

ST100-SU Series Product User Manual

V1.0

History

Revision	Date	Author	Description
V1.0	2024/3/13	Yuki/Barry	Initial ST100

SAFETY INFORMATION

In this document, you will be introduced to how to use an A series tracker safely. We suggest you adhere to the following recommendations in order to avoid personal injuries and or property damage.

You have to be familiar with the safety requirements before using the device!

To avoid burning and voltage-caused traumas, of the personnel working with the device, please follow these safety requirements.



All wireless data transferring devices produce interference that may affect other devices which are placed nearby.



Do not disassemble the device. If the device is damaged, the power supply cables are not isolated or the isolation is damaged, DO NOT touch the device before unplugging the power supply.



The device can be used with the Personal Computer (first safety class) or Notebook (second safety class). Associated equipment: PSU (power supply unit) (LPS) and personal computer (PC) shall comply with the requirements of standard EN 60950-1.



Do not mount or service the device during a thunderstorm.



To avoid mechanical damage to the device it is recommended to transport it packed in a damage-proof pack.



Protection in primary circuits of associated PC and PSU(LPS) against short circuits and earth faults of associated PC shall be provided as part of the building installation.

To avoid mechanical damage to the device it is recommended to transport it packed in a damage-proof pack. While using the device, it should be placed so, that its indicating LEDs would be visible as they inform in which working mode the device is and if it has any working problems.

The signal level of the device depends on the environment in which it is working. In case the device starts working sufficiently, please refer to qualified personnel in order to repair this product. We recommend forwarding it to a repair center or the manufacturer. There are no exchangeable parts inside the device.

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1. Introduction

Integrates global connectivity by cellular network Cat.M1 without data plan contract.

ST100-SU series tracker devices have integrated multiple sensors for monitoring movement, light, and geofence. Indoor and outdoor positioning is supported by LBS . Data is always crucial for asset management, which has been encrypted, data buffer capacity, and uploaded via TCP/MQTT protocols, making it easy to deploy in the cloud platform. Firmware over-the-air OTA is always important for after-sale maintenance.

2. Product Overview

2.1. ST100-SU Series Overview



Figure1 ST100-SU Overview

2.2. Main Functions

❖ Buffer data Supplementary Transmission

When the assets enter the area without network signal, the device stores the location information temporally, and uploads the historical location information to the platform when the device is back online.

❖ Multiple Positioning Technology

Integrate GNSS positioning (GPS, Beidou, GLONASS), LBS base station positioning, WiFi and other positioning technologies to fix the location of assets in real-time. Support electronic fences*, transportation route planning* and location deviation alarms*.

❖ OTA Technology and Configuration Flexibility

Parameter configuration and firmware maintenance can be done locally and remotely (Servers and SMS).

❖ Light Monitoring Technology

24H real-time monitoring and recording of the change of light. When an asset is abnormally unboxed, it will trigger an alarm on the platform.

❖ Comprehensive Monitoring Technology

The device monitors the assets in all aspects. In case of severe vibration, abnormal LED status, and low voltage*, alarms will be generated automatically.

❖ Dual Server

The device supports dual IP simultaneous reporting.

❖ Data encryption*

808 protocol data encryption supports RSA/AES/TEA*.

❖ Network and Band Configuration

Support network and band configuration.

2.3. Package Contents

The ST100-SU series device will send to customers in a cardboard box. The package contains:

- Device
- USB to serial port cable

2.4. General Specification

Table1.General Specification

Type	ST100-SU
Material	ABS(Food grade plastic is optional)
Operating Temperature	-20°C ~ +70°C
Dimensions	87.5mm x 69mm x 18.7mm
Firmware Upgrade	USB interface, OTA
Data Encryption*	TEA, AES or RSA(optional)*
Supply Voltage	3.0V Non-rechargeable
Stand-by Current	≤70uA

2.5. Global Deploy

Table2.Global deploy

Variant for the Global	
ST100-SU(Cat M1) Modules using BG95M1	LTE FDD: B2/B4/B12/B13

2.6. Hardware Features

Table3.Hardware features

Hardware Features	
USB	× 1, Micro
(U)SIM Interface	Nano SIM card
Cellular Antenna	internal
LED	× 3, Power LED, Network LED, GNSS LED
Motion Sensor	Gravity Measurement Range: ±2g/ ±4g/±8g/±16g ODR Bandwidths: 1Hz ~ 400Hz
Light Sensor	Measuring Range: 1~ 1000 levels Spectral Peak: 540 nm
Battery Capacity	3400 mAh (Lithium thionyl chloride batteries)

2.7. Air Protocol

Table4.Air Protocol

Air protocol	
LTE (Cat M1)	LTE FDD: Max 588Kbps (DL)/Max 1119Kbps (UL)
GSM	GPRS: Max 107Kbps (DL)/Max 85.6Kbps (UL) EDGE: Max 296Kbps (DL)/Max

	236.8Kbps (UL)
Command Set	Track protocol command
Transmit Protocol	TCP, MQTT
Working Modes	Sleep mode for long standby time Run mode for emergency tracking
Scheduled Timing Report	Report position and status at preset time intervals
Geo-fences*	Support up to 5 internal geo-fence regions
Low Power Alarm	Alarm when internal battery is low
Wakeup Report	Report when the device wakes up
Motion Detection	Motion detection based on internal 3-axis accelerometer

2.8. Buffer Storage

Table5.Buffer storage

Buffer storage	
Product	Max storage quantity
ST100-SU	60000 message

3. Work mode

3.1. Work mode

The ST100-SU device has two working modes:

3.1.1. Tracking mode + Trigger mode

When the AT command "AT + WORKMODE=2" is used, the device will enter "tracking mode + Trigger mode", and the minimum cycle reporting and sampling time of the device can be configured as 10s, and the network module will not enter hibernation after the reporting.

3.1.2. Periodic mode + trigger mode

When the AT command "AT + WORKMODE=4" is used, the device will enter "Cycle mode + trigger mode". The minimum cycle reporting and sampling time of the device can be configured as 600s. At this time, the network module will enter hibernation after the reporting.

3.2. Conditional trigger mode

When a trigger alarm (configurable) occurs during the normal reporting period, the device can change the working mode and the time of periodic reporting and sampling over a period of time.

How to use the conditional trigger reporting mode:

"AT+TRIGGERMODE=<duration>,<condition>,<report>,<sampling>,<workmode>"

<duration>: The time that the condition trigger can be maintained, during which both the reporting and sampling periods change after the trigger condition. (Disabled when the value is set to 0.)

<condition>: trigger condition parameters, 1: LOW_POWER, 2: MOTION, 3: CRASH, 4: LIGHT, 5: TEMP_HUMI, 6: TEMP, 7: HUMI (Default value: 0)

<report>: Periodic reporting time

<sampling>: Periodic sampling time

<workmode>: Working mode configuration

For example:

We set the reporting period to 3600s and the sampling period to 3600s.

AT+TRIGGERMODE=3600,1,600,600,4

When LOW_POWER is triggered, the periodic reporting time is changed to 600 and the periodic sampling time is changed to 600 within one hour. WorkMode=4. After one hour, the periodic reporting time and sampling time of the device return to the previous Settings 3600 seconds.

3.3. Sleep mode

Sleep mode are only valid when the tracking mode + trigger mode and the conditional trigger mode are used.

Its AT command is "AT+SLEEPMODE=<mode>",

<mode>:

0.The power consumption of this network module is low. (After the device report is complete, the network module sleeps.)

1.The network module is working properly. (After the device report ends, the network module does not sleep.)

For example:

When workmode=2, sleepmode=0, the minimum value is 60s. When workmode=2, sleepmode=1, the minimum value is 10s.

4. Configuration

All devices will have default factory settings. These settings should be changed according to the user's needs. If you need to change the parameters, please configure them through the latest **configuration tool**.

4.1. LED light indications

Table6.System LED

COLOR	STATE	MEANING
Red	Flash slowly	The device works normally
	Flash quickly	The device works abnormally.
	Off	No power or in sleep mode

Table7.Network LED

COLOR	STATE	MEANING
Green	On	Linking server succeeded
	Flash	Searching for network or linking server
	Off	No power or in sleep mode

Table8.GNSS LED

COLOR	STATE	MEANING
Blue	On	Fix normally
	Flash	Searching GNSS
	Off	No power or in sleep mode

4.2. Install USB driver

- ① Please download the USB-to-Serial cable driver [here](#).
- ② Install the driver according to the prompt on the screen.
- ③ After installation, go to **Device Manager** and check for the “**Prolific USB-to-Serial Com Port**” device and the **COM port** number assigned by Windows.
- ④ You are now ready to use the device on your computer.

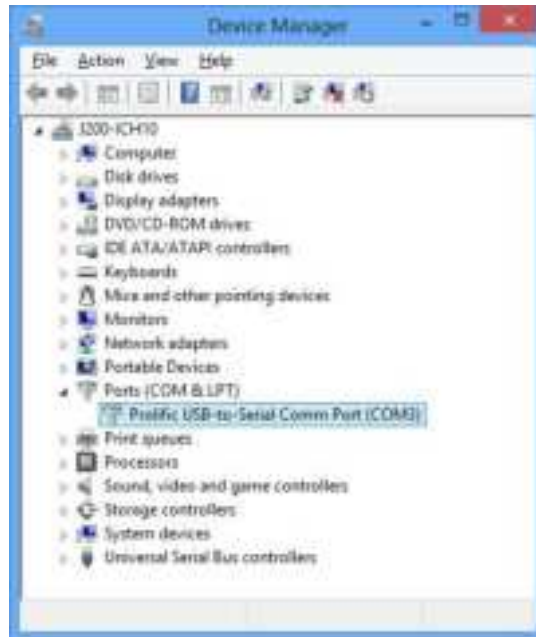


Figure1 Device Manager Inte

4.3. Set your device

4.3.1. Steps for set up

- ① Unscrew the screws and remove the cover.
- ② Insert the **Nano SIM card**. Then turn the internal switch to **ON**.
- ③ Connect the device to PC via USB data to the serial port cable.
- ④ Make sure the device is powered on and check the LED lights are in normal state. See [LED indicators](#).

4.3.2. Main buttons of configuration tool

Open the **configuration tool**; Select the corresponding COM port; **DeviceInfo** is in the lower left corner of the tool, it shows the **Type**, **IMEI**, **ICCID** and **Version** of the device. Main buttons offer following functionality:

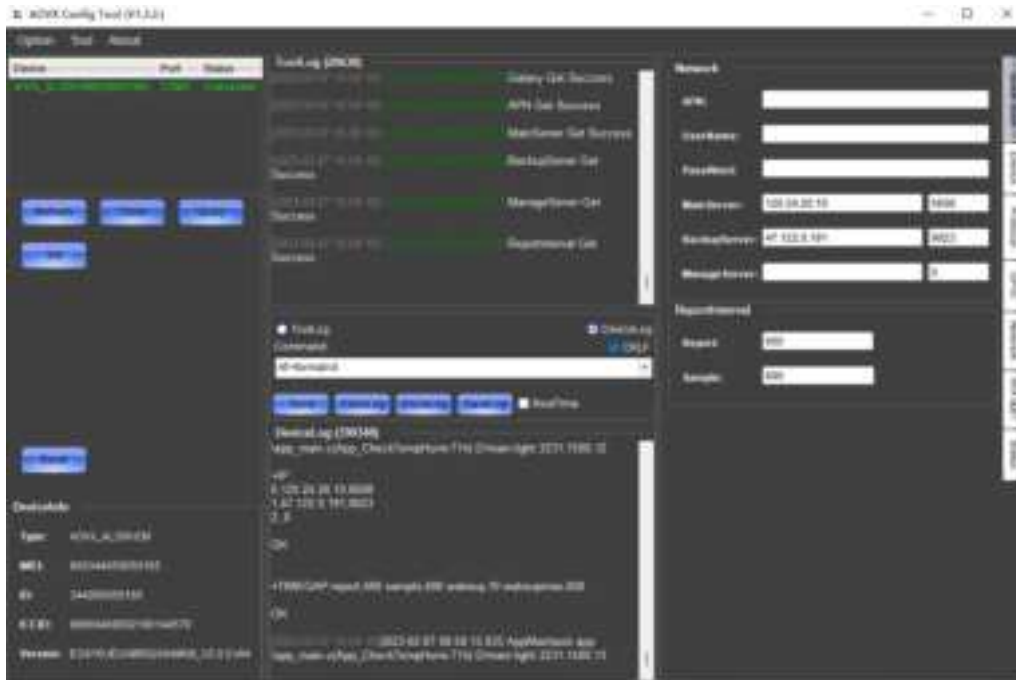


Figure1 Config tool interface

- ①  **Option- Language-** Languages supported by the tool.
View- Check device log or tool log.
Property- Settings of the tool.
- ②  **Tool- Protocol Analyze-** Analyze JT808/T808 protocol.
Power consumption evaluate- Evaluate usage time based on battery capacity, or evaluate battery capacity based on usage time
Download- Loads upgrade package from file..
Import config Information-Import the parameter configuration information of the device
Export config Information-Export device parameter configuration information
- ③  **About- Version-**The version of the tool.
Help- If you need more information contact us here..
- ④  **Refresh-**Refresh the COM port and device information.
- ⑤  **Connect-** Connect/disconnect the COM port.
- ⑥  **Query-** Query the device information.
- ⑦  **Set-** Save configuration to device.

- ⑧  **Reset-** Reset the device.
- ⑨  **Quick start-** Configure Network and Report interval.
- ⑩  **Device config-**configure the device information
- ⑪  **Network config-**configure band and LTE FDD.

4.3.3. Default configuration

Report Interval



ReportInterval:Report:Report every 3600s by default.



Sample:Sampling every 3600s by default.

Device configuration



Work mode*:Optional*



G sensor:Enable:OFF TimeGap: 300 Threshold:100 Count:3 Time:10 Range:±4G by default.



Light: Enable:OFF Threshold:500 TimeGap:60s by default.



Timezone: UTC+0 by default.



GNSS Galaxy: Disable by default.

4.4. APN configuration

Chinese users do not need to configure APN and can directly use the device after insert the nano SIM card.

For overseas customers please confirm the APN with telecommunication operator.

4.4.1. Configure APN by config tool

The configuration process begins with the device to the DC power supply and connecting to a computer via cable.

- ① Open the **Configure Tool** and select the right COM port. The device information can be found on the rear left of the tool.

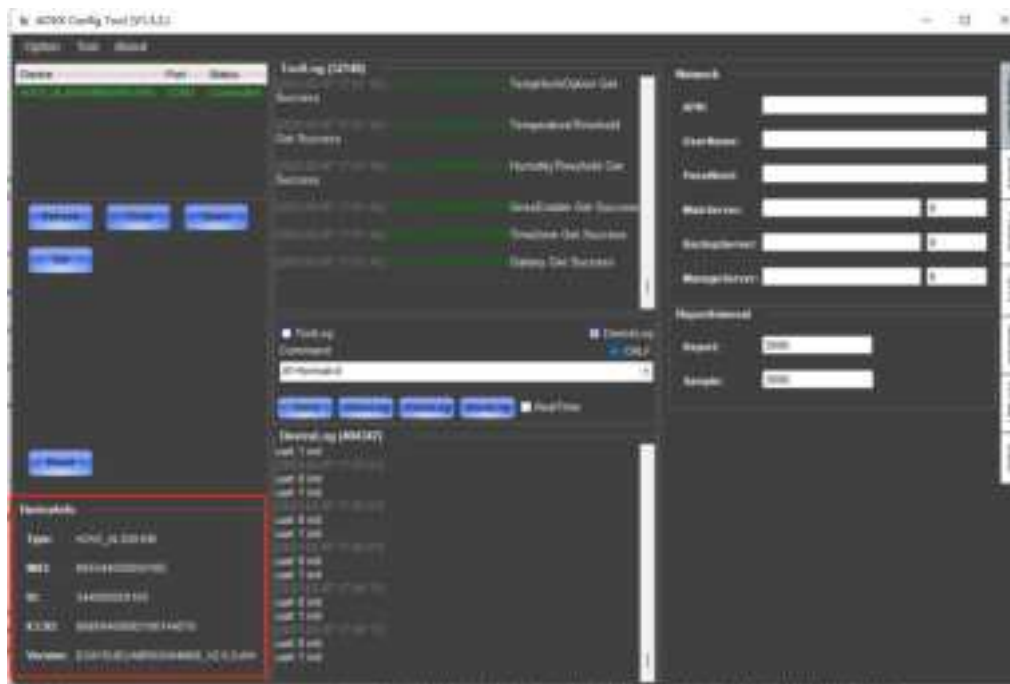


Figure2 COM port interface

② Configure APN/username/password on the right of the tool, then click set.

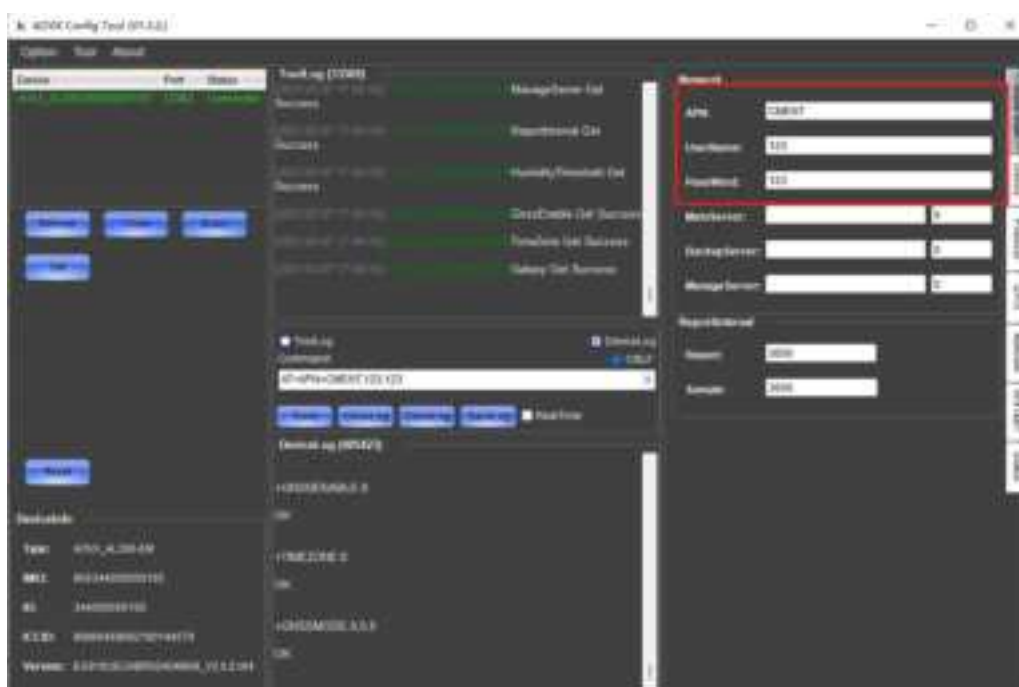
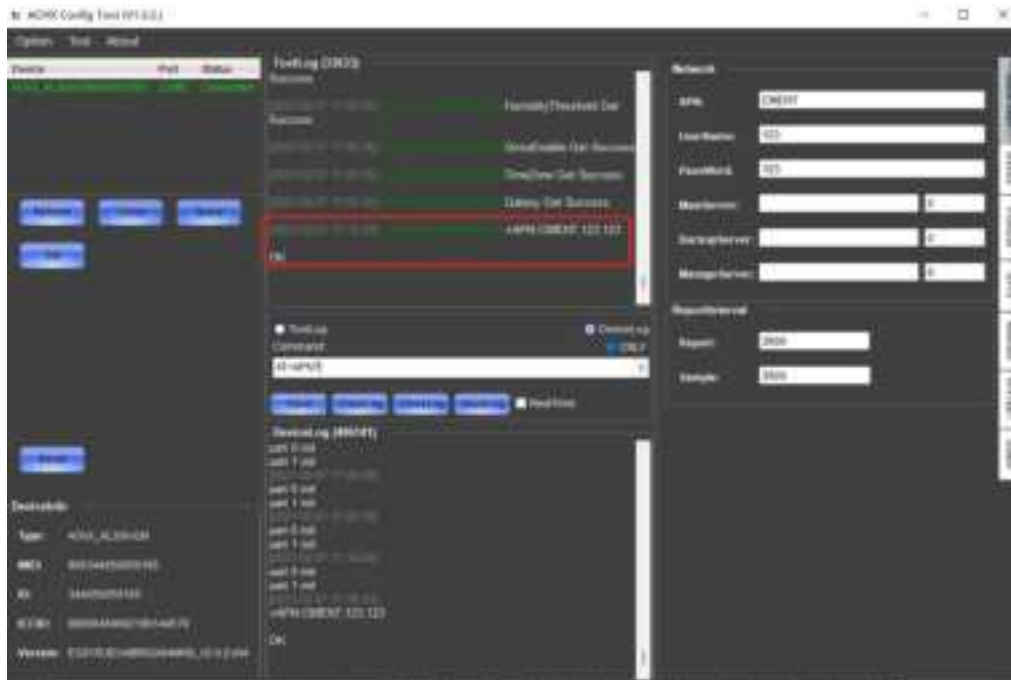


Figure3 configure APN

③ Send **AT+APN?**, And check the APN.

**Figure4 Check APN by sending AT command**

4.4.2. Configure APN by AT Command

The configuration process begins with the device to the DC power supply and connecting to a computer via cable.

①Open the **Configure Tool**, select the right COM port.

②Send **AT+APN=<apn>,<name>,<password>**, to the device.

For example:

AT+APN=CMENT,123,123

Then received the reply:

+APN:CMENT,123,123

OK

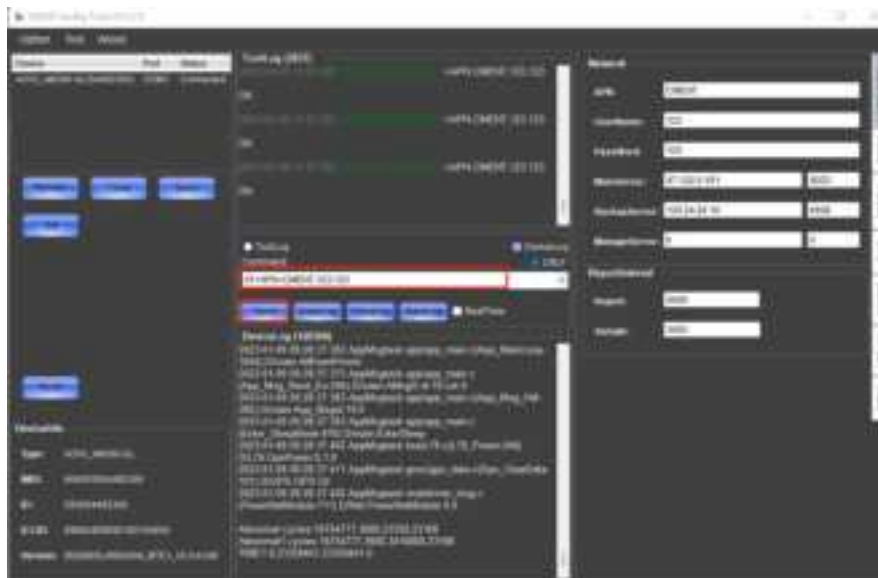


Figure5 Config APN by sending AT commands

Configuration explanation:

<apn>:Access point name <name>:user name

<password>:usder password

③ Send **AT+APN?** to check the APN.

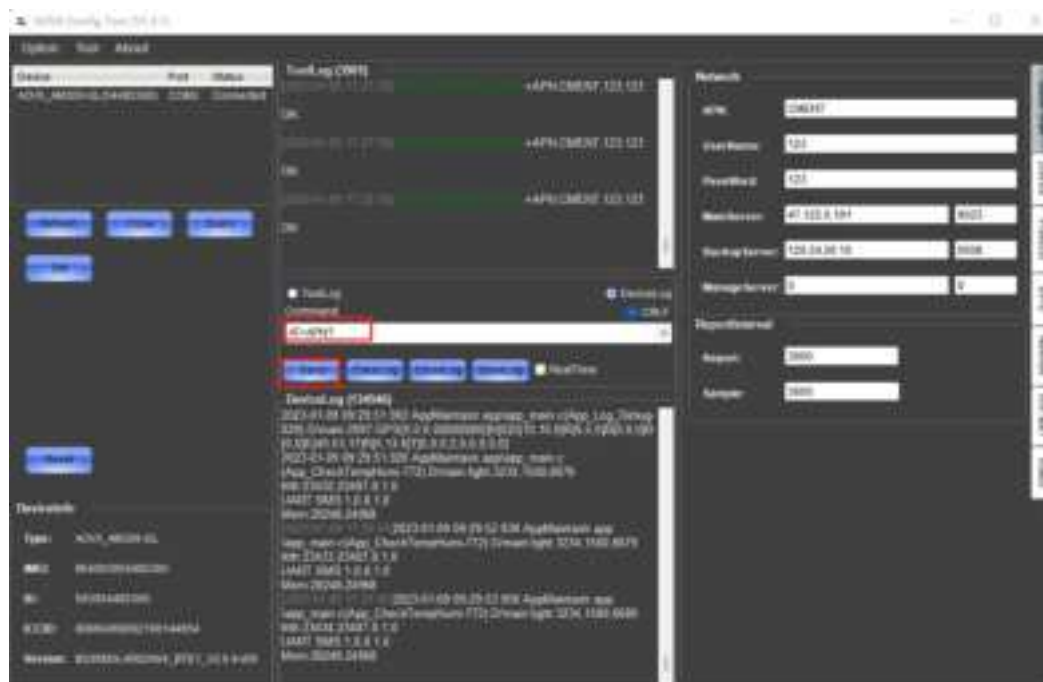


Figure6 Check APN by sending AT command

4.4.3. Configure APN by SMS Command

① Make sure the device is online.

② Send **APN=<apn>,<name>,<password>** to the device.

For example:

APN=apn,123,123

Then received the reply:

+

APN=apn,123,123



Figure7 configure APN by sending SMS command

③ Send **APN?** to check the APN.



Our devices support JTT/T808 protocol. More details can be found [here](#).

①Open configuration tool,make sure the device connect the DC power supply and PC.

For example:

AT+IP=0,124.223.60.234,60000

Then received the reply:

+IP:0,124.223.60.234,60000

OK

Configuration explanation:

<index>: 0.MainServer 1.BackupServer <ip>: The IP address of the server <port>:port number

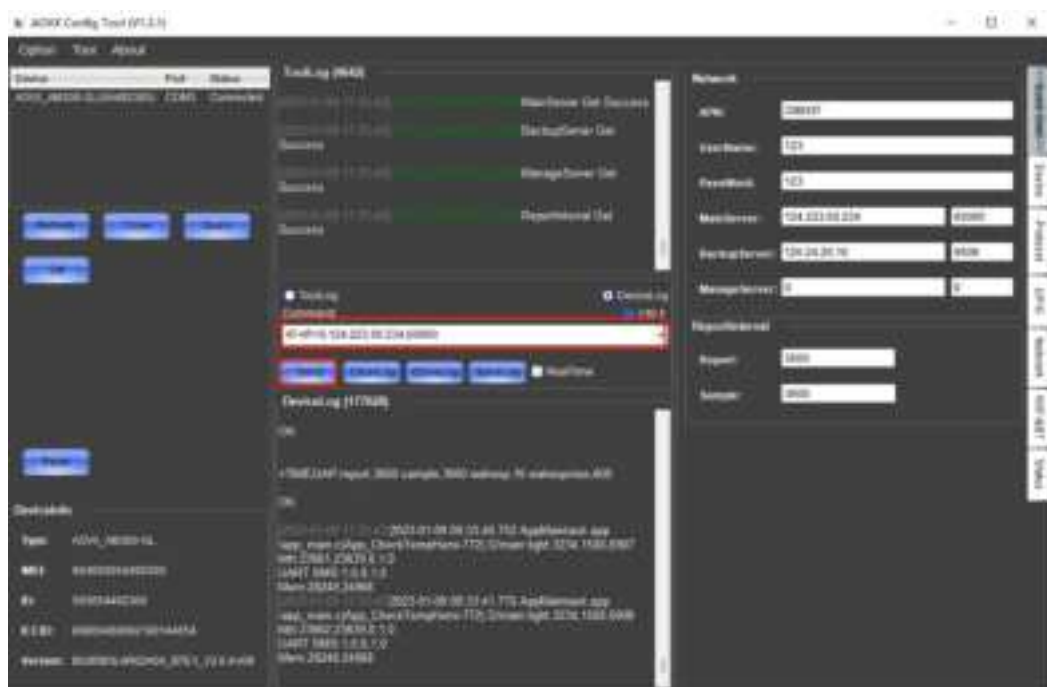


Figure9 Configure IP by sending AT command

③Send **AT+IP?** to check the IP and port

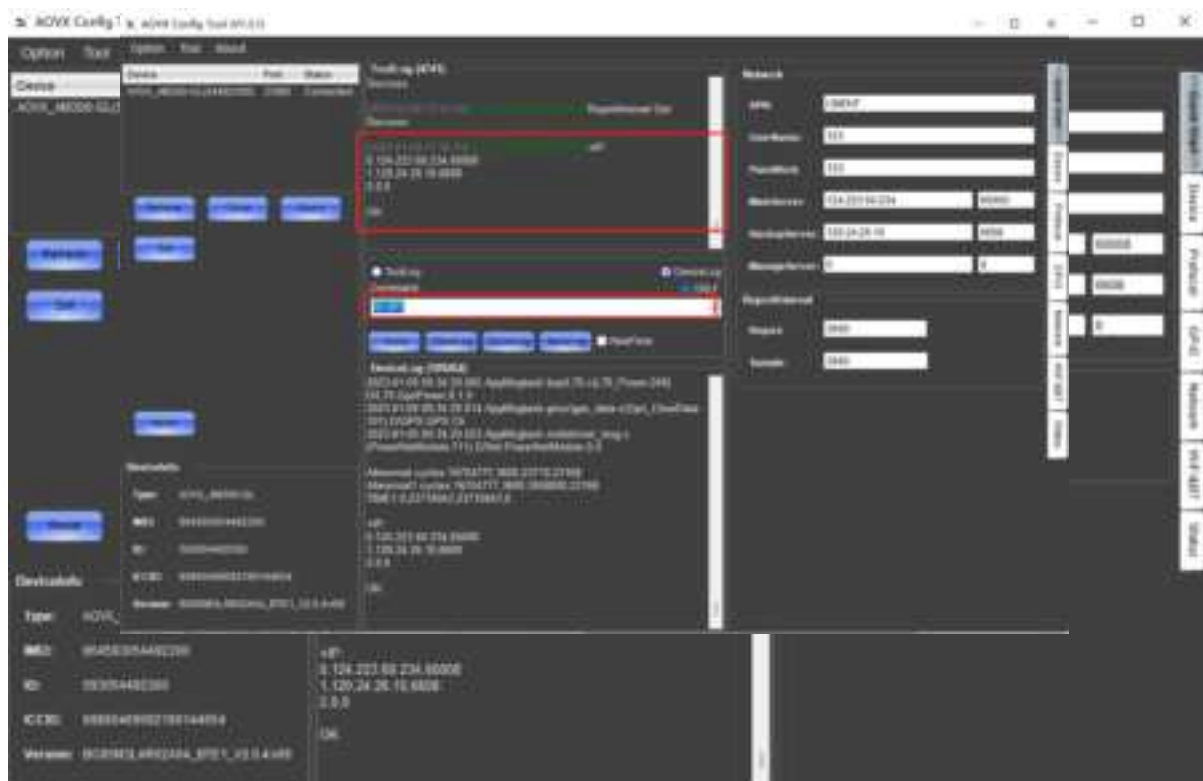


Figure10 Check IP by sending AT command

4.5.2. Configure IP by SMS command

① Make sure the device is online.

②Send **IP=<index>,<ip>,<port>** to the device.

For example:

IP=0,124.223.60.234,60000

Then received the reply:

+

IP:0,124.223.60.234,60000



Figure11 Configure IP by sending SMS command

③Send **IP?** to check the IP of the device now.



Figure12 Check IP by sending SMS command

4.6. Report Interval Configuration

4.6.1. Configure Report Interval by config tool

The configuration process begins with the device to the DC power supply and connecting to a computer via cable.

①Open the **Configure Tool**,select the right COM port. The device information can be found in the rear right of the tool.

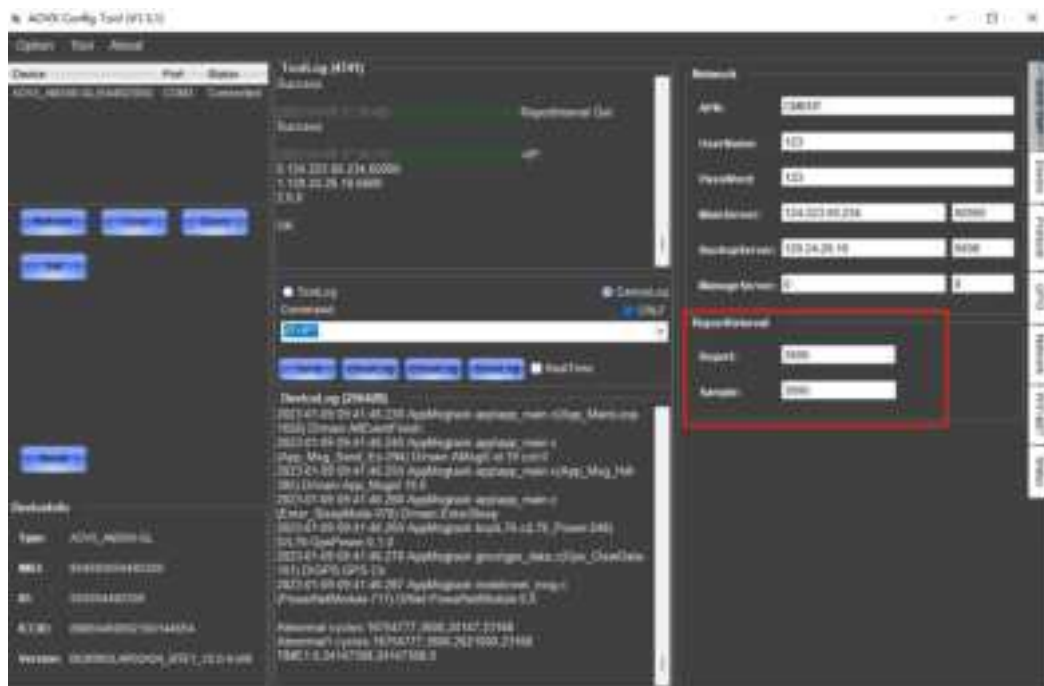


Figure1 Check device information

②Configure the report interval .The unit is seconds.The click **set**.

For example:

Report:3600, Sample:600

Then received the reply:

Run report set success.

Sleep report set success.



Figure2 Configure report interval by config tool

③Send **AT+TIMEGAP?** to check the report interval of the device now.



Figure3 Check report interval

4.6.2. Configure Report Interval by AT Command

- ① Open configuration tool, make sure the device connects the DC power supply and PC.
- ② Send **AT+TIMEGAP=<index>,<time>**. Index: 0:Reporting cycle. 1:Sampling period.

For example:

AT+TIMEGAP=0,3600

Then received the reply:

+TIMEGAP report,3600

OK

Configuration explanation:

<Index>: 0:Reporting cycle. 1:Sampling period. **<time>**:Sampling or reporting time of the data

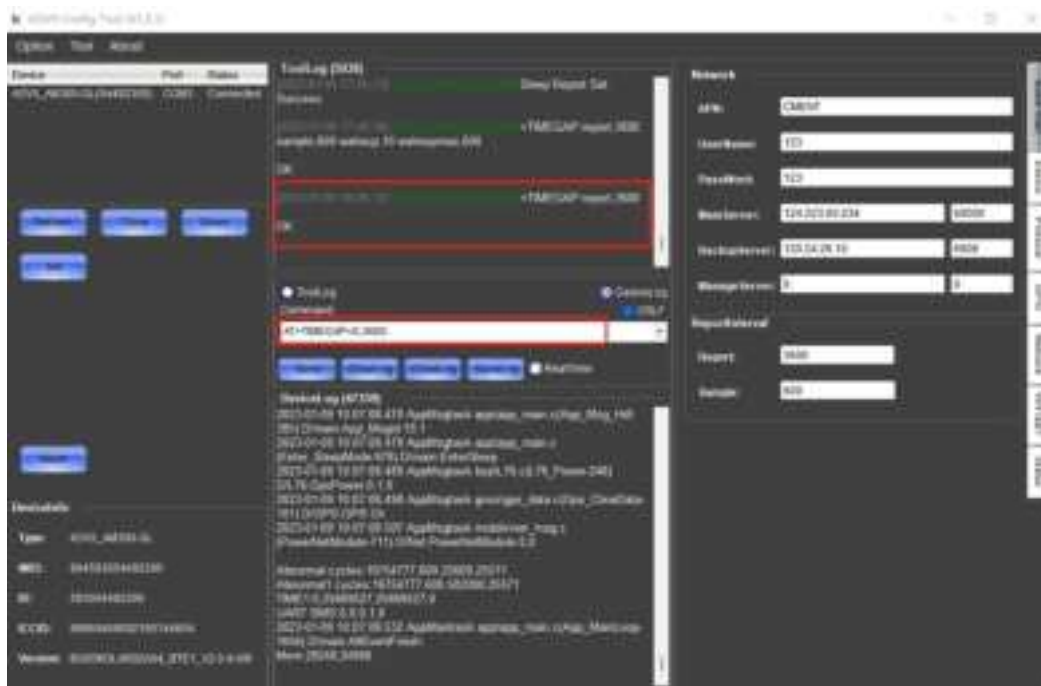


Figure4 Configure report interval by sending AT command

③Send **AT+TIMEGAP?** to check the report interval of the device now.

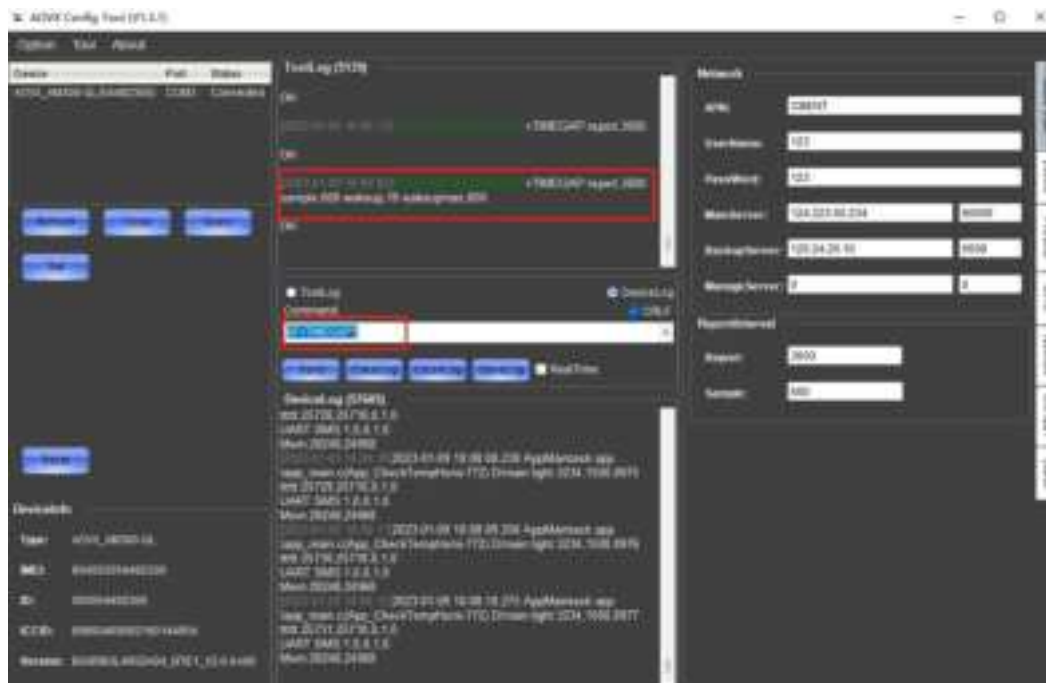


Figure5 Check report interval

4.6.3. Configure Report Interval by SMS Command

①Make sure the device is online.

②Send **TIMEGAP=<index>,<time>**. Index: 0:Reporting cycle. 1:Sampling period.

For example:

TIMEGAP=0,3600

Then received the reply:

+

TIMEGAP:report,3600



Figure6 Configure report interval by sending SMS command

③Send **TIMEGAP?** to check the report interval of the device now.



Figure7 Configure report interval by sending SMS command

4.7. Light parameter configuration

4.7.1. Configure light parameter by Config Tool

Configuration The configuration process begins with the device to the DC power supply and connecting to a computer via cable.

①Open the **Configure Tool**, and select the right COM port. The device information can be found in the rear right of the tool.

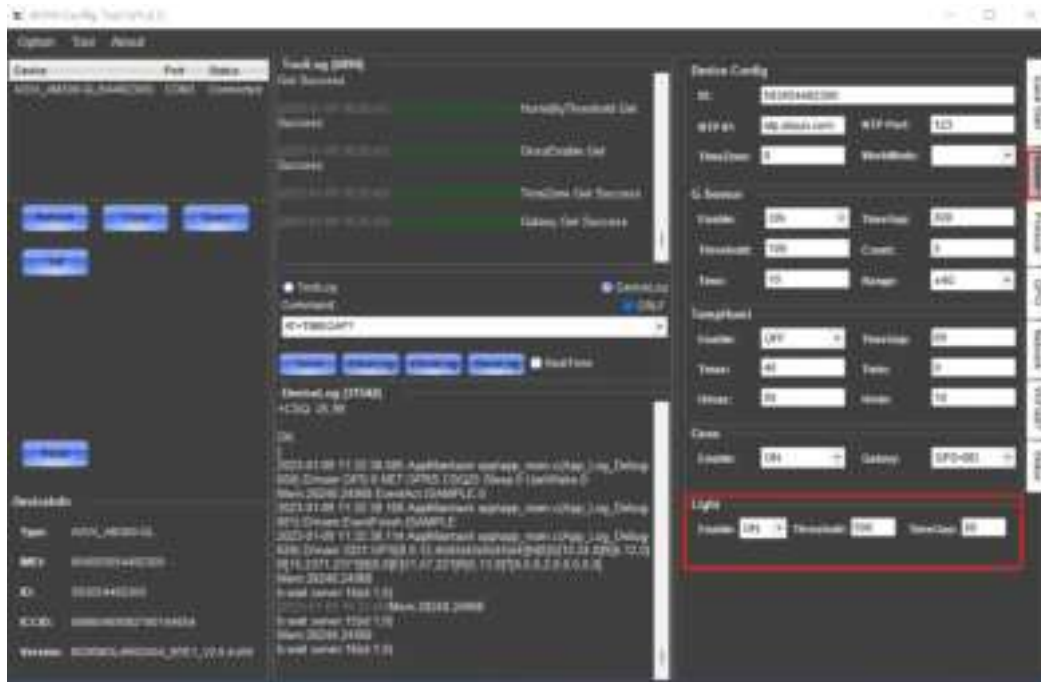


Figure8 Check device information

②Configure the Enable Threshold and TimeGap for Light

For example:

Enable:ON,Threshold:500, TimeGap:60

Then received the reply:

LightThreshold Set Success

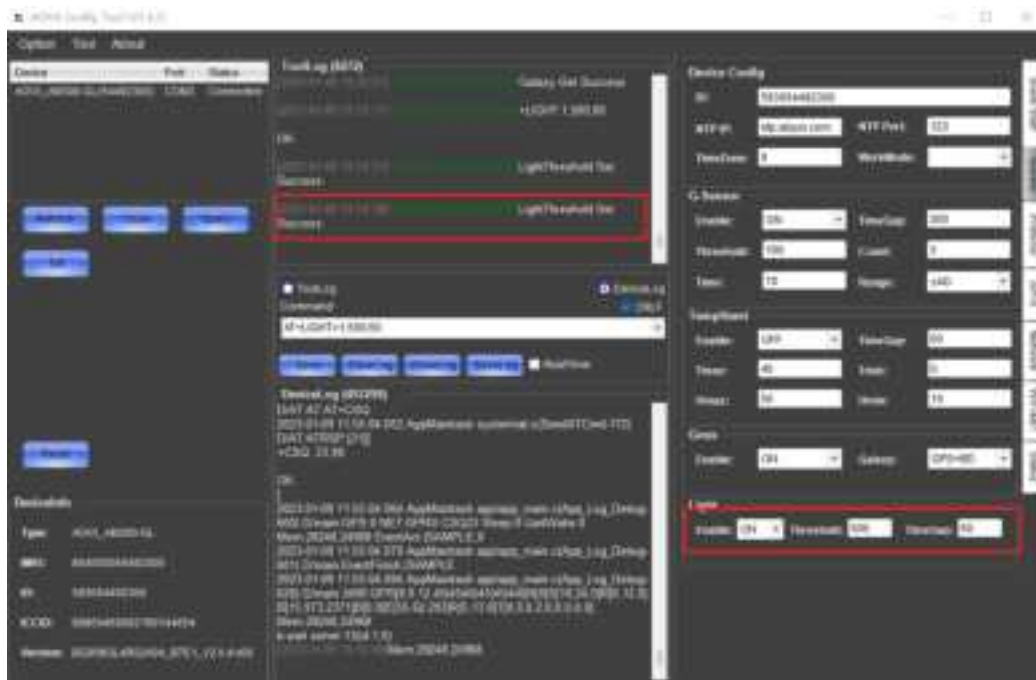


Figure9 Configure Light by config tool

③Send **AT+LIGHT?** to check the light .

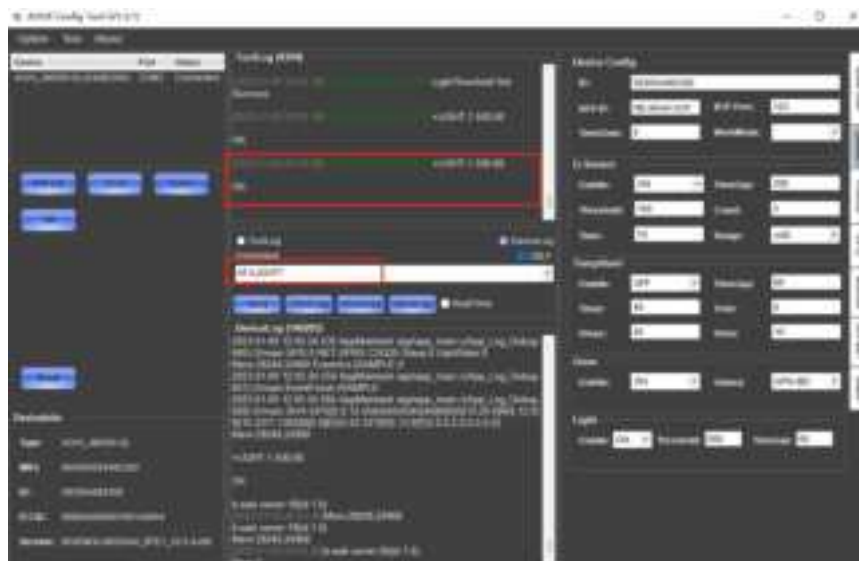


Figure10 Check Light interval

4.7.2 Configure Light by AT Command

①Open configuration tool,make sure the device connect the DC power supply and PC.

②Send **AT+LIGHT=<enable>,<threshold>,<timegap>**.

For example:

AT+LIGHT=1,1500,60

Then received the reply:

+LIGHT:1,1500,60

OK

Configuration explanation:

<enable>:0.OFF 1.ON (Light sensor switch)

<threshold>:Light threshold (0-1000) (The smaller the threshold, the easier it is to trigger the light alarm)

<timegap>:Light reporting interval (Light alarm trigger interval)

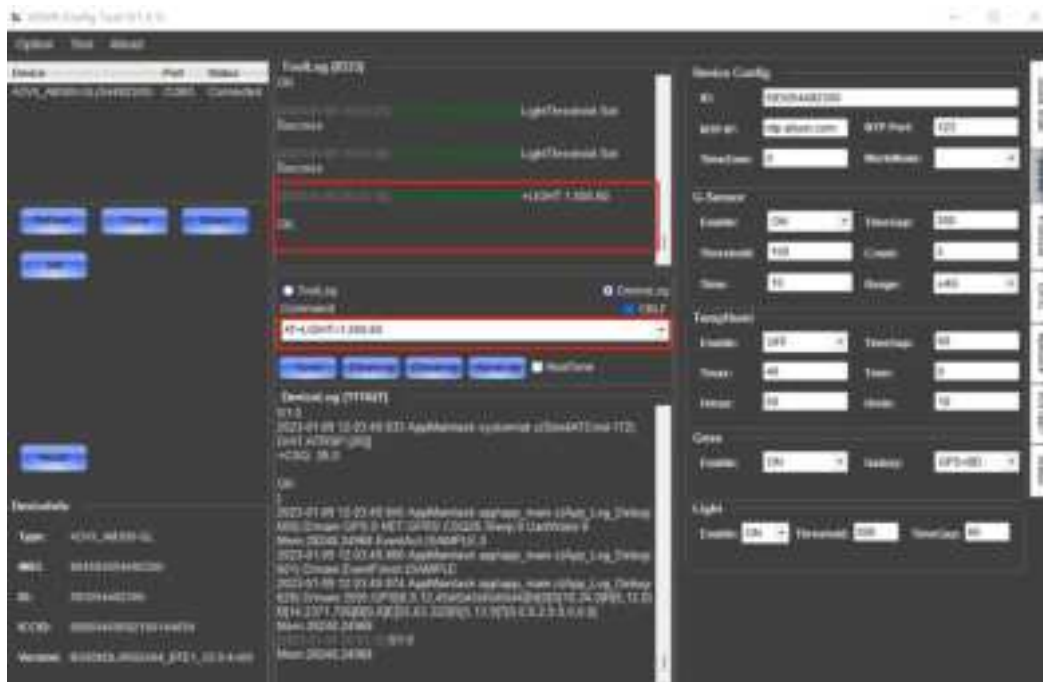


Figure11 Configure Light by sending AT command

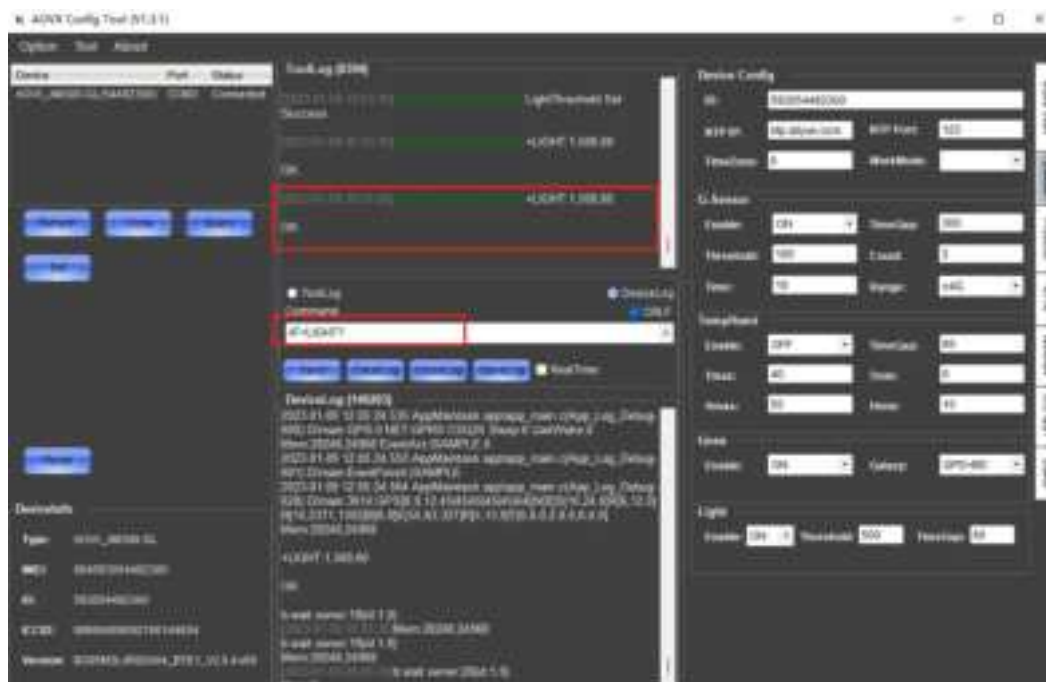
③Send **AT+LIGHT?** to check the light .

Figure12 Check Light interval

4.7.3. Configure Report Interval by SMS Command

- ① Make sure the device is online.
- ② Send **LIGHT=<enable>,<threshold>,<timegap>**.

For example:

LIGHT=1,500,60

Then received the reply:

+

LIGHT:1,500,60



Figure13 Configure Light by sending SMS command

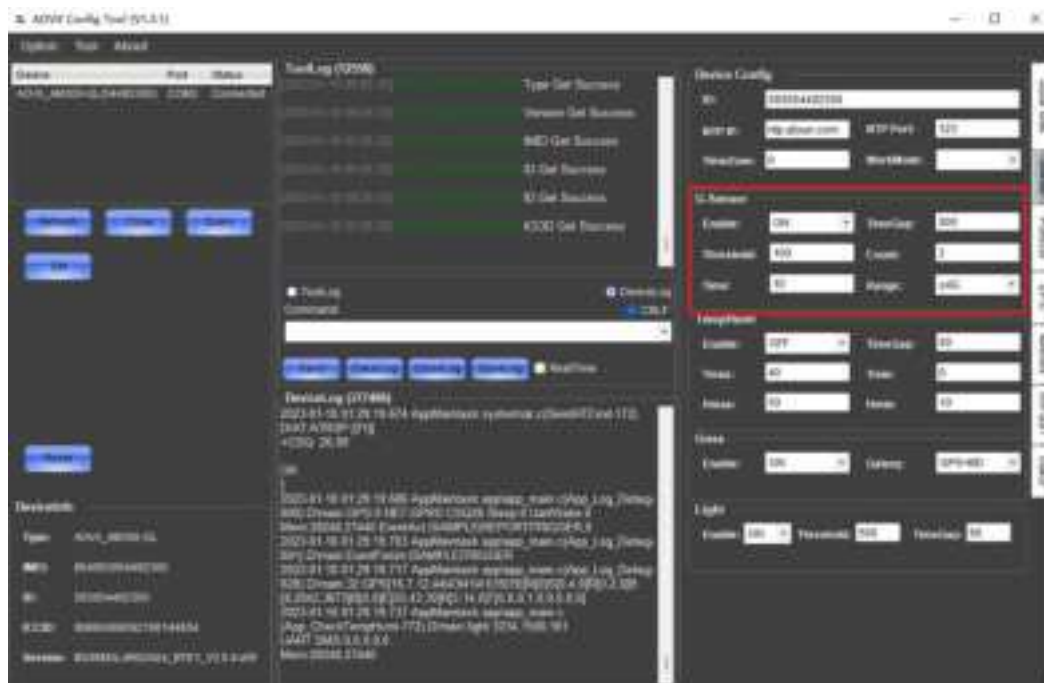
- ③ Send **LIGHT?** to check the light .



Figure14 Configure Light by sending SMS command**4.8. G-sensor parameter configuration****4.8.1 Configure G-sensor parameter by Config Tool**

The configuration process begins with the device to the DC power supply and connecting to a computer via cable.

①Open the **Configure Tool**,select the right COM port.The device information can be find in the right of the tool.

**Figure15 Check device information**

②Configure the Enable and parameter for G-Sensor

For example:

Enable:ON,Range:2G, Threshold:100

Count:3,Time:10,TimeGap:300

Then received the reply:

(Please click Set on the left after configuring the parameters)

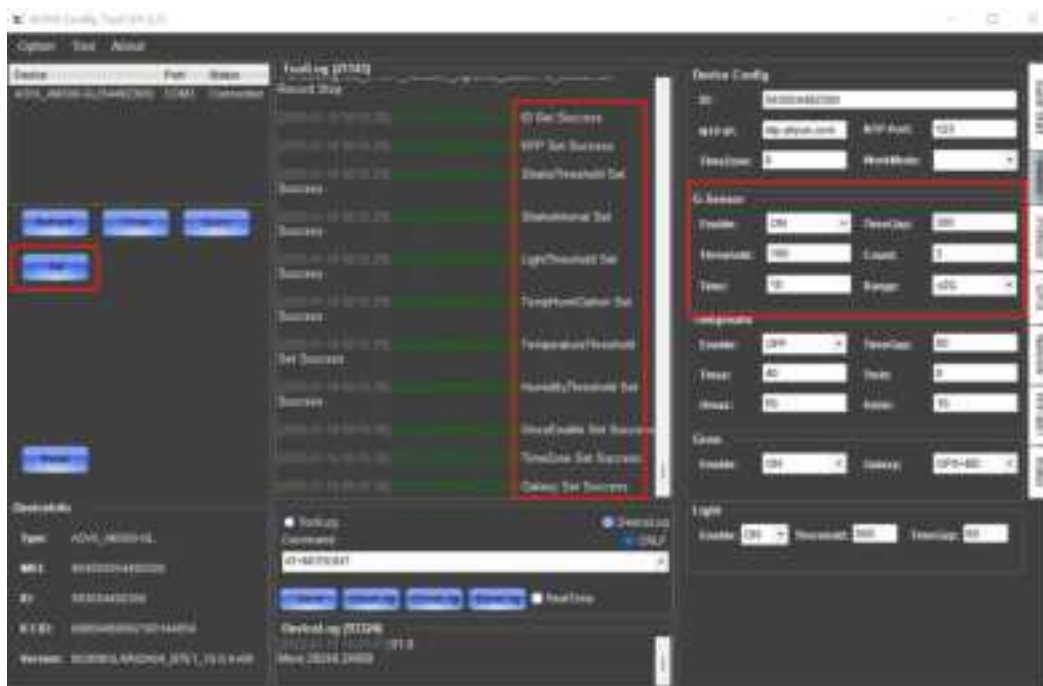


Figure16 Configure G-Sensor by config tool

③ Send **AT+MOTION?** And **AT+VIBPARAM?** to check the G-Sensor

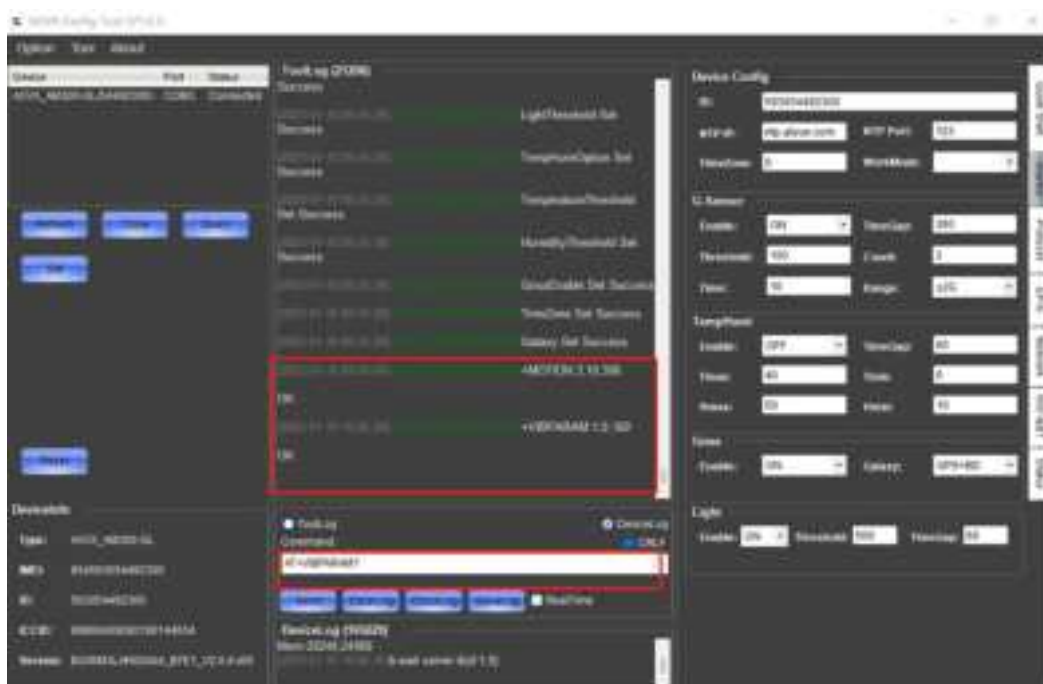


Figure17 Check G-Sensor interval

4.8.2 Configure G-Sensor by AT Command

① Open configuration tool, make sure the device connect the DC power supply and PC.

② Send **AT+MOTION=<count>,<time>,<timegap>**.

AT+VIBPARAM=<enable>,<range>,<sensitivity>

For example:

AT+VIBPARAM=1,0,100

Then received the reply:

VIBPARAM:1,0,100

OK

For example:

AT+MOTION=3,10,300

Then received the reply:

MOTION:3,10,300

OK

Configuration explanation:

<enable>:0.OFF 1.ON (OFF/ON G-Sensor)
3.16G(Gravitational acceleration)

<range>:0.2G 1.4G 2.8G

<sensitivity>:0-255(Sensitivity of equipment to vibration)

<count>: Vibration frequency of equipment
device monitors the number of vibrations

<time>: The time range over which the

<timegap>:The period during which the device is triggered by vibration

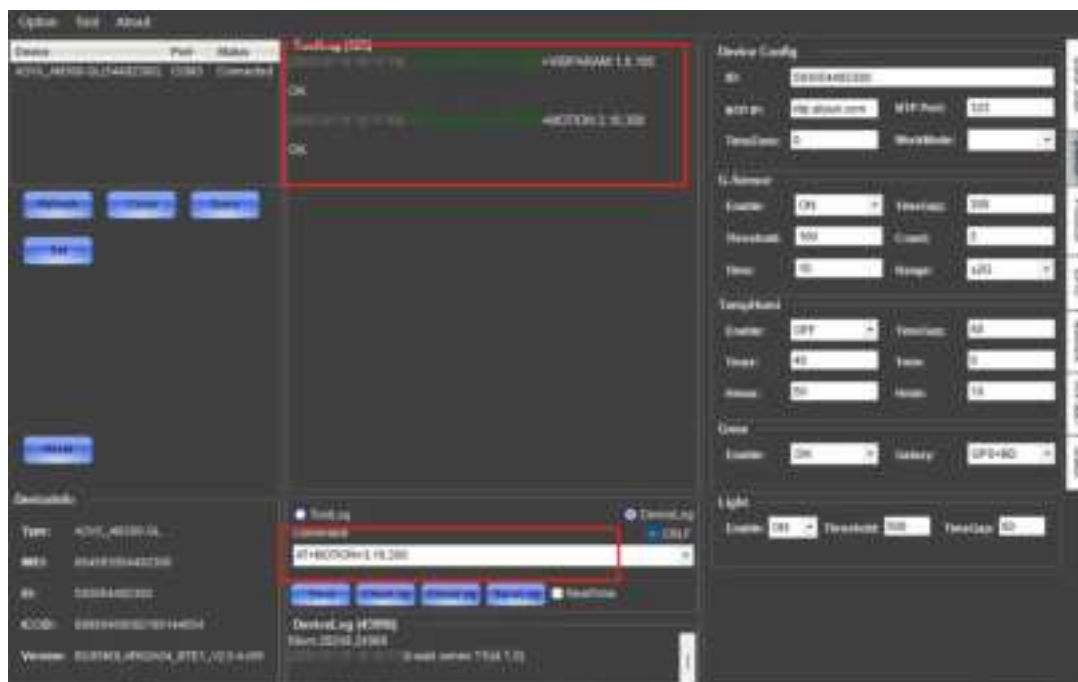


Figure18 Configure G-Sensor by sending AT command

③Send **AT+MOTION?** And **AT+VIBPARAM?** to check the G-Sensor

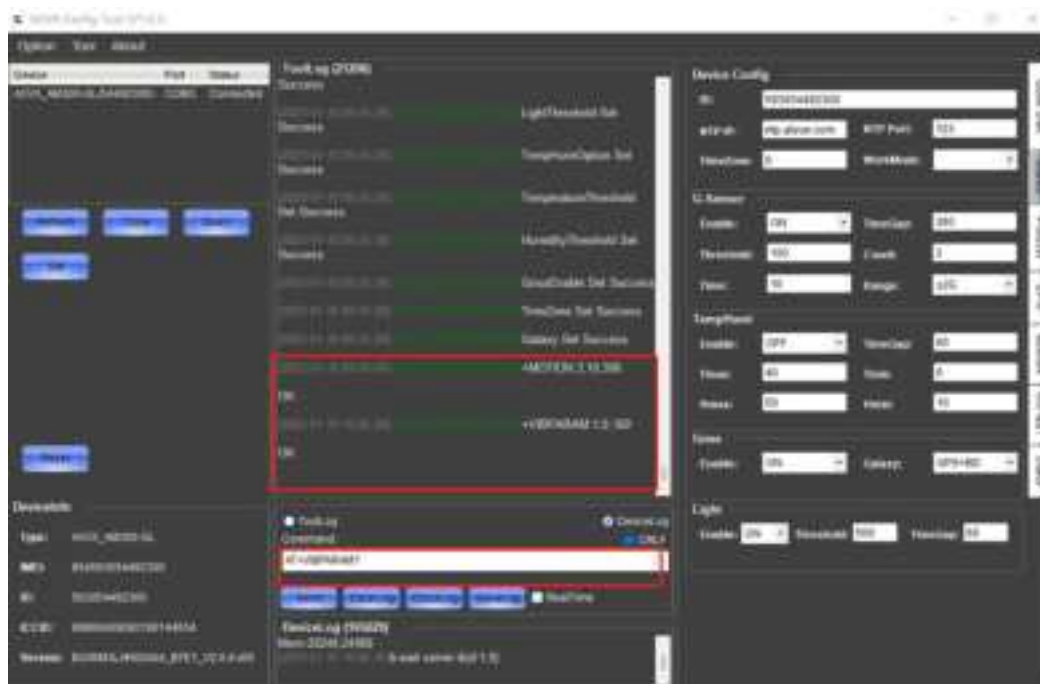


Figure19 Check G-Sensor interval

4.8.4. Configure G-Sensor by SMS Command

- ① Make sure the device is online.
- ② Send Send **MOTION=<count>,<time>,<timegap>**.

VIBPARAM=<enable>,<range>,<sensitivity>

For example:

VIBPARAM=1,0,100

MOTION=3,10,300

Then received the reply:

+

VIBPARAM:1,0,100

+

MOTION:3,10,300



Figure20 Configure G-Sensor by sending SMS command

③ Send **MOTION?** and **VIBPARAM?** to check the G-Sensor



Figure21 Configure G-Sensor by sending SMS command

5. Firmware Upgrade

5.1.OTA Upgrade

5.1.1.Third Party or Customer Owned Platform

For third-party or customer owned platforms, please refer to [Product protocol integration guidance](#)

5.1.2. Aovx Platform

If you need to use the Aovx platform for OTA upgrade, You can use the AT instruction to upgrade.

Open a link:<https://icloud.jointcontrols.com>



Figure22 Platform login interface

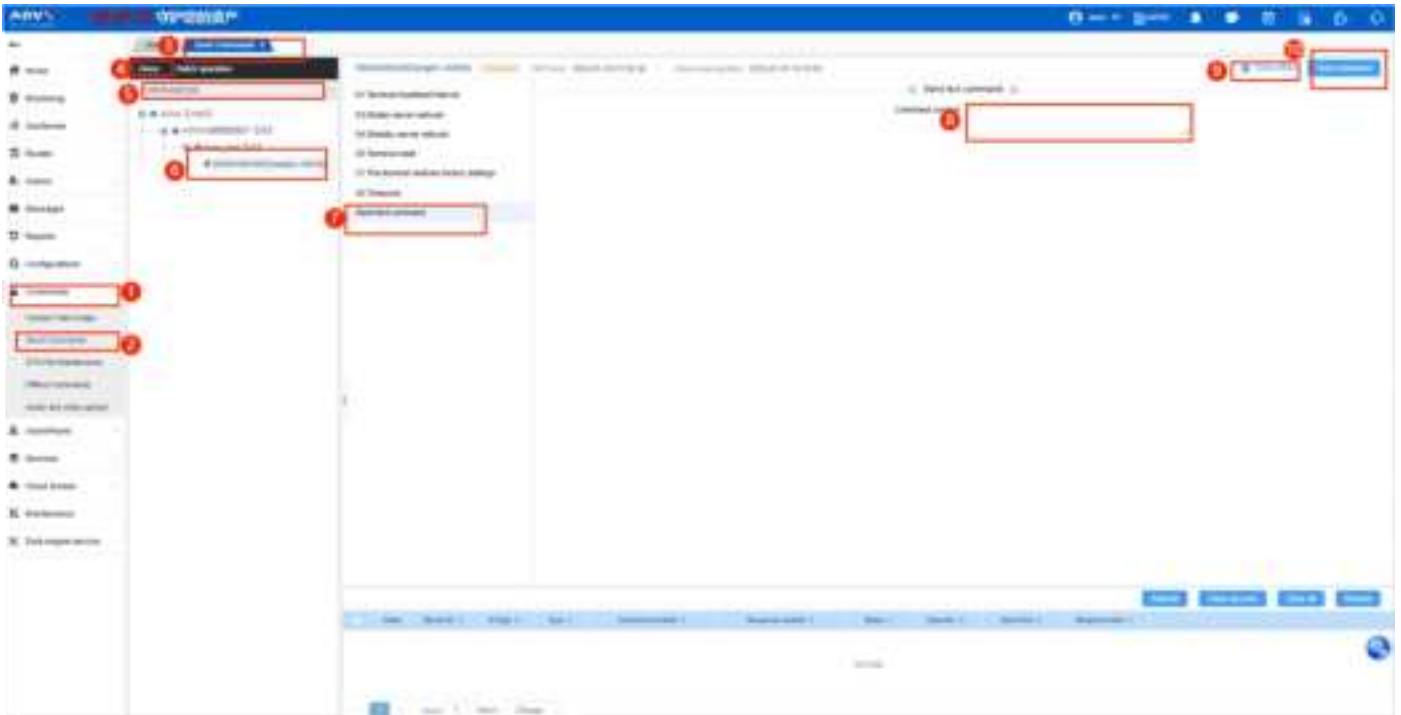


Figure23 AT command configuration interface

1. Select Commands
2. Select Send Commands
3. Select the Send Commands window on the right
4. Choose Alone
5. Enter the device ID
6. Select the device to be upgraded
7. Select Send text command on the right
8. Enter the AT command to configure the firmware upgrade:

AT+FOTA=[type],[version],[url]

type: 0:update app 1:update core

version:It can be ignored if the “url”include the version.

url:full http url for fota

Eg:

AT+FOTA=0,AOVX_ST100-XX_H2.0_V2.0.2_v04.bin,http://47.122.0.191:8080/file/Firmware_Jt808_AOVX/20221028/AOVX_ST100-XX_H2.0_V2.0.2_v04.bin

9. Select Send offline
10. Send command

Note: If you need to use this server for remote instruction configuration, just replace the AT command in Step 8 with the command you need to use

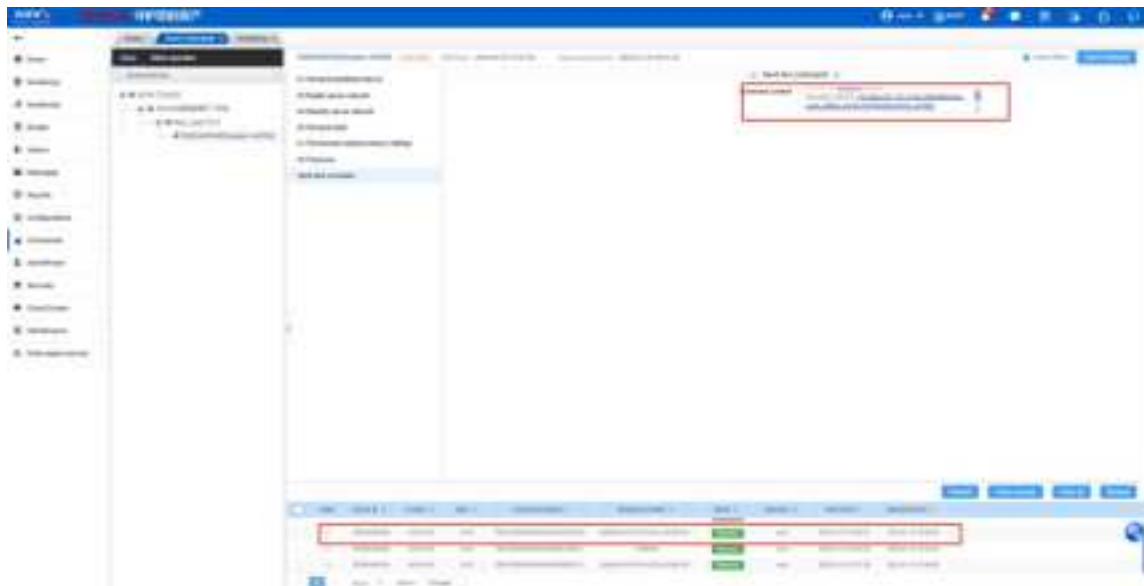


Figure24 OTA upgrade success page

5.2. Local Upgrade

5.2.1. The device and fittings



ST100

5.2.2. Upgrade Steps

- ① Unscrew the screws, remove the back cover and turn the built-in switch to off. Then power on the device and connect to computer via USB cable.
- ② Open the **Config Tool** and choose the right port.

③Click **Tool-Download** in the top left corner of the tool.

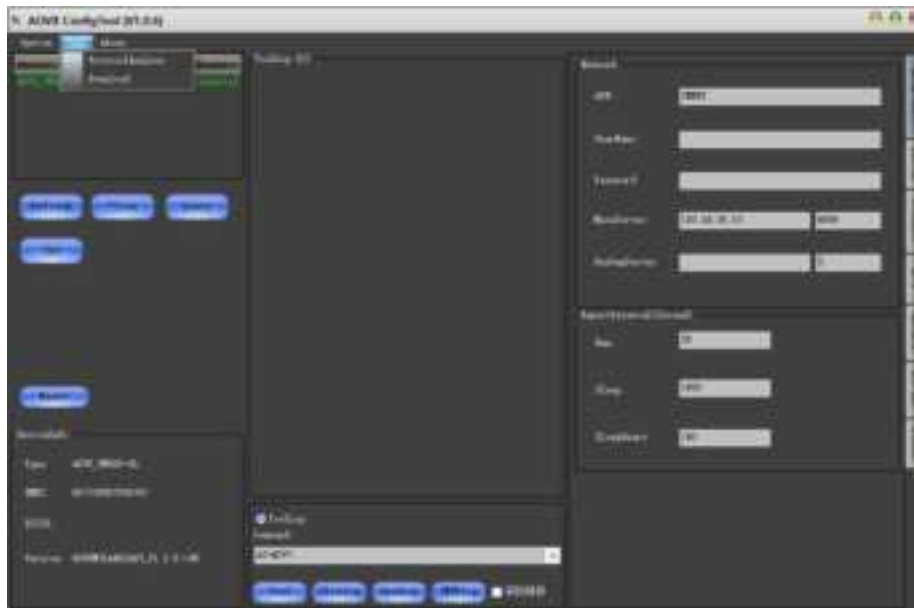


Figure25 Firmware upgrade interface

④Click **here** to find the latest firmware. Click **Browse** and choose the latest upgrade package, then click **Download**.

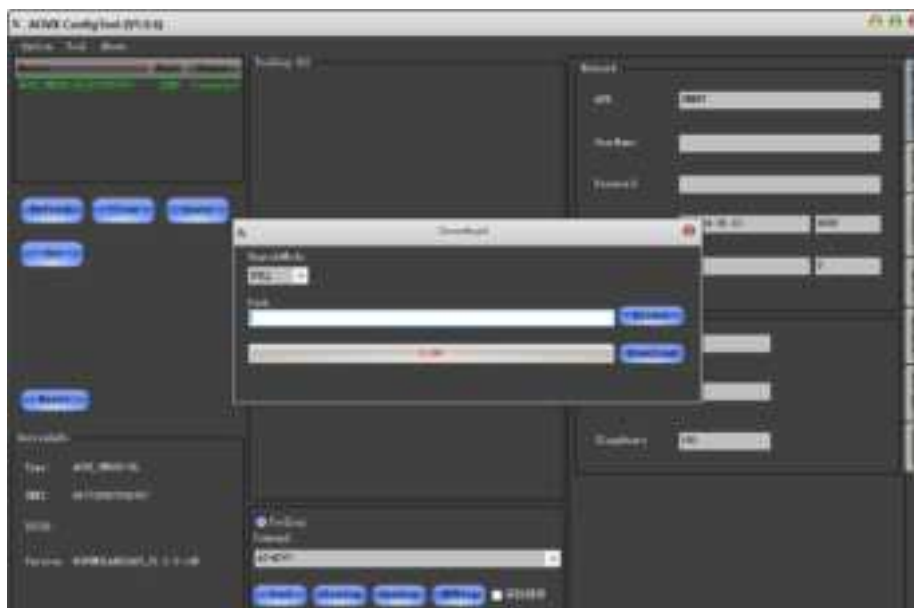


Figure26 Download firmware

⑤Wait for the progress becomes 100% and says **Download success**. It means the upgrade is complete.

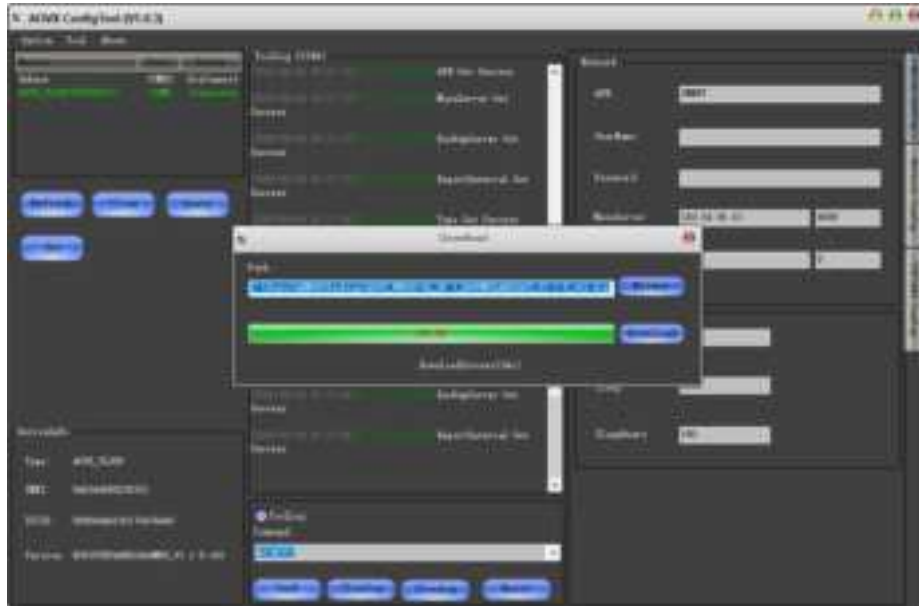


Figure27 Upgraded success interface

⑥ Check the version of the device. The version is in the left corner of the tool. It also can be checked by sending **AT+QTV?**

6. Installation

A Series devices can be installed in two ways:

1. Install the device by screws.
2. Install the device by magnets.(magnets are optional)
- 3 Install the device by 3M tape

7. FAQ

7.1. Unable to Register

Question1: The SIM card is not installed properly or loose / there is dirt on the metal surface of the SIM card / the SIM card is damaged or invalid

Solution1: Check SIM card, and reinstall / please wipe it with a clean cloth / replace the valid SIM card.

Question2: Beyond the operator's service area

Solution2: Please move the device to the service area of the network service provider or change local SIM card.

Question3: No APN configured or APN configured incorrectly

Solution3: Ask the operator about the APN, username and password of the SIM card then configured them by config tool.

Question4: Determine whether there is a problem with the SIM.

Solution4: You can replace your own mobile phone card for verification.

Question5: Test if the SIM card is identified.

Solution5:AT+CMD=AT+CPIN?

If identified, the device will reply with :

+CPIN: READY

OK

Question6: Determine if the SIM has a user name and a password.

Solution6:Check with your carrier.

Question7: Determine the SIM card operator and ask if it is a directional card.

Solution7:If it is a directional card, you need to add our website to the whitelist of the SIM card.

Question8:View the SIM card injection network situation.

Solution8:AT+CMD=AT+CGREG? or AT+CMD=AT+CEREG?

If identified, the device will reply with :

+CGREG: 0,1 or +CEREG: 0,1

OK

7.2. Unable to use the config tool



Figure28 USB serial cable

1. It is recommended to use the USB serial port cable provided by our company. Please confirm the line sequence is correct when you are using another USB cable.
2. If you still cannot display any devices after waiting for one minute, click refresh.
- 3 Install USB driver, more details please find [here](#).

7.3. Config tool connect Fail

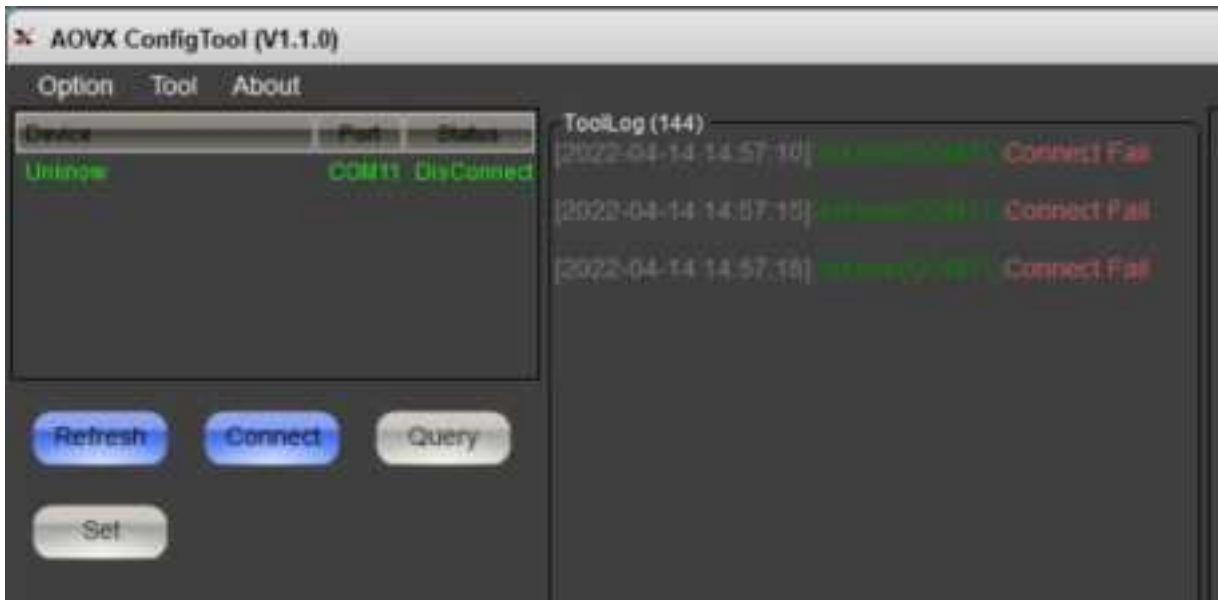


Figure29 Connect fail interface

There should be a disconnect from the device or the COM port has been occupied. Please reconnected the device or

closed all other com port related applications.

7.4. Device status

Question1:When is a message transmitted, if the device moves, if the device does not move ?

Solution1:When the device is at rest, it will report the information of the device according to the configured reporting period and sampling period,

For example:

The reporting period of the device is one hour, and the sampling period is 10 minutes. When the device is abled, the device reports six samples of device information every hour. When the device detects illumination or vibration beyond the threshold, a conditional trigger is generated and reported to the server. When the device is moving, the reporting cycle/sampling cycle and trigger condition are the same as that of the stationary one (it is recommended to turn off the enable of the G-sensor at this time, otherwise the vibration trigger will occur frequently).

Question2:What is the use of the WiFi ?

Solution2:It's used to locate the device.

Question3:Can we change the priority of WiFi vs GNSS for geolocation?

Solution3:GNSS location information is more accurate when the device is outdoors, WiFi and GNSS have no priority, their location information is not in the same field.

FCC part

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

This device may not cause harmful interference, and this device must accept any interference received, including interference that may cause undesired operation.

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

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: -Reorient or relocate the receiving antenna. -Increase the separation between the equipment and receiver. -Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. -Consult the dealer or an experienced radio/TV technician for help. This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.