

Millimeter Wave Radar

MS72SF1

Datasheet

V 1.0.1

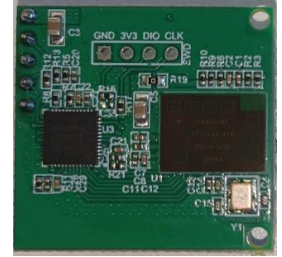
Applicable Product Model
MS72SF1

Version Note

Version	Details	Contributor(s)	Date	Notes
1.0.0	First edit	Coral	2023.05.30	
1.0.1	Addition housing layout and welding requirements	Vinle	2023.7.10	

MS72SF1

Low-cost,high-reliability,high-performance,accurate tracking and positioning of multiple people indoors,user motion track detection



MS72SF1 is a 60G millimetre wave radar module, relative to the traditional visual, infrared, laser and other means of perception, millimetre wave radar is not affected by light, can be achieved around the clock without sensing active indoor personnel perception and monitoring, and has a personal privacy protection function, it is the best sensor for the current application of home scenes. This product adopts the national production chip, independent and controllable, to achieve accurate tracking, and can inhibit curtains, green plants and other interference. This product has the advantages of low cost, high reliability and high performance and so on.

■ Features

- Low-cost
- High-reliability
- High-performance
- User motion track detection
- accurate tracking and positioning of multiple people indoors

■ Application

- Smart home people detection
- User motion track detection
- Indoor personnel track detection
- Industrial control radar sensor

■ Key parameter

Working frequency	60~64GHz	Antenna	PCB
Module size	29.36×28mm	Processing Period	≤30ms
Installation method:	top/side installation	Detection Distance	0.5 ~ 8m
Azimuth Coverage	±60°	Pitch angle coverage	±60°
Max Consumption	1.7W	Avg Current	110mA(Processing Period 100ms)
Firmware	top/side firmware		

INDEX

1 Module Description	6
1.1 Module Function Description	6
1.2 Module Features	7
2 Electrical Specification	8
3 Pin Description	8
4 Pin Definition	9
4.1 Mechanical Drawing	9
5 Electrical Characteristics	10
5.1 Limit Rated Parameters	10
5.2 Typical working parameters	10
5.3 Module Consumption	10
6 Environmental Build	11
6.1 Hardware components	11
6.2 Installation position	11
7 Parameter Configuration	13
8 Radar Module Serial Data Communication Protocol Description	15
8.1 Communication parameters	15
8.2 Message Output Protocol Format	16
Provide example	18
9 Use of the upper computer	19

10 Housing Layout and Welding Requirements20

 Quality 21

 Contact Us 21

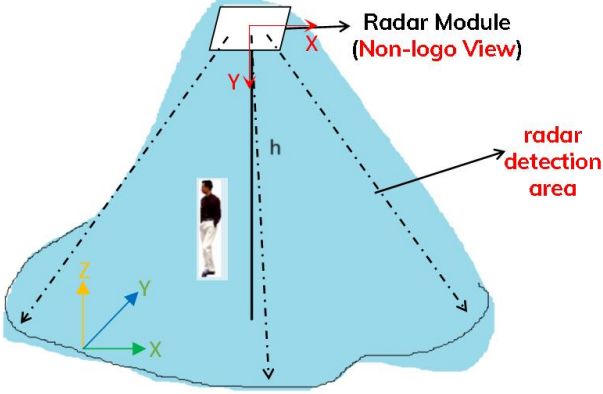
 Copyright Statement22

1 Module Description

1.1 Module Function Description

No.	Function	Details
1	Multi-target tracking	1) It can realize the target tracking function of up to 10 people, including the target movement trajectory and the real-time position of the target; 2) Strong ability to suppress false targets (curtains, green plants, multipath, etc.); High sensitivity to detect micro-moving targets (stationary, shaking, waving, etc.).
2	Area division	The user can flexibly configure the detection area.

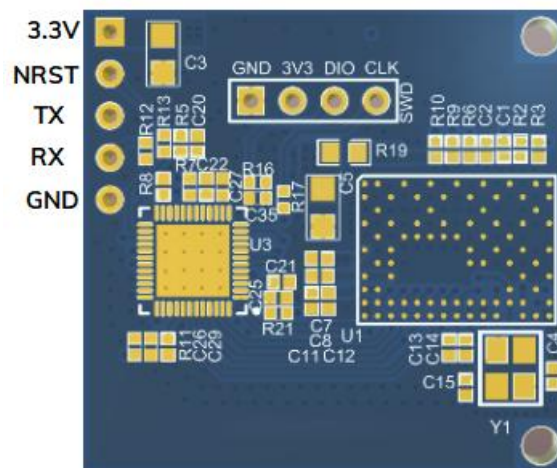
1.2 Module Features

No.	Function	Details
1	Installation scene	 <p>Detection distance: 0.5~8m, (the effective projection ground is a circle with a radius of 4meters, and the installation height is 2.7meters)</p> <p>(Note: The detection distance is related to factors such as installation environment, human body volume, relative angle, and movement range. The above parameters are the test results of our company. Under different test conditions, the actual test results shall prevail)</p>
2	Unaffected by the environment	Unaffected by temperature, humidity, dust, light, noise, etc.
3	Flexible parameter configuration	The detection threshold, function mode, etc. can be configured through the serial port.

2 Electrical Specification

Parameter	Values	Notes
Working Voltage	2.5 ~ 3.3	Standard supply voltage 3.3V
Working Temperature	-40°C~+85°C	Storage temperature is -40°C~+125°C
Transmission Power	-20 ~ +8dBm	
Avg Current	110mA	Processing Period 100ms
Max Consumption	1.7W	
Module Dimension	29.36*28mm	
Quantity of IO Port	5	

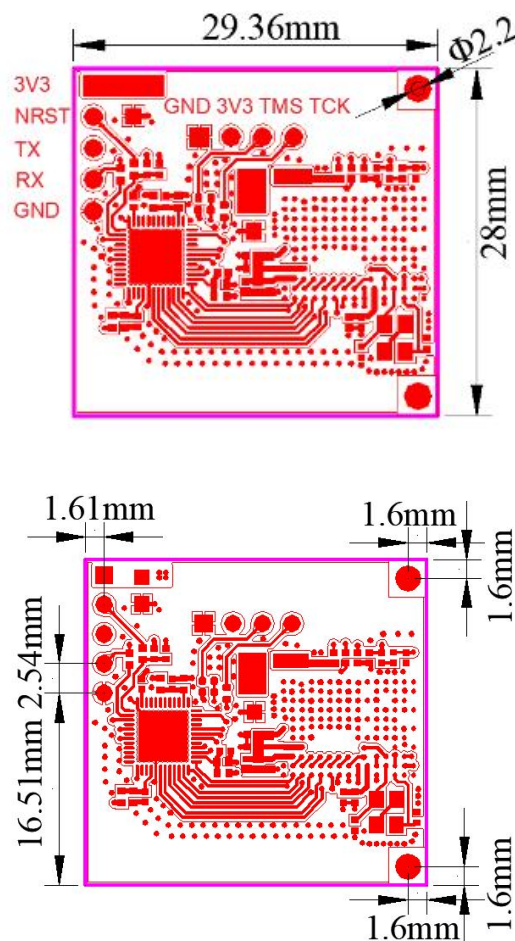
3 Pin Description



4 Pin Definition

Symbol	Type	Definition
3.3V	Power Supply	Power supply, input voltage 3.3V
NRST	Reset	Module reset pin
TX	UART TX	Used for UART serial transmitter (UART TX)
RX	UART RX	Used for UART serial reception (UART RX)
GND	Power supply ground	Ground

4.1 Mechanical Drawing



* (Default unit: mm Default tolerance: ± 0.1)

5 Electrical Characteristics

5.1 Limit Rated Parameters

Pin	Min	Max	unit
3.3V	-0.5	3.6	v
I/O (TX/RX/VO)	-0.5	3.6	v

5.2 Typical working parameters

Pin	Typical value	unit
3.3V	3.0 ~ 3.3	v
I/O (TX/RX/VO)	-0.5 ~ VDD+0.3	v





Notice: .VDD in the above table refers to the power supply input.

5.3 Module Consumption

The radar module contains RF devices, the current is about 530mA during the working time of starting RF transceiver, and about 80mA during the working time of shutting down RF transceiver. the average power consumption of the module is related to the frame period of the radar detection and processing, and if the radar works with a frame period of 100ms, then the average current is about 110mA. for the power supply input of the module, the power supply needs to be of high driving capacity, and the output current needs to be not less than 1A.

6 Environmental Build

6.1 Hardware components

NO.	Name	Figure	Description
1	Radar Module		Model NO.: MS72SF1
2	USB to TTL Module		USB to TTL module for serial port command configuration, antenna calibration and other functions.
3	USB Extension Cable		USB extension cable for connecting PC to USB TTL module
4	ST-LINK Down-loader		ST-LINK down-loader for radar module firmware upgrade and secondary development simulation debugging.

6.2 Installation position

The module is installed on the ceiling with the antenna facing down, and the installation height is 2.3-2.8m. When installing the module, try to keep it as fixed as possible to avoid shaking of the module. The surrounding environment should be as open as possible, and the USB extension cable should be fixed as much as possible to avoid interference caused by the cable. See e.g. Figure 1.

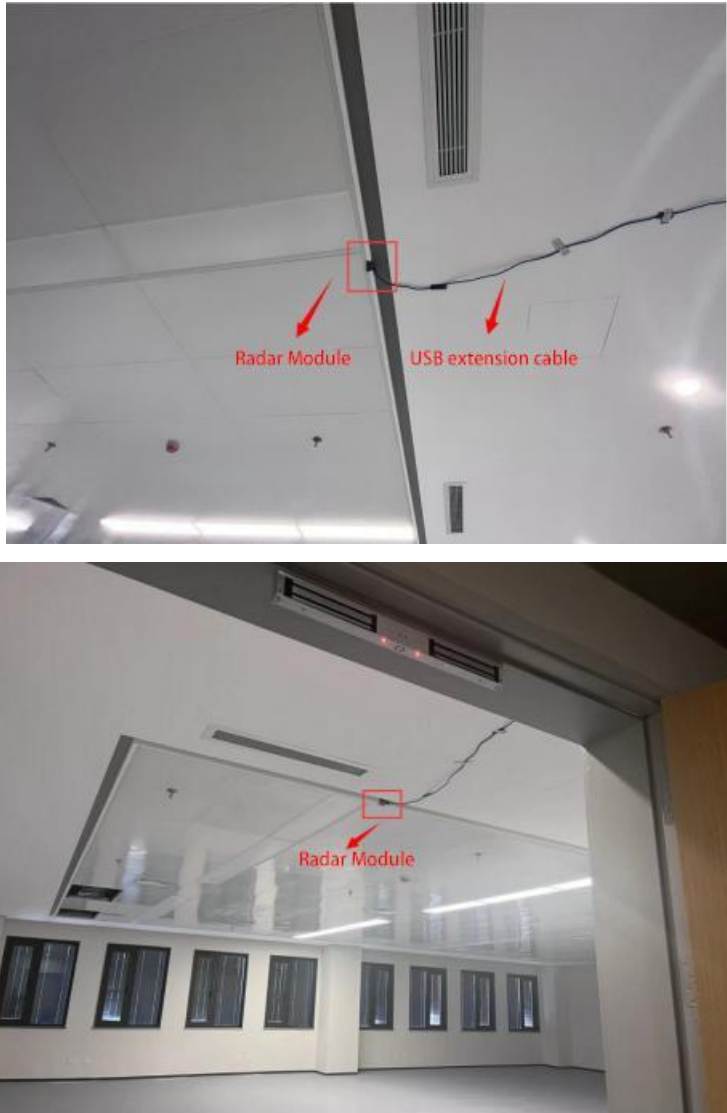
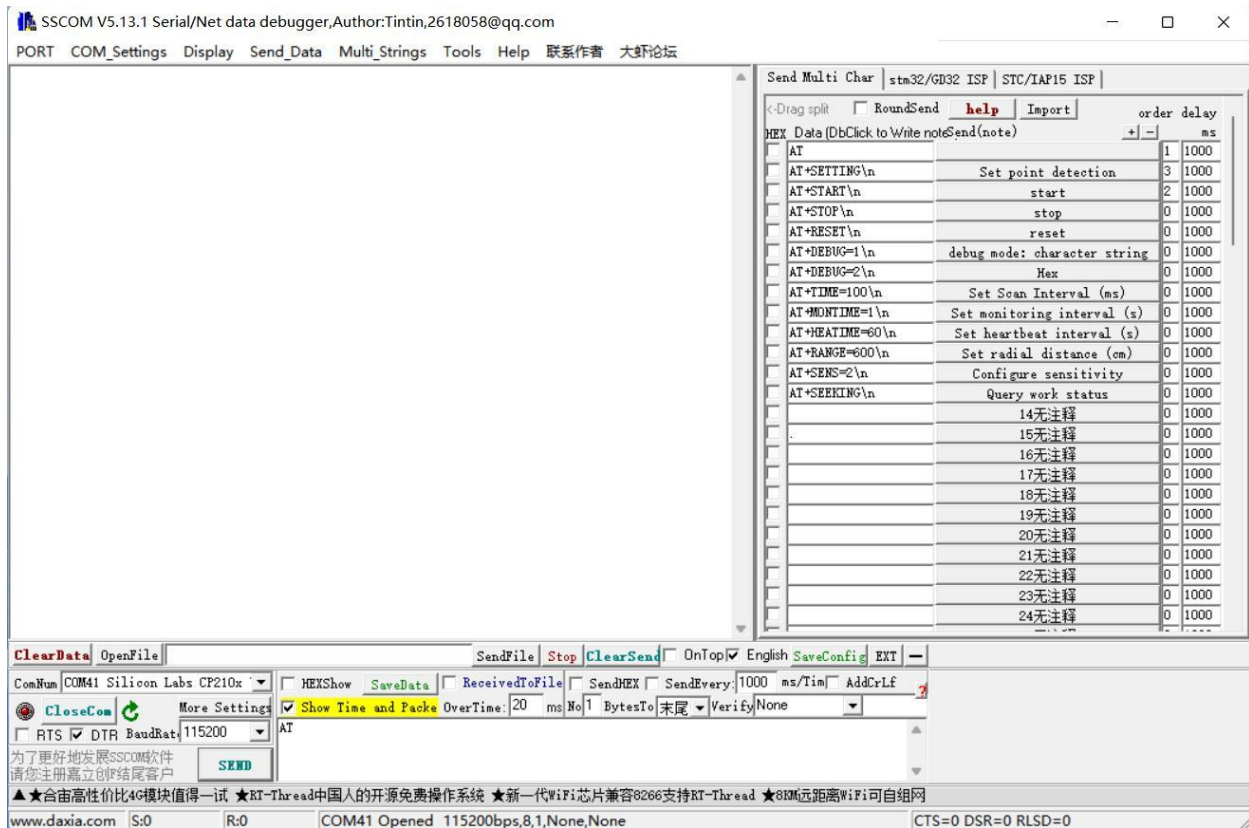


Figure 1 Top Mounting Legend

7 Parameter Configuration



Adjust the corresponding parameters as needed. Note: After modifying the parameters, click the button behind the parameters to complete the parameter modification.

Common parameters are as follows:

Command	interpretations
AT+START\n	Start Operation
AT+STOP\n	Stop Operation
AT+RESET\n	Module reset
AT+TIME=XX\n	Configure scan interval (unit:ms, range:100-10000, default value 100)
AT+MONTIME=XX\n	Configure monitoring interval(units:s, range 1-99, default value 1)
AT+HEATIME=XX\n	Configure heartbeat interval (unit s, range 10-999, default value 60)
AT+RANGE=XX\n	Configure radial distance (in cm, range 10-1000, default 600)
AT+SENS=XX\n	Configure sensitivity (range 1-19, default is 2)

AT+SETTING\n	Fixed-point detection mode
AT+SEEKING\n	Check operation status
AT+WINARANGE=XXXXXXXXXXXX\n	Gate 1 configuration
AT+WINBRANGE=XXXXXXXXXXXX\n	Gate 2 configuration
AT+WINCRANGE=XXXXXXXXXXXX\n	Gate 3 configuration
AT+WINDRANGE=XXXXXXXXXXXX\n	Curtain 1 configuration
AT+WINERANGE=XXXXXXXXXXXX\n	Curtain 2 configuration
AT+WINFRANGE=XXXXXXXXXXXX\n	Curtain 3 configuration

Typical example:

If the configuration is successful, it will return AT+OK, if the configuration fails, it will return Save Para Fail, and you need to resend the command.

AT+SETTING\n

Before performing fixed-point detection, please first ensure that the detection environment has no other interference and let people stand still at the place where the fixed point is required, and then send AT+SETTING\n to configure. At this time, the module will upload the location information of the person as follows.

In this way, the coordinates of each point are recorded

AT+WINARANGE=XXXXXXXXXXXX\n

AT+WINARANGE followed by 12 digits, e.g.AT+WINARANGE=123211128217\n

It means that the doors and windows are on the straight line between point x1=-2.3, y1=1.1 and point x2=-2.8, y2=1.7, and the radar module will discard detection targets outside the straight line.

AT+WINARANGE=999999999999\n means to delete the restriction (the 1st, 4th, 7th, and 10th digits indicate that the sign bit can only be 1 or 2, and 1 means negative, 2 means positive,AT+WINBRANGE=, AT+WINCRANGE=, AT+WINDRANGE=,

AT+WINERANGE=, AT+WINFRANGE= the same reason)

As shown in Figure 2, the radar detection area is diagrammed.

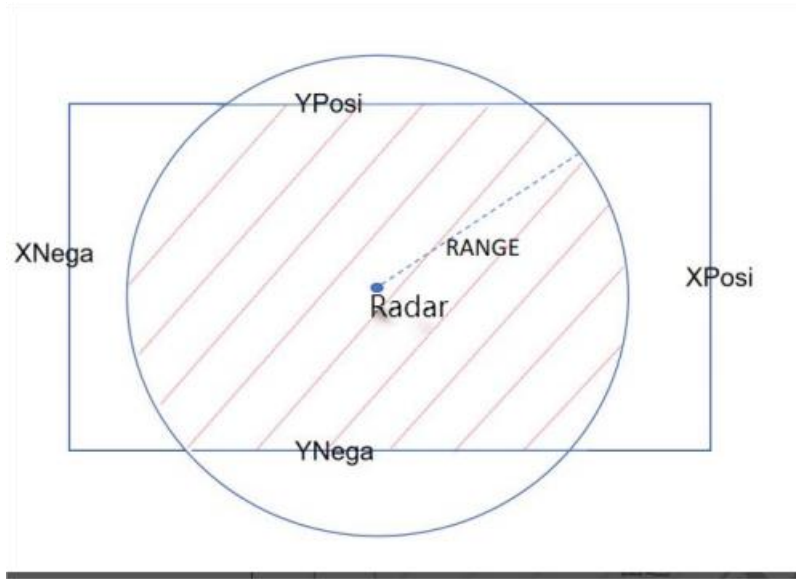


Figure 2 Radar detection area diagrammed.

8 Radar Module Serial Data Communication Protocol Description

8.1 Communication parameters

Baud Rate	115200
Data bits	8
Stop bits	1
Parity	NONE
Flow control	None

Notice: Existing firmware module can update the firmware by serial port burning

8.2 Message Output Protocol Format

Field		Number of bytes	Description
HEAD		8	Frame header, fixed\x01\x02\x03\x04\x05\x06\x07\x08
LENGTH		4	Whole frame data length (uint32)
FRAME		4	Frame number (uint32)
TLVs		4	TLVs=1 followed by point cloud information (uint32)
POINTLENTH		4	Point cloud data length (points = POINTLENTH/25) (uint32)
Point 1	x	4	Coordinates x/y/z and energy signal-to-noise ratio information (v is int8, all others are float)
	y	4	
	z	4	
	v	1	
	SNR	4	
	PO W	4	
	DPK	4	
.....			
Point n	x	4	Coordinates x/y/z and energy signal-to-noise ratio information (v is int8, all others are float)
	y	4	
	z	4	
	v	1	
	SNR	4	
	PO W	4	
	DPK	4	
TLVs		4	TLVs=2 followed by person information (uint32)
TRACKLENTH		4	Length of person data (number of persons = TRACKLENTH/32) (uint32)

Personnel 1	ID	4	Personnel markers (uint32)
	Q	4	(uint32)
	X	4	X/Y/Z coordinates of the person and the speed (float)
	Z	4	
	Y	4	
	Vx	4	
	Vz	4	
	Vy	4	
.....			
Personnel n	ID	4	Personnel markers (uint32)
	Q	4	(uint32)
	X	4	X/Y/Z coordinates of the person and the velocity (float), in units: coordinates in m and velocity in m/s, to two decimal places. Single precision floating point type according to the standard for binary floating point arithmetic (IEEE 754), with the small end unwrapped before. https://www.binaryconvert.com/convert_float.html https://www.cnblogs.com/guanshan/articles/guan022.html
	Z	4	
	Y	4	
	Vx	4	
	Vz	4	
	Vy	4	

Provide example

```

01 02 03 04 05 06 07 08 BE 01 00 00 6E 6F 09 00 01 00 00 00 00 00 5E 01 00 00 01 CC 34
BF 01 A0 CE 3D 08 5A B9 3F 00 BE B3 07 40 00 06 8B 3F EA 86 87 41 01 B6 41 BF 01 08
3B 3E 6E 1B BD 3F FF B4 93 79 41 00 E4 8F 3F 63 32 50 41 01 B6 41 BF 01 50 20 3E 7C
7D BD 3F 00 36 A9 01 40 00 C2 11 40 03 A3 78 41 01 08 3B BF 01 98 05 3E 2D 7B BF 3F
01 68 19 99 41 00 E5 92 3F 33 6E 77 41 01 2B 48 BF 01 A8 25 3E 77 CE C3 3F FF DD 6C
72 41 00 7F 8F 3F 54 F6 4C 41 01 2B 48 BF 01 0C 0A 3E 0A 24 C4 3F 00 59 D0 02 40 00
D4 0D 40 DF C7 5F 41 01 2B 48 BF 01 E0 5C 3E FB F3 C2 3F 01 0D 4B C8 41 00 C7 8A
3F E4 19 68 41 01 C0 55 BF 01 80 0E 3E 37 9C C8 3F 00 15 00 0A 40 00 1D 9A 3F 7B 9B
22 41 01 5B 36 BF 01 F0 0A 3E 23 F5 02 40 00 97 6C 09 40 00 DF B7 3F 56 B1 06 41 01
F0 43 BF 01 20 32 3E 33 5A 05 40 00 D0 1C 0F 40 00 1D D0 3F 7B B2 DF 40 01 E9 35 BF
01 C3 22 3F 0C 82 0C 40 00 C0 A6 09 40 00 42 BE 3F 5B 9B C6 40 01 58 30 BF 01 8C 26
3F A1 8B 10 40 FF 22 FD 2E 43 00 9C D5 3F 15 5C 01 41 01 8C 26 BF 01 8C 26 3F 16 45
11 40 00 B6 B3 05 40 00 20 5F 40 7D 2C 00 41 01 8C 26 BF 01 8C 26 3F 16 45 11 40 01
45 00 78 41 00 AF E7 3F 5E B5 08 41 02 00 00 00 00 40 00 00 00 00 01 00 00 00 08 00 00
00 26 C2 2C BF 98 C1 B1 3E 6D 86 E7 3F 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
03 09 00 00 00 3E 4F 81 BF B1 3D 38 BF 45 06 2B 40 00 00 00 00 00 00 00 00 00 00 00
    
```

01 02 03 04 05 06 07 08 : Frame header
BE 01 00 00 : frame length 446 bytes
6E 6F 09 00 : frame number 618350
01 00 00 00 : TLVs=1 followed by point cloud information
 5E 01 00 00 : Length of point cloud 350, number of points = 350/25 = 14
 01 CC 34 BF 01 A0 CE 3D 08 5A B9 3F 00 BE B3 07 40 00 06 8B 3F EA 86 87 41:
 Point information, X=-0.7,Y=0.1,Z=1.44,V=0,SNR=2.12,POW=1.08,DPK=16.94
02 00 00 00 : TLVs=2 followed by person information
 40 00 00 00 : Length of person 64, number of points = 64/32 = 2

9 Use of the upper computer

- 1) Use USB to TTL to power the radar with 3.3V voltage, then open "Radar_DemoSideMount.exe" (Check that it has been adjusted to HEX data mode (AT+DEBUG=3));
- 2) Select the serial port number as shown in Figure 3, the default baud rate is 115200, click "Open Serial Port";
- 3) Select "Top or Side Fit";
- 4) Click on "Start" and the radar starts to operate;
- 5) Selecting "R&D Mode" displays the point cloud, while selecting "Demo Mode" does not display the point cloud data;
- 6) As in Figure 3, the left side is 2D coordinates display, the right side is 3D display;
- 7) Click on the " Stop " button and the radar stops working.

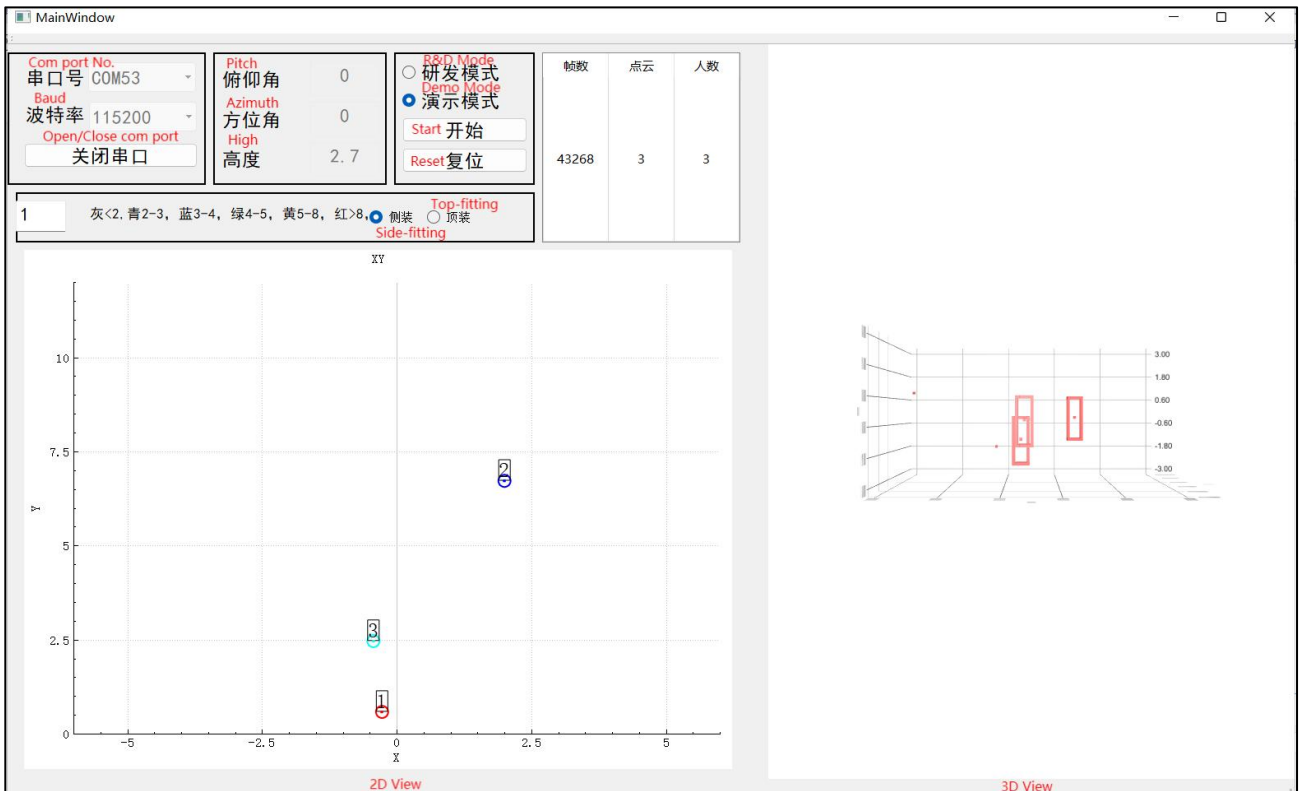


Figure3 Upper computer diagram

10 Housing Layout and Welding Requirements

- The module recommends a clearance of 2.5mm from the antenna surface to the inner surface of the housing, and a housing (PC/ABS material) thickness of 1.44mm or an integral multiple of 1.44mm.
- The PCBA in SMT, do not contaminate the chip, the chip must be pasted flat, not warped.
- Housing detection surface: non-metallic, need to be flat to avoid bending surface, affecting the performance of the entire swept area.

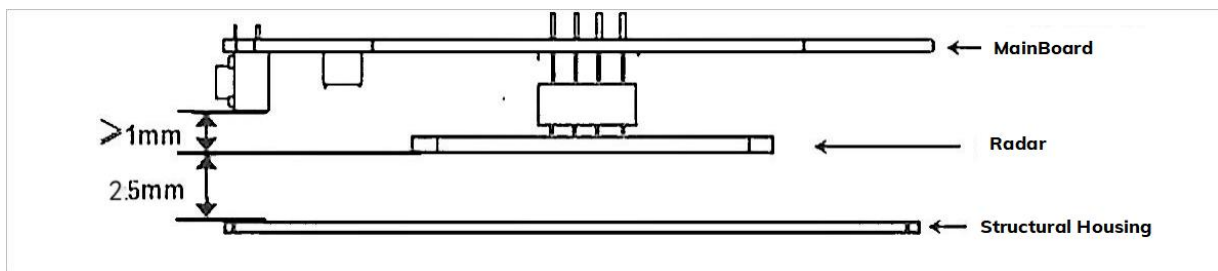


Figure2 Layout diagram of antenna and housing

● Quality

Cognizant of our commitment to quality, we operate our own factory equipped with state-of-the-art production facilities and a meticulous quality management system. We hold certifications for ISO9001, ISO14001, ISO27001, OHSAS18001, BSCI.

Every product undergoes stringent testing, including transmit power, sensitivity, power consumption, stability, and aging tests. Our fully automated module production line is now in full operation, boasting a production capacity in the millions, capable of meeting high-volume production demands.

● Contact Us

Shenzhen Minewsemi Co., Ltd. is committed to swiftly delivering top-quality connectivity modules to our customers. For assistance and support, please feel free to contact our relevant personnel, or contact us as follows:

Web: www.minewsemi.com

Email: minewsemi@minew.com

Linkedin: www.linkedin.com/company/minewsemi

Shop: <https://minewsemi.en.alibaba.com/>

Tel: +86 0755-28010353

Address: 3rd Floor, I Building, Gangzhilong Science Park, NO.6, Qinglong Road, Longhua District, Shenzhen, China

**Click the icon to view and download
the latest product documents electronically.**



● Copyright Statement

This manual and all the contents contained in it are owned by Shenzhen Minewsemi Co., Ltd. and are protected by Chinese laws and applicable international conventions related to copyright laws.

The certified trademarks included in this product and related documents have been licensed for use by MinewSemi. This includes but is not limited to certifications such as BQB, RoHS, REACH, CE, FCC, BQB, IC, SRRC, TELEC, WPC, RCM, WEEE, etc. The respective textual trademarks and logos belong to their respective owners. For example, the Bluetooth® textual trademark and logo are owned by Bluetooth SIG, Inc. Other trademarks and trade names are those of their respective owners. Due to the small size of the module product, the "@" symbol is omitted from the Bluetooth Primary Trademarks information in compliance with regulations.

The company has the right to change the content of this manual according to the technological development, and the revised version will not be notified otherwise. Without the written permission and authorization of the company, any individual, company, or organization shall not modify the contents of this manual or use part or all of the contents of this manual in other ways. Violators will be held accountable in accordance with the law.

MINEWSEMI

Tel: 0086-755-2801 0353

Email: minewsemi@minew.com

Web: www.minewsemi.com

Address: 3rd Floor, Building I, Gangzhilong Science Park, Qinglong Road Longhua District, Shenzhen 518109, China

