



RTAP2U

GNSS Receiver User Guide

Version 1.1.0

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1. Overview

1.1 Receiver Overview

Thank you for purchasing RTAP2U, a high-precision GNSS receiver. This user guide is designed to assist users in configuring the receiver and utilizing its features.

RTAP2U is the dual-frequency multi-band GNSS receiver that uses a u-blox ZED-F9P module. It can receive GPS, GLONASS, BeiDou, Galileo, and QZSS signals. The receiver supports GPS L1 C/A, L2C, GLONASS L1OF, L2OF, Galileo E1B/C, E5b, BeiDou B1I, B2I, QZSS L1 C/A, L2C, SBAS L1 C/A signals and can process 184 channels. The device supports RTCM protocol and RTK, VRS, FKP, and PPP-RTK positioning are available. PPP-RTK positioning based on SSR correction messages can be enabled through a simple firmware update. With PPP-RTK, more reliable and accurate navigation is achievable.

RTAP2U delivers centimeter-level accuracy within a few seconds at a data output up to 20 Hz and provides an accuracy of about 2 centimeters. The device is lightweight and hand-held size which allows users to carry it and use it for not only surveying but also drones, autonomous driving, precision agriculture, location monitoring, and more. The receiver is controllable with a mobile device and a desktop through a user-friendly web interface “RTAP2U Viewer”. It does not require an app download, and is designed for both the general public and professionals.



1.2 Receiver Features

RTAP2U has an antenna connector for GNSS antennas in the front. The power button is located on the back side, and UBX¹⁾, NMEA²⁾ data are receivable through the USB port.



Four LEDs are visible on the top and provide Wi-Fi, Positioning, GPS, and Power status.

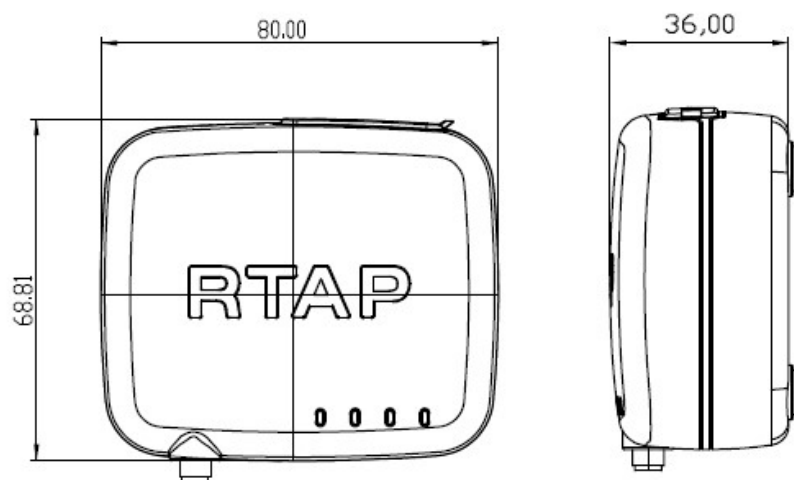
- Wi-Fi (📶): Wi-Fi connection
- Positioning (📍): GPS positioning type
- GPS (📡): Satellite signal
- Power (🔌): On and off

LED	Receiver Status
Wi-Fi	Red: Wi-Fi network connection error Yellow: Connected to the internal Wi-Fi network but not an external Wi-Fi network Green: Connected to the internal and external Wi-Fi network
Positioning	Red: Standalone Yellow: DGPS Green blink: RTK-Float Green solid: RTK-Fix
GPS	Green: Receiving satellite signals
Power	Green: Power on

1) UBX: u-blox module raw data protocol

2) NMEA: National Marine Electronics Association, a standard data format that includes the time, location, and more from the GNSS device

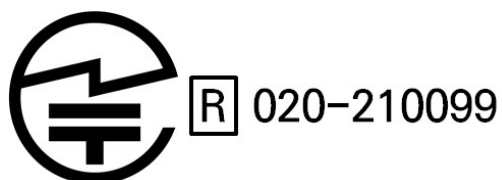
The physical dimension of RTAP2U is 80.00 × 68.81 × 36.00 mm as described in the image below.



RTAP2U received the KC certification (Registration of Broadcasting and Communication Equipments) and the Japan MIC (Requirement for wireless radio communication devices) certification.



R-R-R2U-RTAP2U
R-C-R2U-RTAP2U-B



2. Receiver Operation

2.1 Powering On and Off

Users can turn on RTAP2U by pressing the power button on the back side. The LED indicator changes by each step as described in the table below. When the device is completely booted, the Power LED () turns green and the Wi-Fi LED () turns yellow. It takes about one to two minutes to reboot. You can turn off RTAP2U by pressing the power button on the back side again.



Step					Description
①					Rebooting (1~2 minutes)
②					Booting complete

2.2 Setting Up Connectivity

RTAP2U has both “AP” mode and “Station” mode. RTAP2U generates and provides internal Wi-Fi through the AP mode, and users can also connect to the external Wi-Fi network through the Station mode. With the AP mode, users can access RTAP2U Viewer and check the accuracy, configure settings, and download data.

RTK and Network RTK positioning is available by receiving RTCM messages. RTAP2U should be connected to an external Wi-Fi network to receive the messages through the Internet. The steps below describe how to connect the receiver to an external Wi-Fi network.

- ① Search and connect to the internal Wi-Fi network
- ② Log in to RTAP2U Viewer
- ③ Establish connection with an external Wi-Fi network

The following steps (1) through (6) illustrates how to access the RTAP2U Viewer, connect to the external Wi-Fi network, and receive RTCM messages.

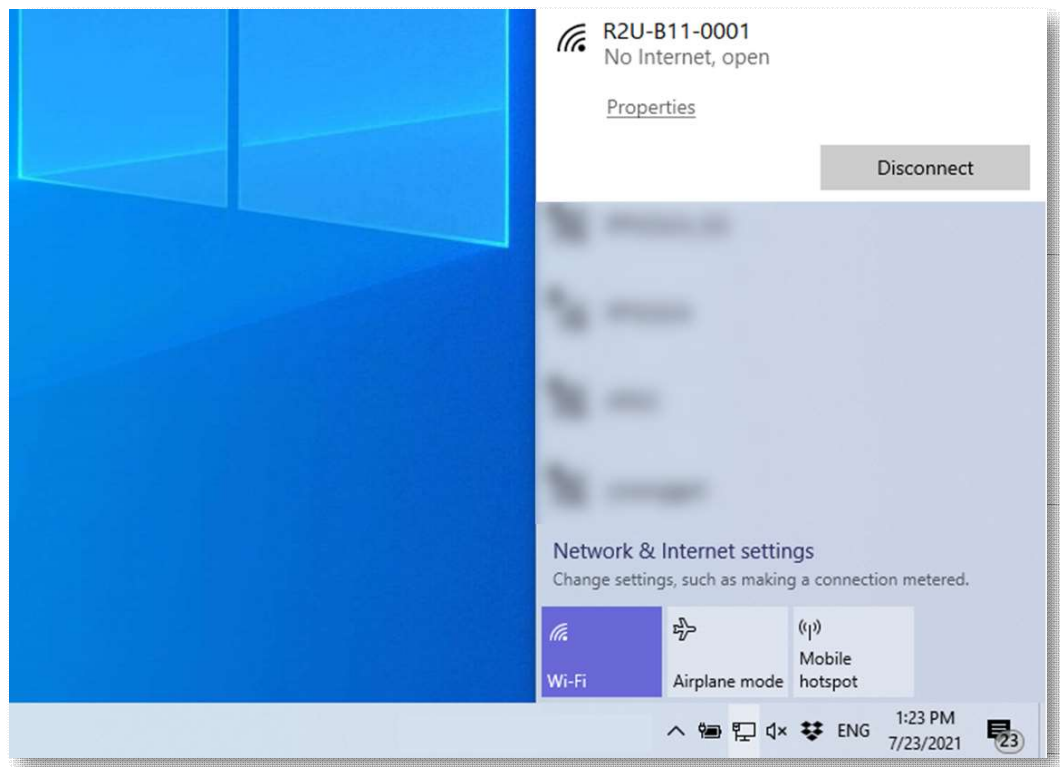
※ This document is based on firmware (v1.1.0 kernel.fw), made in September, 2021.

(1) Connect to the internal Wi-Fi (AP Mode)

<Desktop>

When connecting to the network by a desktop, follow the two steps below. Also note that the images may differ depending on the user's PC type, operating system, and settings.

- ① R2U-B11-XXXX will appear on the Wi-Fi list.
- ② Click on it and allow a few seconds to pair.



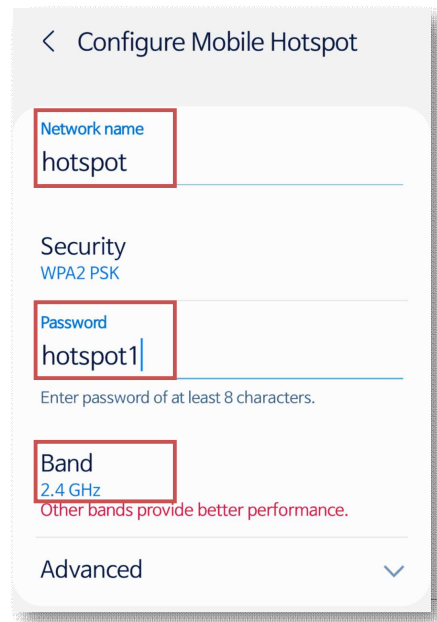
<Mobile Device>

When connecting to the network by a mobile device, follow the three steps below. The receiver connects to your mobile hotspot for the external network. Also note that the images may differ depending on the user's mobile device type, operating system, and settings.

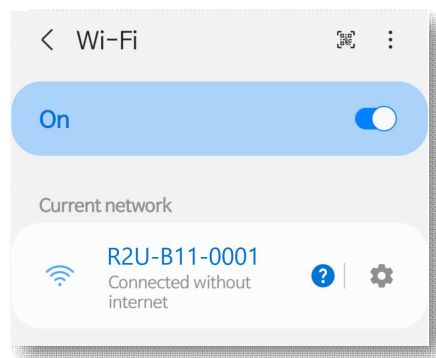
- ① Set up your mobile hotspot ID and password. The image below is an example.

※ Note

- If there is a special character other than “_” included in the SSID, the receiver may not be able to connect to the hotspot network.
- Connection with a 5G network is not available, so please use a 2.4G network.

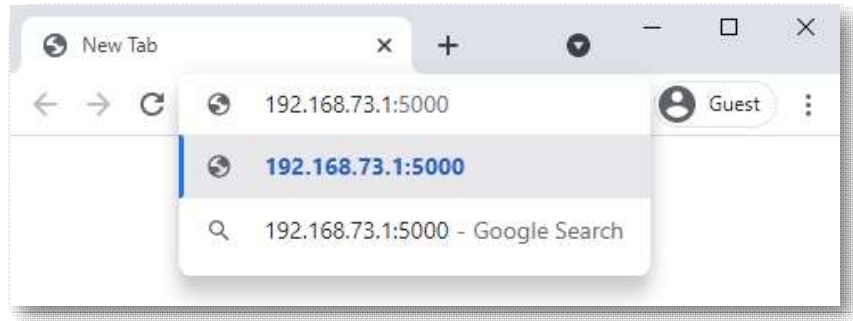


- ② R2U-B11-XXXX will appear on the mobile Wi-Fi list.
- ③ Tap on it and allow a few seconds to pair.



(2) Open RTAP2U Viewer

Enter 192.168.73.1:5000 on the web browser.



(3) Enter the login information

Type in the below **User ID** and **Password** in the RTAP2U Viewer login window. Then click **SIGN IN**.

- User ID: root
- Password: rtap2u

A screenshot of the RTAP2U Viewer login window. The window has a title 'Sign In'. It contains two input fields: 'User ID *' and 'Password *'. Below the input fields is a blue button labeled 'SIGN IN'.

(4) Check the connection status with RTAP2U

RTAP2U connection status is visible on the bar at the top left of RTAP2U Viewer.



(5) Connect to the external network (Station mode)

The Station mode should be set up through RTAP2U Viewer to connect to an external network.

- ① Click **Config** on the bottom bar and select **WI-FI** on the top bar.
- ② Enter the Wi-Fi name (**SSID**) and password (**Security Key**), and then click **SUBMIT**. The image below is an example.

※ Note

- Connection with a 5G network is not available, so please use a 2.4G network.
- If there is a special character other than “_” included in the **SSID**, the receiver may not be able to connect to the external network.

RTAP2U Viewer

Wi-Fi RTCM SYSTEM

AP SSID

SSID
PPSOLN_AP_19

Station Mode

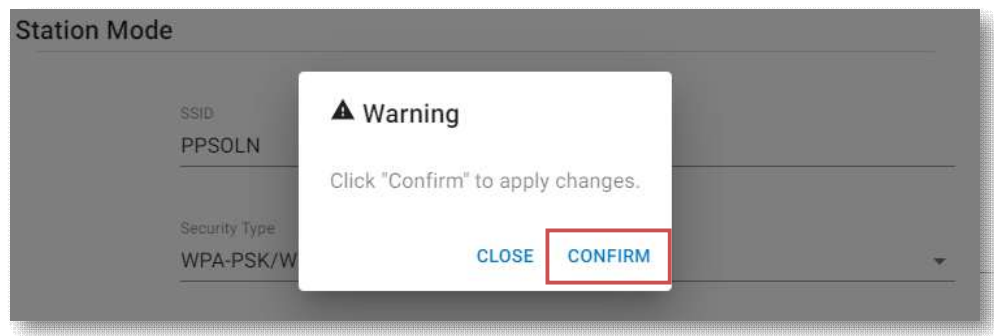
SSID
PPSOLN

Security Type
WPA-PSK/WPA2-PSK

Security Key
12345678

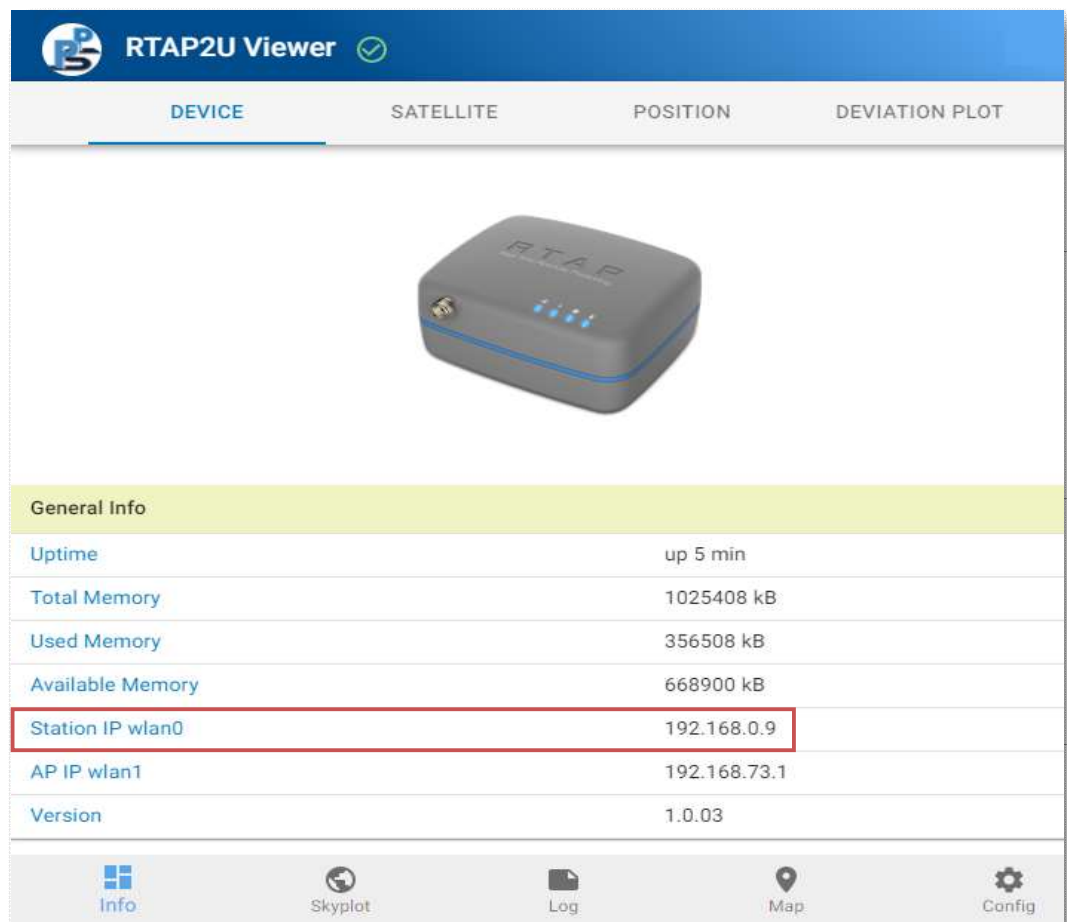
SUBMIT

- ③ Click **CONFIRM** on the **Warning** window to proceed with the changes.



- ④ A green notice "Submission was successful." will pop up on the top right of RTAP2U Viewer.

- (6) Check the external network (Internet) connection status



Click **Info** on the RTAP2U Viewer bottom bar and select **DEVICE** on the top bar. If the **Station IP wlan0** under **General Info** is 0.0.0.0, it indicates that the external network is not connected. The network is connected if a valid IP address is visible as the above image.

You have completed the initial device setting. There is no need to repeat the steps after this. To access the RTAP2U Viewer later on, users have to first connect to the internal Wi-Fi (R2U-B11-XXXX) and enter 192.168.73.1:5000 on the web browser.

2.3 Receiving RTCM Messages

RTAP2U can receive RTCM messages through NTRIP or TCP/IP. After connecting RTAP2U to the external Wi-Fi network, RTCM message reception and precision positioning are possible through the settings illustrated in the following steps.

(1) Enter server information for correction messages

<Using NTRIP>

- ① Click **Config** on the RTAP2U Viewer bottom bar and select **RTCM** on the top bar.
- ② Tap on **NTRIP** as the **Connection Type**.
- ③ Enter your NTRIP server information in the **NTRIP Server Setting** section.
Information to fill out are as the following:
 - Server Address: NTRIP server address
 - Server Port: Server port number
 - Stream: Mount information
 - User ID: Enter when necessary
 - Password: Enter when necessary
- ④ Click **SUBMIT** after entering the information. The following image is for reference.
- ⑤ A green notice "Submission was successful." will pop up on the top right of RTAP2U Viewer.

RTAP2U Viewer ✓

Submission was successful. ✕

WI-FI **RTCM** SYSTEM

Connection type

Connection Type
NTRIP

NTRIP Server Setting

Server Address
fkp.ngii.go.kr

Server Port
2201

Stream
VRS_V31

User ID

Password

SUBMIT

Info Skyplot Log Map **Config**

<Using TCP/IP>

- ① Click **Config** on the RTAP2U Viewer bottom bar and select **RTCM** on the top bar.
- ② Tap on **TCP/IP** as the **Connection Type**.
- ③ Enter your TCP/IP server information in the **TCP/IP Setting** section.
Information to fill out are as the following:
 - Server Address: TCP/IP server address
 - Server Port: Server port number
 - User ID: Enter when necessary
 - Password: Enter when necessary
- ④ Click **SUBMIT** after entering the information.

- ⑤ A green notice “Submission was successful.” will pop up on the top right of RTAP2U Viewer.

RTAP2U Viewer

WI-FI **RTCM** SYSTEM

Connection type

Connection Type
TCP / IP

TCP / IP Setting

Server Address

Server Port

User ID

Password

SUBMIT

Info Skyplot Log Map Config

(2) Check the positioning status

The LEDs indicate the receiver's positioning status according to the correction data received.

				Positioning
				Standalone
				DGPS
				RTK-Float
				RTK-Fix

2.4 Checking Performance

Quality of the real-time and high-precision positioning by RTAP2U is visible on the device LED and on the RTAP2U Viewer. The RTAP2U Viewer provides the satellite signal status, positioning mode, accuracy, and map view in a user-friendly interface.

2.4.1 Positioning Mode

RTAP2U functions in four positioning modes depending on the correction data received. The modes are Standalone, DGPS, RTK-Float, and RTK-Fix.

- Standalone : When the correction data is unavailable
- DGPS : When meter level correction data is available and applicable
- RTK-Float : When the integer ambiguity is estimated as a float number
- RTK-Fix : When the ambiguity is fixed as an integer

The mode and accuracy improves from Standalone to DGPS, RTK-Float, and RTK-Fix. It also changes according to the observation environment and the correction data availability. The real-time mode is visible as the below.

- ① The LED () on the receiver's front panel indicates the positioning status.

	Positioning
	Standalone
	DGPS
	RTK-Float
	RTK-Fix

- ② Click **Info** on the RTAP2U Viewer bottom bar and select **POSITION** on the top bar. The positioning status is visible in the **Quality** section.

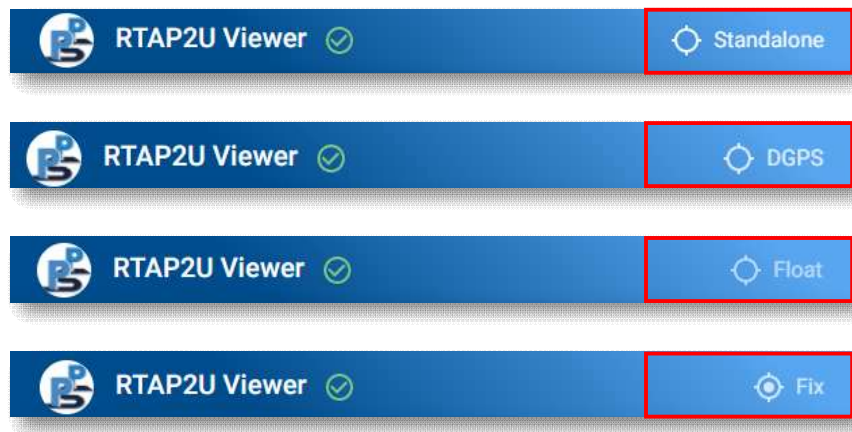
RTAP2U Viewer 

DEVICE	SATELLITE	POSITION	DEVIATION PLOT
Position Information			
Latitude	37°28'46.7268" N		
Longitude	126°52'36.4608" E		
Ellipsoidal Height	162.2m		
Orthometric Height	143.9m		
Geoidal Height	18.3m		
Velocity 2D	0.01km/h		
Quality	Fix		
PDOP	1		
HDOP	0.58		
VDOP	0.82		
Local time	14:31:23		
Receiver date	2021-07-23		

The information available in the **Position Information** table is as the following.

- Latitude: dd.mm.ss N/S
- Longitude: dd.mm.ss E/W
- Ellipsoidal Height: meter
- Orthometric Height: meter
- Geoidal Height: meter
- Velocity 2D: km/h
- DOPs: Dilution of Precision (PDOP, HDOP, VDOP)
- Local time: hh:mm:ss
- Receiver date: yyyy-mm-dd

- ③ Users can confirm the positioning mode on the top right part of the RTAP2U Viewer bar.



2.4.2 Accuracy

Users can compare a true coordinate with RTAP2U's high-precision coordinate in real-time. The comparison is visible through a graph and numerical data on **DEVIATION PLOT** in the RTAP2U Viewer.

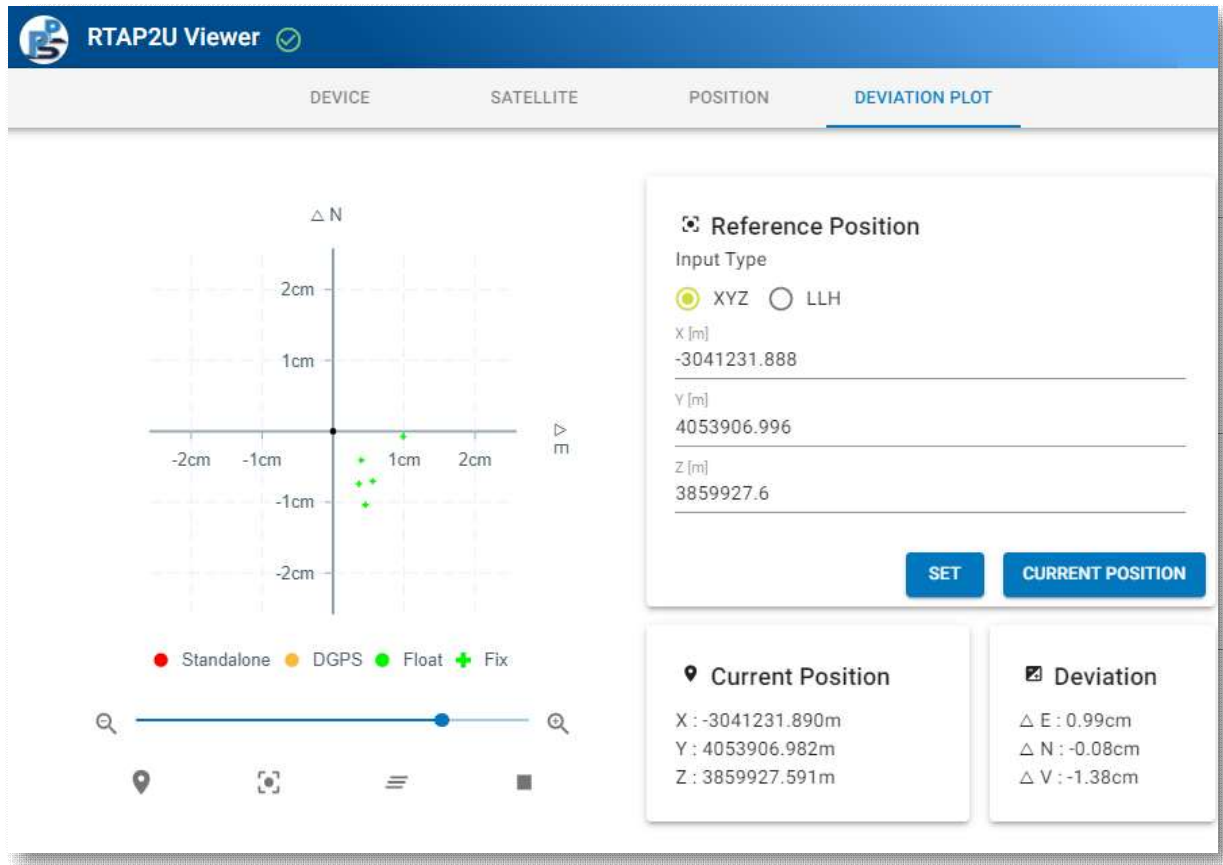
- ① Click **Info** on the RTAP2U Viewer bottom bar and select **DEVIATION PLOT** on the top bar.
- ② Choose the **Input Type** of the **Reference Position**. Click **ENTER** and type in the coordinate needed to calculate the accuracy. Then click **SET** to apply.
 - XYZ: ECEF³⁾ X, Y, Z coordinate (meter)
 - LLH: latitude/longitude (degree), height (meter)
- ③ Instead of manually typing in the coordinates, users can also click **CURRENT POSITION** to use the current RTAP2U coordinate for the **Reference Position**.
- ④ Click ► to start calculating the accuracy in comparison to the **Reference Position**.
- ⑤ Click ■ to pause the calculation.

Use the icons below the graph for tracking, zooming in and out, and more.

- 🔍🔍: Zoom in and out
- ▶■: Start and pause the comparison recording
- 📍: Set the recent comparison point as the center
- 📐: Move to the origin of the graph
- ≡: Restart the comparison recording

3) ECEF: Earth-Centered Earth-Fixed

The graph shows the horizontal accuracy of the receiver coordinate. It displays the East-West and North-South difference in comparison with the true coordinate. The **Deviation** section shows accuracies of East-West (ΔE), North-South (ΔN), and Vertical (ΔV) direction.



2.4.3 Satellite Tracking

Real-time information on the GNSS constellation, number of satellites tracked, elevation and azimuth of the satellites, signal strength, and more are available on the RTAP2U Viewer.

- ① Click **Info** on the RTAP2U Viewer bottom bar and select **SATELLITE** on the top bar.
- ② Information available in the first table is as the following.
 - System: GNSS constellation
 - Tracked: Number of satellites tracked
 - Used: Number of satellites used for coordinate calculation

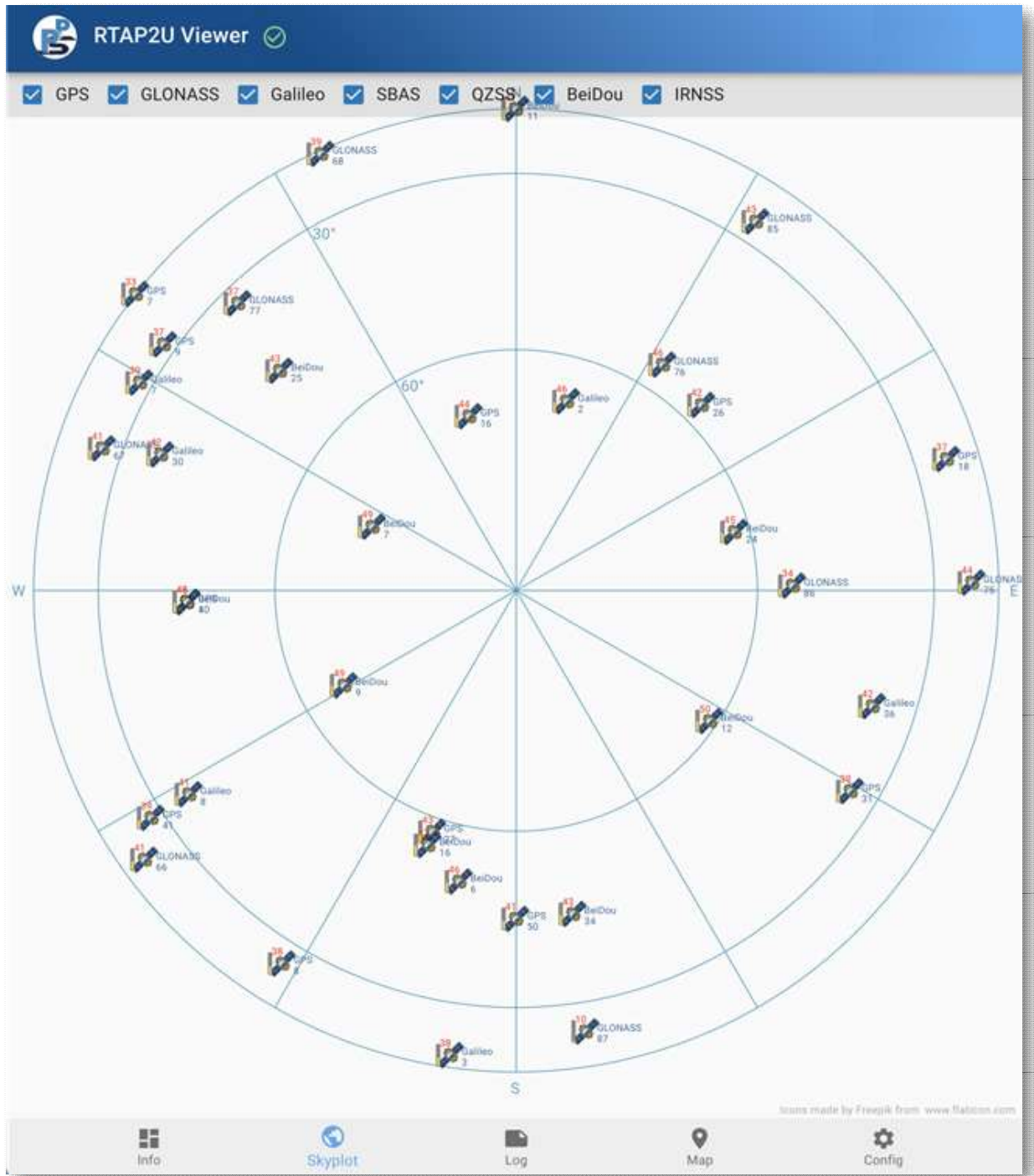
③ Information available in the second table is as the following.

- PRN: Satellite identification code
- EL: Satellite elevation angle (degree)
- AZ: Satellite azimuth angle (degree)
- SNR: Signal to noise ratio (dB)
- Status: Satellite tracking status

RTAP2U Viewer 					
DEVICE		SATELLITE		POSITION	DEVIATION PLOT
System	Tracked		Used		
GPS	14		13		
GLONASS	8		8		
Galileo	10		10		
SBAS	-		-		
QZSS	-		-		
BeiDou	9		9		
IRNSS	-		-		
System	PRN	EL(°)	AZ(°)	SNR	Status
GPS	2	58	323	43	tracking
GPS	4	16	42	33	tracking
GPS	5	17	244	31	tracking
GPS	6	65	47	40	tracking
GPS	9	42	69	36	tracking
GPS	11			40	tracking
GPS	12	23	274	32	tracking
GPS	17	22	152	31	tracking
GPS	19	45	155	41	tracking
GPS	20	49	261	42	tracking
GPS	25	11	305	29	tracking
GPS	40	6	259		in view
GPS	41	27	238	37	tracking
GPS	50	47	180	39	tracking
GLONASS	65	8	32	29	tracking
GLONASS	66	70	42	41	tracking
GLONASS	67	51	204	34	tracking

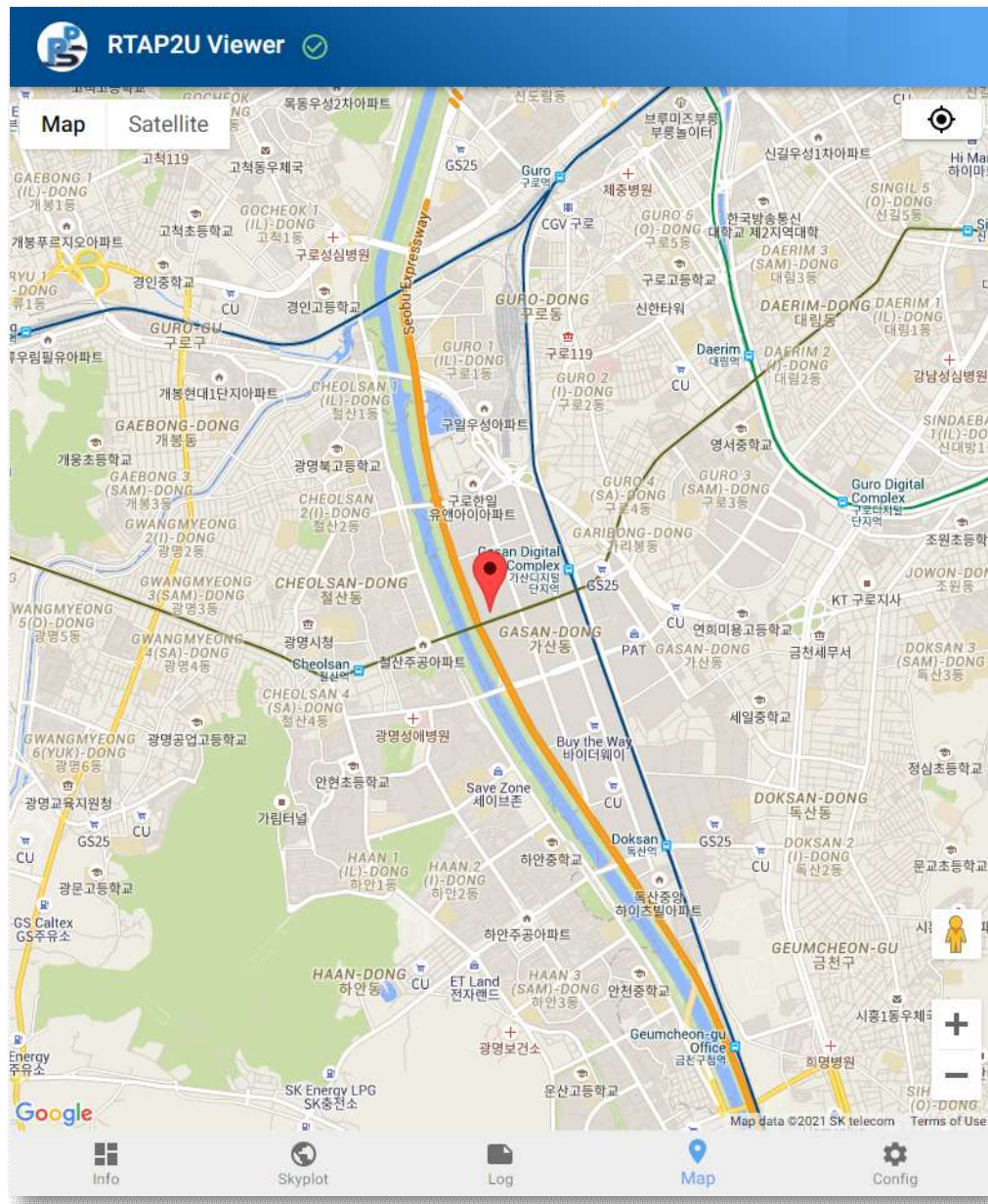
 Info
 Skyplot
 Log
 Map
 Config

- ④ Click **Skyplot** on the RTAP2U Viewer bottom bar
- ⑤ Users can observe the skyplot with the RTAP2U's location as the center point.
Select the check box to choose GNSS constellations to display.



2.4.4 Map

Click **Map** on the RTAP2U Viewer bottom bar to see the user location, which is based on the receiver's precise coordinate. Note that this is available only when the Internet is connected.

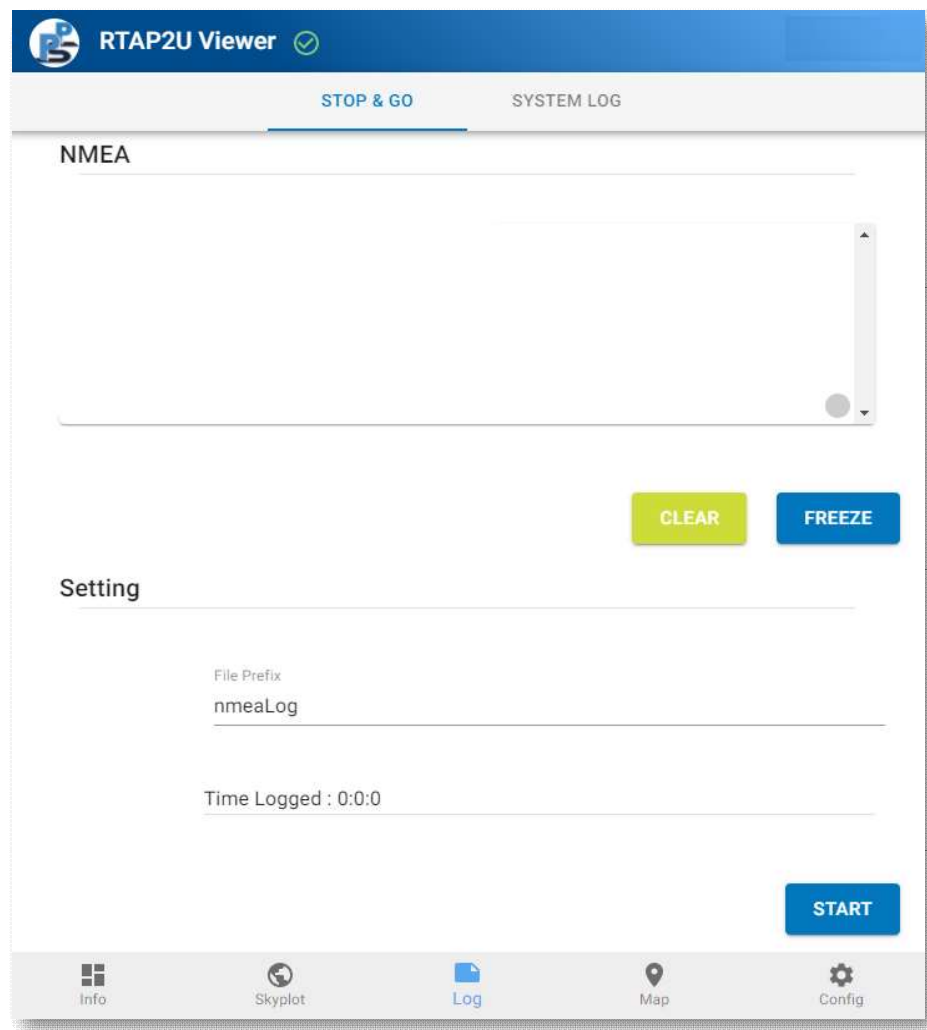


2.5 Managing Log Files

STOP & GO tab is used to log coordinates for a short period. When logging coordinates for long intervals, users can set the length of the interval through the **SYSTEM LOG** tab. The log files are saved in the RTAP2U internal memory and can be downloaded.

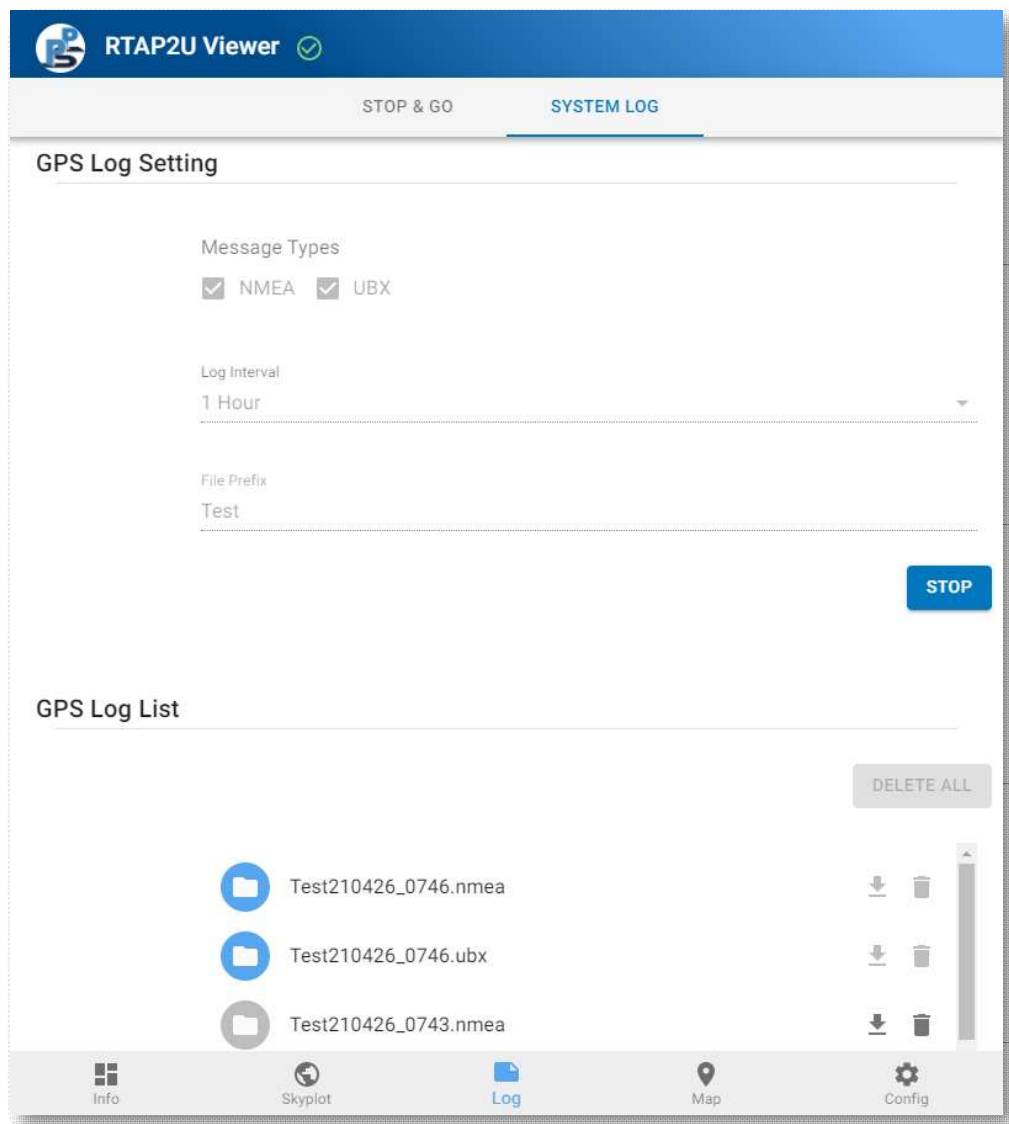
2.5.1 STOP and GO logging

- ① Click **Log** on the RTAP2U Viewer bottom bar and select **STOP & GO** on the top bar.
- ② Real-time logging is visible in the **NMEA** panel. Click **CLEAR** to remove logs in the **NMEA** panel and **FREEZE** to pause logging.
- ③ Enter the log file name using **File Prefix** in the **Setting** section. Click **START** to start saving coordinates. It will be saved in an NMEA format. The elapsed time is shown in the **Time Logged** section. Click **SAVE** to stop logging and the NMEA file will be downloaded in a .txt format.



2.5.2 Saving Log Files

- ① Click **Log** on the RTAP2U Viewer bottom bar and select **SYSTEM LOG** on the top bar.
- ② Choose the log file format between NMEA and UBX in **Message Types**.
- ③ Select the **Log Interval** and enter the **File Prefix** to set the logging period and file name.
 - Time: Separate files are made according to the time period selected.
 - File Prefix: Enter the file name that will be saved in the internal memory.
- ④ The **GPS Log List** shows all files that are saved in the internal memory. Click the downward arrow and trash bin icon to download and delete files. Click **DELETE ALL** to remove all files.

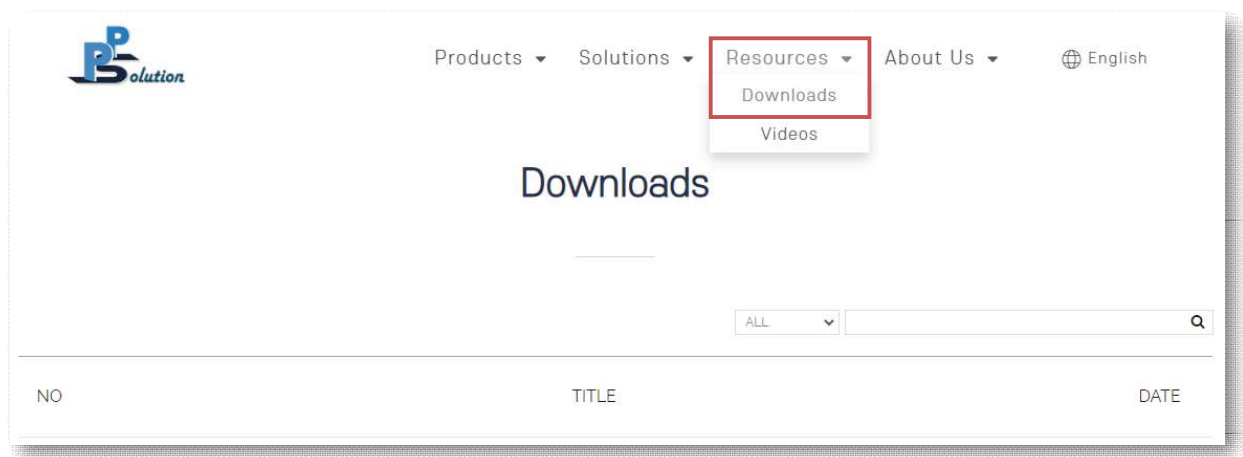


2.6 Updating Firmware

RTAP2U's latest firmware is available on the PP-Solution Inc. website. Users can easily download the firmware file and update the receiver. The firmware includes updates on the device and RTAP2U Viewer functions so it is highly recommended for the receiver's best performance. The following steps (1) through (4) illustrate how to download the firmware and update the receiver.

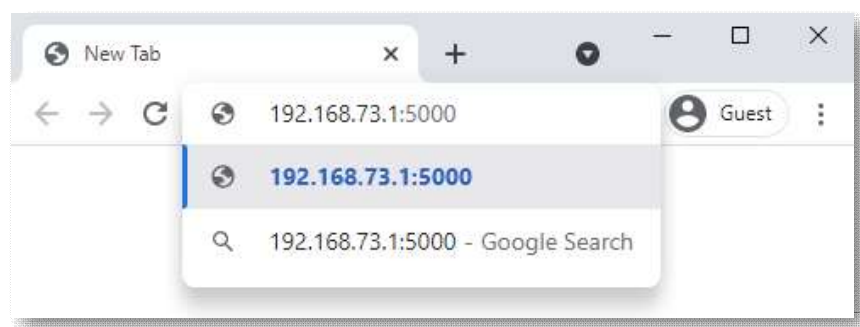
(1) Download the firmware

Visit www.ppsoln.com and click **Resources** on the top menu and select **Downloads**. Download the latest firmware file (.fw format).



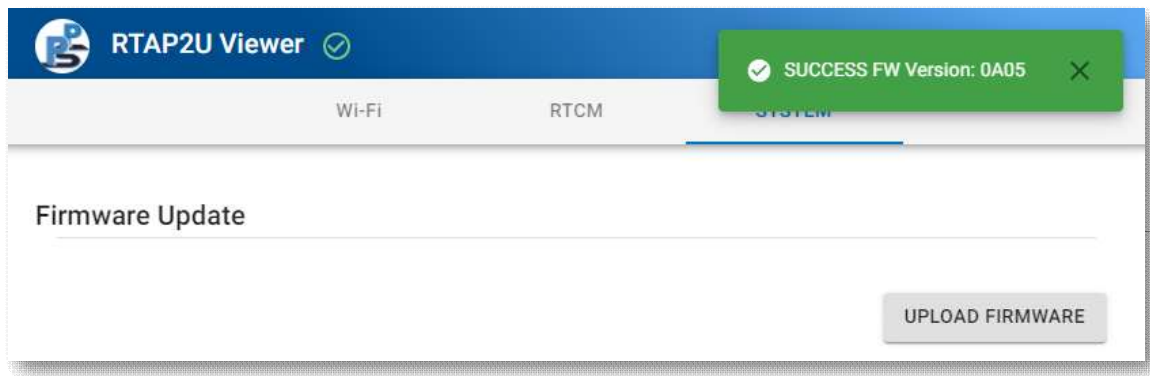
(2) Connect to RTAP2U Viewer

- ① Turn on RTAP2U by pressing the power button on the back side.
- ② Connect to the internal Wi-Fi (R2U-B11-XXXX).
- ③ Enter 192.168.73.1:5000 on the web browser.



(3) Upload the firmware

- ① Click **Config** on the RTAP2U Viewer bottom bar and select **SYSTEM** on the top bar.
- ② Click **UPLOAD FIRMWARE** and choose the latest firmware file. This may take up to three minutes depending on the network environment.
- ③ After a green notice “SUCCESS FW Version: XXXX.” pops up on the top right, close the RTAP2U Viewer window.



(4) Reboot the receiver

The receiver automatically starts rebooting once the firmware is uploaded. It takes about one to two minutes to reboot.

Step					Description
①					Rebooting (1~2 minutes)
②					Booting complete

3. Specifications

General	
Power	DC 5V 1A
Size	80 mm × 69 mm × 36 mm
Weight	160 g
Operating Temp.	-20 °C ~ 55 °C
Ingress Protection	IP 54
GNSS Receiver Specifications	
Signal Tracking	· 184 Channels · GPS L1 C/A, L2C · GLONASS L1OF, L2OF · Galileo E1B/C, E5b · BeiDou B1I, B2I · QZSS L1 C/A, L2C · SBAS L1 C/A
Data Management	· Up to 20 Hz · RTCM version 3.3 · NMEA Output · RTK, VRS, FKP, MAC, PPP-RTK · 10 GB Internal Memory
Time to First Fix	· Cold Start: 24 s · Warm Start: 2 s · Reacquisition: 2 s
Accuracy	· RTK: 0.01 m + 1 ppm CEP · RTK convergence: < 10 s
Input & Output	
USB	USB C type: Power charging, data transmission
Wi-Fi	2.4 GHz Wi-Fi (802.11 b/g)
LED	4 indicator lights
Battery	
Type	Internal chargeable Li-ion battery
Voltage	3.7 V
Capacity	3000 mAh
Operating Time	About 6 hours (May vary depending on the user environment.)

4. Service

4.1 Customer Service

Please contact your dealer to receive technical support and service. If you need to obtain information regarding your dealer's contact, reach out to PP-Solution Inc. at the following address:

- Website: www.ppsoln.com
- Telephone: +82-2-6925-1516
- Address: PP-Solution Inc., 606 Seobusaet-gil #B-2311, Seoul, Korea 08504

4.2 Warranty

This product is warranted for a period of one year from the original purchase date. PP-Solution Inc. does not warrant or provide technical support due to modification of the original board.

FCC Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module.

This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: **2A4BV-RTAP2U** Or Contains FCC ID: **2A4BV-RTAP2U**

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product

Any company of the host device which install this modular with limit modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C : 15.247 and 15.209 requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 requirement then the host can be sold legally.

FCC RF Exposure Information

This equipment complies with FCC RF exposure limit requirements set for in an uncontrolled environment.



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