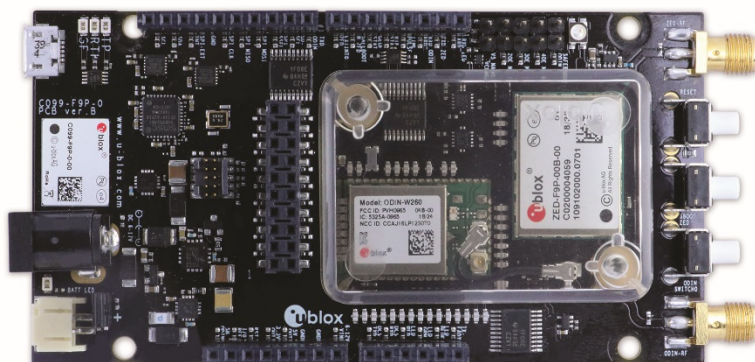


# C099-F9P

## Application Board (Rev. B)

### User Guide



### Abstract

The C099-F9P board enables customers to evaluate RTK operation with the ZED-F9P high precision GNSS receiver. The board provides short-range wireless connection via Bluetooth® or Wi-Fi for receiving correction data and logging via wireless connectivity.

## Document Information

<b>Title</b>	<b>C099-F9P</b>	
<b>Subtitle</b>	Application Board (Rev. B)	
<b>Document type</b>	User Guide	
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This document applies to the following products:

Product name	Type numbers	Firmware version	PCN reference	Product status
C099-F9P	C099-F9P-0-01	HPG 1.00	N/A	Advance Information
	C099-F9P-1-01	c099mbed3_v1.0.0		
	C099-F9P-2-01			

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# 1 Introduction

The C099-F9P board is a convenient tool that allows customers to become familiar with the u-blox ZED-F9P high precision GNSS module. The board provides facilities for evaluating the product and demonstrating its key features. The C099-F9P application board offers:

- A ZED-F9P module for use as a RTK rover or reference station.
- An ODIN-W2 short-range module to provide untethered operation using Bluetooth.
- Power supply options comprising a USB connection, LiPo cell with recharging ability, and 6-17 V DC input<sup>1</sup>.
- Small and light board (110 x 55 mm) with Arduino R3 shield connections for host expansion.

The board comes pre-configured to connect wirelessly via Bluetooth to a host. This makes it possible to stream in RTCM corrections while sending back logged data using u-center evaluation software [3].

This User Guide is split into several useful sections:

- The C099-F9P quick start section provides information to get up and running straight out of the box.
- The C099-F9P description identifies the board's facilities.
- Using the C099-F9P provides a comprehensive guide for in-depth usage.
- Rover operation using NTRIP shows different ways of connecting to an NTRIP service.
- The [Firmware updates](#) section provides instructions for updating the firmware of the ZED-F9P high precision GNSS module as well as the ODIN-W2 short-range module.

---

<sup>1</sup> The C099-F9P kit does not contain a battery or external power adapter.

## 1.1 Package contents

The delivered package contains:

- C099-F9P board (Rev. B)
- u-blox multi-band GNSS antenna and ground plane
- Wi-Fi/Bluetooth antenna
- USB interconnect cable
- Quick start guide

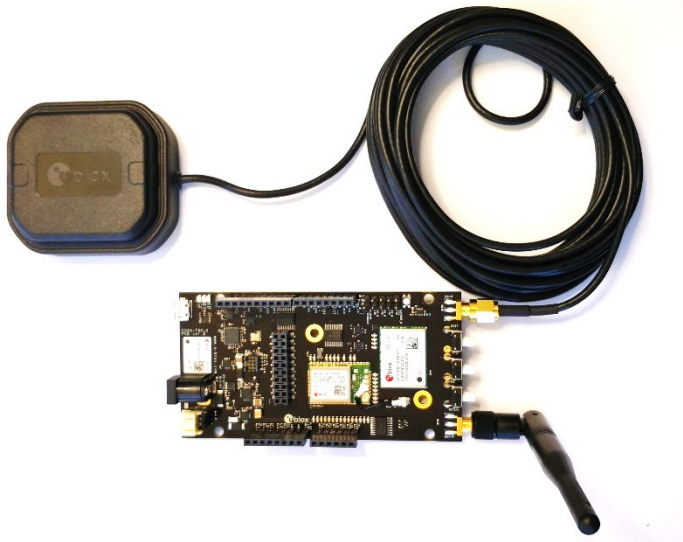


Figure 1: C099-F9P board and antennas

## 1.2 Additional sources of information

Prior to using the board, it is useful to download the appropriate evaluation software and keep handy the following documents:

- ZED-F9P Integration Manual, Doc. No. UBX-18010802
- ZED-F9P Interface Description, Doc. No. UBX-18010854
- Download u-center: <https://www.u-blox.com/en/product/u-center-windows> and the u-center User Guide: [https://www.u-blox.com/sites/default/files/u-center\\_UserGuide\\_\(UBX-13005250\).pdf](https://www.u-blox.com/sites/default/files/u-center_UserGuide_(UBX-13005250).pdf)
- Download the u-blox GNSS Sensor and VCP Device Driver guide: [https://www.u-blox.com/sites/default/files/products/documents/u-blox-GNSS-Sensor-and-VCP-Device-Driver\\_UserGuide\\_\(UBX-15022397\).pdf](https://www.u-blox.com/sites/default/files/products/documents/u-blox-GNSS-Sensor-and-VCP-Device-Driver_UserGuide_(UBX-15022397).pdf)

## 2 C099-F9P quick start

This section provides some short steps to enable ZED-F9P operation before exploring the more complex configurations described later.

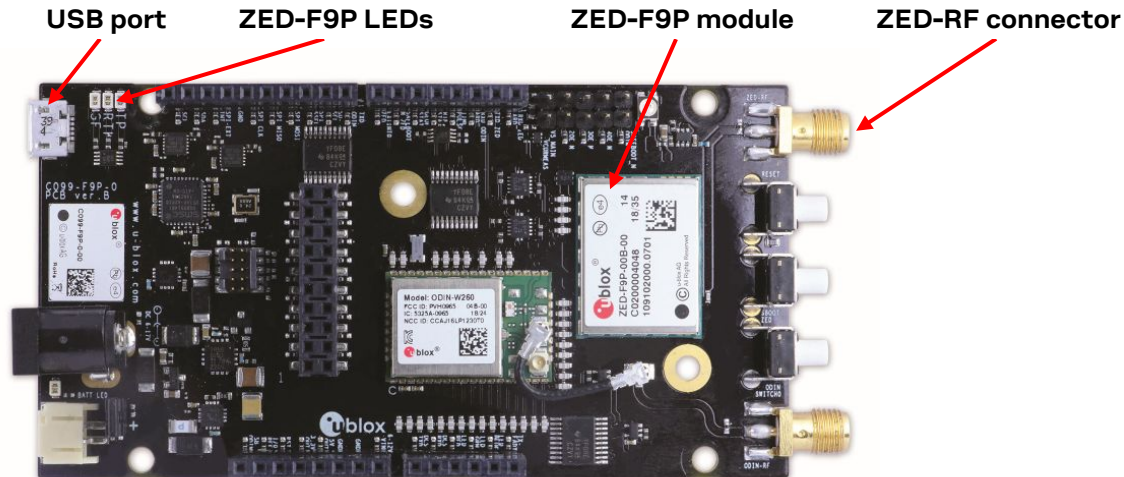


Figure 2. Basic C099-F9P overview with details needed for quick start

### 2.1 Starting up

- Connect the supplied multi-band GNSS antenna to the ZED-RF SMA connector. Ensure good signal reception.
- Connect the USB to a Windows PC; this will power the board. The FTDI and USB drivers will be installed automatically from Windows Update when a user connects the board for the first time.
- Start u-center and connect to the COM port identified as “C099 application board, ZED-F9P” using Device Manager. Set the baud rate to 460'800 baud. See section 4.3.1 for detailed instructions.
- The TP LED on the C099-F9P board will blink in blue color. Figure 3 below shows a typical u-center view with active satellite signal levels.

To operate the ZED-F9P in RTK mode, the GNSS antenna must be placed in an open environment and the unit must be connected to an RTK correction service. Where available, the evaluation kit comes with a free trial of the SmartNet correction service. Consult the leaflet included with the kit for information on how to register for the service and how to obtain mount point and user connection details before moving to the next steps.

RTK corrections can be applied using a u-center built-in NTRIP client. To use the C099-F9P board with a correction service follow these next steps:

- In u-center, click on the Receiver Menu item.
- Select “NTRIP Client...”
- Fill in the settings for the NTRIP caster, username and password.
- Click “Update source table” and select the recommended NTRIP mount point.
- Click OK to close the dialog and connect to the service.
- In the Data View of u-center, the Fix Mode should change from “3D” to “3D/DGNSS” when RTCM corrections are received. The RTK LED will blink in green color.
- Eventually, the status will change to “3D/DGNSS/FIXED” and the RTK LED will show a steady green color.

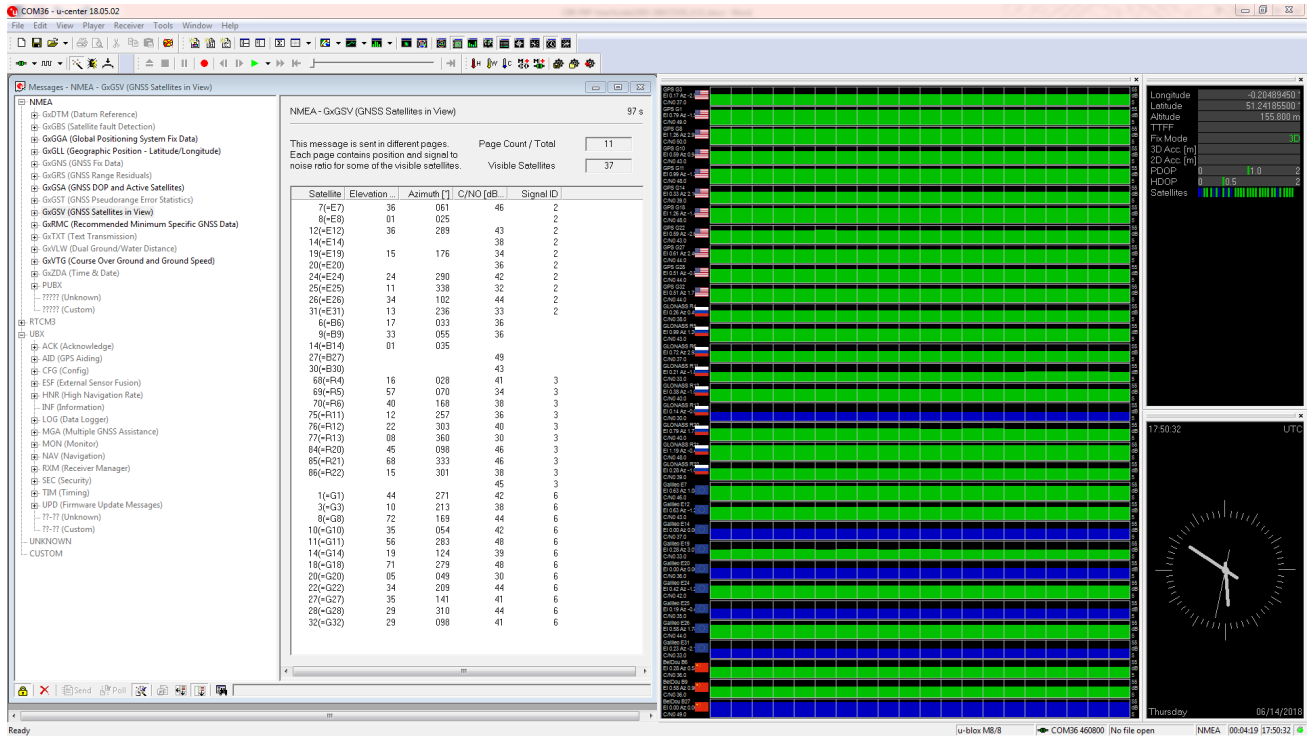


Figure 3: u-center showing a view of the ZED-F9P default operation



## 3 C099-F9P description

### 3.1 Component overview

The C099-F9P houses the ZED-F9P RTK high precision positioning module plus an ODIN-W2 module for wireless short-range communications. An FTDI component provides dedicated COM port connections with the ZED-F9P and ODIN-W2 via USB.

The board can be powered by USB, a DC supply socket, or from a LiPo (lithium polymer) battery. The board has been designed using an Arduino form factor with the modules' serial ports routed to the shield headers.

The block diagram in Figure 4 shows the logical signal flow between the individual parts.

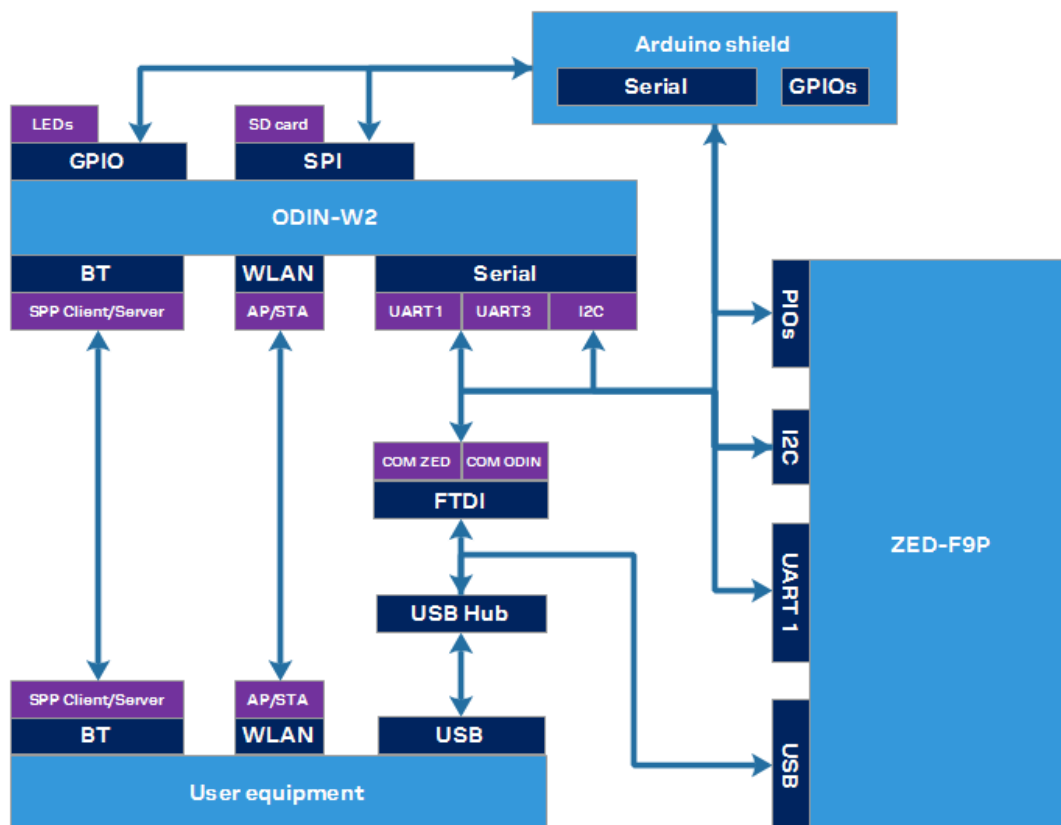


Figure 4: C099-F9P block diagram

### 3.2 Component identification

The following images show the position of major parts and user interfaces.

- Main components – Figure 5.
- Switches and LEDs – Figure 6.

The functions of these are described later on in this section.

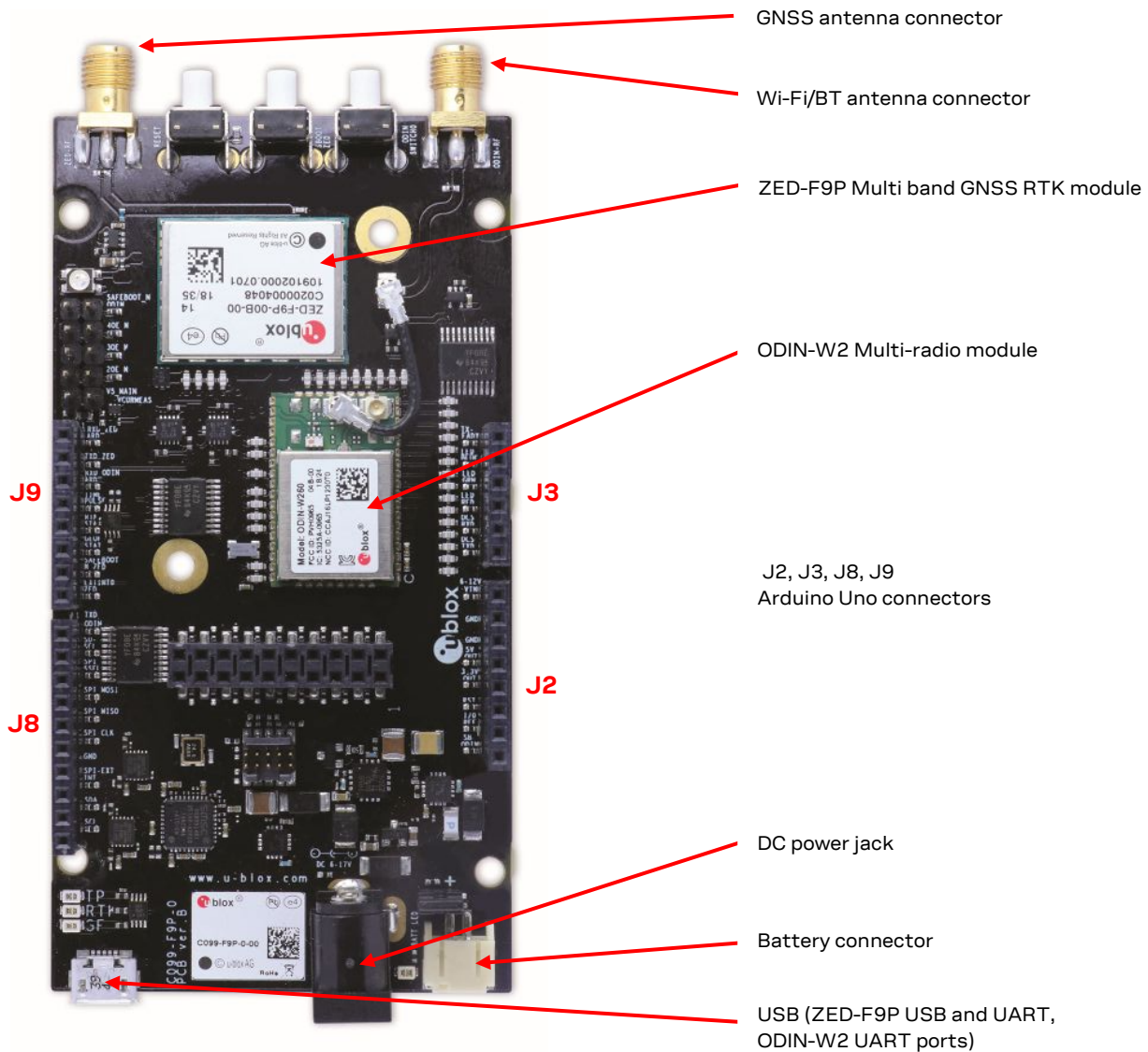


Figure 5: Main components and USB ports

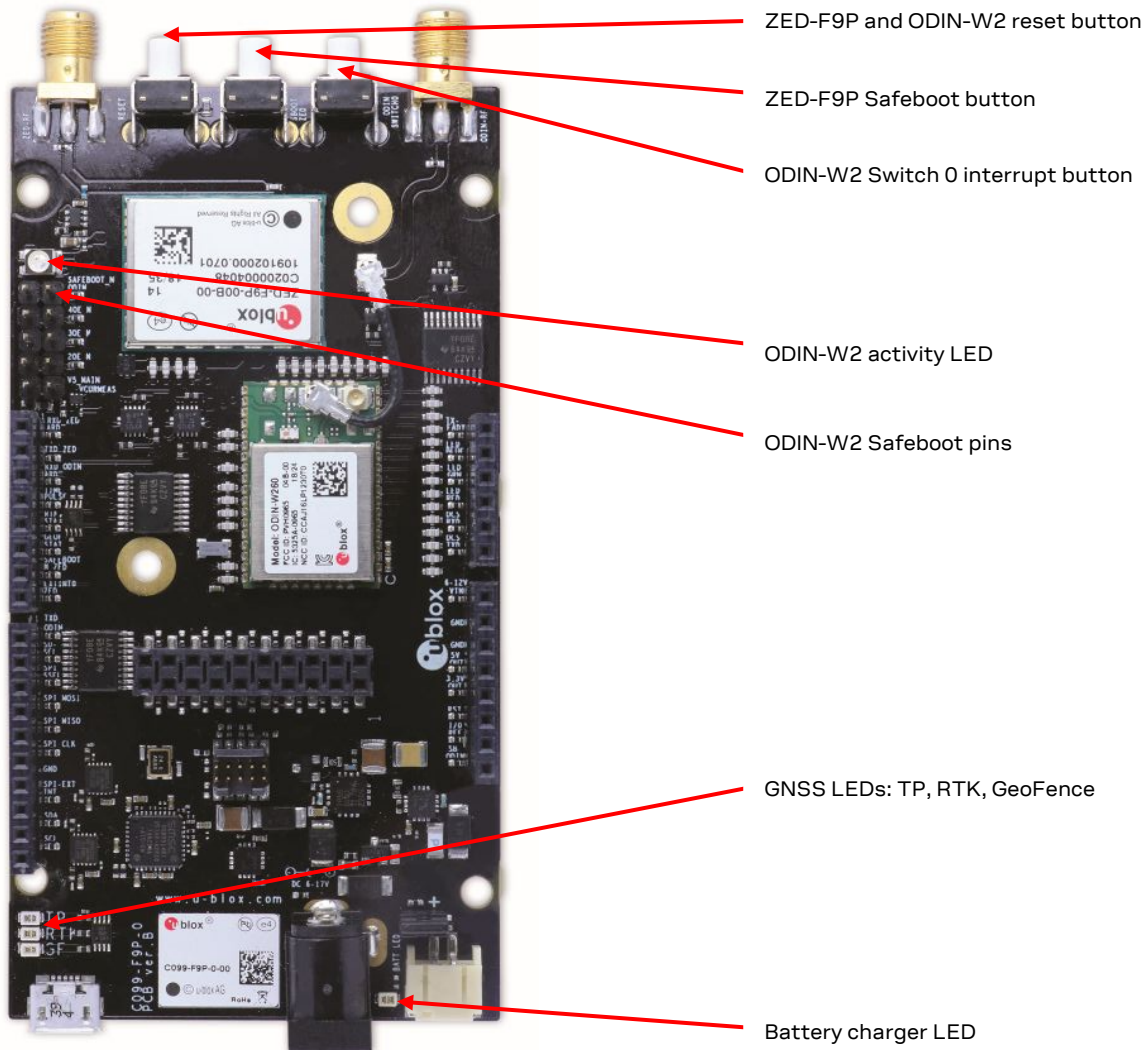


Figure 6: Switches and LEDs

 The MicroSD card slot is not used in this version of the board. The ODIN-W2 Switch 0 interrupt is not required for normal customer use.

### 3.2.1 ZED-F9P status LEDs

The board provides three LEDs to show the ZED-F9P status. The location of the LEDs is shown in Figure 7 below.

The **RTK Status** LED provides an indication of the state of the ZED-F9P module RTK-STAT pin.

- At start-up the LED is off.
- When in RTK Float mode, the yellow LED flashes at the navigation rate (1Hz default). This is also an indication that RTCM corrections are received.
- When in RTK fixed mode, the yellow LED is turned on.

The **Time Pulse** blue LED will flash at the default 1Hz rate when the time solution is valid.

If activated, the **Geofence status** LED indicates the current Geofence status, i.e. in or outside a designated area.

See the ZED-F9P Interface Description [2] for help with configuring the Time Pulse output or activating the Geofence pin.

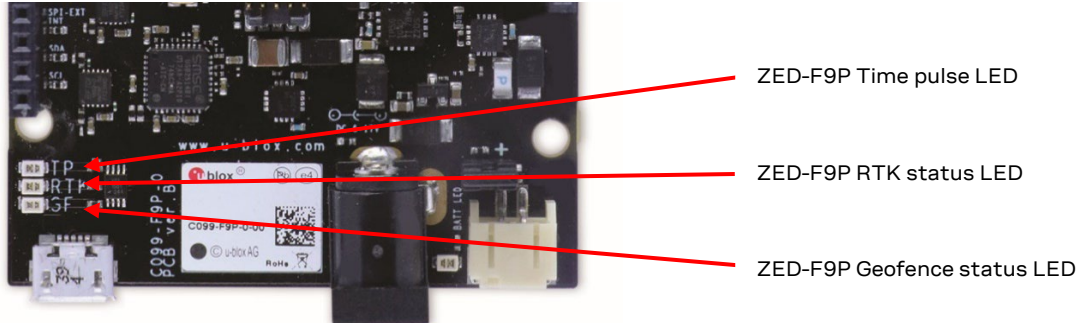


Figure 7: ZED-F9P LEDs

### 3.2.2 ODIN-W2 activity LED

The ODIN-W2 module uses a multi-colored LED to show particular activity status. This is positioned adjacent to the ZED-F9P and ODIN-W2 reset switch and shown below in Figure 8. The activity status is summarized in Table 1 below.

Status	LED color	Remark
Successful start-up, BT radio initialized	Green	
BT Serial Port Profile connection created	Blue	Connection initiated and accepted
Successful SPP data packet transmission	Blinking blue	
Failed SPP data packet transmission	Blinking red	Weak signal, SPP connection failure

Table 1: LED activity states and colors

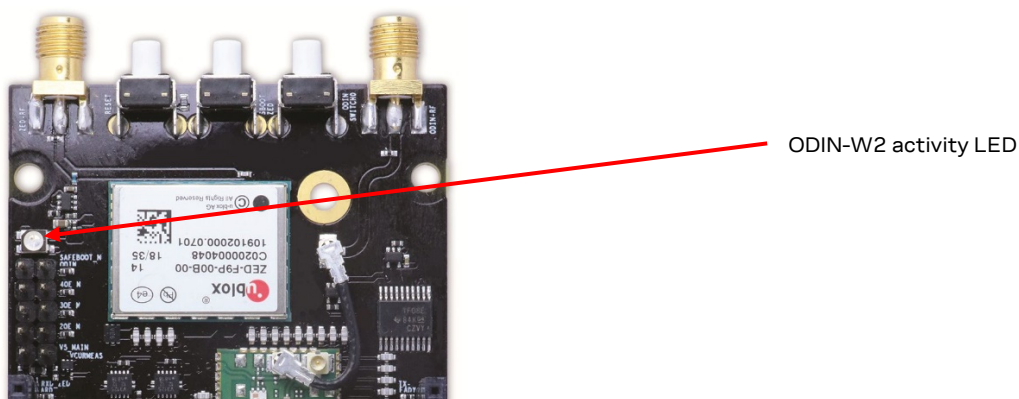


Figure 8: ODIN-W2 Activity LED position on C099-F9P board

## 4 Using the C099-F9P

The ZED-F9P is shipped with the latest firmware and the ODIN-W2 is pre-configured as a Bluetooth serial device. Information on updating either module's firmware is provided in section 6.

### 4.1 Powering the board

The board can be powered from a variety of sources:

- The USB connection,
- A 3.7 V LiPo Battery via a JST connector,
- An external 6-17 V DC source via a 2.1 mm connector; center pin V+.

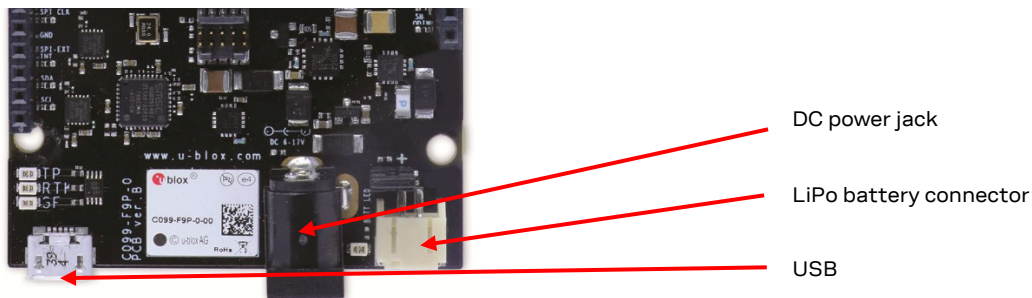


Figure 9: Power connections

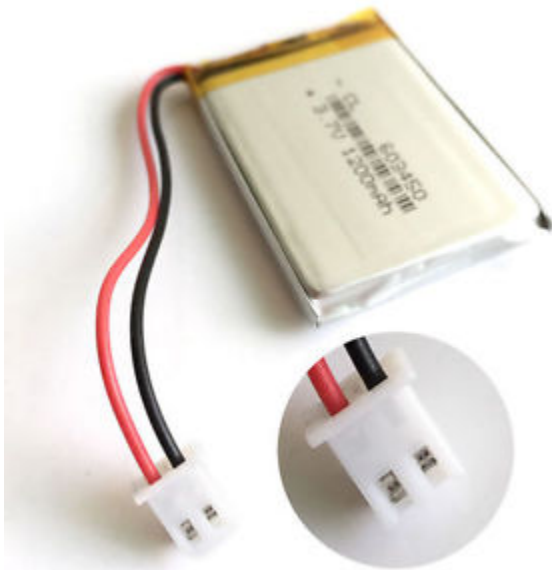


Figure 10: Typical single cell 3.7 V LiPo battery with JST connector

Follow all published safety advice for using bare cell LiPo batteries while charging and protecting them from mechanical damage. Fire risk can occur if the advice is not followed.

All supply connections are fed via a Schottky diode to the main supply bus to allow multiple sources to be connected in parallel. The LiPo battery will be charged from either the DC power source or the USB power source. The charging status is indicated by a red LED which is on during charging and turned off when fully charged.



When less than 500 mA is available through a USB connector, ensure sufficient supply via the DC power jack. Hot swap from USB powered mode to battery powered mode is bounded by present battery voltage level. It is recommended to apply hot swap only if a battery is fully charged.

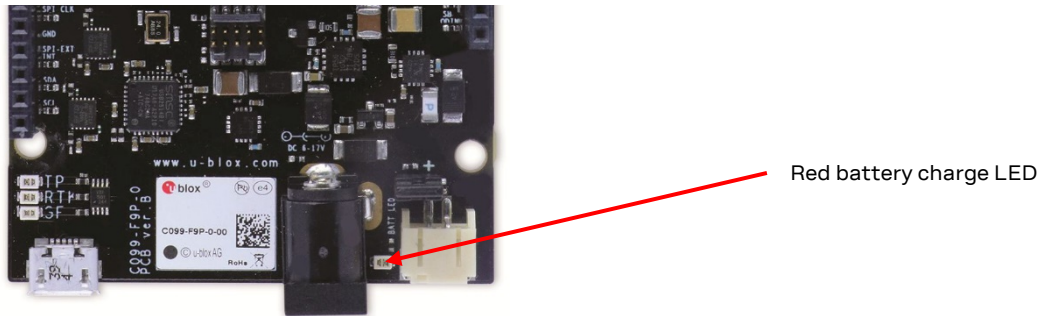


Figure 11: Battery charge status LED

## 4.2 GNSS RF input

The C099-F9P board should be used with the antenna supplied with the kit. If another active antenna is used, be aware that the RF input has a bias output designed to supply 3.3 V DC with a 70 mA maximum current load. A DC block is advisable if the board is connected to a signal distribution scheme or GNSS simulator to prevent any potential shorting of the antenna bias.

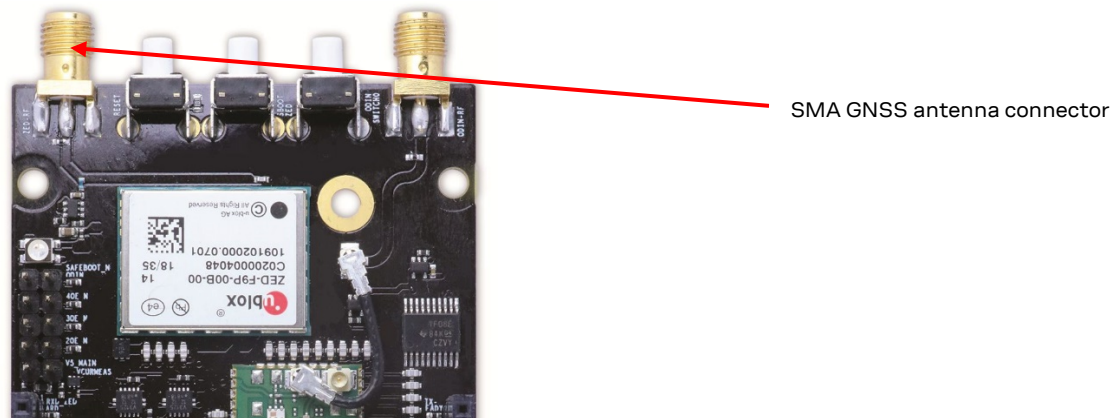


Figure 12: GNSS antenna connector

When using the supplied antenna it is advisable to use the ground plane provided. Otherwise ensure that there is an adequate ground plane, e.g. by mounting in the center of a metallic car roof.



Figure 13: The supplied GNSS multi-band antenna

## 4.3 User interfaces

The C099-F9P has a number of fixed connection options besides the wireless modes. There is also an additional Arduino R3 / Uno interface for external host connection.

The USB connector on the board provides connection via an on-board hub providing:

- An FTDI USB bridge to ZED-F9P UART1 and ODIN-W2 UART COM ports.
- Dedicated connection to the ZED-F9P USB port.

### 4.3.1 FTDI USB Bridge

When the USB cable from the user's PC is connected, a driver will load and set up two virtual serial ports, as shown below in Figure 14. Additionally, a further serial VCP will be created to provide a direct connection with the ZED-F9P USB port.



Ensure that the PC is connected to the internet to load the drivers from Windows Update.

The first of these is connected to the ZED-F9P serial port and should be selected with u-center. The second serial device is for the ODIN-W2 module when using s-center. In Figure 14, the ODIN-W2 connection is the first port (COM 62) and the ZED-F9P connection is the second port (COM 64). Port numbering can be different between individual PCs, but the same arrangement applies.

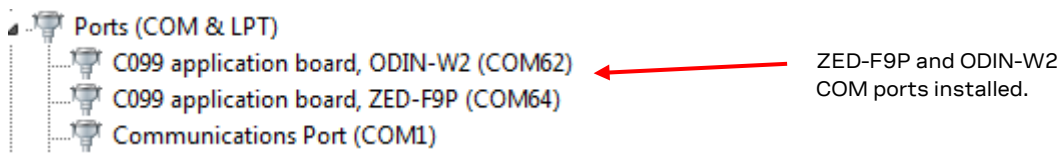


Figure 14: Windows Device Manager COM port view

In addition, a third VCP will be created corresponding to the ZED-F9P USB port. Windows 10 users will see a new VCP device in the Device Manager window when it loads a built-in driver. With older Windows installations, a driver will be loaded via Windows Update. In this case the device will be identified as a u-blox GNSS device in the Device Manager window.

Open u-center (V18.12 or later), select the ZED-F9P serial port, and set the baud rate to 460800 to match the ZED-F9P default UART setting. Once connected, u-center shows typical received signal levels from multiple GNSS bands, see Figure 15 below.

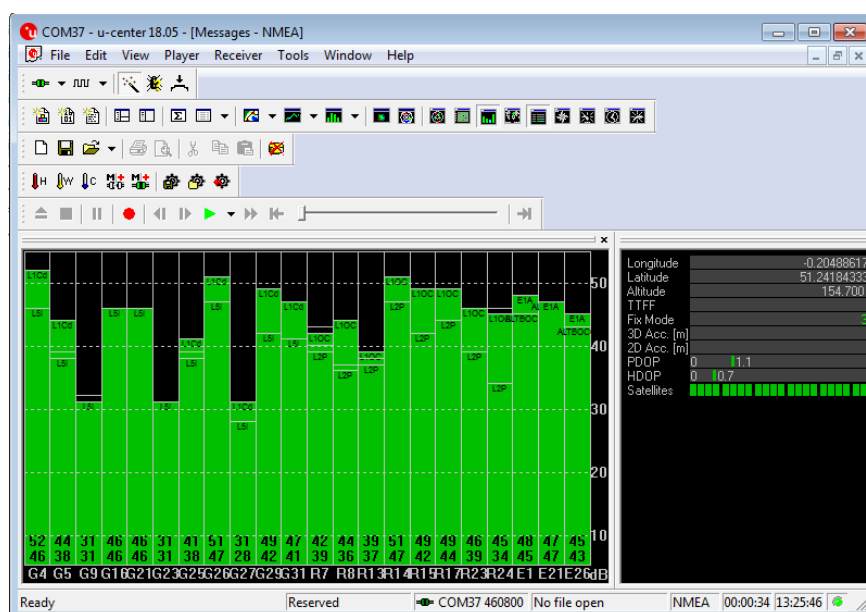


Figure 15: u-center view with ZED-F9P connected

Additional UBX protocol messages can be enabled to view additional information in u-center. For example, the following are typical messages the user can poll or enable for periodic update.

- NAV-HPPOSLLH
- NAV-RELPOSNED
- NAV-SIG
- NAV-SOL
- NAV-STATUS
- NAV-SVIN



For help with the Message view see section 5.2.6 in the u-center User Guide [3]

### 4.3.2 Command Line Interface of ODIN-W2

The user controls ODIN-W2 through a Command Line Interface (CLI) which supports Remote Procedure Call syntax as described below:

```
/<function_name>/run <argument 1> <argument 2> ...
```

To access ODIN-W2 CLI use the following serial settings:

- Baud rate: 460 800
- Serial frame: 8 bits, 1 stop bit, no parity
- Flow Control: None

Prior to connecting to the ODIN-W2 CLI check the below terminal settings:

- Putty (Settings - Terminal)
  - local echo force off
  - implicit CR in every LF off
  - implicit LF in every CR off
- Tera Term (Setup - Terminal)
  - newline receive CR and transmit CR
  - local echo disabled
  - terminal ID VT100

```
[BOOT] u-blox AG - www.u-blox.com
[BOOT] C099-F9P started!
[BOOT] SW version=v.0.8.x dev
[INIT] I2C clock speed=400000 Hz.
[INIT] UART1 baudrate=460800 bit/s.
[INFO] For help please type: /help/run
[INIT] BT Tx Power=14
[INIT] BT Name=BT_C099-F9P_1BF9
[INIT] BT MAC=D4CA6E801BF9
[INFO] Waiting for user input ...
~$ /help/run
```

Figure 16: CLI help command

```
[INFO] Waiting for user input ...
~$ /print_version/run 0
C099-F9P
[INFO] Waiting for user input ...
~$
```

Figure 17: Example RPC syntax

By typing the help command as in Figure 16, the ODIN-W2 will display all available user commands with a short description. The CLI embodies character echo with limited text edit functions. Misspelled commands are replied with a list of supported commands. Please note, that ODIN-W2 features I/O related functions for diagnostic purposes. Those functions are listed by the CLI but are not documented.



## 4.4 Arduino Uno header connections

The board size and four connectors comply with the Arduino R3/Uno mechanical specification. The functions of each I/O align as much as possible to the Arduino specified functions. Check the pin functions before using with an Arduino R3/Uno - see Figure 18 below. All the pin functions besides power are 3.3 V compliant.

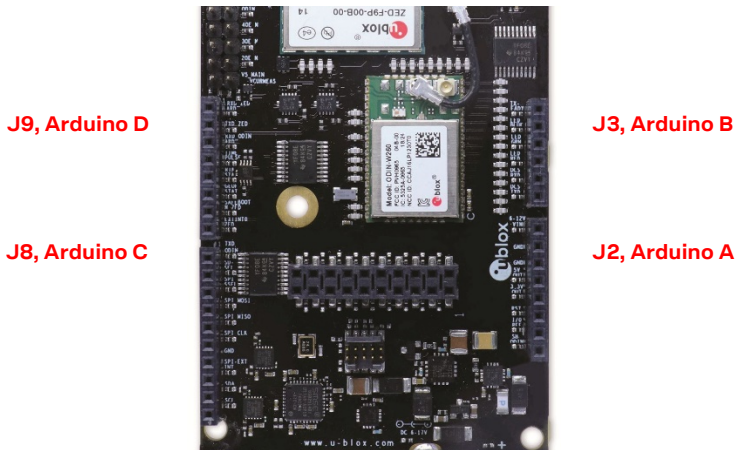


Figure 18: C099-F9P Arduino connectors

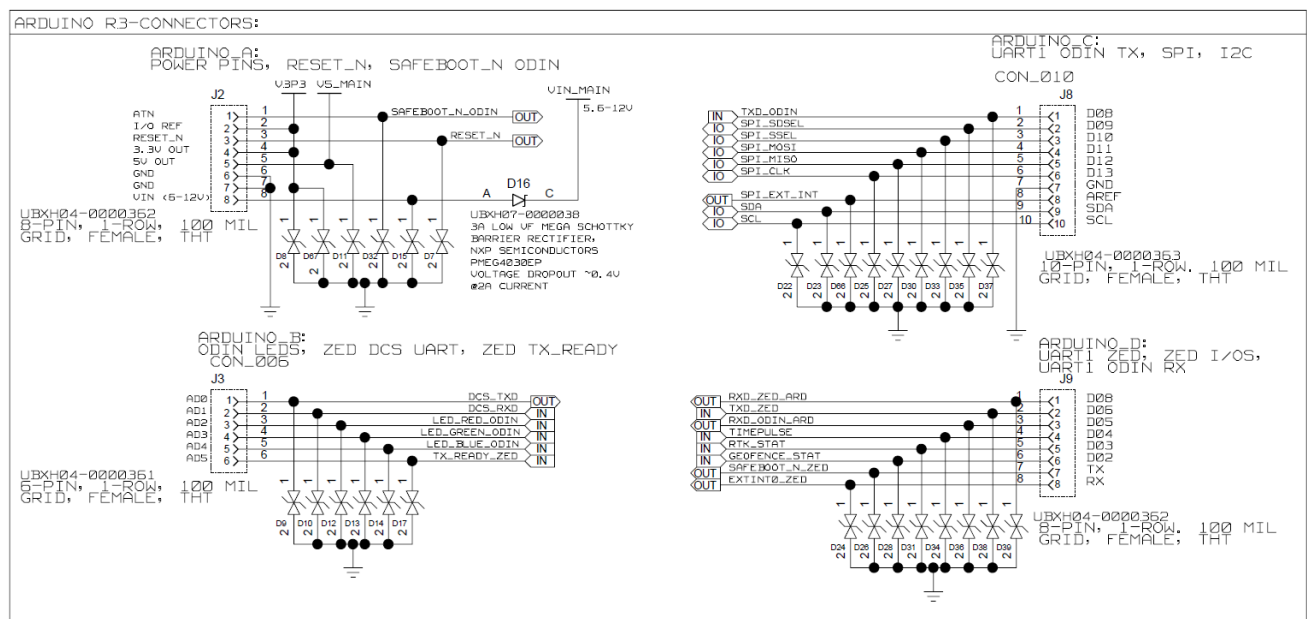


Figure 19: C099-F9P Arduino R3 connections

## 5 Rover operation using NTRIP

This section shows how the ZED-F9P is used as a rover using correction information provided over the internet using NTRIP. This is usually provided by a host from a single reference station or as a Network RTK Virtual Reference Service (VRS).

A suitable host is a PC with internet access. A host runs an NTRIP client and streams RTCM corrections to the C099-F9P through a UART or Bluetooth connection. A user shall note, that messages transmitted through a Bluetooth link are forwarded to I2C bus and vice versa. A user is advised to enable desired messages in both UART and I2C interfaces in ZED-F9P.

### 5.1 PC hosting via u-center

The u-center application includes an NTRIP client for PC hosting. The u-center user guide [3] provides help when setting NTRIP service connections. Users can connect via Bluetooth for wireless operation or directly via a serial COM port. Once the service is active, RTCM corrections are sent over the connection and data can be logged as usual with u-center.

The u-center User Guide [3] section 6 provides more information concerning NTRIP connections. Enter the required connection settings using the client setting window shown below.

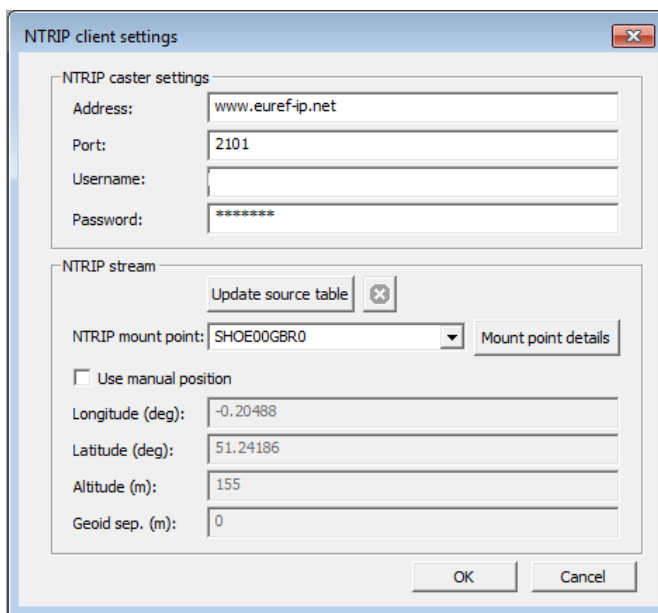


Figure 20: u-center NTRIP Client view

Ensure that the NTRIP Client connection icon is green. This indicates a successful NTRIP connection and that RTCM data is transferred to the C099-F9P.

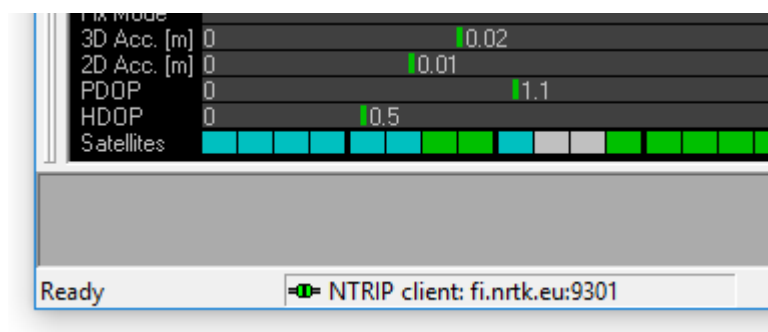


Figure 21: u-center NTRIP Client connection icon in the status bar of u-center

Confirm that the rover has obtained RTK Fixed mode in the u-center data view:

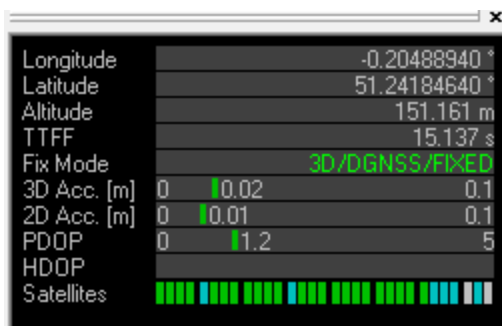


Figure 22: u-center Data view RTK FIXED indication

## 5.2 Bluetooth pairing

Prior to operation the user is requested to pair the ODIN-W2 with a host device. Pairing is the process for creating one or more shared secret keys and is required only once for a pair of devices. The ODIN-W2 can be paired with one of the two alternatives:

1. The host initiates, ODIN-W2 responds.
2. ODIN-W2 initiates, the host responds.

### 5.2.1 ODIN-W2 as pairing responder

Once verified that the terminal connection is available, please use the following command to make the ODIN-W2 visible and connectable:

```
/bt_visible/run
```

ODIN-W2 will acknowledge successful reception of the command and inform once it is ready to respond to a pairing request.

Next, the user shall perform Bluetooth scan to find the C099-F9P. Every C099-F9P has a predefined unique BT name of type BT\_C099-F9P\_XYZW as shown in Figure 23.

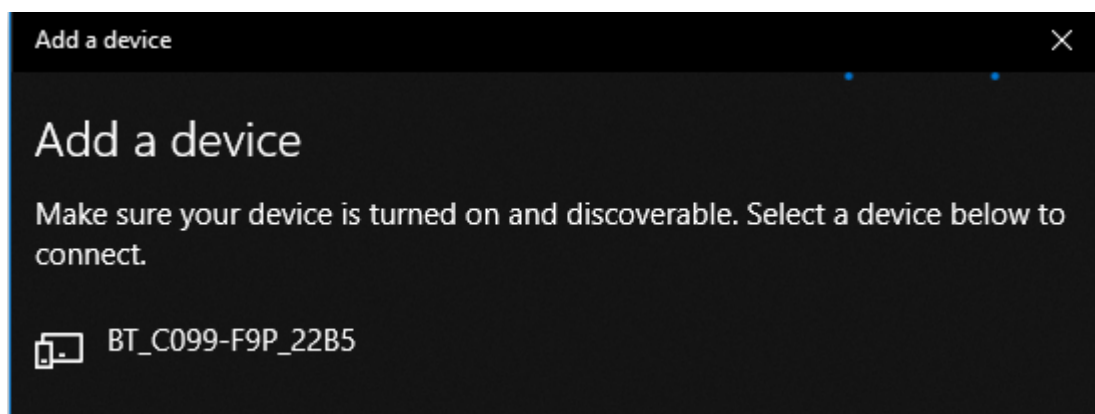


Figure 23: Windows 10 menu for adding a BT device.

### 5.2.2 ODIN-W2 as pairing initiator

Once the user has verified working CLI connection, the following command shall be used to scan nearby Bluetooth devices. Prior to that, Bluetooth visibility at the host device shall be enabled.

```
/bt_inquiry/run
```

The C099-F9P will list nearby BT devices, their BT addresses (“MAC”) and corresponding RSSI values. To ensure sufficient radio link quality, a user is advised to check the RSSI level of the host device is well above -80 dBm. Weak signal levels can result in connection losses and limited range.

Once the host device has been found by the C099-F9P, the following command starts the pairing process:

```
/bt_bond/run <MAC address>
```

ODIN-W2 will wait until the user has accepted the pairing request on the host device. Note that the pairing request will fail if an internal timeout is reached. Typically, the user can accept an incoming pairing request in the host Bluetooth menu. Finally, the host and ODIN-W2 will permanently store their exchanged link keys for future connections.

## 5.3 Bluetooth serial port

C099-F9P supports incoming and outgoing Bluetooth serial connections. In order to find the corresponding BT COM ports refer to Bluetooth options as indicated in Figure 24.

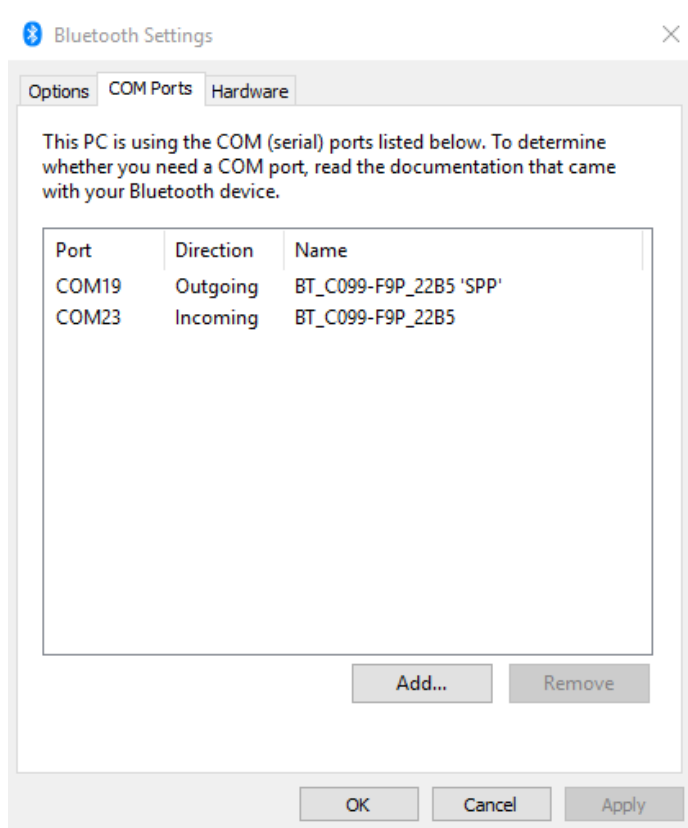


Figure 24: Bluetooth COM ports

Typically Windows hosts will automatically set the corresponding COM ports if the pairing process was initiated at the host, as described in 5.2.1. Often, the user is requested to add incoming and outgoing ports manually if the pairing process was initiated at C099-F9P, as described in 5.2.2.

### 5.3.1 Server SPP connection

In order to use the server port (incoming port) at the host, the user shall select and connect to the incoming COM port at u-center prior to the CLI command on the C099-F9P:

```
/bt_sppcli/run <MAC address>
```

After a successful connection the C099-F9P starts to stream data from ZED-F9P to the Bluetooth COM port. Please note that the baud rate of the BT serial port at the host can be ignored.

### 5.3.2 Client SPP connection

In order to use the outgoing port (client port) at the host the user shall set the C099-F9P in server mode by issuing the following command:

```
/bt_visible/run
```

After selecting the client port (outgoing port) at u-center, the C099-F9P will be automatically requested to open a data stream between the ZED-F9P and the Bluetooth COM port. Note that u-center has default COM port behavior resulting in connection failures or non-listed outgoing Bluetooth COM ports. As a workaround it is recommended to change the default COM port enumeration in u-center as shown in Figure 25: u-center COM port enumeration

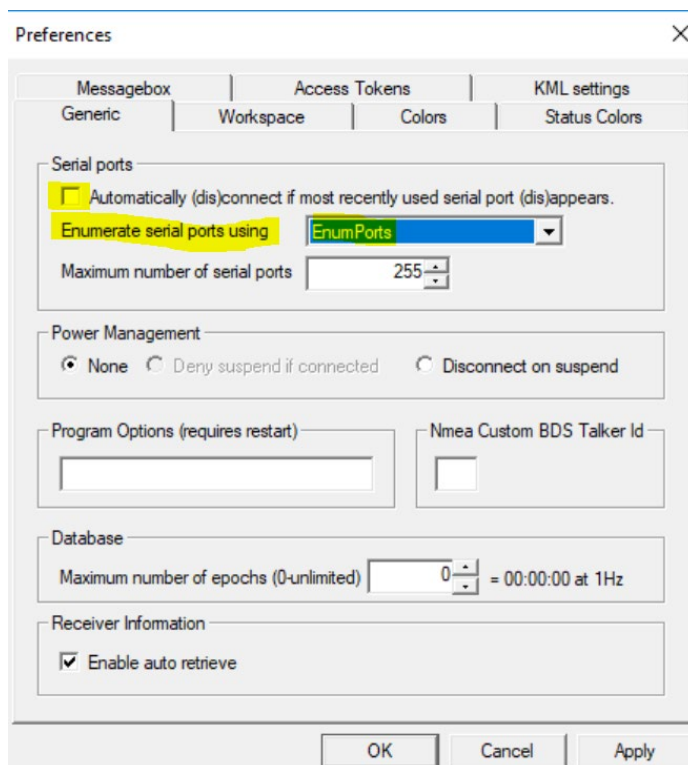


Figure 25: u-center COM port enumeration

## 5.4 Wireless link limitations

### 5.4.1 Bluetooth link

The system throughput of the BT link is determined by the effective I2C and BT Classic SPP byte rates. The user is recommended to limit the average byte load from ZED-F9P to 17 kB/sec. The following examples approximate the load of the default configuration of ZED-F9P HPG100 firmware:

- 1Hz Navigation Rate: NMEA, UBX-DBG-NAV, UBX-NAV-PVT enabled -> 2.4 kB/sec
- 5Hz Navigation Rate: NMEA, UBX-DBG-NAV, UBX-RXM-RTCM enabled -> 17 kB/sec
- 10Hz Navigation Rate: NMEA, UBX-RXM-RTCM enabled -> 14 kB/sec

In case of Bluetooth transmission failure (red LED blinking), check the system for typical root causes:

- BT SPP COM port on the host device stalled or disconnected.
- Insufficient signal quality between the host device and C099-F9P.

To recover the system after a failing BT link, reset ODIN-W2 by pressing the reset button.

If ZED-F9P is configured through a Bluetooth link, e.g. using UBX-CGF messages, it is recommended to apply all configurations manually at u-center. Uploading an extensive configuration file may fail due to limited link bandwidth.

## 5.4.2 Windows OS issues with Bluetooth SPP

There are some known issues with the Windows Bluetooth Serial Port Profile (SPP) implementation for Windows 7-10. Symptoms include the Bluetooth Virtual COM port not installing or applications not connecting to the Bluetooth Virtual COM port. In other cases Windows might crash or become un-responsive. This is not related to the ODIN-W2 Bluetooth implementation that uses the Bluetooth standard SPP.



Figure 26: ASUS USB-BT400

A known industry fix is not to use the Windows Bluetooth stack and PC Bluetooth hardware. This is done by using a USB Bluetooth adapter that uses its own Bluetooth stack. A device that is known to work is the ASUS USB-BT400 (USB 2.0). Once installed use the Bluetooth Virtual COM port assigned to this device and not the built-in Bluetooth interface.

## 6 Firmware updates

This section shows how to update the GNSS and Wi-Fi/Bluetooth modules' firmware if required.

The board is delivered with the latest versions of firmware running on the ZED-F9P and ODIN-W2 modules. However, newer versions may become available during the lifetime of the product.

### 6.1 ZED-F9P firmware update

This section shows how to update the firmware and re-enable the configuration settings required for the C099-F9P. The user has two possible serial communication channels to update ZED-F9P: UART1 and USB2.0 ports. At the time of writing, the current Microsoft USB driver in Windows 10 does not allow ZED-F9P FW update.

To update the ZED-F9P, connect via USB to the COM port identified as the ZED-F9P to u-center and poll MON-VER to view the installed firmware: see Figure 14 for the Device Manager COM port view. The shipped units will have HPG1.00 firmware or newer. To download a new firmware follow the sequence detailed below.

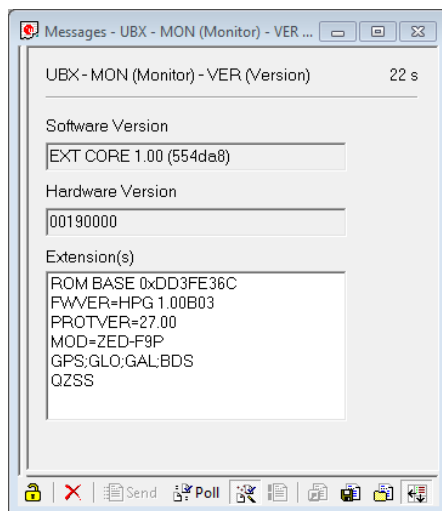


Figure 27: MON-VER poll response

To begin updating the firmware, select “Tools > Firmware Update...”

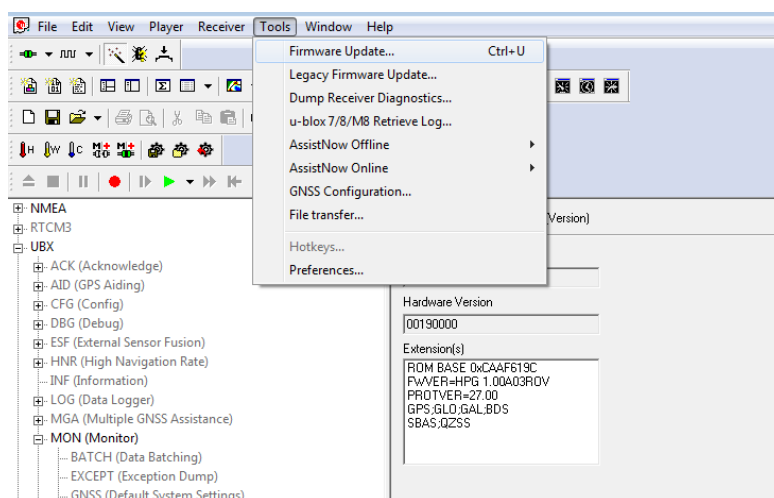
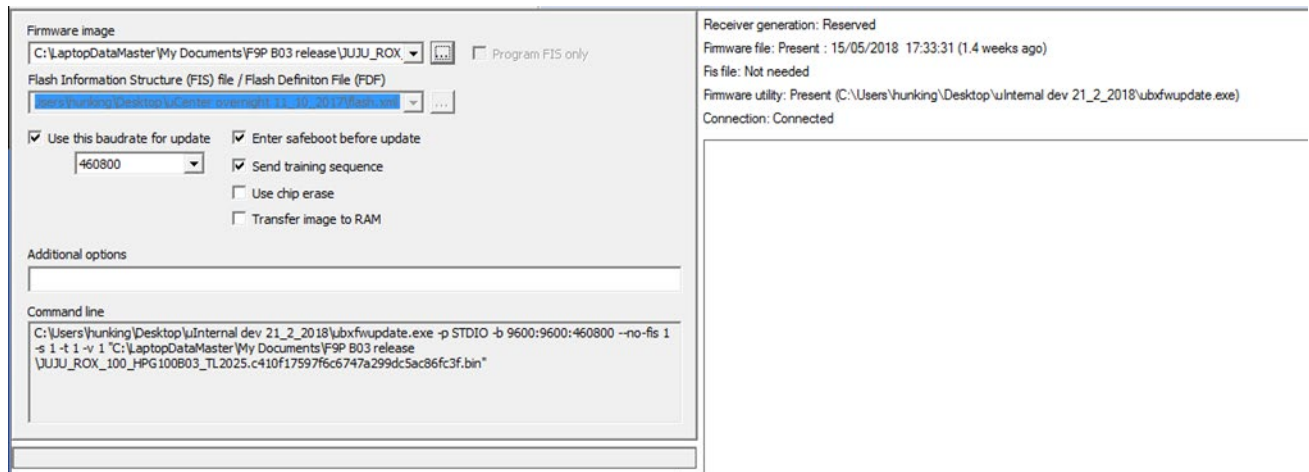


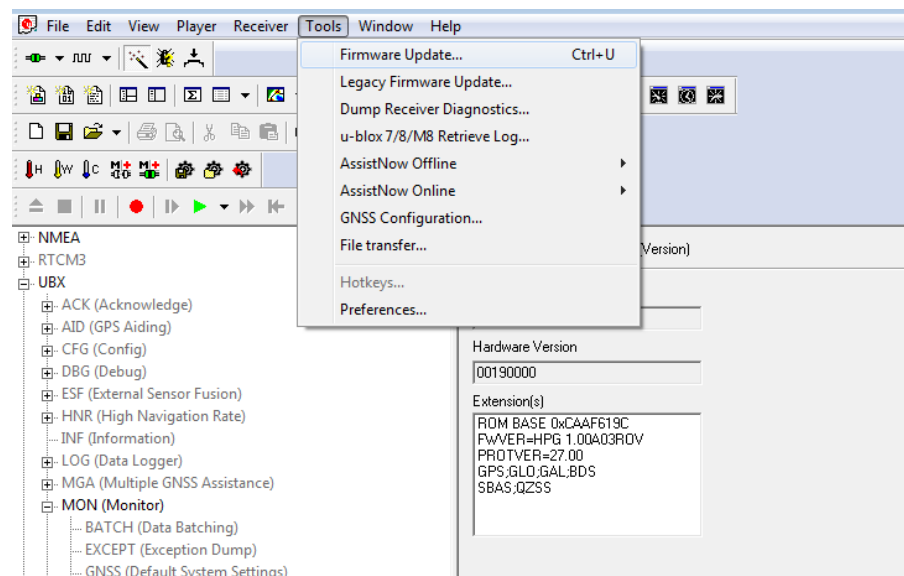
Figure 28: Selecting u-center Firmware Update mode

The following firmware image update window will appear as shown below:



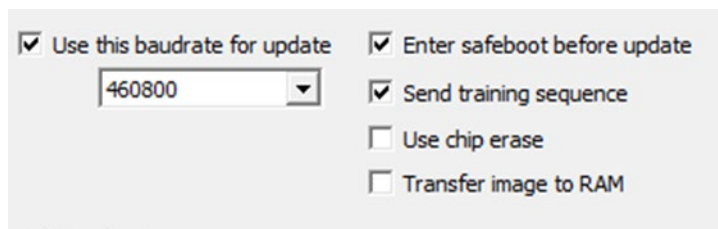
**Figure 29: Selecting u-center Firmware image folder**

At the top is the Firmware image file selection window. Click on the button to the right of the window. This allows you to select the folder and file. Select the new firmware image bin file.



**Figure 30: Selecting u-center Firmware image file**

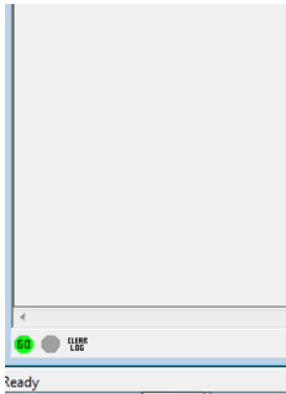
Set the “Enter safeboot before update” and “Send training sequence” options. Set the “Use this baudrate for update” option and select e.g. 460800 from the pull-down list. This is shown in Figure 30 below.



**Figure 31: Setting the required baud rate, safeboot and training sequence options**

Then click the GO button at the bottom left corner of the window to begin the download.

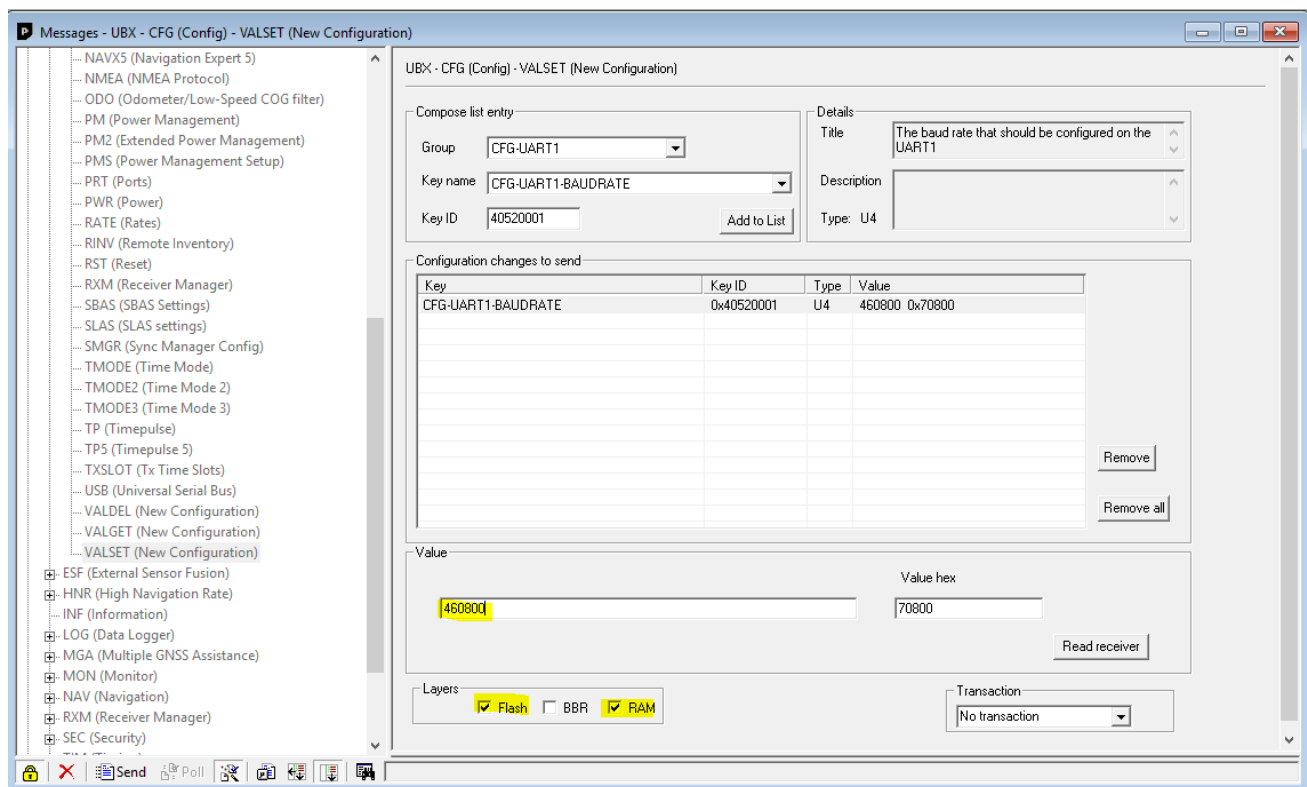




**Figure 32: Click GO for firmware update**

The firmware update progress indication is shown adjacent to the input window.

When programming is complete, the module will start up in a default configuration in which the ZED-F9P serial port is set to 38400 baud. This requires changing to 460800 baud to provide sufficient data bandwidth and work correctly with the ODIN-W2 module. In order to make the baud rate change persistent follow the instruction in Figure 33.



**Figure 33: Setting ZED-F9P UART1 back to 460800 baud and saving it to Flash memory.**

## 6.2 ODIN-W2 firmware update

Users have a choice to run two distinct firmware variants in ODIN-W2. By factory default the ODIN-W2 on a C099-F9P runs a dedicated application firmware.

### 6.2.1 Mbed OS 3 application firmware

The latest released binary is available via the u-blox git-hub repository:

[https://github.com/u-blox/ublox-C099\\_F9P-mbed-3](https://github.com/u-blox/ublox-C099_F9P-mbed-3)

Firmware update on ODIN-W2 is possible by the following tool set:

- Through ODIN-W2 UART1 by using stm32flash.exe

It is recommended to download the stm32flash.exe command line tool from STM website or from Sourceforge:

<https://sourceforge.net/projects/stm32flash/>

Prior to firmware upload, the ODIN-W2 must be started in safe boot mode. Proceed by placing a safe boot jumper and reboot C099-F9P. Location of the safe boot pin header and the reset button is depicted in Figure 6. To confirm the ODIN-W2 started in safe boot mode the ODIN-W2 activity LED remains off. Please use the following command structure in Power Shell or Command Prompt to start FW upload:

```
./stm32flash.exe -b 115200 -w <c099mbed3.bin> -S 0x8000000 COM<port number>
```

A successful FW upload is confirmed by removing the safe boot jumper and restarting the device. The ODIN-W2 activity LED should lit up.

### 6.2.2 Connectivity software

In order to utilize the standard ODIN-W2 connectivity stack a firmware update is required. Latest u-blox connectivity software and documentation is available via u-blox.com:

<https://www.u-blox.com/en/product/odin-w2-series>

Software upload procedure consists of two consecutive phases. Firstly, a bootloader is required to be uploaded:

```
./stm32flash.exe -b 115200 -w <ODIN-W2-BOOT.bin> -S 0x8000000 COM<port number>
```

After a succesful bootloader upload, the actual connectivity software shall be uploaded while incrementing the memory index as shown below

```
./stm32flash.exe -b 115200 -w <ODIN-W26X-SW.bin> -S 0x8010000 COM<port number>
```

Instructions of connectivity configurations of ODIN-W2 running the Connectivity SW are available in C099-F9P User Guide [5].

# Appendix

## A Glossary

Abbreviation	Definition
FW	Firmware
LiPo	Lithium Polymer
NTRIP	Networked Transport of RTCM via Internet Protocol
RTK	Real Time Kinematic
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
UTC	Coordinated Universal Time
VCP	Virtual Com Port

**Table 2: Explanation of the abbreviations and terms used**


## B C099-F9P antenna specification

### B.1 Wi-Fi/Bluetooth antenna specification

EX-IT WLAN RPSMA / Ex-IT WLAN SMA	
Manufacturer	ProAnt
Type	½ wave dipole dual-band antenna
Polarization	Vertical
Gain	+3 dBi
Impedance	50 Ω
Size	107 mm (straight)
Type	Monopole
Connector	<ul style="list-style-type: none"> <li>Reverse polarity SMA plug (inner thread and pin receptacle)</li> <li>SMA plug (inner thread and pin)</li> </ul>
Comment	To be mounted on the U.FL to SMA or reverse polarity SMA adapter cable
Approval	FCC, IC, RED, MIC, NCC, KCC*, ANATEL, and ICASA



**Table 3: Wi-Fi/Bluetooth antenna**

 The variant included in the C099-F9P kit is with SMA connector and has to be mounted on the corresponding antenna connector of the C099-F9P board if you wish to use Wi-Fi or Bluetooth connectivity.

### B.2 Multi-band GNSS antenna specification

This section details the u-blox multi-band GNSS antenna specification and performance on the required ground plane.

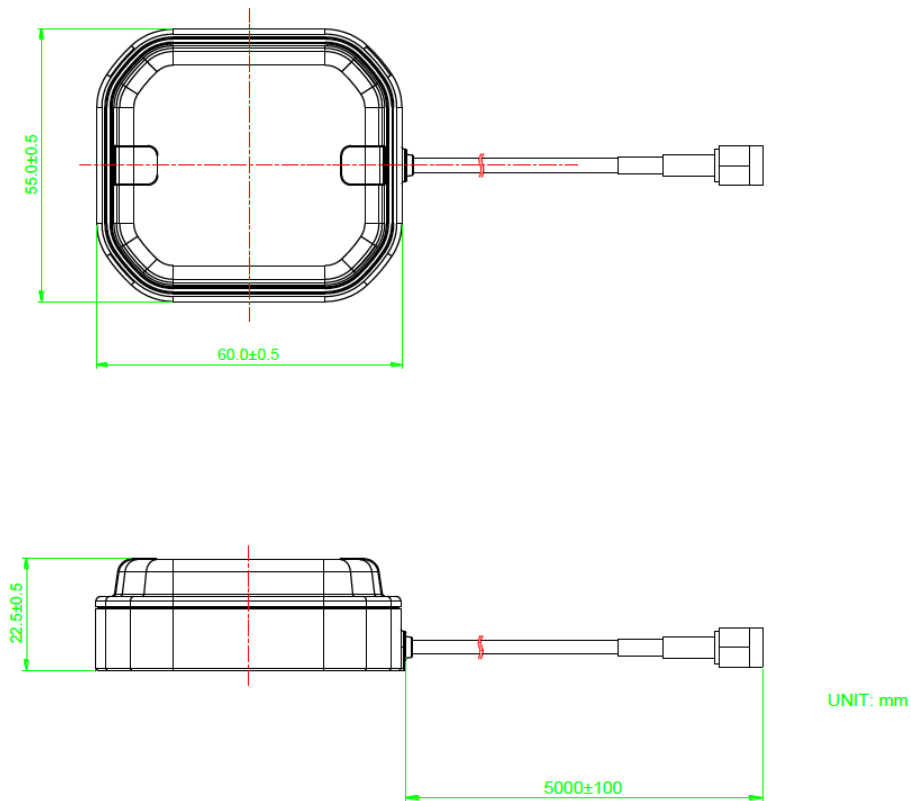


Figure 34: u-blox dual band GNSS antenna

### B.2.1 Patch antenna element specification

No	Item	Spec.		Unit	Remark
		L1 Band	L2 Band		
1	Frequency	1559.0~1606.0	1197.0~1249.0	MHz	Note: 1)
2	Polarization	RHCP	RHCP	-	Note: 1)
3	Gain @ Zenith	Typ. 3.5	0~2.0	dBic	Note: 1)
4	Axial Ratio	Max. 2.0 @Zenith	Max. 2.0 @Zenith	dB	Note: 1)
5	Bandwidth @ -10dB	200 min.	200 min.	MHz	Note: 1)
6	Impedance	50		ohm	Note: 1)
7	Patch antenna size	Ø42-14T		mm	Note: 1)

Note: 1) Measured on the 150Ø mm ground plane

Figure 35: Patch elements specification

## B.2.2 LNA electrical specification

No	Item	Spec.		Unit
		L1 Band	L2 Band	
1	Frequency	1559.0~1606.0	1197.0~1249.0	MHz
2	Gain	28.0 ± 3.0 @5V	28.0 ± 3.0 @5V	dB
3	Noise Figure	Max 2.7 @5V	Max. 3.2 @5V	dB
4	Output VSWR	Max. 2.0 : 1	Max. 2.0 : 1	-
5	Voltage	DC 3.0~5.0		V
6	Current	16.0 Typ. @ 5.0V		mA
7	Impedance	50		ohm

Figure 36: LNA specification

## B.2.3 Overall performance

No	Item	Spec.		Unit	Remark
		L1 Band	L2 Band		
1	Frequency	1559.0~1606.0	1197.0~1249.0	MHz	Note:2)
2	Total System Zenith Gain	25~26	24~27	dBic	
3	Axial Ratio	Max. 2.0 @Zenith	Max. 2.0 @Zenith	dB	
4	Output VSWR	Max. 2.0 : 1	Max. 2.0 : 1	-	
5	Output Impedance	50		ohm	

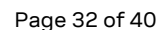
Note:2) Measured on the 150Ø mm ground plane, DC 5V, 5m cable.

Figure 37: u-blox multi-band GNSS antenna performance

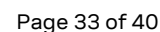


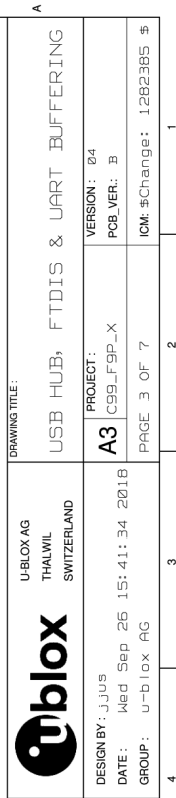
## D C099-F9P schematics

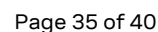
The following pages show the complete schematic for the C099-F9P evaluation board.

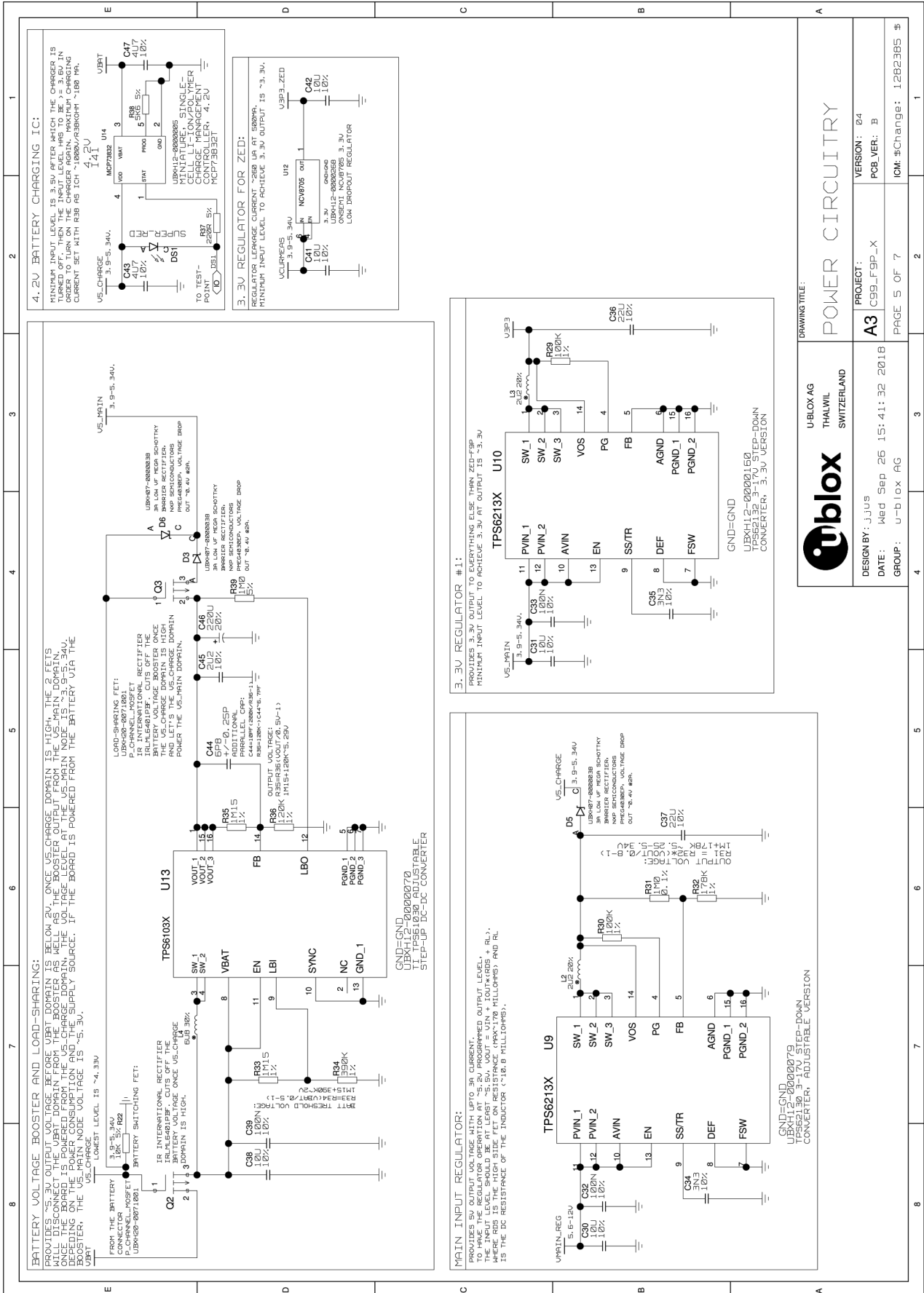


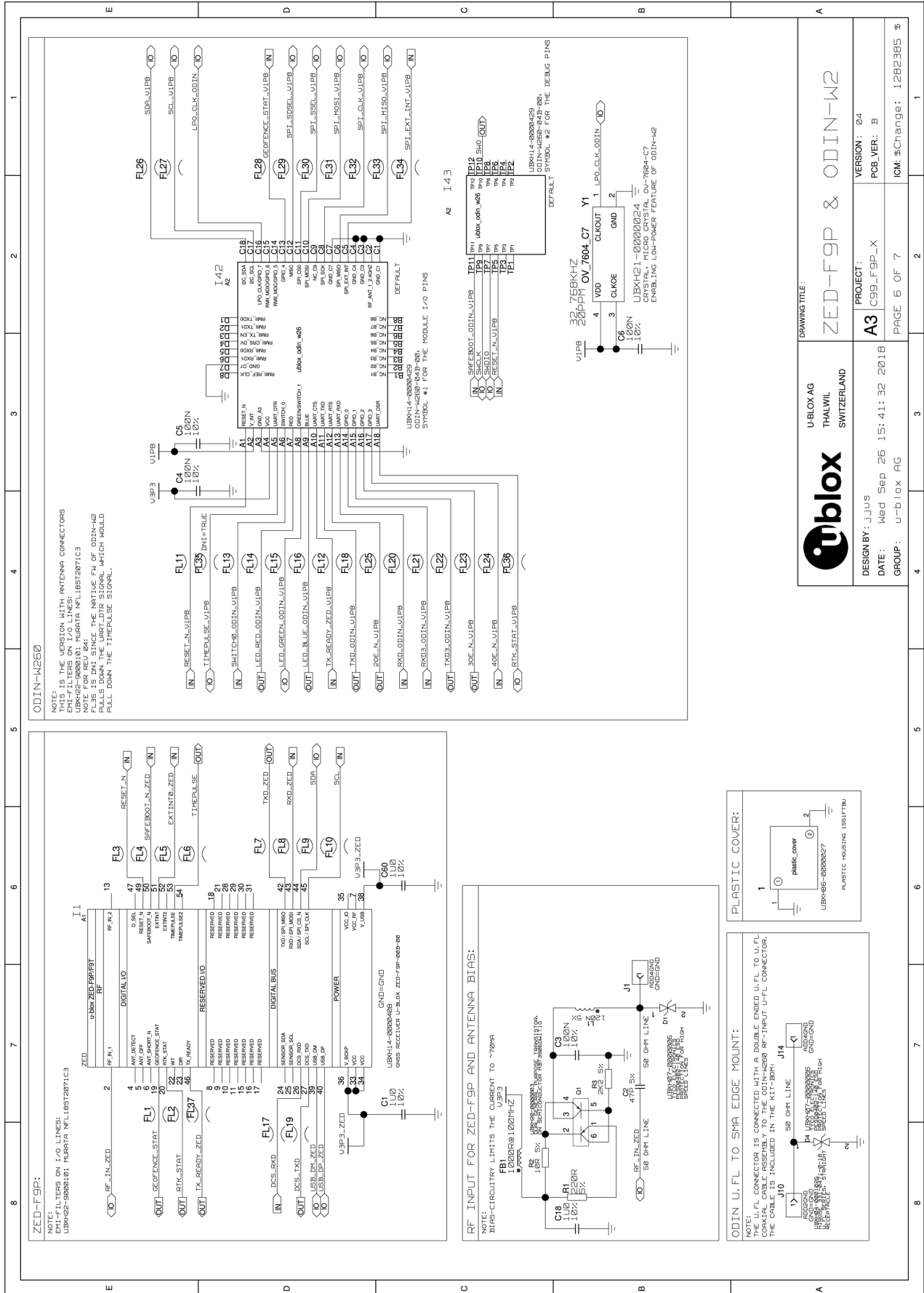












## E ODIN-W2 firmware upload via JTAG


ODIN-W2 firmware upload is possible through the 10-pin JTAG connector by using the STM Link Utility SW and ST LINK V2 debugger device. STM Link Utility software can be found on

<https://www.st.com/en/development-tools/stsw-link004.html>

Availability of ST LINK V2 debugger device shall be checked with local STM distributors.

## Related documents

- [1] u-blox GNSS Sensor and VCP Device Driver guide, Doc. No. UBX-15022397
- [2] ZED-F9P Interface Description, Doc. No. UBX-18010854
- [3] u-center User Guide, Doc. No. UBX-13005250
- [4] ZED-F9P Integration Manual, Doc No. UBX-18010802
- [5] C099-F9P User Guide (with ODIN-W2 Connectivity SW), Doc No. UBX-18055649

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

## Revision history

Revision	Date	Name	Comments
R01	10-Jul-2018	ghun/byou	Initial release
R02	19-Oct-2018	byou	Updates for the C099-F9P rev. B board revision.
R03	8-Nov-2018	olep	Updates for mbed3 FW on ODIN-W2

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