

INDUSTRY OVERVIEW

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SENSING SYSTEMS ARE BECOMING A CRITICAL PART OF THE INTELLIGENT WORLD

With the continuous advancement of technology, sensing systems are shifting from passive data acquisition to active cognitive decision-making. Their applications are expanding across key strategic sectors including smart driving, transportation safety, robotics, and the low-altitude economy. As the core interface between intelligent devices and their operating environments, the ongoing enhancement of sensing capabilities is critical to enabling a future ecosystem of deeply integrated human-machine intelligence. Sensing systems encompass a broad spectrum of technologies designed to emulate human perceptual abilities across vision, hearing, spatial awareness, and motion tracking. Visual perception is primarily achieved through cameras, which capture high-resolution imagery to enable object detection, classification, and semantic understanding. Auditory perception utilizes microphones and acoustic sensors to detect environmental sounds and speech cues for auxiliary awareness. Spatial perception, focused on distance, velocity, and environmental structure, is usually enabled by LiDAR, millimeter-wave radar, and ultrasonic sensors, each offering distinct advantages in range, resolution, and robustness. Motion tracking is supported by inertial sensors such as IMUs and accelerometers, and in more advanced systems, may also involve visual or fused sensor inputs to enable continuous estimation of orientation and displacement. These modalities are increasingly deployed in multi-sensor fusion systems to complement each other’s limitations and enhance overall perception accuracy, robustness, and redundancy.

Within this context, millimeter-wave radar serves as an essential component of modern sensing systems. Its advantages, including reliable all-weather operation, strong anti-interference performance, penetration capability, and cost efficiency, make it especially valuable. As sensing systems evolve toward greater systemic integration and collaborative functionality, millimeter-wave radar continues to play an indispensable role in establishing secure, autonomous, and scalable perception capabilities, thereby laying the groundwork for the accelerated development of the broader sensing industry.

OVERVIEW OF THE MILLIMETER-WAVE RADAR INDUSTRY

Definition and Value Chain of Millimeter-Wave Radar

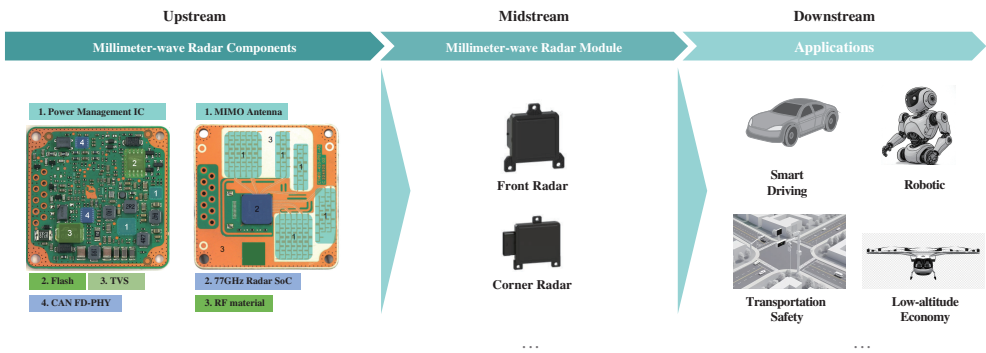
Millimeter-wave radar is a type of non-contact sensor that operates within a frequency range of 10 millimeters (30 GHz¹) to 1 millimeter (300 GHz). By emitting, receiving, and processing radio signals, millimeter-wave radar can detect targets and determine their spatial position, movement direction, velocity, relative distance, and shape characteristics.

The upstream of the millimeter-wave radar value chain mainly involves the production of key components such as radio frequency front-end modules (“MMIC”), digital signal processors (“DSP/FPGA”), PCB boards, antennas, and control circuits. The midstream segment includes the design and manufacturing of millimeter-wave radar systems. Downstream applications are primarily found in sectors such as smart driving, transportation safety, robotics, and the low-altitude economy.

¹. Although 24 GHz technically falls outside the strictly defined millimeter-wave band, it is widely regarded as a peripheral application of millimeter-wave radar in engineering practice due to its high-frequency characteristics and similar use cases.

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Value Chain of the Millimeter-Wave Radar Industry



Source: The CIC Report.

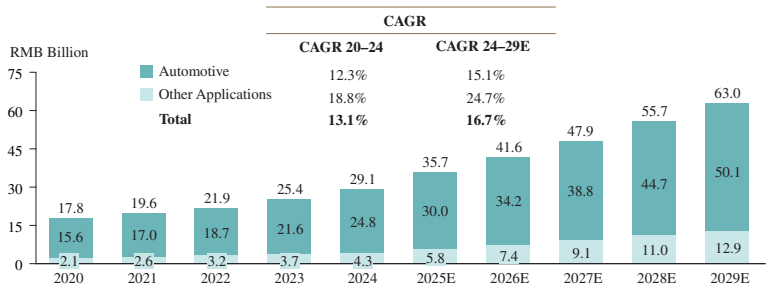
Major Application Scenarios and Classification of Millimeter-Wave Radar

With its high-precision sensing capabilities and all-weather operability, millimeter-wave radar has achieved large-scale adoption across multiple sectors. Among them, the automotive sector represents the core battlefield for millimeter-wave radar deployment. Millimeter-wave radar can be categorized into three distinct frequency bands, 24GHz, 60GHz and 77GHz, each offering unique technical characteristics and application suitability.

Market Size of Global and China’s Millimeter-Wave Radar

The millimeter-wave radar industry is currently in a phase of rapid growth. The market size of global millimeter-wave radar expanded from RMB17.8 billion in 2020 to RMB29.1 billion in 2024, representing a compound annual growth rate (“CAGR”) of 13.1%. It is expected to grow at a CAGR of 16.7% and reach RMB63.0 billion by 2029. Among them, automotive applications represent a significantly larger share than other application categories. Please see below for the market size of global millimeter-wave radar application.

Market Size of Global Millimeter-Wave Radar Application by Revenue, 2020–2029E



Note: ‘Other Applications’ include transportation safety, robotics, the low-altitude economy and others.

Source: the International Organization of Motor Vehicle Manufacturers (OICA), China Passenger Car Association (CPCA), Ministry of Industry and Information Technology (MIIT), National Bureau of Statistics of China (NBS), The CIC Report.

The market size of China’s millimeter-wave radar increased from RMB5.4 billion in 2020 to RMB9.8 billion in 2024, with a CAGR of 16.1%. The market is projected to reach RMB27.5 billion by 2029, growing at a CAGR of 22.9% during the forecast period.

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OVERVIEW OF THE AUTOMOTIVE MILLIMETER-WAVE RADAR INDUSTRY

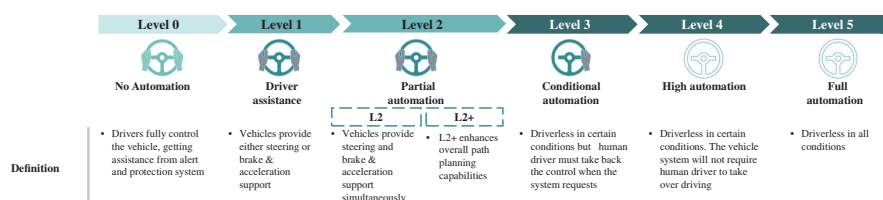
According to the CIC Report, the main driver of growth in the millimeter-wave radar market is the automotive industry, which comprises the market for automotive millimeter-wave radar that have achieved mass production, currently dominated by smart driving applications.

Classification of Smart Driving Industry

The levels of driving automation essentially reflects the progressive transfer of driving authority from humans to machine systems. According to the standards set by the Society of Automotive Engineers (the “SAE”), smart driving is divided into six levels, from L0 to L5. Among them, Level 2 and Level 3 represent a critical inflection point in industry development.

Smart driving encompasses all technologies from basic driver assistance to full self-driving, and automated driving is categorized as a subset under this broader umbrella.

Levels of Driving Automation



Source: SAE, The CIC Report.

The “Notice on Further Strengthening the Admission, Recall, and Over-the-Air Software Update Management of Intelligent Connected Vehicle Products” published by China’s Ministry of Industry and Information Technology and the State Administration for Market Regulation in 2025 requires that intelligent connected vehicles equipped with combined driving assistance systems must possess hardware and software capabilities matching their functional specifications, while also meeting stringent safety requirements. Therefore, global mainstream OEMs and tech companies have adopted the “L2+” technical route as a transitional strategy. Under the framework of L2-level liability, they enhance the performance of sensors and algorithms to expand the functional boundaries of smart driving, thereby building user trust and accumulating technical redundancy within a controlled safety scope.

With continuous advancements in smart driving technologies, a positive reinforcement loop has formed from “functional innovation” to “user experience” and eventually “market adoption.” The iteration of technology has enabled L2+ systems to expand their functionality from basic ACC + LKA to include advanced features such as NOA and Home-zone Parking Assist (HPA), significantly enriching the function set. From the perspective of user value, this functional expansion has substantially enhanced safety, comfort, and convenience, further accelerating the penetration of smart driving systems. At the same time, regulatory mandates for compulsory installation of smart driving functions (e.g., automatic emergency braking, lane-keeping assist) are reinforcing the rigid demand for L2+ technology from the policy side. Looking ahead, as algorithm generalization improves and road infrastructure becomes more intelligent, L2+ will serve as the key engine driving large-scale deployment of smart driving and lay the technical foundation and market awareness for the commercialization of higher-level autonomous systems.

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Automated vehicles equipped with smart driving technologies are developing rapidly in recent years, with the objectives of achieving higher levels of driving safety, enhancing driver experience, increasing fuel efficiency and reducing environmental impact. With technological advances and popularizing intellectualization, the penetration rate of smart driving is expected to improve steadily over the next decade. The global shipments of automated vehicles are expected to grow from 37.9 million units in 2024 to 65.7 million units in 2029, with a CAGR of 11.6%.

Given the largest new car sales volume and increasing penetration of smart driving technologies, China is expected to be the leading market for automated vehicles shipments. The shipments of automated vehicles in China are expected to reach 15.2 million units by 2024 and further increase to 30.8 million units by 2029, representing a CAGR of 15.2% during 2024 and 2029. Hence, Chinese automotive OEMs have been proactively bolstering their hardware capabilities to meet the demands for automated vehicles.

Trends of the Smart Driving Industry

The smart driving industry is evolving along the following key trends:

- ***Penetration of Smart Driving in Mid- to Low-End Vehicles is Increasing Rapidly:*** Smart driving is rapidly expanding into mid- to low-end vehicles, driven by declining costs, advancements in sensors and computing platforms, as well as regulatory support and rising consumer demand for intelligent features. Millimeter-wave radar, offering an optimal balance of performance and cost, has become the mainstream perception solution in this market segment. The growth in vehicle sales reflects a continuous improvement in intelligence levels, accelerating the industry’s evolution toward higher levels of autonomy.
- ***Multi-Sensor and Multi-Modal Fusion is Becoming the Main Development Direction: Multi-sensor fusion, supported by high-precision positioning, enables more comprehensive and stable environmental perception. This approach significantly improves sensing accuracy and adaptability in challenging conditions such as poor weather and nighttime driving. Fault-tolerant system design also plays a critical role. This redundancy improves the overall reliability and safety of autonomous systems and provides a technical foundation for high-level autonomous functions.***
- ***OEMs’ Increased Investment Drives Growth in Millimeter-Wave Radar Value and Adoption:*** As smart driving continues to advance in intelligence, vehicles are placing higher demands on the accuracy, real-time performance, and reliability of perception systems, driving continuous upgrades in both configuration and technology. In response, many leading OEMs have continuously increased their investment in smart driving, driving continuous upgrades in perception system configurations. The number of millimeter-wave radars installed per vehicle is expected to steadily rise, with the product value poised for significant growth, further unlocking market potential.

Adoption of Millimeter-Wave Radar in the Automotive Market

Perception system is one of the indispensable components of smart driving. The major sensors for smart driving perception include millimeter-wave radars, cameras, ultrasonic radars and LiDARs which are considered to be complimentary to each other. The table below sets forth an overview of and the performance comparison between these four types of sensors in the automotive market.

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Comparison of Millimeter-Wave Radar and Other Sensor Types

	Price range	Global Market size, 2024	Market Share ^[2]	Detection distance (meter)	3D Imaging	Weather adaptability	Night vision	Precision	Resolution	Adaptability	Automotive application examples
 Millimeter wave radars	RMB100 - RMB1,000	RMB24.8 billion	~10%	100 200 300 ✓ ✓ ✓	3D: None 4D: Limited	Highly adaptive to all weather conditions	Great, not affected by darkness	Low	Low	High	
 LiDARs	RMB1,400 - RMB50,000	~RMB7.1 billion	~3%	✓ ✓ ✓	Great, able to draw complete obstacle images	Limited, operate poorly in rainy or foggy weather	Great, not affected by darkness	High	High	High	
 Ultrasonic radars	RMB20 - RMB100	~RMB28.5 billion	~12%	✓ ^[1]	Unable to detect size and shape of obstacles	Adaptive to some weather conditions	Great, not affected by darkness	High	Low	Low	
 Cameras	RMB140 - RMB700	~RMB178.2 billion	~75%	✓ ✓ ✓	Need to rely on 2D images to draw 3D	Limited, cannot operate under strong light intensity	Limited, detection distance decrease	Low	High	Low	

Low   High 

Notes:

- [1] Ultrasonic radars are generally used for short-range detection, typically within a few meters and not suitable for distances over 100 meters.
- [2] The market share of a sensor is calculated by its market size divided by the sum of the market sizes of the four sensors in the table

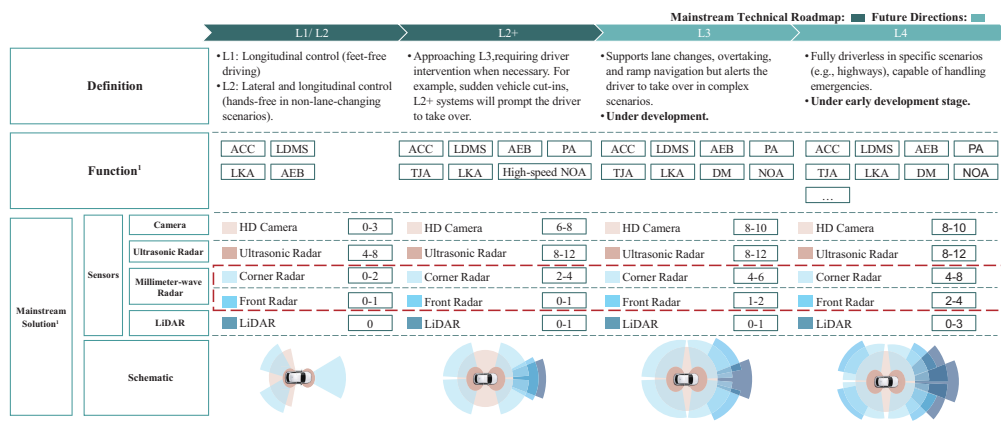
Source: The CIC Report.

Millimeter-wave radar is assuming a pivotal role in smart driving perception systems due to its stable detection capabilities under adverse weather conditions and precise measurement of motion parameters. It provides accurate real-time detection of the distance and velocity of surrounding vehicles or obstacles, serving as a core sensor for active safety features such as collision warning and adaptive cruise control. Compared with LiDAR, millimeter-wave radar offers stronger anti-interference performance and fulfills all-weather operation requirements with a clear advantage in cost-effectiveness. Unlike cameras, which cannot directly measure object speed, millimeter-wave radar provides real-time velocity information, enabling faster response and more accurate motion tracking; and in comparison, with ultrasonic sensors, it delivers safety in high-speed scenarios and offers broader coverage. These comprehensive advantages establish millimeter-wave radar as a foundational all-weather sensor in the perception layer of smart driving. Its high reflectivity and accurate identification of metallic objects, such as truck rears and traffic barriers, further enhance reliability in high-risk driving environments.

As smart driving progresses to higher levels, multi-sensor fusion architecture are becoming mainstream. Millimeter-wave radar, with its maturity, low power consumption, and cost-efficiency, plays an increasingly critical role, not only as a supplementary sensor in challenging conditions but also as one of the most engineering-ready and cost-effective components in current perception systems.

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Sensor Requirements for Various Levels of Driving Automation



¹Note: Based on mainstream millimeter wave radar solutions.

Source: The CIC Report.

Early 2D millimeter-wave radar (measuring only range and velocity) dominated the market with their cost advantage, for basic functions like blind spot warning. With the decline in prices and the advancement of technology, 3D radars capable of detecting horizontal positions have gradually replaced 2D radars and are being applied in the smart driving field of L1. While 3D millimeter-wave radar currently represents the mainstream configuration in automotive applications, the industry is rapidly shifting toward more advanced solutions. Compared with 3D radar, which captures distance, velocity, and azimuth, 4D millimeter-wave radar adds vertical elevation as a fourth dimension, enabling full spatial perception. This enhancement improves the recognition of low-lying and overhead objects, reduces false positives, and supports more accurate classification and decision-making in smart driving. With ongoing improvements in antenna design and signal processing, 4D radar is generating denser point cloud, allowing for more precise reconstruction of object contours and better environmental modeling. The integration of AI algorithms further enhances its semantic recognition capability, enabling it to identify object types and predict motion. These advances are driving the rapid adoption of 4D radar in smart driving systems.

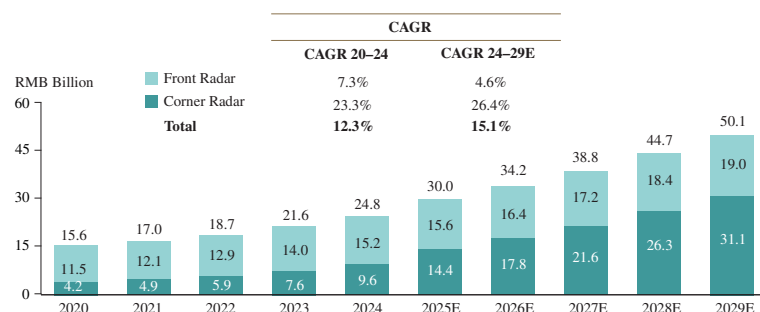
The 4D millimeter-wave radar market in China is experiencing rapid growth. According to the CIC Report, the market size in China for 4D millimeter-wave radar in the automotive sector was RMB1.2 billion in 2024 and is expected to grow at a CAGR of 55.7% to RMB10.7 billion by 2029, with its market share rising from 14.3% in 2024 to 49.4% by 2029. Currently, 4D millimeter-wave radar is experiencing rapid adoption in front-end mass production and is progressively replacing traditional radar systems, with its penetration rate steadily increasing across different levels of smart driving.

Market Size of Global Millimeter-Wave Radar Application in Automotive Industry

Driven by the rapid development of the smart driving industry, the automotive millimeter-wave radar sector has entered a period of accelerated growth. The market size analysis includes front and corner radars, and excludes in-cabin radars as they differ significantly from front and corner millimeter-wave radars in terms of application scenarios, technical specifications, industry dynamics, and supplier competitive landscape. The market size of global automotive millimeter-wave radar increased from RMB15.6 billion in 2020 to RMB24.8 billion in 2024, representing a CAGR of 12.3%. The market is expected to grow at a CAGR of 15.1% and reach RMB50.1 billion by 2029.

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Market Size of Global Millimeter-Wave Radar Application in Automotive Industry by Revenue, 2020–2029E

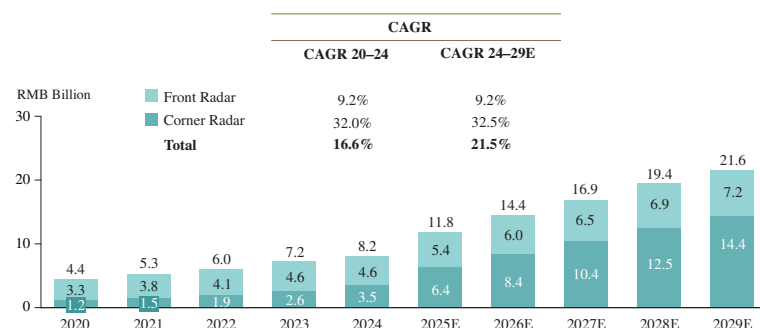


Source: OICA, CPCA, The CIC Report.

Market Size of China’s Millimeter-Wave Radar Application in Automotive Industry

The market size of China’s automotive millimeter-wave radar increased from RMB4.4 billion in 2020 to RMB8.2 billion in 2024, with a CAGR of 16.6%. It is projected to grow at a CAGR of 21.5% and reach RMB21.6 billion by 2029. In February 2025, a leading Chinese OEM unveiled its upgraded smart driving system, significantly boosting millimeter-wave radar adoption rates and average sensor deployment per vehicle. This technological advancement is projected to drive substantial growth in China’s millimeter-wave radar market throughout 2025. The adoption rate of millimeter-wave radar in China in the automotive industry was approximately 26.6% in 2020 and 56.6% in 2024, and is expected to reach 82.8% in 2029. Smart driving systems increasingly adopt a multi-modal perception architecture, where multiple sensing technologies, such as LiDAR, millimeter-wave radars, ultrasonic sensors and cameras, are applied in parallel rather than as substitutes. As such, the adoption rates of other sensors cannot be used to directly assess or negate the mainstream position of millimeter-wave radar. Instead, its high and rising standalone penetration rate combined with its functional indispensability in enabling key smart driving features, provides a clear basis to support its classification as a mainstream perception solution in the mid- to low-end smart driving segment.

Market Size of China’s Millimeter-Wave Radar Application in Automotive Industry by Revenue, 2020–2029E



Source: CPCA, The CIC Report.

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The market size of China’s automotive millimeter-wave radar by shipment volume increased from 13.1 million units in 2020 to 41.6 million units in 2024, with a CAGR of 33.6%. It is projected to grow at a CAGR of 24.8% and reach 126.1 million units by 2029. In 2024, China’s front radar and corner radar by shipment volume were 19.2 million units and 22.4 million units respectively. The unit price of millimeter-wave radar products exhibits a wide range. This is primarily driven by differences in radar type, dimensional capability, chip architecture, antenna design, integration level, supply chain maturity, among others. Historically, the price range has declined from a broader range of approximately RMB100 to over RMB1,000, mainly due to technology maturation and economies of scale. Going forward and up to 2030, the average unit price is expected to remain within a narrower range of approximately RMB100 to RMB700. Meanwhile, the unit price of similar types of millimeter-wave radar is expected to decline over time. No material short-term price fluctuations have been observed beyond the long-term downward trajectory, as changes in demand, component costs, and competitive dynamics have generally evolved gradually and in line with market expectations.

Key Drivers and Trends of the Automotive Millimeter-Wave Radar Market

The automotive millimeter-wave radar market is driven by the following key factors and trends:

- ***Regulatory Support Accelerating Radar Adoption:*** Regulatory developments such as the mandatory AEB standards effective from 2028, L3 highway test licenses in major cities, and the national pilot program for intelligent connected vehicles announced in November 2023 are all driving radar adoption. Functions like AEB and FCW rely heavily on millimeter-wave radar for forward sensing. These regulations are turning millimeter-wave radar from an optional feature into a compliance necessity, especially in commercial vehicles and urban ride-sharing fleets. At the same time, the maturing domestic supply chain is driving down manufacturing costs and enhancing performance, offering more cost-effective solutions for both passenger and commercial vehicles.
- ***Rapid Penetration of Higher-Level Smart Driving:*** As smart driving technology evolves from L2 to L2+, an increasing number of OEMs are integrating advanced features such as NOA, automatic lane change, and intelligent parking into mainstream vehicle models. These advanced functions demand higher precision and stability in environmental perception. Millimeter-wave radar, as a core component for long-range speed measurement and obstacle detection, is increasingly becoming a standard feature. Particularly in L2+ configurations, a typical system includes one long-range front radar and two to four corner radars – significantly more than the one to two sensors used in L1 configurations. The proliferation of higher-level driving functions is directly driving up both the average number of millimeter-wave radars per vehicle and the overall system demand.
- ***Continuous Technological Advancements in Millimeter-Wave Radar:*** Millimeter-wave radar is transitioning from traditional 3D sensing to 4D imaging through technologies such as multi-chip cascades and synthetic aperture. These enable higher spatial resolution and dynamic target tracking. Improvements in antenna integration, MIMO channel expansion, and beamforming using metamaterials are enhancing resistance to interference, ensuring stable output even in complex urban or high-speed driving scenarios. In addition, With the rising computing power of domain controllers, millimeter-wave radar is evolving from waveform-based reflection detection to point cloud generation and semantic recognition. The integration of AI significantly enhances adaptability and accuracy in complex traffic environments, transforming the radar from a basic range sensor into a “semantic perception node” supporting intelligent decision-making.

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Major Regulatory Development of NEVs in China

In recent years, China has been continuously advancing the development of its policy framework for the new energy vehicle (NEV) industry. In November 2020, the State Council released the New Energy Vehicle Industry Development Plan (2021–2035), which called for enhancing core technological capabilities, accelerating the construction of charging and battery swapping infrastructure, and promoting the widespread adoption of NEVs in both public and private sectors. Building upon these long-standing efforts, a series of supportive policies have continued to emerge. Notably, in March, 2024, the State Council issued the Action Plan for Large-Scale Equipment Renewal and Trade-in of Consumer Goods, which proposed accelerating the replacement of aging NEVs. In September, the National Development and Reform Commission, along with three other ministries, jointly released the Notice on Advancing Large-Scale Application Pilots of Vehicle-to-Grid (V2G) Integration, encouraging the coordinated development of NEVs and power grids through smart charging and efficient resource utilization.

The prevailing regulatory developments and potential fluctuations in the demand for and retail prices of NEVs are unlikely to have a material adverse impact on the Group’s operational or financial performance. This assessment is based on the observation that millimeter-wave radar has increasingly become a standard configuration across a broad range of NEV models, including those in the RMB100,000 price segment and below. As a result, the adoption of such radar systems is not significantly affected by vehicle price variations and has reached a level of structural integration that supports consistent demand.

The intensified price competition in China’s NEV sector primarily reflects adjustments in retail pricing and marketing strategies among OEMs, rather than affecting the pricing mechanism of smart driving components. The pricing of the Group’s products is determined by supply arrangements and technical specifications, and is therefore independent of retail vehicle price movements. Demand for millimeter-wave radar products in the automotive industry is mainly driven by regulatory safety standards and the increasing penetration of intelligent configurations across vehicle models. Accordingly, fluctuations in NEV retail prices have not had, and are not expected to have, any material adverse impact on the Group’s operations or financial performance.

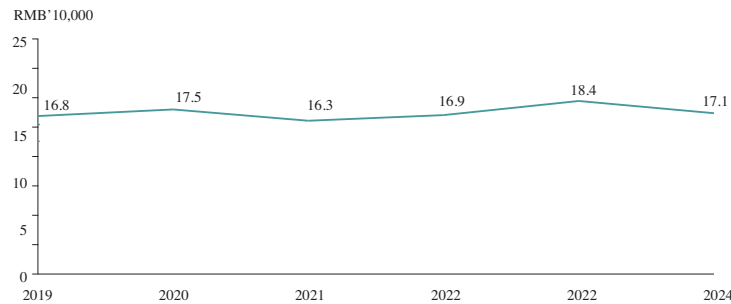
In addition, recent NEV-related policies in China have generally been supportive of the continued development and application of smart driving technologies, which further reinforces long-term demand for perception solutions such as millimeter-wave radar. Notably, the Ministry of Industry and Information Technology has led the introduction of mandatory national standards such as the “Safety Requirements for Combined Driving Assistance Systems of Intelligent Connected Vehicles,” which regulates the safety performance of L2-level driving assistance systems, and the “Technical Requirements and Test Methods for Automatic Emergency Braking Systems of Light Vehicles.” These standards directly strengthen the role of perception sensors, including millimeter-wave radar, in ensuring compliance with safety regulations. While the outlook remains positive, a slower-than-expected increase in the penetration of smart driving features could potentially moderate demand for perception components across the industry, which may in turn have an adverse impact on the Group’s growth prospects.

There has been no clear trend observed up to this day. Given the complexity of influencing variables and market dynamics, it may not be feasible to conduct a reliable forecast for the future retail price trend of NEVs at this stage.

The chart below illustrates the historical retail price trend of NEVs in China. The historical average retail price of NEVs in China has remained relatively stable between 2019 and 2024.

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Historical Average Retail Price of NEVs in China



Source: CPCA, The CIC Report

COMPETITIVE LANDSCAPE OF CHINA’S AUTOMOTIVE MILLIMETER-WAVE RADAR MARKET

The following tables set forth the competitive landscapes of China’s automotive millimeter-wave radar market and the segmented markets.

Ranking of Major Suppliers in China’s Automotive Millimeter-Wave Radar Market by Shipment Volume in 2024*

Ranking	Company	Shipment Volume (Units in millions)	Market Share (%)	2022–2024 CAGR
1	Company A ⁽¹⁾	~5.0	~12.0%	~2%
2	Company B ⁽²⁾	4.0–5.0	~10.6%	~50%
3	The Company	~1.9	~4.5%	180%
4	Company C ⁽³⁾	~1.7	~4.1%	~5%
5	Company D ⁽⁴⁾	~1.3	~3.1%	~-40%

Notes:

* To ensure a fair representation of the competitive landscape, this analysis excludes OEM-affiliated companies that were established primarily to meet internal demand rather than broader market needs.

- (1) Company A is a private multinational engineering and technology company established in 1886 and headquartered in Germany. Its operations are divided into four business sectors: mobility, industrial technology, consumer goods, and energy and building technology. It provides automotive systems including millimeter-wave radar.
- (2) Company B is a company established in 2016 and headquartered in China. It is engaged in the research and development, manufacturing, and sales of automotive electronics and safety driving systems, with product offerings including millimeter-wave radar systems. It operates as a subsidiary of a publicly listed group.
- (3) Company C is a public company established in 1994 and headquartered in Ireland. It is a global technology company engaged in the design, development, and manufacturing of software and hardware products for the automotive industry. Company C is listed on the New York Stock Exchange.
- (4) Company D is a public company founded in 1871 and based in Germany. Its automotive group sector offers technologies for safety, brake, chassis, motion and motion-control systems. Company D is listed on the Frankfurt Stock Exchange. Company D was one of our five largest customers in 2022 and 2023, respectively. In these years, we were still at a start-up phase with a relatively small scale incomparable to Company D. Therefore, we partnered with Company D to leverage its OEM channels for project deployment, and acted as a technological development service provider for Company D’s expansion in the China market. For details of the technological development services we provided to Customer B, see “Business – Customers – Major Customers”. Such business collaboration was transitional and aligned with early-stage market dynamics in previous years. Along with the growing market acceptance of domestic suppliers by OEMs, we no longer collaborated, and directly competed, with Company D. We were not involved in any business transactions with Customer B in 2024 or 2025.

Source: The CIC Report.

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Ranking of Major Suppliers in China’s Automotive Front Millimeter-Wave Radar Market by Shipment Volume in 2024*

Ranking	All Suppliers	Shipment Volume (Units in millions)	Market Share (%)	Domestic Suppliers	Shipment Volume (Units in millions)	Market Share Among Chinese Suppliers (%)
1	Company A	~2.0	~10.4%	The Company	~1.0	~9.3%
2	The Company	~1.0	~5.2%	Company B	~0.9	~8.4%
3	Company D	~0.9	~4.7%	Company F ⁽²⁾	~0.4	~3.6%
4	Company B	~0.9	~4.7%			
5	Company E ⁽¹⁾	~0.5	~2.6%			

Notes:

* To ensure a fair representation of the competitive landscape, this analysis excludes OEM-affiliated companies that were established primarily to meet internal demand rather than broader market needs.

(1) Company E, established in 1949 and headquartered in Japan. It is a global manufacturer of automotive components offering automotive technologies, systems and products, including millimeter-wave radar. It is listed on the Tokyo Stock Exchange.

(2) Company F is a private company established in 1987 and headquartered in China. Its business spans key sectors such as transportation, manufacturing, information and communications technology (ICT), among others, and it develops intelligent automotive solutions including millimeter-wave radar.

Source: The CIC Report.

Ranking of Major Suppliers in China’s Automotive Corner Millimeter-Wave Radar Market by Shipment Volume in 2024*

Ranking	Company	Shipment Volume (Units in millions)	Market Share (%)
1	Company B	3.0–4.0	~15.6%
2	Company A	~3.0	~13.4%
3	Company C	~1.7	~7.6%
4	The Company	~0.9	~3.9%
5	Company F	~0.5	~2.1%

Notes:

* To ensure a fair representation of the competitive landscape, this analysis excludes OEM-affiliated companies that were established primarily to meet internal demand rather than broader market needs.

Source: The CIC Report.

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Ranking of Major Chinese Suppliers in China’s 4D Automotive Corner
Millimeter-Wave Radar Market by Shipment Volume in 2024*

Ranking	Company	Shipment Volume (Units in millions)	Market Share Among Chinese Suppliers (%)
1	The Company	~0.9	~26.1%
2	Company B	0.7–0.8	~22.3%
3	Company F	0.3–0.4	~9.5%

Notes:

* To ensure a fair representation of the competitive landscape, this analysis excludes OEM-affiliated companies that were established primarily to meet internal demand rather than broader market needs.

Source: The CIC Report.

Additionally, the Company ranked the second in terms of revenue in 2024, with a market share of 4.8%, among all suppliers in China’s automotive front millimeter-wave radars; and the first in terms of revenue in 2024, with a market share of 9.0%, among the Chinese suppliers in China’s automotive front millimeter-wave radars.

Comparison Among Mainstream Products

Radar products can be commonly assessed based on the following key parameters:

- Dimensions and weight: Affect ease of installation and integration across different vehicle models; more compact and lighter designs are preferred.
- Detection range: The minimum and maximum distance within which the radar can reliably detect objects, directly impacting the performance of functions such as AEB and ACC; higher values are preferred.
- Data update period: The frequency at which radar data are refreshed, determining the real-time responsiveness of smart driving functions; shorter cycles are preferred.
- Field of view (horizontal and vertical): The angular coverage of the radar, influencing perception in cross-traffic and lateral scenarios; wider coverage is preferred.
- Azimuth accuracy: The precision of azimuth angular detection, affecting the ability to distinguish adjacent targets; lower values (higher accuracy) are preferred.

The Company’s radar products, especially the Pro series, demonstrate strengths in key parameters such as size, detection range and azimuth accuracy, and present a well-balanced performance profile without material shortcomings across major technical dimensions, according to CIC.

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Key Success Factors for Automotive Millimeter-Wave Radar Providers

The main success factors for players in the automotive millimeter-wave radar industry are as follows:

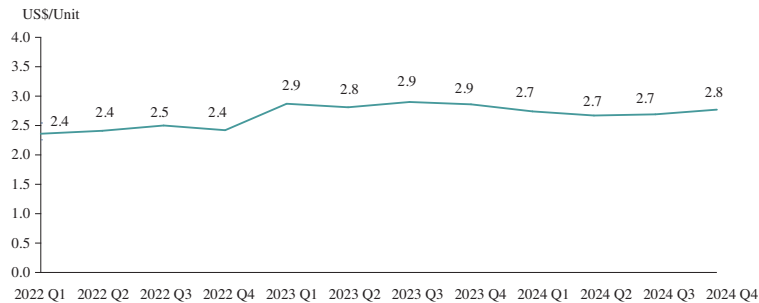
- ***Responding Swiftly and Decisively to Industry Change:*** In the rapidly evolving millimeter-wave radar industry, the ability to accurately anticipate technological trends and decisively respond to disruptive changes has become a critical factor for companies to stand out. Companies with strong technological foresight actively explore and invest in cutting-edge innovation, demonstrating a high level of strategic initiative. Those capable of rapidly responding to market shifts, efficiently allocating resources, and accelerating product development are more likely to gain a competitive edge in the future landscape.
- ***Technological Capabilities:*** The development of millimeter-wave radar involves multiple disciplines. Companies with in-house R&D capabilities can build sustainable technology platforms, enabling flexible combinations of frequency bands and beam configurations through modular architecture to meet OEMs’ diverse application needs, such as forward detection, surround perception, and in-cabin monitoring. Algorithm capability plays a decisive role in overall performance, encompassing key modules such as target detection, point cloud processing, false alarm suppression, and trajectory prediction.
- ***Supply Chain Integration Capability:*** Millimeter-wave radar products often rely on core components with high technical barriers and limited production capacity, making stable supply chain resources essential for ensuring delivery capabilities. Companies with foresight in planning typically establish long-term partnerships with key raw material and component suppliers, ensuring continuous supply during capacity constraints or price fluctuations. These deep collaborative relationships also improve access to upstream technological advancement, offering dual advantages in product performance and cost control. Supply chain coordination capabilities have become a critical factor for millimeter-wave radar providers to enter the designated supplier systems of mainstream OEMs.
- ***High-Quality Mass Production Capability:*** Millimeter-wave radar manufacturing demands high standards for process stability, product consistency, and signal integrity. For advanced products like 4D imaging radar, which involve complex structures and precision processes, extremely high levels of automation and standardization in manufacturing systems are required. To ensure long-term operational stability under harsh road conditions, manufacturers must comply with automotive certification systems across design, production, and quality management. Providers with system-level design and validation capabilities hold a distinct competitive edge. As industry enters a phase of large-scale commercialization, manufacturing capacity will directly impact delivery efficiency and customer retention, becoming a foundational support for long-term development.
- ***Establishing Strong Ecosystem Partnerships:*** With advantages such as cost-effectiveness and strong environmental adaptability, millimeter-wave radar has become an indispensable component in smart driving perception systems. It plays a key role in vehicle autonomous systems, but its standalone value is only fully realized when integrated with other sensors and control domains to form a cohesive unit. Radar solutions with open interfaces, standardized data outputs, and hardware–software decoupling are more easily integrated into vehicle E/E architecture, enhancing overall system reliability and scalability. Radar providers that engage in joint development with OEMs and solution integrators, and offer customized solutions for specific application scenarios, can gain competitive advantages in collaboration depth and lifecycle management.

INDUSTRY OVERVIEW

Key Components’ Cost

The key components contributing to the hardware cost of millimeter-wave radar primarily include integrated circuits (ICs), printed circuit boards (PCBs), and structural parts such as injection-molded plastic components. ICs are one of the essential raw materials in millimeter-wave radar hardware. The chart below illustrates the historical price trend of global automotive MCUs from Q1 2022 to Q4 2024. The price of automotive MCUs (Microcontroller Unit) in both China and global is expected to show a steady decline while remaining generally stable.

Global Average Selling Price of Automotive MCUs (by Quarter)



Source: WSTS, The CIC Report.

PCBs used in millimeter-wave radar products are generally customized to fit specific product architectures, with their cost influenced by board size, layer count, and processing complexity. Companies that source PCBs domestically tend to benefit from notable cost advantages due to localized procurement and more agile supply chains. As a result, these companies generally observe a stable to mildly declining unit cost trend for PCBs, barring major fluctuations in raw material prices or production capacity.

Structural components are typically sourced from domestic suppliers and priced based on weight and material grade. These parts are often standardized and mass-produced, making them less sensitive to global commodity price fluctuations and contributing to consistently stable cost trends across the industry.

SOURCE OF INFORMATION

We engaged CIC, an independent market research and consulting company that provides industry consulting services, commercial due diligence, and strategic consulting, to conduct detailed research on and analysis of the global millimeter-wave radar industry. We have agreed to pay a fee of RMB560,000 to CIC in connection with the preparation of the CIC Report. We have incorporated certain information from the CIC Report into this section, as well as into “Summary,” “Business,” “Financial Information,” and elsewhere in this document to provide potential with a comprehensive presentation of the industries where we operate.

During the preparation of the CIC Report, CIC conducted both primary and secondary research, and gathered knowledge, statistics, information, and insights on industry trends within the target research markets. The primary research involved interviews with key industry experts and leading industry participants. The secondary research consisted of analyzing data from various publicly available sources, such as the National Bureau of Statistics.

INDUSTRY OVERVIEW

The CIC Report was compiled based on the following assumptions: (i) the overall social, economic, and political environment in China is expected to remain stable during the forecast period; (ii) related key industry drivers are likely to propel continued growth in the global millimeter-wave radar industry throughout the forecast period, including favorable policies and wider acceptance of different levels of smart driving features in vehicle; and (iii) there will be no extreme force majeure or unforeseen industry regulations in which the market may be affected in either a dramatic or fundamental way during the forecast period.

Our Directors, after making reasonable enquiries, confirm that there have been no adverse change in the market information since the date of the CIC Report which may qualify, contradict or have an impact on the information in this section.