

# LC86L EVB User Guide

#### **GNSS Module Series**

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## About the document

## History

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## **1** Introduction

This document specifies the usage of LC86L EVB (Evaluation Board) which is an assistant tool for engineers to develop and test Quectel LC86L module.

## 1.1. Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any terminal incorporating Quectel LC86L module. Manufacturers of the terminal should notify users and operating personnel of the following safety information by incorporating these guidelines into all manuals supplied with the product. If not so, Quectel assumes no liability for any failure to comply with these precautions.





Proper ESD handling procedures must be applied throughout the mounting, handling and operation of any application that incorporates the module to avoid ESD damages.



## **2** General Overview

## 2.1. Top view of LC86L EVB

The following figure illustrates the top view of LC86L EVB.



Figure 1: Top View of LC86L EVB



#### Table 1: Interfaces of LC86L EVB

SN.	Designator	Description
А	Y404	LC86L module
В	J403	Antenna connector
С	S101	Power switch
D	J103	Micro-USB connector
E	S302	Force_on button
F	J301	Reset button
G	U201	USB and SD switch
Н	D303,D304,D305,D306,D307	Indication LEDs
	S401	Boot button



## 2.2. LC86L EVB & Kit Accessories



Figure 2: LC86L EVB & Kit Accessories

Items	Description	Quantity
USB Cable	USB cable	1
EVB	Evaluation board	1
Antenna	GNSS antenna (active)	1
USB Flash Drive	USB flash drive (including LC86L related documents, tools, drivers, etc.)	1
Instruction Sheet	A sheet of paper giving instructions for EVB connection, details of EVB accessories, etc.	1
Others	Bolts and coupling nuts	4 pairs

#### Table 2: List of Accessories



## 2.3. EVB and Accessories Assembly

The following figure shows the assembly of LC86L EVB and its accessories.



Figure 3: LC86L EVB and Accessories Assembly



# **3** Interface Applications

### 3.1. Micro-USB Interface

Micro-USB connector is used for EVB power supply as well as data transmission.



Figure 4: Micro-USB Connector



## 3.2. Antenna Interface

The antenna connector is used to connect an external passive or active GNSS antenna.



Figure 5: Antenna Connector

## 3.3. Switches and Buttons

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





Figure 6: Switches and Buttons

#### **Table 3: Switches and Buttons**

Part No.	Name	I/O	Description
D101	POWER	PI	Power switch
S201	USB/SD switch	DI	LC86L for data transmission via USB
S301	RESET	DI	The module will be reset through pressing and then releasing the button.
S302	FORCE_ON	DI	In Backup mode, press this button, the module will be woken up
S401	BOOT	DI	Unused



## **3.4. Operation Status Indication LEDs**



Figure 7: Operation Status Indication LEDs

#### **Table 4: Operation Status Indication LEDs**

Part	Name	I/O	Description
D303	1PPS	DO	Light: positioning success, frequency 1Hz Dark: no positioning
D304	TXD	DO	Light: data output Dark: no data output
D305	JAM_IND	DO	Jamming detection indicator, LC86L not used
D306	GEO_FORCE	DO	Geo-fence boundary indicator, LC86L not used
D307	AADET_N	DO	Light: active antenna is connected well Dark: active antenna is not connected to EX_ANT or has poor contact with antenna feeding point



### 3.5. Test Points



The following figure illustrates the test points of the EVB.

#### Figure 8: Test Points - J104

#### **Table 5: Pin Description**

Pin No.	Signal	I/O	Description
1	RXD	DI	Receive data
2	TXD	DO	Send data
3	1PPS	DO	One pulse per second
4	RESET	DO	Module reset
5	GND	/	Ground
6	3.0V	PI	/
7	SCL	I/O	/
8	SDA	I/O	/
9	3DFIX	DO	/
10	GND	/	Ground



## **4** EVB Operation Procedures

This chapter mainly illustrates the operation procedures of LC86L EVB.

#### 4.1. Communication via Micro-USB Interface

- **Step 1:** Connect the EVB and the PC with a Micro-USB cable through Micro-USB interface, and then switch POWER to ON state to power on the EVB.
- **Step 2:** Run the USB flash drive on PC to install the USB driver. The USB port numbers can be viewed in Device Manager of the PC after the USB driver is installed, as shown below.

✓ 賞 端□ (COM 和 LPT) 員 Silicon Labs CP210x USB to UART Bridge (COM18)

#### Figure 9: USB Ports

**Step 3:** Install and then use the tool QCOM provided by Quectel to realize the communication between LC86L module and the PC.

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

COM Port Setting	_
COM Port: 18 💌 Baudrate: 9600 💌 StopBits: 1 💌 Parity: None 💌	1
ByteSize: 8 💌 Flow Control: SW Ctrl Flow 💌	
[2020-03-27_15:30:21:265]\$GNGLL,,,,,000149.099,V,N*68	^
[2020-03-27_15:30:21:959]\$GPTXT, 01, 01, 02, ANTSTATUS=0PEN*2B	
[2020-03-27_15:30:22:230]\$GNTMC,000150.099,V,,,,,0.00,0.00,060180,,,N,V*22	
[2020-03-27_15:30:22:230]\$GNVTG, 0.00, T, , M, 0.00, N, 0.00, K, N*2C	
[2020-03-27_15:30:22:230]\$GNGGA,000150.099,,,,,0,0,,,M,, M,, *52	
[2020-03-27_15:30:22:230]\$GNGSA, A, 1, , , , , , , , , , , , 1*1D	
[2020-03-27_15:30:22:230]\$GNGSA, A, 1, , , , , , , , , , , , 2*1E	
[2020-03-27_15:30:22:230]\$GPGSV, 1, 1, 00, 0*65	

Figure 10: COM Port Setting of QCOM



### 4.2. Firmware Download

The LC86L module upgrades the firmware through the USB port by default. Please follow the procedure below to upgrade the firmware:

**Step 1:** Install and open the Flash tool software;

**Step 2:** Connect the EVB to a PC through the USB cable, and switch POWER to ON state to power on the EVB.

**Step 3:** Follow these steps to upgrade the firmware:

- Click "Settings"-"Baud rate"-"Auto Detect" to select the baud rate;
- Click "Settings"-"COM Port"-"COM3" to select the communication port;
- Select the download file: Click the two red boxes shown in step c in the figure below to select the corresponding file path: "Reserve" corresponds to the download management file, and "ROM" corresponds to the project firmware;
- Click the "Download", "OK" and "Go" buttons to start the firmware upgrade



Figure 11: Flash tool configuration and firmware upgrade



## **5** PowerGPS instructions

The PowerGPS tool can be used to view the status of GPS, GLONASS, BeiDou, and Galileo satellite reception. This chapter will mainly introduce the use of the tool

### 5.1. COM Port and Baud Rate Setting

**Step 1:** After the EVB and its accessories are properly connected, power on the EVB and start PowerGPS (this article uses PowerGPS Trial 2.3.5 as an example), and the following main interface is displayed:



Figure 12: PowerGPS main interface (not connected)

Step 2: At the bottom of the interface, select a correct **COM port** and **baud rate** (LC86L module supports 9600 bps by default), click the button *Create Connection*, and then the following

supports 9600 bps by default), click the button 2 "Create Connection", and then the interface in default layout will be shown:





Figure 13: PowerGPS main interface (connected)

#### 5.1.1. PowerGPS interface description

On the PowerGPS interface, GNSS information such as CNR message, time, position, speed and precision can be viewed. Explanations are listed in the table below.

#### Table 6: Explanations of PowerGPS Interface

Icon	Explanation	
65	<ul> <li>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°.</li> <li>Blue means this satellite is being tracked.</li> </ul>	
4	• Light blue means this satellite is not being tracked.	

47 49 47 36 28 619 G22 G28 S40 Q194 P	43 44 43 44 33 33 38 44 44 • • • • • • • • • • • • • • • •	The CNR of PRN 28 is 49 dB/Hz. G means it is a GPS satellite, B means it is a BeiDou satellite, and S means it is a SBAS. Light blue column means the navigation data of this satellite is in use.	
47 49 47 42 43 44 48 44 6 48 44 44 44 44 44 44 44 44 44		The CNR of PRN 3 is 42 dB/Hz. White column means the navigation data of this satellite is not in use.	
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	

## 5.2. PMTK Command Sending

PowerGPS supports sending PMTK commands to control the module. The format of PMTK commands to be sent include only characters between '\$' and '\*', for example: **PMTK869,0**.



M MTK GPS	
PMTK TX/BX NMEA TX	
Send MTK Packet (only chars between \$ and *)	
Send PMTK869,0	
Receive	
	^
	-
	Þ

Figure 14: PMTK Command Sending via PowerGPS

## 5.3. Automatic TTFF Testing

PowerGPS tool allows users to measure the TTFF (Time to First Fix) under different testing conditions. The TTFF can be tested under full cold start, cold start, warm start or hot start conditions, and the number of tests can be selected 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:



s,		Static TTF	<b>F</b> Testing	8		HET	20		
190		Dynamic	TTFF Testi	ng		STILL			_
TK GPS		EPO Man	agement	Tool		3	Sky Vie	w	-
TYPY	lines	Get EDO	Data						
- Inthe	I NMEA	Geleron	vala						
MTK Pa	icket (on	HotStill To	loo						
end F	MTK	LOCUS TO	loc						
P	200.042	to and	Test					1	1
ive		Jamming	1001			FL			14
A	tomatic TIFE I	esting				18.11.1		1000	0
Berta	time	- and		-					
G H	DT CW	ARM C	COLD	C FULL		Resta	rt Typ	e	
Numb	er of Tests						-	Tho	NI
Numb C 1	er of Tests (* 10	C 20	C 100	C 1000	C 10000	C Define		The	Nun
Numb C 1	er of Tests (* 10	C 20	C 100	C 1000	C 10000	C Define	18/101	> The	Nun
Numb	er of Tests (* 10 Stop	⊂ 20 esull Chart	C 100 Config	C 1000 Set Reference	C 10000	C Define	(8/10)	> The	Nun
Ref. La	er of Tests	C 20 esult Chart	C 100 Config	C 1000 Set Reference	Point Hot	C Define	(8/10) (11C Time	Fix Mode	Num
Ref. La	er of Tests (* 10 Stop   F # Ref. Lon 319   117.198	← 20 esult Chart    Current 807 31.8464	C 100 Config 1 Lat Currer 162 117.1	C 1000 Set Reference nt Lon 20 F 98947 20.7	C 10000 Point Hot Error(m) 30	C Define Restart TTFF Enor(m) U 9 0	(8/10) ITC Time 8.35:17	Fix Mode 3D	Num
Numb C 1 Bur Ref. La 31.846	er of Tests	C 20 esull Chart Current 207 31.8464	C 100 Config Lat Currer 162 117.1	C 1000 Set Reference N Lon 20 F 98947 20 7	C 10000 Point Hot Inor(m) 30 27	C Define Restart TTFF Eno(m) U 9 0	(8/10) ITC Time 8.35:17	Fix Mode 3D	Num
Ref. La 31.846	et of Tests	← 20 esult Chart Current 207 31.8464	C 100 Config Lat Currer 162 117.1	C 1000 Set Reference 11 Lon 20 F 98947 20 7	C 10000 Point Hot Error(m) 30 27	C Define Restart TTFF Enorm U 9 0	(8/10) (8/10) ITC Time 8.35.17	Fix Mode 30	Num
Ref. La 31.846	et of Tests	C 20 esult Chert Current 07 31.8464 TT3SV 0.7	C 100 Config 1 Lat Currer 162 117.1 11745V 0.7	C 1000 Set Reference 11 Lon 20 B 98947 20 7 1173EPH 0.7	C 10000 Point Hol Inor(m) 30 27 1774EPH 0.7	C Define Restart TTFF Emo(m) U 3 0 TTTIGNSS 0.7	(8/10) ITC Time 8.35:17 FF2DAcc 20.7	Fix Mode 30 FFVAcc 188	Num
Numb	er of Tests	C 20 exult Chart Current 807 31.8464 1T13SV 0.7 0.5	C 100 Config 1 Lat Currer 162 117.1 11745V 0.7 0.5	C 1000 Set Reference 11 Lon 20 B 98947 20 7 11 35PH 0.7 0.5	C 10000 Point Hot Inor(m) 30 27 1114EPH 0.7 0.5	C Define Restart TTFF Emot(m) U 3 0 TT1GNSS 0.7	(8/10) ITC Time 8.35:17 FF2DAcc 20.7 4.9	Fix Mode 30 FFVAcc 188 158	Num
Ref. La 31.846 C I NFD Current Min Mean	er of Teets	C 20 eoult Chart Current 807 31.8464 11135√ 0.7 0.5 0.6	C 100 Config 1 Lat Currer 162 117.1 1174SV 0.7 0.5 0.6	C 1000 Set Reference 11 Lon 20 B 98947 20 7 11 13EPH 0.7 0.5 0.6	C 10000 Point Hot Enor(m) 30 27 1114EPH 0.7 0.5 0.6	C Define Restart TTFF Emo(m) U 9 0 1T11GNSS 0.7	(8/10) ITC Time 8.35:17 FF2DAcc 20.7 4.9 14.5	Fix Mode 30 188 158 196	Num
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Ref. Lo Ref. Lo INFO Current Min Mean Mas 905 55 111FF Tests	er of Tests	<ul> <li>⊂ 20</li> <li>exult Chart</li> <li>Current</li> <li>07 31.8464</li> <li>1113SV</li> <li>0,7</li> <li>0,6</li> <li>0,7</li> <li>0,7</li></ul>	C 100 Config 1 Let Currer 62 117.1 TT4SV 0.7 0.7 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 1000 Set Fielerence */Len 20 B 98947 20 7 0.7 0.7 0.6 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 10000 Point Hot trofml 3D 27 1114EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	Define Restat TTFF Enor(m) 0 0 1T11GNSS 0.7 3D-50m 0.7 8 0.7 0	(8/10) TC Time 8/35/17 FF2DAcc 20.7 4.9 14.5 22.6 22.6 22.6 Dynamic	Fix Mode 30 FFVAcc 18.8 15.8 19.6 23.9 23.9 23.9 23.9 23.9 23.9 23.9	
Ref. La Ref. La Ref. La INFO Current Min Mean Mas S03 S53 ITFF Tests Min	er of Tests F 10 Stop F Ref. Lon 319 117 198 TTTSV 02 05 06 07 07 07 07 07 07 07 07 07 07	<ul> <li>⊂ 20</li> <li>eoult Chart</li> <li>Current</li> <li>07 31.8464</li> <li>07 31.8464</li> <li>0.7</li> <li>0.5</li> <li>0.6</li> <li>0.7</li> <li>0.5</li> </ul>	C 100 Config Lat Currer 62 117.1 TT4SV 0.7 0.7 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 1000 Set Reference *Lon 20 B \$8897 207 1113EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 30-100m 0.7 8 0.5	C 10000 Point Hot Inor(m) 3D 27 1114EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	Define     Define     Restat TTFF     Enor(m) U     9 0      TT1GNSS     0.7      30-50m     0.7      8     0.5	(8/10) TC Time 8/35/17 FF20Acc 20.7 4.9 14.5 22.6 22.6 22.6 22.6 22.6 22.6 22.6 22.6	Fix Mode           30           IFFVAcc           188           158           196           239           239           239           239           1T4GNS5	
Numb C 1 Flur Ref. La 31.846 UNFD Current Mean Max 90% 95% 95%	er of Tests F 10 Stop F Ref. Lon 319. 117.198 TTTSV 0.5 0.6 0.7 0.7 0.7 20-10km 0.7 8 0.5 0.6 0.5 0.6	<ul> <li>Content</li> <li>Content</li></ul>	C 100 Config 1 Lat Currer 62 117.1 TT4SY 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 1000 Set Reference */ Lon 20 F \$6597 207 1173EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 10000 Point Hot 27 1114EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C Define Restart TTFF 2 Enci(m) U 9 0 1TT1GNSS 0.7 3D-50m 0.7 8 0.5 0.6	(8/10) If C Time 8:35:17 FF2DAcc 20.7 4.9 14:5 22:6 22:6 22:6 22:6 22:6 22:6 22:6 22	Fix Mode 30 FFV/Acc 18.8 15.8 19.6 23.9 23.9 23.9 23.9 11T46N55	
Numb C 1 Burn Ref. Lo 31.846 Min Mean Max 95% ITFF Tests Min Mean Max	er of Tests F 10 Stop F Ref. Lon 319 117.198 117.198 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	<ul> <li>⊂ 20</li> <li>exult Chart</li> <li>Current</li> <li>07 31.8464</li> <li>11135V</li> <li>0.7</li> <li>0.5</li> <li>0.6</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> </ul>	C 100 Config 1 Lat Currer 62 117.1 1145 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 1000 Set Reference Lon 20 F S6947 20 7 ITT3EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 3D-100m 0.7 8 0.5 0.6 0.7	C 10000 Point Hot 27 27 1114EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	Define Restart TTFF Encu(m) 9 0 1111GNSS 0.7 3D-50m 0.7 8 0.5 0.6 0.7 0.6 0.7 0.6 0.7 0.7 0.6 0.7 0.7 0.6 0.7	(8/10) ITC Time 8/35.17 FF20Acc 20.7 4.9 14.5 22.6 22.6 22.6 Dynamic	Fix Mode           3D           FFYAcc           188           196           23.9           23.9           TT46NSS	
Numb C 1 Ref. La 31.846 Current Min Mean Max 90% 95% TIFF Tests Min Mean Mean Mean Max	er of Tests	<ul> <li>⊂ 20</li> <li>exult Chart</li> <li>Current</li> <li>07 31.8464</li> <li>1113SV</li> <li>0,7</li> <li>0,6</li> <li>0,7</li> <li>0,5</li> </ul>	C 100 Config Lai Currer 62 117.1 TT4SV 0.7 0.7 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.5 0.6 0.7 0.7 0.7 0.5 0.6 0.7 0.7 0.7 0.5 0.6 0.7 0.7 0.5 0.6 0.7 0.7 0.5 0.6 0.7 0.7 0.7 0.5 0.6 0.7 0.7 0.5 0.6 0.7 0.7 0.7 0.5 0.6 0.7 0.7 0.7 0.5 0.6 0.7 0.7 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 1000 Set Fielerence */Len 20 F \$6947 20 7 TT3EPH 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 10000 Point Hot roofml 30 27 1114EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	Define Restat TTFF Eno(m) 0 0 1T11GNSS 0.7 3D-50m 0.7 3D-50m 0.7 0.5	(8/10) TC Time 8/35/17 FF2DAcc 20.7 4.9 14.5 22.6 22.6 22.6 Dynamic	Fix Mode 30 FFVAcc 18.8 15.8 19.6 23.9 23.9 23.9 23.9 23.9 23.9 23.9	
Numb C 1 Ref. La 31.846 31.846 UNFO Current Min Mean Mas 55% T1FF Tests Min Mean Mas 56%	er of Tests F 10 Stop F K Ref. Lon 319 1117 198 TTTSV 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	<ul> <li>C 20</li> <li>eoult Chart</li> <li>Current</li> <li>Current</li> <li>07 31.8464</li> <li>11135√</li> <li>0.7</li> <li>0.5</li> <li>0.6</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> <li>0.5</li> <li>0.6</li> </ul>	C 100 Config Lat Currex 662 117.1 TT4SV 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 1000 Set Reference *Lon 20 B 98897 207 1113EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 10000 Point Hot Inor(m) 3D 27 1114EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	Define Restat TTFF Enor(m) 9 0.7 3D-50m 0.7 3D-50m 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.5 0.6 0.6 0.7 0.5 0.6 0.6 0.7 0.5 0.6 0.6 0.5 0.6 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.6 0.6 0.5 0.6 0.6 0.5 0.6 0.6 0.5 0.6 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5 0.6 0.5	(8/10) TC Time 8/35/17 FF20Acc 20.7 4.9 14.5 22.6 22.6 22.6 22.6 22.6 Dynamic	Fix Mode 30 188 158 196 239 239 239 239 239 239	
Numb C 1 Ref. Lo Ref. Lo Sal 246 UNFD Cunerd Min Mean Mean Mean Mean Mean Mean Mean Mea	er of Tests F 10 Stop F K Ref. Lon 319. 117.198 TTTSV 0.5 0.6 0.7 0.7 20-70km 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	<ul> <li>Content</li> <li>Content</li> <li>Content</li> <li>Content</li> <li>Content</li> <li>Content</li> <li>TT3SV</li> <li>O.7</li> <li>O.6</li> <li>O.7</li> <li>O.6</li> <li>O.7</li> </ul>	C 100 Config 1 Lat Currer 62 117.1 TT4SY 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 1000 Set Reference */ Lon 20 F \$65947 20 7 1173EPH 0.7 0.5 0.6 0.7 0.7 30-100m 0.7 8 0.5 0.6 0.7 0.5 0.5 0.5 0.5 0 0.5 0 0.5 0 0 0 0 0 0	C 10000 Point Hot 27 1114EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C Define Restart 11FF 2 Enco(m) U 9 0 1111GNSS 0.7 30-50m 0.7 8 0.5 0.6 0.7 0.5 0.6 0.7 0.5 0.6 0.7	(8/10) ITC Time 8:35:17 FF2DAcc 20.7 4.9 14:5 22:6 22:6 22:6 22:6 22:6 22:6	Fix Mode 30 188 15.8 19.6 23.9 23.9 23.9 23.9 11146NSS	
Numb C 1 Ref. La Ref. La Sil 846 Nin Mean Max S05 S55 Nin Mean Max S05 S55 S55 S55 S55 S55 S55 S55 S55 S55	er of Tests	<ul> <li>⊂ 20</li> <li>exult Chart</li> <li>Current</li> <li>07 31.8464</li> <li>1T13SV</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> <li>0.7</li> <li>0.6</li> <li>0.7</li> <li>0.5</li> <li>0.6</li> <li>0.7</li> <li>0.5</li> <li>0.6</li> <li>0.7</li> </ul>	C 100 Config Lat Currer 62 117.1 TT4SV 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 1000 Set Fielerence */Len 20 F 98947 20 7 1113EPH 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	C 10000 Point Hot roofml 30 27 1114EPH 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	Define  Flextat TTFF  Enor(m) U 3 0  TT11GNSS 0.7  3D-50m 0.7  3D-50m 0.7  0.5 0.6 0.7 0.5 0.6 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	(8/10) ITC Time 8/35.17 FF2DAcc 20.7 4.9 14.5 22.6 22.6 22.6 22.6 Dynamic	Fix Mode           30           FFVAcc           188           158           196           239           239           239           1TT46NS5	

Figure 15: Static TTFF Testing via PowerGPS

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



Options					÷.	ander	×
Reference	e Location	MTK Cł	nip	Device	. )	AGF	S Agent
General	System	Data Log	Maintena	ince	Replay	6	iPS Setting
⊢Pivot senter	nce (Identify th	at a full NMEA :	set had beel	n receive	:d)		
💽 GGA		C GSA		0	RMC		
C GLL		C GSV		0	° VTG		
Decode sen	itence						
🔽 GGA	🔽 GSA	🔽 RMC	🔽 GLL	🔽 GS	sv 🔽	VTG	
Verify NM	eriodic mode st	atus	in startup				
_			ОК				

Figure 16: Choose Reference Location

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

Options
General         System         Data Log         Maintenance         Replay         GPS Setting           Reference Location         MTK Chip         Device         AGPS Agent
Use Mean Position Edit Location List
Hererence Point     C LLH(Deg, Min) O ECEF (XYZ)     Apply
Lat 31.846319391 D Lat 31 D 50.77916 M ONCS
Lon 117.19880533 D Lon 117 D 11.92832 M @ E C W
Hgt 43.127883929 m Hgt 43.13 m
X -2478789.84 Y 4823450.77 Z 3345990.56
OK

Figure 17: Click Use Mean Position



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

Restart Ty HOT	pe C WA	RM C	COLD (	FULL				
Number of	Tests							
C 1	• 10	C 20	C 100	C 1000	C 10000	C Define		
Bun 1	Stop   Re	esult Chart	Config   S	Set Referenc	e Point   Hot	Restart TTFF	[8/10]	
Ref. Lat	Ref. Lon	Current	Lat Curren	t Lon 2D	Error(m) [3D	Error(m)	JTCTime	Fix Mode
	1	1	1	Terrere		1	1	- I · · I
INFO	TTISV	TT3SV	TT4SV	TT3EPH	TT4EPH	TT1GNSS	FF2DAcc	FFVAcc
Current	0.7	0.7	0.7	0.7	0.7	0.7	20.7	18.8
Min	0.5	0.5	0.5	0.5	0.5		4.9	15.8
Mean	0.6	0.6	0.6	0.6	0.6		14.5	19.6
Max	0.7	0.7	0.7	0.7	0.7		22.6	23.9
90%	0.7	0.7	0.7	0.7	0.7		22.6	23.9
95%	0.7	0.7	0.7	0.7	0.7		22.6	23.9
	2D-10km	2D-600m	2D-100m	3D-100m	2D-50m	3D-50m	Dynamic	TT4GNSS
TTFF	0.7	0.7	0.7	0.7	0.7	0.7	100	
Tests	8	8	8	8	8	8		
Min	0.5	0.5	0.5	0.5	0.5	0.5	1	
Mean	0.6	0.6	0.6	0.6	0.6	0.6		
Max	0.7	0.7	0.7	0.7	0.7	0.7		
50%	0.5	0.5	0.5	0.5	0.5	0.5		
67%	0.6	0.6	0.6	0.6	0.6	0.6		
A D M D M M M M M M M M M M M M M M M M	0.7	0.7	0.7	0.7	0.7	0.7	1	
90%			0.7	07	07	07		
90% 95%	0.7	0.7	0.7	0.7	0.7	0.7		

Figure 18: Click Config



TTFF Criteria ✓ 2D 10km ✓ 2D 600m ☐ 2D 100m ☐ 3D 100m ☐ 2D 50m ☐ 3D 50m ☐ Dynamic	Default Criteria C 2D 10km C 2D 600m C 2D 100m C 3D 100m C 3D 100m C 2D 50m C 3D 50m C Dynamic C TT4GNSS	When to Count TTFF  After Restart Message  After Restart Command  Auto re-send restart CMD  Waiting time before testing
Waiting time before Waiting Mode Wait after TT Hot Restart Wa 12	e next TTFF test	ed interval C Specific subframe time
Warm/Cold Re	estart Waiting Time ( Delay[0 ~ 29]	Sec] Random Base 0

Figure 19: Set TTFF Time-out (Sec)

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

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



Restart T	уре								
🕶 нот	с w/	ARM C	COLD (	G FULL					
Number o	of Tests						1.00		
<b>€</b> 1	C 10	C 20	C 100	C 1000	C 10000	C Define	_ Iı		
Run	Stop	esult Chart	Config 9	Set Reference	Point Hot	Start TTFF			
Ref Lat	Beflon	Current	Lat Curren	tion 2D.E	rror(m) 3D	Error(m)	TC Time	Fix Mode	
		Carcine				Enol(in) 10	re rine	T IN MODE	
				1.					
	1	1	Inner	1	In	1	Inner (	1	
NFO	TTISV	TT3SV	TT4SV	TT3EPH	TT4EPH	TT1GNSS	FF2DAcc	FFVAcc	
urrent						-			
lin	-					-			
lean	-						-		
lax	-					-			
10%	-					-			
5%									
	2D-10km	2D-600m	2D-100m	3D-100m	2D-50m	3D-50m	Dynamic	TT4GNSS	
TFF			Contraction of the second	[]			-		
ests									
tin			1						
lean			1						
fax			1						
0%									
7%		_	1						
0%		_	1						
			1	11					
15%									

#### Figure 19: Click Run/Stop Button

**Step 5:** After finishing the testing, users can see the testing result charts. The test result will be stored in the directory where the tool is installed, for convenient view of the log at any time.



# **6** Appendix A Reference

#### **Table 7: Related Documents**

SN	Document Name	Remark
[1]	Quectel_LC86L_Hardware_Design	LC86L Hardware Design
[2]	Quectel_L76-LB&L26-LB&LC86L_GNSS_Protocol_S pecification_V1.1	L76-LB&L26-LB&LC86L GNSS Protocol Specification
[3]	Quectel_LC86L_Reference Design	LC86L Reference Design
[4]	Quectel_QCOM_User_Guide	QCOM User Guide

#### **Table 8: 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
Ю	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