

Product Manual

Name : Drone navigation decoy system

Model : _____

drafting : _____

audit : _____

standardisation : _____

countersigning : _____

approval : _____

1、 Product Profile

The UAV navigation deception system is based on navigation satellite signal simulation technology, which works in the working frequency bands of GPS, GLONASS, BDS, Galileo and other GNSS global positioning systems, and broadcasts analogue satellite signals that are identical to real satellite signals through real-time simulation of on-orbit navigation satellite signals. After the UAV receives the analogue satellite signals from the device, it uses the analogue satellite signals for positioning and outputs the corresponding position. A variety of deception methods for drones can be realised, including: heading induction, repulsion, smooth forced landing, fast crash and so on.

2、Function



Picture Show

2.1 Functional indicators

(1) Adopting generative deception jamming, the product calculates in real time the necessary parameters such as GPS, BDS, GLONASS, Galileo signals and other necessary parameters required to be received by the target at the position according to the pre-specified desired target position, constructs the corresponding mathematical simulation model and signal synthesis module, and generates the corresponding navigation satellite deception signals in real time;

Table 2-1 Output frequency information

No.	Type	Frequency and bandwidth(MHz)
fundamental frequency		
1	GPS L1	1575.42±1.023
2	BDS B1	1561.098±2.046
3	GLONASS L1	1602±4.17
4	GPS L2	1227.6±1.023
5	Galileo E1	1575.42±12.276

- (2) It can realise a variety of deception methods for UAVs, including: heading deception, repulsion, smooth forced landing, fast crash, etc;
- (3) It has the ability to receive GPS, BDS, GLONASS, Galileo signals and resolution, and realises the function of star-ground time synchronization and ephemeris acquisition;
- (4) With analogue point static and dynamic track generation function;
- (5) With channel time delay, power and other parameters setting function;
- (6) with ephemeris external refill function;
- (7) With equipment status reporting function;
- (8) With B code / 1PPS signal interface, through the B code / 1PPS external equipment timing;
- (9) Timing indicators: 3-minute timing 500ns
- (10) Support NTP timing function;
- (11) Active defence distance: greater than 2000m, less than 25000m and the distance is adjustable.
- (12) Number of simultaneous luring drones: unlimited
- (13) Effective decoy angle Horizontal: 360°, vertical: 90°.

2.2 Indicators of environmental adaptation

- (1) Working temperature: -40°C ~ +70°C, meeting GJB1621.7A-2006 standard;
- (2) Storage temperature: -45°C ~ +80°C, meet GJB1621.7A-2006 standard;
- (3) Lightning protection: 1.2/50us & 8/20us, differential mode 2kV (2Ω), common mode 4kV (12Ω) & open level, meet IEC61000-4-5 & GB/T17626.5 standards
- (4) Protection grade: IP66

2.3 Product shape, power supply

(1) Product dimensions:

410mm × 330mm × 190mm

(2) Weight: ≤ 13kg

(3) Power input: 220V

3、Using instructions of the upper computer

The main interface of the upper computer is shown in Picture 2.



Picture2

3.1 UDP Settings

The computer running on the host computer may have more than one NIC, such as wireless NIC, virtual NIC, wired NIC, and it is necessary to determine through which NIC the device is connected, the host computer will obtain all the IPs of the local computer when it starts up and display them in the form of a drop-down box in the interface of the "UDP Settings" function, and the above problem can be solved by selecting the IPs of the valid cards to be connected. By selecting the IP of the valid NIC and connecting to it, the above problem can be solved. The "UDP Setting" function interface includes the selection of local IP and local port input, as well as the functions of UDP connecting and

disconnecting, as shown in Picture 3.

UDP设置

本地IP192.168.10.100本地端口8000连接

Picture3

3.2 Device Search

Firstly, make a UDP connection, after successful connection, the "Search" button is enabled, click the "Search" button on the main interface to search for devices. As shown in Picture 4, it is an example of the interface of the searched device, each line is a device, which contains the simple information of the device (device type, IP and MAC address), and for the device type, the content of the satellite type and the number of transmission channels are combined, for example, "GPS(9)/GLO(7)" means that the number of transmission channels are searched for the GPS pseudo-satellite veneer with the number of transmission channels 9 and the GPS pseudo-satellite veneer with the number of transmission channels 7, and the GPS pseudo-satellite veneer with the number of transmission channels 9. For example, "GPS(9)/GLO(7)" in the figure means that the GPS pseudo-satellite veneer with the number of transmission channels 9 and the GLONASS pseudo-satellite veneer with the number of transmission channels 7 are searched.

设备信息

搜索基础信息网络参数

	设备类型	IP地址	MAC地址
1	☒ GPS(9)/GLO(7)	192.168.10.224	00:5e:31:02:c6:3c

Picture4

3.3 Network settings for the device

Since the device search is based on UDP broadcasting, and the broadcasting port (9999) is not consistent with the normal communication port (7000), when the device is detected to be not in the same network segment with the host computer, the network of the device must be reconfigured, otherwise it will affect the host computer to control the device and obtain the status.

Click the "Network Parameters" button in the "Device Information" interface, the "Device Network Parameters" interface will pop up, as shown in Picture 5.



MAC地址	00:5e:31:02:87:56
IP	192.168.10.224
子网掩码	255.255.255.0
默认网关	192.168.10.1

Picture5

In the MAC address input box of the interface, enter the MAC address of the device to be modified, modify the IP, subnet mask and default gateway parameters to make it consistent with the host computer network segment, click the "Broadcast Settings" button, and send the changed network parameters to the device, and you can see the corresponding prompt information in the debug log section, and after the modification is successfully completed, search for the device again, and then you can complete the interface operation of all the devices.

3.4 Device Management Parameter Acquisition

In the device information interface, select the device to be viewed, the host computer automatically obtains the timing time, crystal working status, receiver working status, receiver positioning status, time synchronisation status, ambient temperature and and displays them on the interface every 1s, as shown in Picture 6.

设备管理参数		
授时时间	23/05/24 11:27:05	晶振工作状态
环境温度	38.8°C	接收机工作状态
时间精度	0ns	接收机定位状态
系统运时	000 00:46:29	时间同步状态
		失锁
		●
		●
		●
详细信息		授时

Picture6

3.5 Obtaining detailed information of devices and restarting devices

If you want to get the detailed information of the management centre, first select the device you want to view in the device information interface, and then click the "Detailed Information" button in the "Management Centre" section, and the "Management Centre Related Information" interface will pop up. The "Management Centre Related Information" interface will pop up, as shown in Picture 7. You can follow the operation method of the above function to get the relevant status of the Management Centre according to your needs.

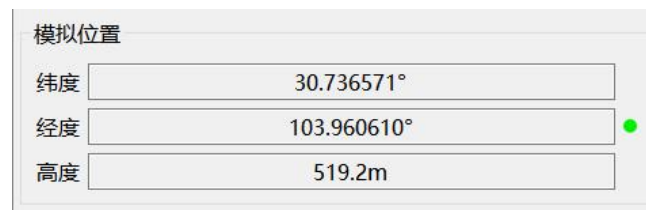
If you need to reboot the management centre, click the "Device Reboot" button in the "Management Center Related Information" interface, and if successful, the management centre will perform the reboot operation. The reboot of the Management Centre completes in about 1 minute.

定位位置		授时	
纬度	30.574920°	授时时间	23/05/24 11:27:48
经度	104.058465°	接收机工作状态	●
高度	479.324m	接收机定位状态	●
晶振		接收机闰秒有效状态	●
工作状态	跟踪	时间同步状态	●
压控电压	1.87502V		
时间精度	-28.0309ns		
频率精度	-2.55093e-10		
PRN			
GPS	共9颗:14 30 01 17 07 19 21 06 03		
BDS	共10颗:24 12 10 07 25 11 08 26 09 22		
GLO	共5颗:23 17 24 14 13		
GAL	共7颗:11 25 10 24 36 02 12		
L2C	共9颗:14 30 01 17 07 19 21 06 03		
		设备重启	

Picture7

3.6 Analogue Position Acquisition

The host computer automatically acquires the pseudo-satellite analogue position of the first ticked device in the device information column every 1s, and the interface is shown in Picture 8, when there is data refresh, the indicator on the interface will turn green, otherwise it will turn grey.



The screenshot shows a software interface titled '模拟位置' (Simulated Position). It contains three input fields with their respective values: '纬度' (Latitude) is 30.736571°, '经度' (Longitude) is 103.960610°, and '高度' (Altitude) is 519.2m. To the right of the longitude field, there is a small green dot, indicating that data is being refreshed.

模拟位置	
纬度	30.736571°
经度	103.960610°
高度	519.2m

Picture8

3.7 Common parameters reading and setting

With the help of the host computer, it can complete the reading and setting of the common parameters of pseudo-satellite, such as channel power, channel delay, maximum speed, cut-off elevation angle, initial speed, acceleration and circular motion parameters, and the host computer will automatically obtain the above parameters of the first ticked device in the device information column every 1s, and the interface is shown in Picture 9. For example, the reading result of power attenuation value is "G:0 B:0 R:0 E:0 L2C:0", in which G means GPS L1, B means BDS B1I, R means GLONASS L1, E means Galileo E1, and L2C means GPS L2C; and the whole value means that the power attenuation value of all channels is 0dB in the input box. The value is 0dB, enter the required value in the input box and click the Set button to complete the power attenuation parameter setting, the rest of the parameter setting method is similar.

常用参数操作

发射开关

星历加注

上电自动发射

未使能

未使能

设置

整点授时使能

未使能

未使能

设置

功率衰减

G:0

B:0

R:0

E:0

L2C:0

dB

ALL

设置

通道时延

G:0

B:0

R:0

E:0

L2C:0

ns

ALL

设置

初速度

0

m/s

设置

初速度方向

0

°

设置

最大速度值

60

m/s

设置

加速度

0

m/s²

设置

加速度方向

0

°

设置

半径

0

m

设置

周期

1

s

设置

旋转方向

顺时针

顺时针

设置

FIR使能

未使能

设置

模拟位置相关操作

特别功能

纬度

30.634182

°

经度

104.084778

°

高度

500

m

同步定位位置

设置位置

地图取点

特定圆周运动

Picture9

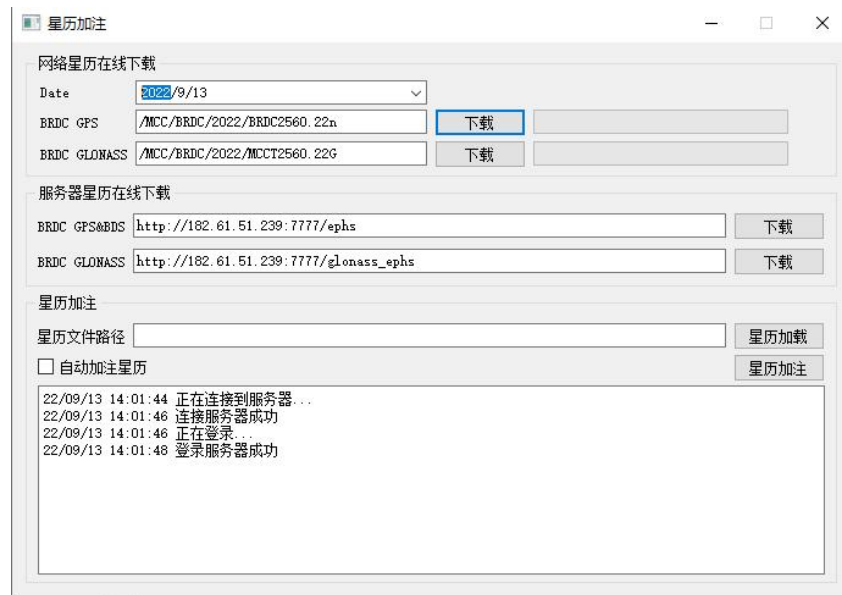
3.8 Ephemeris refilling

After the system is powered on, if the GNSS receiving antenna has been connected and the receiver has been positioned at this time, the management centre will automatically collect the real-time broadcast ephemeris and calculate the visible stars according to the position information sent by the pseudo-satellites, and carry out the star-changing processing according to the up-to elevation angle, the up-to-elevation angle can be set up and configured in the uploader, generally speaking, the receiver's default star-changing angle of elevation is 5°, and the default star-changing elevation of the management centre is also The default elevation angle of the receiver is 5°, and the default elevation angle of the management centre is also 5°.

The ephemeris that needs to be matched with the current moment can be downloaded through the Internet, and after downloading, it can be annotated by the host computer. Specific ephemeris download and annotation method can refer to the following steps.

(1)Download ephemeris: Click the "ephemeris annotation" button in the function interface of "Common Parameters of Pseudo-Satellites" to pop up the interface of "ephemeris annotation", as shown in Picture 10. The interface is divided into two parts according to the function: online download of ephemeris and add ephemeris. When the "Download" button is enabled in the Calendar

Online Download function interface, the latest GPS and GLONASS ephemeris files can be downloaded. The downloaded ephemeris files will be downloaded to the "EPHEM" folder



Picture10

(2) Ephemeris file loading: Click "Ephemeris Load" button to select ephemeris file, after successful selection, the ephemeris file path display box will show the path name of the selected ephemeris file.

(3) Ephemeris Refill: After completing the above two steps, tick the device to be refilled in the device information column, click the "Ephemeris Refill" button to refill the ephemeris, in the process of refilling, the display bar at the bottom of the interface will print the reminder message.

(4) Automatic Ephemeris Refill: If you can connect to the Internet, you can also directly check the automatic ephemeris refill.

3.9 Switching on/off signal emission

As shown in Picture 11, if the signal has been turned on, clicking the "Launch Switch" button will turn off the signal launch. If the signal is off, clicking the "Pseudo Satellite Launch Switch" button will turn on the pseudo-satellite launch. You can judge the transmission status of the signal by checking the status of the transmit switch light on the panel indicator of the device, red colour means the transmission is closed and green colour means the signal is transmitting.

When the corresponding channel is unenabled, it is impossible to transmit or turn off the signal of the related access.

常用参数操作

发射开关

星历加注

上电自动发射

未使能

未使能

设置

整点授时使能

未使能

未使能

设置

功率衰减值

G:0 B:0 R:0 E:0 L2C:0

dB

ALL

设置

通道时延

G:0 B:0 R:0 E:0 L2C:0

ns

ALL

设置

初速度

0

m/s

设置

初速度方向

0

°

设置

最大速度值

60

m/s

设置

加速度

0

m/s²

设置

加速度方向

0

°

设置

半径

0

m

设置

周期

1

s

设置

旋转方向

顺时针

顺时针

FIR使能

未使能

设置

模拟位置相关操作

特别功能

纬度

30.634182

°

经度

104.084778

°

高度

500

m

同步定位位置

设置位置

地图取点

特定圆周运动

伪卫星状态

Type	FPGA	RF	星历	发射通道	发射开关	EN
GPS						☐ 不使能
BDS						☐ 不使能
GLO						☐ 不使能
GAL						☐ 不使能
L2C						☐ 不使能

Picture11

3.10 Analogue Position Related Operations

In the equipment information column, check the equipment to be set, enter the simulated position in the input boxes of latitude, longitude and altitude in the "Simulated Position Related Operation" function interface, click the "Set Position" button to complete the simulated position setting operation, and you can check whether the position in the "Simulated Position" interface is set successfully or not. Click "Set Position" button to complete the simulated position setting operation, and you can check whether the position in the "Simulated Position" interface is set successfully.

Click "Synchronise Position" button, you can synchronize the position information in the interface of "Device Positioning Position" to the position input box in the interface of "Analog Position Related Operation", so that you can modify the settings on the basis of this information. The position information in the interface of "Device Positioning Position" can be synchronised to the position input box in the interface of "Analogue Position Related Operation".

伪卫星模拟位置相关操作

纬度	30.634182	°
经度	104.084778	°
高度	500	m

Picture12

You can also set the simulation position by taking points on the map, click "Map Take Points" button, the interface of "Set Simulation Position According to Map Marker Points" will pop up, right click on the map interface to get the marker points, and click the "Set" button to complete the simulation position setting of the marker points.



Picture13

4、Use method

4.1 Preparation for switching on the computer

(1) Connect the power cord and network cable correctly, and connect the network cable to the host after powering on.

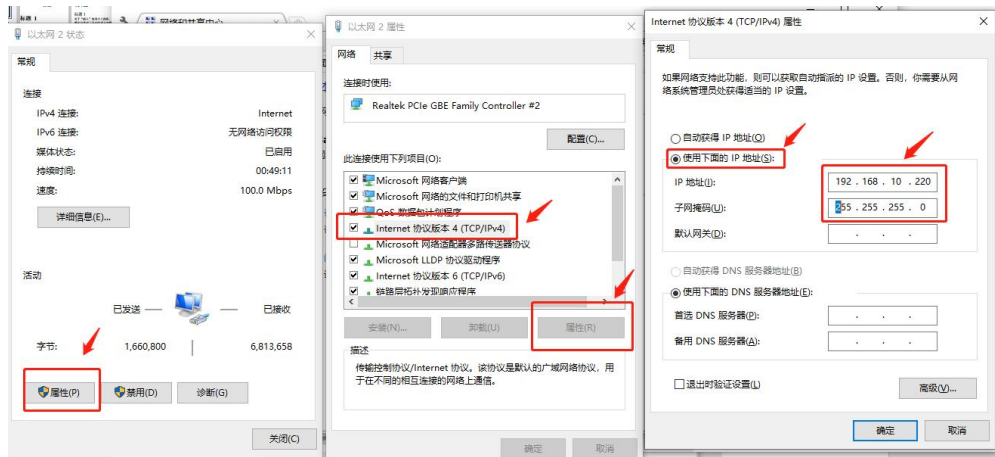
(2) Setting UDP

① Enter Network and Sharing Centre, click Ethernet



Picture13

②Click "Properties" in the Ethernet status box, select Internet Protocol version 4 (TCP/IPv4) in the Ethernet properties, and click Properties. In the Internet Protocol version 4 (TCP/IPv4) properties, select "Use the following IP address", enter "192.168.10.220" as the IP address, and then click the box after the subnet mask. The system will automatically fill in "255.255.255.0", click OK after completing the above configuration.



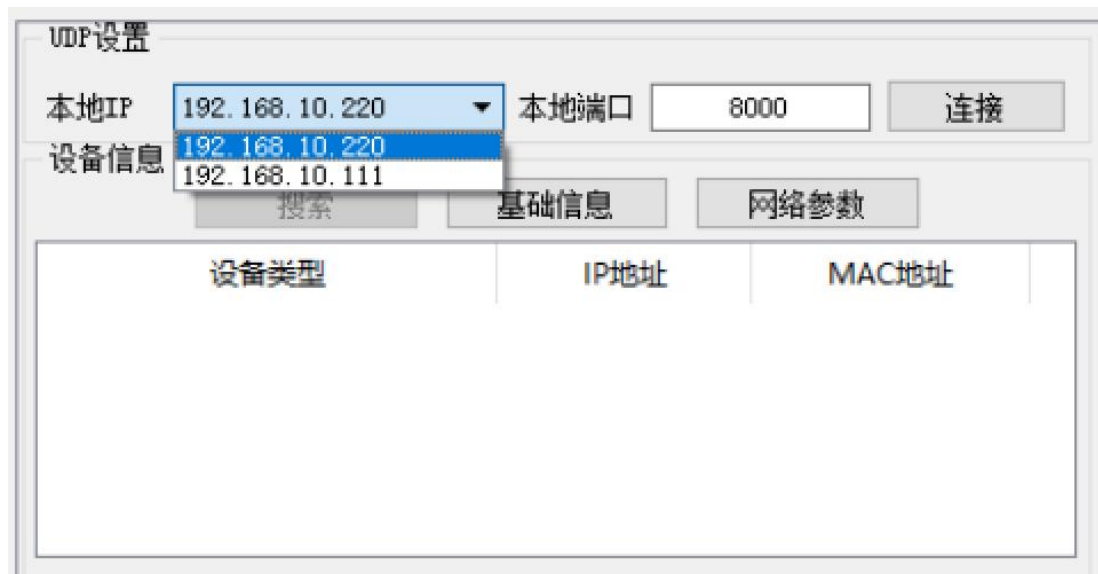
Picture15

Note: The default IP address of the device is 192.168.10.230, the IP of the computer and the IP of the device can be in the same network segment, here 192.168.10.230 is just a sample IP, but if the IP of the board has been modified, you need to use the serial port to connect to the board, and use the command "show ip" to check the IP in the serial tool. in the serial port tool, use the command "show ip" to view the IP.

4.2 Upper computer operation

---Connecting the device

- (1) Open the upper computer software.
- (2) Connect the device: click the local IP in the upper left corner, select 192.168.19.220, click Connect



Picture16

---Ephemeris Note

(1) Outdoor application scenario

You need to connect the GNSS receiving antenna correctly (the antenna should be placed in the open area as far as possible, without serious obstructions, otherwise it is not conducive to the antenna to receive GNSS signals), and wait for the receiver to search for available stars.

Waiting time is about 4 minutes, when the following two states are found, the signal can be transmitted:

① crystal working status shows "locked", the receiver positioning status and time synchronisation status are green;

② the number of available satellites GPS and GLO total more than 10;

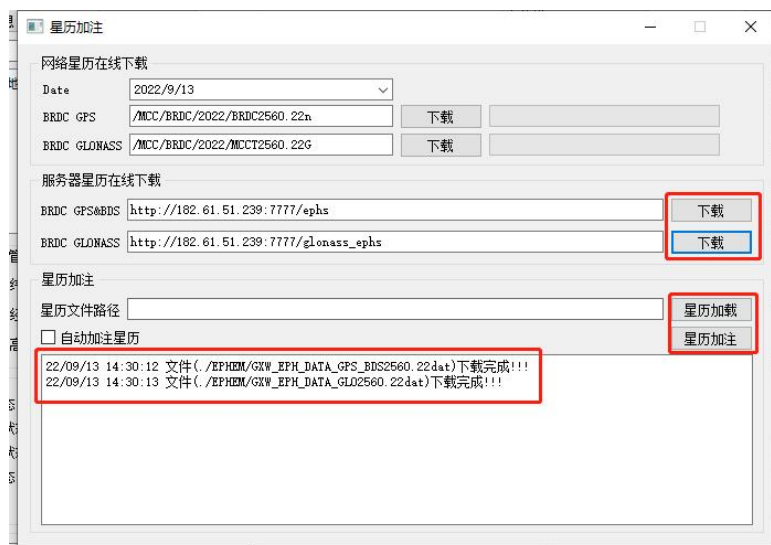
(This state characterises the number of available satellites at the simulated position, and the UAV needs to receive more than 8 pseudo-satellites to be able to locate the decoy position.)



Picture17

(2) Indoor application scenarios (can also be used in cases where the number of outdoor satellites is small)

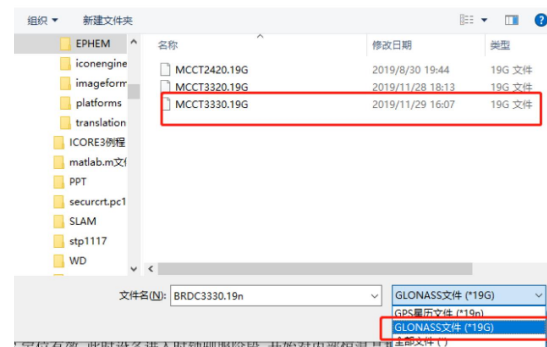
① Network ephemeris refilling: under the premise that the host computer can access the network, click on the "ephemeris refilling" button in the upper right corner of the host computer to enter the ephemeris refilling page, click on the two download buttons, and then click on the ephemeris to load the ephemeris after the ephemeris file is finished downloading, or you can directly check the automatic refilling of ephemeris to complete the ephemeris loading.



Picture18

Go to the ephemeris loading page, select the latest file in the GPS ephemeris file format, click Open, and then click Ephemeris Refill in the Ephemeris Refill page.

Click Calendar Load again, select GLONASS Ephemeris File in the lower right corner, then select the latest file, click Open, and then click Ephemeris Refill in the Ephemeris Refill page.



Picture18

② Timing: After completing the annotation of ephemeris, click the timing button on the bottom left of the main page of the host computer, wait for about 30s, the satellite status bar on the top left, the number after GPS and GLONASS changes from 0 to other positive integers.

--- parameter configuration

(1)Power attenuation:Configure power attenuation parameters at the power attenuation in the upper right corner of the main page of the host computer, and the power attenuation value of each unit is 1dBm.The set parameters are displayed on the left side of the setting box.

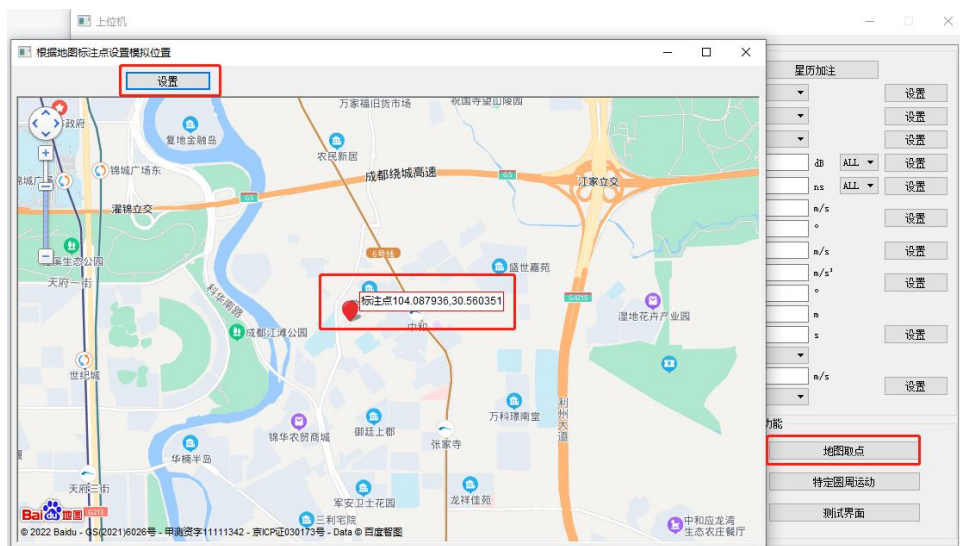
(2)Channel Delay:Configure the channel delay parameter at the channel delay in the upper right corner of the main page of the host computer, and then click on setup, the channel delay set value value = $-2 \times \text{distance of the drone from the device}$.



Picture20

(3) Signal Transmission:

① Select the positioning location simulated by the decoy signal: click on the map to take points, select any location on the map, right-click on a location and then click on Settings in the upper left corner of the page, that is to say, the selection of the simulated location is completed.



Picture21

Transmit Signal: Click the pseudo-satellite transmit switch above and the device transmits an analogue signal.