LG290P (03)&LGx80P Series
Base Station Mode
Application Note

GNSS Module Series

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	Ensure that the product may be used in the country and the required environment, as well as that it conforms to the local safety and environmental regulations.
	Keep away from explosive and flammable materials. The use of electronic products in extreme power supply conditions and locations with potentially explosive atmospheres may cause fire and explosion accidents.
	The product must be powered by a stable voltage source, and the wiring shall 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	**LG290P (03)&LGx80P Series Base Station Mode Application Note**
Subtitle	GNSS Module Series
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Revision History

Version	Date	Description
-	2024-07-12	Creation of the document
1.0	2024-11-25	First official release
1.1	2025-07-28	1. Added applicable modules LG580P (03, 06) and LG680P (03). 2. Added the information about Survey-in auto-convergence position hold function and related example (*Chapter 2.2.3*). 3. Updated the information about module RTK fixed solution implementation in base station mode (*Chapter 4*).

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1 Introduction

LG290P (03) and LGx80P series (comprising LG580P (03, 06) and LG680P (03)) are quad-band, multi-constellation GNSS modules that support concurrent reception of GPS, GLONASS, Galileo, BDS, QZSS and NavIC satellite signals and the SBAS (Satellite-Based Augmentation System). All modules support 20 Hz output and operation in rover and base station modes. This document uses the LG290P (03) module as an example to introduce the module usage in base station mode.

For the sake of simplicity and preciseness, the definitions of “base station” and “rover” are as follows.

- Base station: GNSS receiver broadcasting satellite observation data (RTCM) streams to the rover.
- Rover: GNSS receiver receiving satellite observation data (RTCM) streams broadcast from the base.

2 Base Station Mode Introduction and Configuration

2.1. Base Station Mode Introduction

The rover must receive the satellite observation data from the reference station to use the RTK function. The two most common mainstream reference stations are commercial VRS services or user-built base stations. User-built base stations are suitable for scenarios where the rover works within a short range (usually < 10 km from the base station). It can rely on the local area networks (radio, LoRa, etc.) to connect to the base station and get the GNSS satellite observation data necessary for RTK function. The absolute positioning accuracy of the rover is influenced by the accuracy of the base station location, so you need to know precise coordinates of the base station location to construct the base station.

The LG290P (03) module is designed for scenarios with user-built base stations. LG290P (03) uses the RTCM3.3 protocol to output base station positions, GNSS satellite observation data, as well as optional satellite ephemeris data.

2.2. Base Station Mode Configuration

This chapter outlines configuration methods and command examples for LG290P (03) module when it is operating in base station mode. For command details, see *document [1] protocol specification*.

2.2.1. Base Station Mode Configuration

The LG290P (03) module operates in rover mode by default. The module operating mode can be switched through **PQTMCFGRCVRMODE** as shown in the following example:

Example:

```
//Set the module operating mode to base station mode
$PQTMCFGRCVRMODE,W,2*29
//Command executed successfully
$PQTMCFGRCVRMODE,OK*64
```

```
//Save configuration
$PQTMSAVEPAR*5A
//Command executed successfully
$PQTMSAVEPAR,OK*72
//Restart Module
```

NOTE

For the configuration set through **PQTMCFGRCVRMODE** to take effect, the configuration must be saved and the module must be restarted.

Once the module switches to the base station mode, it automatically turns off the NMEA 0183 protocol output and instead starts outputting satellite observation data and module location information in RTCM3.3 protocol format. The main differences are as follows:

Table 1: Differences Between Rover Mode and Base Station Mode

Item	Rover Mode	Base Station Mode
Output protocol	NMEA 0183	RTCM3.3
Output message 1)	RMC, GGA, GSV, GSA, VTG, GLL	1005, MSM4
Update frequency 1)	10 Hz	1 Hz

NOTE

1. 1) Output message and update frequency may vary depending on the software version and configuration. Please refer to the actual firmware version for details.
2. The differences listed are the default configurations for rover mode and base station mode.

2.2.2. RTCM Configuration

In the base station mode, the user can configure the RTCM through **PQTMCFGRTCM**, including the output message type (RTCM MSM3–MSM7) and output mode of the satellite observation data, the satellite elevation threshold, the ephemeris output mode and interval.

Example:

```
//Set module to output RTCM MSM4 with no limitation on elevation threshold and ephemeris output when updated
$PQTMCFGRTCM,W,4,0,-90,07,06,1,0*25
```

```
//Command executed successfully
$PQTMCFGRTCM,OK*7A

//Set module to output RTCM MSM7 with 5° elevation threshold and ephemeris output when updated and at 1-hour intervals.
$PQTMCFGRTCM,W,7,0,5,07,06,2,3600*01
//Command executed successfully
$PQTMCFGRTCM,OK*7A
```

NOTE

To successfully output ephemeris data, first employ **PQTMCFGRTCM** with **<EPH_Mode>** parameter to set the ephemeris output mode, which is designed to output ephemeris by default when updated. Then, apply **PQTMCFGMSGRATE** to specify the corresponding message name and output rate. For details on **PQTMCFGRTCM** and **PQTMCFGMSGRATE**, see *document [1] protocol specification*.

2.2.3. Fixed Mode and Survey-in Mode Configuration

The accuracy of the base station position coordinates is crucial because the positioning accuracy of a rover in RTK mode is influenced by the accuracy of the base station position. If you know the base station position coordinates, you can set the module to Fixed mode and the known coordinates directly to module through **PQTMCFGSVIN**.

If you do not know the accurate coordinates, you can obtain them automatically through the Survey-in mode of the module, which calculates the weighted average of all valid 3D position coordinates. In Survey-in mode, you need to set the 3D positioning accuracy and the number of position coordinates (i.e., the minimum positioning times in Survey-in mode) used to calculate the weighted average of position coordinates. Only coordinates that meet the set 3D position accuracy are considered valid and are included in the weighted average calculation. Once the number of valid position coordinates reaches the set value, the module automatically saves the averaged coordinates and outputs them. If the module is restarted, the saved averaged coordinates will be used for output. To recalculate the coordinates, just re-execute **PQTMCFGSVIN**. The Survey-in mode also supports an auto-convergence position hold function. If the distance between the module's current auto-converged coordinate and the last auto-converged coordinate is less than the set distance, the module will output the last auto-converged coordinate. Otherwise, it outputs the current auto-converged coordinate. The module also supports RTK function in base station mode, which helps the module to obtain accurate position.

The Survey-in mode can be configured via **PQTMCFGSVIN**, and its status can be viewed by **PQTMSVINSTATUS**. Example for setting or getting Survey-in feature is shown below:

Example:

//Set module to Fixed mode and manually configure the module's coordinates based on known base station coordinates (coordinates are in ECEF format)
$PQTMCFGSVIN,W,2,0,0,-2519265.0514,4849534.9045,3277834.6432*2A
//Command executed successfully
$PQTMCFGSVIN,OK*70

//Set module to Survey-in mode with 3600 positioning times and 1.2 m 3D position accuracy threshold.
$PQTMCFGSVIN,W,1,3600,1.2,0,0,0*0A
//Command executed successfully
$PQTMCFGSVIN,OK*70

//Set module to Survey-in mode with 3600 positioning times, 1.2 m 3D position accuracy threshold and 1.5 m auto-convergence position hold distance.
$PQTMCFGSVIN,W,1,3600,1.2,0,0,0,1.5*0C
//Command executed successfully
$PQTMCFGSVIN,OK*70

//Query whether the Survey-in mode of the module is enabled
$PQTMCFGSVIN,R*26
//Survey-in mode of the module is disabled
$PQTMCFGSVIN,OK,0,0,0.0,0.0000,0.0000,0.0000*40

NOTE

After configuring the parameters in the "set" commands, send **$PQTMSAVEPAR*5A** to save the configuration, and then restart the module to ensure that all changes take effect. Otherwise, the module will restore the default values after power-up.

3 Base Station Mode Assembly and Usage

This chapter describes the base station assembly process, the base station configuration via Fixed mode or Survey-in mode and satellite observation data (RTCM) transition between base station and rover.

3.1. Base Station Hardware Assembly

3.1.1. Required Components

The following components are required for assembling the base station:

- Quectel GNSS-MODULE EVB V1.3 with USB Type-C cable
- LG290P TE-A V1.1, base station antenna and rover antenna
- EG25-G TE-A, 4G antenna and (U)SIM card
- PC with internet connection

Figure 1: Base Station Antenna

Figure 2: Rover Antenna

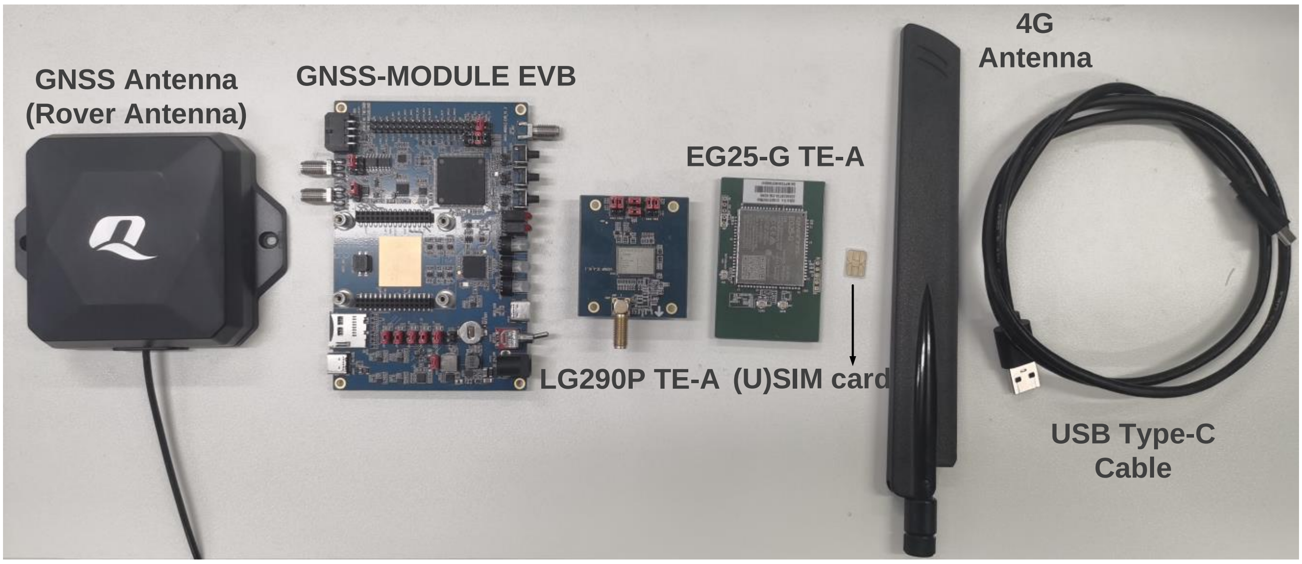

Figure 3: Components for Base Station Assembly

3.1.2. Base Station Assembly

This usage example demonstrates how to assemble a base station using a Quectel GNSS-MODULE EVB. For demonstration purposes, rover antennas are used for both the rover and the base station.

The connection schematic of the base station assembly is shown in *Figure 4: Base Station Assembly – Front Side* and *Figure 5: Base Station Assembly – Back Side*. For information on using Quectel GNSS-MODULE EVB, see *document [2] EVB user guide*.

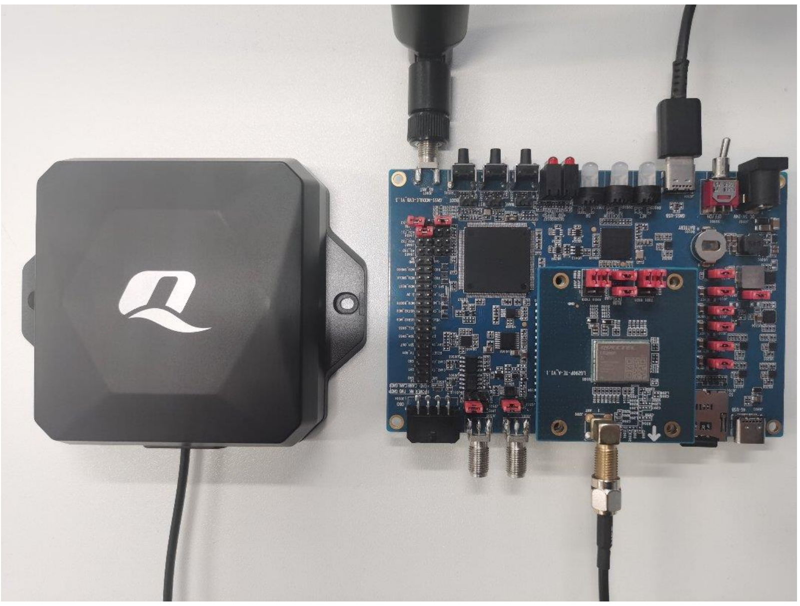

Figure 4: Base Station Assembly – Front Side

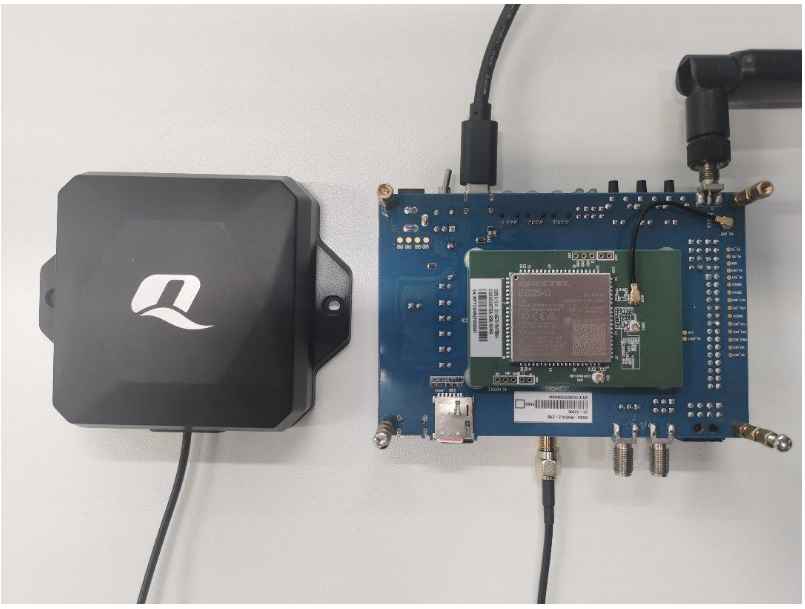

Figure 5: Base Station Assembly – Back Side

Base Station Antenna Installation: For optimal performance, install the base station in an open sky environment. You can mount it on the roof of a building using a measurement type antenna. The signal is transmitted to the base station equipment using a proprietary RF cable.

Figure 6: Base Station Antenna Installation

For rover and base station antennas, you can choose the LG290P (03) companion antenna, as shown in *Figure 1: Base Station Antenna* and *Figure 2: Rover Antenna*, or other antennas that meet the antenna specifications outlined in *document [3] hardware design*. For more information about the antenna, contact Quectel Technical Support (support@quectel.com).

3.2. Base Station Configuration

Before using the LG290P (03) as a base station, you need to set the module to base station mode and then fix the base station position. As mentioned in the previous chapter, there are two methods to determine the base station position. One is to manually configure the known base station location coordinates in the LG290P (03) module via Fixed mode, and the other is to use the Survey-in mode of the LG290P (03) to automatically determine the position. The following chapters describe the configuration process for each method.

3.2.1. Manual Configuration of Base Station Coordinates by Fixed Mode

The following example describe the manual configuration of base station coordinates in detail:

Example:

//Configure the module operating mode to base station mode
$PQTMCFGRCVRMODE,W,2*29
//Command executed successfully
$PQTMCFGRCVRMODE,OK*64
//Save configuration
$PQTMSAVEPAR*5A
//Command executed successfully
$PQTMSAVEPAR,OK*72
//Reboot the module via the relevant command (software reboot) or the RESET_N pin (hardware reboot) and the software reboot is used here
$PQTMSRR*4B
//Wait for the module to power on
//Configure the ECEF coordinates of the base station (X = -2519265.0514, Y = 4849534.9045, Z = 3277834.6432)
$PQTMCFGSVIN,W,2,0,0,-2519265.0514,4849534.9045,3277834.6432*2A
//Command executed successfully
$PQTMCFGSVIN,OK*70
//Configure **PQTMSVINSTATUS** to output once per positioning times via **PQTMCFGMSGRATE** to view the Survey-in status (It is an optional step.)
$PQTMCFGMSGRATE,W,PQTMSVINSTATUS,1,1*58
//Command executed successfully
$PQTMCFGMSGRATE,OK*29
//Save configuration
$PQTMSAVEPAR*5A
//Command executed successfully
$PQTMSAVEPAR,OK*72
//Reboot the module via the relevant command (software reboot) or the RESET_N pin (hardware reboot) and the software reboot is used here
$PQTMSRR*4B
//Output the configured value of base station ECEF coordinates via **RTCM3-1005** (The module outputs this message by default in base station mode.)
D3 00 13 3E D1 22 03 3A 22 66 A8 EE 8B 4A 8C 4D 35 07 A1 BD DF BF BB 0A 12
//View the base station ECEF coordinate configuration values via **PQTMSVINSTATUS** (It is an optional

```
step and it is also recommended to disable the message output after verifying the status.)
$PQTMSVINSTATUS,1,288282000,2,,00,0,0,-2519265.0514,4849534.9045,3277834.6432,0.0000*3E
$PQTMSVINSTATUS,1,288283000,2,,00,0,0,-2519265.0514,4849534.9045,3277834.6432,0.0000*3F
$PQTMSVINSTATUS,1,289072000,2,,00,0,0,-2519265.0514,4849534.9045,3277834.6432,0.0000*32
//Disable PQTMSVINSTATUS output via PQTMCFGMSGRATE
$PQTMCFGMSGRATE,W,PQTMSVINSTATUS,0,1*59
//Command executed successfully
$PQTMCFGMSGRATE,OK*29
//Save configuration
$PQTMSAVEPAR*5A
//Command executed successfully
$PQTMSAVEPAR,OK*72
//Reboot the module via the relevant command (software reboot) or the RESET_N pin (hardware reboot)
and the software reboot is used here.
$PQTMSRR*4B
```

3.2.2. Automatic Convergence of Coordinates by Survey-in Mode

The following examples describe the automatic convergence of coordinates by Survey-in mode in detail:

Example:

```
//Configure the module operating mode to base station mode
$PQTMCFGRCVRMODE,W,2*29
//Command executed successfully
$PQTMCFGRCVRMODE,OK*64
//Save configuration
$PQTMSAVEPAR*5A
//Command executed successfully
$PQTMSAVEPAR,OK*72
//Reboot the module via the relevant command (software reboot) or the RESET_N pin (hardware reboot)
and the software reboot is used here
$PQTMSRR*4B
//Wait for the module to power on
//Configure the base station to Survey-in mode with 60 positioning times and 15.0 m 3D position accuracy
threshold
$PQTMCFGSVIN,W,1,60,15.0,0,0,0*3E
//Command executed successfully
$PQTMCFGSVIN,OK*70
```

//Configure **PQTMSVINSTATUS** to output once per positioning times via **PQTMCFGMSGRATE** to view the Survey-in status (It is an optional step.)

$PQTMCFGMSGRATE,W,PQTMSVINSTATUS,1,1*58

//Command executed successfully

$PQTMCFGMSGRATE,OK*29

//Save configuration

$PQTMSAVEPAR*5A

//Command executed successfully

$PQTMSAVEPAR,OK*72

//Reboot the module via the relevant command (software reboot) or the RESET_N pin (hardware reboot) and the software reboot is used here.

$PQTMSRR*4B

//Output the mean ECEF coordinates of the base station during convergence via **RTCM3-1005** (The module outputs this message by default in base station mode.)

D3 00 13 3E D1 22 03 3B 54 97 DA 6F 8C 99 B2 AF 40 06 4C FC 1A 4B 1E 7D F1

//View the mean ECEF coordinates of the base station from the beginning to the completion of convergence via **PQTMSVINSTATUS** (It is an optional step and it is also recommended to disable the message output after the completion of convergence.)

$PQTMSVINSTATUS,1,291264000,1,,11,1,60,-2005560.2218,5411825.5447,2706139.7061,1.8691*0C

$PQTMSVINSTATUS,1,291265000,1,,11,2,60,-2005560.1264,5411824.9421,2706139.6738,4.9992*09

$PQTMSVINSTATUS,1,291266000,1,,11,3,60,-2005560.1137,5411824.5510,2706139.6722,4.3119*0B

$PQTMSVINSTATUS,1,291267000,1,,11,4,60,-2005560.2000,5411824.9447,2706140.0627,1.3000*04

… …

$PQTMSVINSTATUS,1,291320000,1,,11,57,60,-2005559.8625,5411823.2315,2706139.4103,1.7206*36

$PQTMSVINSTATUS,1,291321000,1,,11,58,60,-2005559.8577,5411823.2160,2706139.4067,1.6716*3A

$PQTMSVINSTATUS,1,291322000,1,,11,59,60,-2005559.8530,5411823.2016,2706139.4032,1.7830*31

$PQTMSVINSTATUS,1,291323000,2,,11,60,60,-2005559.8481,5411823.1873,2706139.3995,1.8075*3F

$PQTMSVINSTATUS,1,291324000,2,,11,60,60,-2005559.8481,5411823.1873,2706139.3995,1.8075*38

$PQTMSVINSTATUS,1,291325000,2,,11,60,60,-2005559.8481,5411823.1873,2706139.3995,1.8075*39

//Convergence completed and disable **PQTMSVINSTATUS** output via **PQTMCFGMSGRATE**

$PQTMCFGMSGRATE,W,PQTMSVINSTATUS,0,1*59

//Command executed successfully

$PQTMCFGMSGRATE,OK*29

//Save configuration

$PQTMSAVEPAR*5A

//Command executed successfully

$PQTMSAVEPAR,OK*72

//Reboot the module via the relevant command (software reboot) or the RESET_N pin (hardware reboot)

and the software reboot is used here.
$PQTMSRR*4B

NOTE

1. If the base station position changes after the base station coordinates converge, the output coordinates no longer match the actual base station position, and you need to configure the coordinates through **PQTMCFGSVIN**. Refer to *Chapter 3.2.2 Automatic Convergence of Coordinates by Survey-in Mode* to reconfigure the Survey-in mode, then save the changes and restart the module. If the Survey-in configuration is still the same as the previous configuration then there is no need to save it again, simply execute **PQTMCFGSVIN** and then restart the module.
2. If the Survey-in status message (**PQTMSVINSTATUS**) of the base station is transmitted to the rover, the rover will report an error indicating that the command is not supported. For details about the error, see *document [1] protocol specification*.

3.3. Data Transmission

For the rover to receive satellite observation data from the base station, it is necessary to transmit the data from the base station to the rover. Generally, there are two transmission methods: wired connection and wireless connection. The wired connection is limited by the wire harness and it is rarely used. In practical applications, data is mostly transmitted wirelessly. Many wireless transmission options are available, cellular networks, Wi-Fi, radios, LoRa, etc.

3.3.1. Network Transmission

This chapter employs LG290P (03) and GNSS-MODULE EVB as an example to explain the wireless transmission of base station's satellite observation data via PC-based or cellular-based network, with the assistance of QGNSS NTRIP. The QGNSS supports NTRIP Caster, NTRIP Server and NTRIP Client functions.

3.3.1.1. PC-based Network

As shown in figure below, the satellite observation data from the base station is transmitted to the NTRIP Caster via the NTRIP Server, and the rover obtains the satellite observation data uploaded by the base station from the NTRIP Caster via the NTRIP Client.

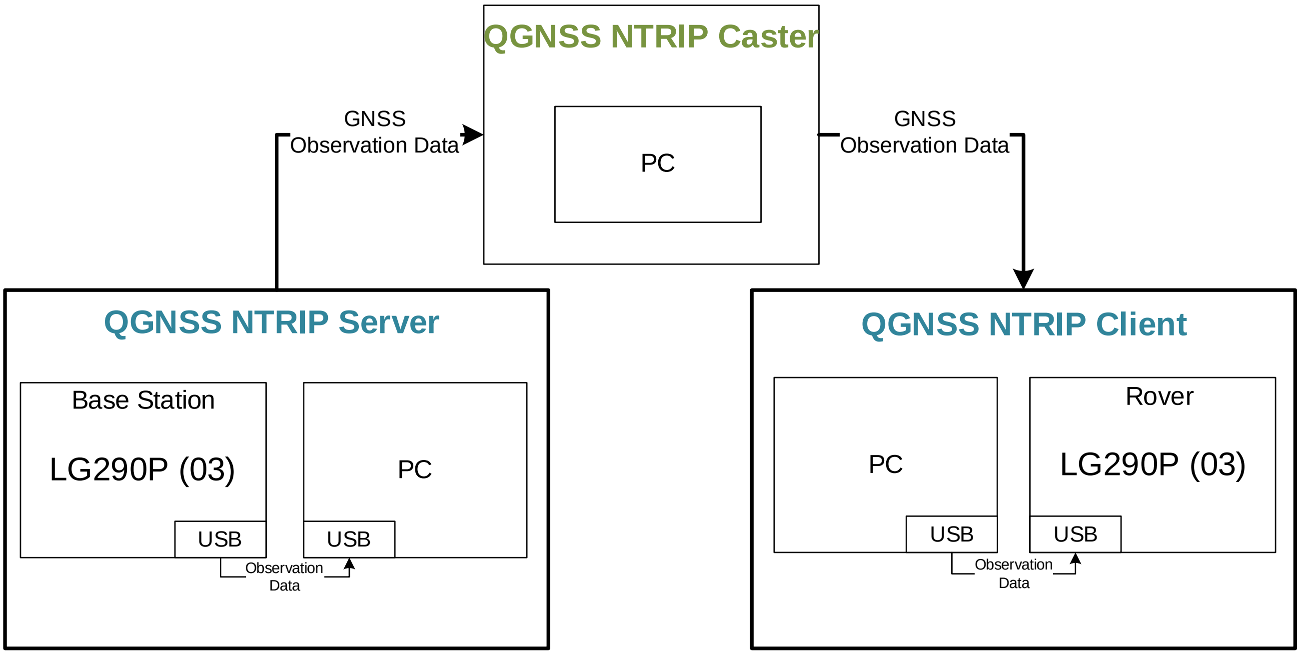

Figure 7: Schematic Diagram of PC-based Network Connection

Step 1 PC-based network connection diagram is shown in figure below. To set up the base station and rover, see [Figure 4: Base Station Assembly – Front Side]() and [Figure 5: Base Station Assembly – Back Side](). For convenient RTK verification, the NTRIP Server and NTRIP Caster can be set up with the same PC and the same QGNSS. For more information on the use of QGNSS, see [document [4] QGNSS user guide]().

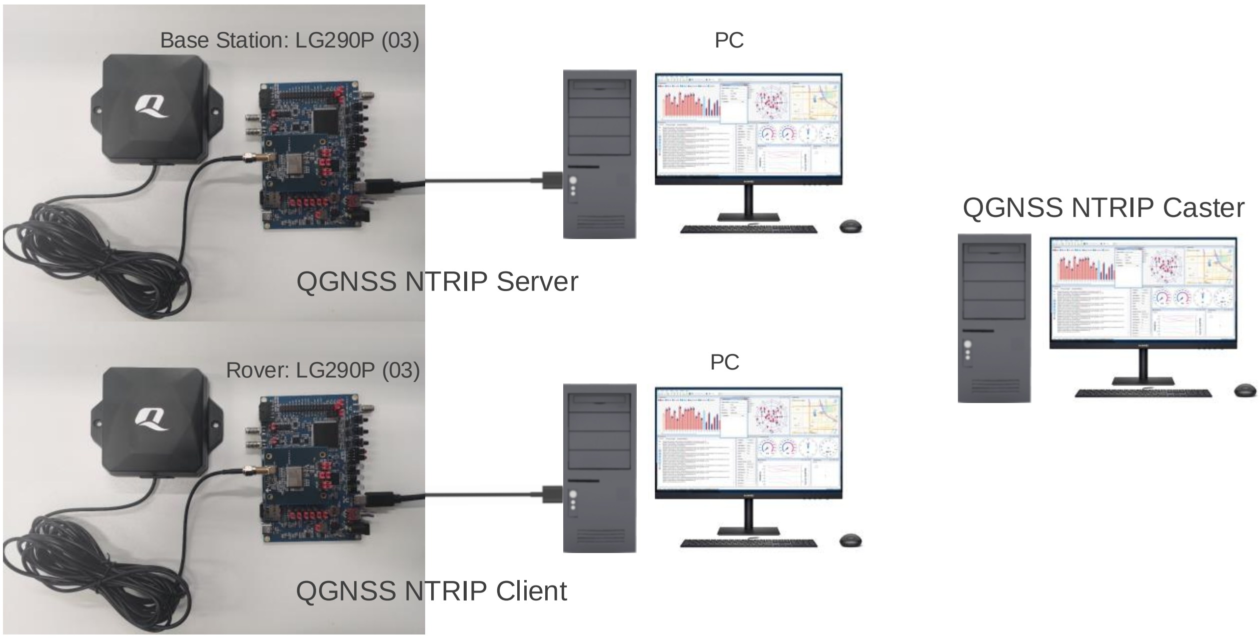

Figure 8: PC-based Network Connection

Step 2 Click to open the NTRIP Caster and enter the IP address, port, user and password. Check the checkbox next to "**Start/Stop**" to start NTRIP Caster.

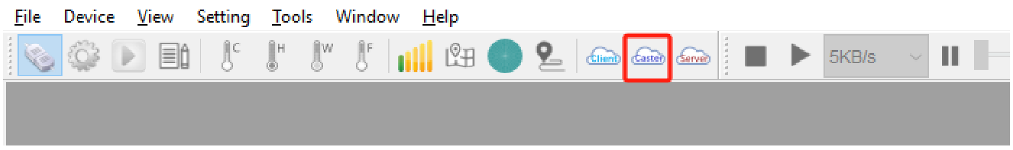

Figure 9: Opening NTRIP Caster

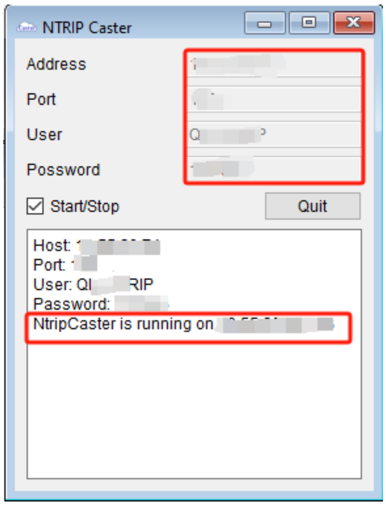

Figure 10: Configuring NTRIP Caster

NOTE

If NTRIP Server, NTRIP Caster and NTRIP Client are not in the same local area network, you need to use a public IP address. If you use a cellular network, you must use a public IP address.

Step 3 Click to open the NTRIP Server and enter the IP address, port, user and password of the NTRIP Caster to be connected and the mount point. Check the checkbox next to "**Start/Stop**" to start NTRIP Server. If the NTRIP Server successfully connects to the NTRIP Caster, you can see the connection information in the NTRIP Caster, as shown in *Figure 13: Successful Connection of NTRIP Server to NTRIP Caster*.

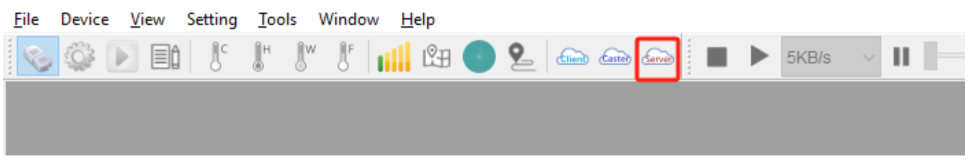

Figure 11: Opening NTRIP Server

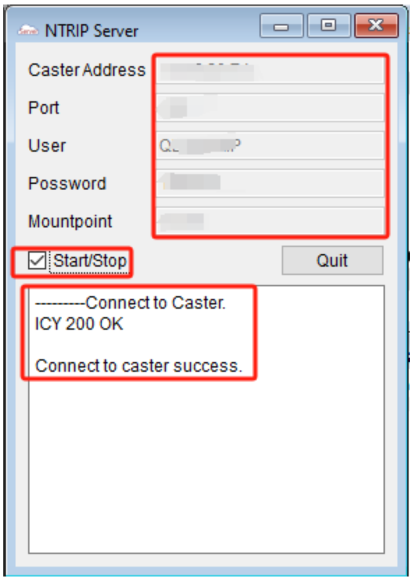

Figure 12: Configuring NTRIP Server

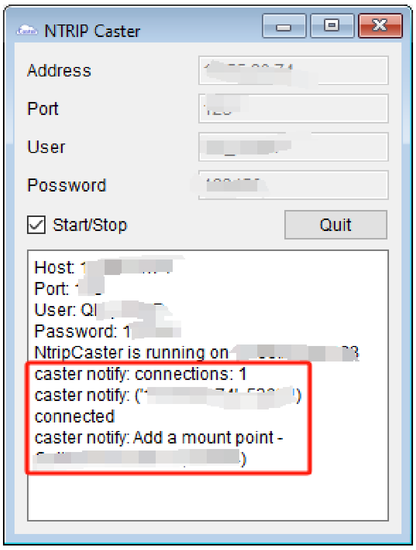

Figure 13: Successful Connection of NTRIP Server to NTRIP Caster

Step 4 Click [Client icon] to open the NTRIP Client and enter the IP address, port, username and password of the NTRIP Caster to be connected and the mount point. Turn on the "**Connect To Host**" switch to start NTRIP Client. If the NTRIP Client successfully connects to the NTRIP Caster, you can see the connection information in the NTRIP Caster, as shown in *Figure 16: Successful Connection of NTRIP Client to NTRIP Caster*.

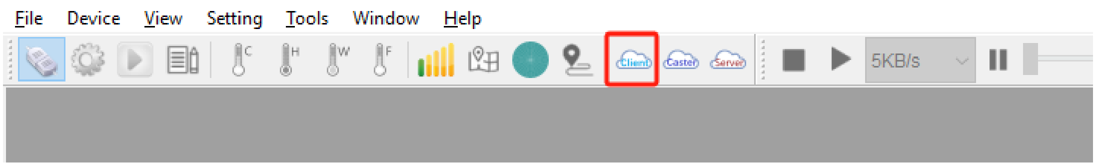

Figure 14: Opening NTRIP Client

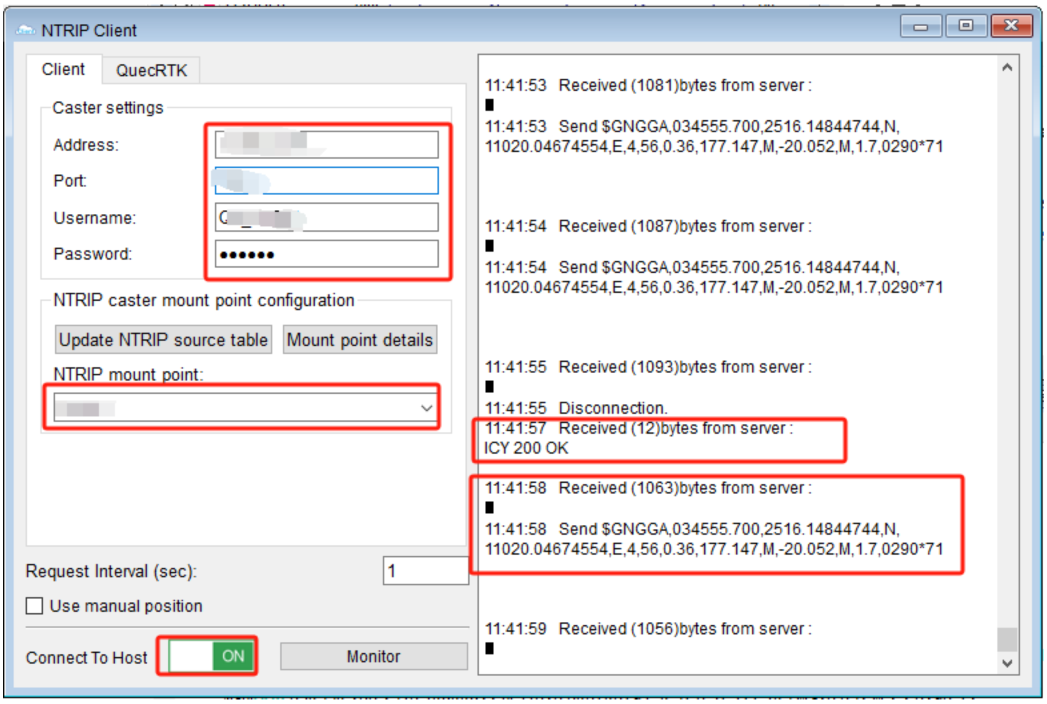

Figure 15: Logging in to NTRIP Client (Obtaining Satellite Observation Data)

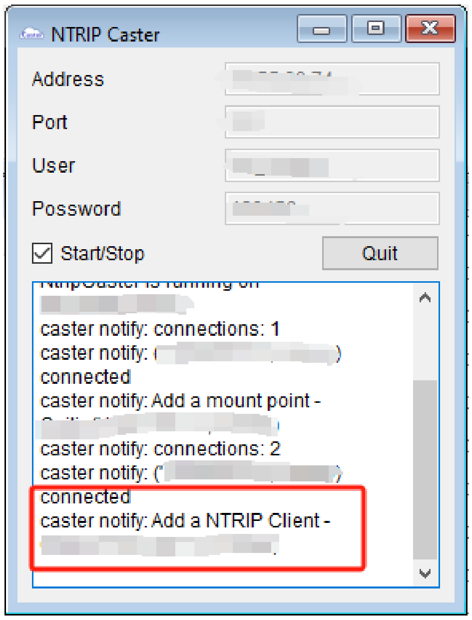

Figure 16: Successful Connection of NTRIP Client to NTRIP Caster

Step 5 As shown in figure below, click to display the search box and enter the "**GGA**". Then, click the button under the search box to display the matched **GGA** messages in the right box. The **<Quality>** parameter value in **GGA indicates** that the LG290P (03) as the rover has transitioned from a single-point solution to an RTK floating-point solution, and then to an RTK fixed solution. For more information about **GGA** and QGNSS operation, see *documents [1] protocol specification* and *[4] QGNSS user guide*.

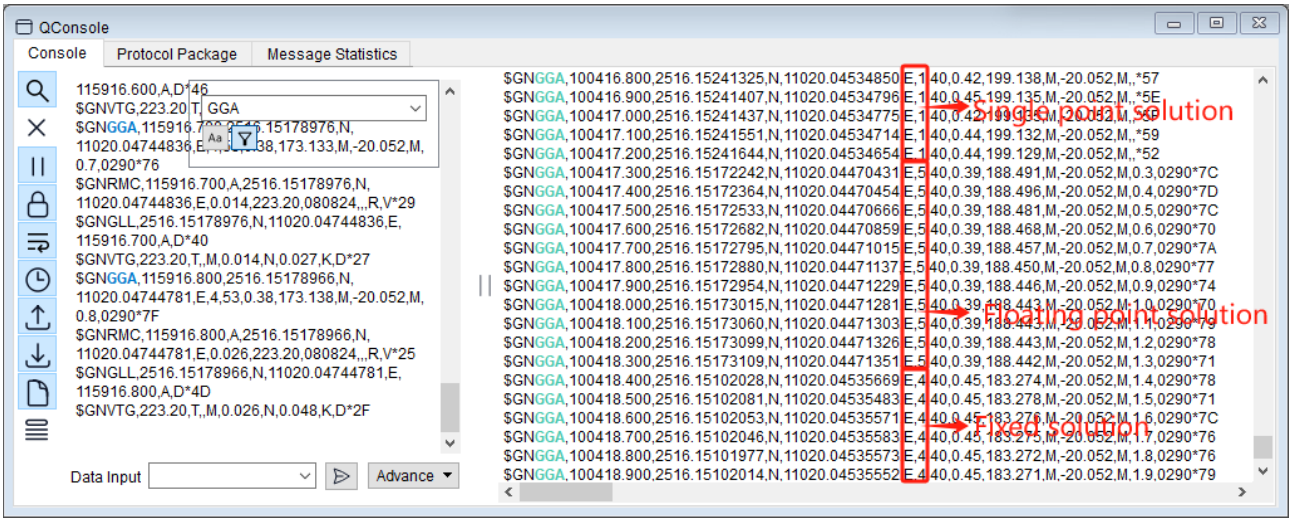

Figure 17: Successful Enabling of Fixed Solution on Rover

3.3.1.2. Cellular-based Network

As shown in figure below, the satellite observation data from the base station is uploaded to the NTRIP Caster using data transmission capabilities of the cellular module. The rover obtains the satellite observation data uploaded by the base station from the NTRIP Caster also through the cellular module's data transmission capabilities.

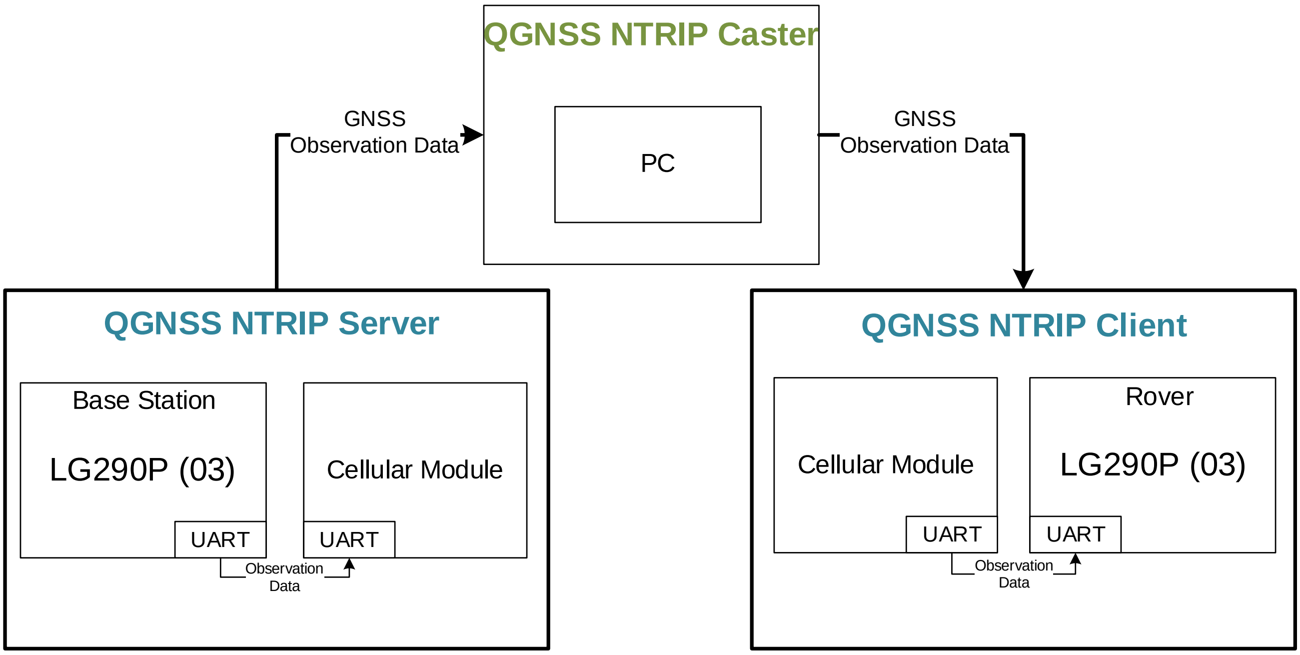

Figure 18: Schematic Diagram of Cellular-based Network Connection

Step 1 Cellular-based network connection schematic is shown in figure below. To set up the base station and rover, see *Figure 4: Base Station Assembly – Front Side* and *Figure 5: Base Station Assembly – Back Side*. For more information on the use of the Quectel GNSS-MODULE EVB, see *document [2] EVB user guide*.

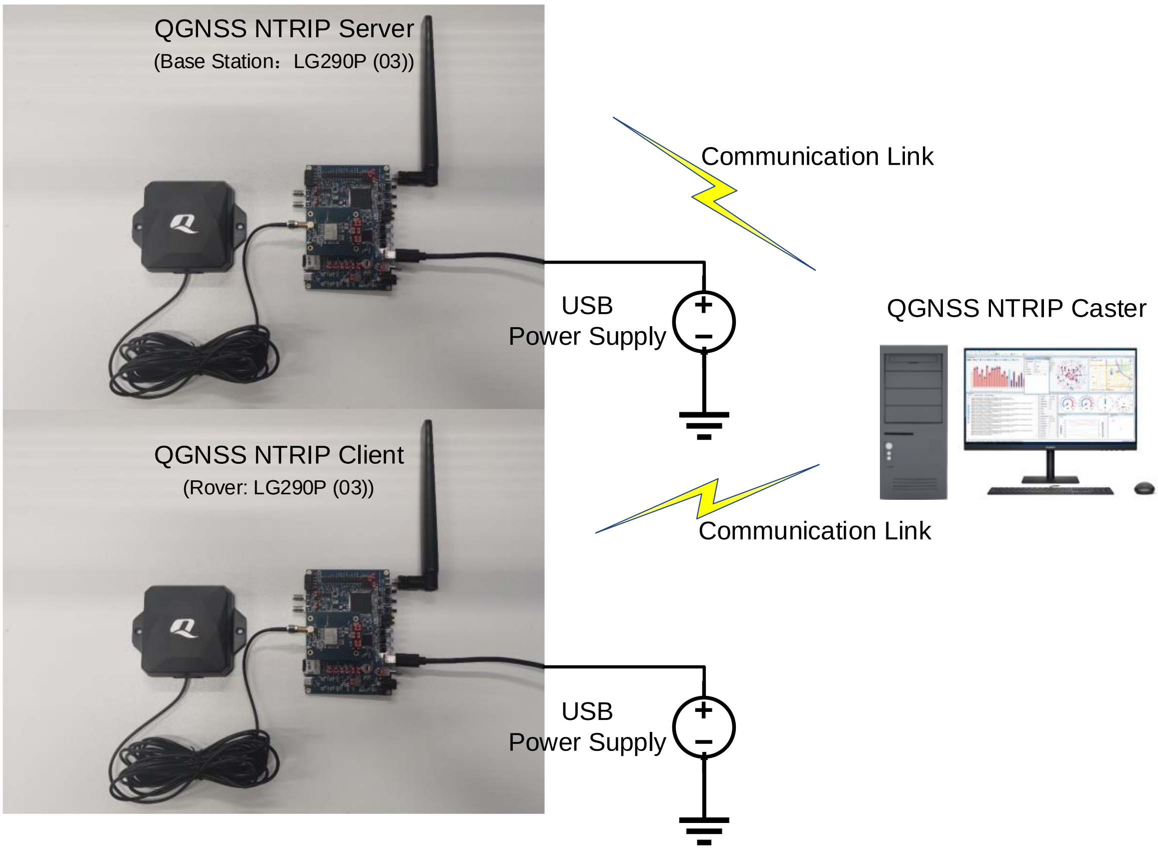

Figure 19: Cellular-Based Network Connection

Step 2 Access the EVB console of the base station and enter the command to connect to the NTRIP Caster using the NTRIP Caster IP address (host), port, username (user), password (pwd) and the NTRIP Server mount point (mnt), and then configure the MCU of the GNSS-MODULE EVB to the base station mode. After a while, you can see that you have successfully connected to the NTRIP Caster and the NTRIP server is transferring the satellite observation data to the NTRIP Caster, as shown in *Figure 21: Configurating NTRIP Server via EVB Console*. If the NTRIP Server successfully connects to the NTRIP Caster, you can also see the connection information in the NTRIP Caster, as shown in *Figure 22: Successful Connection of NTRIP Server to NTRIP Caster*. The address, port, user and password of the NTRIP Caster should be configured before the NTRIP Server configuration. For the configuration of the NTRIP Caster, see the **Step 2** of *Chapter 3.3.1.1 PC-based Network*. For access to the GNSS-MODULE EVB Console at the base station, see *document [2] EVB user guide*.

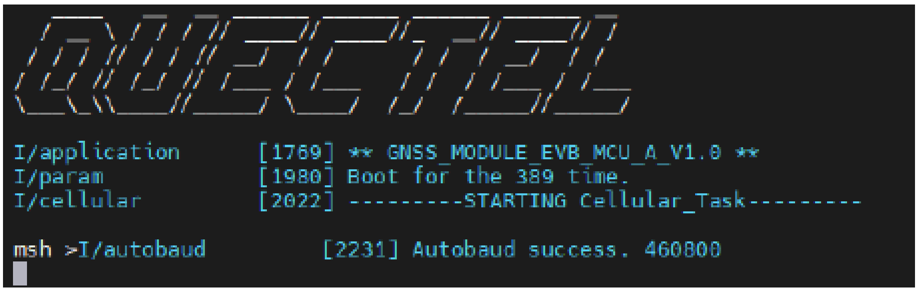

Figure 20: Accessing EVB Console

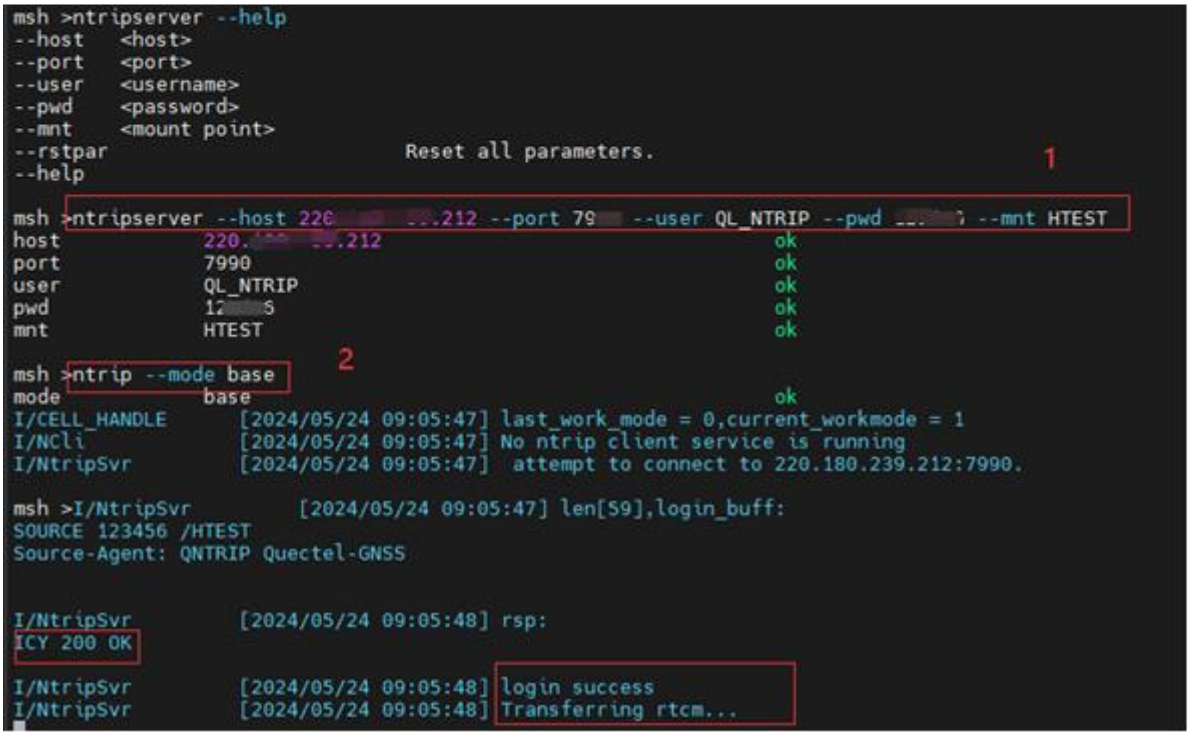

Figure 21: Configurating NTRIP Server via EVB Console

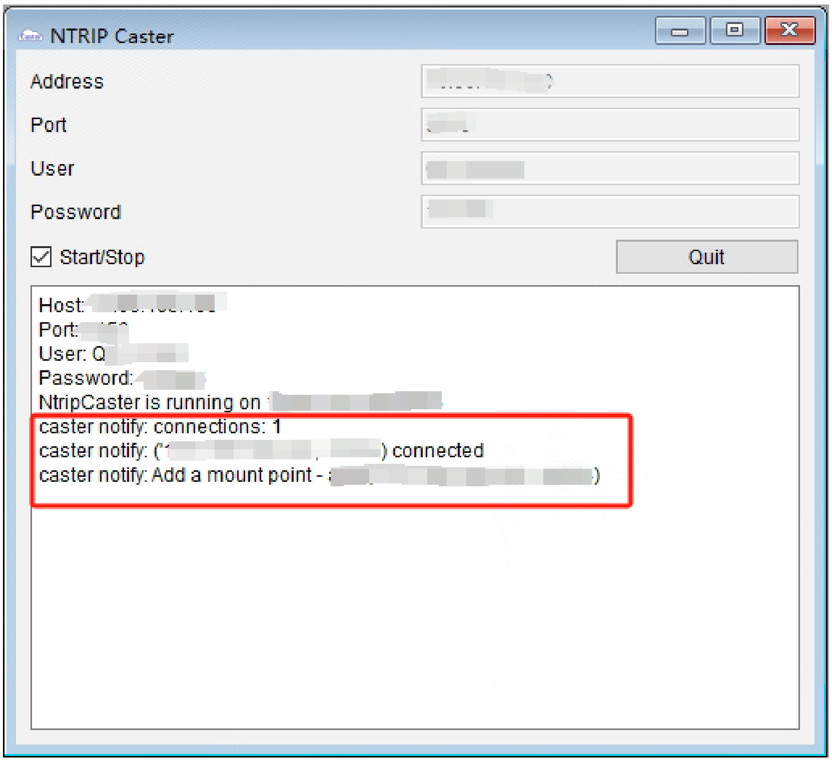

Figure 22: Successful Connection of NTRIP Server to NTRIP Caster

Step 3 Access the EVB console of the rover and enter the command to connect to the NTRIP Caster using the NTRIP Caster IP address (host), port, username (user), password (pwd) and the NTRIP Server mount point (mnt), and then configure the MCU of the GNSS-MODULE EVB to rover mode. After a while, you can see that you have successfully connected to the NTRIP Caster and the NTRIP Client is receiving the satellite observation data from the NTRIP Caster as shown in *Figure 23: Configurating NTRIP Client via EVB Console*. If the NTRIP Client successfully connects to the NTRIP Caster, you can also see the connection information in the NTRIP Caster, as shown in *Figure 24: Successful Connection of NTRIP Client to NTRIP Caster*.

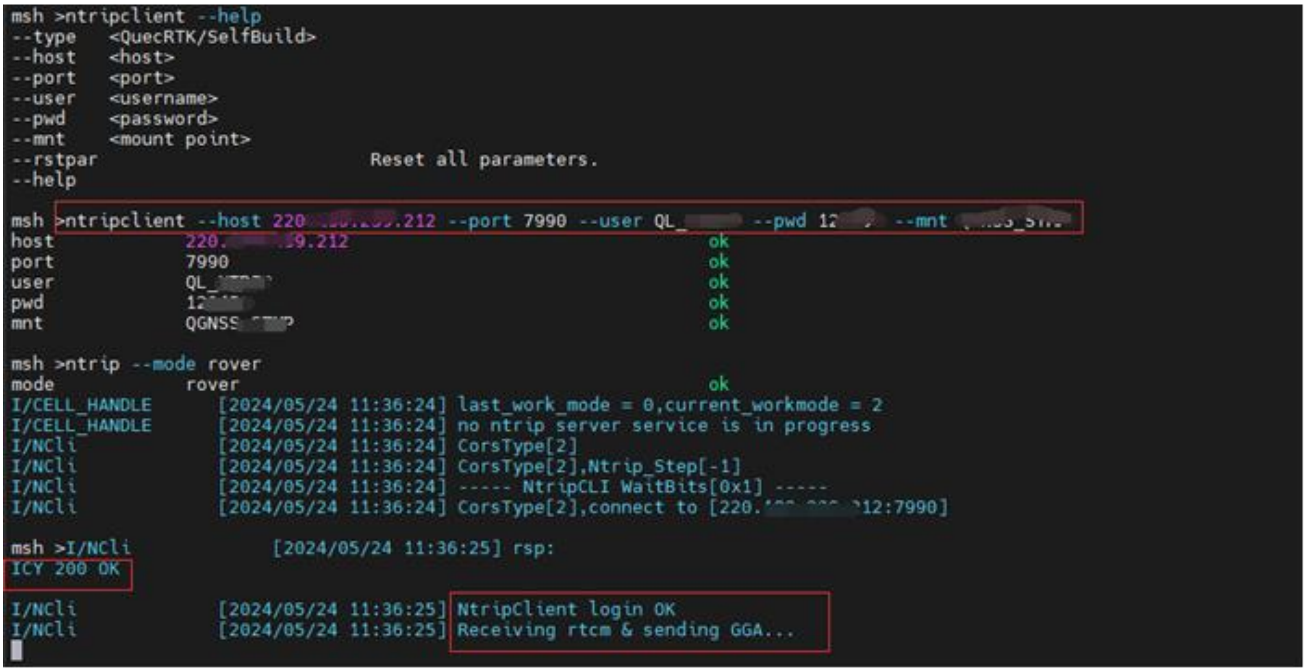

Figure 23: Configurating NTRIP Client via EVB Console

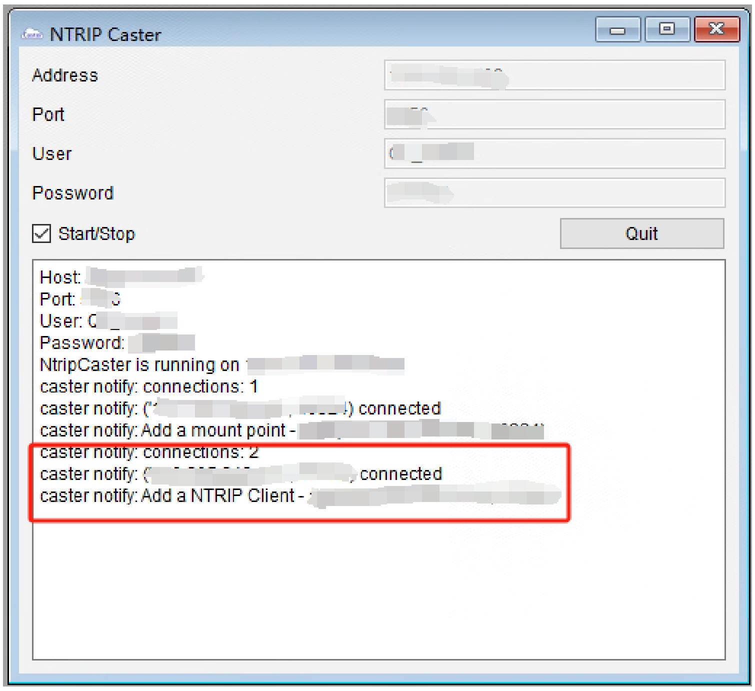

Figure 24: Successful Connection of NTRIP Client to NTRIP Caster

NOTE

When using the rover with the cellular network as the NTRIP Client, insert the MCU_TXD1 (J0404) jumper cap of the GNSS-MODULE EVB as shown in figure below.

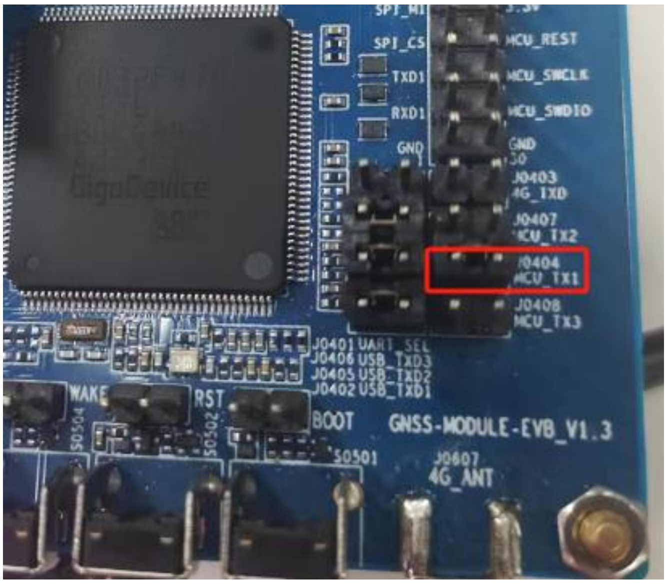

Figure 25: EVB Jumper Cap

Step 4 As shown in figure below, click to display the search box and enter the "**GGA**". Then, click the button under the search box to display the matched **GGA** messages in the right box. The **<Quality>** parameter value in **GGA** indicates that the LG290P (03) as the rover has transitioned from a single-point solution to an RTK floating-point solution, and then to an RTK fixed solution through the QGNSS tool. For more information about **GGA** and QGNSS operation, see *documents [1] protocol specification* and *[4] QGNSS user guide*.

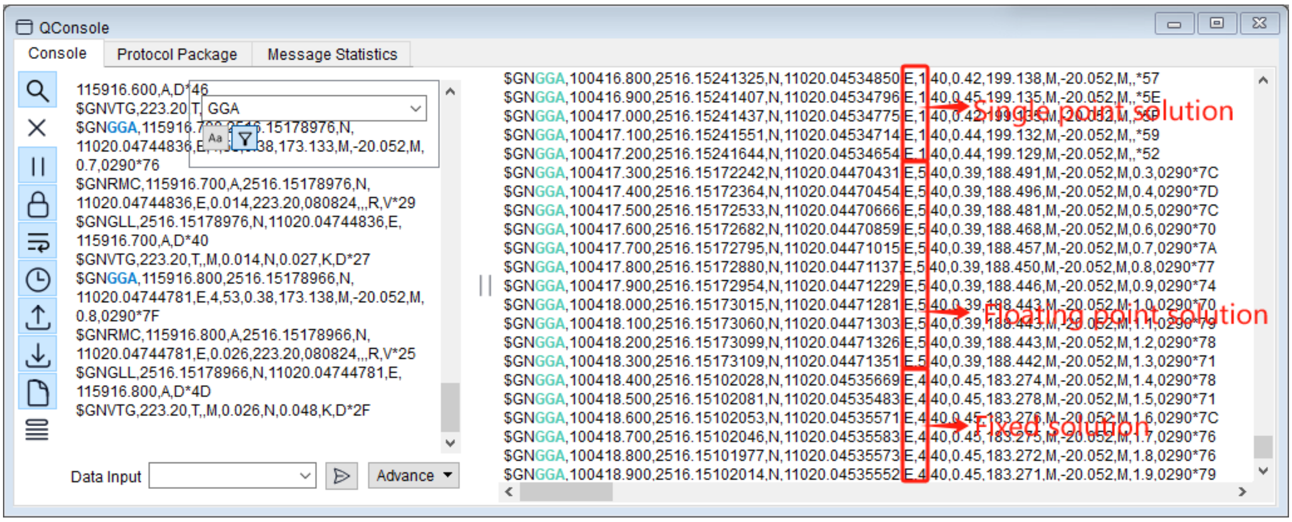

Figure 26: Successful Enabling of Fixed Solution on Rover

4 FAQs

1. **Why hasn't the module achieved RTK fixed solution after receiving satellite observation data from the base station for a while?**
   - The issue may be due to the poor GNSS signal received by the base station, resulting in low-quality satellite observation data, or the poor GNSS signal received by the rover leads to a poor RTK calculation result preventing the module from achieving RTK fixed solution.

2. **Why does the convergence count of the base station (<Obs> parameter value) remain unchanged or zero when viewing the Survey-in status with PQTMSVINSTATUS after the module enters the Survey-in mode as a base station?**
   - The convergence count increments only when the current base station coordinates meet the set 3D position accuracy threshold. This situation could arise if the 3D position accuracy threshold is set too low or if the current coordinate accuracy is insufficient to meet the 3D position accuracy threshold.

3. **After the module enters the base station mode, can the RTK fixed solution be enabled? How to achieve it?**
   - It is possible. After the module enters the base station mode, the RTK calculation continues to operate normally. Therefore, the RTK fixed solution can be enabled by injecting satellite observation data (RTCM) while the module is in the base station mode, and the **RTCM3-1005/1006** formatted coordinate data output after the base station convergence will be more accurate.
   - The process for the module to achieve the RTK fixed solution in base station mode is the same as for the rover.

4. **What could be the cause for the loss of satellite observation data received by the rover?**
   - Insufficient transmission bandwidth of the base station could be the cause. This can be addressed by reducing the message output frequency with **PQTMCFGMSGRATE**. If you are using the UART for direct output of satellite observation data, it is possible that the baud rate used for transmission is inadequate; consider switching to a higher baud rate.

5 Appendix References

Table 2: Related Documents

Document Name
[1] Quectel_LG290P(03)&LGx80P(03)_GNSS_Protocol_Specification
[2] Quectel_GNSS-MODULE_EVB_User_Guide
[3] Quectel_LG290P(03)_Hardware_Design
[4] Quectel_QGNSS_User_Guide

Table 3: Terms and Abbreviations

Abbreviation	Description
3D	Three-Dimensional
ACK	Acknowledgment
BDS	BeiDou Navigation Satellite System
ECEF	Earth-Centered, Earth-Fixed
Galileo	Galileo Satellite Navigation System (EU)
GGA	Global Positioning System Fix Data
GLL	Geographic Position – Latitude/Longitude
GLONASS	Global Navigation Satellite System
EVB	Evaluation Board
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GSA	GPS DOP and Active Satellites

Abbreviation	Description
GSV	GPS Satellites in View
LoRa	Long Range Radio
MCU	Microcontroller Unit/Microprogrammed Control Unit
NavIC	Indian Regional Navigation Satellite System
NMEA	National Marine Electronics Association
NTRIP	Networked Transport of RTCM via Internet Protocol
PC	Personal Computer
RF	Radio Frequency
RMC	Recommended Minimum Specific GNSS Data
RTCM	Radio Technical Commission for Maritime Services
RTK	Real-Time Kinematic
SBAS	Satellite-Based Augmentation System
TE-A	Terminal Equipment Adapter
TXD	Transmit Data (Pin)
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identity Module
VRS	Virtual Reference Station
QZSS	Quasi-Zenith Satellite System