UMTS&LTE 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	Huik LI	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 Quectel's UMTS&LTE module. The UMTS&LTE evaluation board is an assistant system integrator for developing and evaluating products based on Quectel Wireless Modules.

This document is applicable to the following modules:

- UC20 series modules
- UGxx series modules
- EC20 series 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 USIM 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 UMTS&LTE-EVB kit for testing UMTS and LTE modules. This EVB can test basic functionalities of these modules.

2.1. Key Features

Table 1: Features

Features	Implementation
Power Supply	● DC supply 4.5~5.5V typically 5V ● VBAT: 3.8V at J102
USIM Interface	● Support card detection ● Support USIM/SIM cards: 3.0V and 1.8V
Audio Interface	● Analog interface used for loud speaker, earphone and handset
UART Interface	● Two UART interfaces: COM1-serial interface for data communication COM2-serial interface for debug purpose (reserved) ● Max. baud rate for COM1: 460800bps
USB Interface	● USB 2.0
Signal Indication	● 5 LEDs are available for signal indication
Physical Characteristics	● Size: 13.6 × 10.5cm

2.2. System Overview
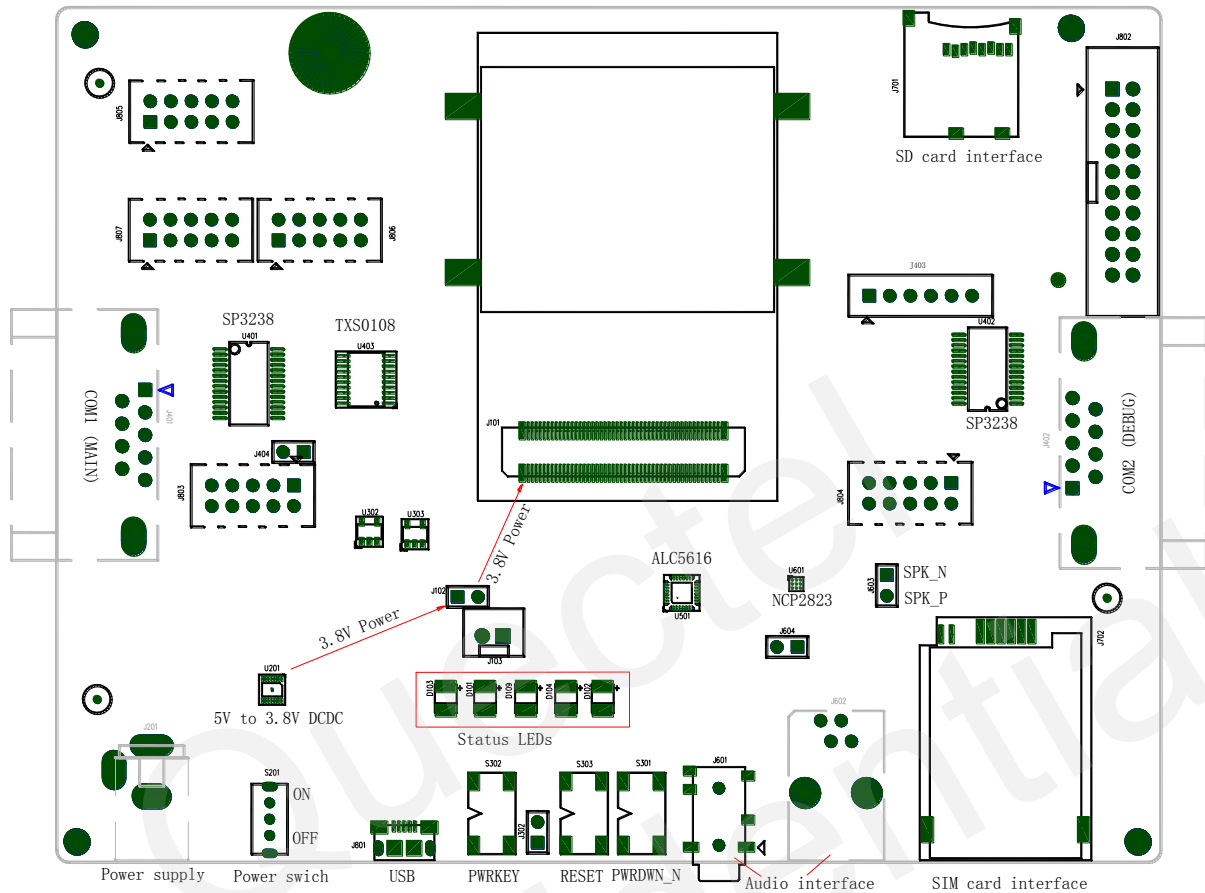
Figure 1: System Overview

2.3. Interface Overview

Table 2: Interfaces of UMTS&LTE EVB

Interface	Reference Number	Description
Power Supply	J201 (bottom side)	The power jack on the EVB board. Supply voltage typically +5V
	J801	USB_VBUS supply +5V voltage
Power Switch	S201	Control power supply VBAT ON/OFF
PWRKEY	S302	PWRKEY push button It's used to turn on/off the UMTS&LTE module

	J302	Jumper is used to connect PWRKEY to GND
PWRDWN_N	S301	It's used to turn off module[1]
RESET	S303	Reset push button. It's used to reset the UMTS&LTE module
Micro USB	J801	USB device interface
Audio	J603	Used for loud speaker
	J601	Used for earphone
	J602 (bottom side)	Used for handset
USIM	J702	USIM card holder
COM1	J401 (bottom side)	Main UART port
COM2	J402 (bottom side)	Debug UART port
LEDs	D103, D101, D109, D104, D102	D103 is VBAT ON/OFF indicator. D101 is used for indicating whether the UMTS&LTE module is turned on. D109 is used for whether module is in sleep mode. D104 and D102 are used for indicating the net status of UMTS&LTE module.
UMTS&LTE	J101	UMTS&LTE module connector
VBAT	J102	Jumper used for VBAT voltage test
Test Points	J403, J802, J803, J804, J805, J806, J807	These are test pins

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NOTE

[1] Only some of Quectel modules have this function, please refer to Quectel module hardware design for more details.

2.4. EVB View
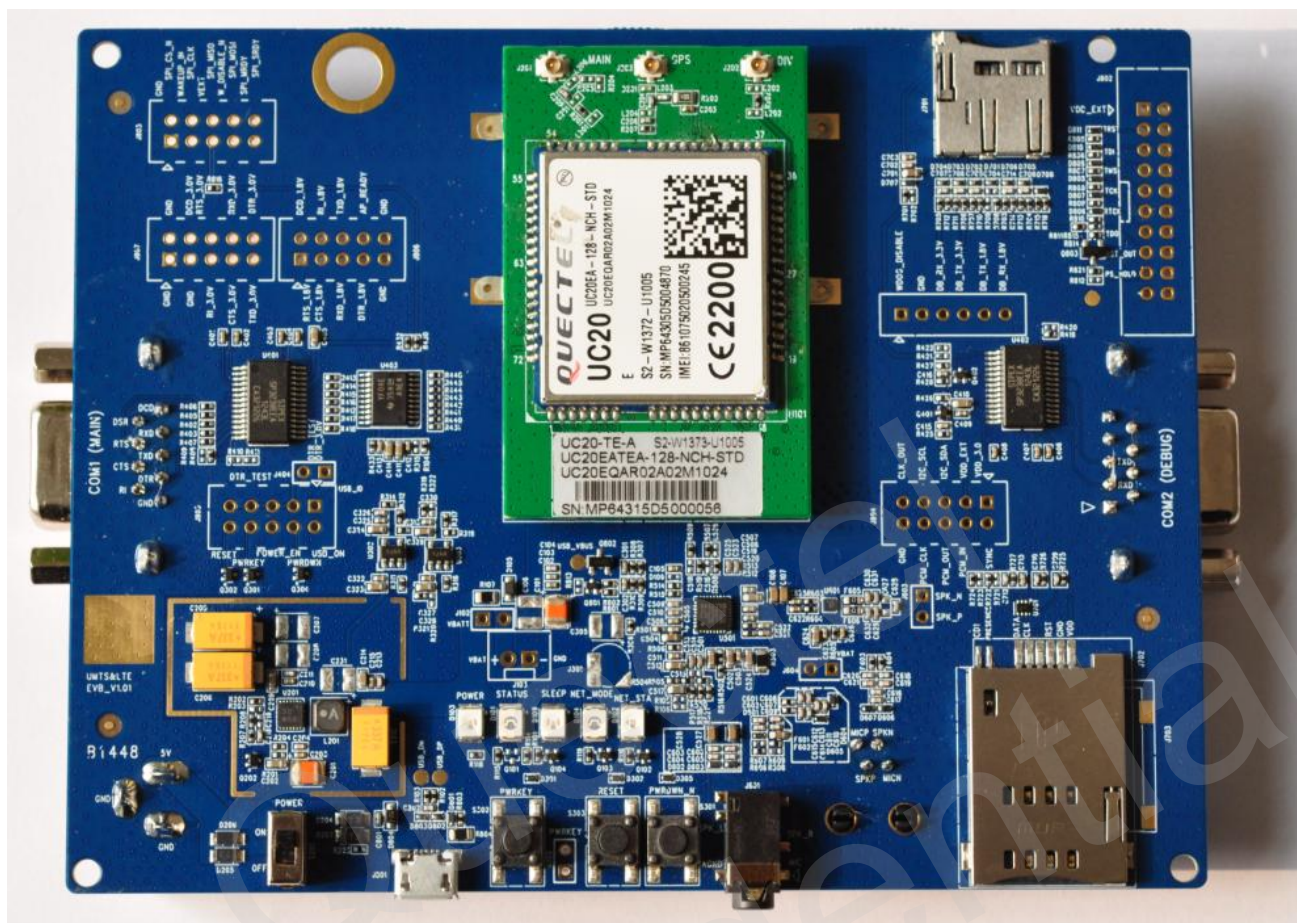
Figure 2: EVB Top View

2.5. EVB Accessories

All the items of EVB kit are listed in Table 3 and Figure 3 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

NOTE

The main antenna can also be used as diversity reception.

3 Interface Application

This chapter describes the hardware interfaces of UMTS&LTE EVB, shown as follows:

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

It also provides information about LEDs, buttons and test points to help you use the UMTS&LTE EVB.

3.1. Power Interface

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

Figure 4 shows the simplified power supply schematic, and Figure 5 shows the power interface of UMTS&LTE EVB.
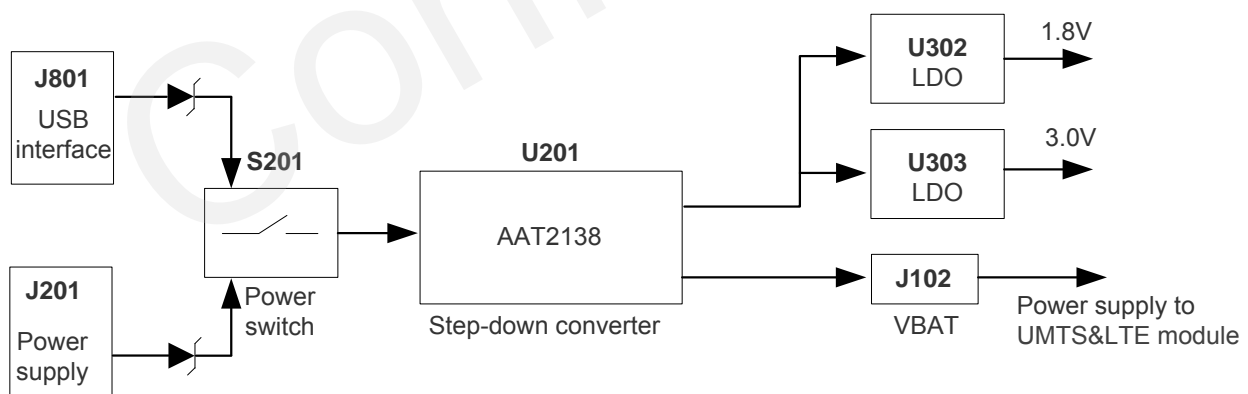
Figure 4: Simplified Power Supply Schematic

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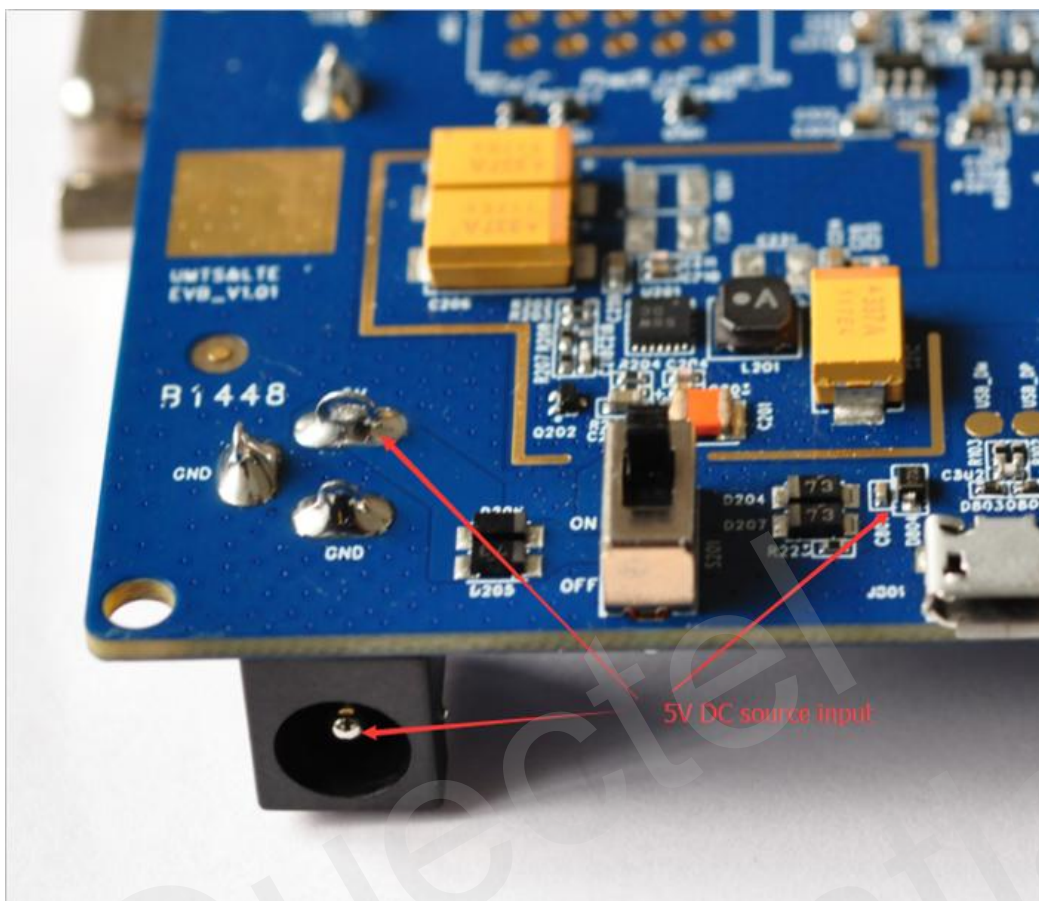
You can also use an extra +5V DC adapter to supply power, shown as Figure 6.
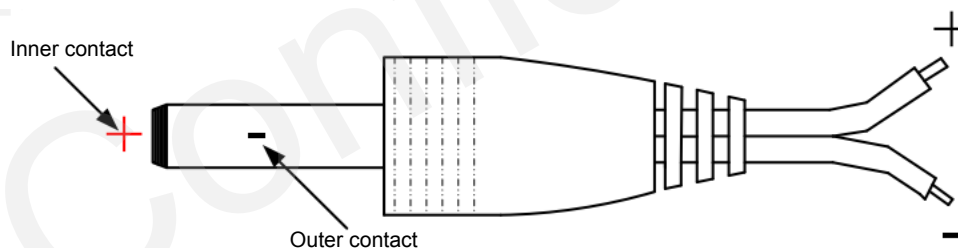

Figure 6: Power Plug

3.2. USB Device Interface

UMTS&LTE module provides a USB 2.0 interface which complies with USB 2.0 standard and supports high-speed (480Mbps), full-speed (12Mbps) and low-speed (1.5Mbps) mode. It is used for AT command, data transmission, firmware upgrade and GNSS NEMA output.

UMTS&LTE EVB provides a Micro-USB receptacle J801 to connect a host device. The USB data lines USB_DP and USB_DM are connected directly to the UMTS&LTE module.
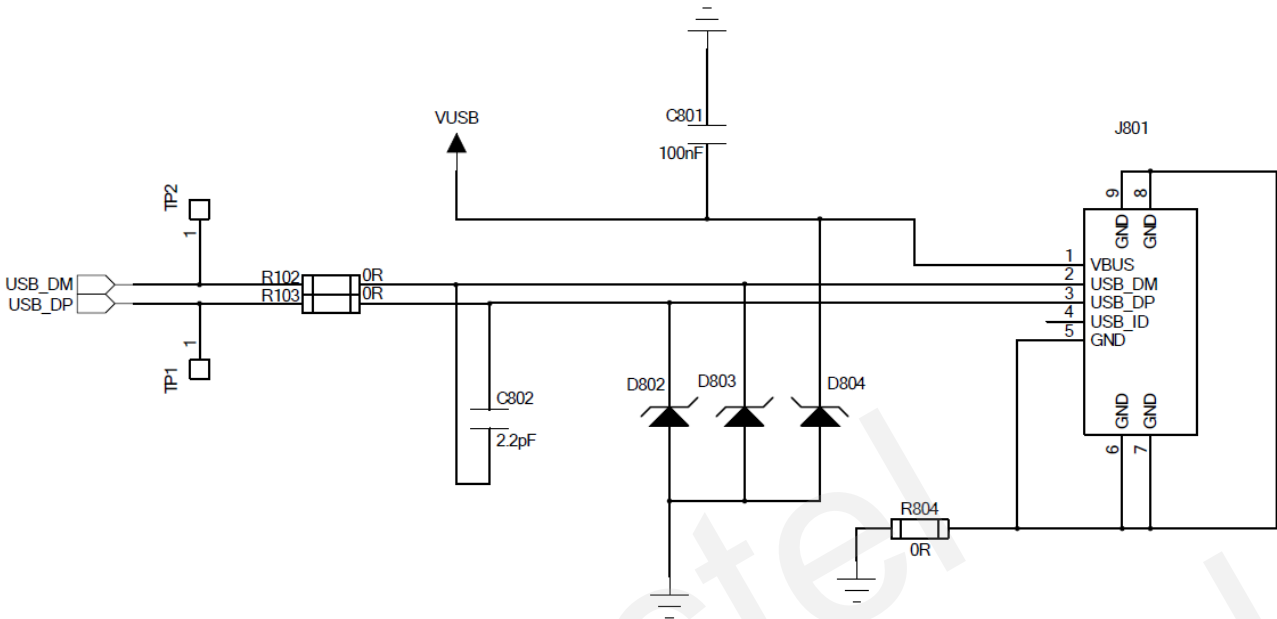
Figure 7: Circuit of USB Interface

Table 4: Pin Assignment of USB Device Interface J801

J601 Pin	Pin Name	Function
1	USB_VBUS	This pin is used for USB detection and power supply
2	USB_DM	USB serial differential bus (minus)
3	USB_DP	USB serial differential bus (positive)
4	USB_ID	Reserved
5	GND	GND for USB interface

3.3. Audio Interface

UMTS&LTE module provides digital audio interface (PCM). UMTS&LTE EVB is equipped with an external audio codec called ALC5616. Figure 8 shows the audio codec circuit.

The UMTS&LTE EVB provides three analog audio interfaces J601, J602, J603. This chapter gives a detailed introduction on these analog audio interfaces.
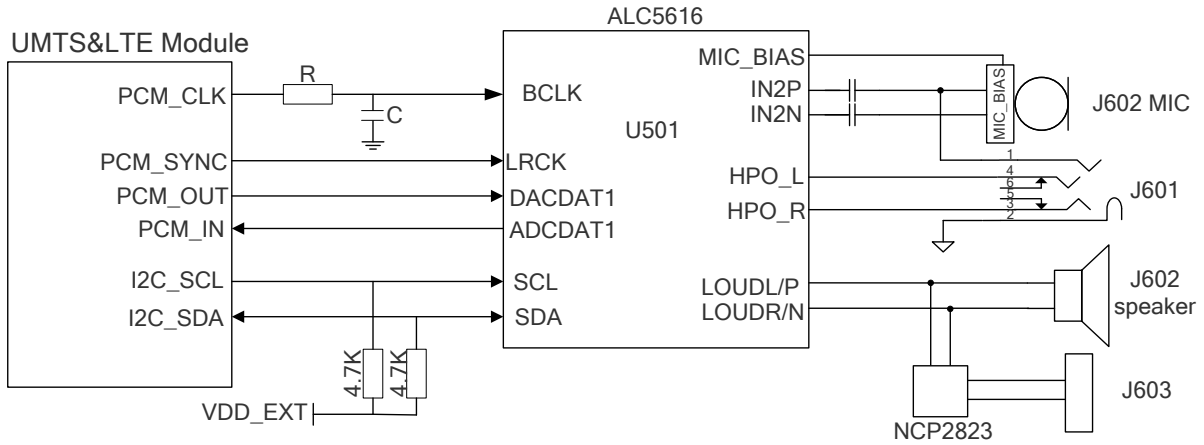
Figure 8: Audio Codec Circuit

3.3.1. Loud Speaker (J603)

Figure 9 shows the loud speaker circuit with external audio Class-D amplifier. And the name of the J603 pins has been marked on the EVB.
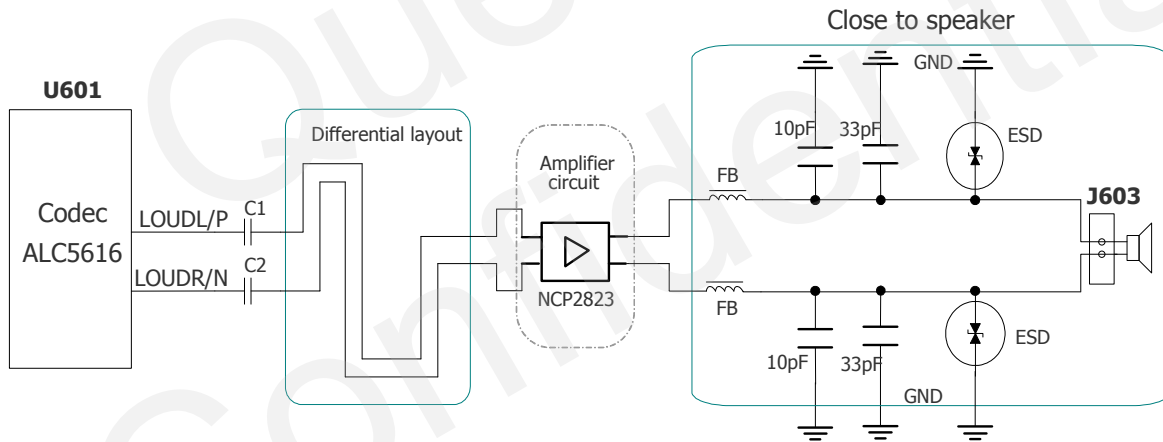
Figure 9: Loud Speaker Circuit

3.3.2. Earphone (J601)

An earphone can be used in audio interface J601. Figure 10 shows the circuit of audio interface J601 for earphone:
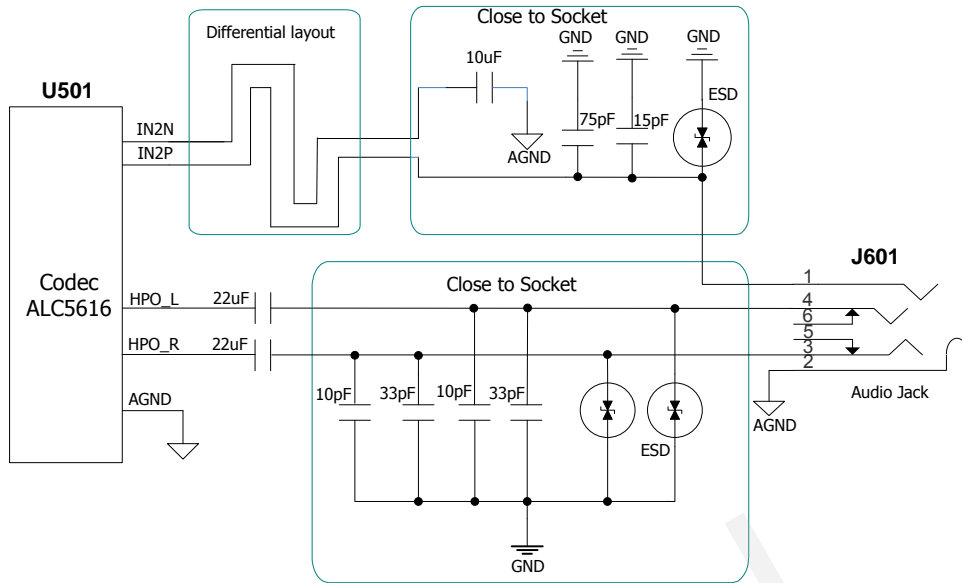
Figure 10: Earphone Circuit

Figure 11: Pin Assignment of J601

Table 5: Pin Assignment of J601

J404 Pin	Pin Name	Function
1	MICP	Positive microphone input
2	AGND	Dedicated GND for Audio

3, 5	SPKP	Speaker output right channel
4, 6	SPKL	Speaker output left channel

The following figure shows the sketch of audio plug which suits for the audio jack on UMTS&LTE EVB.
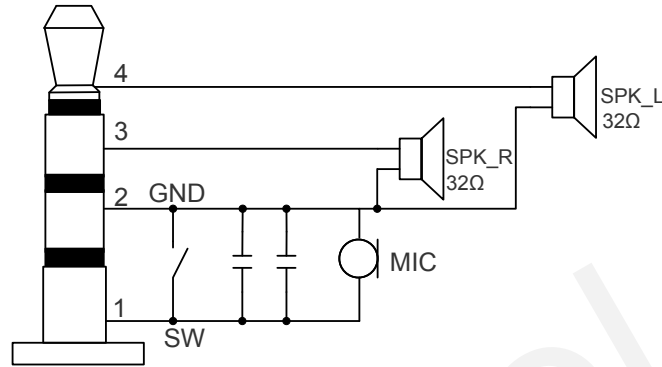
Figure 12: The Sketch of Audio Plug

3.3.3. Handset (J602)

A handset can be used in audio interface J602. Figure 13 shows the circuit of audio interface J602 for handset. And the name of the corresponding pins has been marked on the EVB.
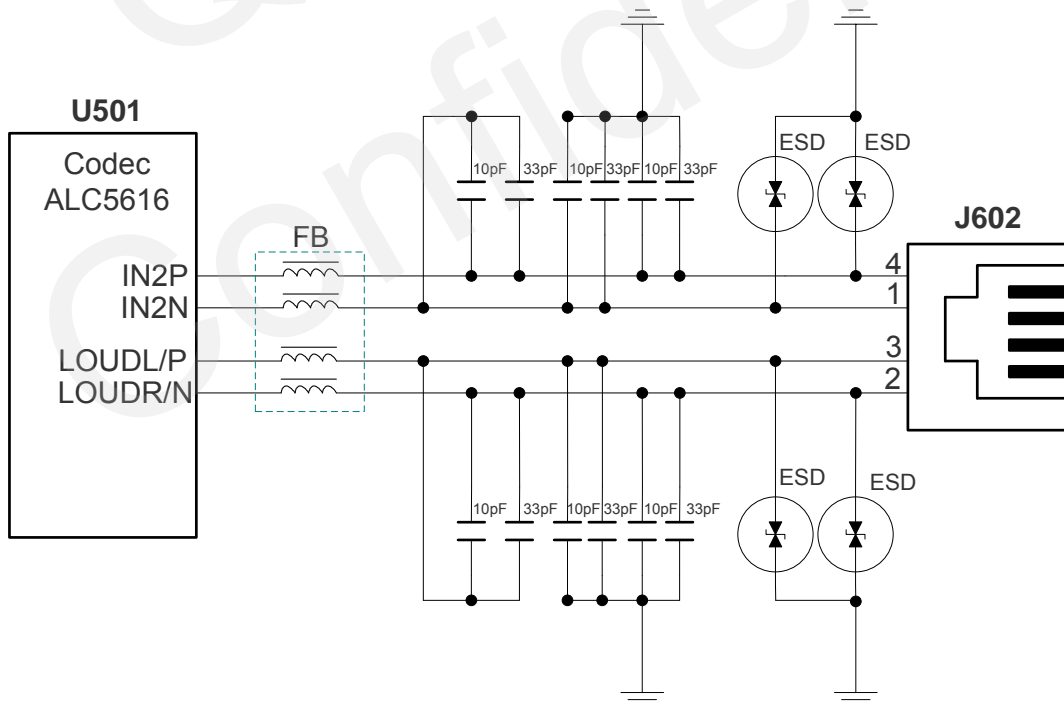
Figure 13: Handset Circuit

Table 6: Pin Assignment of J602

J401 Pin	Pin Name	Function
1	MICN	Negative microphone input
2	SPKN	Negative loud speaker output
3	SPKP	Positive loud speaker output
4	MICP	Positive microphone input

3.4. USIM Card Interface

The UMTS&LTE EVB has a USIM card interface. A suitable USIM card (3V or 1.8V) is required to start the UMTS&LTE module. Figure 14 shows the simplified interface schematic for J702.
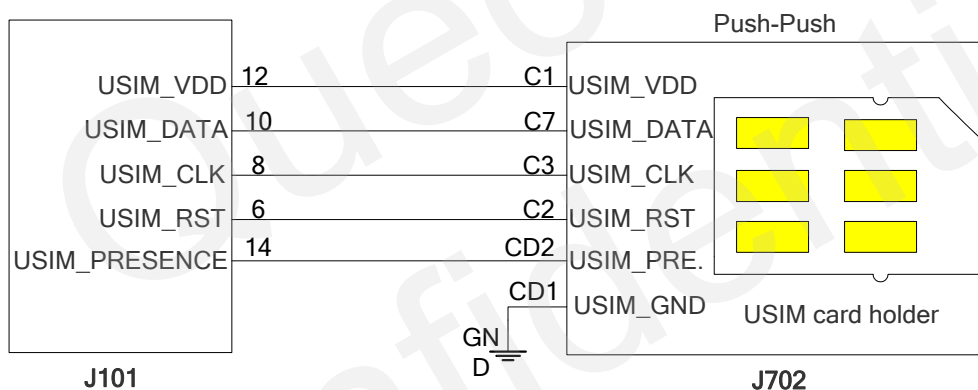
Figure 14: Simplified USIM Card Interface Schematic
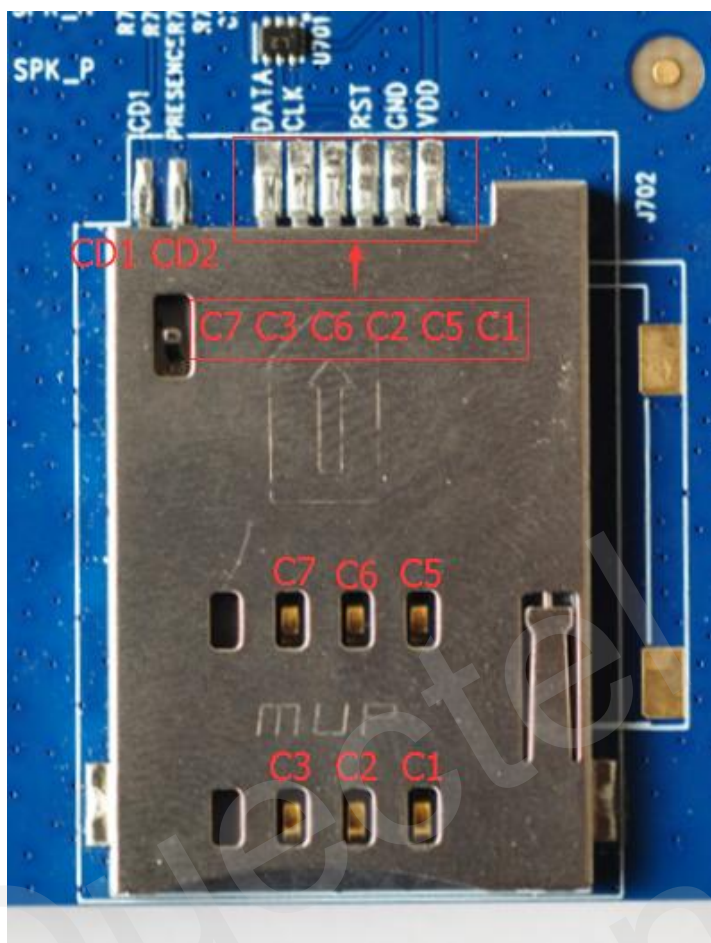
Figure 15: Pins Assignment of USIM Card Holder

Table 7: Pin Assignment of J702

J702 Pin	Signal Name	I/O	Function
C1	USIM_VDD	O	USIM/SIM card power
C2	USIM_RST	O	USIM/SIM card reset
C3	USIM_CLK	O	USIM/SIM card clock
C5	GND	/	Ground
C6	VPP	/	Not connected
C7	USIM_DATA	I/O	Data line, bi-directional
CD1	GND	GND	USIM card detection
CD2	USIM_PRESENCE	I	USIM card detection

> **NOTE**
>
> The USIM card detection function of UMTS&LTE module is disabled by default.

3.5. UART Interface

UMTS&LTE EVB offers two UART interfaces, COM1 (Main UART port) and COM2 (Debug UART port).

The UART interface COM1 of the UMTS&LTE 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 UMTS&LTE EVB.
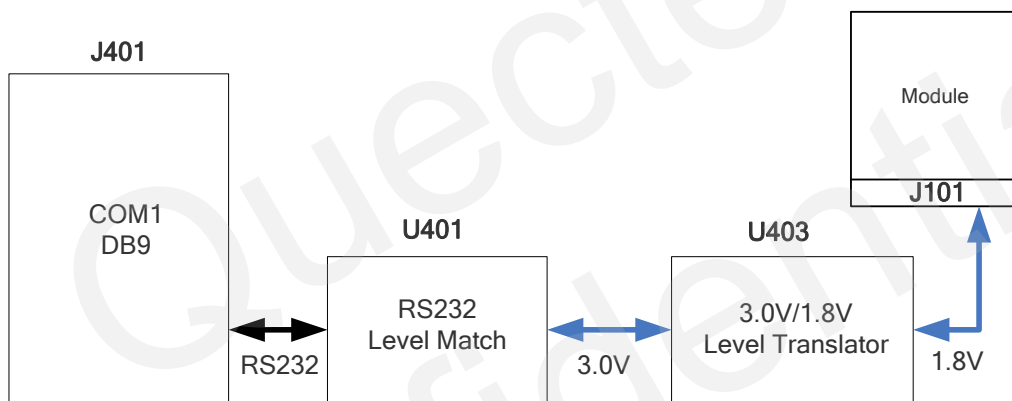
Figure 16: UART Block Diagram

Figure 17: Main UART Port (J401)

Table 8: Pin Assignment of J401

J401 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 Buttons

UMTS&LTE EVB comprises three buttons (S301/S302/S303) and one switch (S201). Figure 18 shows the switch and buttons.
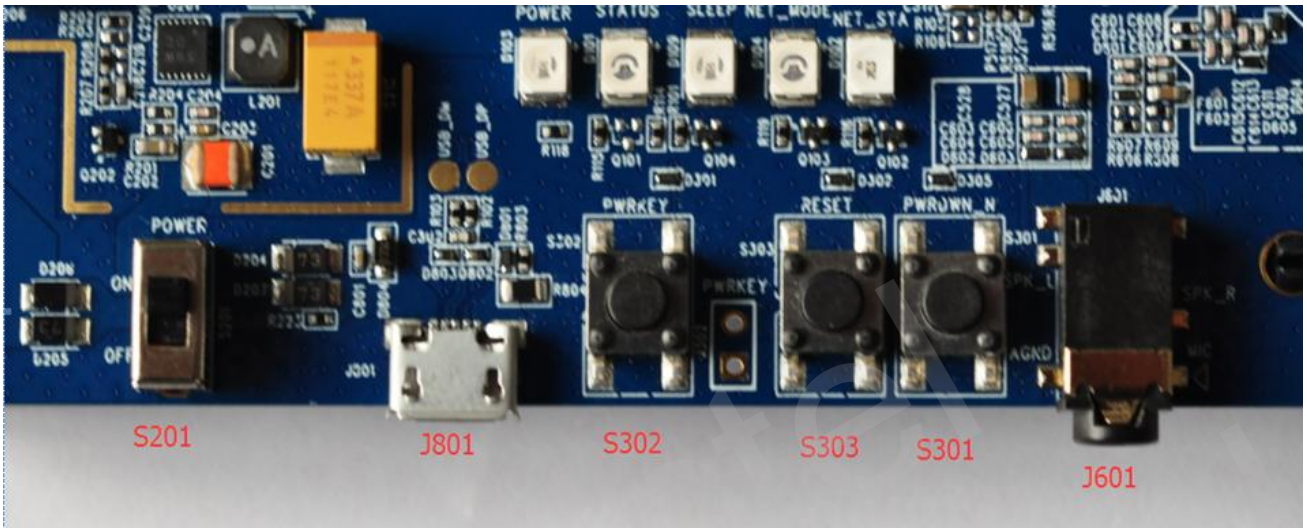
Figure 18: Switch and Buttons

Table 9: Description of Switch and Buttons

Reference	Description
S201	Control power supply VBAT ON/OFF
S302	Used to turn on/off the UMTS&LTE module
S303	Used to reset the UMTS&LTE module
S301	Used to turn off the UMTS&LTE module[1]

NOTE

[1] Only some of Quectel modules have this function, please refer to Quectel module Hardware Design for more details.

3.7. Status LEDs

UMTS&LTE EVB comprises several status LEDs (D103, D101, D109, D104, D102). Figure 19 shows the position of LEDs.

Figure 19: Status LEDs

Table 10: Description of Status LEDs

Reference	Used for UMTS&LTE Module
D103	Indicate the power supply for module is ready Bright: VBAT ON Extinct: VBAT OFF
D101	Indicate the module operation status Bright: module is powered on Extinct: module is powered down
D109	Indicate the sleep status Bright: module is in sleep mode Extinct: module is not in sleep mode
D104, D102	Indicate the module network registration mode The indication varies in different modules. Refer to related Hardware Design for detailed information

3.8. Test Points

J403, J802, J803 and J805 are internally used. Figure 20 and 21 shows J804, J806 and J807 test points.
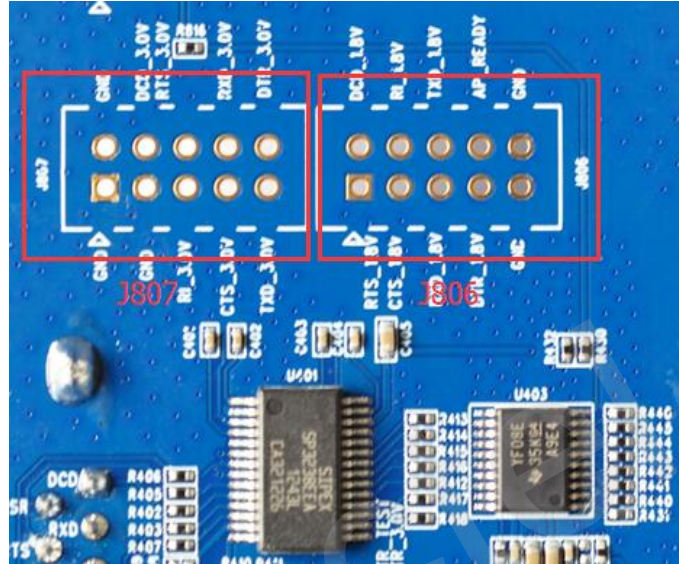

Figure 20: Test Points J806 and J807

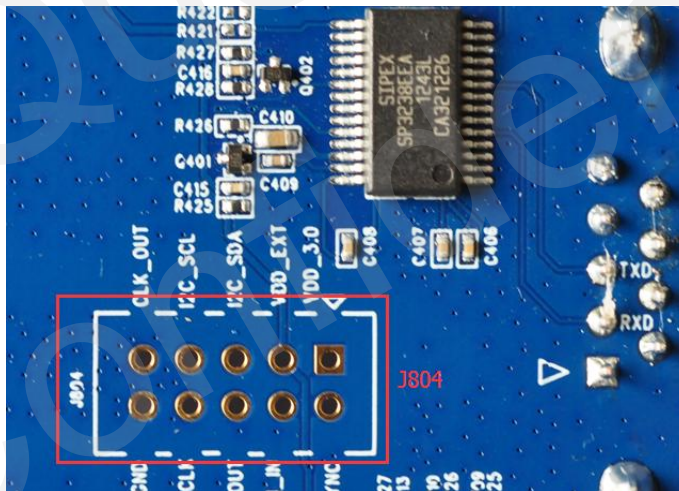**Figure 21: Test Points J804**

Table 11: Pin Assignment of J804, J806 and J807

J804 Pin	Pin Name	Description
1	VDD_3.0	3.0V power supply from U303
2	PCM_SYNC	Connected directly to module's PCM_SYNC

3	VDD_EXT	Connected directly to module's VDD_EXT
4	PCM_IN	Connected directly to module's PCM_IN
5	I2C_SDA	Connected directly to module's I2C_SDA
6	PCM_OUT	Connected directly to module's PCM_OUT
7	I2C_SCL	Connected directly to module's I2C_SCL
8	PCM_CLK	Connected directly to module's PCM_CLK
9	CLK_OUT	RESERVED
10	GND	GND
J806 Pin	**Pin Name**	**Description**
1	RTS_1.8V	Connected directly to module's RTS
2	DCD_1.8V	Connected directly to module's DCD
3	CTS_1.8V	Connected directly to module's CTS
4	RI_1.8V	Connected directly to module's RI
5	RXD_1.8V	Connected directly to module's RXD
6	TXD_1.8V	Connected directly to module's TXD
7	DTR_1.8V	Connected directly to module's DTR
8	AP_READY	Connected directly to module's AP_READY
9	GND	GND
10	GND	GND
J807 Pin	**Pin Name**	**Description**
1	GND	GND
2	GND	GND
3	GND	GND
4	DCD_3.0V	3.0V DCD signal
5	RI_3.0V	3.0V RI signal

6	RTS_3.0V	3.0V RTS signal
7	CTS_3.0V	3.0V CTS signal
8	RXD_3.0V	3.0V RXD signal
9	TXD_3.0V	3.0V TXD signal
10	DTR_3.0V	3.0V DTR signal

4 Operation of UMTS&LTE Module

4.1. Power On

1. Connect the UMTS&LTE module to the connector J101 on UMTS&LTE EVB, charge with USB cable or +5V power adapter and pull S201 to ON state, then D103 will be light.

2. Press the S302 (PWRKEY) for at least 100ms. The module will be in the power-on mode and D101 (STATUS) will be light.

The follow tables show the module's working state which can be judged by D102 and D104.

Table 12: UMTS&LTE Module Indication of D102 and D104

Reference	State	Description
D102 NET_STATUS	0.2s On/1.8s OFF	Network searching
	1.8s On/0.2s OFF	Idle mode
	0.125s On/0.125s OFF	Data transfer is ongoing with GSM/3G/4G network
	Always ON	Voice calling
D104 NET_MODE	Always ON	Registered to 3G network (UC20) Registered to 4G network (EC20)
	Always OFF	Others

NOTE

The indication of D102 and D104 varies in different modules. Please refer to related Hardware Design for detailed information.

4.2. Power Off UMTS&LTE Module

There are several ways to power off UMTS&LTE module.

One way is to execute AT command **AT+QPOWD**. It is the best and safest approach. It logs off the network and saves data before shutdown.

The other way is to press down S302/S301, the module will be shut down.

4.3. Reset UMTS&LTE 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 S303 (more than 150ms) then releasing it to reset UMTS&LTE 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 UMTS or LTE module.
2. Connect EVB and PC with USB cable through USB interface, install USB driver from the Driver Disk.
3. Configure AT Command Window, select correct port and operate the UMTS or LTE 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 Window, set correct baud rate (such as 115200bps) and COM number which can be checked by the Device Manager on PC.
4. Power on the UMTS or LTE module and operate the UMTS or LTE module via AT commands.

4.5. Firmware Upgrade

UMTS&LTE 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 UMTS/LTE 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.
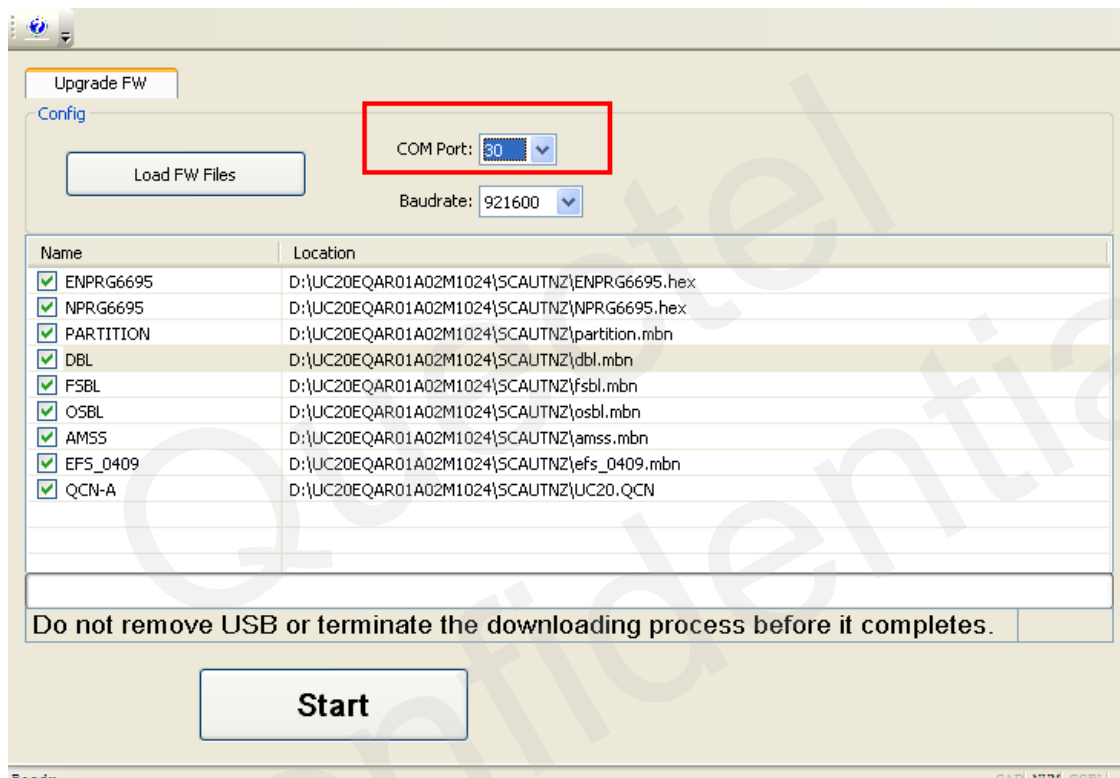4. Click the "**Start**" button to upgrade the firmware.

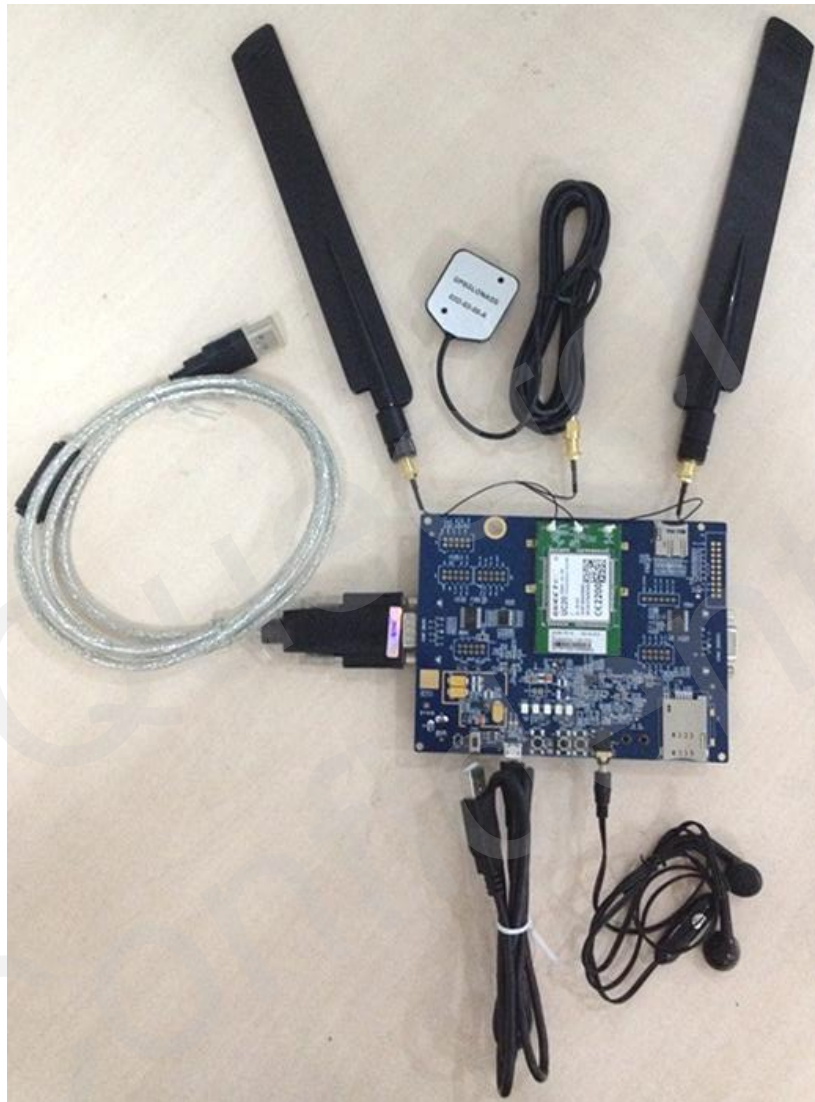**Figure 22: Select the USB DM Port to Update Firmware**

5 EVB Accessories Assembly

Figure 23: UMTS&LTE EVB and Accessories Equipment

6 Appendix A Reference

Table 13: Terms and Abbreviations

Abbreviation	Description
LTE	Long Term Evolution
EVB	Evaluation Board
USIM	Universal Subscriber Identity Module
SIM	Subscriber Identity Module
PC	Personal Computer