LC79H (AL)
EVB User Guide

GNSS Module Series

Version: 1.1

Date: 2023-05-10

Status: Released

At Quectel, our aim is to provide timely and comprehensive services to our customers. If you require any assistance, please contact our headquarters:

Quectel Wireless Solutions Co., Ltd.
Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China
Tel: +86 21 5108 6236
Email: info@quectel.com

Or our local offices. For more information, please visit:
http://www.quectel.com/support/sales.htm.

For technical support, or to report documentation errors, please visit:
http://www.quectel.com/support/technical.htm.
Or email us at: support@quectel.com.

Legal Notices

We offer information as a service to you. The provided information is based on your requirements and we make every effort to ensure its quality. You agree that you are responsible for using independent analysis and evaluation in designing intended products, and we provide reference designs for illustrative purposes only. Before using any hardware, software or service guided by this document, please read this notice carefully. Even though we employ commercially reasonable efforts to provide the best possible experience, you hereby acknowledge and agree that this document and related services hereunder are provided to you on an “as available” basis. We may revise or restate this document from time to time at our sole discretion without any prior notice to you.

Use and Disclosure Restrictions

License Agreements

Documents and information provided by us shall be kept confidential, unless specific permission is granted. They shall not be accessed or used for any purpose except as expressly provided herein.

Copyright

Our and third-party products hereunder may contain copyrighted material. Such copyrighted material shall not be copied, reproduced, distributed, merged, published, translated, or modified without prior written consent. We and the third party have exclusive rights over copyrighted material. No license shall be granted or conveyed under any patents, copyrights, trademarks, or service mark rights. To avoid ambiguities, purchasing in any form cannot be deemed as granting a license other than the normal non-exclusive, royalty-free license to use the material. We reserve the right to take legal action for noncompliance with abovementioned requirements, unauthorized use, or other illegal or malicious use of the material.

Trademarks

Except as otherwise set forth herein, nothing in this document shall be construed as conferring any rights to use any trademark, trade name or name, abbreviation, or counterfeit product thereof owned by Quectel or any third party in advertising, publicity, or other aspects.

Third-Party Rights

This document may refer to hardware, software and/or documentation owned by one or more third parties ("third-party materials"). Use of such third-party materials shall be governed by all restrictions and obligations applicable thereto.

We make no warranty or representation, either express or implied, regarding the third-party materials, including but not limited to any implied or statutory, warranties of merchantability or fitness for a particular purpose, quiet enjoyment, system integration, information accuracy, and non-infringement of any third-party intellectual property rights with regard to the licensed technology or use thereof. Nothing herein constitutes a representation or warranty by us to either develop, enhance, modify, distribute, market, sell, offer for sale, or otherwise maintain production of any our products or any other hardware, software, device, tool, information, or product. We moreover disclaim any and all warranties arising from the course of dealing or usage of trade.

Privacy Policy

To implement module functionality, certain device data are uploaded to Quectel's or third-party's servers, including carriers, chipset suppliers or customer-designated servers. Quectel, strictly abiding by the relevant laws and regulations, shall retain, use, disclose or otherwise process relevant data for the purpose of performing the service only or as permitted by applicable laws. Before data interaction with third parties, please be informed of their privacy and data security policy.

Disclaimer

a) We acknowledge no liability for any injury or damage arising from the reliance upon the information.
b) We shall bear no liability resulting from any inaccuracies or omissions, or from the use of the information contained herein.
c) While we have made every effort to ensure that the functions and features under development are free from errors, it is possible that they could contain errors, inaccuracies, and omissions. Unless otherwise provided by valid agreement, we make no warranties of any kind, either implied or express, and exclude all liability for any loss or damage suffered in connection with the use of features and functions under development, to the maximum extent permitted by law, regardless of whether such loss or damage may have been foreseeable.
d) We are not responsible for the accessibility, safety, accuracy, availability, legality, or completeness of information, advertising, commercial offers, products, services, and materials on third-party websites and third-party resources.

Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any terminal incorporating Quectel LC79H (AL) module. Manufacturers of the terminal should distribute the following safety precautions to users and operating personnel, and incorporate them into all manuals supplied with the product. Otherwise, Quectel assumes no liability for customers' failure to comply with these precautions.

	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, 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	**LC79H (AL) 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	2022-07-20	First official release
1.1	2023-05-10	1. Added the model information of GNSS antenna, deleted the description of USB flash drive and instruction sheet (*Chapter 2.1*). 2. Added the description of SAM connector for 1PPS (*Figure 3* and *Table 2*). 3. Added the information of test points (U410) (*Figure 3* and *Table 4*). 4. Deleted the communication via QCOM tool. 5. Updated the firmware upgrade tool as QGNSS (*Chapter 4*). 6. Added the installation of EVB and antenna (*Chapter 5*). 7. Added power consumption measurement for the module (*Chapter 6*). 8. Added the EVB framework (*Chapter 7*). 9. Added the common problems and troubleshooting (*Chapter 8*). 10. Added the cautions (*Chapter 9*).

Contents

Table Index

Figure Index

1 Introduction

This document provides information on the steps needed to evaluate the Quectel LC79H (AL) module using the Evaluation Board (EVB). The EVB is a convenient tool that allows you to become familiar with the LC79H (AL) module.

Specifically, the document is divided into several sections:

- Chapter 2 provides the general overview of EVB kit.
- Chapter 3 describes the EVB user interfaces.
- Chapter 4 describes how to test the module and upgrade the firmware via QGNSS tool.
- Chapter 5 describes the installation of EVB and antenna.
- Chapter 6 describes how to measure power consumption for the module.
- Chapter 7 provides the EVB framework.
- Chapter 8 describes the common problems and troubleshooting.
- Chapter 9 describes the cautions.
- Chapter 10 is an appendix, which summarizes the relevant documents and terms and abbreviations appearing herein.

NOTE

Request QGNSS software tool from Quectel Technical Support (support@quectel.com).

2 General Overview

2.1. EVB Kit

The EVB kit includes: Evaluation Board (EVB), active GNSS antenna, Type-B USB cables, bolts and coupling nuts.

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

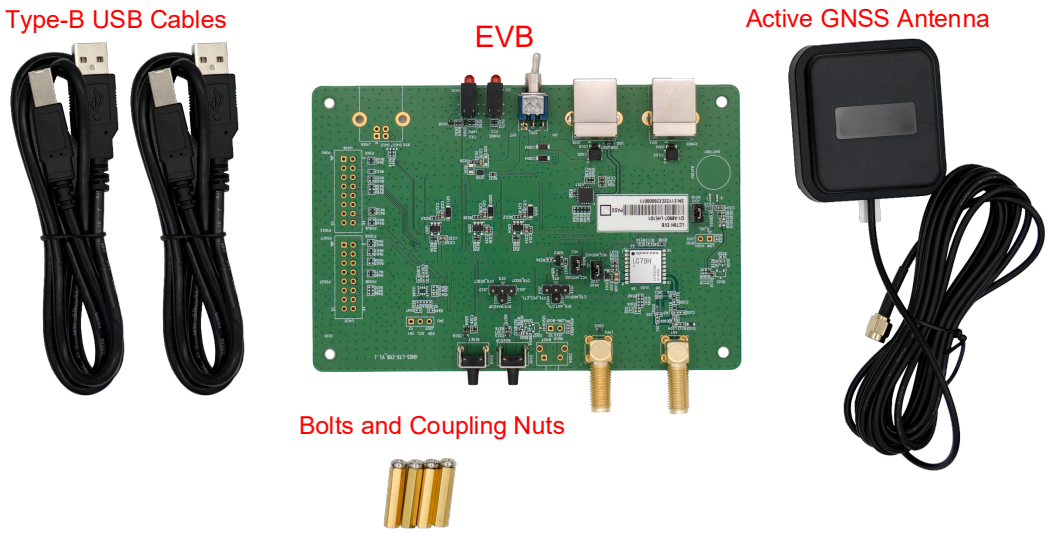


Figure 1: EVB and Components

Table 1: List of Kit Components

Items	Description	Quantity
EVB	Evaluation Board Size: 80 mm × 120 mm	1
USB Cable	Type-B USB Cable	2
Active GNSS Antenna	Active GNSS Antenna (Model: YB0017AA) Antenna Size: 61.5 mm × 56.5 × 23 mm Cable Length: 3000 mm	1
	The antenna in the kit supports: ● GPS L1 C/A and L5 ● GLONASS L1 ● Galileo E1 and E5a ● BDS B1I and B2a ● QZSS L1 C/A and L5 ● SBAS L1	
Others	Bolts and Coupling Nuts	4 pairs

NOTE

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

2.2. Connect Cable and Antenna to EVB

The connection between the EVB and its components is shown in the figure below.

Figure 2: EVB and Components Assembly

NOTE

1. It is optional to connect PC and the "**POWER**" (J204) on the EVB via a Type-B USB cable. For more information, see *Chapter 3.2 EVB Interfaces*.
2. 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.

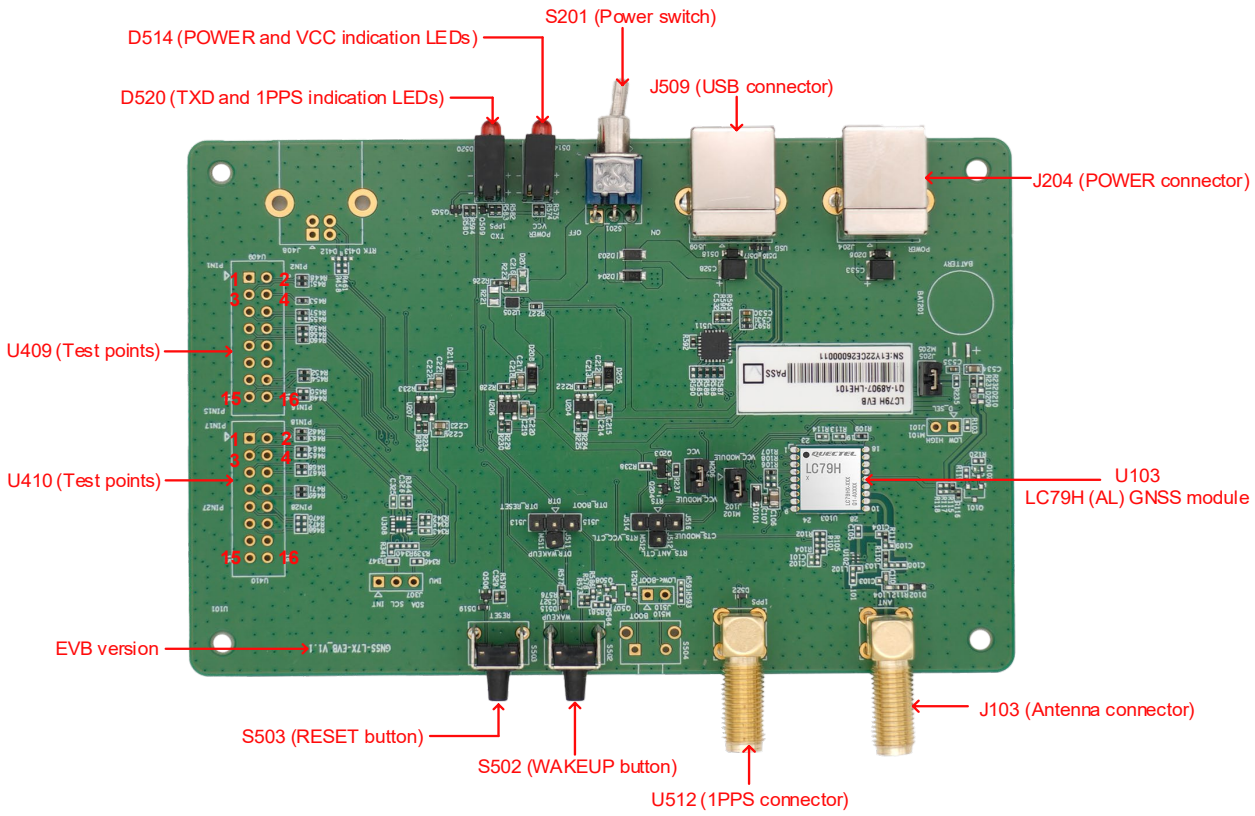


Figure 3: EVB Top View

3.2. EVB Interfaces

The EVB interfaces are detailed in the table below.

Table 2: Detailed EVB Interfaces

Function		Interfaces	Description
Power Supply		J204 POWER	J204: Only used to supply power to avoid the insufficient supply of J509.
		J509 USB	J509: Used to communicate and supply power. Power supply input: ● DC power supply: 4.5–5.5 V, typ. 5.0 V ● Current capability should be > 100 mA
Communication Interface		J509 USB	Supports RTCM and standard NMEA message, PAIR/PQTM message, binary data and firmware upgrade.
SAM Connector		J103 Antenna connector	Used for connecting the GNSS antenna.
		U512 1PPS connector	Used for testing 1PPS signal.
Signal Indication	D514 Indication LEDs	POWER (Green)	Bright: The EVB is powered well. Extinct: The EVB is not powered.
		VCC (Red)	Bright: The module is powered well. Extinct: The module is not powered.
	D520 Indication LEDs	TXD (Red)	Flashing: Data are being output from UART TXD pin. Extinct or Bright: No data are output from UART TXD pin.
		1PPS (Green)	Flashing: Successful position fix. Frequency: 1 Hz. Extinct: No position fix.
Switch and Buttons		S201 Power switch	Powers the EVB on/off.
		S503 RESET	Short press on the button to reset the module.
		S502 WAKEUP	Short press on the button to wake up the module from Backup mode.

The U409 and U410 test points of LC79H (AL) are shown below:

Table 3: U409 Pin Description

Test Point No.	Test Point Label	Test Point Function	I/O	Description
1	PIN1	U103: Pin 1	-	Ground
2	PIN2	U103: Pin 2	DO	TXD: Transmits data
3	No label	U103: Pin 3	DI	RXD: Receives data
4	No label	U103: Pin 4	DO	1PPS: 1 pulse per second
5	No label	-	-	Reserved
6	No label	U103: Pin 6	PI	V_BCKP: Backup power supply for backup domain of module
7	No label	-	-	Reserved
8	No label	U103: Pin 8	PI	VCC: Main power supply
9	No label	U103: Pin 9	DI	RESET_N: Reset the module
10	No label	-	-	Ground
11	No label	-	-	NC (Not Connected)
12	No label	U103: Pin 12	-	Ground
13	No label	U103: Pin 13	DI	ANT_ON: Power control for external LNA or active antenna in power saving mode
14	No label	VDD_RF	PO	VDD_RF: Power supply for external RF components
15	PIN15	U103: Pin 15	-	Reserved
16	PIN16	U103: Pin 16	DIO	I2C_SDA: I2C serial data

Table 4: U410 Pin Description

Test Point No.	Test Point Label	Test Point Function	I/O	Description
1	PIN17	U103: Pin 17	DI	I2C_SCL: I2C serial clock
2	PIN18	U103: Pin 18	DI	WAKEUP: Wake up the module from the Backup mode.
3	No label	-	-	Reserved
4	No label	-	-	Reserved
5	No label	U103: Pin 21	DO	GEOFENCE: Indicates geofence status
6	No label	U103: Pin 22	DO	JAM_IND: Jamming indication
7	No label	U103: Pin 23	DO	3D_FIX: 3D position fix indication
8	No label	-	-	Reserved
9	No label	-	-	Reserved
10	No label	-	-	Reserved
11	PIN27	U103: Pin 27	-	Reserved
12	PIN28	U103: Pin 28	-	Ground
13	No label	-	-	NC
14	No label	-	-	NC
15	No label	-	-	NC
16	No label	-	-	NC

NOTE

1. The serial numbers of U409 and U410 test points are shown in red text in *Figure 3: EVB Top View*.
2. The U409 and U410 test points refer to the module's corresponding function. For detailed descriptions, see *document [1] hardware design*.

4 Testing and Firmware Upgrading via QGNSS Tool

This chapter explains how to use the QGNSS software tool for verifying the status of GNSS module and for firmware upgrade. For more information about QGNSS use, see *document [2] QGNSS user guide*.

4.1. Testing via QGNSS

Step 1: Assemble the EVB components.

Step 2: Connect the EVB and the PC with two Type-B USB cables via "**POWER**" and "**USB**" interfaces or connect the EVB to the PC with a Type-B USB cable via "**USB**" interface. Then flip the power switch (S201) to **ON** position to power on the EVB.

Step 3: Start the QGNSS and click "**Device**" and "**Serial Device Information**" (default baud rate: 115200 bps [1]).

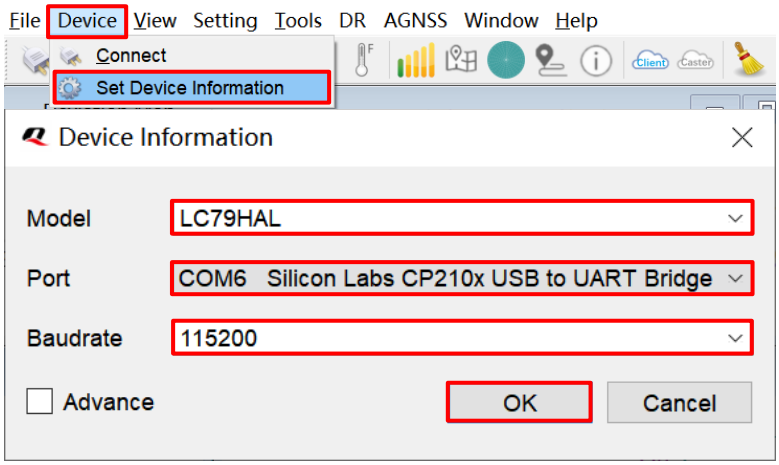


Figure 4: COM Port and Rate Setting

Step 4: Click the  "**Connect or disconnect**" button. The interface shown in the figure below appears once the module is connected.

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

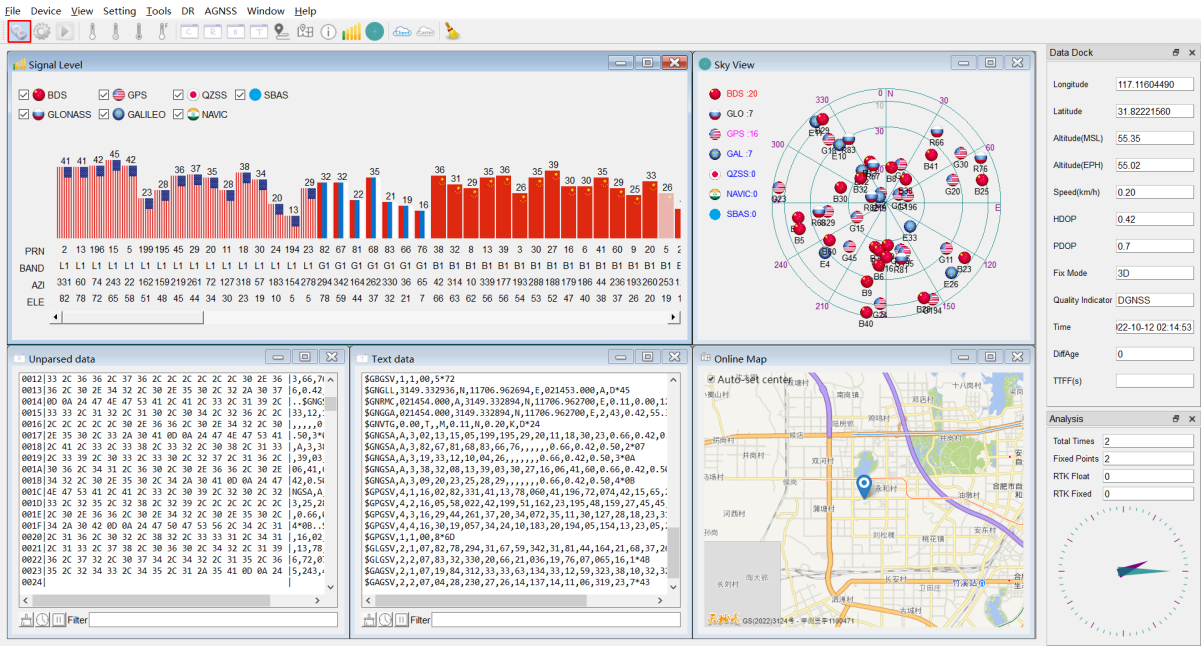


Figure 5: QGNSS Interface (Connected)

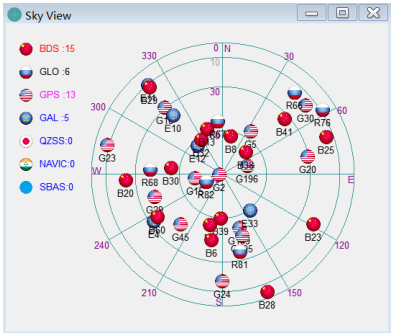
NOTE

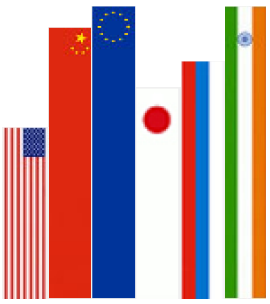
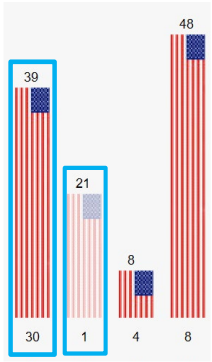
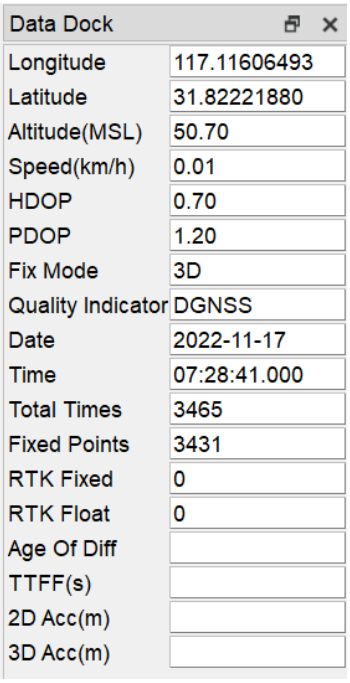
Ensure the CP210x driver has been installed when you use the QGNSS tool for the first time. For more information about the driver, please contact the Quectel Technical Support (support@quectel.com).

4.2. 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
	This sky view interface shows the position of the satellites in use. 1) The left column icons show the satellites in use and their numbers. ● BDS: 15 ● GLO (GLONASS): 6 ● GPS: 13 ● GAL (Galileo): 5 ● QZSS: 0

Icon	Explanation
	● NavIC: 0 ● SBAS: 0 2) The sky view on the right shows the position of the satellites in use.
	GPS satellite BDS satellite GLONASS satellite Galileo satellite QZSS satellite NavIC 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: °) ● Latitude (unit: °) ● Altitude (MSL) (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, Float RTK and Fixed RTK modes ● Date: UTC date ● Time: UTC time ● Total Times ● Fixed Points ● RTK Fixed ● RTK Float ● Age of differential GPS data ● TTFF (unit: s) ● 2D accuracy (unit: m) ● 3D accuracy (unit: m)

4.3. Firmware Upgrading

Power on the EVB before upgrading the firmware, see *Chapter 4.1 Testing via QGNSS* for details.

Firmware upgrading steps:

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

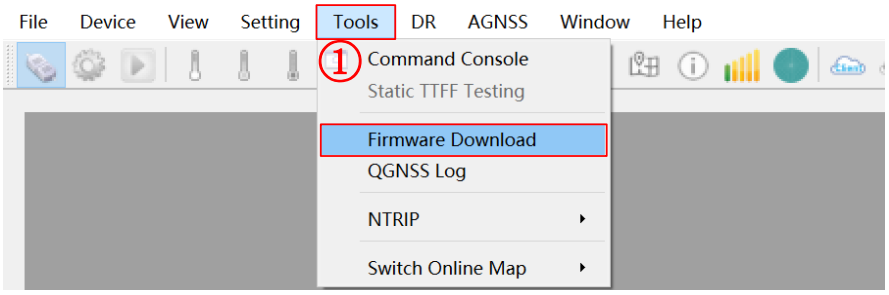


Figure 6: Tool Startup

Step 2: Select the "**Download Baudrate**" (921600 bps or 115200 bps) in the drop-down box of "**Setting**".

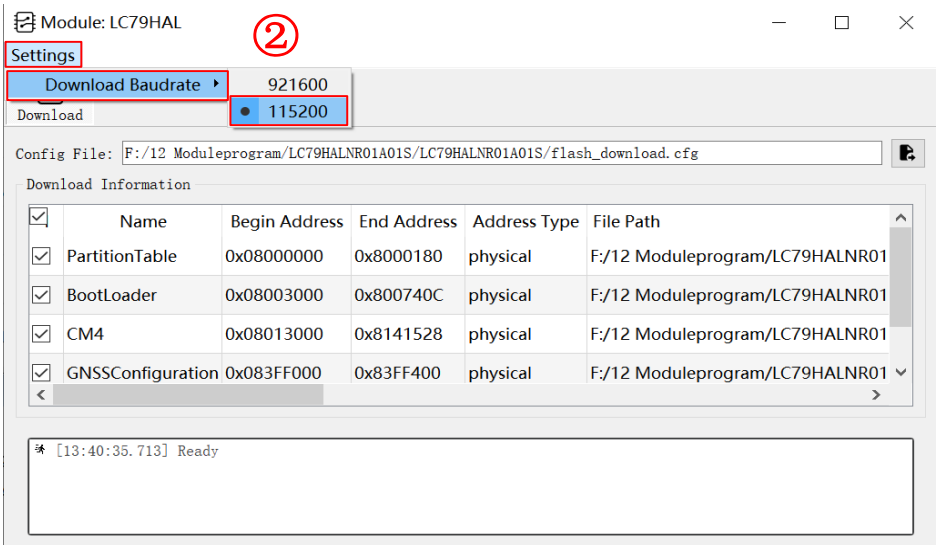


Figure 7: Tool Setting

Step 3: Click the "**Open Config File**" button to select Config file, e.g., "**flash_download.cfg**".

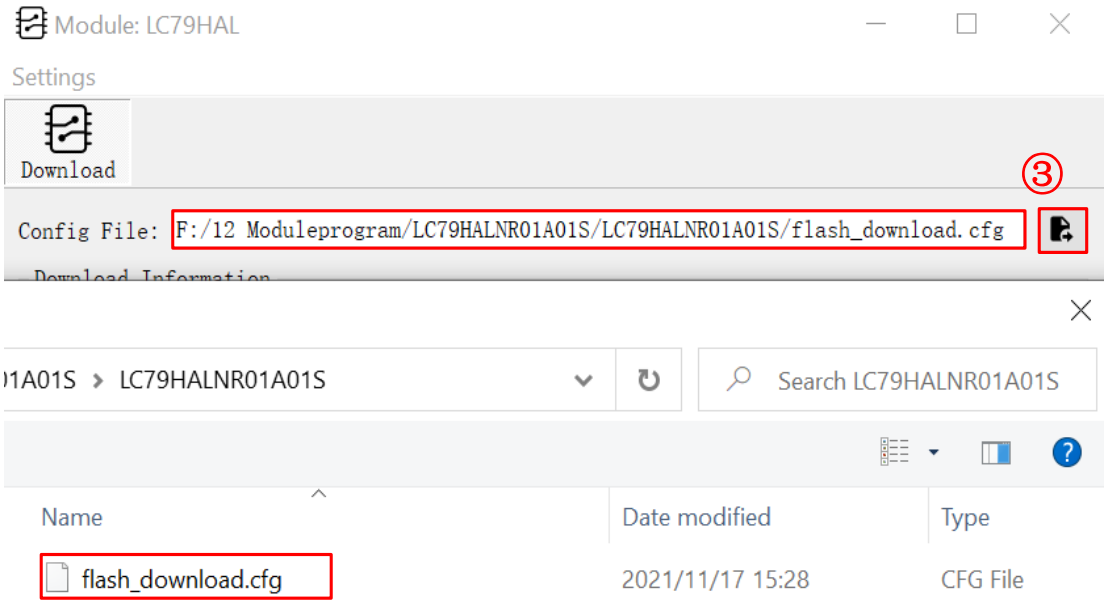


Figure 8: Firmware Selecting

Step 4: Click the ▶ "**Run**" button and the short press the RESET button after the progress bar prompts you to reset the module.

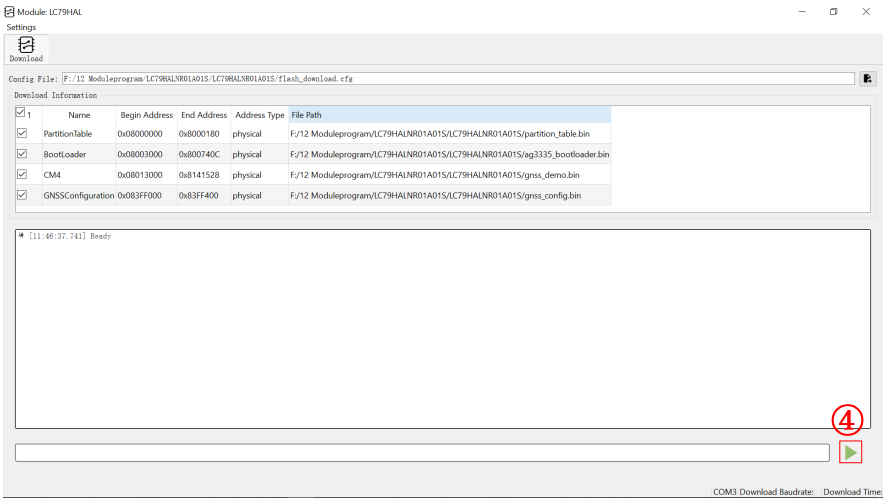


Figure 9: Firmware Upgrading – 1

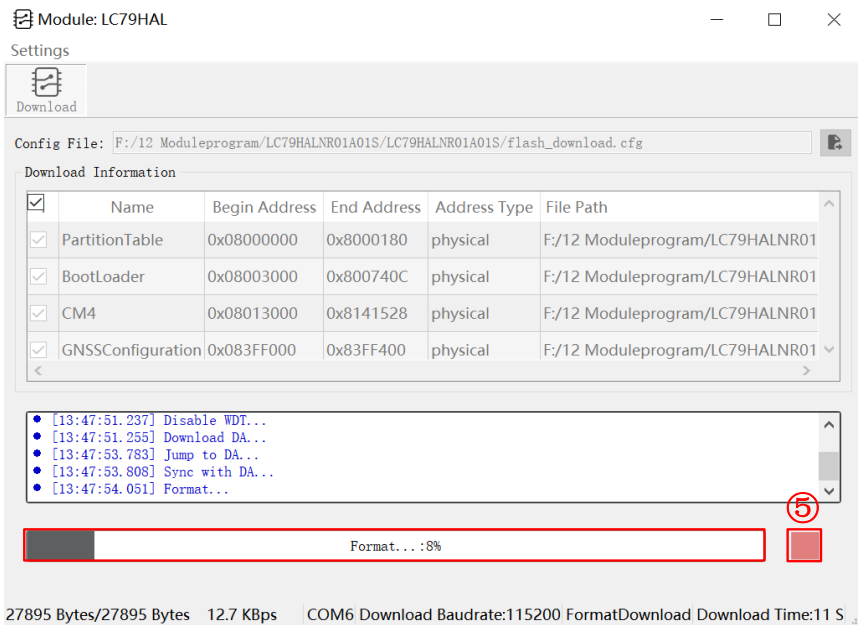


Figure 10: Firmware Upgrading – 2

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

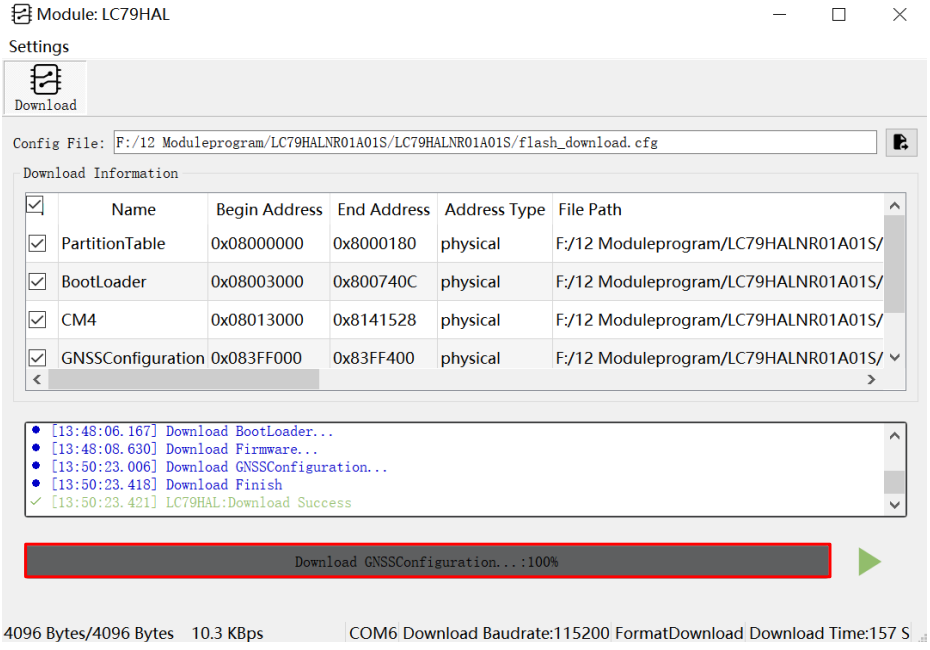


Figure 11: Successful Firmware Upgrading

5 EVB and Antenna Installation

5.1. GNSS Antenna Installation

The installation environment affects antenna reception performance and satellite visibility, which in turn affect the position quality of a GNSS receiver. In addition, antenna's orientation can also impact its reception performance. Therefore, it is important to avoid obstacles and interference when installing antenna. Place the ceramic patch antenna horizontally and make sure it faces toward the sky.

If dynamic testing is required, make sure that the GNSS antenna is firmly fixed to the device under test so as to avoid any movement or vibration with respect to the device.

5.2. EVB Installation

If dynamic testing is required, make sure the EVB is fixed to the device under test so as to avoid any movement or vibration with respect to the device.

6 Measuring Power Consumption

6.1. Power Consumption at Different Stages

Module power consumption is measured in three stages: acquisition and tracking (including almanac update), tracking (almanac update is over) and upon entering Backup mode.

- Acquisition and Tracking (including almanac update): 0 s to 12.5 min
- Tracking (almanac update is over): > 12.5 min
- Entering Backup mode

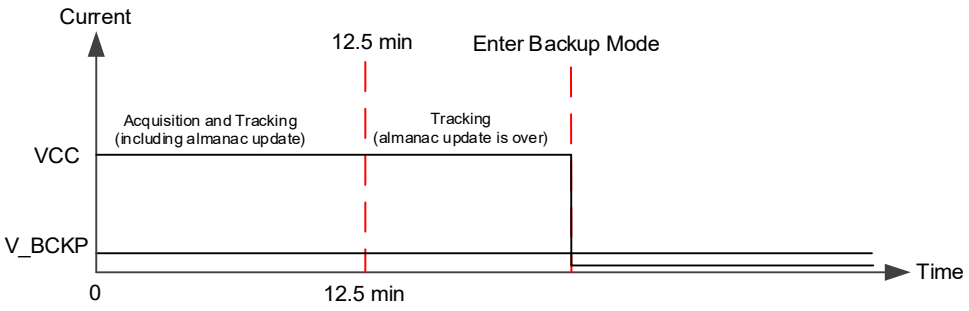


Figure 12: Power Consumption at Different Stages

6.2. VCC Power Consumption Measurement

Before measuring the VCC power consumption, you must connect the components to the EVB to ensure that the module can communicate and fix normally. See *Chapter 4.1 Testing via QGNSS* for details.

Detailed steps for measuring VCC power consumption with an ammeter:

Step 1: Switch off the power supply (S201) and pull out the VCC_MODULE jumper cap (J102). Connect the ammeter in series to the head pins of J102 as shown below.

Step 2: Switch on the power supply (S201) and read the ammeter.

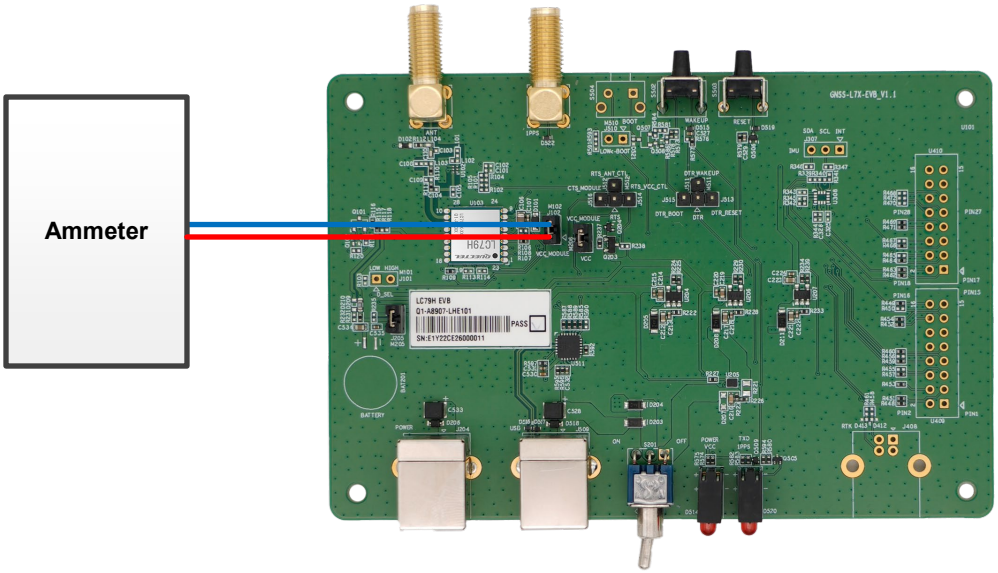


Figure 13: VCC Power Consumption Measured with Ammeter

Detailed steps for measuring VCC power consumption with a power consumption meter:

Step 1: Switch off the power supply (S201) and pull out the VCC_MODULE jumper cap (J102). Make sure the positive pole of the power consumption meter is to be connected to pin 2 (without arrow silkscreen) of J102, and the negative pole is connected to GND.

Step 2: Switch on the power supply (S201) and read the power consumption meter.

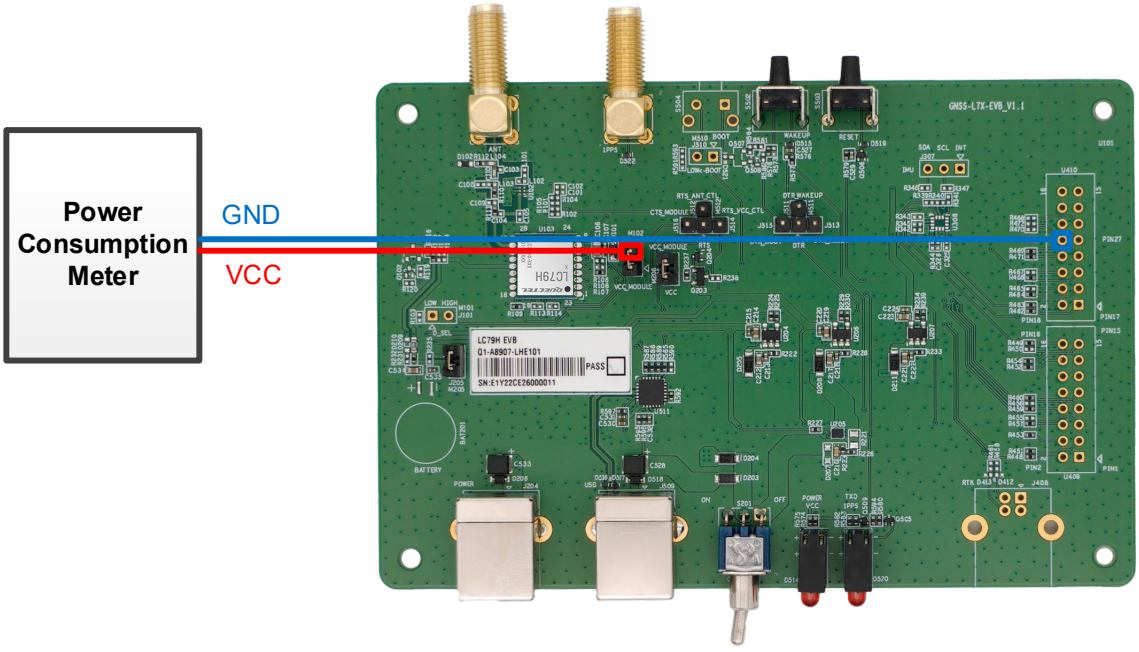


Figure 14: VCC Power Consumption Measured with Power Consumption Meter

6.3. V_BCKP Power Consumption Measurement

Before measuring the V_BCKP power consumption, you must connect the components to EVB to ensure that the module can communicate and fix normally. See *Chapter 4.1 Testing via QGNSS* for details.

Detailed steps for measuring V_BCKP power consumption with an ammeter:

Step 1: Switch off the power supply (S201). Pull out the V_BCKP jumper cap (J205). Connect the ammeter in series to the head pins of J205, as shown below.

Step 2: Switch on the power supply (S201) and read the ammeter.

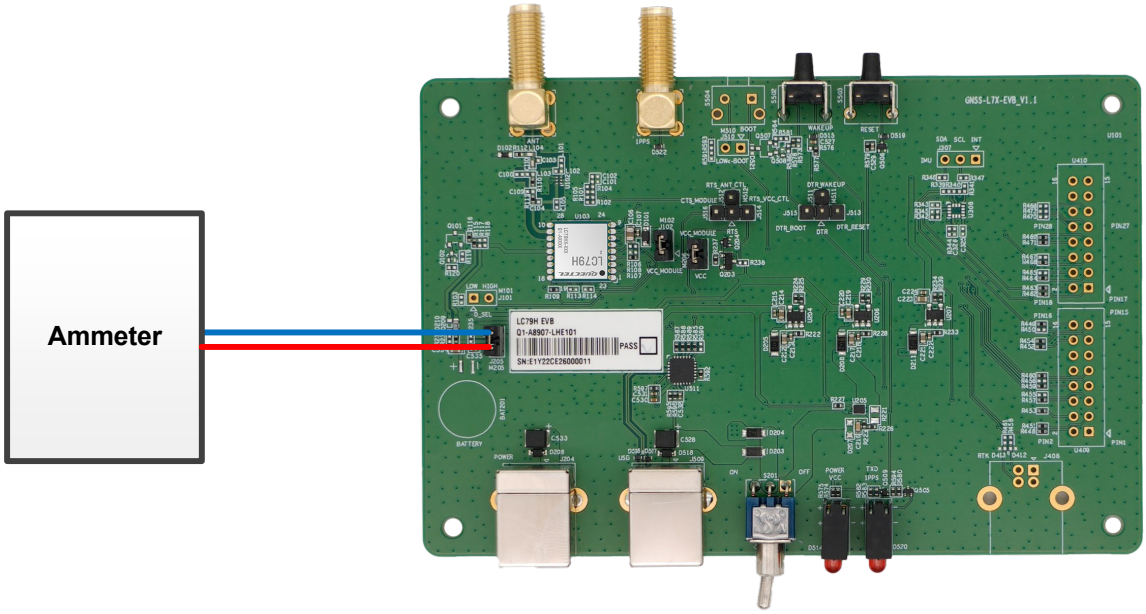


Figure 15: V_BCKP Power Consumption Measured with Ammeter

Detailed steps for measuring V_BCKP power consumption with a power consumption meter:

Step 1: Switch off the power supply (S201). Pull out the VCC_MODULE jumper cap (J102) and the V_BCKP jumper cap (J205). Then, ensure the positive pole of the power consumption meter is connected to pin 1 (with arrow silkscreen) of J205, and the negative pole is connected to GND.

Step 2: Switch on the module power supply (S201) and read the power consumption meter.

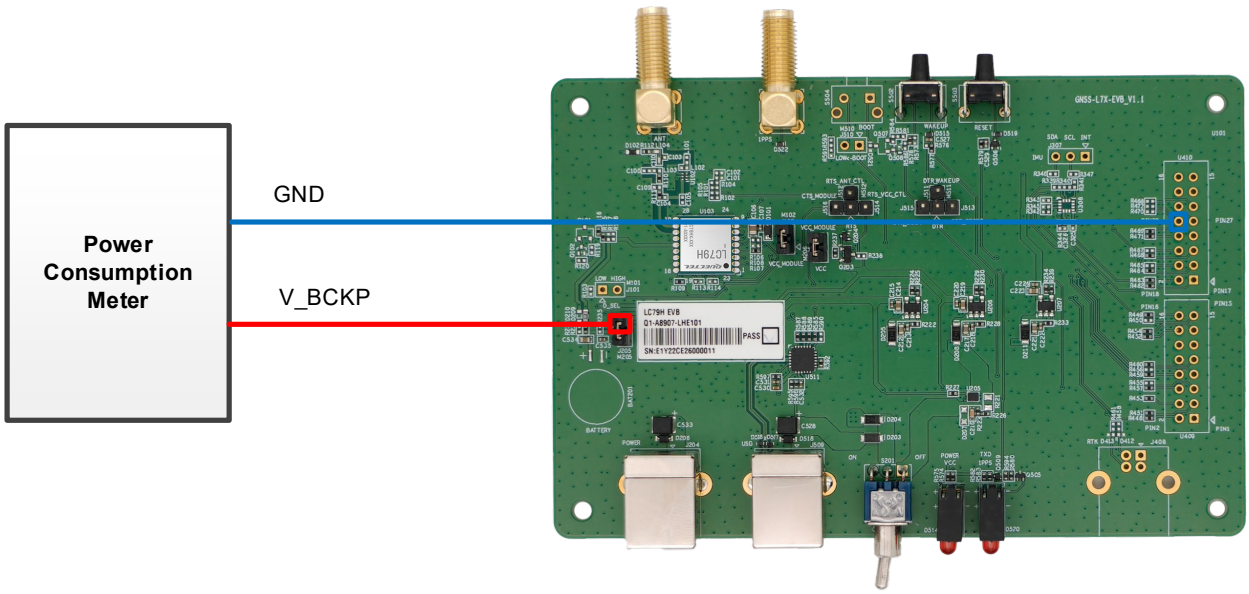


Figure 16: V_BCKP Power Consumption Measured with Power Consumption Meter

NOTE

1. Adjust the current resolution when using the power consumption meter.
2. The power value can be calculated according to the following formula: $P = V_{Supply} \times I_{Test}$.
3. When measuring the V_BCKP power consumption in Backup mode, ensure that the module has entered Backup mode, and then remove the jumper cap of VCC_MODULE (J102) to cut off the power supply of VCC. For more information about the way to enter/exit Backup mode, see *document [1] hardware design*.

7 EVB Framework

The power is supplied to EVB via Type-B, and then to GNSS module via a low dropout regulator (LDO). GNSS module outputs the signals from communication interface on EVB via USB to UART Bridge Chip (CP2102N). There are an antenna interface and a control button on EVB. All functions of the module are available, including debugging.

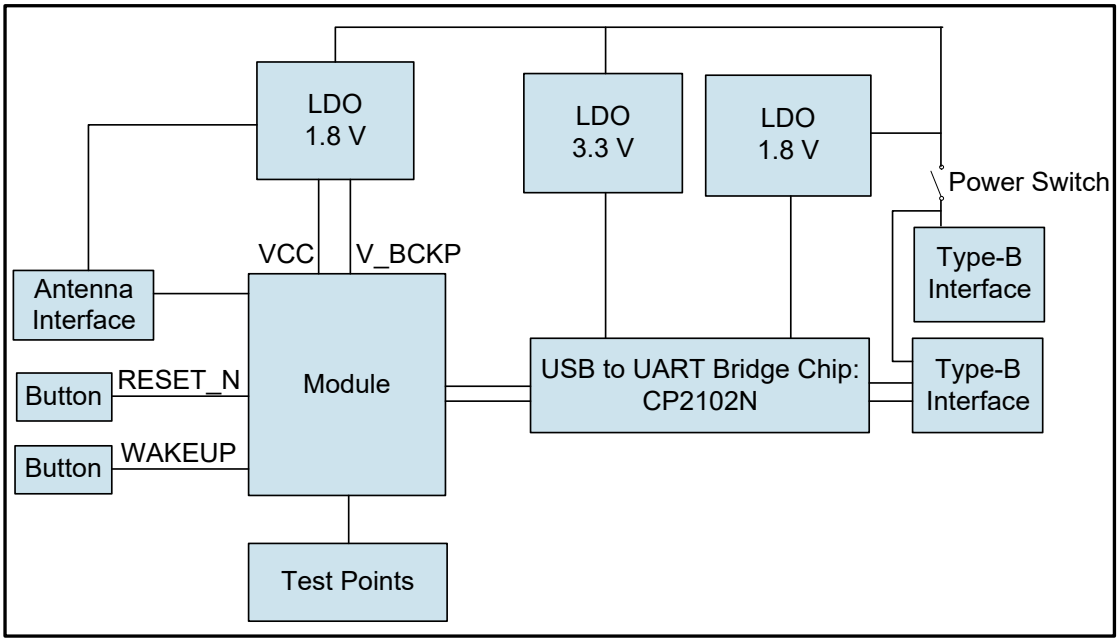


Figure 17: EVB Framework

8 Common Problems and Troubleshooting

1. **Unable to find COM port in the Device Manager when EVB is connected to PC with a USB cable.**
   - Check that the EVB communication interface is properly connected to the PC.
   - Verify that CP210x Driver has been installed successfully.

2. **Communication interface not outputting any messages or commands.**
   - Check that the power supply indication LED on the EVB is illuminated.
   - Verify that the jumper cap(s) is(/are) connected correctly, as shown in *Figure 1: EVB and Components*.
   - Ensure that the module's power supply is normal.

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

4. **Module unable to upgrade.**
   - Verify whether the module is in normal operating mode.
   - Check that the downloaded firmware is correct.
   - Confirm that the correct COM port has been selected.

NOTE

For the problem(s) that cannot be solved, please contact Quectel Technical Support (support@quectel.com).

9 Cautions

- Make sure to conduct tests under the same environment when comparing different parameters of GNSS modules.
- Note that parameters, such as cold start, acquisition and tracking, may be defined differently by chip suppliers.
- Ensure that the measurement method is correct. If there are significant differences between parameters tested via EVB and those provided by Quectel, please contact Quectel Technical Support.
- 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.
- Keep in mind that the QGNSS Tool may updated periodically to fix bugs or improve performance. Please make sure that you are using the latest version of the tool.

10 Appendix References

Table 6: Related Documents

Document Name
[1] Quectel_LC79H(AL)_Hardware_Design
[2] Quectel_QGNSS_User_Guide

Table 7: Terms and Abbreviations

Abbreviation	Description
1PPS	One Pulse Per Second
2D	2 Dimension
3D	3 Dimension
BDS	BeiDou Navigation Satellite System
C/N_0	Carrier-to-Noise Ratio
CEP	Circular Error Probable
COM Port	Communication Port
DC	Direct Current
DI	Digital Input
DO	Digital Output
ECEF	Earth-Centered, Earth-Fixed
ESD	Electrostatic Discharge
EVB	Evaluation Board
Galileo	Galileo Satellite Navigation System (EU)

Abbreviation	Description
GLONASS	Global Navigation Satellite System (Russia)
GND	Ground
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HDOP	Horizontal Dilution of Precision
I2C	Inter-Integrated Circuit
I/O	Input/Output
LED	Light Emitting Diode
LLA	Longitude, Latitude, and Altitude
MSL	Mean Sea Level
NavIC	Indian Regional Navigation Satellite System
NMEA	NMEA (National Marine Electronics Association) 0183 Interface Standard
PC	Personal Computer
PCB	Printed Circuit Board
PDOP	Position Dilution of Precision
PI	Power Input
PO	Power Output
PRN	Pseudo Random Noise
QZSS	Quasi-Zenith Satellite System
RF	Radio Frequency
RTK	Real Time Kinematic
RXD	Receive Data (Pin)
SBAS	Satellite-Based Augmentation System
SDA	I2C Serial Data

Abbreviation	Description
SPS	Standard Positioning Service
TTFF	Time to First Fix
TXD	Transmit Data (Pin)
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
UTC	Coordinated Universal Time
WGS84	World Geodetic System 1984