ROHS , ISO9001

ST915P

All Satellites Multi Frequency Band High Precision Navigation and Positioning Module Manual

July，2023

www.xbteek.com

Revision History

Ver. NO.	Version	Date
V.1	New	July, 2022

Disclaimer

This document only indicates the information of the products of Shenzhen Simple Technology Electronics Co., LTD without any transfer purposes, including has no transfer any patent, trademark, Copyright or ownership right or any rights or licenses under Company or any third party by implication, estoppel or other ways. We (Shenzhen Simple Technology Electronics Co., LTD) accepts no liability other than those stated in the terms and conditions of Sale of its products. Furthermore, regarding the sale and use of its products, Simple makes no any kinds of express or implied warranties including fitness for a particular purpose, marketability or liability for infringement of any patent, copyright or other intellectual property rights. If the connection or operation is not in accordance with the manual requirements, the company is exempt from liability. Simple perhaps make modifications to product specifications and descriptions at any time without prior notice. The products of our company may contain certain design defects or errors, which will be included in the corrigendum upon discovery, and may result in differences between the product and the published specifications. An updated erratum is available upon request.

Catalogue

1. Product Introduction

1.1 Overview

ST915P, all-satellites multi-frequency high-precision positioning and orientation module, launched by Shenzhen Simple Technology Electronics Co., LTD, is a multi-function, high-precision, vehicle-mounted, high-reliability product. ST915P is an all- satellites, multi-frequency, small-size high-precision positioning, directional GNSS module, which meets the requirements of multi-modes and multi-frequency of navigation satellites system, supporting GPS, BDS-2, BDS-3, GLONASS, Galileo, SBAS and QZSS. Mainly apply to UAV, lawn mower, precision agriculture and intelligent driving test and other fields, support the whole satellites full frequency spot the RTK positioning on the chip and dual antenna orientation solution, and can be used as a mobile station or base station.

1.2 Key Indicators

Channel		1408
Satellites		BDS/GPS/GLONASS/Galileo/QZSS
Signals	Main antenna	GPS: L1C/A, L2C, L2P*,L5
		BDS-2: B1I, B2I, B3I
		BDS-3: B1I, B3I, B2I
		GLONASS: G1, G2
		Galileo: E1, E5a,E5b
		QZSS: L1C/A, L2, L5
	Slave antenna	GPS: L1C/A, L2C, L2P*
		BDS-2: B1I,B2I, B3I
		BDS-3: B1I, B3I, B2I
		GLONASS: G1, G2
		Galileo: E1, E5b
		QZSS: L1C/A, L2C
	The items with * , will be adjusted following the version	
First positioning time	Cold Start Cold start	< 30s (Adding capture acceleration module)
	Hot Start (with RTC)	< 10s (recommended)
Signal Capture	Reacquisition	< 1s
	Sensitivity of Signal Capture	-138dBm
Measurement Precision	Pseudo range Precision.	≤ 10cm

Measurement precision	Pseudorange precision	
	Carrier Phase Precision	≤ 1mm
Accuracy	Time Accuracy	20ns
	Orientation accuracy	0.2 degrees /1m baseline
	Single point positioning accuracy	Horizontal:1.5m; Elevation :2.5m
	DGPS	Horizontal: 0.4m +1 ppm; Elevation: 0.8m +1 ppm
	RTK	Horizontal: 0.8cm + 1ppm; Elevation: 1.5cm +1 ppm
	Speed accuracy	≤ 0.03 m/s (PDOP ≤4)
Update rate	Position direction- finding 20 Hz,20 Hz original observed value	
Data Rate	Initialization reliability	
Environmental requirements	Power supply voltage	+ 5.0V ± 5% DC
Electrical characteristics	Power consumption	600mW
Temperature	Operating temperature	-40 ° C ~ +85 ° C
	Storage temperature	-55 ° C ~ +95 ° C
Output data formats	NMEA-0183	1.6 W (Anti-interference off) Set anti-interference on consumes more about 0.2W. Set anti-interference on consumes more about 0.2W
	Defined binary format(CNB)	Defined Binary Indicates
	RTCM3.X	1004 ~ 1008, 1012, 1019, 1020, 1033, 1042, 1045/1046, 1230, 4078 MSM3~MSM7: 1073~1077, 1083~1087, 1123~1127, 1093~1097
Antenna interface	Impedance matching	50 ohms
	Antenna supply voltage	External power supply: +3.3V ± 5%VDC @ 0-100mA
Requirements for external antennas	Requirements for antenna gain: The optimal input gain is 30dB	Antenna gain is lower than 20dB or higher than 36dB, which may cause signal crosstalk and other problems
Power supply requirements	Dc voltage 3.3V, current greater than 1A	
Physical Parameters	Size	30 mm x 40 mm * 3.7 mm
	Weight	7.0 grams (g)
Data interface	3XUART(LVTTL)	UART-TTL data format
	1XEVENT(LVTTL)	
	1X1PPS(LVTTL)	

2. Electrical Characteristics

2.1 Electrical maximum

Parameters	Symbols	Minimum value	Recommended value	Maximum value	Units	Conditions
Supply voltage (VCC)	Vcc	3	3.3	3.6	V	
VCC maximum ripple	Vrpp	0		50	mV	
Storage temperature	Tstg	- 45		85	℃	
ESD	VESD(HBM)			2000	V	

2.2 Operating Conditions

Parameters	symbol	Minimum value	Recommended value	Maximum value	Units	Conditions
Supply voltage (VCC)	Vcc	3	3.3	3.6	V	
Peak current	Iccp		180	230	mA	Vcc = 3.3V
Operating temperature	Topr	- 40		85	℃	

3. Functions

3.1 All Satellites

The ST915P module can receive the signals of multiple satellites system at the same time, including the main satellite system and the wide area and local satellite-based enhancement system signals.

Listed in the table:

	Satellite navigation system	Operation/ maintenance country/region
Main navigation system (GNSS)	GPS	United States
	Beidou (BDS)	China
	GLONASS	Russia
	GALIELO	European Union
Local Area navigation System	QZSS	Japan
Star-based Wide Area Enhancement (SBSA)	WASS	USA
	EGNOS	European Union
	MSAS	Japan
	GAGAN	India

GPS/SBSA/QZSS can be used at the same time. GPS/BDS is factory configured.

3.2 System Enhancements

The ST915P module can accept various enhancement aids.

3.3 Data Refresh Rate

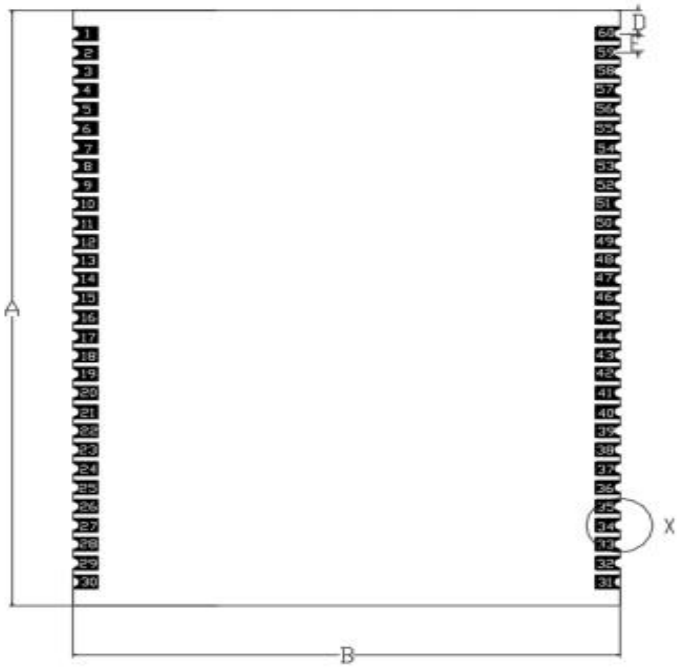
The ST915P module accepts user input configuration and can achieve a refresh rate of 1Hz- 20Hz.

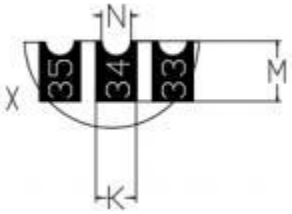
4. Module Dimension and Pins Definition

4.1 Module Dimensions

Table 4-1: Module Dimensions

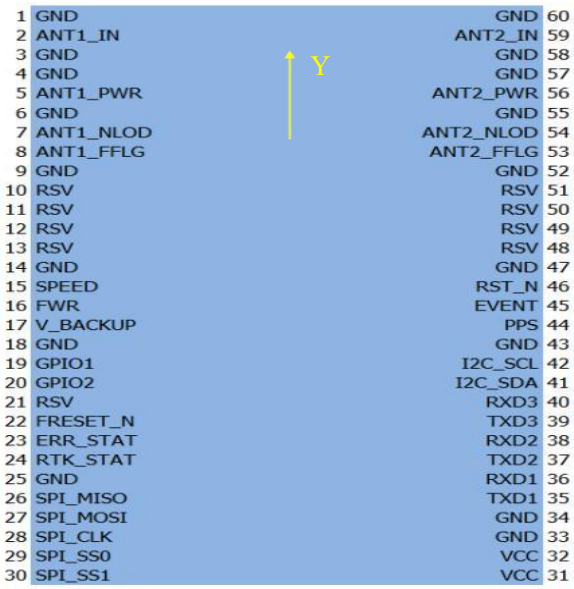
Parameters	Numerical value (mm)	Tolerance (mm)
A	40.00	-0.2 +0.5
B	30.00	+ / - 0.2
C	3.70	+ / - 0.2
D	1.58	+ / - 0.1
E	1.27	+ / - 0.1
K	0.91	+ / - 0.1
M	1.35	+ / - 0.1
N	0.66	+ / - 0.1





4.2 Descriptions of Pins and Inertial Navigation Coordinate System

Table 4-2-1: Pin Diagram



4.3 Pins Description

Table 4-3: Pins Description

Serial No.	Pins	Input/Output	Description
1	GND	-	Ground
2	ANT1_IN	I	GNSS antenna signal input (main antenna)
3	GND	-	Ground
4	GND	-	Ground
5	ANT1_PWR	I	GNSS main antenna power supply (positioning antenna)
6	GND	-	Ground
7	NC	-	
8	NC	-	

9	GND	-	Ground
10	RSV	-	Leave the pin be unconnected
L	RSV	-	Leave the pin be unconnected
12	RSV	-	Leave the pin be unconnected
13	RSV	-	Leave the pin be unconnected
14	GND	-	Ground
15	NC	-	
16	NC	-	
17	V_BACKUP	I	V_BCKP supplies power to the RTC and SRAM when the module main power supply VCC is off. The level requirements are of 2.0~3.6V, and the working current is about 10pA. When the hot start function is not used, it can be unconnected.
18	GND	-	Ground
19	NC	-	
20	NC	-	
21	-	-	Leave the pin be unconnected
22	NC	-	
23	ERR_STAT	O	Abnormal indicator light, it's effective in the high level, when the module system failed in the self-test, the output is of the high level; When the module passed the self-check, output is of the low level.
24	RTK_STAT	O	RTK positioning indicator, active at high level, output in high level when RTK is in fixed solution. Other positioning status or unpositioning output in low.
25	GND	-	Ground
26	SPI_MISO	I	SPI data in
27	SPI_MOSI	O	SPI data out
28	SPI_CLK	O	SPI clock
29	SPI_SS0	O	SPI chip select 0
30	NC	-	
31	3.3 V_VCC	POWER	Power supply (+3.3V)
32	3.3 V_VCC	POWER	Power supply (+3.3V)
33	GND	-	Ground
34	GND	-	Ground
35	TXD1	O	Serial port 1 send
36	RXD1	I	Serial port 1 receive
37	TXD2	O	Serial 2 send

38	RXD2	I	Serial port 2 receive
39	TXD3	O	Serial port 3 send
40	RXD3	I	Serial port 3 receive
41	12C_SDA	I/O	I2C data
42	12C_SCL	I/O	I2C clock
43	GND	-	Ground
44	PPS	O	Second pulse
45	EVENT	I	Event trigger
46	RST_N	I	Quick reset, do not have to clear user's configuration
47	GND	-	Ground
48	RSV	-	Leave the pin be unconnected
49	RSV	-	Leave the pin be unconnected
50	RSV	-	Leave the pin be unconnected
51	RSV	-	Leave the pin be unconnected
52	GND	-	Ground
53	NC	-	
54	NC	-	
55	GND	-	Ground
56	ANT2_PWR	I	GNSS slave antenna power
57	GND	-	Ground
58	GND	-	Ground
59	ANT2_IN	I	GNSS antenna signal input (slave antenna)
60	GND	-	Ground

4.4 Notes for Pins

Table 4-4: Notes for Pins

	Pins	Serial No.	I/O	Description	Remarks
Power Supply	VCC	31, 32	Power source	Power supply	Stable, pure and low ripple power supply, difference between ripple voltage peaks (Max. and Min.) value should not exceed 50mVpp

	ANT1_PWR, ANT2_PWR	5, 46	Power supply	Antenna power	Active antennas provide power for the corresponding electrical voltage
	GND	1, 3, 4, 6, 9, 14, 18, 25, 33, 34, 43, 47, 52, 55, 57, 58, 60	Power supply	Ground	Ground all GND signals of the module, grounding is best made with a large area of copper
Antenna	ANT1_IN, ANT2_IN	2, 59	I	BD, GPS, GLONASS, Galileo, satellite signal input	Wiring 50 ohm impedance matching
UART	TXD1	35	I	Serial port 1 send	Output from serial port 1, if not in use, be unconnected.
	RXD1	36	O	Serial port 1 receive	Output from serial port 1, be unconnected if not in use,
	TXD2	37	I	Serial 2 send	Output from serial port 2, be unconnecteded if not in use
	RXD2	38	O	Serial port 2 receive	Output from serial port 2, be unconnected if not in use
	TXD3	39	I	Serial 3 send	Serial port 3 output, be unconnected if not in use
	RXD3	40	O	Serial port 3 receive	Serial port 3 output, if not in use, be unconnected
System	RESET_N	22	I	Hardware reset (effective in low)	Restore factory Settings by pulling down FRESET_N for no less than 5s
	PPS	44	O	PPS Signals	PPS Signal
	EVENT	45	I	EVENT signal	Event Signal input

5. Module Integration Guide

5.1 Design considerations

To make ST915P work normally, the following signals need to be connected correctly:

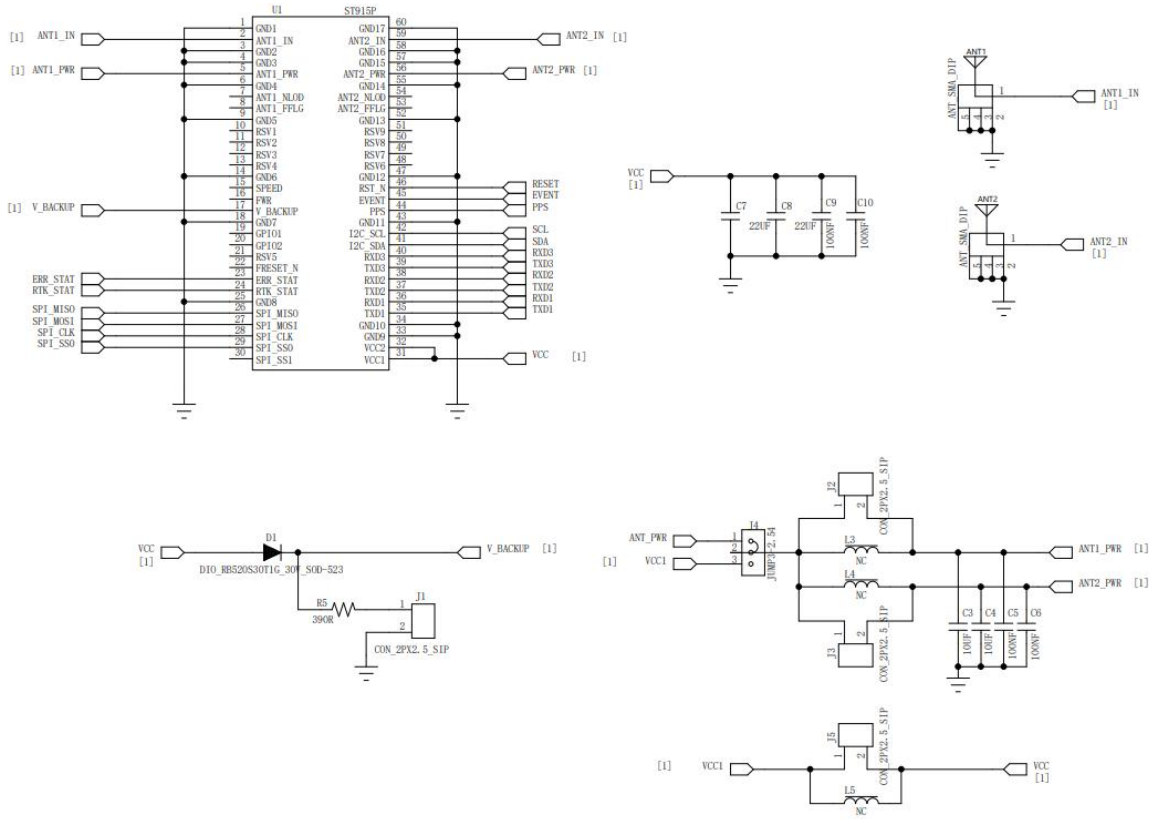
- module VCC power-on with good monotony, and the starting level is lower than 0.4V. The down stroke and ringing are guaranteed within 5%VCC range.
- Use VCC pins to provide a reliable power supply, and ground all GND pins of the module
- ANT1, ANT2 MMCX interfaces provide feeds of +3.3~5.5V, pay attention to line 50ohm impedance matching.
- Ensure that serial port 1 is output. Users need to use this serial port to receive location information and upgrade the software.
- Module reset pin FRESET_N is for restoring module factory settings; RST_N for quick reset, please connect correctly to ensure that the module can be reset reliably.
- ANT_NLOD, ANT_FFLG, when the antenna detection indication signal is connected. The customer MCU end I/O should be the input, and without any pull-up/down.

To obtain good performance, the design should also pay special attention to the following:

- Power supply: Good performance requires stable and low ripple power supply guarantee. Difference between ripple voltage peaks (Max. and Min.) value is best not to exceed 50mVpp. It is recommended to use a power chip with current output capacity greater than 2A to power the board. Except using LDO to ensure pure power supply, it is also necessary to consider the followings:
  - Widen power cables or use split copper surfaces to transmit current
  - Place LDO as close to modules as possible in the layout
  - Do not route power cables through high-power and high-inductive devices such as magnetic coils
- When use the UART interface, need to ensure that the signal and baud rate of the main device are consistent with that of the ST915P module.
- The antenna line should be as short and smooth as possible, avoid going at acute angles and pay attention to impedance matching.
- Avoid running lines directly below the ST915P.
- Try to keep the module away from hot gas.

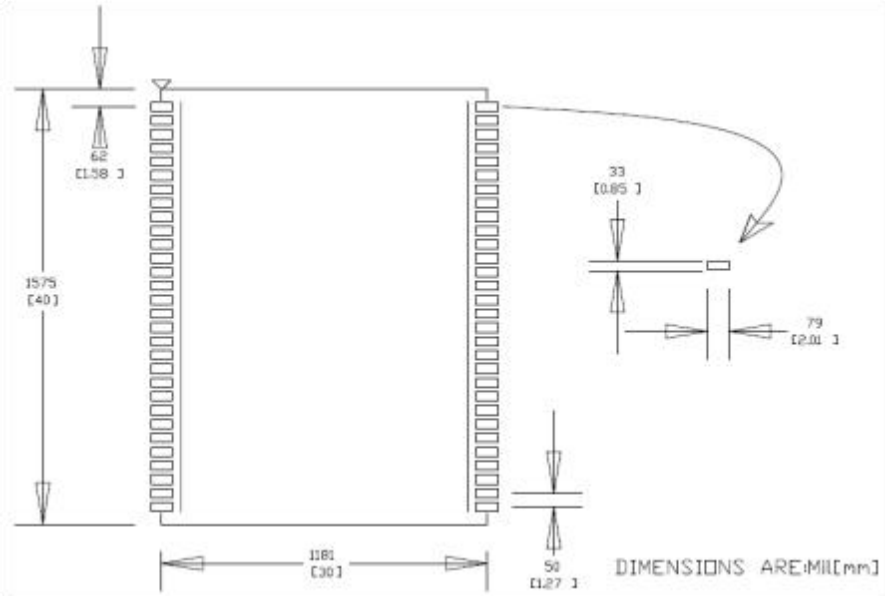
5.2 Minimum recommended design

Figure 5-1 Minimum



5.3 Layout and Cabling

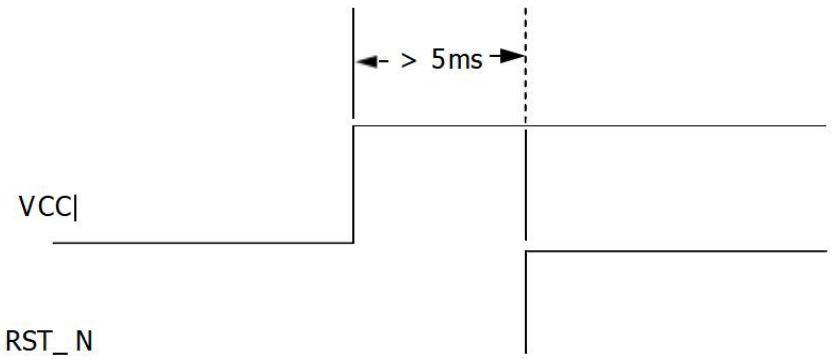
Figure 5-3 Recommended PCB Design (unit: Mil, unit mm in parentheses)



5.4 Module Reset Signal

After the ST915P module is powered on, if the RST_N pin is used to reset, it must be used correctly to work normally. To ensure effective resetting, the following timing sequence requirements must be met between the reset pin RST_N of the module and the power supply VCC during power-on. During the normal operation of the module, lowering the RST_N pin for more than 5ms can also reset ST915P.

Figure 5-4 Module Reset Signal

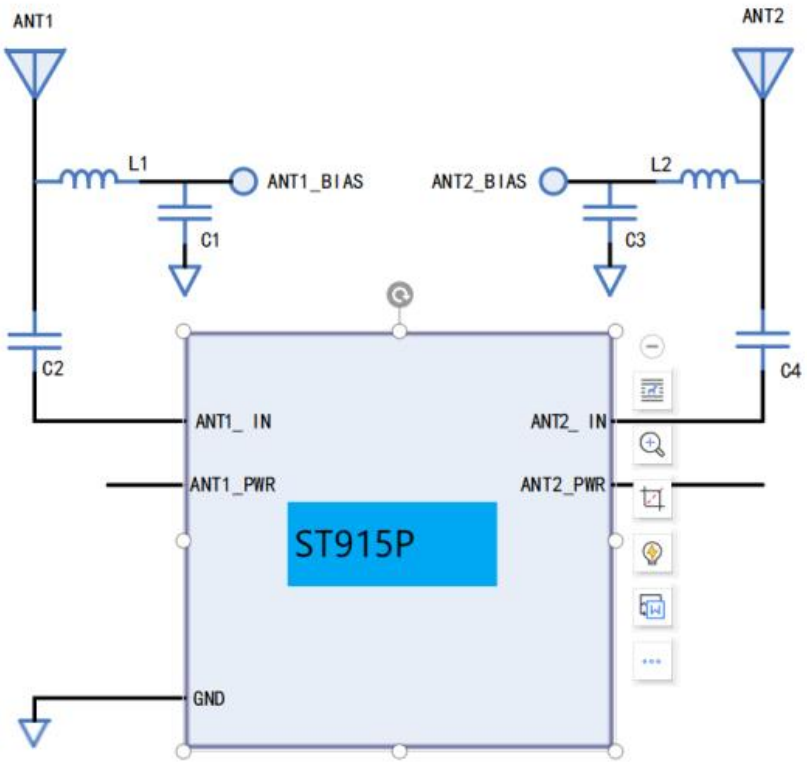


5.5 External antenna feed design

The ST915P module provides the ability to feed the antenna from the inside, but for effective protection against lightning strikes and surges, it is highly recommended that users feed the antenna from the outside of the module.

To feed the antenna from the outside of the module, a high-voltage and high-power feeding chip can be selected. High power protective devices such as gas discharge tube, varistor and TVS tube can also be added to the feed circuit, which can effectively improve the ability of lightning strike prevention and surge prevention.

Figure 5-5 External Feed Reference Circuit



Notes:

① L1 and L2, feed inductors, recommend 68nH RF inductors in 0603 package;

(2) C1 and C3, decoupling capacitors, it is recommended that the 100nF/100pF two capacitors in parallel;

③ C2 and C4, DC blocking capacitors, 100pF capacitors are recommended.

6. Connection and Setting

6.1 ESD Protection

Many components of the ST915P module are susceptible to electrostatic damage, which will affect the IC circuit and other components. Please take the following ESD protection measures before opening the anti-static blister box:

- Electrostatic discharge (ESD) can damage the components. Operate the module on an ESD workbench with wearing an ESD wrist and using the conductive foam pad. If ESD workbench is not available, wear an ESD wrist strap and connect it to the metal part of the chassis for ESD protection.
- Do not touch the components directly on the module when inserting and removing the module

7. Package and Transportation

7.1 Package Dimensions

Carton packing, 100pcs/CNT.

7.2 Anti-static Requirements

ST915P is an electrostatic sensitive module. Pay special attention to the the metal joint electrostatic protection when using.

ESD CAUTION

Shenzhen Simple Technology Electronics Co., LTD.

Focus on Precise Space-time, Assist in Smart Service Worldwide

Address: 23rd Floor, Xinlikang Building,QianHai Nanshan District, Shenzhen City, Guangdong Province

Website: https://xbteek.com