# 5G EVB
# User Manual

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# Contents

# Revision History

| Revision | Date | Author | Description |
|----------|------|--------|-------------|
| V1.0 | 2020-3-5 | Yang Shuang | Initial |
| V1.1 | 2020-6-28 | Yang Shuang | Modify Antenna Definition |

# 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.

| | |
|---|---|
| | Full attention must be given to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Stop the car before you make a call. |
| | Switch off the mobile terminal devices before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden, so as to prevent interference with communication systems. Ignore the note will threaten flight safety or even break the law. |
| | Pay attention to the restrictions on the use of mobile terminal device in hospitals or health care facilities. RF interference can cause medical equipment to run out of order, so it is necessary to turn off the mobile terminal devices. |
| SOS | Mobile terminal device cannot be guaranteed to connect in all conditions, for example no mobile fee or with an invalid SIM card. While you are in this condition and need emergent help, remember to use emergency call. The mobile terminal device must be switched on and in a service area with adequate signal strength in order to make or receive a call. |
| | Your mobile terminal device receives and transmits radio frequency signal when it is on. RF interference can occur if it is use to close to TV set, radio, computer or other electronic equipment. |
| | Please keep the mobile device away from areas with potentially explosive atmospheres. When you are near a gas station, oil depot, chemical plant or an explosion site, please turn off your mobile terminal. There is a potential safety hazard to operate electronic equipment at any potential explosion hazardous locations. |

## 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.

# 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 |

## 2.2 Interface Introduction

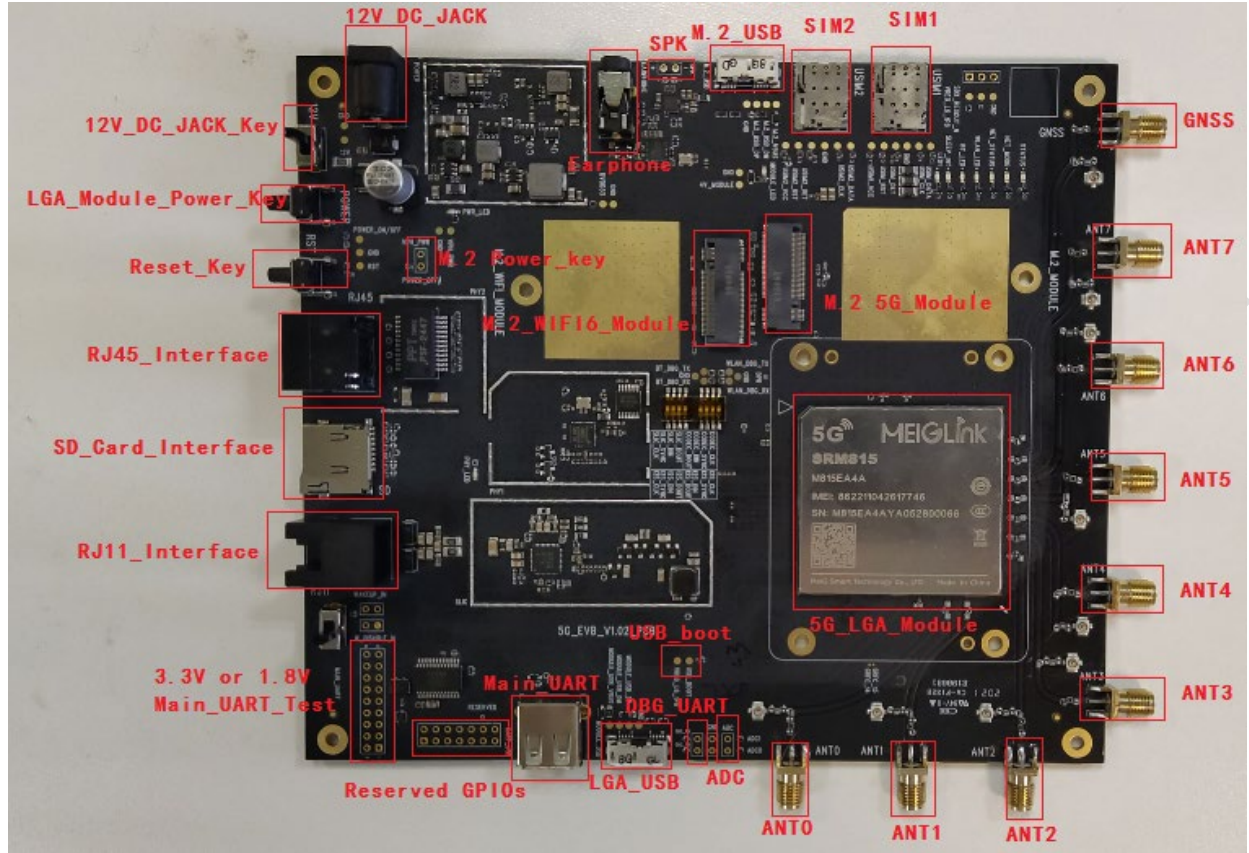Figure 1 shows the 5G EVB interfaces positions.



Figure 1 Interfaces Positions

Table 2: 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<br>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 net chip |
| SD Interface | J900 | Support SD card interface |
| (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/USB2.0S device interface |
| | J705 | M.2 5G Module USB3.1/USB2.0S 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 |
| | LED508 | System 4VPower supply indicator |
| Signal Indicator | LED500 | Module status indicator |
| | LED501 | Module network operation status indicator |
| | LED502 | Module network registration status indicator |
| | LED503 | Network port status indicator |
| | LED504 | System 4V power indicator |
| | LED505 | WI-FI operation status indicator |
| | LED506 | Module power-on status indicator |
| | LED507 | Bluetooth operation status indicator |
| | LED510 | Reserved Indicator verification for sink current capacity |
| RESERVED | J2001 | |

| | | |
|---|---|---|
| | J300 | 4G_TRX |
| | J301 | 4G_DIV |
| | J307 | PRX_MIMO |
| | J304 | 5G_DIV1 |
| Antenna Interface | J306 | DIV_MIMO |
| | J303 | 5G_DIV0 |
| | J302 | 5G_TRX0 |
| | J305 | 5G_TRX1 |
| | J308 | GNSS |

## 2.3 EVB Front Side and Reverse Side

The front side and reverse side photos 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.
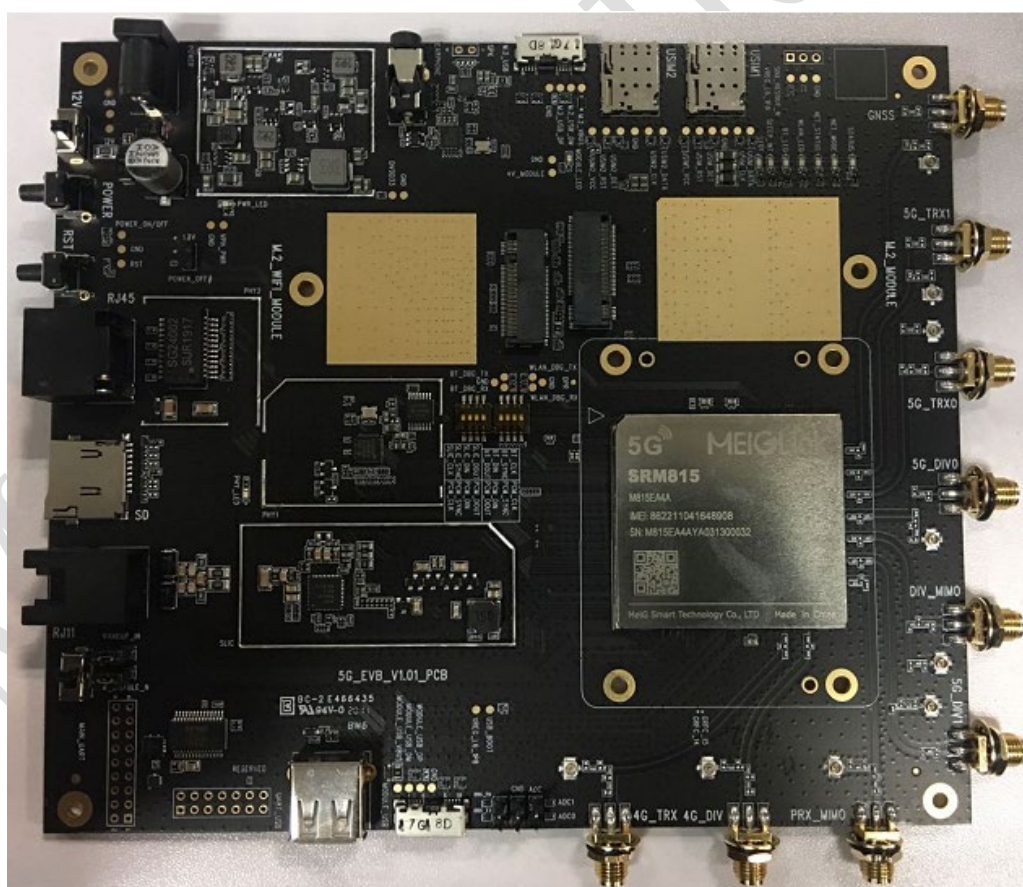


**Figure2 Front Side**
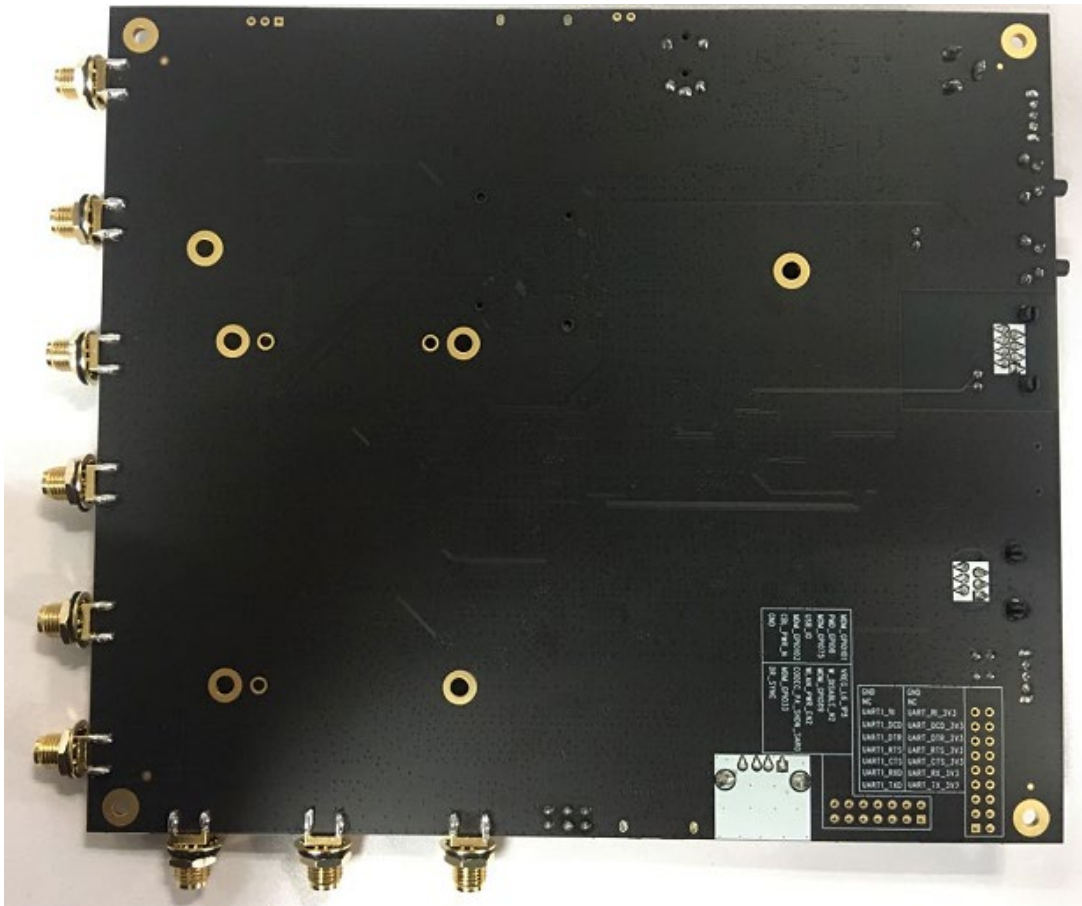
**Figure 3 Reverse Side**

# 3 Interface Applications

- Power interface
- Module interface
- Keys
- RGMII Function
- SLIC Function
- CODEC Circuit
- USB Interface
- UART Interface
- SIM Card Interface
- SD Card Interface
- ADC Interface
- ANTENNAS
- M.2 Wi-Fi6 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.
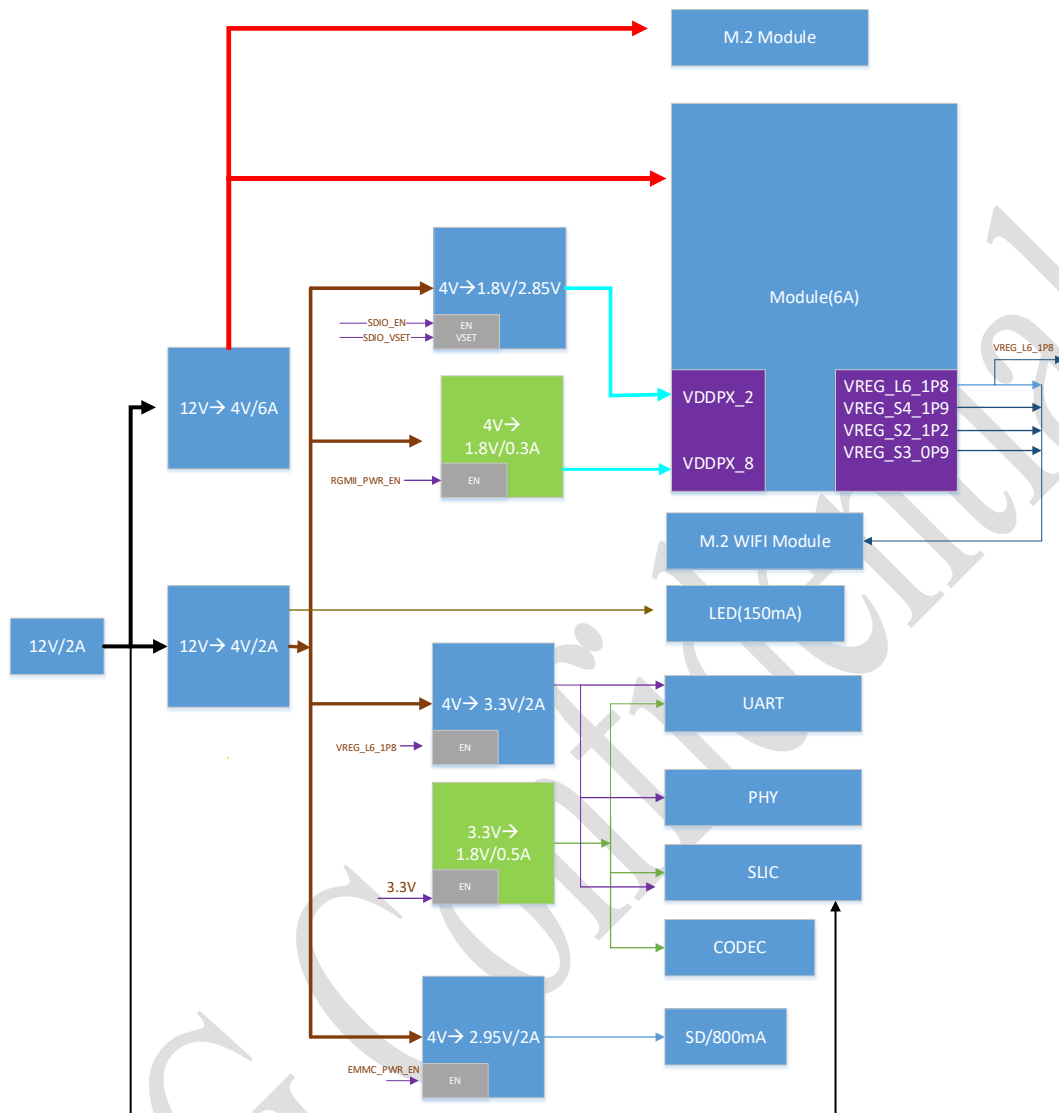


Figure 4 Simplified Principle Block Diagram of Power Interface

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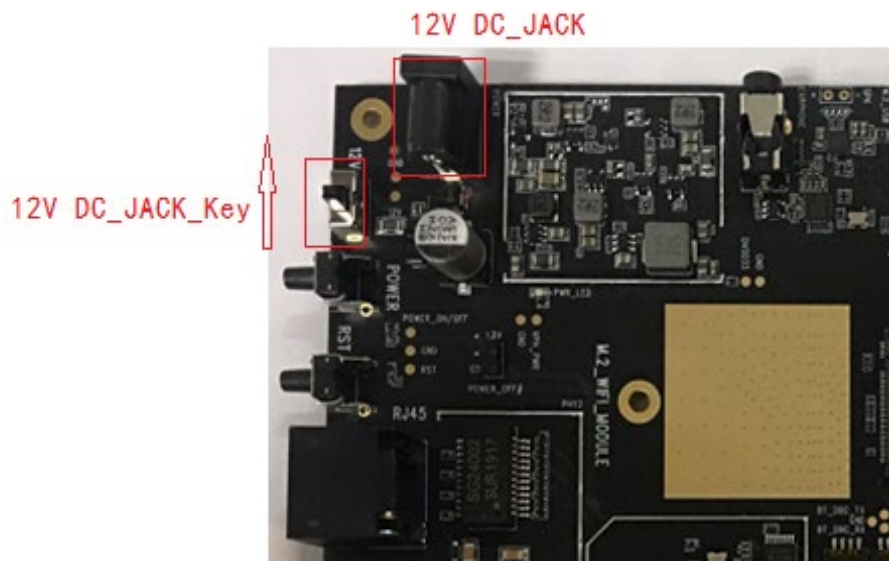
Figure 5 External Power Interface

Note:

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

## 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.
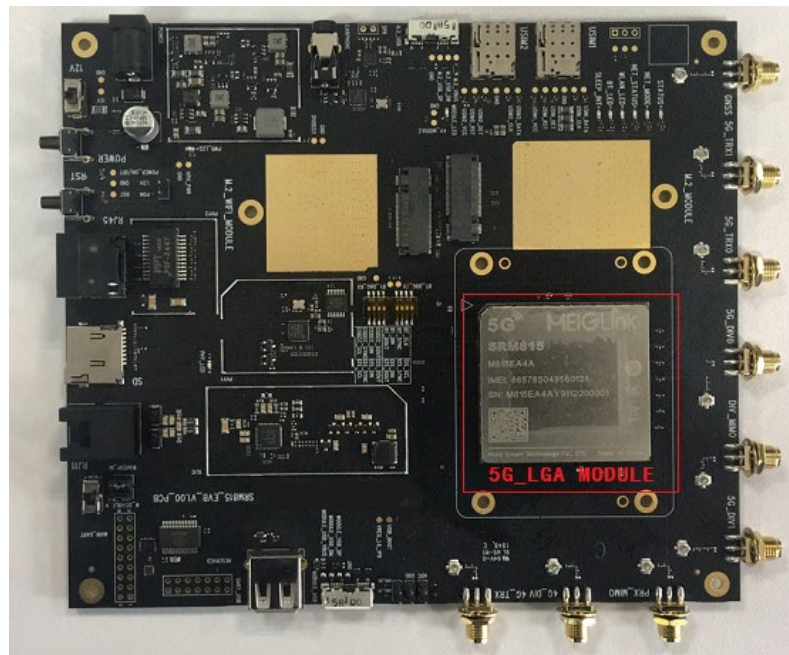
Figure 6 5G LGA Interfaces

M.2 module dimension 52mm x 30mm x 2.3mm. Standard gold finger interface is used. The plug position on EVB is shown in Figure 7.
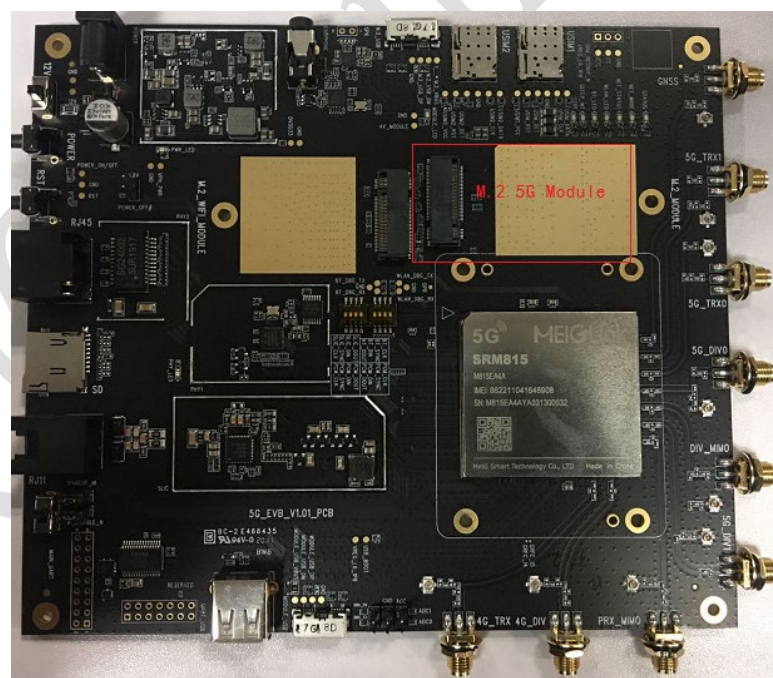


Figure 7 M.2 5G Module Interface

## 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.
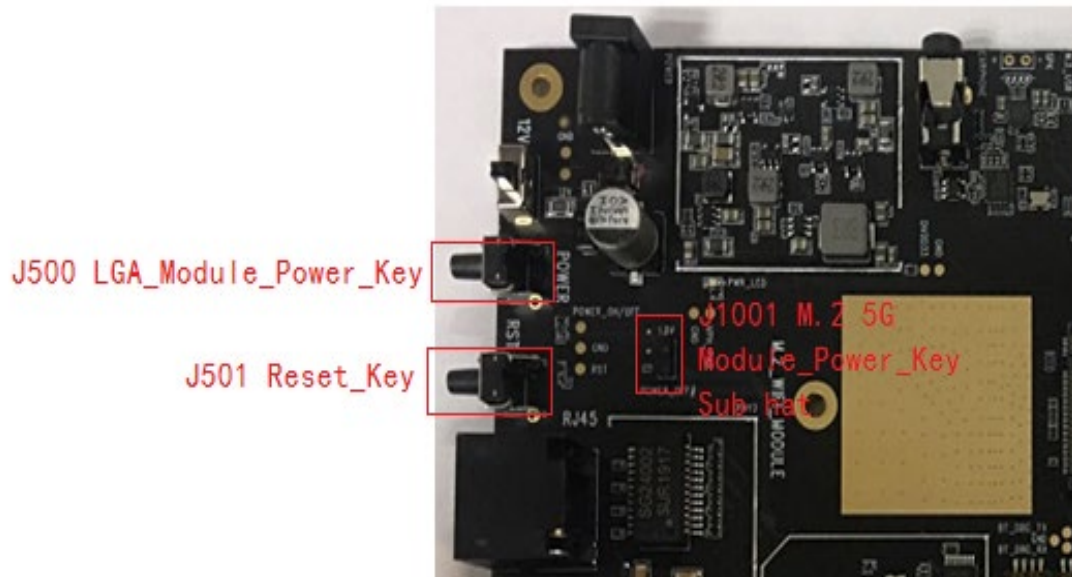


Figure 8 Keys

## 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.
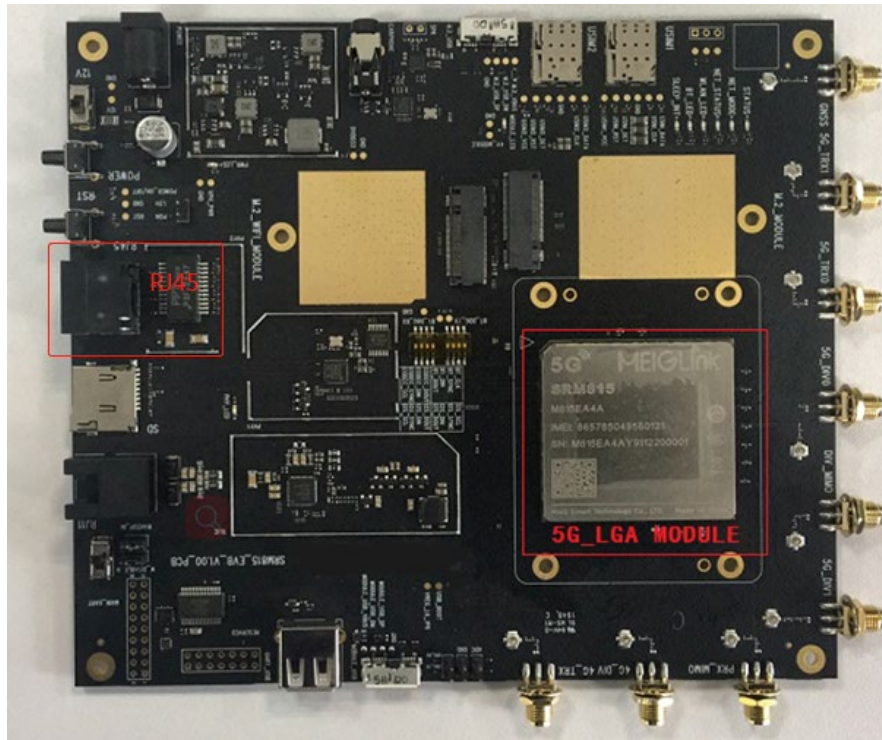
Figure 9 Network Interface

## 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.
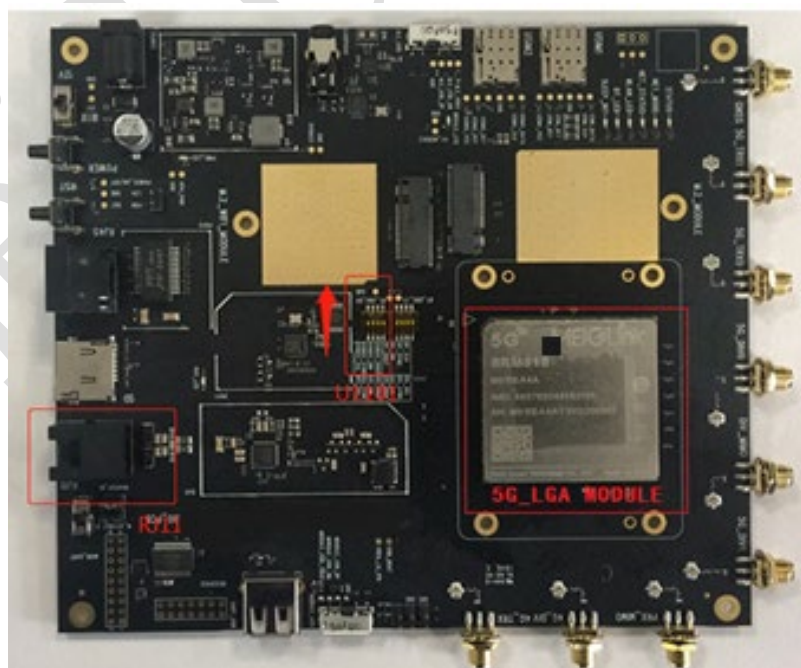


Figure 10 SLIC Function

# 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.
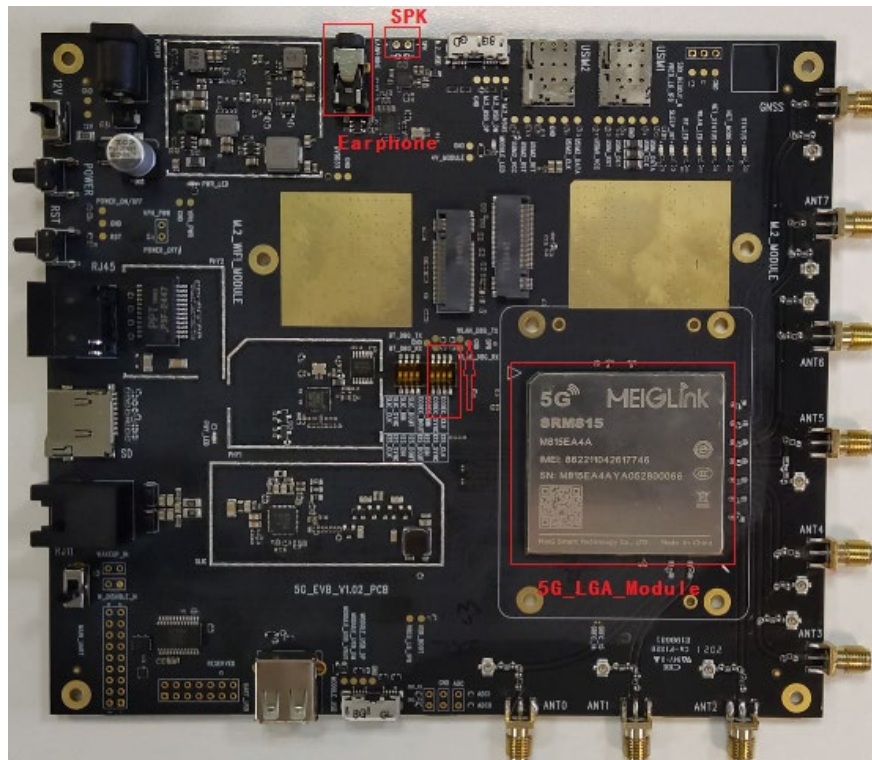


Figure 11 CODEC Function

# 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.
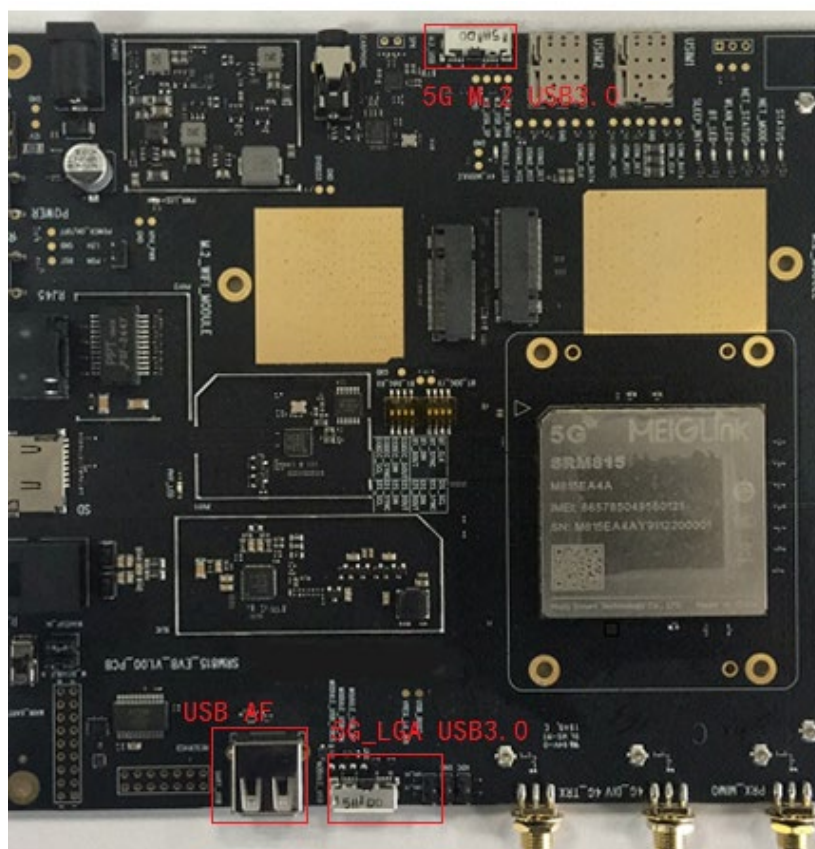
Figure 12 USB Interface

# 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 3.6 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.
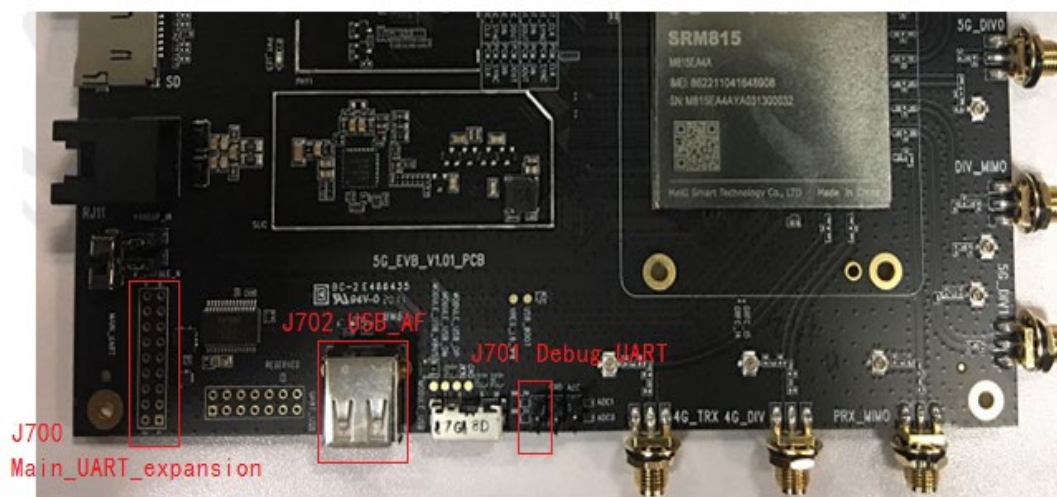
Figure 13 UART DB9 Interface

## 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.
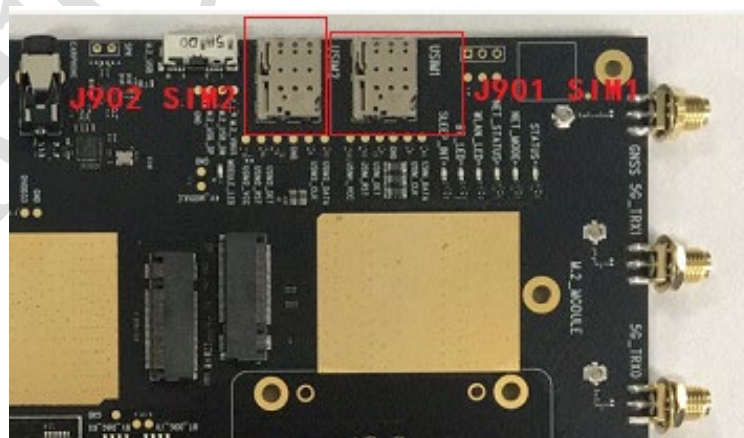


Figure 14 SIM Card Interface

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.
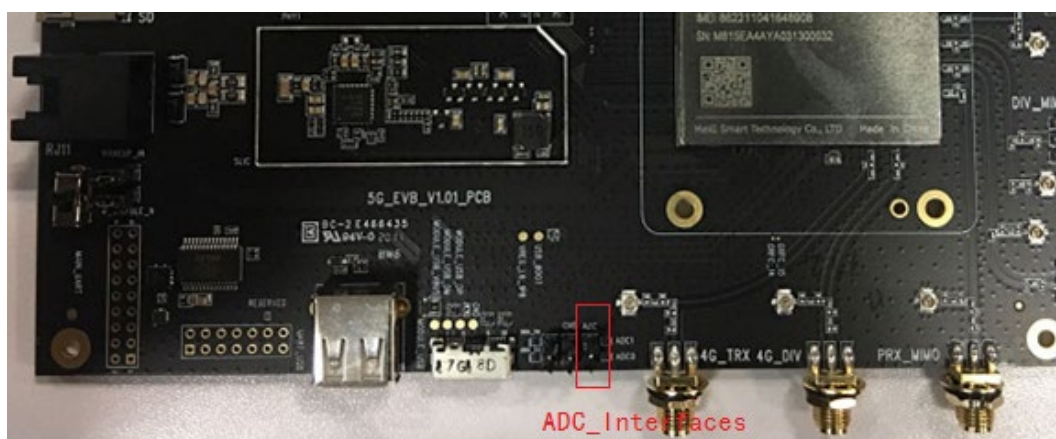


Figure 17 ADC Interface

## 3.12 Antenna

| Pin Name | Component No. | Description |
|---|---|---|
| ANT0 | J300 | LMHB TRX<br>n41 TRX1<br>n79 DRX1 |
| ANT1 | J301 | LMHB DRX<br>n41 DRX1<br>n79 TRX1 |
| ANT2 | J307 | n79 DRX0 |
| ANT3 | J304 | n79 TRX0 |
| ANT4 | J306 | MHB PRX_MIMO<br>n77/78 TRX0<br>UHB TRX |
| ANT5 | J303 | n77/78 TRX1<br>n41 TRX0<br>UHB TRX1 |
| ANT6 | J302 | MHB DRX_MIMO<br>n77/78 DRX0<br>n41 DRX0<br>UHB DRX |
| ANT7 | J305 | n77/78 DRX1<br>UHB DRX1 |
| ANT_GNSS | J308 | GNSS antenna interface |

Figure 18    ANT Locations

## 3.13 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.
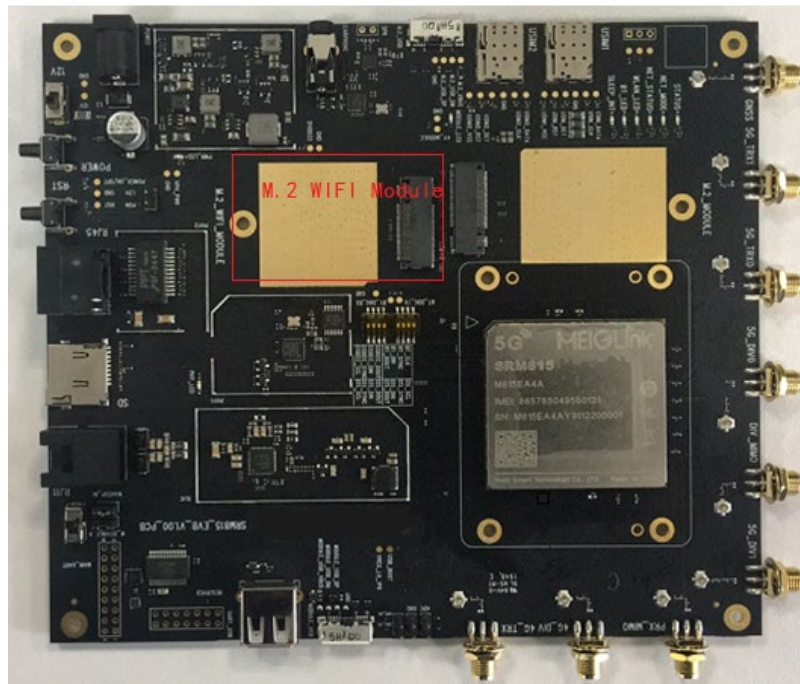
The plug-in position on EVB for M. 2. Wi-Fi 6 Module is shown in Figure 19.

Figure 19 M.2 Wi-Fi Module Interface