EVK-F10T

Evaluation kit

User guide

Abstract

This document describes the structure and use of the EVK-F10T evaluation kit and provides information for evaluating and testing u-blox F10 high precision timing technology.

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C1- Public

Document information

Title	**EVK-F10T**	
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This document applies to the following products:

Product name	Type number	Firmware version	IN/PCN reference
EVK-F10T	EVK-F10T-00-00	TIM 3.01	N/A

Contents

1 Product description

1.1 Overview

The u-blox EVK-F10T evaluation kits make evaluation of all features of the u-blox F10 GNSS timing simple. For an overview of u-blox NEO-F10T features, see the product page on the u-blox website: www.u-blox.com/en/product/neo-f10t-module.

The built-in USB interface provides both power supply and USB-to-Serial communication to the receiver, keeping the possibility to also connect through a 14-pin connector via UART. 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. Furthermore, they can be used with a desktop or a laptop, making them the perfect companion through all stages of design-in projects.

Evaluation kit	Description	Related products
EVK-F10T	u-blox F10 GNSS evaluation kit for timing receivers	u-blox NEO-F10T module [1]

Table 1 EVK-F10T supported products

1.2 Kit contents

The delivery package contains:

- Compact 105 x 64 x 26 mm EVK-F10T unit
- ANN-MB1 multi-band (L1/L5) active GNSS antenna with 3 m cable
- USB cable (Type-C)
- EVK Welcome card

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 u-blox NEO-F10T products.

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

1.4 System requirements

- PC with a USB 2.0 interface
- Operating system: Microsoft Windows 10 onwards.
- Internet connection for the first-time use to download the required Windows drivers. See section Installing u-center 2 software for details.

2 Specifications

Parameter	Specification
Serial interfaces	1 USB Type-C (NEO-F10T serial port)
	14 pin – 3.3 V logic UART (NEO-F10T serial port)
Timing interfaces	1 time pulse output through 14-pin connector
	1 time pulse LED
	1 time pulse output through SMA connector
	1 external interrupt input
Dimensions	105 x 64 x 26 mm
Power supply	5 V via USB or powered via external power supply (pin 14) of the 14 pin connector (V5_IN) and pin 13 (GND)
Normal operating temperature	–40 °C to +65 °C

Table 2 EVK-F10T specifications

2.1 Safety precautions

EVK-F10T must be supplied by a PS1 class limited power source. 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-F10T, including interfaces and antennas. See section 5.2.1.1 of IEC 62368-1:2018 [5] for more information on the ES1 class.

2.2 Certifications

The EVK-F10T is designed to comply with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU.

The EVK-F10T complies with the Directive 2011/65/EU (EU RoHS 2) and its amendment Directive (EU) 2015/863 (EU RoHS 3).

Declaration of Conformity (DoC) is available on the u-blox website.

3 Getting started

3.1 Installing u-center 2 software

u-center 2, the u-blox interactive evaluation software tool 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. For more information on installing and using the u-center 2 evaluation software tool, see the u-center 2 user guide [4].

The required Windows drivers for the FTDI FT4232H USB-to-UART converter that is used in the EVK are available from the Microsoft Windows Update service. To ensure that the latest FTDI drivers are automatically installed from the Windows Update, check, and uninstall the previously installed FTDI drivers. The Windows system driver search mechanism automatically downloads and installs the FTDI drivers from the Microsoft Windows Update service. If the automatic installation fails, contact u-blox support to get the FTDI drivers and install them manually.

3.2 Installing hardware

Refer to chapter Device description for more information on the interfaces.

1. Power the device on, either via USB on the back or through the 5V_IN input on the front of the EVK.
2. Connect the provided GNSS antenna to the evaluation unit using the RF IN SMA (Note that there is also a buffered 50 Ω SMA output for the time pulse) connector and place the antenna in a location with clear sky view.
3. Start the u-center 2 evaluation tool and select corresponding COM port and baud rate as shown in the u-center User guide.

3.3 Default interface settings

Refer to the NEO-F10T Integration manual [3] for more information on the default interface configuration.

Parameter	Description	Remark
UART, Input	UBX and NMEA protocol at 38400 baud	
UART, Output	UBX and NMEA protocol at 38400 baud	Only NMEA messages are activated by default

Table 3 Default configuration

☞ UART 3.3V interface is available on the 14-pin connector for debugging and design-in purposes.

4 Device description

EVK-F10T evaluation kit contains u-blox NEO-F10T GNSS receiver with RTC, SPI flash memory, TCXO and SAW filter.

4.1 Interface connection

The EVK-F10T supports UART and USB (serial to USB communication) interfaces. To connect the EVK to a PC, use the included USB cable depending on the interface in use. The EVK includes an on-board USB-to-Serial converter for USB-to-UART communication with the receiver. 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 of the EVK unit. There is a dedicated, buffered, 50 Ω SMA connector output for the configurable 1 PPS time pulse. 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 and powered up.

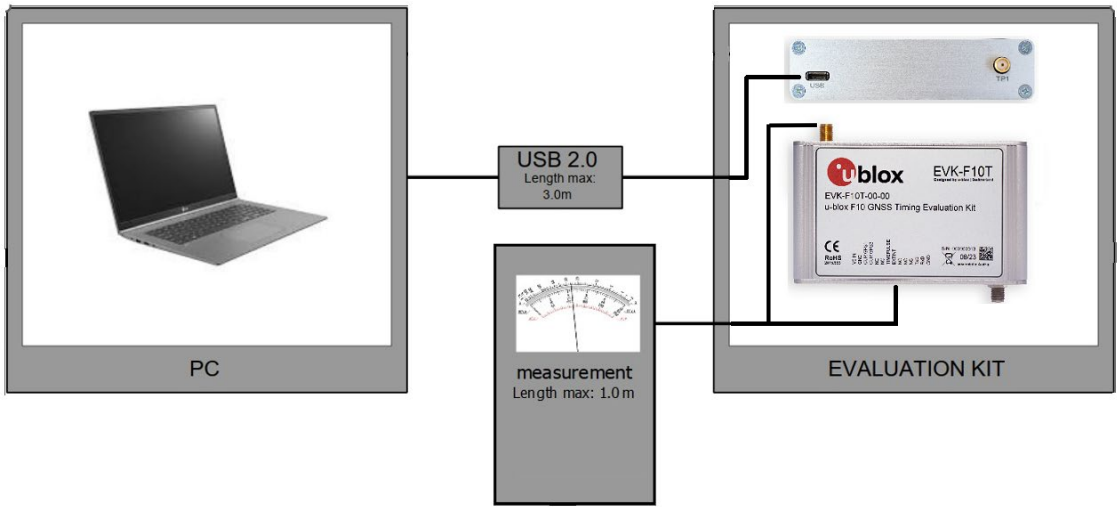

Figure 1 Connecting the EVK-F10T unit for power supply and communication

Figure 2 shows the front and back of the EVK-F10T evaluation unit.

Figure 2 The front and back of EVK-F10T

4.1.1 14-pin connector

The EVK-F10T front side has a 14-pin connector that provides programmable input/output signals, communication interfaces and power supply options. All these pins are ESD protected. The 14-pin connector can be used for communicating with the receiver through the 3.3V UART interface. In addition, the 14-pin connector provides flexibility for evaluating other advanced scenarios.

Figure 3 EVK-F10T 14 Pin connector pin numbering

Pin no.	Pin name	I/O	Level	Description
14	5V_IN	I	4.75 - 5.25 V	Power input – can be used instead of USB.
13	GND	O	3.3 V	Ground
12	GNSS I1	O	3.3 V	Supply current measurement (total current). Current measured from voltage over a 1 Ω 1% resistor between pins 12 (GNSS I1) and 11 (GNSS I2). Pin 12 (GNSS I1) is at higher potential.
11	GNSS I2	O	3.3 V	Supply current measurement (total current). Current measured from voltage over a 1 Ω 1% resistor between pins 12 (GNSS I1) and 11 (GNSS I2). Pin 12 (GNSS I1) is at higher potential.
10	Reserved	-	-	Not connected
9	Reserved	-	-	Not connected
8	TIMEPULSE	O	3.3 V	Time pulse signal
7	EXTINT	I	3.3 V	External interrupt signal. Can be used for time mark feature, time aiding, and wakeup from power save modes.
6	Reserved	-	-	Not connected
5	Reserved	-	-	Not connected
4	Reserved	-	-	Not connected
3	TXD	O	3.3 V	UART1 TXD CMOS 3.6 V max
2	RXD	I	3.3 V	UART1 RXD CMOS 3.6 V max
1	GND	I	-	Ground

Table 4 EVK-F10T 14-pin connector pin description

Figure 4 EVK-F10T 5.0 V DC power supply example

☞ Use a maximum 25 cm cable when using the 3.3 V digital interfaces with your application (e.g. UART)

4.1.2 USB

The USB connector in the evaluation kit can be used for both power supply and communication. The EVK also provides UART communication through the 14-pin connector on the TXD and RXD pins. The maximum operating baud rate is 921600 baud. For more information, see section 14-pin connector.

4.2 GNSS input signal

To evaluate the GNSS reception, the GNSS signal must be supplied to the antenna input SMA connector of the evaluation kit. EVK-F10T evaluation kit includes ANN-MB1 multi-band (L1/L5) active GNSS antenna with a 3 m cable. It is possible to connect various active GNSS antennas with SMA connectors or provide a signal from a recorded or simulated GNSS RF source to the antenna input.

4.2.1 Antenna connector

For connecting an active antenna, an SMA female connector is available on the front of the EVK unit (see Figure 2). The EVK provides 3.3 V bias supply for the external antenna and the recommended maximum antenna supply current for active antennas is 30 mA. This pin is also ESD protected.

☞ EVK-F10T has no antenna supervisor or short circuit detection feature. The short circuit protection is limited to +/- 70mA.

4.3 Time pulse

u-blox receivers include a time pulse function that provides pulses with a configurable pulse period, pulse length and polarity (rising or falling edge). The u-center 2 evaluation tool can be used to configure the time pulse parameters. The time pulse signal is available at the buffered 50 Ω SMA connector and the 14-pin connector. In addition, the time pulse signal is inverted and connected to the LED on the front side of the EVK.

The TP1(J3) SMA connector for the co-ax 1PPS output has a buffered output with configurable drive strength to ensure the time pulse shape and rise time is optimal into various loads. By default, it has no jumper on J2. A jumper can be placed to bypass a resistor to increase the drive strength into low impedance loads.

Open the evaluation kit to access the J2 jumper.

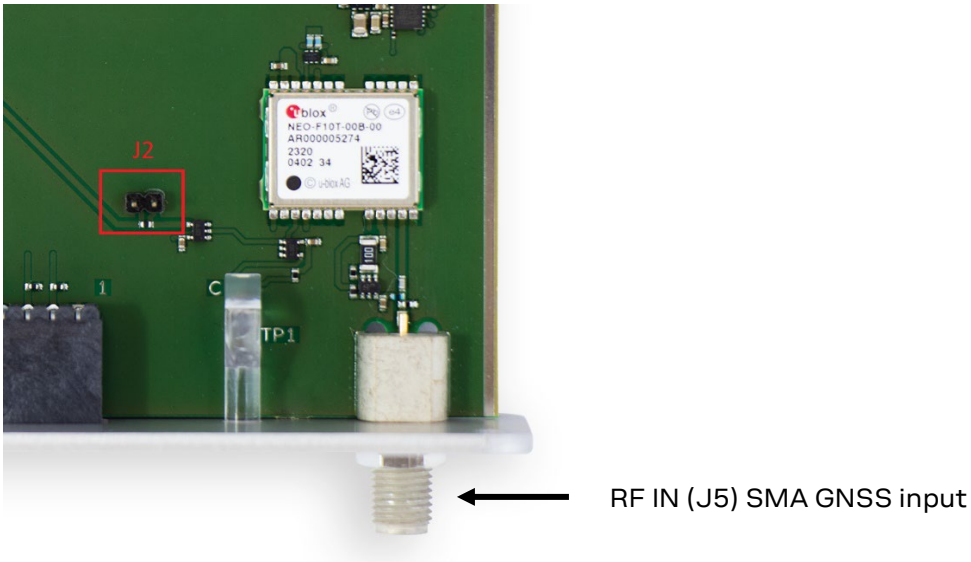

Figure 5 EVK-F10T J2 jumper location on PCB

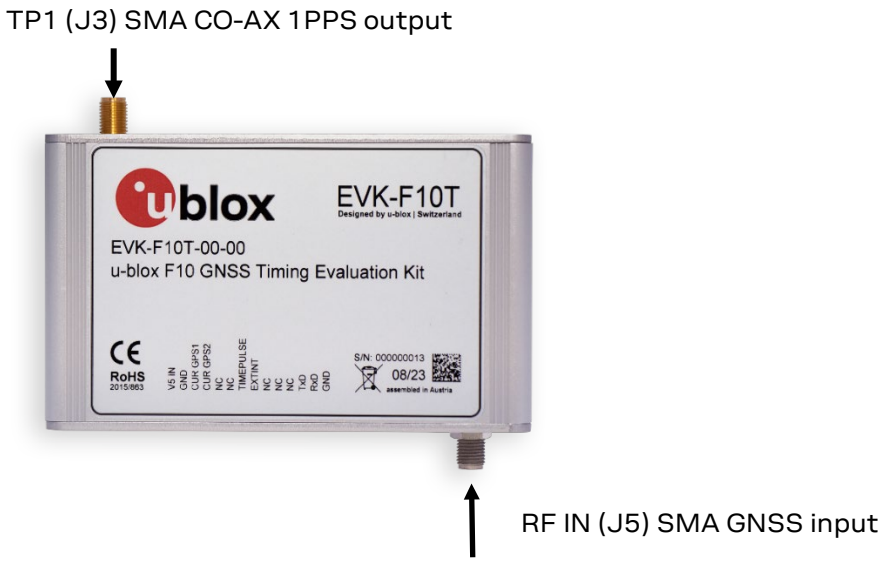

Figure 6 EVK-F10T TP1 (J3) 1PPS output location

4.4 Reset button

The RST button on the front side resets the u-blox F10 receiver.

4.5 Safe boot button

This is used to set the unit in 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 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, a training sequence must be sent to the receiver.

The training sequence is a transmission of 0x55 0x55 at a baud rate of 9600 baud. Wait for at least 100 milliseconds before the interface is ready to accept commands.

4.6 LED

On the front panel of the EVK unit, a single blue LED shows the time pulse signal. The default configuration has the following functionality:

LED	Description
Solid blue	The device is powered on with no GNSS fix.
Flashing blue	The LED flashes one pulse per second during a GNSS fix.

Table 5 LED description

The time pulse signal is configurable. For details, see the Interface description [2].

4.7 Flash memory

EVK-F10T has an 8-Mbit SPI flash built-in in the NEO-F10T receiver. It can be used to store the current configuration permanently.

4.8 External interrupt

On the EVK-F10T, the external interrupt (EXTINT) signal is available on the 14-pin connector. The EXTINT signal can be used for time mark and time aiding features of the receiver, as well as for waking up the receiver from software standby power save mode. See section 14-pin connector for more information.

5 Measuring current

5.1 Measuring GNSS current on the 14-pin connector

The receiver starts up in the acquisition mode to search for available satellites and to 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.

On EVK-F10T, the main supply voltage for the u-blox NEO-F10T GNSS receiver is 3.3 V. To measure the total GNSS supply current with EVK-F10T, follow these steps:

1. Before starting the test, make sure you have good signals and clear sky view to ensure that the receiver can acquire the satellite signals.
2. Power up EVK-F10T.
3. Connect a true RMS voltmeter across GNSS I1 (pin 12) and GNSS I2 (pin 11) of the 14-pin connector. The reading should be in mV.

☞ Use a maximum 25 cm cable when using the 3.3 V digital interfaces with your application (e.g. UART)

4. Read the voltage (and average it if necessary) on the voltmeter and convert to current (For every 1 mV across the resistor it equals 1 mA in current consumption).

☞ The current shunt resistor is 1 Ω 1%.

6 Block diagram

EVK-F10T block diagram provides an overview on supply voltages, current measurement and communication interfaces as shown in Figure 7.

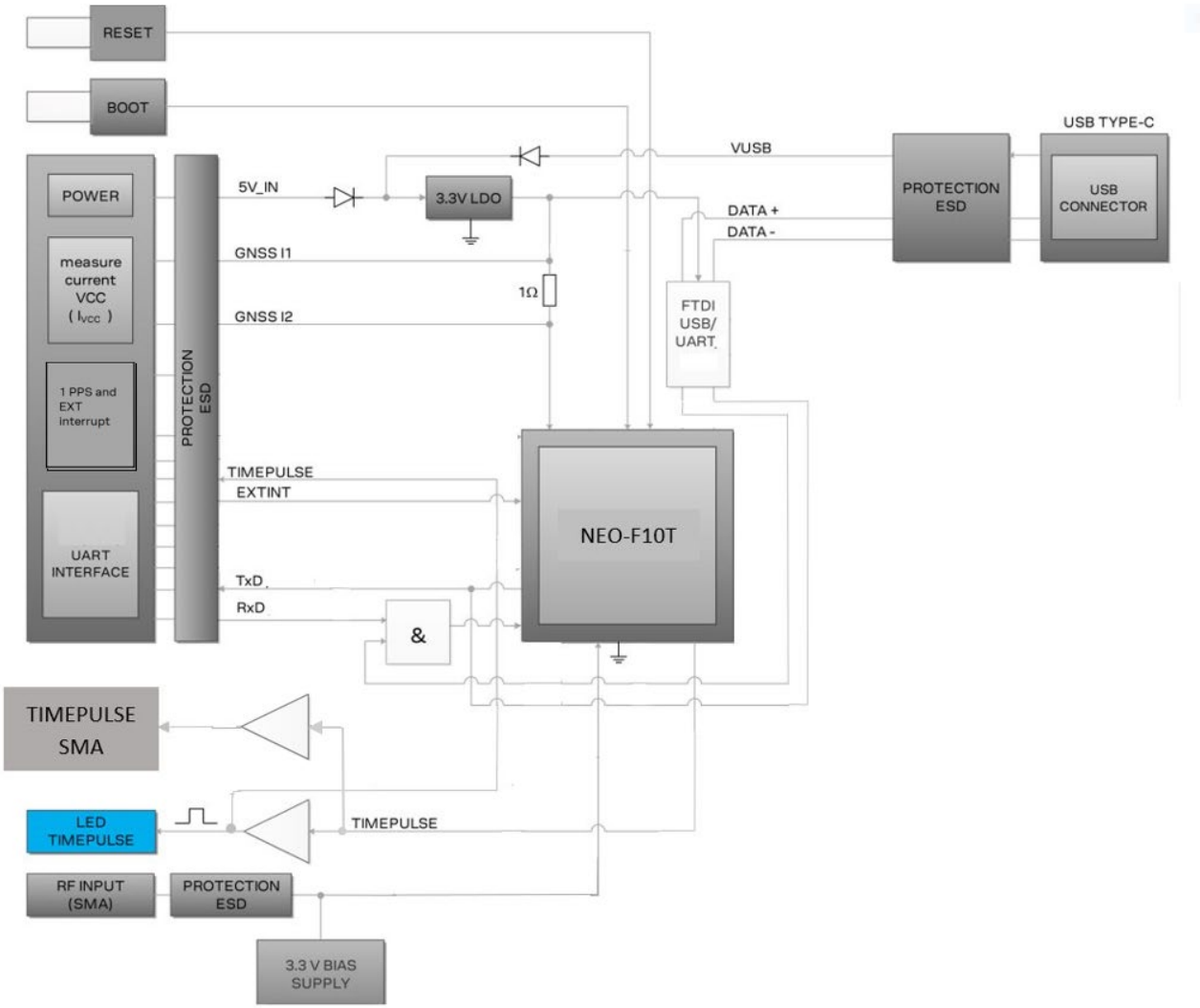

Figure 7 EVK-F10T simplified block diagram

7 Board layout

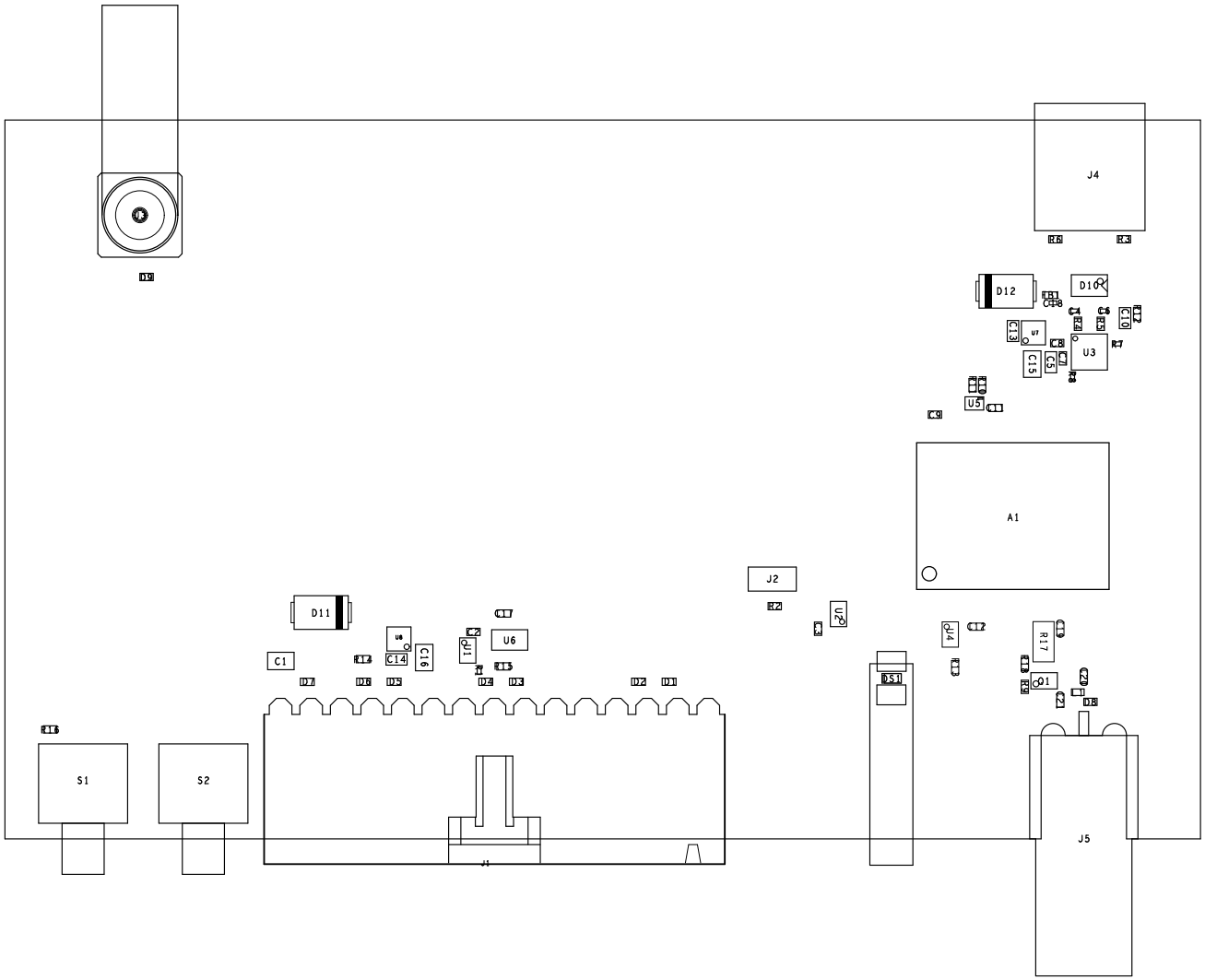

Figure 8 EVK-F10T board layout

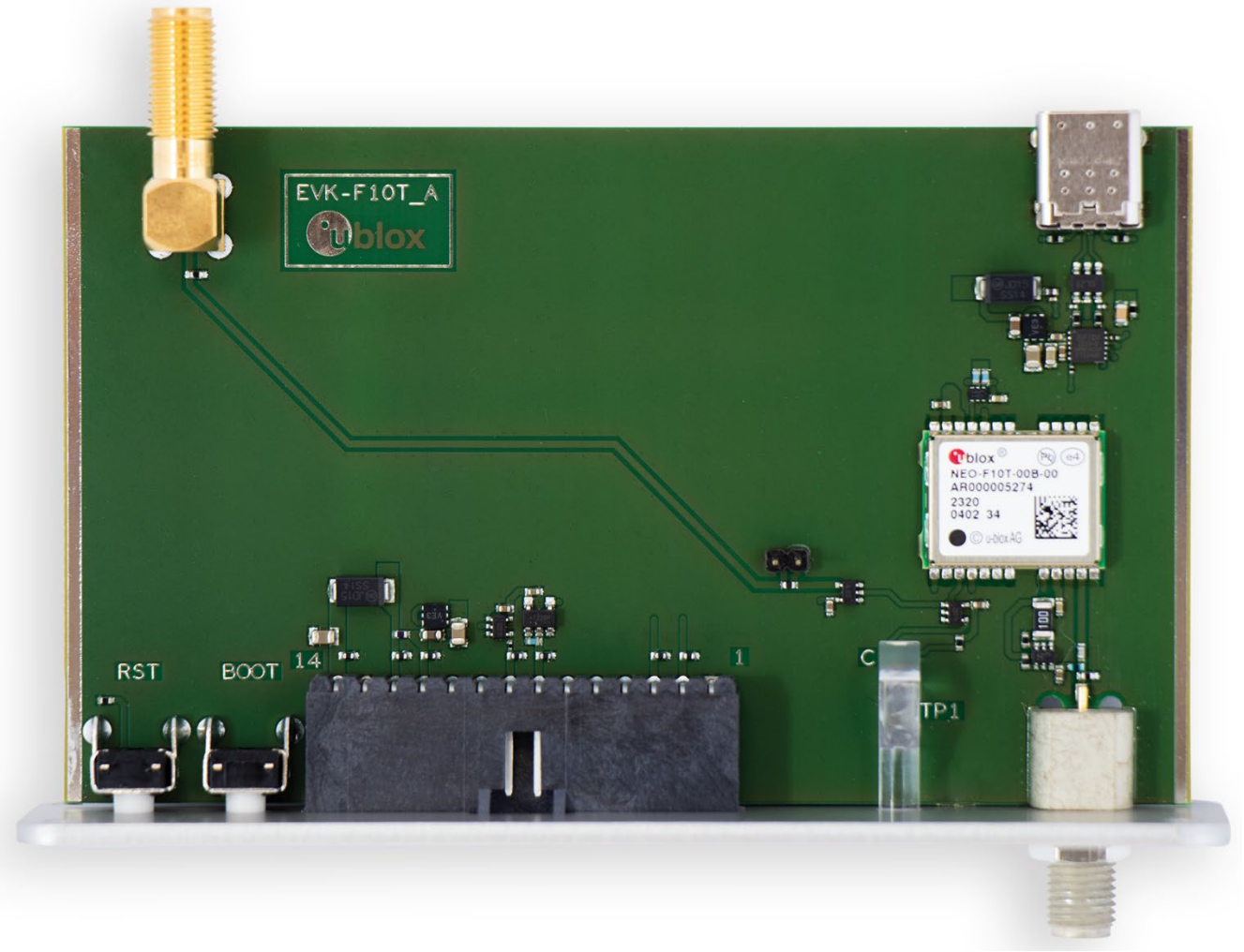

Figure 9 EVK-F10T PCB

8 Schematic

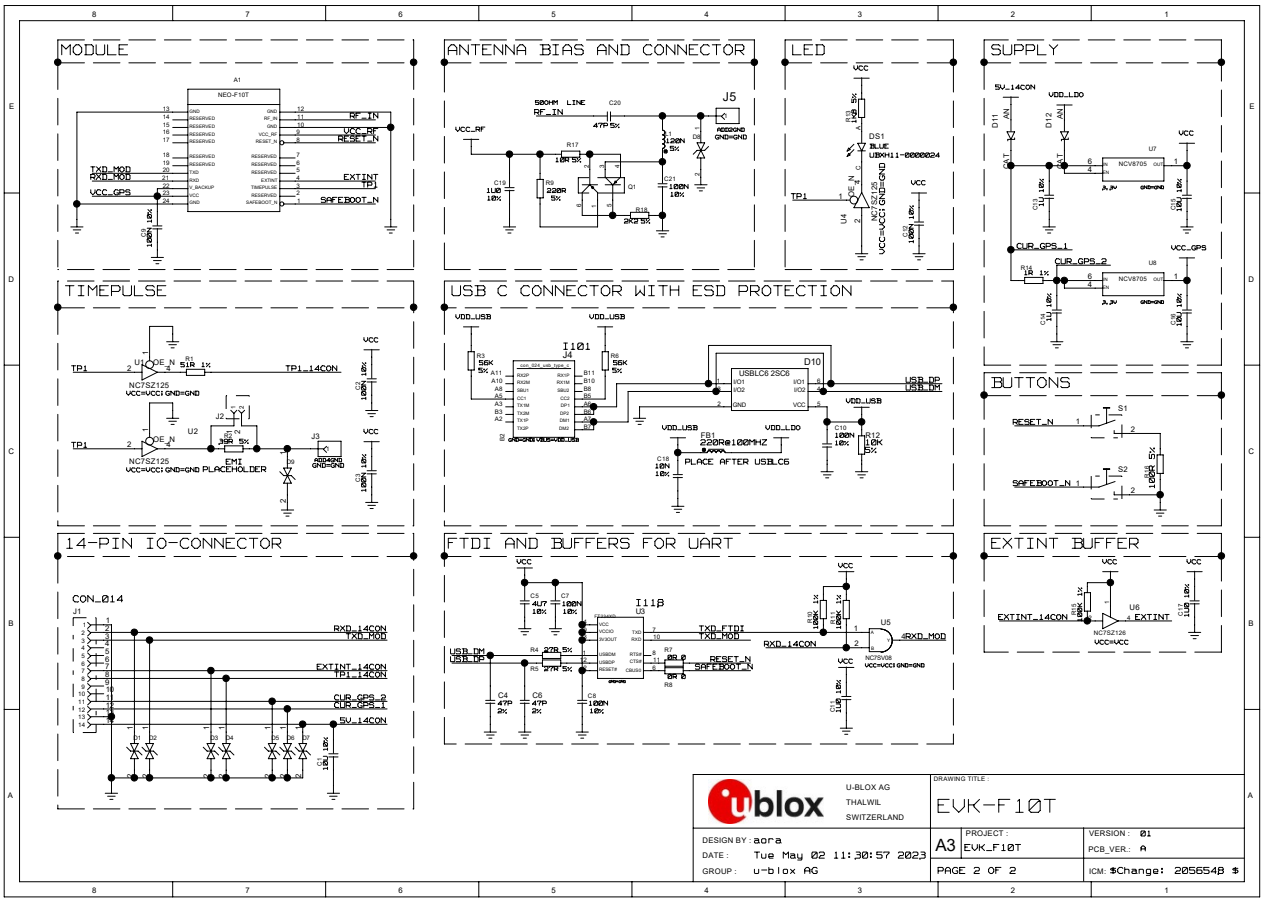

Figure 10 EVK-F10T schematic

9 Device configuration

This chapter shows how to configure and evaluate the EVK-F10T key features related to GNSS constellations, and internal post - LNA modes of the receiver. The receiver can be configured with the configuration keys using the u-center 2 evaluation tool in the **Device configuration** -> **Advanced configuration** view, as shown in Figure 11.

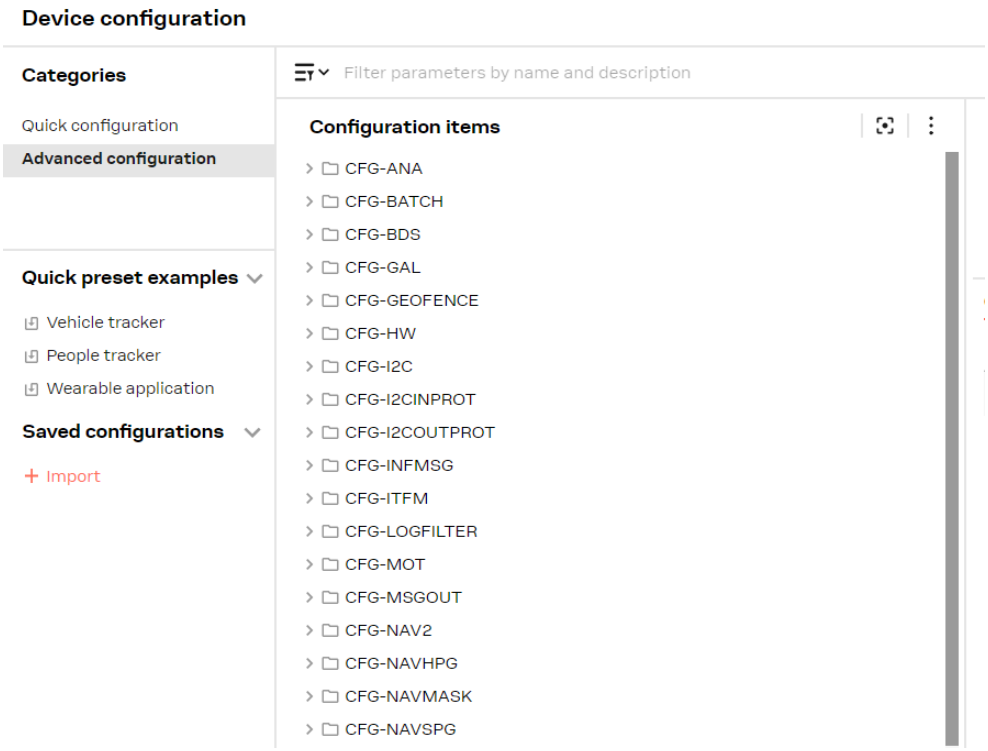

Figure 11 EVK-F10T receiver configuration view

The receiver configuration can be saved to the receiver RAM, battery-backed RAM (BBR), or the available SPI flash memory. The RAM content is cleared after the power supply is disconnected, in the software standby mode or in the off state of the on/off power save mode (PSMOO). 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 (Not supported on the EVK-F10T hardware). 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.

9.1 Connecting the EVK with a PC

The FTDI USB-to-UART converter generates a virtual communication (COM) port as shown in Figure 12.

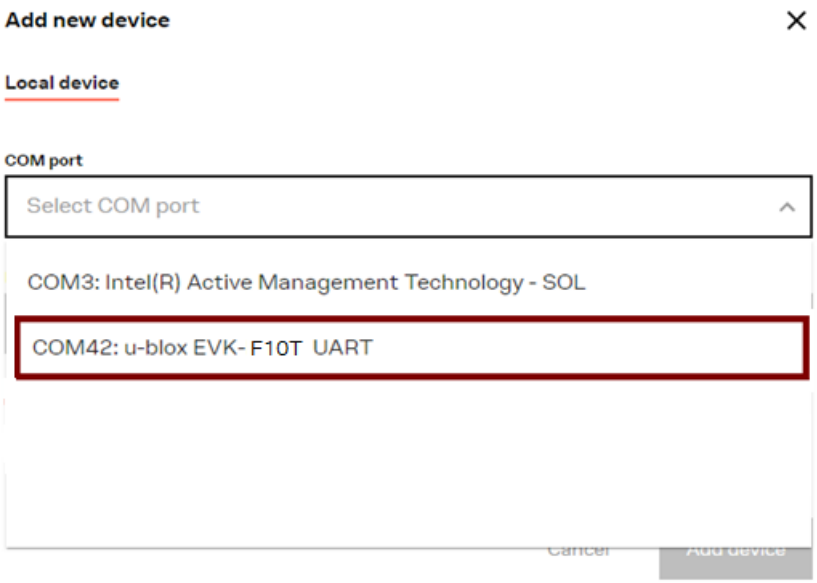

Figure 12 EVK-F10T communication port

The identification of EVK-F10T on Windows machines has been improved to provide descriptive names to each virtual communication (COM) port as shown in Figure 10.

- **EVK-F10T UART:** Use this COM port for UART communication with the receiver via the FTDI USB-to-UART interface.

9.1.1 UART baud rate configuration

The baud rate for the UART communication to the receiver can be configured in the **CFG-UART1 - BAUDRATE** configuration key depending on the UART interface that is in use. The default baud rate is set to 38400 as shown in Figure 13, and the maximum baud rate is 921600.

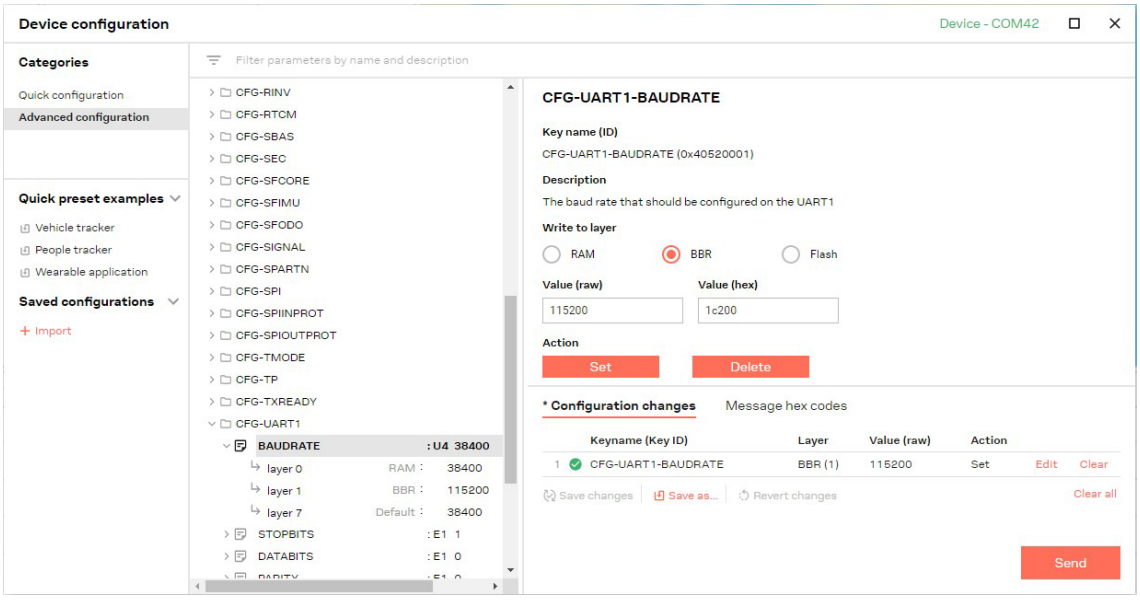

Figure 13 EVK-F10T UART baud rate configuration

☞ Setting a different baud rate will interrupt communication. If other configuration keys were set after, these will not be applied. Therefore, the new baud rate needs to be selected manually to resume communication and apply the remaining configuration items.

9.2 GNSS configuration

The default GNSS constellations that are enabled on the receiver are GPS, Galileo, Beidou, QZSS and SBAS. The receiver GNSS configuration can be updated by selecting the constellations in the GNSS Configuration View as shown in Figure 14. See the NEO-F10T Data sheet [1] section Supported GNSS constellations.

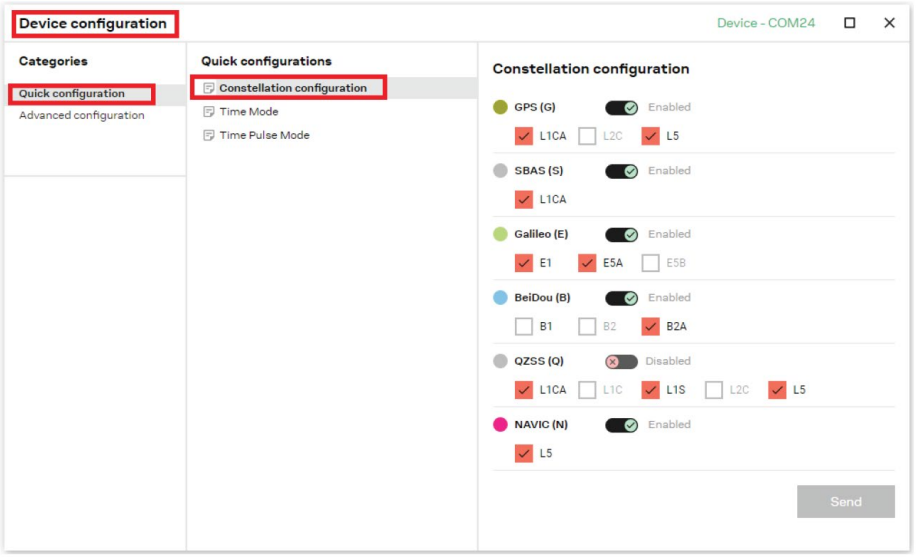

Figure 14 EVK-F10T receiver GNSS configuration

9.3 Time modes

To achieve the best possible time accuracy, configure the NEO-F10T receiver to the time mode. For details, see Integration Manual [3], chapter Timing receiver configuration.

9.3.1 Survey-in

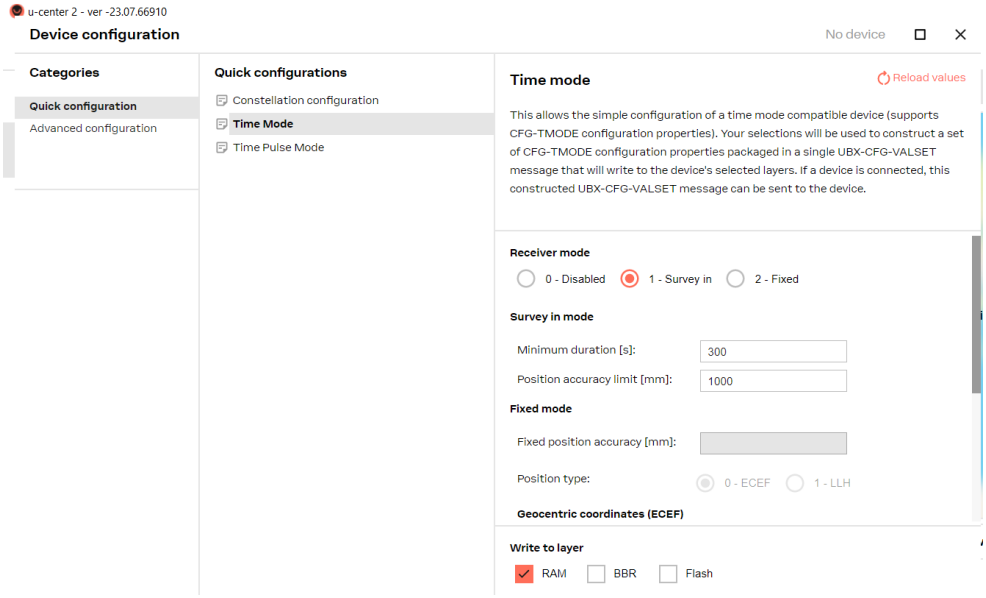

Figure 15 u-center 2 Time mode, mode select: Survey-in

9.3.2 Fixed

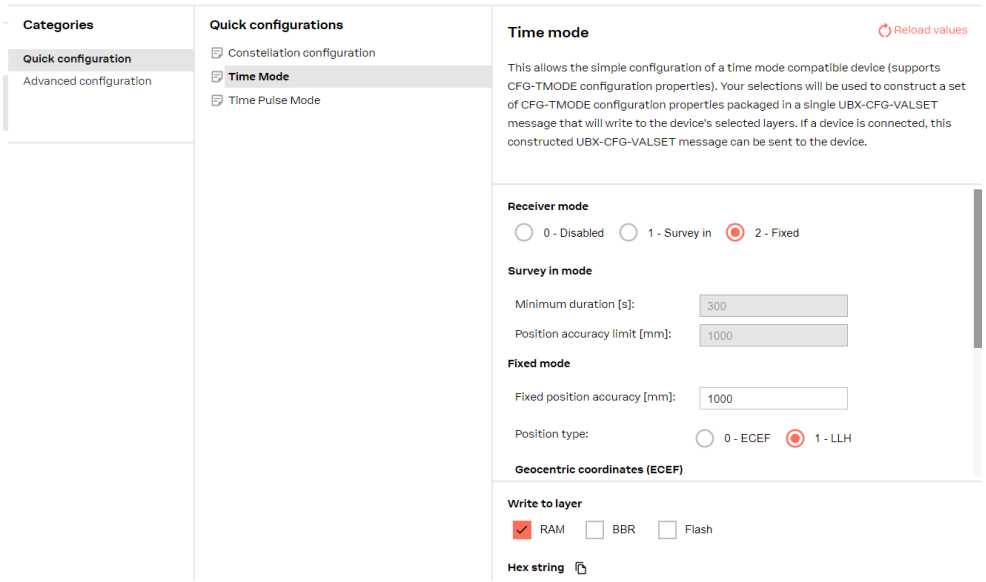

Figure 16 u-center 2 Time mode, mode select: Fixed

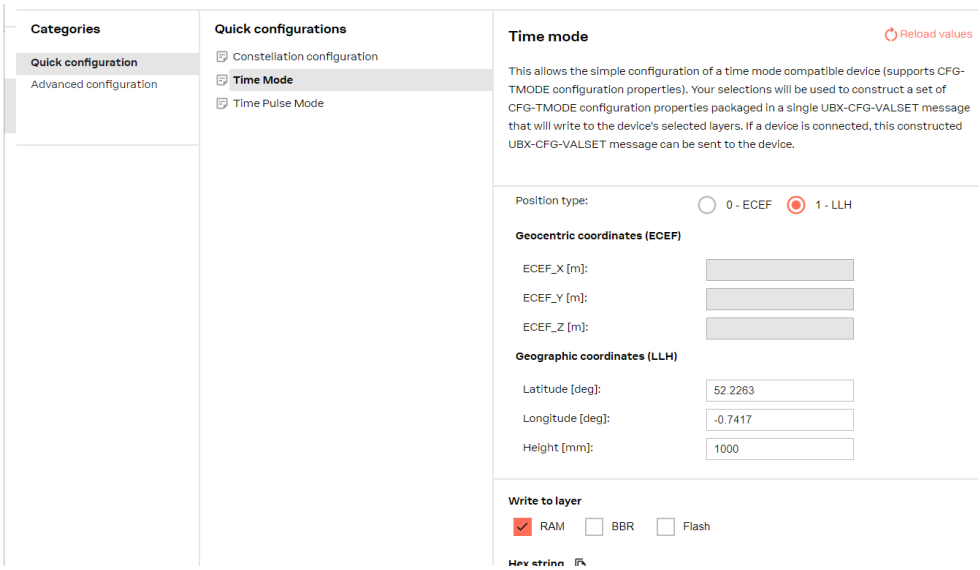

Figure 17 u-center 2 Time mode: Fixed LLH

9.4 Time pulse

The time pulse output is highly configurable in terms of pulse rate and duration, as well as the time base used. See the NEO-F10T Integration manual [3] sections Time and Time pulse for a detailed description. u-center 2 can be used configure the time pulse using the CFG-TP configuration items as shown in Figure 18.

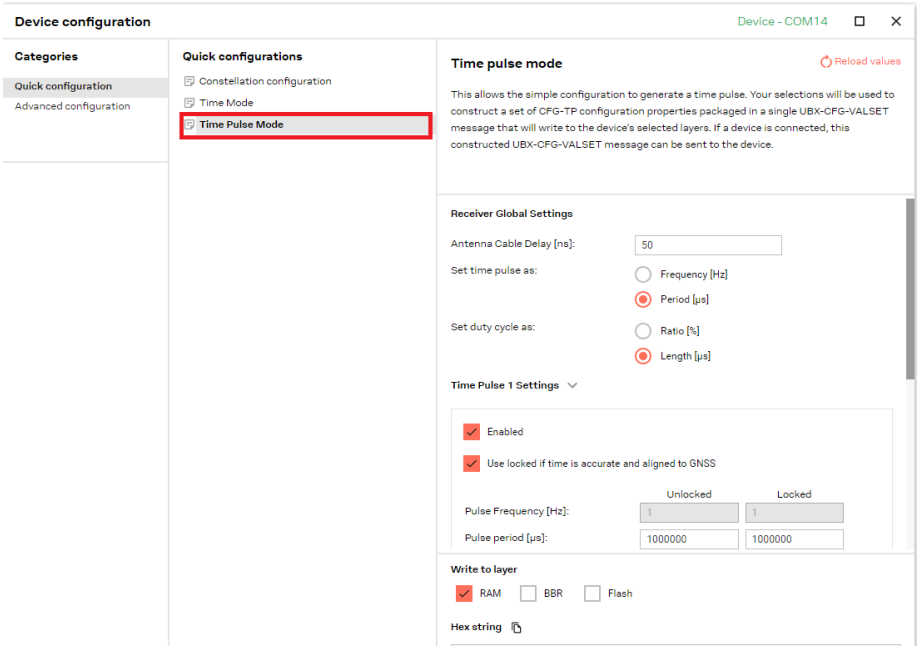

Figure 18 u-center 2 Time pulse mode: Period configuration

Related documentation

[1] NEO-F10T Data sheet, UBX-22022576
[2] u-blox F10 TIM FW 3.01 Interface description, UBX-23003447
[3] NEO-F10T Integration manual, UBX-22018271
[4] u-center 2 User guide
[5] Information technology equipment – Safety Standard IEC 62368-1:2018

☞ For product change notifications and regular updates of u-blox documentation, register on our website, www.u-blox.com.

Revision history

Revision	Date	Comments
R01	12-Mar-2024	Initial release

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