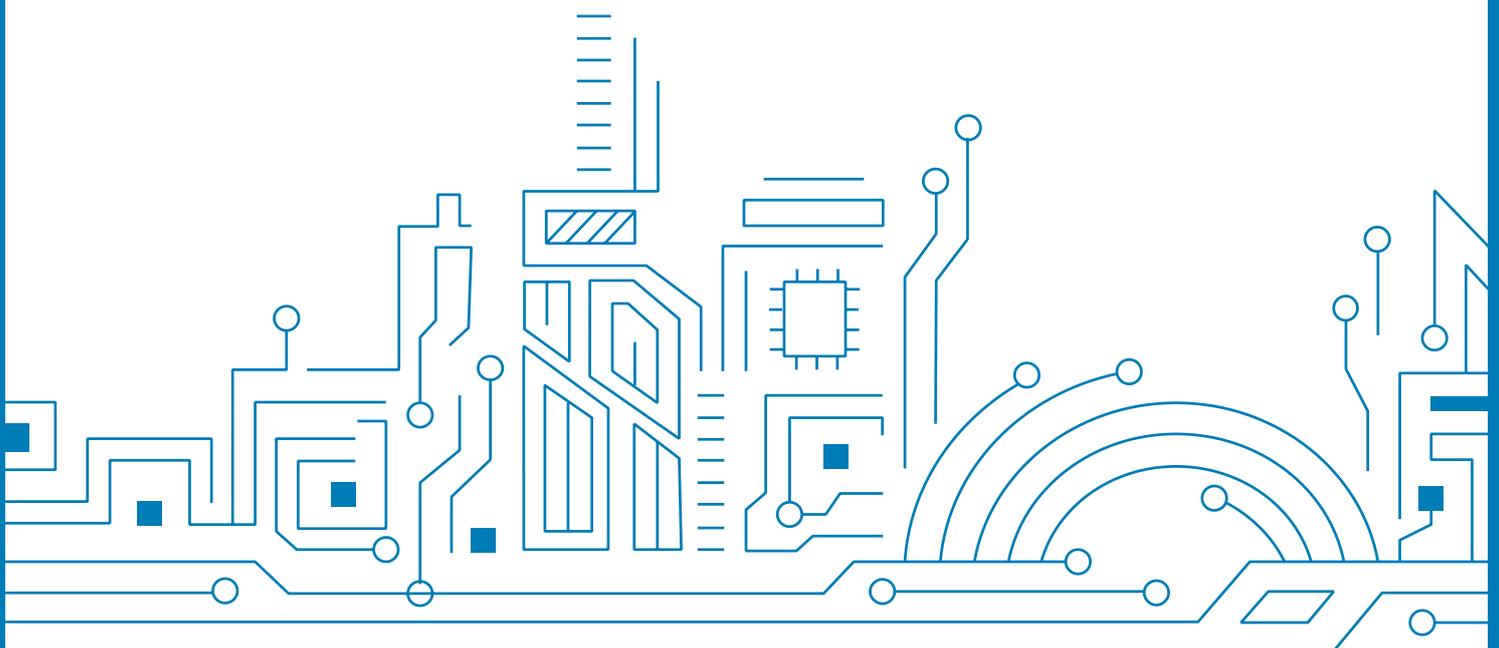


GNSS Evaluation Software

Satrack V3.00.1

User Manual



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1 OVERVIEW

1.1 General description

Satrack is an evaluation software, providing system integrators and end users with a quick and simple way to interface with ALLYSTAR GNSS chipsets, modules and boards. It enables easy Satellite tracking, GNSS messages analyzing, logging data receiving, and graphical representation of signaling, satellite communication and geographical information.

Satrack is designed to communicate with ALLYSTAR's Cynosure GNSS receiver via serial port or USB port. It provides general GNSS functions as well as real time and playback evaluation tools.

The purpose of Satrack is to enable users to:

- Conduct performance tests on ALLYSTAR and other GNSS devices.
- Configure ALLYSTAR GNSS positioning chips and modules.
- Update the firmware on GNSS modules.

1.2 Features

- Control of ALLYSTAR GNSS evaluation kits
- Display of Cynosure Binary Protocol
- Export data files to Earth
- Display of NMEA output
- File-logging of NMEA output
- Display of RTCM output
- Support for Windows® XP, Windows® 7 and Windows® 10

1.3 Applicability table

Products					
HD8020	HD8020D	HD8020S	HD8021	HD8021D	HD8021S
HD8022	HD8030	HD8030D	HD8030S	HD8031	HD8031D
HD8031S	HD8032	HD8040	HD804X	HD8040D	HD8041D
HD8050	HD8140	HD9301	HD9311	HD8140	HD8120
HD8122					

1.4 Software version

Satrack V3.00.XXX

2 GETTING STARTED

2.1 Installation of Satrack

For each type of receiver, please refer to the Applicability table for the supported ALLYSTAR GNSS modules in order to install the applicable USB drivers and connect the receiver to the PC.

2.1.1 System requirements

Satrack is built on top of Microsoft .NET Framework 4.0. Please make sure it is installed on the user's PC. It can be downloaded from Microsoft:

<http://download.microsoft.com/download/2/0/e/20e90413-712f-438c-988e-fdaa79a8ac3d/dotnetfx40.exe>

Some features of Satrack require the support from Google Earth. In order to let Satrack reach its best performance, it is highly recommended to install Google Earth on the user's PC. It can be downloaded from Google: <http://earth.google.com>

2.2 Connect an evaluation kit to the PC

This section assumes that you have an ALLYSTAR evaluation kit. The evaluation kit can be connected to the PC by using either an USB or a serial cable. In case of using the USB port, a driver is required (please contact our technical support to get the USB driver if necessary). Be sure to install the driver before connecting the evaluation kit to the PC.

- 1) Connect one end of the USB cable to the USB connector on the evaluation kit.
- 2) Connect the other end of the USB cable to your PC. The USB cable now supplies power to the unit.
- 3) Connect the GNSS antenna to the interface unit. For the best GNSS reception, place the antenna outside or near a window.

2.3 Start using Satrack

Satrack is a Windows application. After connecting a GNSS receiver to the PC, double click on the Satrack application icon to start using it.

2.3.1 Select the COM port or USB port

To connect Satrack with a GNSS receiver through a COM port or USB port on PC, follow these steps: From the main menu, check the Device combo box, and then choose the desired port.

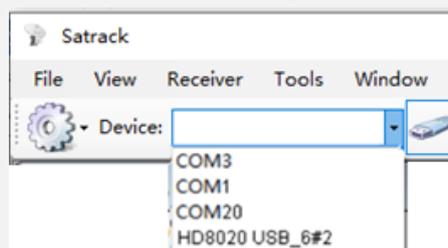


Figure 1 List of available com and usb ports

2.3.2 Select the baud rate

Select either icon named with “Device settings” on strip toolbar. You can change your bits per second (baud rate) (It is only availability on com mode).

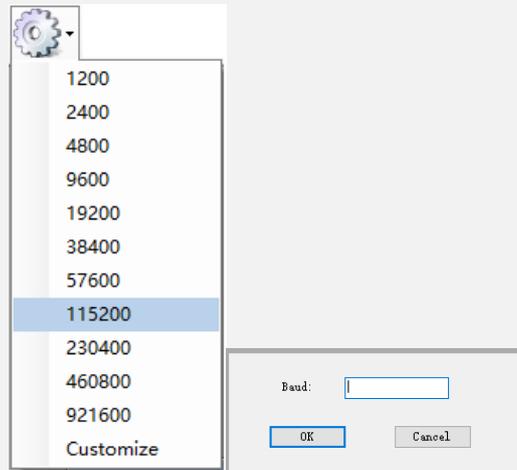


Figure 2 Select the baud rate

If the port is selected and the baud rate is set correctly, Satrack program will show the serial data activities on the screen, as well as the data plots in its open windows. The status bar will show the current communication state. User also can select “Customize”, and input user defined baudrate. The default rate is 115200.

2.3.3 Select the Location Api Port

To connect Satrack with a GNSS receiver through Location Api on PC, follow these steps: From the Device menu, check the Location Port, select Open, then check the Device combo box, and choose the Location Api port. Or, select Close, the Device combo box Location Api is deleted. The Location Api port only support Position Information.

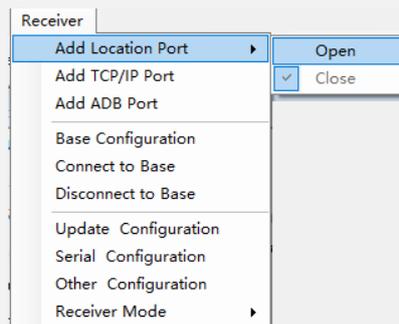


Figure 3 Open or Close Location Api port

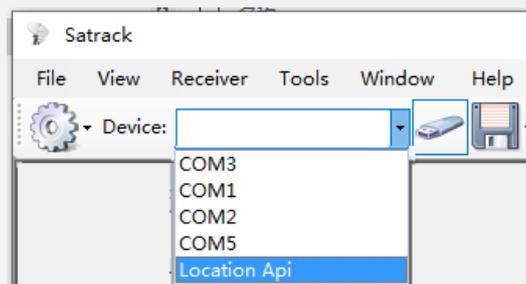


Figure 4 List of available Location Api port

3 INTRODUCTION TO MENUS AND TOOLBAR

3.1 Main screen

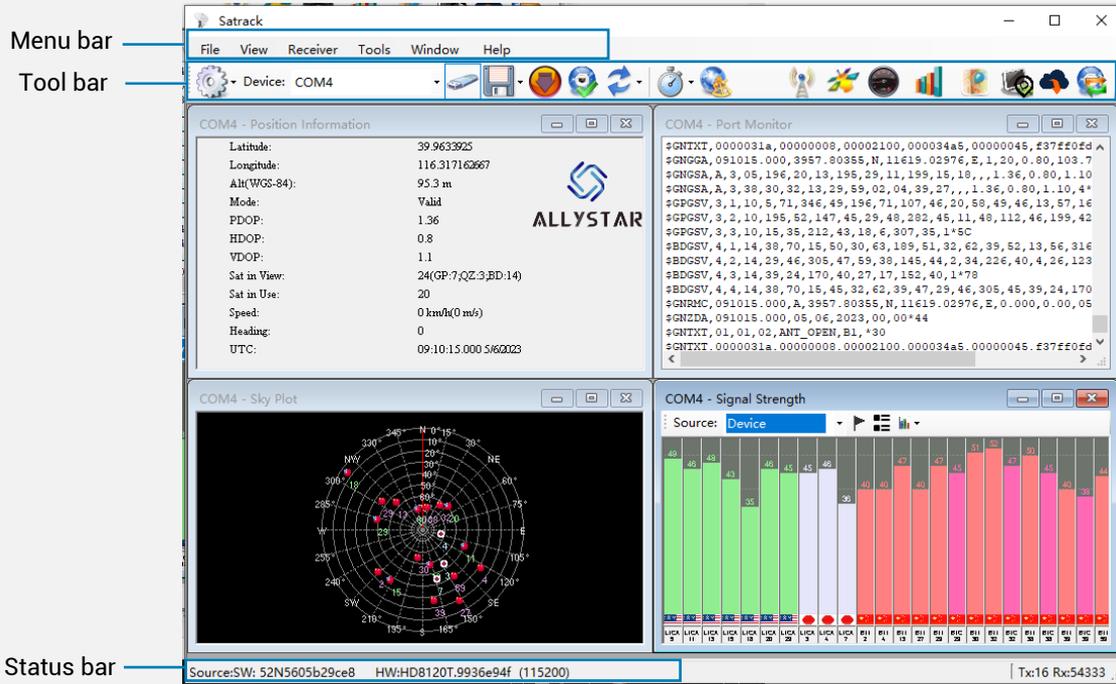


Figure 5 Satrack main screen

3.2 Menu bar

This section describes the drop-down menu entries. All Satrack functions can be accessed through the menu bar. Commands can also be accessed by shortcuts that are listed in the menus. Some often used operations are also available in the different toolbars.

3.2.1 File menu

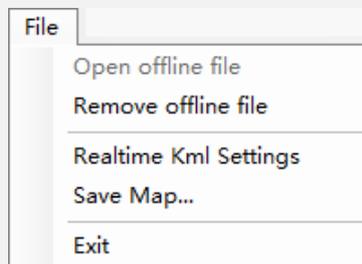


Figure 6 File menu

Table 1 File menu entries

Name	Description
Open offline file	Open a previously recorded log file
Delete offline file	Stop replaying the previously recorded log file

Realtime Kml Settings	Real time KML configurations.
Save Map...	Convert raw data to KML/KMZ files in order to view them in Google Earth after tracking finishes.
Exit	Exit Satrack.

3.2.2 View menu

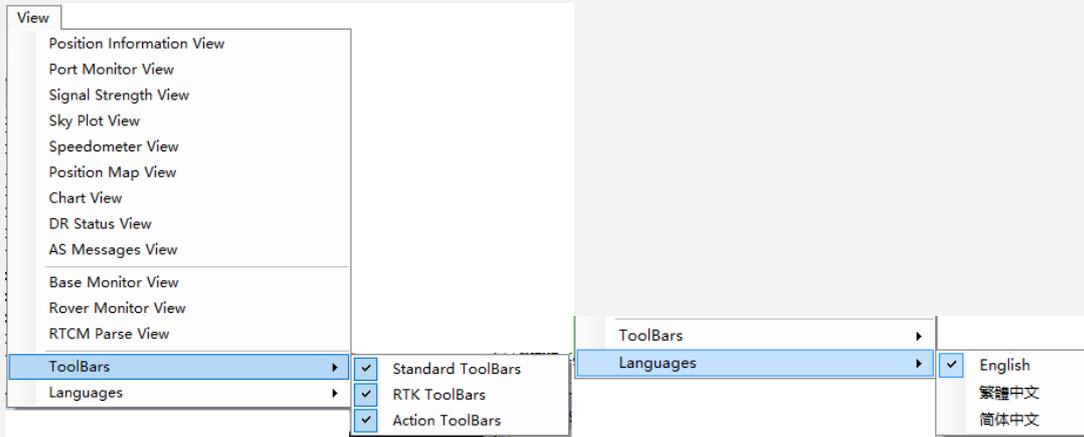


Figure 7 View menu

Table 2 View menu entries

Name	Description
Position Information View	Display general position information, including latitude, longitude, altitude, PDOP (Position dilution of precision), HDOP (Horizontal dilution of precision) and VDOP (Vertical dilution of precision), time, etc.
Port Monitor View	To view ASCII message data from the GNSS receiver, or view HD message data if your data is Aero.
Signal Strength View	Show signal quality of satellites in terms signal-to-noise ratio, in form of CNR bars.
Sky Plot View	Display all plots of position of satellites labeled with their identification number.
Speedometer View	Shows the current speed information.
Position Map View	Shows the position plots.
Chart View	Graphical representation of a wide range of combination among various kinds of data.
DR Status View	Show the DR status.
AS Messages View	Binary message view designed for communicating with GNSS receiver via binary protocol. It is available while device mode is HD User or HD Boot.
Base Monitor View	Parse the RTCM information of Base.
Rover Monitor View	Parse the RTCM information of Rover device.
RTCM Parse View	Parse the RTCM detail of Rover and Base.
ToolBars	Select the toolbars to show or hide.
Languages	Set up the display language.

3.2.3 Receiver menu

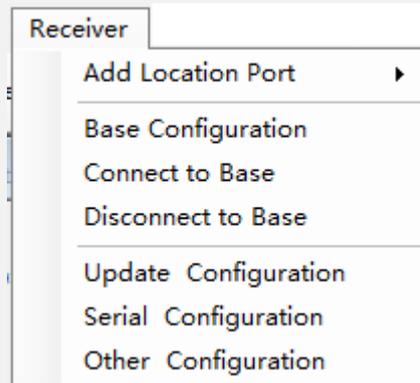


Figure 8 Receiver menu

Table 3 Device menu entries

Name	Description
Add Location Port	Add or delete the location port.
Base Configuration	Set base parameter.
Connect to Base	Connect to base.
Disconnect to Base	Disconnect to base.
Update Configuration	Set the firmware downloading baud rate or packet size.
Serial Configuration	Set the serial port. (It is only availability on COM mode)
Other Configuration	Change the fix mode (2D or 3D) on the location judgment. Select save or not save send data to log file.

3.2.4 Window menu

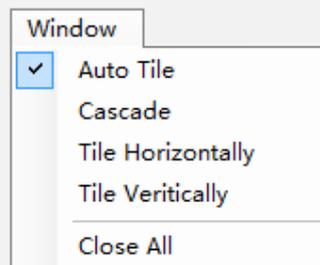


Figure 9 Window menu

Table 4 Window menu entries

Name	Description
Auto Tile	Arranges all open dialogs automatically.
Cascade	Arranges all open dialogs cascaded.
Tile Horizontally	Arranges all open dialogs horizontally.
Tile Vertically	Arranges all open dialogs vertically.
Close All	Closes all open dialogs and windows.

3.2.5 Tools menu

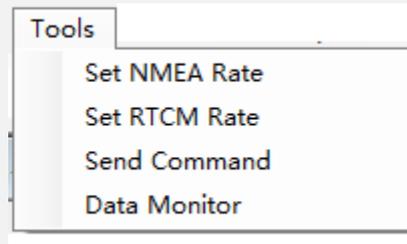


Figure 10 Tools menu

Table 5 Test menu entries

Name	Description
Set NMEA Rate	Set NMEA message baud rate.
Set RTCM Rate	Set RTCM message baud rate.
Send Command	Send command user defined.
Data Monitor	Parse all the data information of Base.

3.2.6 Help menu

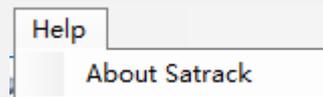


Figure 11 Help menu

Table 6 Window menu entries

Name	Description
About Satrack	Shows the about dialog with the software version.

3.3 Tool bar



Figure 12 Tool bar

Table 7 Tool bar entries

Icon	Name	Description
	Baudrate	Change the bits per second (baud rate).
	Connect/Disconnect	Connect or disconnect with the GNSS receiver.
	Real-time Google Earth link	Real-time link to Google Earth.
	Save log	Save log from GNSS receiver.
	Boot Firmware Update	Firmware update in boot mode, only available in boot mode.
	User Firmware Update	Firmware update in user mode, only available in user mode.

	Restart	Restart the GNSS receiver.
	Comparison Testing	Test the desired GNSS receivers to make a comparison.
	Position Information	Shows the position information.
	Port Monitor	Shows the port monitor.
	Signal Strength	Shows the signal strength.
	Sky Plot	Shows the sky plot.
	Speedometer	Shows the speedometer.
	Chart	Shows the chart.
	Position Map	Shows the position map.
	Base Connect	Base Connect
	Base Disconnect	Base Disconnect
	Rover Monitor	Shows Rover monitor
	Base Monitor	Shows Base Monitor
	RTCM Parse	Shows RTCM Parse information.

3.4 Status bar

Located at the bottom left corner is the status bar. The standard status bar is updated automatically and shows the information about the opened file and the connection status, such as the:

- Connection state: connected, disconnected, or no connection
- Port parameter: port name and baud rate (when the port is connected)
- Bytes information: Tx means total numbers of all sent bytes, and Rx means that of all received bytes. Tx and Rx will become zero when dut reconnected.

4 MONITORING PLATFORMS

Various monitoring platforms can be displayed by clicking their names in "**View**" from the menu bar or by the shortcut icons from the tool bar.

The following table shows monitoring platform with their respective related NMEA message(s): (✓ means Related).

Platform	GGA	GLL	GSA	GRS	GSV	RMC	VTG	ZDA
User Position	✓	✓	✓	✓	✓	✓	✓	✓
Port Monitor	--	--	--	--	--	--	--	--
Signal Strength	--	--	✓	--	✓	--	--	--
Sky Plot	--	--	✓	--	✓	--	--	--
Speedometer	--	--	-	--	--	✓	✓	--
Position Map	✓	✓	-	--	--	✓	--	--
Chart	✓	--	✓	--	--	✓	--	--
Messages	--	--	--	--	--	--	--	--

* The graphical representations on these platforms are based on the raw messages output from the GNSS receiver. If the message outputs from GNSS receivers are corrupted due to COM port error or unstable environment, Satrack will not be able to decode the correct data thus the related platforms may not update accordingly.

4.1 Position Information

Open "**Position Information**" from the menu or tool bar, this platform includes all the information of user position like longitude, latitude, altitude, speed, number of satellites in view, etc. User can select a device from combo box at the top to view user position information. Those information is displayed as follows.

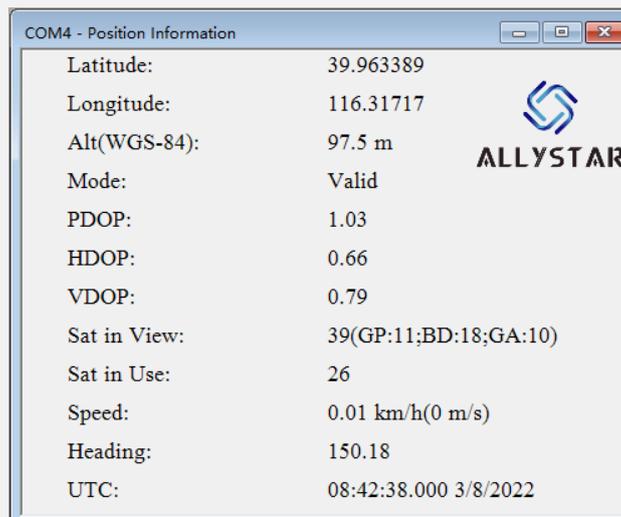


Figure 13 Position information

4.2 Port Monitor

Open "Port Monitor" from the menu or tool bar, this platform allows user to view ASCII message data.

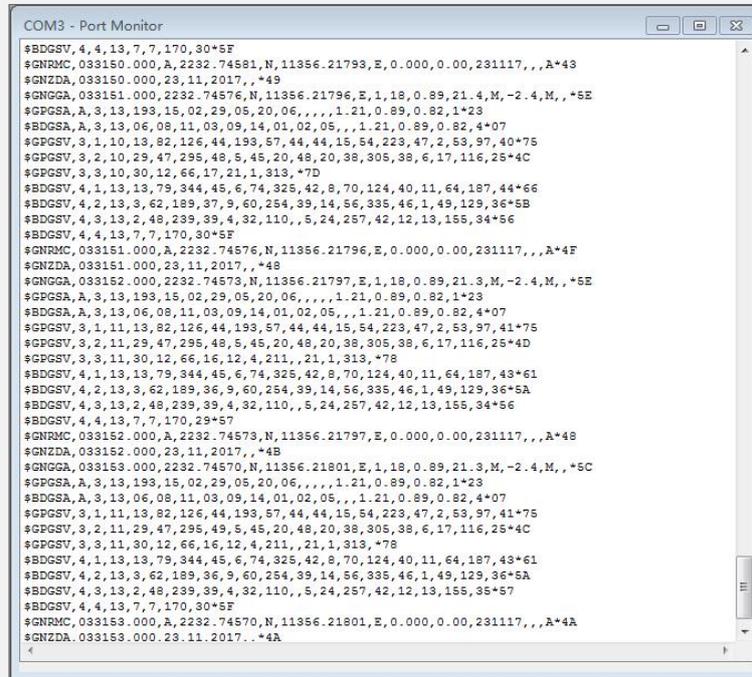


Figure 14 Port Monitor with NMEA messages (ASCII)

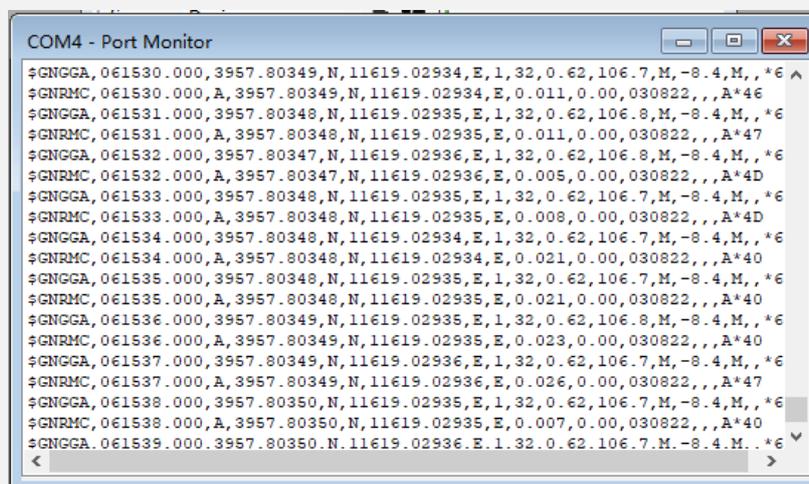
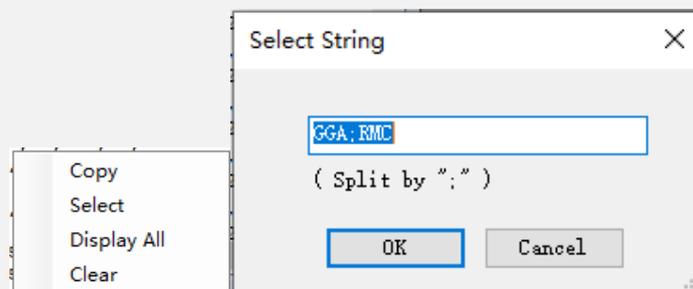


Figure 15 Select display content of Port Monitor

- Re-selection of device from list will refresh the message screen and messages from another device are shown on screen then.
- User can copy the output message by selecting them in Port Monitor window and press Ctrl+C or click "Copy" to copy them into the clipboard.
- User can select the output message by click "Select" menu and input select message to the Select String window. More than one string can split by ";". As the figure, it is only show GGA and RMC message.
- User select "Display All", the message will show without CRC check, or the CRC error message will now show in monitor.
- User can Clear the Port Monitor show by click "Clear".

4.3 Signal Quality

Select "**Signal Strength**" from the menu or tool bar, to view signal quality of all satellites from different devices in form of CNR bars. User can select to view only one device or all devices from combo box at the top. The order of SVID displayed follows the original output sequence of the source device. However, when all devices are displayed together, the order of SVID is sorted in ascending order from left to right.

Explanations:

- The Signal Strength platform shows the information of signal quality. It uses the GSV NMEA messages to extract the signal to noise ratio (SNR C/No) and GSA NMEA messages to extract to satellites in use. The number of SNR bars will vary according to the number of satellites in view.
- SNR values are displayed above each corresponding bar. Full scale is considered for any SNR value of 55 dB or above. Satellite IDs are displayed to identify respective satellites below the signal bars.
- Signal bars are displayed in brighter color if the satellite in view is in used as well. Otherwise, signal bars will be displayed with a transparent color.

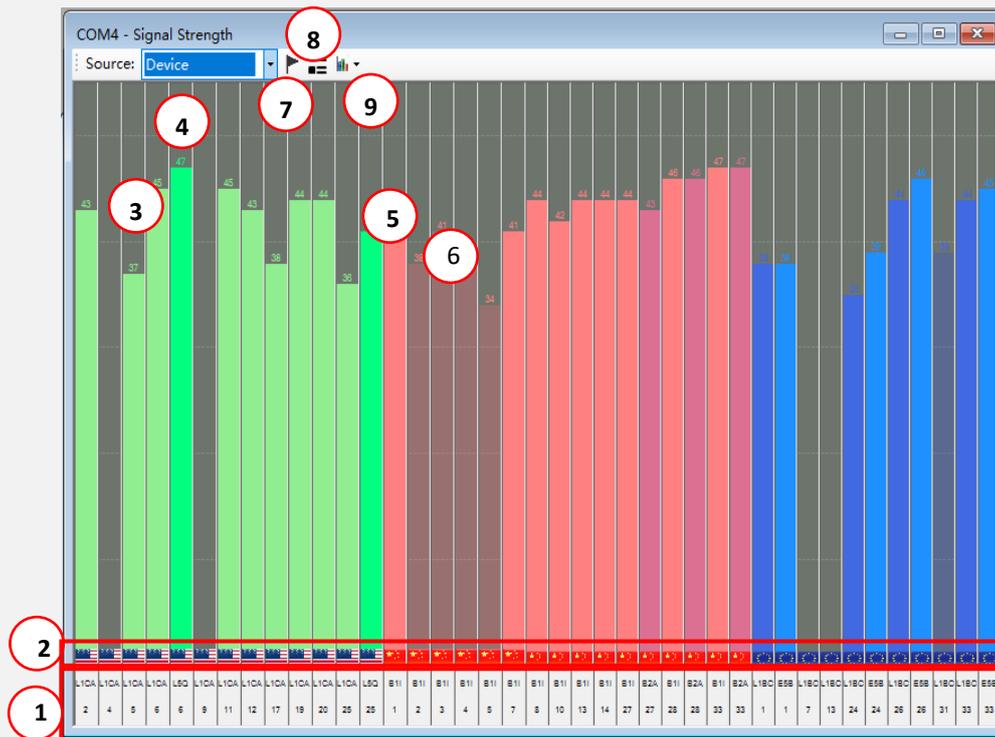


Figure 16 Signal Strength

- (1) - A list of satellite IDs at instance, they are in ascending order. The above means frequency, down means satellite IDs.
- (2) - A list of flags for each satellite. The position can change by (7).
- (3) - A Signal bar in green color, showing signal-to-noise ratio SNR value (45) in rectangular form from a GPS satellite with ID 6 of frequency GPS L1CA.
- (4) - A Signal bar in green color, showing signal-to-noise ratio SNR value (47) in rectangular form from a GPS satellite with ID 6 of frequency GPS L5Q.
- (5) - A Signal bar in green color of USA flag, showing signal-to-noise ratio in rectangular form from a GPS satellite. A Signal bar in red color of China flag, showing signal-to-noise ratio in rectangular form from a BDS satellite. A Signal bar in white color of Japan flag, showing signal-to-noise ratio in rectangular form from a QZSS satellite. A Signal bar in blue color of European Union Nation, showing signal-to-noise ratio in rectangular form from a GALILEO satellite. A Signal bar in yellow color of Russia flag, showing signal-to-noise ratio in rectangular form from a GLONASS satellite. A Signal bar in orange color of India flag, showing signal-to-noise ratio in rectangular form from a IRNSS satellite.
- (6) - A signal bar and SNR value in a transparent red color, meaning that the BeiDou satellite with ID 19 of B1I is currently not in use.
- (7) - The button can change the flags position or not display of flags.
- (8) - The button can show the CNR as float mode.
- (9) - The button can select satellites with different systems.



Figure 17 Different flags options of Signal Quality

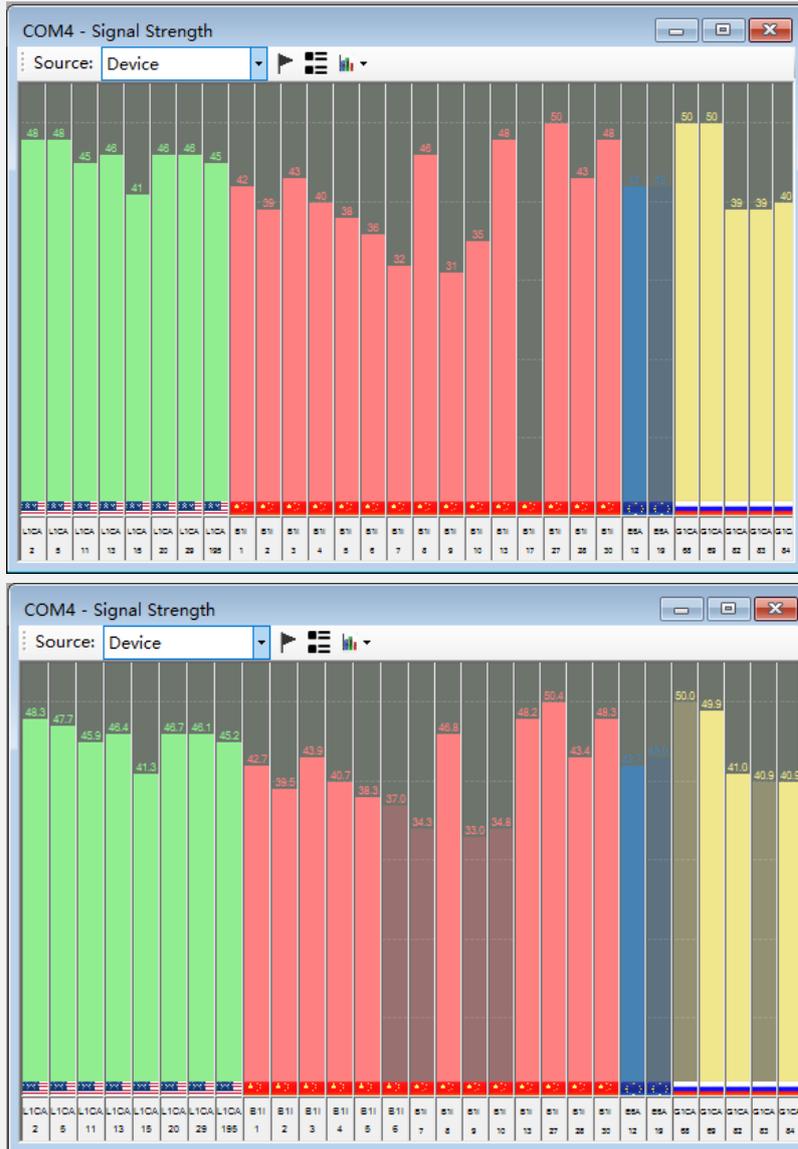


Figure 18 CNR float mode of Signal Quality

provided by the GNSS receiver. To enable this, please right click anywhere in the sky plot and select **"Compass"**.

- The Sky Plot platform shows the information of azimuth and elevation. It shows satellite position and the physical antenna mask angle. The satellite position is represented using azimuth, ranging from 0° to 360°, and elevation, ranging from 0° to 90° where 0° is the horizon.
- Similar to the Signal Bar platform, Sky Plot platform uses the GSV NMEA messages to extract azimuth and elevation for each satellite that is in view and GSA NMEA messages to extract the in-use satellites. Satellite IDs are displayed near the "X" plot to identify respective satellites.
- Plots are displayed in a brighter color for the in used satellites while with transparent color for the not-in-use ones.

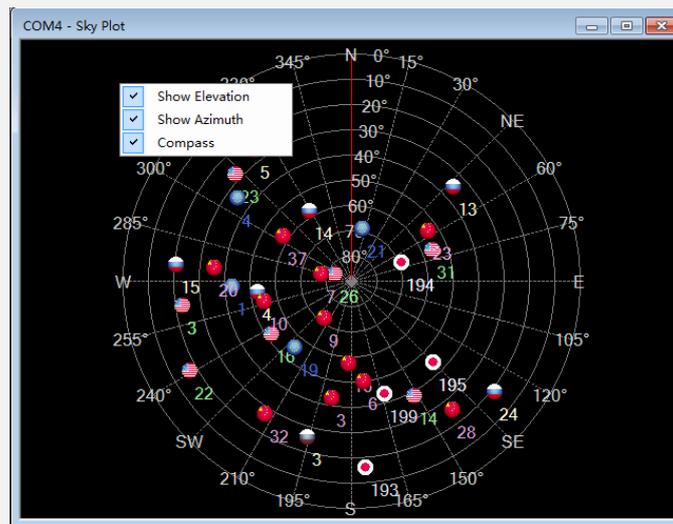


Figure 20 Sky Plots with plots (I)

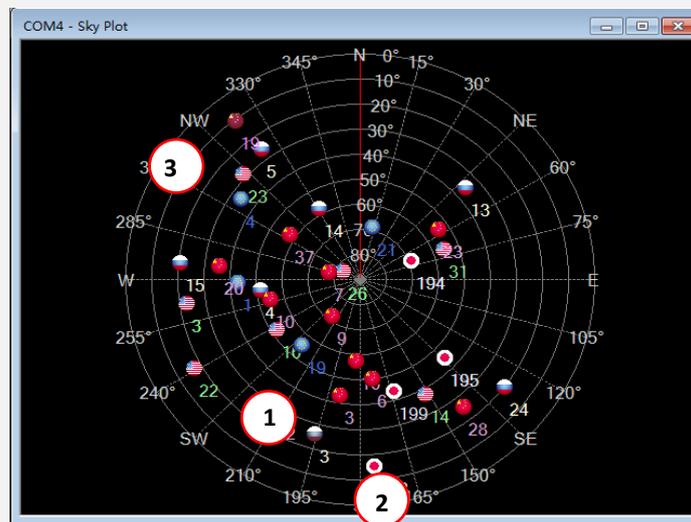


Figure 21 Sky Plots with plots (II)

- (1) - Plot of position of satellite with ID 22 which is in use, flag of USA means GPS signal.
- (2) - Flag of USA means GPS signal. Flag of China means BDS signal. Flag of Japan means QZSS signal. Flag of European Union Nation means GALILEO signal. Flag of Russia means GLONASS signal. Flag of India means IRNSS signal.
- (3) - Plot of position of satellite with ID 19 of transparent flag of China which means BD signal

and not in use.

4.5 Speedometer

Open **"Speedometer"** from the menu or tool bar, this platform allows user to view the speedometer.

- The speedometer can swap its speed displayed unit between km/h and m/s. To do the swapping, please right click anywhere on the speedometer and follow instructions.
- The maximum speed speedometer can display is 80m/s or 300km/h.



Figure 22 Speedometer

4.6 Position Map

Open **"Position Map"** from the menu or tool bar, this platform allows user to view the deviation positions in longitude and latitude relative to a defined reference position.

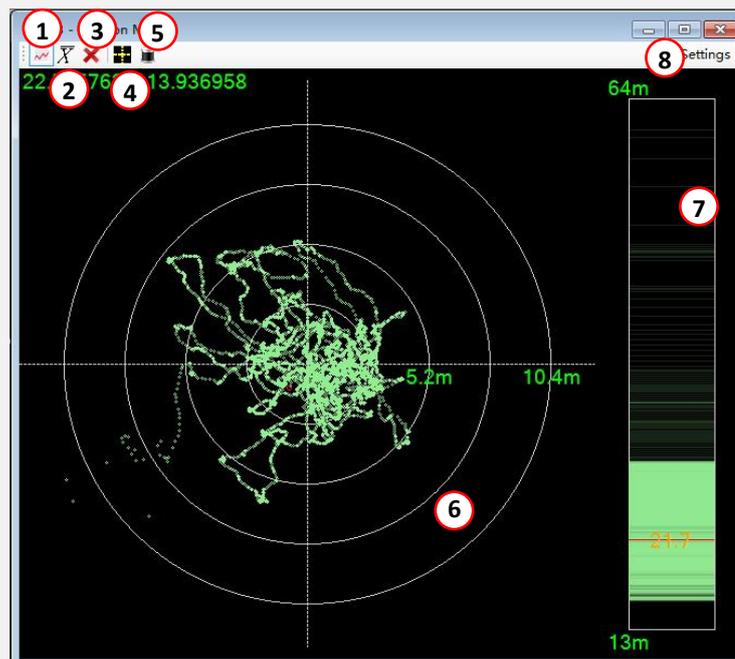


Figure 23 Position Map

- (1) Make sure the connection to devices has been started.
- (2) Select **"Position Map"** in **"View"** menu.
- (3) This platform includes information of user position like longitude, latitude and altitude.
- (4) User can select a device from combo box at the top to view user position information from that device. Position information is displayed as follows.

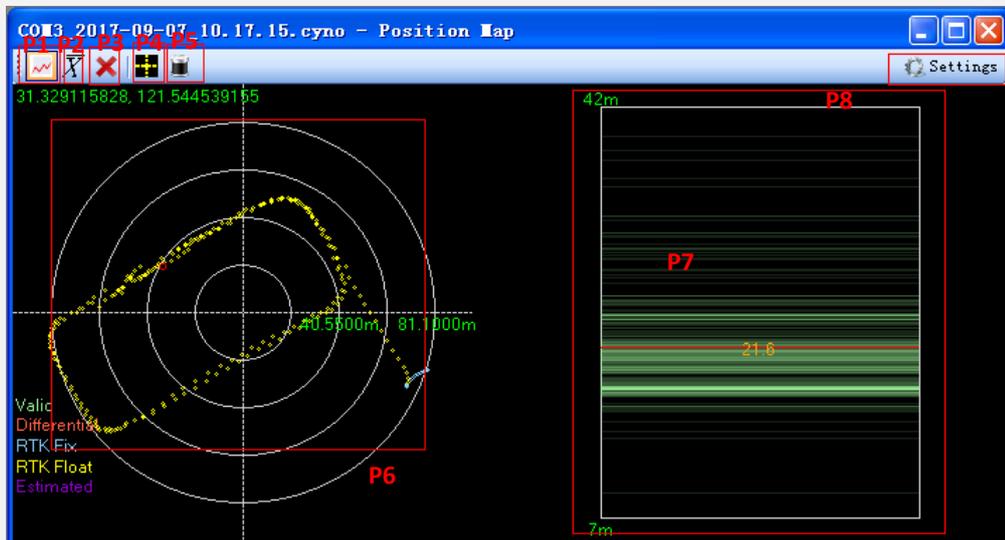


Figure 24 Position Map with default setting

- P1 - Show/Hide information from target device
 - P2 - Show/Hide position averaged line from target device
 - P3 - Remove all data from target device
 - P4 - Show/Hide position averaged line from all device
 - P5 - Remove all data from all devices
 - P6 - The position chart displaying fixed positions, the different color means different fix mode
 - P7 - The height chart displaying fixed altitude
 - P8 - Open the setting dialogue of position map platform
-
- (1) - Show/hide information from target device.
 - (2) - Show/Hide position averaged line from target device.
 - (3) - Remove all data from target device.
 - (4) - Show/Hide position averaged line from all devices.
 - (5) - Remove all data from all devices.
 - (6) - The position chart displaying fixed positions.
 - (7) - The height chart displaying fixed altitude.
 - (8) - Open the setting dialogue of position map platform.

4.6.1 Position Map setting

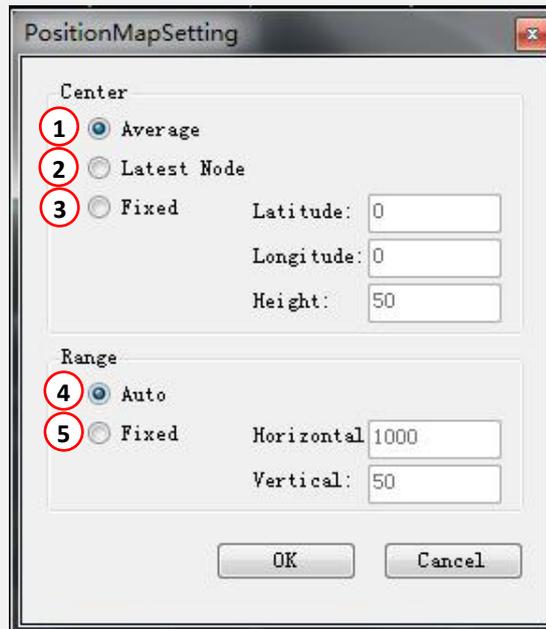


Figure 25 Position Map setting

- (1) - Configure the center of position map and height chart to be the average value of all devices.
- (2) - Configure the center of position map and height chart to be the average of all devices' latest node.
- (3) - Customize the center of position map.
- (4) - Auto tune the range on chart so that it fits all data.
- (5) - Fix the display range to a certain value. By doing this, position chart may not be able to display all data, those out of range data will not be displayed.

4.7 Chart platform

4.7.1 Interface descriptions

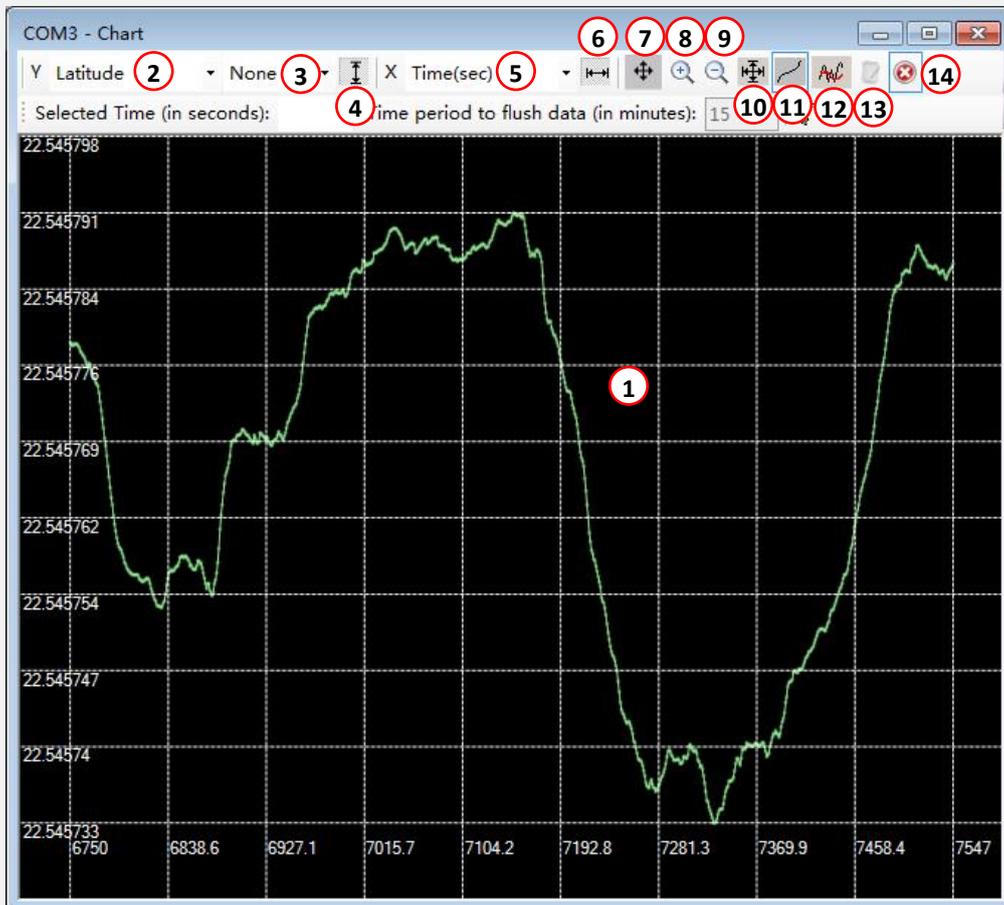


Figure 26 Chart Platform

- (1) - Display of graphs plotted with various kinds of data.
- (2) - A list of values can be selected and displayed on Y-axis. Types of value include latitude, longitude, altitude, PDOP, HDOP, VDOP, speed (m/s), direction (degree) and acceleration (m/s²).
- (3) - Several statistical tools to be selected, only standard deviation and difference between any two devices on same value on across time are available. "None" means no statistical tool is selected.
- (4) - Fit the Y range.
- (5) - A list of values can be selected and displayed on X-axis. Types of value include latitude, longitude, altitude, PDOP, HDOP, VDOP, speed (m/s), direction (degree), acceleration (m/s²) and time (second).
- (6) - Fit the X range.
- (7) - Graph(s) can be moved inside chart platform. Click and drag/drop the chart.
- (8) - Zoom in the chart by clicking on one point of chart.
- (9) - Zoom out the chart by clicking on one point of chart.
- (10) - The chart is auto-scaled based on X and Y ranges.
- (11) - Draw a line to connect all plots on same device.

- (12) - Adds a moving average. The average is calculated over the number of most recent values, specified with the parameter.
- (13) - Add a function to report significant errors based on the standard deviation of value among all devices across time. Errors are reported and output to a txt file.
- (14) - Enable/disable the chart to discard data automatically.

4.7.2 Error Report

- **Introduction**

At the time more than one is connected and reporting error is set up, an error report is generated. It lists out all significant differences as well as errors in values among all devices. If standard deviation of a value at a time is higher than maximum allowable standard deviation for same value, it will be reported. For example, standard deviation of 1.8 of PDOP is recorded at time 1/6/2009 6:49:14 and maximum allowable standard deviation is 1.0, then it's reported. A line of UTC (Coordinated Universal Time), value type, data from different devices and standard deviation at that time is written on that file.

File name is combination of UTC and names of all devices. The file is then saved in a folder called "**Error report**" at the same directory of Satrack.exe file.

- **Maximum allowable standard deviation**

Values chosen for maximum allowable standard deviation are selected through many tests and appropriate amount of errors are reported in ideal case. Values for maximum allowable standard deviation are listed as below (in terms of standard deviation):

Parameter	Maximum allowable standard deviation
Latitude (x-coordinate)	20.0
Longitude (y-coordinate)	20.0
Altitude (meter)	30.0
PDOP	1.0
VDOP	1.0
HDOP	1.0
Speed (meter/second)	1.5
Direction (degree)	20.0
Acceleration (meter/second ²)	2.0

- Outlook of error report

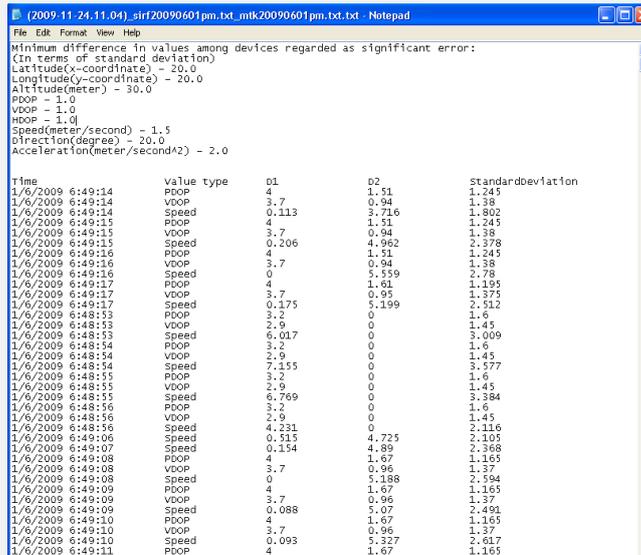


Figure 27 Outlook of error report

4.8 DR Status

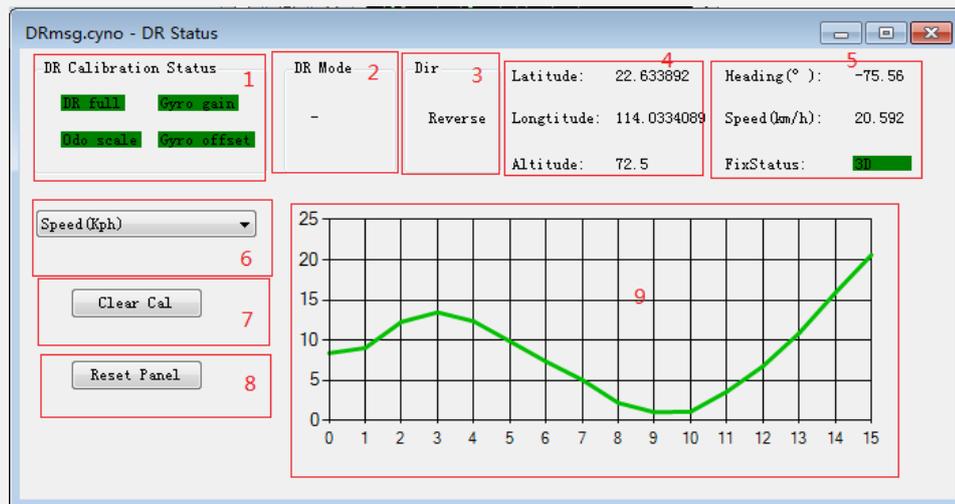
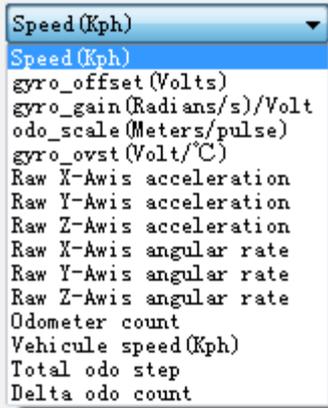


Figure 28 DR Status Form

- (1) Show the DR calibration status.
- (2) Show the DR mode.
- (3) Show the DR dir.
- (4) Show the latitude, longitude and Altitude.
- (5) Show the heading, speed and fix mode of DR.
- (6) Select the date of chart 9.



- (7) Clear the DR calibration status in 1.
- (8) Reset page display.
- (9) The chart, the data of Y is 6, data of X is time.

4.9 Rover Monitor

- (1) Make sure the connection to device has been started.
- (2) Select "Rover Monitor" in "View" menu.
- (3) User can parse RTCM message data from that device.

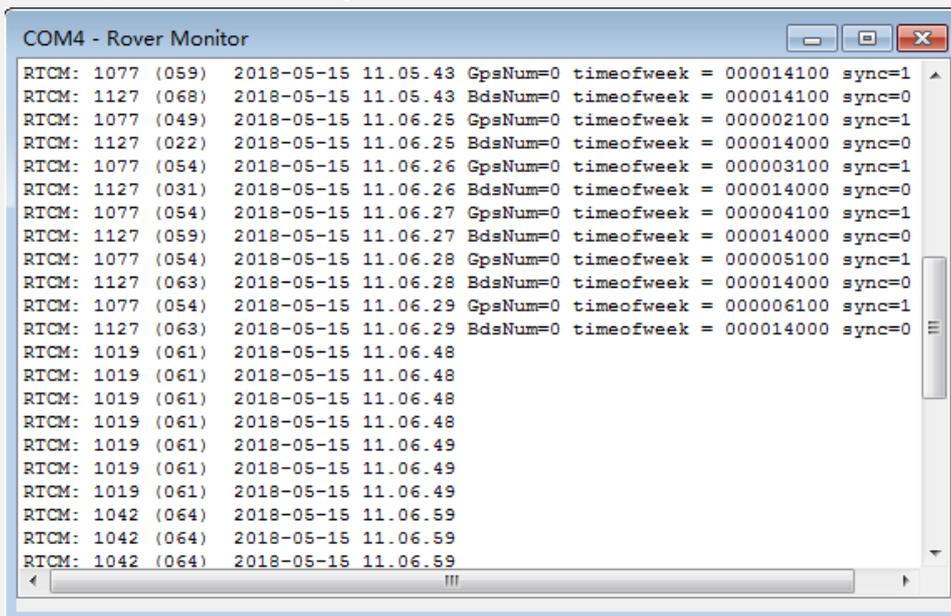


Figure 29 Rover Monitor with RTCM messages Displayed

4.10 Base Monitor

- (1) Make sure the connection to base has been started.
- (2) Select "Base Monitor" in "View" menu.
- (3) User can parse RTCM message data from Base.

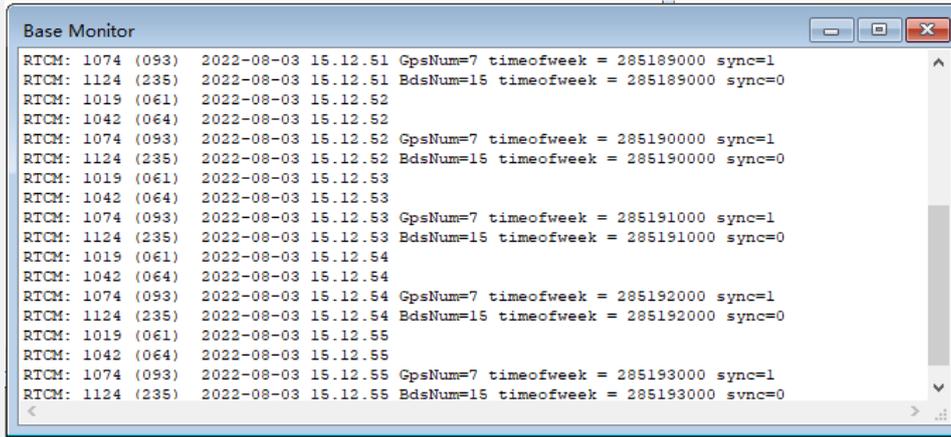
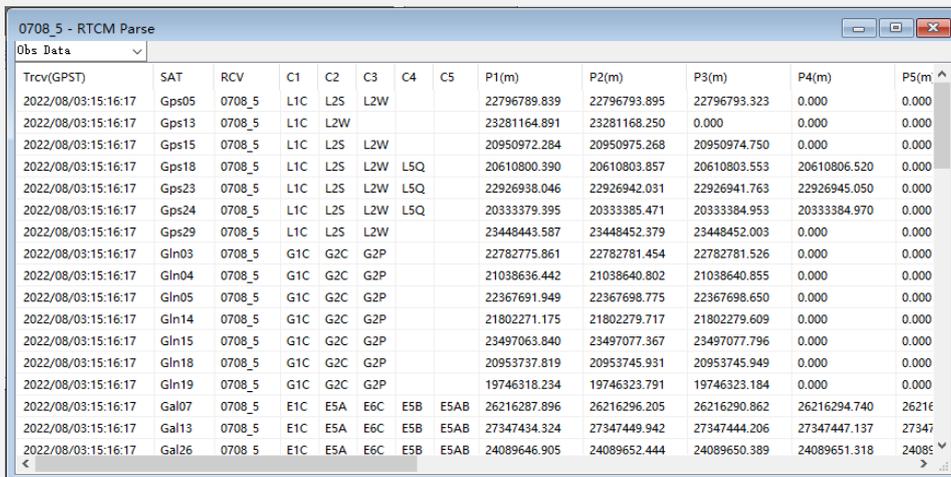


Figure 30 Base Monitor with RTCM messages Displayed

4.11 RTCM Parse

- (1) Make sure the connection to device or base has been started.
- (2) Select "RTCM Parse" in in "View" menu.
- (3) User can parse the RTCM detail of rover or base. The RCV is "base" means base data, or means rover data.
- (4) User can parse the "Obs data", "Nav GPS", "Nav BDS", "Nav GLONASS", "Nav Galileo" and "Nav QZSS".



Trcv(GPST)	SAT	RCV	C1	C2	C3	C4	C5	P1(m)	P2(m)	P3(m)	P4(m)	P5(m)
2022/08/03:15:16:17	Gps05	0708_5	L1C	L2S	L2W			22796789.839	22796793.895	22796793.323	0.000	0.000
2022/08/03:15:16:17	Gps13	0708_5	L1C	L2W				23281164.891	23281168.250	0.000	0.000	0.000
2022/08/03:15:16:17	Gps15	0708_5	L1C	L2S	L2W			20950972.284	20950975.268	20950974.750	0.000	0.000
2022/08/03:15:16:17	Gps18	0708_5	L1C	L2S	L2W	L5Q		20610800.390	20610803.857	20610803.553	20610806.520	0.000
2022/08/03:15:16:17	Gps23	0708_5	L1C	L2S	L2W	L5Q		22926938.046	22926942.031	22926941.763	22926945.050	0.000
2022/08/03:15:16:17	Gps24	0708_5	L1C	L2S	L2W	L5Q		20333379.395	20333385.471	20333384.953	20333384.970	0.000
2022/08/03:15:16:17	Gps29	0708_5	L1C	L2S	L2W			23448443.587	23448452.379	23448452.003	0.000	0.000
2022/08/03:15:16:17	Gln03	0708_5	G1C	G2C	G2P			22782775.861	22782781.454	22782781.526	0.000	0.000
2022/08/03:15:16:17	Gln04	0708_5	G1C	G2C	G2P			21038636.442	21038640.802	21038640.855	0.000	0.000
2022/08/03:15:16:17	Gln05	0708_5	G1C	G2C	G2P			22367691.949	22367698.775	22367698.650	0.000	0.000
2022/08/03:15:16:17	Gln14	0708_5	G1C	G2C	G2P			21802271.175	21802279.717	21802279.609	0.000	0.000
2022/08/03:15:16:17	Gln15	0708_5	G1C	G2C	G2P			23497063.840	23497077.367	23497077.796	0.000	0.000
2022/08/03:15:16:17	Gln18	0708_5	G1C	G2C	G2P			20953737.819	20953745.931	20953745.949	0.000	0.000
2022/08/03:15:16:17	Gln19	0708_5	G1C	G2C	G2P			19746318.234	19746323.791	19746323.184	0.000	0.000
2022/08/03:15:16:17	Gal07	0708_5	E1C	E5A	E6C	E5B	ESAB	26216287.896	26216296.205	26216290.862	26216294.740	26216
2022/08/03:15:16:17	Gal13	0708_5	E1C	E5A	E6C	E5B	ESAB	27347434.324	27347449.942	27347444.206	27347447.137	27347
2022/08/03:15:16:17	Gal26	0708_5	E1C	E5A	E6C	E5B	ESAB	24089646.905	24089652.444	24089650.389	24089651.318	24089

Figure 31 RTCM parse with rover and base

4.12 Communicate with GNSS receiver

Open "Messages" from the "View", the Messages handled the communication in binary protocol between computer and GNSS receiver, for the details on how to use binary protocol, please refer to the protocol specification.

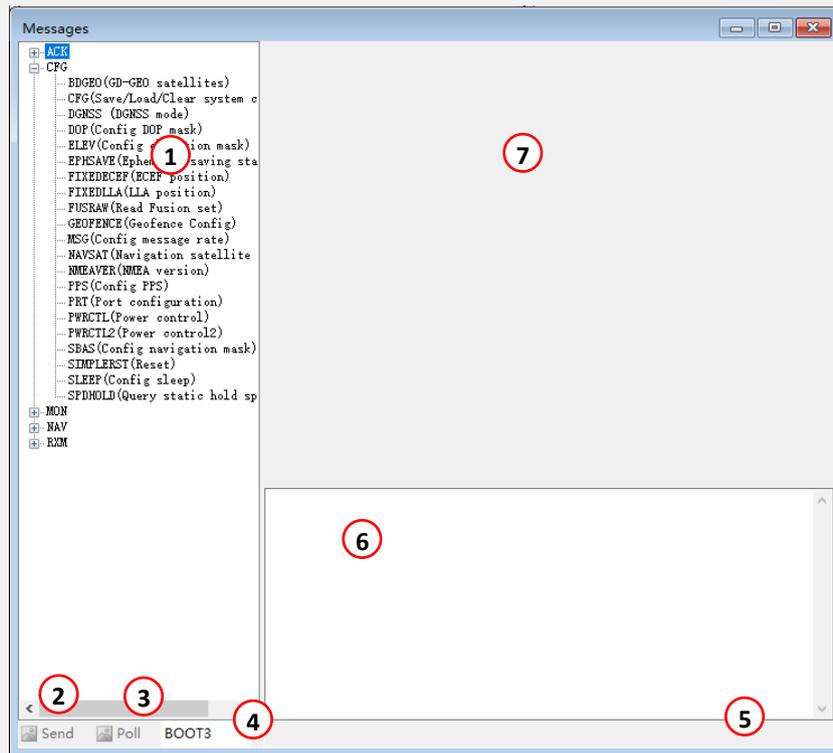


Figure 32 Messages form

- (1) - List of messages to communicate with GNSS receiver.
- (2) - Button to send binary message if applicable.
- (3) - Button to poll binary message if applicable.
- (4) - Command mode, you can select HEX mode or txt mode.
- (5) - Button to lock screen update to region (6) and (7).
- (6) - It has different orientation for its respective binary message, depending on the node selected in (1).
- (7) - Region shows binary message to be sent/received in HEX.

4.13 Data Monitor

Open “Data Monitor” from the menu or tool bar, this platform allows user to view all message data. NMEA data will show as ASCII, other will show as hex mode, and it all show time at the beginning of the message.

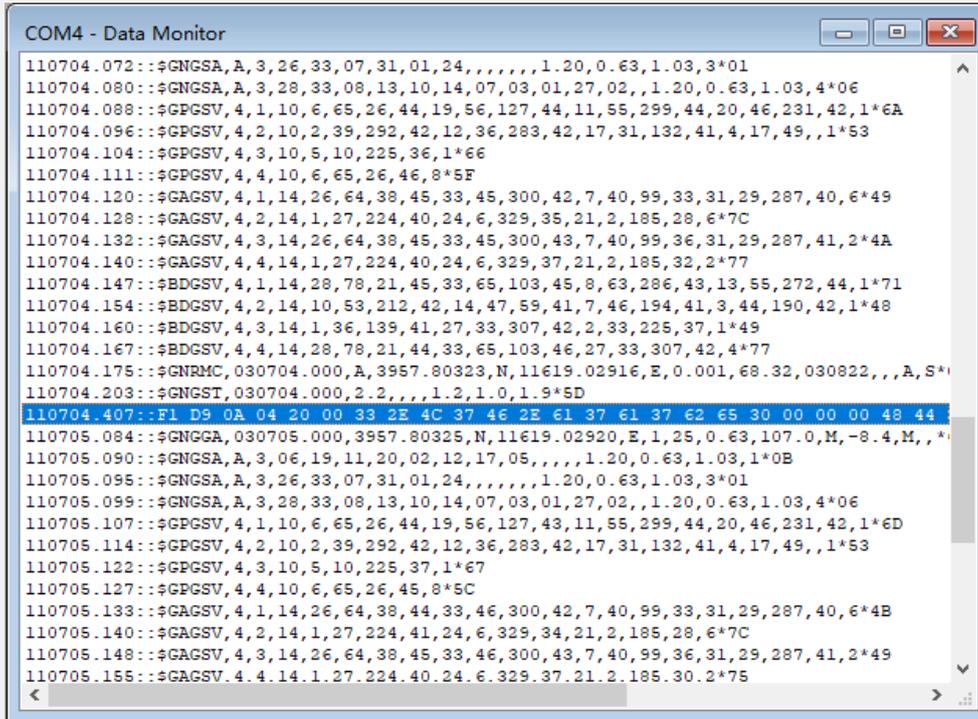
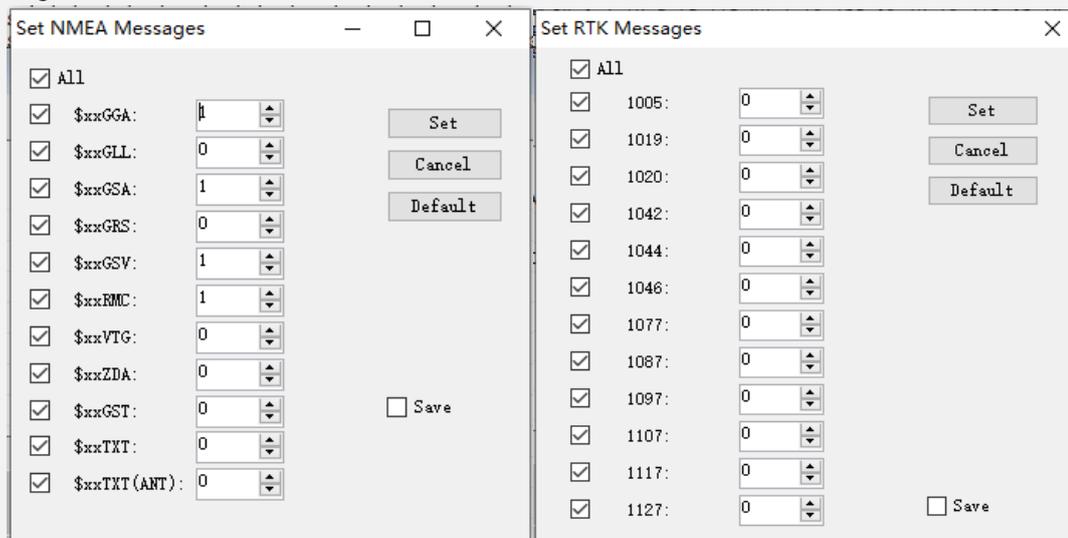


Figure 33 Data Monitor form

5 CONFIGURATION

5.1 Set Rate

Satrack allows user to change each NMEA message or RTCM message output interval, click "Receiver" in the menu bar to choose "Set NMEA rate" or "Set RTCM rate". Select the target option, and then modify the message rate values. (0 refers to disabling that message output, any values greater than 0 refer to the interval in seconds that message should output. The maximum output interval for a message is 255 seconds). Click "Save" to confirm and transmit the configured messages.



Message ID	Rate (seconds)
<input checked="" type="checkbox"/> All	
<input checked="" type="checkbox"/> \$xxGGA:	1
<input checked="" type="checkbox"/> \$xxGLL:	0
<input checked="" type="checkbox"/> \$xxGSA:	1
<input checked="" type="checkbox"/> \$xxGRS:	0
<input checked="" type="checkbox"/> \$xxGSV:	1
<input checked="" type="checkbox"/> \$xxRMC:	1
<input checked="" type="checkbox"/> \$xxVTG:	0
<input checked="" type="checkbox"/> \$xxZDA:	0
<input checked="" type="checkbox"/> \$xxGST:	0
<input checked="" type="checkbox"/> \$xxTXT:	0
<input checked="" type="checkbox"/> \$xxTXT (ANT):	0

Message ID	Rate (seconds)
<input checked="" type="checkbox"/> All	
<input checked="" type="checkbox"/> 1005:	0
<input checked="" type="checkbox"/> 1019:	0
<input checked="" type="checkbox"/> 1020:	0
<input checked="" type="checkbox"/> 1042:	0
<input checked="" type="checkbox"/> 1044:	0
<input checked="" type="checkbox"/> 1046:	0
<input checked="" type="checkbox"/> 1077:	0
<input checked="" type="checkbox"/> 1087:	0
<input checked="" type="checkbox"/> 1097:	0
<input checked="" type="checkbox"/> 1107:	0
<input checked="" type="checkbox"/> 1117:	0
<input checked="" type="checkbox"/> 1127:	0

Figure 34 Set message rate

- The default values of NMEA messages rate or RTCM messages rate is the recommended minimum output for Satrack to gather information. If too few messages are enabled, some views in Satrack may not work probably as their required information does not exist.

5.2 Base Configuration

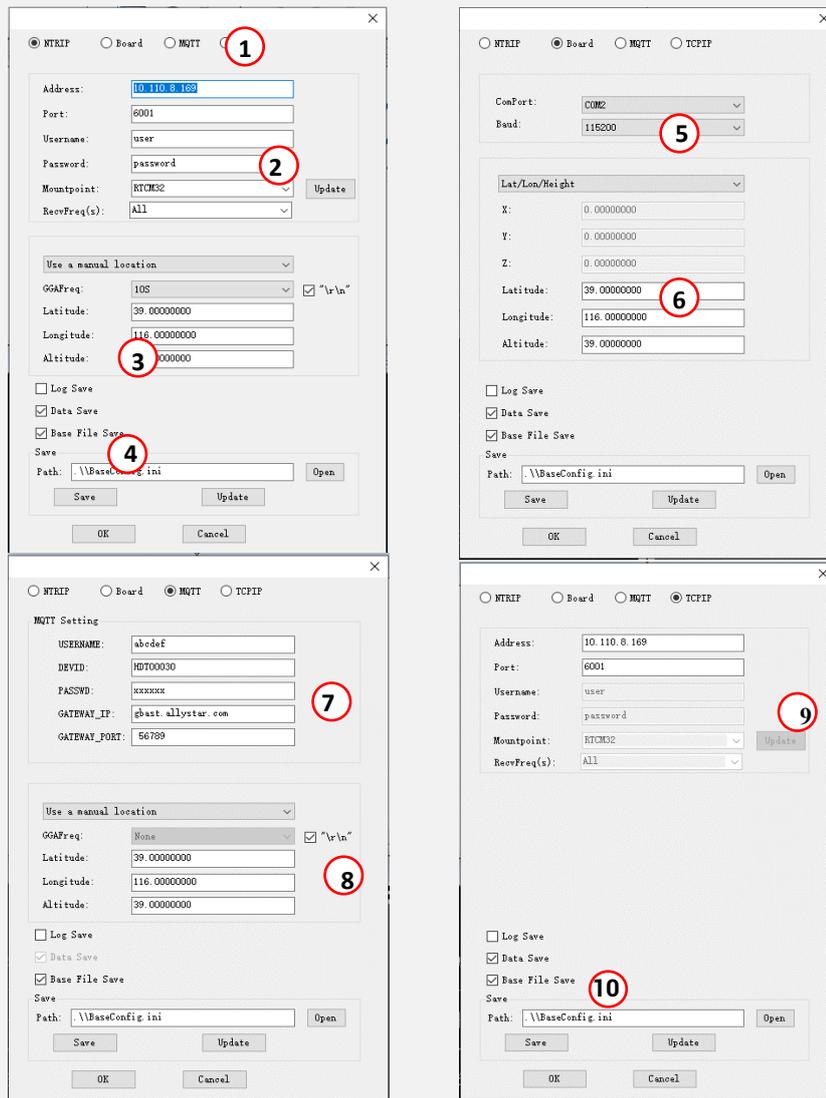


Figure 35 Set Base Form

To enter the base setting dialog, go to menu "Receiver" and select "Set Configuration".

- (1) Chose the Base source, NTRIP, Board, MQTT and TCPIP.
- (2) If (1) choose NTRIP, input NTRIP settings as address, port, username, password. Press update button to get mountpoint, or input manually. It can also input receive data frequency, and the unit is seconds, and "ALL" means receiver all.
- (3) If (1) choose NTRIP, input the location settings. Choose the GGA freq as no gga,1s, 10s ,60s or 300s per times. If choose "Use a manual location", input the longitude, latitude, altitude, or use the rover position.
- (4) User can choose save file.
 "Log Save" saves ASCII parse log to log file as rtcmLog_ yyyyMMdd_HHmmsstxt and baseLog_ yyyyMMdd_HHmmsstxt.
 "Data Save" saves all hex data from rover to log file as receiver data, send data to .cyno and .Gps log file.

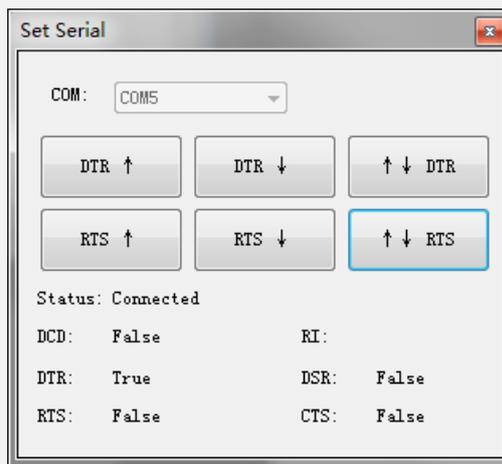
"Base file save" saves all hex data from base to log file as BaseData_YYYYMMDD_HHMMSS.bin file.

- (5) If (1) choose Board, input the board com port and baud rate.
- (6) If (1) choose Board, input the longitude, latitude, altitude, or XYZ of the board position.
- (7) If (1) choose MQTT, input MQTT settings as user name, device ID, password, gateway Ip and gateway port.
- (8) If (1) choose MQTT, input the location settings. If choose "Use a manual location", input the longitude, latitude, altitude, or use the rover position.
- (9) If (1) choose TCPIP, input TCPIP settings as address, port, username, password.
- (10) Save the base configuration in the file selected.

5.3 Serial Configuration

To enter the serial setting dialog, go to menu "**Receiver**" and select "**Serial Configuration**".

User can change the COM port as DTR, RTS, and read the status of COM port as DCD, DRT, DSR, RTS, and CTS as below.



Parameter	Value
COM:	COM5
DTR ↑	Control Button
DTR ↓	Control Button
↑ ↓ DTR	Control Button
RTS ↑	Control Button
RTS ↓	Control Button
↑ ↓ RTS	Control Button (Active)
Status:	Connected
DCD:	False
RI:	
DTR:	True
DSR:	False
RTS:	False
CTS:	False

Figure 36 Set Serial Form

5.4 Update Configuration

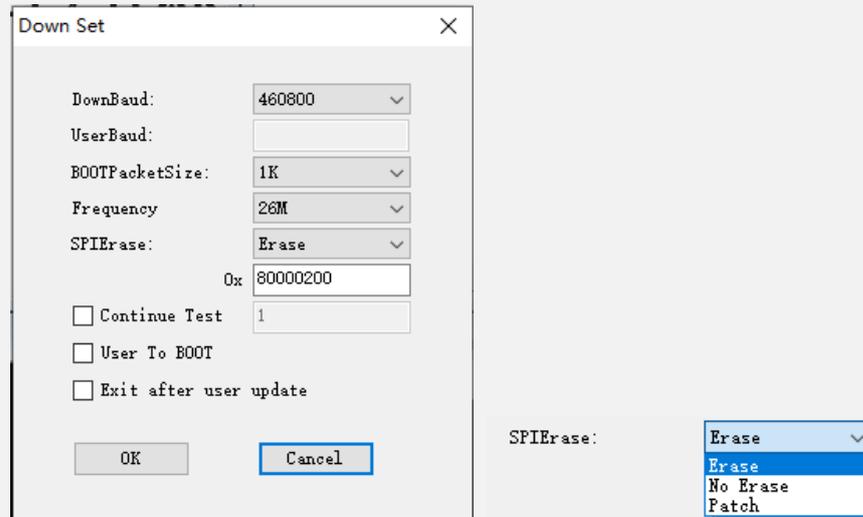


Figure 37 Update Configuration Form

To enter the update configuration dialog, go to menu **“Receiver”** and select **“Update Configuration”**. User can change the UpdateBaud from 1200 to 921600, or user defined baud (It is only availability on com mode).

User can change the download packet size (It is only availability on HD BOOT mode) and frequency. User can set SPIErase mode, Erase, No Erase or Patch mode. It can check the mode automatically, and also support user specified.

It can do continue download test or “user to BOOT” test too.

The user download form will disappear when checking “Exit after user update”.

5.5 Other Configuration

To enter the config setting dialog, go to menu **“Receiver”** and select **“Other Configuration”**.

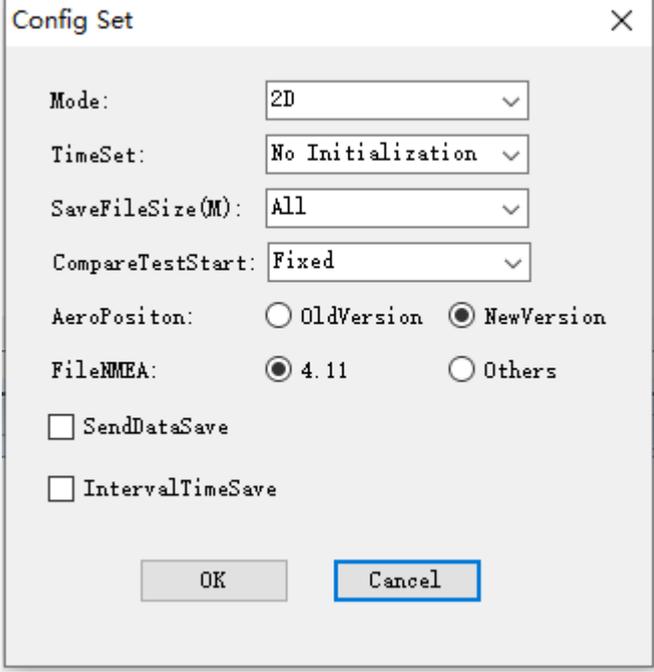
User can select the fix mode 2D or 3D. And user can choose the fix time include initialization time or not in compare test. If user select “fixed” in CompareTestStart, it means the “Duration” is fixed, or it will start next compare test if the dut is fixed position.

User can set the maximum size of save file. It will save in the other file if size of the save file is exceeding the maximum size.

If playback offline file, it can set NMEA version 4.11 or others.

User can select save the send data to the log file or not if select “SendDataSave”.

User can select save the interval time to the log file or not if select “IntervalTimeSave”.



The image shows a 'Config Set' dialog box with the following settings:

- Mode: 2D
- TimeSet: No Initialization
- SaveFileSize(M): All
- CompareTestStart: Fixed
- AeroPositon: OldVersion NewVersion
- FileNMEA: 4.11 Others
- SendDataSave
- IntervalTimeSave

Buttons: OK, Cancel

Figure 38 Set Config Form

6 HOW TO

6.1 Raw data logging/replaying

Satrack allows recording and playing log files. After connected to COM port or USB device, user can choose to save immediate data from GNSS receiver through COM port or USB into log files by clicking icon named **"Save Log"** on the tool bar.

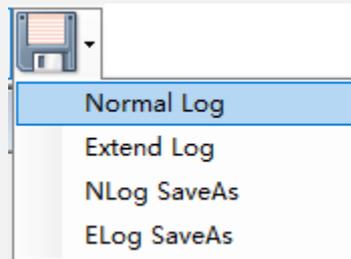


Figure 39 Save Log entries

6.1.1 Raw data logging

- 1) Click the **"Save Log"** button to start raw data logging.
- 2) Choose the following options to set file format and file directory.
 - » **"Normal log"**: save only NMEA messages. Directory of the saved normal log files is at My Documents\Satrack\logs. File name format: <Port name>_<Date>_<Log Start Time>.cyno.
 - » **"Extend log"**: save all messages. Directory of the saved extend log files is at My Documents\Satrack\logs. File name format: <Port name>_<Date>_<Log Start Time>.GPS.
 - » **"ELog SaveAs"**: save extend log to the address user selected.
- 3) Click the **"Save Log"** button again to finish raw data logging and save the log file.

6.1.2 Raw data replaying

After finish raw data logging and save the log file to the desired file directory, user can click **"File"** in the menu bar to choose **"Open offline file"** to select the log file to replay it. To stop replaying the log file, click **"Delete offline file"**.

6.2 Cold/Warm/Hot start

Select **"Restart"** from the tool bar, you can send a cold/warm/hot start to the receiver. After a cold/warm/hot start, you can check the result from the status bar.

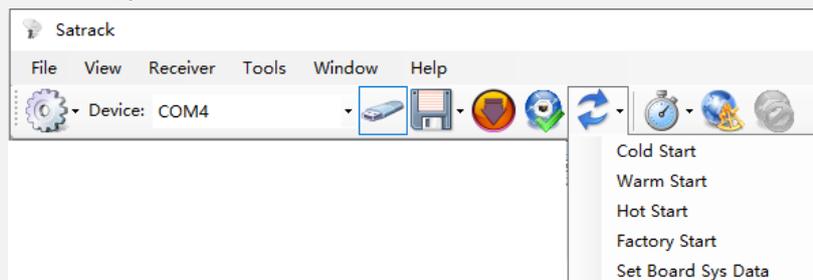


Figure 40 Cold/Warm/Hot start

Table 8 Cold/Warm/Hot start description

Function	Description
Cold start	Sends a cold start command to the receiver. All information is deleted from the memory.
Warm start	Sends a warm start command to the receiver. Only the ephemeris is deleted from the memory.
Hot start	Sends a hot start command to the receiver. No data is deleted in the receiver.
Factory Start	Sends a factory start command to the receiver. The receiver recover factory.

6.3 A-GNSS online and offline

Satrack allows user to save the time, location and ephemeris information to the receiver, thus it provide A-GNSS for a cold or warm start online or offline. Click **“Restart”** from the tool bar to choose **“Set Board Sys Data”**. You can get ephemeris information from online mode or offline mode.

Ephemeris information from online mode is getting information from website

<http://agnss.hbds.com>. Ephemeris information from offline mode is getting information from self-board, or another board.

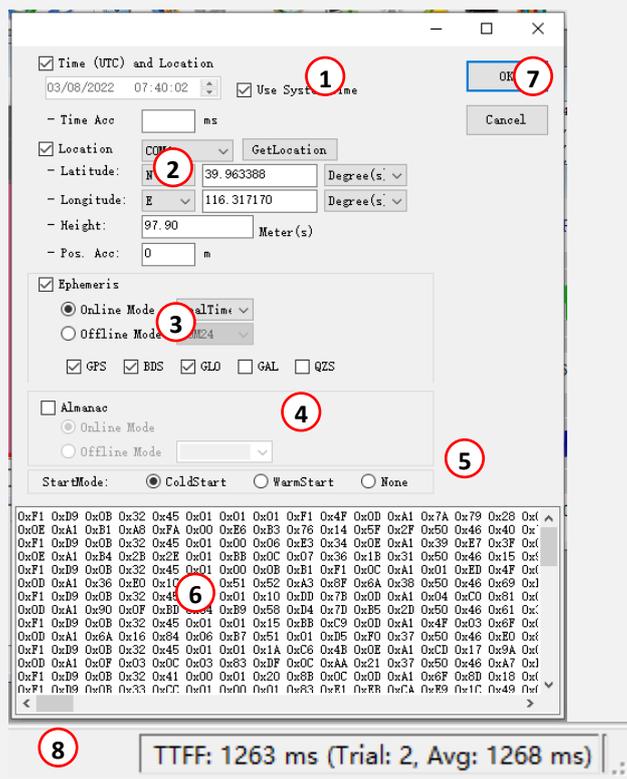


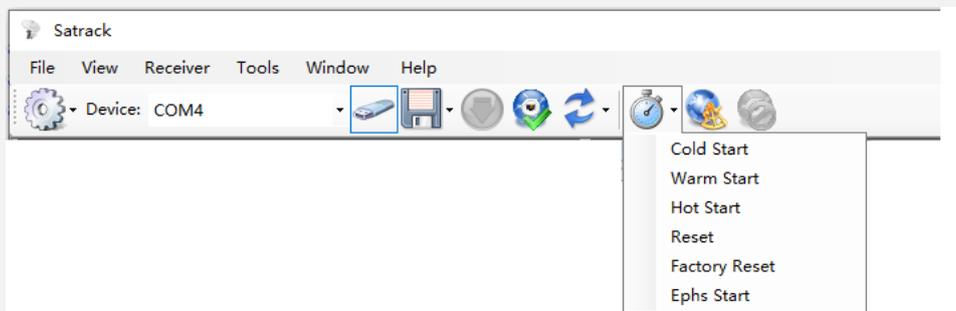
Figure 41 A-GNSS online and offline

- (1) - Send time to assistant position. Or use system time or user set time.
- (2) - Send location to the assistant position, including latitude, longitude, height and position accuracy. User can get the parameters from board using “GetLocation”.
- (3) - Send ephemeris information to the assistant position. User can choose to get ephemeris information online or offline mode. Online mode support realtime data and estimated data of one day to seven days. The ephemeris information can support various system options as GPS, BDS, GLONASS, Galileo and QZSS.

- (4) - Send almanac information to the assistant position. User can choose to get almanac information online or offline mode.
- (5) - The cold start mode, warm start mode or none start mode.
- (6) - The ephemeris information. If the **"Ephemeris"** is checked, then press F1, you can get the ephemeris information.
- (7) - Press "OK", it will do one time "EPHS Start" test.
- (8) -The result will display in the lower right corner of the main page.

6.4 Compare testing

If there are multiple receivers connected, Satrack allows user to make comparison of those receivers at the same time. Just click **"Comparison Testing"** from the tool bar to choose the desired test item: Cold start, Warm start, Hot start, Reset, Factory reset and Ephs start (A-GNSS). It will display the times and the average, the success rate and so on.



Comparison Testing Panel

Always on Top Restart(F5) Repeat 4 Duration(ms) 40000 No Log Save

ColdStartTest

Device	Results	Latitude	Longitude	Height	SatUsed	Average	Rate
COM4	21092	—	—	—	—	29783	5/6

Comparison Testing Panel

Always on Top Restart(F5) Repeat 0 Duration(ms) 30000 No Log Save

WarmStartTest (3D-Error = 0 km)
 NS-Err = 0 km, EW-Err = 0 km, Alt-Err = 0m

Device	Results	Latitude	Longitude	Height	SatUsed	Average	Rate
COM4	23603	39.963383	116.31719283	96.2	11	23615	1/1

Comparison Testing Panel

Always on Top Restart(F5) Repeat 0 Duration(ms) 30000 No Log Save

HotStartTest (3D-Error = 0 km)
 NS-Err = 0 km, EW-Err = 0 km, Alt-Err = 0m

Device	Results	Latitude	Longitude	Height	SatUsed	Average	Rate
COM4	500	39.963362	116.31715516	111	9	585	11/11

Comparison Testing Panel							
Always on Top		Restart(F5)	Repeat	0	Duration(ms)	30000	No Log Save
EphsStartTest (3D-Error = 0 km)							
NS-Err = 0 km, EW-Err = 0 km, Alt-Err = 0m							
<u>Device</u>	<u>Results</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Height</u>	<u>SatUsed</u>	<u>Average</u>	<u>Rate</u>
COM4	1586	39.963400	116.31716316	96.9	20	1449	11/11

Figure 42 Compare testing

7 GOOGLE EARTH SERVER

This section gives an overview of the Google Earth server support in Satrack. The Google Earth server can continuously send positioning data in a specific format to the Google Earth application. By hosting such a server in Satrack we are able to visualize positioning data in real time.

7.1 Real time tracking with Google Earth

- 1) In order to use real time tracking with Google Earth, please make sure Google earth is installed on the computer.
- 2) Establish the communication between Satrack and the receiver.
- 3) Select **"Real-time Google Earth Link"** from the tool bar to direct to Google Earth.
- 4) Only some limit latest nodes are showed, if it is needed to investigate a long chain of nodes, please log the raw messages from device and use Save KML dialog to convert raw data to KML/KMZ files in order to view them in Google Earth after tracking finishes.

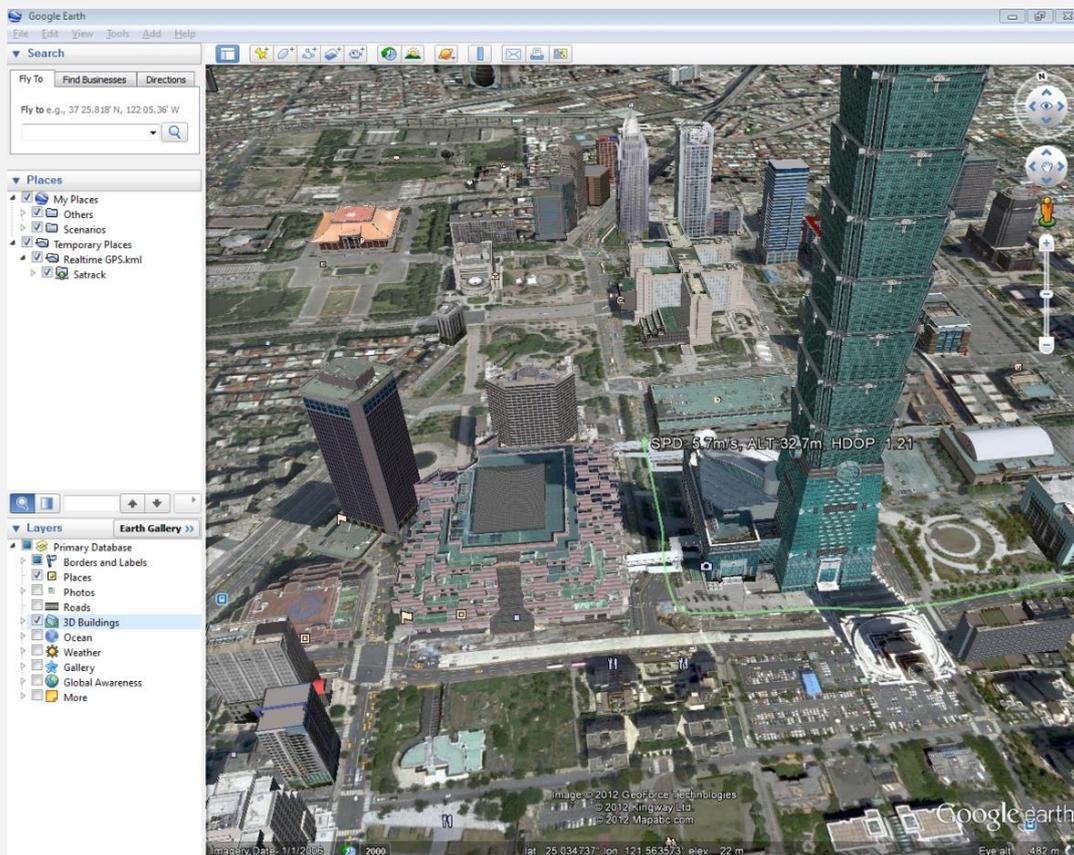


Figure 43 Google Earth

7.1.1 Real time tracking setting

After real time tracking is enabled, the option for real time tracking will be available. To enter the setting dialog, go to menu "File" and select "Real Time Kml Settings".

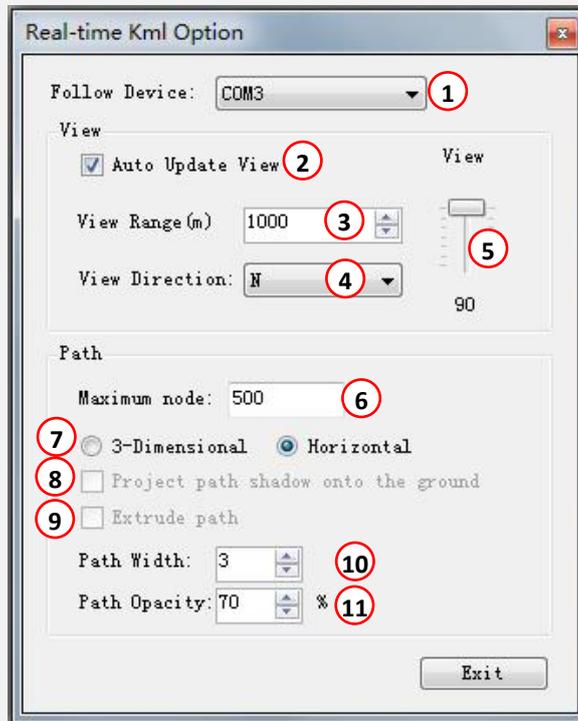


Figure 44 Real time Kml option

- (1) - Choose the GNSS device to follow when adjusting view.
- (2) - Auto update view to the latest position of following device.
- (3) - The distance of the view point from the last position fix node.
- (4) - Select fixed view direction or relative angle with heading direction.
- (5) - View angle relative to sea level. 90 degrees means perpendicular.
- (6) - Maximum latest node to store and display.
- (7) - Track orientation.
- (8) - Project path shadow onto the ground. (Only applicable in 3D mode.)
- (9) - Extrude path onto the ground. (Only applicable in 3D mode.)
- (10) - Width of the path.
- (11) - Opacity of the path.

7.2 Convert raw data to KML/HTML files

After logging the raw messages from the receiver, Satrack allows user to convert raw data to KML/HTML files. And then user can view them in Google Earth.

- 1) Go to menu "File" and select "Save Map".
- 2) Choose "Input" to browse for the desired output folder with raw data messages. The file list is read from folder under user profile, My Documents\Satrack\logs.
- 3) Click "Browse..." to set the file directory where the saved files should be stored.
- 4) There are some options for KML file settings. Set advanced options if needed (e.g. line color, alpha, time constrain, indicator).
- 5) Choose the files, and then click "Save(Google)" to start converting the files. When finishes the KML files converting, user can view the file in Google earth.

* For details of viewing the converted files by using Google Earth, please refer to Google Earth User Guide:

<http://www.google.com/earth/learn/>

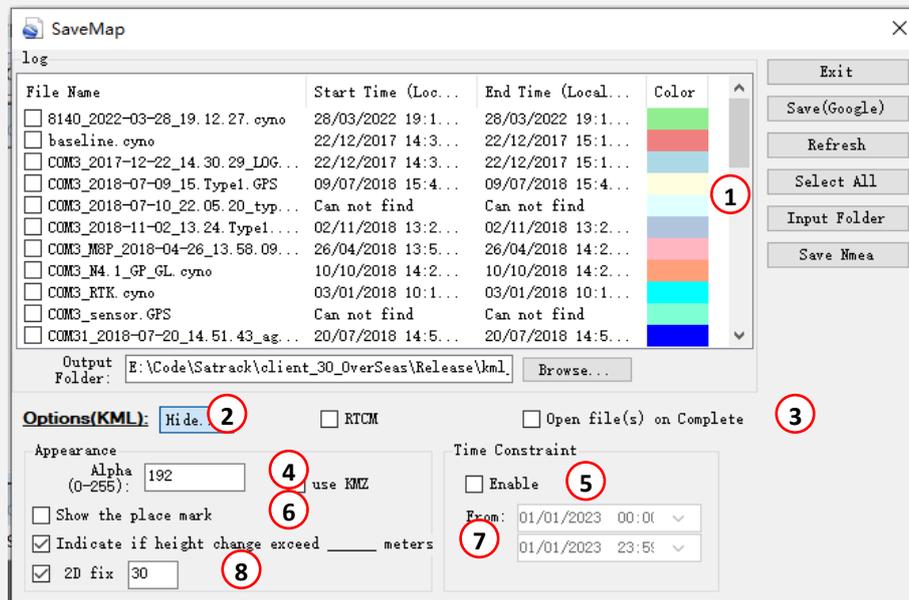


Figure 45 Save as Map file

- (1) - Click to change the track color in the output file.
- (2) - Show or hide advanced options.
- (3) - Indicate whether to open the saved files automatically when saving completes. It is highly recommend installing Google Earth for opening the converted files.
- (4) - Set the alpha of the path viewing under Google Earth.
- (5) - Set to extract a period of time from the input files to be converted.
- (6) - If checked, there will always have a node code beside the node icon.
- (7) - If checked, the icon of a node will be in green color if the statement holds.
- (8) - If checked, the icon of a node will be in red color to indicate 2D position fix.

8 FIRMWARE UPDATE

8.1 Preparation

To update firmware please ensure the following steps have been done before proceed:

- You have prepared a write version of the firmware file.
- Ensure you need to update firmware.
- Make sure your receiver can enter BOOT mode.

8.2 Firmware updating

8.2.1 Updating in User normal mode

- 1) Connect to the target receiver through COM ports or USB ports.
- 2) Select "User Firmware Update" from the tool bar.



Figure 46 User firmware update

- 3) A file choosing dialog will be shown.
- 4) Find the file to send and press "Open" to start sending the file and finish firmware updating.

8.2.2 Updating in BootROM command mode

- 1) Connect to the target receiver through COM ports or USB ports.
- 2) User needs to use the **PRTRG** and **PRRSTX** buttons on the EVK board. Press the **PRTRG** button first, and then press **PRRSTX** button. After that, release the **PRRSTX** first, and then release the **PRTRG** button.

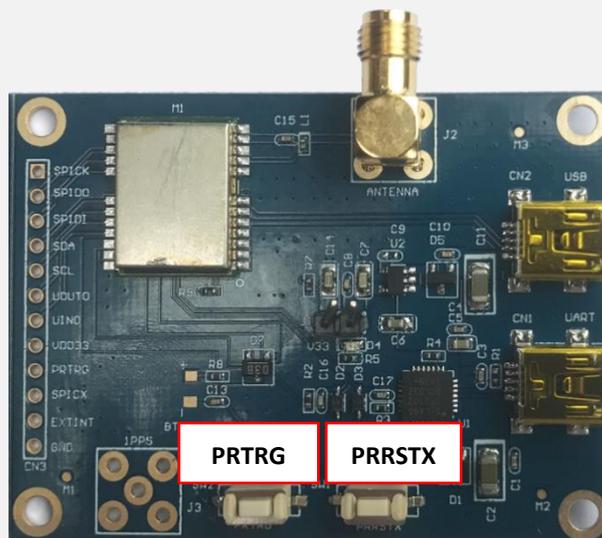


Figure 47 Board hardware

- 3) Disconnect the receiver first by clicking "**DisConnect**" from the tool bar and then reconnect the receiver again by clicking "**Connect**" from the tool bar. The receiver will enter the BootROM command mode.
- 4) Select "**Boot Firmware Update**" from the tool bar.



Figure 48 Boot firmware update

- 5) A file choosing dialog will be shown.
- 6) Find the file to send and press "**Open**".
- 7) Press "**Send**" to start sending the file and click "**Close**" to close the updating window after firmware updating finishes.
- 8) After firmware updating completed, press **PRRSTX** button on the EVK board to restart the receiver.

8.3 Firmware updating caution

DO NOT interrupt file transfer, keep program running and make sure all cables are well connected when file is transmitting.

9 RELATED DOCUMENTS

- [1] HD80XX Series Datasheet
- [2] Cynosure Receiver Protocol

10 REVISION HISTORY

Revision	Date	Author	Status/Comments
v1.00	2009-08-10	Thompson Lau	First Draft
V1.01	2011-03-30	Gary Hau	Updated screenshots
V1.02	2011-04-20	Paul Lam	restructure document hierarchy
V1.03	2011-04-29	Paul Lam	Added master firmware update
V1.04	2011-05-04	Paul Lam	Set NMEA message rate
V1.05	2011-05-17	Paul Lam	Update screenshot and include position map.
V1.06	2011-06-23	Paul Lam	Typo correction
V1.07	2011-06-30	Paul Lam	Real time Tracking part changed. Corrected some typing errors in Save Kml files.
V1.08	2011-07-11	Paul Lam	SaveKML update
V1.09	2012-05-05	Paul Lam	Update
V1.10	2013-08-29	Mingo Tsai	Updated Contents
V1.11	2014-05-20	Yunzhi Li	Updated
V1.12	2015-04-02	LiminWang	Updated Contents
V1.14	2015-04-02	LiminWang	Updated Contents
V1.15	2015-08-21	LiminWang	Updated Contents
V1.16	2015-11-12	LiminWang	Updated Contents
V1.17	2016-03-22	LiminWang	Updated Contents
V1.18	2017-06-21	LiminWang	Updated Contents
V1.19	2017-08-03	Daisy yin	Change to ALLYSTAR word format
V1.20	2017-09-03	LiminWang	SW updated
V1.21	2017-09-15	LiminWang	SW updated
V1.22	2017-10-03	LiminWang	SW updated
V1.23	2017-10-15	LiminWang	SW updated
V1.24	2017-11-03	LiminWang	SW updated
V1.25	2017-11-15	LiminWang	SW updated
V1.26	2017-12-12	Daisy yin	File content updated, and add DR mode descriptions.
V1.29	2019-04-03	LiminWang	SW updated
V1.29.1	2020-06-10	Vita Wu	Updates table of content
V1.29.2	2021-02-24	LiminWang	SW updated
V1.29.3	2022-08-03	LiminWang	Software updated
V1.29.4	2022-12-12	LiminWang	Software updated
V3.00.1	2023-06-01	LiminWang	Software updated



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