

TSC224 Multi-lane Speed Measuring Radar White paper

Version history

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TSC224 Multi-Lane Speed Radar White Paper

Overview: Multi-lane speed measurement radar adopts international advanced microwave radar technology, and is optimized for application in radar system, signal processing, target recognition algorithm, etc. Radar has the ability of multi-target recognition and tracking, which can monitor 1 to 4 lanes at the same time, and can obtain the speed, distance and lane information of vehicles in each lane in the irradiation area, so it is suitable for a highly integrated speed checkpoint system.

The application of multi-lane speed radar is very extensive, which is suitable for traffic speed checkpoints, security monitoring checkpoints and other scenes of expressways, inter-city highways, urban trunk highways, urban and rural highways and other roads.

Keywords: TSC224, speed radar, bayonet system, flow monitoring

1 Application requirements of speed measuring radar

1.1 Development of Traffic Speed Measurement System

In recent years, with the rapid development of road traffic in China, especially the soaring number of urban motor vehicles, many traffic problems and security risks have been brought. For this reason, the traffic management department of public security has increased its investment in off-site punishment facilities. At present, in the traffic speed measurement system, there are mainly the following means:

(1) The loop coil sensor is used as a means of overspeed detection, and the camera forensics system can ensure the accuracy of speed measurement, but this method needs to break the road, and the maintenance cost is high;

(2) Video image virtual coil is used as overspeed detection means, together with camera forensics system, which can not be "calibrated" due to inconsistent installation, and is rarely

used at present;

(3) The use of laser speed radar as a means of overspeed detection, coupled with camera forensics system, this method has high measurement accuracy, but the cost of equipment is very high, and it is still difficult to be widely used at present.

1.2 Application requirements of bayonet speed measuring radar

With the rapid development of national highway traffic construction and the popularization of motor vehicles, the number of roads is increasing and the road conditions are changing. Because of the fast speed, the driver has a short reaction time to the road conditions, the front vehicles, pedestrians and other situations. At the same time, because of the fast speed, the braking distance is long when an emergency occurs, which will cause "rear-end collision" and damage to the vehicle. It has brought great losses to society and families. In this case, how to use advanced scientific and technological means to improve the level of urban traffic management, curb traffic accidents, control the phenomenon of illegal speeding, make drivers drive strictly according to the requirements of road speed limits, reduce traffic accidents and illegal phenomena caused by speeding, has become an urgent problem to be solved by the current public security and traffic departments.

The intelligent monitoring and recording system of road vehicles (referred to as the checkpoint monitoring system) is an important part of the intelligent transportation system. The bayonet monitoring system uses advanced vehicle detection, communication, computer control, network, image processing, information processing and other technologies to automatically collect and process vehicle information such as vehicle passing time, location, speed, direction, number plate, color of number plate, vehicle image and so on. By recording and analyzing the composition, flow distribution and violation of regulations of running vehicles all the year round, it provides important basic and operational data for traffic planning, traffic management and road maintenance departments.

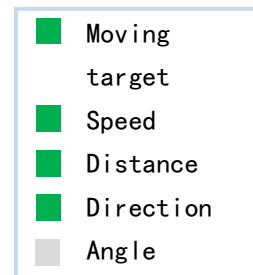
The main purpose of the radar bayonet monitoring and speed measurement system is to collect vehicle characteristic data such as vehicle picture capture, vehicle number plate recognition, control comparison and alarm, and police interception at the reporting station, and to automatically record the illegal situation of speeding all the year round, so as to provide important technical means and evidence for quickly correcting the illegal behavior of speeding.

It plays an important role in the process of urban public security and traffic management, and is of great significance to solve the shortage of police force and improve the level of traffic law enforcement.

2 Overview of TSC224 Multi-lane Speed Radar

2.1 Product features

TSC224 multi-lane speed radar is a very cost-effective short-range K-band millimeter-wave radar sensor. With a set of vehicle capture equipment, it can monitor multiple lanes (1 to 4 lanes) at the same time, and obtain the distance and speed information of vehicles in each lane. Detect 20 ~ 50 meters, capture rate is more than 99%, support top and side top installation, greatly increase the adaptability of radar to the scene.



The functional diagram of the product is as follows:

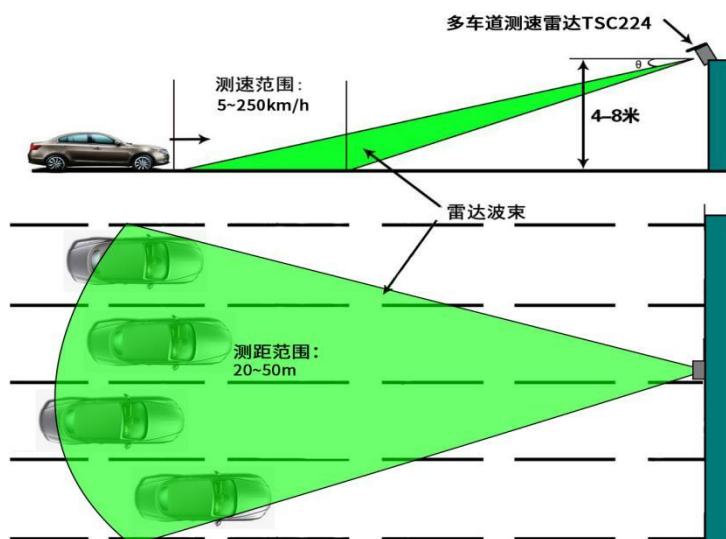


Figure1 Functional diagram of TSC224

2.2Product parameters

Classification	Description	Indicators	Remarks
Performance	Modulation mode	FMCW	
	Operating frequency	24~24.25GHz	
	Center frequency deviation error	$\leq \pm 45\text{MHz}$	
	Transmit Power (EIRP)	10dBm	Adjustable power
	Response time	50ms	
	Trigger consistency	$\leq \pm 0.5\text{m}$	
	Capture rate	>99%	
	Capture distance	1-70m	
	Speed measurement range	5~250km/h	
	Speed measurement accuracy	$(-2 \sim 0) \text{ km/h}$	
	Cover the lane	Four lanes	
	Beamwidth (Azimuth/Tx)	64°	
	Beamwidth (Elevation/Tx)	16°	
Power source	Power source	9~32V DC	
	Electric current		
Material	Antenna panel material	ABS+PC	
	Bottom shell material	ABS+PC	
External interface	Interface	RS485/Wi-Fi/network port	
	Indicator light	Three (red for power light, green for status)	

		light, blue for Wi-Fi working status light)	
Environmental adaptability	Degree of protection	IP67	
	Corrosion protection grade	IEC 60068-2-11	
	Operating temperature	-40℃~85℃	
	Operating humidity	5%RH~95%RH	
Certification	Certification	CE/ROHS/FCC	
	Certification	OINLR91	
Installation	Installation method	Top mounting, side top mounting	
	Mounting height	Standard 6m (4-10 m)	

TSC224 antenna is in the form of microstrip series-fed standing wave array, which can detect the moving speed and moving direction of the moving target. The direction diagram of the transmitting/receiving antenna system of the radar is as follows:

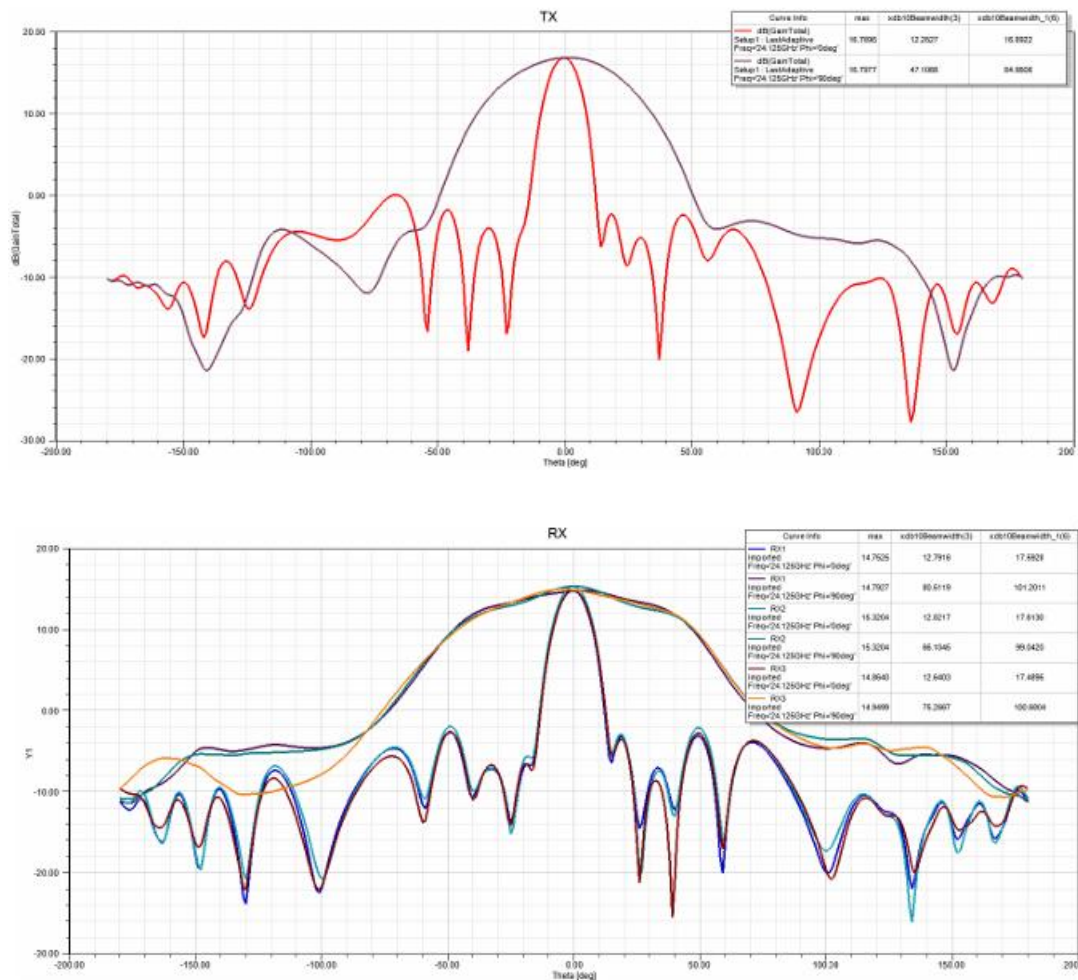


Figure 2 Direction Diagram of TSC224 Radar System

2.3 Product features

Multi-lane speed radar is a kind of equipment that can simultaneously measure and record the speed of vehicles running in multiple lanes through radar technology. The use of multi-lane speed radar has the following advantages:

- Support WIFI remote debugging and upgrading, and install the pole once without maintenance.
- Covering 1 ~ 6 lanes
- High capture rate: capture rate $\geq 99\%$
- Precise positioning: vehicle snapshot positioning accuracy $\pm 0.5\text{m}$
- Setting range of vehicle capture position: 15 ~ 50m
- Support three capture modes of coming, going and two-way
- Adapt to mainstream cameras in Dahua, Haikang and other markets

The outline of the product is shown in the figure below:

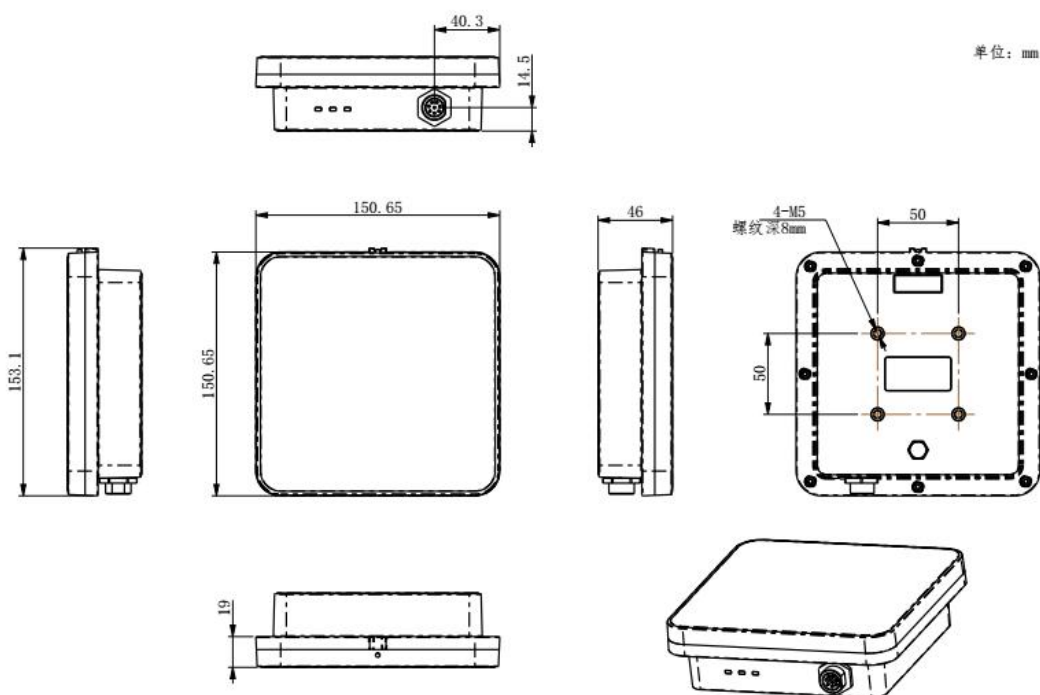


Figure3 Outline of TSC224

The product appearance is shown in the figure below:



Figure 4 Appearance of TSC224

2.4 Product application field

- Traffic Speed Measurement ● Flow monitoring
- Checkpoint
- Retrograde violation snapshot

3 Typical application cases

3.1 Traffic speed-measuring bayonet system

When the vehicle drives into the radar detection area, the camera receives the radar trigger signal and takes pictures of the passing vehicle. The trigger position is consistent ($\pm 0.5\text{m}$), and the trigger accuracy is 99%.

Radar bayonet front-end subsystem is mainly composed of the following functional units:

Vehicle speed measurement unit: radar;

An image acquisition, identification and processing unit which comprises a bayonet snapshot unit and a fill light;

Front-end data processing and uploading unit: including terminal server;

Network transmission unit: including intersection switch and optical fiber transceiver;

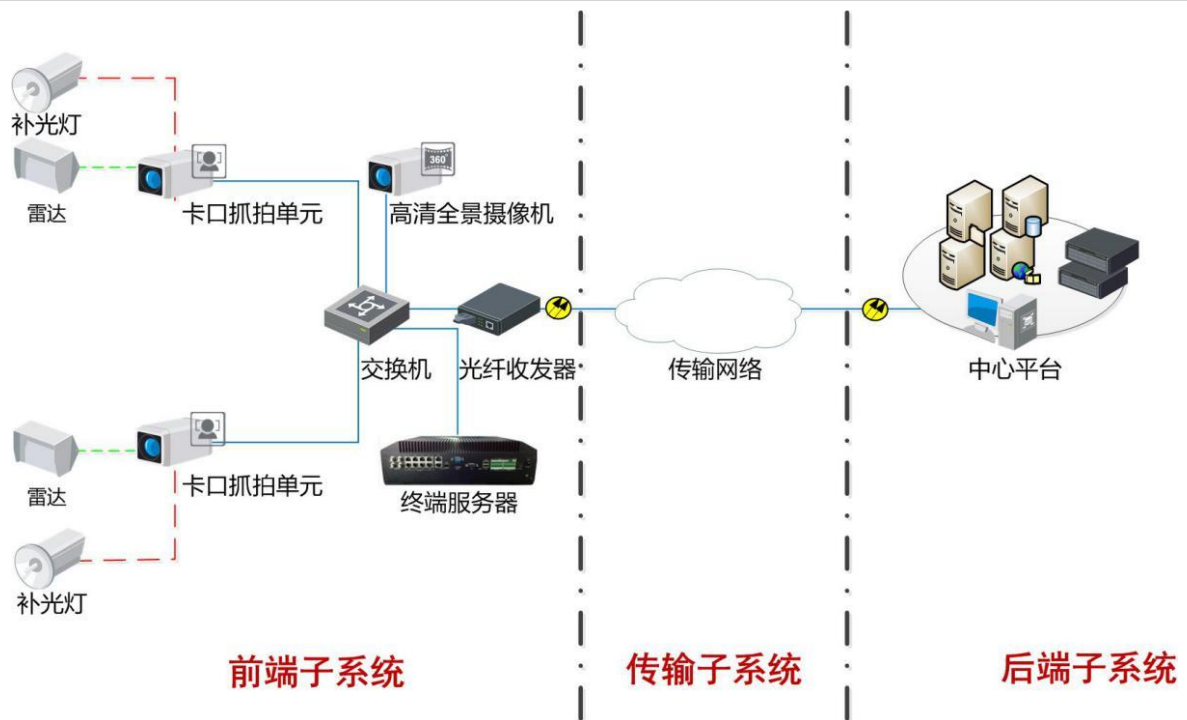


Fig. 5 Structure Diagram of Radar Checkpoint System

4 Scenario description:

4.1 Highway monitoring

On the highway, the multi-lane speed radar is widely used to monitor the speed of vehicles and traffic flow. These radar systems are usually mounted on elevated or vertical columns, covering multiple lanes of the entire highway. By monitoring the speed of vehicles in real time, traffic management departments can detect speeding behavior in time and take corresponding punishment measures. In addition, multi-lane speed radar can also be used to detect traffic congestion and help traffic management departments adjust road conditions and traffic flow.

4.2 Urban road monitoring

On urban roads, multi-lane speed radar is usually installed at busy traffic sections or intersections to monitor the speed and driving status of vehicles. These radar systems can help traffic management departments to monitor traffic conditions in real time, detect traffic violations in time, such as running red lights, changing lanes illegally, and take corresponding punishment measures. In addition, multi-lane speed radar can also be used to optimize signal

control and reduce traffic congestion and accidents.

4 Concluding remarks

TSC224 is a single-lane ranging and speed radar independently developed by Hunan Nanoradar Technology Co., Ltd. The product adopts advanced MMIC and signal processing technology, with high capture rate, accurate speed measurement and stable performance, which can be widely used in road traffic checkpoint system and other fields. The product can significantly improve the vehicle capture performance and greatly improve the capture rate. Reduce the driver's speeding violations.