# UC20 EVB User Guide

**UMTS/HSPA Module Series**

Rev: UC20_EVB_User_Guide_V1.2

Date: 2014-02-17

**Our aim is to provide customers with timely and comprehensive service. For any assistance, please contact our company headquarters:**

**Quectel Wireless Solutions Co., Ltd.**
Office 501, Building 13, No.99, Tianzhou Road, Shanghai, China, 200233
Tel: +86 21 5108 6236
Mail: info@quectel.com

**Or our local office, for more information, please visit:**
http://www.quectel.com/support/salesupport.aspx

**For technical support, to report documentation errors, please visit:**
http://www.quectel.com/support/techsupport.aspx

**GENERAL NOTES**

QUECTEL OFFERS THIS INFORMATION AS A SERVICE TO ITS CUSTOMERS. THE INFORMATION PROVIDED IS BASED UPON CUSTOMERS' REQUIREMENTS. QUECTEL MAKES EVERY EFFORT TO ENSURE THE QUALITY OF THE INFORMATION IT MAKES AVAILABLE. QUECTEL DOES NOT MAKE ANY WARRANTY AS TO THE INFORMATION CONTAINED HEREIN, AND DOES NOT ACCEPT ANY LIABILITY FOR ANY INJURY, LOSS OR DAMAGE OF ANY KIND INCURRED BY USE OF OR RELIANCE UPON THE INFORMATION. THE INFORMATION SUPPLIED HEREIN IS SUBJECT TO CHANGE WITHOUT PRIOR NOTICE.

# About the Document

## History

| Revision | Date | Author | Description |
|---|---|---|---|
| 1.0 | 2013-05-31 | Jerry YOU | Initial |
| 1.1 | 2013-11-14 | Radom XIANG | 1. Added new interface of Mini PCIe.<br>2. Updated general overview and interface application.<br>3. Added more information about UMTS module operation. |
| 1.2 | 2014-02-17 | Radom XIANG | 1. Clarified USB_VBUS can be used as power supply of UC20-TE-A module only in the download mode.<br>2. Added reference document for USB driver installation in Table 14. |

# Contents

## Table Index

# Figure Index

# 1 Introduction

This document describes the evaluation board of UC20. The UC20 evaluation board is an assisted 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. |
| SOS | GSM 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 UC20-EVB kit for designers to develop applications based on the UC20-TE-A module and UC20 Mini PCIe module. This EVB can test all functionalities of these two modules.

## 2.1. Key Features

**Table 1: Features**

| Features | Implementation |
|---|---|
| Power Supply | ● DC supply 4.5~5.5V typically 5V<br>● VBAT: 3.8V at J102<br>● VDD_3.3: 3.3V at J702 |
| SIM Interface | ● SIM card (8 pins) connector with front tray loading and support card detection<br>● Support SIM card: 3V and 1.8V |
| Audio Interface | ● Analog interface used for loud speaker, earphone and handset (Both UC20-TE-A and UC20 Mini PCIe) |
| UART Interface | ● Two UART interfaces:<br>COM1-serial interface for data communication (default 115200bps)<br>COM2-serial interface for debug purpose (reserved)<br>● Max. baud rate for COM1: 460800 bps |
| USB Interface | ● USB 2.0 |
| Signal Indication | ● 5 LEDs are available for signal indication |
| Physical Characteristics | ● Size: 13.6*10.6 cm |

## 2.2. System Overview
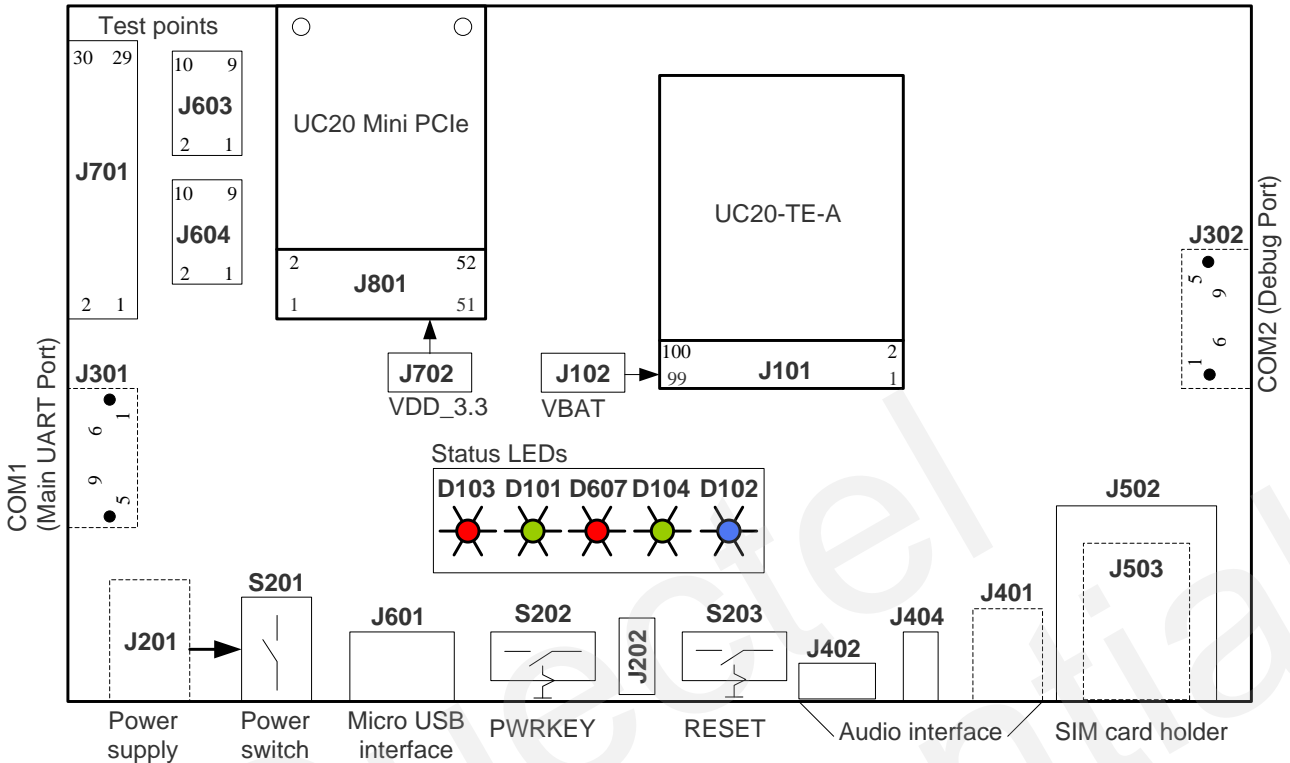


**Figure 1: System Overview**

## 2.3. Interface Overview

**Table 2: Interfaces of UC20 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. |
| PWRKEY | S202 | PWRKEY push button. It's just used to turn on/off the UC20-TE-A module. |
| | J202 | Jumper is used to connect PWRKEY to GND. |
| RESET | S203 | Reset push button. It's used to reset the UC20-TE-A module and UC20 Mini PCIe module. |

| Micro USB | J601 | USB device interface. |
|---|---|---|
| Audio | J402 | Used for loud speaker. |
| | J404 | Used for Φ2.5mm earphone. |
| | J401 (bottom side) | Used for handset. |
| SIM | J502 | SIM card holder. |
| | J503 (bottom side) | SIM card holder (not used). |
| COM1 | J301 (bottom side) | Main UART port. |
| COM2 | J302 (bottom side) | Reserved. |
| LEDs | D103, D101, D607, D104, D102 | D103 is VBAT ON/OFF indicator. D101 is used for either UC20-TE-A module or UC20 Mini PCIe module. D607, D104 and D102 are used only for indicating the status of UC20-TE-A module. |
| UC20-TE-A | J101 | UC20-TE-A connector. |
| UC20 Mini PCIe | J801 | Mini PCI Express connector for UC20 Mini PCIe module. |
| VBAT | J102 | Jumper used for VBAT voltage test. |
| VDD_3.3 | J702 | Jumper used for VDD_3.3 voltage test. |
| Test Points | J701, J603, J604 | J701 has 30 test pins, J603 and J604 are internally used. |

## 2.4. EVB View
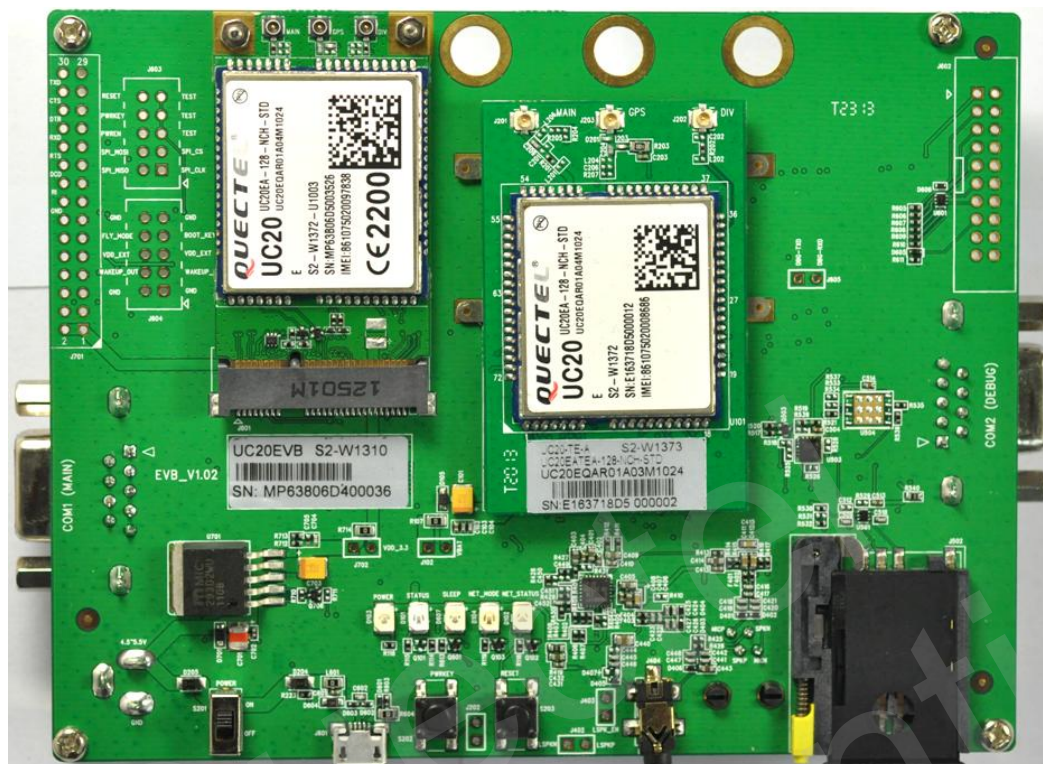


**Figure 2: EVB Top View**

---

**NOTE**

UC20-TE-A and UC20 Mini PCIe use the same EVB, however, they cannot be enabled at the same time.

---

## 2.5. EVB Accessories

All the items of EVB kit are listed in Table 3 and Figure 3 below. Please contact the supplier if there is something missing.

**Table 3: Accessories List**

| Items | Description | Quantity |
|---|---|---|
| Power Supply | 5V DC switching adaptor | 1 |

---

| | | |
|---|---|---|
| | USB to UART converter cable | 1 |
| Cables | USB cable | 1 |
| | RF cable | 2 |
| 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 UC20 EVB, shown as follows:

- Power interface
- USB interface
- Audio interface
- SIM card interface
- UART interface

It also provides information about LEDs, buttons and test points to help you use the UC20 EVB.

## 3.1. Power Interface

The power supply of UC20 EVB could come from the external input which is connected with power jack on the EVB board. The power jack not only connects a step-down converter which can provide the supply voltage (VBAT) required for operating EVB and UC20-TE-A module, but also provides a correct voltage (VDD_3.3) after a LDO power is supplied to UC20 Mini PCIe module.

Figure 4 shows the simplified power supply schematic, and Figure 5 shows the power interface of UC20 EVB.
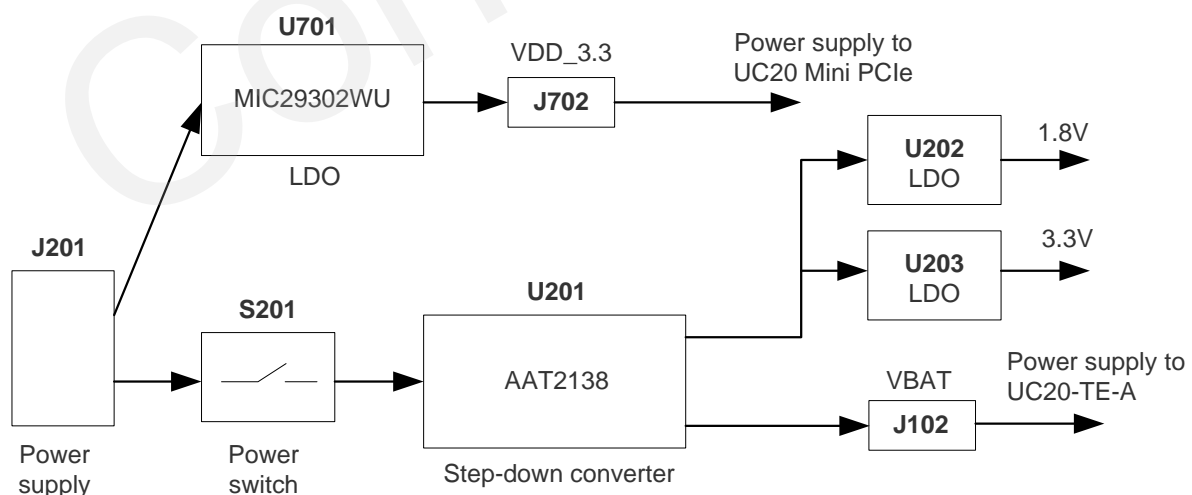


**Figure 4: Simplified Power Supply Schematic**
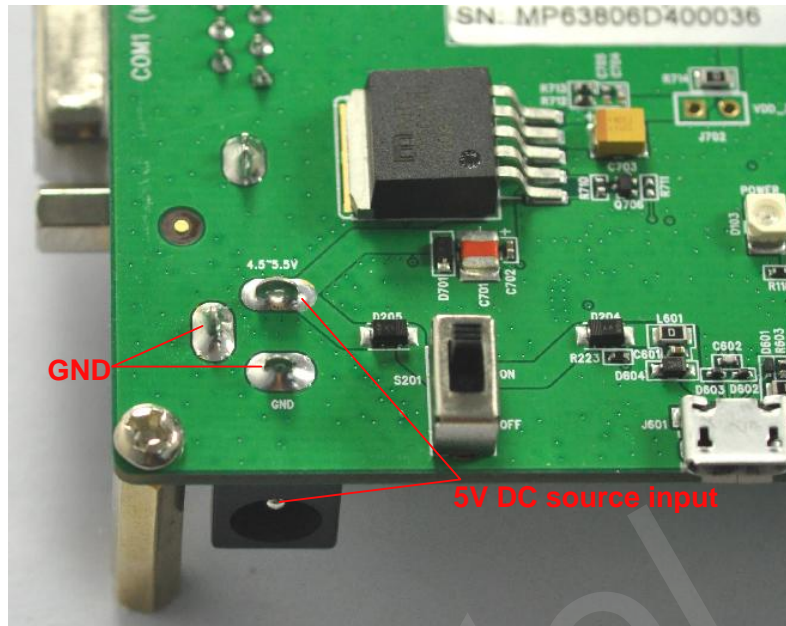
**Figure 5: Power Interface**

You need to use the right DC adapter provided by Quectel, shown as Figure 6.
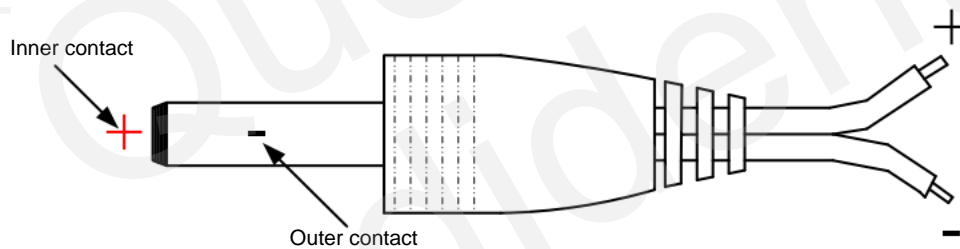


**Figure 6: Power Plug**

| NOTE |

In download mode, USB_VBUS can be used to supply power to UC20-TE-A module. While in other modes, it is not recommended to use USB_VBUS to supply power due to current limitation.

## 3.2. USB Device Interface

Both UC20-TE-A and UC20 Mini PCIe provide 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.

UC20 EVB provides a Micro-USB receptacle J601 to connect a host device. The USB data lines USB_DP and USB_DM are connected directly to the UC20-TE-A and UC20 Mini PCIe.
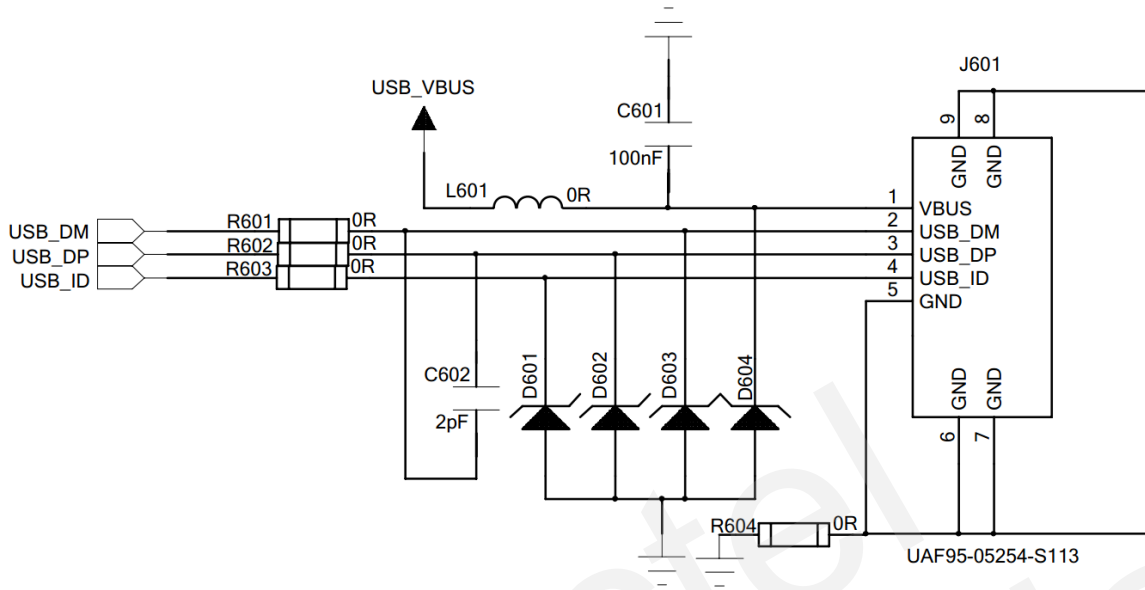


**Figure 7: Circuit of USB Interface**

**Table 4: Pin Assignment of USB Device Interface J601**

| J601 Pin | Pin Name | Function |
| --- | --- | --- |
| 1 | USB_VBUS | This pin is used for USB detection. |
| 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

UC20-TE-A and UC20 Mini PCIe just provide digital audio interface (PCM). UC20 EVB equips an external audio codec called NAU8814. Figure 8 shows the audio codec circuit.

The UC20 EVB provides three analog audio interfaces J402, J404, J401. This chapter gives a detailed introduction on these analog audio interfaces.
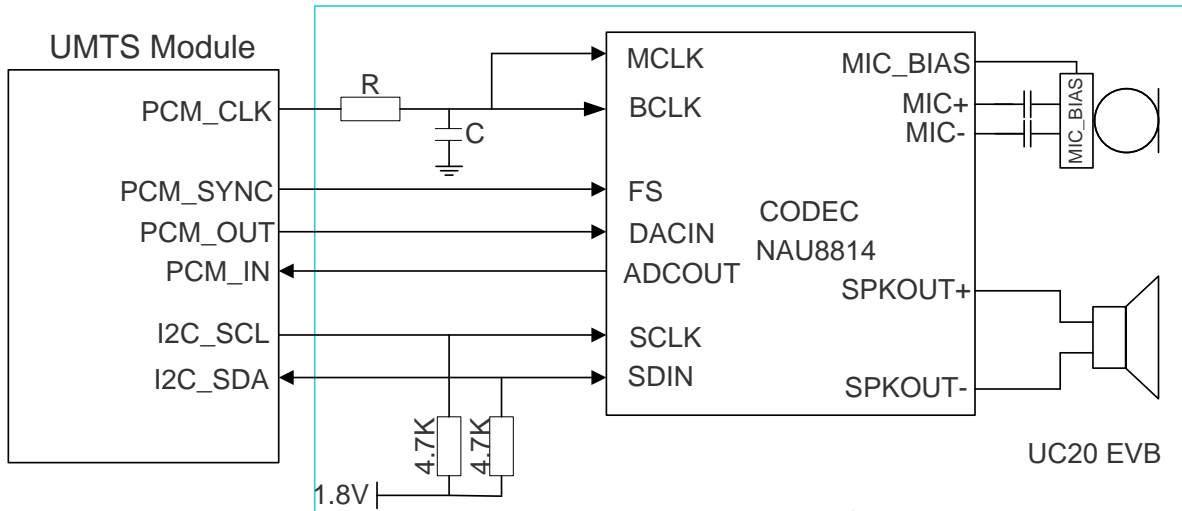
**Figure 8: Audio Codec Circuit**

### 3.3.1. Loud Speaker (J402)

Figure 9 shows the loud speaker circuit with external audio Class-D amplifier. And the name of the J402 pins has been marked on the EVB.
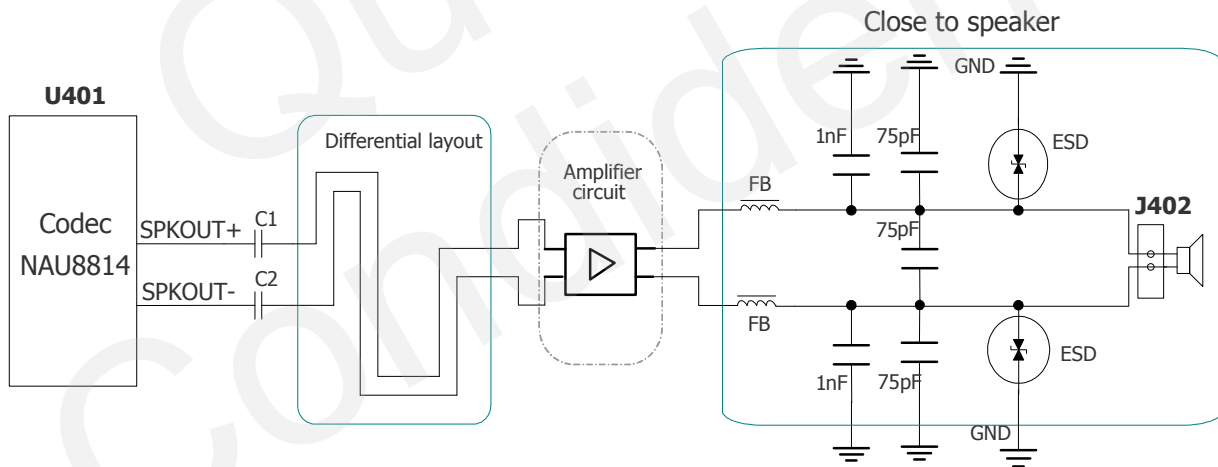


**Figure 9: Loud Speaker Circuit**

### 3.3.2. Earphone (J404)

An earphone can be used in audio interface J404. Figure 10 shows the circuit of audio interface J404 for earphone:
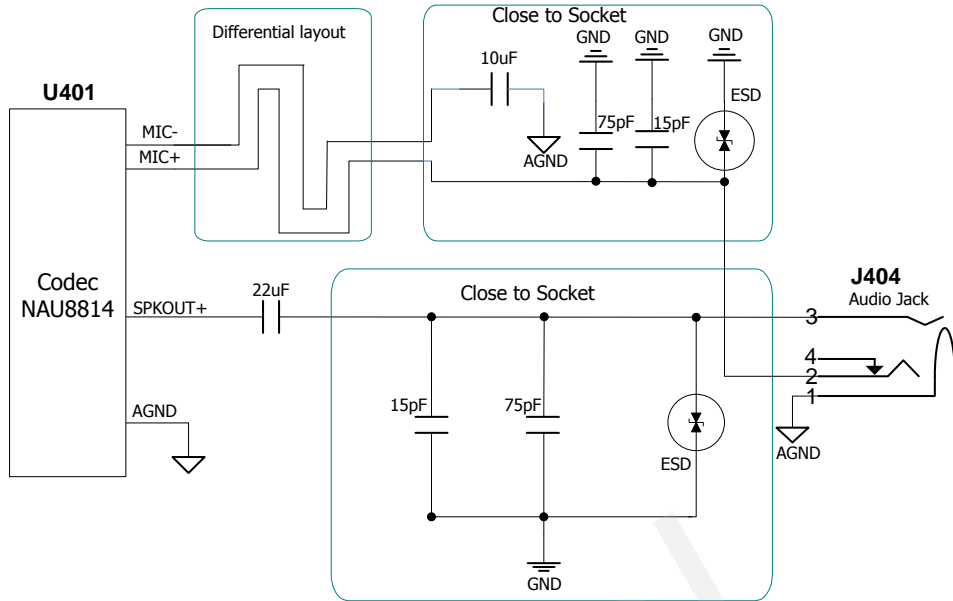
**Figure 10: Earphone Circuit**
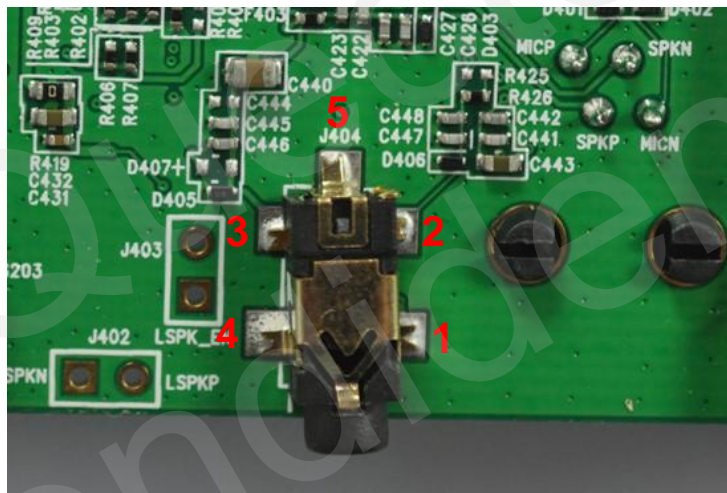


**Figure 11: Pin Assignment of J404**

**Table 5: Pin Assignment of J404**

| J404 Pin | Pin Name | Function |
|---|---|---|
| 1 | AGND | Dedicated GND for Audio. |
| 2 | MICP | Positive microphone input. |
| 3 | SPKP | Positive speaker output. |
| 4, 5 | NC | / |

The following figure shows the sketch of audio plug which suits for the audio jack on UC20 EVB.
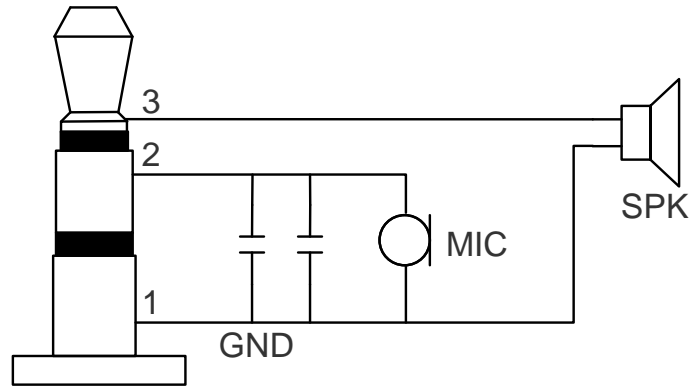


**Figure 12: The Sketch of Audio Plug**

### 3.3.3. Handset (J401)

A handset can be used in audio interface J401. Figure 13 shows the circuit of audio interface J401 for handset. And the name of the corresponding pins has been marked on the EVB.
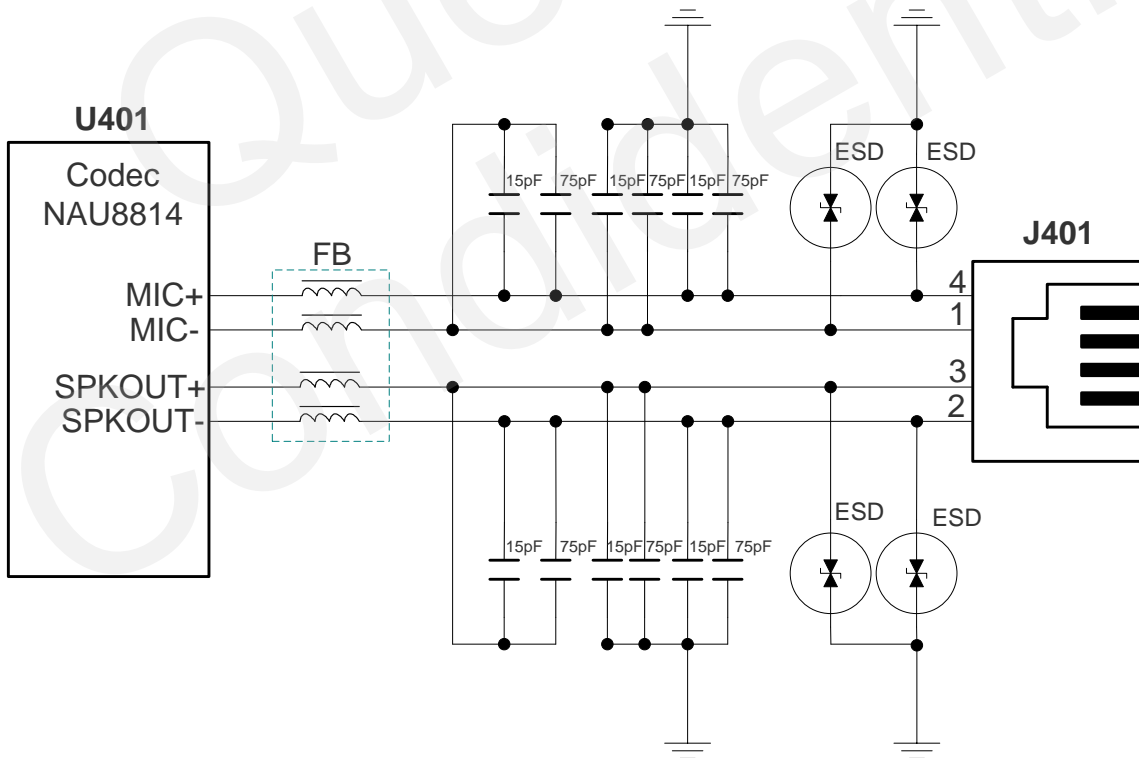


**Figure 13: Handset Circuit**

**Table 6: Pin Assignment of J401**

| J401 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. SIM Card Interface

The UC20 EVB has two integrated SIM card interfaces. A suitable SIM card (3V or 1.8V) is required to start the UMTS module. The 8pin SIM card holder J502 placed on the UC20 EVB is from type Molex, and the 6pin SIM card holder J503 is not used. Figure 14 shows the simplified interface schematic for J502.
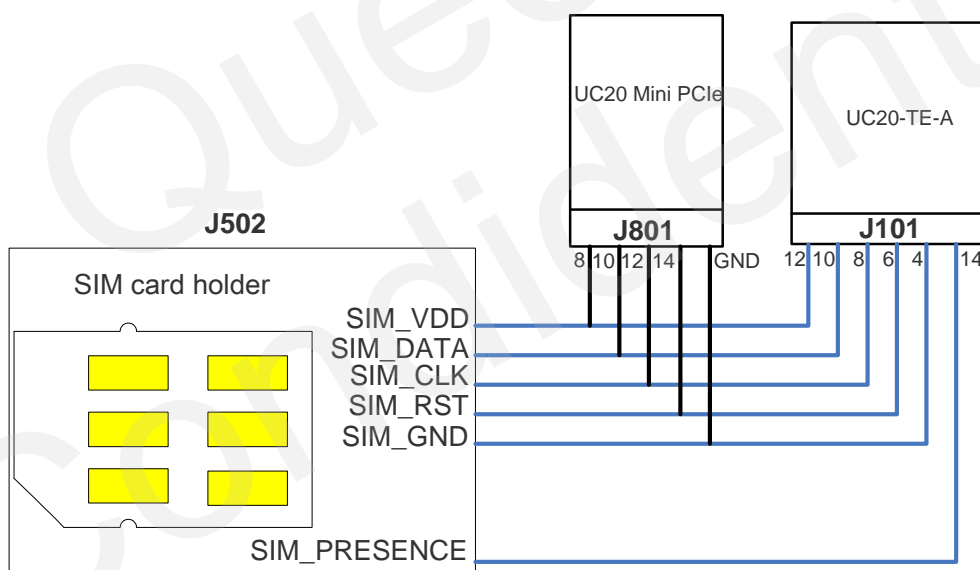


**Figure 14: Simplified SIM Card Interface Schematic**
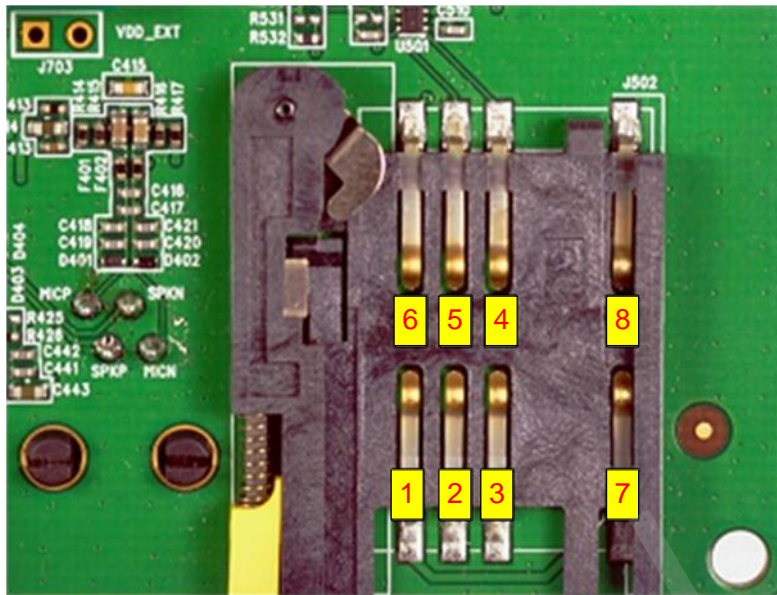
**Figure 15: Pins Assignment of SIM Card Holder**

**Table 7: Pin Assignment of J502**

| J502 Pin | Signal Name | I/O | Function |
|---|---|---|---|
| 1 | GND | / | Ground. |
| 2 | VPP | / | Not connected. |
| 3 | SIM_DATA | I/O | Data line, bi-directional. |
| 4 | SIM_CLK | O | SIM card clock. |
| 5 | SIM_RST | O | SIM card reset. |
| 6 | SIM_VDD | O | SIM card power, generated by the UMTS module. |
| 7 |  | / | Connected to GND. When the SIM card cover is inserted, pin 7 is connected to pin 8. |
| 8 | SIM_PRESENCE | I | SIM card detection. |

**NOTES**

1. UC20 Mini PCIe does not support SIM card detection.
2. The SIM card detection function of UC20-TE-A is disabled by default.

## 3.5. UART Interface

UC20 EVB offers two UART interfaces: COM1 (Main UART port) and COM2. And COM2 is reserved.

The UART interface COM1 of the UC20 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 UC20 EVB.
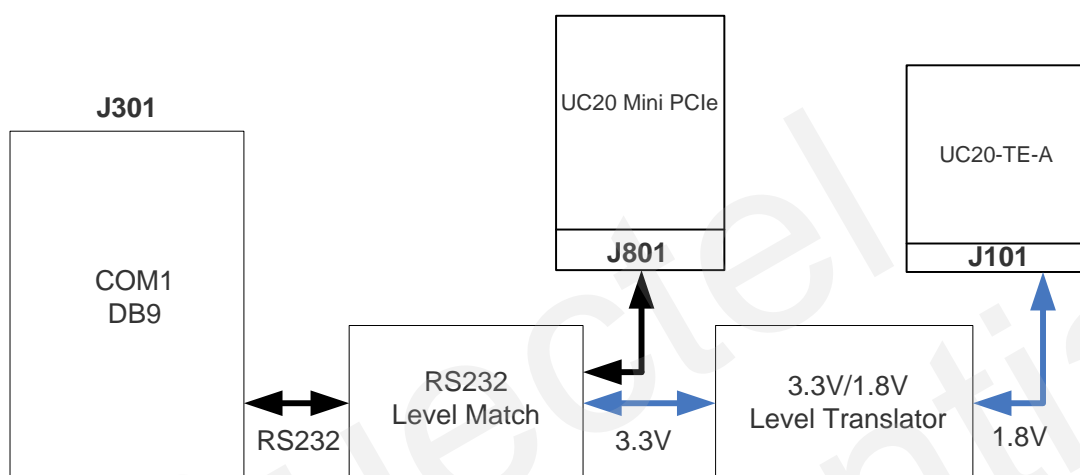


**Figure 16: UART Block Diagram**
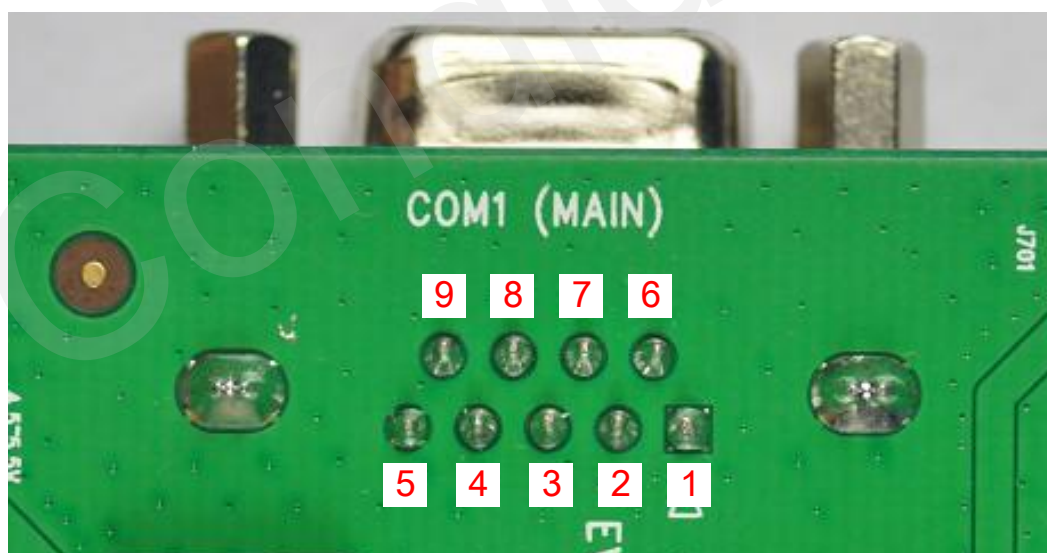


**Figure 17: Main UART Port (J301)**

**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 Buttons

UC20 EVB comprises two buttons (S202 and S203) and one switch (S201). Figure 18 shows the switch and buttons.
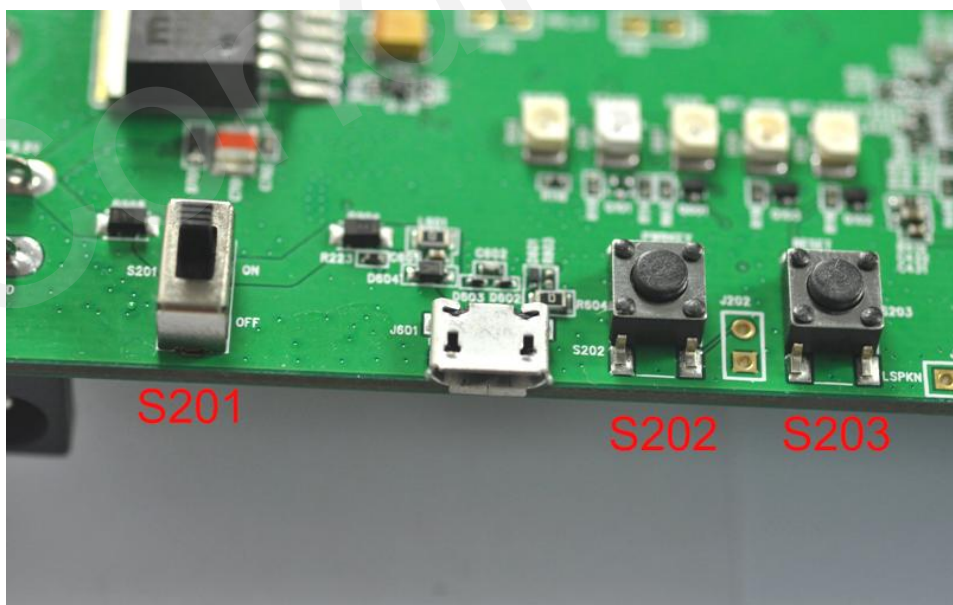


**Figure 18: Switch and Buttons**

**Table 9: Description of Switch and Buttons**

| Reference | Description |
|-----------|-------------|
| S201 | Control power supply VBAT ON/OFF. |
| S202 | It's just used to turn on/off the UC20-TE-A module. Press the button for at least 100ms to turn on the module. Press the button for at least 0.6s and then release to turn off the module. |
| S203 | It's used to reset the UC20-TE-A module and UC20 Mini PCIe module. Press the button for more than 150ms and then release to reset the module. |

## 3.7. Status LEDs

UC20 EVB comprises several status LEDs (D103, D101, D607, D104, D102). Figure 19 shows the position of LEDs.
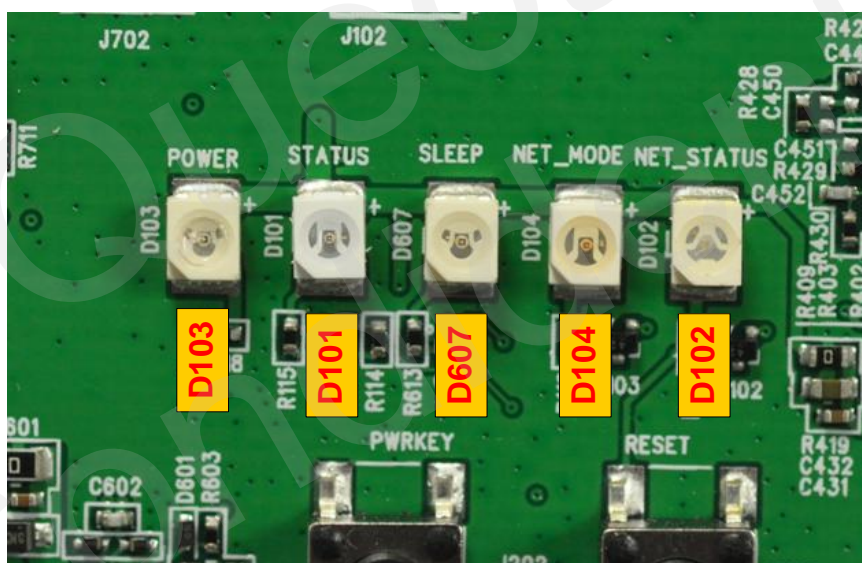


**Figure 19: Status LEDs**

**Table 10: Description of Status LEDs**

| Reference | Used for UC20-TE-A | Used for UC20 Mini PCIe |
|-----------|--------------------|--------------------------|
| D103 | Power supply for module and EVB is ready. Bright: VBAT ON Extinct: VBAT OFF | Power supply for EVB is ready. Bright: VBAT ON Extinct: VBAT OFF |

| | | |
|---|---|---|
| D101 | STATUS, indicate the module operation status.<br>Bright: module powers on<br>Extinct: module powers down | Indicate the module network registration mode.<br>Bright: registered to network<br>Extinct: not registered or in airplane mode |
| D607 | SLEEP, indicate the sleep status.<br>Bright: module is in sleep mode<br>Extinct: module is not in sleep mode | None |
| D104 | NET_MODE, indicate the module network registration mode.<br>Bright: registered to 3G network<br>Extinct: others | None |
| D102 | NET_STATUS, indicate the module network activity status. Blinking at a certain frequency according to various network status. | None |

## 3.8. Test Points

J603 and J604 are internally used. Figure 20 shows J701 test points.
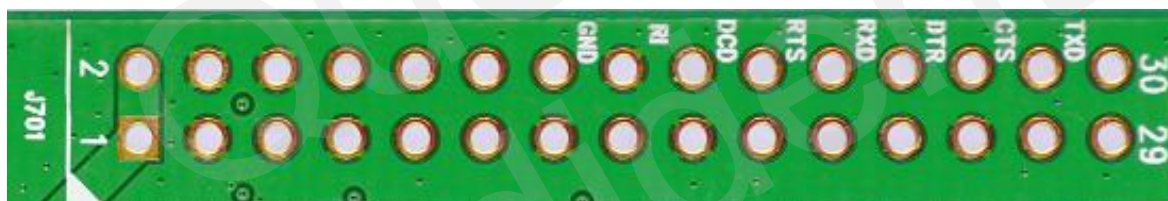


**Figure 20: Test Points**

**Table 11: Pin Assignment of J701**

| J401 Pin | Pin Name | Description |
|---|---|---|
| 30 | TXD | Converted from UC20-TE-A Main UART's TXD.<br>Connected directly to UC20 Mini PCIe UART's TXD. |
| 28 | CTS | Converted from UC20-TE-A Main UART's CTS.<br>Connected directly to UC20 Mini PCIe UART's RTS. |
| 26 | DTR | Converted from UC20-TE-A Main UART's DTR.<br>Connected directly to UC20 Mini PCIe UART's DTR. |
| 24 | RXD | Converted from UC20-TE-A Main UART's RXD.<br>Connected directly to UC20 Mini PCIe UART's RXD. |
| 22 | RTS | Converted from UC20-TE-A Main UART's RTS. |

| | | |
|---|---|---|
| | | Connected directly to UC20 Mini PCIe UART's CTS. |
| 20 | DCD | Converted from UC20-TE-A Main UART's DCD. Connected directly to UC20 Mini PCIe UART's DCD. |
| 18 | RI | Converted from UC20-TE-A Main UART's RI. Connected directly to UC20 Mini PCIe UART's RI. |
| 16 | GND | Ground. |
| Others | / | Reserved. |

**NOTE**

These test pins belong to 3.3V power domain.

# 4 Operation of UMTS Module

## 4.1. Power On

### 4.1.1. Power On UC20-TE-A

1. Connect the UC20-TE-A module to the connector J101 on UC20 EVB, charge in the 5V power adapter and pull S201 to ON state, then D103 will be light.
2. Press the S202 (PWRKEY) for at least 100ms. D101 (STATUS) will be light and the module will be in the power-on mode.

The following table shows the module's working state which can be judged by D102 and D104.

**Table 12: Indication of D102 and D104**

| Reference | State | Description |
|---|---|---|
| D102 NET_STATUS | 0.2s On/ 1.8s OFF | Networks searching. |
| | 1.8s On/ 0.2s OFF | Idle mode. |
| | 0.125s On/ 0.125s OFF | Data transfer is ongoing with GSM/3G network. |
| | Always ON | Voice Calling. |
| D104 NET_MODE | Always ON | Registered to 3G network. |
| | Always OFF | Others. |

### 4.1.2. Power On UC20 Mini PCIe

1. Connect the UC20 Mini PCIe module to the connector J801 on UC20 EVB, charge in the 5V power adapter, the module will be in the power-on mode.
2. Pull S201 to ON state, D103 will be light and indicates power supply for EVB is ready. D101 (STATUS) will be light which indicates the network registration mode.

**Table 13: Indication of D101**

| Reference | State | Description |
|-----------|-------|-------------|
| D101 STATUS | Always ON | Registered to network. |
| | Always OFF | Others. |

## 4.2. Power Off UC20-TE-A and UC20 Mini PCIe

There are several ways to power off UC20-TE-A module and UC20 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 it is shut down. This way suits for UC20-TE-A module and UC20 Mini PCIe module, but UC20 Mini PCIe module will be powered on again after shut-down.

The other way is to press S202 (PWRKEY) at least 0.6 second and then release, the module will be shut down. This way is only used for UC20-TE-A module.

## 4.3. Reset UC20-TE-A and UC20 Mini PCIe

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

Pull down the UMTS module's reset pin by pressing the key S203 (more than 150ms) to release a reset and then reset UMTS module. This may cause the loss of information stored in the memory since the reset is initialized.

## 4.4. Communication via USB or UART Interface

### 4.4.1. Communication via USB Interface

1. Power on the UMTS module.
2. Connect EVB and PC with USB cable through USB interface, refer to **document [1]** to install USB driver from the Driver Disk, select communication port number as below:
   USB AT Port (COM46) .
3. Configure AT Command Window, correct port and operate the UMTS 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 module and operate the UMTS module via AT commands.

## 4.5. Firmware Upgrade

UC20 upgrades firmware via USB port by default, follow the procedures below to upgrade firmware.

1. Open the firmware upgrade tool "*QFlash*" in the PC and power on the UMTS 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.
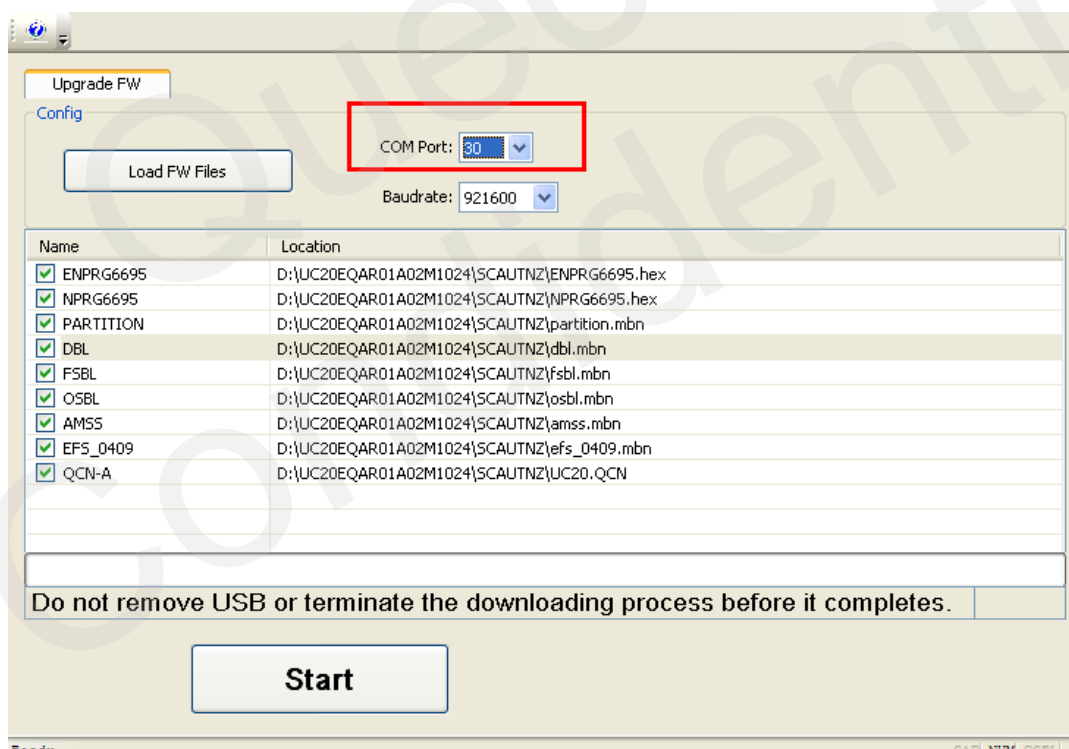


**Figure 21: Select the USB DM Port to Update Firmware**
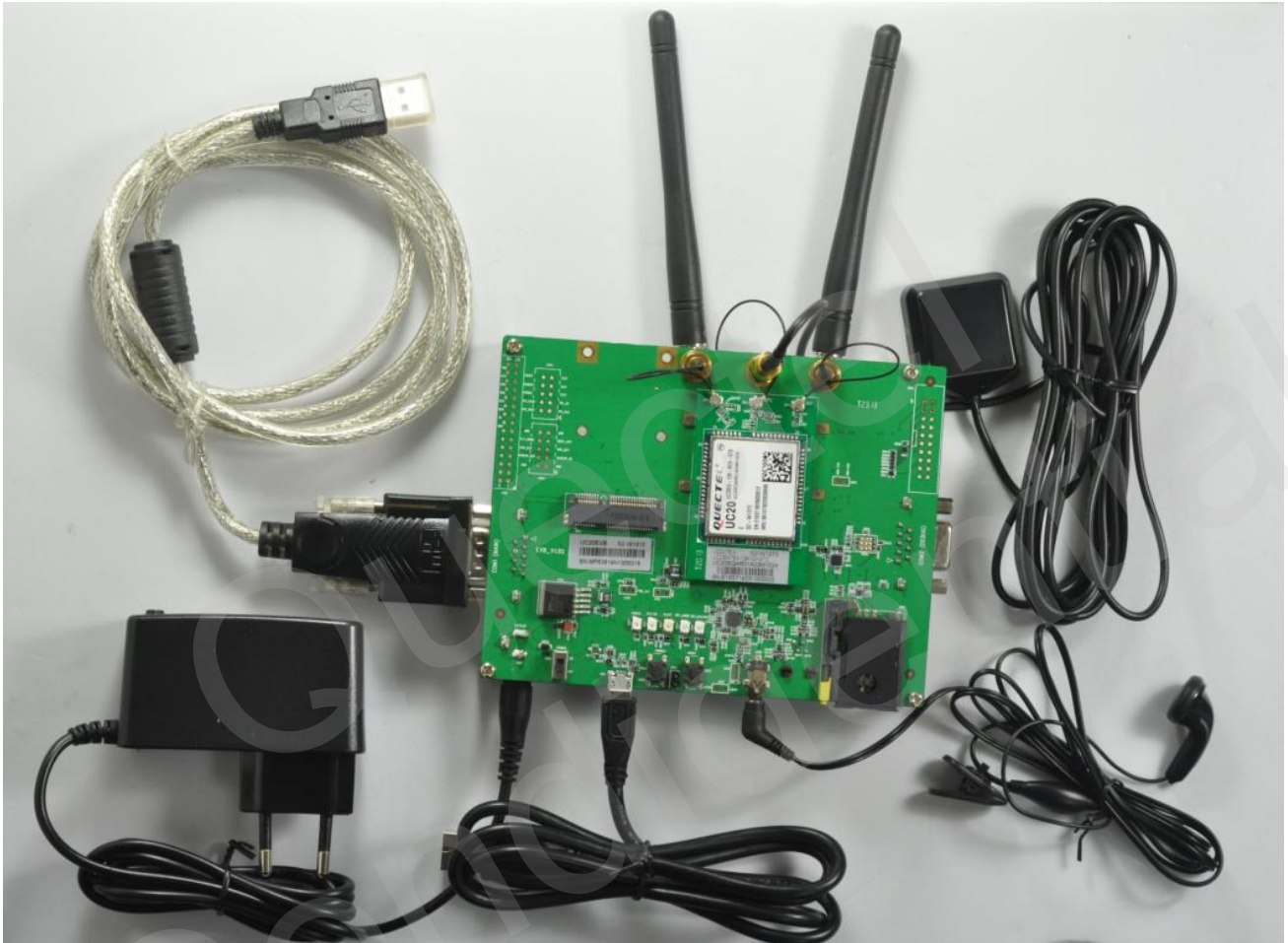
# 5 UC20 EVB Accessories Assembly



**Figure 22: UC20 EVB and Accessories Equipment**

# 6 Appendix Reference

**Table 14: Related Documents**

| SN | Document Name | Remark |
|----|---------------|--------|
| [1] | Quectel_UC20_Windows_USB_Driver_User_Guide | Install USB driver of UC20 module in Windows XP/Vista/7/8. |
| [2] | Quectel_UC20_AT_Commands_Manual | UC20 AT Commands Manual. |