LG69T (AM,AS)
EVB User Guide

GNSS Module Series

Version: 1.0

Date: 2022-10-20

Status: Released

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	The product must be powered by a stable voltage source, while the wiring must conform to security precautions and fire prevention regulations.
	Proper ESD handling procedures must be followed throughout the mounting, handling and operation of any devices and equipment that incorporate the module to avoid ESD damages.

About the Document

Document Information	
Title	**LG69T (AM,AS) EVB User Guide**
Subtitle	GNSS Module Series
Document Type	EVB User Guide
Document Status	Released

Revision History

Version	Date	Description
-	2022-03-14	Creation of the document
1.0	2022-10-20	First official release

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1 Introduction

This document provides information on the steps needed to evaluate the Quectel LG69T (AM) and LG69T (AS) GNSS modules using the Evaluation Board (EVB). The EVB is a convenient tool that allows you to become familiar with the modules.

Specifically, the document is divided into several sections:

- Chapter 2 provides the general overview of EVB Kit;
- Chapter 3 describes the EVB interfaces;
- Chapter 4 describes how to communicate with the modules via the QCOM tool;
- Chapter 5 describes how to upgrade firmware of GNSS modules via the QGNSS tool;
- Chapter 6 describes how to upgrade firmware of EG25-G module via the QFlash tool;
- Chapter 7 introduces the RTK (Real-Time Kinematic) application;
- Chapter 8 is an appendix, which summarizes the relevant documents, terms and abbreviations appearing herein.

NOTE

1. For EVB schematic and PCB layout design files, contact Quectel Technical Support (support@quectel.com).
2. Download the QCOM software tool from our website Download Zone or request it from Quectel Technical Support (support@quectel.com).
3. Request the QGNSS and QFlash software tools from Quectel Technical Support (support@quectel.com).

2 General Overview

2.1. EVB Kit

The EVB kit includes: Evaluation Board (EVB), Quectel Active GNSS Antenna, LTE Antenna, Micro-USB Cable, Type-B USB Cable, Bolts and Coupling Nuts.

The EVB kit components are shown in the figure below. Check *Table 1: List of Kit Components* for more information.

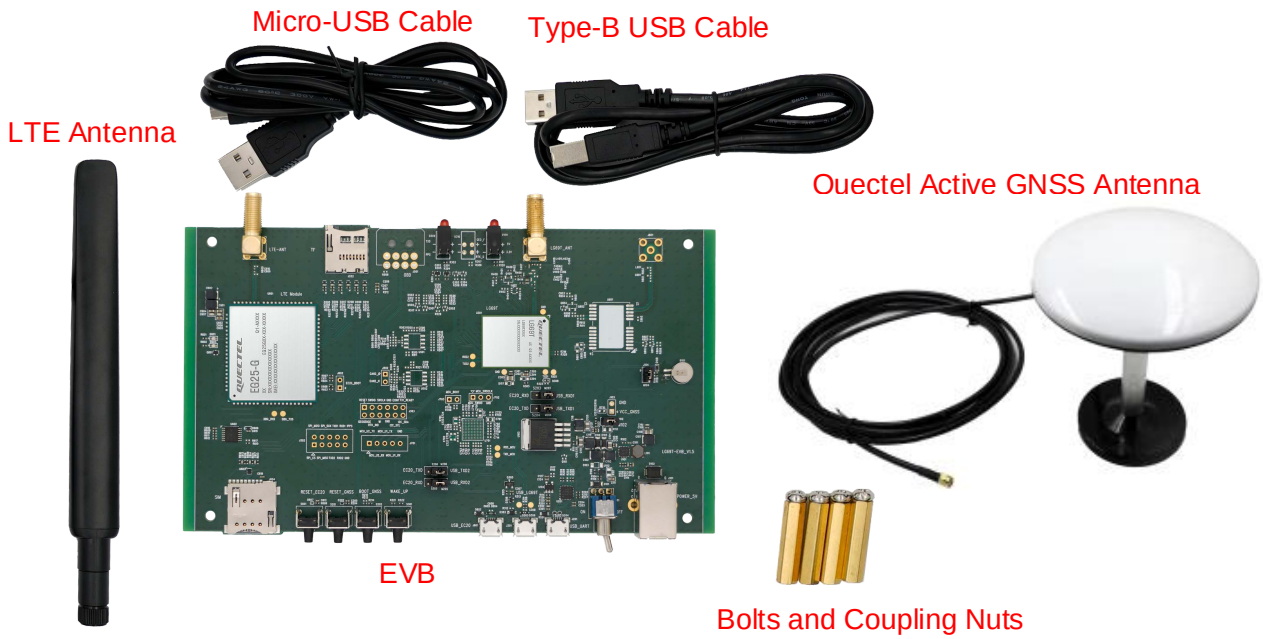


Figure 1: EVB and Components

Table 1: List of Kit Components

Items	Description	Quantity
EVB	Evaluation Board Size: 100 mm × 175 mm	1
USB Cables	Micro-USB Cable	1
	Type-B USB Cable	1
GNSS Antenna	Active GNSS Antenna: **YEGM011AA** Antenna Size: Φ 146.4 mm × 65 mm Cable Length: 4000 mm	1
	The GNSS antenna supports: ● GPS L1 C/A and L5 ● Galileo E1 and E5a ● BDS B1I and B2a ● QZSS L1 C/A and L5 (Only for LG69T (AS))	
LTE Antenna	LTE Antenna	1
Instruction Sheet	Sheet providing instructions on how to connect the EVB and its components, detailed information on EVB components, etc.	1
Others	Bolts and Coupling Nuts	4 pairs

NOTE

Request Quectel Technical Support (support@quectel.com) for details about Quectel Active GNSS Antenna and LTE Antenna.

2.2. Connect Cables and Antenna to EVB

The connection between the EVB and its components is shown in the figure below. For more information on how to connect the EVB and its components, see the instruction sheet inside the EVB Kit.

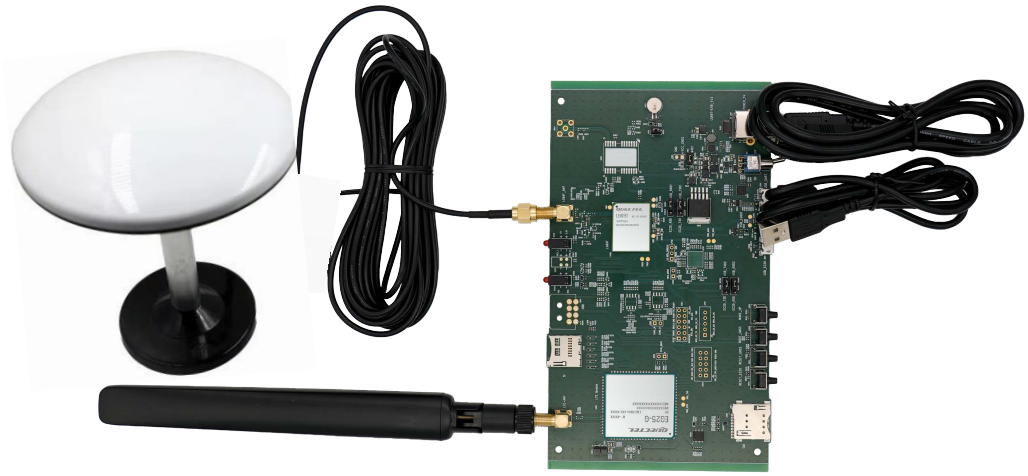


Figure 2: EVB and Components Assembly

NOTE

Make sure that the active GNSS antenna is placed with a clear line of sight to the sky.

3 EVB Interfaces

3.1. EVB Top View

EVB top view is shown in the figure below.

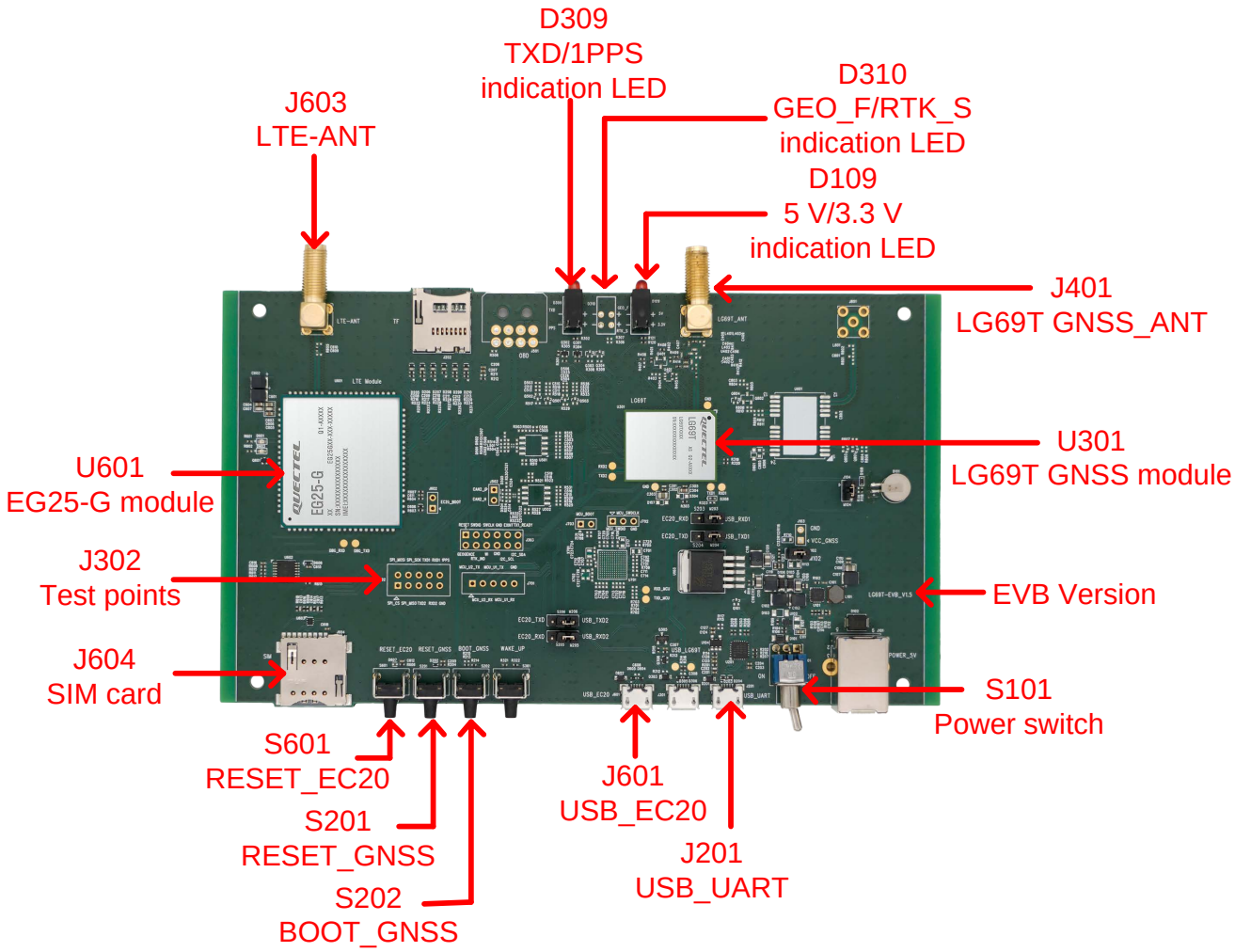


Figure 3: EVB Top View

3.2. EVB Interfaces

The EVB interfaces are detailed in the table below.

Table 2: Detailed EVB Interfaces

Function	Interfaces		Description
Power Supply	J201 USB_UART		Power supply input: ● DC power supply: 4.5–5.5 V, typ. 5.0 V ● Current capability should be > 2 A
	J601 USB_EC20		
Communication Interface	J601 USB_EC20		Used for configuring RTK account.
	J201 USB_UART		**Enhanced COM Port**: Used for standard NMEA/RTCM message output, PQTM command input, and firmware download. **Standard COM Port**: Used for standard NMEA/RTCM message output, PQTM command input. If you need to use the Standard COM Port, configure the RTK function of the GNSS module via EG25-G module and insert the SIM card.
RF Interface	J401 LG69T GNSS_ANT Connector		Used for connecting GNSS antenna.
	J603 LTE_ANT Connector		Used for connecting LTE antenna
Signal Indication	D309 TXD/1PPS indication LED	1PPS (Red LED)	Flashing: 1 Hz pulse signal output. Off: 1PPS is unavailable.
		TXD (Green LED)	Flashing: Data output from UART1 TXD. Fixed Off/On: No data output from UART1 TXD.
	D109 5 V/3.3 V indication LED	3.3 V (Red LED)	EVB 3.3 V power indicator.
		5 V (Green LED)	EVB 5 V power indicator.
	D310 GEO_F/RTK_S Indication LED (Only for LG69T (AM))	GEO_F (Red LED)	Geofence indicator.
		RTK_S (Green LED)	RTK indicator.

Function	Interfaces	Description
Switches and Buttons	S101 Power Switch	Powers the EVB on/off.
	S201 RESET_GNSS	Short press the button to reset the GNSS module.
	S601 RESET_EC20	Short press the button to reset the EG25-G module.
	S202 BOOT_GNSS	Press and hold the BOOT_GNSS button first and then flip the power switch to **ON** position to set the GNSS module to Boot download mode.
Others	J604 SIM Card Connector	If the SIM card is not inserted and the RTK account is not configured, UART2 Standard COM Port cannot receive data.
Test Points	J302 Test Points	Pins are detailed in *Table 4: J302 Pin Detailed Description*.

J302 pin assignment is shown below:

Table 3: J302 Pin Assignment

SPI_MOSI	SPI_SCK	TXD1	RXD1	1PPS
SPI_CS	SPI_MISO	TXD2	RXD2	GND

Table 4: J302 Pin Detailed Description

Pin Name	I/O	Description
SPI_MOSI	-	NC (Not connected)
SPI_SCK	-	NC
TXD1	DO	TXD1 transmits data
RXD1	DI	RXD1 receives data
1PPS	DO	One pulse per second
SPI_CS	-	NC
SPI_MISO	-	NC
TXD2	DO	TXD2 transmits data
RXD2	DI	RXD2 receives data
GND	-	Ground

4 Communication via QCOM Tool

This chapter explains how to use the QCOM software tool to communicate with the module via the Micro-USB interface. For more information, see *document [1] QCOM User Guide*.

To establish communication with the GNSS module via QCOM tool:

Step 1: Connect the EVB and the PC with a Micro-USB cable via the Micro-USB connector. Flip the Power switch (S101) to **ON** position to power on the EVB.

Step 2: View the USB port numbers in the PC OS system Device Manager.

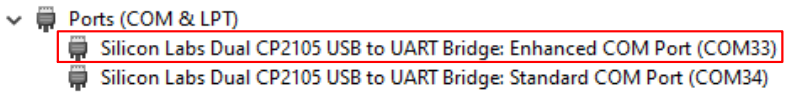


Figure 4: USB Ports

Step 3: Install the QCOM tool provided by Quectel. The QCOM interface for COM port setting is shown in the figure below (default baud rate: 460800 bps [1]).

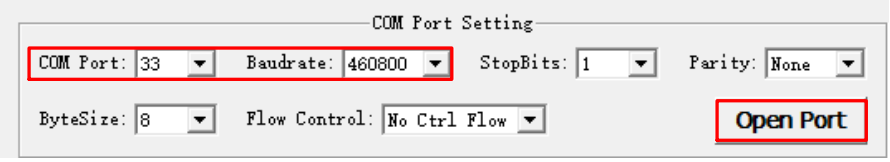


Figure 5: QCOM Interface for COM Port Setting

Step 4: Select the correct "**COM Port**" (USB Port shown in *Figure 4: USB Ports*) and correct "**Baudrate**".

Step 5: Click "**Open Port**" to establish communication with the EVB, as shown in *Figure 5: QCOM Interface for COM Port Setting* . The NMEA or RTCM message output by the module will be displayed on the QCOM tool interface, as shown in the figures below.

[1] UART interface default settings may vary depending on software versions.

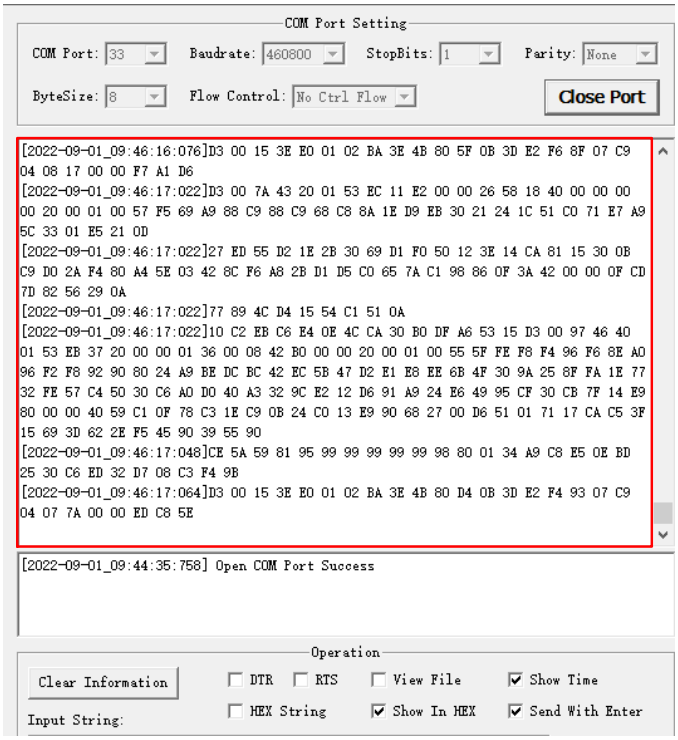


Figure 6: RTCM Message Output of LG69T (AS) – Displayed on QCOM Tool Interface

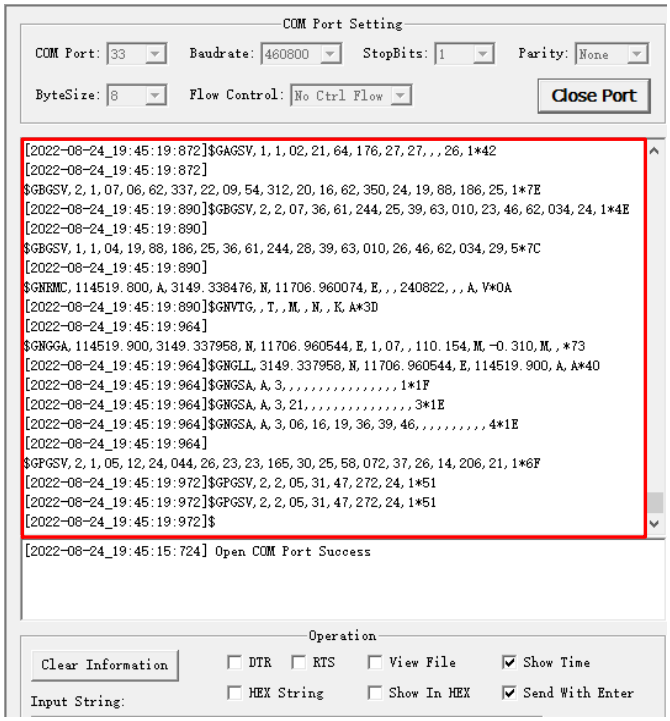


Figure 7: NMEA Message Output of LG69T (AM) – Displayed on QCOM Tool Interface

5 GNSS Module Firmware Upgrade via QGNSS Tool

This chapter explains how to use the QGNSS software tool for verifying the status of GNSS modules and firmware upgrading. For more information about QGNSS usage, see *document [2] QGNSS User Guide*.

5.1. QGNSS Setting

Step 1: Assemble the EVB components.

Step 2: Connect the EVB and the PC with a Micro-USB cable. Flip the Power switch (S101) to **ON** position to power on the EVB.

Step 3: Start the QGNSS and click "**Device**" and "**Set Device Information**" (default baud rate: 460800 bps [2]).

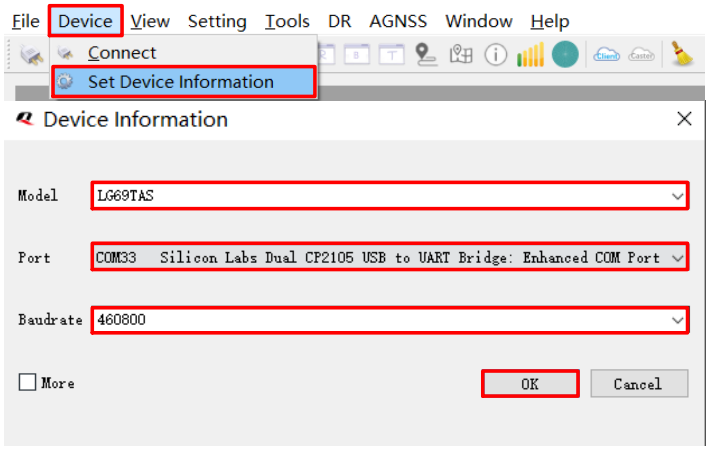


Figure 8: COM Port and Baud Rate Setting

Step 4: Click  "**Connect or disconnect**" button. Once the module is connected, the interface shown in the figure below will appear.

[2] UART interface default settings may vary depending on software versions.

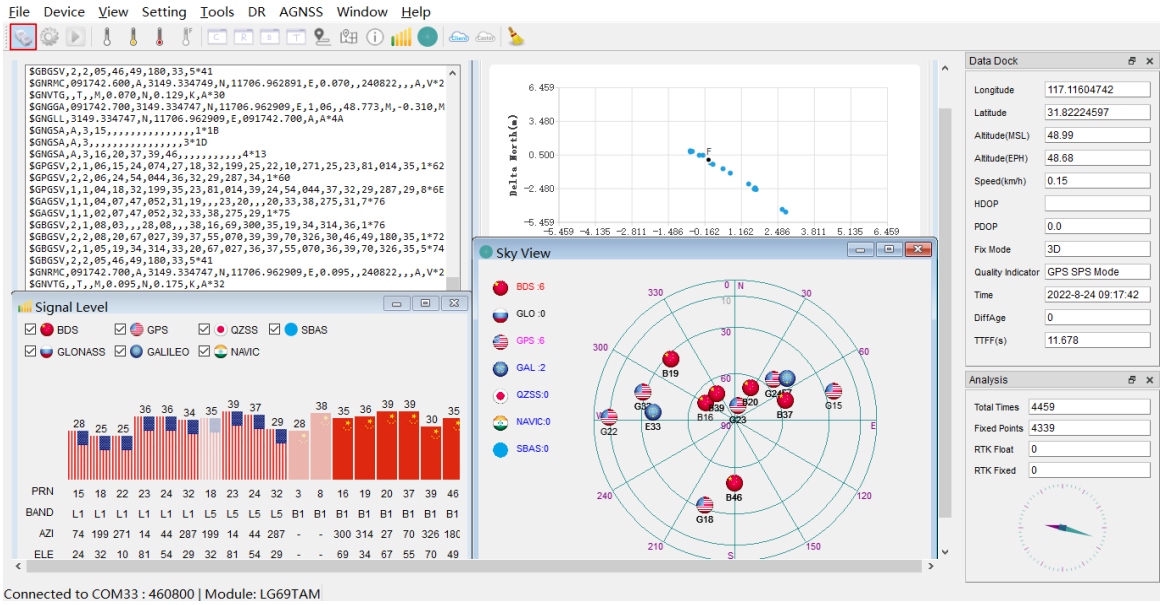


Figure 9: QGNSS Interface (Connected)

Step 5: Click "**Deviation Map**" button in the QGNSS toolbar, select "**Setup**" interface to convert WGS84 (World Geodetic System) to ECEF (Geocentric Coordinate System). Enter the corresponding coordinates of Lon (Degree), Lat (Degree), Alt (m) in the LLA column, and then select "**Calculate CEP50**" to convert WGS84 to the X, Y, Z coordinates of ECEF, as shown in the figures below.

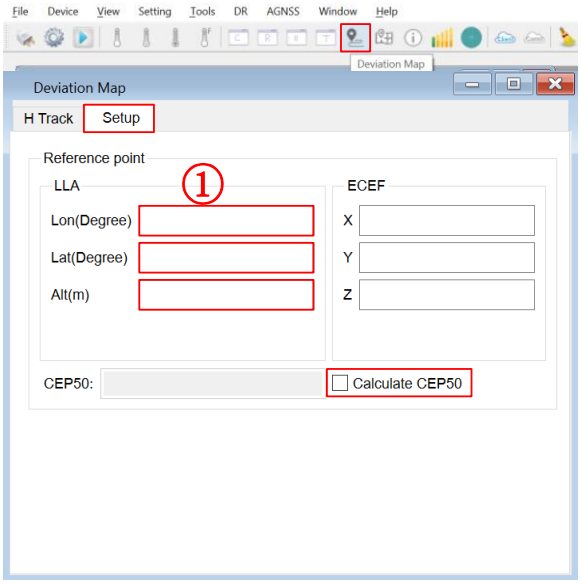


Figure 10: Converting WGS84 to ECEF

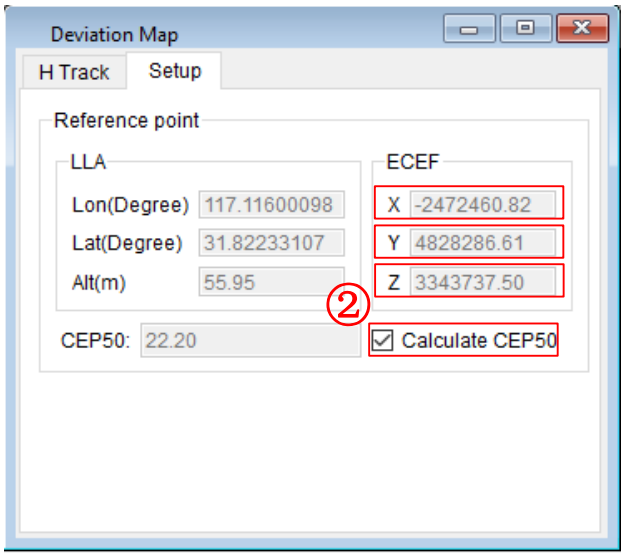


Figure 11: Converting WGS84 to ECEF

NOTE

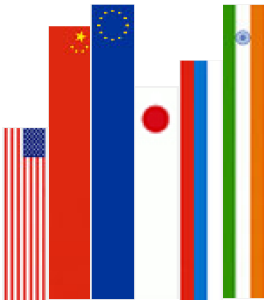
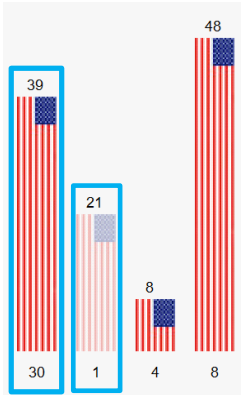
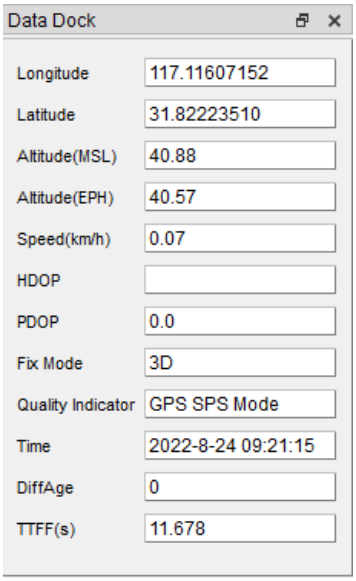
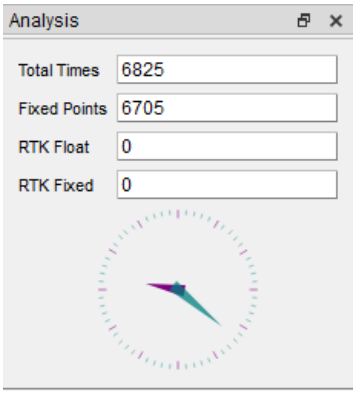
WGS84 can be converted to ECEF regardless of whether QGNSS is connected or unconnected .

5.2. QGNSS Interface Explanation

You can view GNSS information, such as C/N_0 message, time, position, speed, and precision in the QGNSS interface. See the following table to find out more about these parameters.

Table 5: QGNSS Interface Explanation

Icon	Explanation
	The sky view interface shows the position of the satellites in use. 1) The left column icons show the satellites in use and their number. ● BDS: 6 ● GLO (GLONASS): 0 ● GPS: 6 ● GAL (Galileo): 2 ● QZSS: 0 ● NavIC (IRNSS): 0 ● SBAS: 0 2) The sky view on the right shows the position of the satellites in use.

Icon	Explanation
	GPS satellite BDS satellite GLONASS satellite Galileo satellite QZSS satellite NavIC (IRNSS) satellite
	• PRN 30 C/N_0 is 39 dB-Hz. • Column in bright red means that the navigation data of the satellites are in use. • PRN 1 C/N_0 is 21 dB-Hz. • Column in light red means that the navigation data of the satellites are not in use.
	• Longitude (unit: degree) • Latitude (unit: degree) • Altitude (MSL) (unit: m) • Altitude (EPH) (unit: m) • Receiver speed (unit: km/h) • Horizontal dilution of precision • Position dilution of precision • Fix Mode: 2D, 3D • Quality Indicator: DGNSS, DGPS, GPS SPS mode • UTC date and time • Age of differential GPS data • Last TTFF(s) (unit: second)
	• Total Times • Fixed Points • RTK Float • RTK Fixed

5.3. Firmware Upgrade

The firmware of GNSS module's MCU is upgraded with QGNSS via the UART interface.

5.3.1. Module's MCU Firmware Download in Boot Download Mode

Before the module's MCU firmware download process, connect the EVB to a PC with a Micro-USB cable and flip the power switch (S101) to **OFF** position.

To download the module's MCU firmware in Boot download mode:

Step 1: Open QGNSS tool, and click "**Tools**" and select "**Firmware Download**" in the drop-down box.

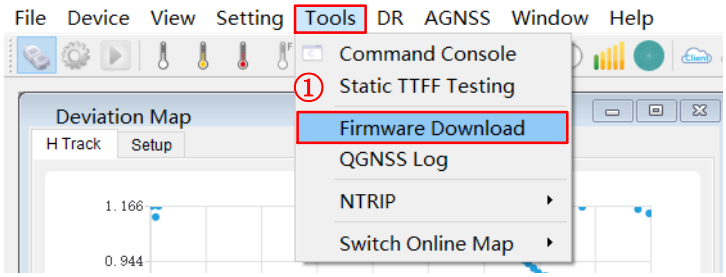


Figure 12: Launch Tool for MCU Firmware Downloading

Step 2: Select "**Download Baudrate**" in the drop-down box of "**Settings**".

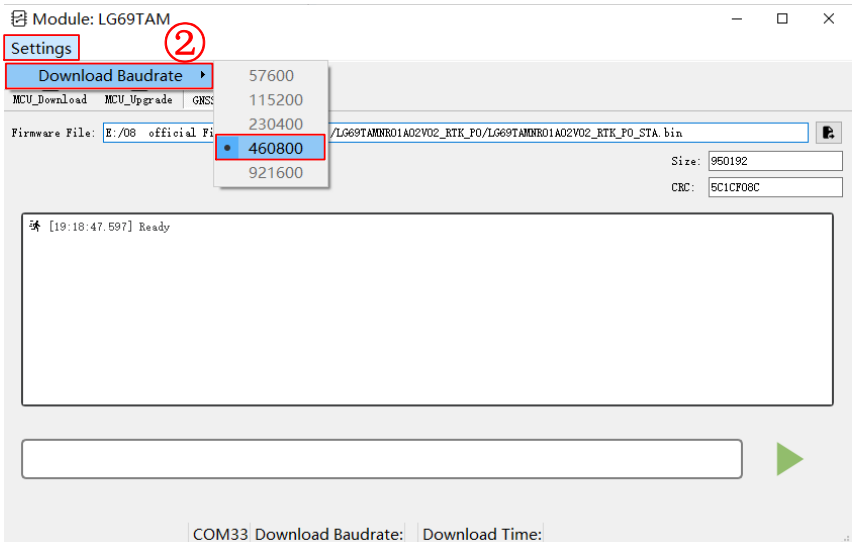


Figure 13: Configure Tool for MCU Firmware Downloading

Step 3: Select "**MCU_Download**" and then click button to select firmware file, e.g., "**LG69TAMNR01A02V02_RTK_PO_BOOT.bin**".

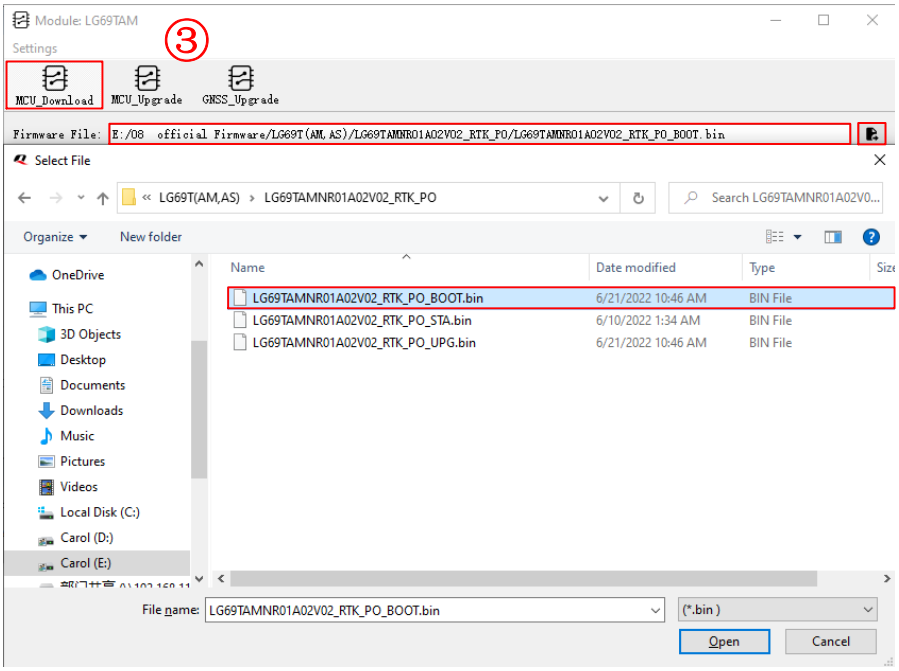


Figure 14: Select MCU Firmware to be Downloaded

Step 4: Press and hold the BOOT_GNSS button before flipping the power switch to **ON** position, and then release the BOOT_GNSS button to set the module to Boot download mode. Then, click button.

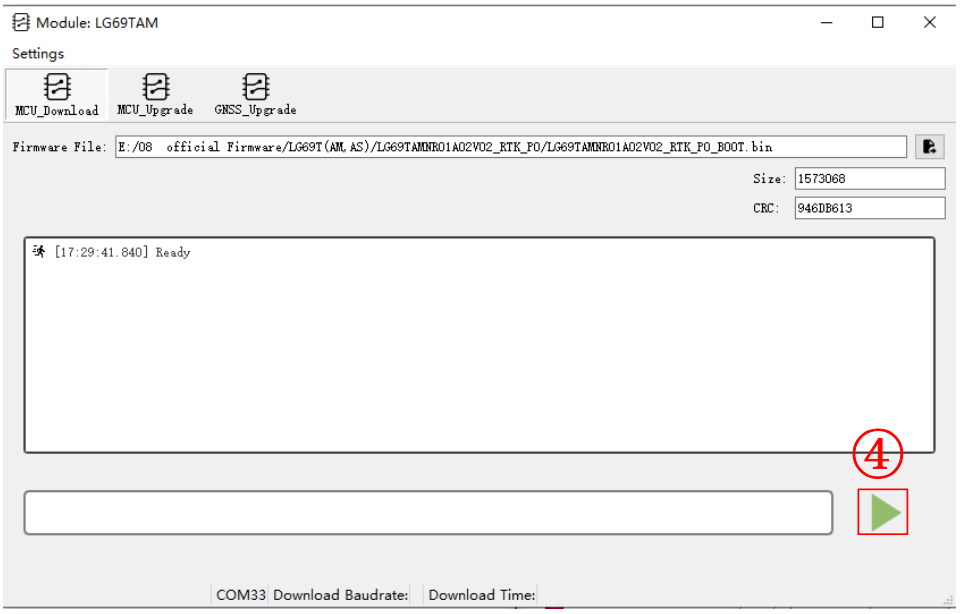


Figure 15: Start MCU Firmware Downloading

Step 5: Upon successful MCU firmware download, the QGNSS tool progress bar on the screen will indicate “100 %”.

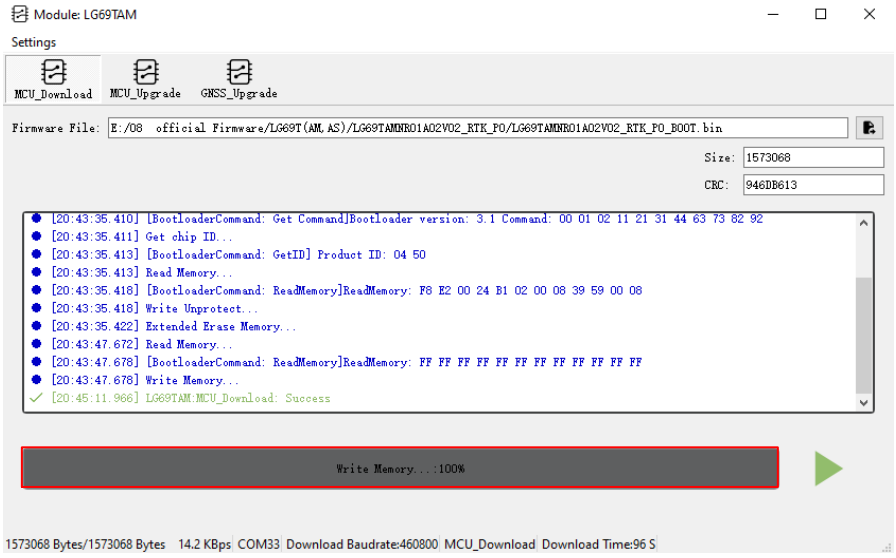


Figure 16: Successful MCU Firmware Downloading

5.3.2. Module’s MCU Firmware Upgrade in Normal Operating Mode

Before the module’s MCU firmware upgrade process, connect the EVB to a PC with a Micro-USB cable and flip the power switch (S101) to **OFF** position.

To upgrade the module’s MCU firmware in Normal operating mode:

Step 1: Open QGNSS tool, and click “**Tools**” and select “**Firmware Download**” in the drop-down box.

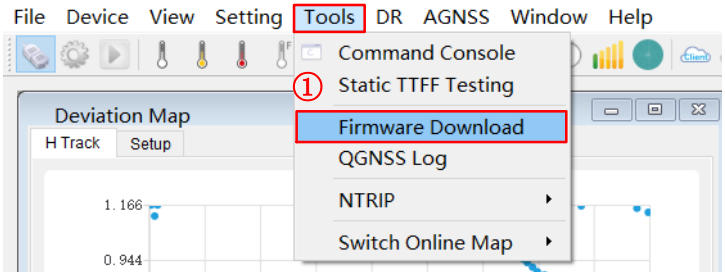


Figure 17: Launch Tool for MCU Firmware Upgrading

Step 2: Select "**Download Baudrate**" in the drop-down box of "**Settings**".

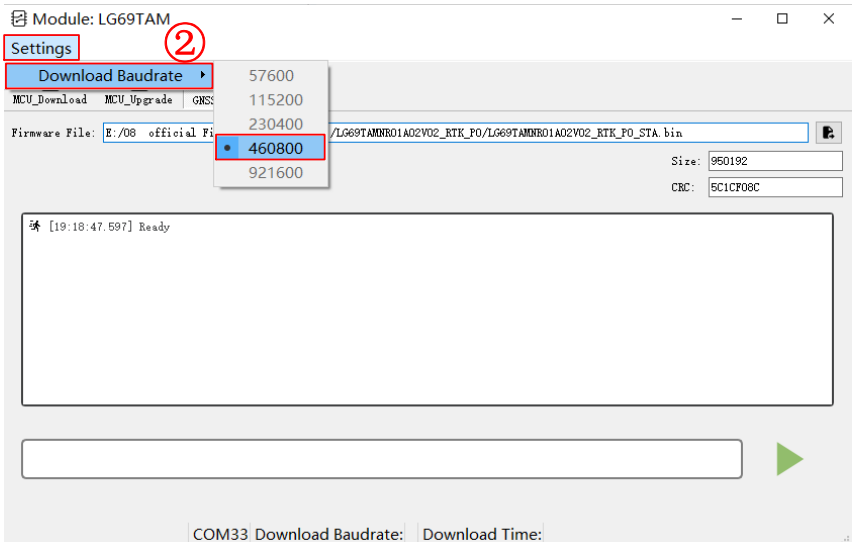


Figure 18: Configure Tool for MCU Firmware Upgrading

Step 3: Select "**MCU_Upgrade**" and then click  to select firmware file, e.g., "**LG69TAMNR01A02V02_RTK_PO_UPG.bin**".

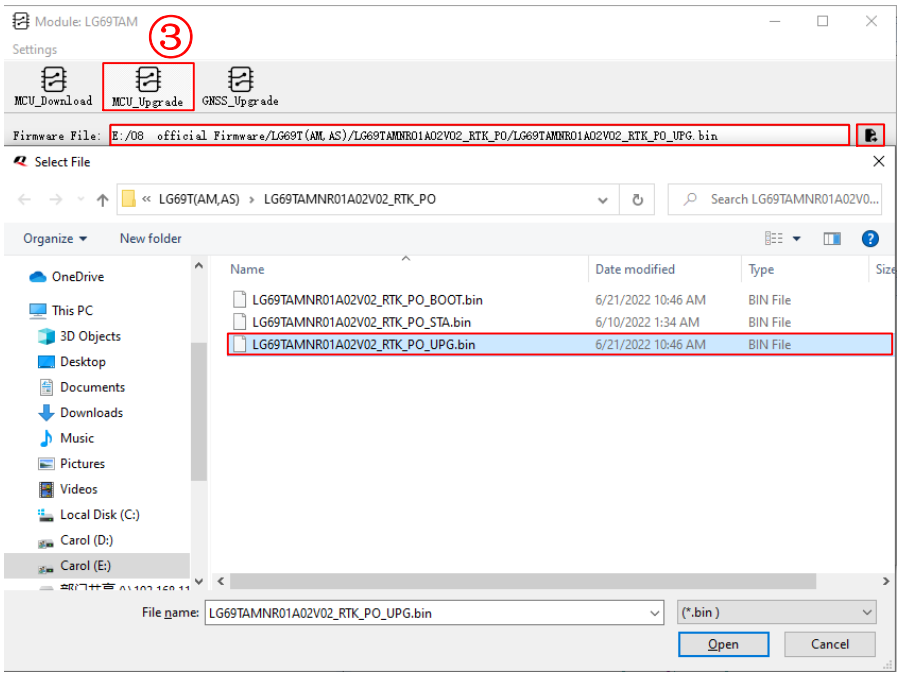


Figure 19: Select MCU Firmware to be Upgraded

Step 4: Click button before flipping the power switch to **ON** position, and then start downloading the MCU firmware.

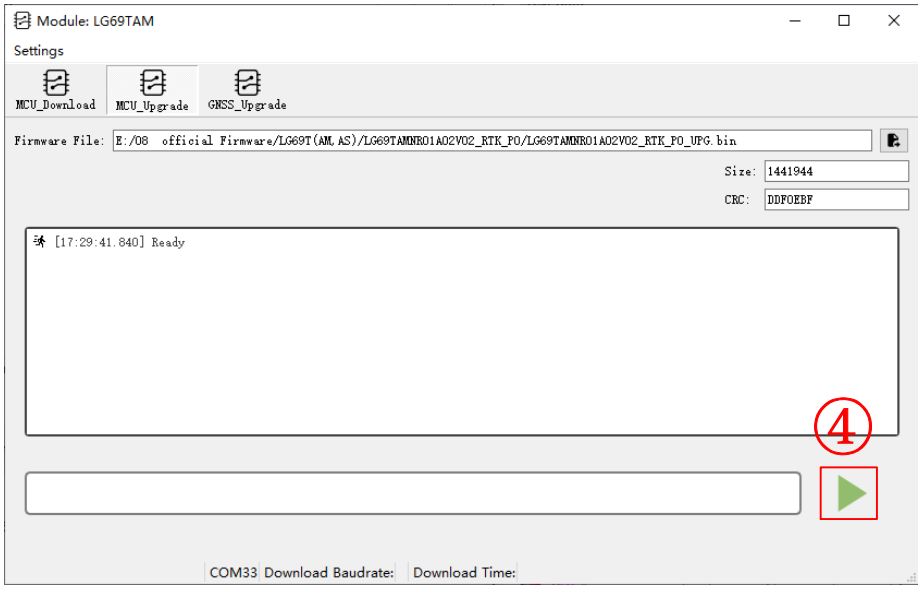


Figure 20: Start MCU Firmware Upgrading

Step 5: Upon successful firmware upgrading, the QGNSS tool progress bar on the screen will indicate "100 %".

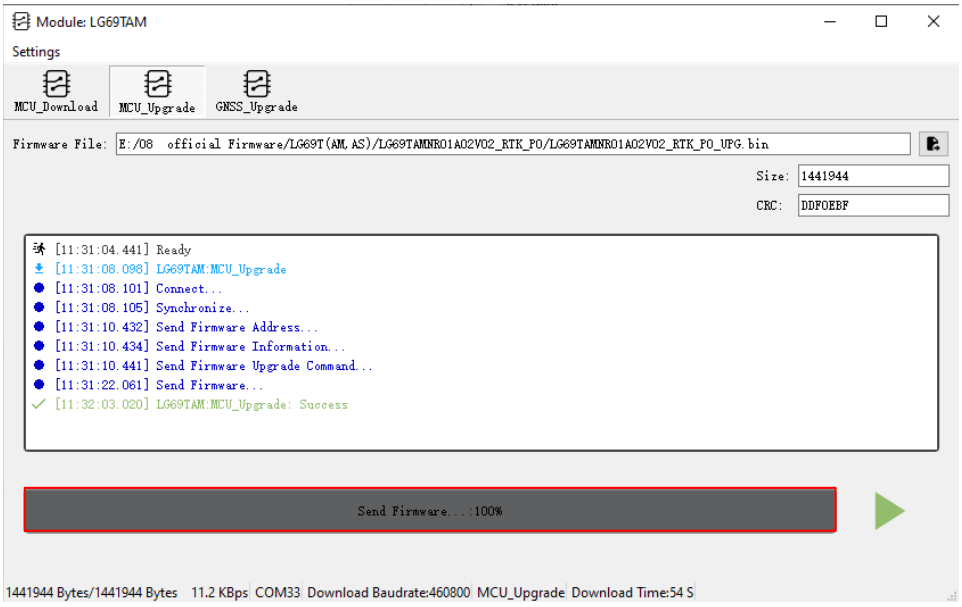


Figure 21: Successful MCU Firmware Upgrading

5.3.3. GNSS Firmware Upgrade

Before GNSS firmware upgrade process, connect the EVB to a PC with a Micro-USB cable and flip the power switch (S101) to **OFF** position.

To download GNSS firmware in Normal operating mode:

Step 1: Open QGNSS tool, and click "**Tools**" and select "**Firmware Download**" in the drop-down box.

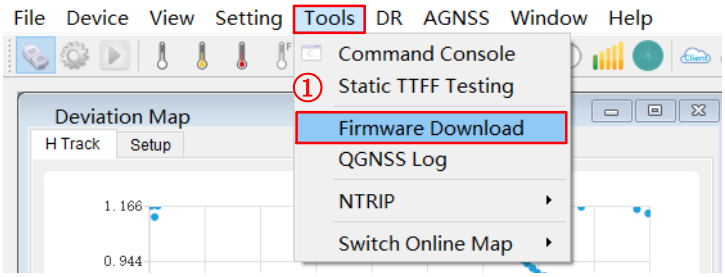


Figure 22: Launch Tool for GNSS Firmware Upgrading

Step 2: Select "**Download Baudrate**" in the drop-down box of "**Settings**".

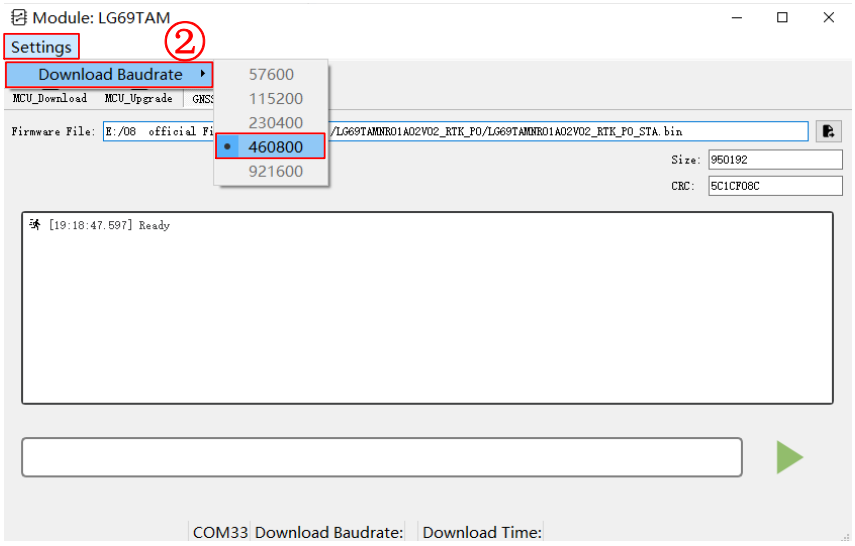


Figure 23: Configure Tool for GNSS Firmware Upgrading

Step 3: Select "**GNSS_Upgrade**" and then click  "**Open**" button to select firmware file, e.g., "**LG69TAMNR01A02V02_RTK_PO_STA.bin**".

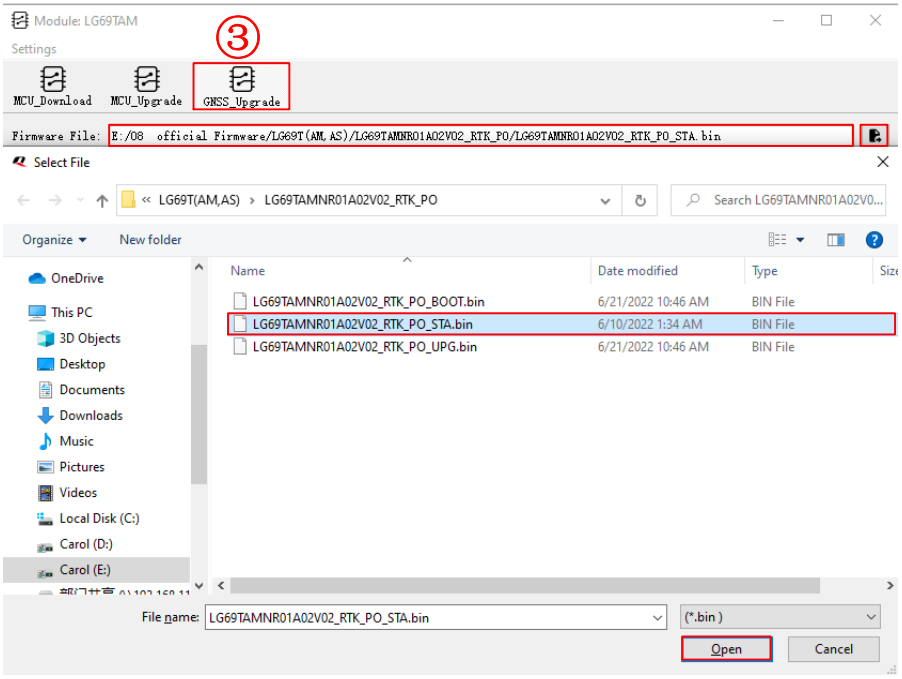


Figure 24: Select GNSS Firmware to be Upgraded

Step 4: Click ▶ button before flipping the power switch to **ON** position, and then start downloading the firmware.

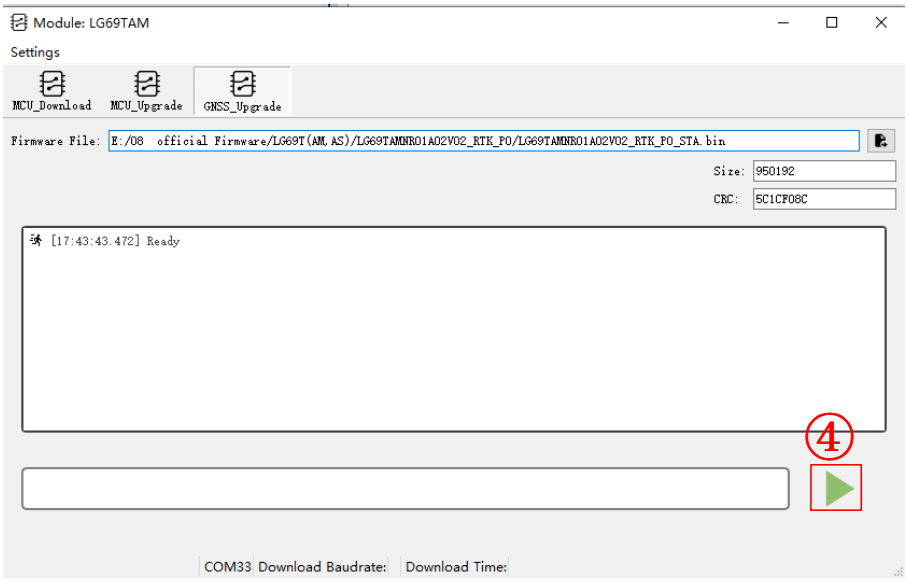


Figure 25: Start GNSS Firmware Upgrading

Step 5: Upon successful firmware upgrading, the QGNSS tool progress bar on the screen will be indicate "100 %".

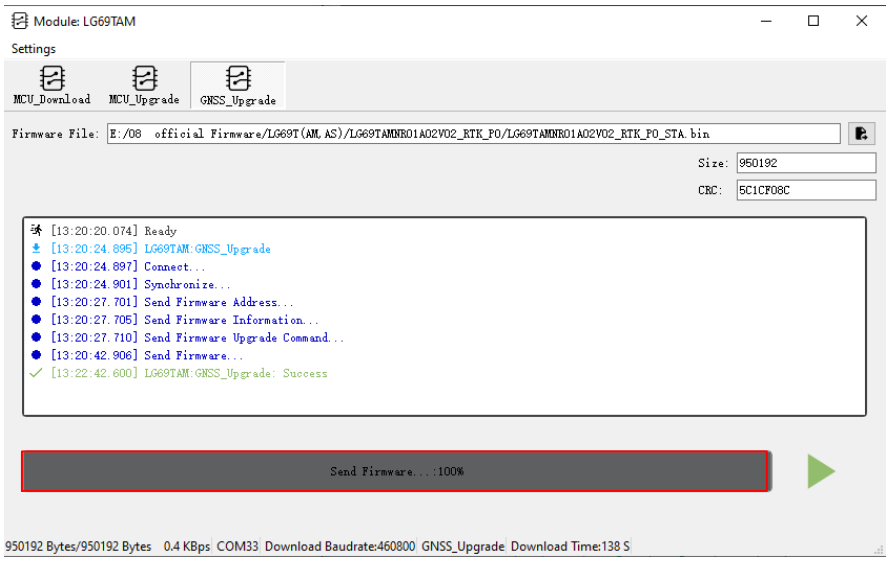


Figure 26: Successful GNSS Firmware Upgrading

NOTE

Make sure the GNSS module is in Continuous mode before GNSS firmware upgrading.

6 EG25-G Module Firmware Upgrade via QFlash Tool

This chapter explains how to use the QFlash software tool to upgrade EG25-G module firmware. For more information about QFlash usage, see *document [3] QFlash User Guide*.

To upgrade EG25-G module firmware:

Step 1: Before EG25-G module firmware upgrade process, connect the EVB to a PC with a Micro-USB cable via USB_EC20 interface (J601).

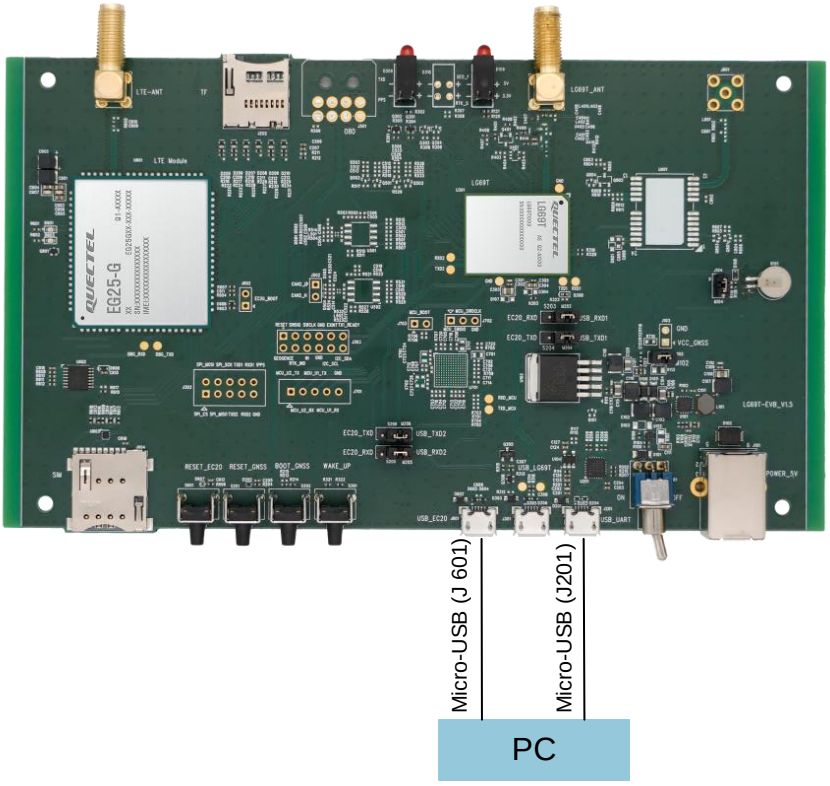


Figure 27: Connection Between EVB and PC

Step 2: Flip the power switch (S101) to **ON** position to power on the EVB. View the AT and DM COM port number in the Device Manager, as shown in the figure below.

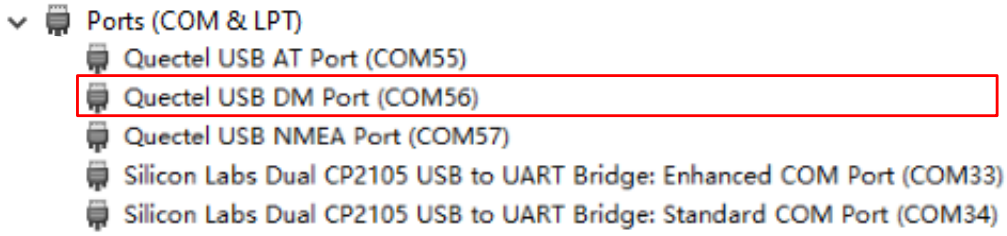


Figure 28: USB Ports

Step 3: Open QFlash tool, click "**Load FW File**" and select "**ENPRG9x07.mbn**". Then set the "**COM Port**" to DM Port and "**Baudrate**" to 921600 bps.

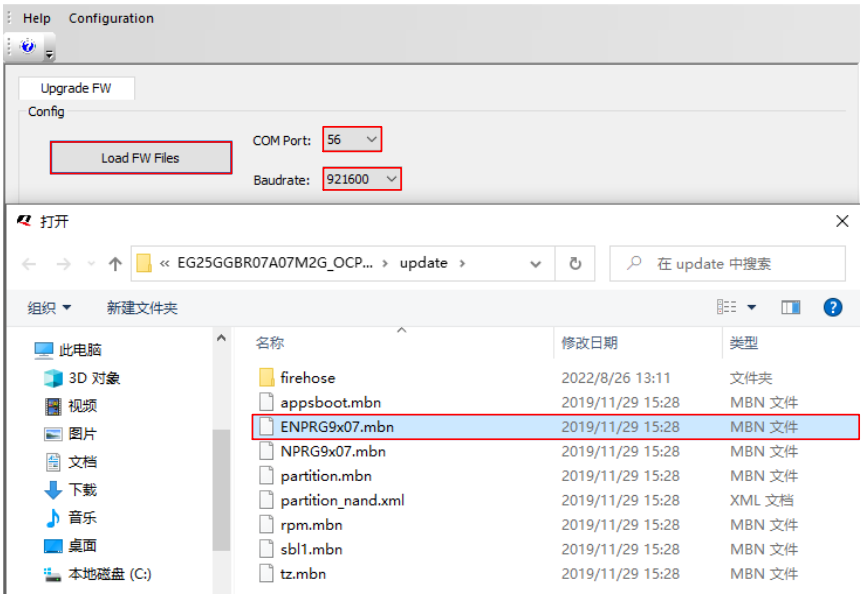


Figure 29: QFlash Tool Setting

Step 4: Click "**Start**" to start firmware downloading, as shown in the figure below.

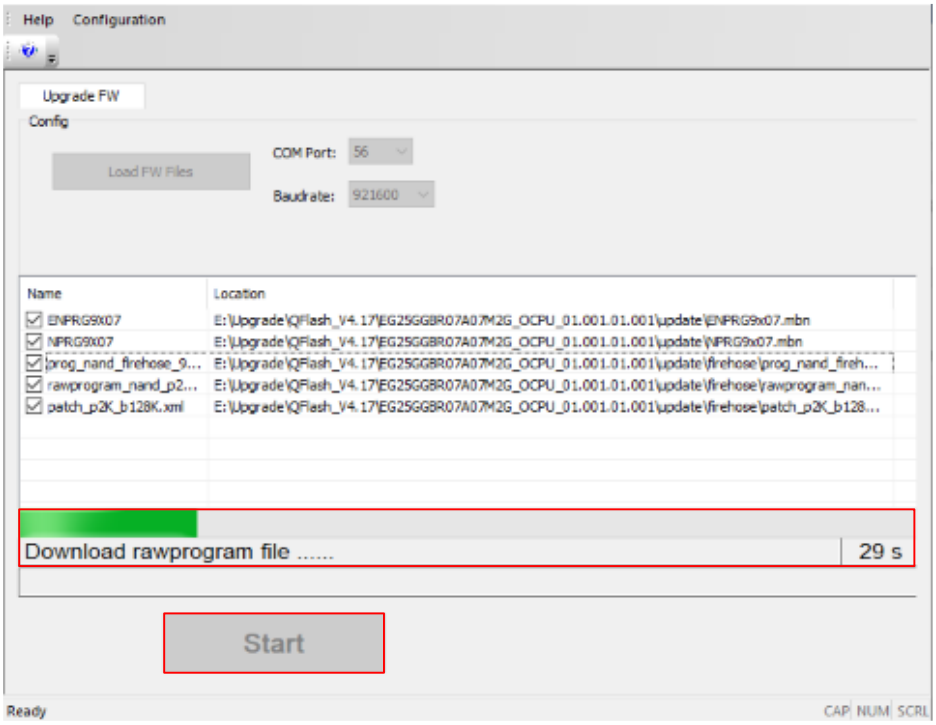


Figure 30: Firmware Downloading

Step 5: Upon successful firmware downloade, the QFlash tool progress bar on the screen will indicate "**PASS**".

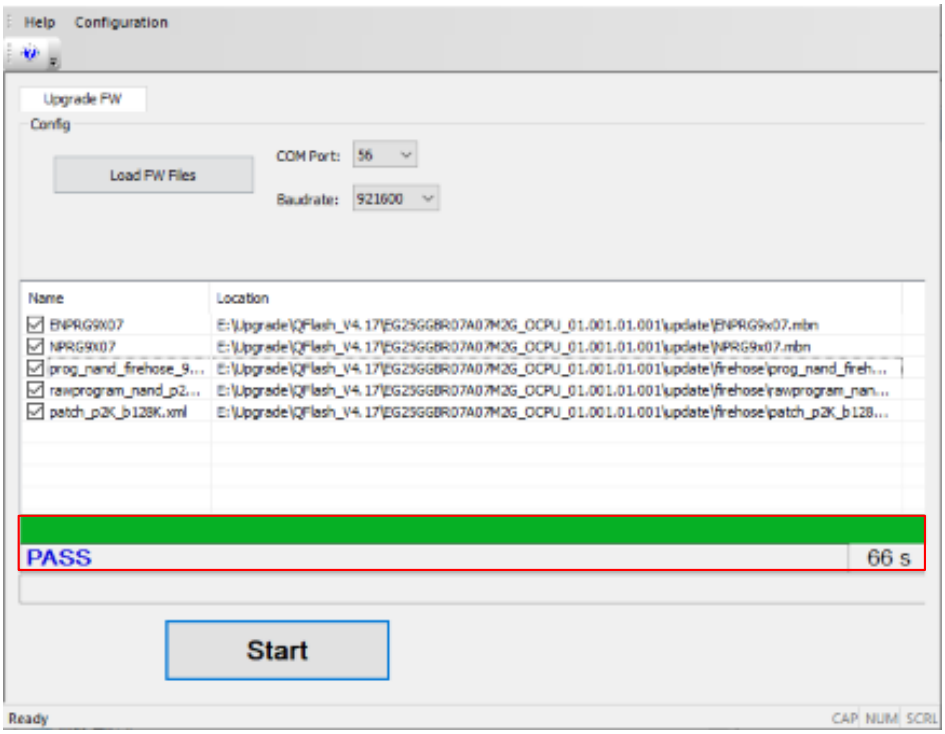


Figure 31: Successful Firmware Downloading

NOTE

The software version and QFlash tool cannot be stored in directories containing Chinese characters, special characters, and spaces when you download the firmware of the EG25-G module. Otherwise, the download will fail.

7 RTK Application

RTK is a technique for increasing GNSS positioning accuracy. It involves the use of one stationary reference receiver, called the base station, that sends correction data to one moving receiver, called the rover. The correction data source can either be a:

- local fixed base station; or
- third party correction service

This chapter outlines how the LG69T (AM) module is used as the rover and LG69T (AS) module is used as the base station, as well as how to:

- Connect to the base station,
- Configure the base station,
- Configure RTK data interaction mode, and
- Configure STRSVR tool.

7.1. Connect to Base Station

LG69T (AS) module is the base station that provides correction data required by the rover to enter RTK mode. The transmission of such data from the base station to the rover is carried out via NTRIP or TCP protocol with STRSVR tool over the Internet. Users need to keep delays to a minimum when transmitting the data.

The connection to the base station with STRSVR tool via NTRIP or TCP protocol illustrates below:

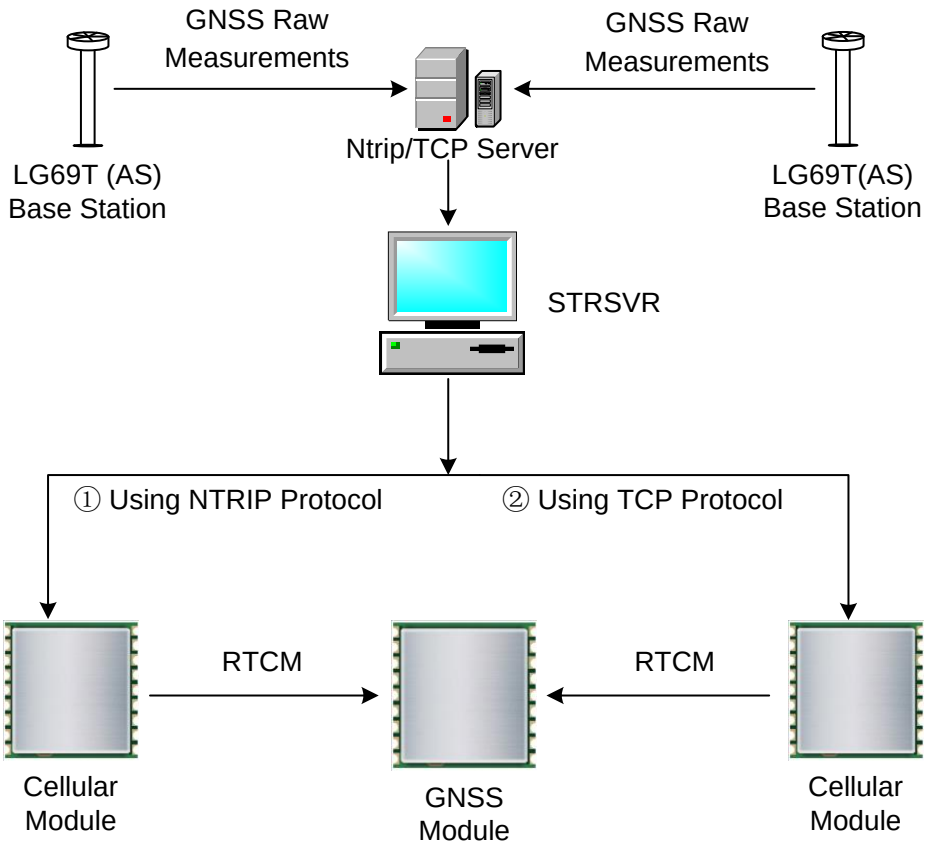


Figure 32: Connect to Base Station

7.1.1. Hardware Connection

The connection between EVB and PC is shown in the figure below. For more information about how to connect to the EVB and its components, see *Chapter 2.2 Connect Cables and Antenna to EVB*.

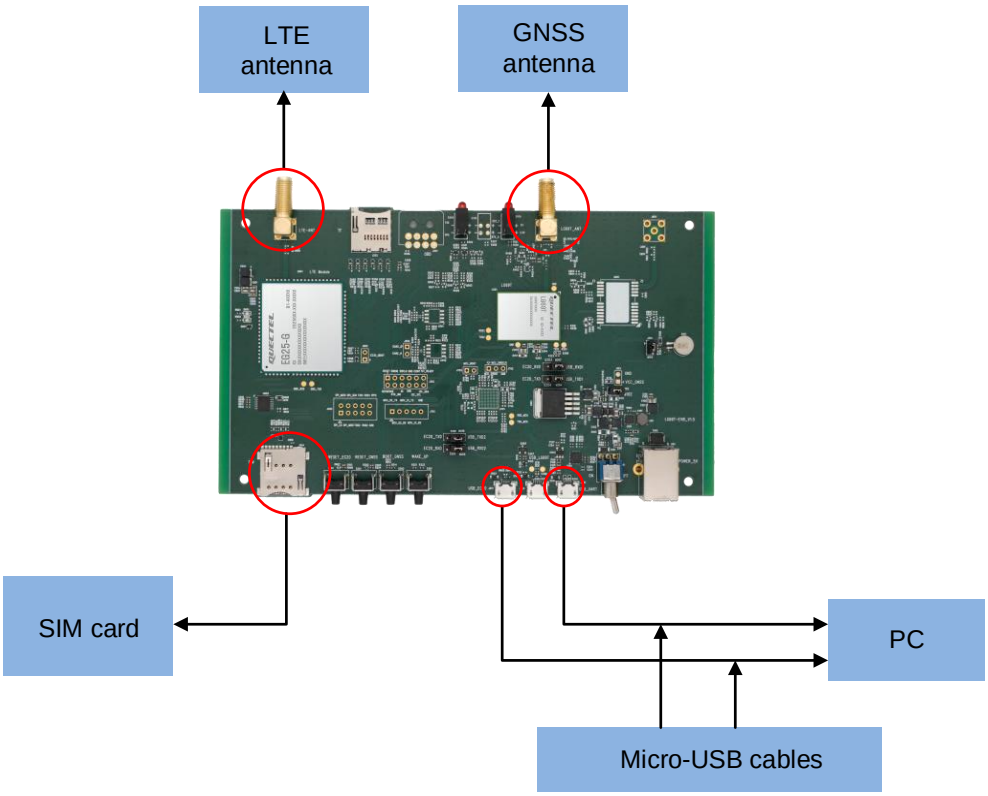


Figure 33: EVB and Components Assembly

7.2. Base Station Configuration

7.2.1. Base Station Receiver Mode Configuration

The following command is used to set the Receiver Mode of base station. The base station needs to work in static mode and there are two ways to enter static mode: Survey-in mode and Fixed mode. For more information, see *document [4] Protocol Specification*.

Synopsis:

```
$PQTMSETRECVMODE,<Mode>,<Duration>,<AntHeight>,<ECEF_X>,<ECEF_Y>,<ECEF_Z>*<Checksum><CR><LF>
```

7.2.2. Base Station RTCM MSM Mode Configuration

The following command is used to set the RTCM MSM (Multiple Signal Messages) mode of base station. For more information, see *document [4] Protocol Specification*.

Synopsis:

```
$PQTMSETMSMMODE,<Mode>*<Checksum><CR><LF>
```

7.3. RTK Data Interaction Mode Configuration

RTK data interaction mode is configured by sending the command to the AT port of the EG25-G module. The RTK data interaction mode needs to be reconfigured every time the EG25-G module upgrades its firmware. The commands format is as follows:

Synopsis:

```
AT+QGNSSPARAM="ProtoMode","DataMode","ip","port","usr","pwd","mount_point"
```

Parameter

Parameter	Description
ProtoMode	0 = NTRIP protocol 1 = TCP protocol
DataMode	0 = Rover Station 1 = Base station
ip	Server IP address
port	Server port
usr	Username
pwd	Password
mount_point	Mount point

NOTE

The parameters **"usr","pwd"** and **"mount_point"** are only used for configuring RTK data interaction mode through NTRIP method.

- If successful, the module returns:

```
+QGNSSPARAM OK
```

- If failed, the module returns:

```
+QGNSSPARAM ERR
```

7.4. STRSVR Tool Configuration

The main function of STRSVR tool is to transmit the differential data of the base station to the rover via NTRIP or TCP protocol over the network. The basic steps for data transmission via NTRIP or TCP protocol are listed below.

7.4.1. Steps for Data Transmission via NTRIP Protocol

Step 1: Send **AT+QGNSSPARAM=1,1,"ip","port","usr","pwd","mount_point"** to AT port of the EG25-G to configure the LG69T (AS) module as the **Base Station**.

Step 2: Send **AT+QGNSSPARAM=1,0,"ip","port","usr","pwd","mount_point"** to AT port of the EG25-G to configure LG69T (AM) module as the **Rover Station**.

Step 3: Open **STRSVR** tool. "**(0) Input**" is the configuration of the **Base Station** and "**(1) Output**" is the configuration of the **Rover Station**. For "**(0) Input**" and "**(1) Output**", set the "**Type**" to "**NTRIP Caster**".

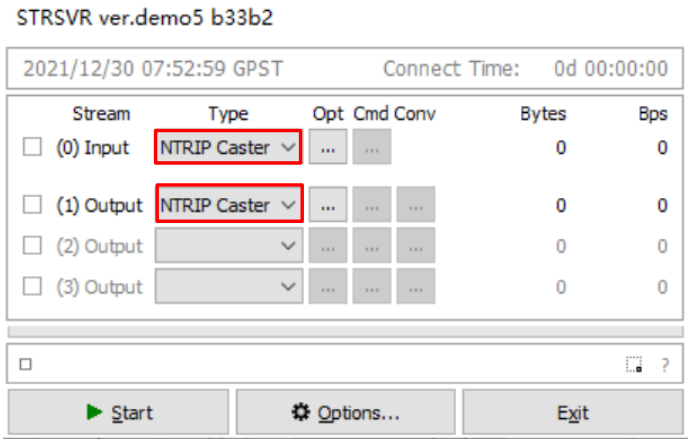


Figure 34: Configure STRSVR Tool – NTRIP 1

Step 4: For "**(0) Input**", set RTK account configuration information in the "**NTRIP Caster Server Options**" interface.

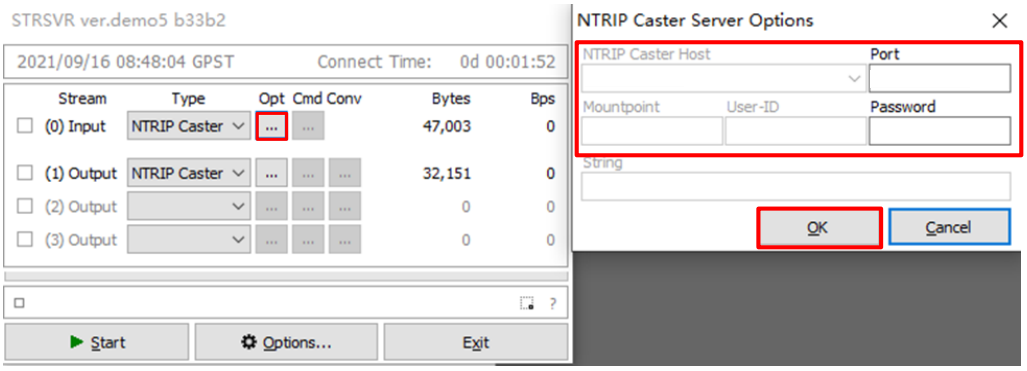


Figure 35: Configure STRSVR Tool – NTRIP 2

Table 6: NTRIP Caster Server Options

Parameter	Description
NTRIP Caster Host	Server IP address
Port	Server port
Mountpoint	Mount point
User-ID	Username
Password	Password

Step 5: For "**(1) Output**", set RTK account configuration information in the "**NTRIP Caster Server Options**" interface as shown below, and see *Table 6: NTRIP Caster Server Options* for details. Multiple modules can simultaneously be connected to the "**(1) Output**" port.

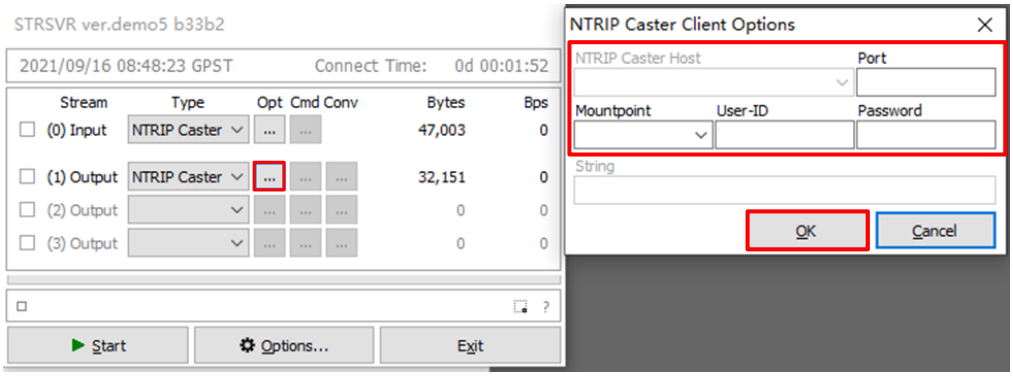


Figure 36: Configure STRSVR Tool – NTRIP 3

Step 6: Click "**Start**" to start configuring the server. Once the configuration is complete, the STRSVR tool progress bar on the screen will indicate 100%.

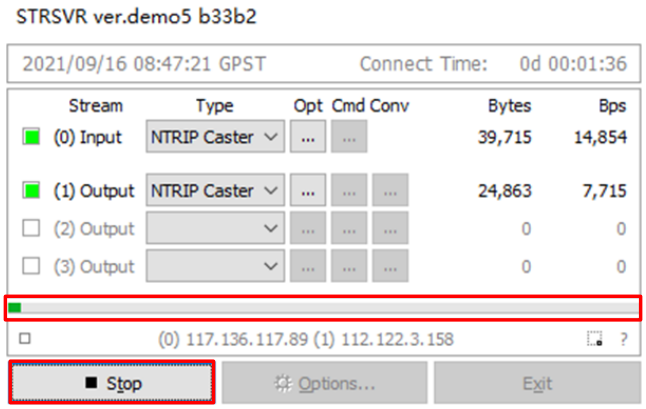


Figure 37: Configure STRSVR Tool – NTRIP 4

7.4.2. Steps for Data Transmission via TCP Protocol

Step 1: Send **AT+QGNSSPARAM=1,1,"ip","port"** to AT port of the EG25-G to configure the LG69T (AS) module as the **Base Station**.

Step 2: Send **AT+QGNSSPARAM=1,0,"ip","port"** to AT port of the EG25-G to configure LG69T (AM) module as the **Rover Station**.

Step 3: Open **STRSVR** tool. "**(0) Input**" is the configuration of the **Base Station** and "**(1) Output**" is the configuration of the **Rover Station**. Set the "**Type**" of "**(0) Input**" and "**(1) Input**" to "**TCP Server**".

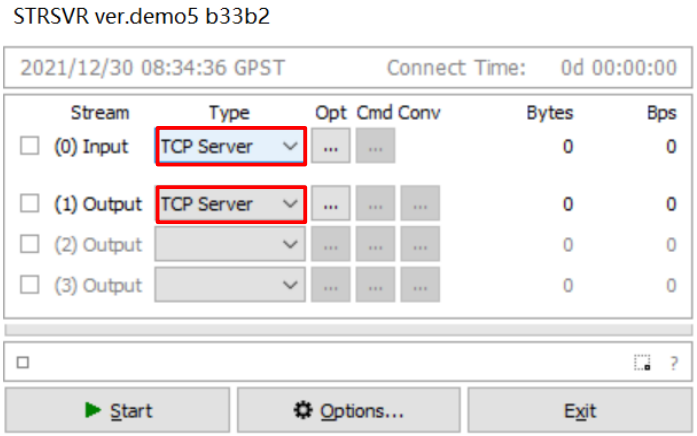


Figure 38: Configure STRSVR Tool – TCP 1

Step 4: For "**(0) Input**", set RTK account configuration information in the "**TCP Server Options**" interface.

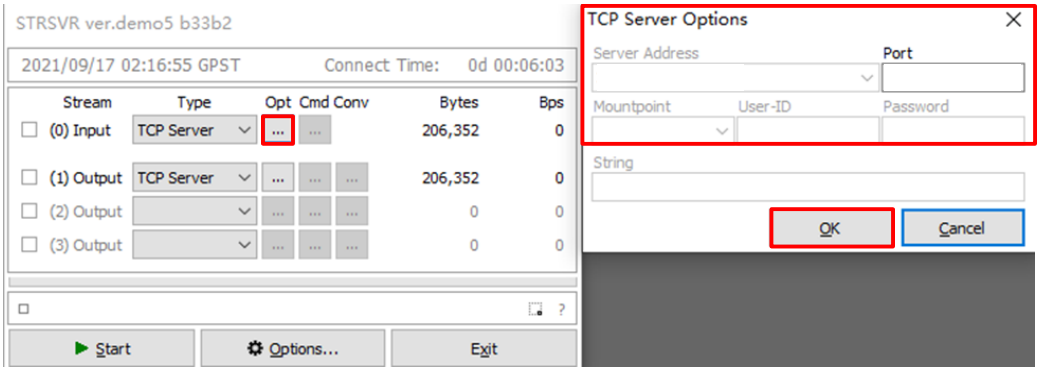


Figure 39: Configure STRSVR Tool – TCP 2

Table 7: TCP Server Options

Parameter	Description
Server Host	Server IP address
Port	Server port

NOTE

TCP method does not require you to enter **Mountpoint, User-ID** and **Password** when setting RTK account configuration information.

Step 5: For "**(1) Output**", set RTK account configuration information in the "**TCP Server Options**" interface as shown below and see *Table 7: TCP Server Options* for details. Multiple modules can simultaneously be connected to the "**(1) Output**".

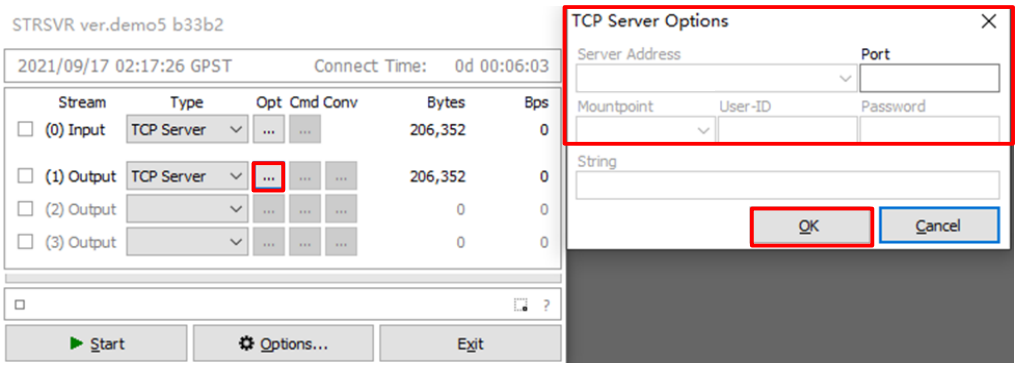


Figure 40: Configure STRSVR Tool – TCP 3

Step 6: Click "**Start**" to start configuring the server. Once the configuration is complete, the STRSVR tool progress bar on the screen will indicate 100%.

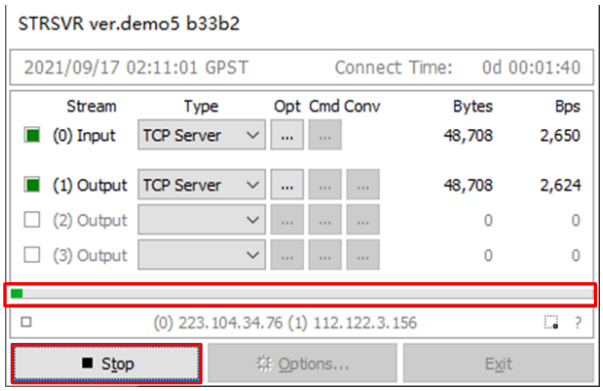


Figure 41: Configure STRSVR Tool – TCP 4

8 Appendix Reference

Table 8: Related Document

Document Name
[1] Quectel_QCOM_User_Guide
[2] Quectel_QGNSS_User_Guide
[3] Quectel_QFlash_User_Guide
[4] Quectel_LG69T(AS)_GNSS_Protocol_Specification

Table 9: Terms and Abbreviations

Abbreviation	Description
2D	2 Dimension
3D	3 Dimension
AT	Attention
BDS	BeiDou Navigation Satellite System
CEP	Circular Error Probable
C/N_0	Carrier-to-Noise Ratio
DI	Digital Input
DO	Digital Output
DR	Dead Reckoning
EPH	Ellipsoidal Height
ESD	Electrostatic Discharge
EVB	Evaluation Board

Abbreviation	Description
Galileo	Galileo Satellite Navigation System (EU)
GLONASS	Global Navigation Satellite System (Russia)
GND	Ground
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
I/O	Input/Output
LED	Light Emitting Diode
Micro-USB	Micro Universal Serial Bus
MISO	Master In Slave Out
MOSI	Master Out Slave In
MSL	Mean Sea Level
MSM	Multiple Signal Messages
NAVIC/IRNSS	Indian Regional Navigation Satellite System
NMEA	National Marine Electronics Association
NTRIP	Networked Transport of RTCM via Internet Protocol
PC	Personal Computer
PCB	Printed Circuit Board
1PPS	One Pulse Per Second
PRN	Pseudorandom Noise
QZSS	Quasi-Zenith Satellite System
RTCM	Radio Technical Commission for Maritime services
RTK	Real-Time Kinematic
RXD	Receive Data (Pin)
SBAS	Satellite-Based Augmentation System

Abbreviation	Description
TCP	Transmission Control Protocol
TF	TransFlash
TNC	Thread Neill-Concelman
TTFF	Time to First Fix
TXD	Transmit Data (Pin)
USB	Universal Serial Bus
UTC	Coordinated Universal Time