

# Quectel SC20

## Multi-mode Smart LTE Module with Wi-Fi & Bluetooth



Smart LTE Cat.4 Module  
Max. 150Mbps (DL)  
Max. 50Mbps (UL)



Max. 42Mbps (DL)  
Max. 5.76Mbps (UL)



LCC Package



Android 5.1



Powerful Multimedia  
Function



GPS+GLONASS  
+BeiDou



USB 2.0 High Speed  
Interface



USB Drivers



Quectel Enhanced  
AT Commands

### Key Benefits

- Integrates Android OS, Wi-Fi, Bluetooth and GNSS into one module
- Worldwide LTE, UMTS/HSPA+ and GSM/GPRS/EDGE coverage
- MIMO technology meets demands for data rate and link reliability in modern wireless communication systems
- Multi-constellation GNSS receiver available for applications requiring fast and accurate fixes in any environment
- LCC package ensures reliable connectivity with applications



SC20 series is Quectel's new generation of multi-mode Smart LTE Cat.4 modules with built-in Android 5.1 Lollipop OS. It supports short-range wireless communication via Wi-Fi 802.11b/g/n and BT4.1 LE, and offers data rate up to 150Mbps. It is ideal for both industrial and consumer applications requiring the highest data-rate and high-speed internet access.

SC20 series comes in five variants: SC20-CE, SC20-E, SC20-A, SC20-AU and SC20-J. This makes it backward-compatible with existing EDGE and GSM/GPRS networks, ensuring that it can be connected even in remote areas devoid of 3G or LTE coverage.

SC20 features multiple-input multiple-output (MIMO) technology, a cutting edge antenna technology capable of transmitting multiple data streams on multiple transmitters to multiple receivers. The antennas at each end of the communications circuit are combined to minimize errors and optimize data speed. The module also combines high-speed wireless connectivity with embedded multi-constellation and high-sensitivity GPS+GLONASS+BeiDou receiver for positioning.

A rich set of interfaces (such as LCM, Camera, Touch Panel, MIC, SPK, UART, USB, I2C) and abundant drivers (USB drivers for Windows XP, Windows Vista, Windows 7, Windows 8/8.1, Linux) extend the applicability of the module to a wide range of M2M applications, such as CPE, wireless POS, smart metering, router, data card, automotive, smart phone, digital signage, alarm panel, security and industry PDA.

# Quectel SC20

## Multi-mode Smart LTE Module with Wi-Fi & Bluetooth

### General Features

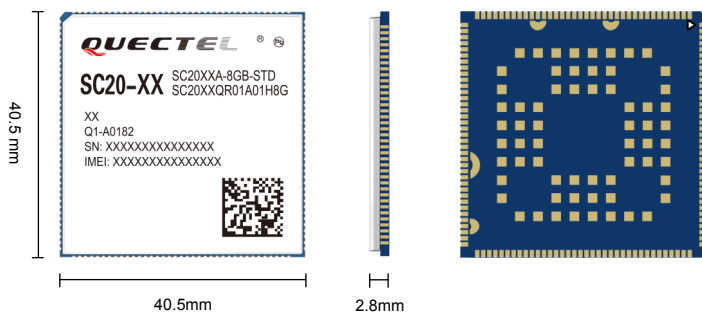
<b>Frequency Bands</b>	<b>SC20-CE</b> FDD LTE: B1/B3/B8 TDD LTE: B38/B39/B40/B41 TDSCDMA: B34/B39 EVDO/CDMA: BC0 WCDMA: B1/B8 GSM: 900/1800MHz  <b>SC20-E*</b> FDD LTE: B1/B3/B5/B7/B8/B20 TDD LTE: B38/B40/B41 WCDMA: B1/B5/B8 GSM: 850/900/1800/1900MHz  <b>SC20-A*</b> FDD LTE: B2/B4/B5/B7/B12/B13/B25/B26 WCDMA: B1/B2/B4/B5/B8 GSM: 850/1900MHz  <b>SC20-AU*</b> FDD LTE: B1/B3/B5/B7/B8/B28 TDD LTE: B40 WCDMA: B1/B2/B5/B8 GSM: 850/900/1800/1900MHz  <b>SC20-J*</b> FDD LTE: B1/B3/B8/B18/B19/B26 TDD LTE: B41 WCDMA: B1/B6/B19
<b>OS</b>	Android 5.1
<b>LTE Version</b>	3GPP E-UTRA Release 11
<b>Bandwidth</b>	1.4/3/5/10/15/20MHz
<b>Antenna</b>	DL MIMO 2×2, supports Rx-diversity
<b>Supply Voltage Range</b>	3.5V ~ 4.2V, 3.8V Typ.
<b>Operation Temperature</b>	-40°C ~ +85°C
<b>Dimensions</b>	40.5mm × 40.5mm × 2.8mm
<b>Package</b>	LCC
<b>Weight</b>	Approx. 9.8g
<b>Control via AT Commands</b>	3GPP TS27.007 and enhanced AT commands

### Specifications

Data	LTE	LTE-FDD Max 150Mbps (DL) Max 50Mbps (UL) LTE-TDD Max 130Mbps (DL) Max 35Mbps (UL)
	<b>DC-HSPA+</b>	Max 42Mbps (DL) Max 5.76Mbps (UL)
	<b>WCDMA</b>	Max 384Kbps (DL) Max 384Kbps (UL)
	<b>TD-SCDMA</b>	Max 4.2Mbps (DL) Max 2.2Mbps (UL)
	<b>EDGE</b>	Max 236.8Kbps (DL) Max 236.8Kbps (UL)
	<b>GPRS</b>	Max 85.6Kbps (DL) Max 85.6Kbps (UL)
<b>Voice</b>	<b>Speech Codec Modes</b>	HR, FR, EFR, AMR, AMR-WB
	<b>Echo Arithmetic</b>	Echo Cancellation Noise Reduction
<b>VoLTE</b>		Analog Audio and VoLTE (Voice over LTE) (Optional)

### Special Features

<b>Firmware Update</b>	Firmware updated via USB
<b>WLAN</b>	2.4G, 802.11 b/g/n (SC20-CE) 2.4G/5.8G, 802.11 a/b/g/n (SC20-E/-A/-AU/-J)*
<b>BT</b>	BT2.1+EDR/3.0/4.1 LE
<b>GNSS</b>	GPS/GLONASS/BeiDou



### Electrical Characteristics

<b>Output Power</b>	Class 3 (23dBm±2dB) for LTE FDD bands Class 3 (23dBm±2dB) for LTE TDD bands Class 3 (24dBm+1/-3dB) for WCDMA bands Class 2 (24dBm+1/-3dB) for TD-SCDMA bands Class 3 (24dBm+3/-1dB) for CDMA BC0 Class 4 (33dBm±2dB) for EGSM900 Class 1 (30dBm±2dB) for DCS1800 Class E2 (27dBm±3dB) for EGSM900 8-PSK Class E2 (26dBm±3dB) for DCS1800 8-PSK	
<b>Consumption</b>	20uA @Power off 3mA @Sleep, Typ.	
<b>Sensitivity (10MHz for LTE)</b>	LTE FDD B1: -102dBm LTE FDD B2: -101dBm LTE FDD B3: -101dBm LTE FDD B4: -101dBm LTE FDD B5: -101dBm LTE FDD B7: -100dBm LTE FDD B8: -101dBm LTE FDD B12: -100dBm LTE FDD B13: -100dBm LTE FDD B18: -100dBm LTE FDD B19: -100dBm LTE FDD B20: -99dBm LTE FDD B25: -99dBm LTE FDD B26: -99dBm LTE FDD B28: -99dBm LTE TDD B38: -100dBm	LTE TDD B39: -101dBm LTE TDD B40: -100dBm LTE TDD B41: -100dBm WCDMA B1: -110dBm WCDMA B2: -110dBm WCDMA B4: -110dBm WCDMA B5: -112dBm WCDMA B6: -110dBm WCDMA B8: -110dBm WCDMA B19: -110dBm TD-SCDMA: -108dBm CDMA/EVDO: -109dBm GSM 850: -110dBm GSM 900: -109dBm GSM 1800: -109dBm GSM 1900: -108dBm

### Interfaces

<b>LCM</b>	4-lane MIPI_DSI, up to 1.5Gbps for each HD (720P) @60fps
<b>Camera</b>	Use MIPI_CSI, up to 1.5Gbps per lane Support two cameras: 2-lane MIPI_CSI for rear camera, up to 8MP 1-lane MIPI_CSI for front camera, up to 2MP
<b>Touch Panel</b>	Capacitive-screen
<b>Audio</b>	MP3, AAC, AAC+, eAAC, AMR-NB, - WB, G.711, WMA 9/10 Pro
<b>Video</b>	Encode: 30fps 720P (H.264), 30fps WVGA (MPEG-4/VP8) Decode: 30fps 1080P (H.264/MPEG-4/VP8/H.265 DivX4/5/6), 30fps WVGA (H.263)
<b>USB 2.0 Device</b>	×1, high Speed, 480Mbps
<b>I2C</b>	×3
<b>USIM</b>	×2, support 1.8/2.95V
<b>GPIO</b>	×25
<b>UART</b>	×2, high-speed UARTs
<b>SDIO</b>	×1, 3.0, 4bit SDIO
<b>PWRKEY</b>	
<b>Antenna</b>	4 pads for Main Antenna, Diversity Antenna, GNSS Antenna and Wi-Fi/BT Antenna, respectively
<b>ADC</b>	×3 (BAT_SNS, BAT_THERM, ADC)

### Certification

<b>Approval</b>	CCC/CE*/FCC*/GCF*/PTCRB*/AT&T*/ACMA RCM*/Verizon*
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\* Under development



# Smart EVB User Guide

**LTE Module Series**

Rev. Smart\_EVB\_User\_Guide\_V1.0

Date: 2016-09-30



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

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<http://www.quectel.com/support/techsupport.aspx>

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# About the Document

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Revision	Date	Author	Description
1.0	2016-09-30	Vae LIU	Initial

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# 1 Introduction

This document describes the evaluation board of Quectel SC20 Smart module series. The Smart evaluation board is an assistant system integrator for developing and evaluating products based on Quectel Smart modules.

Quectel  
Confidential

## 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 Quectel module. Manufacturers of the cellular terminal should send the following safety information to users and operating personnel, and incorporate these guidelines into all manuals supplied with the product. If not so, Quectel assumes no liability for customer's 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 mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. You must comply with laws and regulations restricting the use of wireless devices while driving.



Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it is switched off. The operation of wireless appliances in an aircraft is forbidden, so as to prevent interference with communication systems. Consult the airline staff about the use of wireless devices on boarding the aircraft, if your device offers an Airplane Mode which must be enabled prior to boarding an aircraft.



Switch off your wireless device when in hospitals, clinics or other health care facilities. These requests are designed to prevent possible interference with sensitive medical equipment.



Cellular terminals or mobiles operating over radio frequency signal and cellular network cannot be guaranteed to connect in all conditions, for example no mobile fee or with an invalid SIM card. While you are in this condition and need emergent help, please remember using emergency call. In order to make or receive a 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 potentially explosive atmospheres, obey all posted signs to turn off wireless devices such as your phone or other cellular terminals. Areas with potentially explosive atmospheres include 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, etc.

## 2 General Overview

Quectel supplies Smart EVB kit for testing basic functionalities on Smart modules.

### 2.1. Key Features

Smart EVB offers the following features:

- Two USIM interfaces
- Two UART interfaces
- Multiple audio interface
- USB interface
- Keypads and LED indication lights

**Table 1: Features of Smart EVB**

Features	Implementation
Power Supply	<ul style="list-style-type: none"> <li>● USB supply voltage: 4.75~6.0V; typical supply voltage: 5.0V</li> <li>● VBAT supply voltage: 3.5~4.3V; typical supply voltage: 3.8V</li> </ul>
USIM Interfaces	<ul style="list-style-type: none"> <li>● Support card detection</li> <li>● Support USIM/SIM cards: 3.0V and 1.8V</li> </ul>
Audio Interface	<ul style="list-style-type: none"> <li>● Analog interface used for loud speaker, microphone, earphone and handset</li> </ul>
UART Interfaces	<ul style="list-style-type: none"> <li>● Two UART interfaces: Main UART for data transmission Debug UART for debugging</li> <li>● Max. baud rate: 460800bps</li> </ul>
USB Interface	<ul style="list-style-type: none"> <li>● USB 2.0, support high speed and OTG function</li> </ul>
Signal Indication	<ul style="list-style-type: none"> <li>● 4 LEDs are available for signal indication</li> </ul>
Buttons	<ul style="list-style-type: none"> <li>● 9 buttons</li> </ul>
Switches	<ul style="list-style-type: none"> <li>● 4 switches</li> </ul>
Physical Characteristics	<ul style="list-style-type: none"> <li>● Size: 24cm × 18cm</li> </ul>

## 2.2. Interface Overview

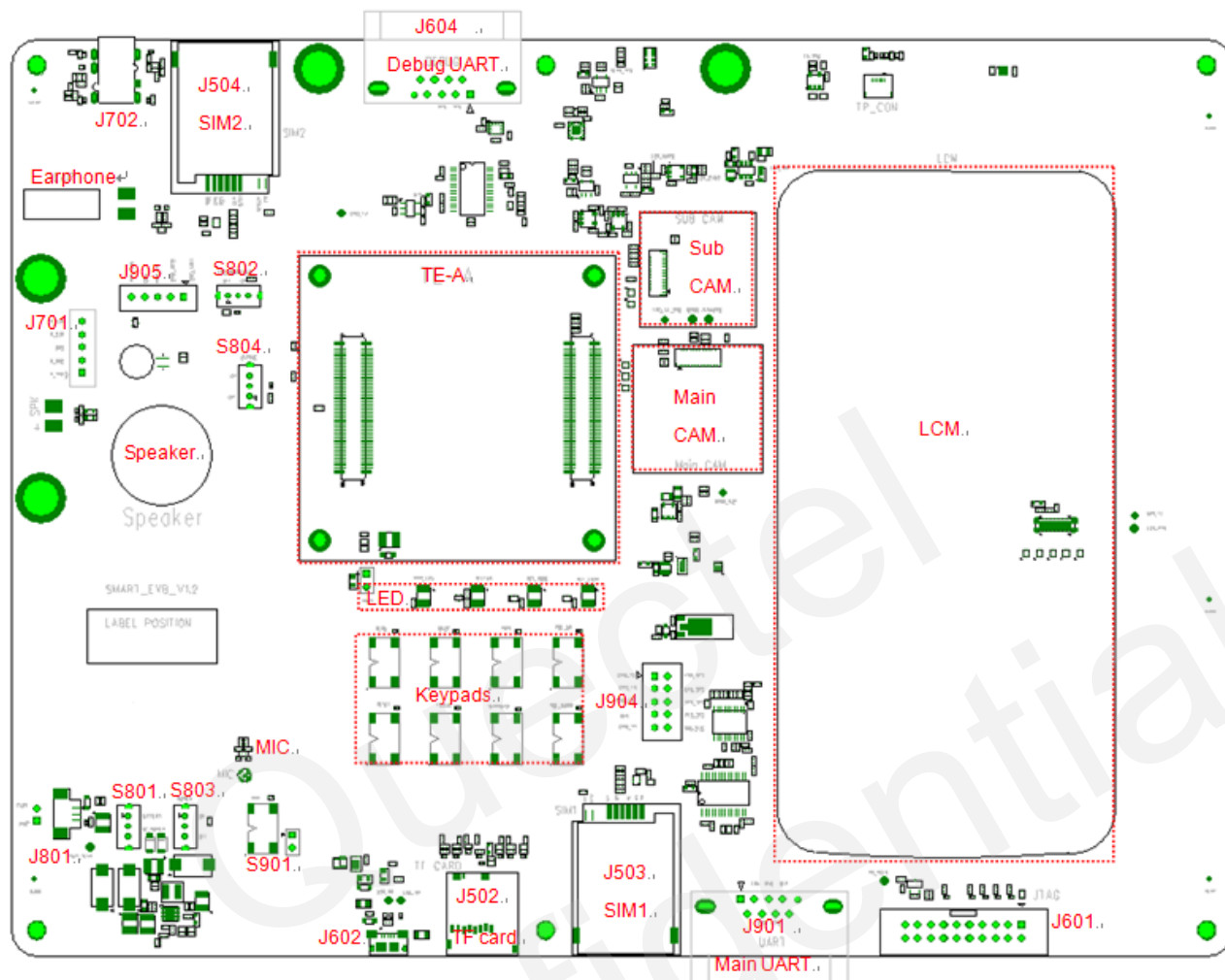


Figure 1: Interface Overview

Table 2: Interfaces of Smart EVB

Interface	Reference Number	Description
VBAT	J801	Connector used for battery
Power Switch	S801	Switch for battery and DC_POWER
	S803	Control power ON/OFF
PWRKEY	S901	PWRKEY push button It's used to turn on/off the module.
	J903	Jumper is used to connect PWRKEY to GND

RESET	S908	Reset push button. It's used to reset the module.
Micro USB	J602	USB device interface USB_VBUS supply voltage: +5.0V
Audio	Speaker	Loud speaker
	Earphone	Earphone
	MIC	Microphone
	J702	Headset
USIM	J503	Main USIM card holder
	J504	Sub USIM card holder
UART	J901	Main UART port
	J604	Debug UART port
LEDs	D805, D806, D807, D808	D805 and D807 indicate network registration mode of the module. D806 indicates the power ON/OFF status. D808 indicates operation status of the module.
TE-A	J101, J102	TE-A module connector

**NOTE**

Some of these functions may not be supported on some modules. For details, please refer to relative module reference designs and hardware designs.

## 2.3. EVB View



Figure 2: EVB Top View

## 2.4. EVB Accessories

All the items of EVB kit are listed in table and figure 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	4
Antennas	Main antenna	2
	WiFi antenna	1

	GNSS antenna (passive)	1
Audio	Earphone	1
Disk	USB2.0 to RS232 driver and USB driver disk	1
Battery	Li-polymer battery	1
Other	Bolts and nuts for fixing EVB	1

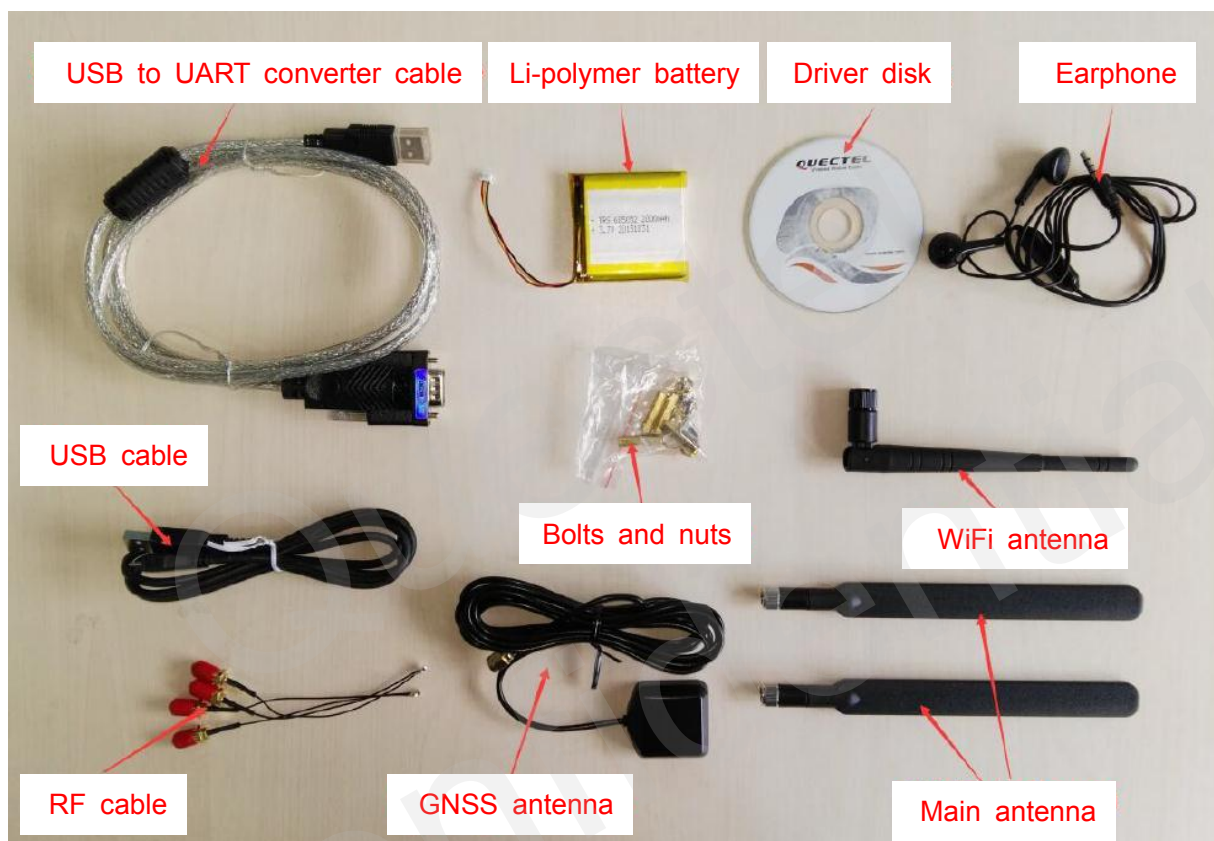


Figure 3: EVB Accessories

**NOTE**

The main antenna can also be used for diversity reception.



# 3 Interface Application

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

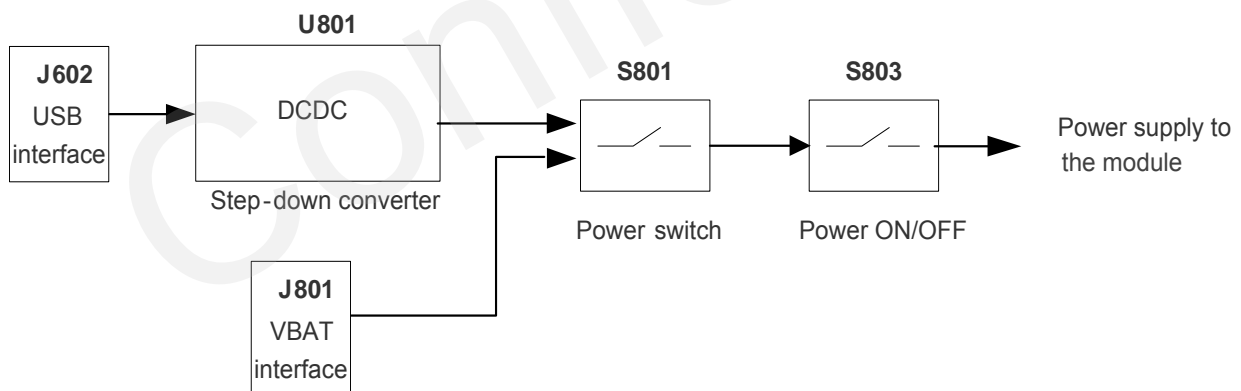
- Power interface
- USB interface
- Audio interface
- USIM card interfaces
- UART interfaces

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

## 3.1. Power Interface

The power supply of Smart EVB could come from the external input which is connected with USB receptacle. The USB receptacle is connected with a step-down converter to provide the supply voltage (VBAT) required for operating the module.

The following figures show the simplified power supply schematic and the power interface of Smart EVB.



**Figure 4: Simplified Power Supply Schematic**



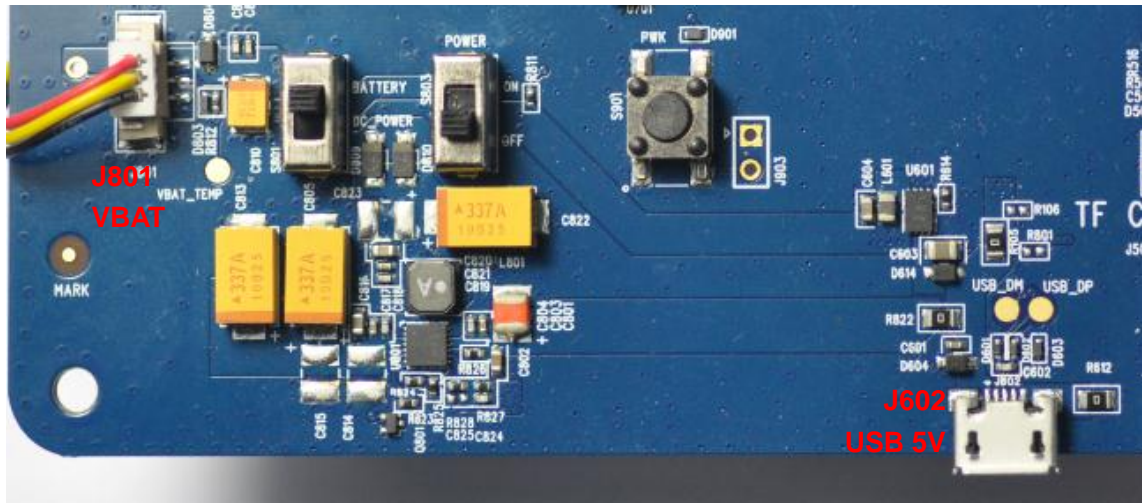


Figure 5: Power Interface

### 3.2. USB Device Interface

The Smart EVB provides a USB 2.0 interface which complies with USB 2.0 standard and supports OTG function. It is used for AT command communication, data transmission, firmware upgrade and GNSS NEMA output.

Meanwhile, Smart EVB provides a micro-USB receptacle J602 to connect with a host device. The USB\_DP and USB\_DM data lines are connected directly to the module. The schematic of the USB interface is shown in the following figure and the pin assignment of the J602 is listed in the table below.

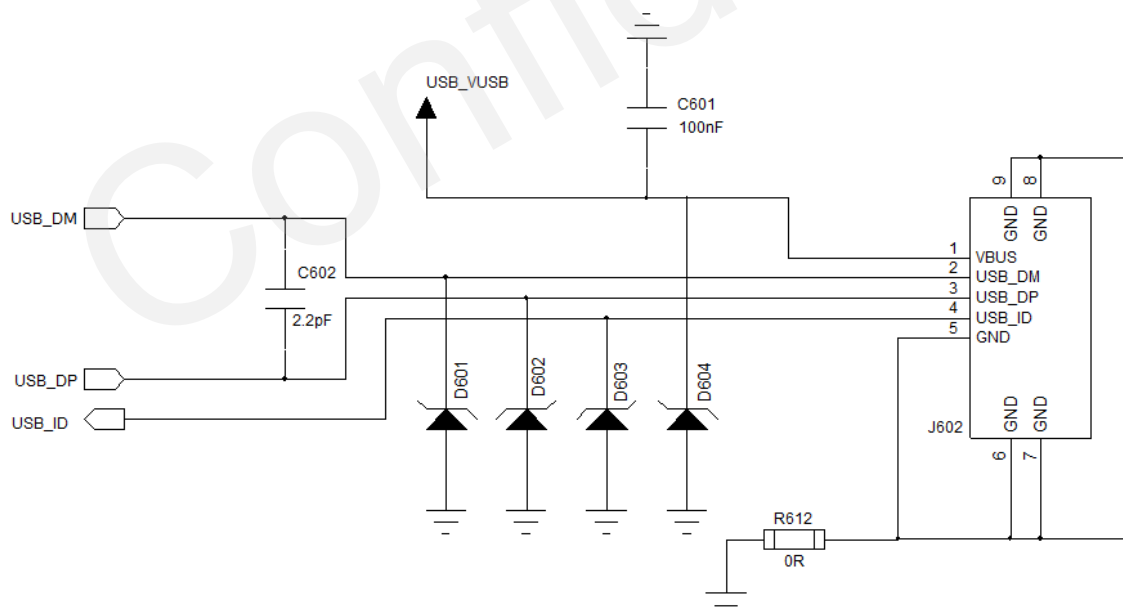


Figure 6: USB Interface Circuit

**Table 4: Pin Assignment of USB Device Interface J602**

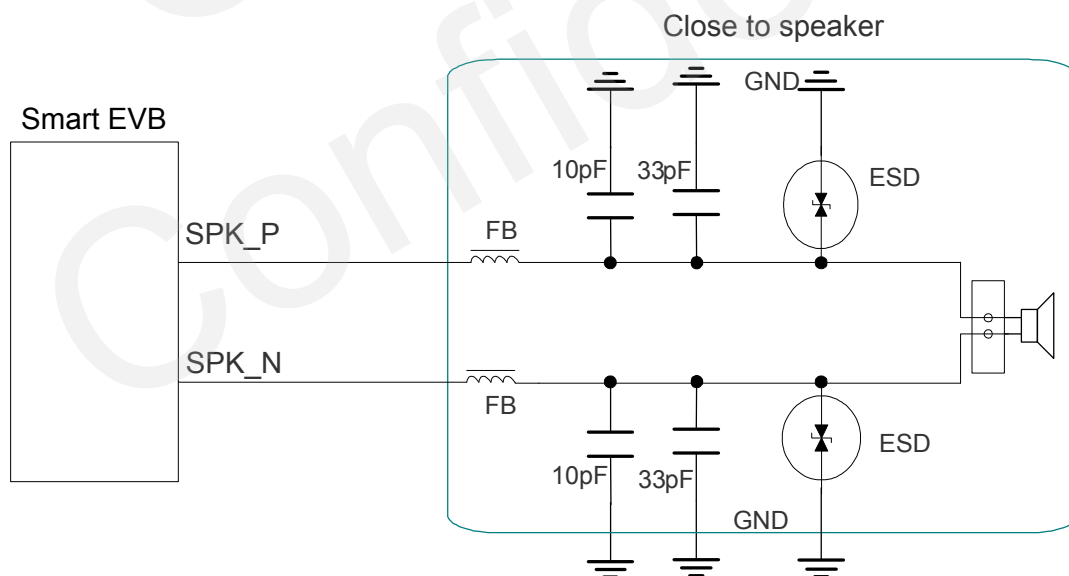
J602	Pin Name	Function
1	USB_VBUS	This pin is used for USB detection and power supply.
2	USB_DM	USB serial differential bus (minus)
3	USB_DP	USB serial differential bus (positive)
4	USB_ID	USB serial ID signal
5	GND	GND for USB interface

### 3.3. Audio Interface

Smart module provides a digital audio interface (PCM). The analog interface J702 on the Smart EVB is used for loud speaker, earphone and microphone.

#### 3.3.1. Loud Speaker

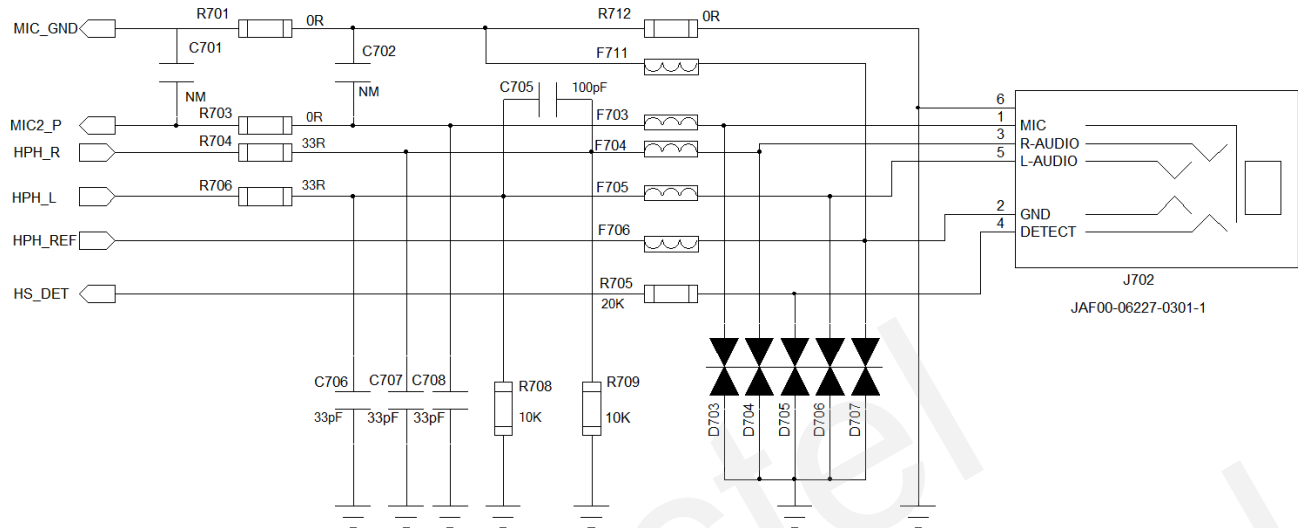
Loud speaker is soldered via TP701 and TP702. The following figure shows the loud speaker circuit.



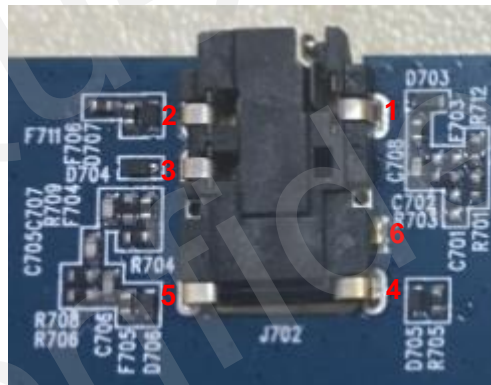
**Figure 7: Loud Speaker Circuit**

### 3.3.2. Earphone

An earphone can be used in audio interface J702. The following figures and table show the circuit of J702 audio interface for earphone and pin assignment of J702.



**Figure 8: Earphone Circuit**



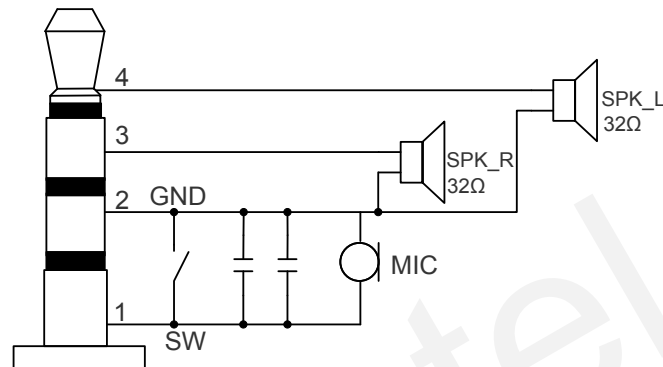
**Figure 9: Pin Assignment of J702**

**Table 5: Pin Assignment of J702**

J404	Pin Name	Function
1	MIC	Positive microphone input
2	GND	Dedicated GND for audio
3	R-AUDIO	Earphone right channel

4	DETECT	Earphone detection
5	L-AUDIO	Earphone left channel
6	GND	Dedicated GND for audio

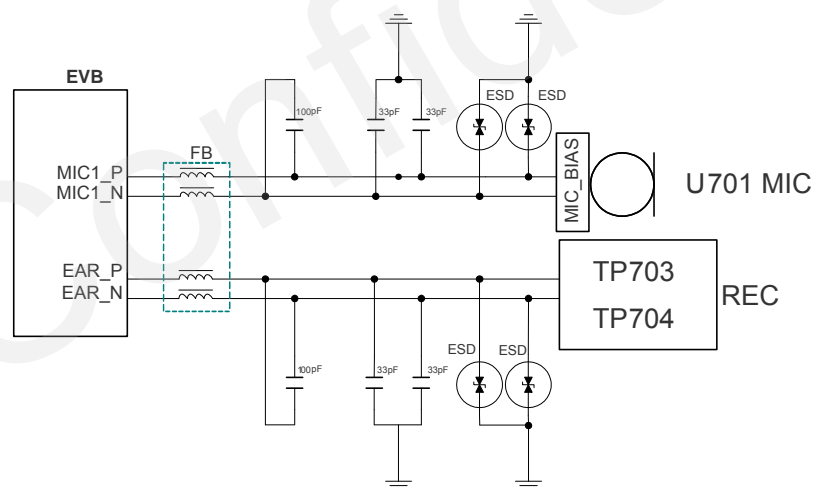
The following figure shows the sketch of audio jack which matches the Smart EVB.



**Figure 10: The Sketch of Audio Jack**

### 3.3.3. MIC and Speaker

SMT U701 MIC is used for microphone and speaker is soldered on TP703 and TP704. The following figure shows the schematic of the MIC and Speaker.



**Figure 11: MIC and Speaker Circuit**

### 3.4. USIM Card Interfaces

The Smart EVB has two USIM card interfaces. A suitable USIM card (3V or 1.8V) is required to start the Smart module. The following figure and table show the simplified interface schematic and pin assignment of J503.

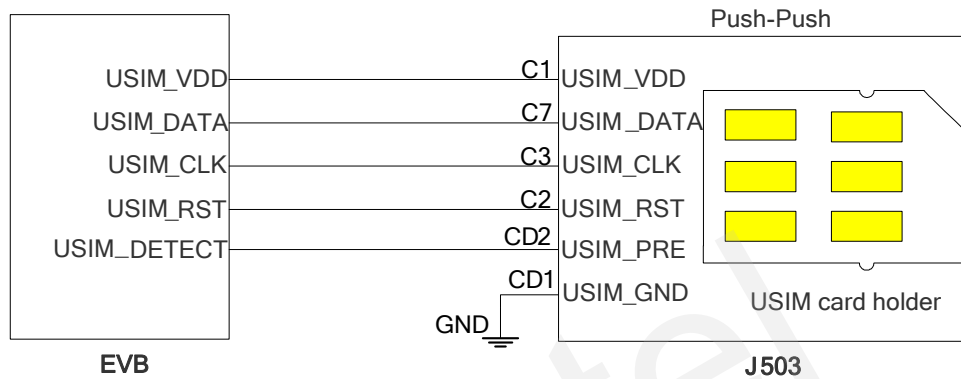


Figure 12: Schematic of Simplified USIM Card Interfaces

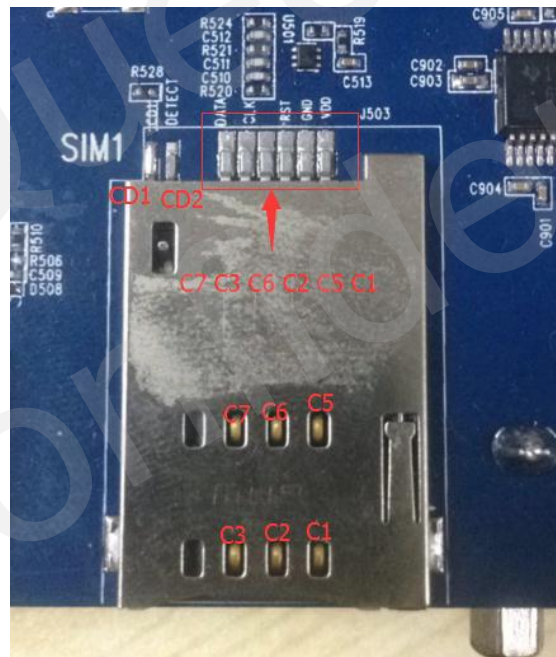


Figure 13: Pins Assignment of USIM Card Holder

**Table 6: Pin Assignment of USIM Card**

No.	Pin 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

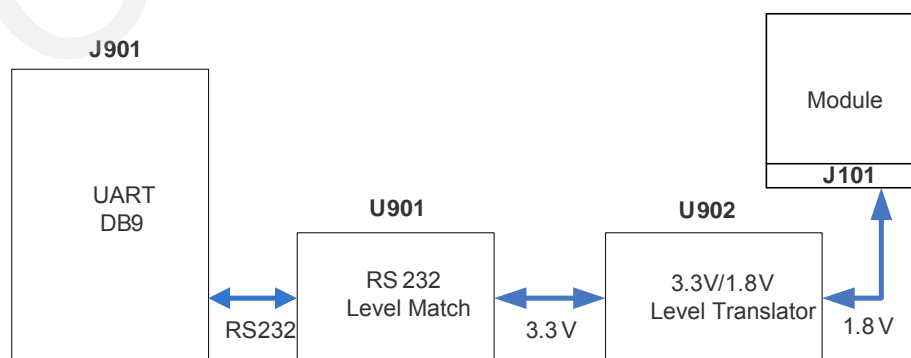
**NOTE**

Pin assignment of J504 is the same as that of J503.

### 3.5. UART Interfaces

Smart EVB offers two UART interfaces, which are main UART port (J901) and debug UART port (J604). The UART interface J901 is intended for the communication between the module and the host application. This interface can be used for data transmission and AT command communication. And the debug UART interface is used for debugging.

The following figure and table show the UART block diagram on Smart EVB and pin assignment of J901.



**Figure 14: UART Block Diagram**

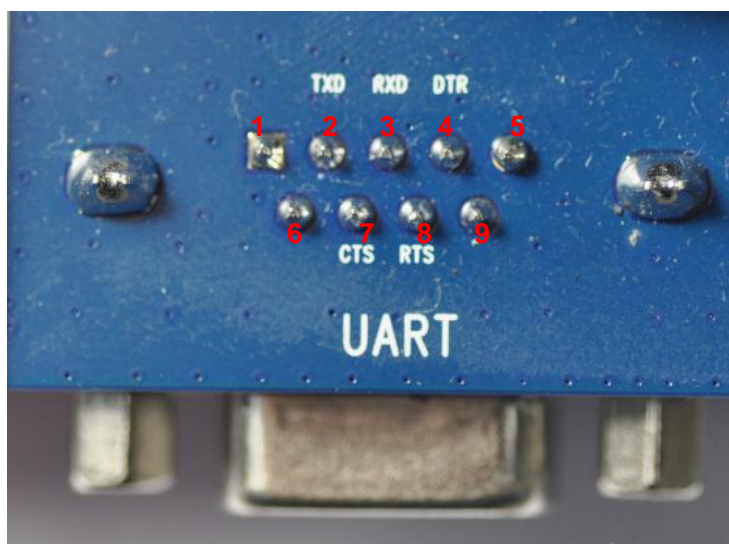


Figure 15: Main UART Port (J901)

Table 7: Pin Assignment of J901

J401	Pin Name	I/O	Description
1			Not connected
2	RS232_TXD	I	Transmit data
3	RS232_RXD	O	Receive data
4			Not connected
5	RS232_GND		Ground
6			Not connected
7	RS232_CTS	I	Clear to send
8	RS232_RTS	O	Request to send
9			Not connected

### 3.6. Switches and Buttons

Smart EVB comprises nine buttons (S901/S902/S903/S904/S905/S906/S907/S908/S909) and four switches (S801/S802/S803/S804). Description of switches and buttons is shown as below.



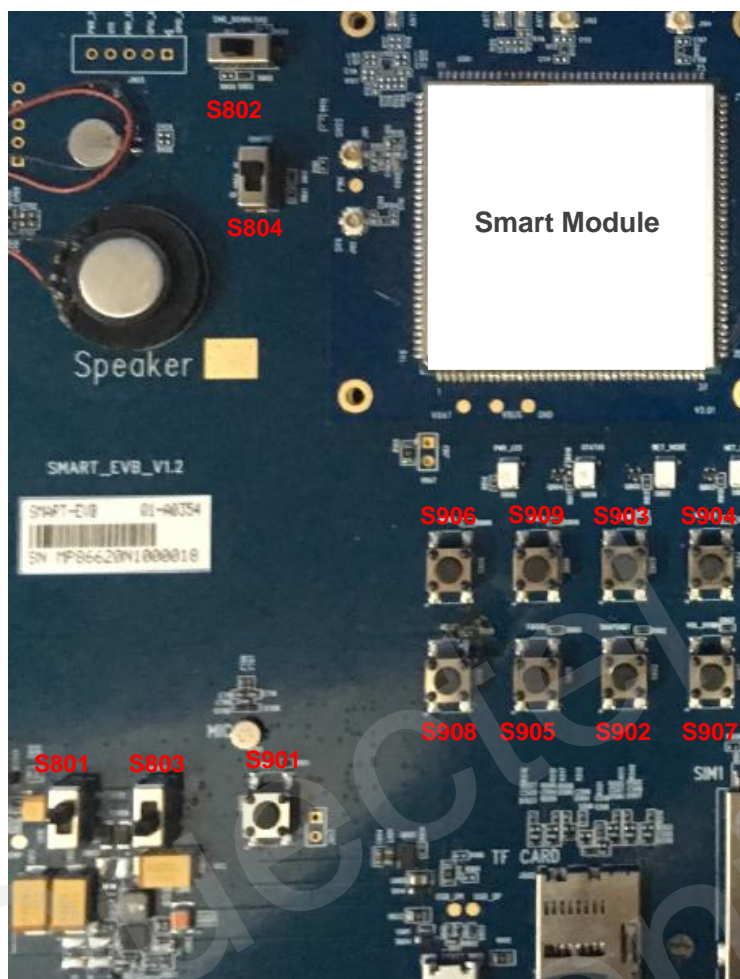


Figure 16: Switches and Buttons

Table 8: Description of Switches and Buttons

Items	Description
S801	Switch for battery power supply or DC power supply
S802	Enter into USB boot mode
S803	EVB power switch
S804	Battery charge ON/OFF
S901	Power on button
S902	Snapshot button
S903	HOME button



S904	Volume up button
S905	Focus button
S906	Menu button
S907	Volume down button
S908	Reset button
S909	Back button

#### NOTE

Some of these functions may not be supported on some modules. For details, please refer to relative module reference designs and hardware designs.

### 3.7. Status LEDs

There are several LED status indication lights (D805, D806, D807 and D808) on Smart EVB, shown as below.



Figure 17: Status LEDs

Table 9: Description of Status LEDs

Items	Description
D806	Indicate the power supply status for the module Light on: VBAT ON Light off: VBAT OFF

D808	Indicate the module operation status Light on: module is powered on Light off: module is powered down
D805, D807	Indicate the module network registration mode The indication varies in different modules. For details, please refer to relative module hardware designs.

### 3.8. Test Points

J904 is used for test. The following figure and table show the details.

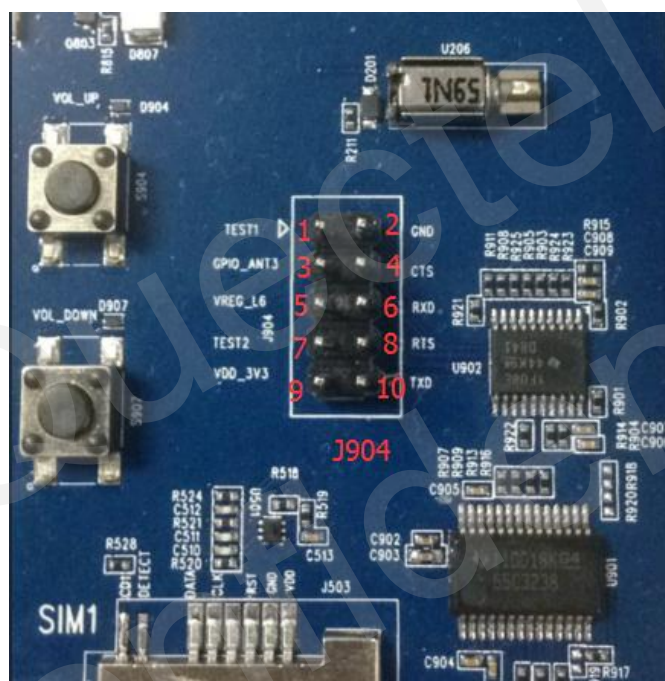


Figure 18: Pins Assignment of J904

Table 10: Details of Test Points

J904	Pin Name	Description
1	GPIO_68	GPIO68 of the module
2	VDD_3V3	3.3V power supply of EVB
3	GPIO_69	GPIO69 of the module

4	CTS_3.0V	3.2V CTS signal
5	VREG_L5	L5 power supply of the module
6	RXD_3.3V	3.3V RXD signal
7	GND	Ground
8	RTS_3.3V	3.3V RTS signal
9	GPIO_14	GPIO14 of the module
10	TXD_3.3V	3.3V TXD signal

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# 4 Operation Procedure

This chapter introduces how to use the Smart EVB for testing and evaluation Quectel Smart modules.

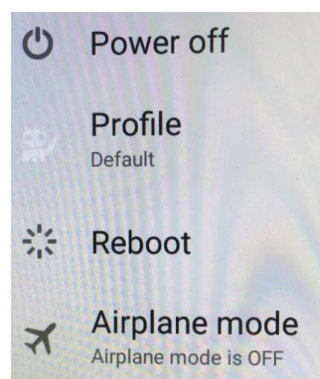
## 4.1. Power ON

1. Connect the Smart module to the connector J101 and J102 on smart EVB.
2. Install battery on J801 and switch S801 to BATTERY state. Or charge with USB cable and pull S801 to DC\_POWER state.
3. Pull S803 to ON state and D806 will be lighted.
4. Press the S901 (PWRKEY) for at least 2s. The module will be in power-on mode and D808 (STATUS) will be lighted.
5. LCM display starts to work. And wait for the module to be full booted.

## 4.2. Power OFF

There are two ways to power off the module. One way is to operate via the system. The steps are shown as follows.

1. Press S901 (PWRKEY) for at least 1s under power on state, and then LCM will display a menu as shown in the following figure.



**Figure 19: Menu on LCM**

2. Choose **"Power off"**.
3. Module will be powered off after D808 (STATUS) light is off.

Another way is to press down S901 (PWRKEY) until the module is shut down.

### 4.3. Reset

Pressing S908 key then releasing it can reset the module. This may cause loss of information stored in the memory since the module has been initialized after reset.

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.

### 4.4. Communication Via USB or UART Interface

#### 4.4.1. Communication via USB Interface

1. Power on the module.
2. Connect EVB and PC with USB cable through USB interface and install USB driver from the Driver Disk.
3. Open QCOM tool and configure AT Command window, then select correct port and operate the module by AT commands.

#### 4.4.2. Communication via UART Interface

1. Power on the module.
2. Connect the UART interface to PC with USB-to-RS232 converter cable and install the driver from the Driver Disk.
3. Open QCOM tool and configure AT Command window, then set correct baud rate (such as 115200bps) to operate the module by AT commands.

#### NOTE

The port can be checked by the Device Manager on PC.

## 4.5. Firmware Upgrade

Firmware can be upgraded via USB port (default), please follow the procedures below to upgrade firmware.

1. Open the firmware upgrade tool “**QEIL**” on the PC and power on the module.
2. Click the “**SelectPort**” dropdown list and select the USB port.
3. Select “**Flat Build**” from “**Select Build Type**”.
4. Select software to load files from “**Select Programmer**”.
5. Choose load content to load XML from “**Select Build**”.
6. Click “**Download**” to upgrade the firmware.

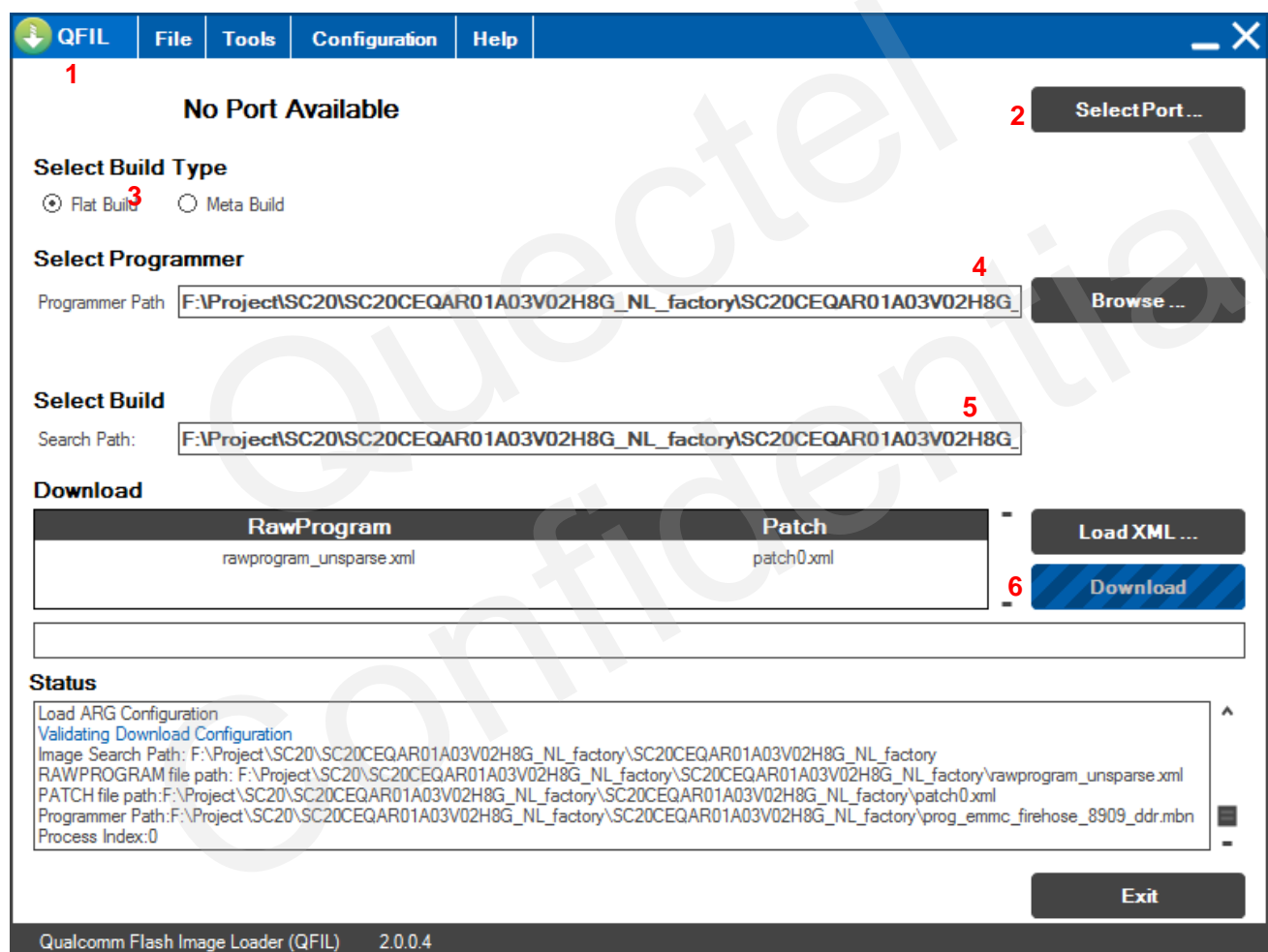


Figure 20: Select the USB Port to Update Firmware



## 5 EVB Accessories Assembly



Figure 21: Smart EVB and Accessories Assembly

## 6 Appendix A Reference

Table 11: Related Documents

SN	Document name	Remark
[1]	Quectel_SC20_Hardware_Design	SC20 Hardware Design
[2]	Quectel_QCOM_User_Guide	QCOM User Guide

Table 12: Terms and Abbreviations

Abbreviation	Description
EVB	Evaluation Board
OTG	On-The-Go
PC	Personal Computer
SIM	Subscriber Identity Module
USIM	Universal Subscriber Identity Module