EVK-X20P

Evaluation kit

User guide

Abstract

This document describes the structure and use of the EVK-X20P evaluation kit and provides information for evaluating u-blox X20P high precision positioning technology.

UBXDOC-963802114-12969 - R05
C1-Public

Document information

Title	**EVK-X20P**	
Subtitle	Evaluation kit	
Document type	User guide	
Document number	UBXDOC-963802114-12969	
Revision and date	R05	16-Feb-2026
Disclosure restriction	C1-Public	

This document applies to the following products:

Product name	Type number	FW version	IN/PCN reference
EVK-X20P	EVK-X20P-00-00	HPG 2.00	N/A
EVK-X20P	EVK-X20P-00-01	HPG 2.02	N/A

Contents

1 Product description

1.1 Overview

The EVK-X20P evaluation kit simplifies the evalution of the u-blox X20P all-band high precision positioning product.

The built-in USB interface provides both power and USB-to-serial communication to the receiver, keeping the possibility to also connect through a 14-pin connector or a dedicated RS-232 port. The versatile interfaces and measurement points enable advanced evaluation needs.

u-blox evaluation kits are compact, and their user-friendly interface and power supply make them ideally suited for use in laboratories or vehicles.

Evaluation kit	Description	Related products
EVK-X20P	u-blox X20 GNSS evaluation kit for ZED-X20P module with ANN-MB2 included	ZED-X20P-00B, ZED-F20P-00B

Table 1: List of products supported by EVK-X20P evaluation kit.

1.2 Kit contents

The delivery package contains:

- Compact EVK-X20P evaluation unit
- 14-pin front connector breakout cable
- ANN-MB2 all-band (L1/L2/L5/E6/B3/L) active GNSS antenna with 5m cable
- Antenna ground plane
- USB-A to USB-C cable
- EVK welcome card
- Promotional card of PointPerfect Service

1.3 Software and documentation

The product evaluation software includes u-center 2, an interactive tool for configuration, testing, visualization and data analysis of GNSS receivers. It provides useful assistance during all phases of system integration. Use the latest software version available for X20 products.

The product evaluation software and documentation are available on the u-blox web site.

1.4 System requirements

- PC with USB interface (compatible with USB 2.0)
- Operating system: Microsoft Windows 10 and later (x86 and x64 versions)
- Internet connection for the first-time and for receiving corrections if PointPerfect service is opted

2 Specifications

Parameter	Specification
Serial interfaces	1 USB Type-C 1 UART, maximum data rate 8 Mbit/s via the 14-pin connector or 3 Mbit/s via USB-to-UART bridge DB9-RS-232 with Time pulse 14 pin-3.3 V logic, maximum baud rate 921600 bauds 1 DDC (I2C compatible) max 400 kHz 1 SPI - clock signal max 12 MHz - SPI DATA max 1 Mbit/s
Interfaces	1 RTK state output 1 slide switch to select between I2C and SPI interfaces 1 TXD/SDO, can act as either TXD or SDO depending on usage (I2C/SPI) 1 RXD/SDI, can act as either RXD or SDI depending on usage (I2C/SPI) 1 LED, device status indicator 1 Time pulse output through 14-pin connector 1 external interrupt input
Dimensions	105 x 64 x 26 mm
Power supply	5.0 V via USB or powered via external power supply pin 14 (5V_IN) and pin 13 (GND)
Normal operating temperature	-40 °C to +65 °C

Table 2: EVK-X20P specifications

2.1 Safety precautions

EVK-X20P must be supplied by a PS1 class limited power source while not powered via USB. See section 6.2.2.4 of IEC 62368-1:2018 [5] for more information on the PS1 class.

In addition to a limited power source, only ES1 class circuits are to be connected to the EVK-X20P, including interfaces and antennas. See section 5.2.1.1 of IEC 62368-1:2018 [5] for more information on the ES1 class.

2.1.1 Certifications

EVK-X20P is designed to comply with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU.

EVK-X20P complies with the Directive 2011/65/EU (EU RoHS 2) and its amendment Directive (EU) 2015/863 (EU RoHS 3).

3 Device description

3.1 Interface connection

EVK-X20P supports USB and UART communication interfaces. To connect the EVK to a PC, use a standard D-Sub DB9 cable or the USB-C cable included in the product package. The EVK includes an on-board USB-to-Serial converter for USB-to-UART communication with the receiver and as a direct USB interface. For measuring current and evaluating the available digital interfaces, additional measurement equipment and devices can be connected to the 14-pin connector on the front side of the EVK unit. The EVK design allows the front side pins to be used simultaneously with the other ports.

☞ Do not drive any of the IO pins when the EVK is not connected to a power supply.

Figure 1: Connecting the EVK-X20P unit for power supply and communication

3.2 Active antenna

The EVK-X20P evaluation kit includes an ANN-MB2 all-band (L1/L2/L5/E6/B3/L) active GNSS antenna with a 5-meter cable and an SMA connector.

Typical DC current consumption of the ANN-MB2 antenna is 15 mA at 5 V.

3.3 Evaluation unit

Figure 2 shows the front and back of the EVK-X20P evaluation unit. The front panel provides reset and safe boot buttons (RST and BOOT), 14-pin connector, slide switch, LED (TP1) and antenna connector (RF IN), while the rear panel provides USB and DB9 connectors.

Figure 2: The front and back of EVK-X20P

3.3.1 Antenna connector (RF IN)

⚠ **CAUTION** Risk of equipment damage. Connecting this equipment to cable distribution systems may damage the EVK. Use the connector only with a GNSS antenna or a GNSS simulator.

An SMA female jack is available on the front side of the evaluation unit for connecting an active GNSS antenna (see Figure 2). A DC voltage of 3.3 V is provided to power the active antenna, and the RF input is 3.3 V. The internal short circuit protection limits the maximum current to 60 mA. This pin is also ESD protected.

3.3.2 USB connector

The device features a USB port that serves both the data communication and power supply. It is connected to a USB hub, two USB-to-UART bridges, and a direct USB interface. This configuration enables simultaneous communication with the module's UART1, UART2, and the module's native USB interface via a single USB connection. For details of the receiver configuration, see the Interface description [4].

3.3.3 DB9 connector (RS-232)

The evaluation unit includes an RS-232 serial communication port which is compatible with PC serial ports. The DB9 connector is an alternative option to access the UART1 input if the user prefers not to use the UART1 via USB.

Connect a straight RS-232 serial cable with male and female connectors to the port on your PC. The maximum cable length is 3 meters. To configure the RS-232 port, use the CFG-UART1 command in the u-center 2 application. If you are using a USB to RS-232 adaptor cable, you can connect it directly to the evaluation kit RS-232 port.

The 9-pin D-Sub female connector is assigned as listed in Table 3 and diagram from schematic:

Pin no.	Assignment
1 & 6	Time pulse 1 output (RS-232 levels)
2	TXD, GNSS Transmit Data, SPI/SDO
3	RXD, GNSS Receive Data, serial data from DTE, SPI/SDI
4	EXTINT (External Interrupt)
5	GND
7, 8 & 9	not connected

Table 3: D-Sub DB9 connector pin description for EVK-X20P

3.3.4 UART1 through 14-pin connector

The EVK also provides UART1 communication through the 14-pin connector on the TxD and RxD pins. The maximum operating baud rate is 8000000 baud. These pins are LVCMOS standard and cannot drive cables. See section 14-pin connector for more information.

3.3.5 Reset button

The reset button (RST) on the front panel resets the unit.

⚠ **CAUTION** Risk of data loss. The RST button deletes all information from the volatile memory and triggers a cold start. Reset the system only as a recovery option.

3.3.6 Safe boot button

The safe boot button (BOOT) is used to set the unit in the safe boot mode. In this mode, the receiver executes only minimal functionality, such as updating new firmware into the flash memory. To set the receiver in the safe boot mode:

1. Press the BOOT button and keep holding it down.
2. Press the RST button.
3. Release the RST button.
4. Release the BOOT button.
5. If the UART interface is used, send a training sequence to the receiver. The training sequence is a transmission of 0x55 0x55 at 9600 baud. Wait for at least 100 milliseconds before the interface is ready to accept commands.

3.3.7 Slide switch

Use the slide switch on the front panel to choose between I2C (with UART1) and SPI communication ports.

1. **I2C** – In this selection, the EVK operates with the 3.3 V DDC interface (I2C compatible) with the UART1 (TxD and RxD) via the front panel and the UART1 via the RS-232 (DB9) port.
2. **SPI** – In this selection, the EVK operates only with the SPI interface while the UART1 communication via the front panel (TxD and RxD) and the RS-232 (DB9) port and is disabled.

⚠ **CAUTION** Risk of device damage. Changing the interface switch position while the EVK is powered on may damage the GNSS receiver chip. Power off the EVK before changing the interface switch mode.

3.3.8 14-pin connector

The 14-pin connector provides additional functionality to the EVK, allowing access to the interface pins and an ability to measure the current used by the ZED-X20P module. All the pins are ESD protected.

Pin no.	Pin name	I/O	Level	Description
14	VIN 5V	I	4.75 - 5.25 V	Power input. This can be used instead of USB.
13	GND	-	-	Common ground pin
12	CUR GPS1	O	3.3 V	Supply current measurement (Module current consumption) node 1. Current is measured over a 1Ω 1% tolerance resistor between pins 12 and 11. Pin 12 (CUR_GPS1) is at higher potential.
11	CUR GPS2	O	3.3 V	Supply current measurement (Module current consumption) node 2. See description for pin 12.
10	TxD2	O	3.3 V	UART2 TxD
9	RxD2	I	3.3 V	UART2 RxD
8	TIMEPULSE 1	O	3.3 V	Output signal for the timepulse1 signal.
7	EXTINT	I	3.3 V	External interrupt or time-mark input (connected directly to the module pins)
6	RTK status	O	3.3 V	RTK status: 0 = RTK/PPP-RTK fixed blinking = receiving and using corrections 1 = no corrections

Pin no.	Pin name	I/O	Level	Description
5	SDA / CS	I/O	3.3 V	If slide switch on I2C, the DDC interface is selected; Function: data input / output If slide switch on SPI, the SPI interface is selected; chip select input – LOW ACTIVE
4	SCL / CLK	I/O	3.3 V	Clock input / output (signals are pulled up and then straight to the module)
3	TxD / SDO	O	3.3 V	If slide switch on I2C, the DDC interface is selected; UART1 TxD (3.3 V level) If slide switch on SPI, the SPI interface is selected; Primary in secondary out (SDO)
2	RxD / SDI	I	3.3 V	If slide switch on I2C, the DDC interface is selected; UART1 RxD (3.3V Level) If slide switch on SPI, the SPI interface is selected; Primary in secondary in (SDI)
1	TX Ready	O	3.3 V	

Table 4: Connector pin description for EVK-X20P (pins numbered from right to left on the front panel)

For power supply, use a max 1 m cable. Figure 3 shows an example of a power supply connected to the test connector by using standard adapter cables manufactured by Hirschmann. Table 4 shows an example for overall current measurement. When connecting the 3.3 V UART, SPI and DDC digital interfaces to your application, use a maximally 25 cm long cable.

Figure 3: EVK-X20P 5.0 V DC power supply example

3.3.9 LED (TP1)

On the front panel of the EVK unit, there is a single blue LED with the following functionality:

LED	Description
Solid blue LED	The device is powered on with no GNSS fix.
Flashing blue LED	The LED flashes one pulse per second during a GNSS fix The time pulse signal is configurable, see the Interface description [4] for details.

Table 5: LED description

3.3.10 Battery-backed RAM functionality

A battery is not included in the EVK-X20P kit. To use the battery-backup RAM (BBR) functionality, open the evaluation unit and insert a lithium coin battery (CR2032, 3V).

4 Getting started

4.1 Installing u-center 2 software

u-center 2, the u-blox interactive evaluation software is required for configuration, testing, visualization and data analysis of u-blox GNSS receivers as well as EVKs. The EVK user guide together with the u-center 2 evaluation tool provide useful assistance during all phases of a system integration project. To install the u-center 2 evaluation software tool, follow the steps available on www.u-blox.com/product/u-center. For more information on using the u-center 2 evaluation software tool, refer to the u-center 2 user guide [1].

The Microsoft driver required for the Windows 11 USB interface is available through the Windows Update service. The system automatically downloads and installs it.

⚠ **CAUTION** If the driver is not installed automatically, you can manually install it from windows drivers for USB to UART converter.

4.2 Installing hardware

⚠ **CAUTION** Changing the slide switch position while the EVK is powered on may damage the GNSS receiver chip. Power off the EVK before changing the slide switch setting.

1. Before connecting the interface cable to the EVK, select the interface that you are using by sliding the interface switch to the correct position:
   - **Slide the switch to I2C to use UART1 via RS-232 and I2C compliant DDC interface.**
   - **Slide the switch to SPI to use the SPI interface.**
   - **The USB-C interface is independent from the slide switch.**
2. Connect the corresponding interface pins on the 14-pin connector (see Table 6 for details).
3. Power the device on, either via USB on the back or through the 5V_IN input on the front of the EVK.
4. Connect the GNSS antenna to the RF IN SMA jack and place the antenna in a good sky view.
5. Start the u-center 2 evaluation tool and select the corresponding COM port and baud rate

☞ Refer to the u-center 2 user guide [1] for more information.

4.3 Default interface configuration

Parameter	Specification
UART1, Input	38400 baud, 8 bits, no parity bit, 1 stop bit. UBX, NMEA and RTCM 3.4 input protocols are enabled by default.
UART1, Output	38400 baud, 8 bits, no parity bit, 1 stop bit. NMEA protocol with GGA, GLL, GSA, GSV, RMC, VTG, TXT messages are output by default. UBX and RTCM 3.3 protocols are enabled by default, but no output messages are enabled by default.
UART2, Input	38400 baud, 8 bits, no parity bit, 1 stop bit. UBX protocol is enabled by default. NMEA protocol is disabled by default.
UART2, Output	38400 baud, 8 bits, no parity bit, 1 stop bit. UBX protocol is enabled by default. NMEA protocol is disabled by default.
USB	Default messages activated as in UART1. Input/output protocols available as in UART1.

Parameter	Specification
I2C	Compatible with the I2C industry standard, available for communication with an external host CPU or u-blox cellular modules, operated in the peripheral mode only. Default messages activated as in UART1. Input/output protocols available as in UART1. Maximum bit rate 400 kb/s.
SPI	Allow communication to a host CPU, operated in the peripheral mode only. Default messages activated as in UART1. Input/output protocols available as in UART1. SPI is not available unless D_SEL pin is set to low.

Table 6: Default configuration

5 Measuring current

The receiver starts up in the acquisition state to search for available satellites and download GNSS orbital data, i.e. ephemeris and almanac. After downloading the data, the receiver switches to the tracking mode and typically stays in it during continuous operation, reducing the current consumption. The time required to enter the tracking mode can be reduced by downloading aiding data from the AssistNow™ Online service.

To measure the total GNSS supply current with EVK-X20P, follow these steps:

1. Place the EVK in clear sky view and perform the test with good signals to ensure that the receiver can acquire the satellite signals.
2. Power up EVK-X20P.
3. Connect a true RMS voltmeter across CUR GPS1 (pin 12) and CUR GPS2 (pin 11) of the 14-pin connector.
4. Read the voltage (and average if necessary) on the voltmeter and convert it to current (1 mV equals 1 mA).

☞ For accurate supply current measurements, use a max 1 m cable.

☞ When connecting the 3.3 V RS-232, SPI and DDC digital interfaces to your application, use a max 25 cm cable.

☞ The total current measurement also accounts for the active antenna load. This is because the active antenna connected to the EVK's RF IN connector is powered via module's VCC_RF supply.

For more details, see the schematic in Figure 18

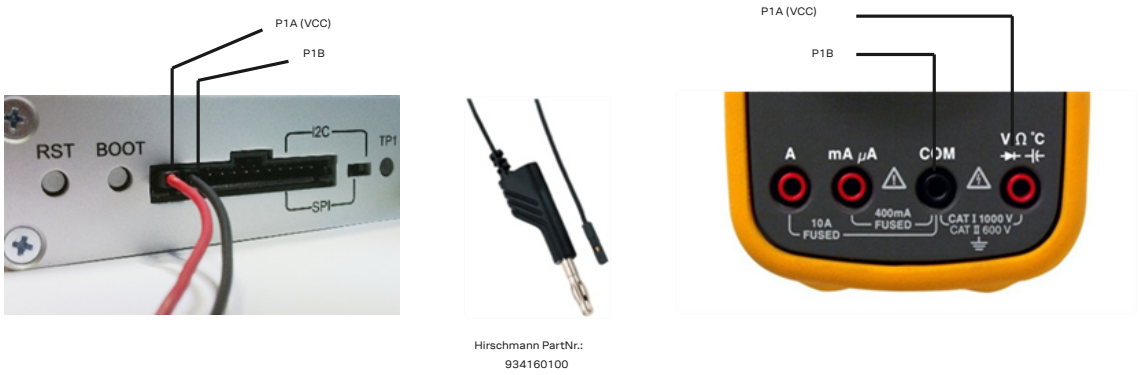

Figure 4: Example of tracking current measurement.

6 Device configuration

This section shows how to configure and evaluate EVK-X20P. The receiver can be configured with the Advanced Configuration View of the u-center 2 evaluation tool as shown in Figure 5.

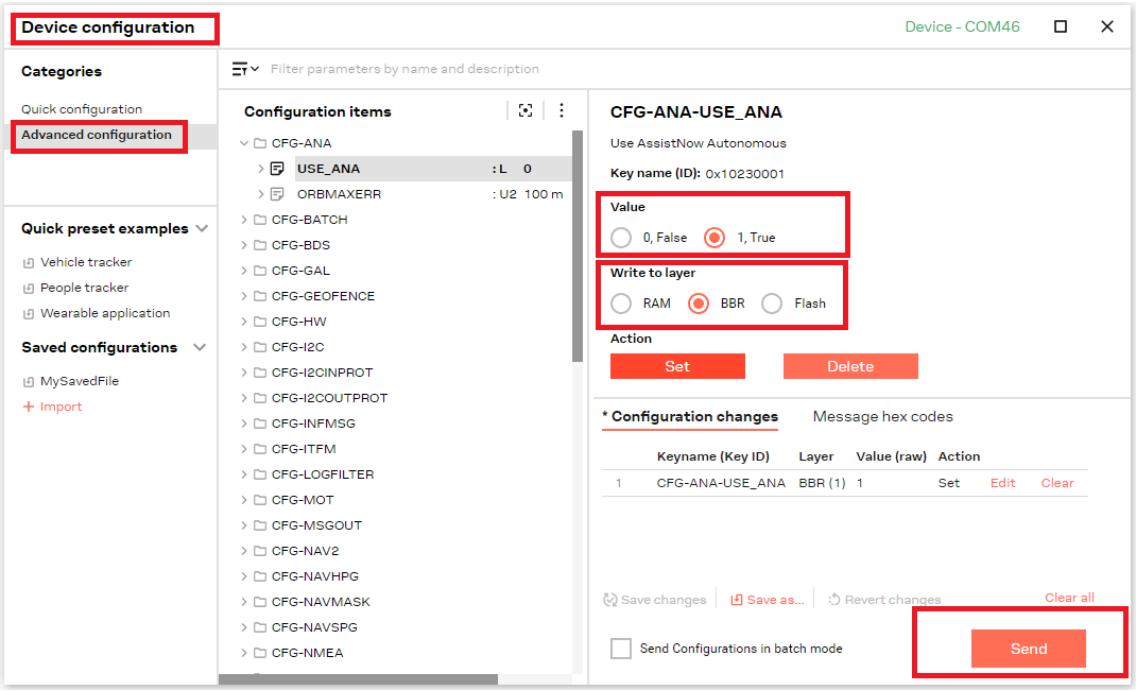

Figure 5: EVK-X20P receiver configuration view

The receiver configuration can be saved to the receiver RAM, battery-backed RAM (BBR), or to the available SPI flash memory. The RAM content is cleared after the power supply is disconnected or in software standby mode. Therefore, it is recommended to save the receiver configuration to RAM and BBR or permanently in the Flash memory. The BBR content is maintained as long as the backup battery supply is available. The content of the flash memory is preserved between power cycles and thus, it is the preferred option for long-term storage of the receiver configuration.

6.1 Communication ports

The FTDI USB-to-UART converter generates three virtual communication (COM) ports as shown in Figure 6. One USB serial interface and two UART interfaces.

☞ If the RS-232 port is also connected to the same PC, there will be an additional COM port for the RS-232 serial connection.

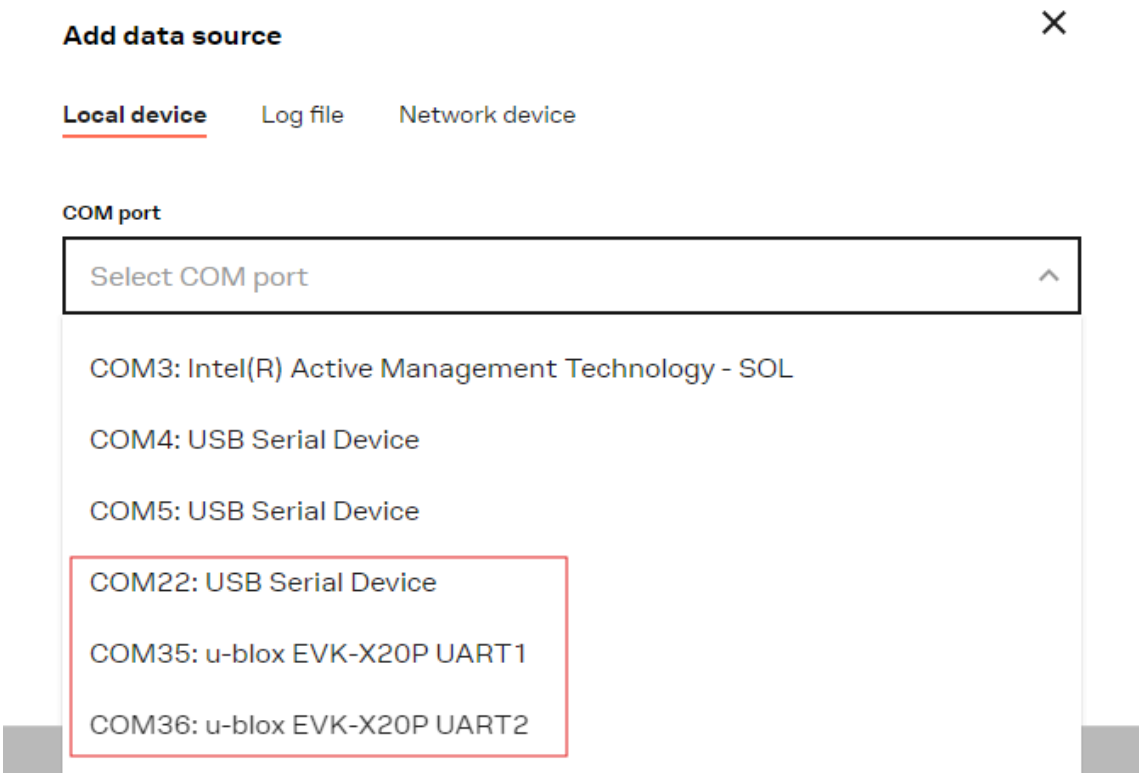

Figure 6: EVK-X20P communication ports identification on Windows

The identification of EVK-X20P on Windows machines has been improved to provide descriptive names to each virtual communication (COM) port as below.

- **u-blox EVK-X20P UART 1:** Use this COM port for UART 1 communication with the receiver via the FTDI USB-to-UART interface.
- **u-blox EVK-X20P UART 2:** Use this COM port for UART 2 communication with the receiver via the FTDI USB-to-UART interface.
- **USB Serial Device:** Use this COM port for USB communication with the receiver.

6.1.1 Configuring UART baud rate

Configure the baud rate for the UART communication with the `CFG-UART1-BAUDRATE` configuration key. The default baud rate is set to 38400 as shown in Figure 7, and the maximum baud rate is 8000000 via FTDI USB-to-UART interface. The UART1 through 14-pin connector also supports maximum baud rate of 8000000.

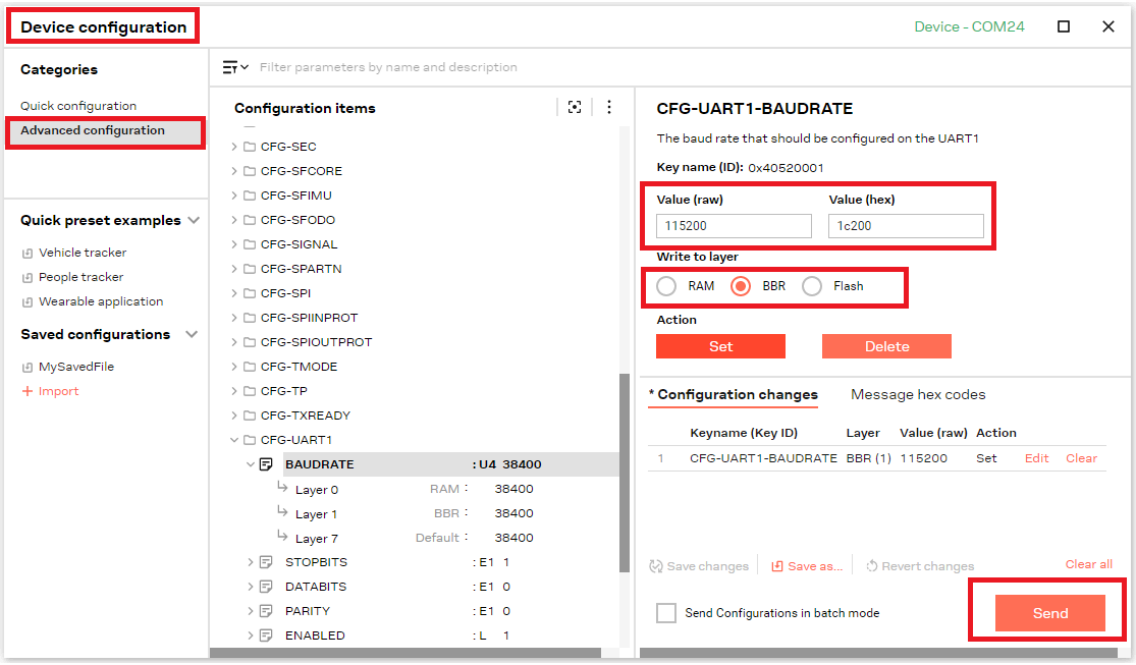

Figure 7: EVK-X20P UART baud rate configuration

6.2 Configuring navigation update rate

Configure the the navigation update rate with the `CFG-RATE-MEAS` configuration key shown in Figure 8 can be used to configure the navigation update rate. The navigation update rate value is defined in ms, where 100 ms corresponds to 10 Hz. The default update rate is 1000 ms which corresponds to 1 Hz. The default 1 Hz update rate is a good tradeoff between position accuracy and power consumption. Certain applications require faster update rates for high performance but this will increase the receiver power consumption.

☞ When high navigation update rates are used, increase the communication baud rate and reduce the number of enabled messages.

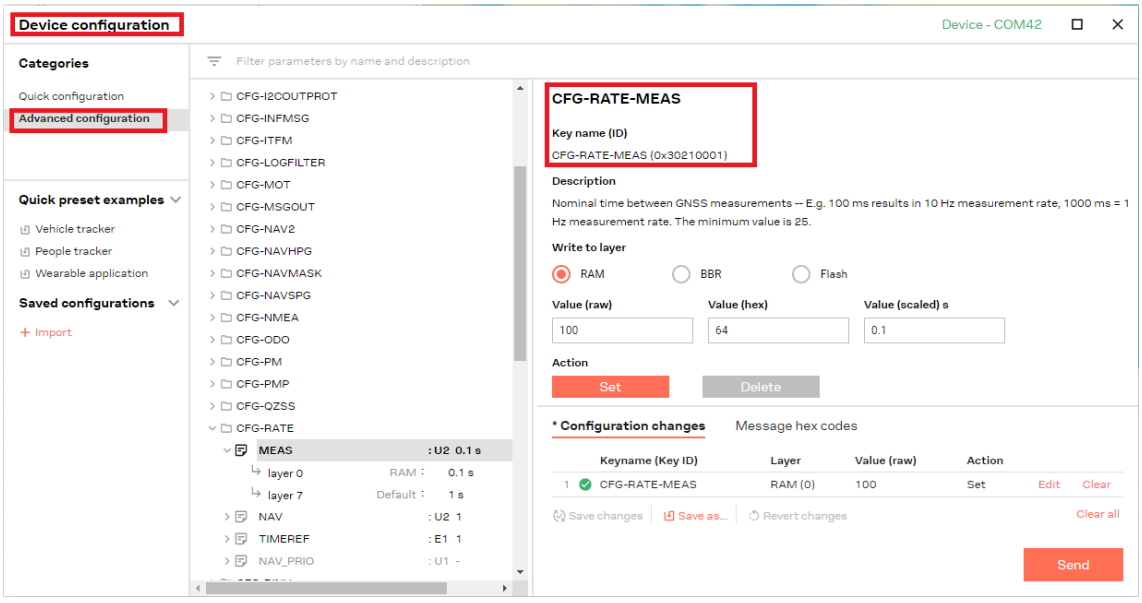

Figure 8: EVK-X20P receiver navigation update rate configuration

6.3 Configuring EVK-X20P to function as ZED-F20P

ZED-F20P is an innovative multi-band receiver module designed to revolutionize positioning technology in industrial applications. Built upon the u-blox new generation receiver platform, this module offers multi-band GNSS capability, supporting bands including L1, L2, and L5. For more details please refer ZED-F20P product documentation.

To evaluate ZED-F20P multi-band product functionalities, one can convert EVK-X20P as ZED-F20P as follows:

1. If EVK-X20P is not in the default configuration, bring it to the default configuration.
2. Send the below HEX command to the EVK via UART.
   B5 62 06 8A 09 00 00 04 00 00 3A 00 31 20 06 2E 44
3. Reset the EVK. Now the EVK is configured to function as ZED-F20P.

☞ To switch back to EVK-X20P mode, send the below HEX command via UART and restart the EVK.
B5 62 06 09 0D 00 FF FF 00 00 00 00 00 00 FF FF 00 00 03 1B 9A

7 RTK setup

To achieve accurate RTK performance, the receiver needs a constant stream of correction data, which can be obtained from correction data providers via NTRIP or MQTT protocols. Application software is needed to fetch the data from the provider's server and send it to the receiver through serial ports. This chapter explains how u-center 2 can be used to setup a NTRIP connection and to monitor the receiver's RTK status.

7.1 Setting up NTRIP caster in u-center 2

EVK-X20P outputs RTCM corrections which are used to simulate RTK solution. Follow the below procedure to setup EVK-X20P as RTCM corrections caster using u-center 2.

7.1.1 Doing Survey-IN process

1. Open u-center 2 and connect to the receiver via **Data sources > Add data sources**.
2. Set the receiver in the base mode by enabling a survey-in procedure or specify fixed coordinates via items within the Time Mode of Quick configuration window. An example of survey-in configuration is shown in Figure 9.
3. When using the survey-in mode, select the settings based on the environment and achievable accuracy in the base location. Start with an estimated accuracy of 5 meters (5000 mm) and survey-in time of 60 seconds. In difficult satellite visibility, the base is unlikely to achieve an accuracy better than 1 m.
4. In multi-path conditions, it can take longer to achieve the specified accuracy. To achieve that, you may need to relocate the base antenna or extend the required accuracy and/or survey-in time. Monitor the status of the survey-in with the `NAV-SVIN` message.
5. The receiver outputs messages upon configuration settings. However, RTCM 1005 is output only once the survey-in has been completed, or the fixed coordinates have been entered for the base antenna.
6. Verify the message output in the u-center 2 **Packet Console View**. Once surveyed-in correctly, it indicates a TIME solution mode in the u-center 2 **Data view**.

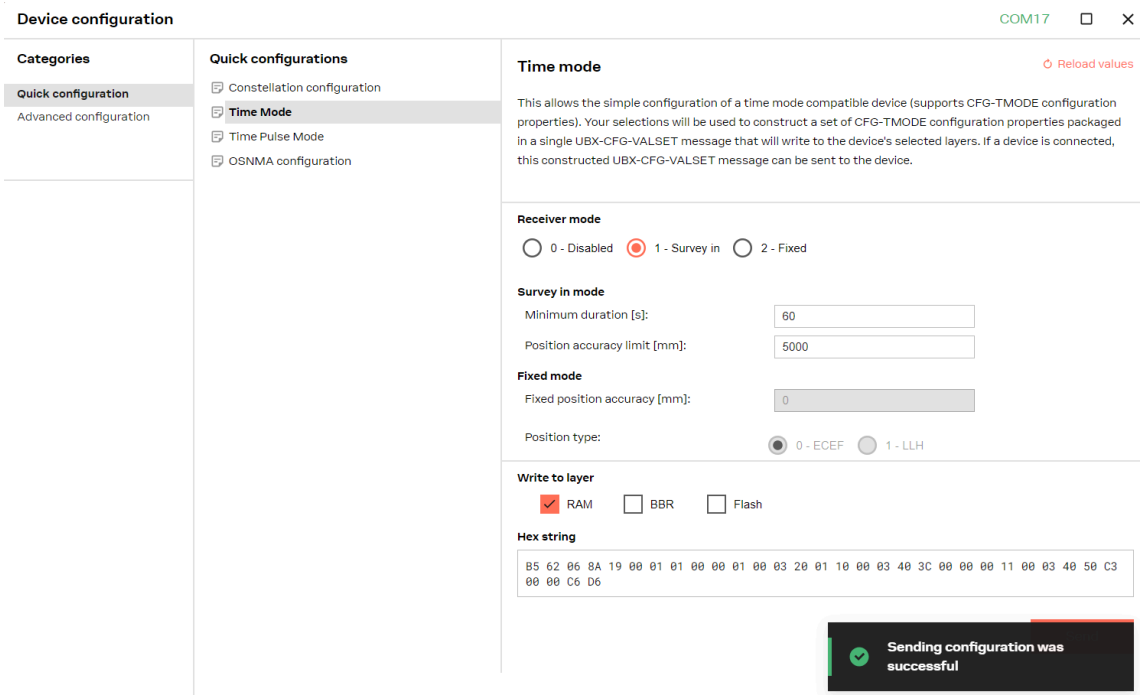

Figure 9: Configuring survey-in with u-center 2

7.1.2 Initialising NTRIP caster

1. Open the NTRIP settings from **Tools and services > NTRIP server/caster**.
2. Set the NTRIP caster settings. Specify the port that is not blocked by firewall.
3. Set the username and password for a secure caster.
4. Name the mount point. The details are used to identify the caster by the client.
5. Enabling **Get configuration automatically** broadcasts all the RTCM messages supported by ZED-X20P. This consumes a lot of data bandwidth and can cause latency.
6. We recommend to deselect this **Get configuration automatically** and select only the required RTCM messages that are to be broadcasted by the caster.
7. Click **Start**
8. IP address of the caster is available at the bottom of the window as shown in Figure 10. This is the IP through which the client can access the caster.
9. Monitor the caster status from the same window, as in Figure 10.

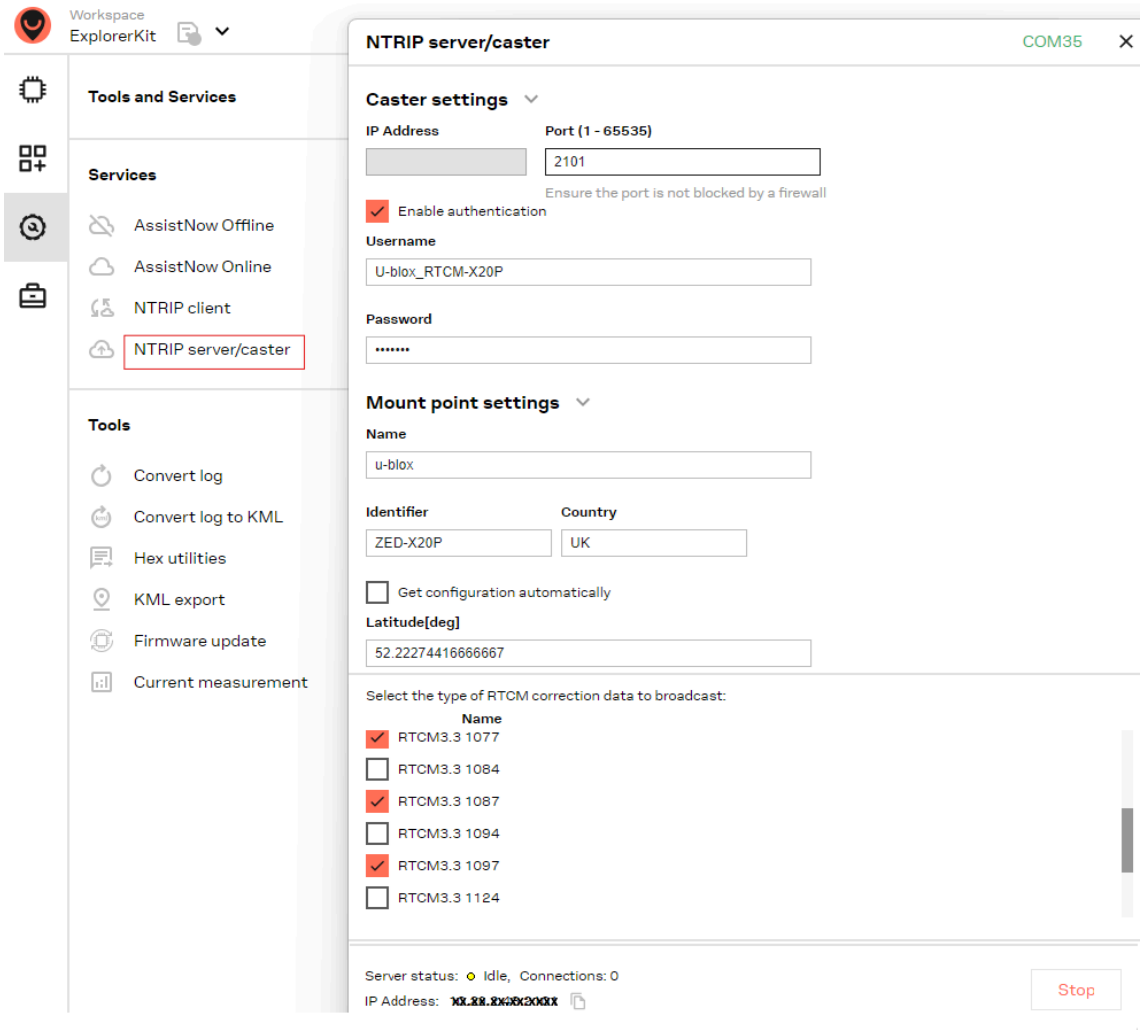

Figure 10: u-center 2 NTRIP caster status

For more information, refer to the u-center 2 user guide [1].

7.2 Setting up NTRIP client in u-center 2

There are commercial and free NTRIP services providing correction data streams. RTK2go is one such free community NTRIP service that hobbyists and early prototyping can use. However, for commercial or production-grade applications, it is recommended to use more reliable commercial NTRIP services.

u-blox offers a suite of commercial services branded PointPerfect. Depending on the location of the user, the service may have different services delivered over an IP network which may be suitable for the intended application.

Please note that the accuracy of the receiver depends on the service and will vary between service providers or compared to a local base station.

Start using the u-center 2 NTRIP client with the following steps:

1. Open u-center 2 and connect to the receiver via **Data sources > Add data sources**
2. Open the NTRIP client settings from **Tools and services > NTRIP**

3. Fill in the NTRIP caster details.
4. To fetch the available mount points from the service, click the **Save & Retrieve** button.
5. Select the correct mount point from the dropdown menu.
6. Click **Connect** to start the NTRIP client.

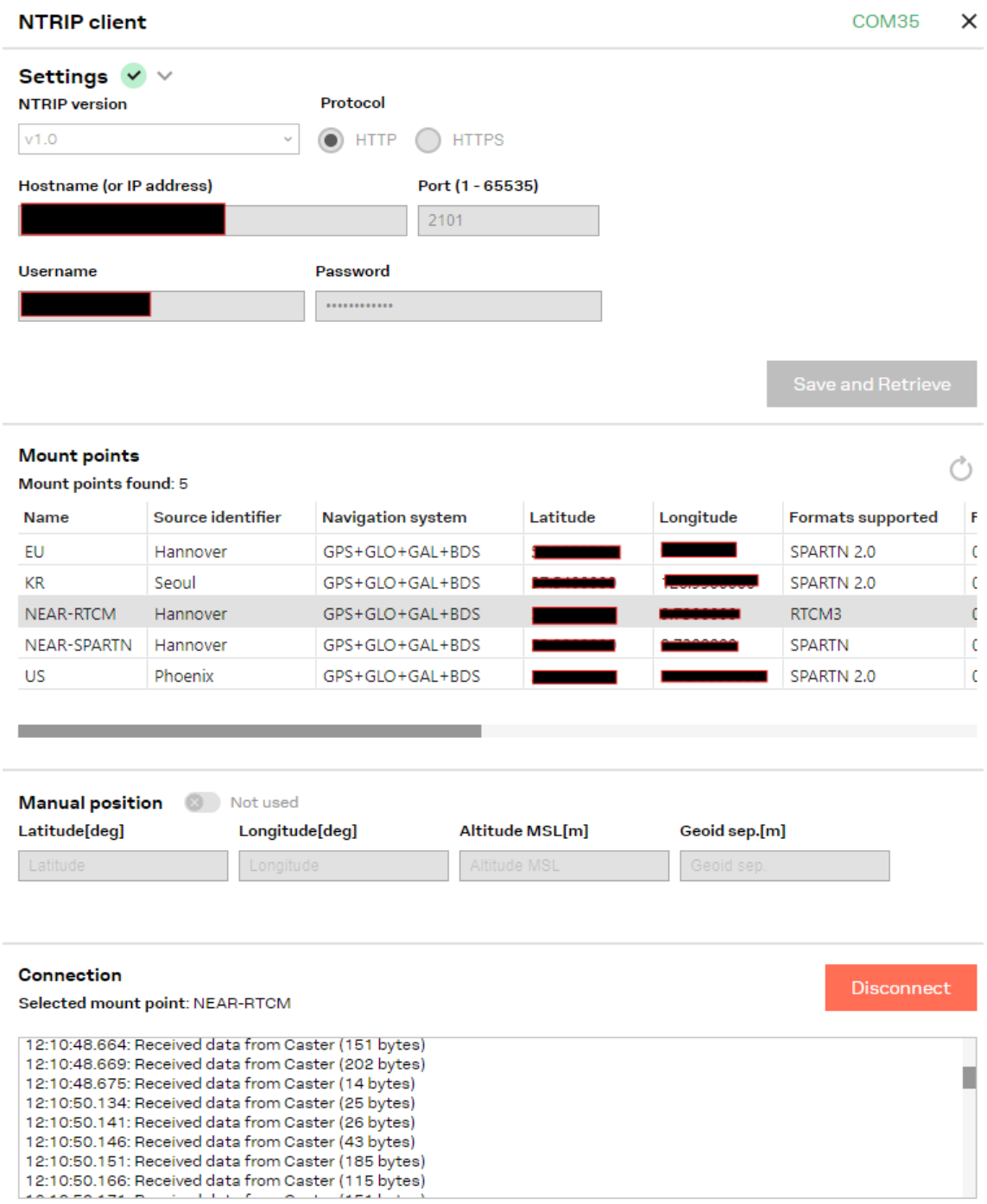

Figure 11: u-center 2 NTRIP client

The message console at the bottom of NTRIP Manager window displays the status of NTRIP client and its logs.

☞ Refer to the u-center 2 user guide [1] for more information.

7.3 Monitoring RTK status

Make sure the receiver is getting correction data by monitoring the RTK status in u-center 2:

- Monitor the UBX-RXM-COR message view to confirm the required correction messages are being received.
- The **Fix mode** field in **Data view (Add view > Data view)** shows the position status of the receiver, displaying **Float** or **Fixed** if correction data is used.
- Alternatively, in the UBX-NAV-PVT (Add view > Message view) message view, the **carrSoln** field shows the Carrier phase range solution status. The value should be 1 (Float) or 2 (Fixed) if correction data is used.

☞ Note that all the fields in the **Data view** are refreshed automatically only if relevant UBX messages are enabled. All the relevant UBX messages are enabled by clicking **Enable messages for view** button in the **Data view** window.

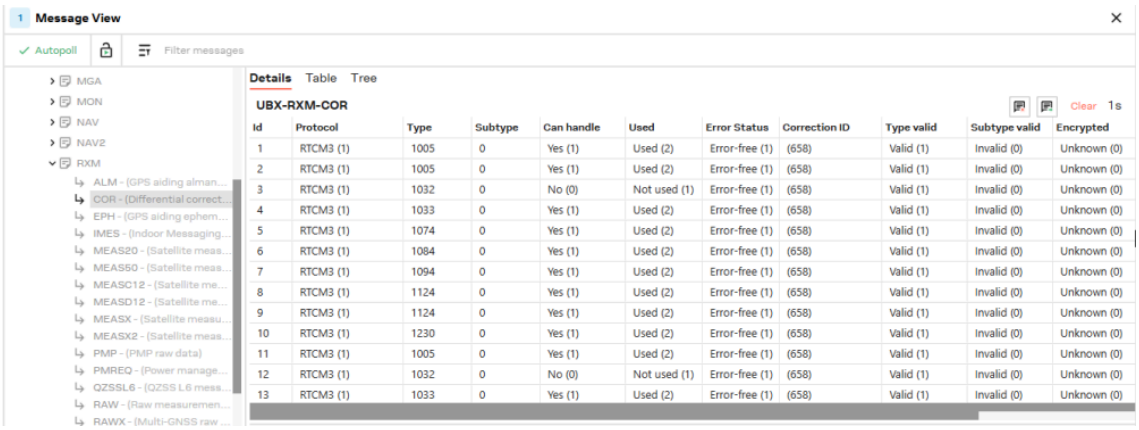

Figure 12: RTK corrections monitoring in u-center 2

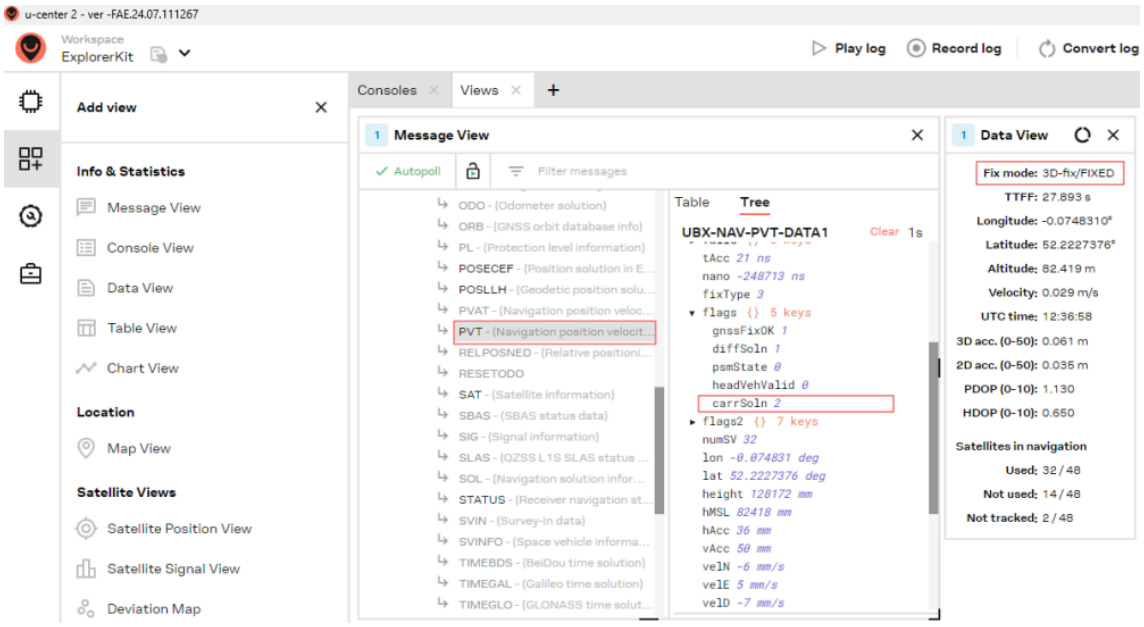

Figure 13: RTK status in u-center 2

In open sky scenarios, if the receiver achieves a fixed state, it indicates that the receiver, antenna, and correction service are compatible and functioning properly.

8 Block diagram

Figure 14 shows the main interfaces and internal connections of the evaluation kit for the EVK-X20P module:

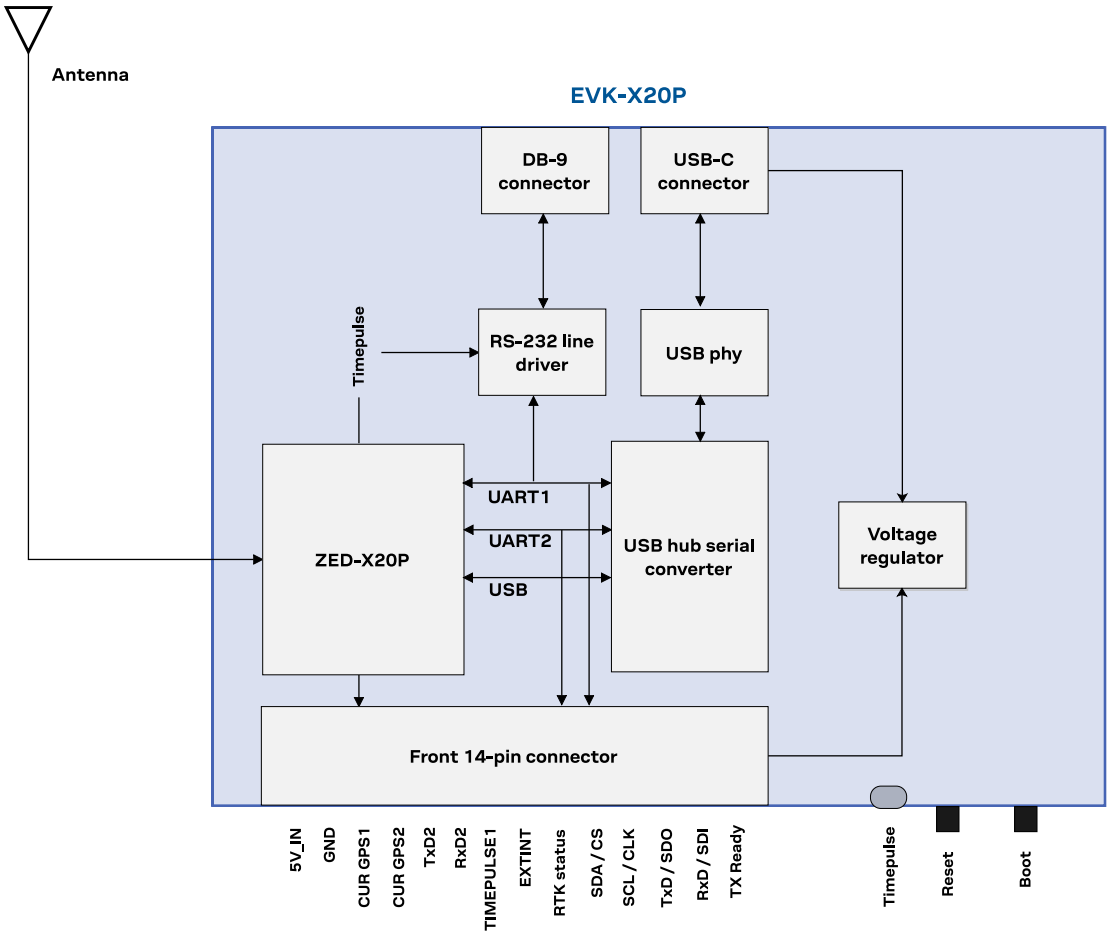

Figure 14: EVK-X20P block diagram

9 Board layout

9.1 PCB version B

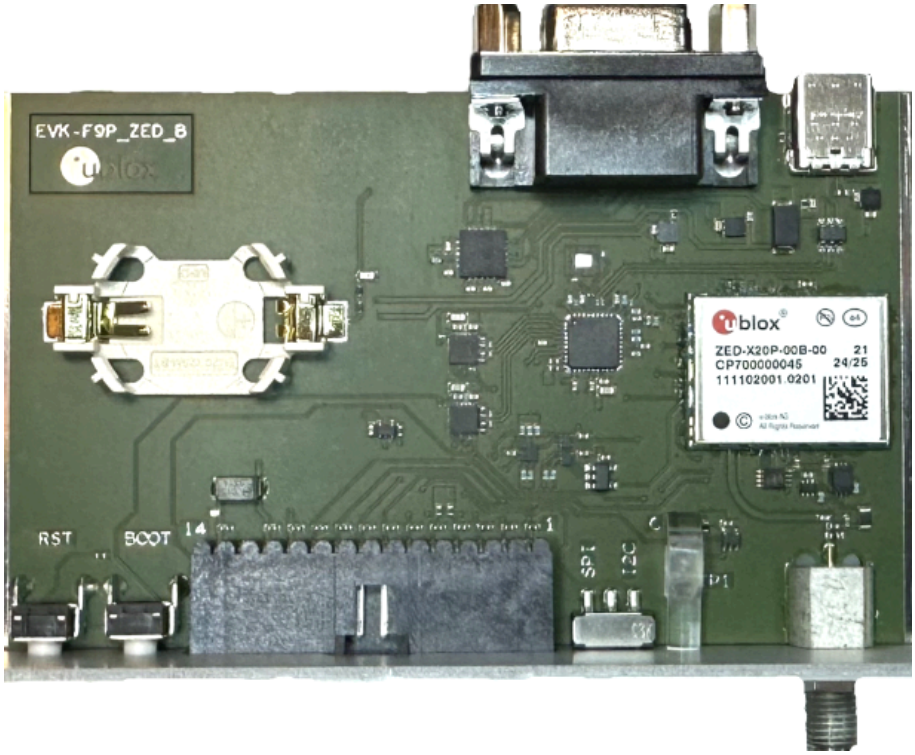

Figure 15: EVK-X20P PCB

9.2 Dimensions

Figure 16 shows the EVK-X20P board layout.

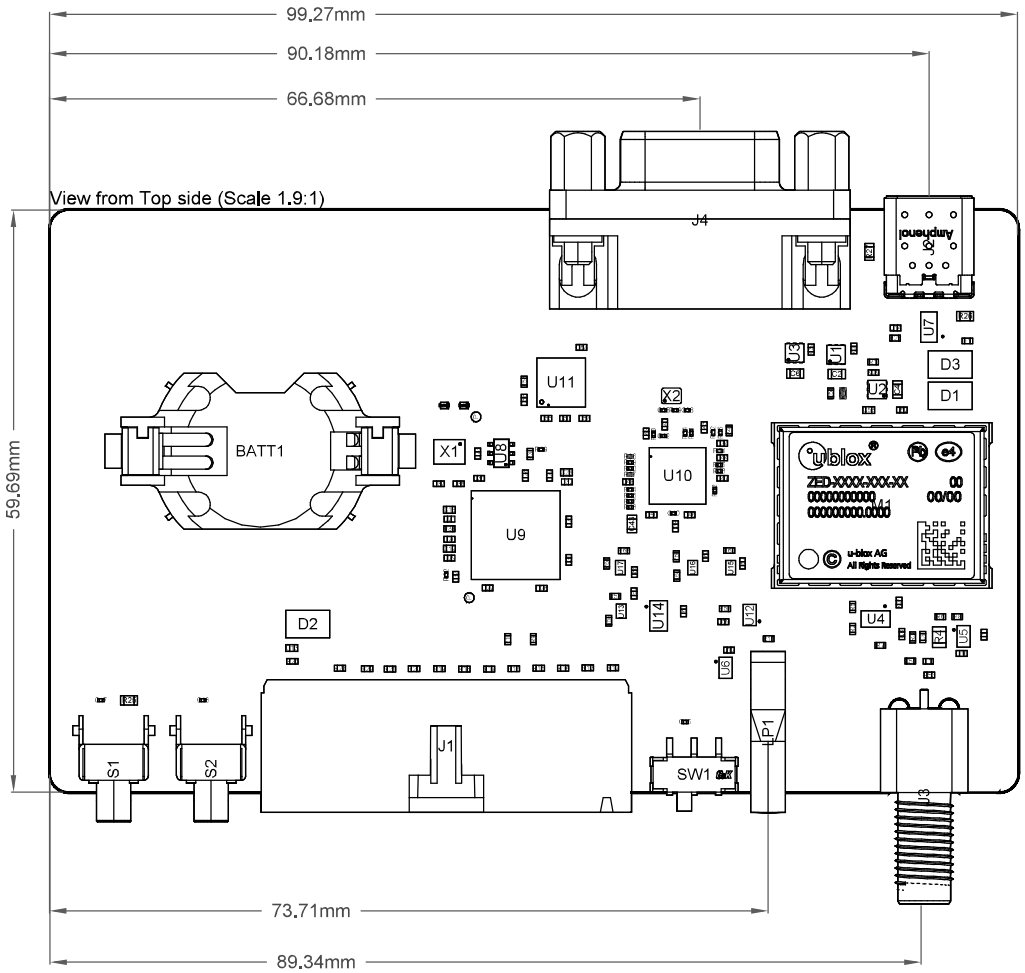

Figure 16: EVK-X20P layout

10 Component list

Regular Components	Description
BATT1	BATTERY HOLDER CR2032
C1 C3 C5	CAP CER X5R 0402 1U0 10% 6.3V
C2 C4 C6	CAP CER X5R 0603 10U 20% 10V
C7 C8 C11 C12 C14 C20 C21 C22 C23 C24 C25 C26 C27 C29 C30 C31 C32 C33 C52 C54 C55 C56 C57 C58 C59 C60 C61 C62 C63 C64	CAP CER X7R 0402 100N 10% 16V
C9 C51	CAP CER C0G 0402 47P 5% 25V
C10	CAP CER X7R 0402 10N 10% 16V
C13	CAP CER X5R 0402 10U 20% 10V
C15 C16 C17 C40 C42	CAP CER X7R 0201 10N 10% 25V
C18 C19 C28 C53	CAP CER X5R 0402 4U7 20% 10V
C18 C19 C28 C53	CAP CER X5R 0402 4U7 20% 10V
C34 C39 C41 C44 C45 C46 C47 C48 C49 C50	CAP CER X5R 0402 100N 10% 50V
C35 C38	CAP CER C0G 0201 18P 5% 50V
C36 C37	CAP CER C0G 0402 18P 5% 25V
C43	CAP CER X5R 0603 4U7 10% 6.3V
D1 D2 D3	SURFACE MOUNT SCHOTTKY BARRIER RECTIFIER SS14 1A
D4	LED CHIP 0603 LOW CURRENT 5mA
D6 D7	DIODE SCHOTTKY SOD923 30V 100mA
F1	FERRITE BEAD MURATA BLM15EX 0402 220R@100MHZ 1.3A
J1	14PIN 90 DEGREE 2.54MM PITCH DISCONNECTABLE CRIMP CONNECTOR
J2	CON_024_USB_TYPE_C, CON USB 3.1 TYPE C RECEPTACLE 24P
J3	CON SMA SMD STRAIGHT JACK 11.4MM HEIGHT W/O WASHER AND NUT
J4	2311765-1, 9 POLE SUBD CON FEMALE
L1	IND MURATA LQG15HS 0402 47N 5% 300mA
M1	ZED_Module, GNSS RECEIVER U-BLOX ZED-X20P
R1	RES THICK FILM CHIP 0402 CURRENT SENSE 1R 1% 1.1V
R2 R5 R8	RES THICK FILM CHIP 0402 10K 1% 63mW
R3 R54	RES THICK FILM CHIP 0402 0R 0R 0 63mW
R4	RES THICK FILM CHIP 0805 10R 5% 125mW
R6	RES THICK FILM CHIP 0402 130R 1% 62.5mW
R7	RES THICK FILM CHIP 0402 180K 1% 63mW
R9 R10 R28	RES THICK FILM CHIP 0402 10K 5% 100mW
R11	RES THICK FILM CHIP 0402 25PPM 1K8 0.1% 63mW

Regular Components	Description
R12 R13 R14 R15 R16 R17 R18 R19 R20 R21 R22 R23 R24	VARISTOR BOURNS MLE SERIES CG0402MLE-18G 18V
R25	RES THICK FILM CHIP 0603 100R 5% 100mW
R26 R27	RES THICK FILM CHIP 0603 5K1 5% 100mW
R29 R32	RES THICK FILM CHIP 0201 10K 1% 50mW
R30	RES THICK FILM CHIP 0402 2K2 5% 100mW
R31 R34	RES THICK FILM CHIP 0201 22R 5% 50mW
R33	RES THICK FILM CHIP 0402 12K 1% 62.5mW
R35	RES THICK FILM CHIP 0201 51K 1% 50mW
R39 R40	RES THICK FILM CHIP 0201 0R 0
R41 R56 R58 R59 R60 R61 R62 R63 R64	RES THICK FILM CHIP 0402 100K 1% 63mW
R42 R43 R45 R51 R52	RES THICK FILM CHIP 0201 100K 1% 50mW
R44 R46 R47 R48	RES THICK FILM CHIP 0201 10K 5% 50mW
R49	RES THICK FILM CHIP 0201 1M0 5% 50mW
R50	RES THICK FILM CHIP 0201 1M0 5% 50mW
R53	ESD PROTECTION FOR HIGH SPEED LINES TYCO 0.25PF PESD0402-140
R57	RES THICK FILM CHIP 0402 51R 1% 100mW
S1 S2	SWITCH SPST ON 1POL TYCO
SW1	2 WAY SUB-MINIATURE SLIDE SWITCH SMD JS SERIES - SPDT
U1 U2 U3	LOW DROPOUT REGULATOR ON SEMI NCP718 WDFN6 0.3A - Maximum input voltage 24V
U4	PRECISION ADJUSTABLE CURRENT-LIMITED POWER-DISTRIBUTION SWITCHES 1.5A
U5	Op-Amp_Single_5Pin_3, CMOS Amp One-channel 1-MHz rail-to-rail input and output SC70-5
U6 U12	TINY LOGIC UHS BUFFER OE_N ACTIVE LOW FAIRCHILD NC7SZ125 SC70
U7	USB DATA LINE PROTECTION ST USBLC6-2SC6 SOT23-6
U8	EEPROM SERIAL 2KBIT 1.8-5.5V SOT23-6
U9	FTDI FT4232H QUAD HIGH SPEED USB TO MULTIPURPOSE UART
U10	USB2514BI, SMSC USB 2.0 HI-SPEED HUB CONTROLLER
U11	RS-232 TRANSCEIVER 250KBIT 3-5.5V QFN20
U13 U15 U16 U17	SN74AUP1G08DRY2, TINY LOGIC ULP-A 2-INPUT AND GATE 1.45X1.0 6-LEAD MICROPAK
U14	TINY LOGIC UHS BUFFER OE ACTIVE HIGH FAIRCHILD NC7SZ126 SOT23-5
X1	CRYSTAL 12MHZ 3225
X2	CRYSTAL CL=6PF MURATA XRCGB_F_H
Additional Component	PCB
Additional Component	SOLDER PASTE

Table 7: EVK-X20P component list

11 Schematic

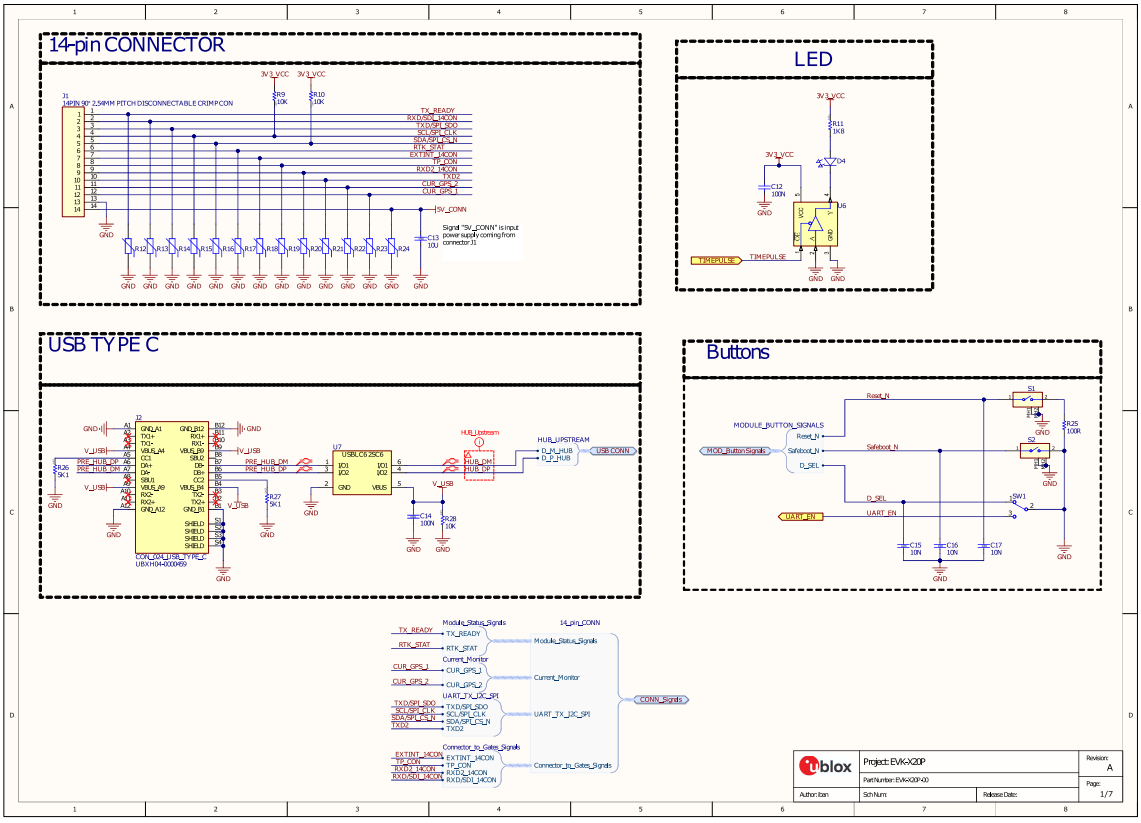

Figure 17: Schematic EVK-X20P: 14-pin connector, LED, USB and buttons

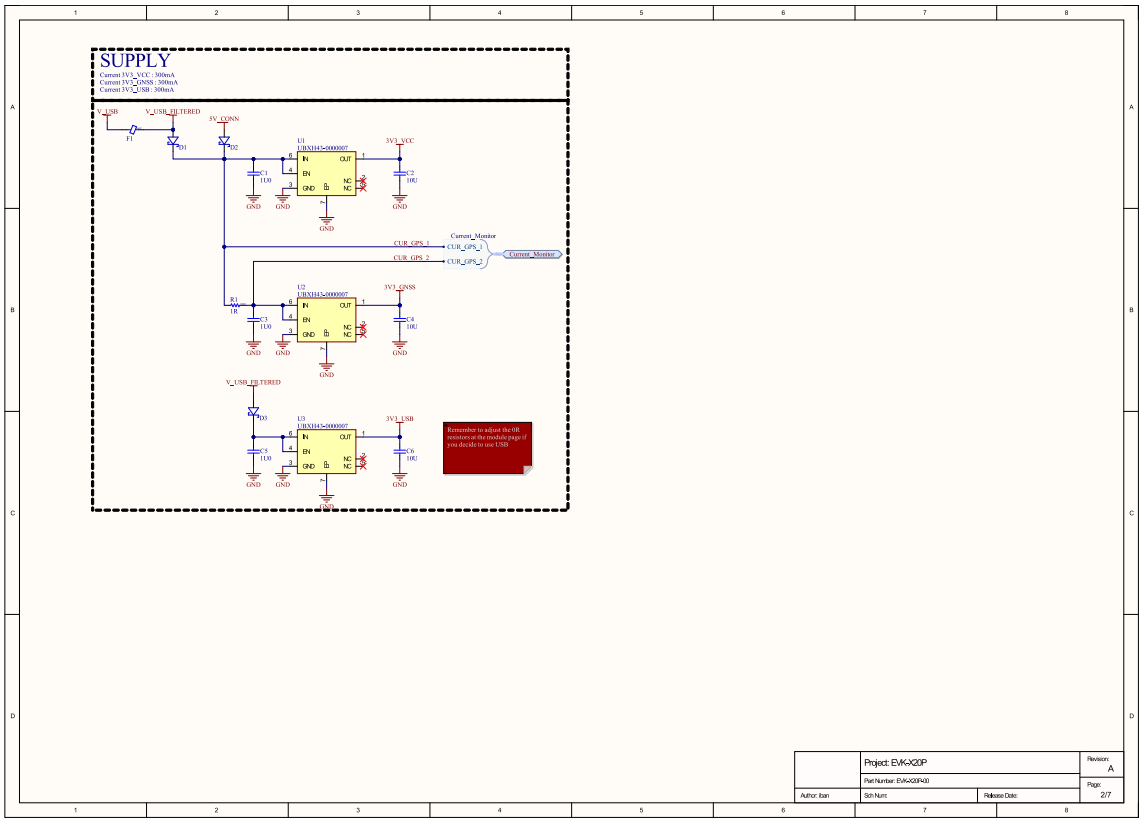

Figure 18: Schematic EVK-X20P: Power supply

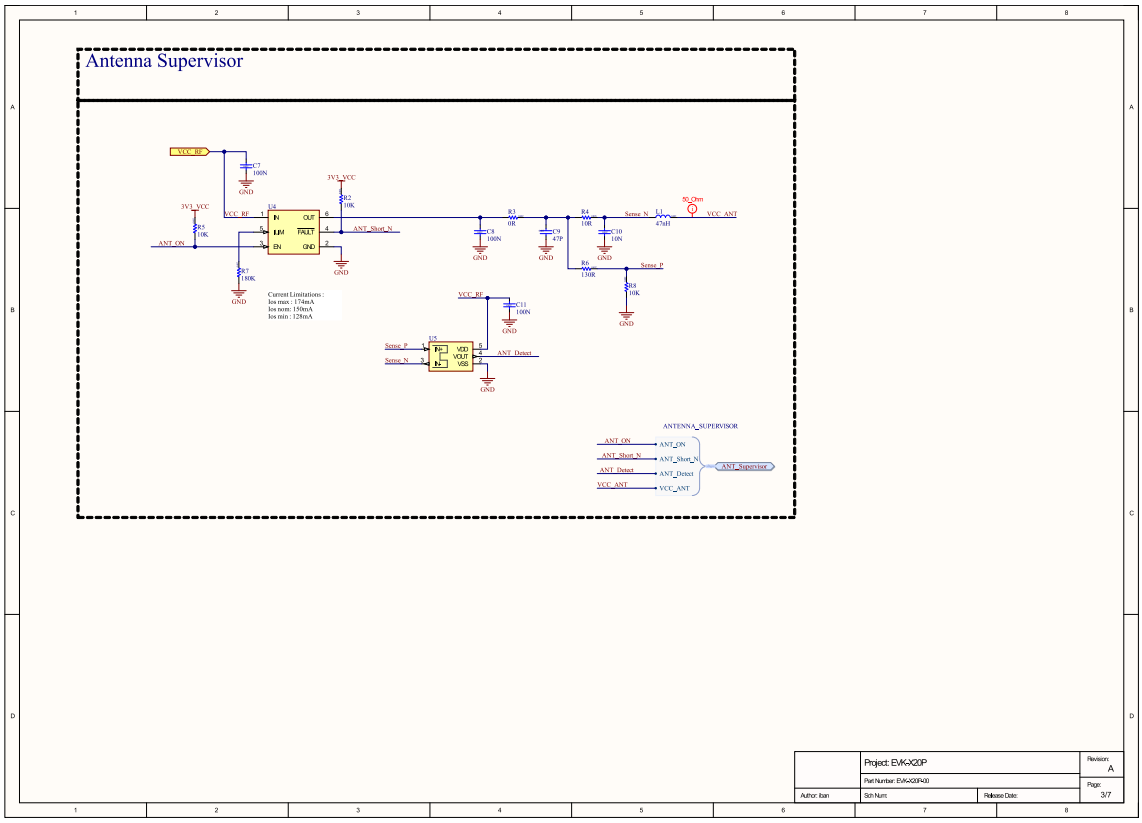

Figure 19: Schematic EVK-X20P: Antenna supervisor

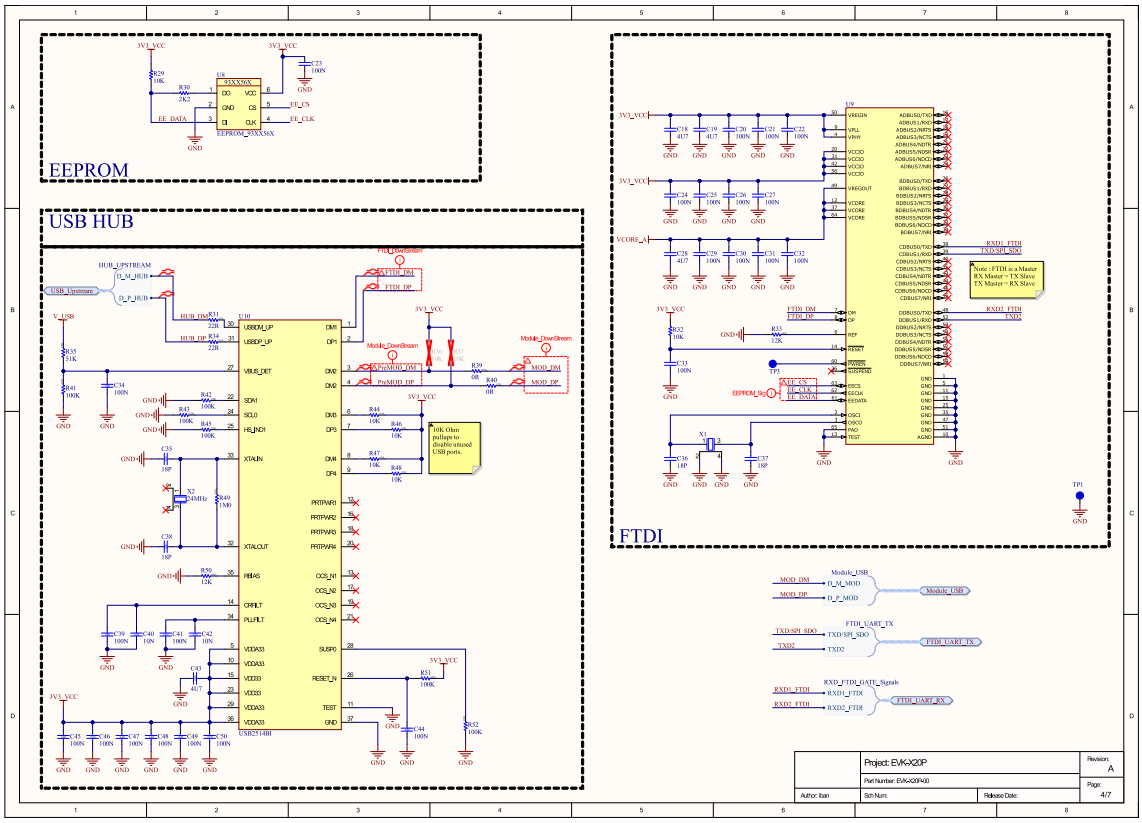

Figure 20: Schematic EVK-X20P: EEPROM, USB hub, FTDI

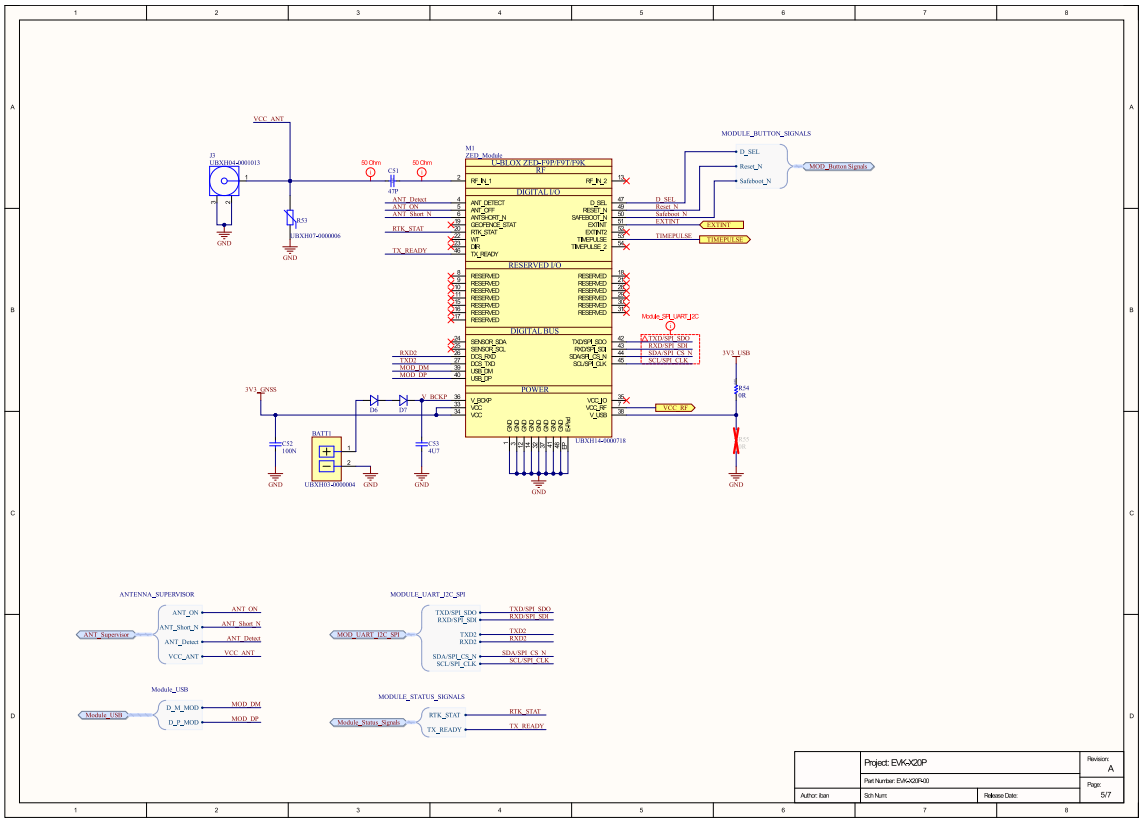

Figure 21: Schematic EVK-X20P: GNSS, ZED module

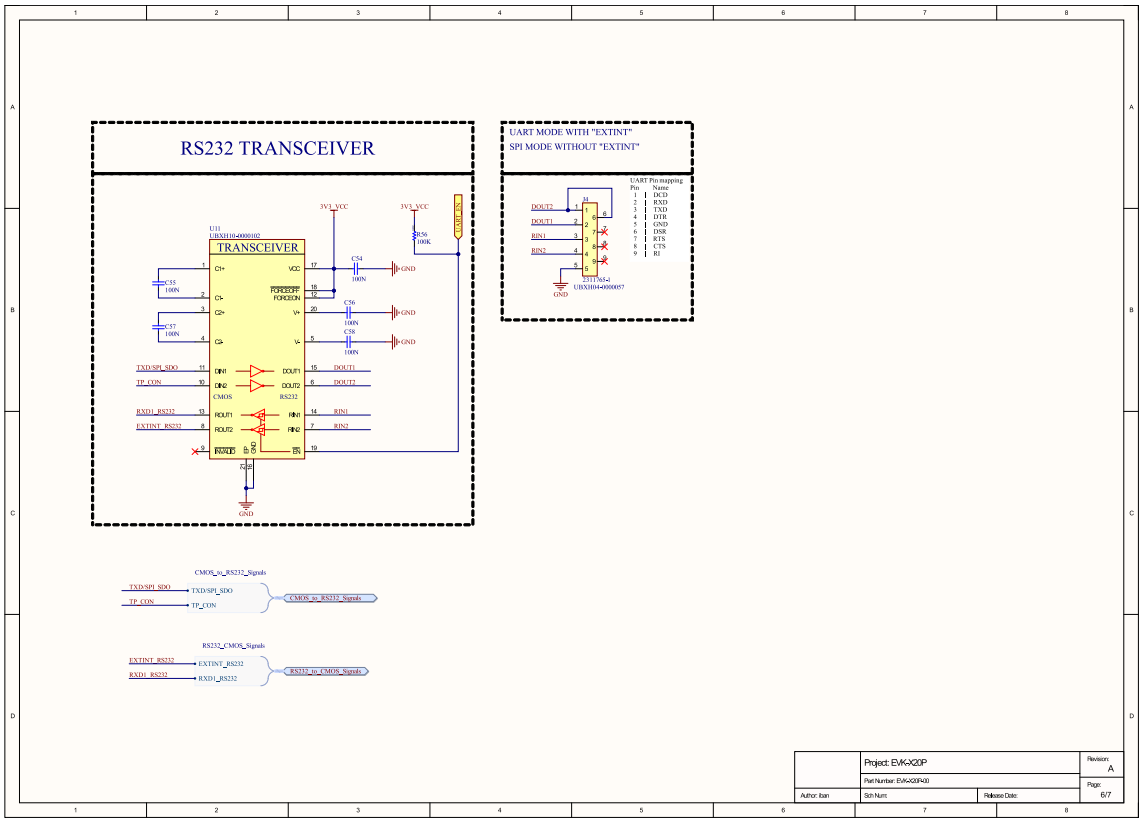

Figure 22: Schematic EVK-X20P: RS232 connector

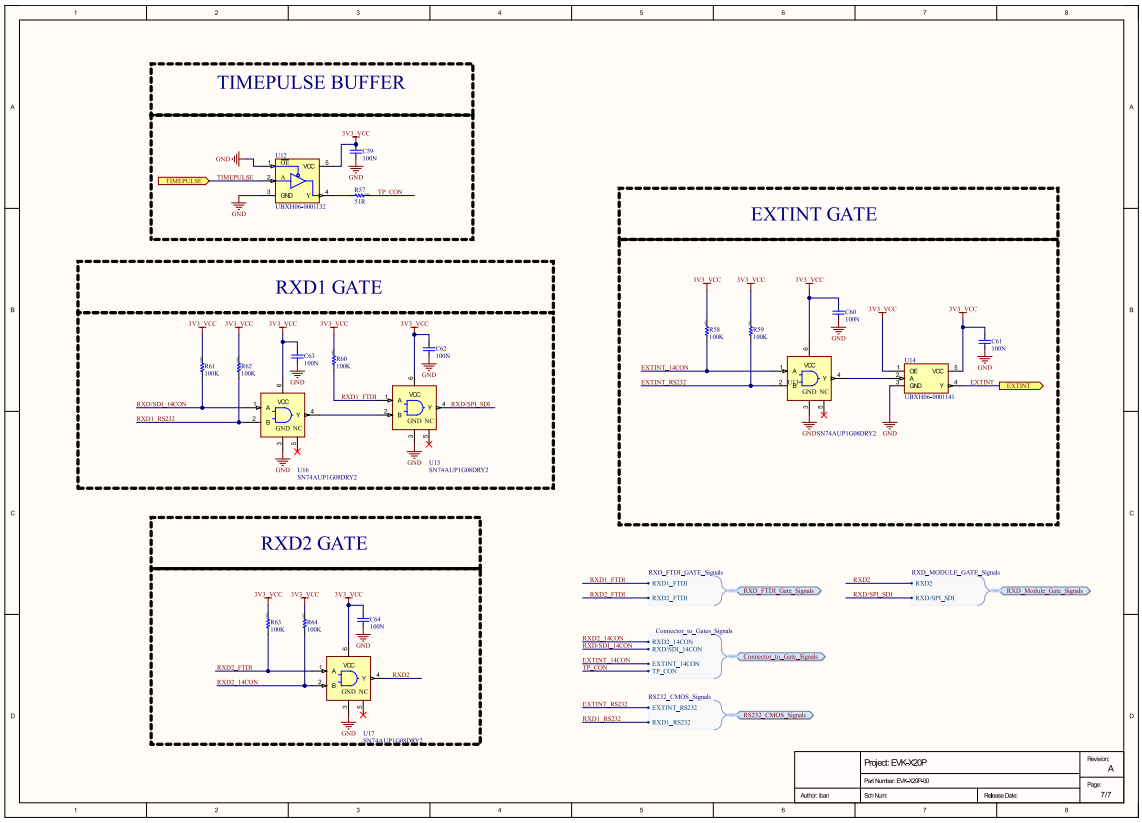

Figure 23: Schematic EVK-X20P: Timepulse buffer, RXD1, RXD2 and EXTINT gates

12 Updating firmware

EVK-X20P is delivered with the latest firmware version. However, as newer images may become available during the product life cycle, you may need to update the firmware. During start-up, EVK-X20P executes the firmware image that is loaded from the flash memory. This section shows how to upload the firmware image on the external flash memory.

To upload the new firmware with u-center 2, do as follows:

1. Connect the EVK to u-center 2 via UART1 of the module using USB-C interface. Check the installed firmware version by polling `UBX-MON-VER`, as shown in Figure 24 or checking the **Data sources** panel as shown in Figure 25.

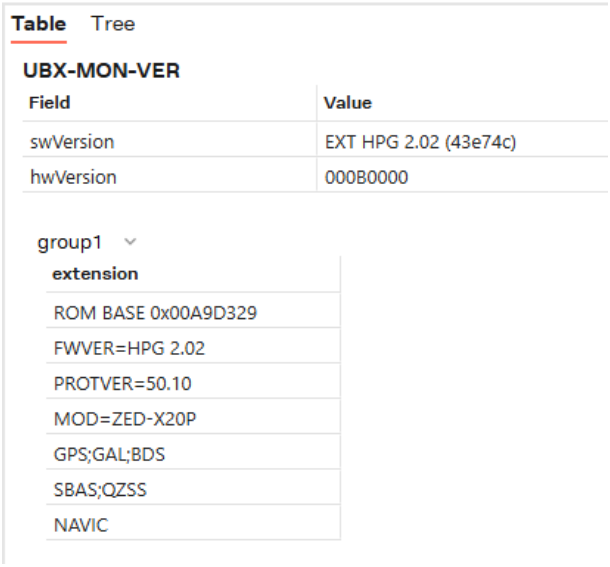

Figure 24: Checking EVK-X20P firmware version from `UBX-MON-VER` of u-center 2

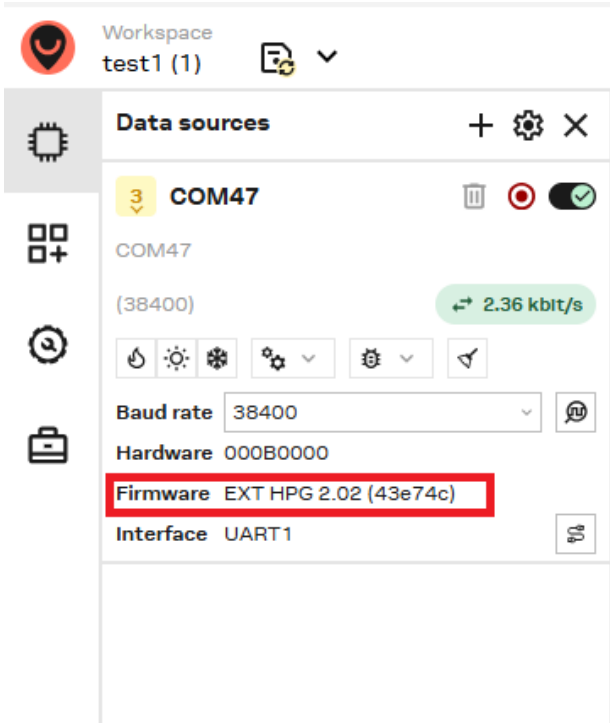

Figure 25: Firmware version displayed in the Data sources panel of u-center 2

2. From the **Tools** section in the left ribbon, select **Tools and Services**
3. Select **Firmware update** from **Tools and Services** as shown in Figure 26. The firmware update window appears, as shown in Figure 26.
4. Select the firmware image by clicking the **Select** button.
5. The default baud rate is 460800. To make the firmware update faster, select a higher baud rate from the **Baud rate for update** drop-down menu, e.g. 921600.
6. Enable **Enter safeboot before update** option as shown in Figure 26.
7. Click **Update**.
8. Firmware update progress is captured under **Firmware update log** section as shown in Figure 26.
9. Once the firmware update is successful the latest firmware details are displayed under **Receiver information** section as shown in Figure 26.

☞ Do not enable safeboot option as shown in Figure 26 while doing firmware update over USB

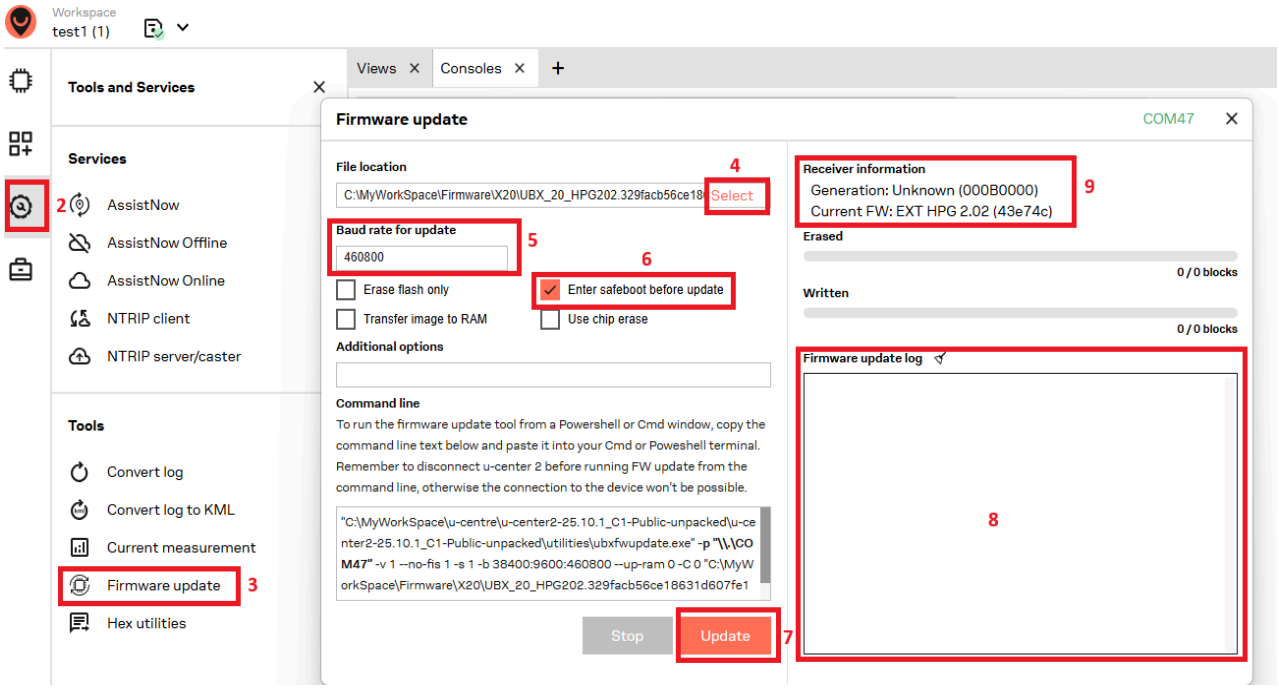

Figure 26: Firmware update tool in u-center 2

13 Troubleshooting

My application (e.g. u-center 2) does not receive any messages

- Check that the GNSS antenna is in clear sky view and the antenna cable is connected.
- Check that the slide switch on the front panel of the EVK is set to the communication port that you are using.
- Check the LED on the front panel of the EVK is on. A solid blue or flashing LED indicates the EVK is powered on. If the LED is off, connect the power source either via USB on the rear or through the V5_IN input on the front of the EVK.

My application (e.g. u-center 2) does not receive all messages

When using UART, make sure the baud rate is sufficient. If the baud rate is insufficient, GNSS receivers based on u-blox GNSS technology will skip excessive messages. Some serial port cards/ adapters (i.e. USB to RS-232 converter) frequently generate errors. If a communication error occurs while u-center 2 receives a message, the user interface on u-center 2 indicates when the messages are dropped.

My application (e.g. u-center 2) loses the connection to the GNSS receiver

u-blox positioning technology and u-center 2 both support an autobauding feature. If frequent communication errors occur (e.g. due to problems with the serial port), the connection may be lost. This happens because the u-center 2 and the GNSS receiver both try to autonomously adjust the baud rate. Do not enable the u-center 2 autobauding if the GNSS receiver has the autobauding flag enabled.

The COM port does not send any messages

Make sure that the slide switch on the front panel is set to I2C and not SPI. In the SPI mode, the RS-232 pins on the DB9 connector are switched off and the RxD and TxD output at the front panel are used for SPI (SDO, SDI) instead.

⚠ **CAUTION** Changing the slide switch position while the EVK is powered on may damage the GNSS receiver chip. Power off the EVK before changing the slide switch setting.

Some COM ports are not shown in the port list of my application (e.g. u-center 2)

Only the COM ports that are available on your computer show up in the COM port drop down list. If a COM port is not listed in u-center 2 or u-center 2 is not able to connect to the selected COM port, check if another application running on the computer is using the same port.

The position is off by a few dozen meters

u-blox X20 GNSS technology starts up with the WGS84 standard GNSS datum. If your application expects a different datum, you will most likely find the positions to be off by a few dozen meters. Do not forget to check the calibration of the u-center 2 map files.

The position is off by a few dozen meters

Position drift may also occur when almanac navigation is enabled. The satellite orbit information retrieved from an almanac is much less accurate than the information retrieved from the ephemeris. With an almanac only solution, the position will only have an accuracy of a few kilometers, but it may start up faster or still navigate in areas with obscured visibility when the ephemeris from one or

several satellites have not yet been received. The almanac information is NOT used for calculating a position, if valid ephemeris information is present, regardless of the setting of this flag.

In NMEA protocol, position solutions with high deviation (e.g., due to enabling almanac navigation) can be filtered with the Position Accuracy Mask. UBX protocol does not directly support this since it provides a position accuracy estimation, which allows the user to filter the position according to his requirements. However, the 'Position within Limits' flag of the UBX-NAV-STATUS message indicates whether the configured thresholds (i.e., P Accuracy Mask and PDOP) are exceeded.

TTFF times at start-up are much longer than specified

At startup (after the first position fix), the GNSS receiver performs an RTC calibration to have an accurate internal time source. A calibrated RTC is required to achieve minimal startup time.

Before externally shutting down the receiver, check the calibration status in the MON-HW 'Real Time Clock Status' field. Do not shut down the receiver if the RTC has not been calibrated.

The EVK-X20P does not meet the TTFF specification

Make sure the antenna has a good sky view. An obstructed view leads to prolonged startup times. In a well-designed system, the average of the C/N0 ratio of high elevation satellites should be in the range of 40 dBHz to about 50 dBHz. With a standard off-the-shelf active antenna, 47 dBHz should easily be achieved. Low C/N0 values lead to a prolonged startup time.

The EVK-X20P does not preserve the configuration in case of reset

u-blox X20 GNSS technology uses a slightly different concept than most other GNSS receivers do. Settings are initially stored in the volatile memory. To save them permanently, sending a second command is required. This allows testing the new settings and reverting to the old settings by resetting the receiver if the new settings are not good. This provides safety, as it is no longer possible to accidentally program a bad configuration (e.g. disabling the main communication port).

For configuration details, see the Interface description [4].

EVK-X20P does not work properly when connected to a GNSS simulator

When using EVK-X20P together with a GNSS simulator, pay attention to proper handling of the EVK. A GNSS receiver is designed for real-life use (i.e. time is always moving forward). When using a GNSS simulator scenario, the scenario time can be in the past causing the receiver to jump backwards in time. This affects the receiver performance.

To avoid this, configure the GPS week rollover value to a week number preceding the date used in the GNSS simulator scenario. For example, setting the GPS week number to 1200 (corresponding to Jan 2003) allows running simulator scenarios taking place after this date. Then, issue the cold start command before every simulator test to avoid receiver confusion due to the time jumps.

Communication does not work with the USB interface in the power save mode

For communication in the power save mode, use the RS-232 interface.

u-center 2 shows a warning after changing the receiver baud rate

Changing the baud rate of the current port in the RAM layer can result a warning (NAK) because the receiver is using the new baud rate while u-center 2 is using the old one. Ignore the warning and change the u-center 2 baud rate to be identical with the receiver baud rate to verify the success of the configuration.

☞ Please note that when you have sequence of configurations to be sent, baud rate changes should be done alone because the ones after baud rate changes are not reliable.

14 Common evaluation pitfalls

- **Parameters may have the same name but a different definition.** GNSS receivers may have a similar size, price and power consumption but different functionalities (e.g. no support for passive antennas, different temperature range). Also, the definitions of hot, warm, and cold start times may differ between suppliers.
- Verify design-critical parameters. Try to **use identical or at least similar settings when comparing** the GNSS performance of different receivers. Data which has not been recorded at the same time and the same place, should not be compared. The satellite constellation, the number of visible satellites and the sky view might have been different.
- **Do not compare momentary measurements.** GNSS is a non-deterministic system. The satellite constellation changes constantly. Atmospheric effects (i.e. dawn and dusk) have an impact on signal travel time. The position of the GNSS receiver is typically not the same between two tests. Therefore, conduct comparative tests in parallel by using one antenna and a signal splitter. Run statistical tests for 24 hours.
- **Monitor the carrier-to-noise-ratio (C/N0).** The average C/N0 of the high elevation satellites should be between 40 dBHz and about 50 dBHz. A low C/N0 will result in a prolonged TTFF and more position drift.
- When comparing side-by-side receivers, make sure that all receivers have the same signal levels. The best way to achieve this is by using a signal splitter. Comparing results measured with different antenna types (with different sensitivity) will lead to incorrect conclusions.
- Try to **feed the same signal to all receivers in parallel** (i.e. through a splitter) with identical cable length. Otherwise, the receivers do not have the same sky view. Even small differences can have an impact on the speed, accuracy, and power consumption. One additional satellite can lead to a lower dilution of precision (DOP), less position drift, and lower power consumption.
- **When doing reacquisition tests,** cover the antenna to block the sky view. **Do not unplug the antenna** since the u-blox positioning technology continuously performs a noise calibration on idle channels.

Related documents

[1] u-center 2 User guide, www.u-blox.com/en/info/u-center-2-user-guide.
[2] ZED-X20P-00B DataSheet, UBXDOC-963802114-12690.
[3] ZED-X20P Integration manual, UBXDOC-963802114-12901.
[4] HPG 2.02 Interface description, UBXDOC-304424225-19967.
[5] Information technology equipment - Safety Standard IEC 62368-1.

☞ For regular updates to u-blox documentation and to receive product change notifications, register on u-blox website https://www.u-blox.com.

Revision history

Revision	Date	Status / comments
R01	05-Sept-2024	Prototype release
R02	22-May-2025	Updated sections: • USB connector New sections: • Device configuration • Setting up NTRIP caster in u-center 2
R03	21-Aug-2025	Updated sections: • Schematic
R04	28-Jan-2026	Updated sections: • Interface connection • Installing u-center 2 software • Dimensions • Component list • Schematic
R05	16-Feb-2026	Updated sections: • Component list

Contact

u-blox AG

Address: Zürcherstrasse 68
8800 Thalwil
Switzerland

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