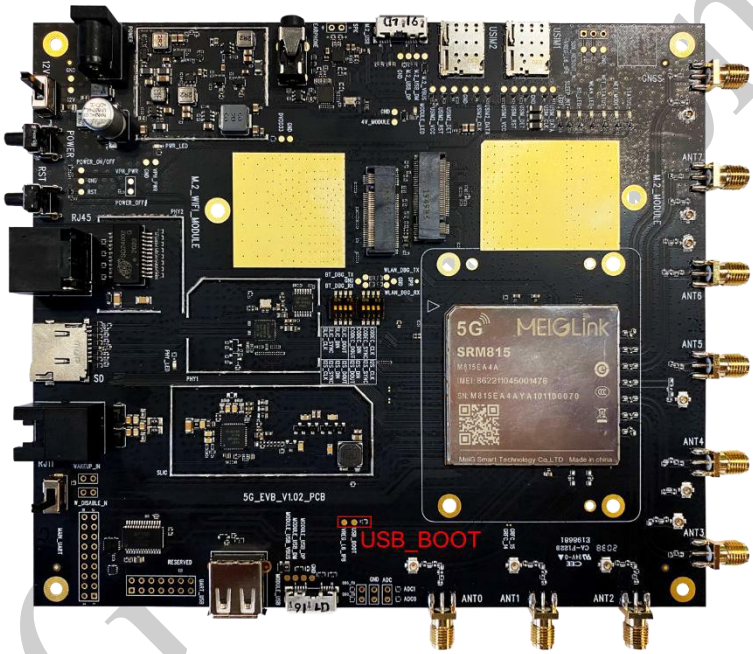

Figure 18 USB_BOOT Interface

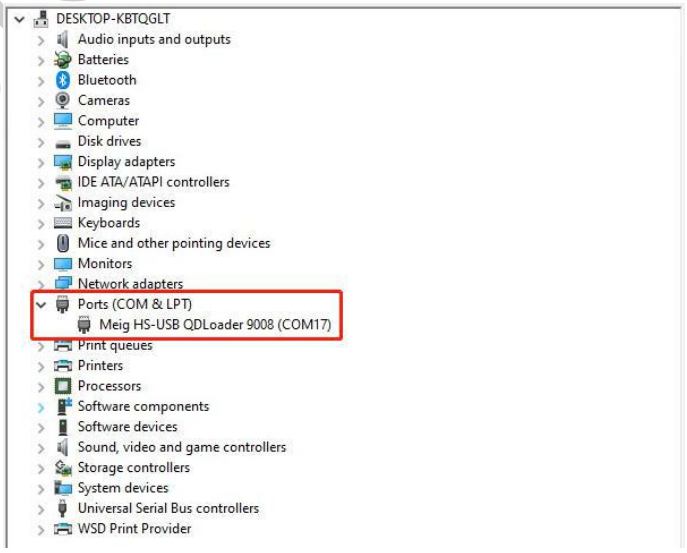

Figure 19 9008 emergency download port on PC

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3.13 Antenna

Table 4 Antenna interface description

Pin Name	Component No.	Description	I/O	Remark
ANT0	J300	LMHB TRX n41 TRX1 n79 DRX1	IO	50Ω impedance
ANT1	J301	LMHB DRX n41 DRX1 n79 TRX1	IO	50Ω impedance
ANT2	J307	n79 DRX0	AI	50Ω impedance
ANT3	J304	n79 TRX0	IO	50Ω impedance
ANT4	J306	MHB PRX_MIMO n77/78 TRX0 UHB TRX	IO	50Ω impedance
ANT5	J303	n77/78 TRX1 n41 TRX0 UHB TRX1	IO	50Ω impedance
ANT6	J302	MHB DRX_MIMO n77/78 DRX0 n41 DRX0 UHB DRX	AI	50Ω impedance
ANT7	J305	n77/78 DRX1 UHB DRX1	AI	50Ω impedance
ANT_GNSS	J308	GNSS antenna interface	AI	50Ω impedance

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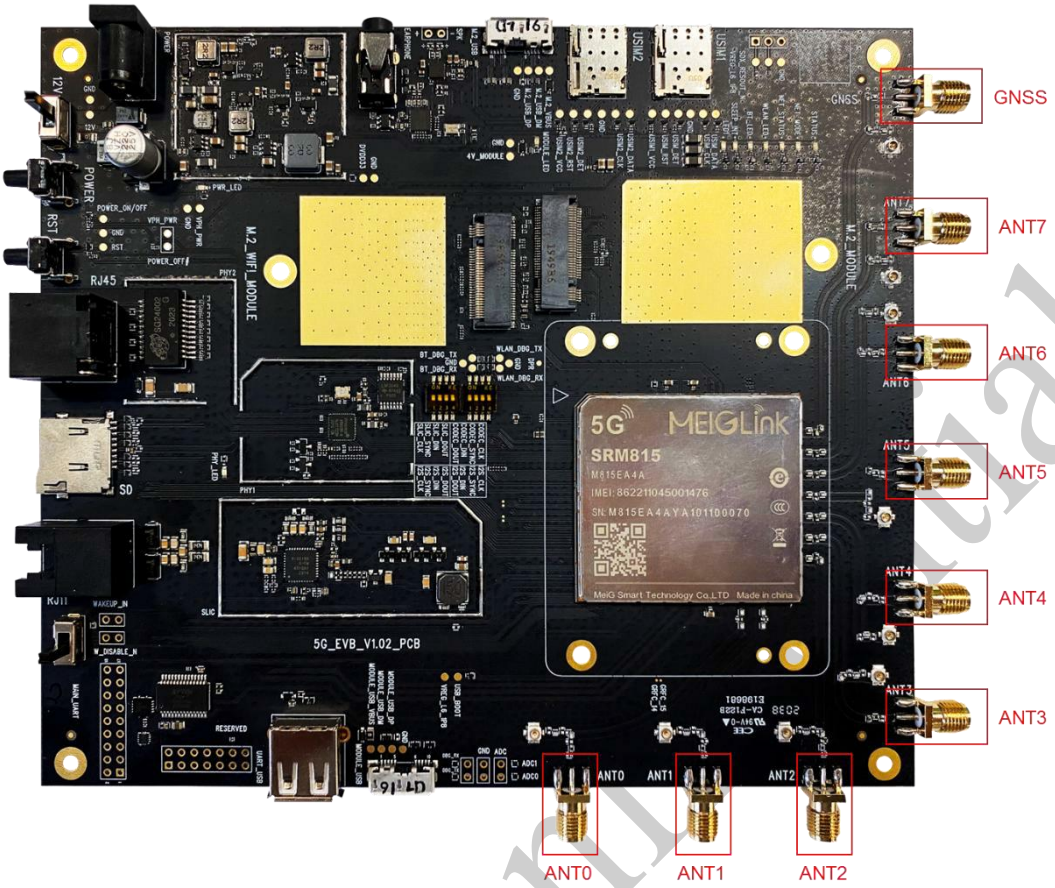

Figure 20 ANT Locations

Note:

The above is the antenna allocation diagram of the 5G_LGA module. The 5G M.2 Module antenna is integrated on the board, and the corresponding hardware manual has detailed antenna allocation.

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3.14 M.2 Wi-Fi 6 Module

The Wi-Fi 6 Module, is designed based on the Qualcomm QCA6391 chip solution compatible with SDX55 platform. The LGA module is pasted to M.2 daughter board. The LGA module is 20*21*2.3mm and the M.2 module is 42mm*30mm in size. It can integrate the functions of Wi-Fi 6 and BT 5.1. The maximum number of access users under the Wi-Fi AP mode is 32, and it can support uplink and downlink MU-MIMO, OFDMA technology, TWT (target wake-up time), BSS Coloring and other new technologies with higher speed and lower delay.

The plug-in position on EVB for M. 2. Wi-Fi 6 Module is shown in Figure 21.

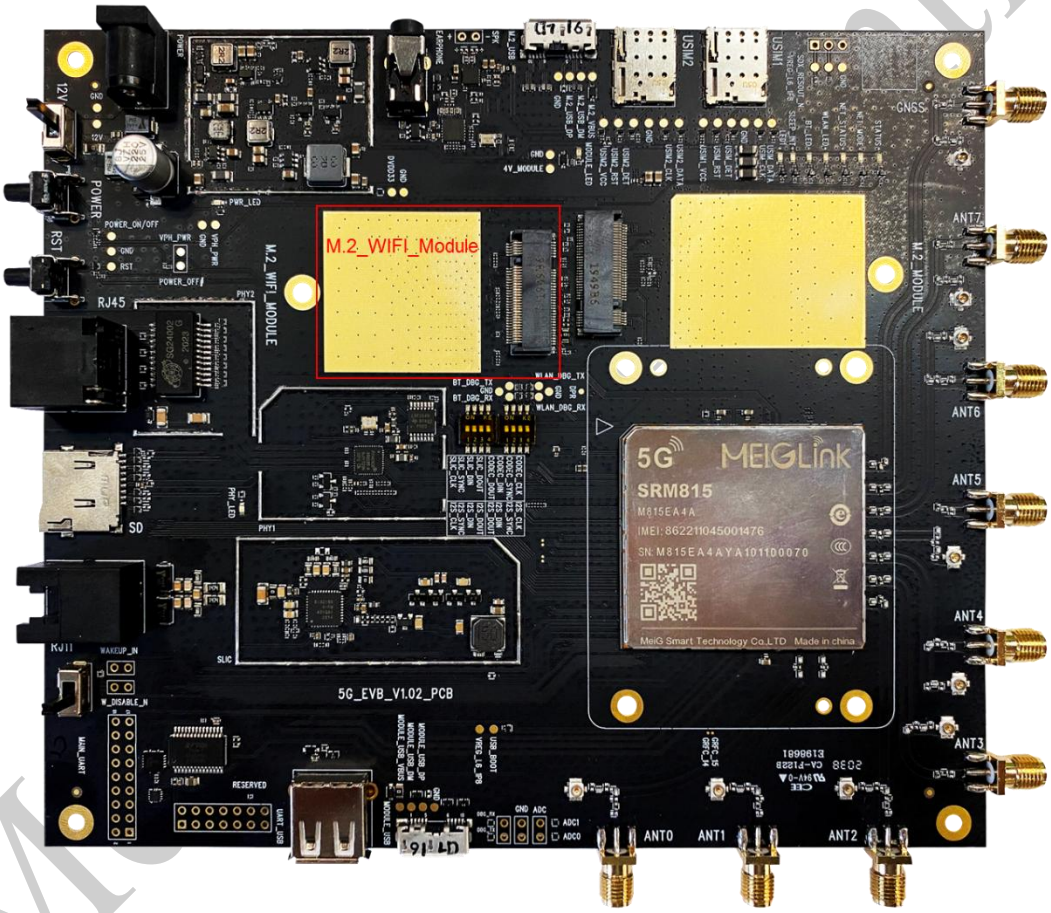

Figure 21 M.2 Wi-Fi Module Interface

Note:
The M.2 Wi-Fi 6 Module can only be used with the 5G LAG module. It is not supported for use with the 5G M.2 Module because the M.2 interface is standard, there is no enough PIN for Wi-Fi power.

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4 EVB Environment Construction

4.1 Hardware Environment Construction

This chapter describes how to use the 5G EVB for testing and evaluation of MeiG Smart 5G modules.

Hardware environment: please refer to Table 2 "List of supporting equipment"

4.1.1 Hardware Connection Instructions

This section describes the connection between the EVB and the computer. For more interface functions, please refer to Chapter 3 Interface Applications.

1. Connect 12V/2A power adapter to supply power of the EVB board.
2. Use the Micro USB3.0/Micro USB2.0 cable to connect the EVB board with computer.
3. Insert the NANO SIM card into the EVB board and insert the card holder 1 first.
4. Connect 4G, 5G and GNSS antennas according to debugging requirements.

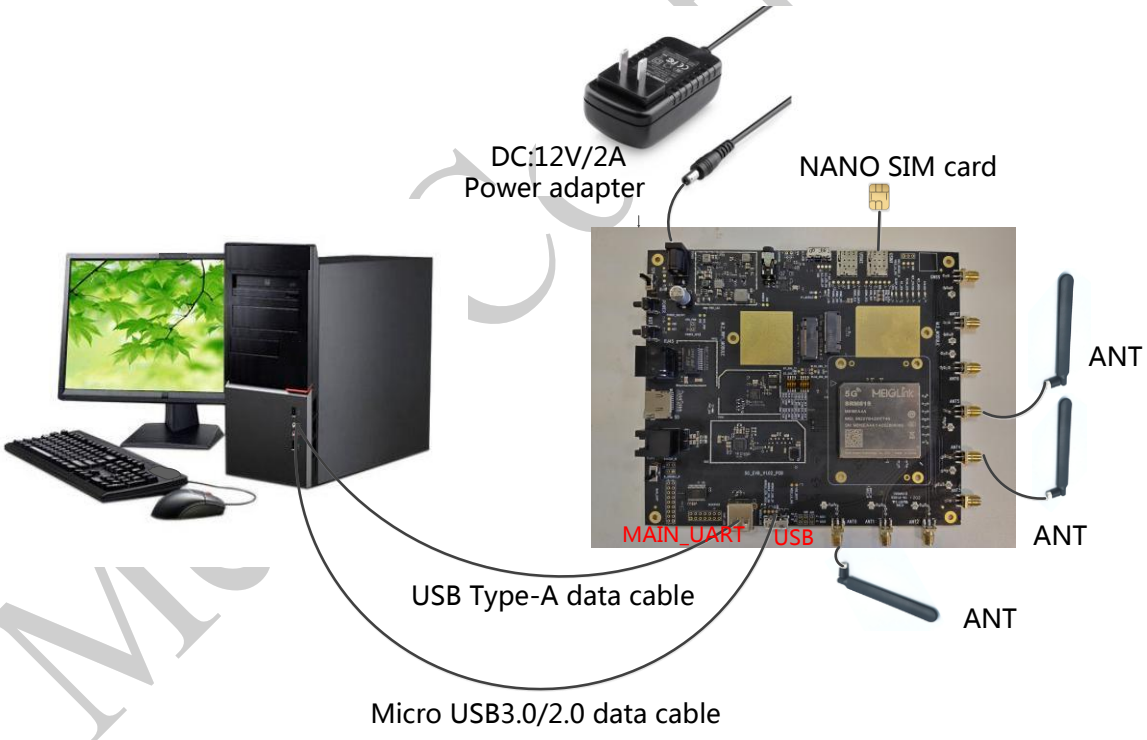

Figure 22 EVB hardware connection

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4.1.2 Turn on EVB

This section describes how to turn on the EVB after connection according to section 4.1.1.

1. After the connection, move the power dial switch to the direction to supply power to the EVB, as shown below, then the PWE_LED indicator light is on, indicating that the supply power is normal.

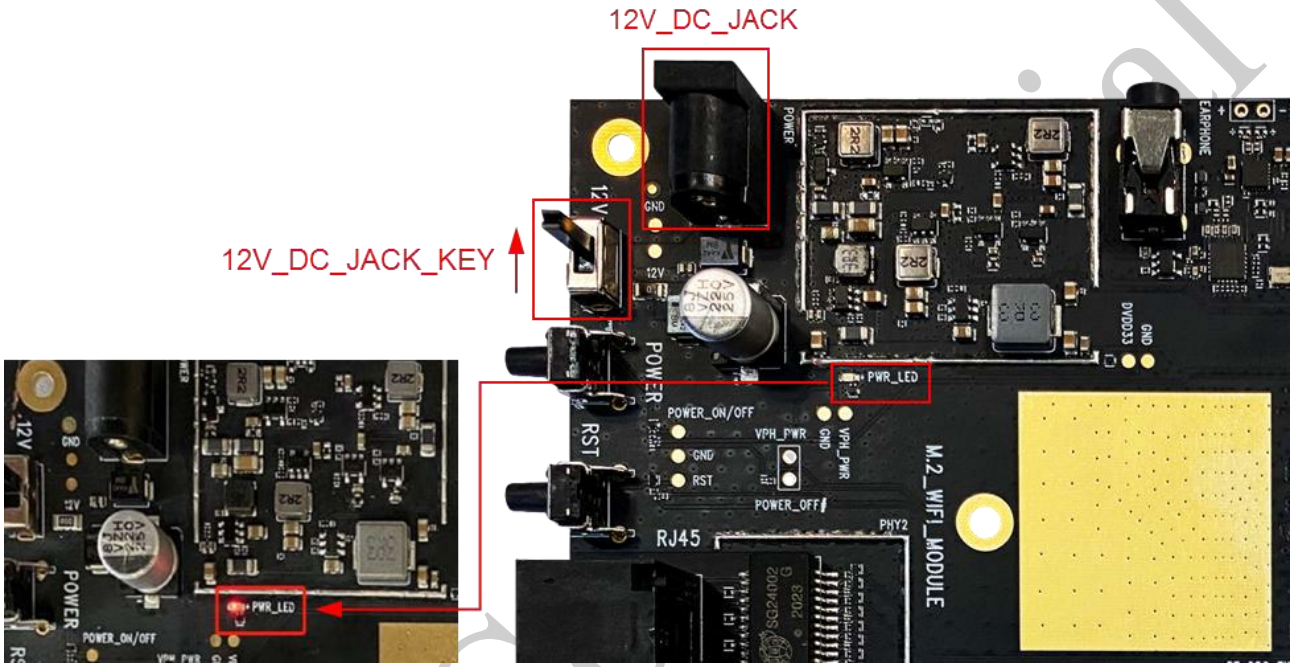
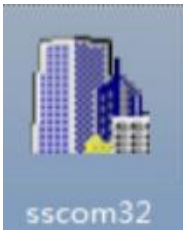


Figure 23 EVB power on diagram

2. Then, short press the POWER button to turn on the EVB. After the system is powered on successfully, the USB normal port combination can be viewed via the computer device manager.

4.2 Software Environment Construction

Software environment: a computer with Windows operating system or Linux operating system and related software tools installed.
For SSCOM related software tools, please contact FAE.



Insert the SIM card into the 5G_EVB board, insert the external adapter, power on, connect the USB data cable to the PC, and check the port shape.

The board is normally powered on, and the AT port can be loaded, that is, the AT command can be issued through the SSCOM tool for SMS, call, NDIS connection and other functions. The normal port for booting is shown in Figure 24.



Figure 24 USB port combination

4.3 Operation Procedures Illustration

4.3.1 AT Commands Interface

The USB AT port is used to run AT command communication and data transfer by default. You can select correct “COM port” (USB AT Port which is shown in figure 24) and set correct “Baudrate” (such as 115200bps). After you open the serial port on the SSCOM tool, you can run AT commands now.

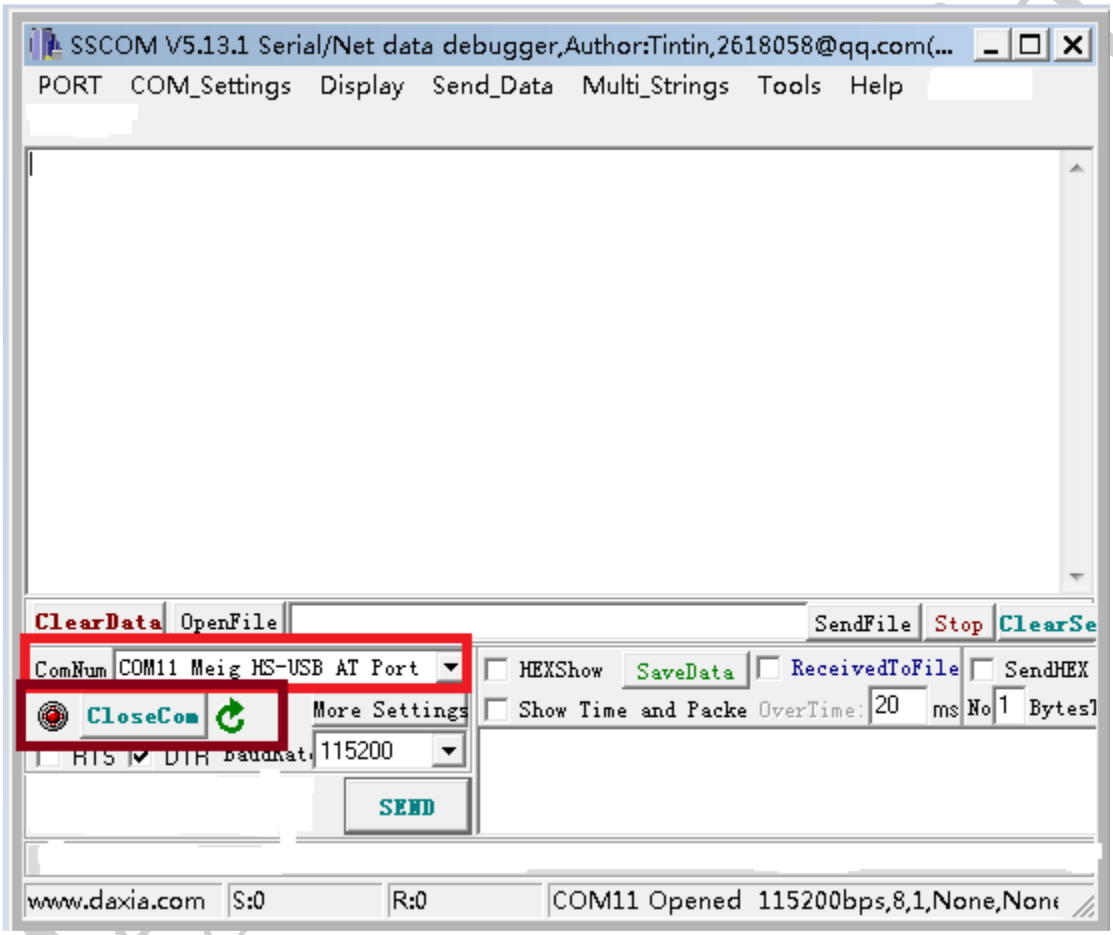


Figure 25 interface of SSCOM tool

4.3.2 Network Service Commands

The AT+COPS? command is used to return the current operators and their status. The return value results are as follows:

1. +COPS: 0,0,"CHINA MOBILE CMCC",7 OK
   \\the last bit 7 represents the current registration to 4G network (the last bit is 2 to register to 3G network, and the last bit is 13 to register to 5 G network)

2. +COPS: 0 OK
   \\the last digit is 0, indicating that you are not registered with the network
   If you are not registered to the network, please check the network mode settings. Please use the SSCOM tool to send AT^SYSCFGEX="00" command. This command sets the network mode to automatic mode

4.3.3 SMS demo

4.3.3.1 Send TEXT SMS

1. Set SMS mode as text mode: AT+CMGF=1.
2. Set the character set to "IRA" or "GSM" format: AT+CSCS="IRA".
3. Set the mobile phone number for receiving SMS: AT+CMGS=”mobile phone number” (for example: AT+CMGS=”182****5579”).

Edit the text message content in the SSCOM display bar behind ">" (as shown in the figure below), such as editing a mixed text message of English, numbers, and symbols, such as: nihao!123, press CTRL+Z to send the text message.

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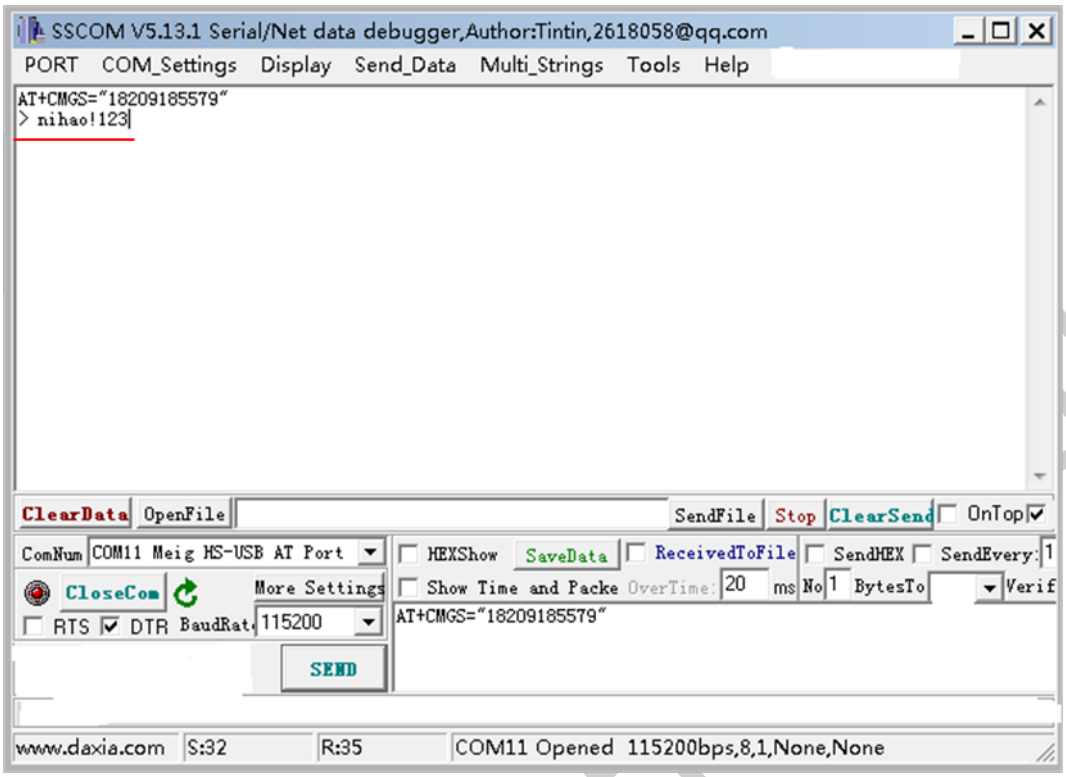

Figure 26 Send SMS interface

CTRL+Z returns the result successfully and returns OK, as shown in Figure 27.

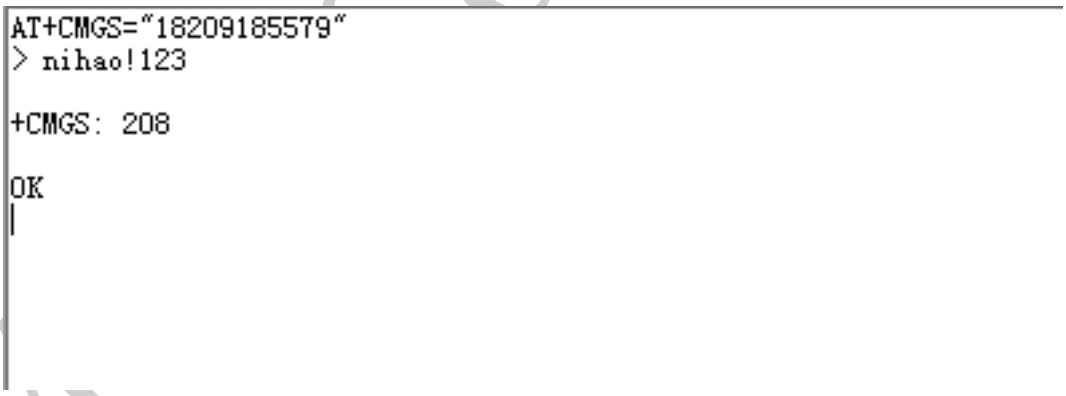

Figure 27 Successfully sent interface

4.3.3.2 Send PDU SMS

1. Set to send PDU SMS: AT+CMGF=0.
2. Set the character set to "UCS2": AT+CSCS="UCS2".
3. Use the PDU encoding tool to convert the content to be sent into a PDU code. For example, if the content to be sent is hello, the conversion into a PDU code is shown in Figure 28.

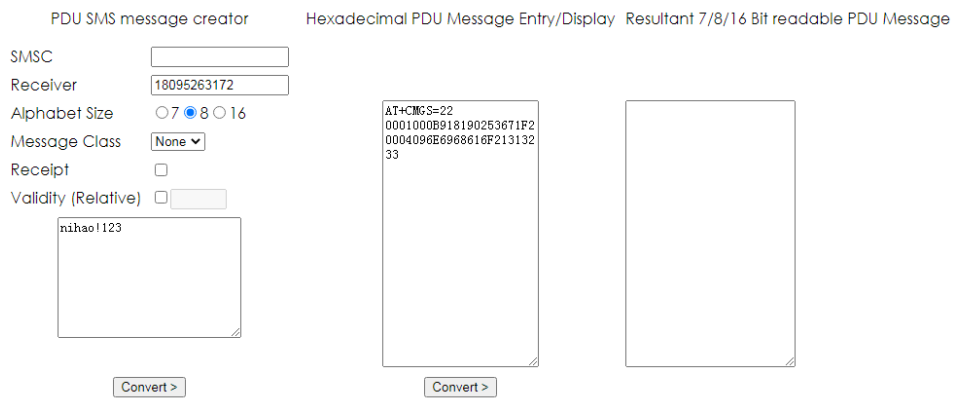

Figure 28 PDU Code conversion

4. Set the message length as: AT+CMGS=22.

Edit the content behind ">" in the SSCOM tool display bar as shown in Figure 28: "0891683108200905F031000B815108927517F40011FF09EE343AFC0EC56433" press CTRL+Z to send the message (after the ">" appears when sending a PDU message, uncheck "Send new line", and then input the PDU code, press CTRL+Z to send a message).

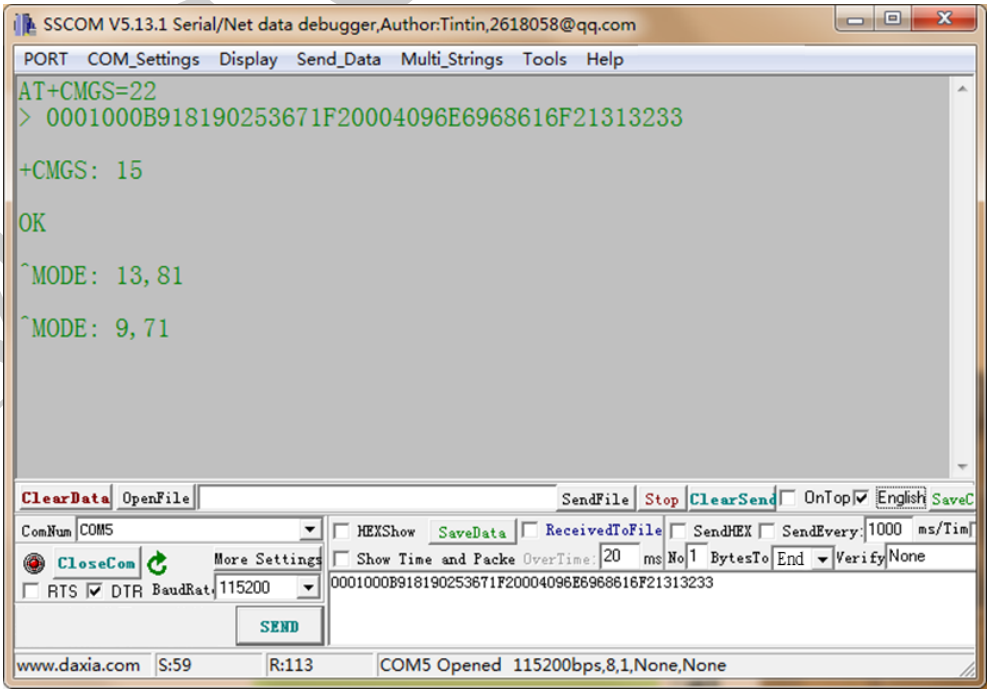

Figure 29 Send PUD SMS

4.3.4 Voice Call Commands

Note: Before testing the voice call function, please make sure that the CODEC dial switch (U1100) has been moved to the top of EVB, as shown in Figure 11.

1. The voice call function is demonstrated in the automatic network mode. You can run the AT command to switch to automatic network mode: AT^SYSCFGEX="00"
2. Run the ATD"mobile phone number" AT command to make a voice call, (for example, ATD "182****5579") is successfully displayed (called but not answered), as shown in the following figure.

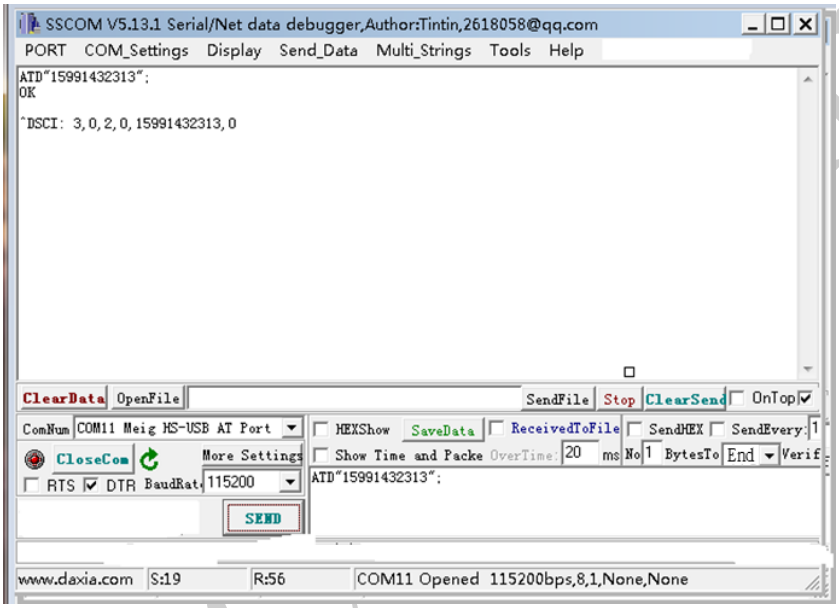

Figure 30 set up outgoing c all demo interface

3. You ca n use the AT commands AT+CHUP to cancel the voice call in the state of Active, Waiting and Held.
4. The ATA command is used to answer an incoming voice call indicated by a **RING .**

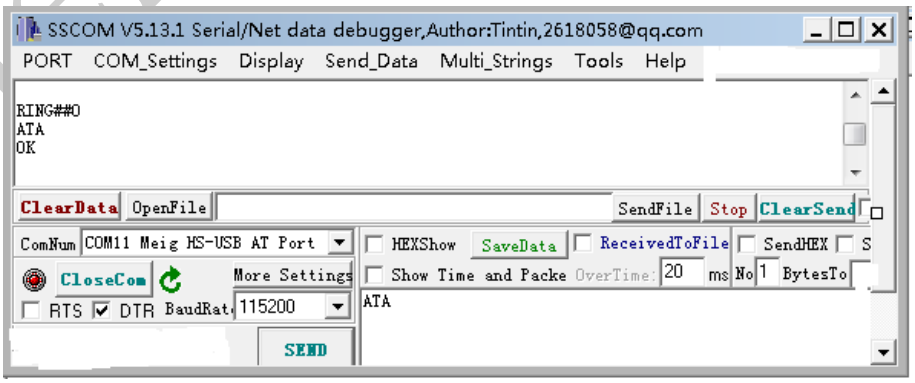

Figure 31 answer an incoming call demo interface

For more AT commands and usage examples, please refer to the 5G module AT command manual.

4.3.5 Data Dial up Commands

There are two ways of dial-up connection: PPP dialing and NDIS dialing.

1. PPP dialing

Open the network sharing center of computer -> set up a new connection or network -> set the dial-up connection -> set the dialing rule to *98# -> and select Create.

After dialing successfully, you can ping the external network, access the external network normally, and run data service.

2. NDIS dialing (AT commands dialing)

Before dialing, please use the AT^SYSINFOEX? command to check whether you have successfully registered to the network.

If the registration is successful, then run the AT command to dial up:

AT$QCRMCALL=1,1,3,2

After dialing successfully, you can ping the external network, and normally access the external network and data services.

Reminder:
The APNs of China Mobile, Unicom,Telecom are "cmnet", "3gnet", and "ctnet" respectively.

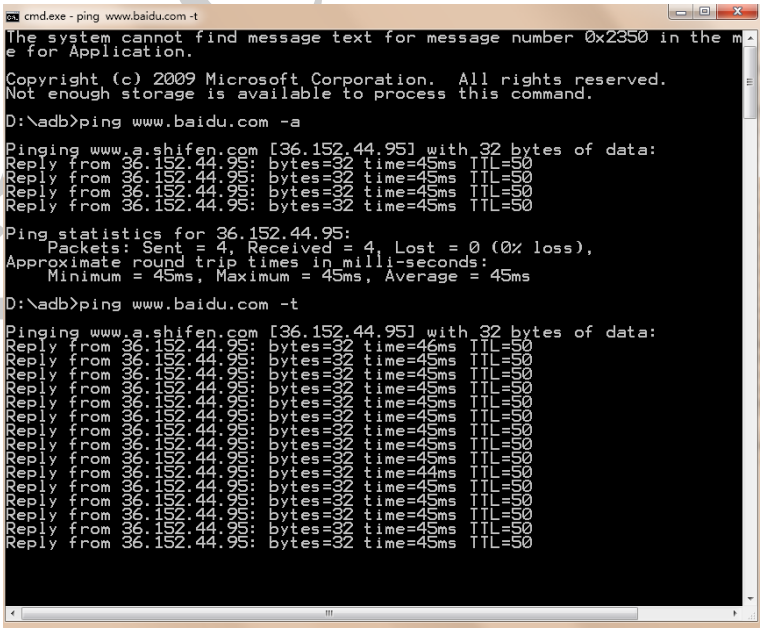

Figure 32 ping command test

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