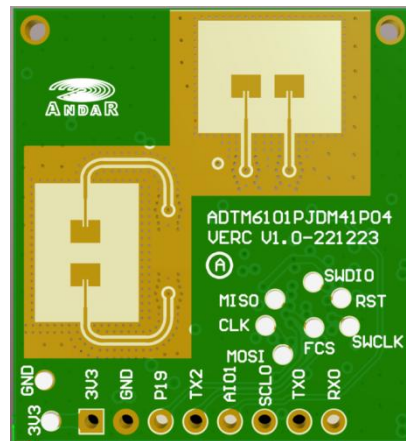


# LD6002B

## 3D presence of radar module specification



In April, 2024

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## 1. Product profile

LD6002B is a radar sensor module developed based on ADT6101P chip, single chip integrated 57~64GHz radio frequency transceiver system, 2T2R PCB microband antenna, 1MB flash, radar signal processing unit, ARM® Cortex® -M3 kernel. By based on FMCW signal processing mechanism and radar signal processing algorithm, this module realizes highly sensitive human state sensing, which can identify motion, static human body, and calculate the target distance, speed and other auxiliary information.

This module is based on two receiver and two receiver antenna form, with a wide beam Angle, and is suitable for top suction installation. Support GPIO, UART signal output, can be flexibly applied to different intelligent scenarios and products.

## 2. Product characteristics

- Radar detection based on FMCW signal
- The detection angle was large with support level  $\pm 60^\circ$  and pitch  $\pm 60^\circ$  detection
- Support top side mounted mode switching, maximum induction distance 6m
- Maximum support 3 people target motion tracking, personnel position x, y, z coordinate output
- It can realize the movement and static detection of indoor personnel, accurate identification within the interval, support the induction interval division, and shield the interference inside and outside the interval
- Universal UART interface, to provide the communication protocol
- Support UART parameter adjustment to meet the requirements of different scenarios
- Small size, only 25 \* 23mm, support row connection
- Not affected by temperature, humidity, noise, airflow, dust, light and other environment

## 3. application scenarios

- ✧ Intelligent home appliance application

According to the detection of whether there is personnel in the room, adjust the working mode of home appliances (work, standby, shutdown) in real time to realize intelligent home appliances

- ✧ Human body induction lamp application

Whether there is a human body in the current space, automatically control the lighting switch, such as public scene lighting, office lighting, all kinds of induction lights

- ✧ Smart home scenario application

For home, hotel, office, toilet and other places, it is necessary to conduct real-time detection of whether there is personnel entering or personnel in the place, and then realize security, electrical control, personnel monitoring and other ways, can be combined with the relevant Internet of things support platform, to achieve the effective application of the relevant places

## 4. Electrical characteristics and parameters

### 4.1 Functional parameters

Parameter content	Min	Type	Max	unit	Remark
Detecting long edges		3		m	Top mounting 2.7m
Detecting short edges		3		m	Top mounting 2.7m
Number of detected objects			3		
Detection distance accuracy		0.4		m	
Side-mounted sensing distance	0		6	m	
Identification accuracy		95		%	

### 4.2 Electrical characteristics

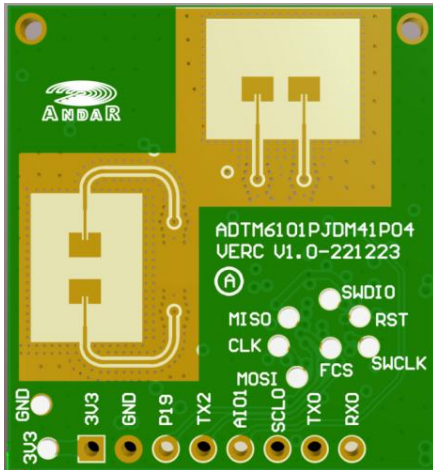
operational parameter	Min	Type	Max	unit
Operating voltage (VCC)	3.1	3.3	3.5	V
Operating current (ICC)		135	600	mA
Operating temperature (TOP)	-20		85	°C
Storage temperature (TST)	-40		85	°C

### 4.3 RF characteristics

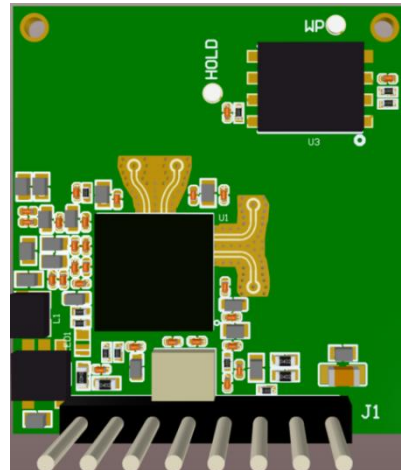
operational parameter	Min	Type	Max	unit
service frequency	58		64	GHz
Emission Power (Pout)		12		dBm
antenna gain		4		dBi
Horizontal beam (-3dB)	-60		60	°
Vertical beam (-3dB)	-60		60	°

## 5. Hardware description

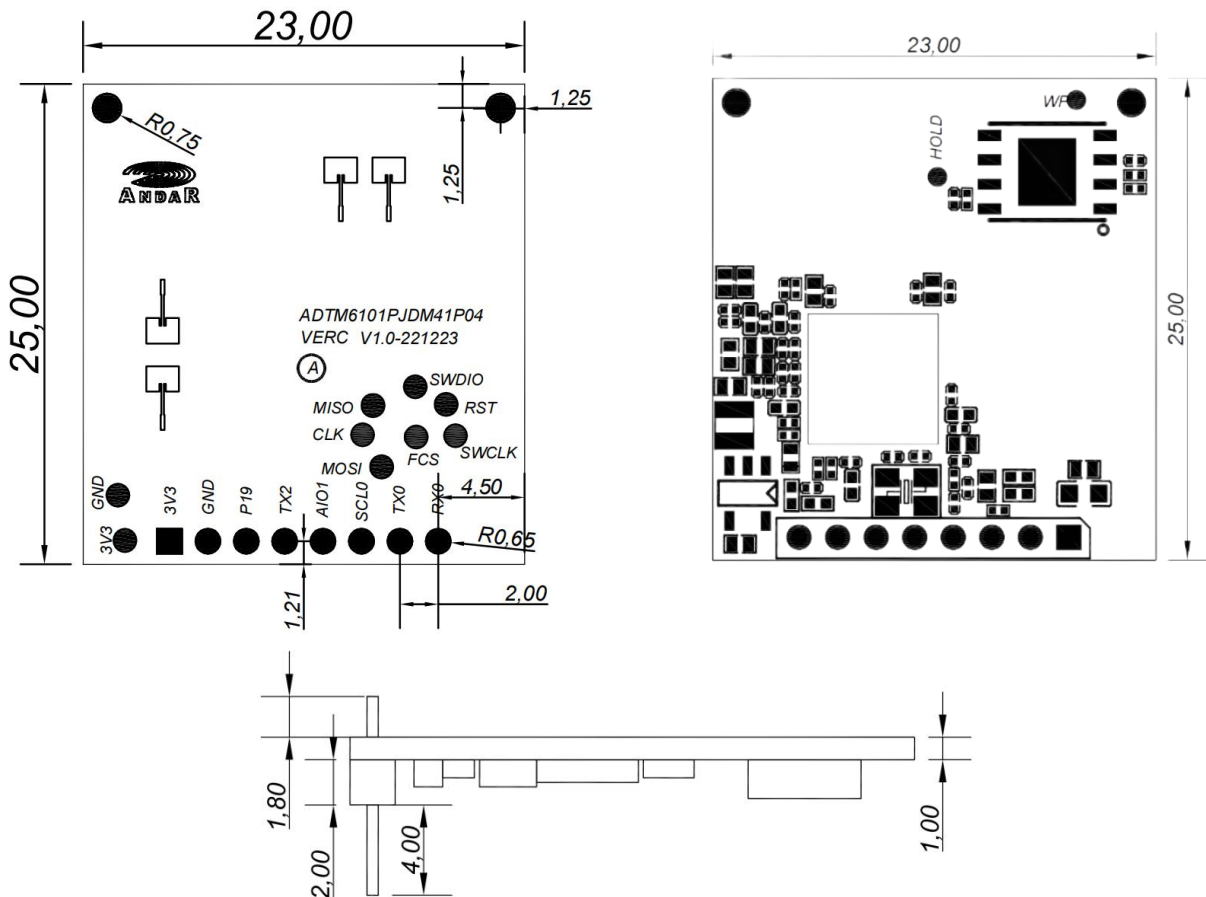
## 5.1 Overall dimensions



TOP View



Bottom View

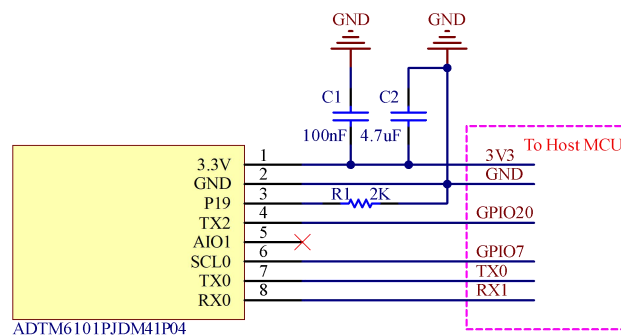


## 5.2 Pin definition

Pin order number	Pin name	description	remarks
1	3V3	POWER INPUT 3.3V	
2	GND	GND	
3	P19	GPIO19	Boot1

4	TX2	GPIO20	
5	AIO1	Analog IO	
6	SCL0	GPIO07	
7	TX0	Connected to external serial port TX	
8	RX0	Connected to external serial port RX	

### 5.3 module peripheral reference design



### 5.4 Boot configuration

	BOOT1	BOOT0	remarks
Configuration level	0	1	Flash starts within the module
Pipe foot position number	Pin3		

\* BOOT 1, BOOT 0 module internal are pulled up. The BOOT 1 must be connected to a low level before the module starts

## 6. Guidance for use

### 6.1 Typical application circuit

LD6002B The module can directly use the TX 2 pin output detected target information (human high level, unmanned low level). Meanwhile, the UART 0 outputs the detection results according to the specified protocol. The serial port data contains the target position and speed auxiliary information, which users can use flexibly according to the specific application scenarios.

The module power supply is 3.3V, and the input power supply capacity is greater than 1A.

The output voltage of the module IO port is 3.3V. The default port rate of the serial port is 115200 with no parity.

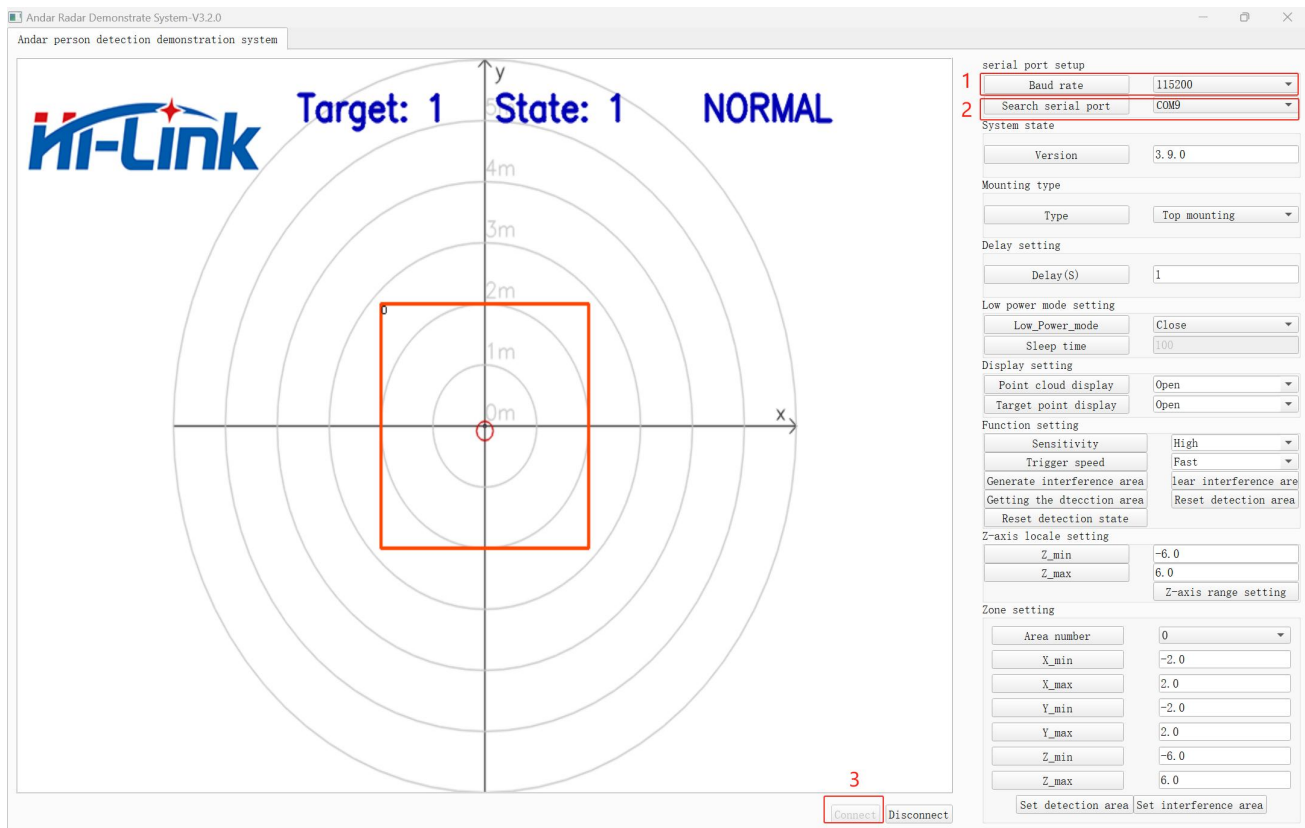
### 6.2 GUI visualization tool application

1. device connection

1) Set the Baud rate to 115200

2) Select the connected serial port

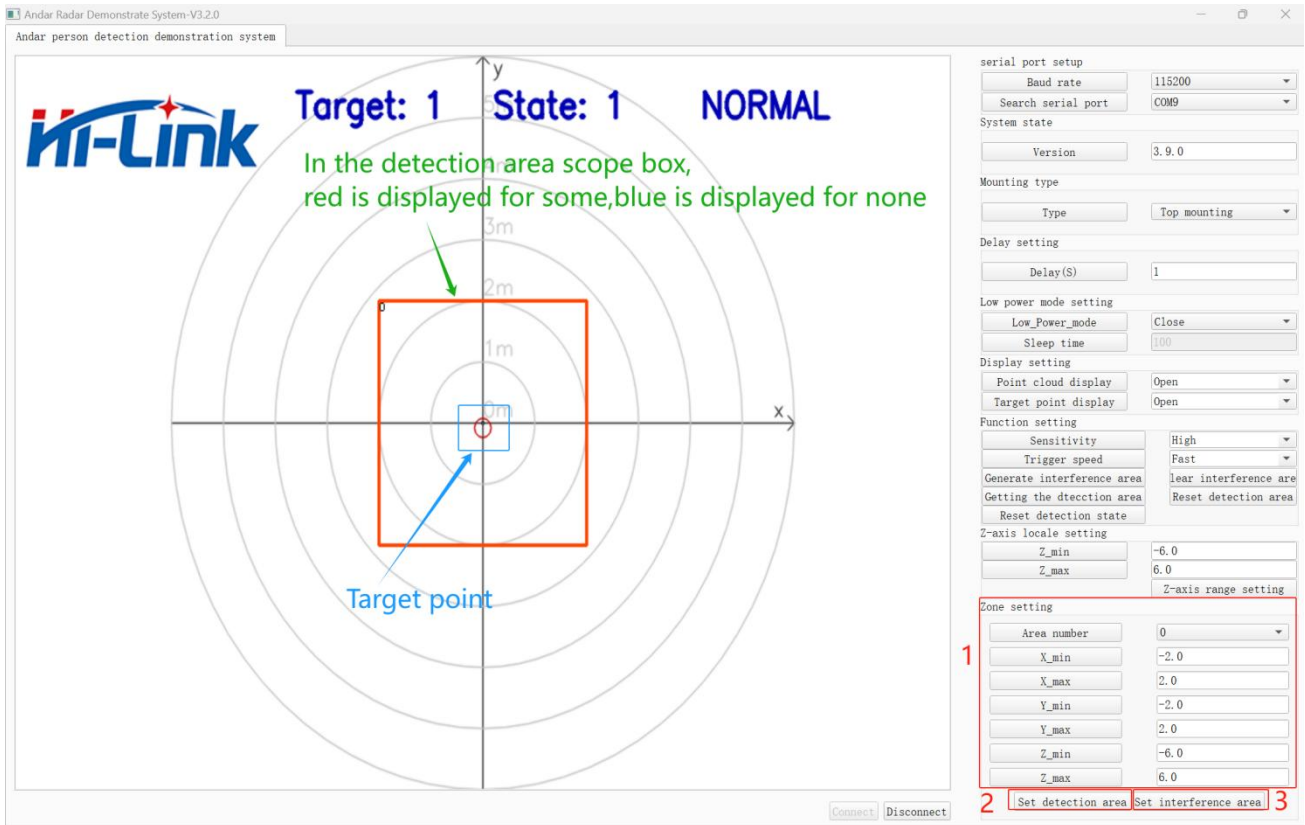
3) Click the [Connect] button, and the module will start the detection



2. Set the detection area

1) Set the coordinates of the detection area (with the point at which the module is vertically projected to the floor as the origin), and select different area numbers to set different detection areas. Up to 4 detection areas can be set up.

2) Enter the coordinates of the probe area, Click the [Set detection area] button. After setting the detection area, the module outside the detection area can still be detected, but the TX2 will output a high level only when triggered within the detection range. Data is not lost when power is lost.



### 3. Set the interference area

1) Set the coordinates of the interference area (according to the actual use scenario, to screen some areas that may cause interference to radar sensors such as air conditioning, fan, curtains, etc.) the target in this area does not trigger the sensor, that is, Module TX2 Pin does not output high level. Up to 4 interference areas can be set up

2) Click [Set interference area] button to save the power.

### 4. Other features

1) [Vision]: Connect the GUI to automatically identify the software version number

2) [Mounting type]: Switch between top mounting and side mounting

3) [Delay setting]: Existing status maintenance time when human presence is detected

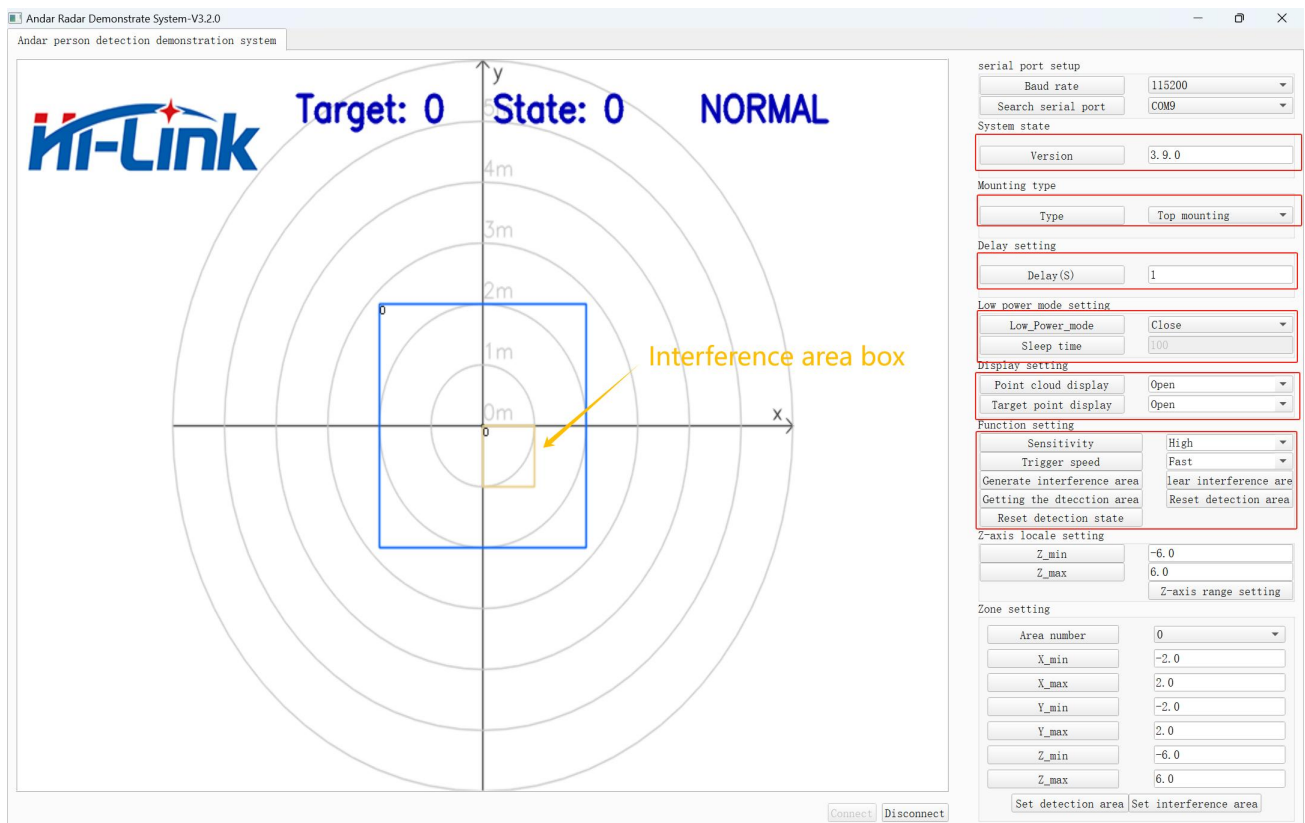
4) [Low\_Power\_mode]: Switch to 1T1R mode when no one is on, switch to 2T2R mode to detect stationary target when motion is triggered, and the average working current is 2.5mA when no one is on. When not turned on, it is always in 2T2R mode with an average working current of 135mA. Enable the low power mode to adjust the sleep time, sleep time is not recommended to exceed 500ms.

5) [Point cloud display]: Original point cloud data display is on or off

6) [Target point display]: Target point data display is on or off

7) [Sensitivity]: There is a trigger sensitivity gear setting

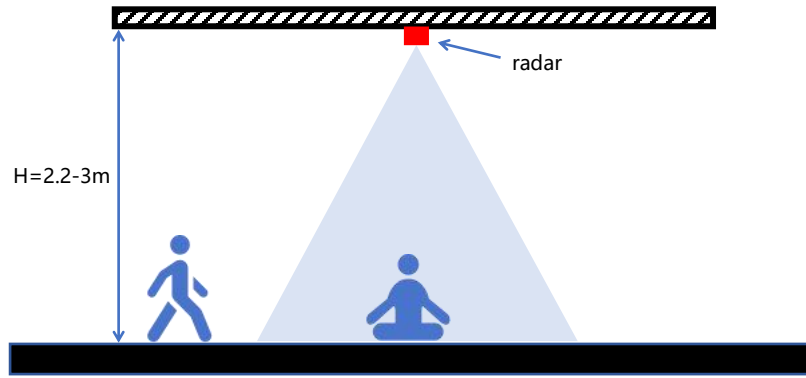
- 8) [Trigger speed]: No one to someone state switch speed setting
- 9) [Generate interference area]: After the installation, under the condition of unmanned detection environment, open the interference source in the room, click the interference target [Generate interference area], and shield the interference target point at a fixed point
- 10) [Clear interference area]: Clear the above manually set interference area or the automatically generated interference area
- 11) [Getting the detection area]: The set detection area and interference area are dropped and still saved. You can click this button to obtain the previously set area of the module
- 12) [Reset detection area]: Restore the default 4 \* 4m detection area
- 13) [Z-axis locale setting]: Set the overall Z axis detection range at the origin, that is, the minimum value of coordinate Z is 0, if the hanging height is 3m, the minimum value of z axis is set to 0, and the maximum value is set to 3.



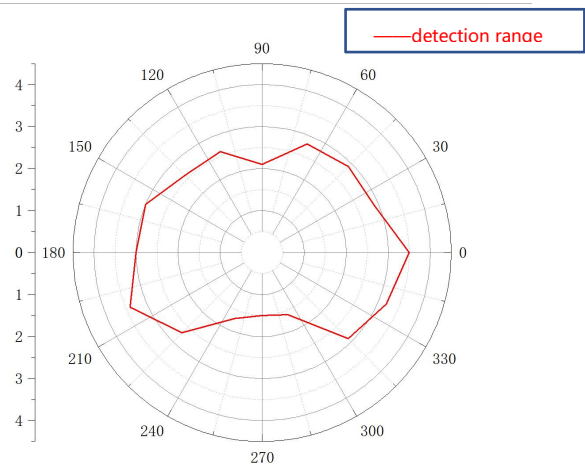
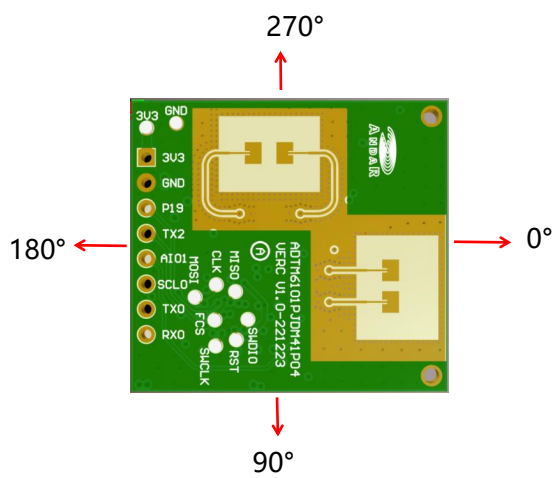
### 6.3 OTA upgrade

Refer to the 《Andar OTA Upgrade Tool Manual\_V1.0》 documentation

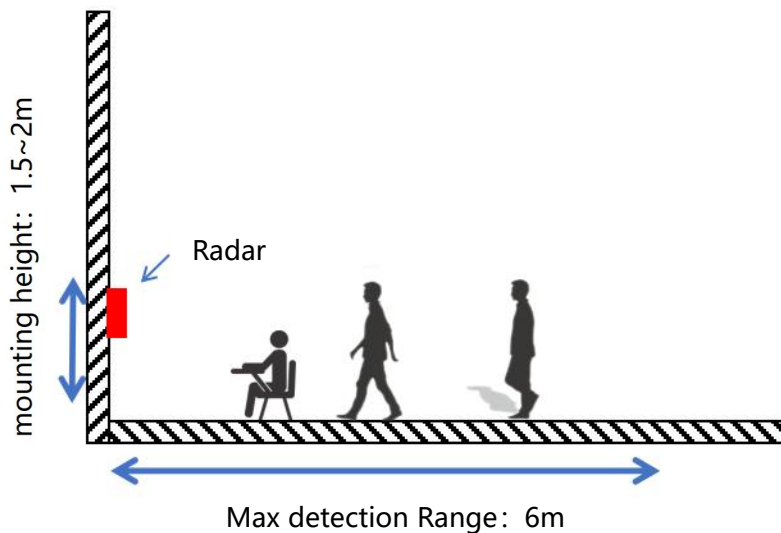
### 6.4 Installation mode and induction range



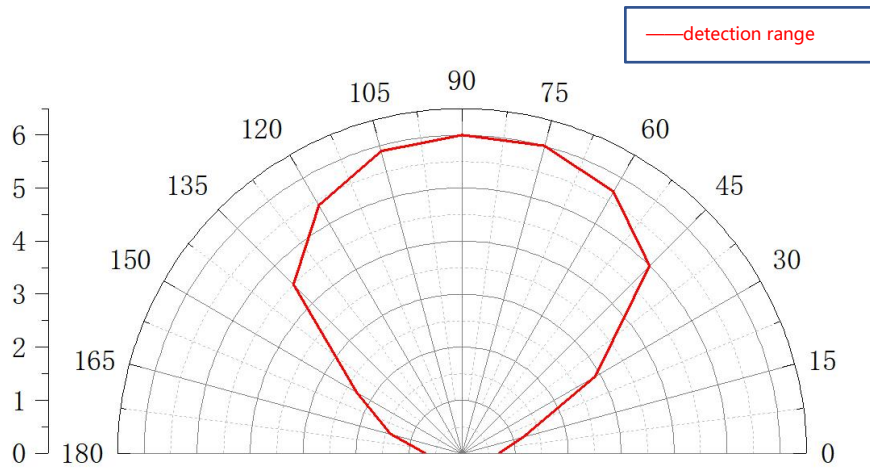
**Schematic diagram of top installation**



**Top-mounted detection zone**



**Schematic diagram of side installation**



**Side-mounted detection range**

## 7. Precautions

1. The detection distance of the radar module is greatly related with the target RCS and environmental factors, and the effective detection distance may change with the change of the environment and the target. Therefore, it is a normal phenomenon for the effective detection range to fluctuate in a certain range.

2. The radar module has high requirements for power supply, requiring input voltage 3.1~3.5V, power ripple 50 mV and current 1A. If DCDC power is used, the switching frequency shall not be no less than 2 MHz.

## 8. Radome design

The radome is used to protect the radar antenna from rain, external environment, and wind. However, it has the following effects on the radar antenna: the dielectric loss and reflection loss caused by the antenna cover will reduce the effective power of the antenna; cause the distortion of the antenna beam, which affects the measurement of the Angle. Therefore, it is very necessary to design the radome to reduce the impact of the shell and improve the radar performance.

### design requirement:

1. When selecting the material of radome, under the premise of ensuring firmness and low cost, the material with smaller dielectric constant and loss angle should be selected to reduce the influence of radome on radar performance.

Dielectric constant and dissipation factor of common materials are shown below:

material	dielectric constant ( $\epsilon_r$ )	Disgution factor ( $\tan \delta$ )
Merlon	2.9	0.012
ABS	2.0-3.5	0.0050-0.019
PEEK	3.2	0.0048

PTFE (Teflon ®)	2	<0.0002
Plexiglass ®	2.6	0.009
glass	5.75	0.003
pottery and porcelain	9.8	0.0005
PE	2.3	0.0003
PBT	2.9-4.0	0.002

2. The radome is required to have a smooth surface and a uniform thickness

3. Radome antenna thickness design requirements

$$T = N \cdot \frac{c}{2f\sqrt{\epsilon_r}}, \quad N=1, 2, 3\dots$$

T: Radome thickness

$3 \times 10^8$  And c: light speed, m/s;

f: center frequency

$\epsilon_r$ : Material permittivity, DK

4. Design requirements of radar antenna from the inner surface of the enclosure

$$d = N \cdot \frac{c}{2f} \quad N=1, 2, 3\dots$$

$3 \times 10^8$  And c: light speed, m/s;

f: center frequency

f=60GHz

c/2f=2.5mm

## Revision History

<b>Revision</b>	<b>Release Date</b>	<b>Description</b>
V1.0	2023/09/26	Initial version
V1.1	2023/11/01	Modify the GUI usage instructions
V2.0	2024/04/20	1、 Added side mount for target tracking performance Optimizations 2、 Detection zone updates 3、 GUI and GUI instructions updates