Mini PCIe EVB User Guide

UMTS/HSPA/LTE Module Series

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About the Document

History

Revision	Date	Author	Description
1.0	2015-03-03	Radom XIANG	Initial
1.1	2015-06-10	Radom XIANG	Deleted +5V adapter parts in EVB accessories

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1 Introduction

This document describes the evaluation board of Mini PCIe card. The Mini PCIe evaluation board is an assistant system integrator for developing and evaluating products based on Quectel Wireless Modules.

1.1. Safety Information

The following safety precautions must be observed during all phases of the operation, such as usage, service or repair of any cellular terminal or mobile incorporating module. Manufacturers of the cellular terminal should send the following safety information to users and operating personnel and to incorporate these guidelines into all manuals supplied with the product. If not so, Quectel does not take on any liability for customer failure to comply with these precautions.

	Full attention must be given to driving at all times in order to reduce the risk of an accident. Using a mobie while driving (even with a handsfree kit) cause distraction and can lead to an accident. You must comply with laws and regulations restrcting the use of wireless devices while driving.
	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it switched off. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. Consult the airline staff about the use of wireless devices on boarding the aircraft, if your device offers a Fight Mode which must be enabled prior to boarding an aircraft.
	Switch off your wireless device when in hospitals or clinics or other health care facilities. These requests are desinged to prevent possible interference with sentitive medical equipment.
	Cellular terminals or mobiles operate over radio frequency signal and cellular network and cannot be guaranteed to connect in all conditions, for example no mobile fee or an invalid SIM card. While you are in this condition and need emergent help, Please Remember using emergency call. In order to make or receive call, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength.
	Your cellular terminal or mobile contains a transmitter and receiver. When it is ON , it receives and transmits radio frequency energy. RF interference can occur if it is used close to TV set, radio, computer or other electric equipment.
	In locations with potencially explosive atmospheres, obey all posted signs to turn off wireless devices such as your phone or other cellular terminals. Areas with potencially exposive atmospheres including fuelling areas, below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles such as grain, dust or metal powders.

2 General Overview

Quectel supplies Mini PCIe-EVB kit for designers to develop applications based on Quectel Mini PCIe module. This EVB can test all functionalities of Quectel Mini PCIe module.

2.1. Scope of the EVB

Mini PCIe EVB is applicable to the following modules. Please refer to *document [3]* to obtain more details for these modules.

- UC20 Mini PCIe
- UC15 Mini PCIe
- EC20 Mini PCIe

2.2. Key Features

Table 1: Features

Features	Implementation
Power Supply	DC supply 4.5~5.5V typically 5V VBAT: 3.3V at J202
USIM Card Interface	USIM/SIM card (6 pins) connector with push loading USIM/SIM card: 3V and 1.8V
Audio Interface	Used for earphone and handset
UART Interface	COM-serial interface for data communication (default 115200bps) Max. baud rate: 460800bps
USB Interface	USB 2.0
Signal Indication	2 LEDs are available for signal indication
Physical Characteristics	Size: 94 × 58mm

2.3. System Overview
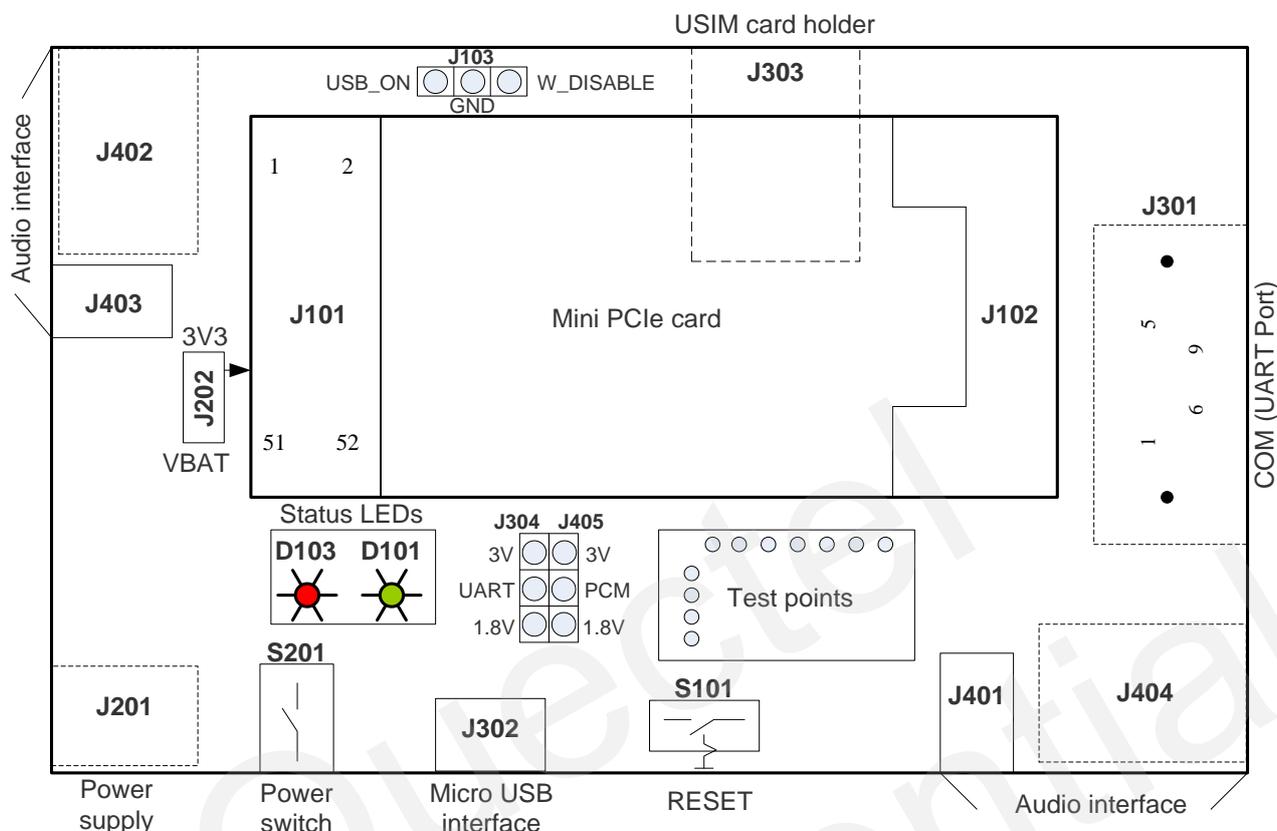
Figure 1: System Overview

2.4. Interface Overview

Table 2: Interfaces of Mini PCIe EVB

Interface	Reference Number	Description
Power Supply	J201 (bottom side)	The power jack on the EVB board. Supply voltage typically +5V
Power Switch	S201	Control power supply VBAT ON/OFF
RESET	S101	Reset button. It is used to reset the Mini PCIe module
Micro USB	J302	USB device interface It can also be used to supply power to EVB board
Audio	J401	Used for Φ3.5mm CTIA earphone by default Used to test module PCM function

	J404 (bottom side)	Used for handset Used to test module PCM function
	J402 (bottom side)	Used for handset Used to test analog audio function of UC15 Mini PCIe only
	J403	Used for Φ3.5mm CTIA earphone by default Used to test analog audio function of UC15 Mini PCIe only
USIM	J303 (bottom side)	USIM/SIM card holder
COM	J301 (bottom side)	UART port
LEDs	D103, D101	D103 is VBAT ON/OFF indicator D101 is used for indicating the status of Mini PCIe module
Mini PCIe	J101	Mini PCI Express connector for Mini PCIe module
	J102	Latch for Mini PCIe module
VBAT	J202	VBAT voltage testing
Jumpers	J304	Used for matching UART's level
	J405	Used for matching PCM's level
Reserved	J103	Reserved for module's W_DISABLE# and USB_ON function
Test Points	/	Used for UART signals and PCM signals testing

2.5. EVB View

Figure 2: EVB Top View

2.6. EVB Accessories

All the items of EVB kit are listed as below. Please contact the supplier if there is something missing.

Table 3: Accessories List

Items	Description	Quantity
Cables	USB to UART converter cable	1
	USB cable	1
	RF cable	3
Antennas	Main Antenna	2
	GNSS Antenna (passive)	1

Audio	Earphone	1
Disk	USB2.0 to RS232 driver and USB driver disk	1
Other	Bolts and nuts for fixing EVB	1

Figure 3: EVB Accessories

3 Interface Application

This chapter describes the hardware interfaces of Mini PCIe EVB, shown as follows:

- Power interface
- USB interface
- Audio interface
- USIM card interface
- UART interface

It also provides information about LEDs, jumper, button and test points to help you use the Mini PCIe EVB.

3.1. Power Interface

The power supply of Mini PCIe EVB could come from the external input which is connected with power jack or USB receptacle on the EVB board. The power supply connects to a step-down converter which can provide the supply voltage (VBAT) required for operating EVB and Mini PCIe module.

Figure 4 shows the simplified power supply schematic, and Figure 5 shows the power interface of Mini PCIe EVB.
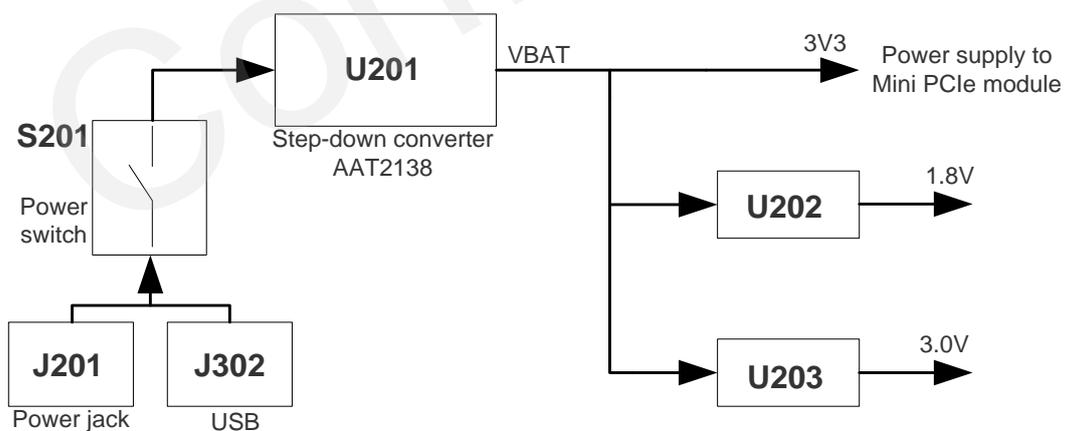
Figure 4: Simplified Power Supply Schematic
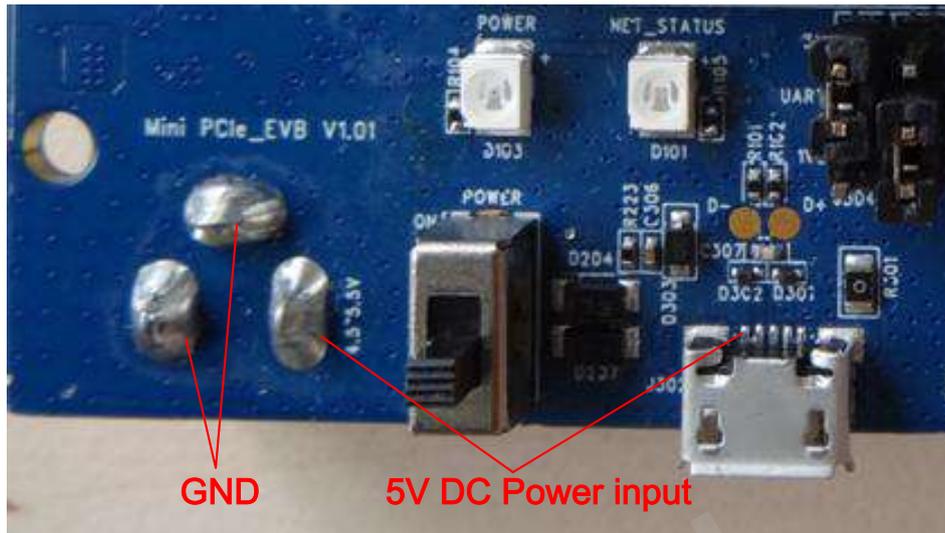
Figure 5: Power Interface

You can also use an extra +5V DC adapter to supply power, shown as Figure 6.
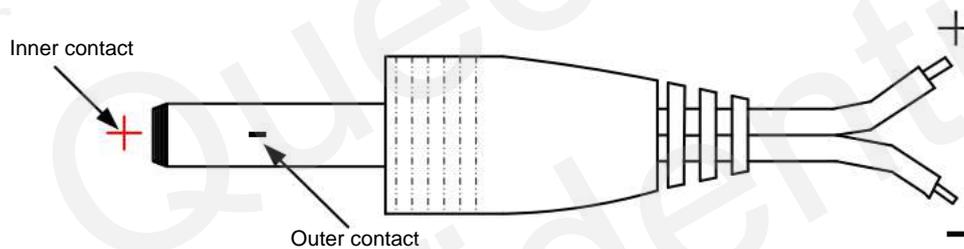
Figure 6: Power Plug

3.2. USB Device Interface

Quectel Mini PCIe module provides a USB 2.0 interface which complies with USB 2.0 standard for high-speed (480Mbps) functions. It is used for AT command, data transmission, firmware upgrade and GNSS NMEA output.

Mini PCIe EVB provides a Micro-USB receptacle J302 to connect a host device. The USB data lines USB_DP and USB_DM are connected directly to the Mini PCIe module. The USB_VBUS line can be used to supply power for EVB.
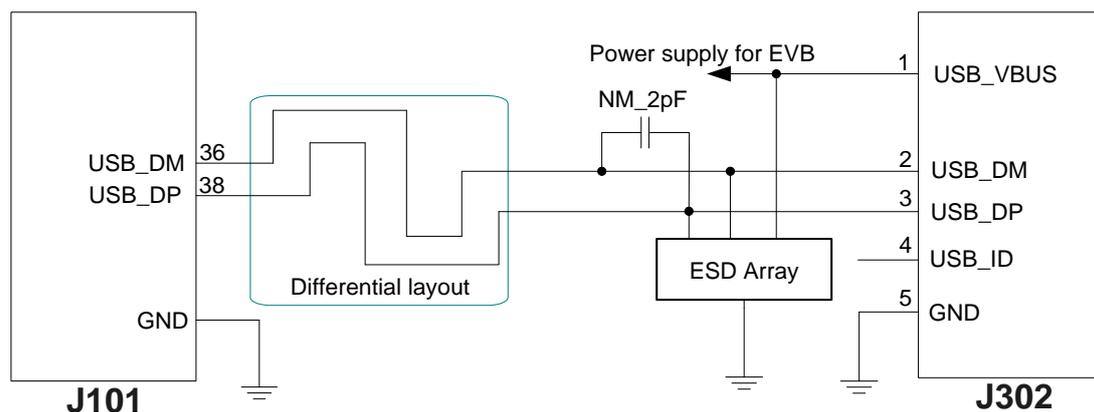
Figure 7: Circuit of USB Interface

Table 4: Pin Assignment of USB Device Interface J302

J302 Pin	Pin Name	Function
1	USB_VBUS	This pin is used to supply power for EVB
2	USB_DM	USB serial differential bus (minus)
3	USB_DP	USB serial differential bus (positive)
4	USB_ID	Not connected
5	GND	GND for USB interface

3.3. Audio Interface

Quectel Mini PCIe module provides one digital audio interface (PCM). Mini PCIe EVB is equipped with an external audio codec called ALC5616, and Figure 8 shows the audio codec circuit.

The Mini PCIe EVB provides several analog audio interfaces. J401 and J404 are used for module PCM function which is connected through codec ALC5616. J402 and J403 are used for UC15 Mini PCIe analog audio function only. This chapter gives a detailed introduction on these analog audio interfaces.
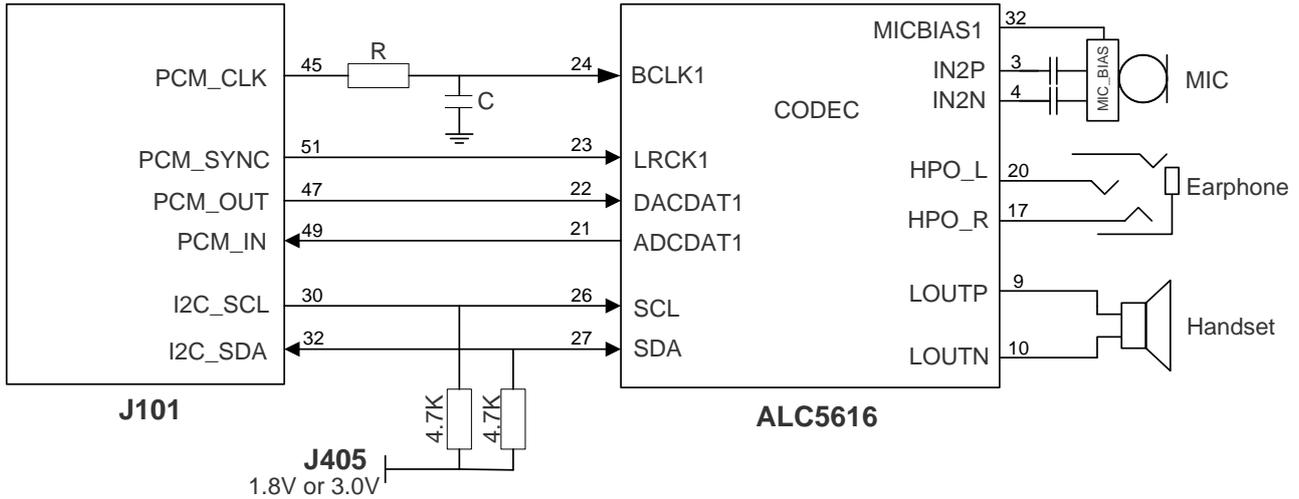
Figure 8: Audio Codec Circuit

3.3.1. Earphone (J401/J403)

A CTIA earphone can be used in audio interface J401 or J403. The name of the corresponding pins had been marked on the EVB. Figure 9 and Figure 10 show the circuit of audio interface J401 and J403 for earphone separately.
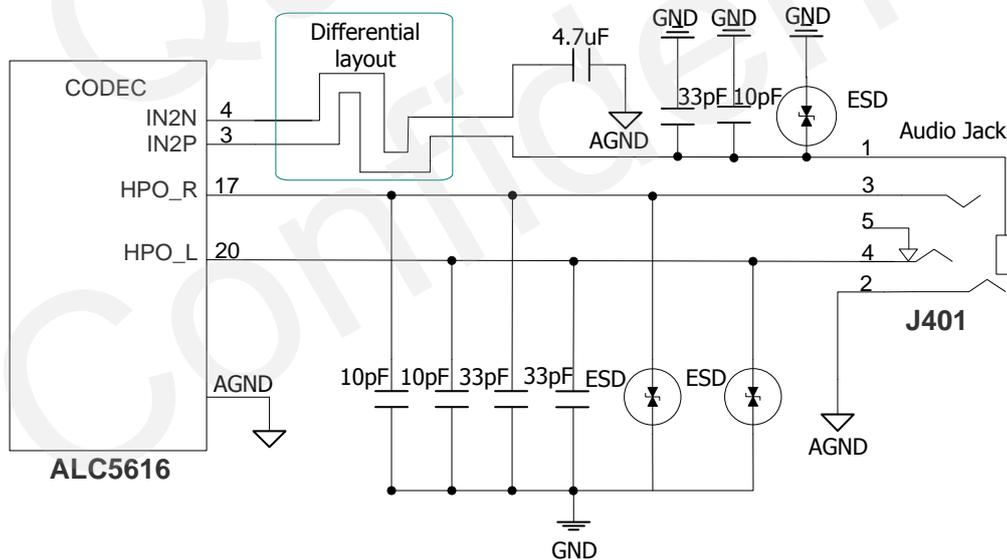
Figure 9: J401 Earphone Circuit
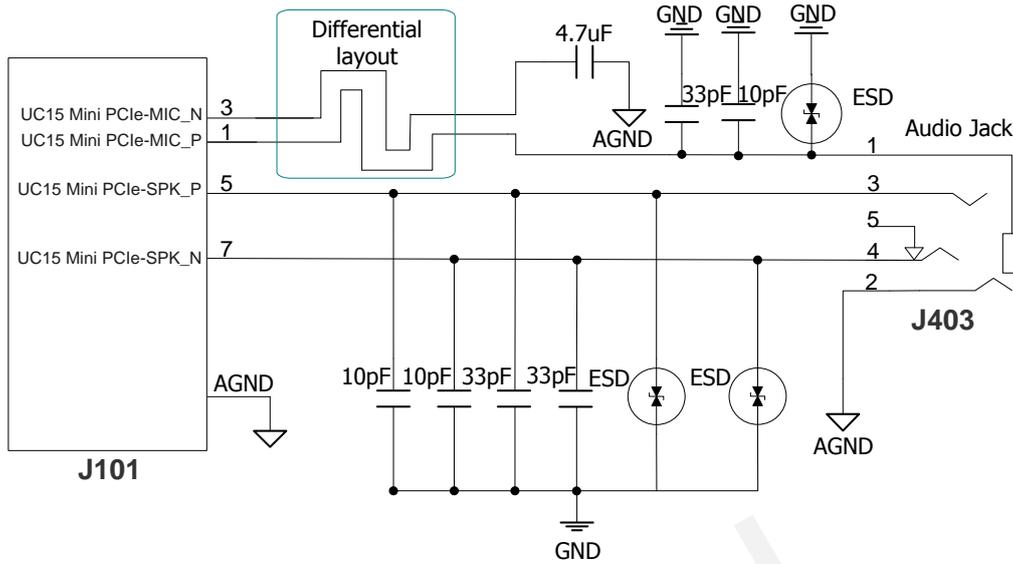
Figure 10: J403 Earphone Circuit
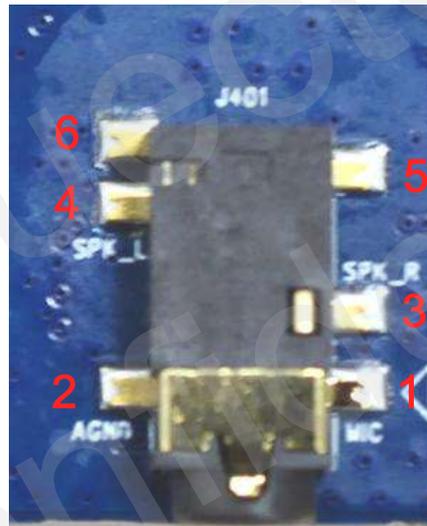
Figure 11: Pin Assignment of J401/J403

Table 5: Pin Assignment of J401/J403

J401/J403 Pin	Pin Name	Function
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	/

The following figure shows the sketch of CTIA audio plug which suits for the audio jack on Mini PCIe EVB.
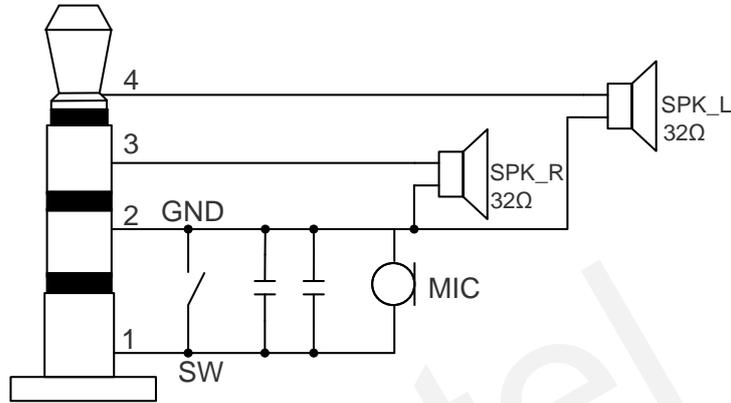
Figure 12: The Sketch of CTIA Audio Plug

3.3.2. Handset (J404/J402)

A handset can be used in audio interface J404 or J402. The name of the corresponding pins had been marked on the EVB. Figure 13 and Figure 14 show the circuit of audio interface J404 and J402 for handset separately.
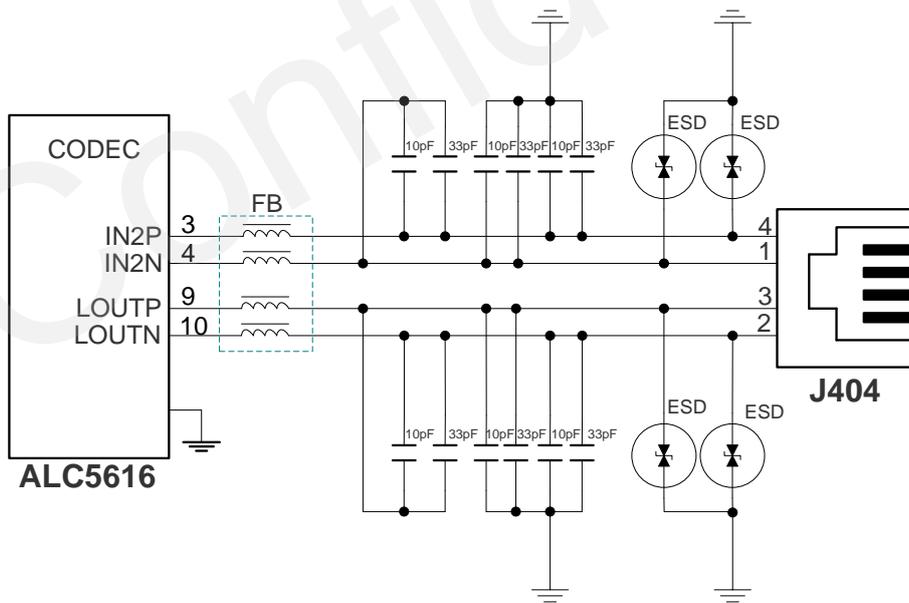


Figure 13: J404 Handset Circuit
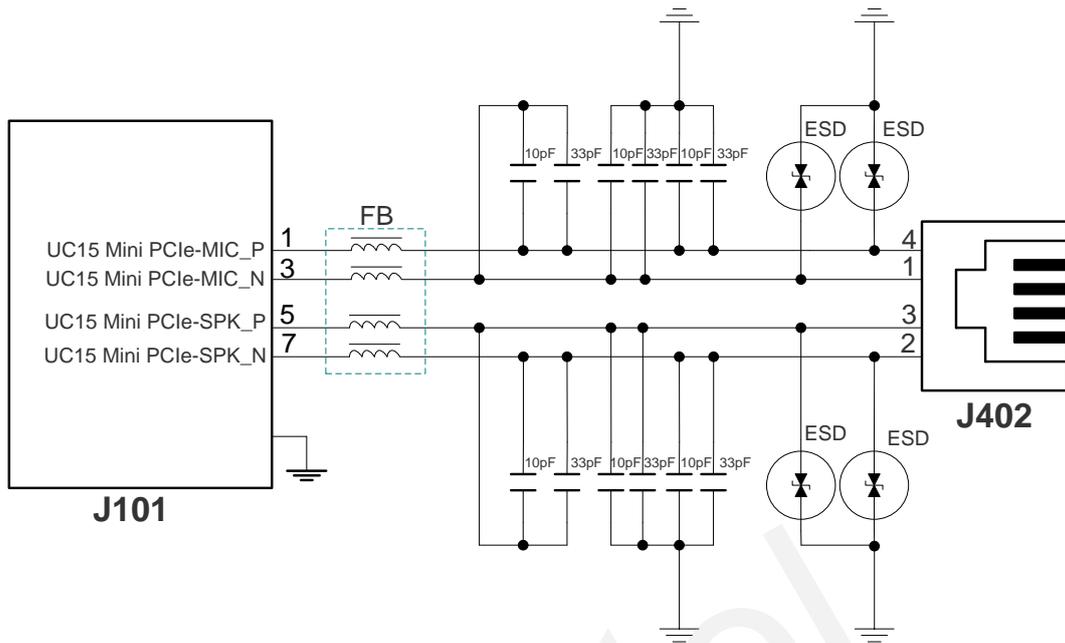
Figure 14: J402 Handset Circuit

Table 6: Pin Assignment of J404/J402

J404/J402 Pin	Pin Name	Function
1	MICN	Negative microphone input
2	SPKN	Negative speaker output
3	SPKP	Positive speaker output
4	MICP	Positive microphone input

3.4. USIM Card Interface

The Mini PCIe EVB has a 6-pin push-push type USIM/SIM card (3V or 1.8V) holder J303. Figure 15 shows the simplified interface schematic for J303.
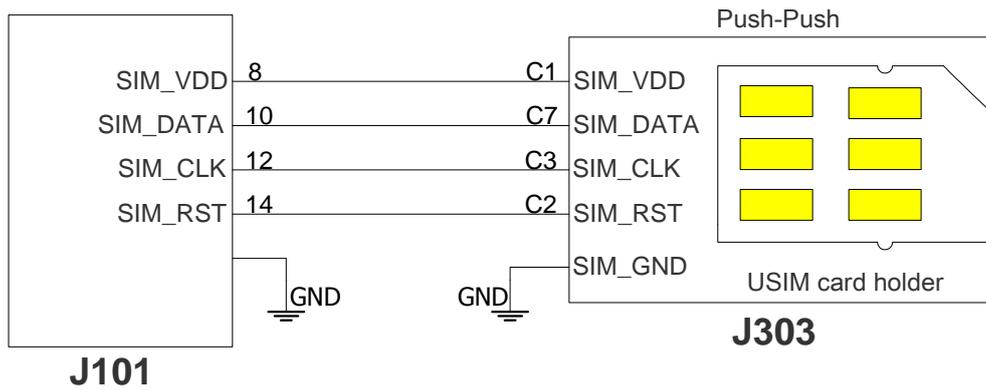
Figure 15: Simplified USIM Card Interface Schematic

Figure 16: Pins Assignment of USIM Card Holder

Table 7: Pin Assignment of J303

J303 Pin	Signal Name	I/O	Function
C1	SIM_VDD	O	USIM/SIM card power, generated by the Mini PCIe module
C2	SIM_RST	O	USIM/SIM card reset
C3	SIM_CLK	O	USIM/SIM card clock

C5	GND	/	Ground
C6	VPP	/	Not connected
C7	SIM_DATA	I/O	Data line, bi-directional
CD1		/	Not connected
CD2		/	Not connected

NOTE

Mini PCIe module does not support SIM card detection.

3.5. UART Interface

The UART interface COM of the Mini PCIe EVB is intended for the communication between the module and the host application. This interface can be used for data transmission and AT communication.

The following figure shows the UART block diagram on Mini PCIe EVB.
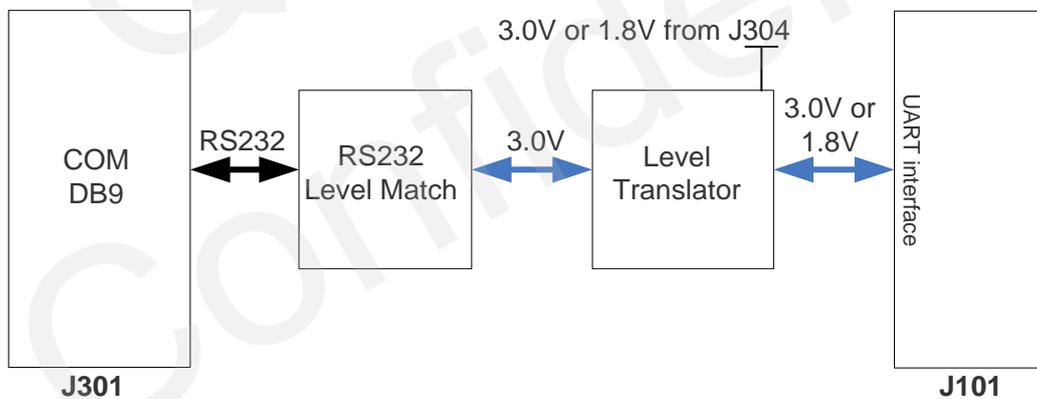
Figure 17: UART Block Diagram
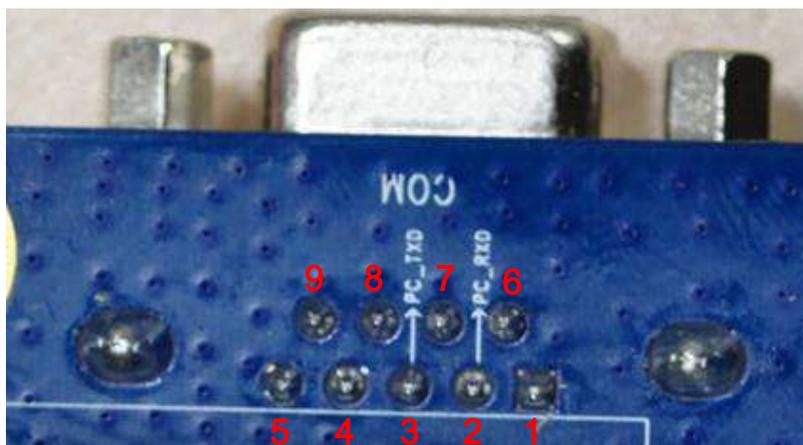
Figure 18: Main UART Port (J301)

Table 8: Pin Assignment of J301

J301 Pin	Signal Name	I/O	Description
1	RS232_DCD	O	Data carrier detection
2	RS232_RXD	I	Receive data
3	RS232_TXD	O	Transmit data
4	RS232_DTR	I	Data terminal ready
5	RS232_GND	/	GND
6	NC	/	NC
7	RS232_RTS	I	Request to send
8	RS232_CTS	O	Clear to send
9	RS232_RI	O	Ring indicator

3.6. Switch and Button

Mini PCIe EVB comprises a button (S101) and a switch (S201). Figure 19 shows the switch and button.
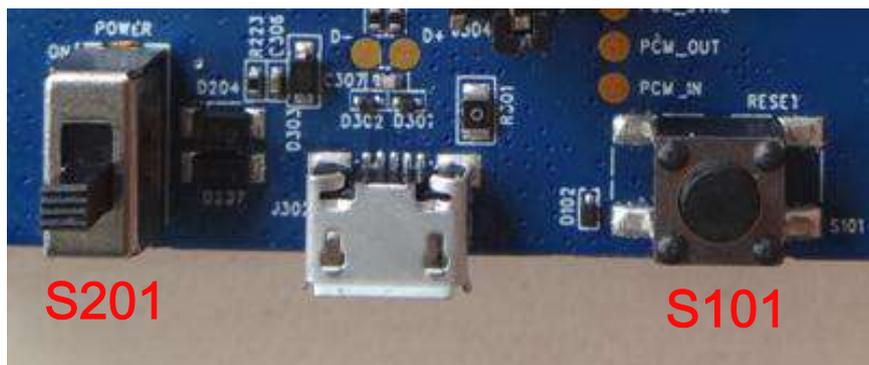
Figure 19: Switch and Button

Table 9: Description of Switch and Button

Reference	Description
S201	Control power supply VBAT ON/OFF.
S101	It is used to reset the Mini PCIe module. Press the button for more than 150ms and then release to reset the module. Please note that press time cannot be more than 200ms for UC15 Mini PCIe, otherwise the module will be powered off.

3.7. Status LEDs

Mini PCIe EVB comprises two status LEDs (D103, D101). Figure 20 shows the position of LEDs.
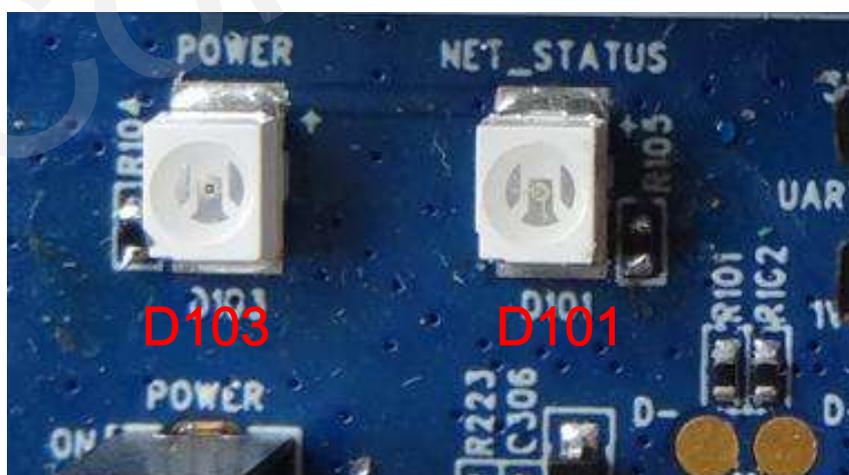
Figure 20: Status LEDs

Table 10: Description of Status LEDs

Reference	Description
D103	Indicate the power supply is ready Bright: VBAT ON Extinct: VBAT OFF
D101	Indicate the module network registration mode Bright: registered to network Extinct: not registered or in airplane mode

3.8. Jumpers

Mini PCIe EVB provides jumper J304 and jumper J405 to match up the UART's and PCM's level with Mini PCIe module. The following table shows the jumper operation of J304/J405.

Table 11: Jumper Operation of J304/J405

| Module Interface Level	Jumper J304	Jumper J405
3.3V UART Level	Connects UART and 3V	/
1.8V UART Level	Connects UART and 1.8V	/
3.3V PCM Level	/	Connects PCM to 3V
1.8V PCM Level	/	Connects PCM to 1.8V

NOTES

1. By default, Jumper J304 is set to UART and 3V, and Jumper J405 is set to PCM and 1.8V.
2. If you want to enable W_DISABLE# function, please connect W_DISABLE and GND by the reserved Jumper J103.

3.9. Test Points

Mini PCIe EVB provides some test points for some signals. It can help to obtain the corresponding waveform.
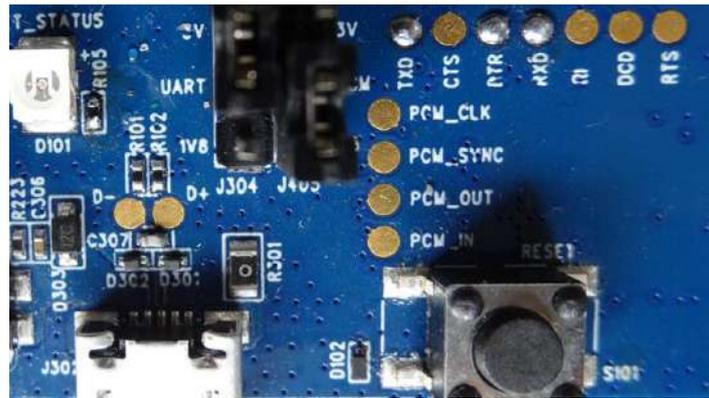
Figure 21: Test Points

Table 12: Test Points

Test Points Name	Description
TXD	Connected directly to Mini PCIe UART's TXD
CTS	Connected directly to Mini PCIe UART's RTS
DTR	Connected directly to Mini PCIe UART's DTR
RXD	Connected directly to Mini PCIe UART's RXD
RTS	Connected directly to Mini PCIe UART's CTS
DCD	Connected directly to Mini PCIe UART's DCD
RI	Connected directly to Mini PCIe UART's RI
PCM_CLK	Connected directly to Mini PCIe PCM's PCM_CLK
PCM_SYNC	Connected directly to Mini PCIe PCM's PCM_SYNC
PCM_OUT	Connected directly to Mini PCIe PCM's PCM_OUT
PCM_IN	Connected directly to Mini PCIe PCM's PCM_IN
D-	Connected directly to Mini PCIe USB's USB_DM
D+	Connected directly to Mini PCIe USB's USB_DP
VBAT	Connected directly to the output of AAT2138
GND	Ground

4 Operation of Mini PCIe Module

4.1. Power On Mini PCIe Module

1. Connect the Mini PCIe module to the connector J101 on Mini PCIe EVB, charge with USB cable or +5V power adapter and insert SIM card to J303.

2. Switch S201 to ON state, D103 will be light and indicates power supply for EVB is ready. The module will be powered on automatically. D101 (NET_STATUS) will be light after the module registered to the network successfully.

Table 13: Indication of D101

Reference	State	Description
D101 NET_STATUS	Always ON	Registered to network
	Always OFF	Others

4.2. Power Off Mini PCIe Module

There are two ways to power off Mini PCIe module.

One way is to execute AT command **AT+QPOWD** (Refer to *document [2]*). It is the best and safest approach. It logs off the network and saves data before shutdown. But Mini PCIe module will be powered on again after shutdown.

The other way is to switch S201 (POWER) to OFF state directly, but this way is not recommended. Please switch S201 to OFF after shutting down the module by executing AT command **AT+QPOWD**.

4.3. Reset Mini PCIe Module

The emergency restart option is only used in case of emergency. For example, the software does not respond for more than 5 seconds due to some serious problems.

Pressing the key S101 for more than 150ms then releasing will reset the Mini PCIe module. This may cause the loss of information stored in the memory since the reset has been initialized.

4.4. Communication via USB or UART Interface

4.4.1. Communication via USB Interface

1. Power on the Mini PCIe module.
2. Connect EVB and PC with USB cable through USB interface, refer to *document [1]* to install USB driver from the Driver Disk.
3. Configure AT Command Window, select correct communication port, and operate the Mini PCIe module via AT commands.

4.4.2. Communication via UART Interface

1. Install the USB-to-RS232 driver from the Driver Disk.
2. Connect the UART interface to PC with USB-to-RS232 converter cable.
3. Configure AT Command configuration tool, set correct baud rate (such as 115200bps) and COM number which can be checked by the Device Manager on PC.
4. Power on the Mini PCIe module and operate the module via AT commands.

4.5. Firmware Upgrade

Mini PCIe Module upgrades firmware via USB port by default, please follow the procedures below to upgrade firmware.

1. Open the firmware upgrade tool "*QFlash*" in the PC and power on the Mini PCIe module.
2. Click the "*COM Port*" dropdown list and select the USB DM port.
3. Click the "*Load FW Files*" button to choose the firmware document package.
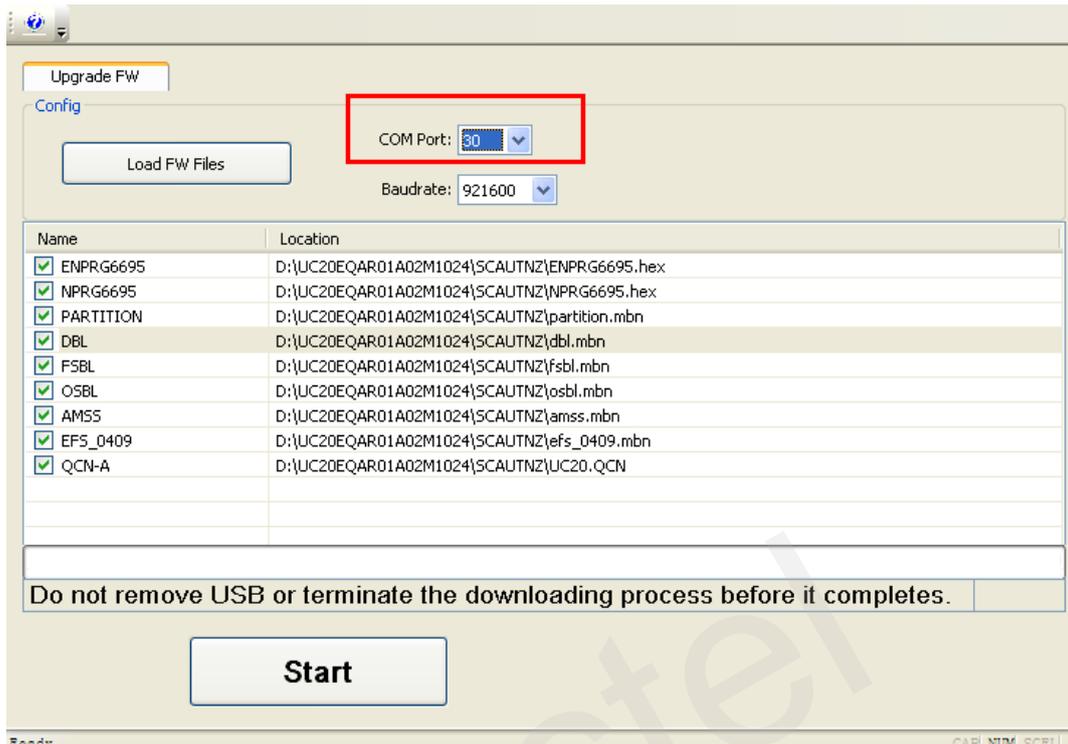4. Click the "*Start*" button to upgrade the firmware.

Figure 22: Select the USB DM Port to Update Firmware

5 EVB Accessories Assembly

Figure 23: EVB and Accessories Equipment

6 Appendix A Reference

Table 14: Related Documents

SN	Document Name	Remark
[1]	Quectel_XX_Drivers_for_Windows_Installation _Guide	XX represents UC20, UC15 and EC20 etc. Install USB driver of module in Windows XP/Vista/7/8.
[2]	Quectel_XX_AT_Commands_Manual	XX represents UC20, UC15 and EC20 etc.
[3]	Quectel_XX_Mini_PCIe_Hardware_Design	XX represents UC20, UC15 and EC20 etc.