S86-T GPS Receiver

User Guide

SOUTH

----STAR S86-T GPS Receiver

User Manual

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CONTENTS

Chapter1 Introduction

1.1 STAR S86-T GPS System Summary

STAR S86-T combines the advantages of SOUTH series RTK products, follows advanced technology and the concept of continuous innovation, brings the most advanced surveying solution to surveyors, offers higher precision and more reliability, makes the surveying work easier and simpler.

1.2 STAR S86-T GPS features and function

The built-in radio modules integrated in STAR S86T supports a longer work distance with the mobile network. The ARM framework adopted by STAR 86-T in the CPU kernel enables the operating speed to reach 400MHz ,thus realizing multi-tasking mainframe, faster processing rate, and higher real time. The USB MASS STORAGE standard protocol makes the operation faster and more flexible.

STAR S86-T main features:

1) Integrated design, high quality screen, and convenient operation.
2) The core technology of data link has been greatly improved, based on typical RTK work distance, STAR S86-T realizes the goal of built-in transmitter radio, abandoning cables and heavy battery cells.
3) The built-in batteries package integrated in the mainframe ensures 12 hours work time, and can be charged without being taken apart.
4) STAR S86-T is integrated with built in radio module, which can be customized by users.
5) STAR S86-T adopts the newest ARM9 CPU, whose speed can reach 400MHz with faster processing speed, bigger memory capacity, and higher real time.
6) The OS is a real-time, multi-tasking, more powerful function, with the standard compact disk file system; STAR S86-T becomes more stable, reliable. Data management and maintenance become more convenient.
7) File system adopts USB MASS STORAGE standard protocol, which enables a faster downloading speed.
8) All-alloy firm housing, shockproof, dustproof, waterproof , more scientific structure, much safer shielding.

1.3 Technical specifications

- Channels: 220
- *Satellite signals tracked:*
- GPS: Simultaneous L1 C/A, L2E, L2C, L5.
- GLONASS: Simultaneous L1 C/A, L1 P, L2 C/A (GLONASS M Only), L2 P.
- SBAS: Simultaneous L1 C/A, L5.
- GIOVE-A: Simultaneous L1 BOC, E5A, E5B, E5AltBOC1.
- GIOVE-B: Simultaneous L1 CBOC, E5A, E5B, E5AltBOC1.
- COMPASS**:** (reserved): B1 (QPSK), B1-MBOC (6, 1, 1/11), B1-2 (QPSK), B2 (QPSK),
- B2-BOC (10, 5), B3 (QPSK), B3BOC (15, 2.5), L5 (QPSK).

- Very low noise GNSS carrier phase measurements with <1 mm precision in a 1 Hz bandwidth.
- Proven low elevation tracking technology.
- Initialization time: typically <8s.
- Up to 50 Hz raw measurement & position outputs.
- Signal recapture: 1 sec.
- RTK signal initialization typically 20 sec.

Mother board

Internal Memory: 64 Mb (25 static hours with frequency of 1 Hz)

Connection devices:

- Connectors I/O: 9-pins serial port (baud rate up to 115.200kbps) and 5-pins LEMO interfaces.
- Multicable with USB interface for connecting with PC.
- 2.4GHz Bluetooth device class II: maximum range is 50m.
- Internal Radio: maximum range=10km.
- External cell phone support for RTK and VRS operation (optional).
- External radio: frequency 450MHz, emitting power and maximum range depending on model, maximum range=22km.
- Serial protocols

Reference outputs: CMR+, CMRx, RTCM 2.1, RTCM 2.3, RTCM 3.0, RTCM 3.1.

Navigation outputs: ASCII (NMEA-0183 GSV), AVR, RMC, HDT, VGK, VHD, ROT, GGK, GSA, ZDA, VTG, GST, PJT, PJK, BPQ, GLL, GRS, GBS, GSOF.

Receiver accuracy

- Static horizontal accuracy= 3mm ± 0.5ppm (RMS).
- Static vertical accuracy= 5mm ± 0.5ppm (RMS).
- Fixed RTK horizontal accuracy= 8mm ± 1ppm (RMS).Fixed RTK vertical accuracy= 15mm ± 1ppm (RMS).
- Code differential positioning accuracy= 0.45m (CEP).
- Stand Alone RTK positioning accuracy= 1.5m (CEP).
- SBAS positioning accuracy typically< 5m (3D RMS).

Power Supply:

- 9 to a 15V DC external power input with over-voltage.
- Voltage: 7.2 V.
- Working time in static mode: typically 6 hours.
- Working time in RTK rover mode: typically 4 hours.
- Charge Time: typically 7 hours.
- Power consumption: < 3.8 W.
- Remaining time with battery light blinking: 1 hour.

Physical specification:

- Size: Height 154mm x 154mm x 88mm .
- Weight: 1.2 Kg with internal battery, radio standard UHF antenna.
- Operating temperature: -25°C to 60°C (-13°F to 140°F)
- Storage temperature: - 55°C to 85°C (-67°F to 185°F)
- IP65
- Waterproof: protected from temporary immersion to depth of 1 meter and from 100% humidity.
- Dustproof.
- Shock resistance: designed to survive a 2m free drop onto the concrete.
- Vibration resistance.

Note: The specifications can come up only if the locked satellites are not less than 5, and must follow the recommended procedure in product manual. Severe multi-path effect, volatile ionosphere environment and HDOP value will influence the performance severely.

Chapter 2 The Hardware of STAR S86-T

2.1 Interface of Mainframe

STAR S86-T mainframe is as following figure 2-1,

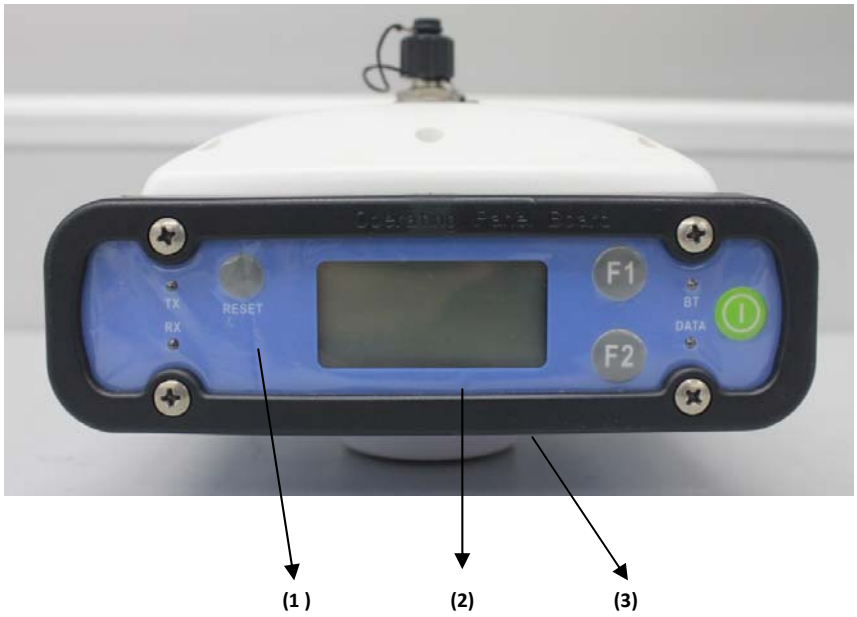


Figure 2-1 Screen of Mainframe

STAR S86-T receiver is integrated with a receiving part,a data collecting part, a power supply, and a radio module. With high quality LCD screen, all-alloy housing, and 3 proof design, STAR S86-T can withstand the worst weather, roughest working conditions.

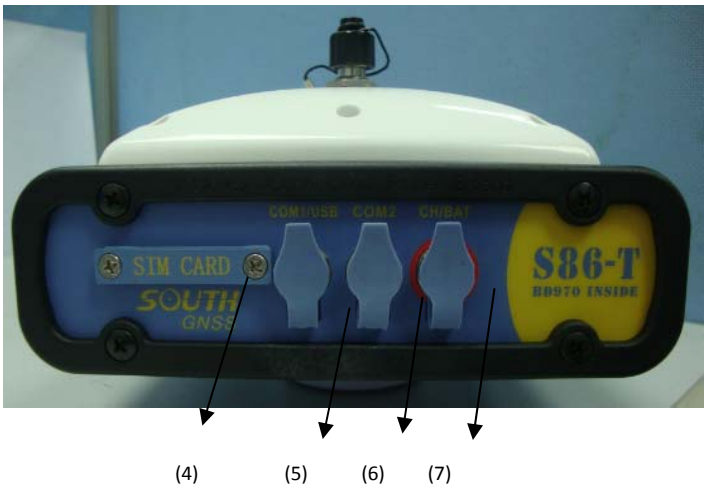


Figure 2-2 the port side of STAR S86-T

(1)----------Operation Button (refer to 3.1)

(2)----------LCD Screen (refer to 3.2)

(3)----------Slot for connecting plummet and tribrach

(4)----------Slot for SIM Card

(5)----------Communication port, 7pins

(6)---------- External Radio port, 5 pins

(7)----------Charger & External power supply port, 4pins

Note: Com2 is for external radio. Com1/USB is for data transferring.CH/BAT is for charging and external power supply.

2.2 Charging

(1) STAR S86-T battery package

The batteries packages are embedded on the two flanks of the mainframe. After being fully-charged, the built-in radio can work continuously for more than 10 hours.

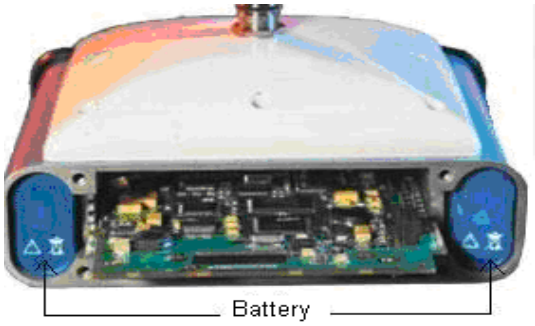


Figure 2-3 dual batteries packages

(2)Charger of STAR S86-T

The charger of STAR S86-T consists of two parts, AC adaptor cable and plug. See as figure 2-4, 2-5.

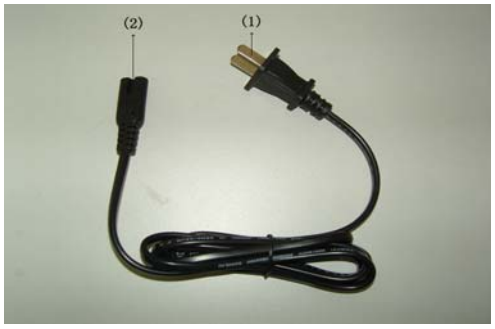


Figure 2-4 Power plug

Figure 2-5AC Adaptor cable

①——220V AC plug

②、③——Connecting part

④——4 pins plug, insert it to the charging port on the mainframe when charging.

⑤——Indicator lights of charger. When the light“CH1”、“CH2” turns red, it means the battery is being charged. The indicator’s turning green means the battery is fully charged or disconnected with mainframe. It doesn’t matter whether you turn on the mainframe or not when charging.our recommendation is to turn it off.

2.3 Communication Cable

Data communication cable is for data downloading,one head of it is 7 pins port, the other head is USB plug and serial port plug, see as figure 2-6,

Figure 2-6 Data communication cable

Notice: when you insert the 7 pins plug to the mainframe, make sure the red point on the plug is aligned with the red point on the mainframe. Serial port plug is designed for special function.

2.4 Controller-PC Cable

Controller-PC cable is for the link between Psion controller and PC. It's composed by two sections, one is connected to controller, and the other is connected to USB port in PC. See as figure 2-7.

Figure 2-7 Controller-PC cable

2.5 Keys and indicator lights

TX light indicates status of signal transmitting, RX light indicates status of signal receiving .BT light is Bluetooth light, DATA light is the data transmitting/receiving light. The keys from left to right are Reset key, two Function keys and Power key. The indicator information is as belows.

	Function	Function or status
 power key	Power on/off, confirm, modify	Power on/off mainframe, confirm edit items, select modified items
	Page up/down, return	Select modified items or return to prior menus
Reset Key	Force to power off	Power off in special condition, without disturbing data collection
DATA light	Data indicator light	blink when collecting or transmitting interval time
BT light	Bluetooth light	Keep on when Bluetooth is connected
RX light	Receiving signal light	Blink when receiving interval time
TX light	Transmitting signal light	Blink when transmitting interval time

1. Static mode

DATA light blinks when collecting data interval time.

2. Base mode(Radio)

TX, DATA lights blink when transmitting interval time simultaneously.

3. Rover mode(Radio)

RX light blinks when transmitting interval time.

DATA light blinks when transmitting interval time after differential signal being received.

BT light keeps on shows Bluetooth is connected.

4. Radio

(1） Built-in radio(UHF)

STAR S86-T is integrated with a 0.5w or 2w UHF built-in transmitting radio, with which the typical work distance can reach 2~5km, and no cable is needed in base station.The battery package in base station enables the built-in radio to work continuously for 10 hours, meeting the demand of surveyors.

(2) External radio

When working in extensive area with STAR S86-T, the built-in radio cannot cover the long distance between base and rover. then you can choose a 2/5w or 15/15w external radio.

Note: whenever you debug the radio, put the radio antenna on top of it. Otherwise, the radio might be broken.

(3) Module

STAR S86-T is integrated built-in radio module, which can get access to various CORS.

It enormously extends work distance, and improves accuracy and reliability.

Chapter3 Accessories of STAR S86-T

3.1 Instrument Case

The instrument case of STAR S86-T contains two layers, the external is hard black case, which is convenient for long distance transport, the inner is a foam box, with individual section for different parts of the instrument. See as figure 3-1.

Figure 3-1 Instrument case

The hard case is portable, durable ,shockproof, and convenient to clean. See as figure 3-2

Figure 3-2 Hard case

The foam box is very light, can hold mainframe and other accessories, you can arrange the space freely. See as figure3-3.

Figure 3-3 Soft bag

3.2 Battery and charger for Controller

About mainframe battery and charger, please refer to chapter2-2. About battery and charger for controller, see as figure 3-4,3-5.

Figure 3-4 Charger

Figure3-5Controller battery

3.3 Transmitting/Receiving antenna of Data link

STAR S86-T adopts 450MHz all-direction antenna, which can work both as transmitting antenna and receiving antenna. See as figure 3-6.

Figure3-6 Receiving & Transmitting Antenna

If you use external radio, you need another 5.5db all-direction antenna, the appearance is as figure 3-7

Figure 3-7

3.4 Cables

1. Communication cable

Communication cable is for the link between mainframe and external radio, also for power supplying ,which enables a longer working time of the mainframe and external radio. See as figure 3-8

Figure 3-8

2.Receiver-controller cable

Receiver-controller cable is for the link between receiver and controller, see as figure 3-9

Figure 3-9 Receiver-controller cable

3.Multi-communication cable

Multi-communication cable is for the link between receiver mainframe and PC.

Which is used for static data downloading and firmware updating.See as figure 3-10

Figure 3-10 Communication cable

4. Other accessories

Bracket for controller

Figure3-11 Bracket

5. Hi measuring plate

help measuring instrument height, see as figure 3-12.

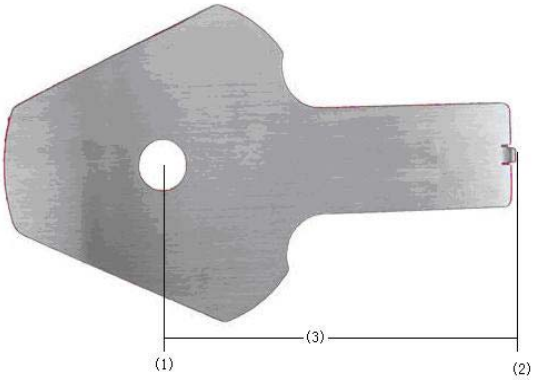


Figure 3-12 Hi measuring plate

(1)—connecting hole

(2) —measuring edge

(3) —the distance is L=120mm

The HI measuring plate is placed between receiver and connector. See as figure 3-13

Figure 3-13 Measure Height

After placing instrument, users need to check once before and after an observation session.The way is to measure from the edge of the measuring plate to the mark point center on ground. After data being input to the software, it will calculate the real height of the instrument.

Chapter4 Operation

4.1 Instruction of STAR S86-T indicator light

1. in Static mode

DATA indicator light blinks when collecting interval time.

2. in Base mode(Radio)

TX, DATA indicator light blink when transmitting interval time simultaneously.

3. in rover mode(Radio)

RX indicator light blink when transmitting interval time.

DATA indicator light blink when transmitting interval time after differential data being received.

BT (Bluetooth) indicator light keeps on after Bluetooth being connected.

4.2 Initialization interface

After you power on STAR S86-T receiver, the initialization interface is as following figure,

Figure 4-1 Initialization interface

You have two choices in this interface, setting mode and collection mode. you can click “F2” to enter setting mode, otherwise, it will enter collection mode automatically after the count-down.

4.3 Setting mode

The setting mode interface includes two main menus and a quit menu. The two main menus are mode select menu and system setting menu. you can press selection buttons（F1，F2）to choose the menu , then press  to confirm, see as figure4-2.

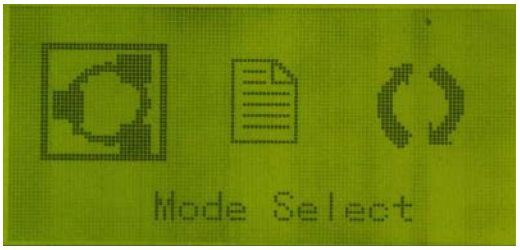


Figure 4-2 Setting interface

4.3.1 Mode select menu

After pressing  button, you can enter work mode selecting interface, see as figure4-3,

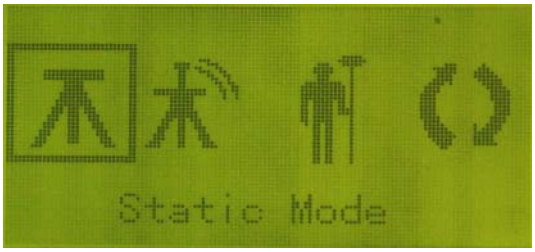


Figure 4-3

There are three kinds of work modes to choose from, static mode, base mode and rover mode. You can press  or  button to select, the last menu is for returning to prior menu.

(1) Parameters setting in static mode

After entering static mode interface, you can set various parameters, such as mask angle, sample interval, record mode (there are two ways, automatic and manual. When you select automatic way, the receiver will collect static data automatically after receiving enough satellites and good PDOP value. If you select manual way, you need press  button to start after receiving enough satellites and good PDOP), see as figure4-4

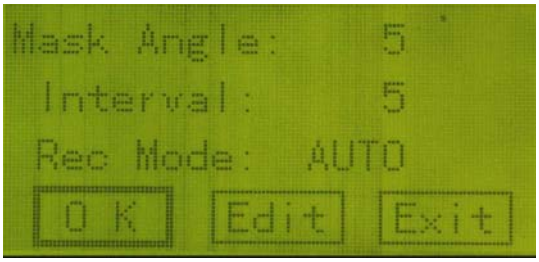


Figure 4-4

There are three options at the bottom of the interface, OK, Edit and Exit. If you want to modify parameters, you can move the cursor to “Edit”, then press button to start modify parameters. After parameters being modified, press F2 to return to “OK”, then press button to confirm it.If you don’t want to save the modified operation, click “Exit” to cancel it. The detailed operations are as follows,

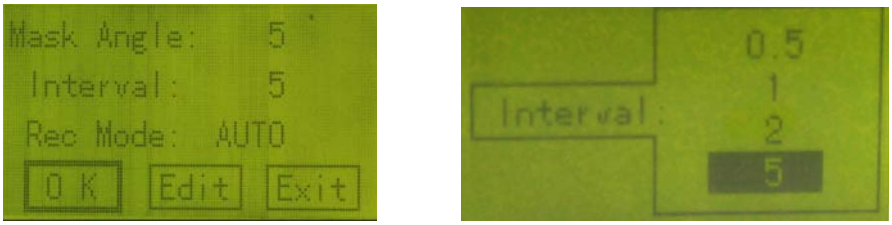


Figure 4-5

Note: *There are 3 special interval items, 0.1s,0.2s and 0.5s, the GPS OEM main board are available,(extra payment needed).*

Figure 4-6

Note: *You’d better make the same parameters setting when several STAR S86-T mainframes working together.*

(2) Parameters setting in base mode

After entering base mode interface, you can set parameters for base mode, see as figure 4-7,

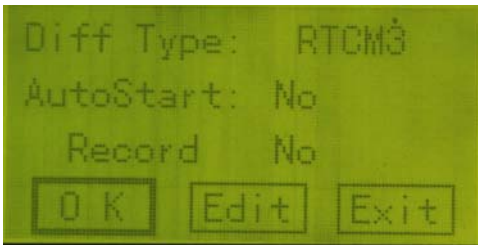


Figure 4-7

There are 4 options in the interface, ***differential type, auto start, record.*** The functions or options are as belows:

Differential type：RTCA，CMR，RTCM2.x（including RTCM2.0 and RTCM2.3）

Interval: Transmitting interval, Default setting is 1 second.

Auto start: Two options," Yes" or "No", if you select "Yes", it means the base station will transmit automatically after receiving enough satellites and good PDOP value. If you select "No", it means you want to transmit the base station manually after checking the satellite situation. "No" is the default setting.

Record*:* When using the receiver in RTK mode, you can still record static data, so if the GPS or radio signal is not good or in some tough places, you can still record static data and post-process it to obtain highly accurate result. "No" is the default setting. See as figure4-8, 4-9,

Figure 4-8

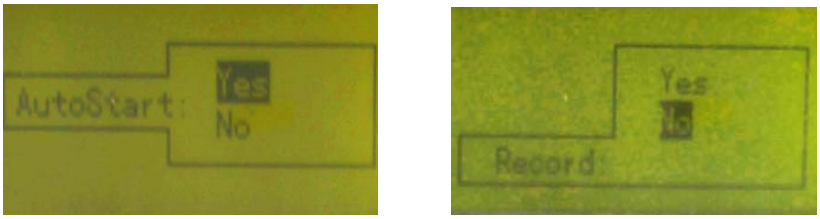


Figure 4-9

After you finish these settings ,press  to confirm, you will enter the second setting interface, data-link setting. There are 2 options in this interface, ***data link, and channel.*** The instructions are as follows:

Data link: 4 options for you to choose from, UHF, external, dual transmit.

UHF :for internal radio,

External: for external radio

Dual transmit: for external radio module working simultaneously.

Channel: Channel means radio channels. There are 8 channels in this item.

Settings finished, press F2 to return to the main interface, move the cursor to “OK” and press ⏻ to confirm your settings. then the receiver will return to the initialization interface. See as figure 4-10~4-15

Figure 4-10

Figure 4-11

Figure 4-12

Figure 4-14

Figure 4-13

(3)Parameters setting in rover mode

The rover mode parameters are the same as the base mode, just set it in accord with base mode settings.

4.3.2 System setting

There are five options in system setting interface, ***display setting, system info, self-check , file list, registration,*** the detailed operations and options are as belows:

Display setting: there are 3 options in this interface, in contrast, rotation and time zone.

Contrast setting: for screen contrast adjustment.

Rotation :for page turning, automatic or manual. There are several pages in collection interface, automatic means these pages will be displayed circularly, manual means you need to turn pages by pressing  button.

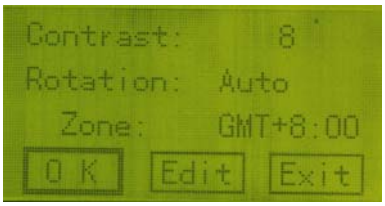
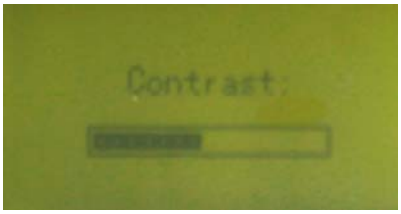


Figure 4-16



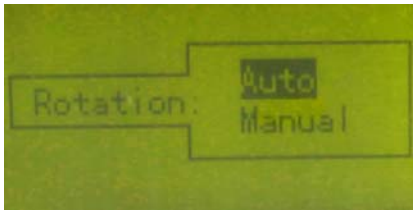


Figure 4-17

After finishing parameters setting, press  button to prior menu.

System info: checking receiver serial number, firmware version, expired date and free space in memory. See as figure 4-18.

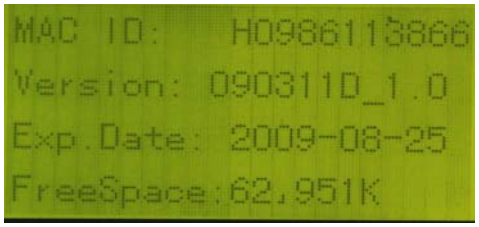


Figure 4-18

self-check: checking screen, LED and beeper, battery. See as Figure 4-19

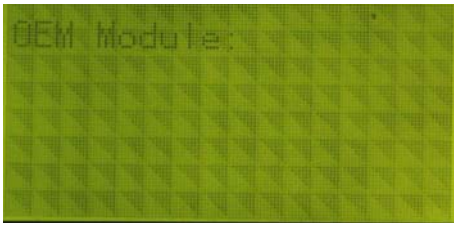


Figure 4-19

File list: checking static data files in receiver memory.checking file size, start time, end time and so on. Press  button when the cursor is on specific file , the confirm-delete frame will pop up, with file detail being shown. see as figure 4-20,

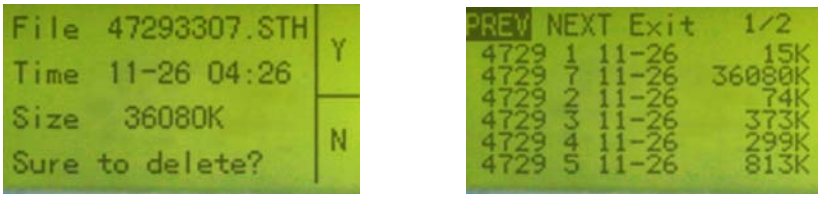


Figure 4-20

Registration: In this interface, you can input register code manually, Registration code can be entered here in case no PC connection is available in the field. Only the last 16 Characters are needed. see as following figure,

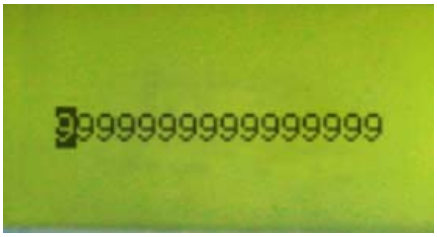


Figure 4-21

4.4 Collection mode

(1) Static work interface

When choosing static mode in setting modes, the receiver will enter static work mode after it being powered on. If manual way is wanted, press  button twice to start recording data. If automatic way

chosen, the receiver will record data automatically. There are 3 satellite information interfaces in this mode; you can set the way of turning pages automatically or manually. See as figure 4-22.

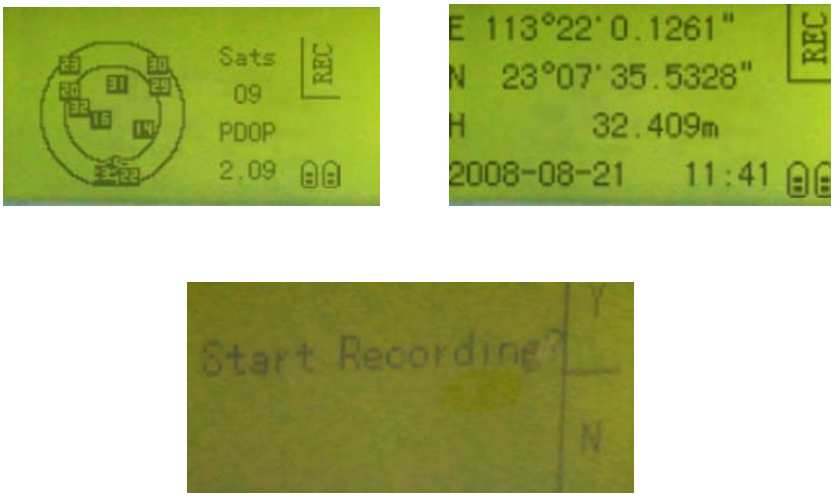


Figure 4-22

If you want to end data recording , press F1 button, then the system will remind you to end data recording or not. press F1 button again, system will show you that files are being closed now. if you want to cancel this operation, press F2 button. See as figure 4-23,

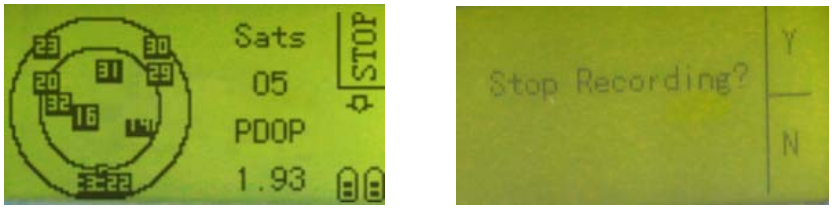


Figure 4-23

(2) Base work interface

When base mode chosen in setting mode, receiver will enter base work mode after being powered on. See as figure 4-24

Figure 4-24

Entering this interface, you will see the word “TRANSMIT” on the up-right corner of screen, press 

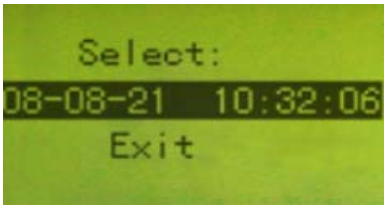
button to enter base setup menu, see as figure 4-25,

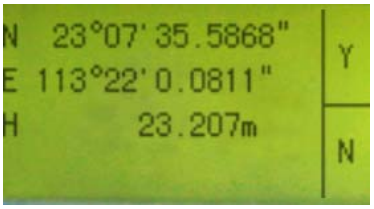
Figure 4-25

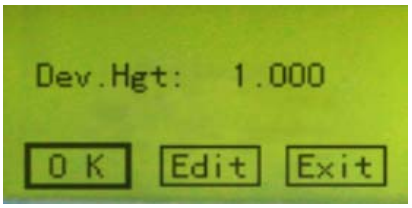
There are 3 options in this menu，***SINGLE TRANS***，***REPEAT TRANS***，***EXIT***，instructions are as belows,

SINGLE TRANS: It means using local coordinate as base coordinate to transmit, you can save this coordinate as a base coordinate file after work being done. It can be used for transmission repeating.

REPEAT TRANS: When setting the base station in the same position, you can use transmission repeating function, in this menu,coordinate can be chosen to be saved in receiver. See as the following figures,







The coordinate has been calculated to the ground, so the device height need to be input before transmission, see as below figure, it's dev.Hgt. You need to measure from base point on the ground to the edge of Hi plate.

EXIT: you can select this item to quit operation.

After selecting, press button to confirm, it will enter the interface as figure 4-15, press button again to start, if the fixed satellites are enough(more than 5) and good PDOP value available(smaller than 3), it will show "Start transmission!" and TX and DATA light will blink simultaneously.if you want to stop transmitting, press F1 button, the system will remind if you want to save the base coordinate or not, the coordinate can be saved and used for transmitting repeating function.

(3) Rover work interface

When rover mode chosen in setting mode, the receiver will enter rover work mode after being powered on, see as figure 4-26,

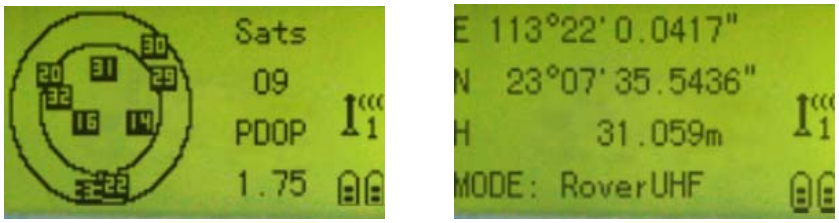


Figure 4-26

There are two pages in the collection mode. It includes satellites number, map, PDOP value, radio channel, module in use, battery power, longitude, latitude, ellipsoid height and so on.

4.5 Module setting

Press  button to enter module setting interface in rover work mode, see as figure 4-27,

Figure 4-27

Note: *In base work mode, you can only enter module setting interface after base station transmitting signals, and only module parameters settings can be changed,such as module, channel.work mode can not be changed here.*

After rover being connected to the base, if you want to change radio channel or change radio module, you can operate it in module setting interface, you can refer to **4.3.1** about ***data link*** and ***channel*** setting.

Figure 4-28

When configure radio module wanted, enter **config mode** to set, usually the receiver is needed to be connected to PC programs to make this configuration. See as following figure 4-29,

Figure 4-29

Press  button to enter configuration interface, you can set parameters in PC program after connection, see as figure 4-30,

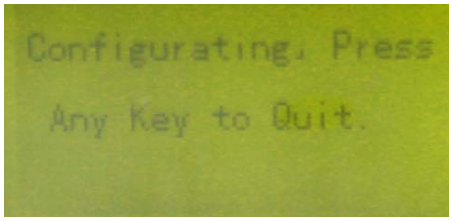


Figure 4-30

After settings done, press any button to return to collection interface.

Chapter5 Data Manage and Transfer

5.1 How to transmit data

Firstly, connect the receiver to PC by the USB cable,which works like a flash disk after being connected to the computer. a removable disk icon will appear at the right bottom of the computer screen, see as figure 5-1.

Figure 5-1

Then you will find a “removable disk” in “my computer”, click it, you will find the data in receiver memory.

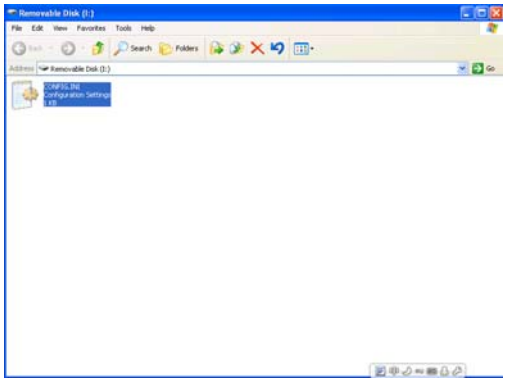


Figure 5-2

The record data file is “*.sth“， the editing time of file is the time to finish data recording ,the static data can be copied directly from this directory .

Notice: *The name of data recording is composed by 8 characters, the first four characters of which is point name, the middle three characters date , for example,31th ,Jan is 031. The last one session.*

5.2 The use of configuration file

When you open the file “CONFIG”, you will see it as belows:

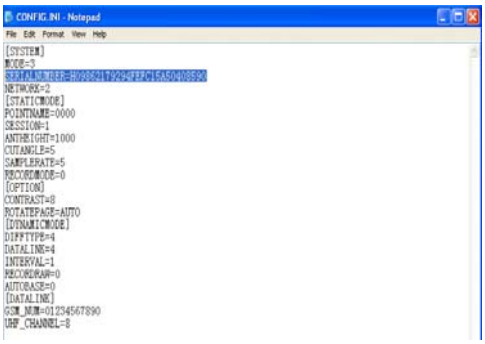


Figure 5-3

Name	Note
Point Name	Four characters, from 0 to 9, a, b, c …… z
Session	From 1 to 9
Ant Height	The Unit is millimeter(mm)
Mask Angle	From 0 degree to 45 degree
Contrast	From 0 to 15
Language	Chinese and English
Serial Number	composed by27 digits and upper case characters.

If the file“CONFIG” is deleted， it will regenerate automatically after the restart of the receiver.

5.3 Register and upgrade

5.3.1 Register

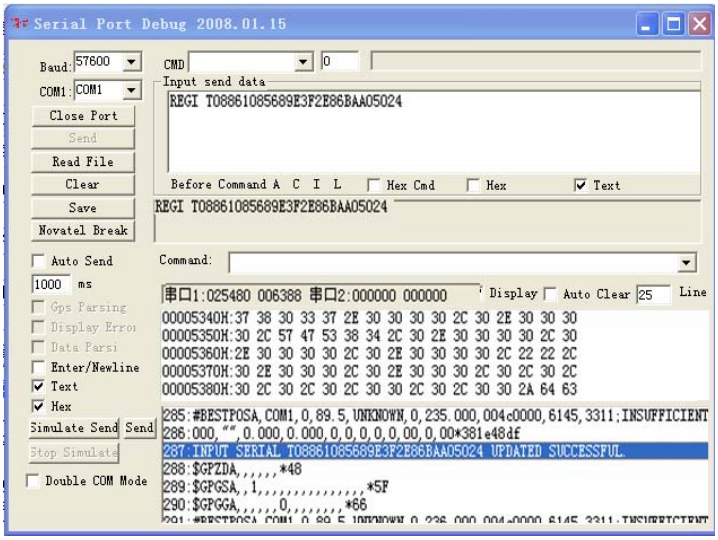
There are 4 methods to make registration:

1. Modify configuration file, conf.ini (USB port). Please refer to figure 5-3. You can replace the content of red frame, then save it. The registration code will be entered to the receiver.

2. Direct serial port command. Connect the receiver to your PC using serial port. Use any serial communication software (e.g. Super Terminal) to send the following command at the baud rate of 115200bps.

REGI H098621123411112222233334444

NOTE: Your serial code should be different from the above one but with same formation. (COM port) See as following figure:



3. By controller. Use controller software EGstar3.0. Refer to the EGstar3.0 User Manual for detailed information.

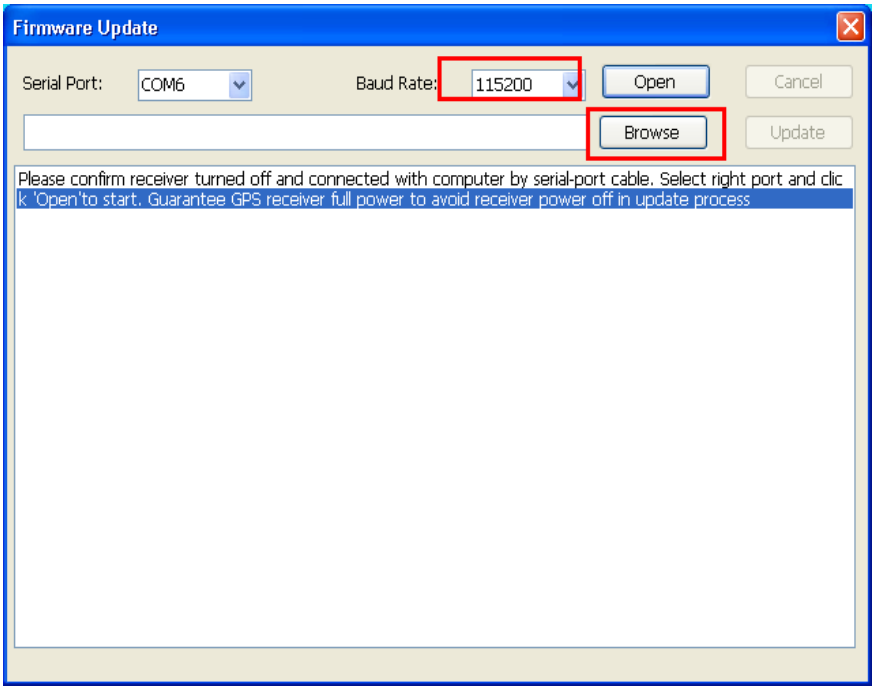
4. Input the serial port from panel. In the case only the last 16 characters are needed . See Registration in System configuration section. Please refer to **4.3.2** about registration.

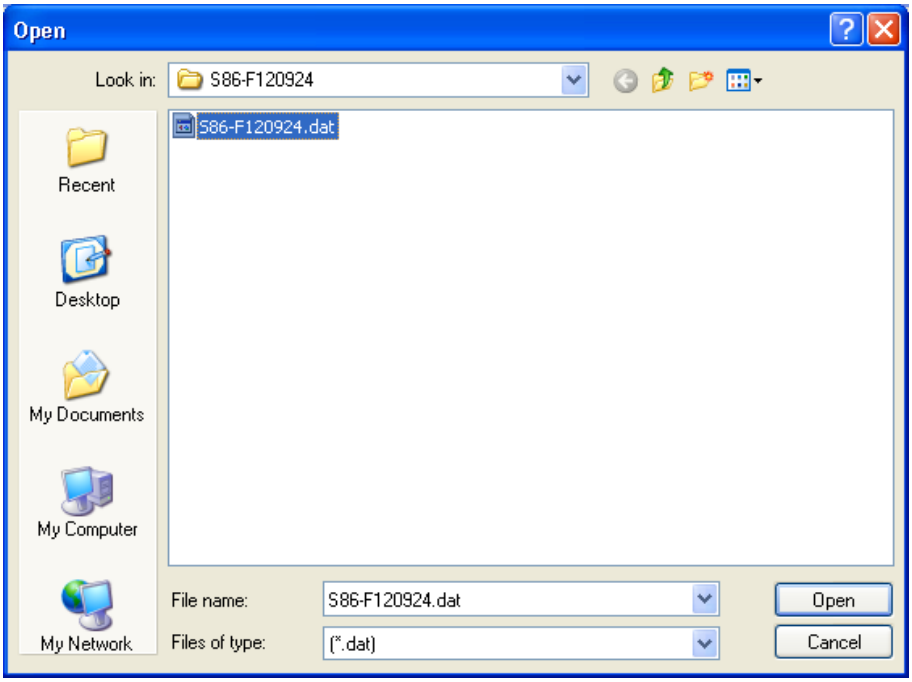
5.3.2 Receiver Upgrade

Sometimes, you need upgrade firmware of receiver, with main program Instar.exe and upgrade file *.dat, the operation steps are as belows.

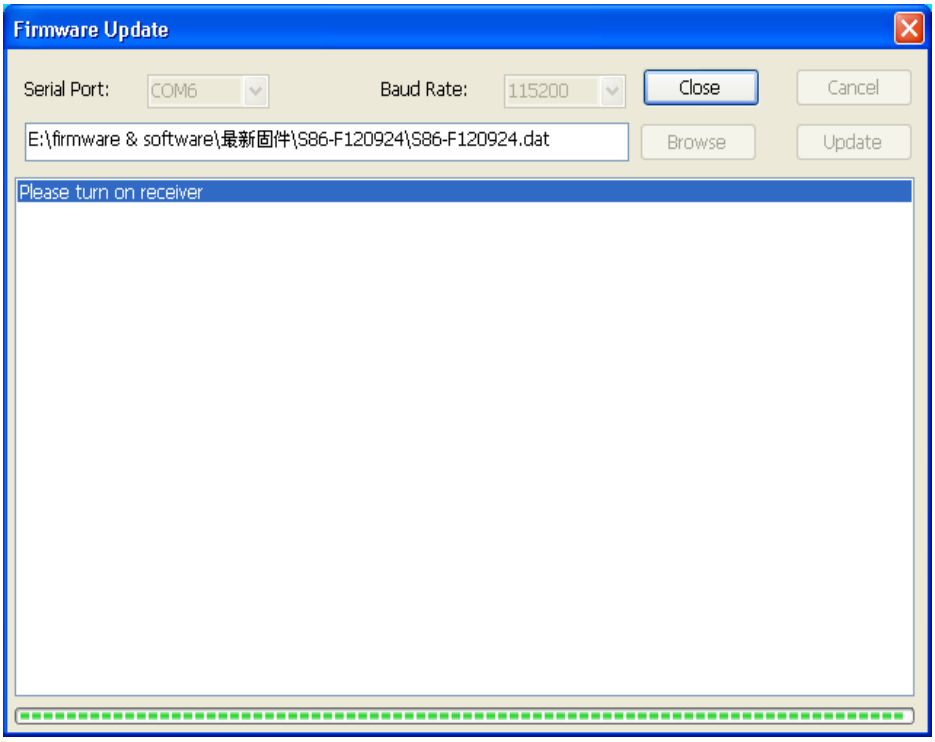
1. Keep S86T off and connect to PC with a L979Y cable.

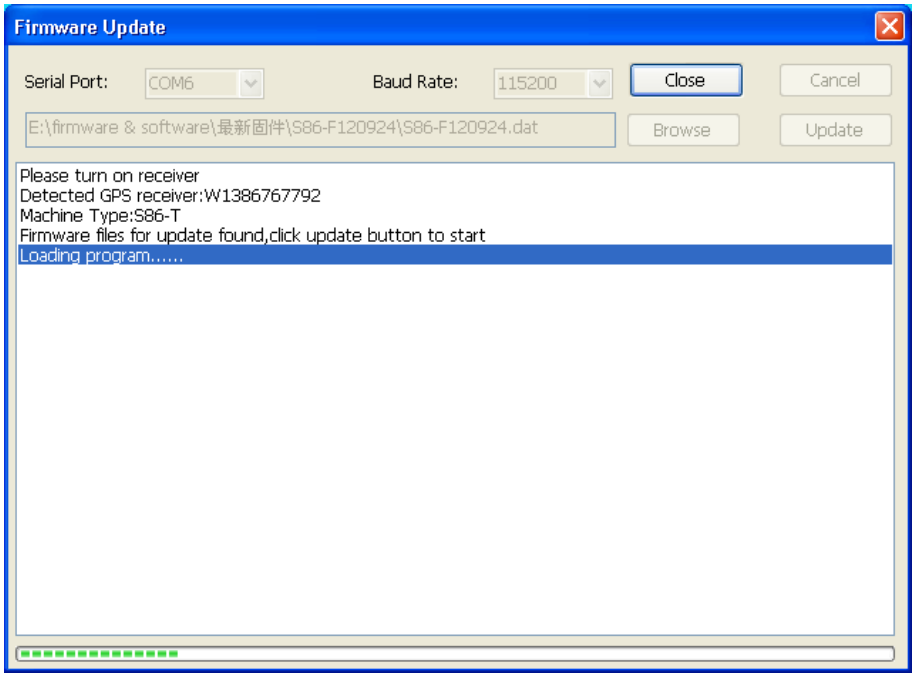
2. Double click “Firmware Update”, Instar will show as follows, then select the baud rate to 115200 and select the latest firmware.

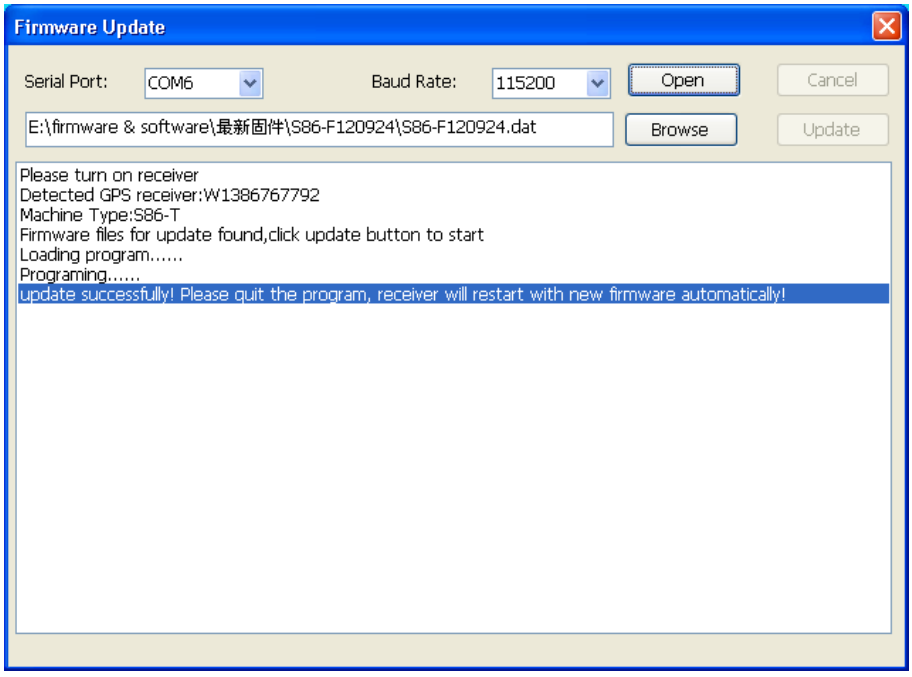




3. Turn on S86T and it will manage to update automatically.




Firmware Update
Serial Port:
COM6
Baud Rate:
115200
Close
Cancel
E:\firmware & software\最新固件\S86-F120924\S86-F120924.dat
Browse
Update
Please turn on receiver
Detected GPS receiver:W1386767792
Machine Type:S86-T
Firmware files for update found,click update button to start
Loading program.....


Firmware Update
Serial Port:
COM6
Baud Rate:
115200
Open
Cancel
E:\firmware & software\最新固件\S86-F120924\S86-F120924.dat
Browse
Update
Please turn on receiver
Detected GPS receiver:W1386767792
Machine Type:S86-T
Firmware files for update found,click update button to start
Loading program.....
Programing.....
update successfully! Please quit the program, receiver will restart with new firmware automatically!

Chapter6 Statement

6.1 Federal Communication Commission Interference Statement

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

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

And 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 of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that
4. to which the receiver is connected.
5. Consult the dealer or an experienced radio/TV technician for help.

FCC Caution:

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

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

To comply with FCC's RF radiation exposure limits for general population/uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

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