

SR75 77GHz
millimeter wave radar
white paper



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Version history

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SR75 77GHz millimeter wave radar white paper

Summary: SR75 is one type high precision 4D point cloudy environment response millimeter wave avoid obstacles radar which specially customized for low speed vehicle application by Nanoradar technology. SR75 adopt special antenna design, add the detection and analyse of target height dimensional data, able to realize that high resolution information response at distance, speed, level and pitch 4D space. SR75 has super high resolution ratio, able to accurately analyse the profile, category and motion status of target, etc. SR75 small and exquisite (105.2×72×19.5mm), far measure distance (40m), integrated outer setting joggle (CAN-FD joggle), it has slow speed forward anti impact function, able to meet the seriously increased special vehicle forward or backward reverse safety assist driving requirements, also able to meeting that various avoid obstacles requirements of robots.

Keywords: SR75, environment response, 4D, high resolution

1 Short distance radar application requirements

1.1 L4 senior drive assist system development

According to the prediction of ZUOSI CHANYAN, China low speed automatic driving vehicle sales volume in 2020 will up to 11,000 sets include low speed passengers carriage unmanned vehicles, low speed cargo carriage unmanned vehicles and unmanned task vehicles, up to 104,000 sets in 2023. The three years from 2020 to 2022 are the one year that low speed automatic driving vehicle sales volume rise abruptly, multiply types low speed automatic driving vehicle enter into grounding business operation stage, example airport unmanned aerial vehicle transmit vehicle, unmanned sweeping vehicle, agriculture unmanned driving, unmanned patrol car, etc.

Automatic driving able to be divided into several grades L0~L5 according to the system and control degree of human to vehicle. Among, L0~L3 grade automatic driving system mainly act assist performance to the drivers, when the automatic

driving system achieved L4 grade then the system already able to completely dispense the drivers and self responsible to operation tasks of vehicles.

L4 grade automatic driving system realize that completely take over the vehicle operation in the special area, the system need realize that: response the around obstacles, vehicle positioning and pathway planing, realize these functions need construct the technical structure at three layers like response layer, make decision layer and carry out layer, these three technical layer represent the eye, ear, brain, hand and feet of L4 automatic driving system.

Response layer mainly obtain the outer driving road environment data for automatic driving system and help the system process vehicle positioning, the representative sensors in the current unmanned driving system have laser radar, camera, millimeter wave radar, ultrasonic radar, GNSS/IMU and others, because different working principles and technical characteristics decide the different application scene, so currently most of the vehicles all are adopt that multiply types sensor merge together method to apply to various possibly happened situation, make ensure system redundancy.

Currently the automatic driving manufacturers sensor assorting mostly same, but decide the time speed of L4 grade automatic driving landing mostly based on the make decision steps of system, include the relate algorithm and calculate platform. We know the sensors all will generate large quantity data per second, the calculate platform need has the capacity to deal with large quantity date in super short time, analyse and issue operating orders to vehicle execute layer to make ensure the automatic driving vehicles safety driving.

Environment response radar able to provide more higher precision road boundary information based on common millimeter wave radar, provide more precision assist positioning information to the high speed driving and change lane. At the same time, more higher target detect precision to static target, especially under the congestion condition, able to validly avoid the pileup and other safety accidents. So, the environment response radar is necessary part of L4 grade

automatic driving system.

1.2 Environment response radar application requirements

The traditional driving assist system mainly formed with laser radar, visual system, GPS and other modules, this module unable to accurately test the around obstacles under serious meteorology condition, frequently caused serious traffic accidents and strict requirements at the visual system working environment. Because limits of technology, production technology, material cost and physical size, the environment response radar mainly applied in the high grade vehicles and forward radar area.

Environment response radar has the whole weather and whole time working features, it has accurate position surface angle distinguish capacity and able to real time response imaging the around environment, output the four dimensional information of distance, speed, position angle and pitch angle of target, able to validly analyse the profile, category and action of target. This means the environment response radar system able to suit more complex road status, include discriminate more smaller objects, the shielded partial objects, static objects and test the transversely moving obstacles, etc.

In the traditional passenger vehicles area, automatic parking is the area which suitable to use L4 grade automatic driving. The passenger vehicles automatic parking technology gradually come to be ripe, main machine factories continue increase the invest of automatic parking system, realize quick increasing from 2020, predict that assemble ratio in 2023 will exceed 20%, already been one firstly landing function in automatic driving area. The tradition based on the problems of ultrasonic radar sensor come to be prominent, error report, leak report and other problems emergency to be solved, L4 grade automatic parking high definition radar come to be the production direction of each one radar factories.

At the same time, Le grade automatic driving also most suitable to develop L4 grade automatic driving application with condition in the business area like sweeping, distributing, logistics and industry transporting. At the same time,

compare to the road, the traffic parties more single and more fixed routine in these environment in more closed application scene like large scale mine and transporting tasks in building site, some scenes have super high task risk at same time. Use L4 grade automatic driving truck replace the drivers not only save the cost, but also avoid the operators risk.

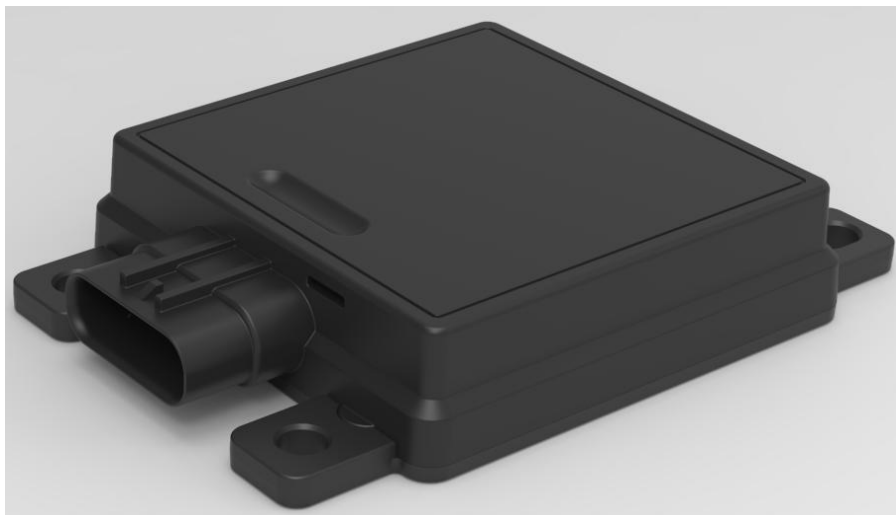
2. SR75 77GHz millimeter wave radar summary

2.1 Product features

SR75 is one type short distance V wave band millimeter radar, detect distance 40m, adopt FMCW modulate mode, able to detect the distance (length, width and height), speed and angle of motion

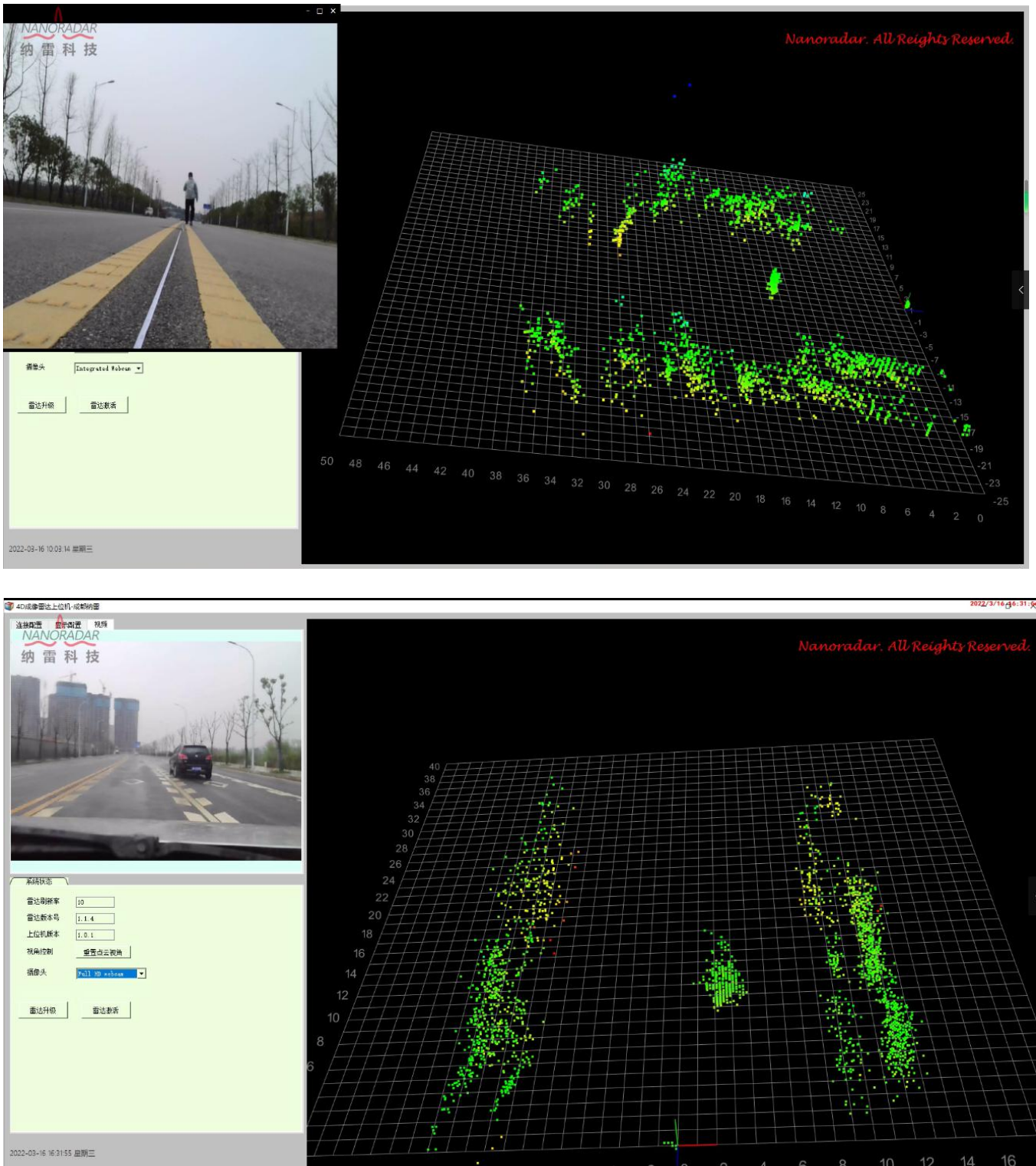
targets, it has more higher distance measure and speed measure precision.

- Speed
- Distance (Length, width, height)
- Direction
- Angle



Picture 1 SR75 77GHz millimeter wave radar appearance diagram

SR75 has the low speed front and back anti impact function, the product function diagram shown as the below:



Picture 2 SR75 77GHz millimeter wave radar function diagram

CAN communication network joggle of SR75 sensor follow the ISO11898-2 standards, communication speed ratio 5Mb/s. The common external communication joggle convenient to integrate with host computer or other ADAS module.

2.2 Product parameters

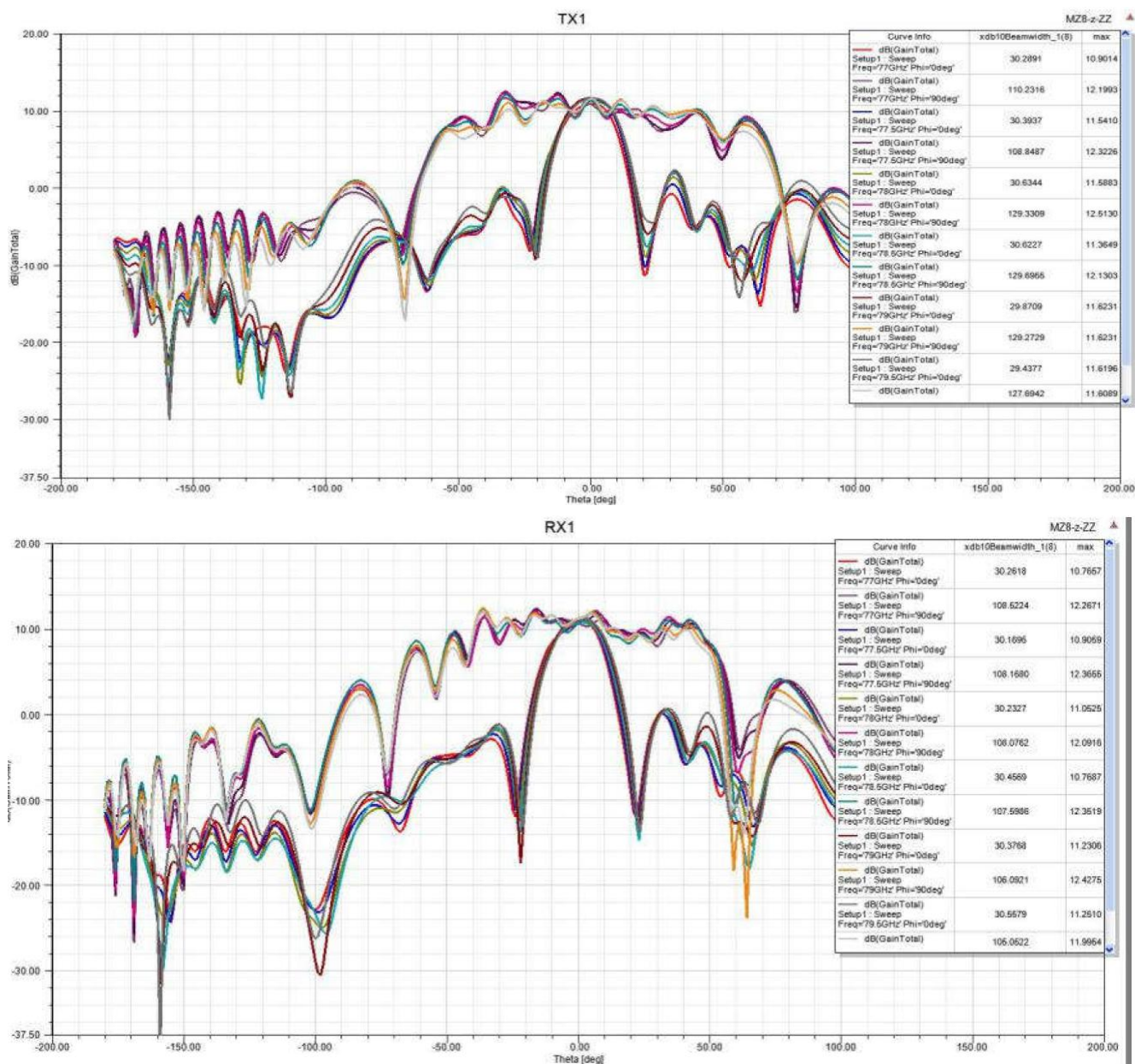
SR75 77GHz millimeter radar specification and parameters shown as the below table:

Table 1 SR75 77GHz millimeter wave radar

Measure performance		Common target (Non reflect target)
Modulate method		FMCW
Distance measure range		0.10~40m
Distance measure resolution	Point target, non tracing	0.1m
Distance measure precision	Point target, non tracing	±0.05m
Angle measure range		150°
Angle precision	Point target, non tracing	±0.4°
Speed range		±18m/s
Speed ratio	Point target, non tracing	0.25m/s
Speed precision	Point target, non tracing	±0.12 m/s
Antenna passageway quantity		3TX/4RX=12 passageways
Circling period		100ms
Pitch wave harness	-6dB	30°
Position wave harness	-6dB	120°
Point cloudy quantity per second		15000
Operating conditions		
Radar launching frequency	Follow ETSI&FCC	76...77GHz
Launching power	Average/peak value EIRP	21dBm
Power supply		+9.0V~24VDC
Power consumption		2.5W
Operating temperature		-40°C...+85°C
Storage temperature		-40°C...+105°C
Protection grade		IP67
Joggle types		
Joggle		1xCANFD-high speed 5Mb/s
Shell		
Size	W*L*H	105.2×72×19.5mm
Weight		112g
Materials	Shell front end/rear cover	PBT+GF30

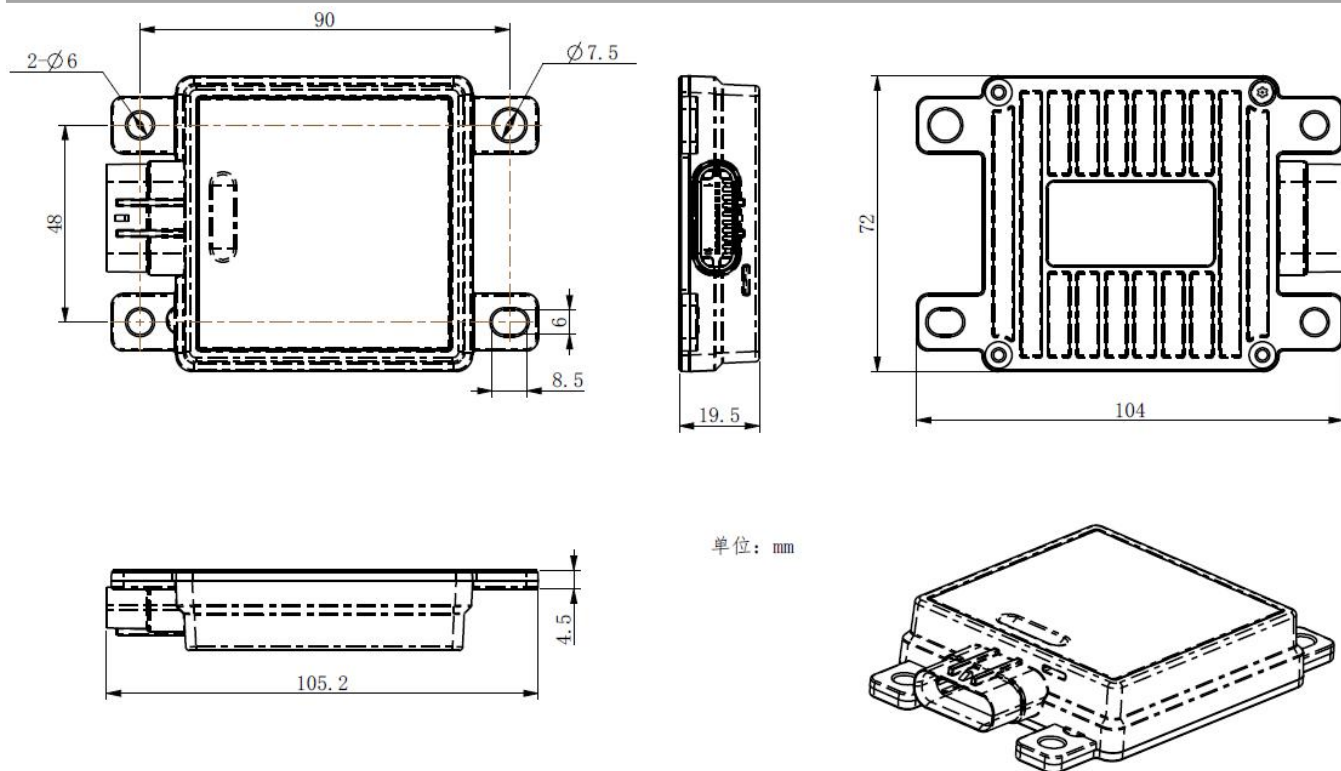
SR75 adopt three launching four retrieve antenna, it has accurate position surface angle distinguish capacity. Able to process 4D response imaging within 40m environment through special antenna and algorithm optimize design, real time output the four-dimensional information of distance, speed, position angle and pitch angle. The system direction diagram of SR75 77GHz millimeter wave radar shown

as the below:



Picture 3 SR75 77GHz millimeter wave radar antenna direction diagram

SR75 77GHz millimeter wave radar product profile shown as the below pictures:



Picture 4 SR75 77GHz millimeter wave radar product profile diagram

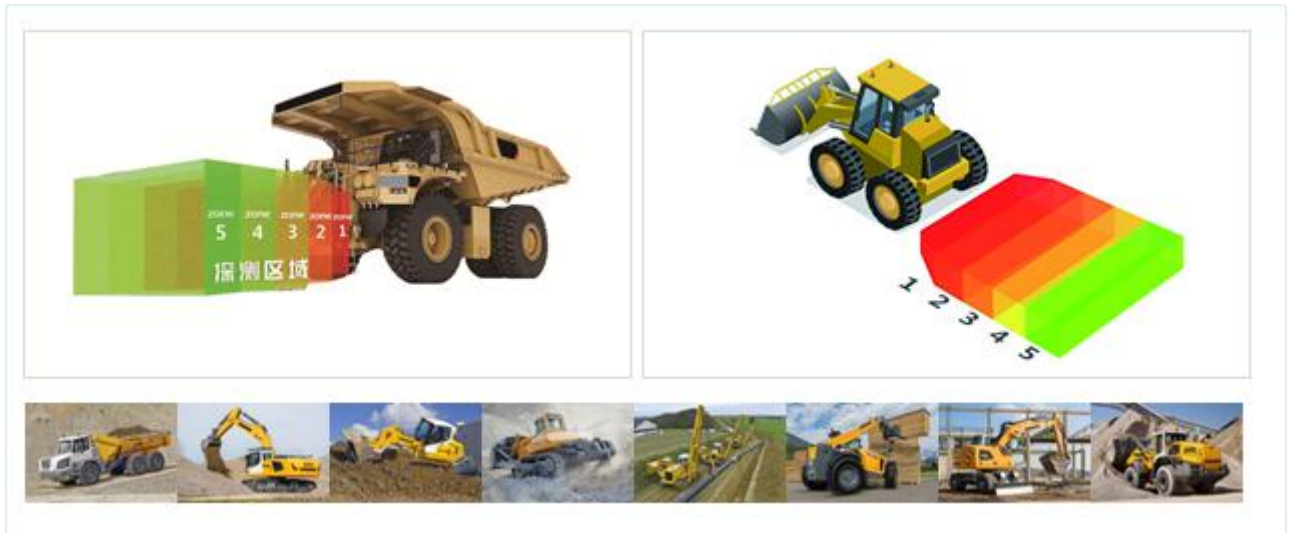
2.3 Product application areas

- Forward anti impact (FCW)
- Rear anti impact (RCW)
- Multiply sensors merge
- Teach exhibition

3 Typical application cases

3.1 Special vehicle anti impact system

Special vehicle anti impact system, agriculture used vehicle anti impact, robot anti impact and other systems utilize SR75 millimeter wave radar sensor response the front or back environment of this vehicle, output the distance, speed and angle information of target and send to main control box. The main control box make the radar around environment information merge this vehicle information, syn make decision system to process that risk pre-alarm or automatic brake function.



Picture 5 SR75 77GHz millimeter wave typical application diagram

The advantages of SR75 in the applications:

1. Compact sealing and solid technology;
2. High cost performance, far detect distance;
3. High detect precision;
4. Leading performance and durable performance.

4 Tag

SR75 is the short distance vehicle millimeter wave radar which self researched and developed by Nanoradar, this product adopt advanced MMIC and signal treatment technology, far measure distance, accurate speed measuring and stable performance, able to widely applied in the low speed front and rear anti impact and other areas. The product able to notably improve the vehicle safety performance, reduce driver's driving load and improve driving safety.

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