

RTA001-EV EVB

User Guide

5G Module Series

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Full attention must be paid 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. Please comply with laws and regulations restricting the use of wireless devices while driving.



Switch off the cellular terminal or mobile before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If there is an Airplane Mode, it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on an aircraft.



Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.



Cellular terminals or mobiles operating over radio signal and cellular network cannot be guaranteed to connect in certain conditions, such as when the mobile bill is unpaid or the (U)SIM card is invalid. When emergency help is needed in such conditions, use emergency call if the device supports it. In order to make or receive a call, the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength. In an emergency, the device with emergency call function cannot be used as the only contact method considering network connection cannot be guaranteed under all circumstances.



The cellular terminal or mobile contains a transceiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.



In locations with explosive or potentially explosive atmospheres, obey all posted signs and turn off wireless devices such as mobile phone or other cellular terminals. Areas with explosive or potentially explosive atmospheres include fuelling areas, below decks on boats, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles such as grain, dust or metal powders.

About the Document

Revision History

Version	Date	Author	Description
-	2022-06-20	Murray YIN	Creation of the document
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1 Introduction

This user guide describes the application details of the RTA001-EV EVB (Evaluation Board), which is an assistant tool for you to develop applications and test basic functionalities of 5G module series.

1.1. Applicable Modules

Quectel RTA001-EV EVB is applicable to the following modules:

Table 1: Applicable Modules

Module Series	Module
RG50xQ	RG500Q Series
	RG501Q-EU
	RG502Q Series
RG5x0F	RG520F Series
	RG530F Series
RG520N	RG520N-NA/-EU/-EB
RG525F-NA	RG525F-NA

2 Product Overview

2.1. Top and Bottom Views

The size of RTA001-EV EVB is 235 mm x 190 mm, and the top and bottom views are as shown below:

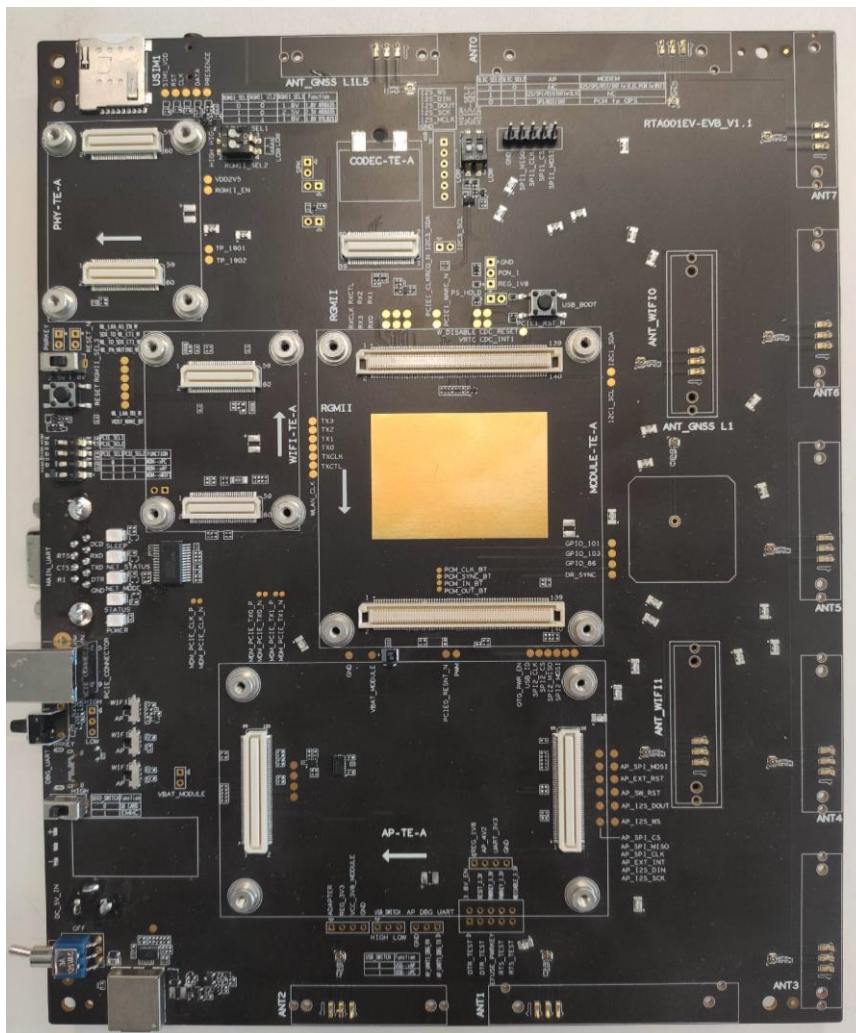


Figure 1: Top View

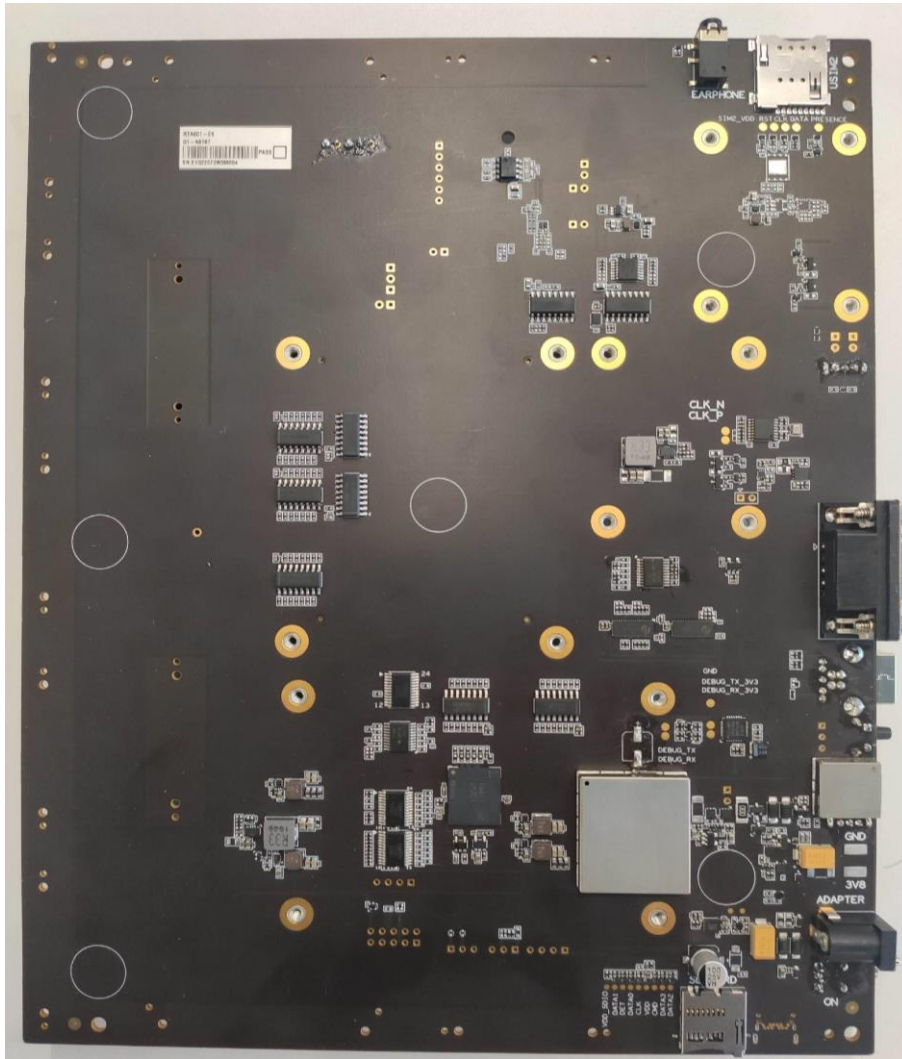


Figure 2: Bottom View

2.2. Component Placement of RTA001-EV EVB

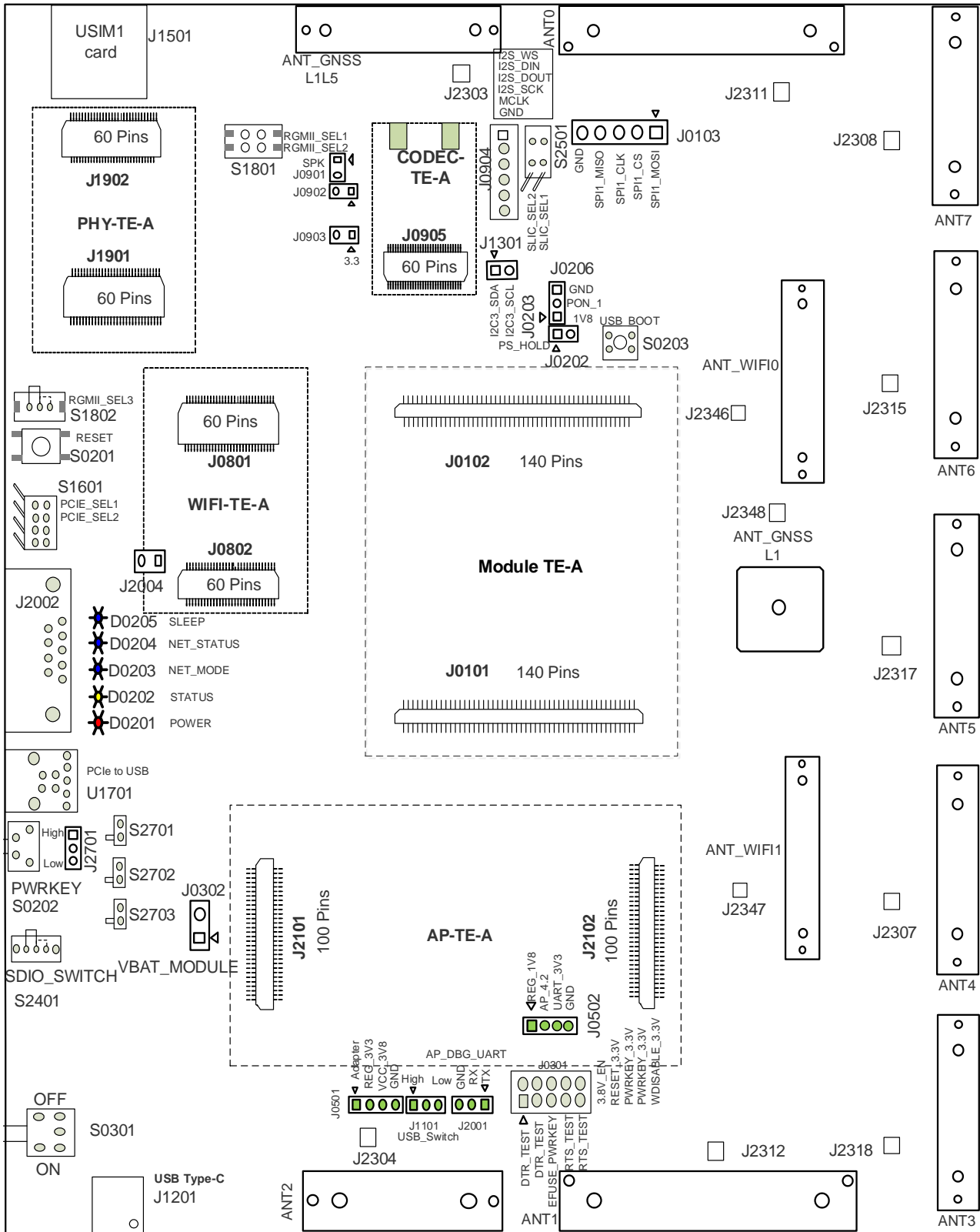


Figure 3: Top View for Component Placement

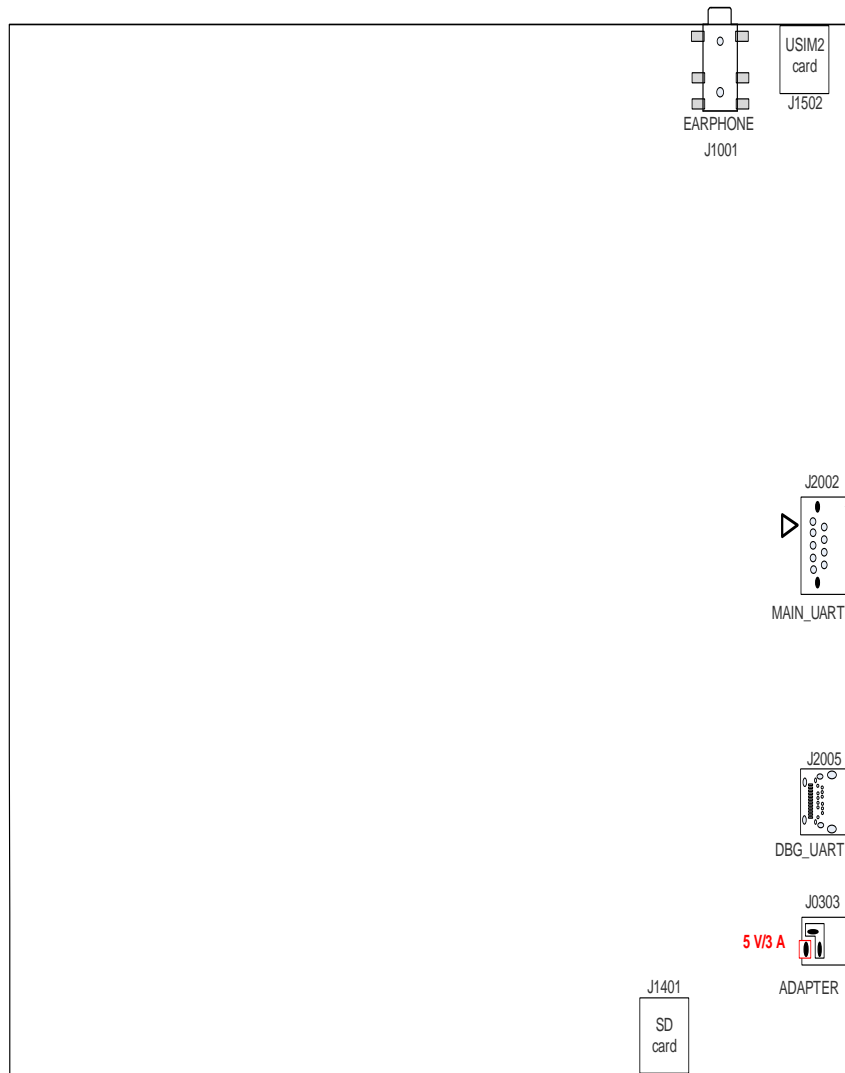


Figure 4: Bottom View for Component Placement

Table 2: Components and Functions

Components	RefDes.	Description
Power supply	J0303	<ul style="list-style-type: none"> ● The power jack on the EVB ● Typical supply voltage: 5 V/ 3 A
Power switch	S0301	VBAT on/off control
PWRKEY	S0202	<ul style="list-style-type: none"> ● Power key (push button) ● Turn on/off the module
PON	J0203	Auto-power on control
USB_BOOT	S0203	Emergency download control
RESET	S0201	<ul style="list-style-type: none"> ● Reset button (push button)

		<ul style="list-style-type: none"> ● Reset the module
USB interface	J1201	<ul style="list-style-type: none"> ● USB Type-C interface ● Support USB 3.0/3.1 and USB 2.0
PCIe-to-USB interface	U1701	PCIe-to-USB interface, not enabled by default
PCIe configuration switch	S1601	Configure the module communication with different devices via PCIe signals
SDIO configuration switch	S2401	Switch between SD card and eMMC
RGMII configuration switch	S1801, S1802	Configure RGMII
Codec configuration switch	S2501	Configure codec
Wi-Fi configuration switch	S2701	Configure Wi-Fi
Wi-Fi clock signal configuration switch	S2702	Select to provide clock signal to Wi-Fi or AP
Wi-Fi sleep clock signal configuration switch	S2703	Select to provide a sleep clock signal to Wi-Fi or AP
Audio interfaces	J0905	<ul style="list-style-type: none"> ● Codec board TE-A connector ● Support ALC5616 TE-A and TLV320AIC3104 TE-A codec boards
	J0901	Designed for loudspeaker
	J1001	Audio jack for earphone
(U)SIM card interfaces	J1501	Support dual (U)SIM cards: 1.8 V and 2.95 V
	J1502	
SD card interface	J1401	SD card connector
Main UART	J2002	<ul style="list-style-type: none"> ● Main UART for data communication ● Default baud rate: 115200 bps
Debug UART	J2005	<ul style="list-style-type: none"> ● Debug UART for debugging ● Default baud rate: 115200 bps
Status indicators	D0201	Power supply on/off indicator, indicating whether the module's power supply is on or off. On: VBAT on Off: VBAT off
	D0202	Module operation status indicator, indicating whether the module is powered on. On: the module is powered on Off: the module is powered off
	D0203	Network registration mode indicator, indicating the module's NET_MODE status.

	D0204	Network activity status indicator, indicating the module's NET_STATUS status.
	D0205	Sleep mode indicator, indicating the module's SLEEP status.
Module TE-A interface	J0101, J0102	Module TE-A connectors
PHY TE-A interface	J1901, J1902	<ul style="list-style-type: none"> ● PHY TE-A connectors ● Support PHY8211 and AR8035
Wi-Fi TE-A interface	J0801, J0802	Wi-Fi TE-A connectors
AP TE-A interface	J2101, J2102	<ul style="list-style-type: none"> ● AP TE-A connectors ● Support IPQ8074A TE-A and QPS615 TE-A
Antenna interfaces	J2303, J2304, J2307, J2308, J2311, J2312, J2315, J2317, J2318, J2346, J2347, J2348	Antenna connectors

3 Kit Accessories

3.1. List of Accessories

All accessories of the RTA001-EV EVB kit are listed below. Please contact the supplier if there is something missing.

Table 3: List of Accessories

Items	Description	Quantity (pcs)
Cables	USB to RS-232 converter cable	1
	USB Type-A to Type-B converter cable	1
	USB Type-C cable	1
	RF cables	9
Antennas	Wi-Fi antenna	2
	Cellular antenna	8
	GNSS antenna (passive)	2
Audio	Earphone	1
USB driver	Module's related documents, tools & drivers, etc.	1
Codec TE-A	ALC5616, TLV320AIC3104	2
Screws	Used to fasten TE-As on the EVB	8
Instruction sheet	A sheet of paper giving instructions for EVB connection, details of EVB accessories, etc.	1
PCIe-to-USB adapter	PCIe signal is transferred through USB 3.0 connector, not used by default.	1
Bolts and nuts	Bolts and nuts for assembling the EVB	4 pairs
Power adapter	5 V/ 3 A power adapter	1

4 Application Interfaces

This chapter describes the hardware interfaces of the RTA001-EV EVB, as listed below:

- Power supply
- Module TE-A interface
- PHY TE-A interface
- AP TE-A interface
- USB interface
- Audio interfaces
 - Digital audio codec board connector
 - Analog audio interfaces
 - Loudspeaker interface
 - Earphone interface
- (U)SIM card interfaces
- SD card interface
- UART interfaces
- PCIe-to-USB interface
- Wi-Fi TE-A interface
- Antenna interfaces

It also provides information about the buttons, switches and status indication LEDs to help you use the EVB.

4.1. Power Supply

The RTA001-EV EVB can be powered by an external power adapter through the power jack.

Table 4: Description of Power Supply

RefDes.	Description
J0303	DC power supply: 4.5–5.5 V Typical supply voltage: 5 V/ 3 A

The following two figures display a simplified power supply block diagram and the power supply interface of RTA001-EV EVB.

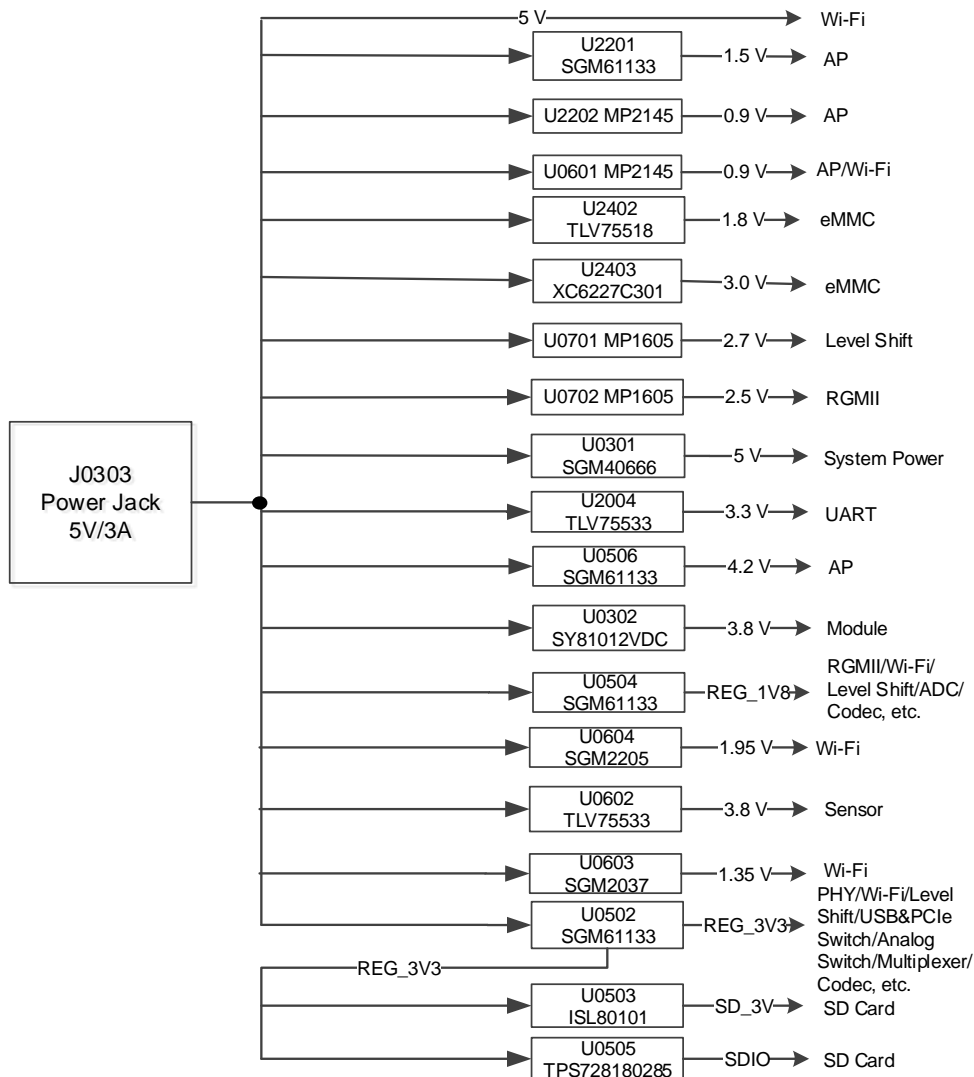


Figure 5: Block Diagram of EVB Power Supply

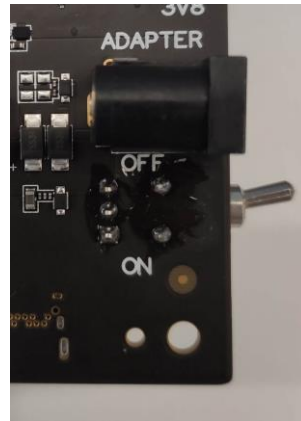


Figure 6: EVB Power Supply Interface

4.2. Module TE-A Interface

Module TE-A interface is designed to accommodate the TE-A of the module. The TE-A is mounted onto and connected to the EVB via BTB connectors J0101 and J0102 (insert as indicated by the arrow to prevent reverse insertion). You can test the functionalities of the module easily through this interface.

Table 5: Description of Module TE-A Interface

RefDes.	Description
J0101	Module TE-A connectors
J0102	

The following figure displays the connection between the module TE-A and the EVB.



Figure 7: Connection Between Module TE-A and EVB

4.3. PHY TE-A Interface

PHY TE-A interface is designed to accommodate the PHY TE-A (PHY8211 TE-A). The PHY TE-A is mounted onto and connected to the EVB via BTB connectors J1901 and J1902 (insert as indicated by the arrow to prevent reverse insertion).

Table 6: Description of PHY TE-A Interface

RefDes.	Description
J1901	<ul style="list-style-type: none"> PHY TE-A connectors
J1902	<ul style="list-style-type: none"> Support PHY8211 and AR8035

The following figures display the connection between PHY8211 TE-A and EVB.

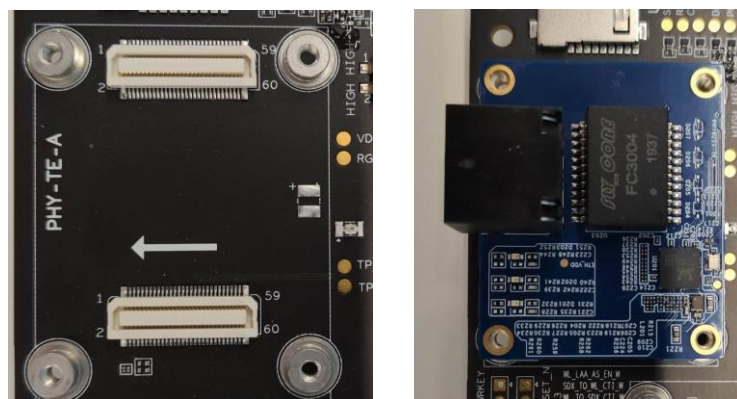


Figure 8: Connection Between PHY8211 TE-A and EVB

Table 7: PHY TE-A Configuration Switch

RGMII_SEL1	RGMII_SEL2	RGMII_SEL3	Function
Low	High	1.8 V	AR8035 RGMII IO 1.8 V
High	Low	2.5 V	AR8035 RGMII IO 2.5 V
High	High	1.8 V	PHY8211 RGMII IO 1.8 V

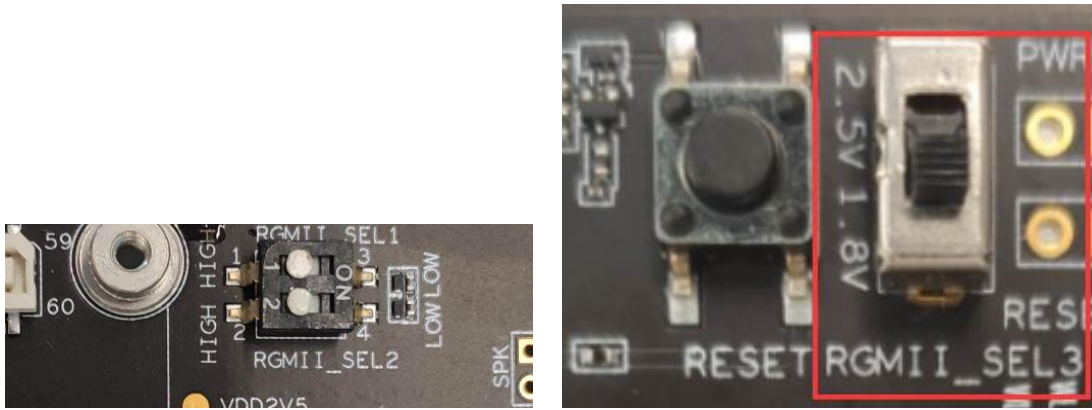


Figure 9: S1801/S1802 Switch

4.4. AP TE-A Interface

AP TE-A interface is designed to accommodate the AP TE-A (IPQ8074A TE-A/QPS615 TE-A). The AP TE-A is mounted onto and connected to the EVB via BTB connectors J2101 and J2102 (insert as indicated by the arrow to prevent reverse insertion).

Table 8: Description of AP TE-A Interface

RefDes.	Description
J2101	<ul style="list-style-type: none"> ● AP TE-A connectors
J2102	<ul style="list-style-type: none"> ● Support IPQ8074A TE-A and QPS615 TE-A

The following figures display the connection between IPQ8074A TE-A and EVB.



Figure 10: Connection Between IPQ 8074A TE-A and EVB

Table 9: AP TE-A Configuration Switch

S2701	S2702	S2703	PCIE_SEL1	PCIE_SEL2	Function
Wi-Fi	Wi-Fi	Wi-Fi	High	High	Module → Wi-Fi
Wi-Fi/AP	AP	AP	High	Low	Module → QPS615 TE-A
AP	AP	AP	High	Low	Module → IPQ8074 TE-A

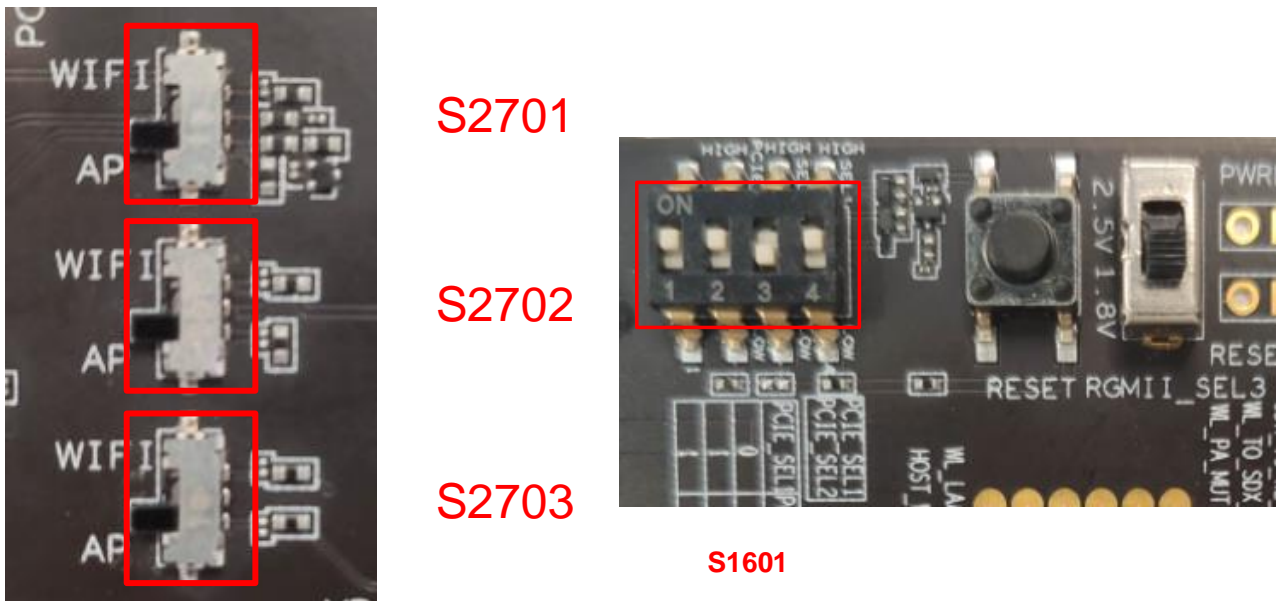


Figure 11: S2701/S2702/S2703/S1601

4.5. USB Interface

A USB Type-C connector, which complies with USB 3.0/3.1 and USB 2.0 standard, is provided. This USB interface is used for AT command communication, data transmission and firmware upgrade.

Table 10: Description of USB Interface

RefDes.	Description
J1201	<ul style="list-style-type: none"> ● USB Type-C interface ● Support USB 3.0/3.1 and USB 2.0



Figure 12: USB Interface Connection

4.6. Audio Interfaces

Quectel RTA001-EV EVB provides one digital audio codec board interface (I2S) J0905 and two analog audio interfaces J1001 and J0901.

4.6.1. Digital Audio Codec Board Connector

The RTA001-EV EVB supports two different external digital audio codec TE-As named ALC5616 and TLV320AIC3104. The codec circuit is assembled on an independent small board which can be interconnected with the EVB by the BTB connector J0905.

Table 11: Description of Digital Audio Codec Board Connector

RefDes.	Description
J0905	<ul style="list-style-type: none"> ● Codec board TE-A connector ● Support ALC5616 TE-A and TLV320AIC3104 TE-A codec boards

Codecs can be selected according to specific application demands, the following two figures display the connection between digital audio codec TE-A and the EVB.

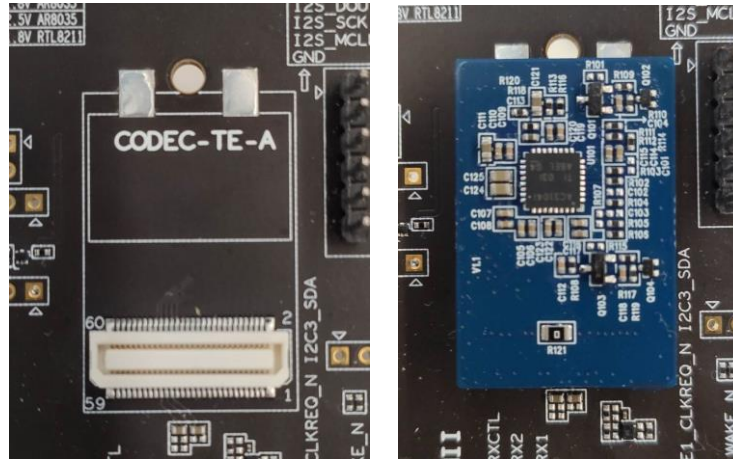
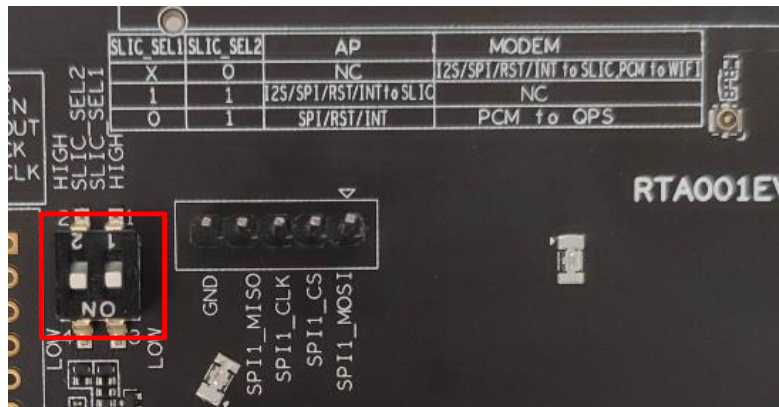


Figure 13: Connection Between Codec TE-A and EVB



S2501: Codec configuration switch
MODEM: Codec connected to the module
AP: Codec connected to the AP

Figure 14: S2501 Switch

Table 12: Codec TE-A Configuration Switch

SLIC_SEL1	SLIC_SEL2	AP	Modem
High/Low	Low	NC	I2S/SPI/RST/INT to SLIC, PCM to Wi-Fi
High	High	I2S/SPI/RST/INT to SLIC	NC
Low	High	SPI/RST/INT	PCM to QPS

4.6.2. Analog Audio Interfaces

Table 13: Description of Analog Audio Interfaces

RefDes.	Description
J0901	Design for loudspeaker
J1001	Audio jack for earphone

4.6.3. Loudspeaker Interface

Audio interface J0901 is designed for loudspeaker and the following figure displays a reference design of loudspeaker with an external audio amplifier.

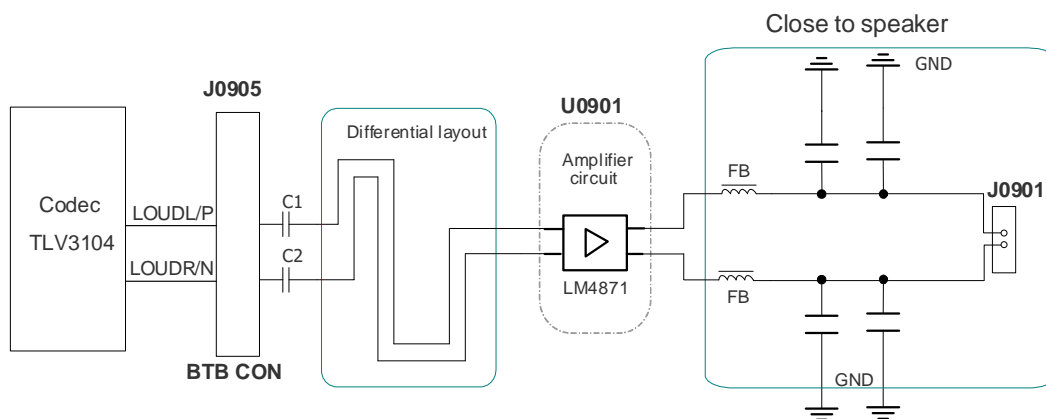


Figure 15: Reference Circuit Design for Loudspeaker Interface J0901

4.6.4. Earphone Interface

Audio interface J1001 is designed for earphone and the following figure displays a reference circuit design of earphone interface.

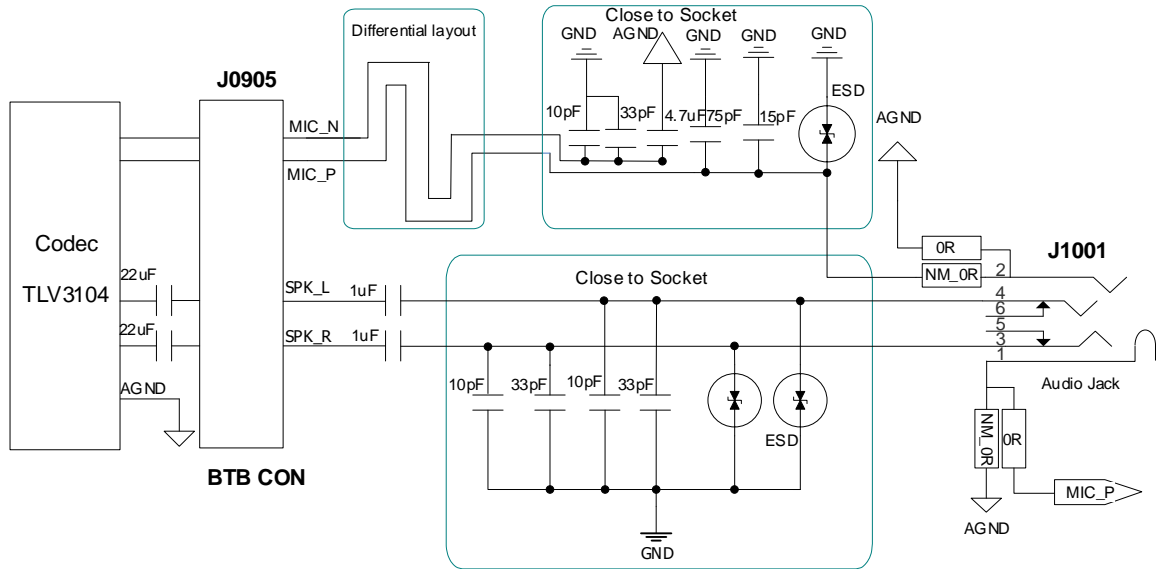


Figure 16: Reference Circuit Design for Earphone Interface J1001

The figure and table below illustrate the pin assignment and pin definition of earphone interface J1001.



Figure 17: Pin Assignment of J1001

Table 14: Pin Definition of J1001

Pin No.	Pin Name	Description
1	MIC	Microphone input
2	AGND	Dedicated GND for audio
3	SPK_R	Right channel of stereo audio output

4	SPK_L	Left channel of stereo audio output
5, 6	NC	Not connected

The following figure displays a schematic of audio plug which suits the audio jack on RTA001-EV EVB.

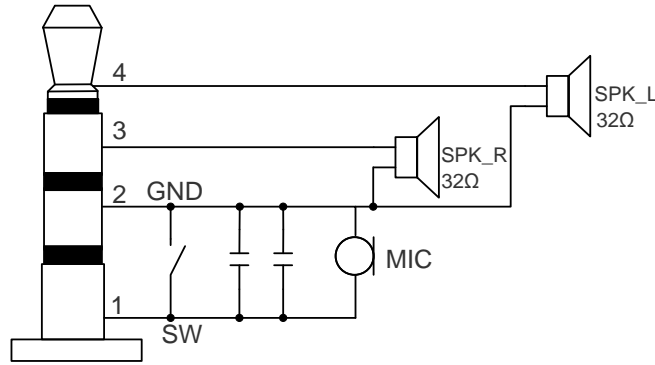


Figure 18: Schematic of Audio Plug

4.7. (U)SIM Card Interfaces

The RTA001-EV EVB has two 8-pin push-push type (U)SIM card (1.8/2.95 V) connectors J1501 and J1502. The following figure displays a simplified schematic for (U)SIM card connectors J1501 and J1502.

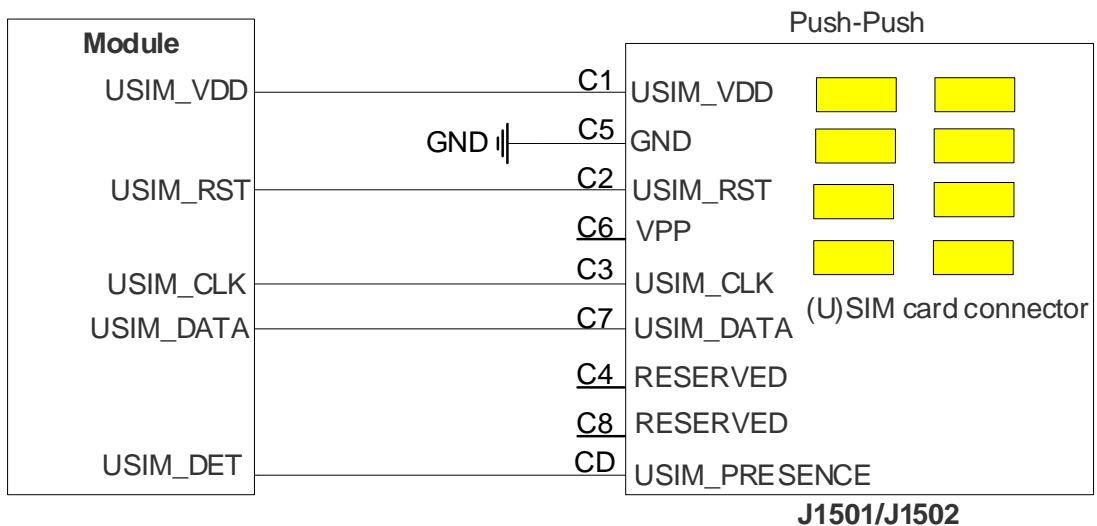


Figure 19: Simplified Schematic for (U)SIM Card Connectors

Table 15: Description of (U)SIM Card Interfaces

RefDes.	Description
J1501/J1502	Support dual (U)SIM cards: 1.8 V and 2.95 V

The figure and table below illustrate the pin assignment and definition of (U)SIM card connectors J1501 and J1502.

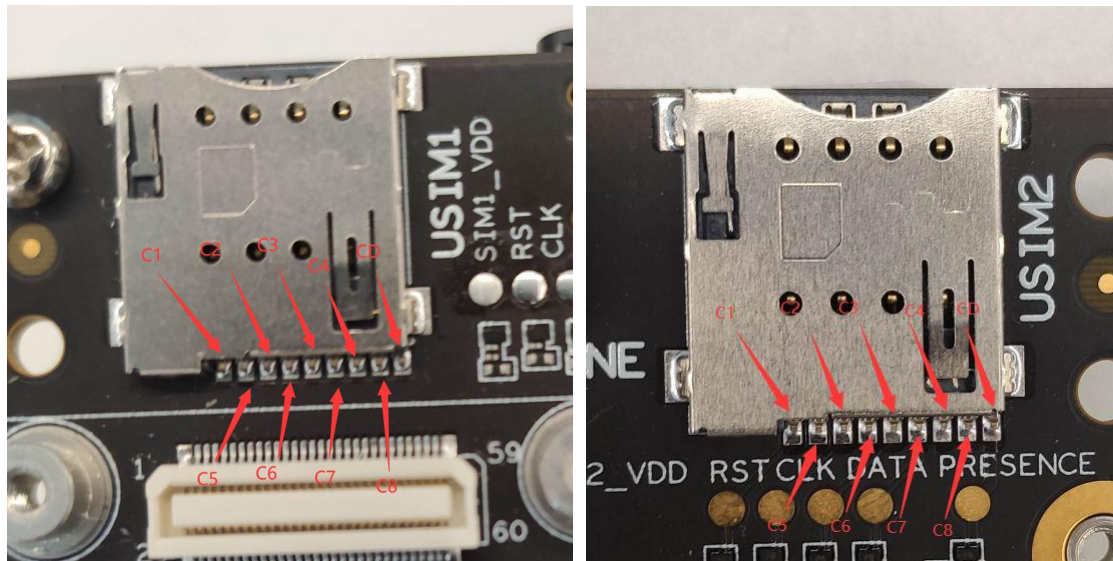


Figure 20: Pin Assignment of (U)SIM Card Connectors J1501/J1502

Table 16: Pin Definition of J1501/J1502

Pin No.	Pin Name	I/O	Function
C1	USIM_VDD	PO	(U)SIM card power supply, provided by module
C2	USIM_RST	DO	(U)SIM card reset
C3	USIM_CLK	DO	(U)SIM card clock
C4	RESERVED1	-	Not connected
C5	GND	-	Ground
C6	VPP	-	Not connected
C7	USIM_DATA	DIOO	Data line, bi-directional

C8	RESERVED2	-	Not connected
CD	USIM_PRESENCE	DI	(U)SIM card insertion detection

4.8. SD Card Interface

The RTA001-EV EVB provides an SDIO interface, which can be used for connecting SD card. The following figure displays the simplified schematic for J1401.

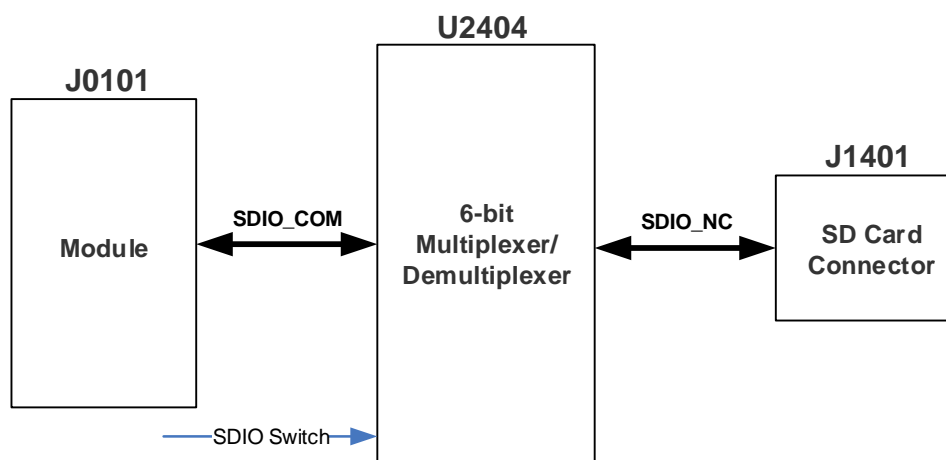


Figure 21: Simplified Schematic for J1401

Table 17: Description of SD Card Interface

RefDes.	Description
J1401	SD card connector

If SD card function needs to be used, switch the SDIO switch to low level illustrated in the figure and table below. A standard SD card can be inserted into J1401 which supports micro SD card of maximum 32 GB. With the SD card interface, you can easily enhance the memory capacity of the module.

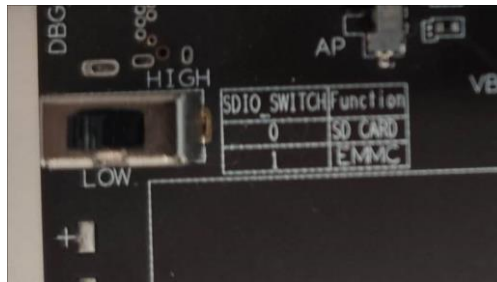


Figure 22: S2401 Switch

Table 18: SDIO Switch Function

SDIO Switch	Function
Low	Enable SD card function
High	Enable eMMC function



Figure 23: Pin Assignment of SD Card Connector J1401

NOTE

eMMC is not supported on the applicable modules.

4.9. UART Interfaces

The RTA001-EV EVB provides two UART interfaces: main UART J2002 and debug UART J2005, both supporting baud rate of 115200 bps by default.

Table 19: Description of UART Interfaces

RefDes.	Description
J2002	<ul style="list-style-type: none"> ● Main UART for data communication ● Default baud rate: 115200 bps
J2005	<ul style="list-style-type: none"> ● Debug UART for debugging ● Default baud rate: 115200 bps

The main UART interface is used for communication between the module and the host application. The debug UART interface is used for Linux console and log output.

The following figure displays the block diagram of UART interfaces of the EVB.

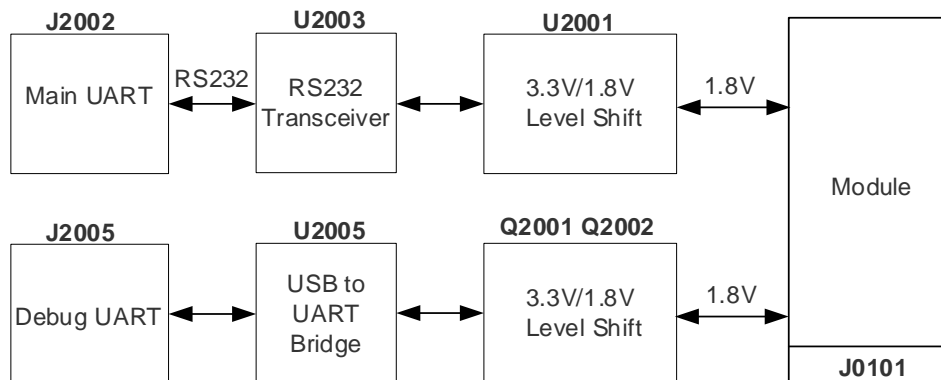


Figure 24: UART Block Diagram

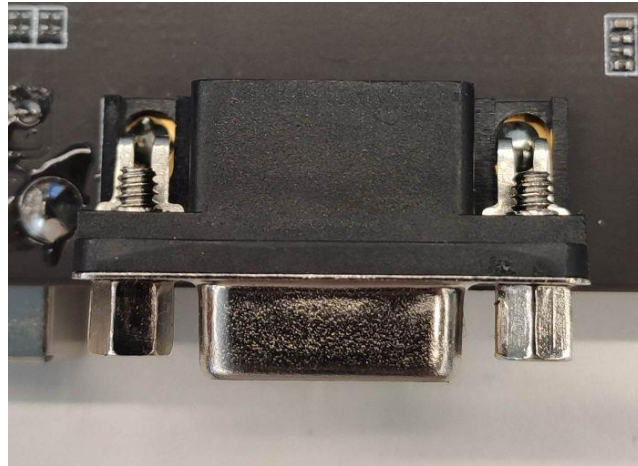


Figure 25: Main UART Interface (J2002)

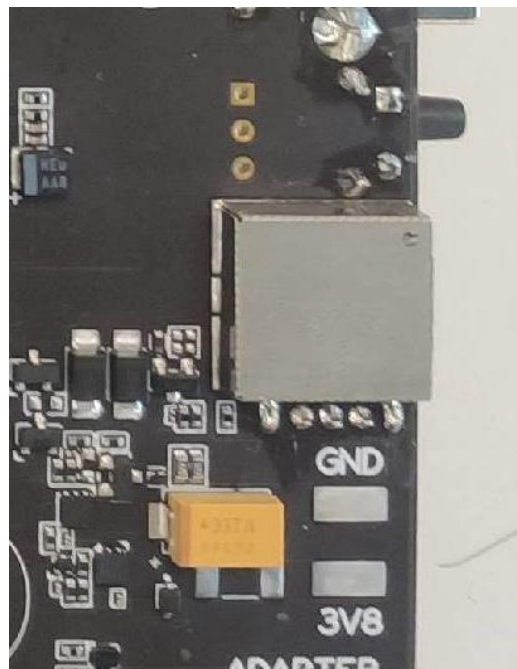


Figure 26: Debug UART Interface (J2005)

4.10. PCIe-to-USB Interface

The RTA001-EV EVB reserves a PCIe 3.0 signal over USB interface for testing, and this function is not enabled by default. The block diagram is shown as follows.

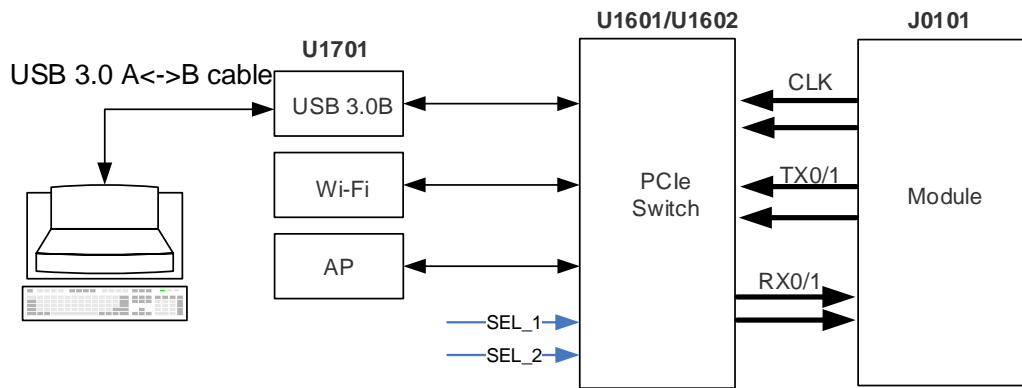


Figure 27: PCIe Block Diagram

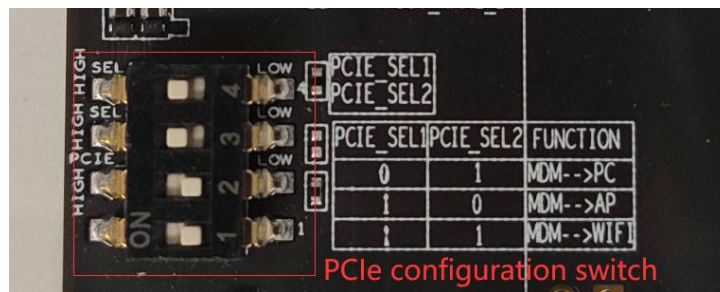


Figure 28: S1601 Switch

Table 20: Description of PCIe-to-USB Interface

RefDes.	Description
U1701	PCIe-to-USB interface, not enabled by default

Table 21: PCIe Connection Truth Table

PCIE_SEL1	PCIE_SEL2	Function
0	1	Module → PC
1	0	Module → AP
1	1	Module → Wi-Fi

4.11. Switches and Buttons

The RTA001-EV EVB provides nine switches (S0301, S1601, S1801, S1802, S2401, S2501, S2701, S2702 and S2703) and three buttons (S0201, S0202 and S0203), as shown in the following figures.

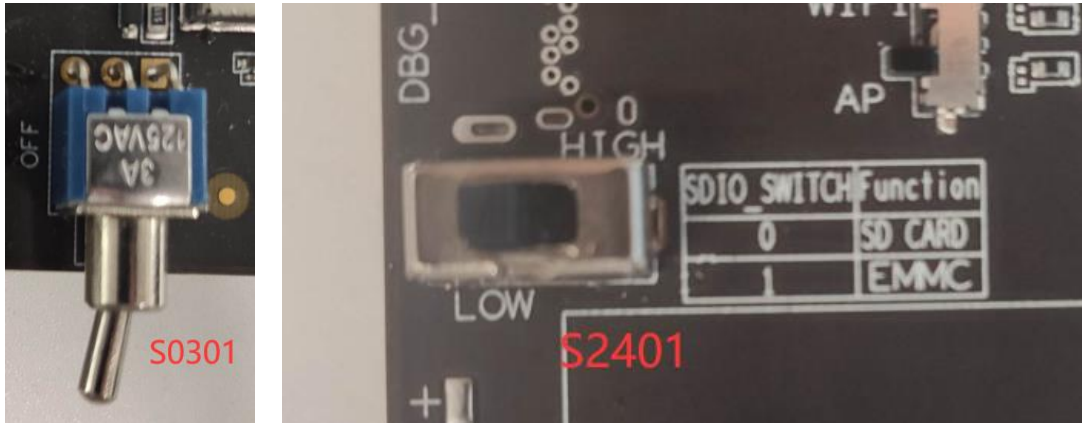
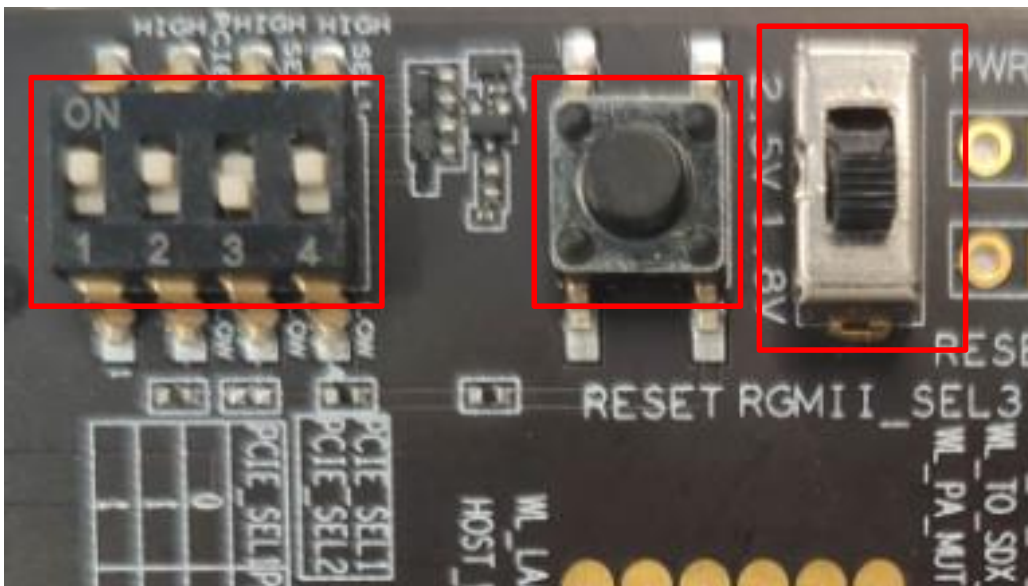


Figure 29: S0301 and S2401 Switches



S1601

S0201

S1802

Figure 30: S1601/S1802 Switch and S0201 Button

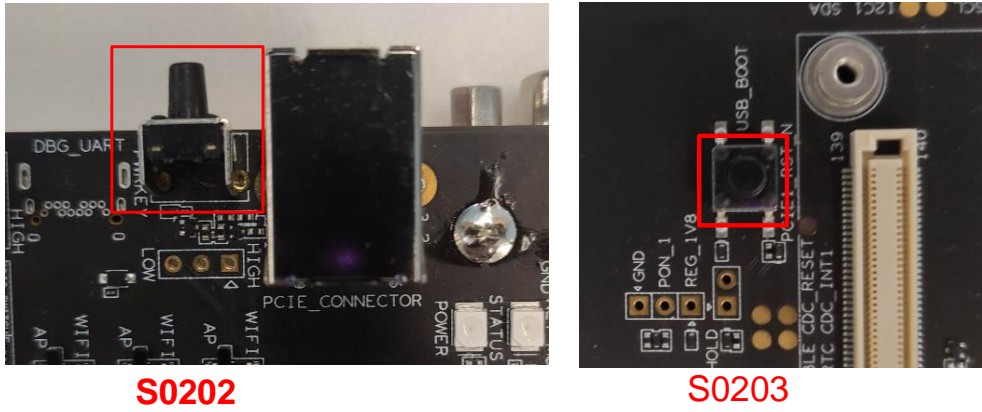


Figure 31: S0202/S0203 Button

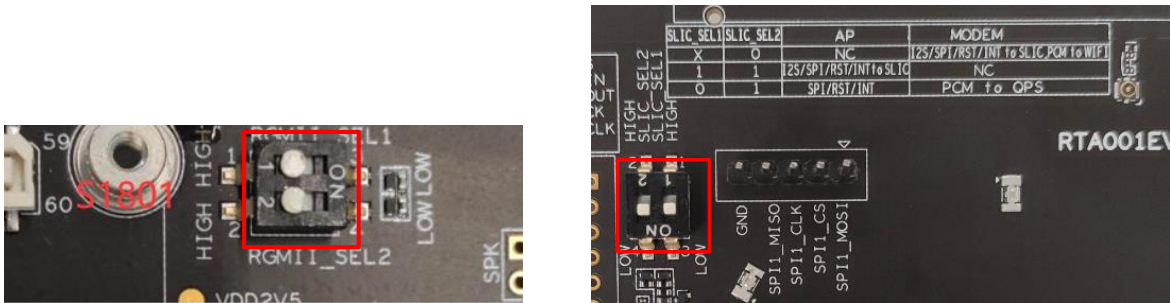


Figure 32: S1801/S2501 Switch

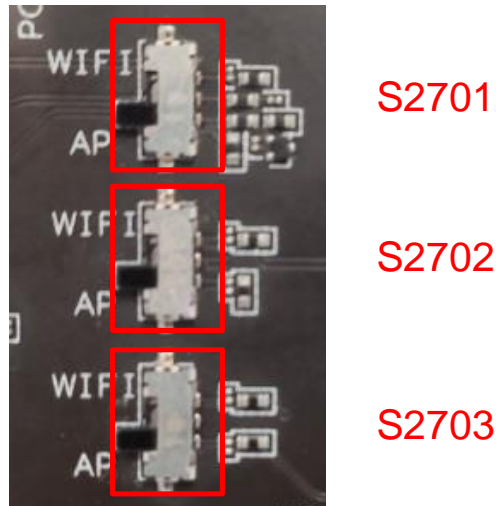


Figure 33: S2701/S2702/S2703 Switch

Table 22: Description of Switches and Buttons

Switches and Buttons	RefDes.	Description
Power switch	S0301	VBAT on/off control
PWRKEY	S0202	Power key to turn on/off the module
PCIe configuration switch	S1601	Configure the module communication with different devices via PCIe signals
RESET	S0201	Reset button to reset the module
USB_BOOT	S0203	Emergency download control
RGMII configuration switch	S1801, S1802	Configure RGMII
SDIO configuration switch	S2401	Switch between SD card and eMMC
Codec configuration switch	S2501	Configure codec
Wi-Fi configuration switch	S2701, S2702, S2703	Configure Wi-Fi

4.12. Status Indicators

There are five status indication LEDs on the EVB. The following figure displays the positions of these LED indicators.

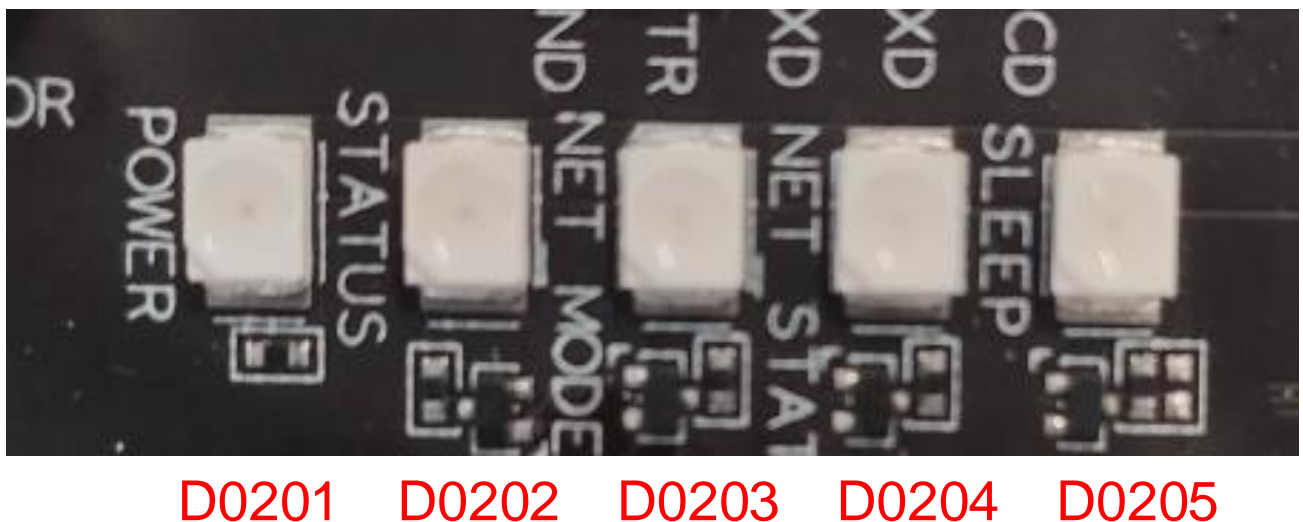


Figure 34: Status Indicators

Table 23: Description of Status Indication LEDs

RefDes.	Description
D0201	Indicates whether the module’s power supply is on or off. On: VBAT on Off: VBAT off
D0202	Indicates whether the module is powered on. On: the module is powered on Off: the module is powered off
D0203	Indicates the module’s NET_MODE status.
D0204	Indicates the module’s NET_STATUS status.
D0205	Indicates the module’s SLEEP status.

4.13. Wi-Fi TE-A Interface

The Wi-Fi TE-A interface is designed to accommodate the TE-A of Wi-Fi modules (paired with WCN6856). The TE-A is connected to the EVB via BTB connectors J0801 and J0802. The interface allows you to test the Wi-Fi function of the module or to develop applications with Wi-Fi function easily.

Table 24: Description of Wi-Fi TE-A Interface

RefDes.	Description
J0801	Wi-Fi TE-A connectors
J0802	

The following two figures display the connection between WCN6856 TE-A and EVB.

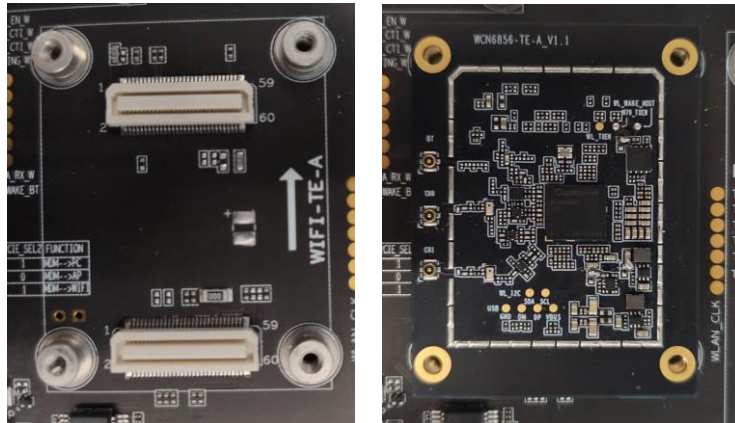


Figure 35: Connection Between WCN6856 TE-A and EVB

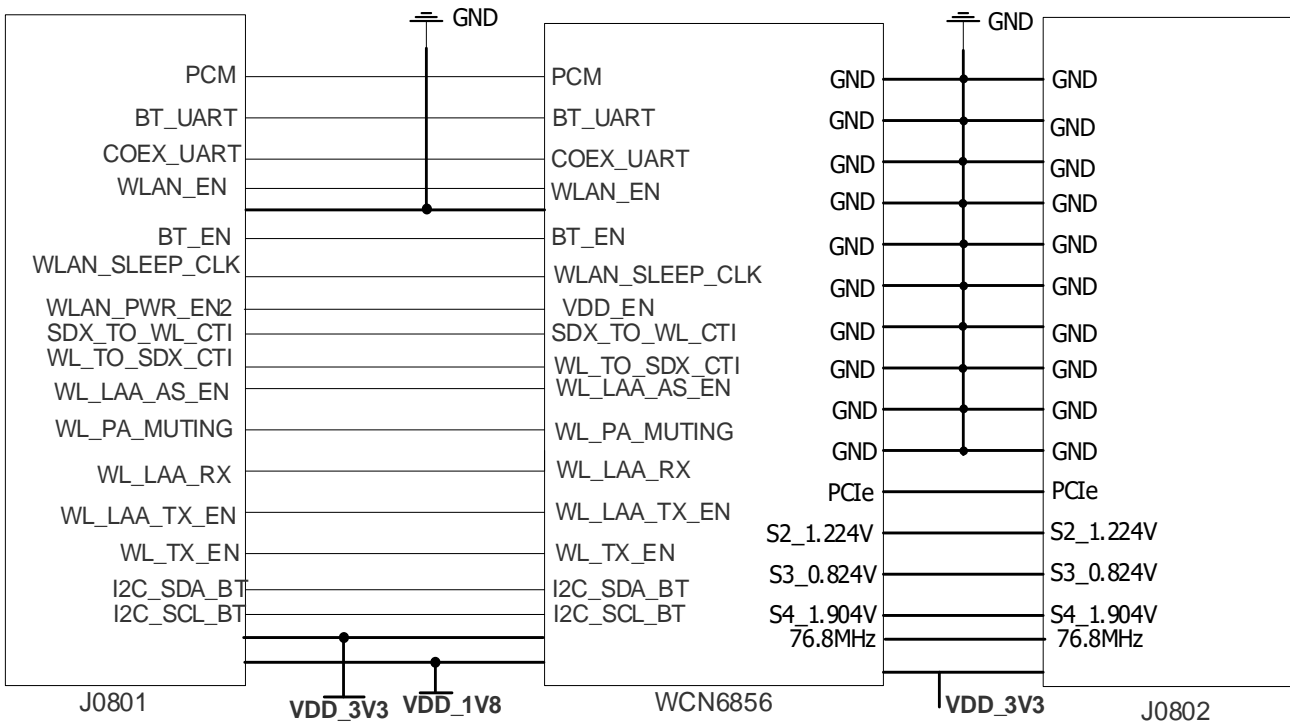
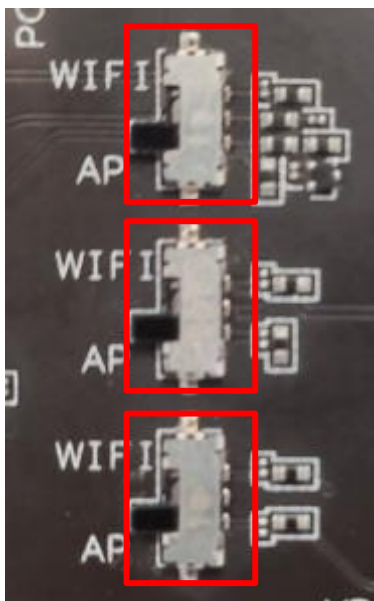


Figure 36: Simplified Schematic for WCN6856 TE-A Interface

Table 25: Wi-Fi TE-A Configuration Switch

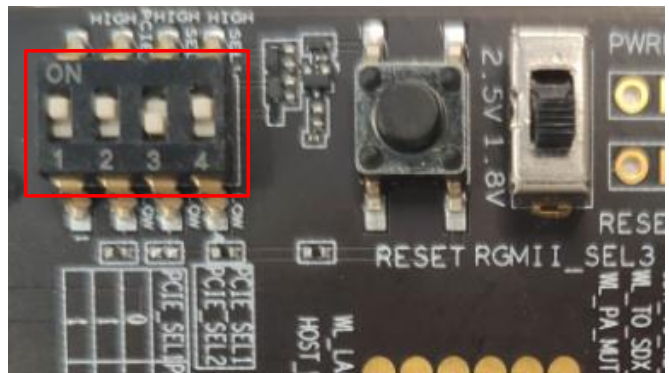
S2701	S2702	S2703	PCIE_SEL1	PCIE_SEL2	Function
Wi-Fi	Wi-Fi	Wi-Fi	High	High	Module → Wi-Fi
Wi-Fi/AP	AP	AP	High	Low	Module → QPS615 TE-A
AP	AP	AP	High	Low	Module → IPQ8074 TE-A



S2701

S2702

S2703



S1601

Figure 37: S2701/S2702/S2703/S1601

4.14. Antenna Interfaces

The RTA001-EV EVB provides 12 antenna interfaces. The following figure displays the assembly of these antenna interfaces.

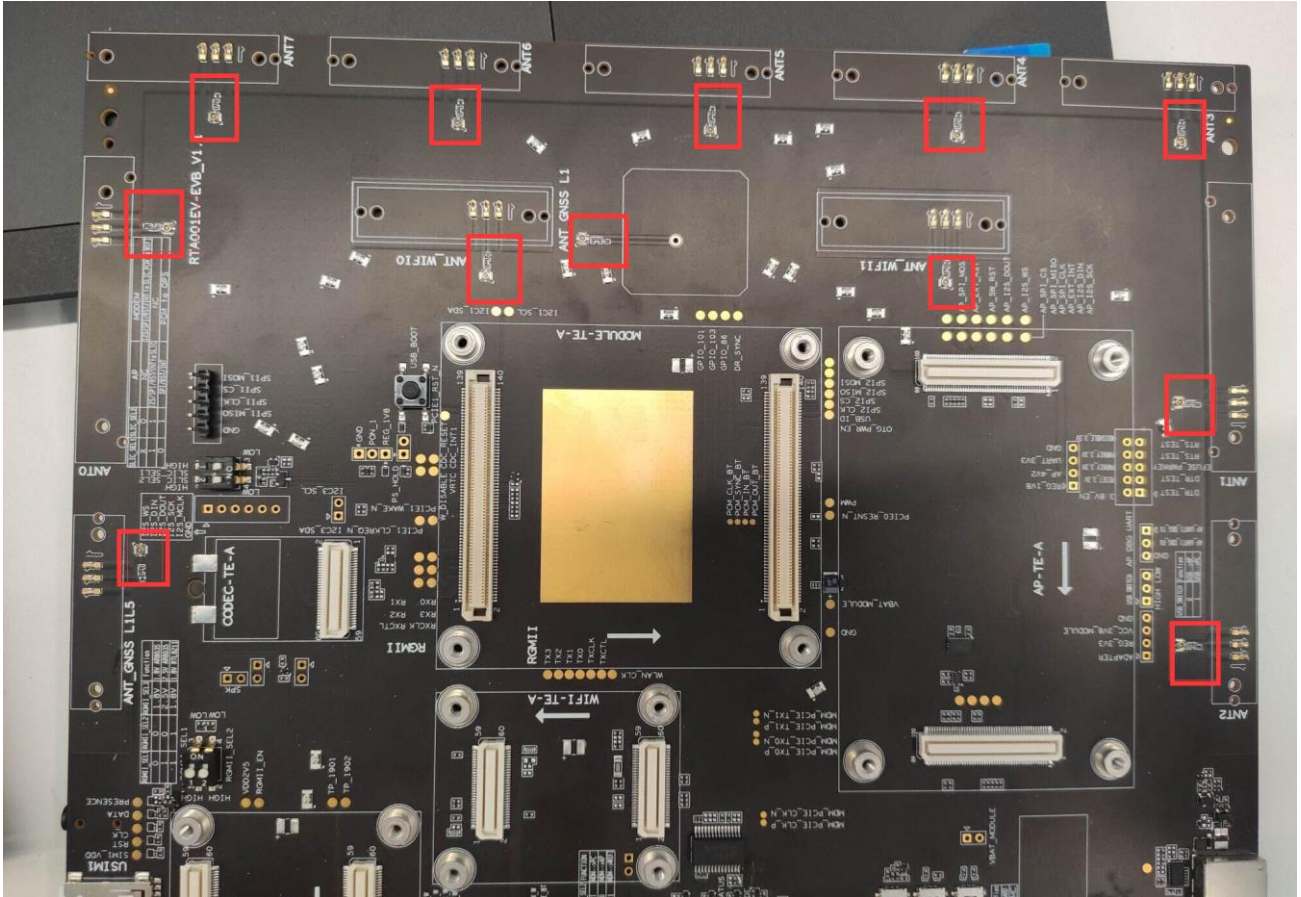


Figure 38: Antenna Interfaces

5 Operation Procedures

This chapter introduces how to use the RTA001-EV EVB for testing and evaluating Quectel modules. Ensure module and the EVB are correctly assembled before beginning the following procedures.

5.1. Turn On the Module

1. Connect the module TE-A to the EVB via connectors J0101 and J0102.
2. Insert a (U)SIM card into the USIM1 card connector on EVB.
3. Use RF cable to connect the module TE-A to the EVB, and connect antennas to the EVB.
4. Connect the EVB to a 5 V/ 3 A power and switch S0301 to ON. Then D0201 (on/off indicator of the module's power supply) will light up.
5. Press the S0202 (PWRKEY) for at least 500 ms and the module will be powered on and D0202 (operation status indicator of the module) will light up.

5.2. Turn Off the Module

There are two methods to turn off the module.

- Turn off the module with AT command **AT+QPOWD**. This is a safer method. The module will log off from the network and save data before shutdown.
- Turn off the module with PWRKEY button (S0202). Long press PWRKEY for at least 800 ms and the module will be powered off.

5.3. Communication Via USB

1. Turn on the module according to the procedures in **Chapter 5.1**.
2. Connect the EVB and a PC with USB cable through USB Type-C interface, and then run the driver disk on the PC to install the USB driver. For details about USB driver installation, see **document [1]**. The USB port numbers can be viewed in Device Manager of the PC when the USB driver is installed, as shown below.

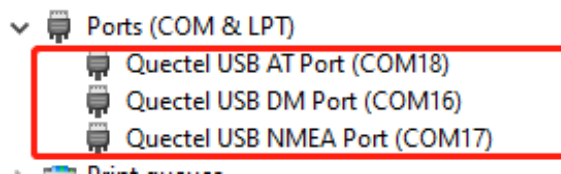


Figure 39: USB Ports

3. Install and then use QCOM provided by Quectel to realize the communication between the module and the PC.

The following figure shows the COM Port Setting of QCOM: select the correct “**COM Port**” (USB AT Port, which is shown in figure above) and set correct “**Baudrate**” (e.g. 115200 bps). For more details about QCOM use and configuration, see **document [2]**.

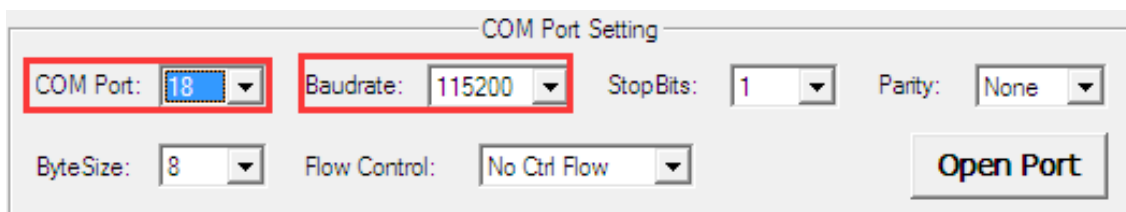


Figure 40: COM Port Setting of QCOM (USB AT Port Connection)

5.4. Firmware Upgrade

Firmware of the module is upgraded via USB port by default, and there are two methods for the upgrade: emergency download and normal download. See the following procedures to upgrade firmware through the EVB.

5.4.1. Emergency Download

1. Install the firmware upgrade tool QFlash on PC.
2. Connect the EVB and the PC through USB Type-C cable.
3. Insert the DC power adapter.
4. Press the USB_BOOT button (S0203) and power on the module.
5. Upgrade the firmware with QFlash. See **document [3]** for details about the use of QFlash.

5.4.2. Normal Download

1. Turn on the module according to the procedures in **Chapter 5.1**.
2. Wait for the USB port to be found in Device Manager of the PC.

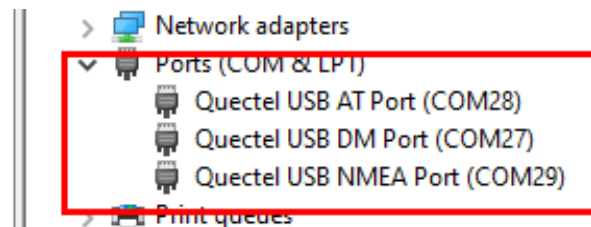


Figure 41: USB Port in PC Device Manager

3. Open QFlash and upgrade the firmware. See **document [3]** for detailed procedures.

5.5. Reset the Module

The reset option is only used in case of abnormality. For example, the software fails to respond for more than 5 seconds due to some serious problems.

Long press the button S0201 (RESET) for more than 8 seconds, and then release it to reset the module.

6 Appendix References

Table 26: Related Documents

Document Name
[1] Quectel_Windows_USB_Driver(Q)_NDIS_Installation_Guide
[2] Quectel_QCOM_User_Guide
[3] Quectel_QFlash_User_Guide

Table 27: Terms and Abbreviations

Abbreviation	Description
AGND	Analog Ground
BTB	Board to Board
COM	Cluster Communication Port
DC	Direct Current
DI	Digital Input
DO	Digital Output
eMMC	embedded Multi-Media Card
EVB	Evaluation Board
GND	Ground
GNSS	Global Navigation Satellite System
I/O	Input/Output
LED	Light Emitting Diode
MIC	Microphone

NC	Not Connected
PC	Personal Computer
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PHY	Physical Layer
PO	Power Output
RF	Radio Frequency
SD	Secure Digital
SIM	Subscriber Identity Module
UART	Universal Asynchronous Receiver & Transmitter
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identity Module
