High Precision GNSS-TAA-KIT EVB Kit User Guide

GNSS Products

Version: 1.0

Date: 2025-09-09

Status: Released

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	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, 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 incorporating the module to avoid ESD damages.

About the Document

Document Information	
Title	**High Precision GNSS-TAA-KIT EVB Kit User Guide**
Subtitle	GNSS Products
Document Type	EVB Kit User Guide
Document Status	Released

Revision History

Version	Date	Description
-	2025-06-30	Creation of the document
1.0	2025-09-09	First official release

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1 Introduction

This document provides information on the steps needed to evaluate Quectel GNSS modules using the Evaluation Board (GNSS-MODULE EVB). GNSS-TAA-KIT is an evaluation board kit designed for high precision GNSS modules.

1.1. Applicable Modules

Table 1: Applicable modules

Module Family	Module
-	LG290P (03)
-	LG580P Series
-	LG680P (03)
-	LG69T (AJ)
LG69xP	LG690P Series
	LG695P (00)

NOTE

The above applicable modules are for reference only. For details, see *document [1] list of EVB applicable modules*.

2 General Overview

2.1. EVB Kit

The EVB kit includes:

- GNSS-MODULE EVB
- USB Type-C cables
- Multi-band active GNSS antennas
- 4G module TE-A
- 4G antenna
- 4G antenna RF cable
- Bolts and coupling nuts

MCU (GD32F470ZIT6), which is shipped with pre-burned firmware, is embedded in the GNSS-MODULE EVB. You can directly test and evaluate Quectel GNSS modules after acquiring the EVB kit and the corresponding module TE-A(s) (Please note that the GNSS module TE-A must be purchased separately).

The EVB kit components are shown in the figure below. For details, see *Table 2: List of Kit Components*.

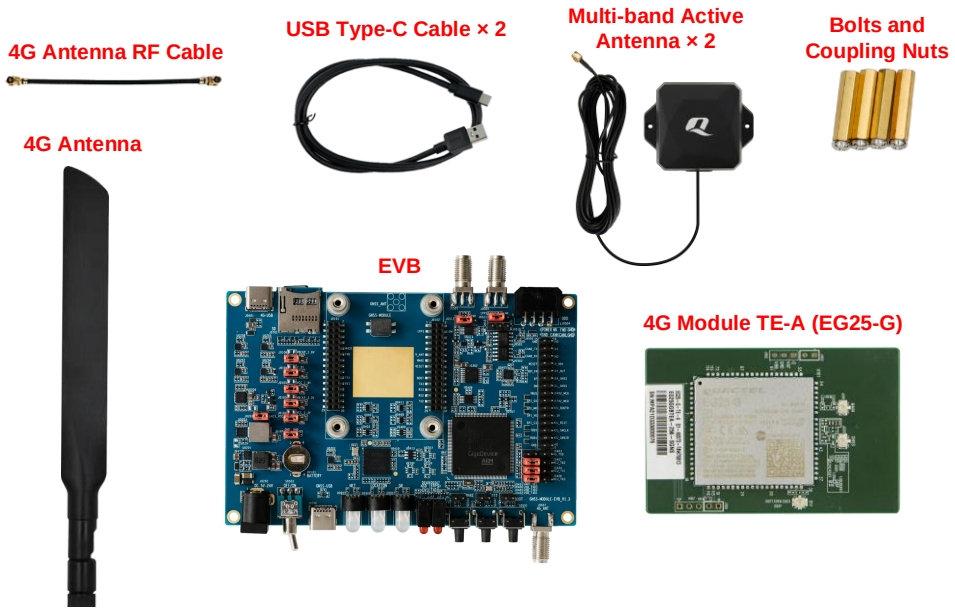


Figure 1: EVB Kit Components

Table 2: List of Kit Components

Item	Description	Quantity
EVB	GNSS-MODULE EVB Size: 120 mm × 80 mm	1
TE-A	4G module (EG25-G) TE-A	1
USB Cable	USB Type-C Cable	2
GNSS Antenna	Multi-band Active Antenna: YEGD006U1A	2
4G Components	4G Antenna	1
	4G Antenna RF Cable	1
Other	Bolts and Coupling Nuts	4 pairs

NOTE

1. The GNSS module TE-A is not included in GNSS-TAA-KIT and must be ordered separately according to your requirements.
2. When testing the heading function of GNSS modules, two GNSS antennas must be connected to the GNSS module TE-A. For more information about the heading function, see the related dual-antenna heading application note of the module.
3. For details about Quectel active GNSS antenna and EVB schematics, contact Quectel Technical Support (support@quectel.com).

2.2. Connect Kit Components and Module TE-A(s) to EVB

To test a GNSS module with the GNSS-MODULE EVB, you must order the corresponding GNSS module TE-A.

2.2.1. Test PVT Performance of High Precision GNSS Module

To test the PVT performance of a high precision GNSS module, it is not necessary to install the 4G module TE-A and connect the 4G antenna. Before using the EVB, ensure that the (red) jumper caps are connected correctly as shown in the figure below.

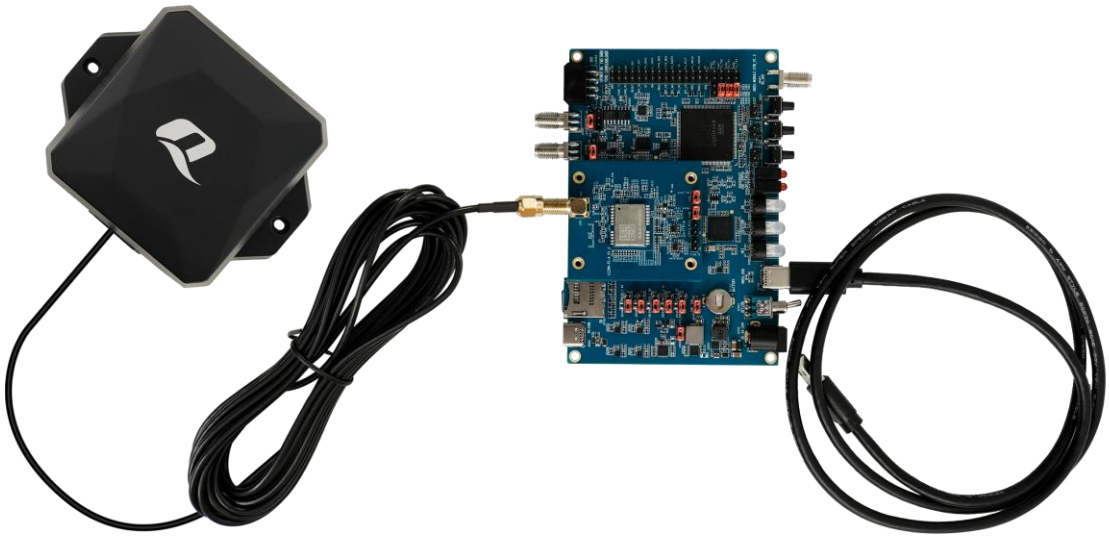


Figure 2: GNSS Module TE-A and Kit Components Mounted on EVB (Without 4G Module TE-A)

NOTE

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

2.2.2. Test RTK Performance of High Precision GNSS Module

To test the RTK performance of a high precision GNSS module, you can connect the EVB kit in two ways. Before using the EVB, ensure that the (red) jumper caps are connected correctly as shown *Figure 2: GNSS Module TE-A and Kit Components Mounted on EVB (Without 4G Module TE-A)* or *Figure 3: GNSS Module TE-A and Kit Components Mounted on EVB (Top View)*.

- Connect the EVB to the PC and use the QGNSS tool to achieve RTK positioning. The connection between the EVB kit components and GNSS module TE-A is shown in *Figure 2: GNSS Module TE-A and Kit Components Mounted on EVB (Without 4G Module TE-A)*.

- Use Compatible 4G module TE-A and (U)SIM card to achieve RTK positioning. The connection between the EVB kit components and GNSS module TE-A is shown in *Figure 3: GNSS Module TE-A and Kit Components Mounted on EVB (Top View)* and *Figure 4: GNSS Module TE-A and Kit Components Mounted on EVB (Bottom View)*.

Figure 3: GNSS Module TE-A and Kit Components Mounted on EVB (Top View)

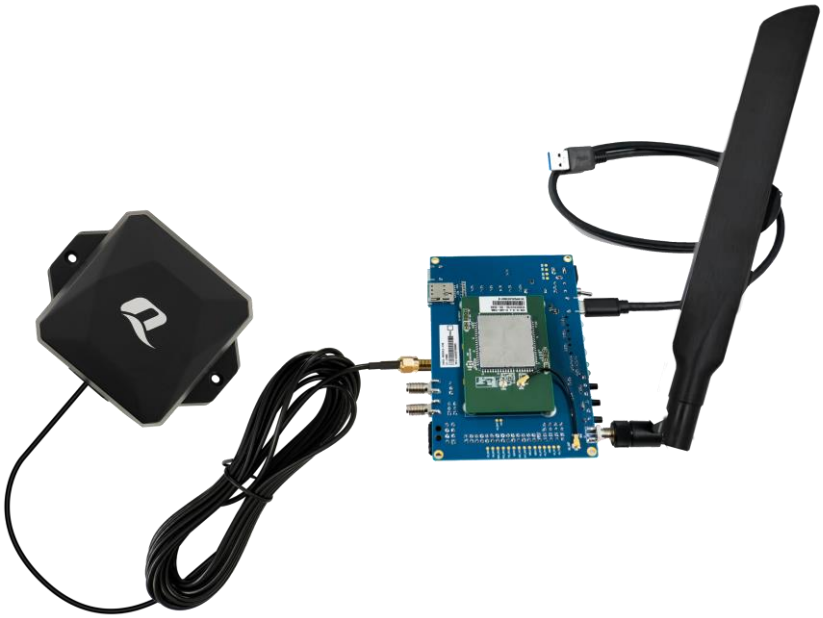


Figure 4: GNSS Module TE-A and Kit Components Mounted on EVB (Bottom View)

NOTE

1. Make sure that the active GNSS antenna is placed with a clear line of sight to the sky.
2. If you use a 4G module for RTK functionality test and verification, make sure a (U)SIM card is inserted into the J0605 (SIM) interface to enable network registration. To ensure stable and effective communication, install jumper caps on J0404 (MCU_TX1) and J0402 (USB_TXD1) on the GNSS-MODULE EVB.
3. EVB can be used with the TE-A of the following 4G module:
   - EG25-G (firmware version: EG25GGBR07A08M2G).

3 Quick Start

This chapter provides a step-by-step guide for setting up and testing high precision GNSS positioning modules with the GNSS-MODULE EVB. The LG290P (03) module is used as an example.

3.1. Set up Test Environment

Before testing the high precision GNSS positioning modules, set up the test environment as follows:

Step 1: Install the required software to your PC. The software includes:

- **USB-to-serial port driver for EVB**.
  For Windows 10 and Windows 11 systems, the PC automatically recognizes and installs the USB-to-serial port driver.
  If the PC does not automatically install the driver, you should manually install the USB-to-serial port driver of the USB-to-UART bridge chip (FT4232HAQ) (*click to download*).
- **QGNSS tool (V2.1 or higher)**. Download the QGNSS tool .zip file (*click to download*) to your PC, extract the contents, and run the executable file to start the tool.

Step 2: Set up the GNSS-MODULE EVB connections. Make sure that connections to related interfaces (as shown in *Figure 5: EVB Interfaces*) are properly configured.

- Install the GNSS module TE-A onto the EVB and connect the GNSS antenna to the GNSS antenna connector on TE-A (Note that the module TE-A must be purchased separately).
- Use USB Type-C cable to connect the GNSS-USB port (J0506) and your PC.
- Insert SD card into the SD socket (J0701) if you need to save log data.
- Place all jumper caps in the exact positions shown the figure below.
- Power on the EVB using the power switch (S0503).
- If the RTK function is achieved through the compatible 4G module TE-A and (U)SIM card, refer to *Figure 4: GNSS Module TE-A and Kit Components Mounted on EVB (Bottom View)* to connect the 4G module TE-A and the 4G antenna, and insert the (U)SIM card.

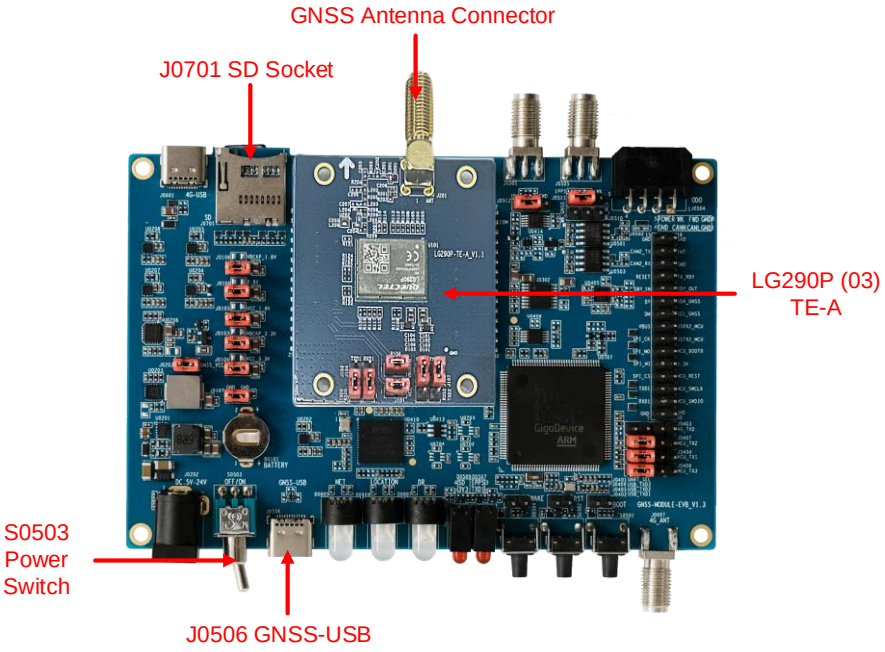


Figure 5: **EVB Interfaces**

Step 3: Check the module's operating status preliminarily against the EVB's LED indicators. As shown in the figure below, observe D0507 (1PPS/TXD1 indication LED) and D0509 (SD/3V3 indication LED).

- **Red D0509: SD indication LED**. Flashing means SD card is storing data and extinct means SD card is not storing data.
- **Green D0509: 3V3 indication LED**. Bright means VCC power supply for module is powered and extinct means VCC power supply for module is not powered.
- **Red D0507: 1PPS indication LED**. Flashing means 1PPS signal output and extinct means 1PPS is unavailable.
- **Green D0507: TXD1 indication LED**. Flashing means data output from UART1 TXD and bright/extinct means no data output from UART1 TXD.

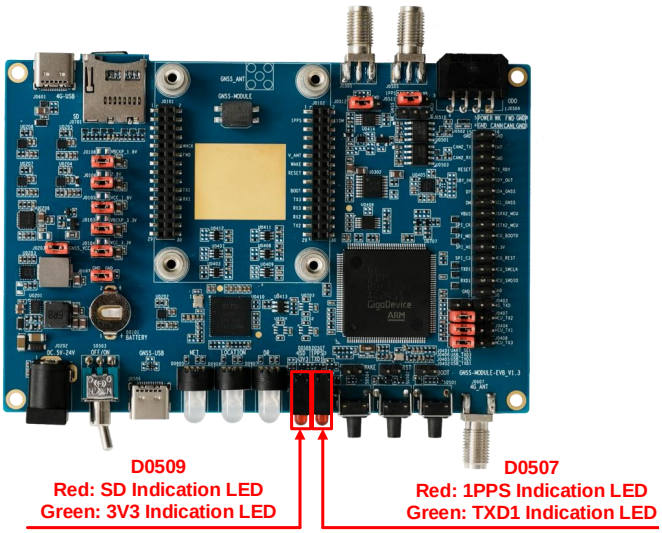


Figure 6: Indication LEDs on EVB

NOTE

1. Make sure that the jumper caps are positioned as in *Figure 5: EVB Interfaces*. If you use a 4G module for RTK functionality testing and verification, to ensure stable and effective communication, you must short J0404 (MCU_TX1) and J0402 (USB_TXD1) with jumper caps on the GNSS-MODULE EVB.
2. For more information about the QGNSS tool, see *document [2] QGNSS user guide*.

3.2. Operation Steps

3.2.1. PVT Positioning

Once the test environment is set up as explained in *Chapter 3.1 Set up Test Environment*, connect the GNSS-MODULE EVB to your PC as follows to perform PVT positioning testing:

Step 1: After the driver is installed, the PC's Device Manager displays four consecutive COM ports with randomly assigned port numbers. The port with the smallest number (COM46) corresponds to the UART of the LG290P (03) module, and the port number with the highest number (COM49) corresponds to the MCU serial port on the EVB. The other two ports are unused and reserved for future use.

Figure 7: COM Ports in Device Manager

Step 2: Double click *QGNSS.exe* to run the QGNSS tool. Click to navigate to the "**Device Information**" window, change the module model, port, and baud rate, and then click "**OK**" to connect the QGNSS tool and the GNSS module on the EVB.

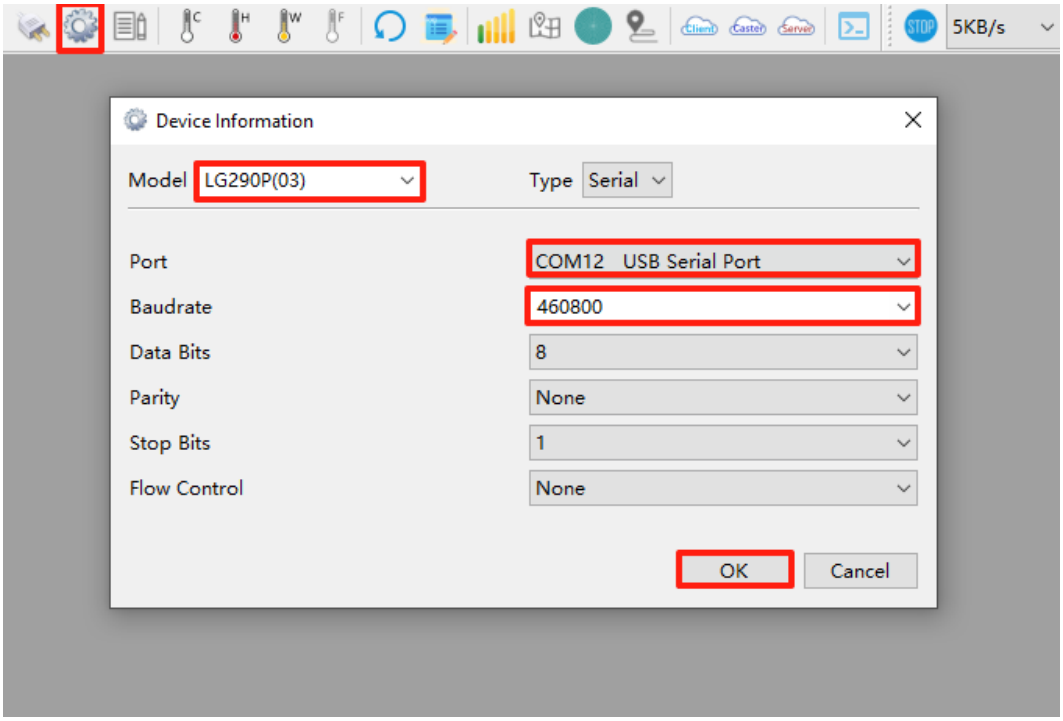


Figure 8: Device Information Window 1

Step 3: If the connection is successful, the QGNSS tool will display data as shown in the following figure. The QGNSS tool supports many functions, such as displaying real-time positioning results, firmware version and raw data from UART. For more details, see *document [2] QGNSS user guide*.

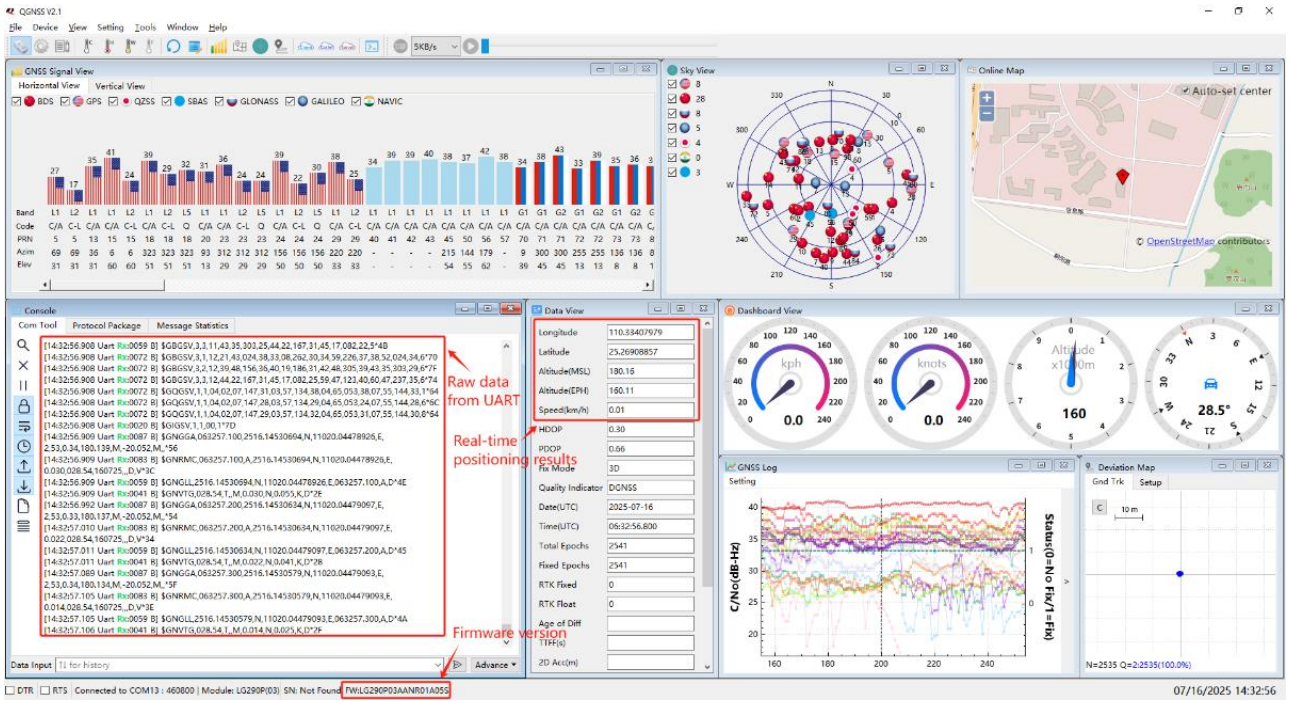


Figure 9: QGNSS Tool Displaying GNSS Module Data

Step 4: QGNSS tool supports saving log files in the <*QGNSS version*>*logFile*\ directory (e.g., *QGNSS_V2.1_EN\logFile*\) by default. To check raw data from UART while the QGNSS tool is running, you can click "" in the QGNSS tool to open the folder.

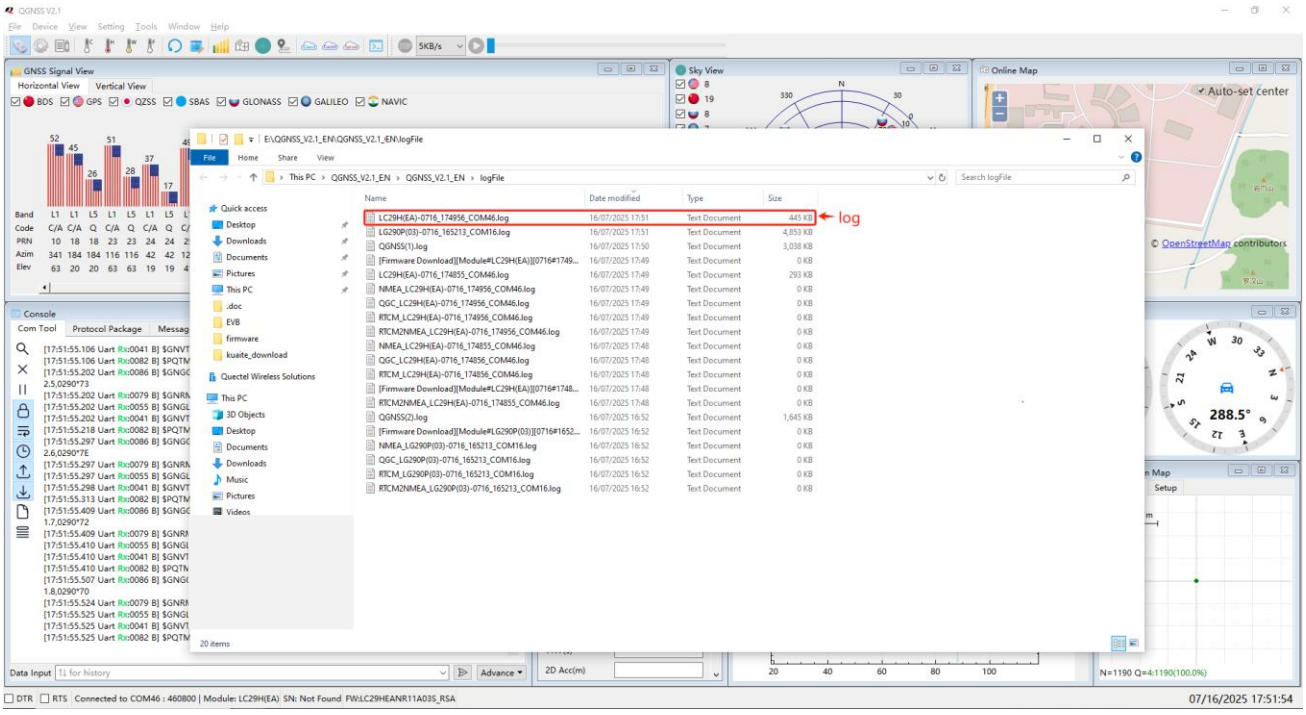


Figure 10: Access Log Data in QGNSS Tool

NOTE

During testing and verification, place the GNSS antenna in an outdoor area with an unobstructed view of the sky.

3.2.2. RTK Positioning

Once the test environment is set up as explained in *Chapter 3.1 Set up Test Environment*, follow the procedures below to perform RTK positioning testing. For more information, see *document [3] RTK application note*.

3.2.2.1. RTK Positioning with QGNSS Tool

Step 1: Connect the GNSS module to the QGNSS tool as explained in *Chapter 3.2.1 PVT Positioning*.

Step 2: Click to open the NTRIP Client as shown below.

Figure 11: Open NTRIP Client

Step 3: Fill in the required information in the "**Caster Settings**" and "**NTRIP Mount Point**" sections, and toggle "**Connect To Host**" to "**ON**" position to connect to the host to acquire network differential data.

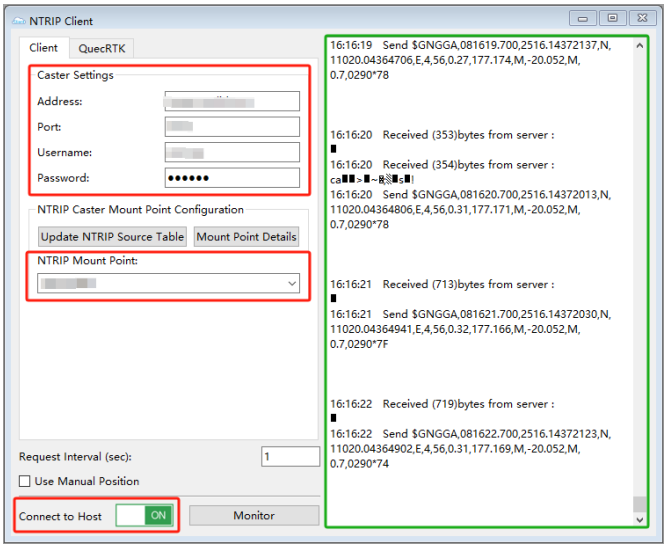


Figure 12: Configure NTRIP Caster

Step 4: Once the connection to the server is established successfully, view the incoming differential data from the NTRIP server.

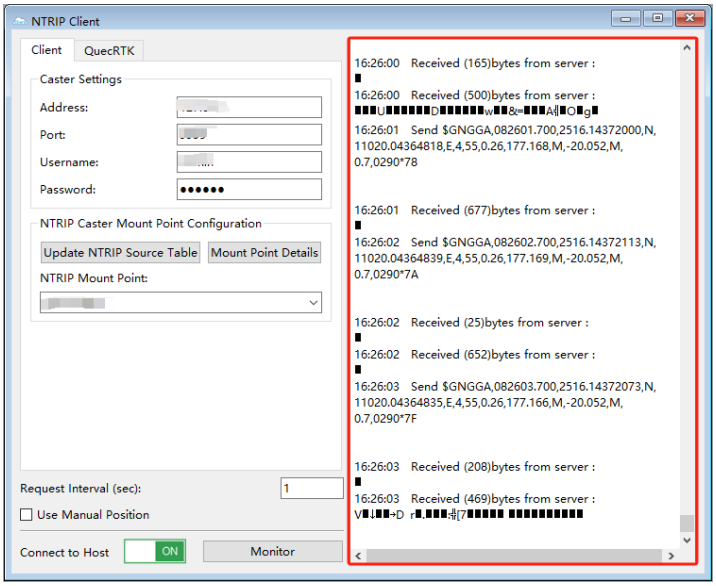


Figure 13: Incoming Differential Data from NTRIP Server

Step 5: Click "**Tools**" > "**Console**" to open the Console and check the **GGA** positioning status. A **<Quality>** parameter of "4" (RTK Fixed) or "5" (RTK Float) confirms successful reception of RTCM correction data, with "4" specifically indicating that an RTK mode with fixed integers has been achieved.

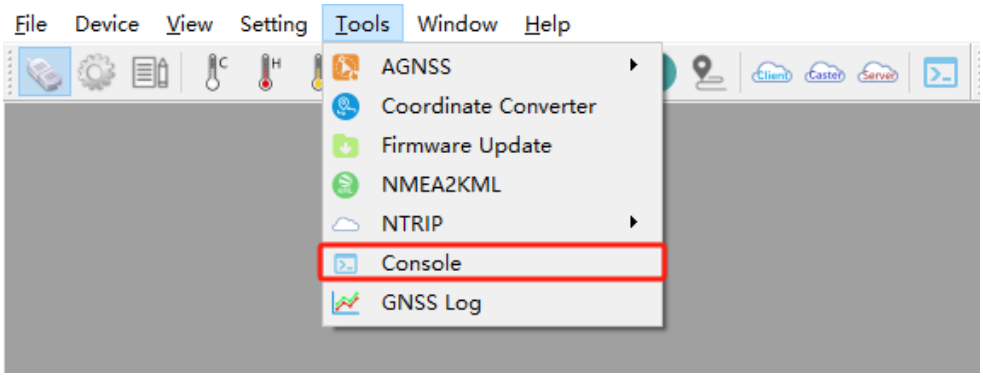


Figure 14: Open Console

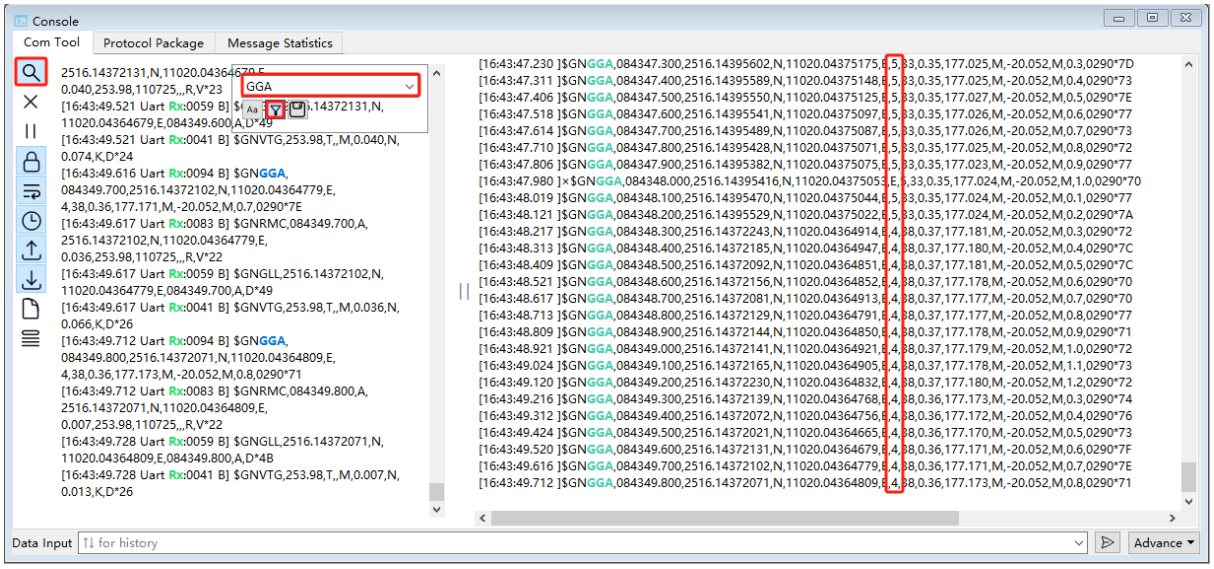


Figure 15: View <Quality> Value

3.2.2.2. RTK Positioning Over 4G Module and EVB MCU

Step 1: After the USB-to-serial port driver is installed, select the COM port with the highest number among the four consecutive COM port numbers in the "**Device Manager**" (see *Figure 7: COM Ports in Device Manager*). Click to navigate to "**Device Information**" window, and select the EVB model, port and baud rate, and then click "**OK**".

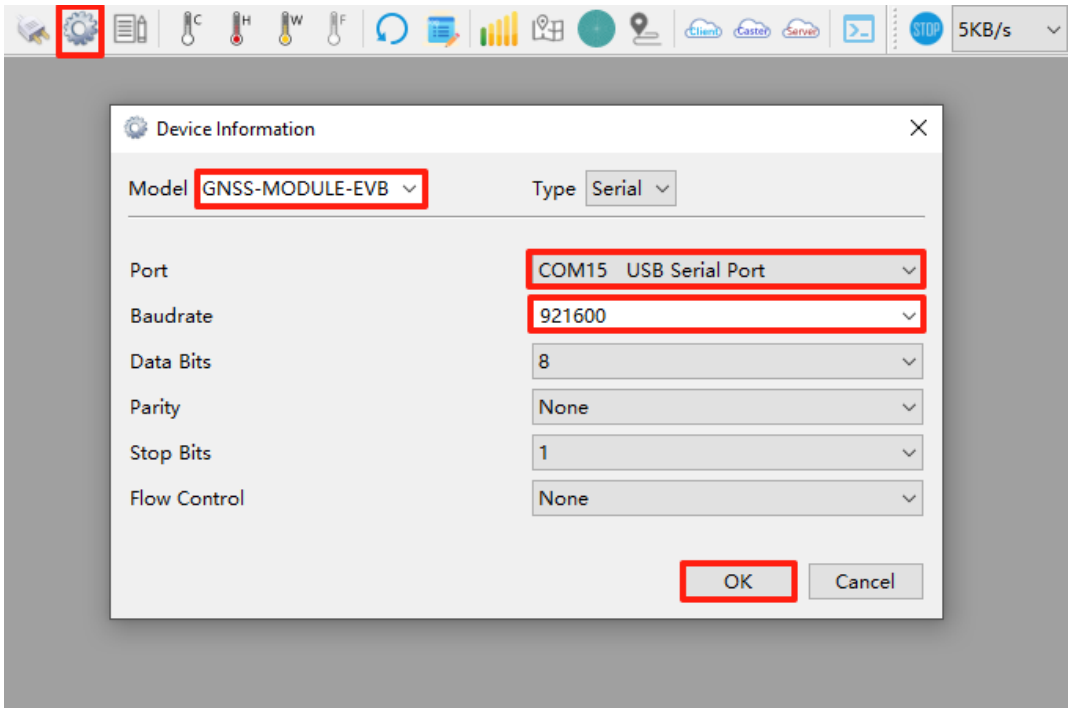


Figure 16: Device Information Window 2

Step 2: Power on the EVB (turn S0503 to the right) and the QGNSS will output the following log data indicating a successful connection.

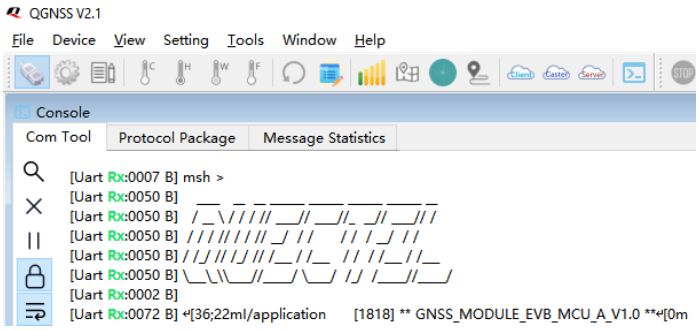


Figure 17: EVB Power-on Output Log

Step 3: Enable and configure 4G module functionality on the EVB.

The Quectel GNSS module can acquire network differential data using the 4G module and the EVB MCU via standard NTRIP Client. Before use, ensure that the 4G module is enabled. The *GNSS_MODULE_EVB_MCU_A_V1.1* or higher MCU firmware version defaults to disabling the 4G module. You can enable the 4G module functionality using the following command.

a) Enable the 4G module functionality on the EVB.

```
msh >cell --state on
cell --state on
state               on                                          ok
```

b) Check 4G module status.

```
msh >cell
cell
state               on
link                gnss1   (PA6:1)
apn
info                See more information: cell -i
```

Step 4: Configure the standard NTRIP Client mode.

a) Enable the EVB to save correction logs.

```
msh >gnss --vrslog on
gnss --vrslog on
vrslog              on                                          ok
```

b) Configure the EVB to work in standard NTRIP Client mode.

```
msh >ntripclient --type SelfBuild
ntripclient --type SelfBuild
```

```
type                SelfBuild                                   ok
```

c) Configure NTRIP Caster parameters.

```
msh >ntripclient --host 192.168.1.xxx --port 1xxx --user admin --pwd 123456 --mnt AUTO
ntripclient --host 192.168.1.xxx --port 1xxx --user admin --pwd 123456 --mnt AUTO
host                192.168.1.xxx                               ok
port                1                                           ok
user                admin                                       ok
pwd                 123456                                      ok
mnt                 AUTO                                        ok
```

d) Activate RTK rover mode.

```
msh >ntrip --mode rover
ntrip --mode rover
mode                rover                                       ok
```

Step 5: After successfully activating RTK rover mode, the EVB will automatically trigger the networking function of 4G module and connect to NTRIP Caster. When the “Receiving rtcm & sending GGA...” log is printed, it means the EVB has successfully connected to the NTRIP Caster.

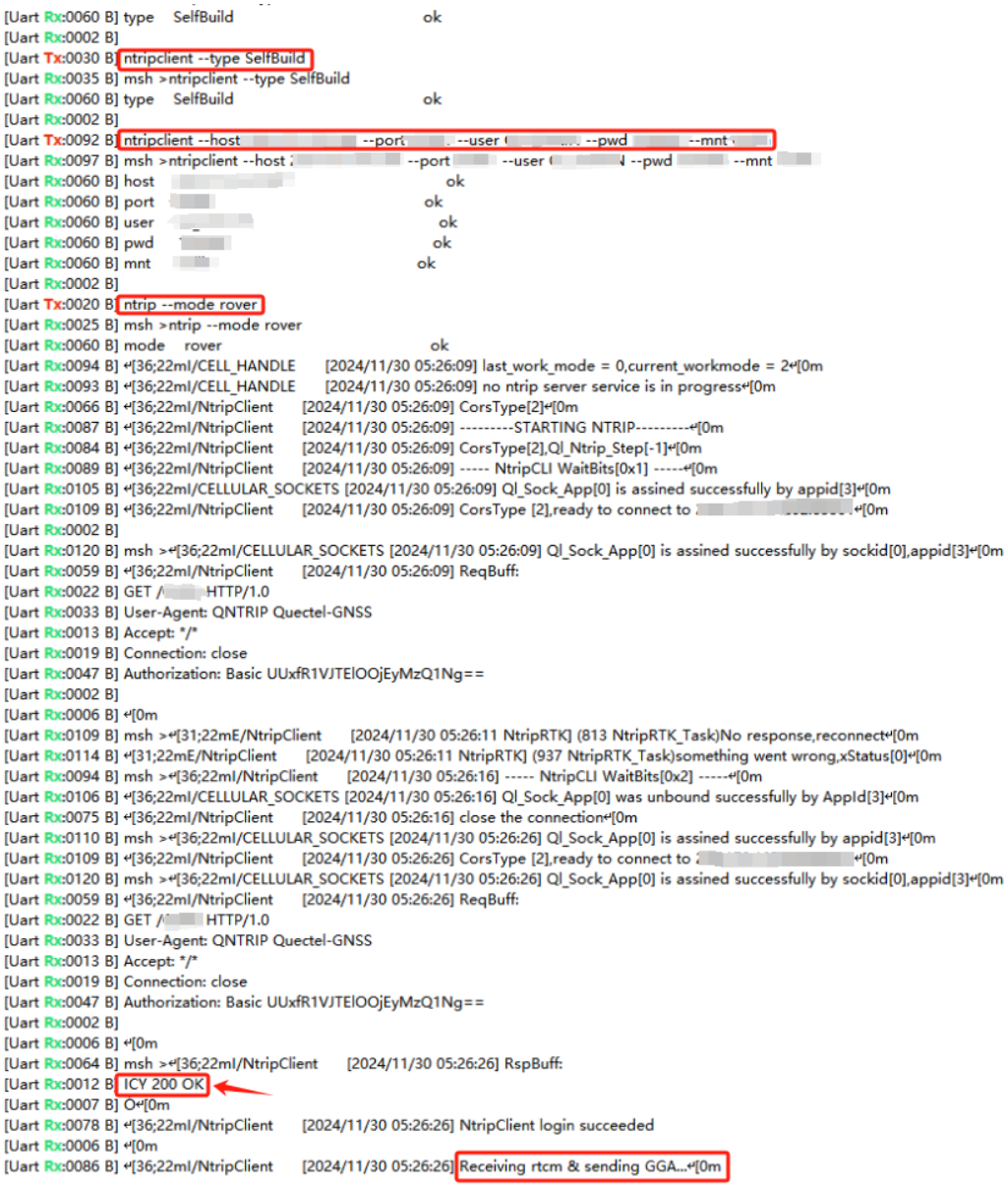


Figure 18: Successfully Connected to NTRIP Caster

Step 6: Observe the D0906 indicator state change.

After successfully connecting to the NTRIP Caster server, the NET indication LED (D0905) turns blue. The LOCATION indication LED (D0906) sequentially changes to red (GNSS single-point solution), green (RTK float solution), and blue (RTK fixed solution), eventually remaining in a constant blue state, as shown in *Figure 20: D0906 Indicator Changes During RTK Operation*.

Figure 19: NET and LOCATION Indication

Table 3: LED Indicator Descriptions

Interface	Description
D0905 NET Indication	● Red: Network searching and registration failed. ● Green: Network registration succeeded. 4G module is in standby mode. ● Blue: Data transmission in progress (network is active).
D0906 LOCATION Indication	● Red: GNSS single-point solution. ● Green: RTK float solution. ● Blue: RTK fixed solution.

Figure 20: D0906 Indicator Changes During RTK Operation

4 EVB Block Diagram

Block diagram of GNSS-MODULE EVB includes:

- USB-to-UART bridge chip (FT4232HAQ),
- Interfaces of GNSS module, 4G module and MCU, and
- Peripheral interfaces.

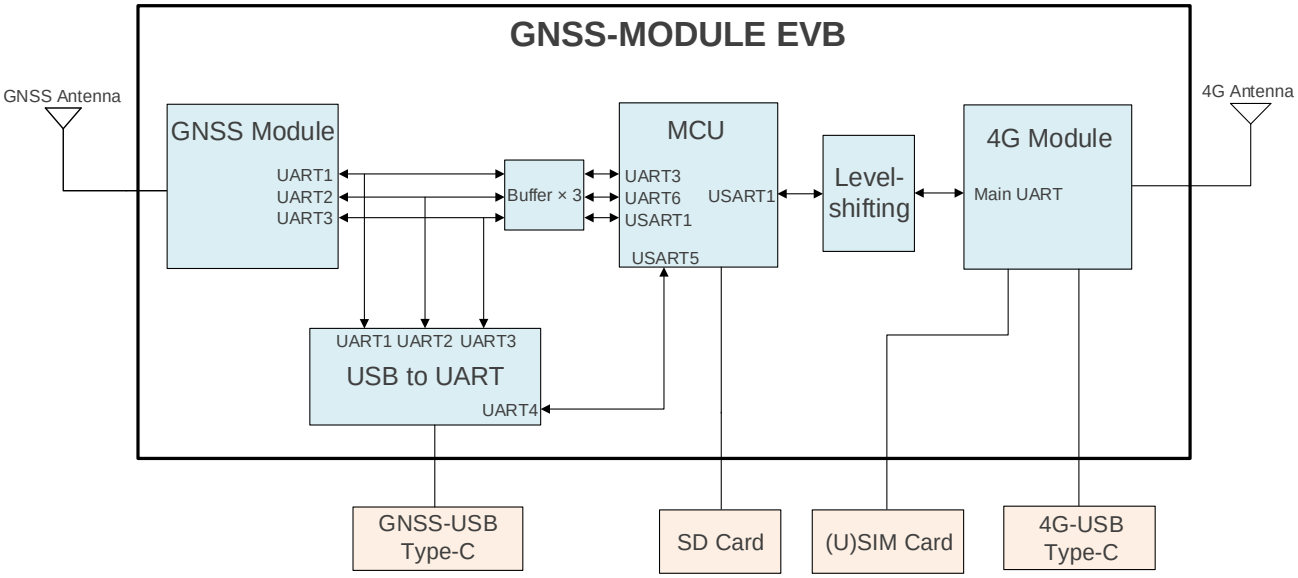
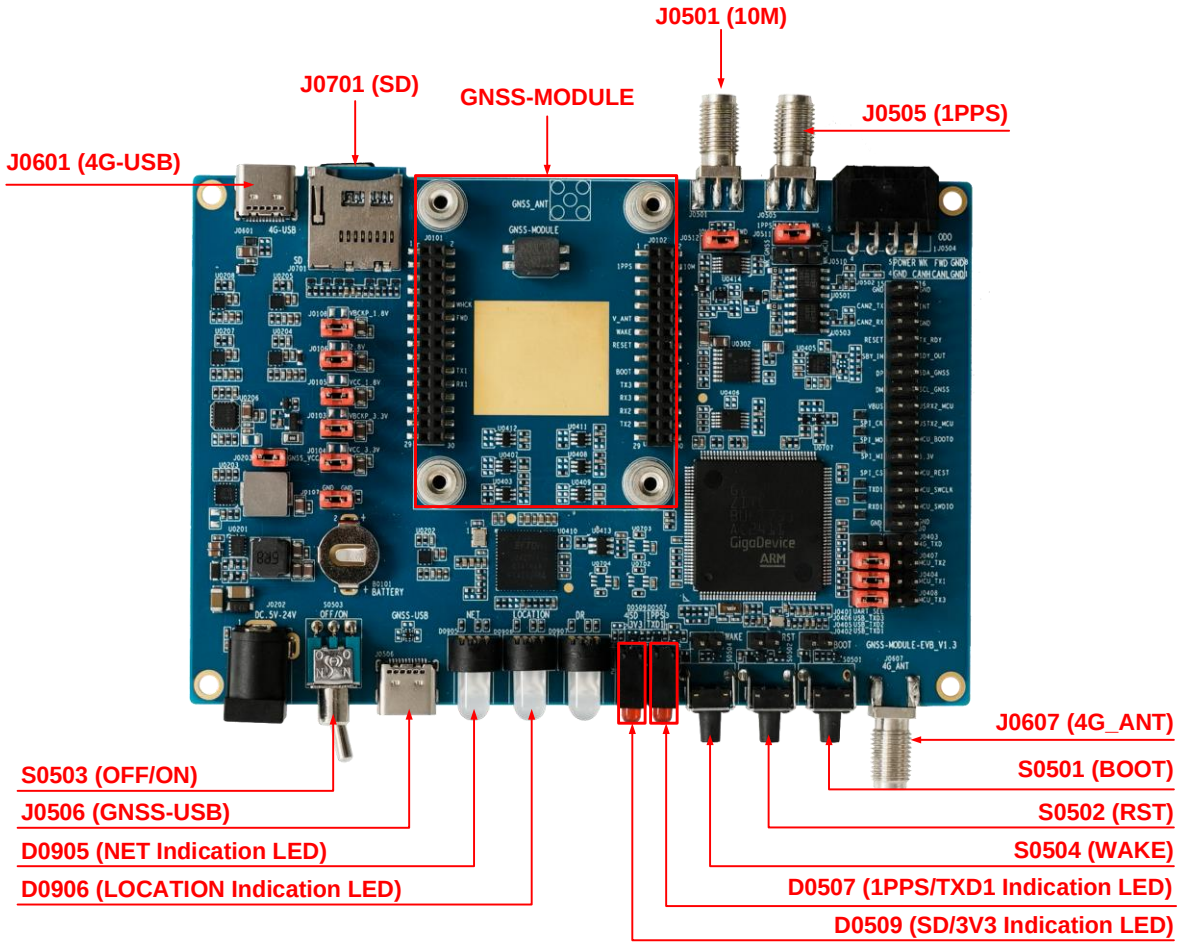


Figure 21: EVB Block Diagram

5 EVB Interfaces

5.1. EVB Top and Bottom Views

EVB top view is shown in the figure below.



Note:
The peripheral interfaces or indicators not marked in red are not applicable to GNSS-TAA-KIT.

Figure 22: EVB Top View

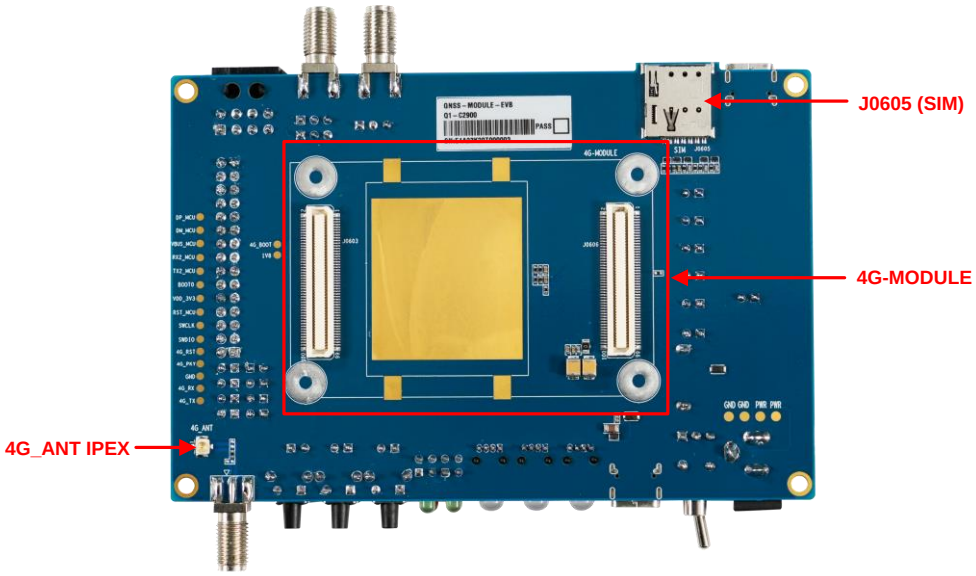


Figure 23: EVB Bottom View

5.2. EVB Interfaces

The EVB interfaces are detailed in the table below.

Table 4: EVB Interface Descriptions

Function	Interfaces	Description	Remark
Power Supply	J0506 GNSS-USB	• EVB power supply: 4.5–5.5 V, typ. 5.0 V • Current capability: > 500 mA	• J0506 is used to supply power for EVB and GNSS module. • J0601 is used to supply power for 4G module.
	J0601 4G-USB		
Communication Interface	J0506 GNSS-USB	Supports data transmission and firmware upgrade for GNSS module.	
	J0601 4G-USB	Used for 4G module debugging.	
SMA Connector	J0501 10M	Used for outputting 10 MHz signal.	
	J0505 1PPS	Used for outputting 1PPS signal.	
	J0607	Used for connecting 4G antenna.	

Function	Interfaces		Description	Remark
	4G_ANT			
Signal Indication	D0905 NET Indication LED		● Red: Network searching and registration failed. ● Green: Network registration succeeded. 4G module is in standby state. ● Blue: Data transmission in progress (network is active).	
	D0906 LOCATION Indication LED		● Red: RTK single-point solution. ● Green: RTK float solution. ● Blue: RTK fixed solution.	
	D0509 Indication LED	SD	Red: ● Flashing: SD card is storing data. ● Extinct: SD card is not storing data.	
		3V3	Green: ● Bright: VCC power supply for module is powered. ● Extinct: VCC power supply for module is not powered.	
	D0507 Indication LED	1PPS	Red: ● Flashing: 1PPS signal output. ● Extinct: 1PPS is unavailable.	
		TXD1	Green: ● Flashing: Data output from UART1 TXD. ● Bright/Extinct: No data output from UART1 TXD.	
Switch and Buttons	S0503 OFF/ON		Powers the EVB on/off. When the switch is turned to the right ("**ON**"), the EVB is turned on.	
	S0504 WAKE		Short press to wake up the GNSS module.	
	S0502 RST		Short press to reset the GNSS module.	
	S0501 BOOT		Press and hold before EVB is powered on to set the module to Boot download mode.	
Other	J0701 SD Card Slot		SD socket for inserting an SD card used to store GNSS log data.	
	J0605 SIM		(U)SIM card inserted at J0605 is used by the 4G module to register on the network.	
	4G_ANT IPEX		Used for connecting the GNSS-MODULE EVB to IPEX connector on the 4G module TE-A via 4G antenna RF cable.	

NOTE

If you use a 4G module for RTK functionality testing and verification, to ensure stable and effective communication, you must short J0404 (MCU_TX1) and J0402 (USB_TXD1) with jumper caps on the GNSS-MODULE EVB.

6 EVB and Antenna Installation

6.1. GNSS Antenna Installation

GNSS antenna installation requirements:

- The installation environment affects antenna reception quality and satellite visibility, which in turn affect the positioning performance of a GNSS receiver.
- Antenna's position and direction can also impact its reception quality. Therefore, it is important to avoid obstacles and interference when installing the antenna.
  For automotive applications, it is recommended to fix the antenna firmly on the roof of the car, as shown in the figure below. Place the ceramic patch antenna horizontally and make sure it radiates toward the sky.
- Ensure that the antenna cable is undamaged, as any damage to the cable may affect reception quality and test results.
- If dynamic testing is required, make sure that the antenna is firmly fixed to the device under test. No relative movement or vibration between the antenna and device is allowed.

For more information about GNSS antenna installation, see *document [4] GNSS antenna application note*.

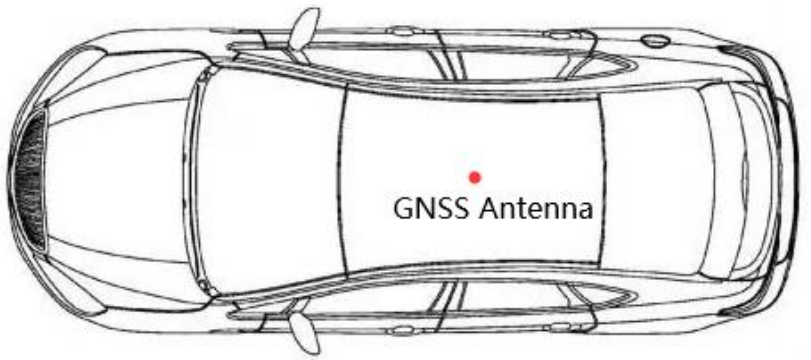


Figure 24: GNSS Antenna Installation

6.2. EVB Installation

If dynamic testing is required, make sure the EVB is firmly fixed to the device under test to prevent any movement or vibration.

Keep the EVB at a sufficient distance from the GNSS antenna, to prevent MCU crystal oscillator harmonics from interfering with antenna performance.

7 Common Issues and Troubleshooting

1. **COM port is not detected in the Device Manager when EVB is connected to your PC via a USB cable.**
   - Verify if the EVB communication interface is properly connected to the PC.
   - Verify if the USB-to-serial driver for FT4232HAQ has been installed successfully.

2. **Communication interface is not outputting any messages or commands.**
   - Verify if the power supply indication LED on the EVB is illuminated.
   - Ensure that the EVB and its accessories are correctly connected according to *Figure 2: GNSS Module TE-A and Kit Components Mounted on EVB (Without 4G Module TE-A)* or *Figure 3: GNSS Module TE-A and Kit Components Mounted on EVB (Top View)*.
   - Check the module power supply status via the D0509 power indicator. If the green LED is extinct, the module has not been powered up correctly.

3. **Module is unable to search for satellite signals.**
   - If there is no transponder indoors, test the module in an open-sky environment.

4. **Module is unable to enter Boot download mode or upgrade mode.**
   - Verify if the module is in Boot download mode.
   - Check if the downloaded firmware is correct.
   - Verify if the correct COM port is selected.

5. **GNSS data is still output when the jumper cap on J0104 (VCC_3.3V) is removed.**
   - Check whether J0103 (VBCKP_3.3V) and J0104 (VCC_3.3V) are shorted through a jumper cap on GNSS TE-A.

NOTE

For the issues that cannot be solved, you can contact Quectel Technical Support (support@quectel.com).

8 Cautions

1. Make sure to conduct tests in the same environment when comparing different parameters of GNSS modules.

2. Ensure that the measurement method is correct. If there are significant differences between parameters tested via EVB and those provided by Quectel, contact Quectel Technical Support.

3. Note that momentary data obtained from measurement cannot always be regarded as reference data, because it may be affected by various factors, such as satellite positions at different times, environmental conditions, temperature, humidity and altitude.

9 Appendix References

Table 5: Related Documents

Document Name
[1] Quectel_List_of_EVB_Applicable_Modules
[2] Quectel_QGNSS_User_Guide
[3] Quectel_GNSS_RTK_Application_Note
[4] Quectel_GNSS_Antenna_Application_Note

Table 6: Terms and Abbreviations

Abbreviation	Description
1PPS	One Pulse Per Second
COM Port	Communication Port
EVB	Evaluation Board
GGA	Global Positioning System Fix Data
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
LED	Light-Emitting Diode
MCU	Microcontroller Unit
NTRIP	Networked Transport of RTCM via Internet Protocol
PC	Personal Computer
PVT	Position Velocity Time
RF	Radio Frequency

Abbreviation	Description
RTCM	Radio Technical Commission for Maritime Services
RTK	Real-Time Kinematic
RXD	Receive Data (Pin)
SD Card	Secure Digital Card
SIM	Subscriber Identity Module
SMA	SubMiniature Version A
TXD	Transmit Data (Pin)
UART	Universal Asynchronous Receiver/Transmitter
USART	Universal Synchronous/Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identity Module
VRS	Virtual Reference Station