USER GUIDE

SP30Pro

SPHEREFIX

www.spherefixgnss.com

contact@spherefixgnss.com

+86-19022028323 (Sunky)

SPHEREFIX

SP30Pro

GNSS RECEIVER USER GUIDE

Guangzhou Spherefix Navigation Technology Co., Ltd.

Preface

Introduction

This section explains the purpose of the manual and the basic use of the SP30Pro GNSS Receiver.

User qualifications

To obtain the best results from the SP30Pro, read this manual in full before operation. If you are unfamiliar with any function, visit https://www.spherefixgnss.com/ for supplementary material.

Safety information

Note: Highlights a procedure or condition that requires extra attention.

Warning: Identifies an operating step whose incorrect execution may damage the equipment, cause data loss, or create a safety hazard.
Radio configuration in the 410-470 MHz band (EN 300 113 V3.1.1) is restricted in some countries; verify local regulations before transmitting.

ES	LU	RO	
CZ	FR	HU	
SI	DK	HR	
	BG	EE	BE

Limitation of liability

Guangzhou Spherefix Navigation Technology Co., Ltd. accepts no responsibility for damage or injury resulting from failure to follow the instructions or from misinterpretation of the contents.
We reserve the right to revise this manual without notice as part of our continuous product-improvement policy.

Although every effort has been made to ensure accuracy, discrepancies between the manual and the actual hardware or software may occur; in such cases the physical product takes precedence.

Technical support & service

Should you encounter any technical issues, please call the Spherefix Technical Support Department; we will respond promptly.

Feedback

Send any suggestions about the product or manual to: contact@spherefixgnss.com. Your comments will help us improve both the product and service.

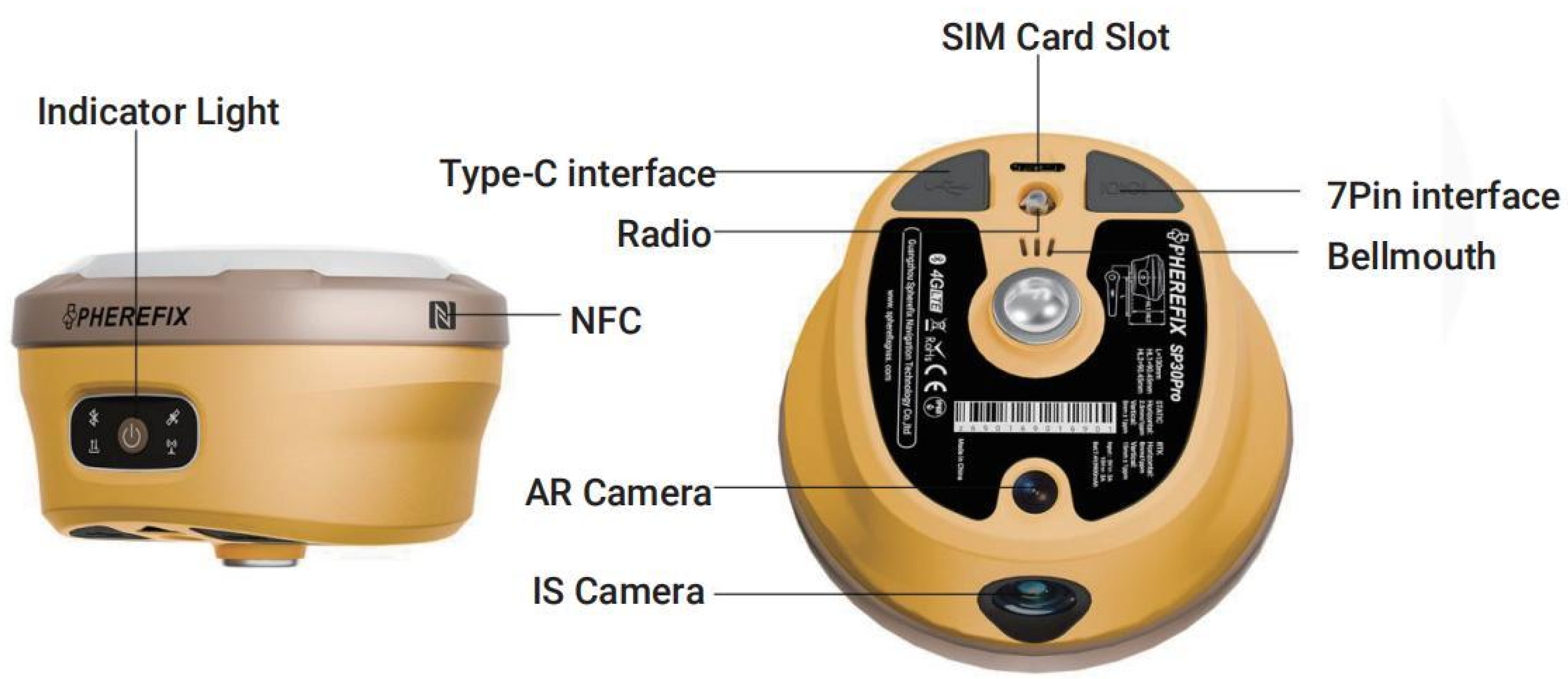
Contents

1. SP30Pro Overview

SP30Pro is a multi-functional GNSS receiver that integrates AR and Image Surveying (IS) modules. It has a built-in high-precision positioning module, which supports the tracking of satellite signals at all frequency points. The device is completely equipped with 4G Full-netcom, Bluetooth, WIFI, and a built-in 5W data transmission radio. Its high-precision inertial navigation module integrates IS and AR real scene stakeout, greatly expanding the boundaries of surveying and mapping.

1.1 Appearance

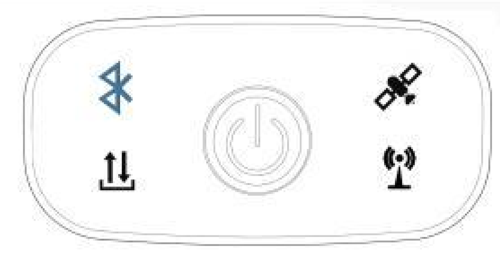
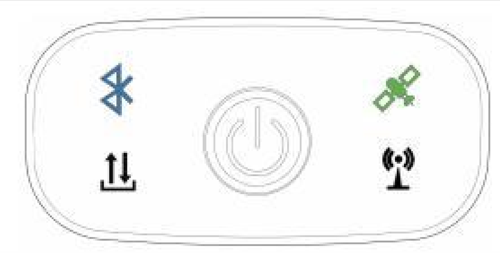
SP30Pro is as follows:

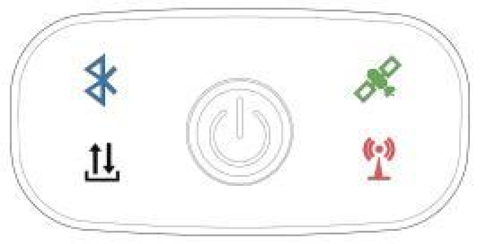
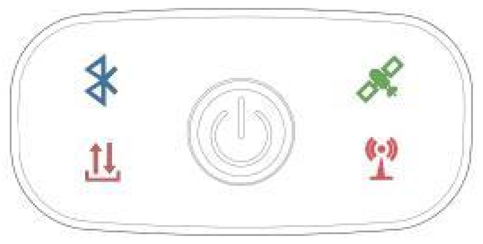


Projects	Function	Function or status
	Power Button	Brief press for 1s to display the battery level; Long press for 3s to turn on the device when it is off; Long press for 3s to turn off the device when it is on.
	Bluetooth Light	Light on for Bluetooth connected; Light off for Bluetooth disconnected; Blink for abnormal condition.
	Satellite lights	Rover/base station: 1 second interval flashing in the positioning state; when not searching for satellites, the light goes out; Static mode: flashes at intervals based on the sampling frequency.
	Differential Light	Rover mode: Blink when receiving differential data; Base mode: Blink when sending differential data.
	Network status	Starting: 1 second 1 flash Networking Success: Always on Network failure: fast flashing (no card, card arrears, etc.)
	7 Pin Interface	RS232 serial port, baud rate supports 1200, 2400, 4800, 9600, 19200, 38400, 115200 and 230400bps.
	USB Interface	Type-C interface, supports PD fast charging up to 33W, please refer to 1.5.
	SIM Card Slot	External SIM card, supports 4G full network access.
	UHF Antenna Interface	Built-in radio: supports low power (1W), medium power (2W) and high power (5W) options.
	AR Camera	Professional ultra-wide-angle camera which provides high-definition real-scene stakeout.
	IS Camera	1/2.6-inch high-definition wide-angle camera, integrated with high-precision inertial navigation algorithm, combined with high-performance Android controller, to achieve high-precision photogrammetry.

1.2 Battery Indicator

Press the power button for one second when the device is off; and the battery level can be informed based on the quantity of lights on.

Indicator Light	Battery Level
	0%-25%
	26%-50%

	51%-75%
	76%-100%

1.3 Power On and Off

Power On: In the power-off state, press and hold the power button for 3 seconds until you hear the voice prompt “waiting to start.” Release the power button and wait for the panel indicator light to stop flashing alternately. Once you hear the voice prompt “communication connection successful,” the device has completed the power-on process.

Power Off: In the power-on state, press and hold the power button for 3 seconds until you hear the voice prompt "Power off." Wait for all the panel indicator lights to go out, indicating that the device has completed the power-off process.

Forced Shutdown: In case of unexpected malfunction, press and hold the power button for 10 seconds, and the device will shut down automatically.

1.4 Insert a SIM Card

The device supports network working mode, a 4G full network solution based on the Linux platform, and fully supports China Mobile/China Unicom/China Telecom 2/3/4G networks, with better compatibility, stronger signals and more stable connections.

How to insert a SIM card?

1.Open the slot;

2.Insert the SIM card into the slot according to the instructions (chip facing the connector and notch facing the slot);

3. Close the slot.

1.5 Charging

The device comes with a Type-C charger that supports up to 33W PD fast charging. The battery can be fully charged in just 4 hours. And the battery indicator light shows:

1. Red light: The battery is charging.
2. Green indicator light: The battery is fully charged.
3. Battery charging: Open the rubber cover, connect one end of the data cable to the Type-C port and the other end to the charger.

Note: For the safety of your device, please use the adapter that comes with the package or a brand adapter that complies with 3C certification for charging.

1.6 Packing List

After receiving and unpacking the box, please check whether the device and all accessories are complete according to the following table.

Serial number	Name	Model	Quantity	Picture	Remark
1	Geodetic GNSS Receiver	SP30Pro	1		Standard
2	450-470M Radio Terminal Antenna	AT0038	1		Standard
3	CC Data Cable	L0602-1	1		Standard
4	33W EU PD Power Adapter	CG0004	1		Standard
5	Base connector	BB0031	1		Optional
6	Height measuring film	BB0039	1		Optional
7	SP30Pro yellow PP box packaging		1		Standard
8	30cm extension rod (yellow)	BB0036	1		Optional
9	5V/2V USB Power Adapter	CG0003	1		Standard
10	USB 3.0 Type-c data cable	L0602-2	1		Standard
11	Controller (5.5 inches) - with touch pen	C500	1		Optional
12	P9N controller bracket	BB0037	1		Optional
13	7-pin USB and serial cable	L0609-15	1		Optional

2. Web UI

The device WIFI can be used as a hotspot, which can be connected with a PC, smartphone or tablet. After connecting to the hotspot, you can log in to the device's Web UI Manage work status, change work mode, modify basic settings, download raw data, update firmware, and register devices, etc.

Taking your computer's interface as an example, enter the Web UI and do the following:

1. Use a computer to find and connect to the device's WIFI hotspot. Hotspot name: device serial number, and the default password is empty.

2. Open the web browser and input the IP address 10.10.10.10. The interface is shown in Figure 2.

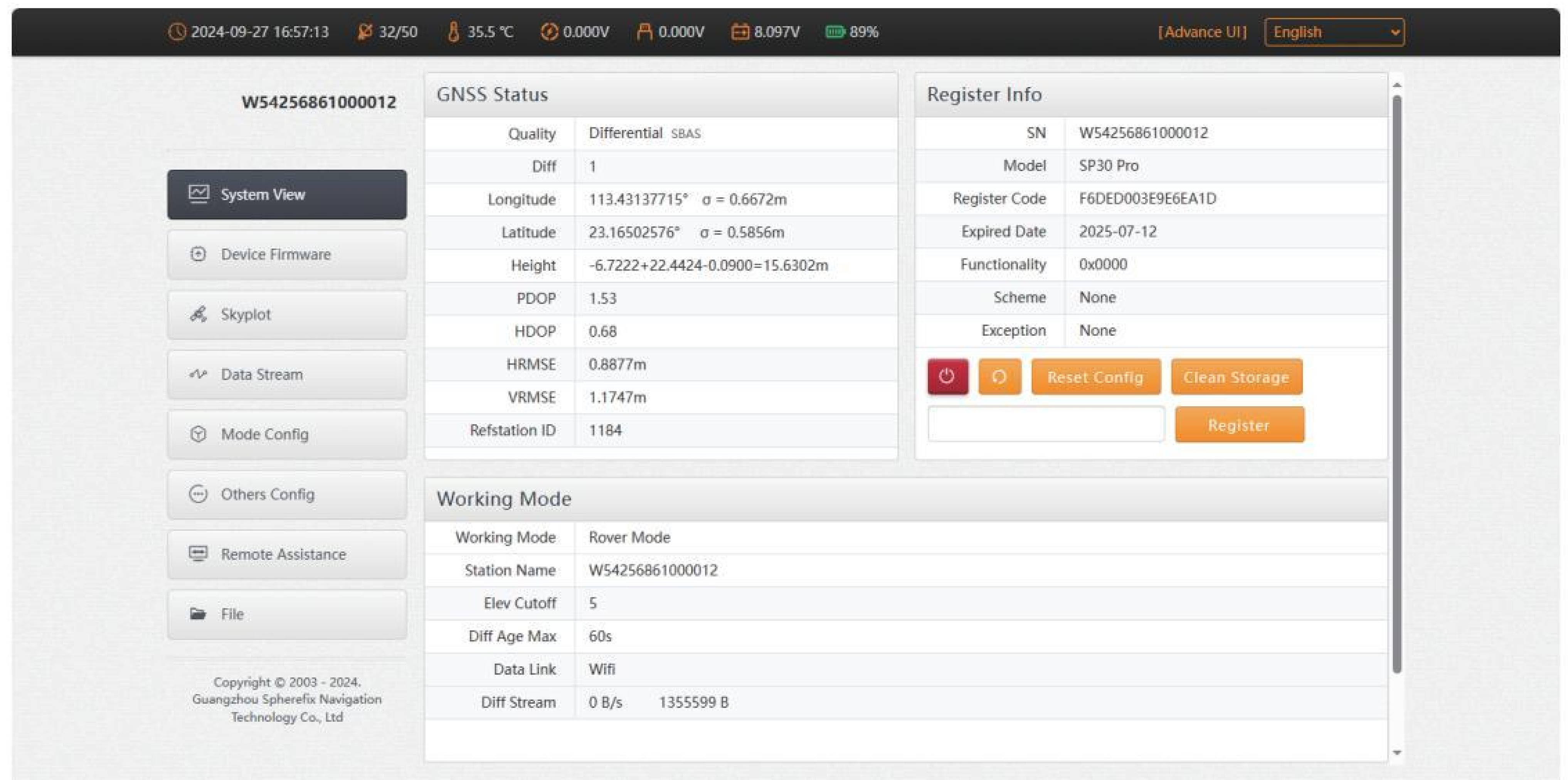


Figure 2

2.1 System View

① **GNSS Status:** Time, Quality, Latitude, Longitude, Height, Satellite.

② **Register Info:** SN, Model, Register Code, Expired Date, Functionality, Scheme, Exception, Reboot, Shutdown, Reset Config, Clean Storage, register.

Note: The registration code is a valid time code that authorizes the location function of the device. When it is found that the registration code has expired and the device positioning function is unavailable, you can obtain a new registration code from the supplier by providing the device SN, and enter it on this page and click [Register] to register.

③ **Working Mode:** Working Mode, Elev Cutoff, Data Link.

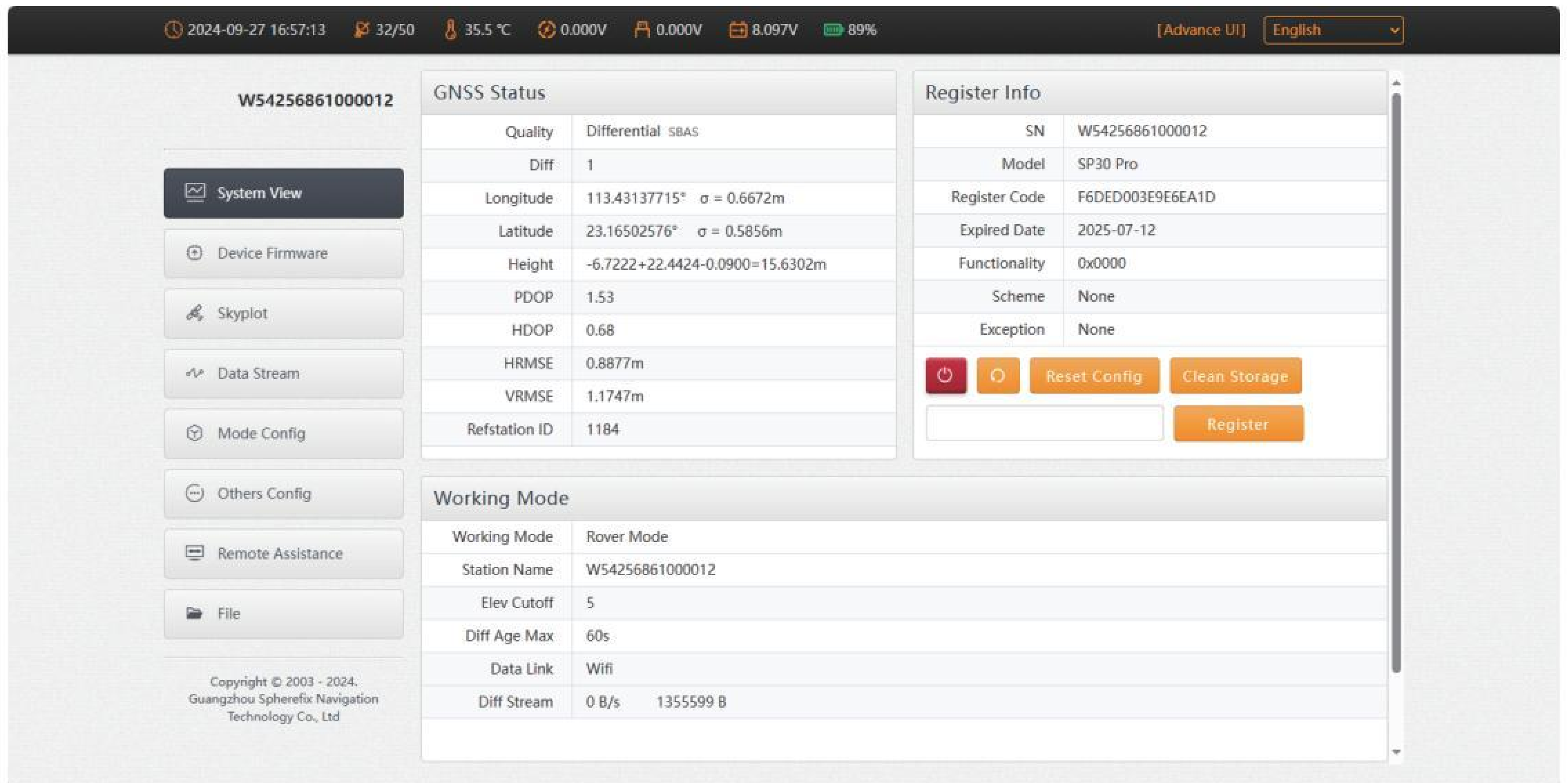


Figure 2.1

2.2 Device Firmware

① **Device Info:**

The info mainly displays the device information. For example, SN, GNSS Type, GNSS Hardware, IMEI, Expired Date, as shown below:

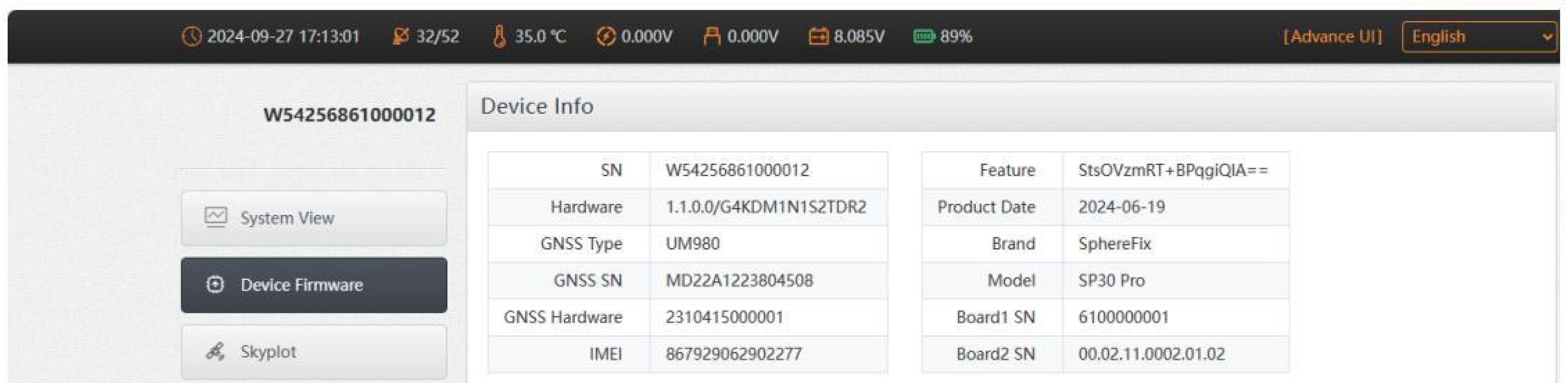


Figure 2.2-1

② **System Version:** System, GNSS, INS, Radio, Firmware.

③ **Local Upgrade:** Click Local Upgrade below to automatically identify and upgrade the positioning board firmware, tilt module firmware, and device firmware. There will be a prompt below during the upgrade process, and the device will restart after the upgrade is complete. The operation steps are as follows:

1. Click [Local Upgrade];
2. Select the correct device firmware in the pop-up window, flash the firmware and wait for the device to restart;
3. After the restart is complete, the firmware upgrade is completed;
4. Reconnect the device WiFi, enter the webui, and check whether the firmware has been upgraded successfully.

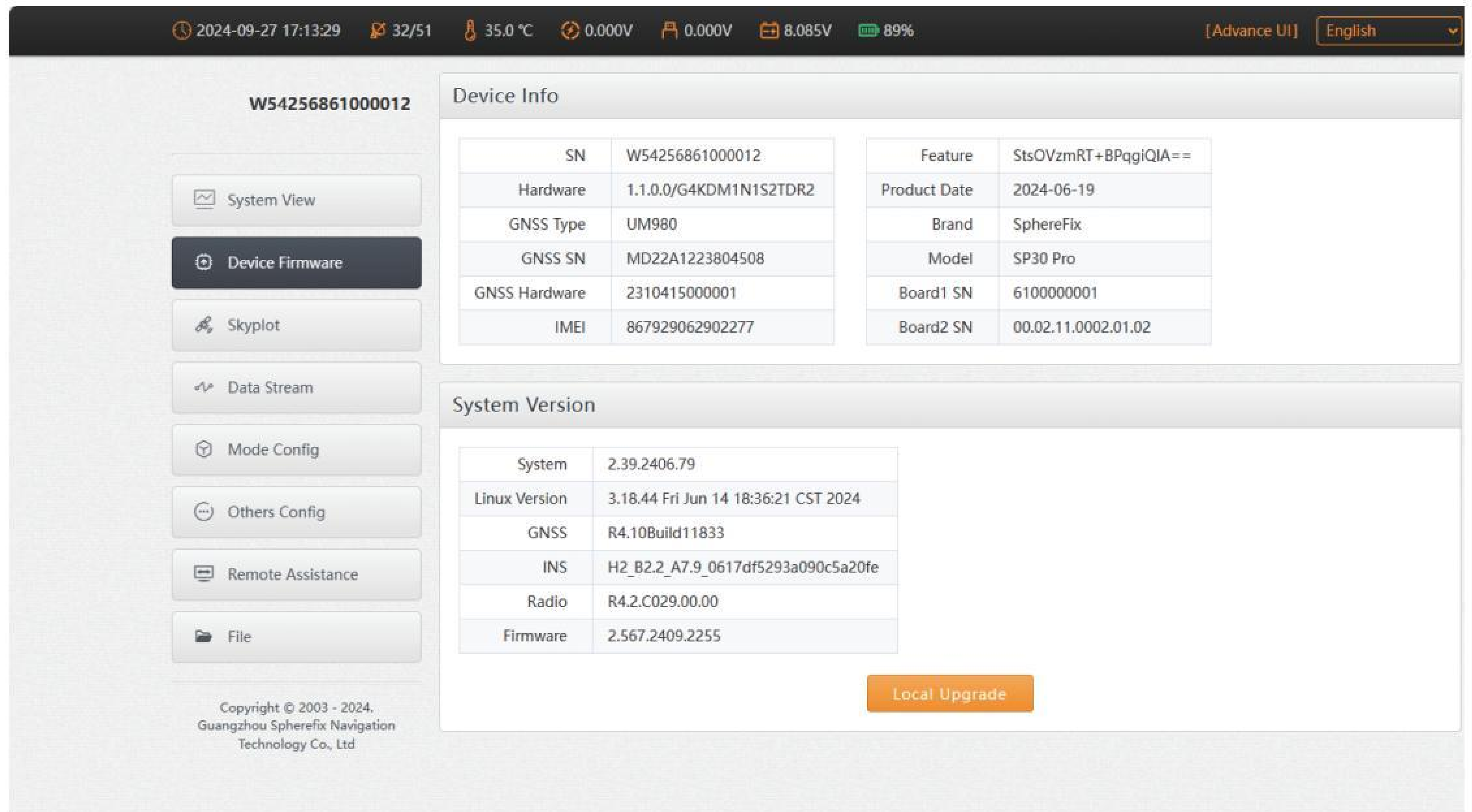


Figure 2.2-2

2.3 Skyplot

The skyplot mainly shows the satellite trajectory satellite status map. For example, Trace, Name, Health, Elev, Azim, as shown below:

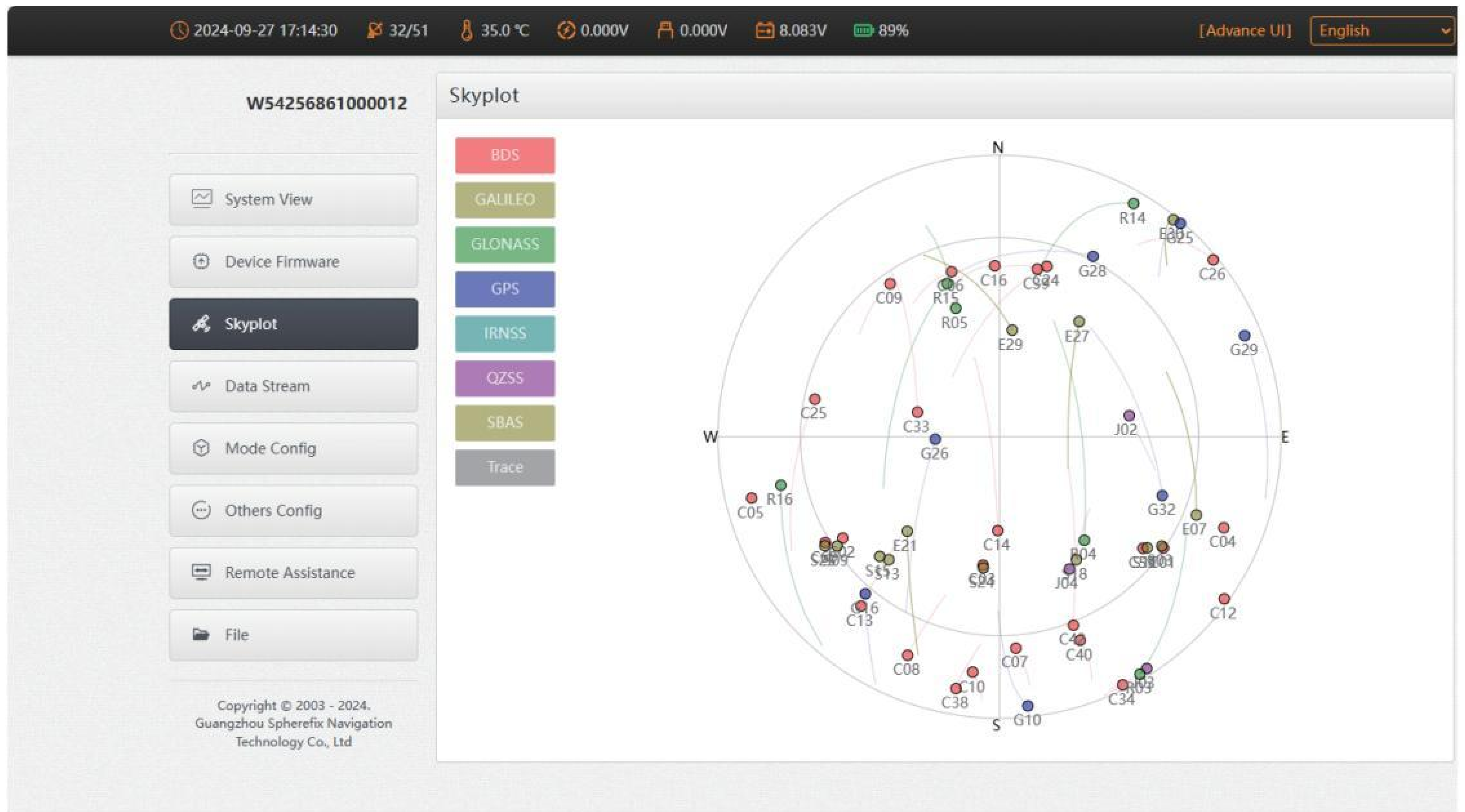


Figure 2.3

2.4 Data Stream

The data stream is mainly used to debug data information; you can view the current data status, as shown below:

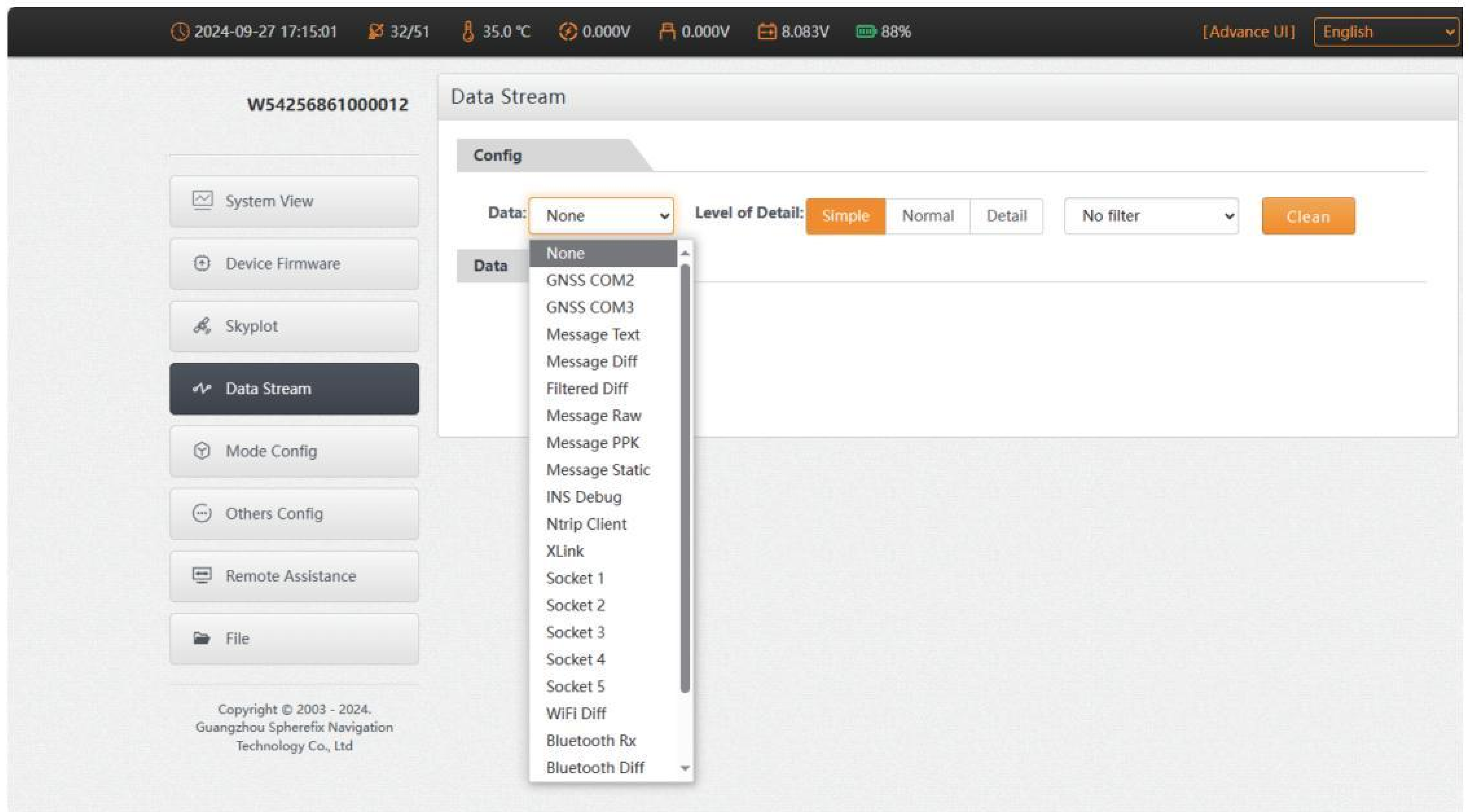


Figure 2.4-1

For example:

1. Message Text: see 2.10 in this Section for the configuration of message text, and the output is shown in Figure 2.4-2:

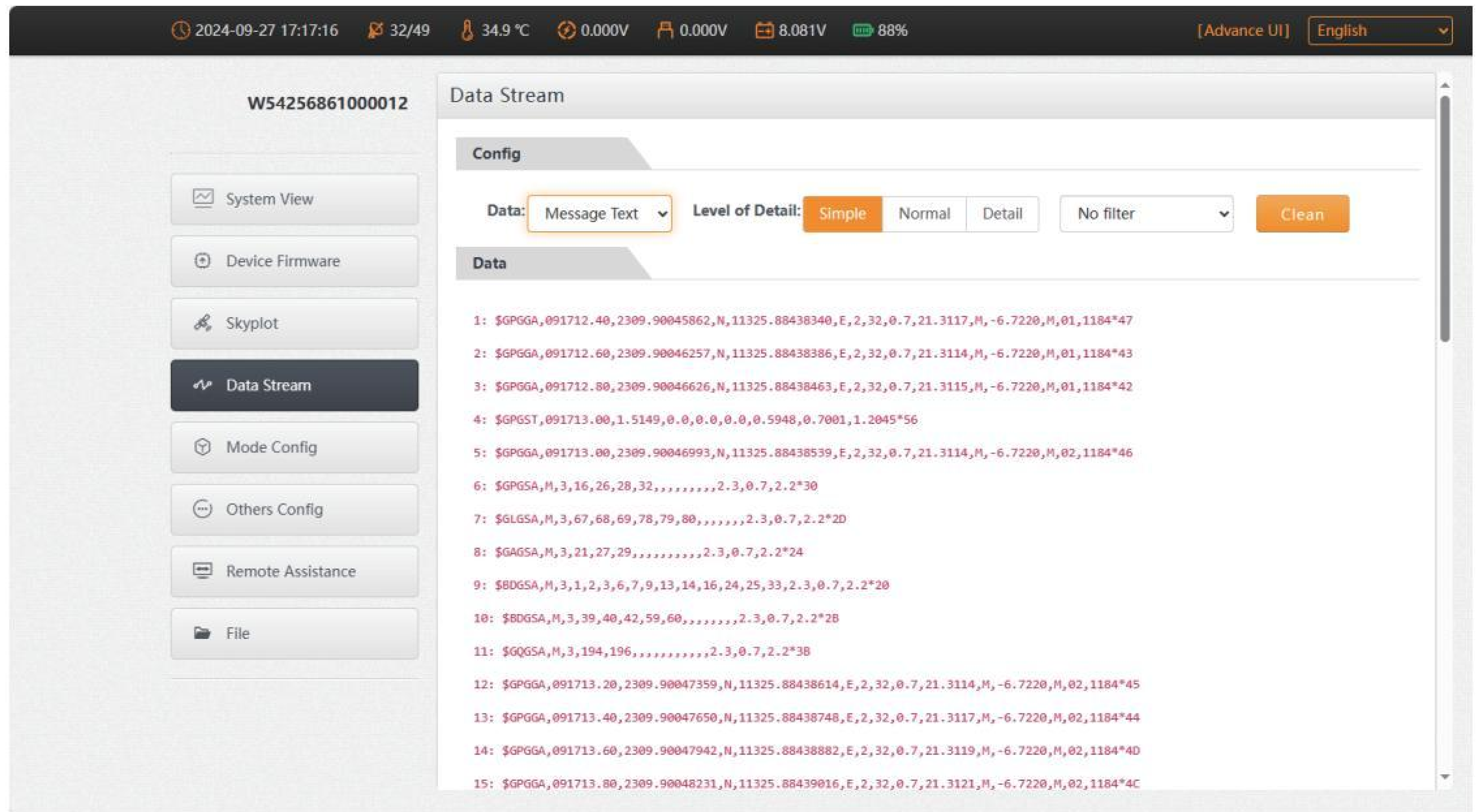


Figure 2.4-2

2. Message Raw: as shown in Figure 2.4-3:

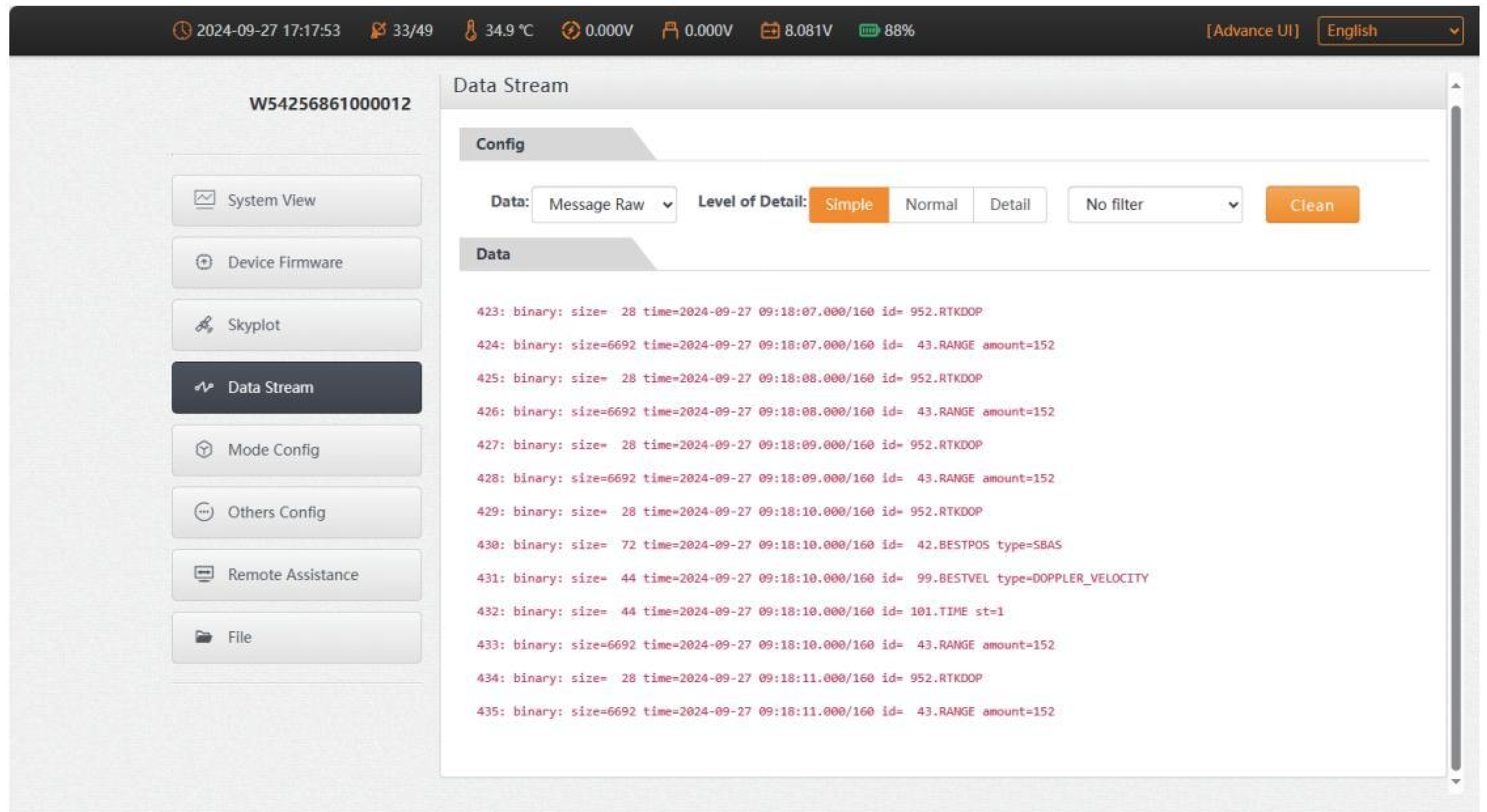


Figure 2.4-3

3. Message Diff: when the device is a base station, you can check here whether there is differential data output, as shown in Figure 2.4-4:

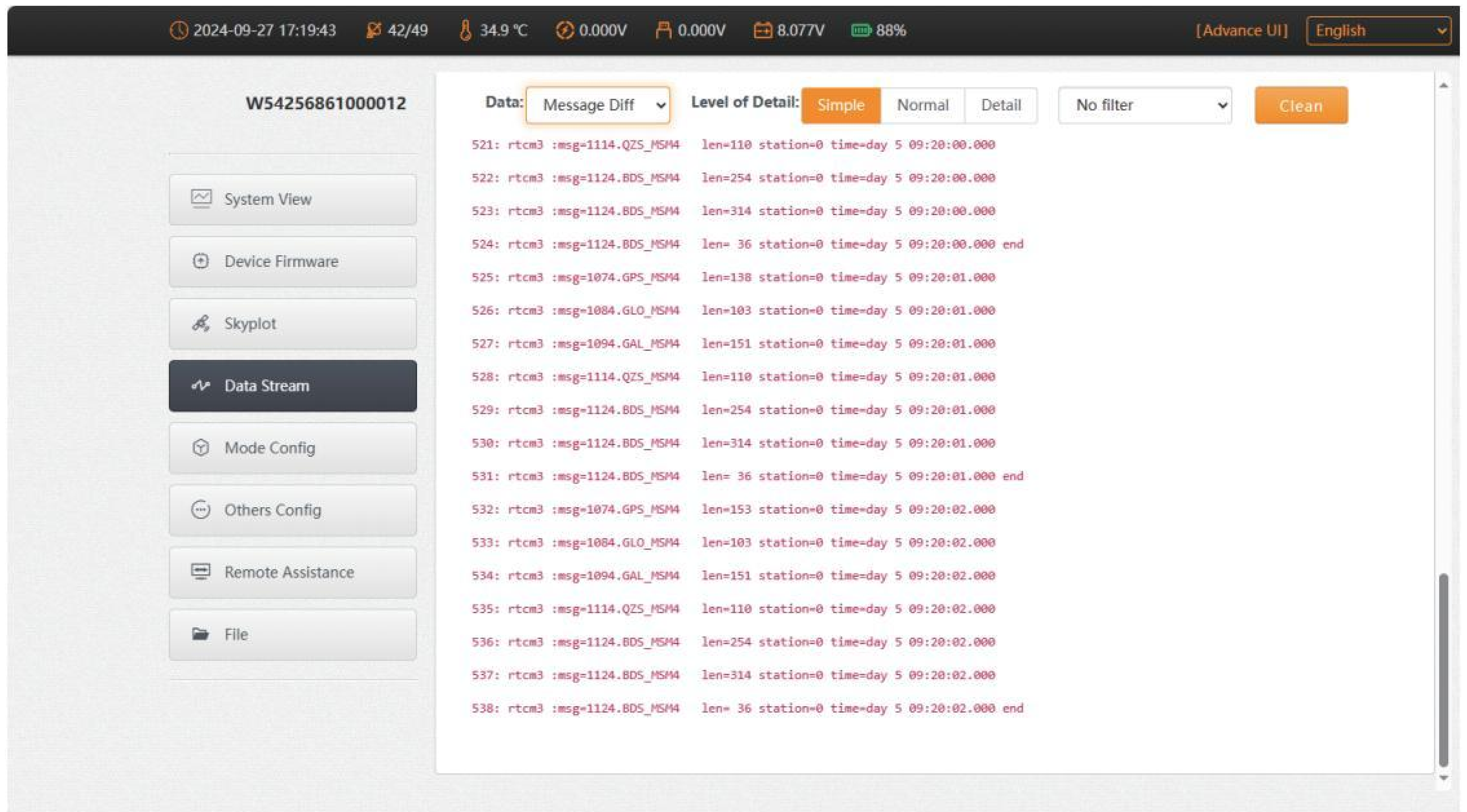


Figure 2.4-4

4. Message Static: When the device is in static mode, you can check here whether there is static data output, as shown in Figure 2.4-5:

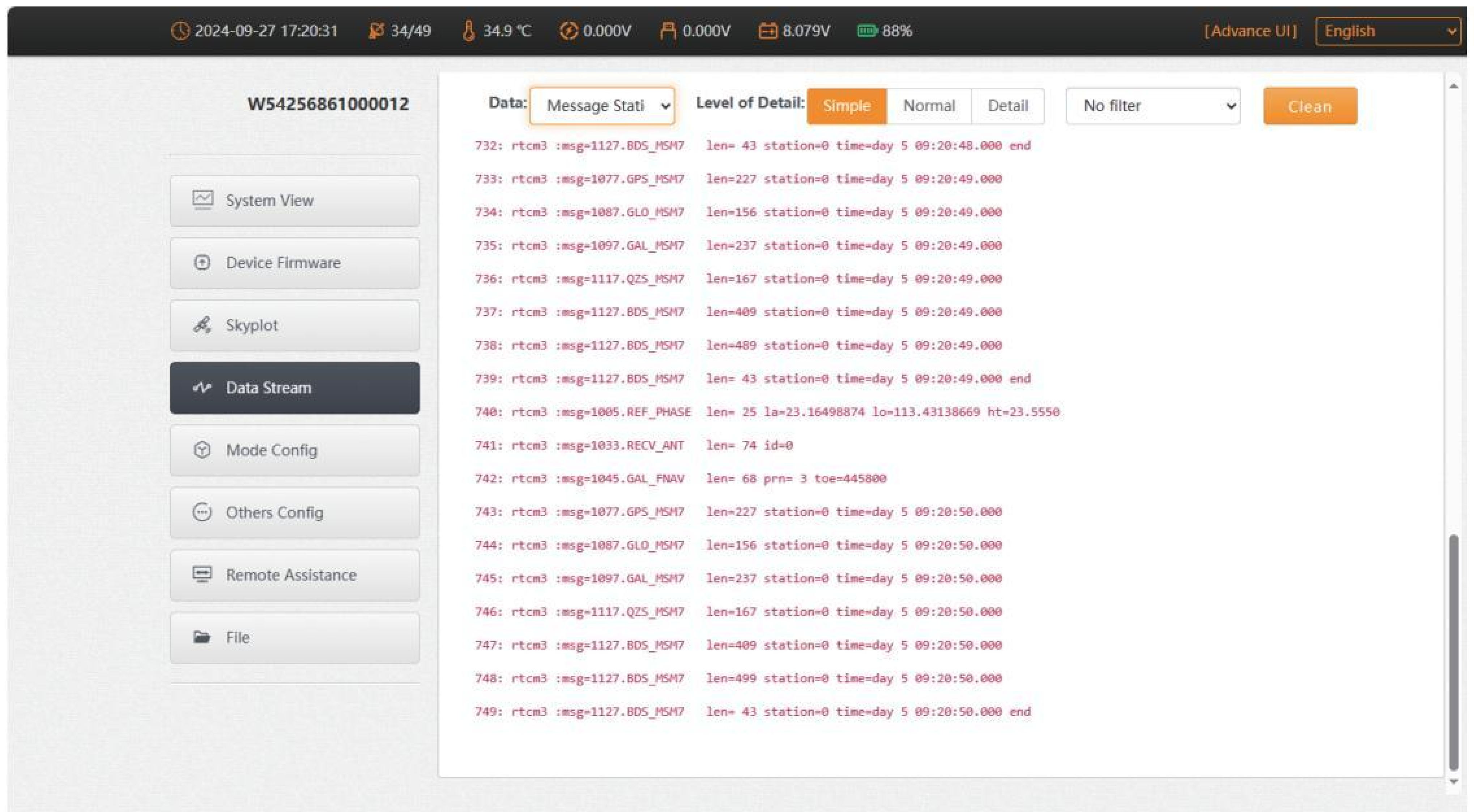


Figure 2.4-5

2.5 Mode Config

① **Working Mode:** You can choose Rover Mode/ Base Mode/ Static Mode, and select the Elev Cutoff at the same time;

1. Rover Mode: the following parameters (Station Name, Elev Cutoff, Diff Age Max, Height Type, Antenna Height, Record, PPK) can be cond.

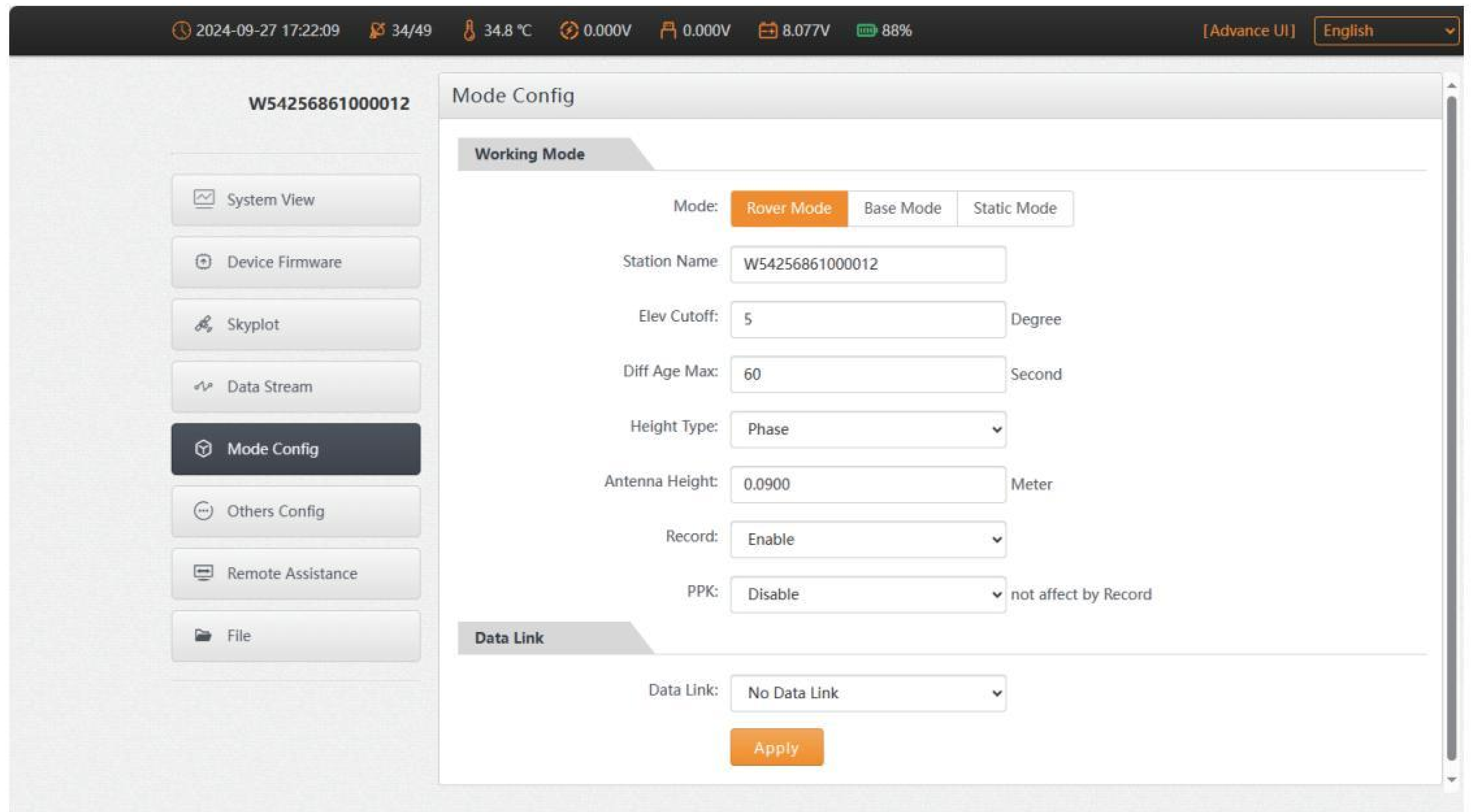


Figure 2.5-1

2. Base Mode: the following parameters (Station Name, Elev Cutoff, Station ID, PDOP Threshold, Diff Type, Base Mode, Height Type, Antenna Height, Record) can be cond.

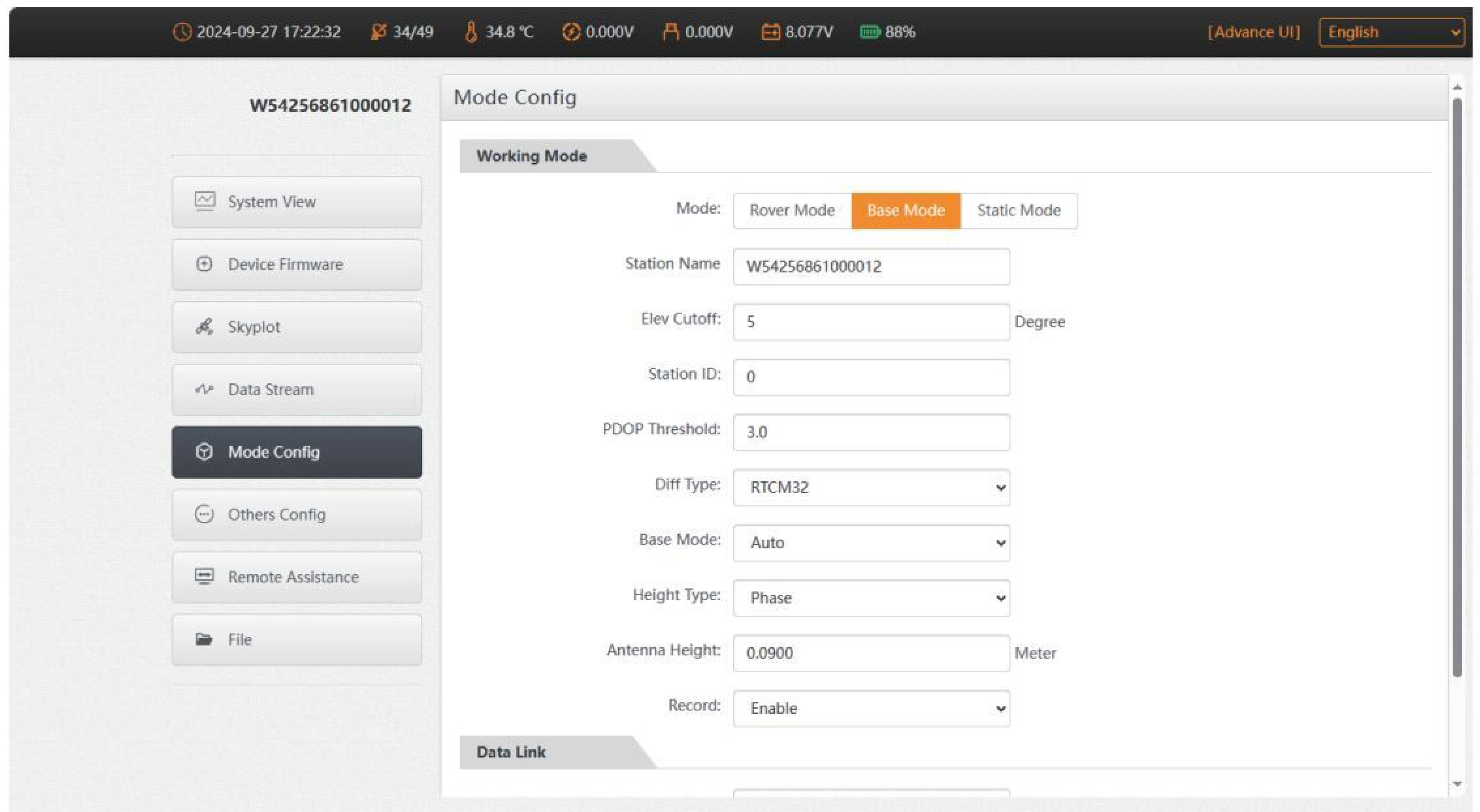


Figure 2.5-2

3. Static Mode: the following parameters (Station Name, Elev Cutoff, PDOP Threshold, Sample Interval, Height Type, Antenna Height, Record) can be cond.

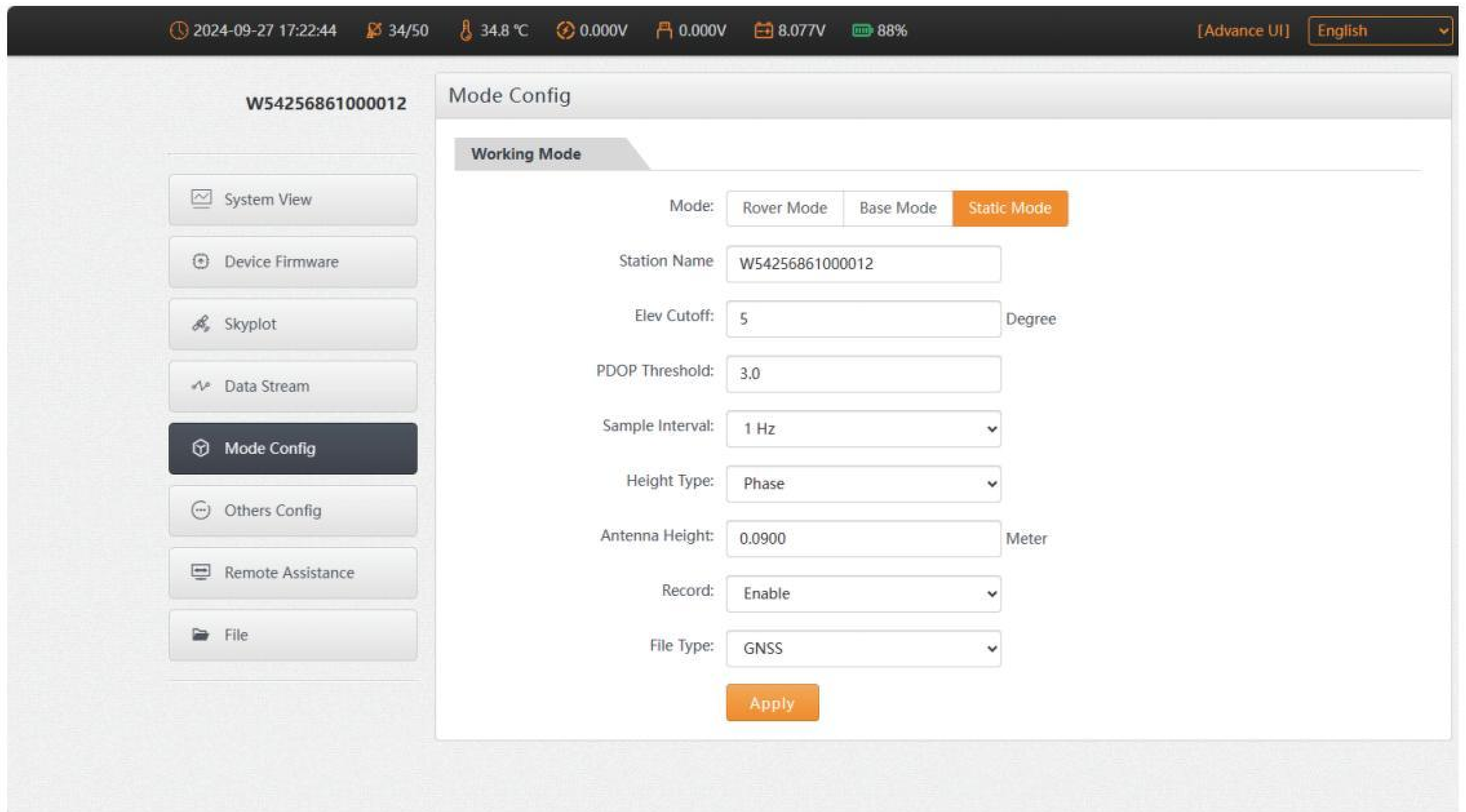


Figure 2.5-3

② **Data link :** You can choose No Data link/ Bluetooth/ Wifi/ Built-in Network/ Built-in Radio/ External Radio/ XLink.

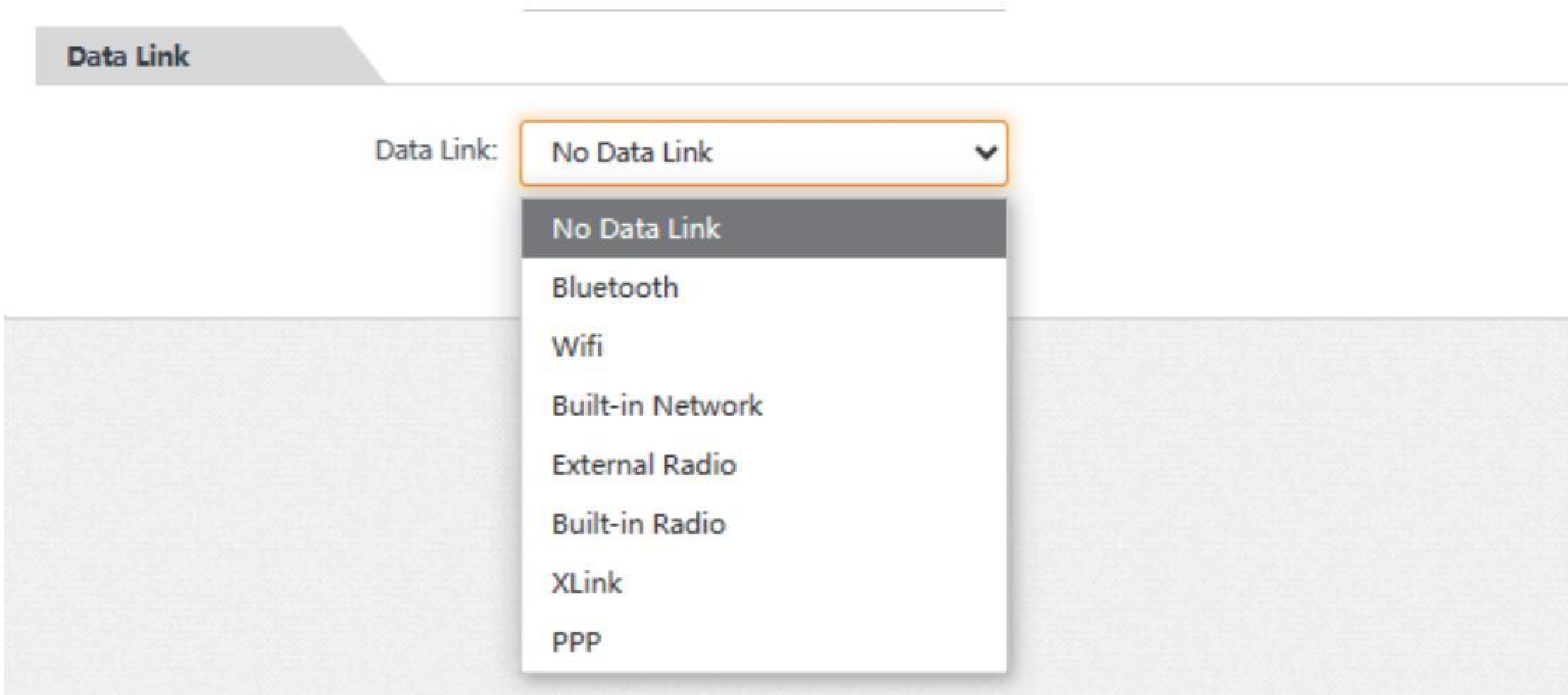


Figure 2.5-4

1. Bluetooth: the device obtains the differential data of SphereFix software accessed by the manual network through Bluetooth connection to the manual;

2. Built-in Network: the device receives or sends data through the built-in network. To select this data link, first insert the SIM card into the device;

3. Built-in Radio: the device receives data through the built-in radio. To select this data link, first connect the radio antenna to the device.

2.6 Others Config

① **WiFi:** You can choose three types of Disable/AP/Station, and you can set the WiFi name and password by yourself. When the device WiFi is used as the Station, you can access the network by entering the name and password of the external hotspot.

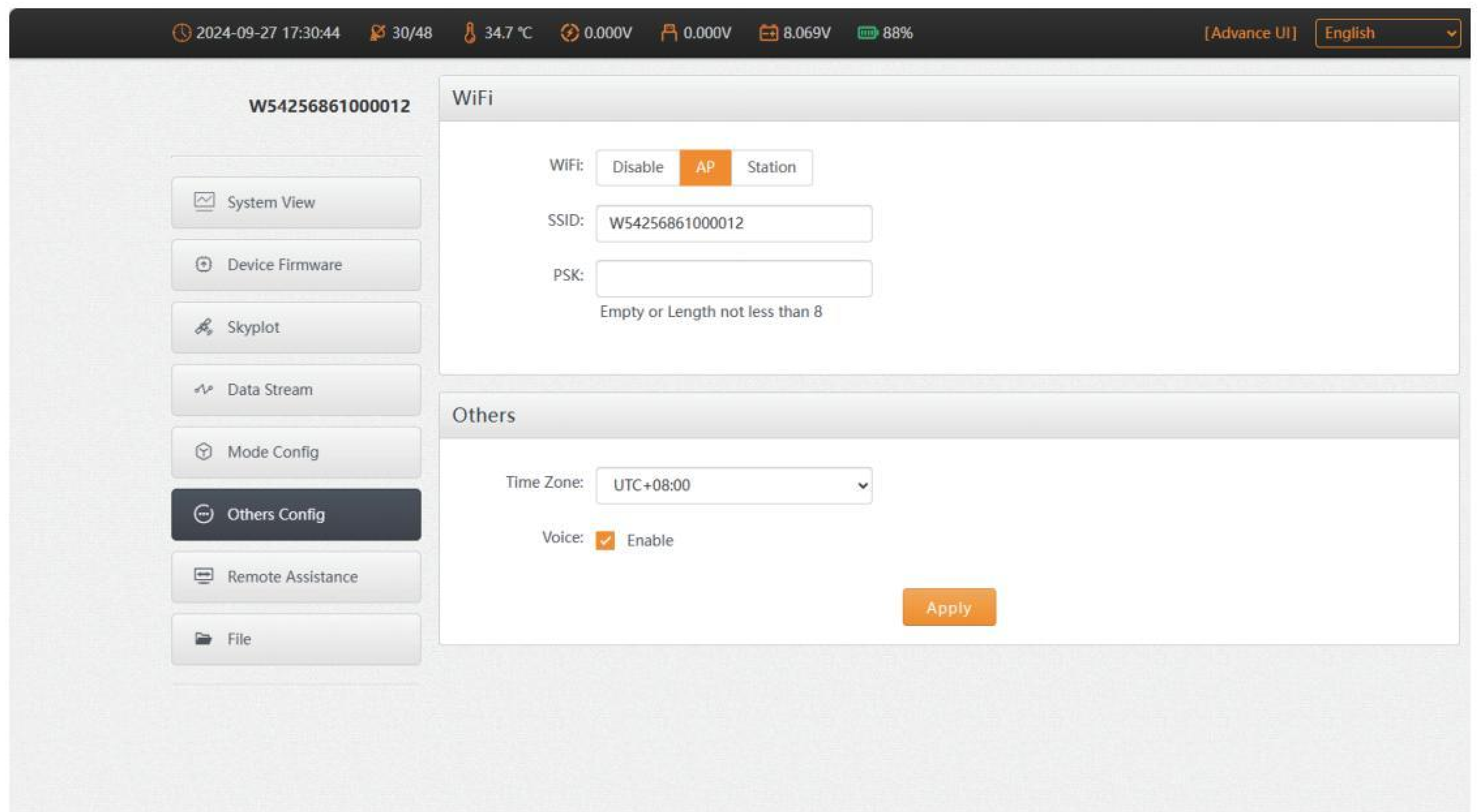


Figure 2.6-1

② **Others** : Time Zone, Voice.

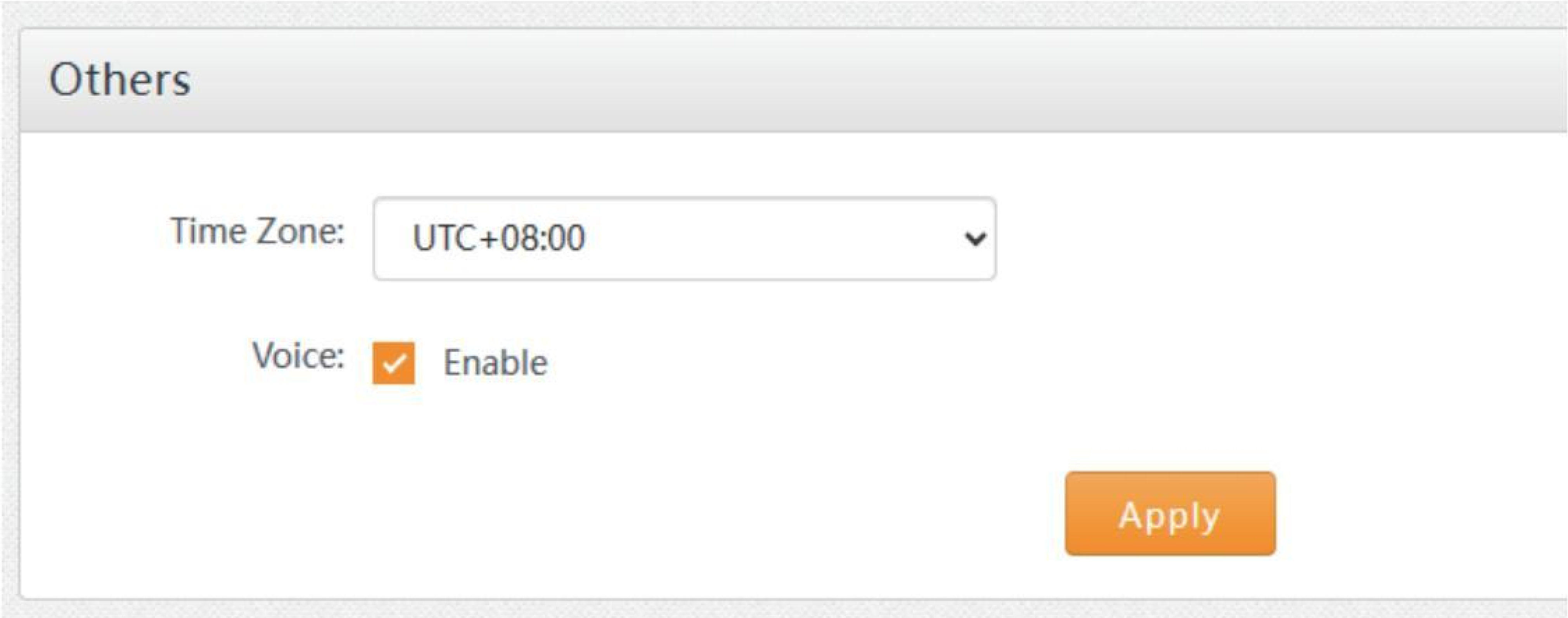


Figure 2.6-2

2.7 Remote Assistance

ZXVPN can provide a virtual LAN, connect the device to the server, and conduct WEBUI access in the background to provide corresponding remote technical support and services.The operation steps are as follows:

1. Insert the mobile network card into the device;
2. Open the mobile network and confirm that the mobile network is online;
3. Click [Use Default Value] to apply.

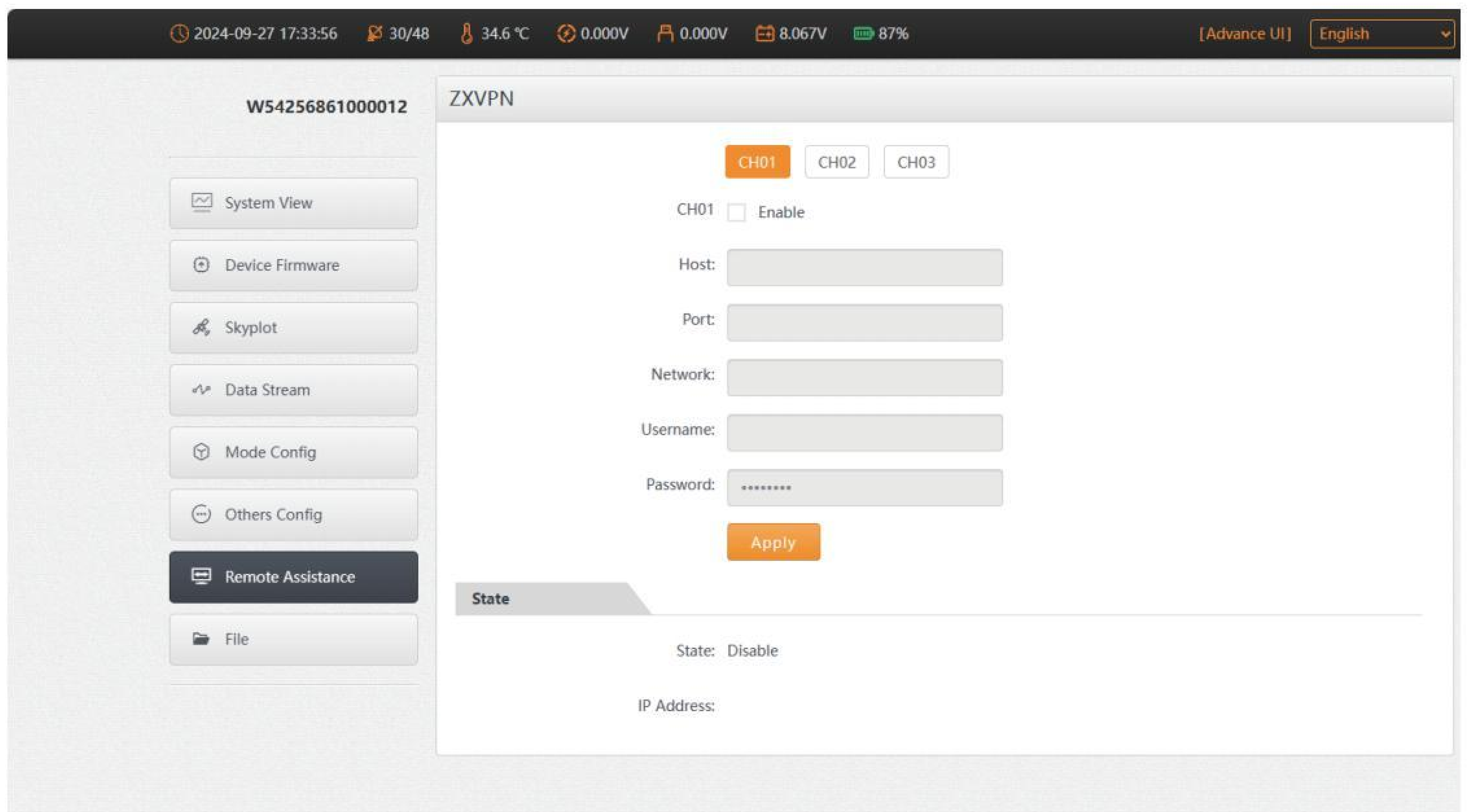


Figure 2.7

2.8 File

File management can delete and download data of each channel in batches , as shown below:

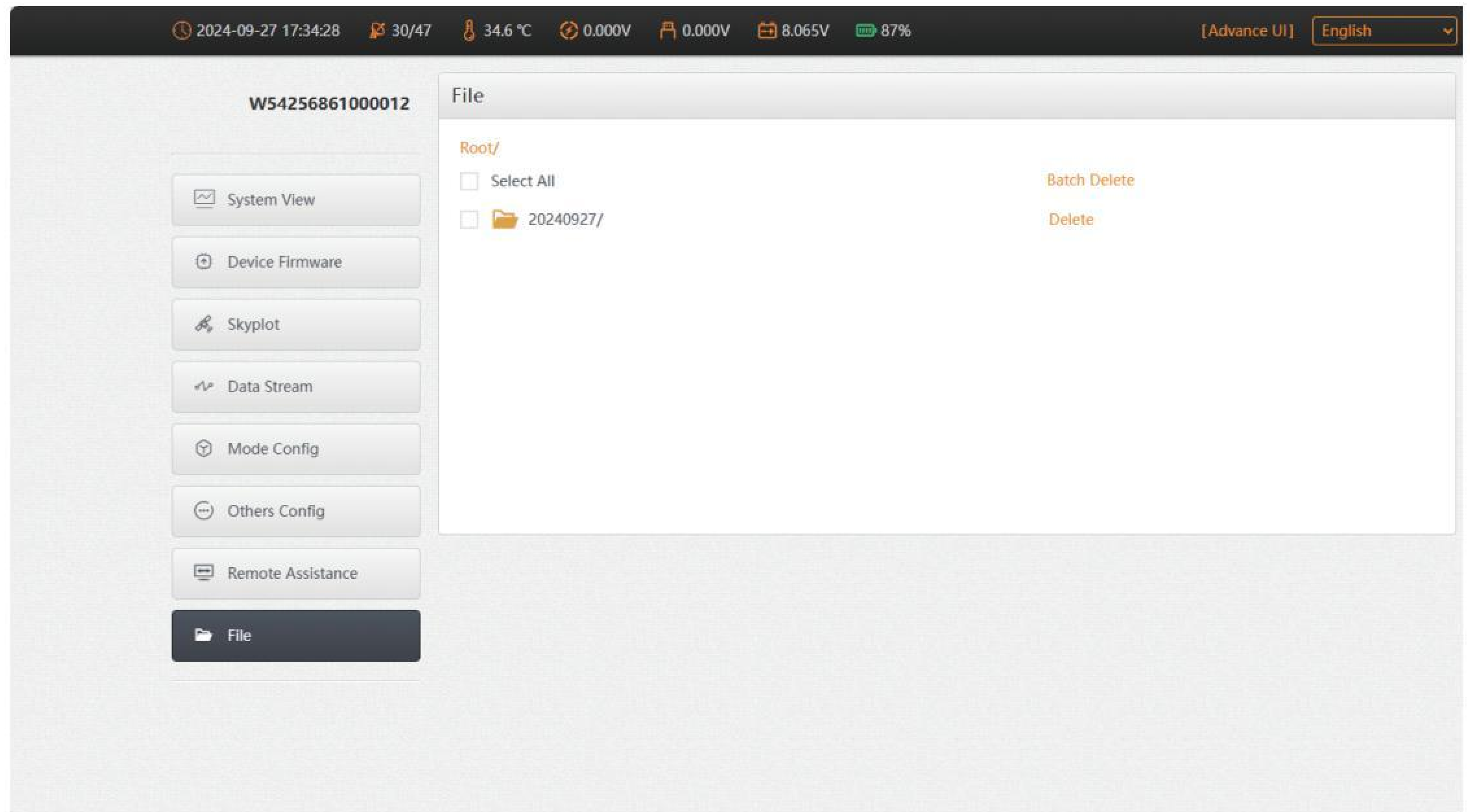


Figure 2.8

2.9 Log

It provides the download of the operation log of the device. When the device is abnormal during use, you can download the log generated at the corresponding time here to the supplier for troubleshooting. As shown below:

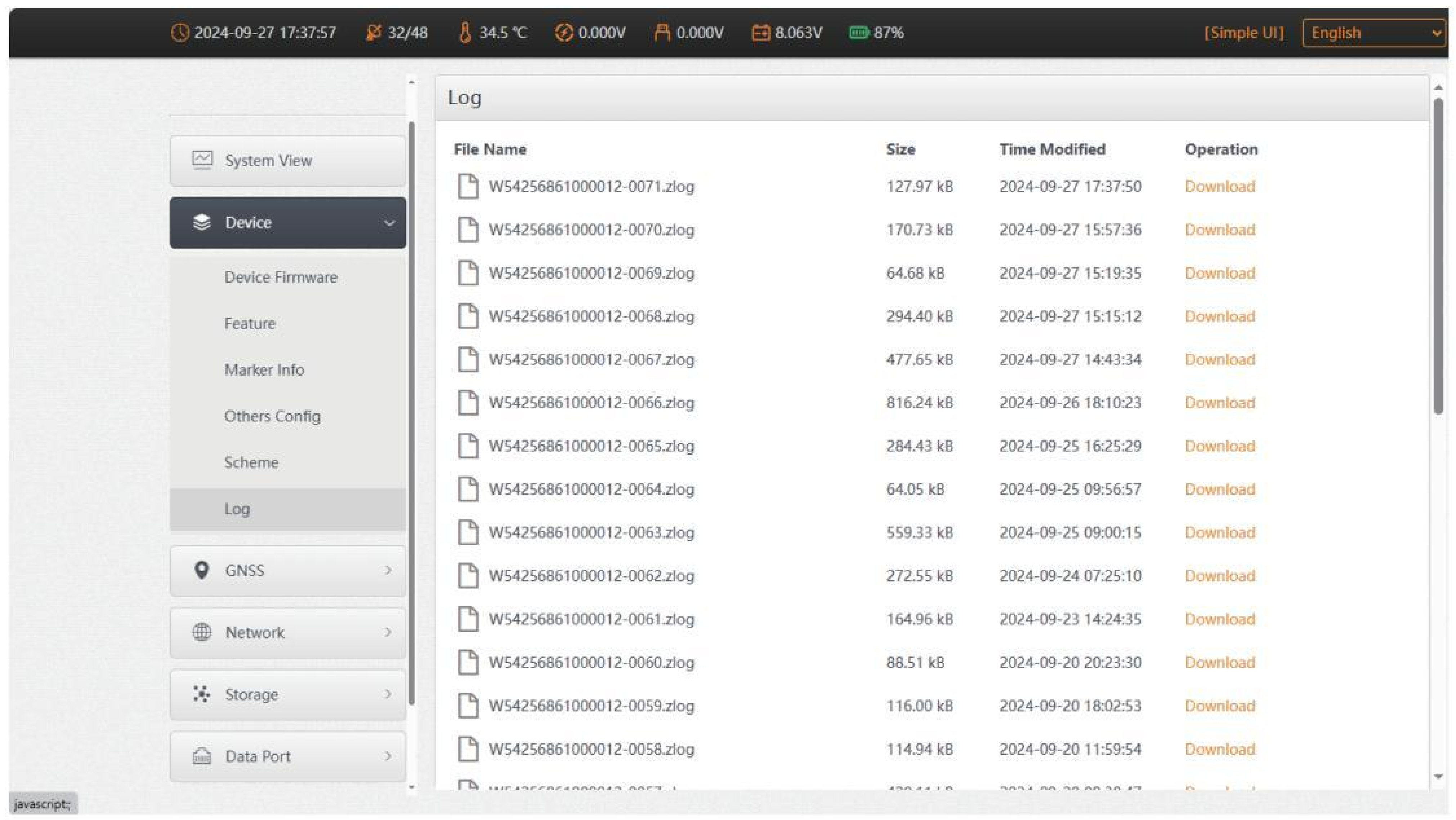


Figure 2.9

2.10 Message Text

You can set the type and frequency of output data in text format, as shown below. After configuration, you can check whether there is corresponding text data output in 2.4 of this section.

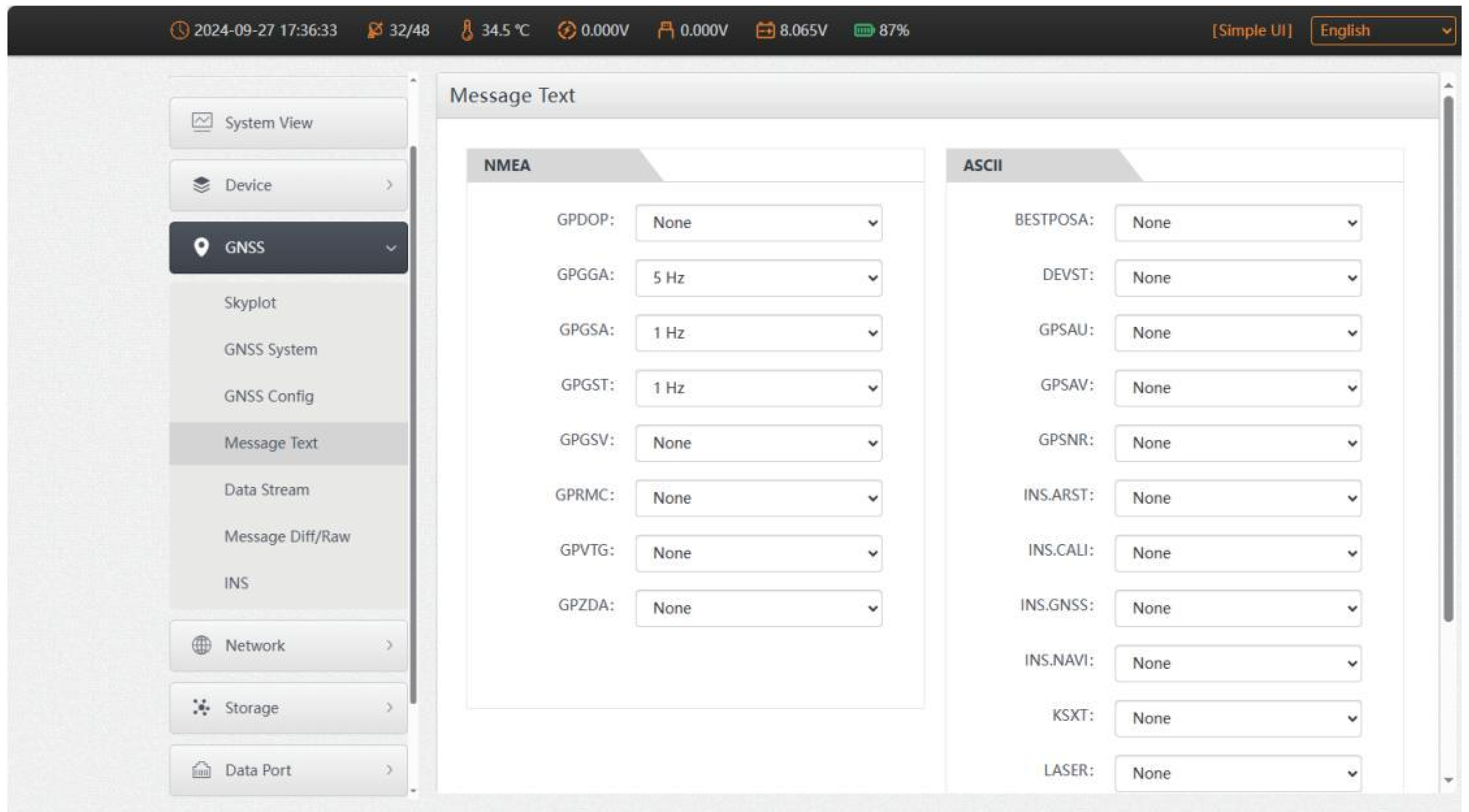


Figure 2.10

The following are the formats of several common message text:

GPGGA	$GPGGA,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,M,<10>,M,<11>,<12>*hh
<1>	UTC time, hhmmss (hour minute second) format, 8 hours different from Beijing time
<2>	Latitude ddmm.mmmm (degrees and minutes) format (the previous 0 will also be transmitted)
<3>	Latitude Hemisphere N (Northern Hemisphere) or S (Southern Hemisphere)
<4>	Longitude dddmm.mmmm (degrees and minutes) format (the previous 0 will also be transmitted)
<5>	Longitude Hemisphere E (East Longitude) or W (West Longitude)
<6>	GPS status: 0=no positioning, 1=single point positioning, 2=SBAS differential positioning, 4=RTK fixed solution, 5=RTK floating point solution, 6=inertial navigation positioning
<7>	The number of satellites (00~12) using the solution position
<8>	HDOP horizontal precision factor (0.5~99.9)
<9>	Altitude (- 9999.9~99999.9)
<10>	Height of earth ellipsoid relative to geoid
<11>	Differential time (the number of seconds since the last differential signal was received. If it is not differential positioning, it will be null)
<12>	Differential station ID No. 0000~4095 (the previous 0 will also be transmitted, otherwise it will be null)

GPGSA	$GPGSA,<1>,<2>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<4>,<5>,<6>*hh
<1>	Mode, M=manual, A=automatic
<2>	Positioning type, 1=no positioning, 2=2D positioning, 3=3D positioning
<3>	PRN code (pseudo-random noise code), the satellite number (01~32, the previous 0 will also be transmitted) being used to calculate the position.
<4>	PDOP position precision factor (0.5~99.9). The spatial geometric intensity factor of satellite distribution. Generally, the better the satellite distribution is, the smaller the PDOP value is, which is generally less than 4.
<5>	HDOP horizontal precision factor (0.5~99.9)
<6>	VDOP vertical precision factor (0.5~99.9)

GPGSV	$GPGSV,<1>,<2>,<3>,<4>,<5>,<6>,<7>,...<4>,<5>,<6>,<7>*hh
<1>	Total number of GSV statements
<2>	Number of GSV in this sentence
<3>	Total number of visible satellites (00~12, the previous 0 will also be transmitted)
<4>	PRN code (pseudo-random noise code) (01~32, the previous 0 will also be transmitted), which can be understood as satellite number.
<5>	Satellite elevation (00~90 degrees, the front 0 will also be transmitted)
<6>	Satellite azimuth (000~359 degrees, the front 0 will also be transmitted)
<7>	Signal to noise ratio (00~99dB, empty when no satellite is tracked, and the previous 0 will also be transmitted), 50 is better.

2.11 Data Config

The device has 24G storage space (recyclable storage) and supports five channels (CH01/CH02/CH03/CH04/CH05) to save various files, as shown in the below. We can con the data source, file period, file name and file format of each channel for storage as required.

Note: Do not change the mode after the device data configuration is completed, or the default storage configuration will be restored.

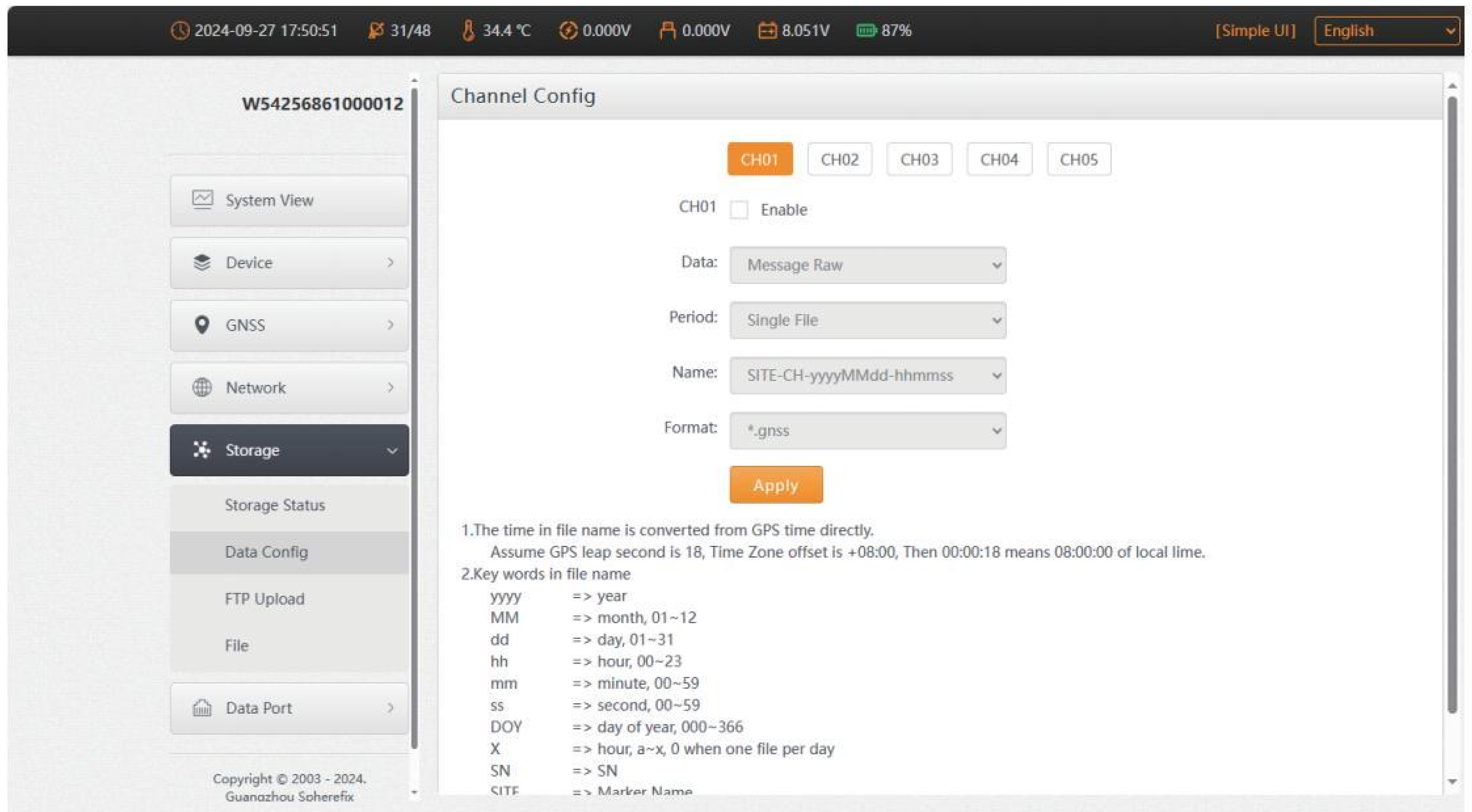


Figure 2.11-1

Data:

- None
- GNSS COM2
- Message Text
- Message Diff
- Message Raw
- Message PPK
- Message Static
- INS Debug
- Ntrip Client
- XLink
- Socket 1
- Socket 2
- Socket 3
- Socket 4
- Socket 5
- WiFi Diff
- Bluetooth Rx
- Bluetooth Diff
- Bluetooth Monitor

Period:

- Single File
- 1 hour
- 2 hours
- 3 hours
- 4 hours
- 6 hours
- 8 hours
- 12 hours
- 24 hours

Name:

- SN-CH-yyyyMMdd-hhmmss
- SN-yyyyMMdd-hhmmss
- SITE-SSSS-yyyyMMdd-hhmmss
- yyyyMMddhhmmss
- SSSSDOYX
- SITEDOYhhmm
- SITEDOYX
- SITEDOYXmm
- SITEDOYhh
- SITE-CH-yyyyMMdd-hhmmss

Format:

- *.gnss
- *.data
- *.txt
- *.dev
- RINEX2.10
- RINEX2.11
- RINEX3.02
- RINEX3.03
- RINEX3.04
- RINEX3.05
- RINEX3.05 (.D)
- RINEX3.05 (.gz)

File name naming rules:

1.The time in file name is converted from GPS time directly.		Assume GPS leap second is 18, Time Zone offset is +08:00, Then 00:00:18 means 08:00:00 of local lime.	
2.Key words in file name			
yyyy	=> year	DOY	=> day of year, 000~366
MM	=> month，01~12	X	=> hour, a~x, 0 when one file per day
dd	=> day，01~31	SN	=> Serial Number
hh	=> hour，00~23	SITE	=> Marker Name
mm	=> minute，00~59	SSSS	=> Marker Number
ss	=> second，00~59		

When the device is set to rover station, base station or static mode, the device will automatically con the corresponding channel for data storage by default.

1. Rover (CH01)

When the device is set as a rover station, the device will automatically con CH01 to store and locate the original data by default. If ppk is enabled, CH05 will also be automatically cond by default to store post positioning data, as shown in the following.

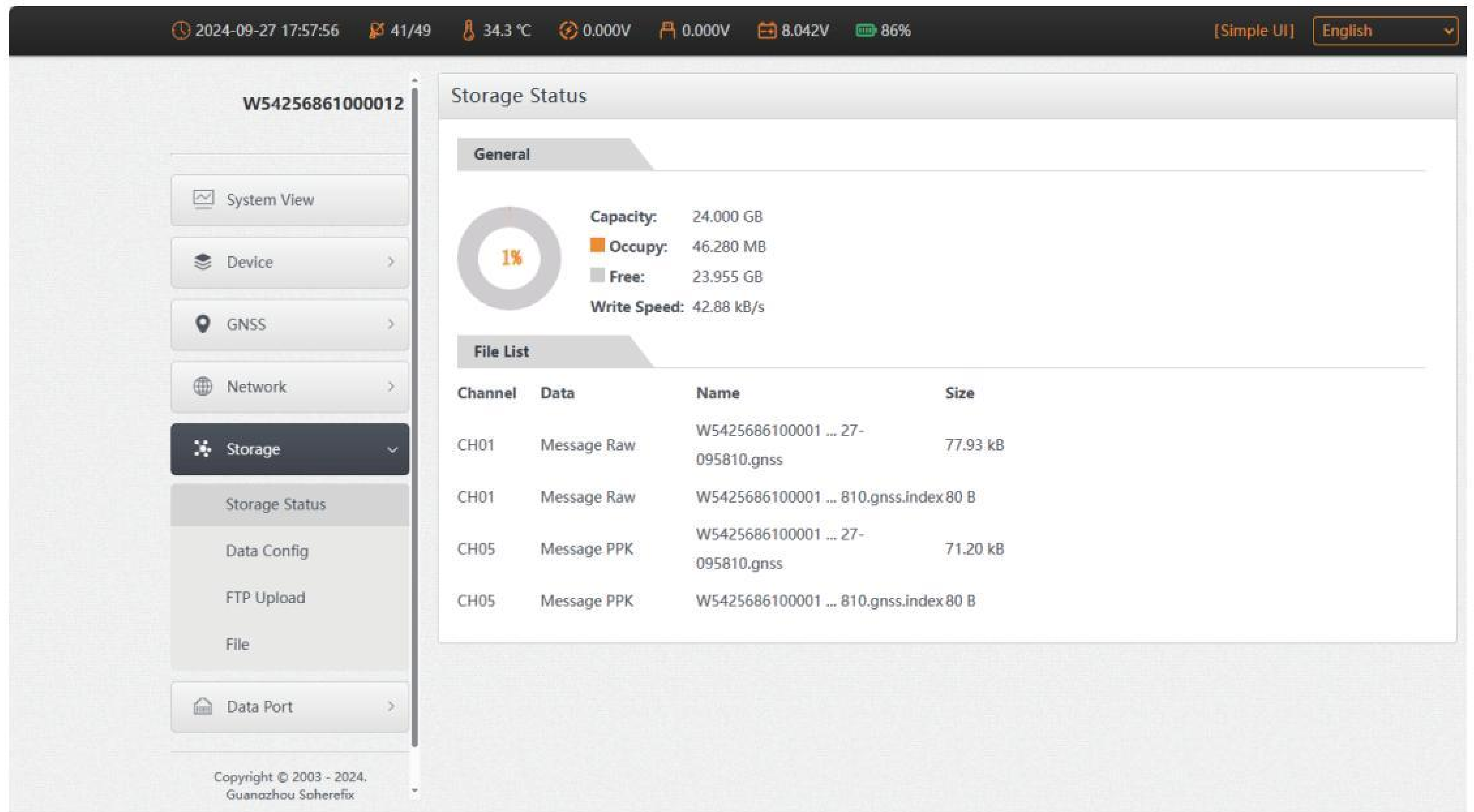


Figure 2.12-2

2. Base (CH02)

When the device is set as the reference station, the device will automatically con CH02 to store and locate the original data by default. If ppk is enabled, CH05 will also be automatically cond by default to store location post-processing data, as shown in the following.

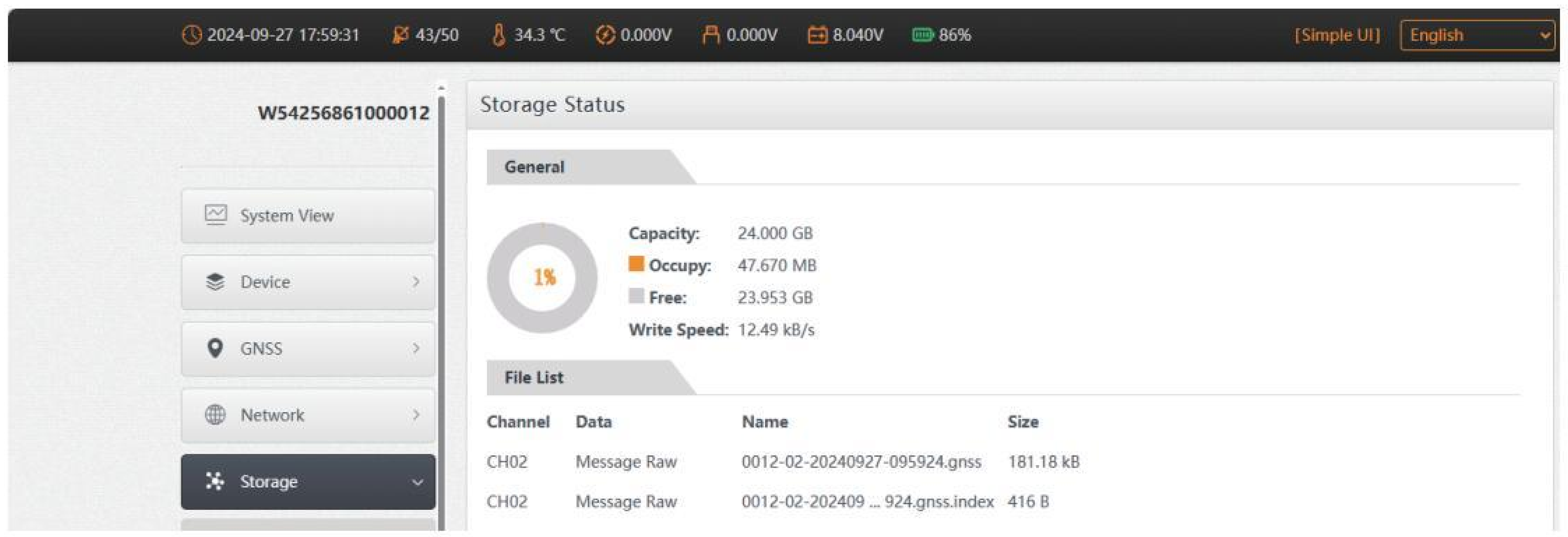


Figure 2.12-3

3. Static (CH03)

When the device is set to the static mode, the device will automatically con CH03 to store static positioning data by default, as shown in the following.

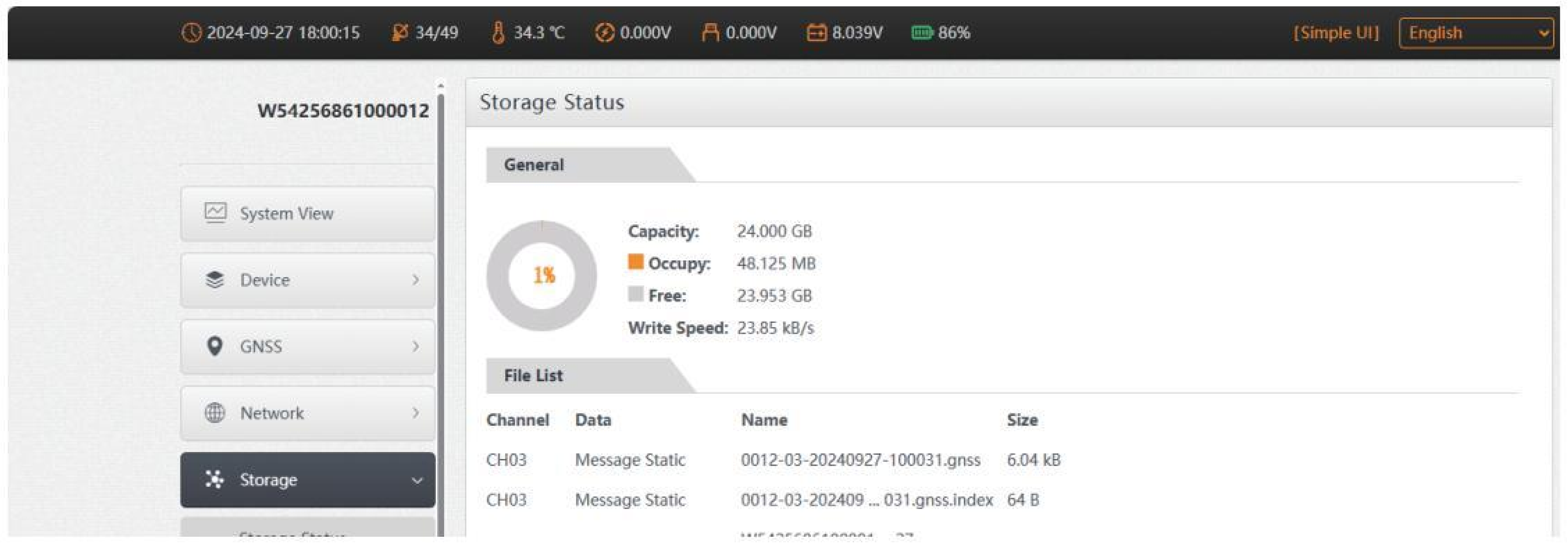


Figure 2.12-4

Note: Whenever the SphereFix software connects to the device through Bluetooth, the device will automatically con CH04 to store Bluetooth monitor data. If there is any problem with the settings of the Bluetooth connection device, you can download the recorded Bluetooth monitor data for troubleshooting.

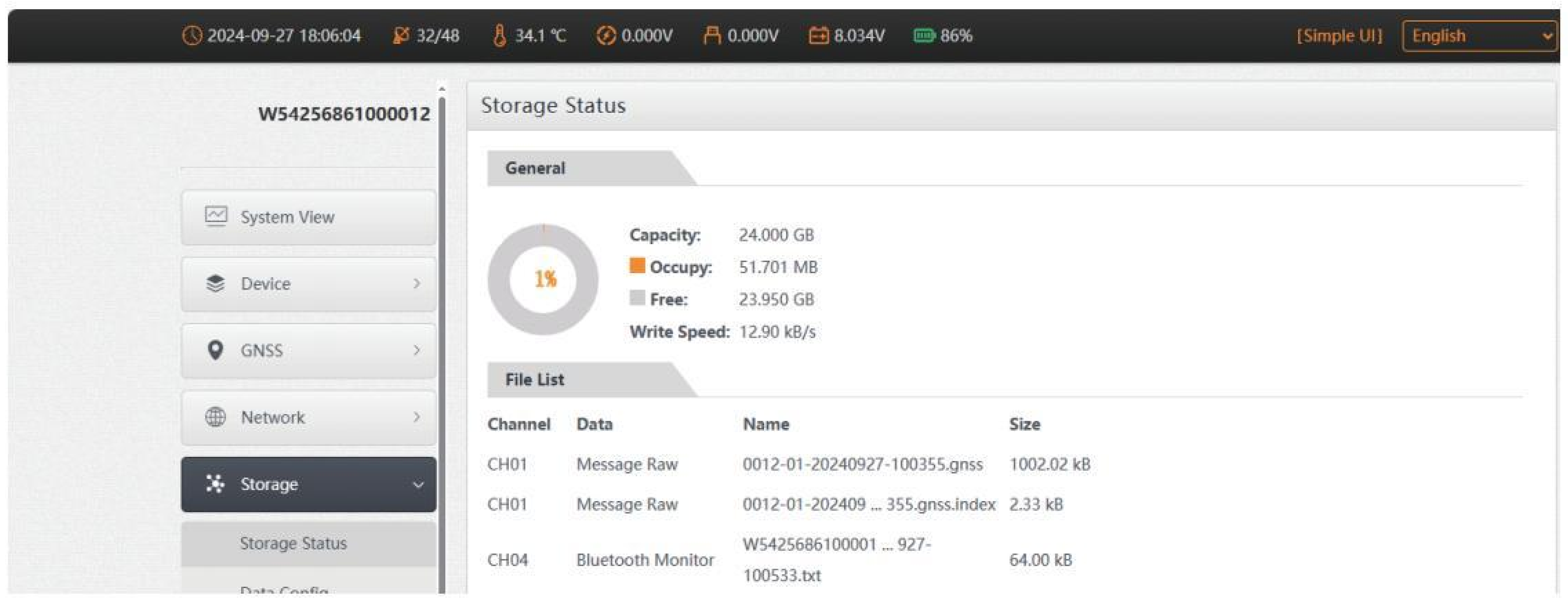


Figure 2.12-5

3. SphereFix Basic Operations

3.1 Software Installation and Uninstallation

Installation process:

1. Download the Android SphereFix program (*.apk);
2. Copy the SphereFix program to your mobile phone (controller);
3. Find the program in the file management of the controller and install it;
4. Click on the SphereFix software on the desktop (you need to create a project for the first time, and the last project used will be automatically opened each time the software is started).

Uninstallation process:

Uninstall method: Long press the software icon on the desktop, drag to the [Uninstall] option box, and click " OK " to complete the software uninstallation.

3.2 Project Manager

Click [Project] -> [Project Manager], as shown in Figure 3.2-1. Project manager includes functions such as creating a new project, importing a project, exporting a project, deleting a project, and opening a project.

Click [Project Path] to modify the path of the project on disk. The default path is in the internal storage -> SphereFix > Project directory.

Click [Details], as shown in Figure 3.2-2, to modify the basic properties of the project, such as Basic Information, Coordinate system parameter, and Code Library.

Click [New], as shown in Figure 3.2-3. To create a new project, you need to fill in the basic properties such as project name, whether to apply the project, and select the coding template.

Click [OK] and fill in the coordinate system parameters used to modify the project, as shown in Figure 3.2-4. Click [OK] to complete the creation of the project.

Click on other items in the list, and the open function will appear, as shown in Figure 3.2-5. Long press on an item in the list, and the delete function will appear, as shown in Figure 3.2-6 (Note: you cannot delete a project that is in use).

Figure 3.2-1

Figure 3.2-2

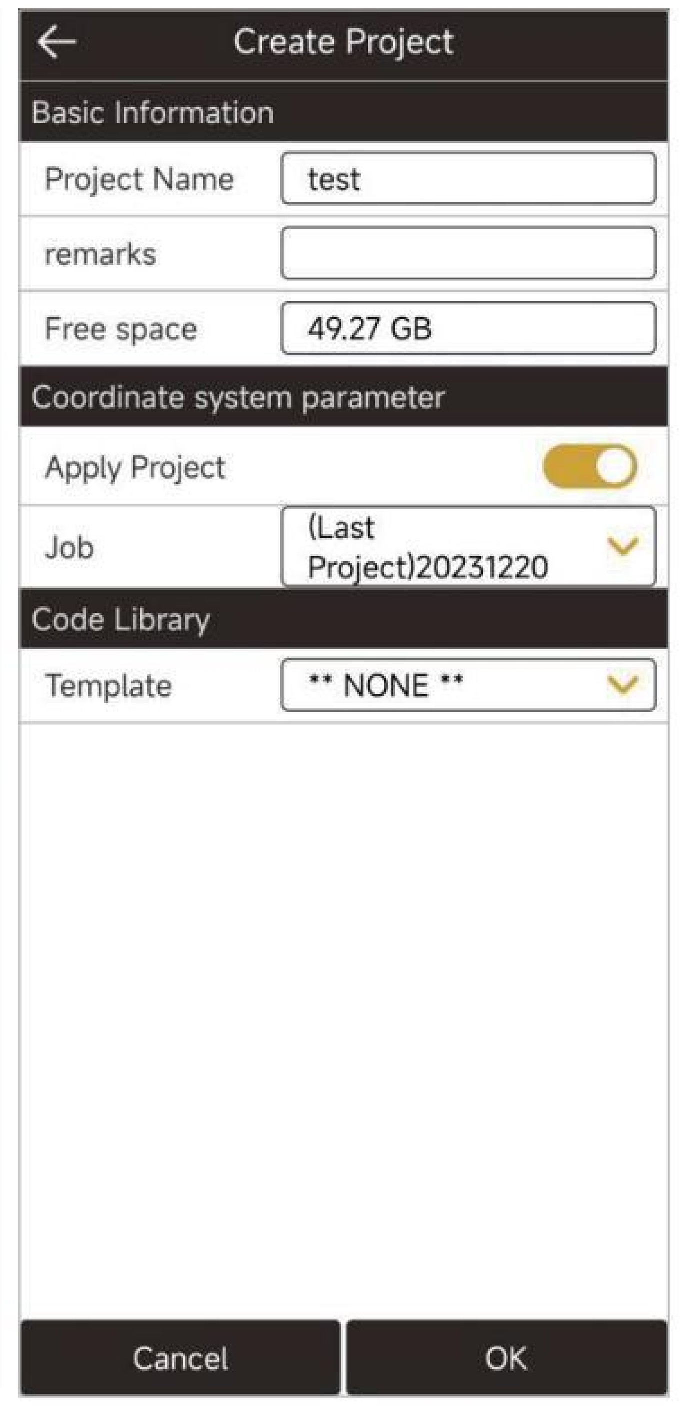


Figure 3.2-3

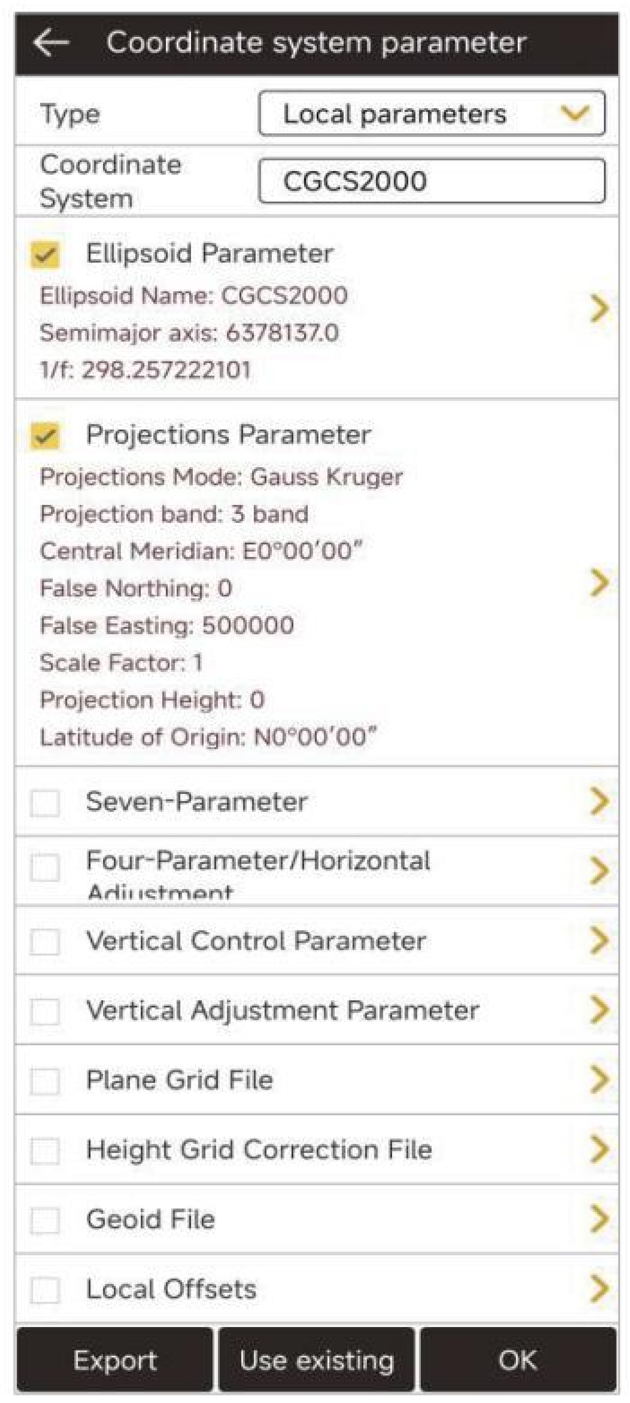


Figure 3.2-4

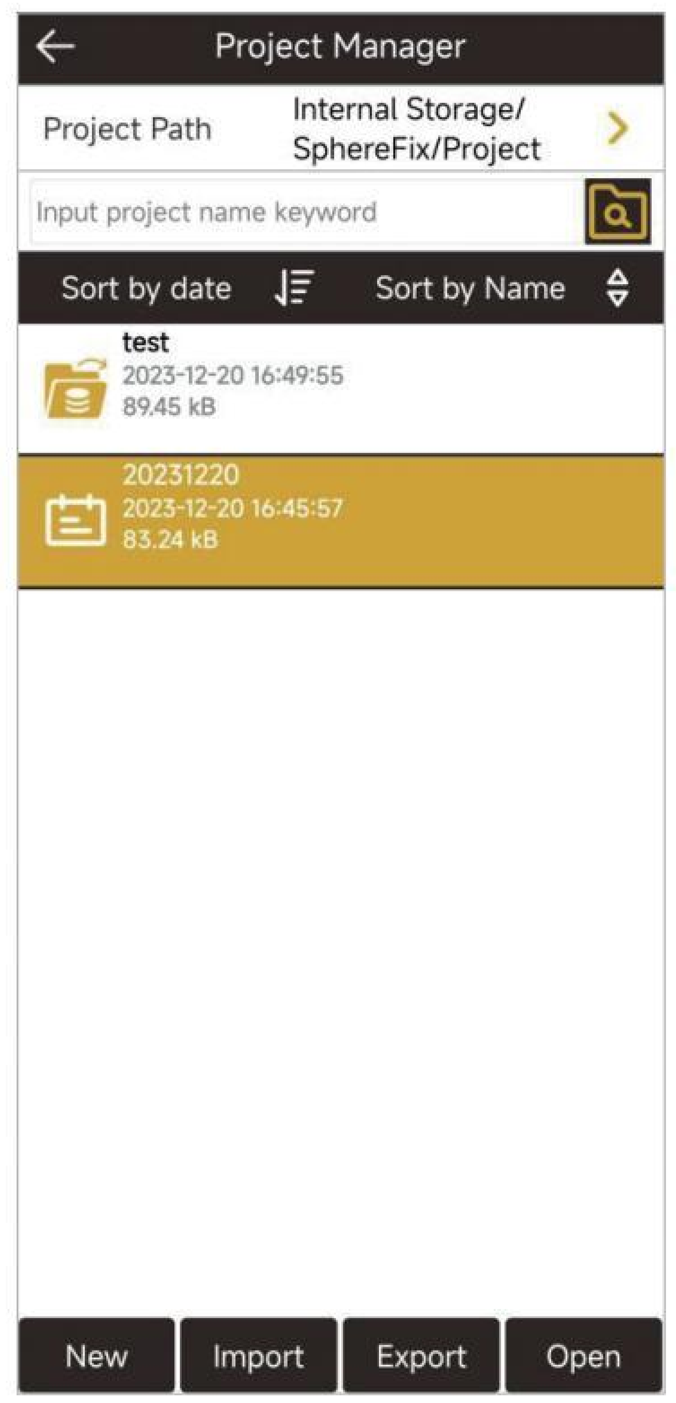


Figure 3.2-5

Figure 3.2-6

3.3 Communication

Click [Device]-> [Communication] to enter the communication settings interface, as shown in Figure 3.3-1. Select the device type ("SP10/SP20/SP30/SP40"), communication mode (Bluetooth), and then click [Search], as shown in Figure 3.3-2. View the Bluetooth device list, select the corresponding device serial number, and click [Connect] to complete the device connection, as shown in Figure 3.3-3. After the device is successfully connected, it will directly return to the device interface, as shown in Figure 3.3-4. Enter the communication settings again, as shown in Figure 3.3-5, and click [Stop] to disconnect the device. Click [Debug] to view the data of the software and device communication, as shown in Figure 3.3-6.

1. Communication mode includes Bluetooth, serial port, TCP client port, etc.;

2. Click [Search] and select the device you want to connect according to the device serial number;

3. After the device is successfully connected, click [Debug] to view the data of communication between the software and the device. You can also send debugging commands to the device to troubleshoot and analyze issues related to device positioning.

Figure 3.3-1

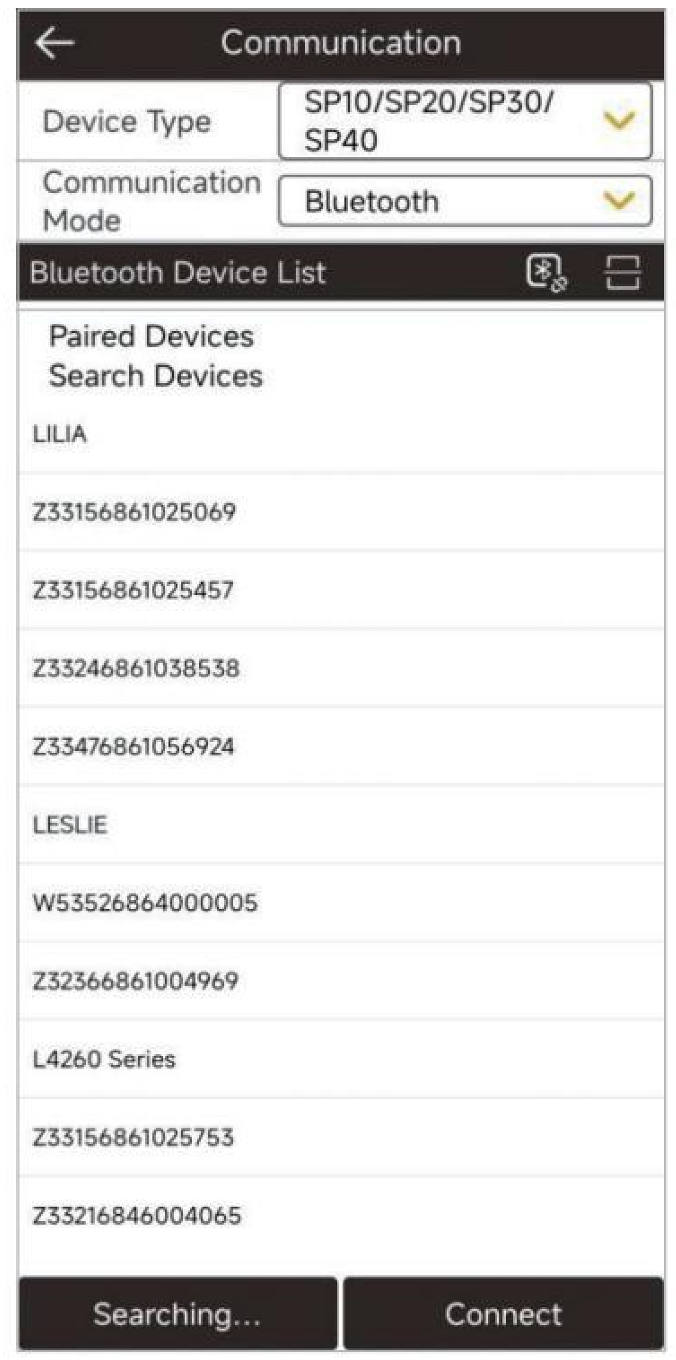


Figure 3.3-2

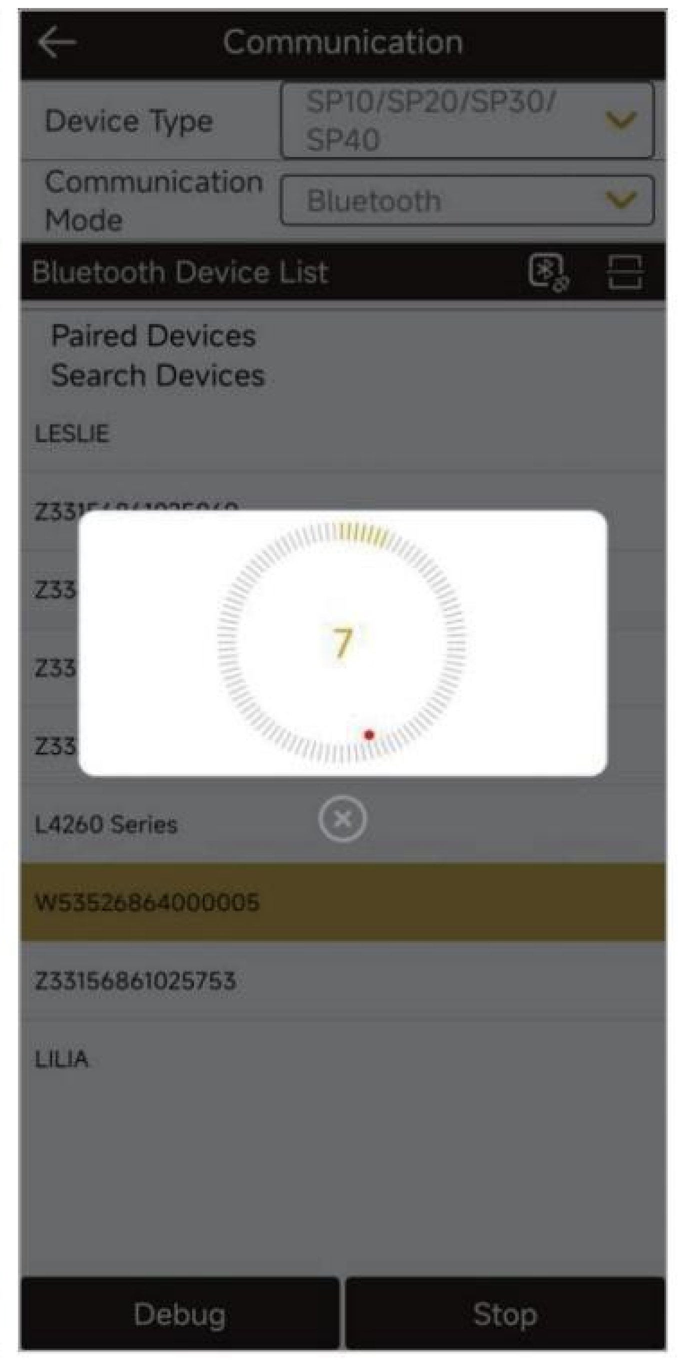


Figure 3.3-3

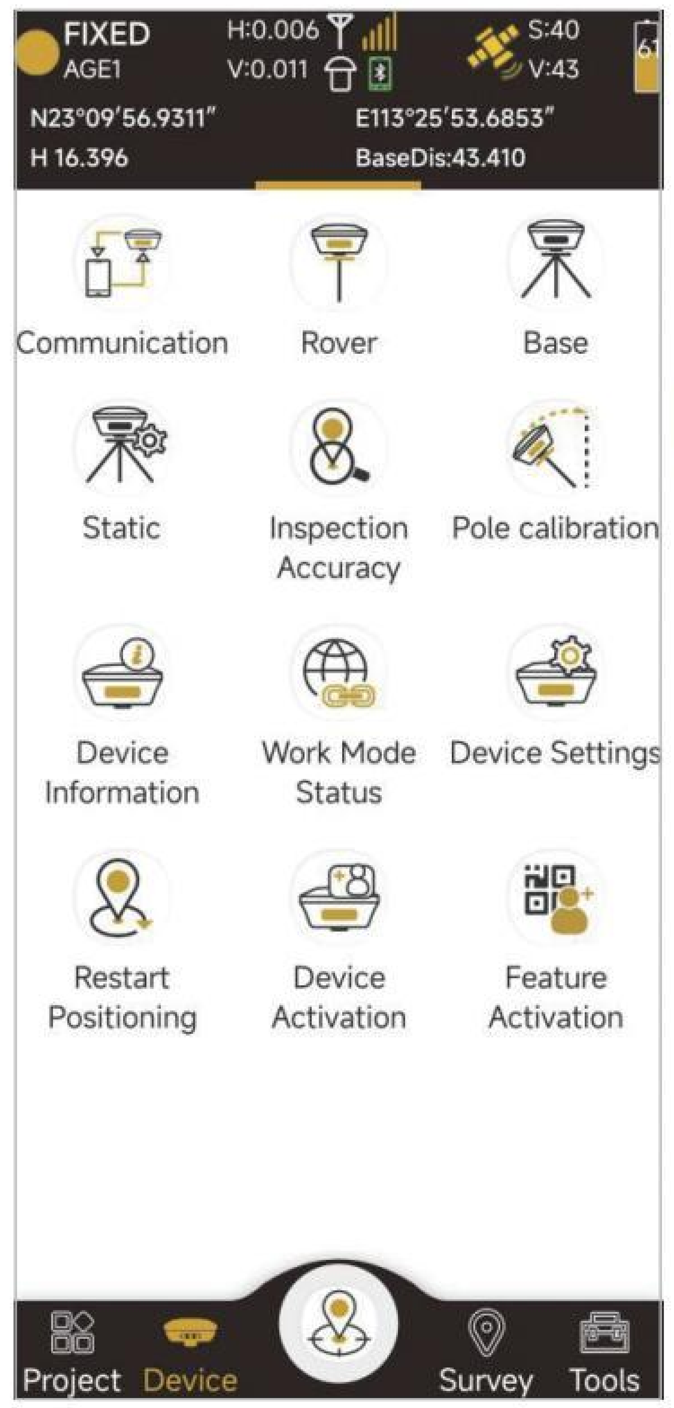


Figure 3.3-4

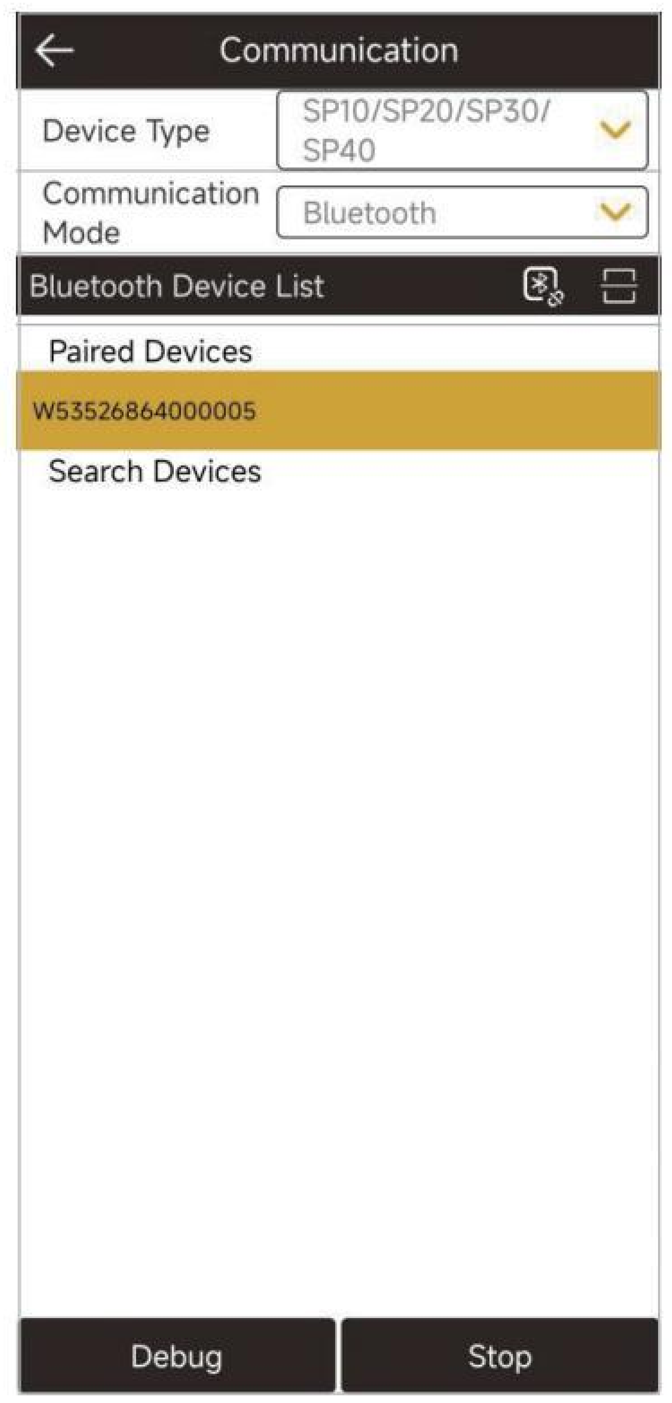


Figure 3.3-5

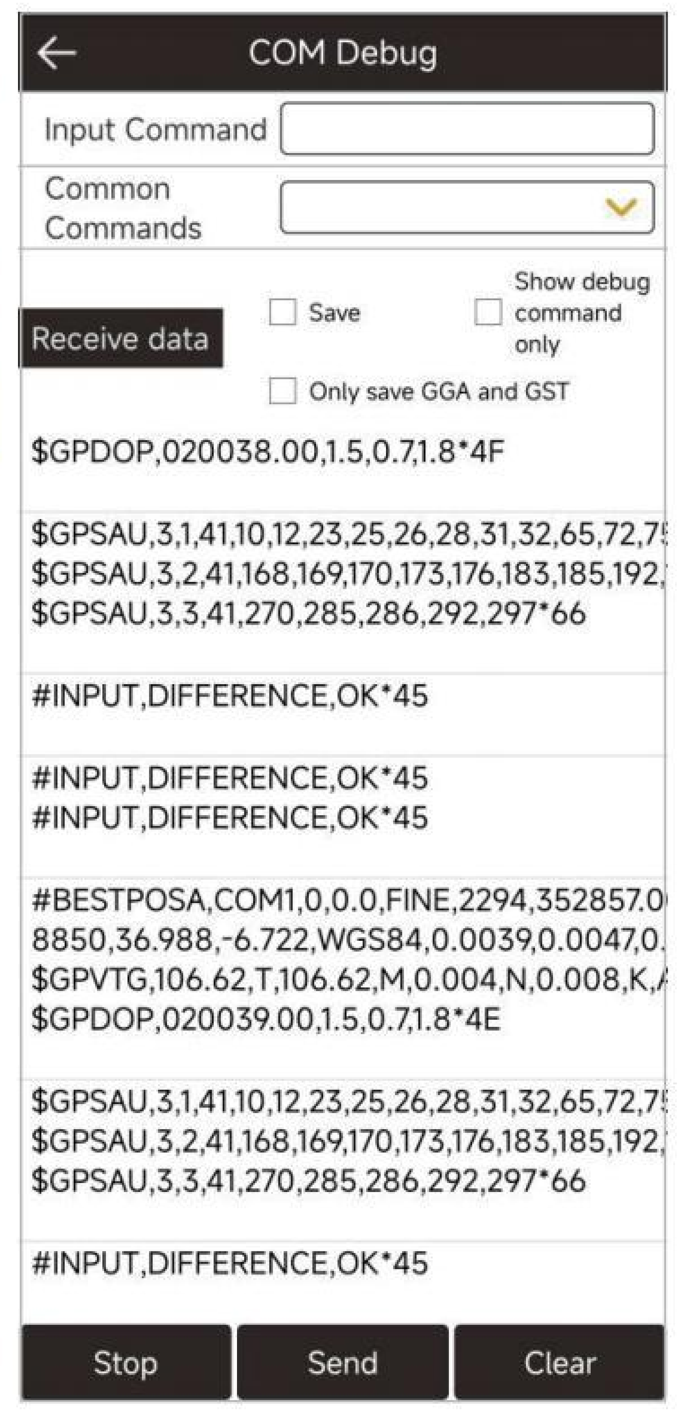


Figure 3.3-6

3.4 Rover Mode Setting

Click [Device] -> [Rover], as shown in Figure 3.4-1. GNSS positioning equipment can calculate positioning coordinates by receiving satellite signals. In the absence of other interferences, the positioning equipment can only obtain the coordinate position of a single point solution due to the interferences of the atmosphere on the signal, and the accuracy is low. In order to ensure that GNSS devices can obtain high-precision positions, in addition to the GNSS device itself receiving satellite signals to calculate the position, it is also necessary to receive the signal of another nearby fixed-position GNSS device, and use the signal of the other device as the reference signal. Since the influence of the atmosphere on the signal is basically the same within a certain area, when the coordinate position of the reference signal is known, the two sets of GNSS can calculate the high-precision position. The GNSS device with a fixed position is called the base, and the GNSS device with a non-fixed position is called the rover. Relative to the GNSS satellite signal of the rover, the data transmitted by the base is called differential data, and the data transmission method is called data link. The rover mode setting is to set the GNSS as a rover, configure certain parameters to transmit the GNSS satellite signal of the base station to the GNSS device in a certain way, so that the GNSS device can obtain a high-precision positioning.

In addition to differential data transmission configuration, you can also set the GNSS altitude cutoff angle, differential delay, and whether to enable PPK and other basic information, as shown in Figure 3.4-1. Set the altitude angle to not receive the satellite signal when it is lower than a certain value. In the case of poor satellite signals at low angles, it is beneficial to precision calculation. The PPK parameter records the original GNSS observation data to the GNSS receiver and uses the post-processing algorithm to calculate high-precision coordinates.

The differential data parameter setting is mainly to set a way to transmit the differential data of the base station to the current device, so as to provide the necessary solution conditions for the device to solve high-precision coordinates. The data link methods mainly include Phone Internet, Device Internet, Internal Radio and other methods.

1. Phone Internet: As shown in Figure 3.4-1, it refers to obtaining differential data from the specified server address through the network of the device where the software is located according to a certain protocol, and then sending it to the device through the communication connection between the software and the GNSS device for high-precision solution. Click on the right side of CORS settings to enter the CORS server management interface, as shown in Figure 3.4-2. You can directly select, edit, and delete existing CORS servers, or manually add CORS server parameters, as shown in Figure 3.4-3. After correctly configuring the server address, obtain the access point list, as shown in Figure 3.4-4, and select the corresponding access point to obtain differential data. Click [Start], if the configuration is correct, the data reception progress bar will move. If there is no data in the progress bar, you need to confirm whether the parameter configuration is correct.

2. Device Internet: As shown in Figure 3.4-5, it refers to obtaining differential data from a specified server address through the SIM card network of the GNSS device according to a certain protocol for high-precision solution. The connection

mode is the transmission protocol of differential data, usually by NRTIP, TCP client, etc., enter the server IP, port, username and password and other connection parameters. The SIM network is a dedicated network and needs to configure APN parameters, as shown in Figure 3.4-6. The CORS setting is similar to the Phone Internet. After correctly configuring the server address, obtain the access point list and select the corresponding access point to obtain differential data. In addition to obtaining access points through the Device Internet, it can also be obtained through the network corresponding to the mobile phone if there is a mobile phone with a network.

3. Internal Radio: As shown in Figure 3.4-7, it means receiving the differential data of the radio station according to a certain protocol and frequency through the internal radio of the GNSS device, and performing high-precision calculation. At this time, it is necessary to ensure that the protocol and frequency of the built-in radio station are consistent with the protocol and frequency of the transmitting radio station, so that the radio station data can be received normally. If the frequency corresponding to the channel is inconsistent with the channel frequency of the transmitting radio station, you can click [Set Radio Frequency] to modify the frequency corresponding to each channel of the radio station, as shown in Figure 3.4-8.

4. XLINK: As shown in Figure 3.4-9, it is a differential forwarding system built based on the CORS network of Qianxun/Liufen/China Mobile. After configuring the Xlink data link, the host can access the differential normally if it can access the Internet, without the need for the customer to manually fill in the CORS account.

Note: Each data link has the base station coordinate change prompt turned on by default, because if the wrong base station signal is received, the coordinates may be inaccurate, reminding the user to check and confirm.

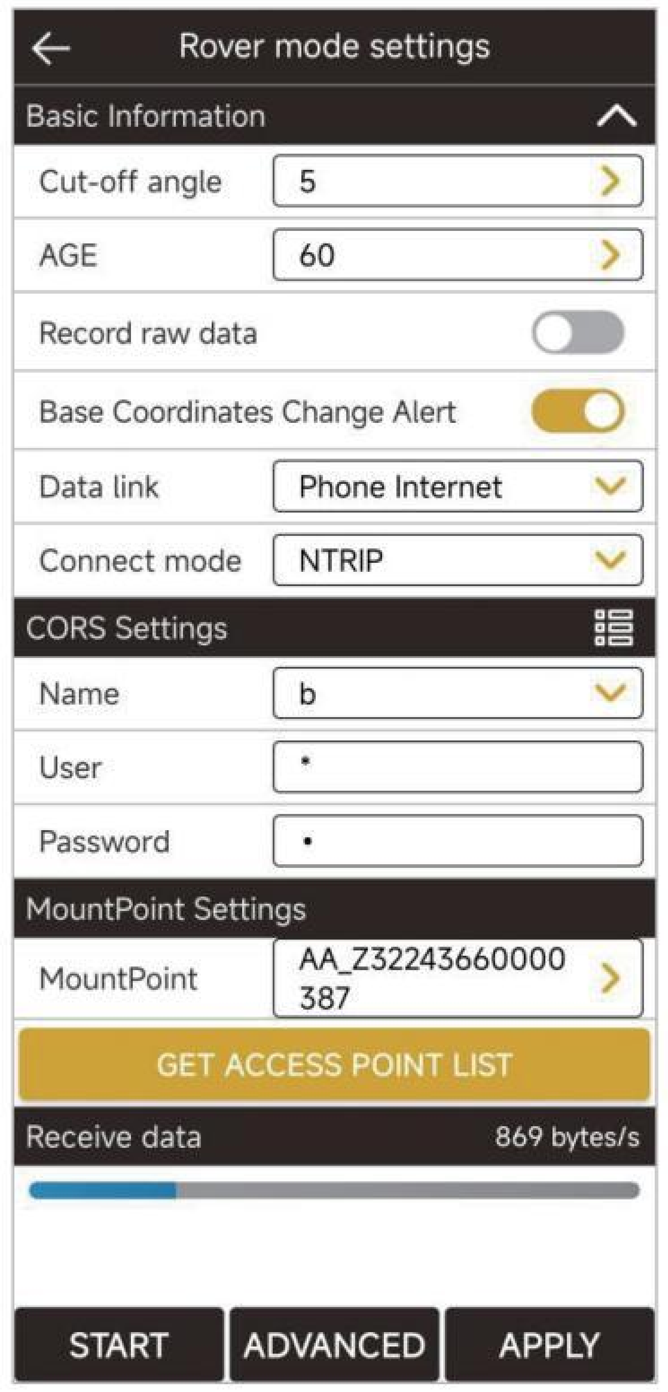


Figure 3.4-1

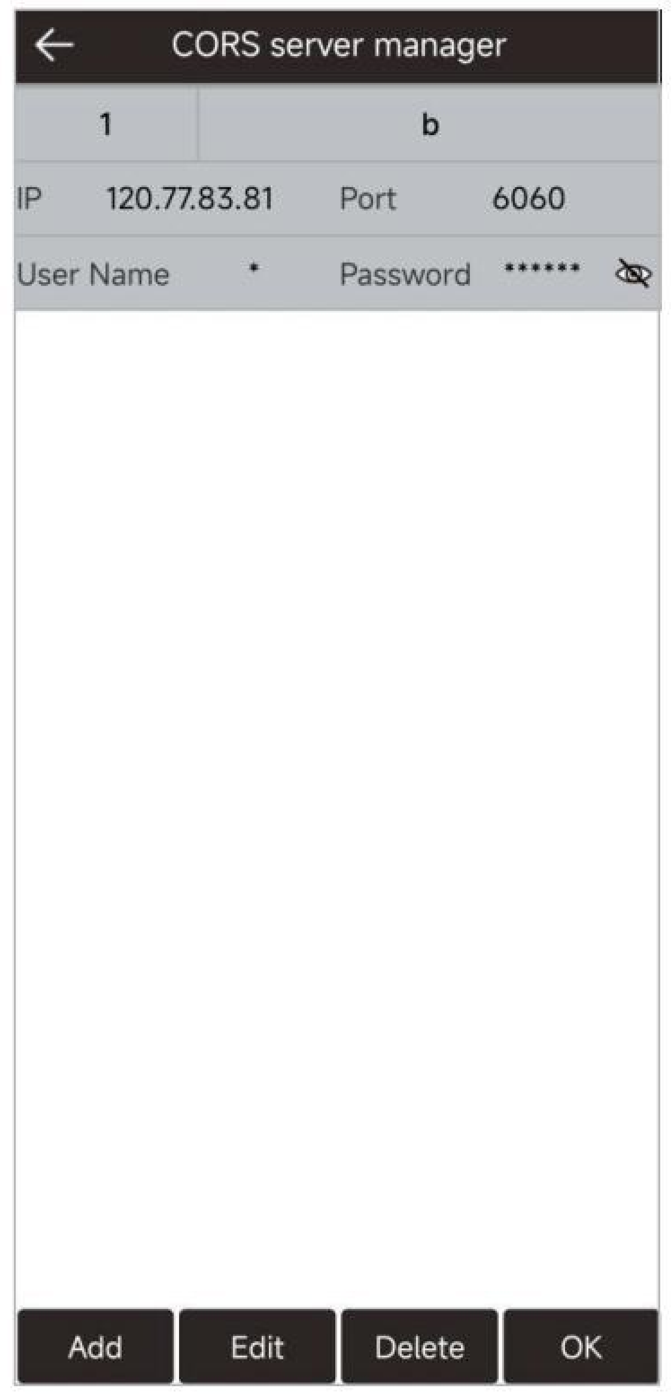


Figure 3.4-2

Figure 3.4-3

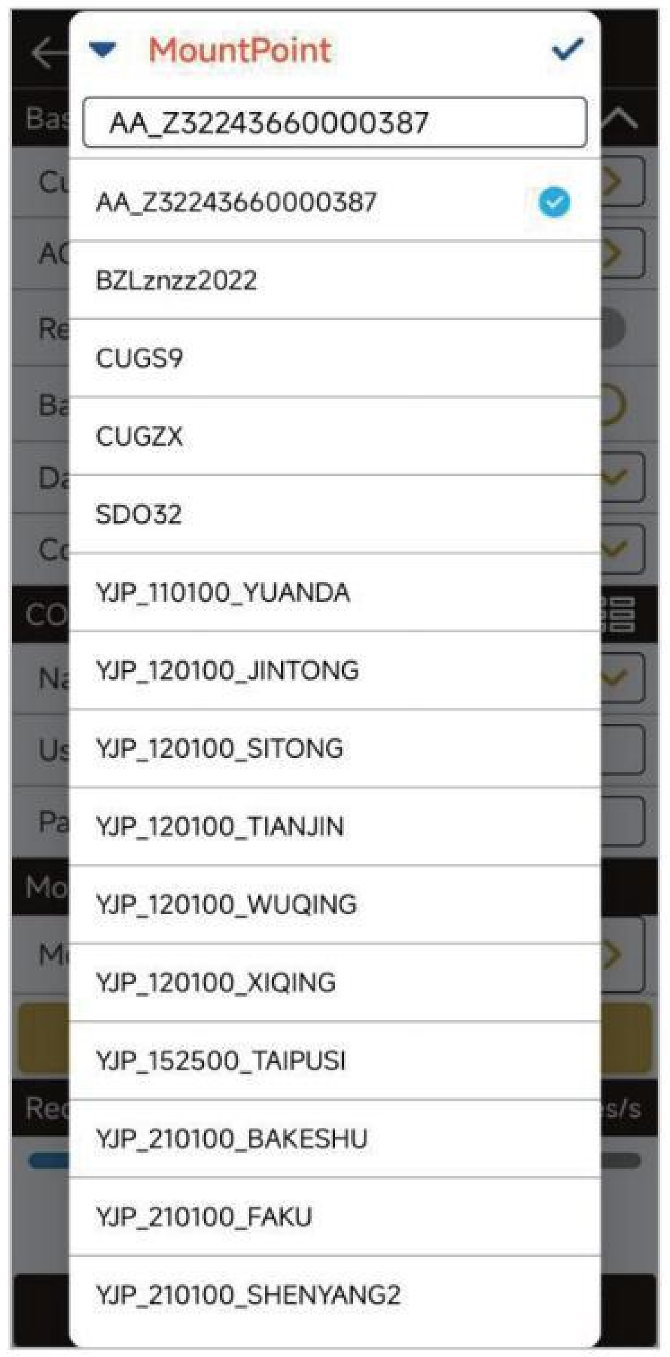


Figure 3.4-4

Figure 3.4-5

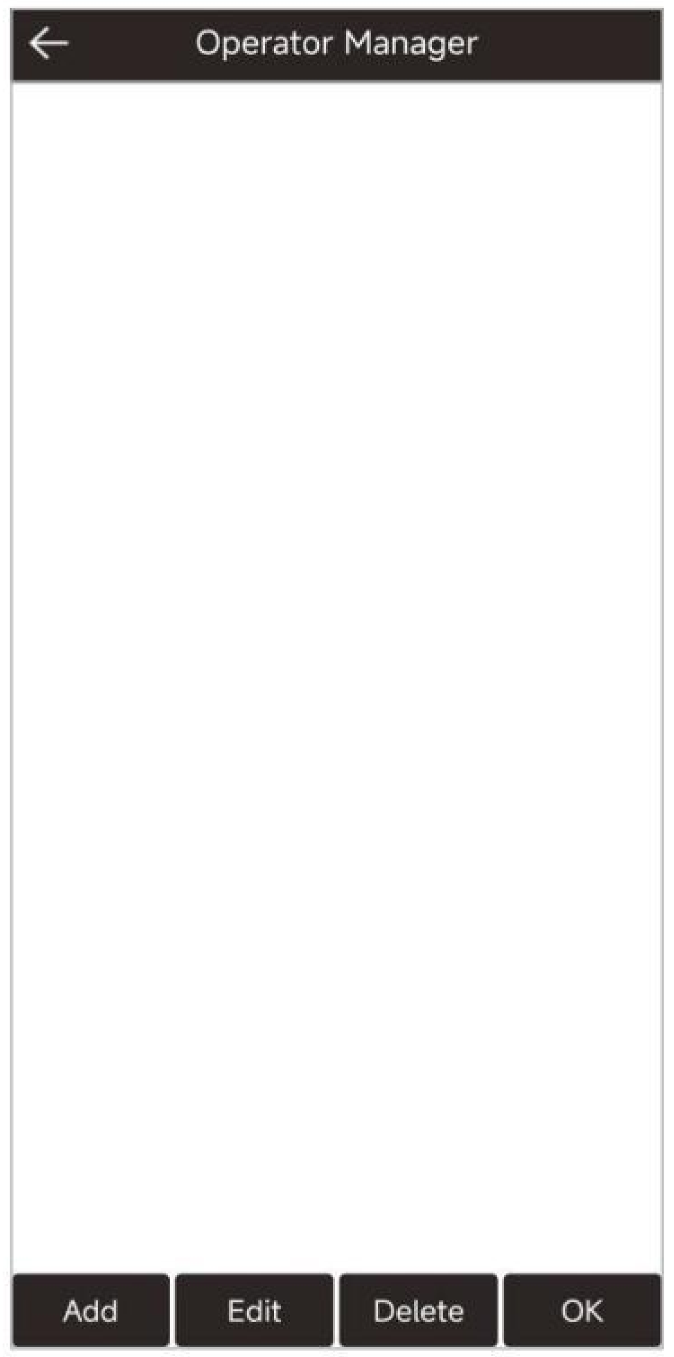


Figure 3.4-6

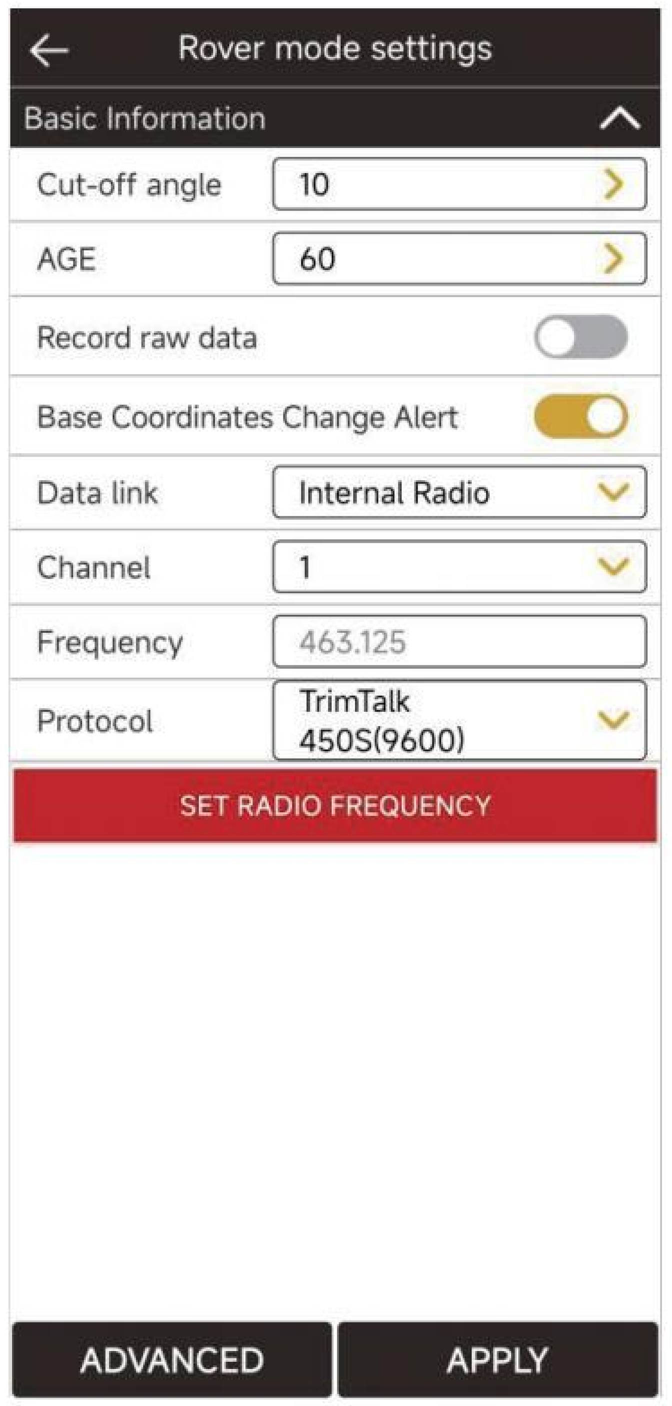


Figure 3.4-7

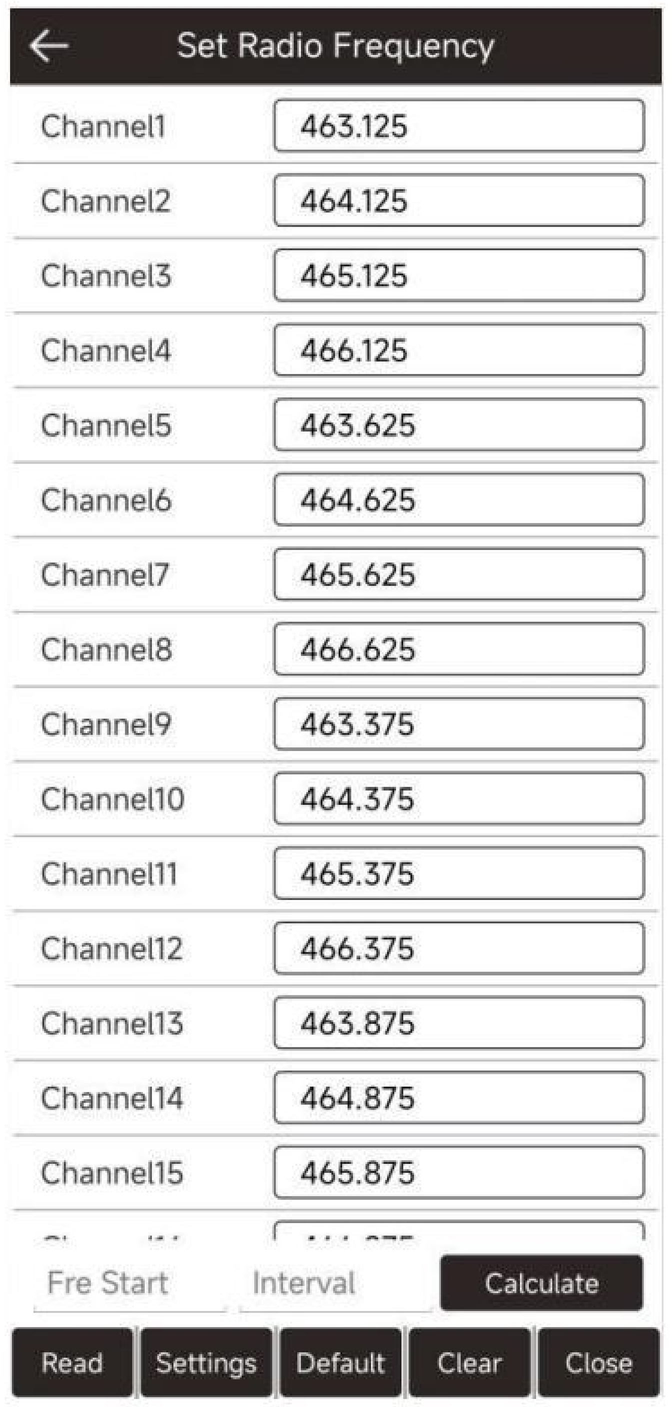


Figure 3.4-8

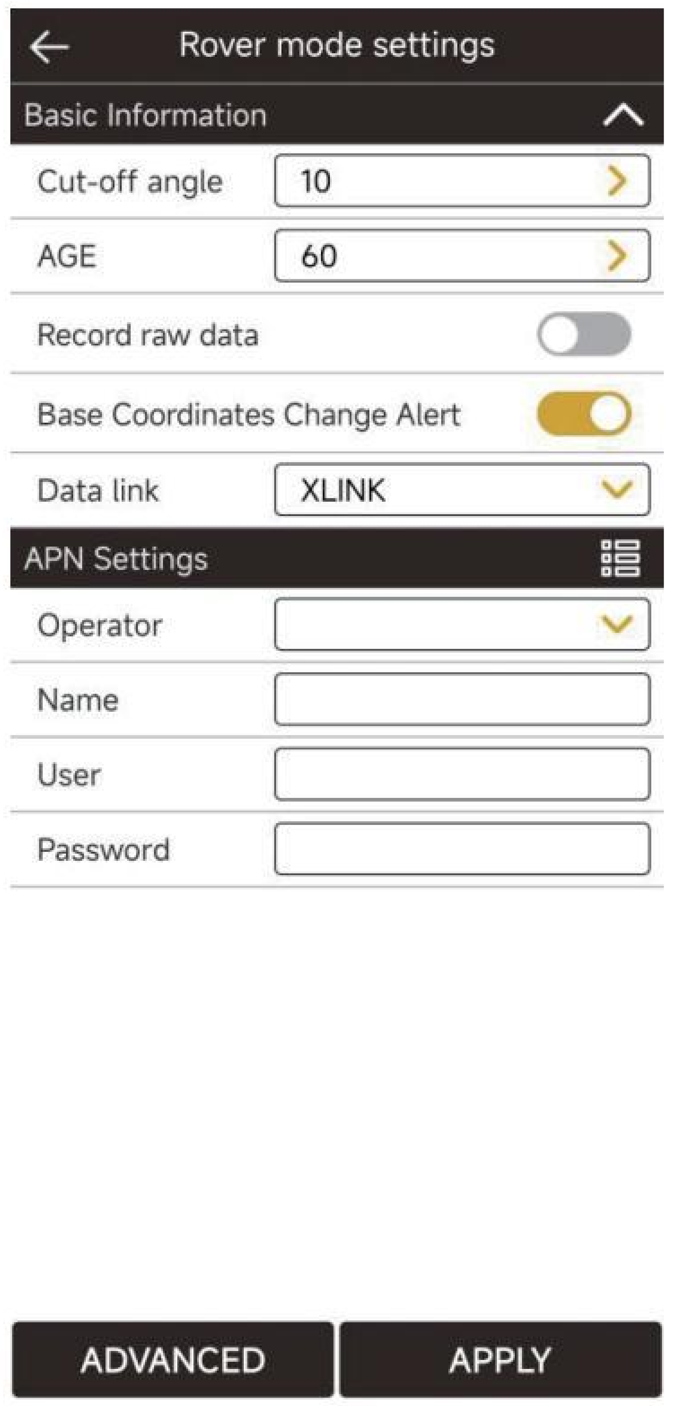


Figure 3.4-9

3.5 Base Mode Setting

Click [Device]-> [Base], as shown in Figure 3.5-1. This function is that the GNSS device acts as a base to send satellite information data in a certain way and provide it to the mobile station to receive it, providing it with high-precision solution conditions. The host needs to set the startup condition parameters, startup mode and data broadcast parameters as a base.

Note: During the startup of the base station, the device is not allowed to move, otherwise the coordinates calculated by the rover will be wrong.

The start-up conditions include Base ID, Diff Mode, cut-off angle, PDOP limit and other parameters. Click [Advanced], as shown in Figure 3.5-2, to configure cut-off angle, PDOP limit and other parameters. The differential data format includes CMR, RTD, RTCM23, RTCM30, RTCM32, RTCM33 and other commonly used differential data encoding formats;

The startup mode includes using Current coordinates, inputting Base coordinates, etc., among which:

1. Use Current coordinates: This means that the GNSS device outputs differential broadcast data for the startup coordinates based on the current positioning value (with low accuracy);

2. Input Base Coordinates: refers to the location where the user sets up the equipment. The user knows the coordinates of this location in advance and uses this coordinate value as the starting coordinate to output differential broadcast data. Click [Specify Base Station Coordinates] to enter the interface for setting base station coordinates, as shown in Figure 3.5-3. You can click the measurement icon to measure a point in real

time, or click to select a coordinate value from the coordinate point library.

The data broadcast parameters are mainly the differential data output by the device after starting the base station, which is transmitted through a certain method and received and used by the rover. The main methods include device Internet, built-in radio, external radio, etc. The parameter settings are similar to those of the rover, with the following differences:

1. The internal radio has a transmission power. The higher the transmission power, the longer the effective distance, and the greater the power consumption;

2. Device Internet NTRIP protocol, the base station is the base station access point that sets the start of transmission, as shown in Figure 3.5-1, and the rover obtains the access point list and selects the corresponding base station access point to connect;

3. The base station uses an external radio to broadcast differential data, as shown in Figure 3.5-4. The baud rate must be consistent with the connected external radio;

4. For CORS settings, refer to the rover data link for corresponding configuration.

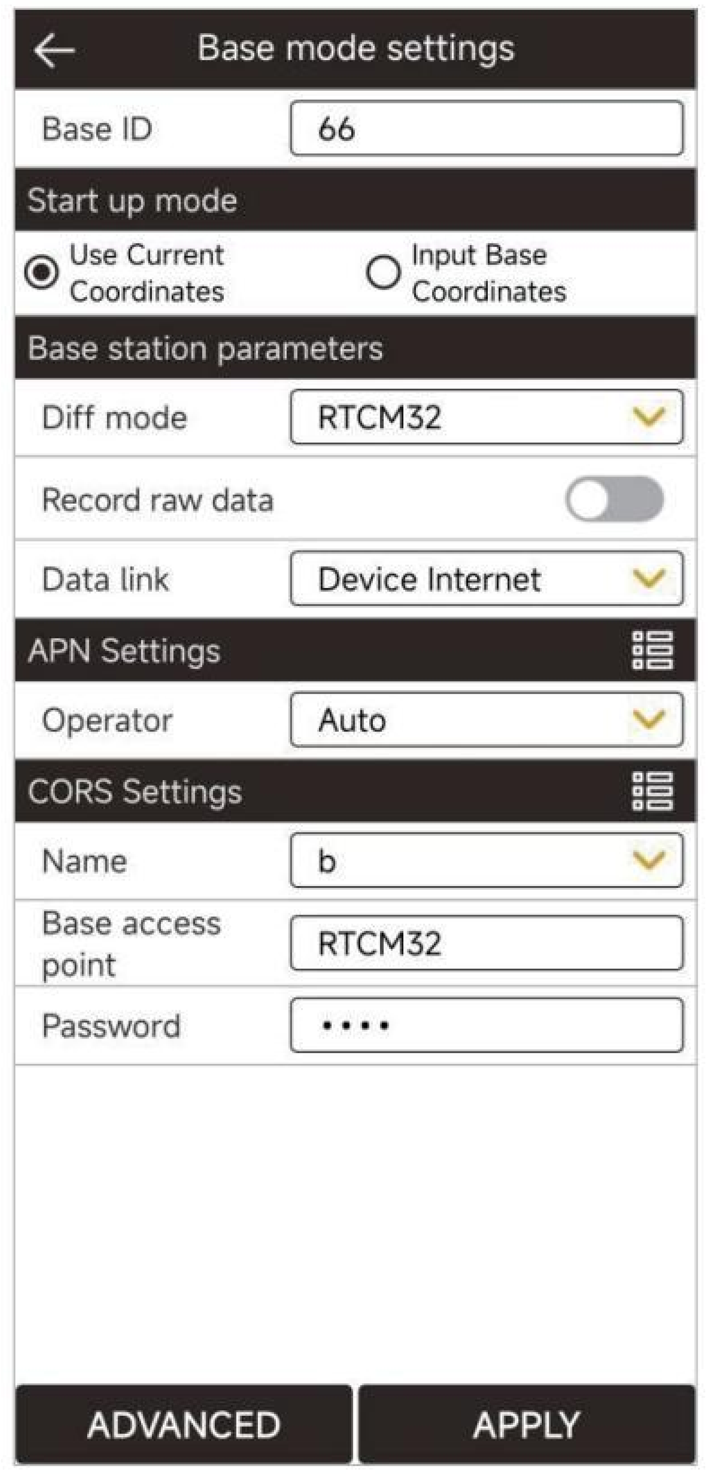


Figure 3.5-1

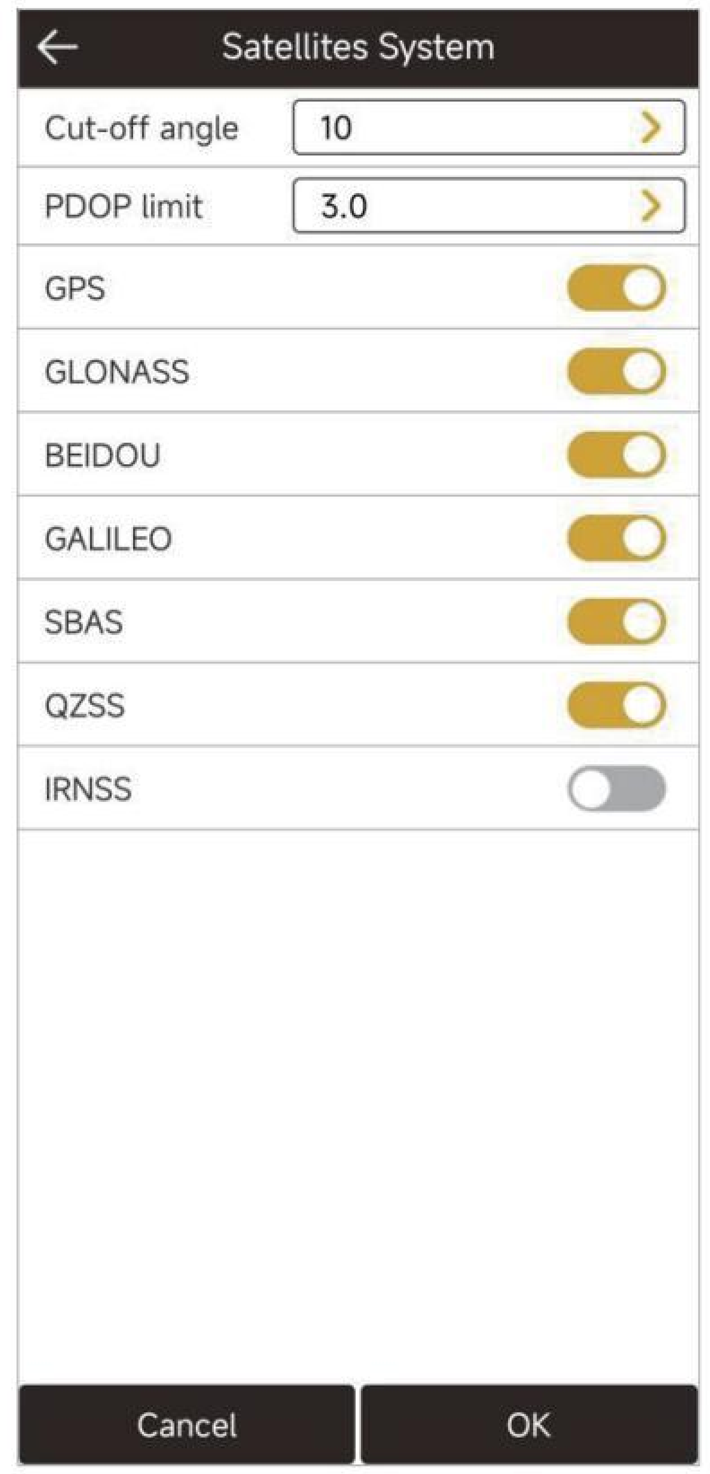


Figure 3.5-2

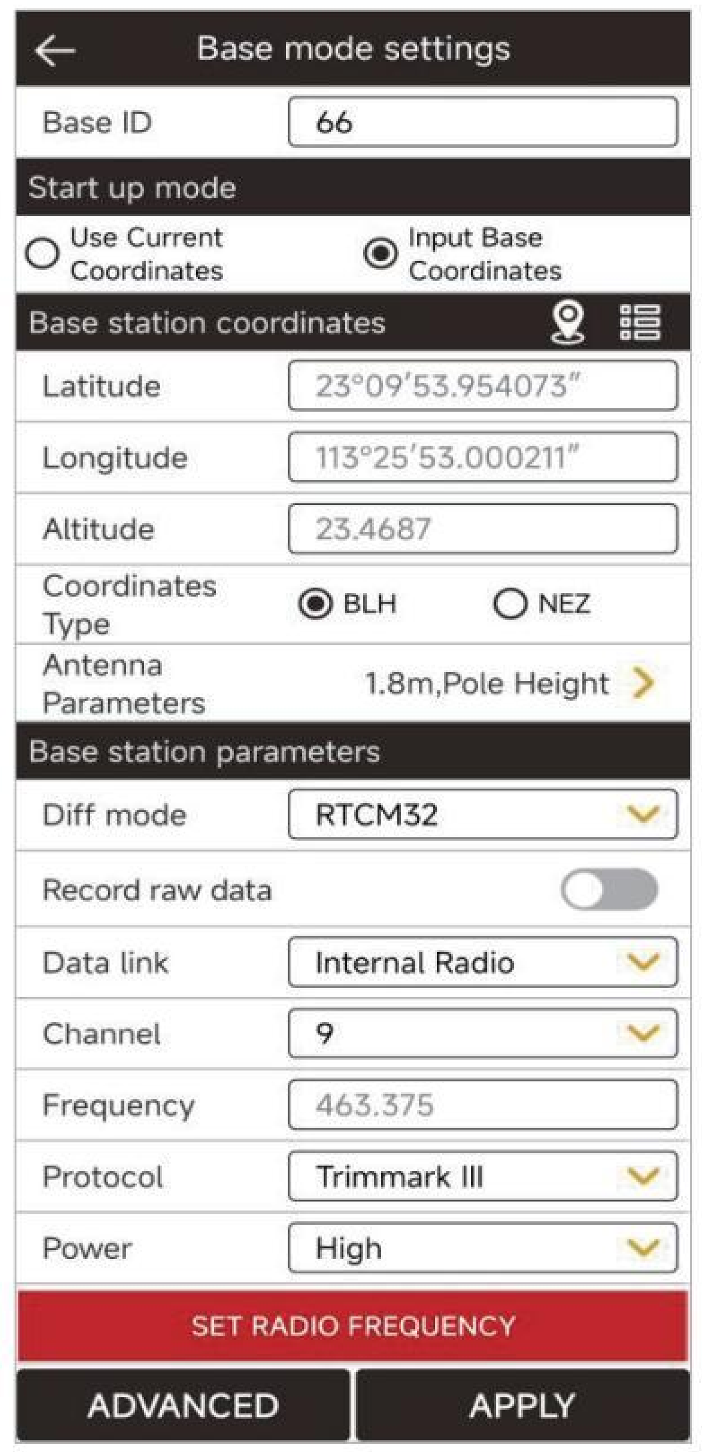


Figure 3.5-3

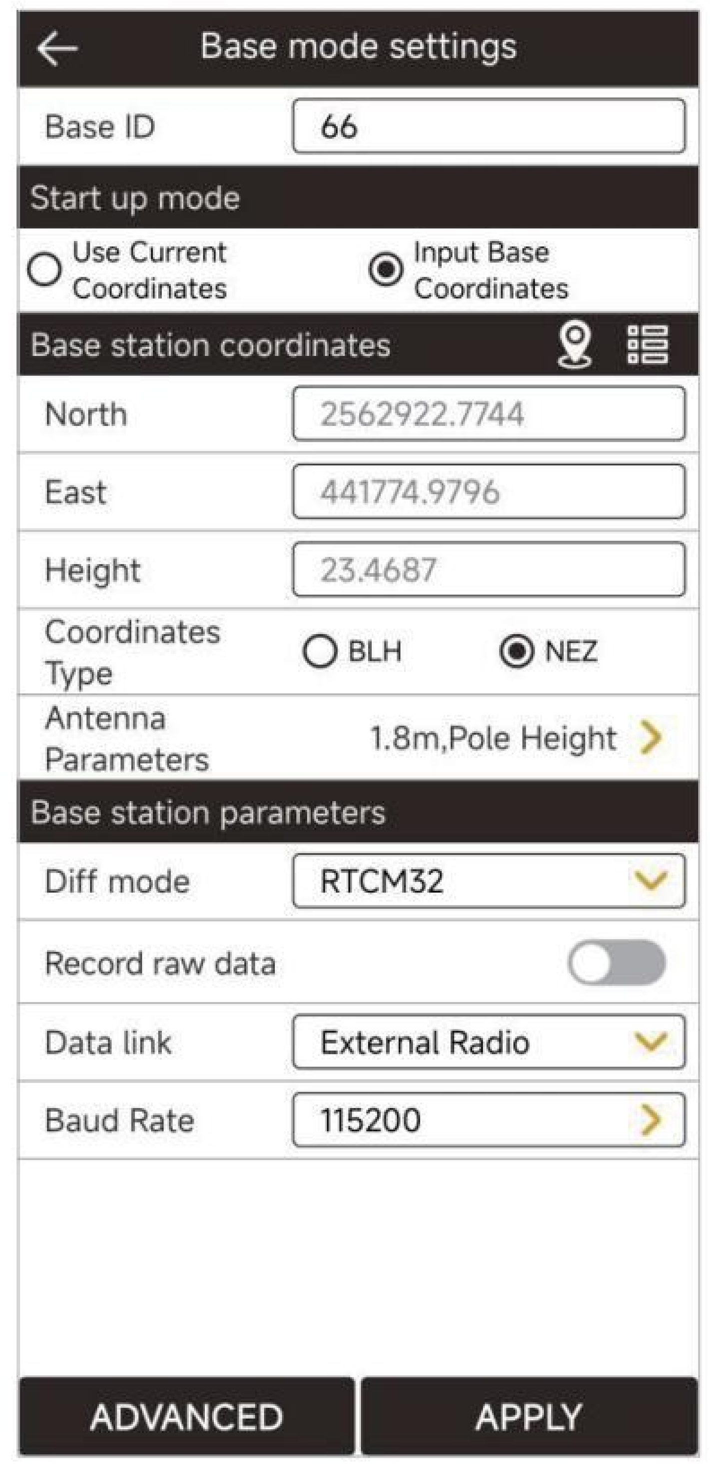


Figure 3.5-4

3.6 Static Mode Setting

Click [Device]-> [Static Mode], as shown in Figure 3.6-1. This function is to store the original satellite observation data of the GNSS device into the set disk file, record the observation data of a period of time for the use of static post-processing software to solve the high-precision coordinate position, usually used for control point acquisition. To start the static mode, you need to set the static file point name, PDOP limit, cut-off angle, Collection interval, antenna parameters and File Format and other recording conditions, as shown in Figure 3.6-2.

Click [Start] to start static collection, as shown in Figure 3.6- 3, and click [Stop] to end static collection. The status will display information such as Record Status, Start Time, Epoch number, and Record file.

Note: During static recording, the device is not allowed to move, otherwise it will cause errors in the coordinates calculated by post-processing.

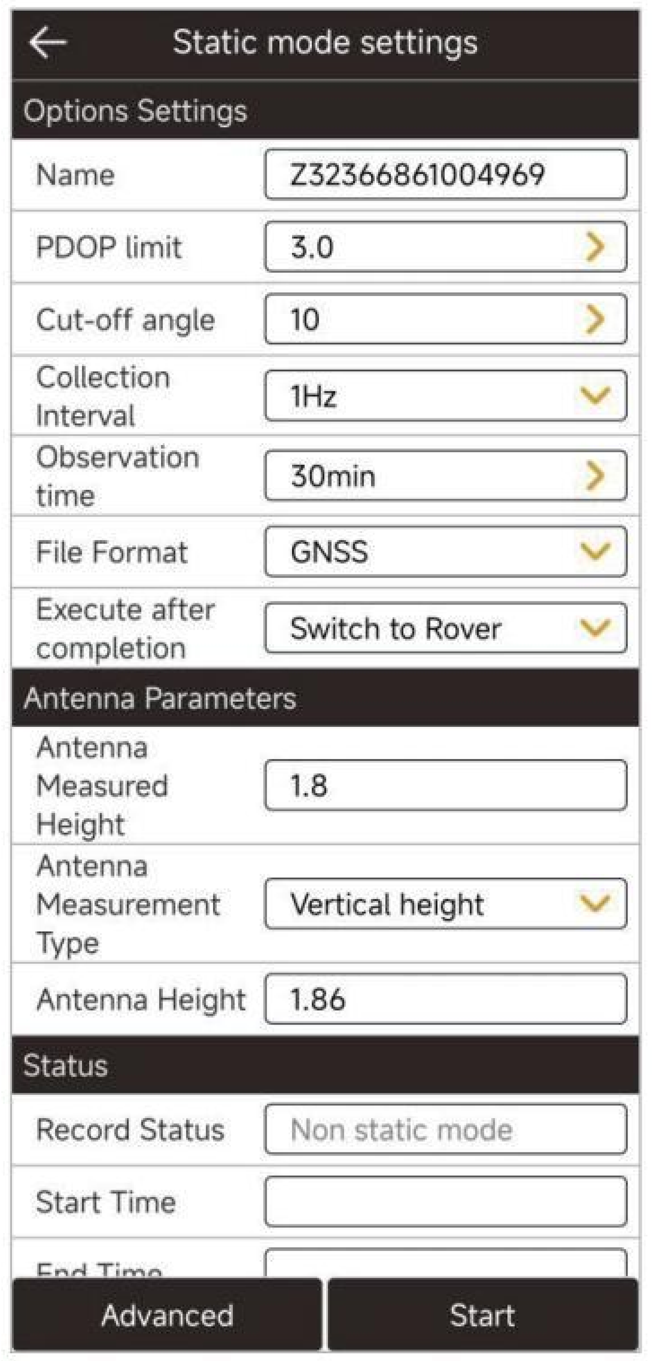


Figure 3.6-1

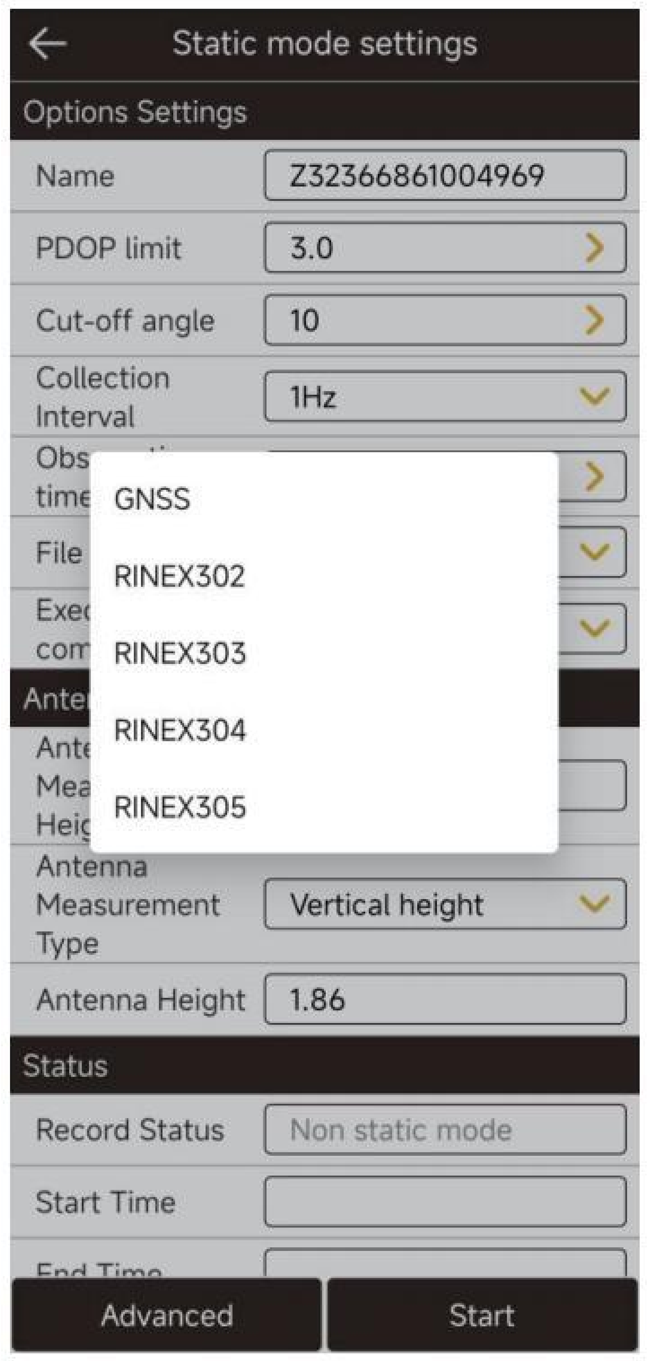


Figure 3.6-2

Figure 3.6-3

3.7 Point Survey

Click [Survey] -> [Point Survey], as shown in Figure 3.7-1. The positioning output by the GNSS device is measured and collected according to certain accuracy constraints and stored in the coordinate point library. In the point survey interface, the top title bar displays the basic information of the positioning output by the current GNSS device, the current solution status, differential delay, HRMS, VRMS and other positioning accuracy assessment values, and the number of received satellites. Below the title bar is the status bar that displays other important information. The display content can be configured according to the user's demand. In point survey, the north-east high coordinates and base station distance information are displayed by default. The middle area is the measurement data drawing information, and the network map can also be set to display.

The icon  in the upper left corner of the drawin g area indicates the direction of the map, which is convenient for users to determine the direction when needed. The lower left corner of the drawing area shows the scale of the drawing. Click the icon  or  on the right to enlarge or reduce the scale of the drawing. Below the drawing area is the display of function collection. These function menus can also be displayed here according to the needs of the user in the settings to quickly operate certain functions.

The icon  in the lower right corner of the drawing area is the button to trigger the survey collection function. This button can be moved according to the user's usage habits and placed in a more convenient place for operation. Click the button to start the survey function, as shown in Figure 3.7-2. You can enter the point name and code. Click the icon ❯ to select the preset code in the code library to quickly fill in the attributes of the feature. If there are many codes in the code library, the codes with higher frequency of use will be displayed in the front to facilitate users to quickly select.

Below the drawing area are the measurement type selection, coordinate point library entry, antenna height setting, and tool menu.

Click [Topo Point], as shown in Figure 3.7-3. Four types of point will pop up: Topo Point, Control Point, Quick Point, and Auto Point. You can select the corresponding point type for surveying according to actual needs.

Click [Point Library] to enter the coordinate point library interface, as shown in Figure 3.7-4, where you can view the surveying point status.

Click the icon to modify and edit the antenna height information, as shown in Figure 3.7-5. The antenna height setting is to subtract the antenna height from the phase center coordinates of the GNSS to get the actual position of the measured target on the ground. If the antenna information is incorrect, click the antenna information to select the correct antenna type in the antenna management (used when the GNSS device does not output antenna information or uses an external antenna).

Click [Tools], as shown in Figure 3.7-6, and you can quickly operate certain functions in the menu as needed, or you can add and delete functions in the toolbar according to user needs in the settings.

Click the icon to enter the surveying setting interface, as shown in Figure 3.7-7. Set the measurement collection

restriction conditions here, such as the solution limit, HRMS Limit, VRMS Limit, PDOP Limit, AGE Limit, etc. Users set the LIMIT conditions according to the accuracy requirements of the operation. Setting the number of smoothing points is to collect multiple positioning points and calculate the average value to indicate the accuracy. In addition, you can also set the default point name and default code, etc. The information bar is to set the display content of the status information bar. Users can set the display according to the information they focus on, as shown in Figure 3.7-8. The toolbar is for users to set common functions according to their needs during the operation, so that users can quickly and conveniently call certain functions, as shown in Figure 3.7-9. These functions include: Auto JUMP, Switch Map, ROSE mode, Take screen point, CAD text, coordinates converter, Perimeter and area, CAD background color, etc. Click the menu icon on the toolbar to trigger the corresponding function.

Click the icon to automatically center the current position on the screen. Click the icon to display all current measurement points on the screen.

Click the icon, as shown in Figure 3.7-10, to turn on/off the tilt measurement function.

Click the icon, as shown in Figure 3.7-11 and Figure 3.7-12, to select the network map you want to display.

Figure 3.7-1

Figure 3.7-2

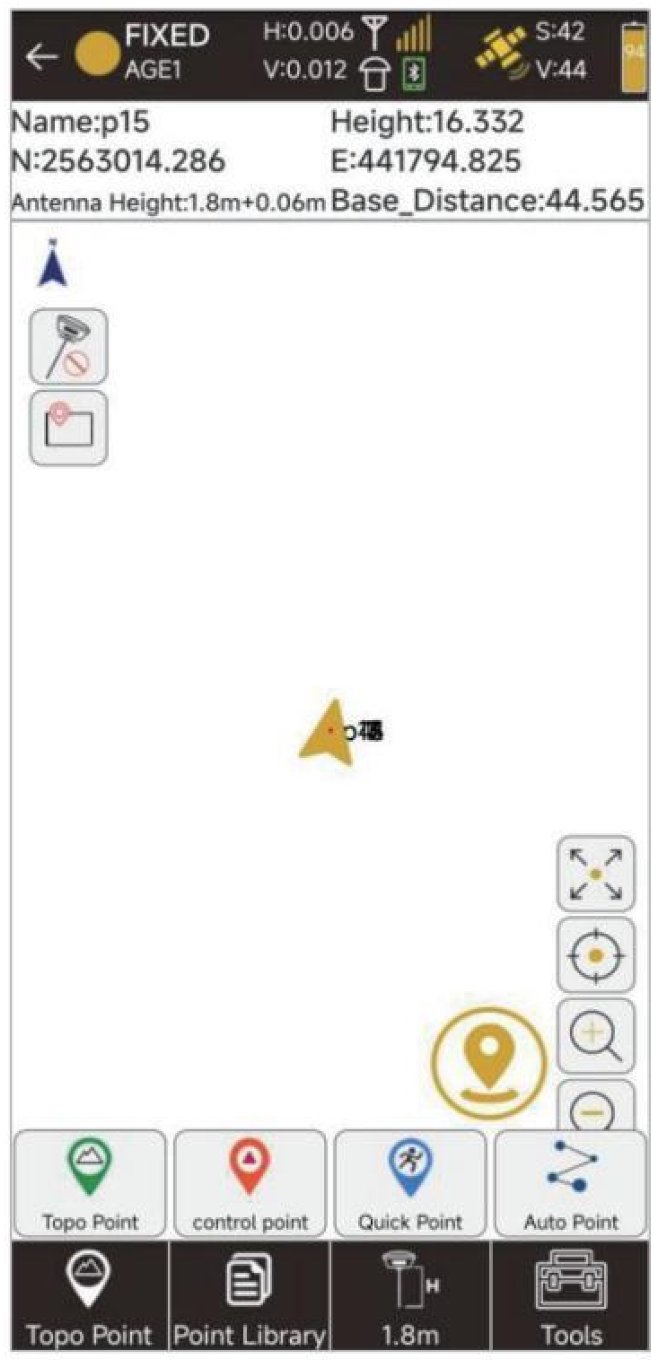


Figure 3.7-3

Figure 3.7-4

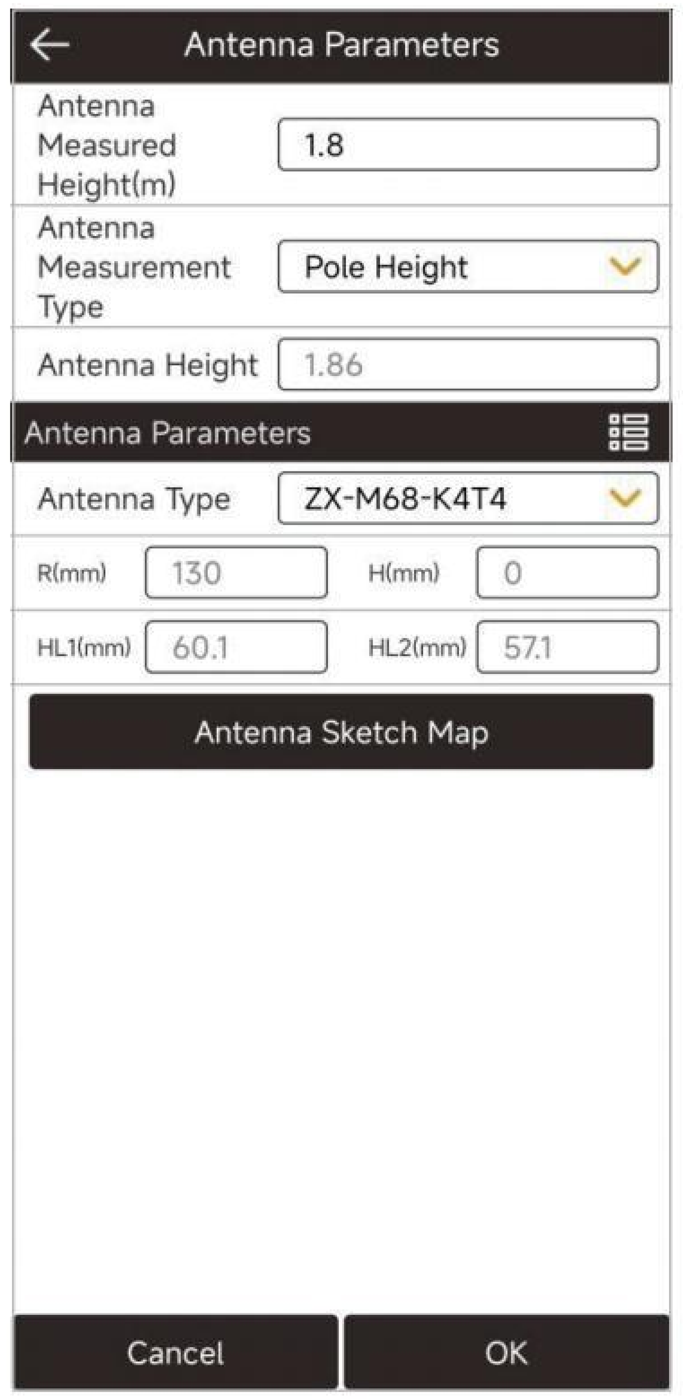


Figure 3.7-5

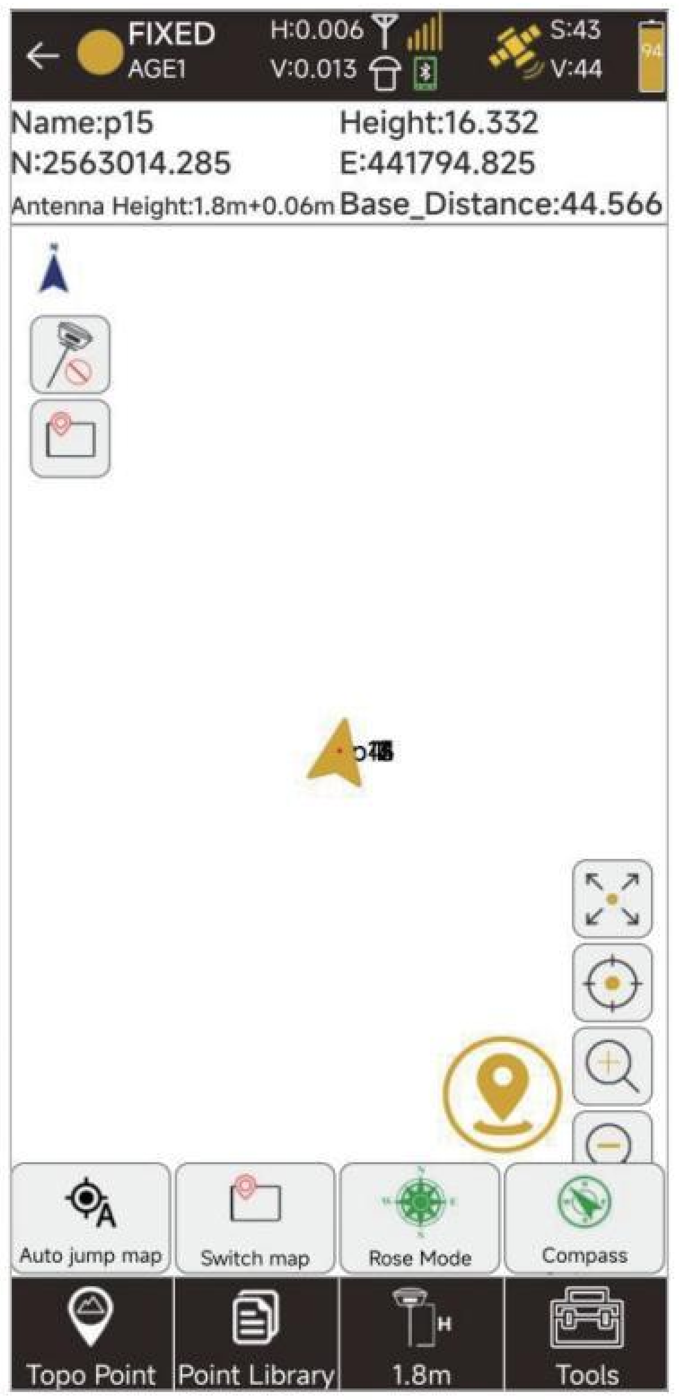


Figure 3.7-6

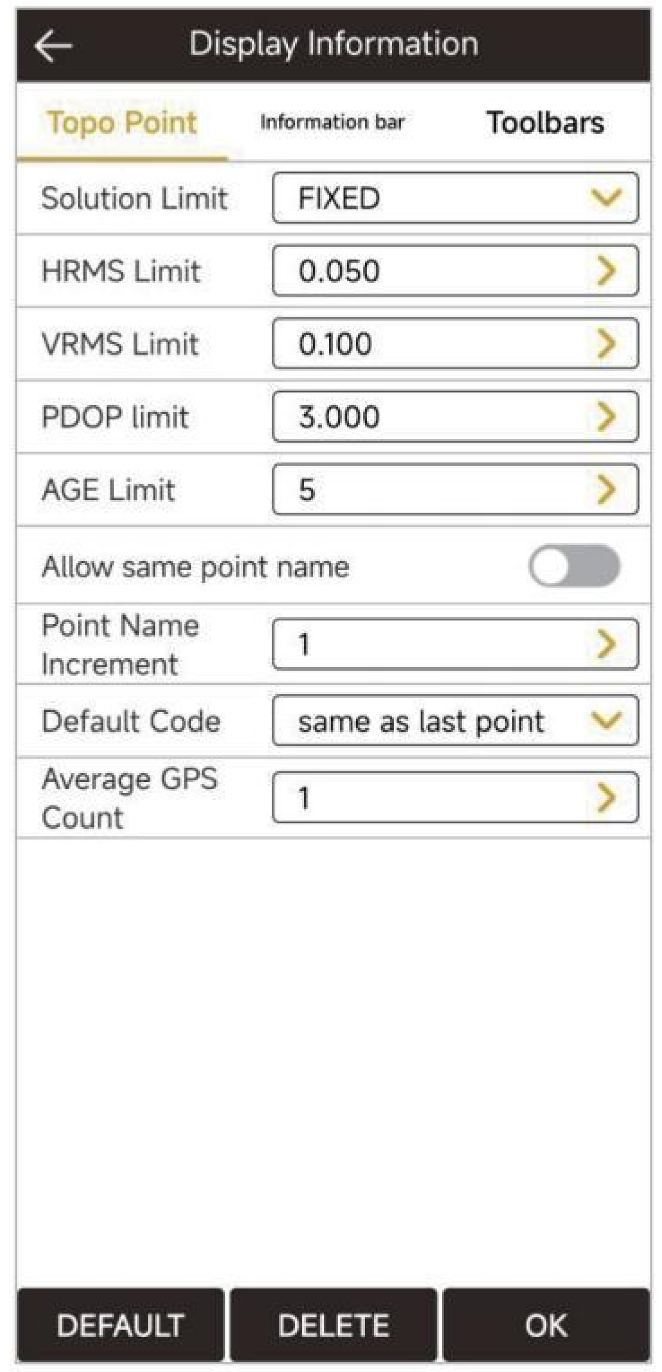


Figure 3.7-7

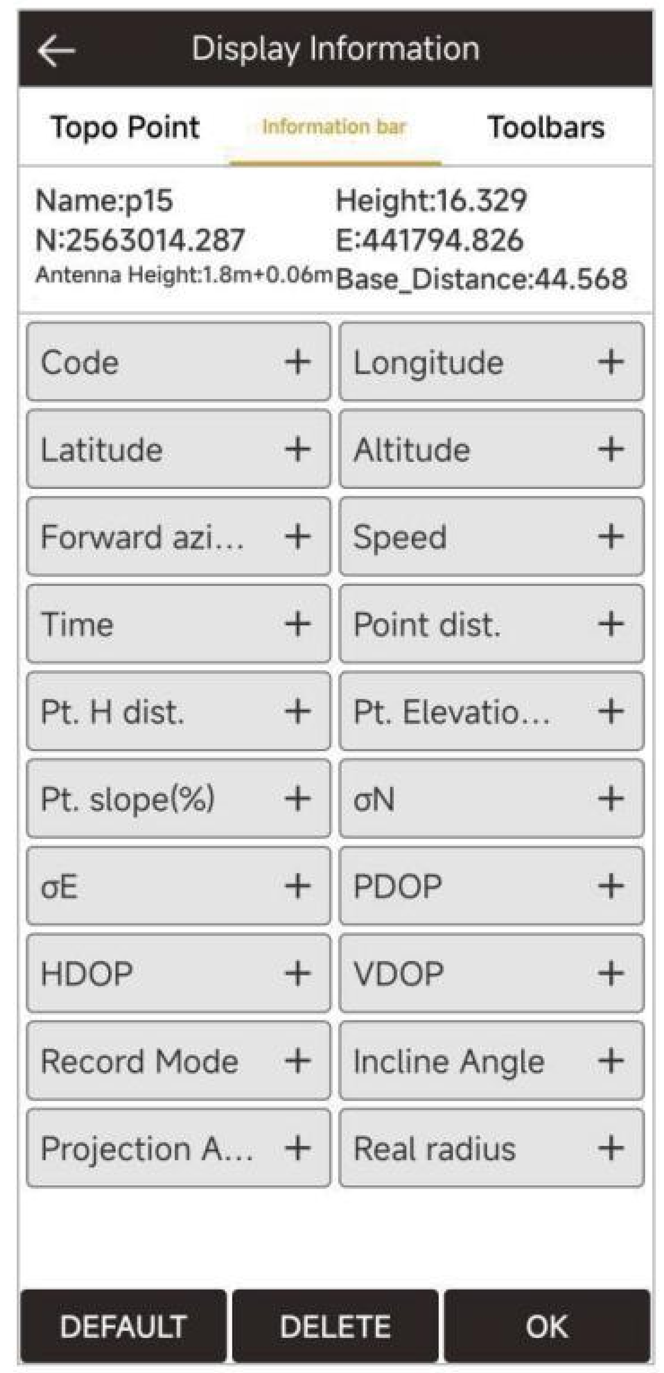


Figure 3.7-8

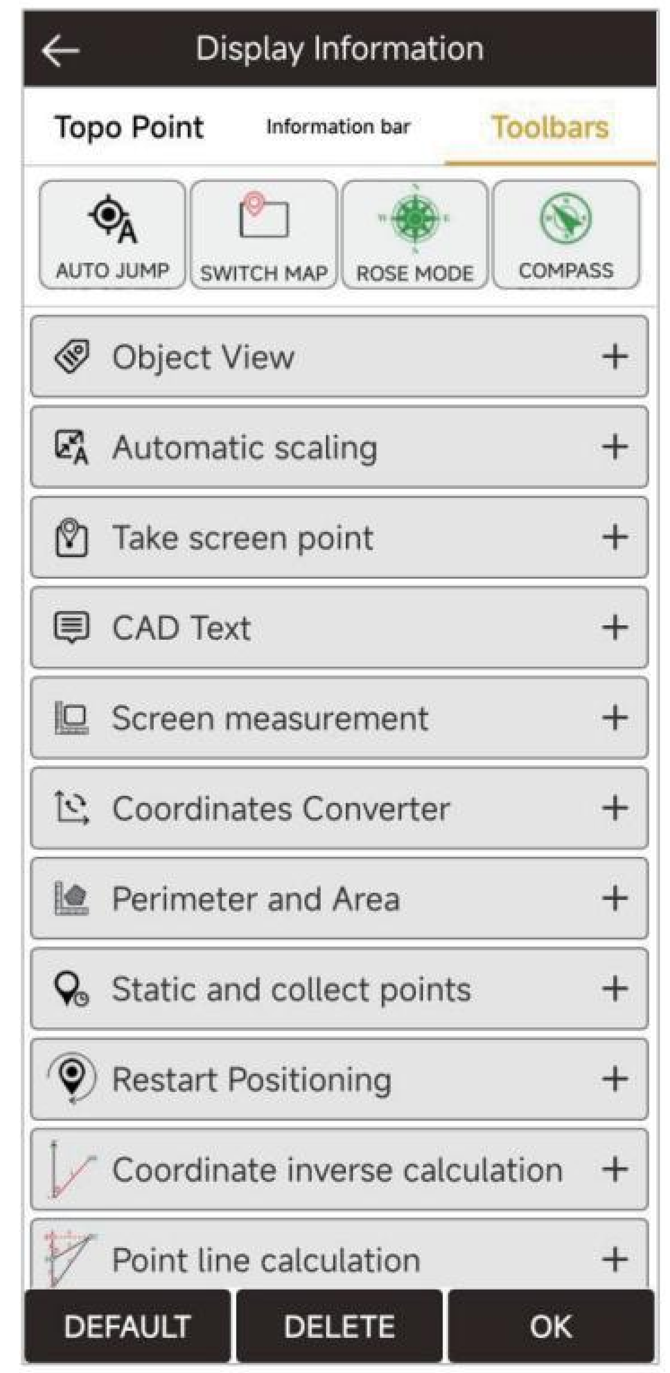


Figure 3.7-9

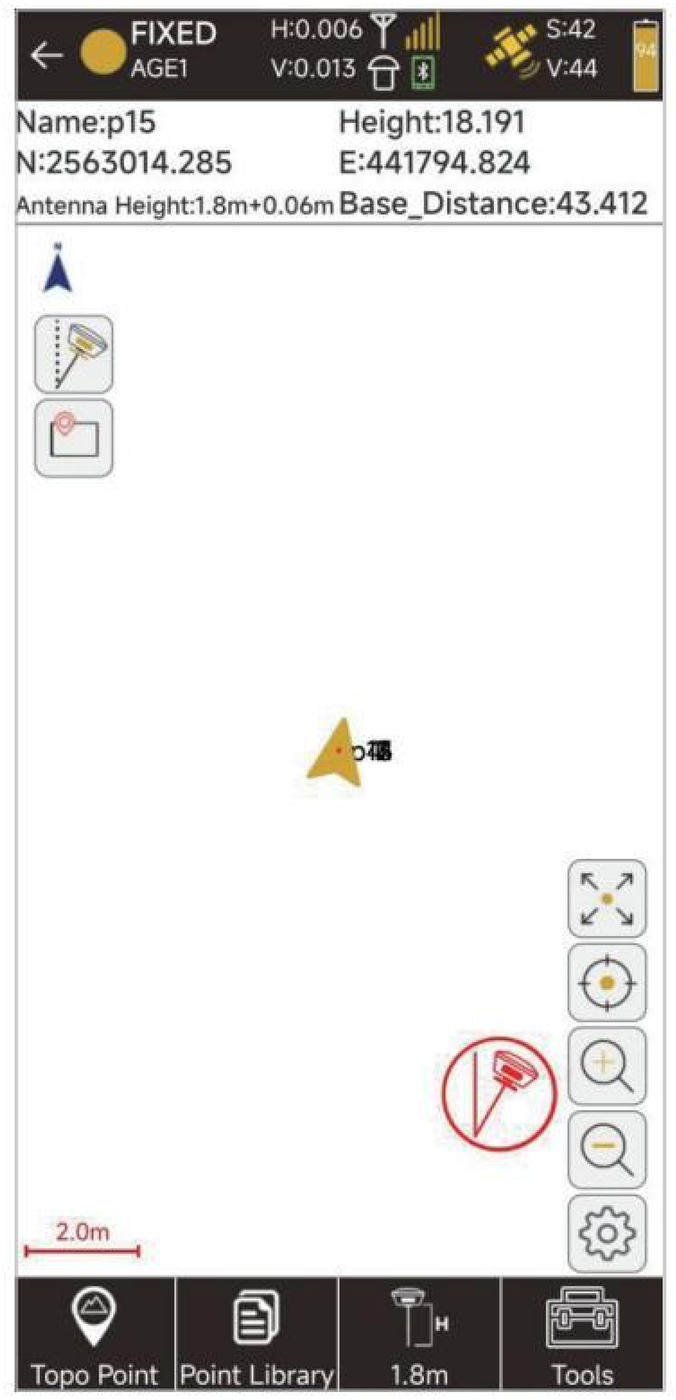


Figure 3.7-10

Figure 3.7-11

Figure 3.7-12

3.8 Tilt Survey

The tilt survey function requires the instrument to have a tilt module. Instruments with this function can do the following:

1. The accuracy of the instrument can be maintained within 2cm within the tilt range of 60 °;
2. The calibration process is simple, just shake the centering pole back and forth in place;
3. Support centering pole calibration, which can eliminate the survey error caused by the curvature of the centering pole.

Click [Survey]-> [Point Survey] to enter the point Survey page, click the tilt survey icon in the upper left corner to turn on the tilt survey function. When turned on, the icon is . Then follow the pop-up prompts, as shown in Figure 3.8-1, and enter the antenna height parameters (centering pole height) according to the actual situation.

At this time, the instrument needs to be in a fixed state. Refer to the pop-up animation, as shown in Figure 3.8-2 , shake the centering pole back and forth for 5 to 10 seconds, then rotate 90°, and continue to shake the centering rod back and forth until the measurement icon changes to , as shown in Figure 3.8-3 , and then you can perform tilt survey.

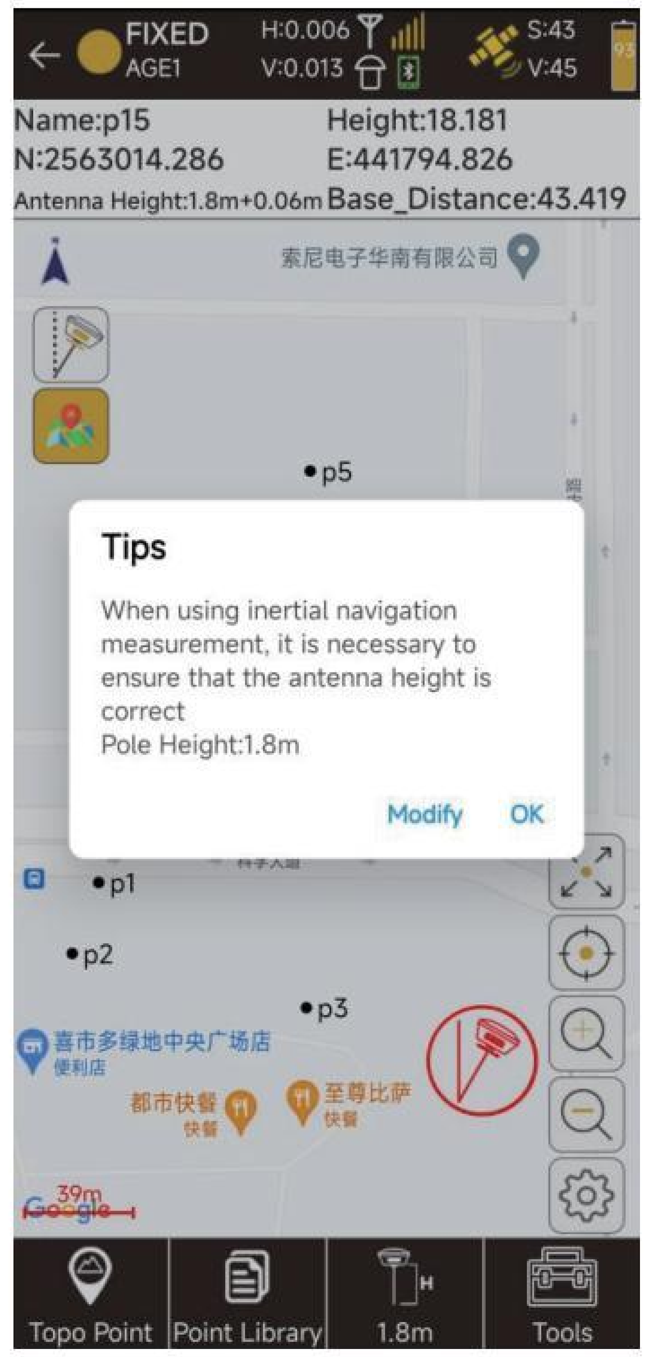


Figure 3.8-1

Figure 3.8-2

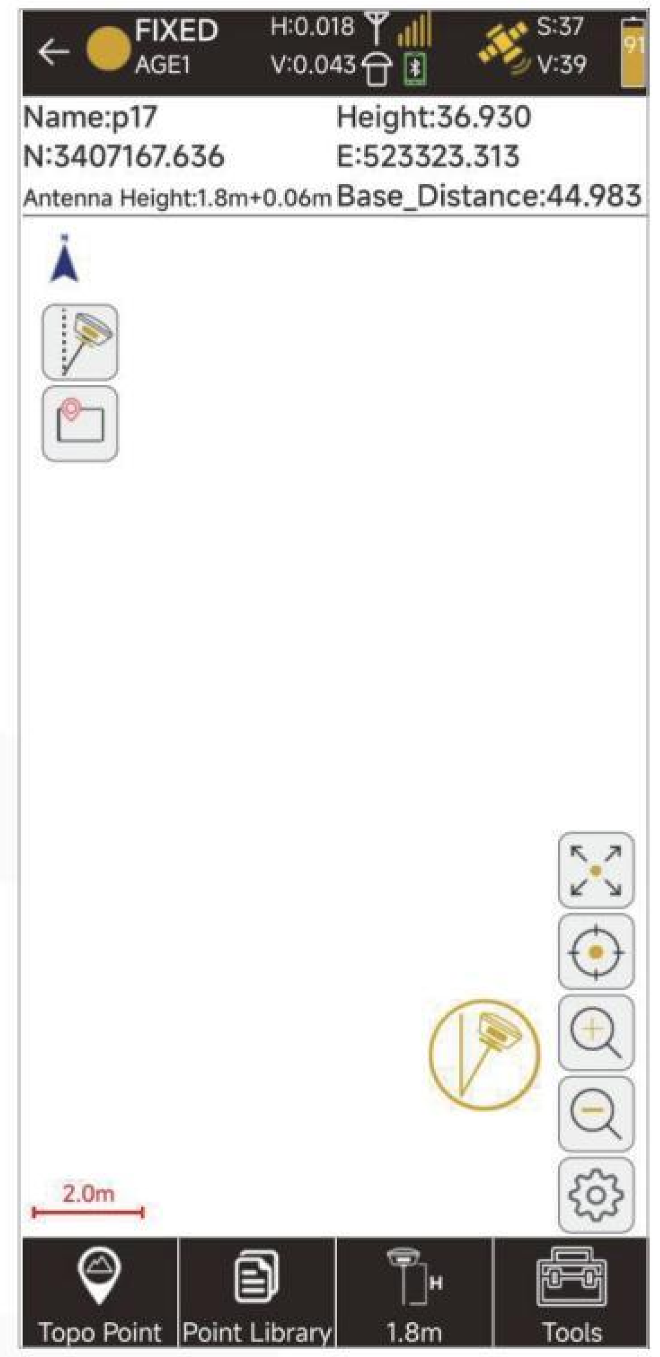


Figure 3.8-3

3.9 Photogrammetry

(communication mode: WIFI)

Photogrammetry combines RTK positioning technology with close-range photogrammetry technology. It is featured by RTK real-time and high precision, close-range photogrammetry's high efficiency and rich surveying results. When there is no fixed stations or control points, it can still effectively solve the problem of poor RTK signal in the surveying environment and photogrammetry's reliance on control points. Besides, it can be solved quickly. After the solution is completed, the three-dimensional coordinates of the point can be obtained by selecting the point on the photo.

1.Click [Device]->[Communication] to enter the communication settings interface,as shown in Figure 3.9-1. Select the Device Type (SP30Pro), communication mode (WIFI), and then click [Search], as shown in Figure 3.9-2. View the WIFI device list, select the corresponding device serial number (default device number), and click [Connect] to complete the device connection, as shown in Figure 3.9-3. After the device is successfully connected, it will directly return to the device interface.

2.Configure the rover to achieve a fixed solution state, please refer to Section 3.4.

Note: When use the Phone Internet, the controller needs to have a SIM card inserted to connect to the Internet.

3.Photogrammetry must be turned on for tilt survey to work properly. It is recommended to turn on the inertial navigation in the point survey interface and complete initialization, refer to Section 3.8.

4.Click [Survey] -> [Photogrammetry] to enter the photogrammetry interface, as shown in Figure 3.9-4. Click the input box on the right side of the task name to customize the task name. Click Antenna Parameters to modify the antenna height parameters (centering pole height) according to actual conditions. When the image appears on the interface, click the Auto-Photo button in the middle of the bottom, as shown in Figure 3.9-5, to start photogrammetry. When the pictures below are 5 pictures or more, you can click the Stop button, as shown in Figure 3.9-6. Then a pop-up prompt will pop up to indicate that the data processing is successful.Click the Image Gallery button on the left side at the bottom, as shown in Figure 3.9-7, to enter the Image Management Library interface. Select the folder you just took a photo of, and you will automatically enter the solution interface, as shown in Figure 3.9-8. Select featured points from the image, and you can move the image to the left or right or zoom in or out, as shown in Figure 3.9-9, so as to more accurately select the points that need to be solved. When you find the desired point, click

[Select] on the right side below to solve, as shown in Figure 3.9-10. If the solution is successful, the corresponding coordinate information will appear in the middle of the interface. At this time, click [Save] to save the coordinates directly to the point library. If the point selected in the first picture is not successfully solved, you can switch to other pictures to try, as shown in Figure 3.9-11. After the point selection is completed, click [Point Library] to enter the coordinate point library to check the point information of photogrammetry, as shown in Figure 3.9-12.

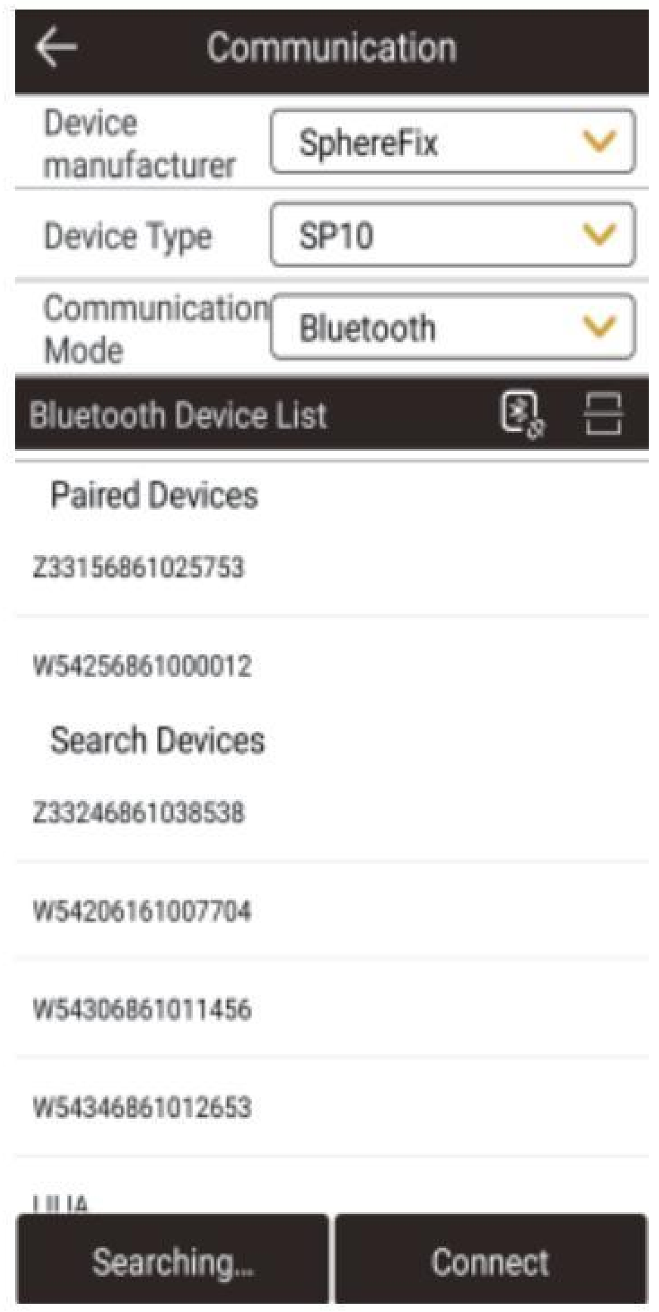


Figure 3.9-1

Figure 3.9-2

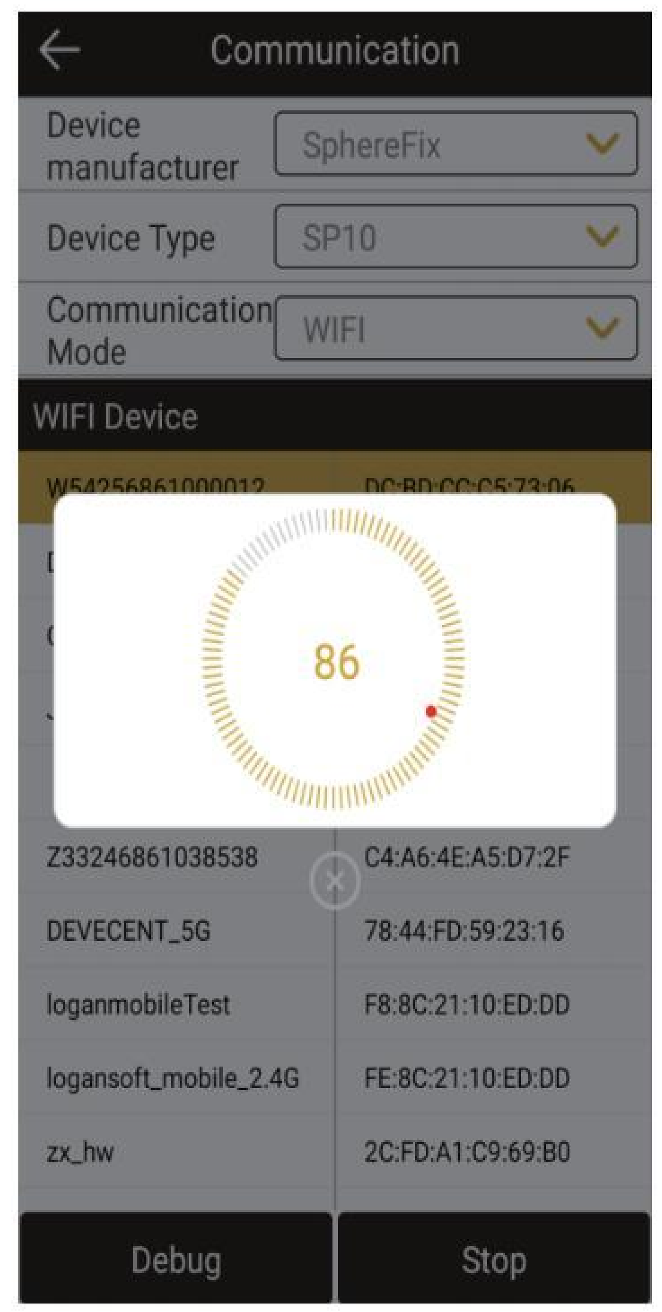


Figure 3.9-3

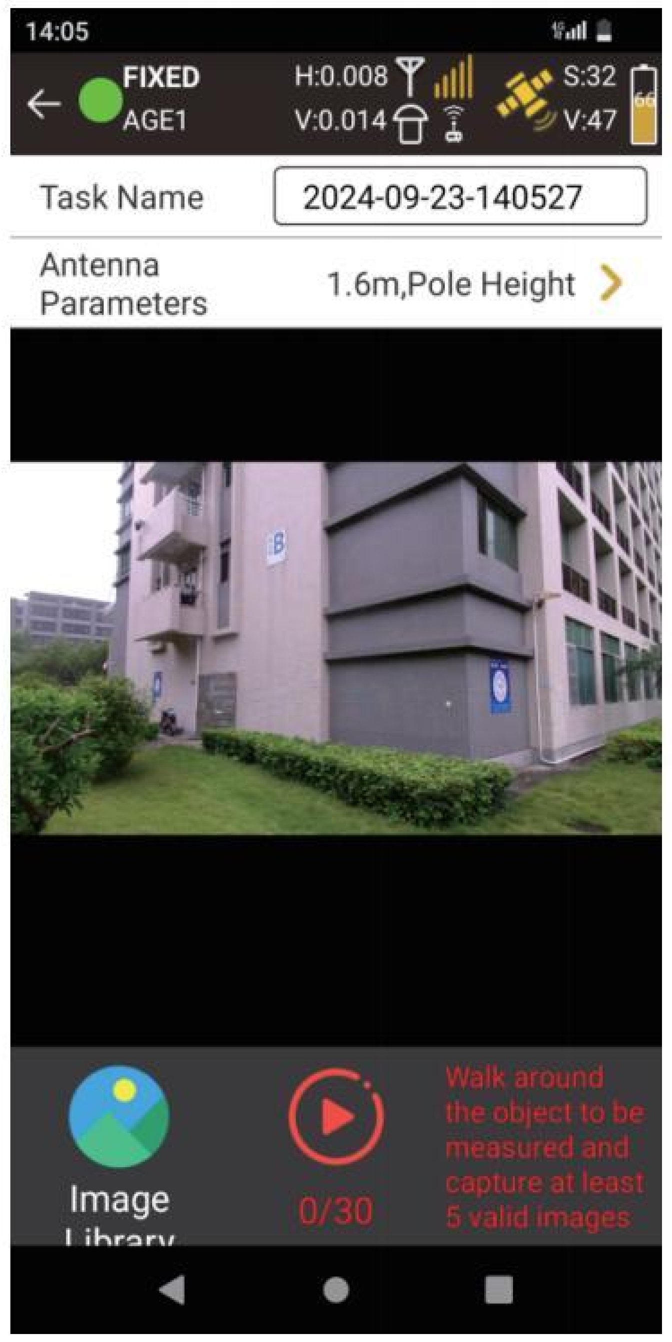


Figure 3.9-4

Figure 3.9-5

Figure 3.9-6

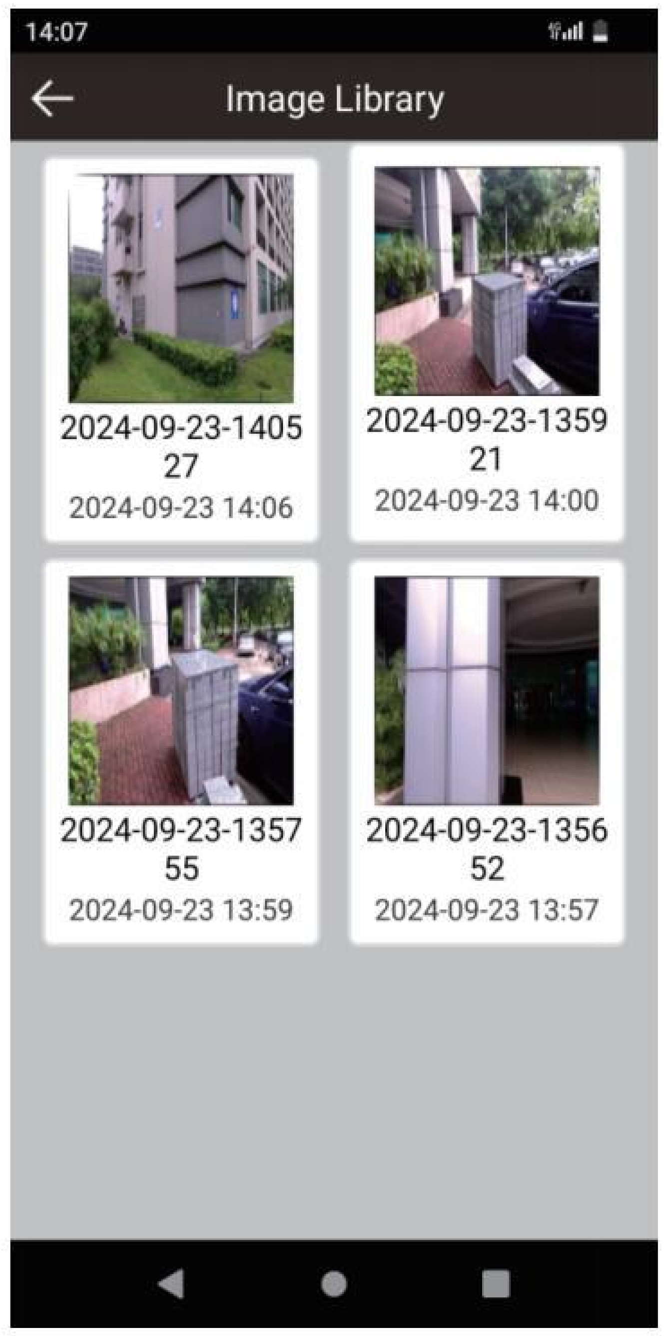


Figure 3.9-7

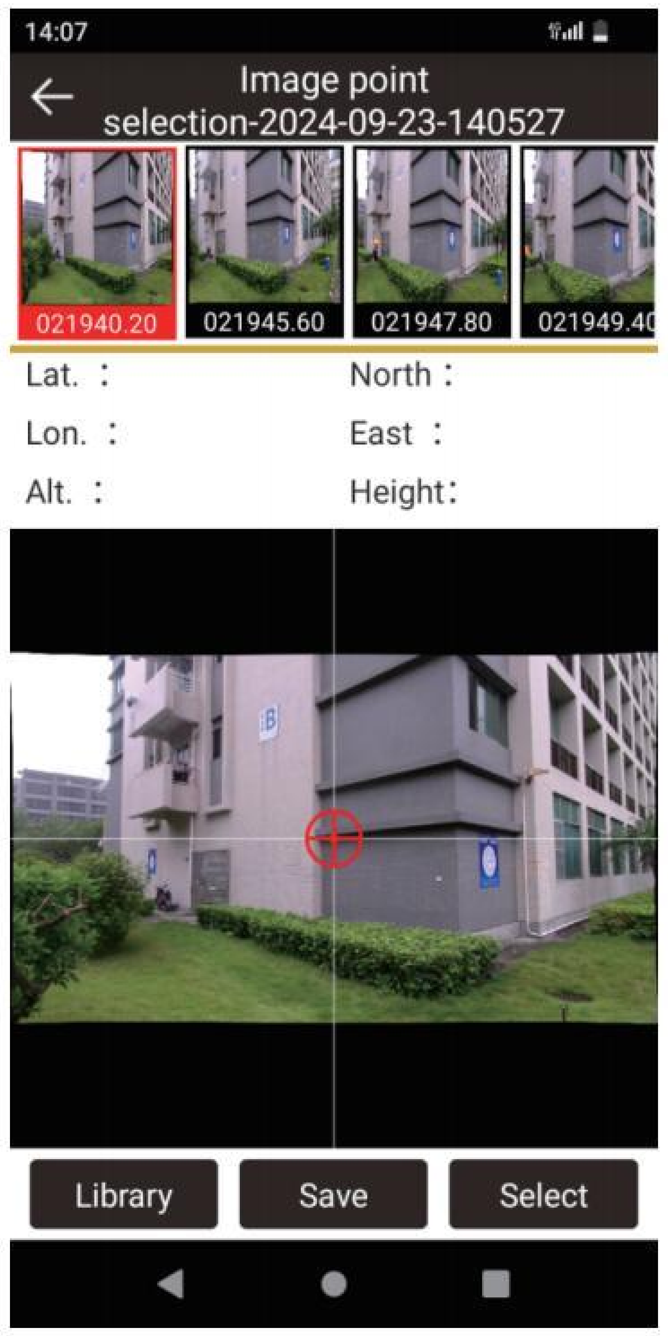


Figure 3.9-8

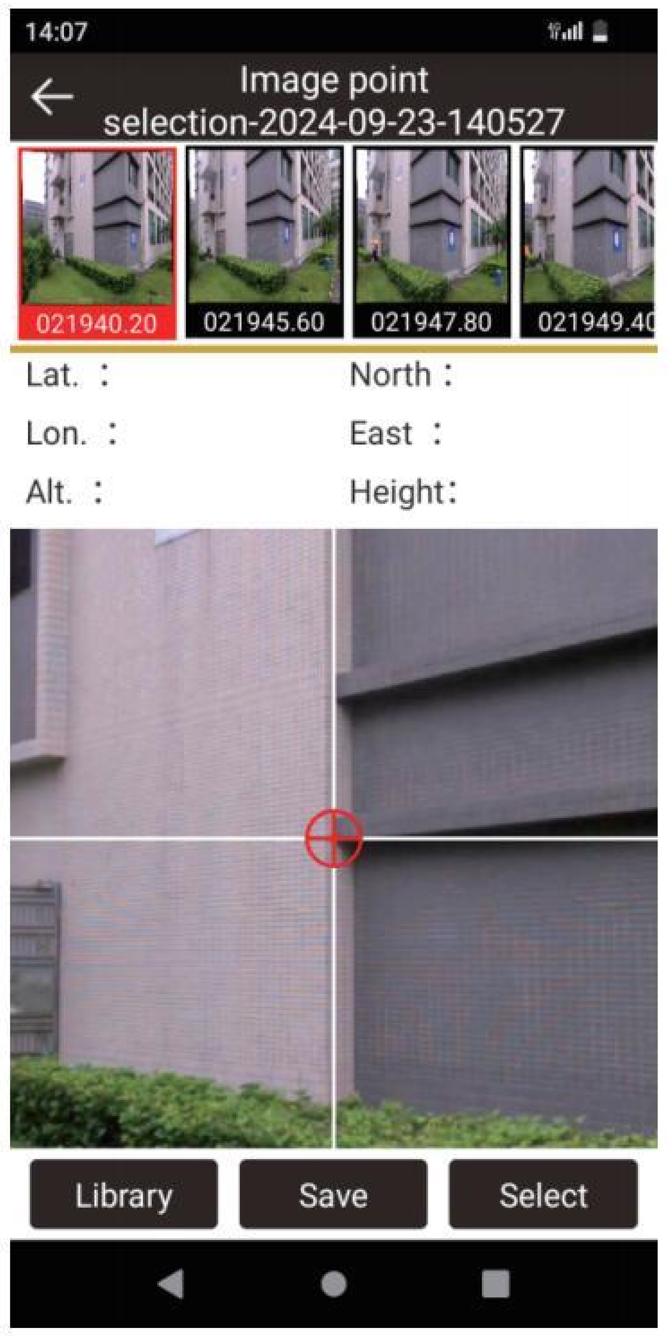


Figure 3.9-9

Figure 3.9-10

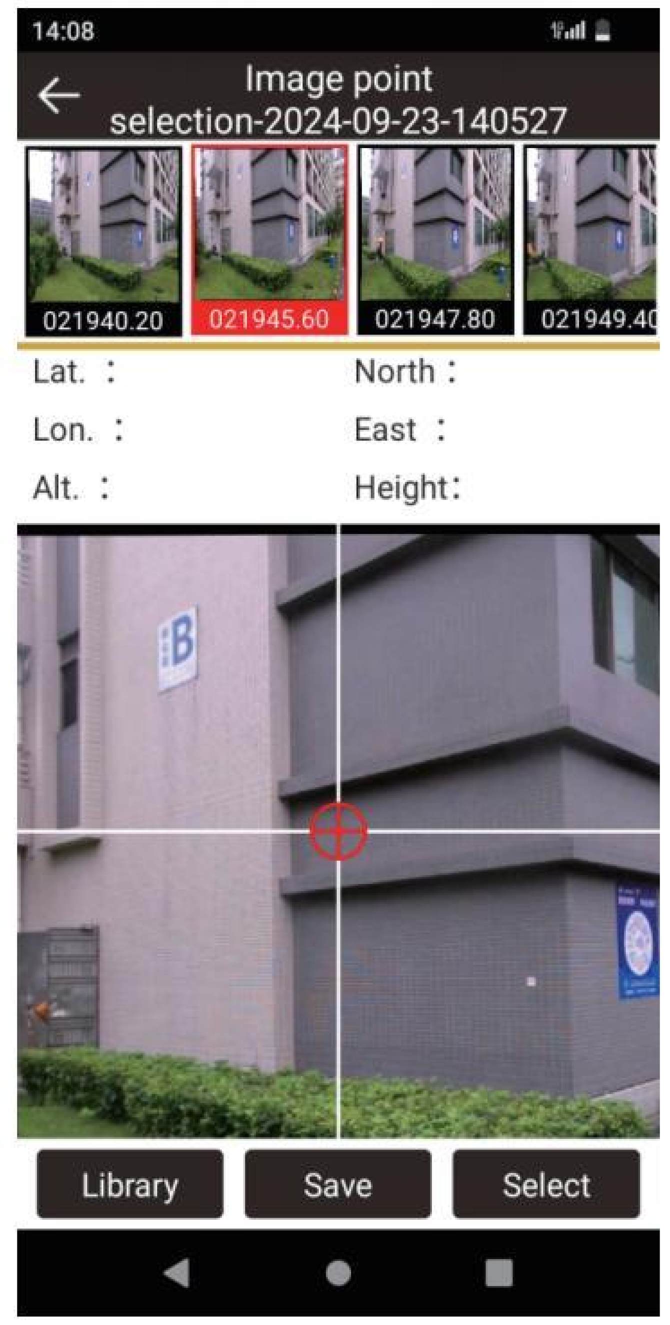


Figure 3.9-11

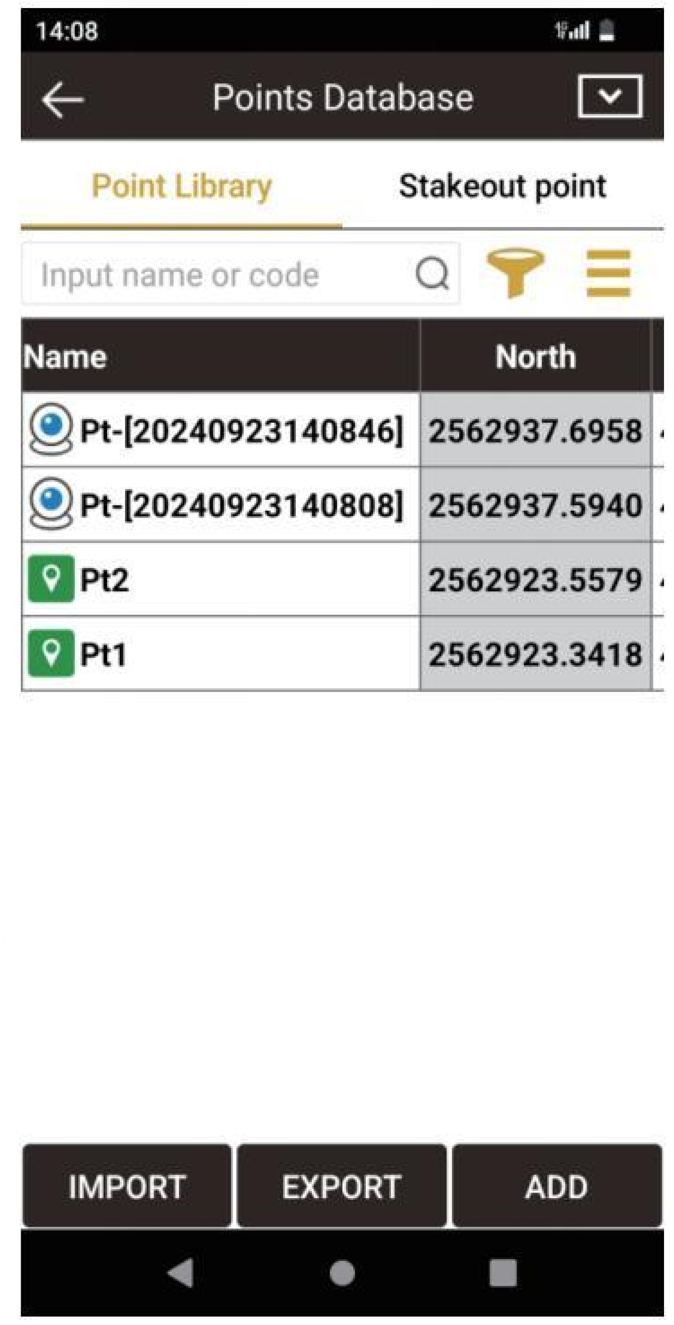


Figure 3.9-12

3.10 Point Stakeout

Click [Survey]-> [Point Stakeout] to enter the point stakeout library interface, as shown in Figure 3.10-1. Point stakeout means finding the location of a point through coordinate points in the field when the coordinates of the point are known. Points that have not been staked out and those have been staked out will be displayed. Click the stakeout point to edit, view details, stake out, and delete the stakeout point, as shown in Figure 3.10-2. The points to be staked out are part of the coordinate point library. The operations of adding, removing, importing, and exporting stakeout points are the same as those in the coordinate point library. Removing points from the points to be staked out does not actually delete points in the point library. You can also select points from the coordinate points (all points in the coordinate point library) for stakeout. After selecting points for stakeout, enter the point stakeout interface, as shown in Figure 3.10-3.

Click the icon ⚙ to enter the layout setting interface, as shown in Figure 3.10-4, where you can set the prompt range, layout tolerance, etc. You can also set the reference direction to east, south, west, north, front, back, left, right, and voice broadcast, etc.

The layout of the point stakeout interface is similar to that of point measurement, but there are some differences. The fill and cut values of the southeast, northwest deviation values from the target are displayed in the status information bar. The compass is together with the current positioning. In addition to the measurement type, coordinate point library, antenna height and tools, there are also functions such as stake out the nearest point, stake out the previous point, and stake out the next point at the bottom of the drawing area.

Click [Nearest Point], as shown in Figure 3.10-5, to stake out the nearest point.

Click the icon , as shown in Figure 3.10-6, to manually add stakeout points at any time.

If you want to reach the target point more quickly:

If the user has a good sense of direction, he can distinguish between east, south, west and north in real-time field work. In the layout compass display, he can directly see the continuity between the current positioning point and the target point, and just walk to the direction it points to. As shown in Figure 3.10-3, you can find the target point Pt1 by walking in the southwest.

What if the user has a poor sense of direction and cannot distinguish between east, south, west and north? You can look at the small arrow of the current location. The direction of this small arrow is the direction of the tablet when it is placed flat. As shown in Figure 3.10-3, the current tablet is pointing to the south. You can turn the tablet to point to the same direction. When the tablet's direction coincides with the current point and the target point, it means that the tablet's direction is consistent with the target point. At this time, follow the tablet's direction and move forward.

Figure 3.10-1

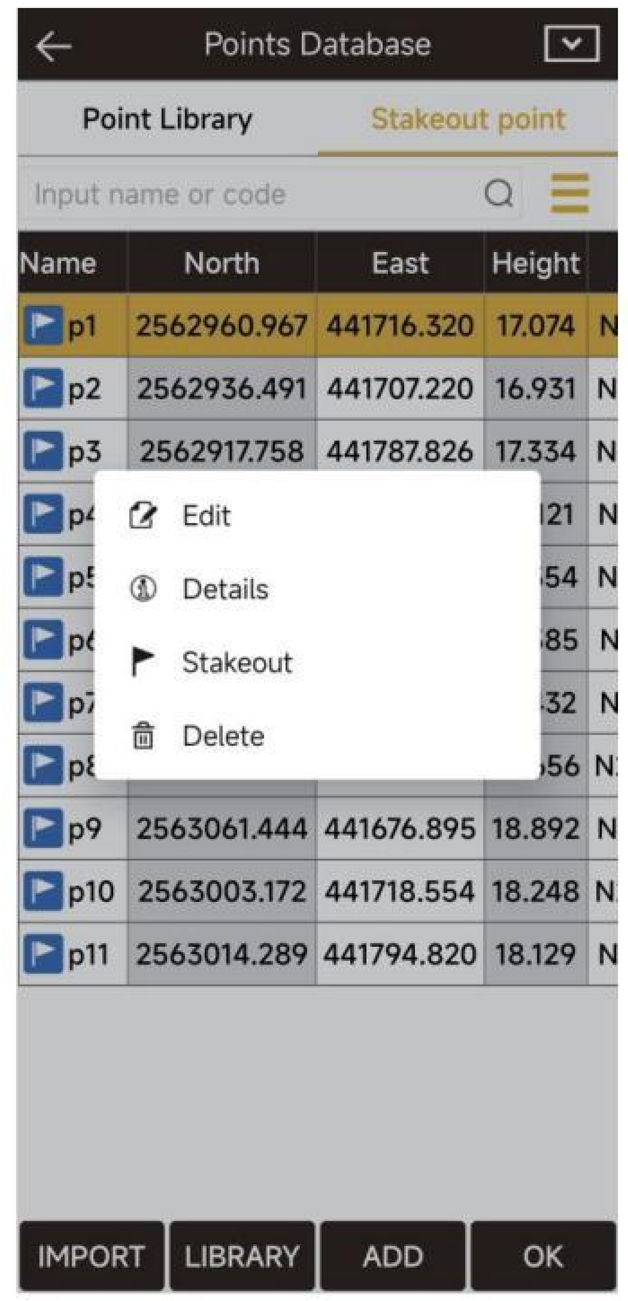


Figure 3.10-2

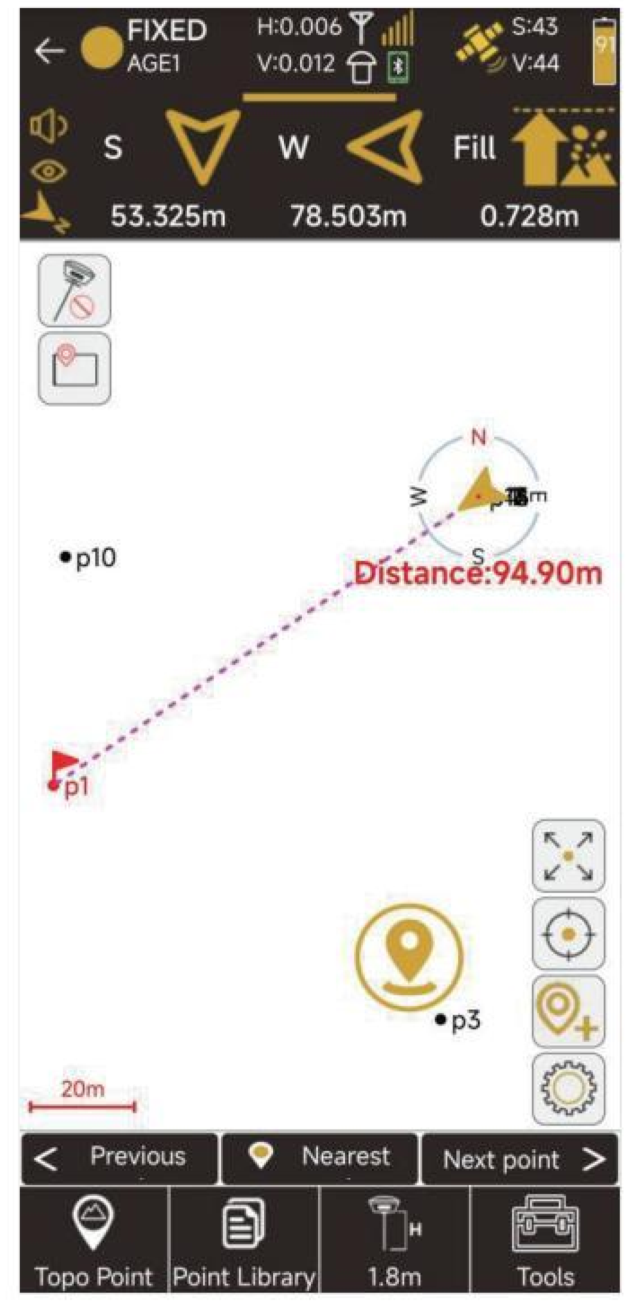


Figure 3.10-3

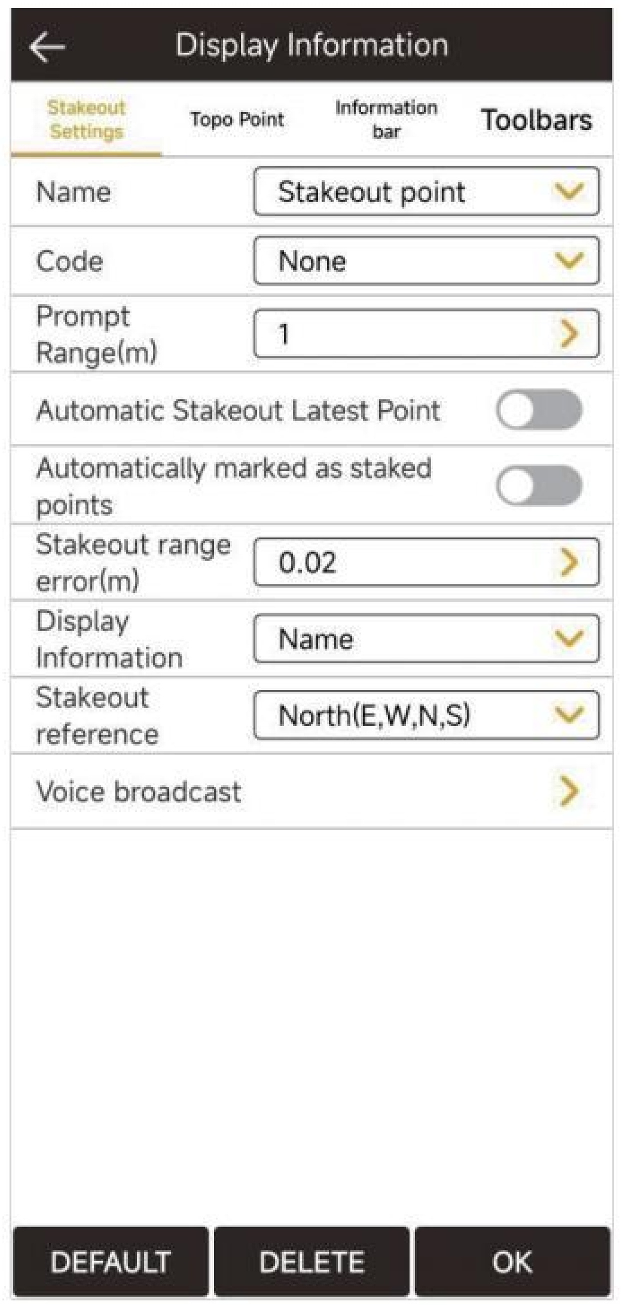


Figure 3.10-4

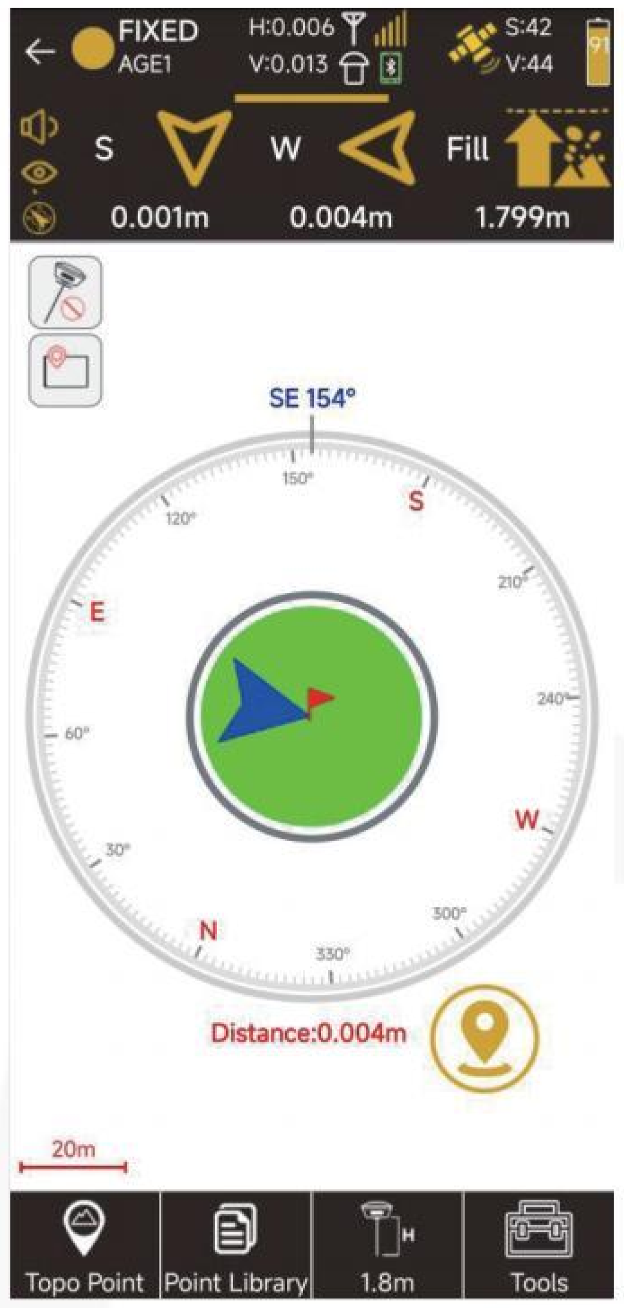


Figure 3.10-5

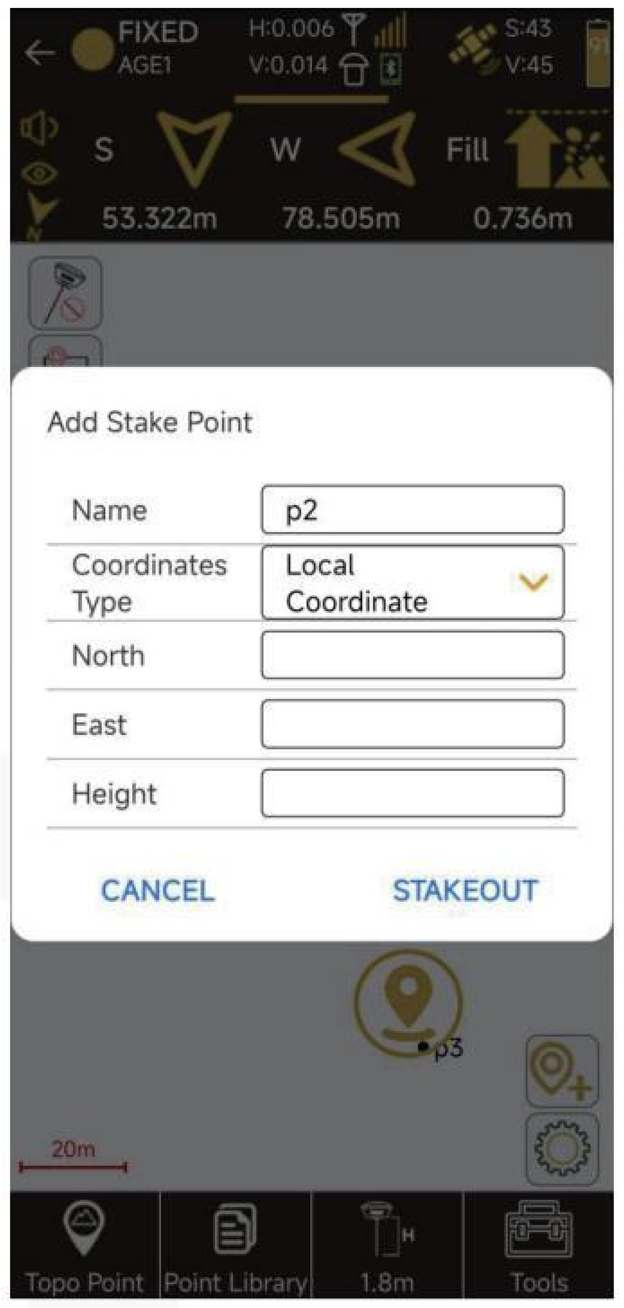


Figure 3.10-6

3.11 AR Stakeout

(communication mode: WIFI)

AR stakeout needs to be connected to an instrument with AR function via WIFI to be displayed. It can provide high-definition real-scene stakeout function and better real-scene stakeout application to help you stake out the target in one shot.

1.Click [Device]-> [Communication] to enter the communication settings interface, as shown in Figure 3.11- 1. Select the device type (SP30), communication mode (WIFI), and then click [Search], as shown in Figure 3.11- 2, view the WIFI device list, select the corresponding device serial number (default device number), and click [Connect] to complete the device connection, as shown in Figure 3.11- 3. After the device is successfully connected, it will directly return to the device interface.

2.Configure the rover to achieve a fixed solution state, refer to Section 3.2.

Note: To use the Phone Internet, the controller needs to have a SIM card inserted to connect to the Internet.

3.Click [Survey]-> [Point Stakeout] to enter the point stakeout library interface, as shown in Figure 3.11-4. The points to be staked will display the unstaken points and the staked points. Click the staked point to edit, view the details, stake out and delete the staked point, as shown in Figure 3.11-5. After selecting the point to stake out, enter the point stakeout interface, as shown in Figure 3.11-6. Click the tilt survey icon in the upper left corner to turn on the tilt survey function, as shown in Figure 3.11-7. When turned on, the icon is .

Then follow the pop-up prompts and enter the antenna height parameters (centering pole height) according to the actual situation, as shown in Figure 3.11-8. At this time, the device needs to be in a fixed state , shake the centering pole back and forth for 5~10s, then rotate 90 ° , and continue to shake the centering pole back and forth until the survey icon changes to , as shown in Figure 3.11-9. Click the AR icon in the upper left corner , as shown in Figure 3.11-10, to enter AR real-scene stakeout.

Finally, follow the arrow direction and distance indication to navigate to the area close to the stakeout point, as shown in Figure 3.11-11. When the tip of the centering rod coincides with the marked point, as shown in Figure 3.11-12, the AR real-scene stakeout is completed. At this time, you can click the survey icon and choose to stake out the next point, previous point, or stake out again according to the pop-up prompt.

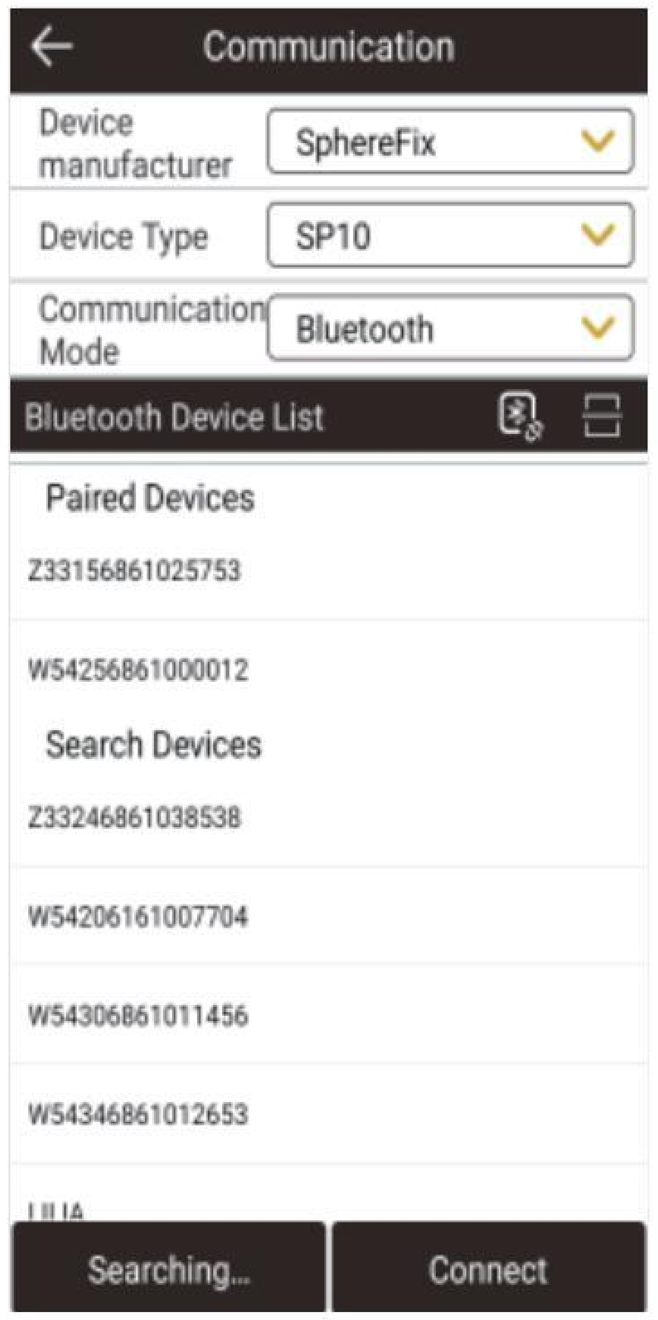


Figure 3.11-1

Figure 3.11-2

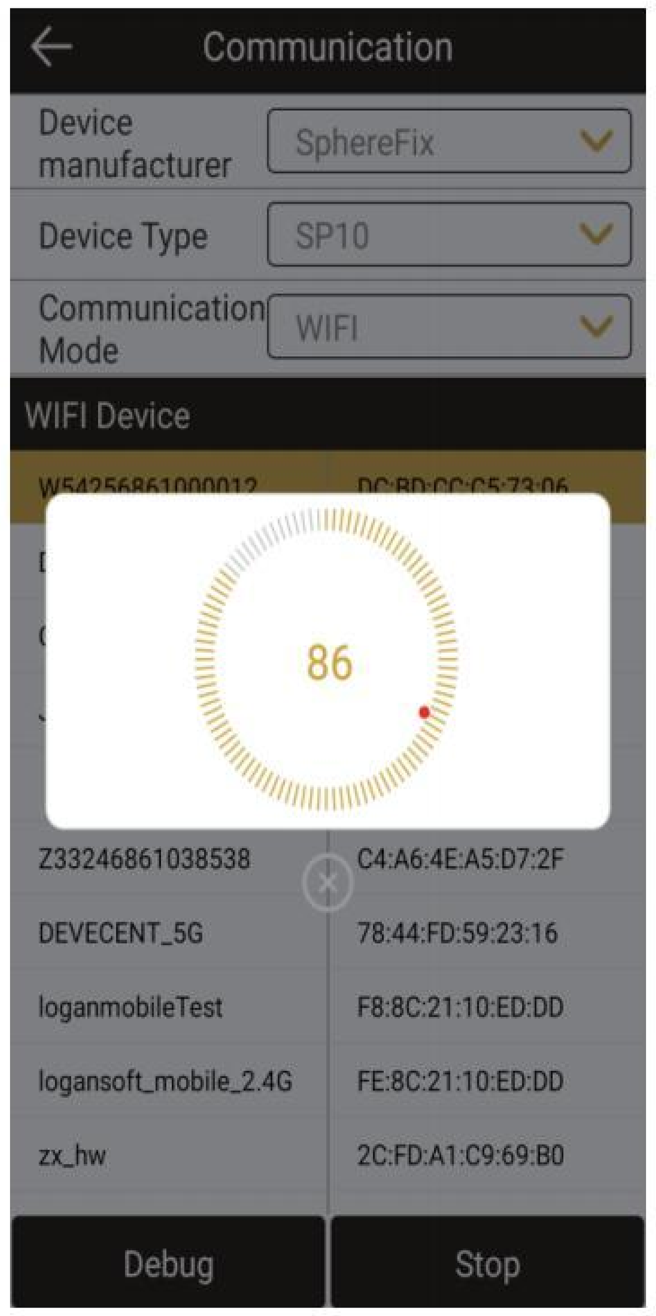


Figure 3.9-3

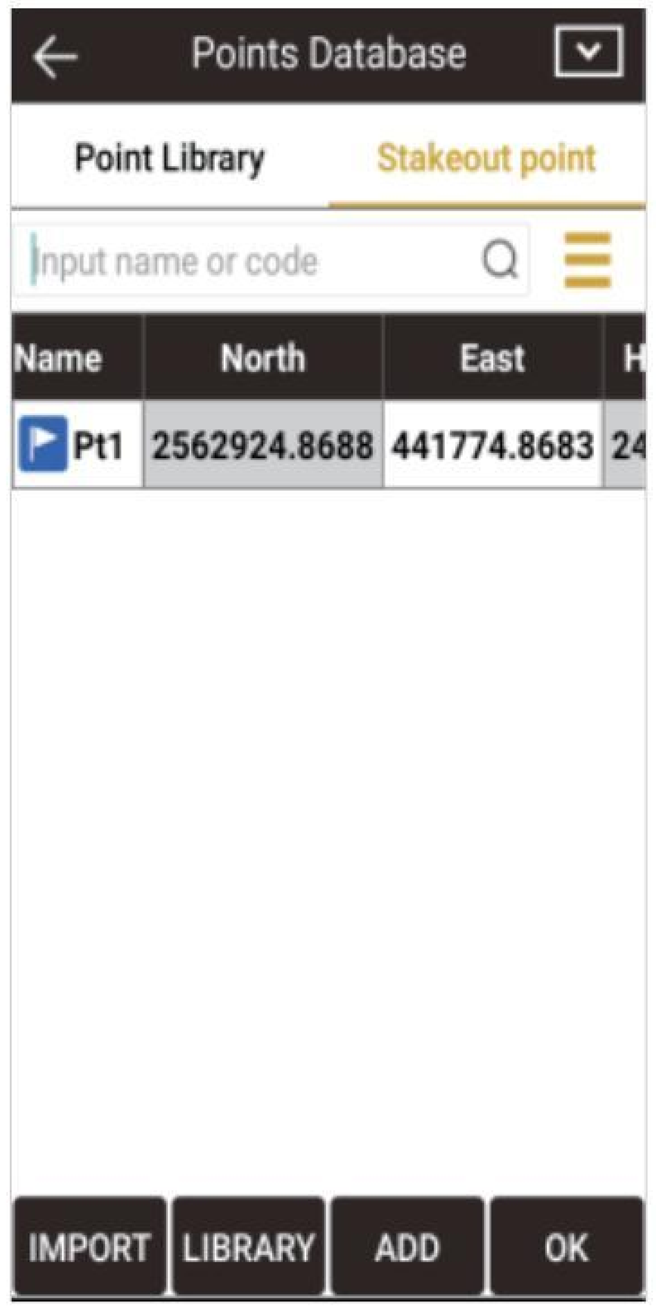


Figure 3.11-4

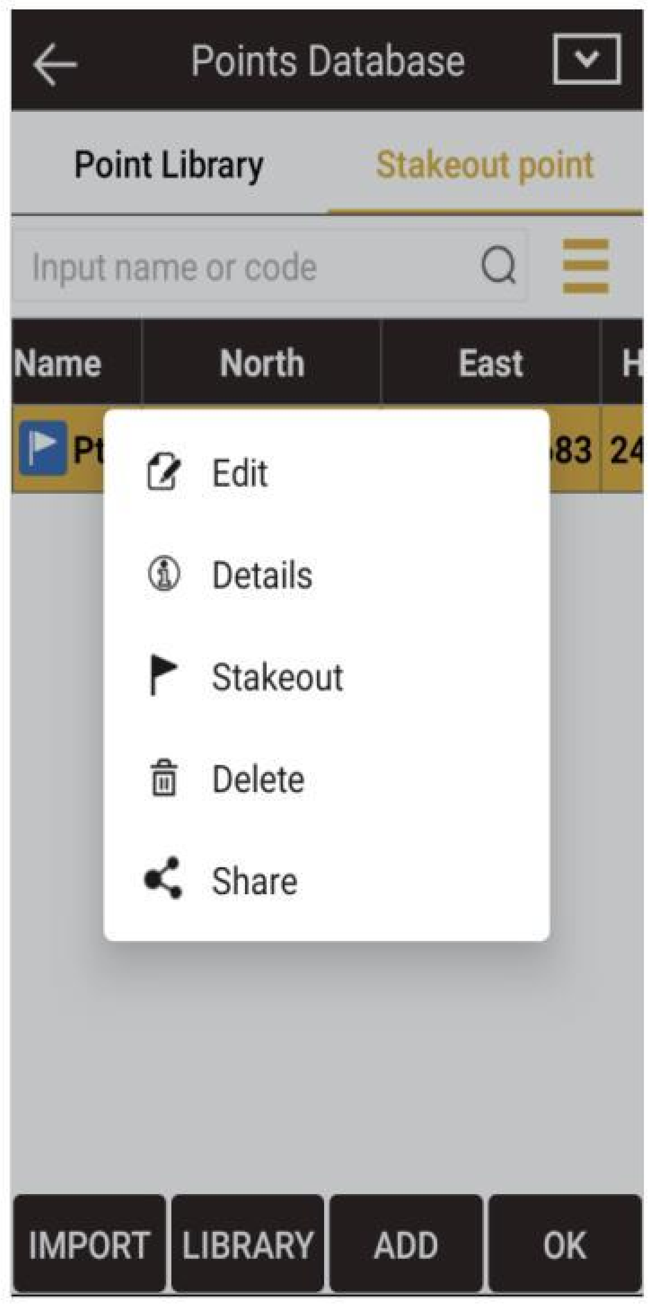


Figure 3.11-5

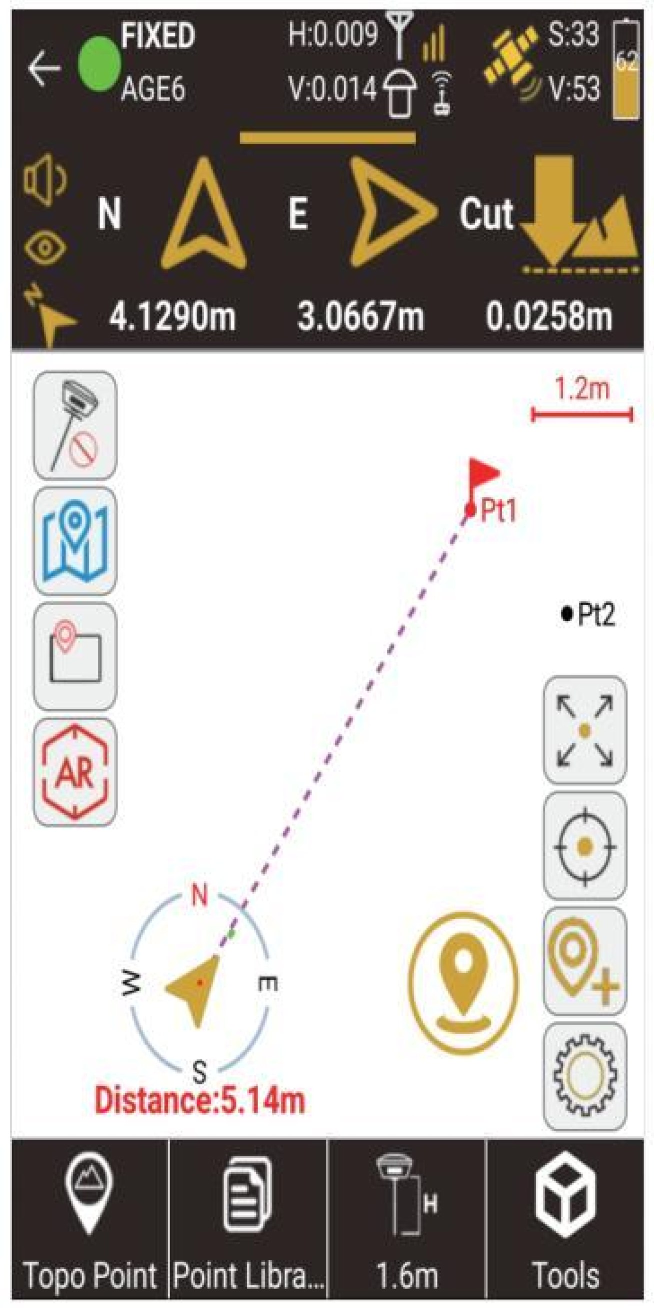


Figure 3.11-6

Figure 3.11-7

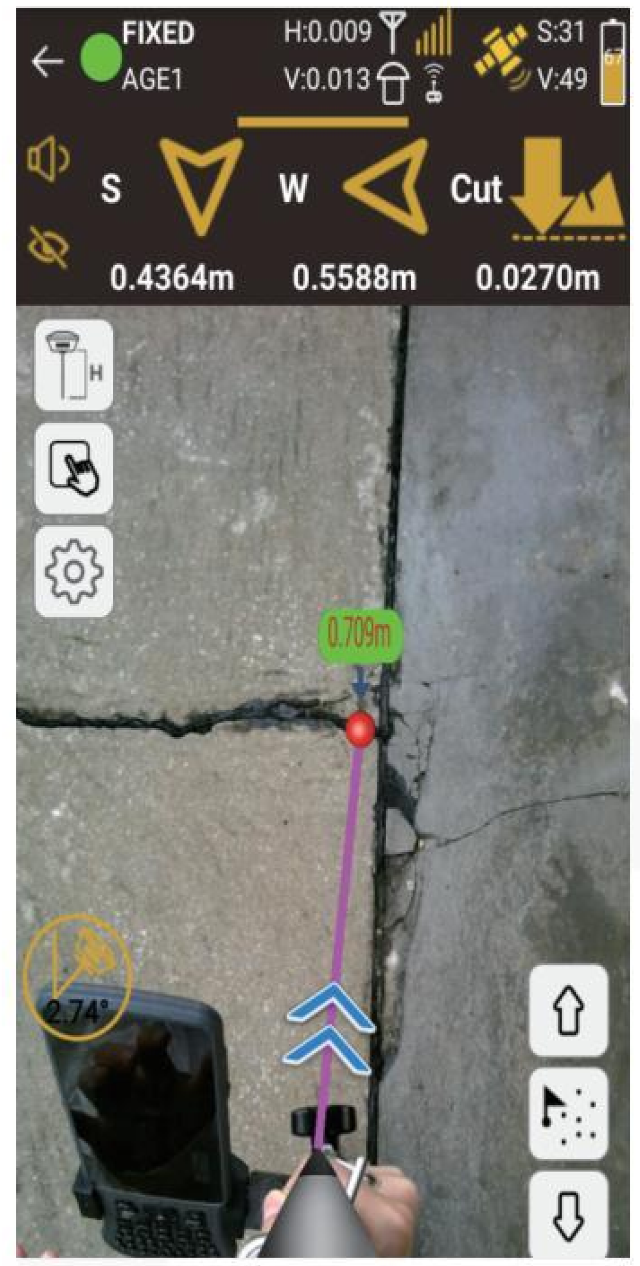


Figure 3.11-8

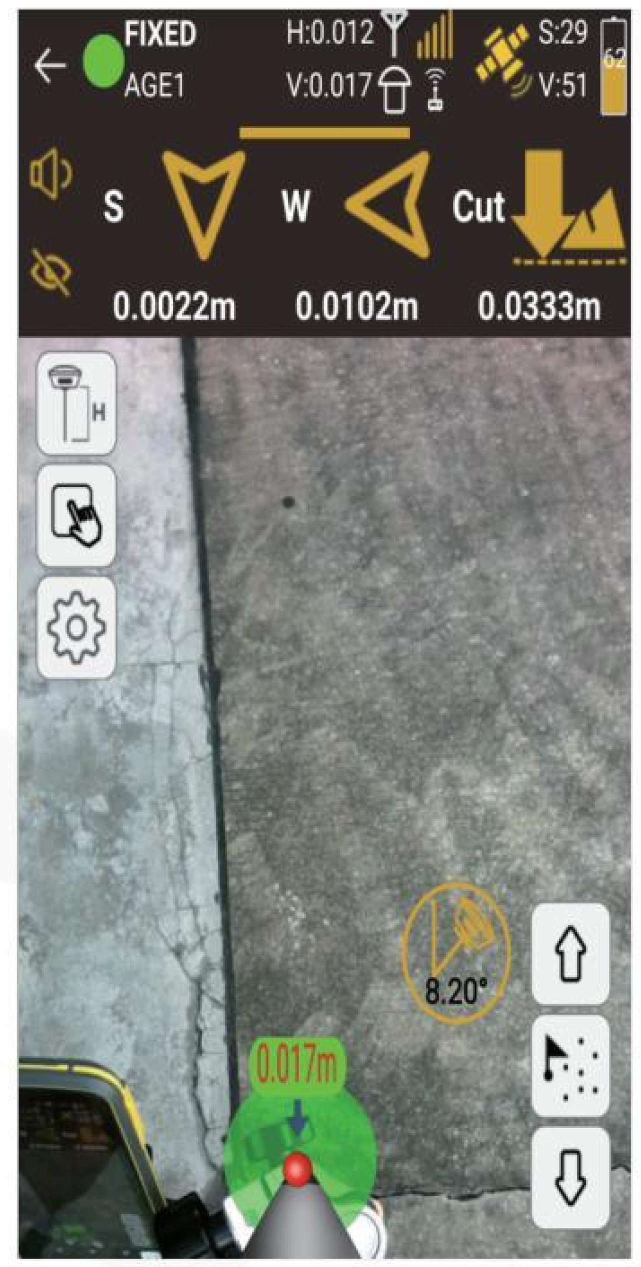


Figure 3.11-9

3.12 Localization

Click [Project]->[Localization], as shown in Figure 3.12-1, you can import control point parameters in various formats, or export control point data into files by third-party software. The high-precision position obtained by the software from the GNSS device is the latitude and longitude coordinates of satellite positioning, but in actual project operations, the plane coordinates on the ground are ultimately required for survey and application. If the customer has coordinates conversion parameters, the coordinate system parameter values can be set directly in the coordinate system (details 2.3). If the customer does not have specific coordinate system parameters, but has corresponding latitude and longitude coordinates and plane coordinates, we call them control points. In the case of control point data, this function can be used to calculate the conversion parameters and apply them to project operations.

Click [Add], as shown in Figure 3.12-2, you can manually enter the control point, or choose to import it from the coordinate point library, as shown in Figure 3.12-3. In the control point list, select the data item to modify, edit and delete the control point parameters, as shown in Figure 3.12-4.

After editing the control point parameters, calculate the conversion parameters for the control points. Click [Calculation Method] to pop up the conversion parameter condition settings, as shown in Figure 3.12-5.

After editing the control point parameters, calculate the conversion parameters for the control points. Click [Calculate Method] to pop up the conversion parameter condition settings, as shown in Figure 3.12-5. Coordinate conversion methods include plane correction, vertical correction, elevation fitting and seven parameters, which can be all or part of the combination. As long as the corresponding accuracy is achieved within the accuracy range, the calculated conversion parameters are considered to be available. The plane correction model includes four parameters and horizontal adjustment. The elevation fitting method includes weighted average, plane fitting, surface fitting and vertical adjustment. Usually, if the operating range is very wide, seven parameters are needed to meet the accuracy requirements of all control points. If the operating range is relatively small, plane correction can usually achieve the corresponding accuracy.

After configuring the calculation conditions, click [Calculate] to display the calculation results of the conversion parameters and the residuals of each control point, as shown in Figure 3.12-6. After calculating the conversion parameters, you can export the calculation report for project review. If the conversion parameters are qualified, apply the parameters to the project and you can perform the surveying work normally.

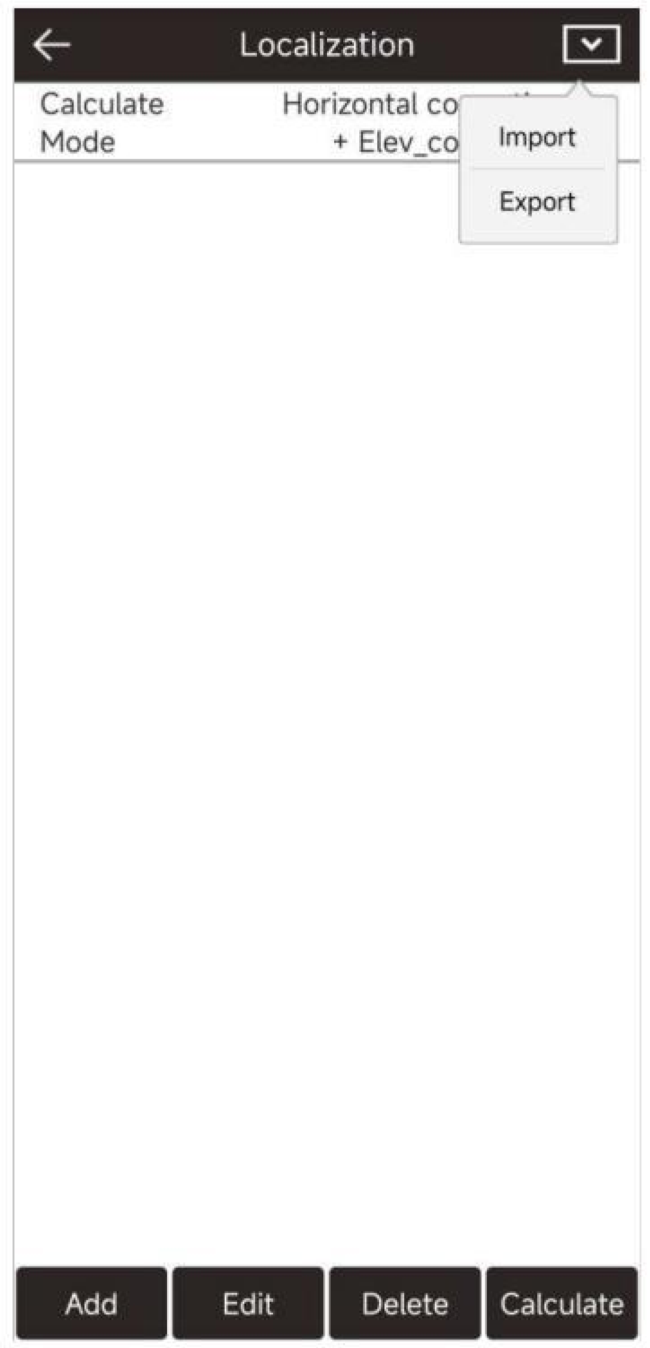


Figure 3.12-1

Figure 3.12-2

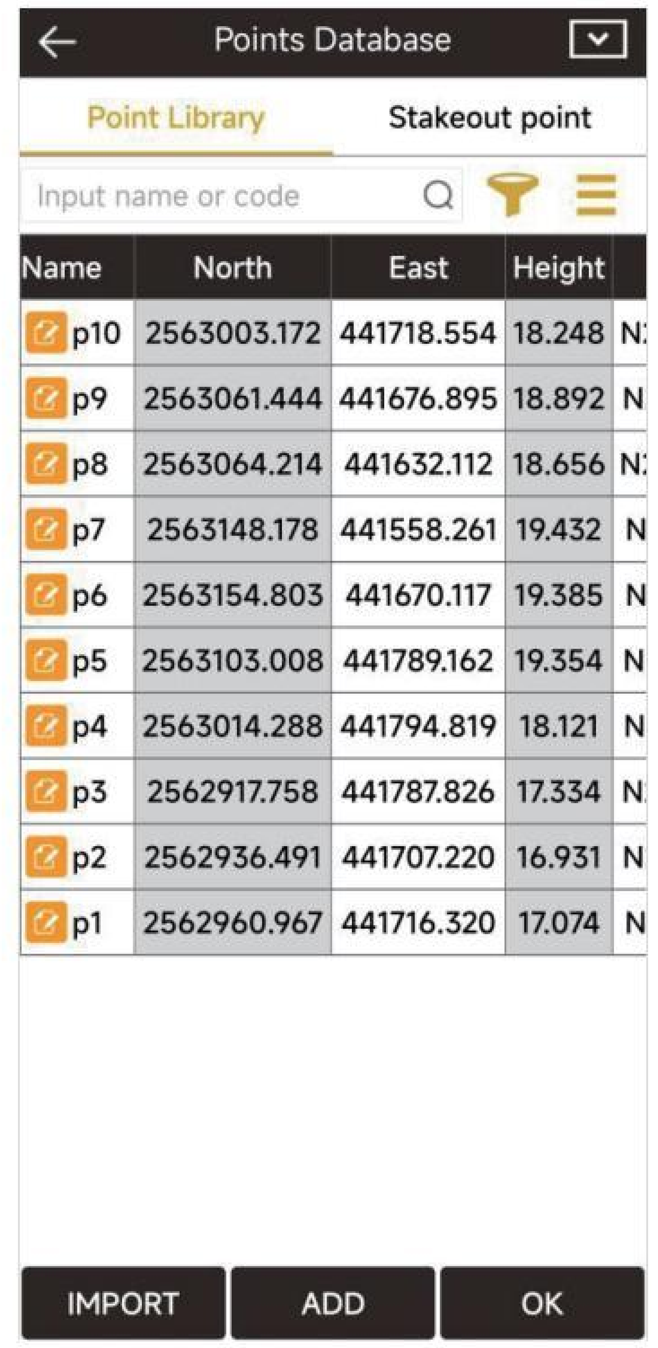


Figure 3.12-3

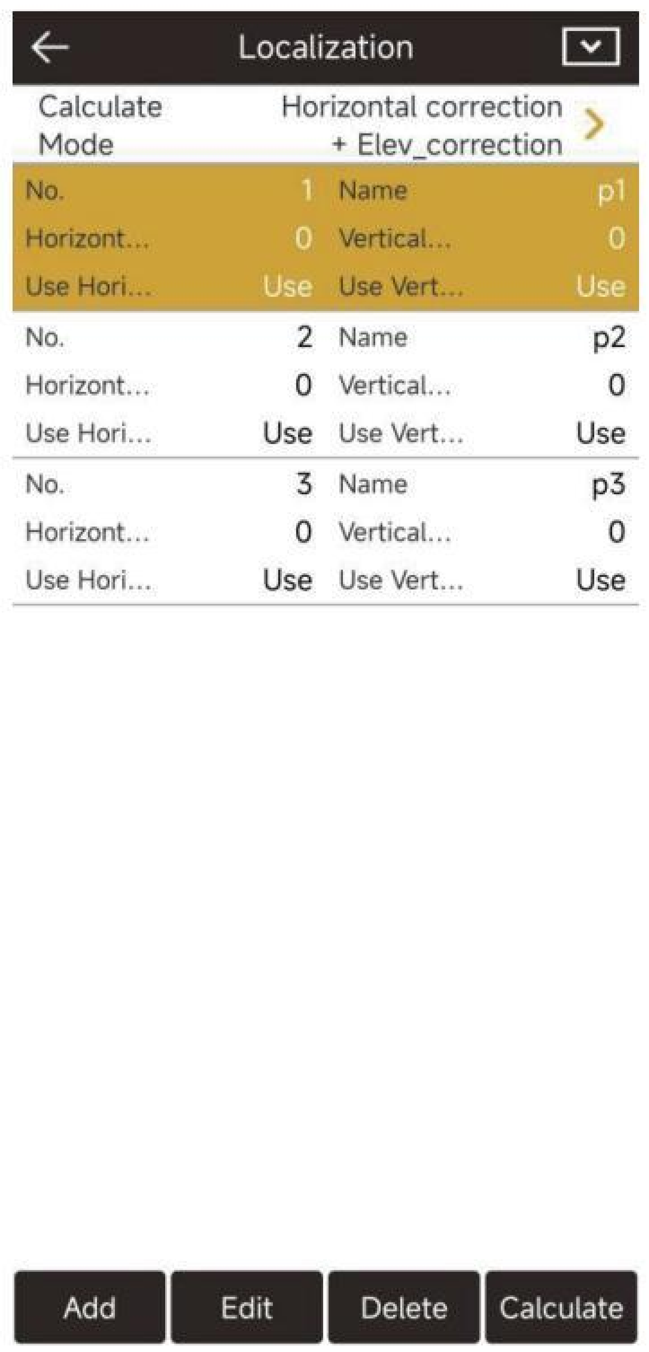


Figure 3.12-4

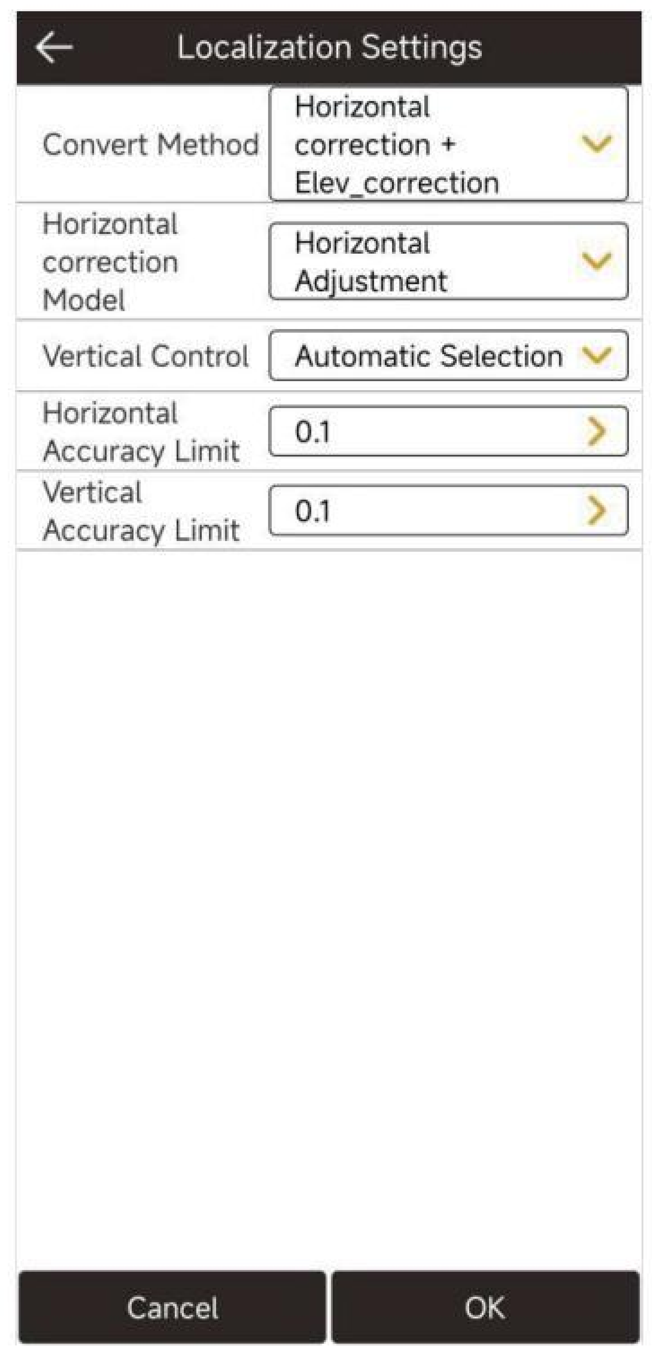


Figure 3.12-5

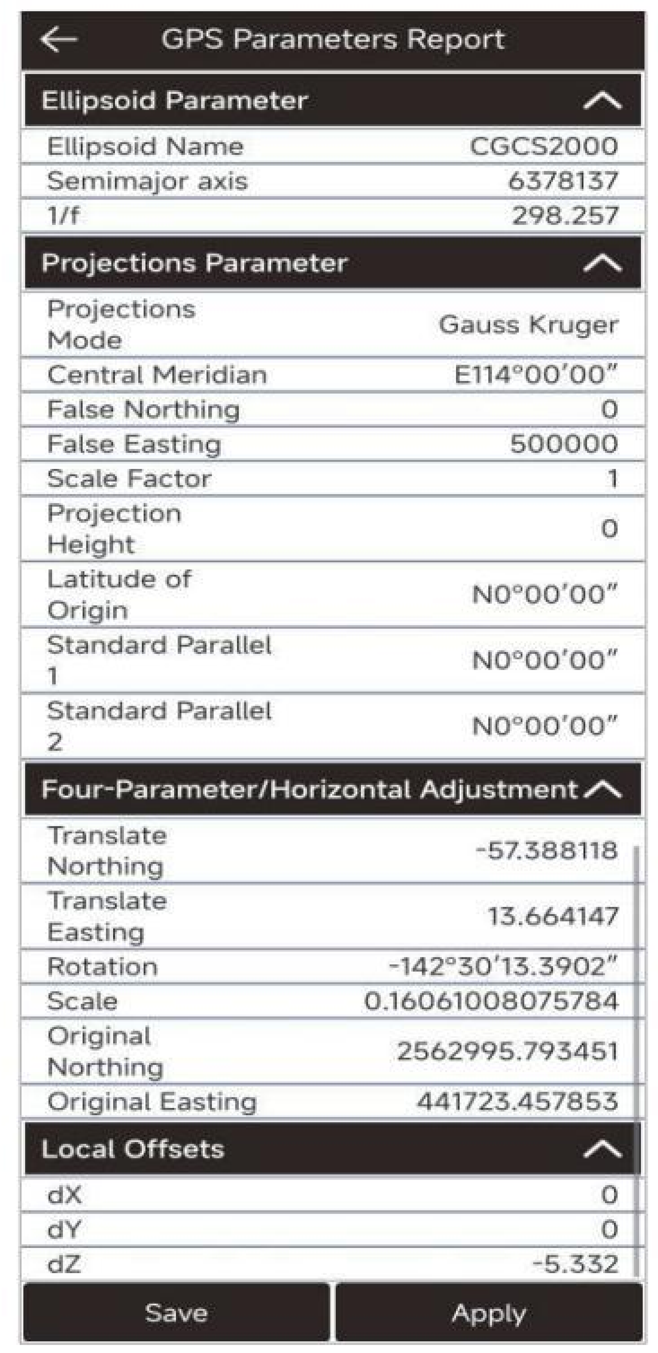


Figure 3.12-6

3.13 Calibrate Point

Click [Project]-> [Calibrate Point], as shown in Figure 3.13-1. In actual application, GNSS equipment obtains high-precision position by combining differential data of base station with solution. Here we know the coordinate position of base station. In fact, the high-precision position output by GNSS equipment is the relative position of base station. In actual application, in addition to some users using differential data of CORS reference station, there are also quite a few users using differential data of base station transmitted by their own GNSS equipment. When transmitting differential data by building their own stations, a project may involve starting base station multiple times. When initiating the base station, the starting position and starting coordinates of base station may change, and the starting coordinates may not be correct. In the absence of calibration, the coordinates of rover obtained by using these base station differentials may be wrong (at the same location, the coordinates measured by previous differential data are different from the coordinates obtained by new differential data). Therefore, when the rover receives new base station differential data for surveying, it needs to perform points calibration so that the coordinates obtained by software match the coordinates obtained by connecting to the last base station. After the starting coordinates or starting position of the base station changes, a known position needs to be used to calibrate the coordinates correctly.

Click [Base Point Calibration], as shown in Figure 3.13-2, and click to select a known point in the coordinate point library (use the coordinates measured by the base station at a certain location last time). Then click [Calculate] and apply.

Click [Marker Point Calibration], as shown in Figure 3.13-3, and click to select a known point in the coordinate point library (use the coordinates measured by the base station at a certain location last time). Then place the GNSS device at the location of the known point. Click to measure a new positioning point, and calculate the deviation value. Click [Apply], and the coordinates received by the software will match the coordinates measured last time.

The base station coordinates change and remind you whether to recalibrate. If the base station coordinates change when receiving the differential signal from the self-built base station, it means that the points calibration of base station is required and needs to be re-calibrated.

Note: The CORS reference station is a long-term operating reference station whose position and startup coordinates will not change. If the differential data of the CORS reference station is used, the received coordinates may change, the obtained coordinates are still correct and no translation calibration is required.

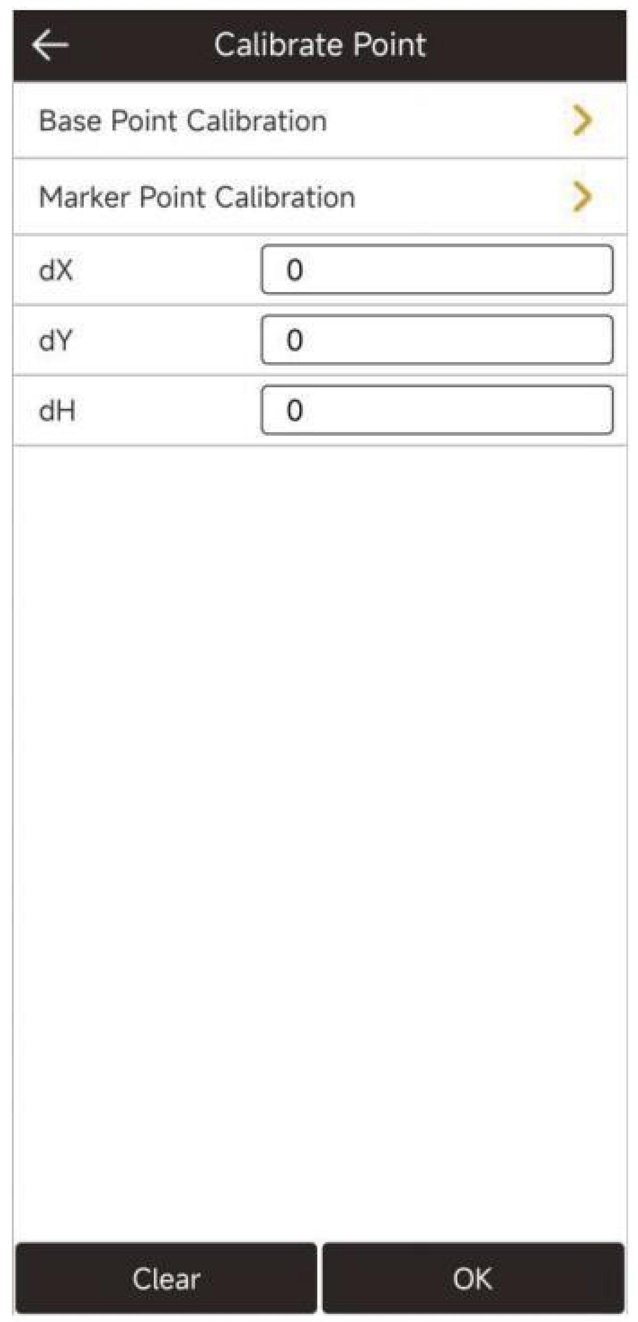


Figure 3.13-1

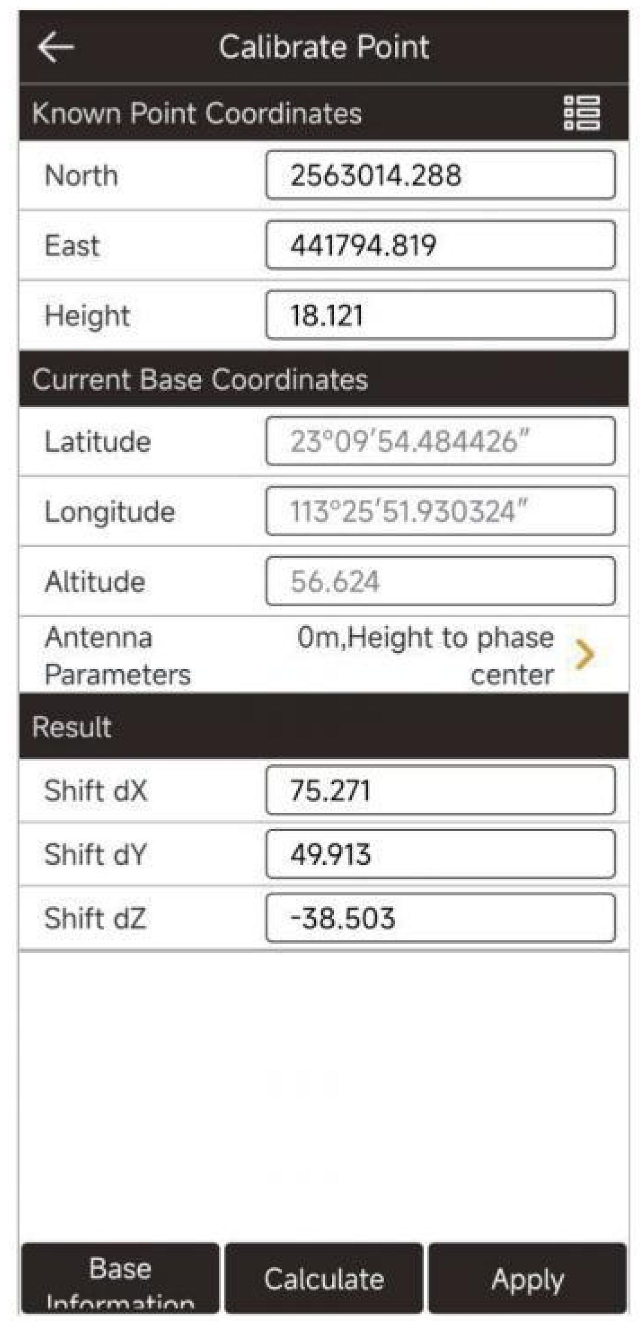


Figure 3.13-2

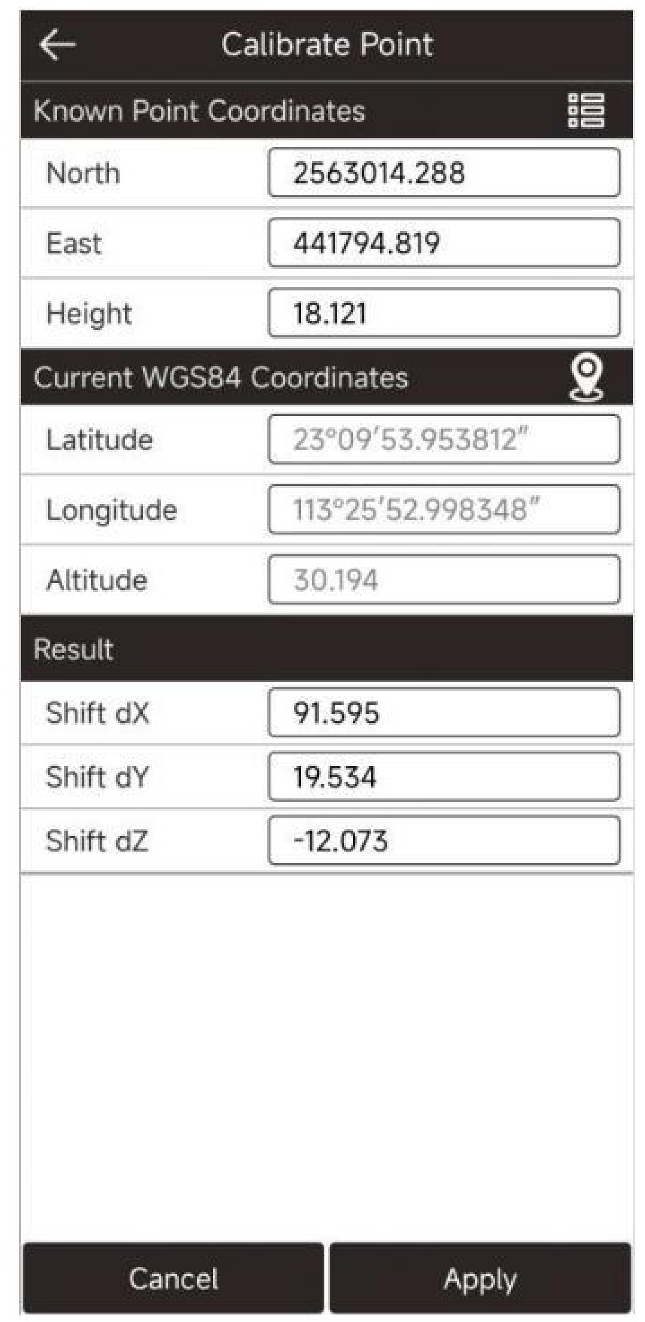


Figure 3.13-3

3.14 Points Database

Click [Project]-> [Points Database], as shown in Figure 3.14- 1. Here you can view and manage the point data in the project, including adding, editing, deleting, and importing.

Click the upper right corner , as shown in Figure 3.14-2 , to switch the display style of point information.

Click [Add], as shown in Figure 3.14-3, to manually enter the point name, code and corresponding coordinates;

Click [Import], as shown in Figure 3.14-4, select the file format of the point data to be imported, and then select the data file to complete the data import.

Select the coordinate point and click [Edit], as shown in Figure 3.14-5, you can edit and modify the name and code of the coordinate point;

Click the upper right corner , as shown in Figure 3.14-6 , to filter the point type.

Click the upper right corner and an operation pop-up will appear, as shown in Figure 3.14-1. You can perform batch deletion, data statistics, sorting and other functions as needed.

Figure 3.14-1

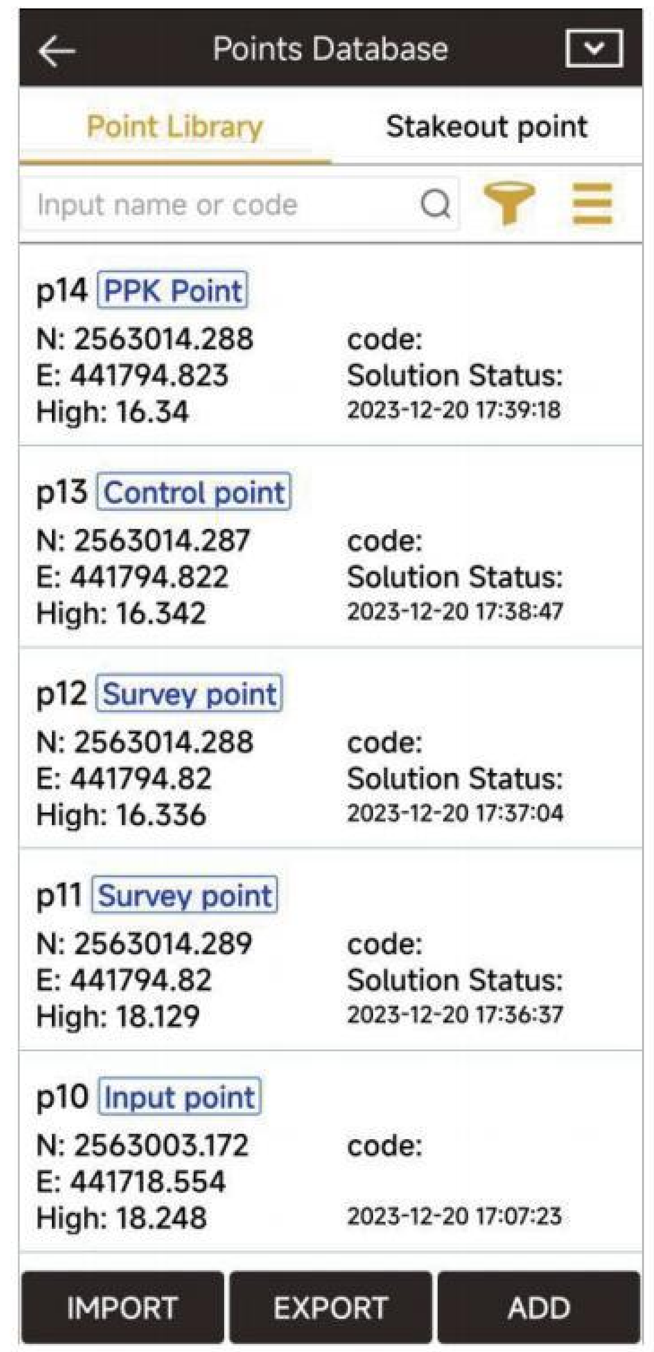


Figure 3.14-2

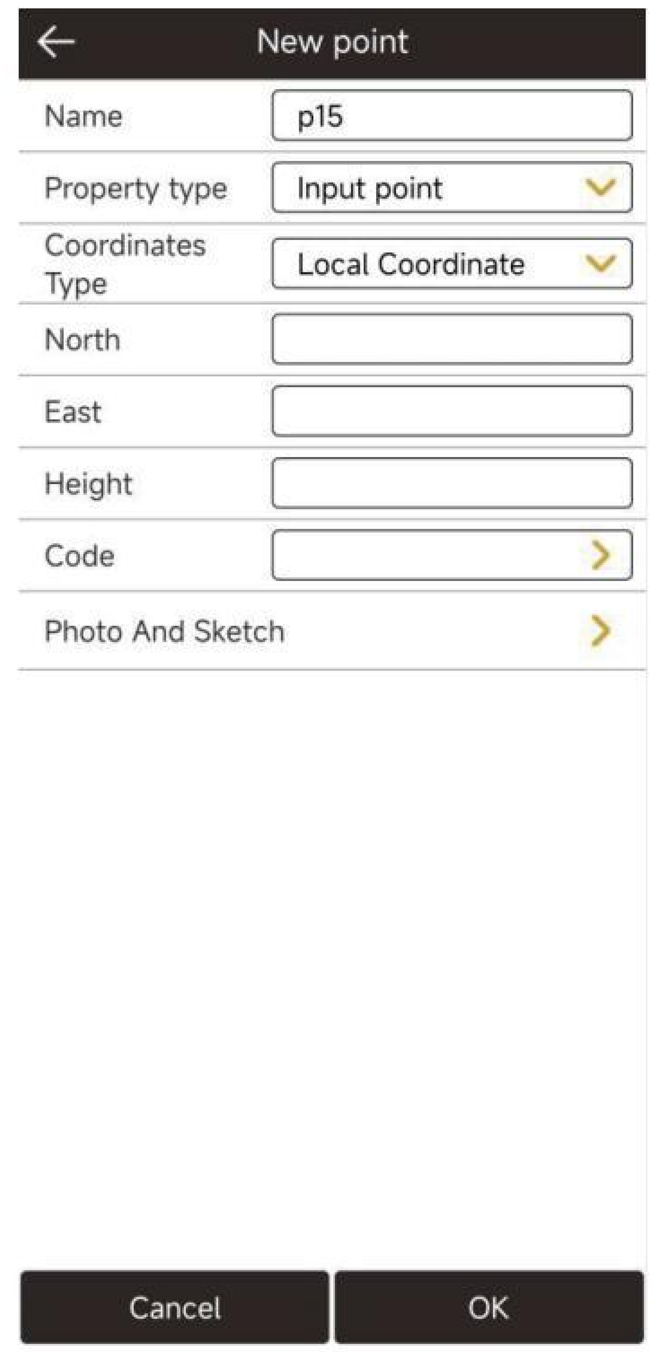


Figure 3.14-3

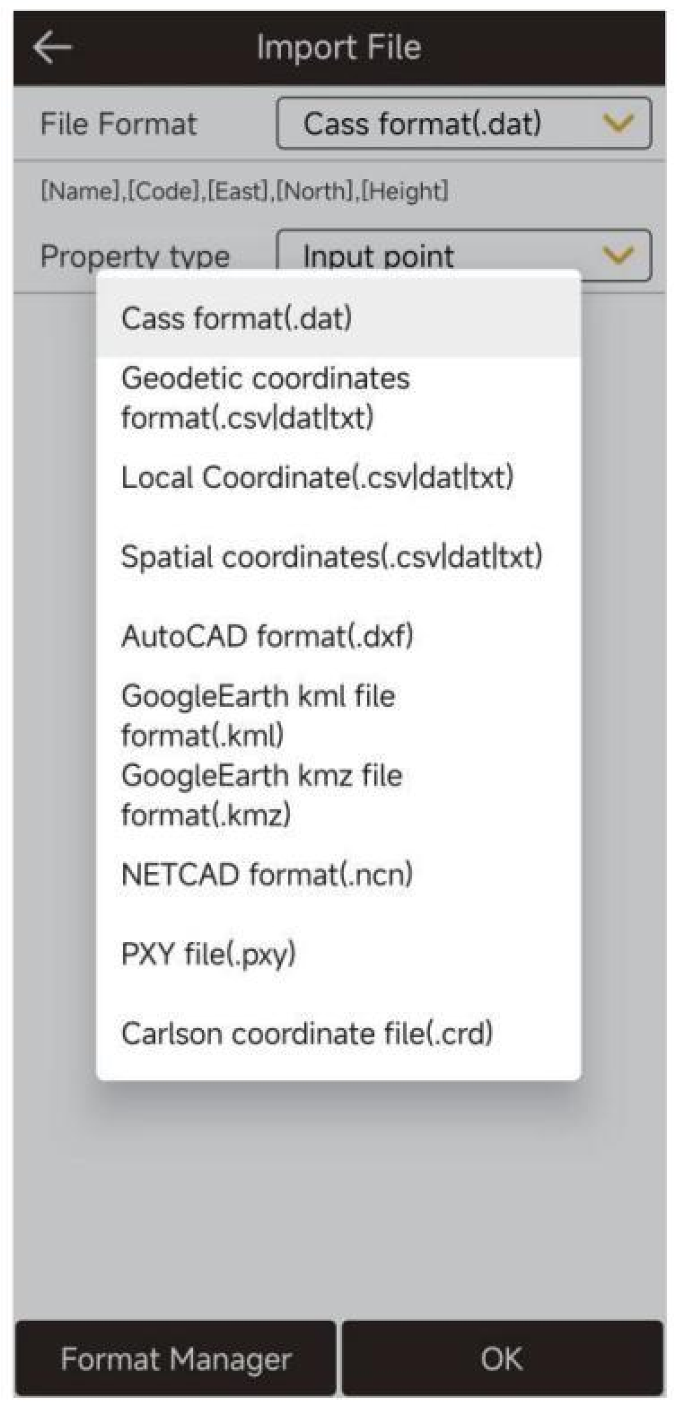


Figure 3.14-4

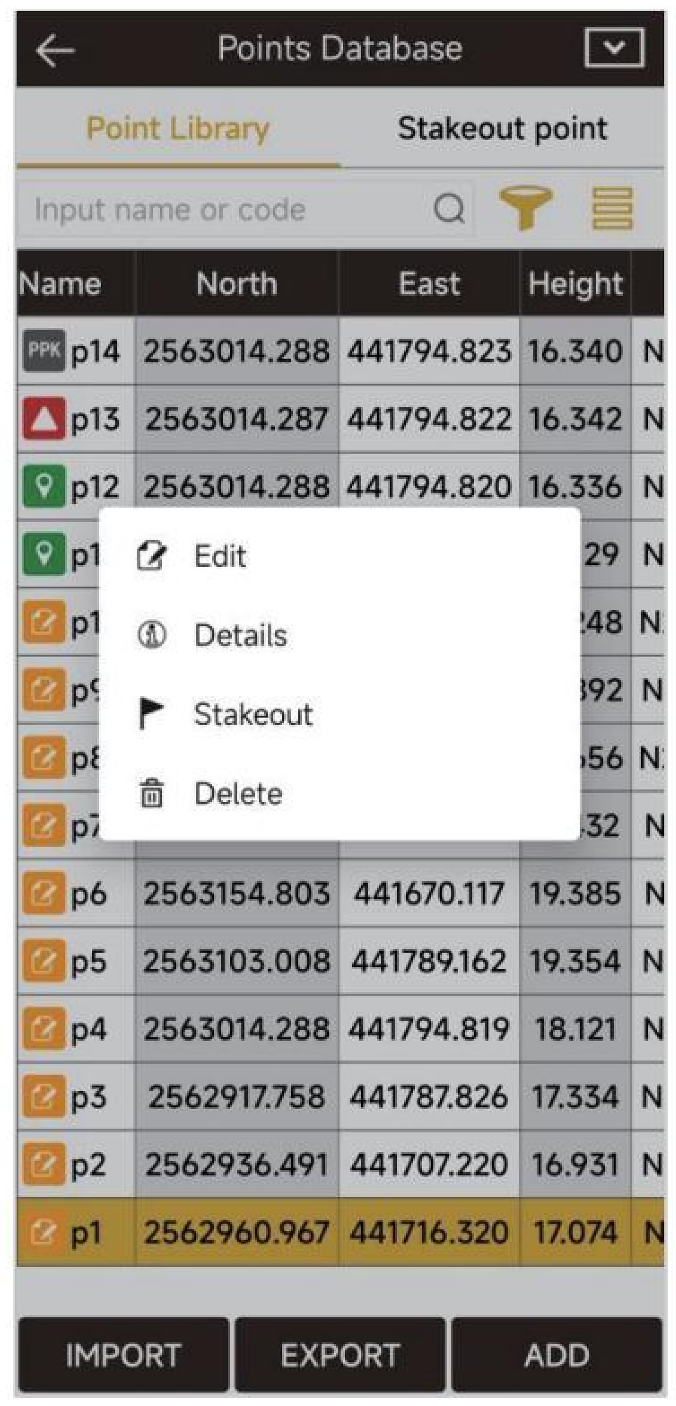


Figure 3.14-5

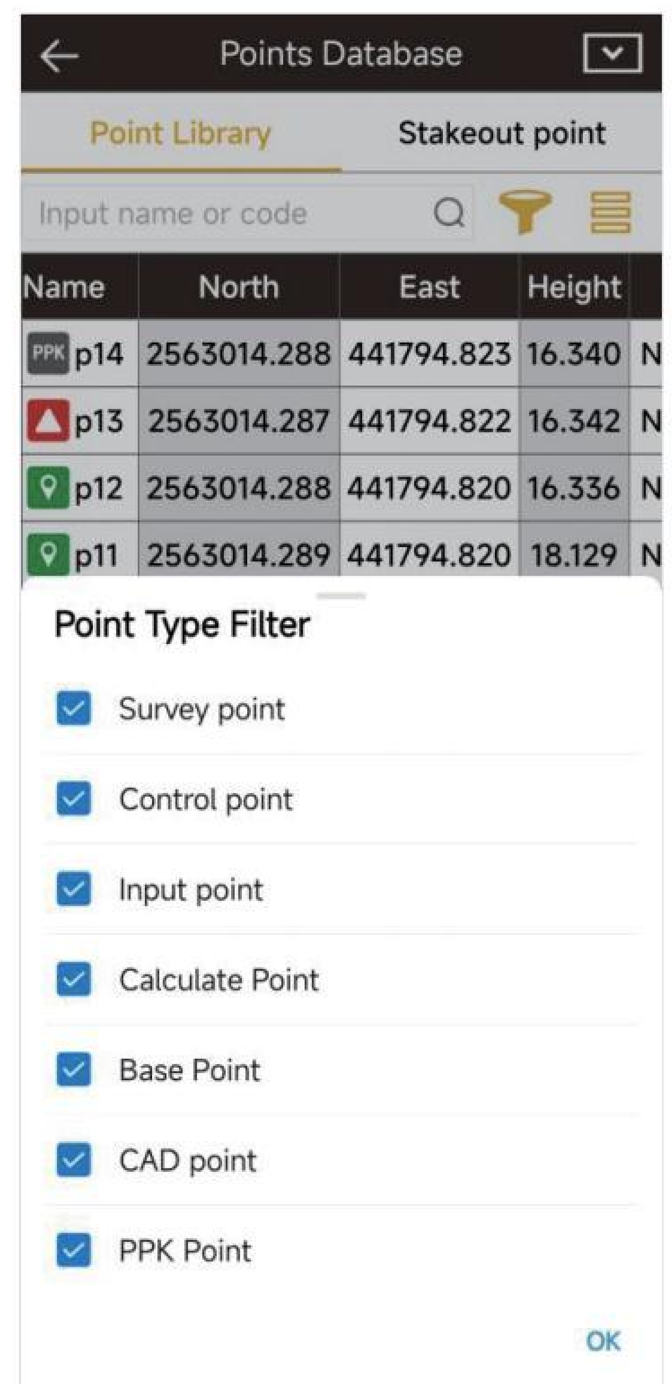


Figure 3.14-6

3.15 Export

Click [Project]-> [Export File], as shown in Figure 3.15-1, and select the type, file format, and angle format of the exported data as needed. Click [Format Manager], as shown in Figure 3.15-2, select the file format of the data to be exported, and click [OK]. Click [User-defined Format], as shown in Figure 3.15-3, and you can manually create and edit the file format of the exported data.

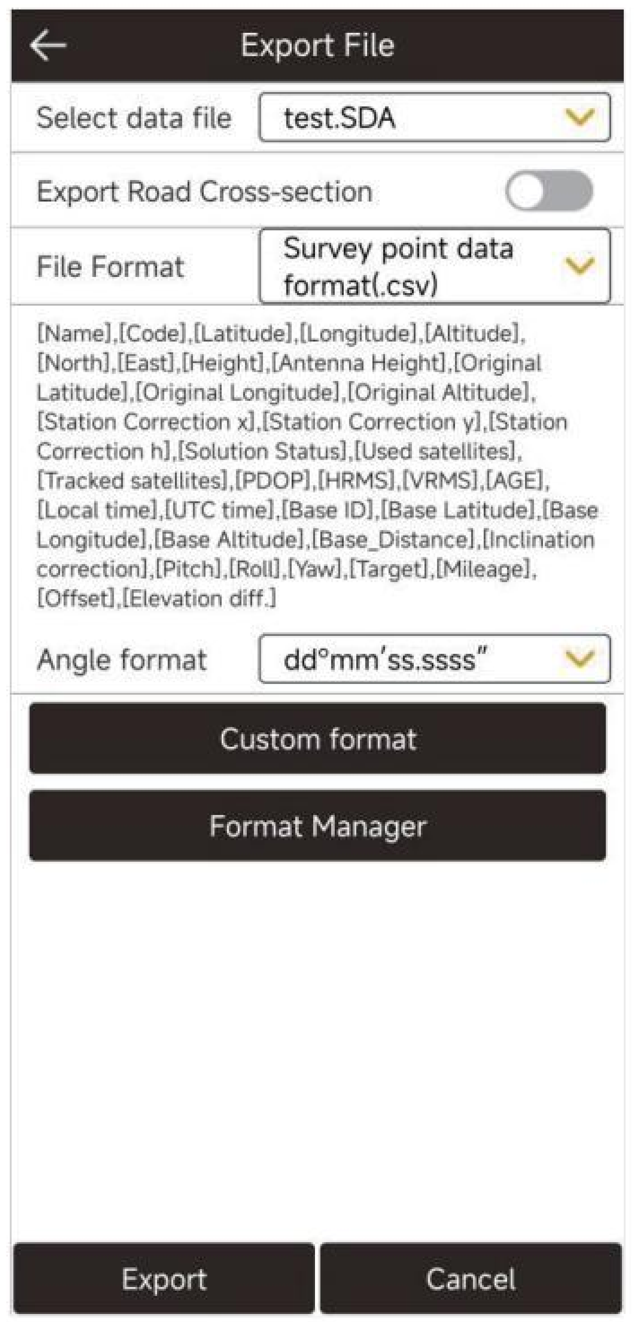


Figure 3.15-1

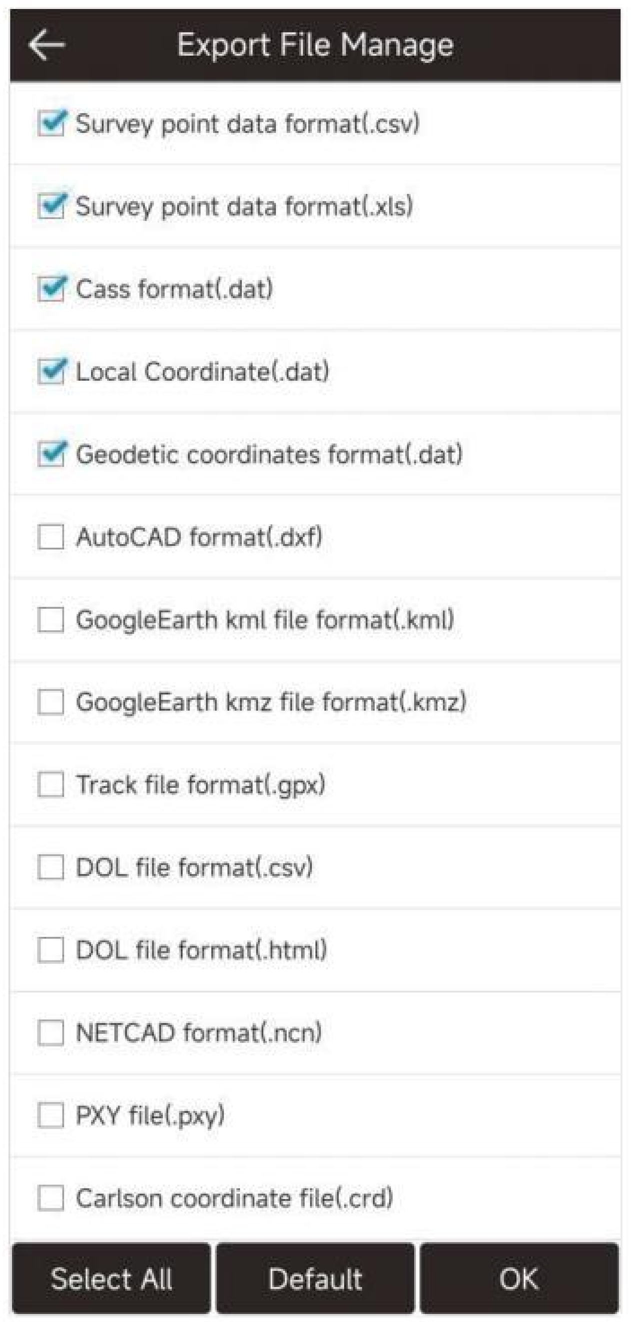


Figure 3.15-2

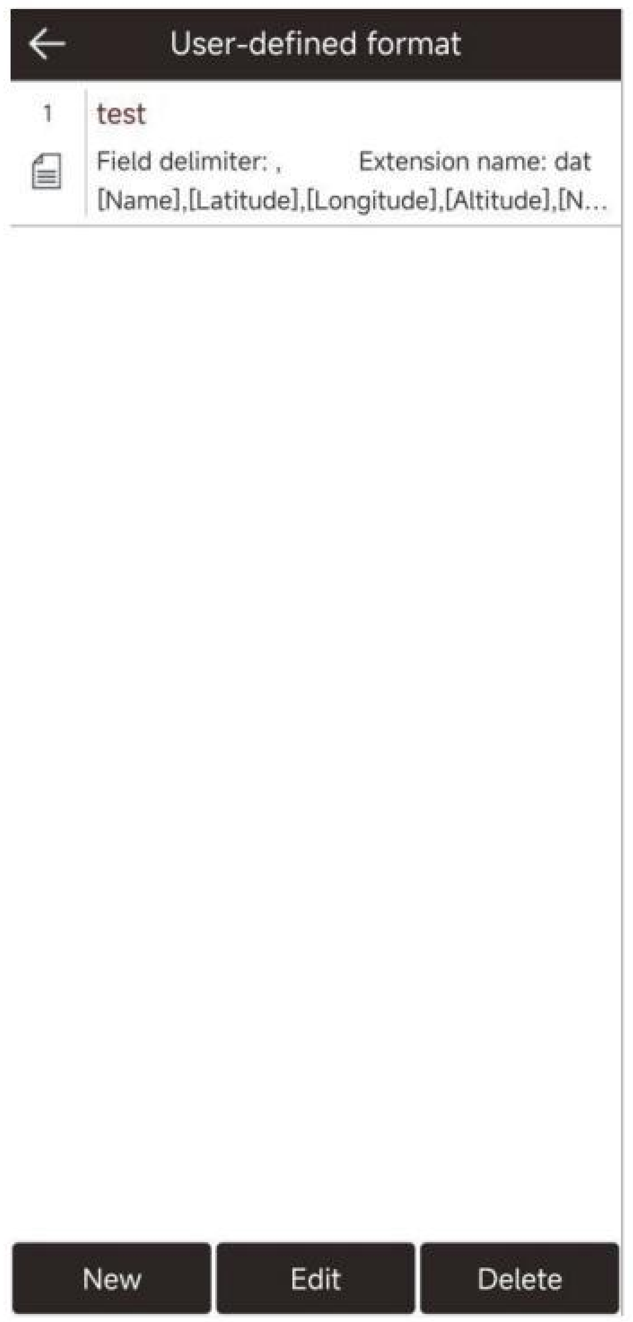


Figure 3.15-3

3.16 Device Information

Click [Device]-> [Device Information], as shown in Figure 3.16, to view basic information such as the GNSS device's working mode, device serial number, Firmware Version, Battery Power, expiry date, Satellites System, Antenna Parameters, etc.

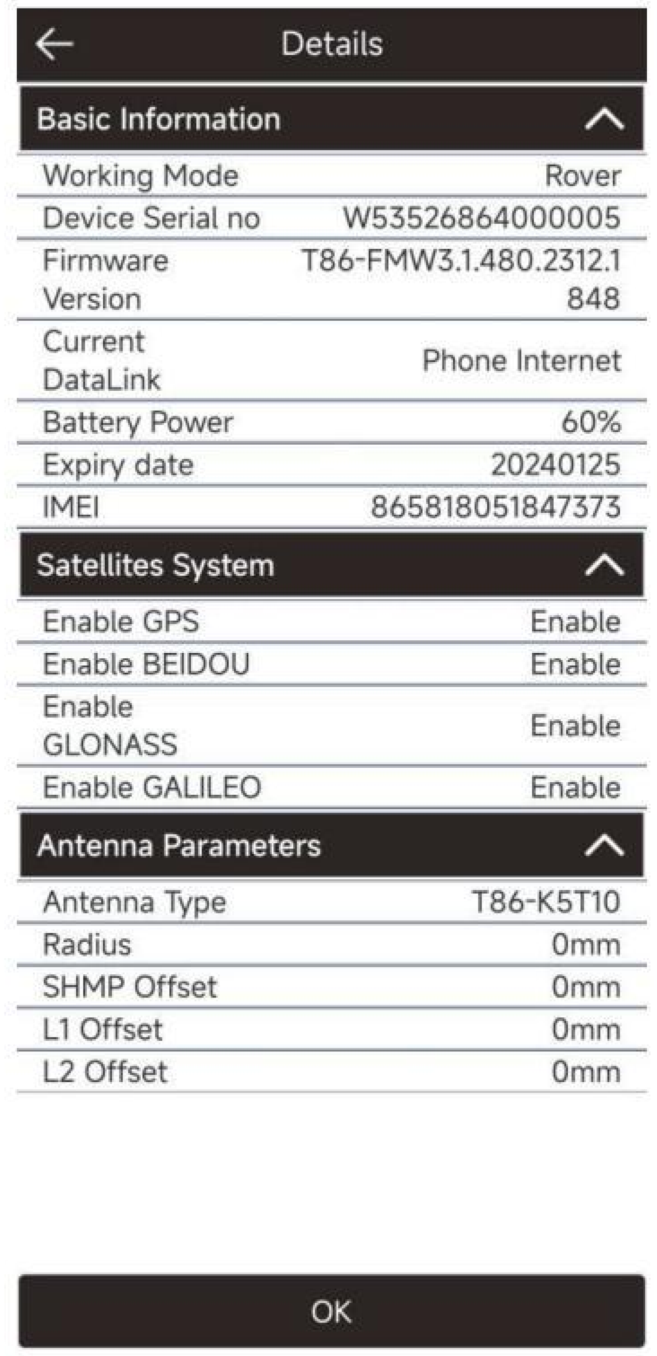


Figure 3.16

4. Device and Software Activation

4.1 Device Activation

Click [Device] -> [Device Activation], as shown in Figure 4.1, to view the device serial number and expiry date. If the GNSS device has expired, you can obtain the registration code from the dealer and authorize the device here.

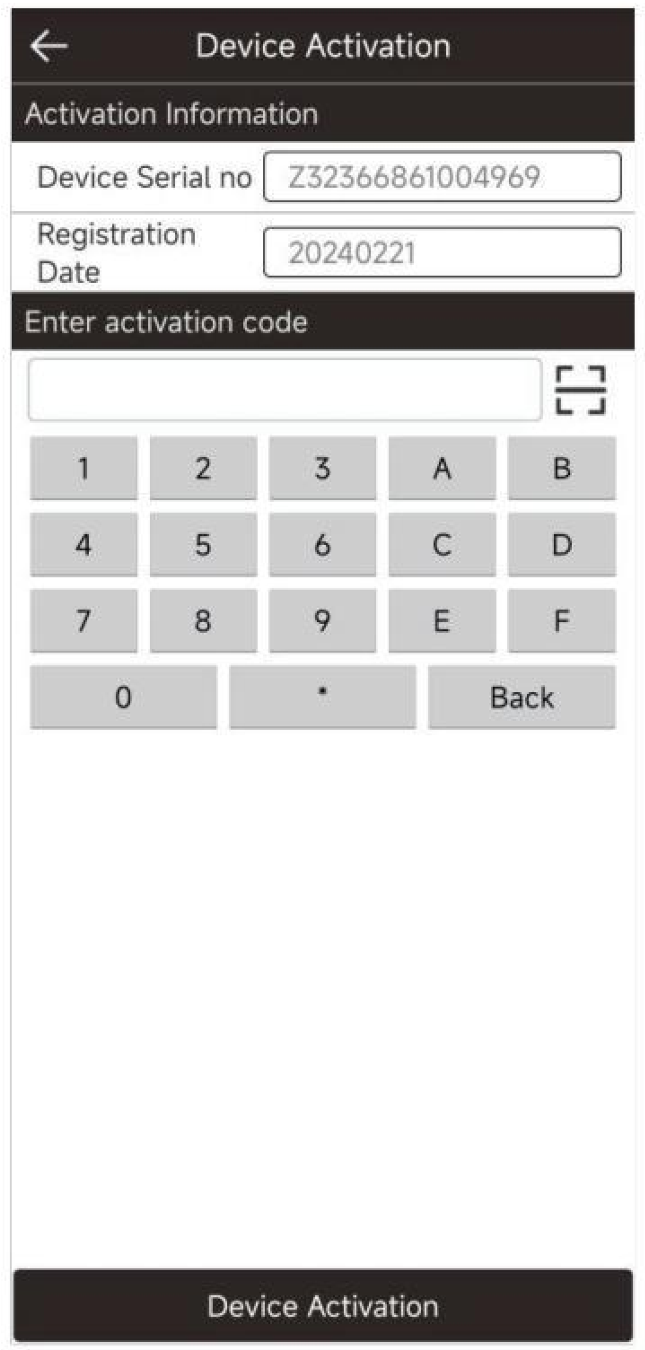


Figure 4.1

4.2 Software Activation

Click [Project]-> [About Software], as shown in Figure 4.2-1, to view the software version information and registration authorization information.

Click [Check for new versions], if there is a new version, the new version update information will pop up, click [Update] to update the software to the latest version. If there is no new version, it will prompt that it is already the latest version.

Click [Software Registration] to jump to the software registration interface, as shown in Figure 4.2-2, to view the activation ID and expiry date.

When you install the software for the first time, click [Online Activation] to activate it for three months of free trial.

Click [Manual Code Activation], as shown in Figure 4.2-3, enter the authorization code here or scan the QR code of the authorization code to activate the software.

If you need to replace a new controller, you can click [Transfer activation code] in the old controller, then enter the software registration of the new controller and enter the transferred activation code to activate the software.

Figure 4.2-1

Figure 4.2-2

Figure 4.2-3

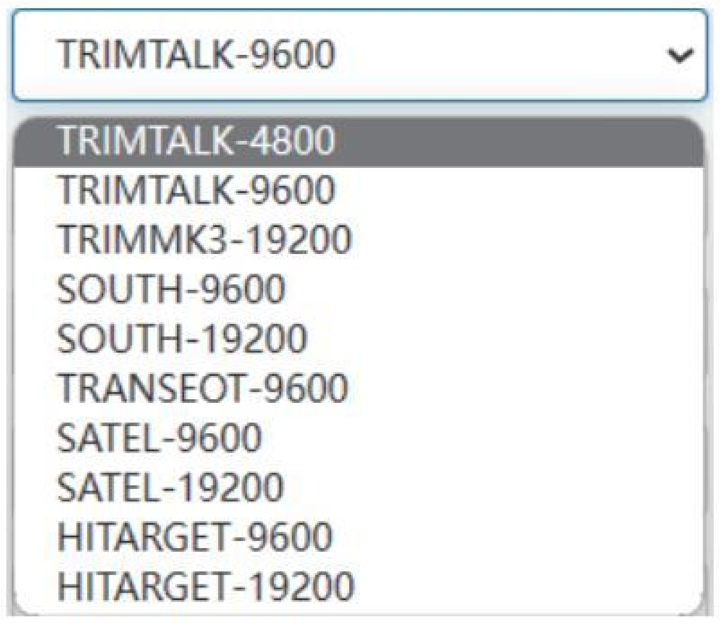
5. Built-in radio

SP30Pro is equipped with a 5Watt digital radio that supports integrated transmission and reception. Users can choose three power levels: low power (1W), medium power (2W), and high power (5W).

Note: Each time you set the data link to the built-in radio, you need to install the radio antenna in advance. Please open the UHF radio cover on the top of the hood and then install it.

5.1 Radio Protocol

The device currently supports the following 10 radio protocols, which you can adjust it according to your needs.



5.2 Default Channel Frequency

The device has 16 default channel frequencies, and the frequency of each channel supports custom configuration modification.

Aisle	Frequency/MHz
1	463.125
2	464.125
3	465.125
4	466.125
5	463.625
6	464.625
7	465.625
8	466.625
9	463.375
10	464.375
11	465.375
12	466.375
13	463.875
14	464.875
15	465.875
16	466.875

6.Specifications

ITEM		SPECIFICATION	REMARKS
HARDWARE SYSTEM		ARM Cortex-A7	
OS		Linux	
GNSS	GPS	L1C/A, L1C, L2P(Y), L2C, L5	Support PPP-B2b Support PPP-E6 Support SBAS
	GLONASS	L1, L2, L3	
	BDS	B1I, B2I, B3I, B1C, B2a, B2b	
	GALILEO	E1, E5a, E5b, E6	
	QZSS	L1, L2, L5	
	SBAS	L1	
	NavIC(IRNSS)*	L5*	Requires latest firmware support
	Channel	1408 channels	
	Data format	NMEA-0183	
	Correction I / O Protocol	RTCM3.X	
	Data update frequency	20Hz	
	Recapture Time	<1s	
	Cold Boot	<40s	
POSITIONING ACCURACY	Single(RMS)	Horizontal: 1.5m; Vertical: 2.5m	
	DGPS(RMS)	Horizontal: 0.4m; Vertical: 0.8m	
	RTK(RMS)	Horizontal: ±(8mm+1ppm); Vertical: ±(15mm+1ppm)	
	Time Accuracy(RMS)	20ns	
	Static Accuracy(RMS)	Horizontal: ±(2.5mm+0.5ppm); Vertical: ±(5mm+0.5ppm)	
	Speed Accuracy(RMS)	0.03m/s	
	Tilt compensation Accuracy (within 60°)	<2cm	
SYSTEM	Bluetooth	BR+EDR+BLE	
	WIFI	802.11 b/g/n	
	Network	LTE FDD: B1/2/3/4/5/7/8/12/13/18/19/20/25/26/28 LTE TDD: B38/39/40/41 WCDMA: B1/2/4/5/6/8/19 GSM: B2/3/5/8	
	Data Radio	Transceiver station Frequency: 410~470MHz Power: 1W/2W/5W Air baud rate: 9600, 19200bps Protocol: TRIMTALK, TRIMMK3, SOUTH,TRANSEOT	
	Storage	32GB	
	AR Camera	Support AR real scene stakeout Sensor Size: 1/2.8 inch Aperture: f/2.5 Pixel: 1920*1080 Angle of view: 69.3°±3° Distortion: <0.38%	
SYSTEM	IS Camera	Support Image Surveying Sensor Size: 1/2.6 inch Focal Distance: 3.27mm Aperture: f/2.8 Pixel: 1920*1080 Angle of view: 83*72*51 Distortion: <0.5%	
INDICATOR	Power Indicator	Show power status	
	Satellite Indicator	Show position status	
	Bluetooth Indicator	Lights up when Bluetooth is connected	
	Data link Indicator	Show differential signal status	
BATTERY	Battery	7.4V, 10000mAh	TBD
	Battery Endurance	More than 24 hours(In Phone network data link mode)	TBD
	Charge	Support USB PD 12v/2A, USB DCP 5V/3A Support external power supply 9~24VDC	
ENVIRONMENT	Working Temperature	-20°C~+60°C	
	Storage Temperature	-20°C~+70°C	
	Shock	Resistant to 1.5m drop with pole at room temperature	
	Protection	IP68	
PHYSICAL	Material	Magenesium alloy main body +ABS/PC plastic top cover	
	Dimension(mm)	Φ145.7*93.6	
	Weight(g)	1000	TBD

▲ *Manufacturers may update parameters at any time, please refer to the latest product information.*

Frequencies and Emission Power for the Bluetooth/ Wi-Fi/LTE/WCDAMA/GSM

EDR

4.4 Channel List

CH	Frequency (MHz)	CH	Frequency (MHz)	CH	Frequency (MHz)	CH	Frequency (MHz)
0	2402	1	2403	2	2404	3	2405
4	2406	5	2407	6	2408	7	2409
8	2410	9	2411	10	2412	11	2413
12	2414	13	2415	14	2416	15	2417
16	2418	17	2419	18	2420	19	2421
20	2422	21	2423	22	2424	23	2425
24	2426	25	2427	26	2428	27	2429
28	2430	29	2431	30	2432	31	2433
32	2434	33	2435	34	2436	35	2437
36	2438	37	2439	38	2440	39	2441
40	2442	41	2443	42	2444	43	2445
44	2446	45	2447	46	2448	47	2449
48	2450	49	2451	50	2452	51	2453
52	2454	53	2455	54	2456	55	2457
56	2458	57	2459	58	2460	59	2461
60	2462	61	2463	62	2464	63	2465
64	2466	65	2467	66	2468	67	2469
68	2470	69	2471	70	2472	71	2473
72	2474	73	2475	74	2476	75	2477
76	2478	77	2479	78	2480	79	/

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting (GFSK/Π/4DQPSK/8DPSK)	2402MHz	2441MHz	2480MHz
Receiving (GFSK/Π/4DQPSK/8DPSK)	2402MHz	2441MHz	2480MHz

6.4 Test Result

Modulation	Test conditions (Temperature)	EIRP (dBm) Hopping mode
GFSK	Normal	5.61
	Lower	5.64
	Upper	5.59
π/4DQPSK	Normal	4.67
	Lower	4.22
	Upper	4.46
8DPSK	Normal	5.79
	Lower	5.71
	Upper	5.5
Limit		≤100mW (20dBm)
Remark: P = A + G + Y,G=1dBi,x=100%		

Remark: This Report only show the test plots of the worst case.

BLE

4.4 Channel List

CH No.	Frequency (MHz)	CH No.	Frequency (MHz)	CH No.	Frequency (MHz)	CH No.	Frequency (MHz)
0	2402	1	2404	2	2406	3	2408
4	2410	5	2412	6	2414	7	2416
8	2418	9	2420	10	2422	11	2424
12	2426	13	2428	14	2430	15	2432
16	2434	17	2436	18	2438	19	2440
20	2442	21	2444	22	2446	23	2448
24	2450	25	2452	26	2454	27	2456
28	2458	29	2460	30	2462	31	2464
32	2466	33	2468	34	2470	35	2472
36	2474	37	2476	38	2478	39	2480

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting(GFSK)	2402MHz	2440MHz	2480MHz
Receiving(GFSK)	2402MHz	2440MHz	2480MHz

6.4 Test Result

Modulation	Test conditions (Temperature)	EIRP (dBm)		
		Low Channel	Middle Channel	High Channel
GFSK	Normal	-3.83	-3.09	**-2.49**
	Low	-3.85	-3.26	-2.68
	High	-3.93	-3.14	-2.58
Limit		≤100mW (20dBm)		
Remark: P = A + G + Y,G=1dBi,x=100%				

Remark: This Report only show the test plots of the worst case.

2.4G WIFI

4.4 Channel List

CH	Frequency (MHz)	CH	Frequency (MHz)	CH	Frequency (MHz)	CH	Frequency (MHz)
1	2412	2	2417	3	2422	4	2427
5	2432	6	2437	7	2442	8	2447
9	2452	10	2457	11	2462	12	2467
13	2472						

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting(802.11b/g/n20)	2412MHz	2442MHz	2472MHz
Transmitting(802.11n40)	2422MHz	2442MHz	2462MHz
Receiving(802.11b/g/n20)	2412MHz	2442MHz	2472MHz
Receiving(802.11n40)	2422MHz	2442MHz	2462MHz

6.4 Test Result

Modulation	Test conditions (Temperature)	EIRP (dBm)		
		Low Channel	Middle Channel	High Channel
802.11b	Normal	13.35	12.74	13.18
	Lower	13.11	12.74	12.41
	Upper	12.36	11.89	12.40
802.11g	Normal	13.19	12.72	13.09
	Lower	12.73	12.35	12.68
	Upper	12.70	11.49	12.59
802.11n(HT20)	Normal	13.26	12.86	13.54
	Lower	12.51	12.71	12.89
	Upper	12.05	12.58	12.01
802.11n(HT40)	Normal	12.35	12.35	12.90
	Lower	12.32	11.89	12.15
	Upper	11.55	11.05	11.34
Limit		≤100mW (20dBm)		
Remark: P = A + G + Y, G=1dBi, x=100%				

4G

4.4 Channel List

N/A

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test Mode	Test Frequency	Bandwidth (MHz)	Number [UL]	Frequency of Uplink(MHz)	Number [DL]	Frequency of Downlink(MHz)
FDD band 1 TX 1920 – 1980 MHz RX 2110 – 2170 MHz	Low Range	5	18025	1922.5	25	2112.5
		10	18050	1925	50	2115
		15	18075	1927.5	75	2117.5
		20	18100	1930	100	2120
	Mid Range	5/10/15/20	18300	1950	300	2140
	High Range	5	18575	1977.5	575	2167.5
		10	18550	1975	550	2165
		15	18525	1972.5	525	2162.5
		20	18500	1970	500	2160

Test Mode	Test Frequency	Bandwidth (MHz)	Number [UL]	Frequency of Uplink(MHz)	Number [DL]	Frequency of Downlink(MHz)
FDD band 3 TX 1710 – 1785 MHz RX 1805 – 1880 MHz	Low Range	1.4	19207	1710.7	1207	1805.7
		3	19215	1711.5	1215	1806.5
		5	19225	1712.5	1225	1807.5
		10	19250	1715	1250	1810
		15	19275	1717.5	1275	1812.5
		20	19300	1720	1300	1815
	Mid Range	1.4/3/5/10/15/20	19575	1747.5	1575	1842.5
	High Range	1.4	19943	1784.3	1943	1879.3
		3	19935	1783.5	1935	1878.5
		5	19925	1782.8	1925	1877.5
		10	19900	1780	1900	1875
		15	19875	1777.5	1875	1872.5
		20	19850	1775	1850	1870

Test Mode	Test Frequency	Bandwidth (MHz)	Number [UL]	Frequency of Uplink(MHz)	Number [DL]	Frequency of Downlink(MHz)
FDD band 7 TX 2500 – 2570 MHz RX 2620 – 2690 MHz	Low Range	5	20775	2502.5	2775	2622.5
		10	20800	2505	2800	2625
		15	20825	2507.5	2825	2627.5
		20	20850	2510	2850	2630
	Mid Range	5/10/15/20	21100	2535	3100	2655
	High Range	5	21425	2567.5	3425	2687.5
		10	21400	2565	3400	2685
		15	21375	2562.5	3375	2682.5
		20	21350	2560	3350	2680

Test Mode	Test Frequency	Bandwidth (MHz)	Number [UL]	Frequency of Uplink(MHz)	Number [DL]	Frequency of Downlink(MHz)
FDD band 8 TX 880 – 915 MHz RX 925 – 960 MHz	Low Range	1.4	21457	880.7	3457	925.7
		3	21465	881.5	3465	926.5
		5	21475	882.5	3475	927.5
		10	21500	885	3500	930
	Mid Range	1.4/3/5/10	21625	897.5	3625	942.5
	High Range	1.4	21793	914.3	3793	959.3
		3	21785	913.5	3785	958.5
		5	21775	912.5	3775	957.5
		10	21750	910	3750	955

Test Mode	Test Frequency	Bandwidth (MHz)	Number [UL]	Frequency of Uplink(MHz)	Number [DL]	Frequency of Downlink(MHz)
FDD band 20 TX 832 –862 MHz RX 791 – 821 MHz	Low Range	5	24175	834.5	6175	793.5
		10	24200	837	6200	796
		15	24225	839.5	6225	798.5
		20	24250	842	6250	801
	Mid Range	510/15/20	24300	847	6300	806
	High Range	5	24425	859.5	6425	818.5
		10	24400	857	6400	816
		15	24375	854.5	6375	813.5
		20	24350	852	6350	811

Test Mode	Test Frequency	Bandwidth (MHz)	Number [UL]	Frequency of Uplink(MHz)	Number [DL]	Frequency of Downlink(MHz)
FDD band 28 TX 703 – 748 MHz RX 758 – 803 MHz	Low Range	5	27385	702.5	9385	775.5
		10	27410	723	9410	778
	Mid Range	5/10	27510	733	9510	788
	High Range	5	27635	745.5	9635	800.5
		10	27610	743	9610	798

Test Mode	Test Frequency ID	Bandwidth (MHz)	Number [UL and DL]	Frequency (UL and DL) (MHz)
FDD band 38 TX 2570 – 2620 MHz RX 2570 – 2620 MHz	Low Range	5	37775	2572.5
		10	37800	2575
		15	37825	2577.5
		20	37850	2580
	Mid Range	5/10/15/20	38000	2595
	High Range	5	38225	2617.5
		10	38200	2615
		15	38175	2612.5
		20	38150	2610

Test Mode	Test Frequency ID	Bandwidth (MHz)	Number [UL]	Frequency of Uplink(MHz)
LTE band 40 TX 2300 – 2340 MHz RX 2300 – 2340 MHz	Low Range	5	38675	2302.5
		10	38700	2305
		15	38725	2307.5
		20	38750	2310
	Mid Range	5/10/15/20	39150	2350
	High Range	5	39625	2397.5
		10	39600	2395
		15	39575	2392.5
		20	39550	2390

3G

4.4 Channel List

N/A

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
WCDMA (FDD band I)	Tx	Channel 9613	Channel 9750	Channel 9887
	（1920 MHz ~1980 MHz）	1922.6MHz	1950.0 MHz	1977.4 MHz
	Rx	Channel 10563	Channel 10700	Channel 10837
	（2110 MHz ~2170 MHz）	2112.6 MHz	2140.0 MHz	2167.4MHz
WCDMA (FDD band VIII)	Tx	Channel 2713	Channel 2788	Channel 2862
	（880 MHz ~915 MHz）	882.6MHz	897.6MHz	912.4MHz
	Rx	Channel 2938	Channel 3013	Channel 3087
	（925 MHz ~960 MHz）	927.6MHz	942.6MHz	957.4MHz

6.5Measurement Record

Operating Band	Test Conditions	Test Channel	Measurement Data(dBm)	Limit(dBm)	Result
Band I	TNVN	LCH	22.91	24(+1.7/-3.7)	Pass
		MCH	22.96	24(+1.7/-3.7)	Pass
		HCH	22.98	24(+1.7/-3.7)	Pass
	TLVL	LCH	22.85	24(+1.7/-3.7)	Pass
		MCH	22.91	24(+1.7/-3.7)	Pass
		HCH	22.97	24(+1.7/-3.7)	Pass
	TLVH	LCH	22.90	24(+1.7/-3.7)	Pass
		MCH	22.95	24(+1.7/-3.7)	Pass
		HCH	22.94	24(+1.7/-3.7)	Pass
	THVL	LCH	22.81	24(+1.7/-3.7)	Pass
		MCH	22.82	24(+1.7/-3.7)	Pass
		HCH	22.91	24(+1.7/-3.7)	Pass
	THVH	LCH	22.74	24(+1.7/-3.7)	Pass
		MCH	22.86	24(+1.7/-3.7)	Pass
		HCH	22.82	24(+1.7/-3.7)	Pass

Operating Band	Test Conditions	Test Channel	Measurement Data(dBm)	Limit(dBm)	Result
Band VIII	TNVN	LCH	22.67	24(+1.7/-3.7)	Pass
		MCH	22.85	24(+1.7/-3.7)	Pass
		HCH	23.09	24(+1.7/-3.7)	Pass
	TLVL	LCH	22.48	24(+1.7/-3.7)	Pass
		MCH	22.76	24(+1.7/-3.7)	Pass
		HCH	22.90	24(+1.7/-3.7)	Pass
	TLVH	LCH	22.54	24(+1.7/-3.7)	Pass
		MCH	22.72	24(+1.7/-3.7)	Pass
		HCH	23.07	24(+1.7/-3.7)	Pass
	THVL	LCH	22.64	24(+1.7/-3.7)	Pass
		MCH	22.84	24(+1.7/-3.7)	Pass
		HCH	23.07	24(+1.7/-3.7)	Pass
	THVH	LCH	22.61	24(+1.7/-3.7)	Pass
		MCH	22.81	24(+1.7/-3.7)	Pass
		HCH	23.06	24(+1.7/-3.7)	Pass

11.5Measurement Record

Operating Band	Test Conditions	Test Channel	Measurement Data(dBm)	Limit(dBm)	Result
Band I	TNVN	LCH	-56.05	-49	Pass
		MCH	-55.41	-49	Pass
		HCH	-55.48	-49	Pass
	TLVL	LCH	-56.11	-49	Pass
		MCH	-55.52	-49	Pass
		HCH	-55.51	-49	Pass
	TLVH	LCH	-56.07	-49	Pass
		MCH	-55.57	-49	Pass
		HCH	-55.65	-49	Pass
	THVL	LCH	-56.22	-49	Pass
		MCH	-55.50	-49	Pass
		HCH	-55.64	-49	Pass
	THVH	LCH	-56.23	-49	Pass
		MCH	-55.60	-49	Pass
		HCH	-55.49	-49	Pass

Operating Band	Test Conditions	Test Channel	Measurement Data(dBm)	Limit(dBm)	Result
Band VIII	TNVN	LCH	-57.54	-49	Pass
		MCH	-57.79	-49	Pass
		HCH	-57.71	-49	Pass
	TLVL	LCH	-57.58	-49	Pass
		MCH	-57.83	-49	Pass
		HCH	-57.87	-49	Pass
	TLVH	LCH	-57.57	-49	Pass
		MCH	-57.86	-49	Pass
		HCH	-57.83	-49	Pass
	THVL	LCH	-57.62	-49	Pass
		MCH	-57.84	-49	Pass
		HCH	-57.74	-49	Pass
	THVH	LCH	-57.59	-49	Pass
		MCH	-57.91	-49	Pass
		HCH	-57.78	-49	Pass

2G

4.4 Channel List

N/A

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
E-GSM900	Tx (880 MHz ~915 MHz)	Channel 975	Channel 37	Channel 124
		880.2MHz	897.4MHz	914.8MHz
	Rx (925 MHz ~960 MHz)	Channel 975	Channel 62	Channel 124
		925.2MHz	947.4MHz	959.8MHz
DCS1800	Tx (1710 MHz ~1785 MHz)	Channel 512	Channel 700	Channel 885
		1710.2MHz	1747.8MHz	1784.8MHz
	Rx (1805 MHz ~1880 MHz)	Channel 513	Channel 698	Channel 884
		1805.4MHz	1842.4MHz	1879.6MHz

10.4Test Procedure

a) Measurement of normal burst transmitter output power.

-The SS takes power measurement samples evenly distributed over the duration of one burst with a sampling rate of at least 2/T, where T is the bit duration. The samples are identified in time with respect to the modulation on the burst. The SS identifies the centre of the useful 147 transmitted bits, i.e. the transition from bit 13 to bit 14 of the mid amble, as the timing reference.

- The transmitter output power is calculated as the average of the samples over the 147 useful bits. This is also used as the 0 dB reference for the power/time template.

b) Measurement of normal burst timing delay.

- The burst timing delay is the difference in time between the timing reference identified in a) and the corresponding transition in the burst received by the MS immediately prior to the MS transmit burst sampled.

c) Measurement of normal burst power/time relationship.

- The array of power samples measured in a) are referenced in time to the centre of the useful transmitted bits and in power to the 0 dB reference, both identified in a).

d) Steps a) to c) are repeated with the MS commanded to operate on each of the power control levels defined, even those not supported by the MS.

e) The SS commands the MS to the maximum power control level supported by the MS and steps a) to c)are repeated for ARFCN in the Low and High ranges.

f) Measurement of access burst transmitter output power.

- The SS causes the MS to generate an Access Burst on an ARFCN in the Mid ARFCN range, this could be either by a handover procedure or a new request for radio resource. In the case of a handover procedure the Power Level indicated in the HANDOVER COMMAND message is the maximum power control level supported by the MS. In the case of an Access Burst the MS shall use the Power Level indicated in the MS_TXPWR_MAX_CCH parameter. If the power class of the MS is DCS 1 800 Class 3, the MS shall also use the POWER_OFFSET parameter.

- The SS takes power measurement samples evenly distributed over the duration of the access burst as described in a). However, in this case the SS identifies the centre of the useful bits of the burst by identifying the transition from the last bit of the synch sequence. The centre of the burst is then five data bits prior to this point and is used as the timing reference.

- The transmitter output power is calculated as the average of the samples over the 87 useful bits of the burst. This is also used as the 0 dB reference for the power/time template.

g) Measurement of access burst timing delay.

- The burst timing delay is the difference in time between the timing reference identified in f) and the MS received data on the common control channel.

h) Measurement of access burst power/time relationship.

- The array of power samples measured in f) are referenced in time to the centre of the useful transmitted bits and in power to the 0 dB reference, both identified in f).

HANDOVER COMMAND with power control level set to 10 or it changes the System Information elements MS_TXPWR_MAX_CCH and for DCS 1 800 the POWER_OFFSET on the serving cell BCCH in order to limit the MS transmit power on the Access Burst to power control level 10 (+23 dBm for GSM 400, GSM 700, GSM 850, and GSM 900 or +10 dBm for DCS 1 800 and PCS 1 900) and then steps f) to h) are repeated.

j) Steps a) to i) are repeated under extreme test conditions (annex 1, TC2.2) except that the repeats at step d) are only performed for power control level 10 and the minimum power control level of the MS.

10.5Measurement Record

N/A

11.4Test Procedure

a) In steps b) to h) the FT is equal to the hop pattern ARFCN in the Mid ARFCN range.

b) The other settings of the spectrum analyzer are set as follows:

- Zero frequency scan;
- Resolution bandwidth: 30 kHz;
- Video bandwidth: 30 kHz;
- Video averaging: may be used, depending on the implementation of the test.

The video signal of the spectrum analyzer is "gated" such that the spectrum generated by at least 40 of the bits 87 to 132 of the burst is the only spectrum measured. This gating may be analogue or numerical,dependent upon the design of the spectrum analyzer. Only measurements during transmitted bursts on the nominal carrier of the measurement are included. The spectrum analyzer averages over the gated period and over 200 or 50 such bursts, using numerical and/or video averaging.

The MS is commanded to its maximum power control level.

c) By tuning the spectrum analyzer centre frequency to the measurement frequencies the power level is measured over 50 bursts at all multiples of 30 kHz offset from FT to < 1 800 kHz.

d) The resolution and video bandwidth on the spectrum analyzer are adjusted to 100 kHz and the measurements are made at the following frequencies:

- on every ARFCN from 1 800 kHz offset from the carrier to the edge of the relevant transmit band for each measurement over 50 bursts;
- at 200 kHz intervals over the 2 MHz either side of the relevant transmit band for each measurement over 50 bursts.

e) The MS is commanded to its minimum power control level. The spectrum analyzer is set again as in b).

f) By tuning the spectrum analyzer centre frequency to the measurement frequencies the power level is measured over 200 bursts at the following frequencies:

FT;

FT + 100 kHz FT - 100 kHz;

FT + 200 kHz FT - 200 kHz;

FT + 250 kHz FT - 250 kHz;

FT + 200 kHz * N FT - 200 kHz * N;

where N = 2, 3, 4, 5, 6, 7, and 8; and FT = RF channel nominal centre frequency.
- Zero frequency scan;
- Resolution bandwidth: 30 kHz;
- Video bandwidth: 100 kHz;
- Peak hold.

The spectrum analyzer gating of the signal is switched off.
The MS is commanded to its maximum power control level.
h) By tuning the spectrum analyzer centre frequency to the measurement frequencies the power level is measured at the following frequencies:
FT + 400 kHz FT - 400 kHz;
FT + 600 kHz FT - 600 kHz;
FT + 1,2 MHz FT - 1,2 MHz;
FT + 1,8 MHz FT - 1,8 MHz;
where FT = RF channel nominal centre frequency.
The duration of each measurement (at each frequency) will be such as to cover at least 10 burst transmissions at FT.
i) Step h) is repeated for power control levels 7 and 11.
j) Steps b), f), g) and h) are repeated with FT equal to the hop pattern ARFCN in the Low ARFCN range except that in step g) the MS is commanded to power control level 11 rather than maximum power.
k) Steps b), f), g) and h) are repeated with FT equal to the hop pattern ARFCN in the High ARFCN range except that in step g) the MS is commanded to power control level 11 rather than maximum power.
l) Steps a) b) f) g) and h) are repeated under extreme test conditions (annex 1, TC2.2). except that at step g) the MS is commanded to power control level 11.

11.5Measurement Record
N/A