L96 EVB User Guide

GNSS Module Series

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Quectel Wireless Solutions Co., Ltd.
7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China
Tel: +86 21 5108 6236
Email: info@quectel.com

Or our local office. For more information, please visit:
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About the Document

History

Revision	Date	Author	Description
1.0	2017-10-27	Brooke WANG	Initial
1.1	2017-12-27	Brooke WANG	Updated Figure 6, Figure 7 and added the description of how to switch between the internal and external antennas.
1.2	2018-08-14	Brooke WANG	Updated Table 5. Updated Chapter 6.

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1 Introduction

This document specifies the usage of L96 EVB (Evaluation Board) which is an assistant tool for engineers to develop and test Quectel L96 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 L96 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 the customers' 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 (U)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

2.1. Top and Bottom Views

The following illustrate the top and bottom views of L96 EVB.

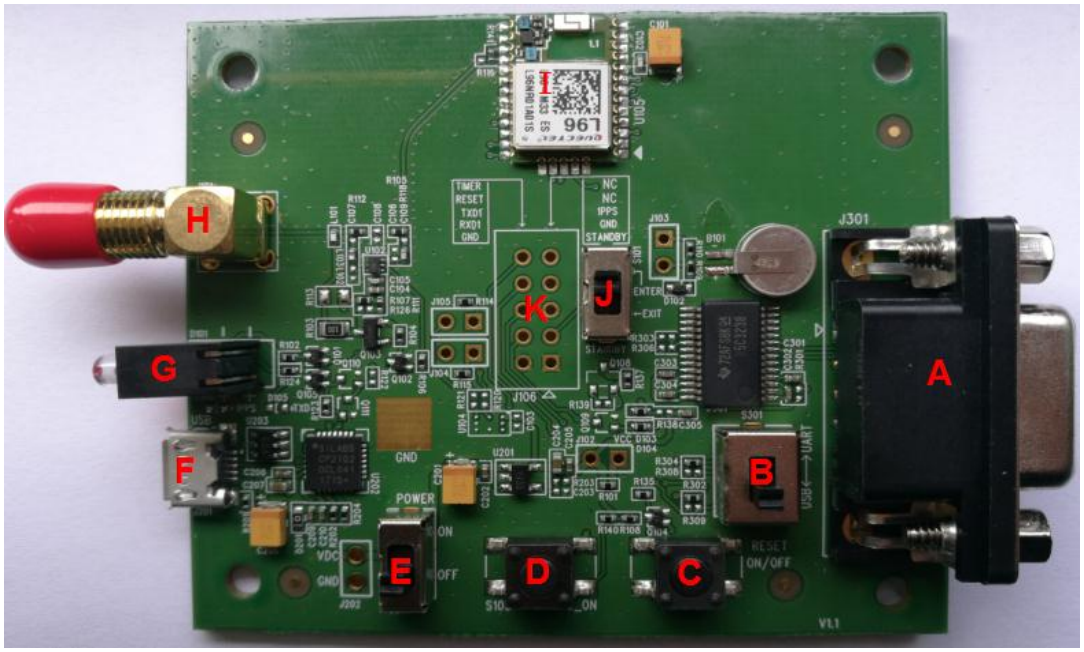


Figure 1: Top View of L96 EVB

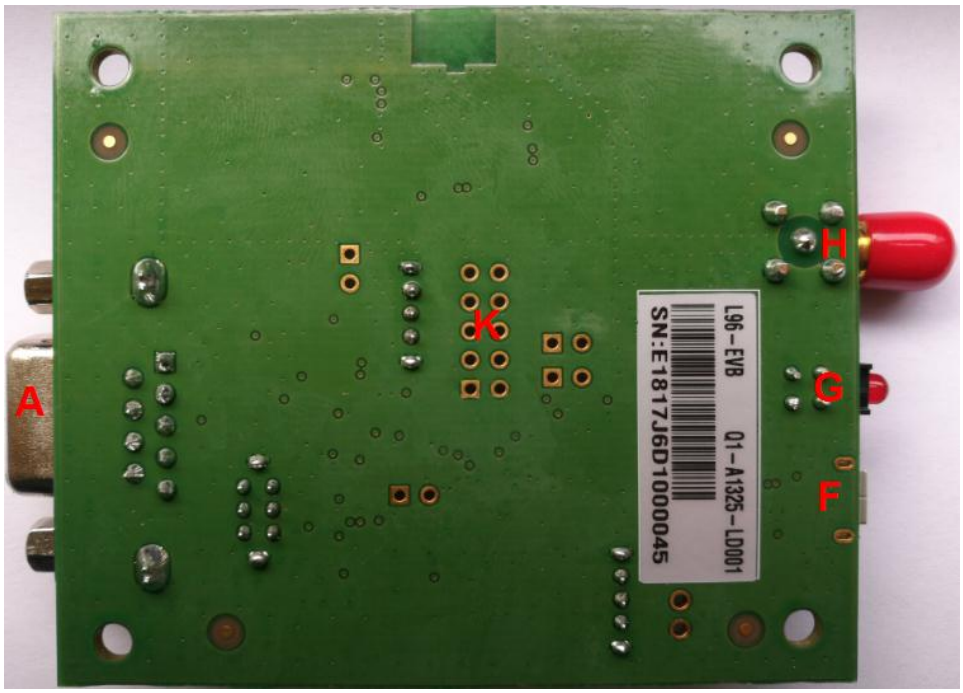


Figure 2: Bottom View of L96 EVB

Table 1: Interfaces of L96 EVB

SN.	Reference Number	Description
A	J301	UART port
B	S301	USB ←→ UART (serial port alternation switch)
C	S102	RESET button
D	S103	FORCE_ON button
E	S201	POWER switch
F	J201	Micro-USB port
G	L1, L2	Indication LEDs
H	J101	Antenna interface
I	U105	L96 module
J	S101	STANDBY switch
K	J106	Test points

2.2. L96 EVB & Kit Accessories

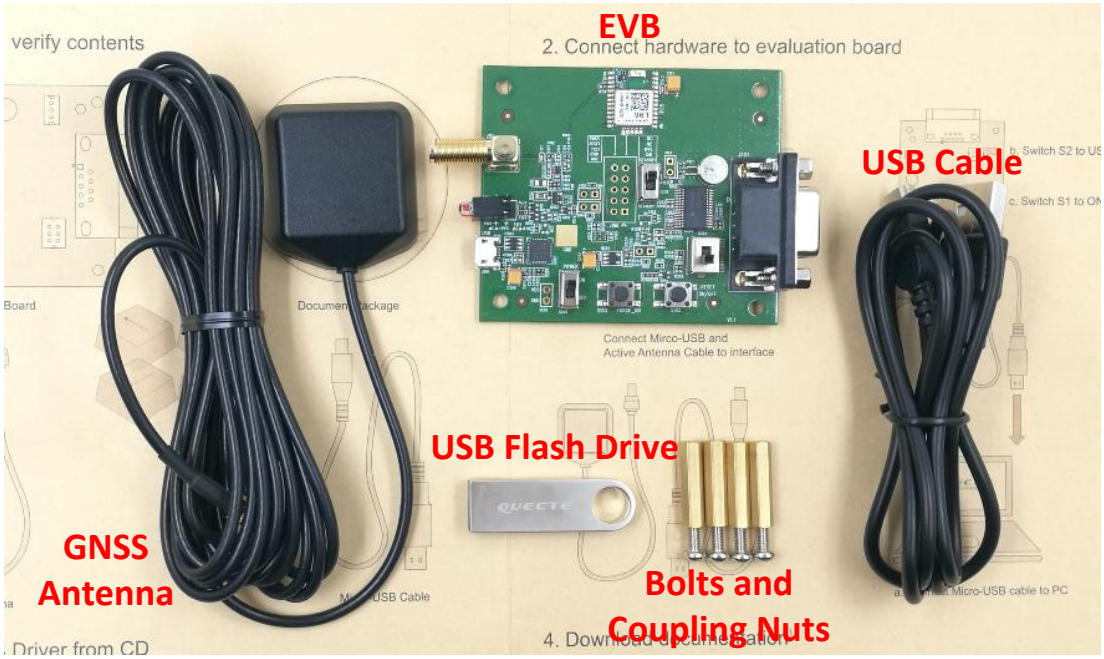


Figure 3: L96 EVB & Kit Accessories

Table 2: Accessories List

Items	Description	Quantity
Cable	USB cable	1
Antenna	GNSS Antenna (Active)	1
USB Flash Drive	USB Flash Drive	1
Instruction Sheet	A sheet of paper giving instructions for EVB connection, details of EVB accessories, etc.	1
Others	Bolts and Coupling Nuts	4 for each type

3 Interface Applications

3.1. USB Interface

The main power is supplied via a micro-USB interface. Both micro-USB and UART interfaces can be used for data communication, and the two interfaces can be switched by the alternation switch (S301). If UART interface is used for data communication (NMEA sentences output), then both RS232 and micro-USB cables are necessary for operating the EVB. So it is strongly recommended to use the micro-USB interface for both power supply and NEMA output, during which only a USB cable is needed.

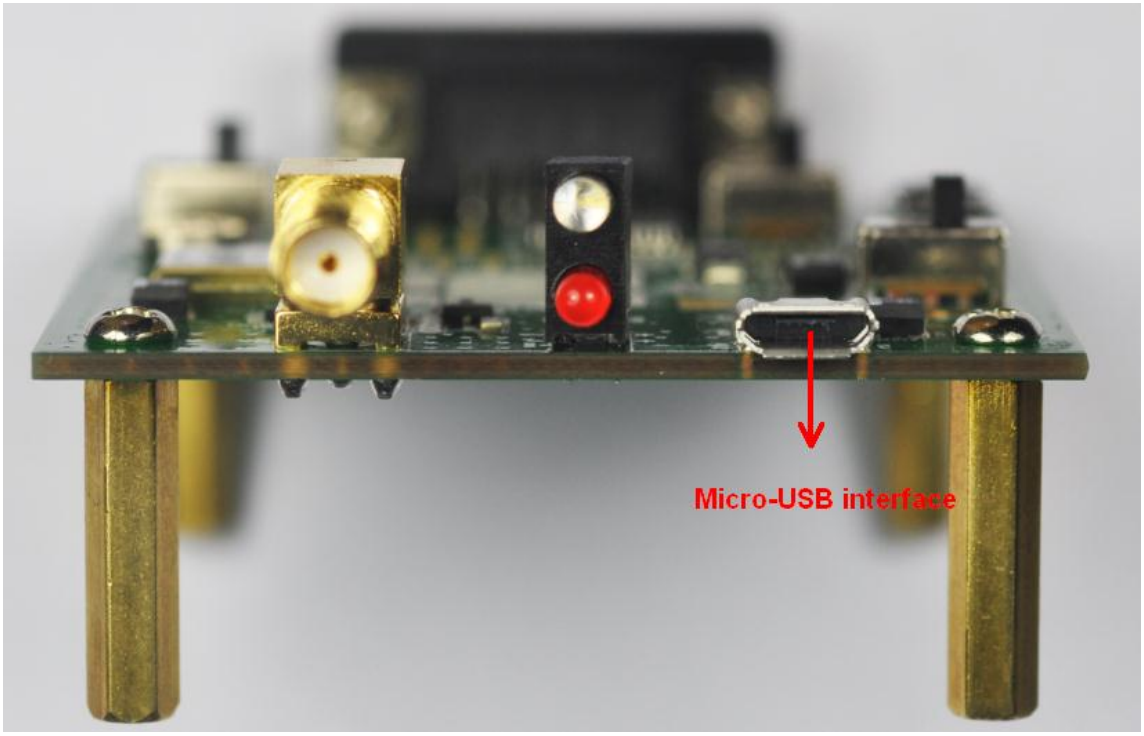


Figure 4: Micro-USB Interface

NOTE

If the PowerGPS Tool needs to be used, then it is recommended to use the UART interface for data communication.

3.2. UART Interface

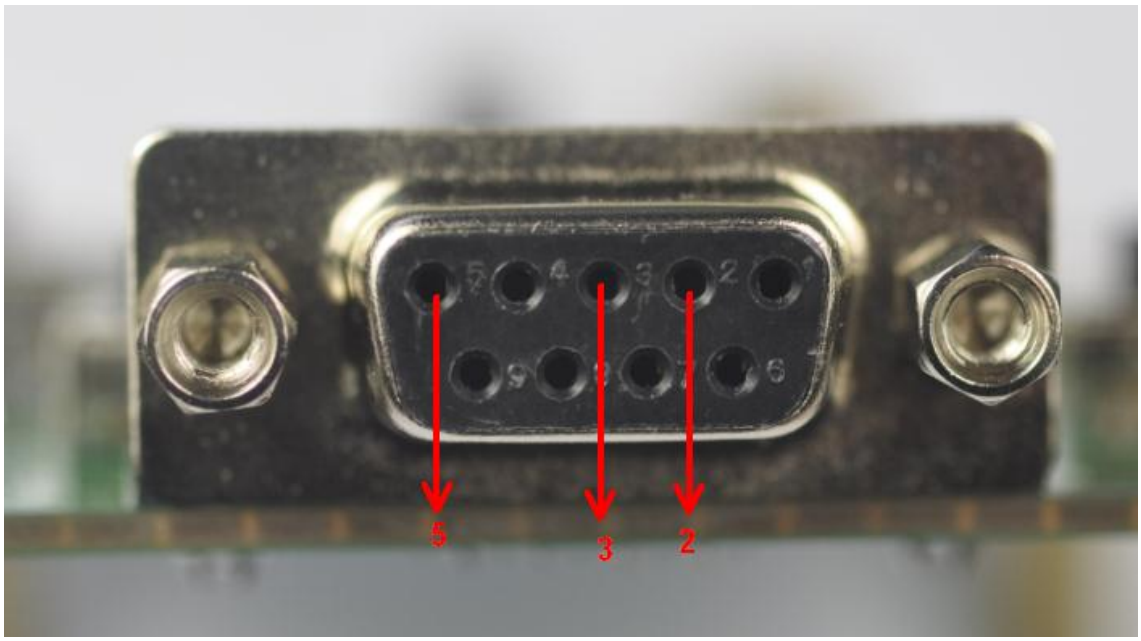


Figure 5: UART Interface

Table 3: Pin Definition of UART Interface

Pin No.	Signal	I/O	Description
2	RXD	DI	Receive data
3	TXD	DO	Transmit data
5	GND		GND

3.3. Antenna Interface

L96 module uses the internal antenna by default, and R141 is mounted by default. If an external antenna needs to be used, then R141 should be moved to R116. Both active antenna and passive antenna can be selected as the external antenna.

The following illustrate the external antenna interface and LNA layout of the EVB.

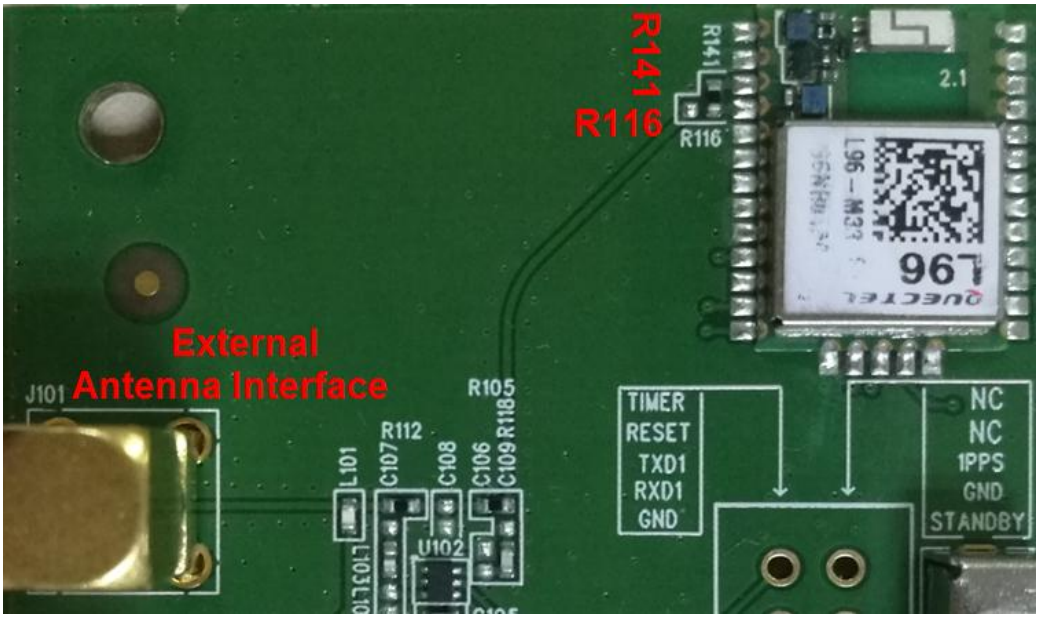


Figure 6: L96 EVB External Antenna Interface

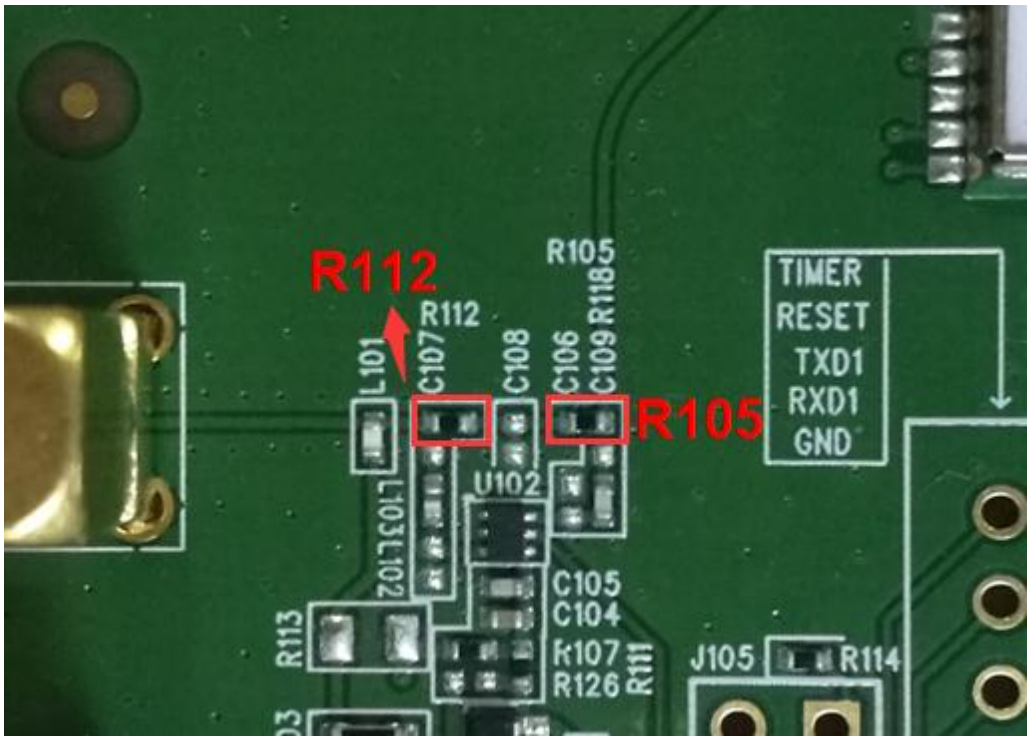


Figure 7: L96 EVB LNA Layout

Please note that the LNA is installed in the EVB by default, and thus customers have to move R112 to C107 and R105 to R118, when the LNA needs to be used.

3.4. Switches and Buttons

The following figure illustrates the switches and buttons of the EVB.

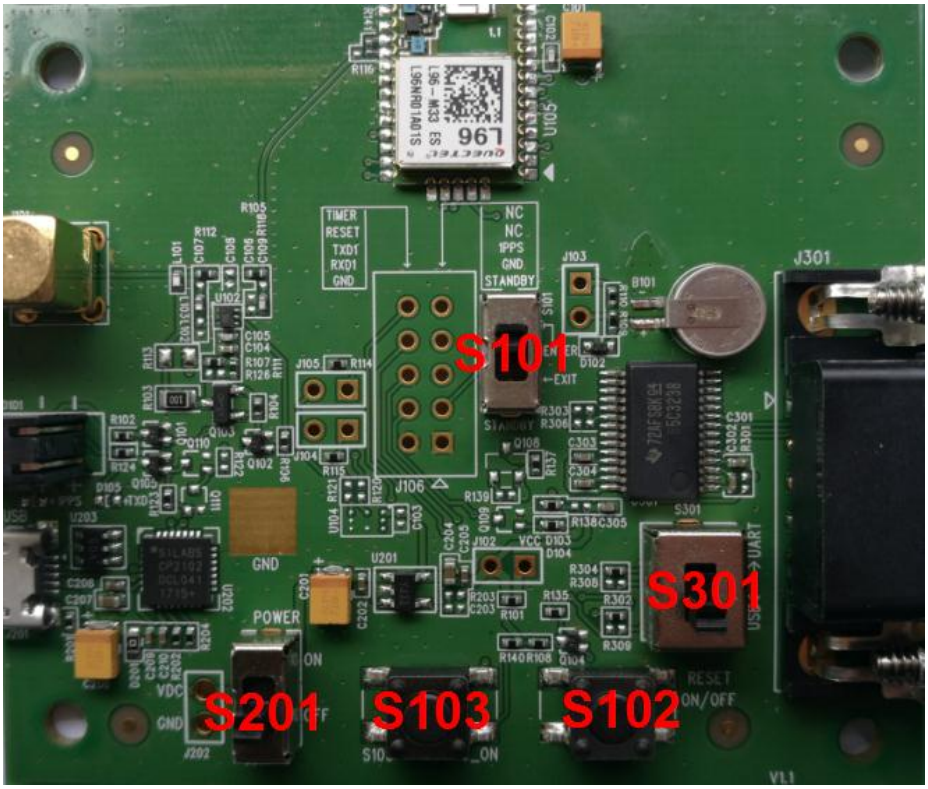


Figure 8: L96 EVB Switches and Buttons

Table 4: L96 EVB Switches and Buttons

Part No.	Name	I/O	Description
S101	STANDBY	DI	The module will enter into standby mode after the S101 is switched from OFF to ON, and exit from standby mode through the opposite operation.
S102	RESET	DI	Press and release the button, the module will be reset.
S103	FORCE_ON	DI	Press and release the button, the module will be woken up from backup mode.
S201	POWER	PI	Control power supply via micro-USB interface.
S301	USB ←→ UART (serial port alternation switch)	DI	L96 EVB supports data communication via both micro-USB and UART interfaces which are controlled by the S301 switch.

3.5. Operation Status Indication LEDs

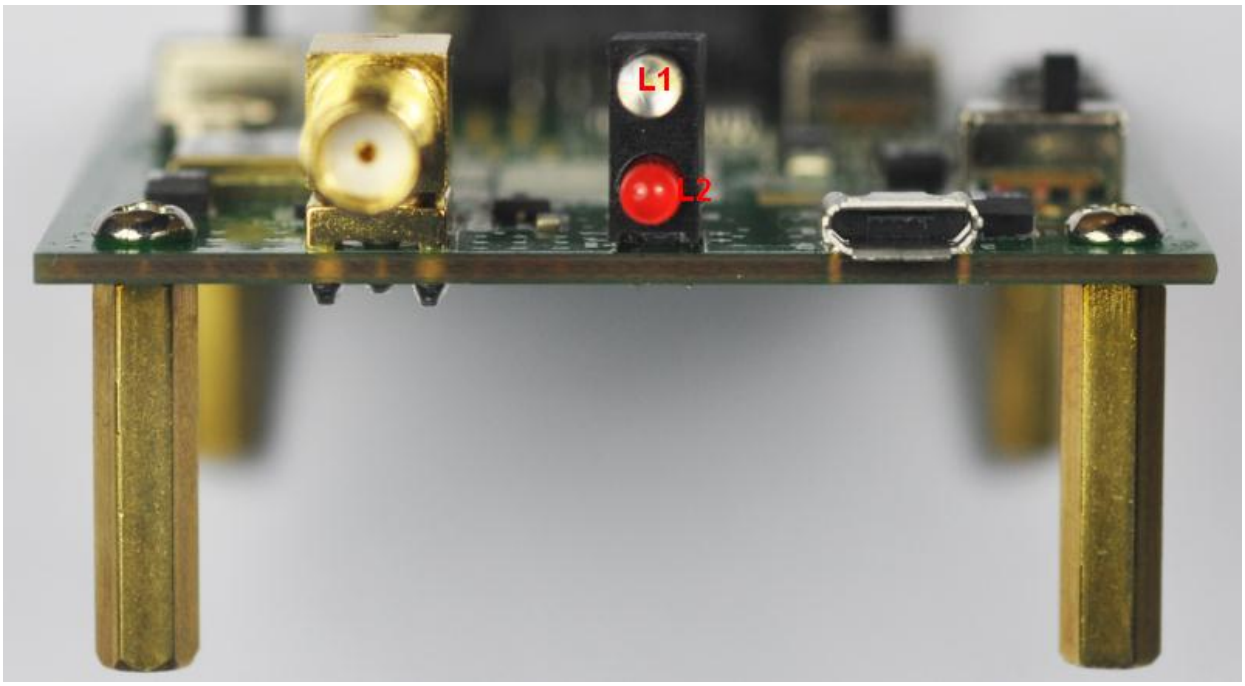


Figure 9: Operation Status Indication LEDs

Table 5: Operation Status Indication LEDs

Part	Name	I/O	Description
L1	TXD1	DO	Flash: the module is turned on successfully, and the micro-USB or UART port can be used to output messages. Extinct: fail to turn on the module.
L2	1PPS	DO	Flash: successful fix. The frequency is 1Hz. Extinct: no fix.

3.6. Test Points

The following figure illustrates the test points of the EVB.

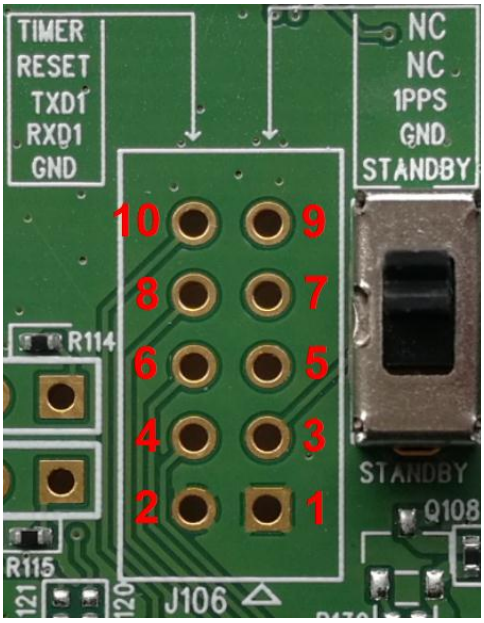


Figure 10: L96 EVB Test Points - J106

Table 6: Pin Description of J106

Pin No.	Signal	I/O	Description
1/2	GND	-	Ground
3	STANDBY	DI	Enter or exit standby mode
4	RXD1	DI	Receive data
5	1PPS	DO	1 pulse per second
6	TXD1	DO	Transmit data
7/9	NC	-	Not connected
8	RESET	DI	System reset
10	FORCE_ON	DI	Logic high will force module to be woken up from backup mode. Keep this pin open or pulled low before entering into backup mode. If unused, keep this pin open.

4 EVB and Accessories Assembly

The following figure shows the assembly of L96 EVB and its accessories.

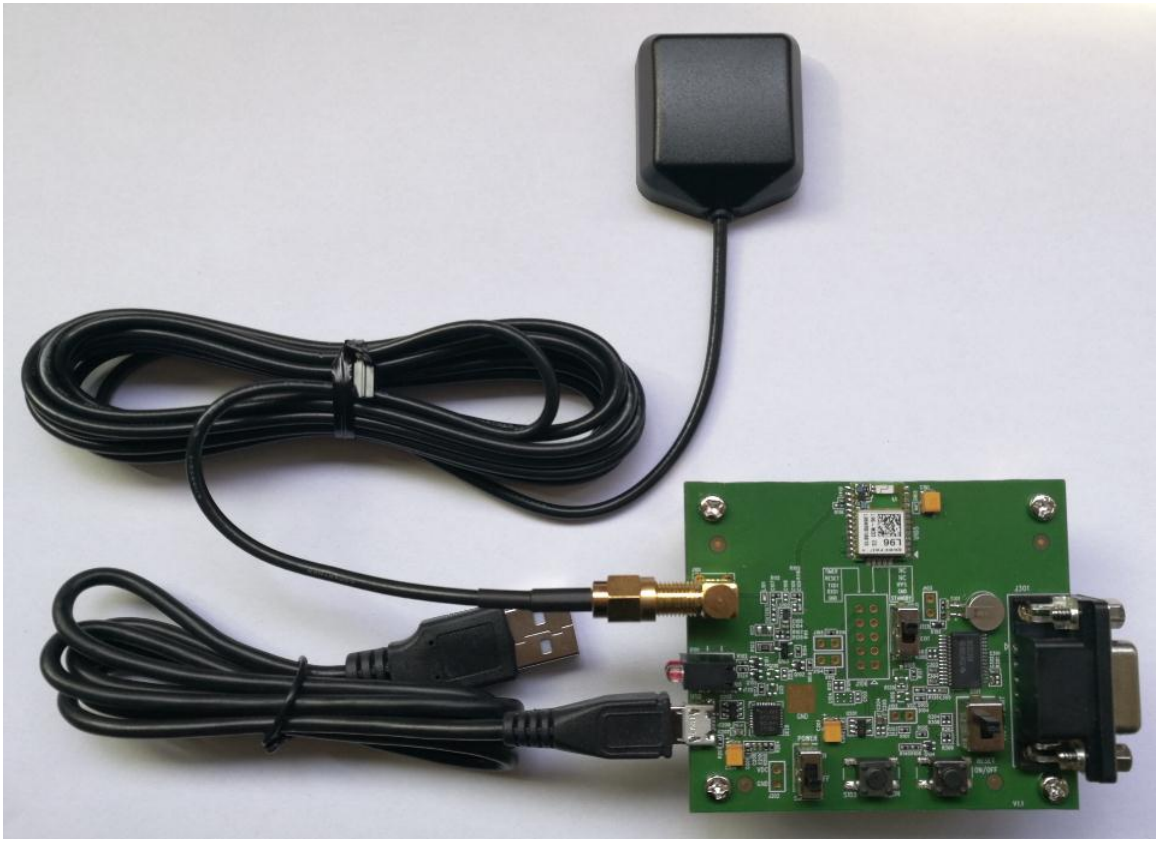


Figure 11: L96 EVB and Accessories Assembly

5 EVB Operation Procedures

This chapter mainly illustrates the operation procedures of L96 EVB.

5.1. Communication via USB Interface

Step 1: Connect the EVB and the PC with a USB cable through USB interface, and then switch the S201 to **ON** state to power on the EVB.

Step 2: Run the driver disk on PC to install the USB driver. The USB port numbers can be viewed through the PC Device Manager, shown as below.

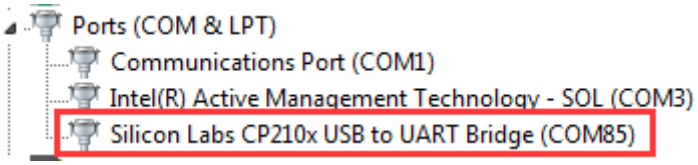


Figure 12: USB Ports

Step 3: Install and then use the QCOM tool provided by Quectel to realize the communication between the L96 module and the PC.

The following figure shows the COM Port Setting interface of QCOM: select correct "**COM Port**" (USB AT Port shown in above figure) and set the correct "**Baudrate"** (the default value: 9600bps). For more details of QCOM usage, please refer to ***document [4]***.

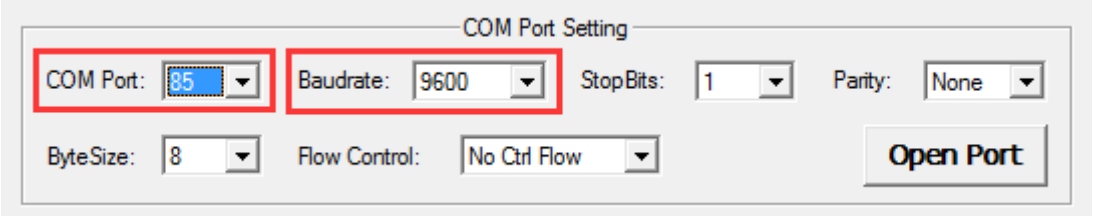


Figure 13: COM Port Setting Interface of QCOM

5.2. Firmware Upgrade

Quectel L96 module upgrades the firmware via USB port by default. Please follow the procedures below to upgrade firmware.

Step 1: Install and open the firmware upgrade tool FlashTool on PC.

Step 2: Power on the EVB according to the procedures mentioned in **Step 1 of *Chapter 5.1***.

Step 3: Follow the steps below to start firmware upgrade.

a) Click the "**Baud rate**" dropdown list and select the "**Auto Detect**".
b) Click the "**COM Port**" dropdown list and select the COM port.
c) Choose the firmware package.
d) Click the "**Download**" and "**Go**" button to upgrade the firmware.

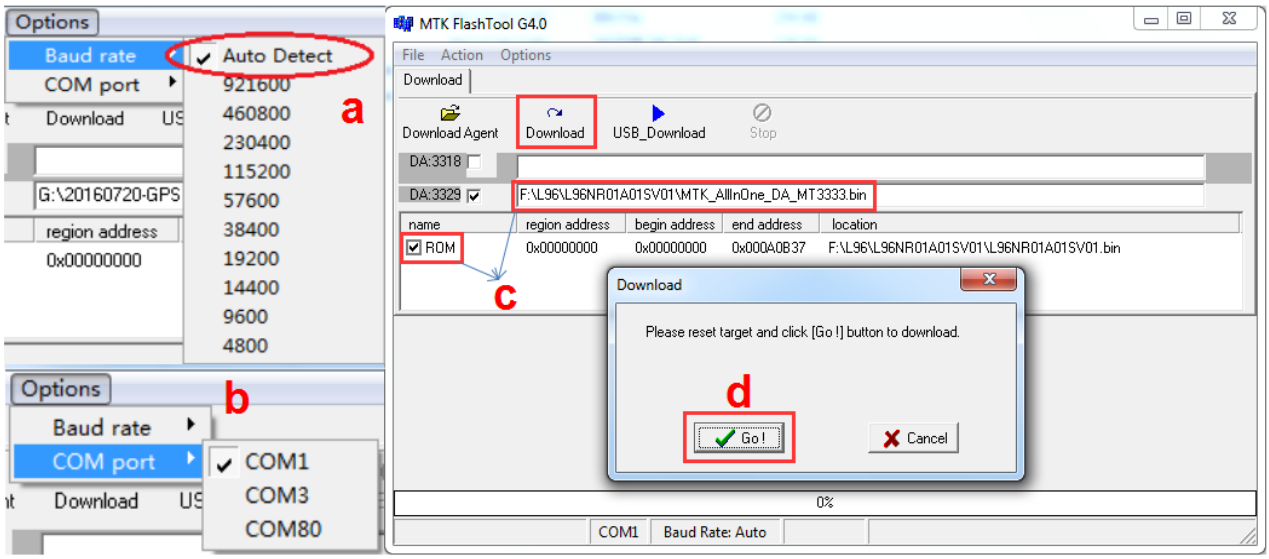


Figure 14: FlashTool Configurations for Firmware Upgrade

6 Usage of PowerGPS

6.1. COM and Baud Rate Setting

The PowerGPS tool can help users to view the status of GPS/GLONASS/BeiDou/Galileo receivers conveniently.

After EVB accessories are assembled, turn on the module and start up the PowerGPS. After the tool (*PowerGPS Trial 2.3.6*) is opened, the following interface in default layout will be shown:

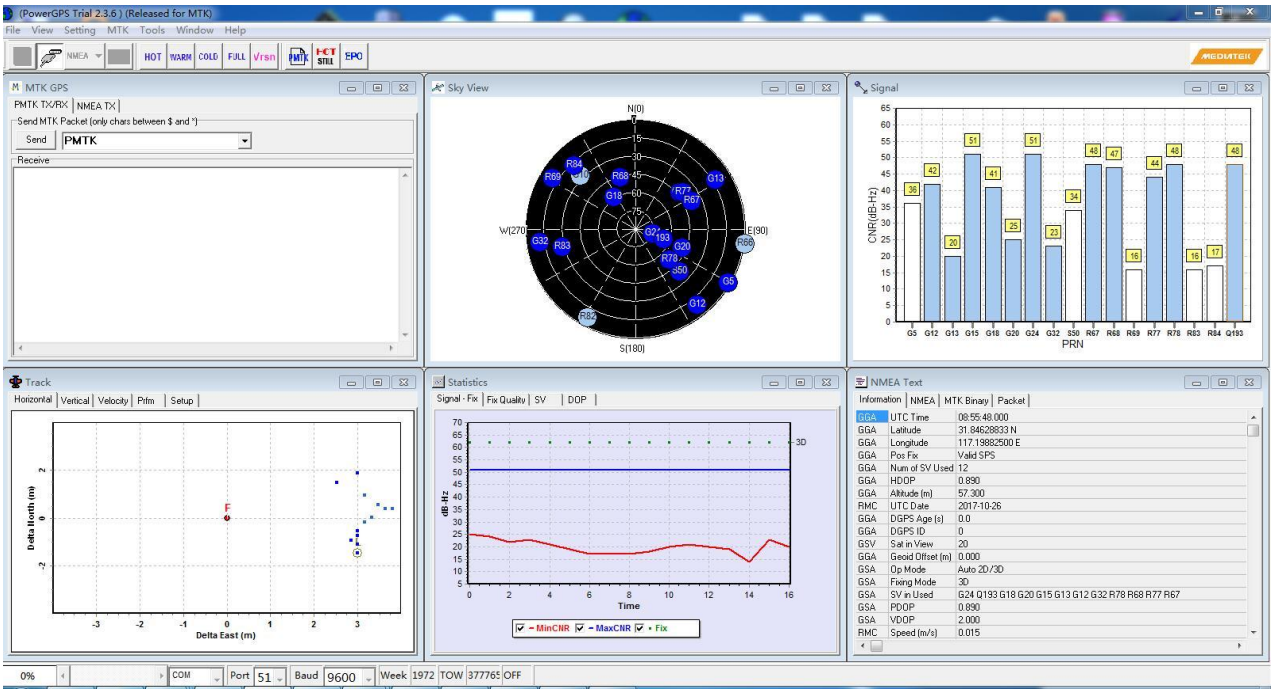


Figure 15: PowerGPS Interface

At the bottom of the interface, select a correct COM port and baud rate (L96 module supports 9600bps by default), then click the button "**Create Connection**".

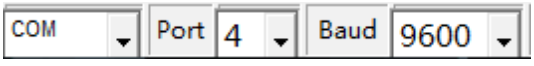
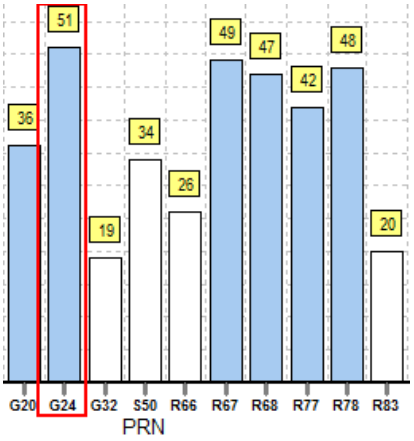
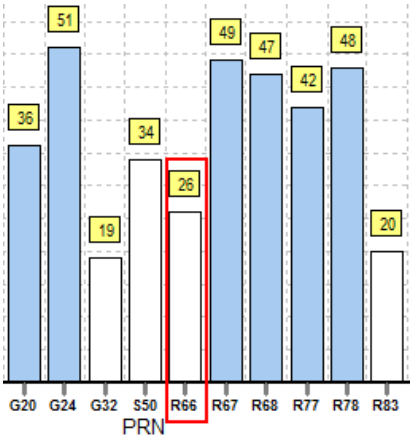


Figure 16: COM Port and Baud Rate Selection

6.1.1. Explanations of PowerGPS Interface

From the PowerGPS interface, users can view CNR message, time, position, speed, precision and so on. Explanations are listed in the table below.

Table 7: Explanations of Signal & NMEA Text

Icon	Explanation
	SV with PRN 65. If the position of SV is near to the centre of the Sky View, the elevation angle of SV is close to 90°. Dark blue means this satellite is in tracking.
	Light blue means this satellite is not in tracking.
	The CNR of PRN 24 is 51dB/Hz. G means it is a GPS satellite, R means it is a GLONASS satellite, S means it is a SBAS. Light blue column means the navigation data of this satellite is in use.
	The CNR of PRN 66 is 26dB/Hz. White column means the navigation data of this satellite is not in use. The range of GLONASS SVID is 65-96.

UTC Time	08:57:29.000	UTC time
Latitude	31.84628000 N	Latitude degree
Longitude	117.19882833 E	Longitude degree
Pos Fix	Valid DGPS	Position fix
Num of SV Used	13	The number of satellites being used
HDOP	0.810	Horizontal Dilution of Precision
Altitude (m)	58.500	Altitude based on WGS84 datum
UTC Date	2017-10-26	UTC date
Fixing Mode	3D	Fixing mode: No-fix, 3D or 2D SPS
SV in Used	G24 Q193 G18 G20	Satellite being used
PDOP	0.810	Position Dilution of Precision
VDOP	2.000	Vertical Dilution of Precision
Speed (m/s)	0.000	Speed of receiver

6.2. PMTK Command Sending

PMTK command can be sent by PowerGPS. The format of PMTK command includes only characters between '$' and '*', for example: PMTK869,0.

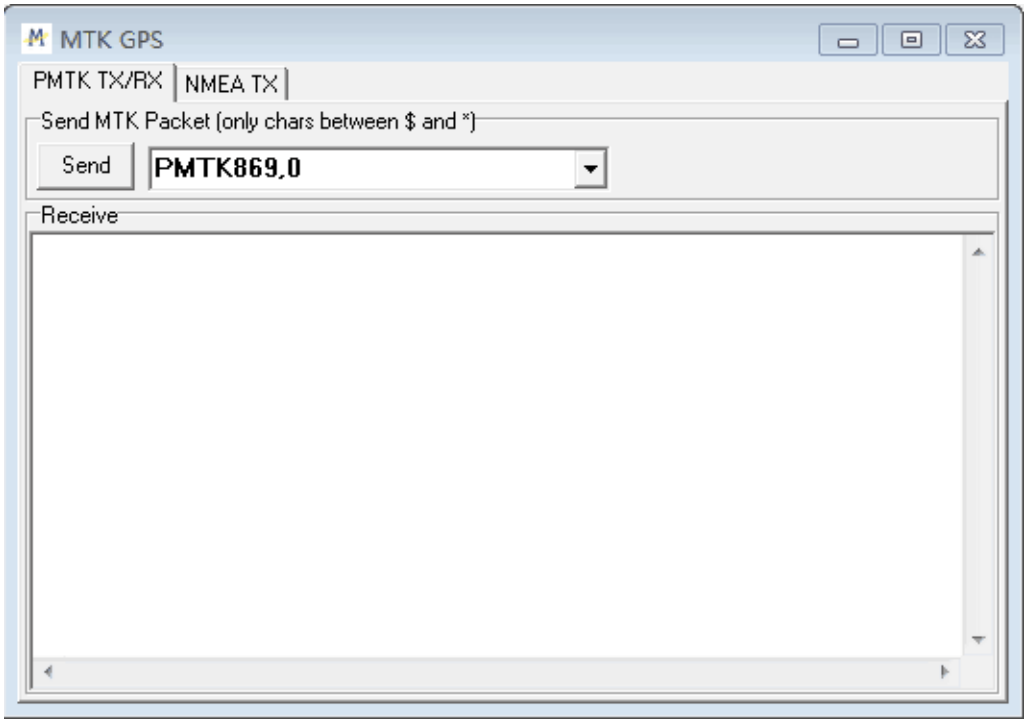


Figure 17: PMTK Command Sending via PowerGPS

6.3. Automatic TTFF Testing

PowerGPS tool allows customers to measure the TTFF (Time to First Fix) under different testing conditions. The TTFF can be tested under full start, cold start, warm start or hot start conditions, and the number of tests can be chosen from 1, 10, 20, 100, 1000 and 10000. Click the "**Run**" button to start the test and it can be stopped by clicking the "**Stop**" button.

The following are the detailed configuration steps during TTFF testing:

Step 1: Start "**MTK**" menu, and then click "**Static TTFF Testing**" to enter Automatic TTFF Testing as shown below:

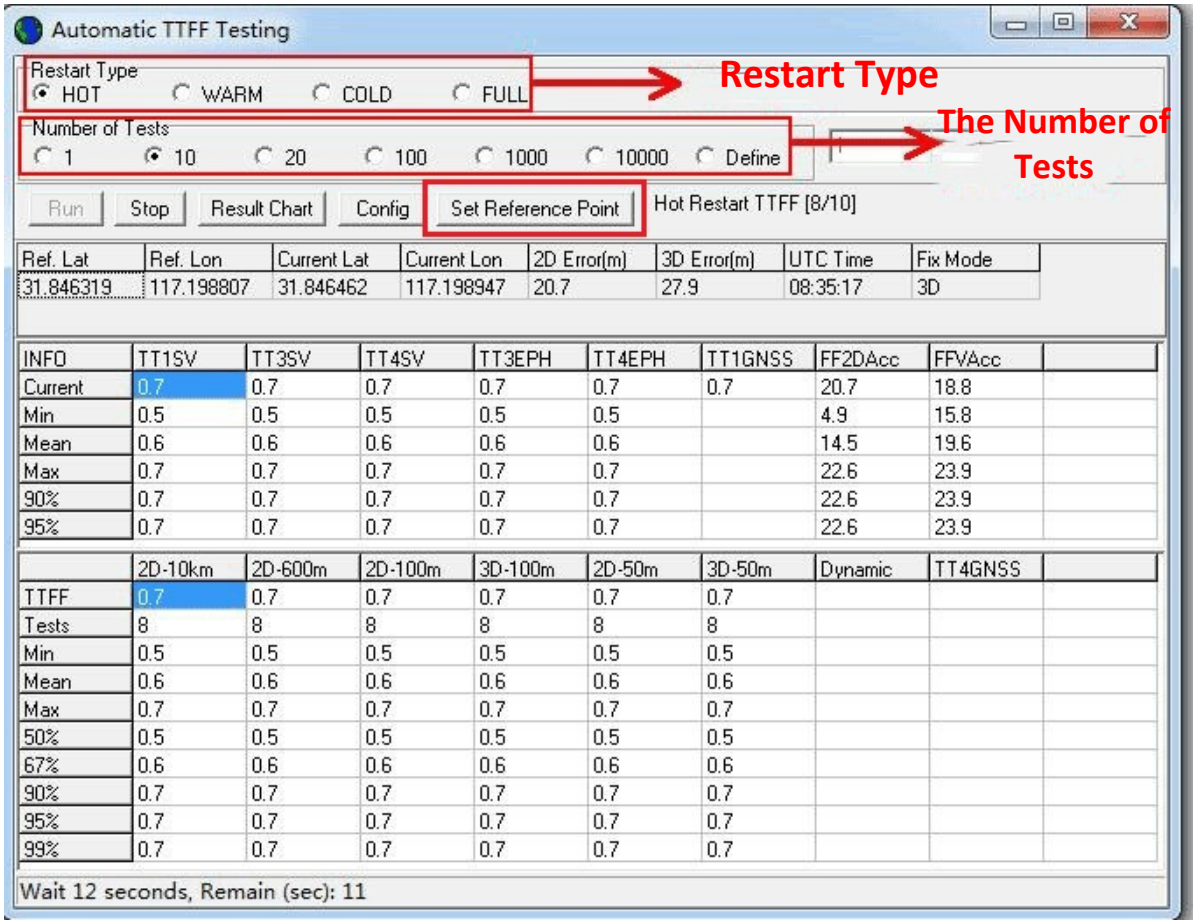


Figure 18: Static TTFF Testing via PowerGPS

Step 2: Click "**Set Reference Point**" and the Options window will be shown as below, then choose "**Reference Location**".

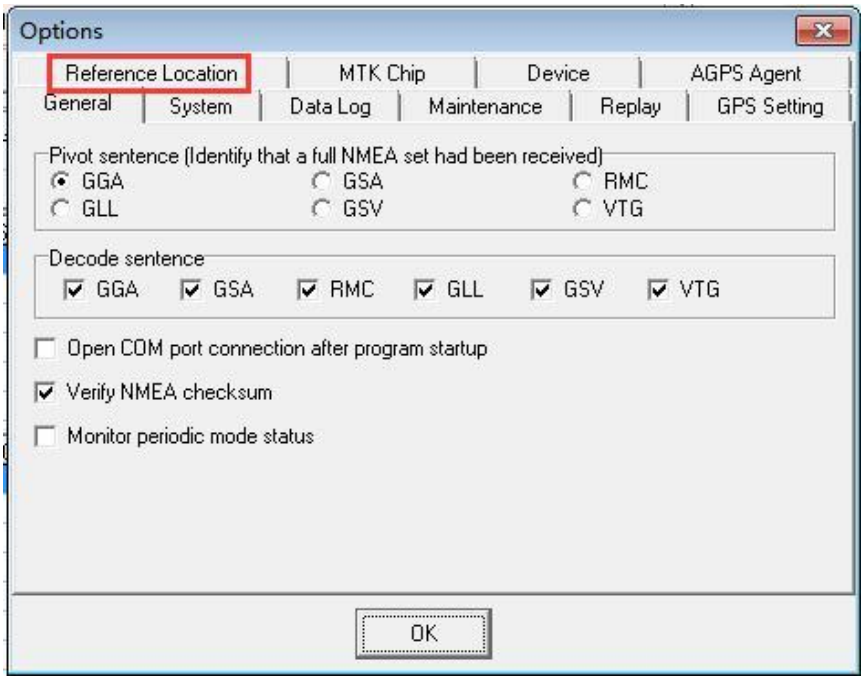


Figure 19: Choose Reference Location

After that, the interface will be shown as below. Click "**Use Mean Position**" and then "**OK**".

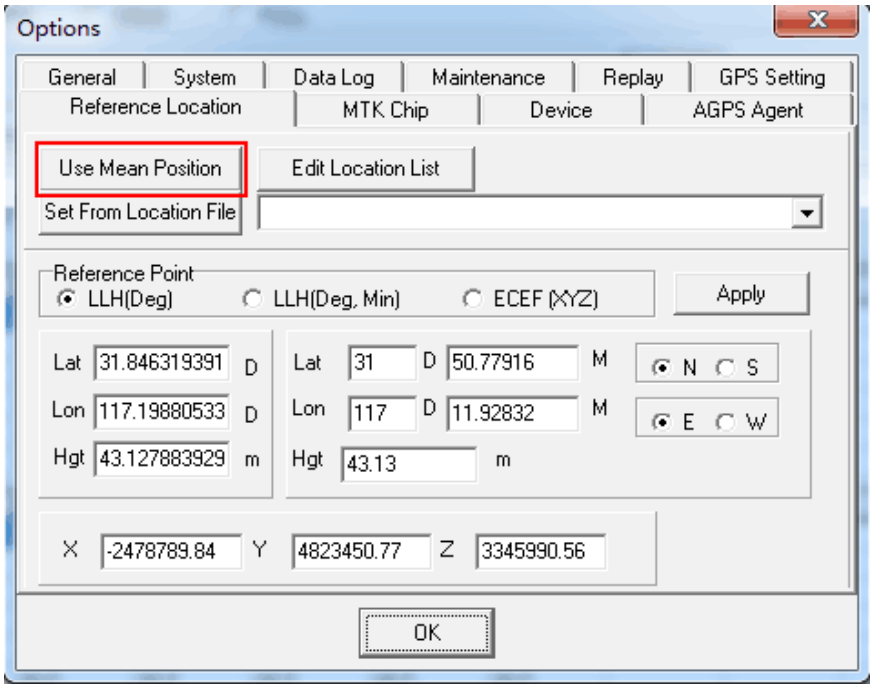


Figure 20: Click Use Mean Position

Step 3: Return to the interface shown in Figure 18 and click "**Config**" to get into the interface of TTFF Configuration. Then set "**TTFF Time- out (sec)**", and finally click "**OK**".

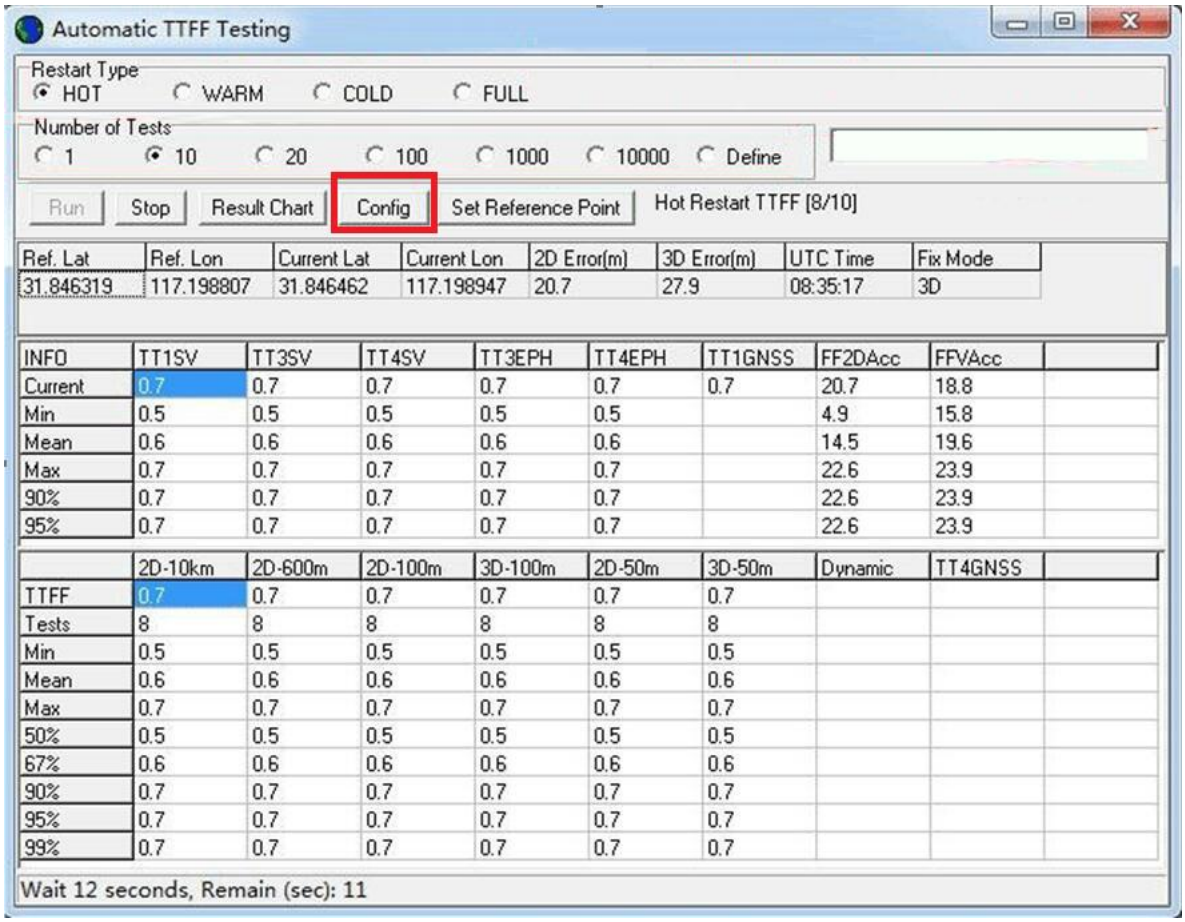


Figure 21: Click Config

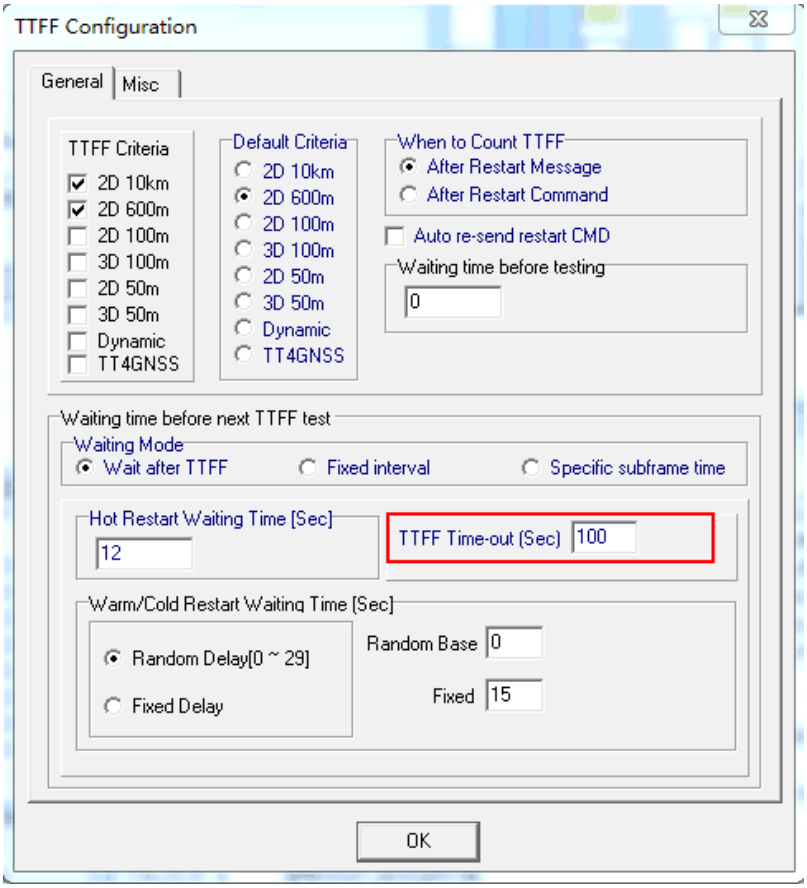


Figure 22: Set TTFF Time-out (Sec)

In generally, if hot start is selected, "**TTFF Time-out (sec)**" is recommended to be set as 10s. If warm start is selected, it can be set as 50s. If cold start is selected, it can be set as 100s. "**TTFF Time–out (sec)**" can help judge TTFF and save time.

Step 4: After the above operations have been completed, click the "**Run"** button to start the test and it can be stopped by clicking "**Stop**" button.

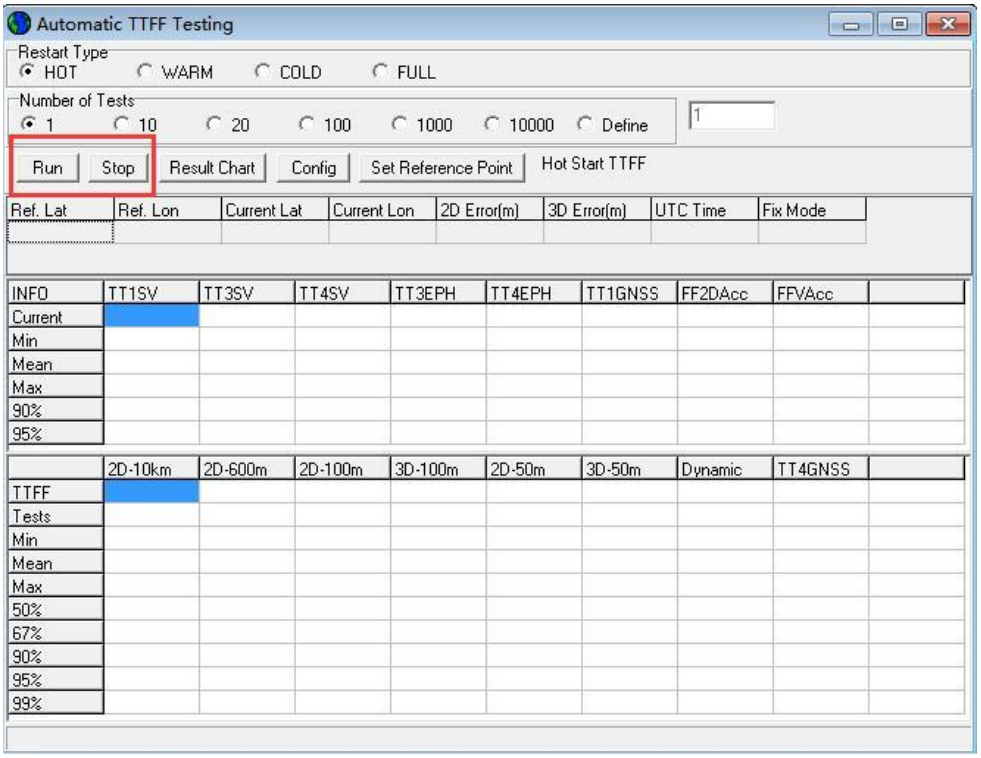


Figure 23: Click Run/Stop Button

Step 5: After finishing the testing, customers can see the testing result charts. Of course, the result also will be stored in the tool installation path, for convenient view of the corresponding log.

7 Appendix A References

Table 8: Related Documents

SN	Document name	Remark
[1]	Quectel_L96_Hardware_Design	L96 Hardware Design
[2]	Quectel_L96_GNSS_Protocol_Specification	L96 GNSS Protocol Specification
[3]	Quectel_L96_Reference Design	L96 Reference Design
[4]	Quectel_QCOM_User_Guide	QCOM User Guide

Table 9: Terms and Abbreviations

Abbreviation	Description
CNR	Carrier-to-Noise Ratio
DI	Digital input
DO	Digital output
GPS	Global Positioning System
GLONASS	Globalnaya Navigazionnaya Sputnikovaya Sistema, or Global Navigation Satellite System (Russia's version of GPS)
GNSS	Global Navigation Satellite System
HDOP	Horizontal Dilution of Precision
IO	Bidirectional
LED	Light Emitting Diode
PDOP	Position Dilution of Precision
PI	Power input

PO	Power output
PPS	Pulse Per Second
PRN	Pseudorandom Noise
SPS	Standard Positioning Service
SV	Satellite Vehicle
UART	Universal Asynchronous Receiver & Transmitter
UTC	Universal Time Coordinated
VDOP	Vertical Dilution of Precision
WGS84	World Geodetic System 1984