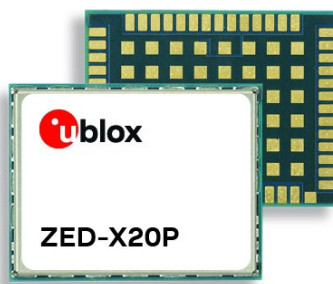


ZED-X20P

Moving base applications

Application note



Abstract

This application note explains how the ZED-X20P multi-band GNSS receivers can be employed in applications that require high precision relative position output or heading and attitude information.

Document information

Title	ZED X20P moving base application note		
Subtitle	Moving base applications		
Document type	Application note		
Document number	UBXDOC-304424225-20512		
Revision and date	R02	24-Jun-2026	
Disclosure Restriction	C1-Public		

This document applies to the following products:

Product name	Type number	Firmware version	RN reference
ZED-X20P	ZED-X20P-01B-00	HPG 2.10	UBXDOC-304424225-21261

Contents

Document information	2
Contents	3
1 Introduction	4
1.1 Terminology and fundamentals.....	4
1.2 Real-world applications.....	5
2 System-level considerations.....	8
2.1 GNSS antenna considerations for moving base RTK.....	8
2.1.1 Ground plane size and shape.....	8
2.1.2 Multipath/obscuration from surrounding structures.....	9
2.2 Providing corrections between base and rover	10
2.2.1 Wired connection between base and rover	10
2.2.2 Wireless connection between base and rover	12
2.2.3 Testing and debugging RF link application.....	13
2.2.4 Improving RF link performance.....	14
2.3 Receiver configurations	14
2.3.1 Default 1 Hz navigation rate application	14
2.3.2 5 Hz navigation rate application	15
2.4 Using the heading output.....	17
3 Using the EVK-X20P as a moving base application	18
3.1 Wired UART base and rover	19
Related documents	20
Revision history	20
Contact.....	21

1 Introduction

The ZED-X20P multi-band GNSS receivers have integrated u-blox all-band RTK technology for centimeter-level accuracy. This application note explains how two ZED-X20P receivers can be employed in applications that require high precision relative position output or heading and attitude information. This is enabled by the so-called moving base support in the module firmware.

This first section introduces the basic terminology and essential elements of a moving base setup with two or more GNSS receivers and shows some typical application scenarios. Section 2, which makes up the core of this application note, covers in-depth system-level considerations from antenna placement up to module configuration.

1.1 Terminology and fundamentals

RTK technology introduces the concepts of a **base** and a **rover**. In such a setup, the base sends a continuous differential correction data stream (complying with the RTCM 3.4 protocol) to one or more rovers via a communication link. This enables the rover to accurately compute its position relative to the base. The vector (or relative position) between the base and the rover is called the **baseline**.

In standard RTK mode, the base remains static in a known position, while in the moving base (MB) RTK mode, both base and rover receivers can move. The latter is ideal for applications where the relative position offset between two moving vehicles is required such as, for example, the follow-me feature on an unmanned aerial vehicle.

The moving base feature also enables derivation of the **vehicle orientation** by mounting two or three GNSS receivers on the same vehicle platform. That is, by fixing the position of the GNSS antennas relative to each other.

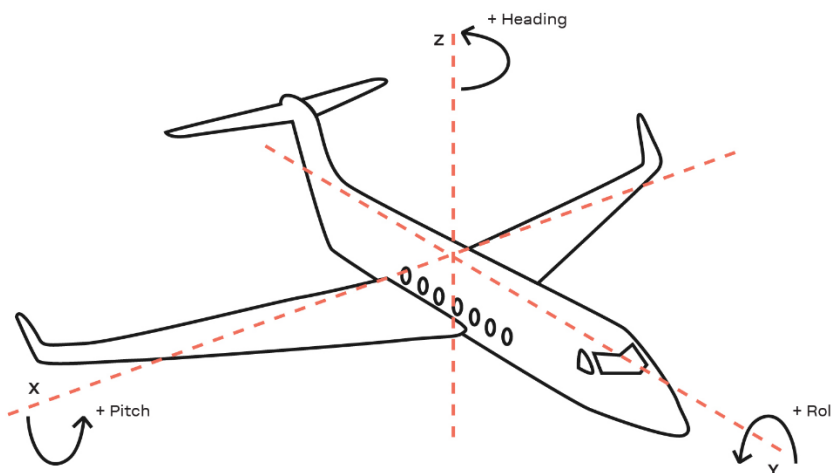


Figure 1: Orientation of a vehicle in space



Mounting two antennas on the X-axis gives heading and roll information.

The **heading** information and **relative position** is output by the rover. See section 2.4 on the output from ZED-X20P base and ZED-X20P rovers.

Using differential correction data for the base receiver.

If the **absolute position** of the rover is required with high precision, the base unit can be provided with correction data as well. See Figure 2 for such a setup. This allows the base to enter the **RTK Fixed mode**, improving the absolute position accuracy. Without receiving corrections, the base has a standard 3D Fix position accuracy.

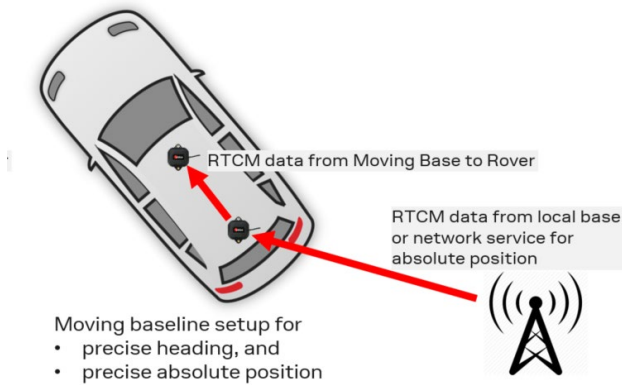


Figure 2: Moving base setup for precise heading and precise absolute position of the rover.

In Figure 2, the rear antenna is the base antenna, and the front antenna is the rover antenna. Heading is from the base to the rover antenna.

1.2 Real-world applications

Moving base support is applicable across a diverse range of fields, including:

- Drone attitude and heading determination
- Drone follow-me sport and filming applications
- Ship heading determination
- Ship portable pilot units
- Vehicle heading determination
- Heavy machinery motion control
- Farming vehicle heading determination and control
- Traditional survey with moving base addition
- Sporting event data analysis
- Cellular base station antenna alignment



Figure 3: Drone attitude determination – base and rover on the drone



Figure 4: Farming application – position and heading, base and rover on the vehicle



Figure 5: Drone follow-me filming – typically only a rover on the drone



Figure 6: Heavy machinery control – blade leveling and heading, base and rover on the vehicle



Figure 7: Automotive vehicle heading determination – base and rover on the vehicle



Figure 8: Antenna pointing systems – base and rover on a single-cell antenna panel



Figure 9: Portable ship pilot systems for entering/exiting harbors - base and rover on the ship.

Table 1 describes typical parameters of the above-mentioned applications.

Application	Key data	Number of GNSS receivers	Baseline length and type
Drone attitude and heading determination	Roll, pitch and yaw	3	Fixed baseline, 20-30 cm
Drone follow-me sport and filming applications	Heading, relative position	2	Several to ten meters
Precise ship navigation	Heading	2	Fixed baseline, up to 100 m
Automotive vehicle heading determination	Heading	2	Fixed baseline, 1-3 m
Antenna attitude measurement and control	Heading / attitude	2	Fixed baseline, 10-50 cm

Table 1: Typical moving base applications and key characteristics

2 System-level considerations

As outlined in the previous chapter, two or more GNSS receivers (with separate antennas) are required to determine the relative position between the GNSS receivers. This chapter provides recommendations and detailed examples on how to develop high-performance moving base applications with u-blox ZED-X20P receivers.

2.1 GNSS antenna considerations for moving base RTK

 The following points only need to be considered if a patch antenna is used and the application has a short baseline and minimal space for ground planes. Typically, these points need to be considered for heading determination in drones and cellular antenna pointing. The use of a helical antenna would be ideal for such applications as they do not require ground planes. Long baselines (meters to kilometers) are not affected.

If used on the same vehicle for heading and precise attitude determination (for example a drone), the antennas should be identical and ideally on an identical ground plane size and shape. In addition, the antennas should be in the same plane with the same orientation.

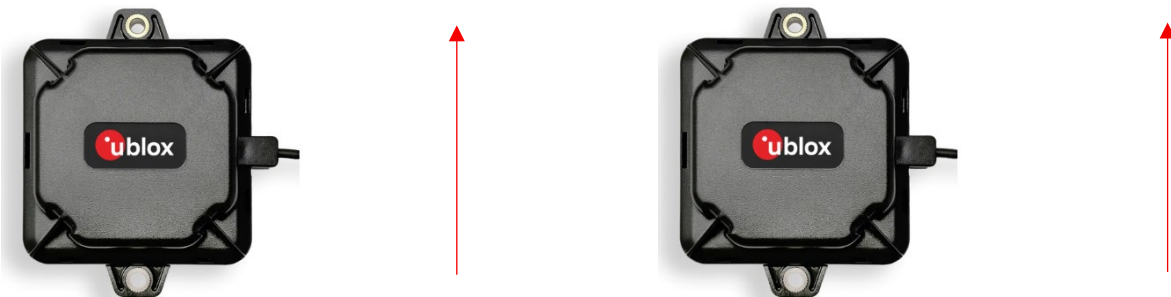


Figure 10: Very short baseline, heading application – patch antenna mounting.

2.1.1 Ground plane size and shape

In an application where the base and rover are located far from each other, for instance the rover on a drone and the base on a ship, the ground plane shape has much less effect as the baseline is very long – possibly kilometers. Nevertheless, it is still required that each antenna has the minimum ground plane size, except for a helical antenna which does not require a ground plane for good RTK performance.

A minimum ground plane size and uniform shape is required for best performance if using a patch antenna in a heading application on a moving object, such as a drone with a short distance between the antennas. The shorter the distance between the two antennas is, the more critical this becomes. The ground plane shape could distort the antenna phase center offset and create an error in the position. The performance of a patch antenna for good RTK performance is also affected by the size and shape of the ground plane. A helical antenna would prevent such issues.

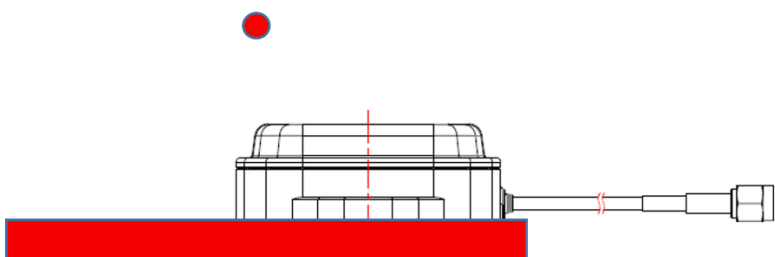


Figure 11: Average antenna phase center offset due to ground plane offset.

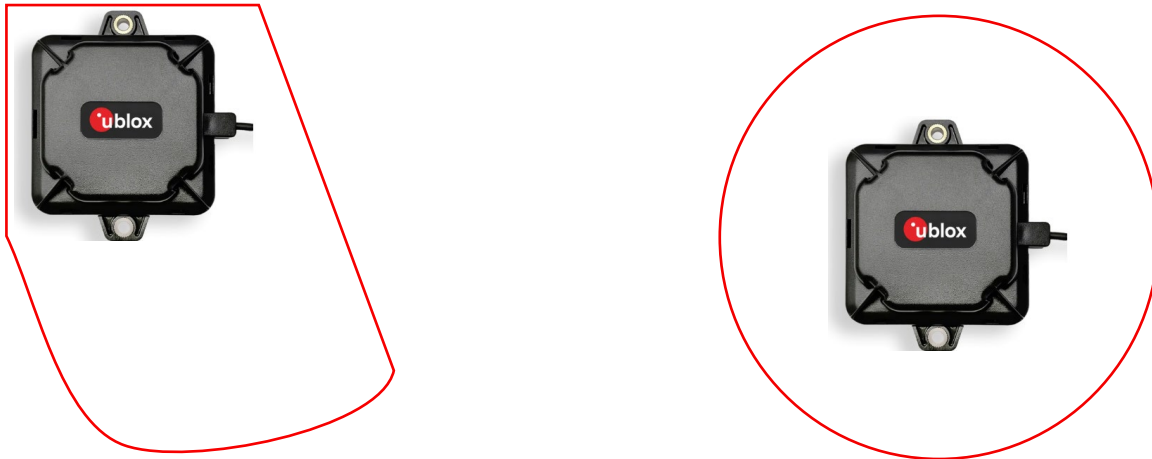


Figure 12: Non-uniform ground plane shape will offset the phase center (image on the left). Uniform circular ground plane (10 cm) provides best accuracy and performance (image on the right).

2.1.2 Multipath/obscuration from surrounding structures

Any surrounding structures will cause multipath (causing position error) and obscure the satellites. Therefore, ensure that the GNSS antennas are above any structures that may cause this issue.



Antennas mounted above structure and noise from motors.

Figure 13: Drone application and recommended position of the GNSS antennas



Antennas mounted above metal back plane.

Figure 14: Cellular base station antenna pointing application.



Antennas mounted up
and away from structure.

Figure 15: Antenna placement in heavy machinery/machine control application

2.2 Providing corrections between base and rover

For each navigation epoch, the base produces a batch of RTCM 3.4 compliant messages. For operation in the default GNSS configuration mode, the recommended list of RTCM messages is:

- RTCM 1074 GPS MSM4
- RTCM 1084 Glonass MSM4
- RTCM 1094 Galileo MSM4
- RTCM 1124 BeiDou MSM4
- RTCM 1230 Glonass code-phase biases
- RTCM 4072.0 Reference station PVT (u-blox proprietary RTCM message)

For detailed configuration instructions, refer to the ZED-X20P Integration manual [2] section 2.4 Base and rover configuration for moving base RTK operation.

Moving base feature improves the reliability and stability of the moving base RTK solution and allows easier integration of RF links and serial links.

For optimal moving base RTK operation, this group of messages should be received at the rover without transmission losses or errors. The size of the messages can vary depending on the number of satellites received and the configured GNSS constellations.

The achievable navigation update rate of the moving base RTK solution is limited by the communication link latency. As a rule of thumb, the communication link latency should be less than the desired navigation update period by 50 ms.

The UART2 interface is recommended as the default RTCM interface. By default, the ZED-X20P UART2 is assigned with a baud rate of 38400 baud. This can be increased if RTCM messages drop due to insufficient baud rate for navigation rates above 1 Hz.

2.2.1 Wired connection between base and rover

For a standard moving platform heading determination application, the corrections from the moving base are supplied to the rover via any available serial port:

- UART1
- UART2
- USB (only via a USB “device – host – device” implementation)
- I2C (only via an I2C “device – host – device” implementation)
- SPI (only via an SPI “device – host – device” implementation)

It is important to ensure that only the RTCM correction data is supplied on the communication interface used between the two units.

Only the RTCM protocol is enabled by default on UART2. No RTCM message is enabled by default to be output on UART2. This allows the UART2, base TX/rover RX communication between the two devices to be connected without issues such as buffer overflowing or the wrong messages being sent into the rover unit if it is powered on with the default configuration. For example, do not allow NMEA output messages to be fed back into UART2. They are disabled by default. Only enable the required RTCM messages to be output on the base ZED-X20P UART2.

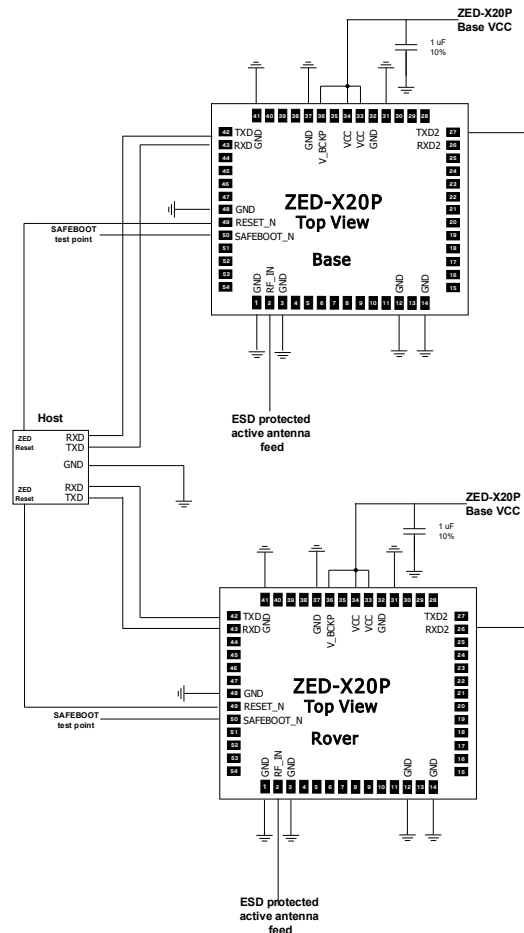


Figure 16: Shows a high-level schematics diagram of a design where the base and the rover are connected via corresponding UART2 interfaces of the modules.

-  Level converters and buffers may be required on the ZED-X20P RX/TX lines to the host. These must be supplied by the ZED-X20P VCC to ensure the correct ZED-X20P I/O states at power up and power off. Remember to not drive any pin when the module is not powered. This also means power up base before rover.
-  This circuit assumes the rover is already configured to provide the required output messages for the remote host. If dynamic message selection is required during the rover use, the base host needs to have a gate to interrupt the RTCM message flow from the base to the rover and insert the UBX configuration commands. However, this results in a loss of RTCM messages at the rover during the transfer of commands.

2.2.2 Wireless connection between base and rover

In some of the moving base applications illustrated before, for example in a ship-to-drone application, both base and rover are moving independently of each other. They are connected via a wireless link.

Typically, this wireless link has a single RX/TX interface. Therefore, we recommend using ZED-X20P UARTs, as they support all NMEA, UBX and RTCM 3.4 protocols.

- Stream RTCM data from the ZED-X20P base to the ZED-X20P rover on drone.
- From the ZED-X20P rover on the drone, stream UBX and NMEA back to the host and not to the ZED-X20P base.

The radio system must be capable of supporting the RTCM messages downstream and the NMEA upstream, ensuring that the RTCM message transmission can be completed fast enough to support the desired rover update rate.

The throughput requirements for the wireless link are stricter if the maximum moving base navigation rate of 5 Hz (default GNSS systems) is to be supported. In this case, the communication link must be able to stream RTCM messages to the rover with the maximum latency of roughly 150 ms. This link must also be capable of streaming the NMEA/UBX data back to the host at 5 Hz. The amount of UBX messages and the type of messages (such as UBX debug info) have a drastic effect on the link capacity and latency. Depending on whether the RF link is also expected to carry a user system protocol and other data, this could be more difficult than expected.

2.4 GHz technologies such as Classic Bluetooth® and Wi-Fi are good for relatively short-range applications¹. They have the RF throughput and low latency capacity as long as any user data does not load the data link to the detriment of the RTCM stream requirements.

Wi-Fi at 2.4 GHz offers good range with a 2.4 GHz single-band antenna. It provides a better gain than a dual band 2.4/5 GHz Wi-Fi antenna. If the UDP protocol is used over the link, it offers the lowest latency and reduced data flow over the link.

Legacy low-power RF devices are usually not suitable as a wireless link due to their limited TX buffer size and real-time link data transfer capacity.

Longer ranges require RF links with greater RF transmit power/ lower frequency, but will need to have the same throughput and latency requirements if running the ZED-X20P at 5 Hz navigation rate. In most countries, longer communication ranges require the use of RF links in licensed bands. However, some countries allow much higher TX power on 2.4 GHz and 900 MHz bands than Europe.

For a 1 Hz navigation rate, the default baud rate of 38400 on UART2 interface on base and rover is sufficient to transmit and receive RTCM messages. While the default baud rate of 38400 on UART1 of rover is enough to transmit basic NMEA and UBX-NAV-RELPOSNE messages back to the host, a higher baud rates should be configured if more messages are enabled.

For a 5 Hz navigation rate, a baud rate of 57600 on UART2 interface on base and rover is recommended to transmit and receive RTCM messages. While a baud rate of 115200 on UART1 of rover is recommended to transmit basic NMEA and UBX-NAV-RELPOSNE messages back to the host, a higher baud rates should be configured if more messages are enabled.

Bluetooth LE and Bluetooth 5 are not ideal technologies for the RF link between base and rover considering required throughput and range. Consider these very carefully along with practical testing before implementing these as the RF solution.

Figure 17 shows the schema for a ZED-X20P base connected to a ZED-X20P rover via a wireless link.

¹ Bluetooth® is a registered trademark of Bluetooth SIG, Inc.

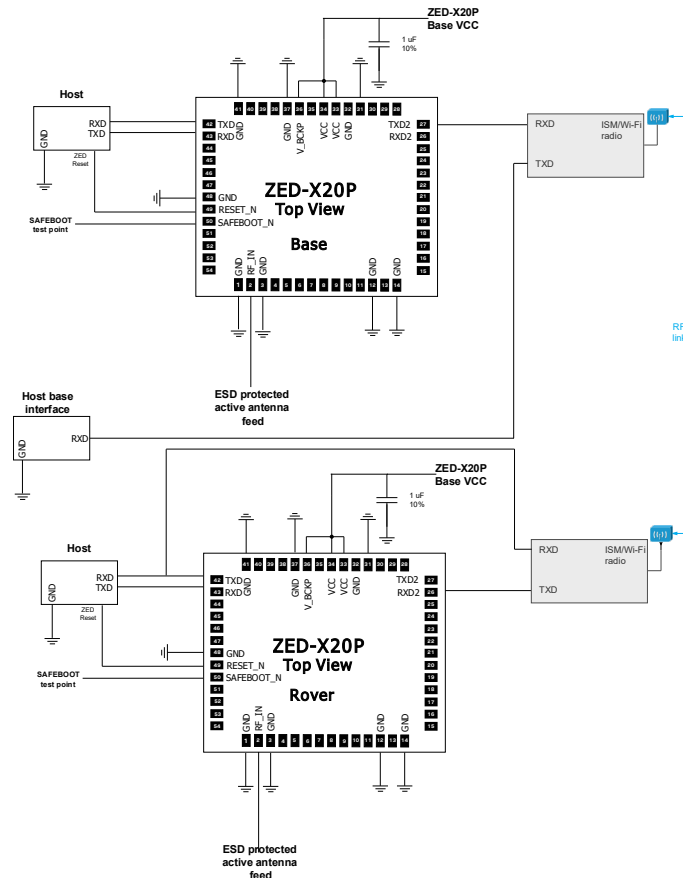


Figure 17: Simplified schematics diagram of a ZED-X20P base and a rover connected via a wireless link.

-  Level converters and buffers may be required on the ZED-X20P RX/TX lines. These must be supplied by the ZED-X20P VCC to ensure the correct ZED-X20P I/O states at power up and power off.
-  This circuit assumes the rover is already configured to provide the required output messages for the remote host. If dynamic message selection is required during the rover use, the base host needs to have a gate to interrupt the RTCM message flow from the base to the rover and insert the UBX configuration commands. However, this results in a loss of RTCM messages at the rover during the transfer of commands.

2.2.3 Testing and debugging RF link application

RF links are inherently prone to issues such as data loss, signal fading, and limited RF link rate. In addition, TX/RX buffer sizes and any existing communication protocols significantly impact the successful reception of RTCM messages. For moving baseline applications, ensure all requirements are met, as these are more demanding than standard static base RTK applications.

1. Ensure that time-tagged RTCM messages are received completely at the rover to be used for each RTK epoch. If operating at navigation rates higher than 1 Hz, monitor the latency of receiving complete groups of valid time-tagged messages, as this becomes increasingly important at higher rates.

2. When using navigation rates such as 5 Hz with default GNSS constellations, observe that excessive latency will cause the rover RTK solution to slow down its navigation rate. To mitigate this, use a higher baud rate on UART interfaces speed for optimal performance. Verify that the effective RF link rate and TX/RX buffer size are sufficient to support this speed, since ZED-X20P does not support hardware flow control.
3. To monitor the effective navigation rate at the rover, check the UBX-NAV-PVT or NMEA RMC messages for GPS Time of Week (TOW) updates. For example, at a 5 Hz navigation rate, GPS TOW should update every 200 ms. Configure these messages to output at the selected navigation rate to ensure accurate monitoring. Alternatively, UBX-NAV-RELPOSNED can be used, provided it is set to output at the selected navigation rate.

2.2.4 Improving RF link performance

To optimize the performance of a wireless base-rover setup, do the following:

1. Start by sending the minimum number of messages back from the rover.
2. Select 1 Hz navigation rate and check the GPS TOW update rate in the NMEA RMC or UBX-NAV-PVT or UBX-NAV-RELPOSNED message flag fields. Slowly increase the navigation rate if required and check if the GPS TOW update rate is the same as the set navigation rate. If the NMEA RMC or UBX-NAV-PVT output does not match the set navigation rate, the link latency and RF range have issues, and some messages can be missing. If the link cannot work as expected with the base and rover near each other, it will not work at real ranges.
3. Test the wireless base-rover setup at the expected RF range and environment and monitor it as indicated in step 2. If your expected range is not achieved, ensure that the antennas on the base and the rover have the maximum legal gain for the frequency you are transmitting at and are not obscured in any way. If the range you need is higher than the link reliably supports, another RF technology could be required.
4. To reduce RF latency and load, decide on the minimum number of GNSS constellations you need and disable those you can do without. Reducing the GNSS systems being received on the base and rover reduces the number of messages and message contents that need to be transferred. If only GPS is needed, the other systems can be disabled.

2.3 Receiver configurations

2.3.1 Default 1 Hz navigation rate application

Running at a default 1 Hz navigation rate is the simplest implementation, especially when a wireless link is used between a base and a rover. The minimum baud rate is 38400 baud if using NMEA only and the required RTCM 3.4 compliant messages.

By default, the receivers operate at 1 Hz. Therefore, no configuration of the navigation rate is required.

- The default UART1/UART2 baud rate of 38400 baud does not need changing.
- Set base ZED-X20P to output the required RTCM messages on UART2.



The binary messages include writing the configuration to flash for each message.

1. Set the base ZED-X20P UART2 to output the required RTCM messages:

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE4072_0_UART2	0x20910300	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 00 03 91 20 01 53 51

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE1074_UART2	0x20910360	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 60 03 91 20 01 B3 31

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE1084_UART2	0x20910365	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 65 03 91 20 01 B8 4A

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE1094_UART2	0x2091036a	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 6A 03 91 20 01 BD 63

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE1124_UART2	0x2091036f	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 6F 03 91 20 01 C2 7C

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE1230_UART2	0x20910305	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 05 03 91 20 01 58 6A

With antennas connected both to the base and the rover, the base outputs all the RTCM messages and the rover switches to the RTK Fixed mode if the GNSS signal conditions are sufficient.

The host UART1 interface has additional messages enabled as per the user's requirement. However, the rover must output UBX-NAV-RELPOSNED message to the host for the heading and base line length output.

2. Enable UBX-NAV-RELPOSNED on the rover UART1:

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-UBX_NAV_RELPOSNED_UART1	0x2091008e	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 8E 00 91 20 01 DE 0B

2.3.2 5 Hz navigation rate application

A default baud rate of 57600 is recommended on the base and rover for UART2, while a baud rate of 115200 is recommended on UART1 of rover to transmit basic NMEA and UBX messages:

- Set the navigation rate on the base and rover to 5 Hz (200 ms).
- Set the baud rate of 57600 on the UART2 of base and rover
- Set UART1 on the rover to 115200 baud.
- Enable the required RTCM messages as shown above on the base.

1. Configure the base and rover navigation rates:

Send this message to each unit.

Key	Key ID	Type	Value	RAM	FLASH
CFG-RATE-MEAS	0x30210001	U2	200 (0xc8)	1	0

Binary message: B5 62 06 8A 0A 00 00 01 00 00 01 00 21 30 C8 00 B5 81

- Configure the base and rover UART2 baud rates:

Send this message to each unit.

Key	Key ID	Type	Value	RAM	FLASH
CFG-UART2-BAUDRATE	0x40530001	U4	57600(0xe100)	1	0

Binary message: B5 62 06 8A 0C 00 00 01 00 00 01 00 53 40 00 E1 00 00 12 06

- Configure the rover UART1 baud rate:

Send these messages to the rover unit.

Key	Key ID	Type	Value	RAM	FLASH
CFG-UART1-BAUDRATE	0x40520001	U4	115200 (0x1c200)	1	0

Binary message: B5 62 06 8A 0C 00 00 01 00 00 01 00 52 40 00 C2 01 00 F3 A5

- Set the base ZED-X20P UART2 to output the required RTCM messages:

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE4072_0_UART2	0x20910300	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 00 03 91 20 01 53 51

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE1074_UART2	0x20910360	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 60 03 91 20 01 B3 31

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE1084_UART2	0x20910365	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 65 03 91 20 01 B8 4A

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE1094_UART2	0x2091036a	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 6A 03 91 20 01 BD 63

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE1124_UART2	0x2091036f	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 6F 03 91 20 01 C2 7C

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-RTCM_3X_TYPE1230_UART2	0x20910305	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 05 03 91 20 01 58 6A

With the GNSS antennas connected both to the base and the rover, the base outputs all the RTCM messages and the rover switches to the RTK Fixed mode if GNSS signal conditions are sufficient.

The host UART1 interface has additional messages enabled as per the user's requirement. However, the rover must output UBX-NAV-RELPOSNED message to the host for the heading and base line length output.

5. Enable UBX-NAV-RELPOSNED on the rover UART1:

Key	Key ID	Type	Value	RAM	FLASH
CFG-MSGOUT-UBX_NAV_RELPOSNED_UART1	0x2091008e	U1	1 (0x1)	1	1

Binary message: B5 62 06 8A 09 00 00 05 00 00 8E 00 91 20 01 DE 0B

2.4 Using the heading output

Obtain the heading output from the UBX-NAV-RELPOSNED message provided by the ZED-X20P rover. For technical details, refer to the ZED-X20P Interface description.

The UBX-NAV-RELPOSNED message provides:

- The RTK-calculated relative position between two antennas.
- A normalized baseline distance of one meter.
- The resulting RTK heading output.

 The normalized distance is always reported as 1 meter, regardless of the actual baseline. It cannot be used to assess RTK performance.

 Note that a valid heading is reported only when the rover is in RTK fixed status.

1. For an application in which two antennas are mounted on the same moving platform, the precise known distance between the two antennas can be used to validate the moving base RTK solution, including the heading output. If the RTK calculated distance does not closely match with the known baseline distance, there is a high probability that ambiguities were fixed incorrectly and, therefore, the computed rover relative position and baseline heading are wrong, especially if the distance between the antennas is very short. The ZED-X20P UBX-NAV-RELPOSNED message, normalized distance between base and rover antenna, cannot be used to verify good RTK performance as it is always output as 1 m.
2. The UBX-NAV-RELPOSNED heading output has no additional low pass filtering. This allows the user application to add additional low pass filtering depending on the application-specific operating conditions and required heading output for the end application.
3. Example
 - For cellular base station antenna attitude applications, there is a maximum settling time requirement for any large physical antenna heading change. The low pass filtering can be adjusted to match this to prevent short-term effects on the heading output in the application. Known dynamics of the antenna position changes can also be used to filter out any sudden angular rates.
 - For automotive applications, a different filtering strategy can be used due to the dynamics and rapidly changing satellite visibility. Urban canyon has the most multi-path and satellite obstruction causing position inaccuracy and it is typical to have angular rates of automobiles in this kind of environment. Suddenly, large angular rates should be filtered.

3 Using the EVK-X20P as a moving base application

The EVK-X20P application board can be used in a base and rover pair using a wired serial connection for moving base applications.

In addition, the base EVK-X20P can receive RTCM 3.4 compliant correction data to improve absolute accuracy.

For further information, see the EVK-X20P User guide [5].

For further information on the moving base configuration, see ZED-X20P Integration manual [2].

3.1 Wired UART base and rover

If two units are to be located close together, the boards can be connected using wires and there is no need for a wireless link.

In this case, we connect via UART1 of the two boards. As one board only transmits and the other one only receives, we can achieve the needed communication by connecting the base TX line to the rover RX line. In addition, we connect the ground between the two boards.

The connections needed are summarized in the table below and illustrated in figure 18.

Base	Rover	Remark
GND pin13	GND pin 13	Connects ground between the two boards
TXD pin 3	RXD pin 2	Connects base TX line to rover RX line

Table 2: EVK-X20P UART1 wired connection list.

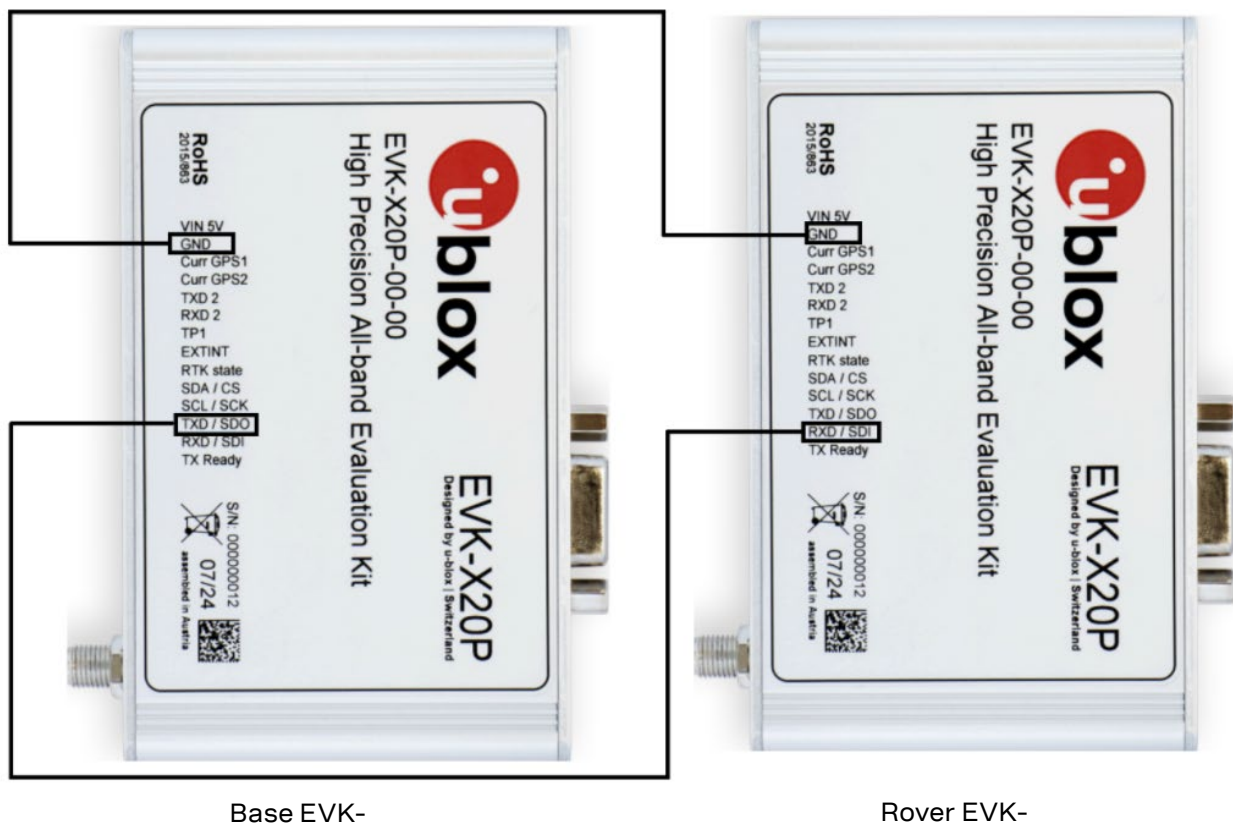


Figure 18: Two EVK-X20P application boards connected via UART lines.

Related documents

- [1] ZED-X20P-00B Data sheet, [UBXDOC-963802114-12690](#)
- [2] ZED-X20P Integration manual, [UBXDOC-963802114-12901](#)
- [3] HPG 2.10 Interface description, [UBXDOC-304424225-21263](#)
- [4] ANN-MB Data sheet, [UBXDOC-963802114-12775](#)
- [5] EVK-X20P User guide, [UBXDOC-963802114-12969](#)
- [6] [u-center 2](#) evaluation software.

 For regular updates to u-blox documentation and to receive product change notifications, register on our homepage (www.u-blox.com).

Revision history

Revision	Date	Comments
R01	07-Oct-2025	Initial revision
R02	24-Jun-2026	Public revision

Contact

u-blox AG

Address: Zürcherstrasse 68
8800 Thalwil
Switzerland

For further support and contact information, visit us at www.u-blox.com/support.