

Imaging Radar for Autonomous Systems

Patent Landscape Analysis – September 2025

The global IP battlefield is heating up: who are the key players, and which technologies will shape the future of imaging radar for autonomous mobility?

REPORT OVERVIEW

Topic: Imaging Radar for Autonomous Systems

Type: Patent Landscape Analysis

Publication: September 2025

Reference: KM25002

Deliverables

- Report (>150 slides)
- Database (>10,600 patent families)
- Interactive dashboard (optional)

Pricing

- €4,990 - Report+Database
- €7,990 - Report+Database+Dashboard

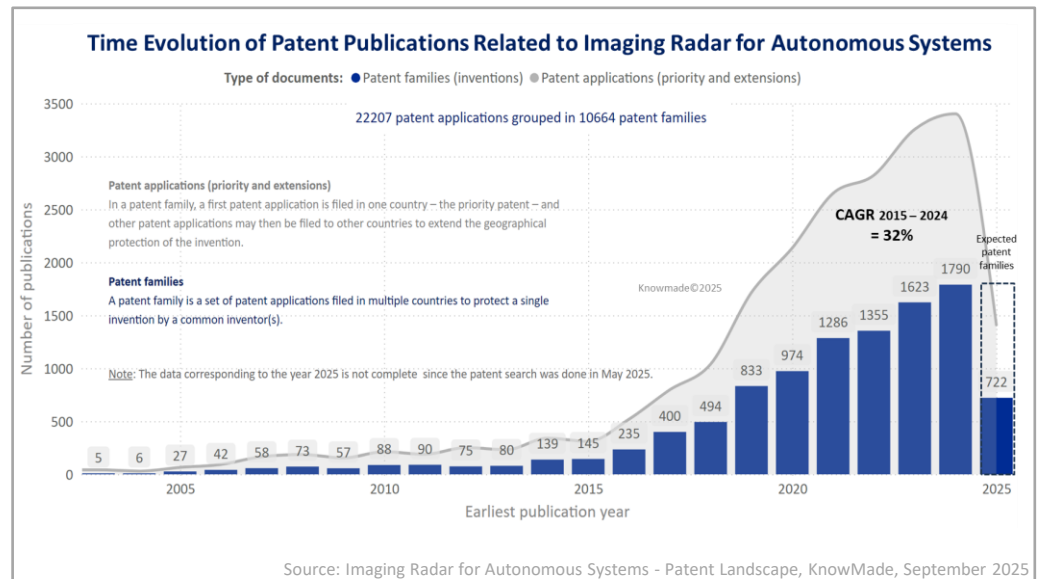


KEY FEATURES

- **Global patenting trends**, including time evolution of patent publications, countries of patent filings, etc.
- **Main patent assignees and IP newcomers** by countries and segments.
- **Key players' IP position** and the relative **strength** of their patent portfolio.
- **IP ecosystems** including sub-brands, JV with shared IP ownership, main co-owned IP, etc.
- Patents categorized by **6 application domains** (*terrestrial, aerial, robotics, space, marine, defense*) and **5 technology layers comprising 11 techniques** (*FMCW, MIMO, Beamforming, 4D imaging radar, SAR, ISAR, calibration, point cloud, SLAM, tracking, AI and sensor fusion*), with a focus on terrestrial applications and 4D imaging radar.
- **IP profile of key players** (portfolio overview, tech coverage, geo coverage, notable patents, etc.).
- **Excel database** with all patents analyzed in the report, including **patent segmentations**.
- **Interactive dashboard** enabling dynamic exploration of the patent landscape, allowing users to instantly drill down into key insights and tailor the analysis to their specific needs.

Imaging Radar A Core Driver of High-Resolution Autonomy

Imaging radar represents the next generation of radar sensing technologies, designed to overcome the limitations of conventional radars that provide only basic range and velocity measurements. By simultaneously capturing range, velocity, azimuth and elevation, imaging radar produces **high-resolution 3D/4D perception**. These dense radar point clouds enable advanced perception functions including object classification, free space detection, mapping and scene reconstruction. Thanks to its robustness in adverse weather, low light and complex operating environments, imaging radar is becoming a cornerstone for safe and reliable autonomous systems. Its deployment spans terrestrial mobility such as ADAS, L2–L4 autonomous driving and robotaxi platforms, as well as aerial drones, marine vessels, robotics, space, and defense applications. The rapid acceleration of patenting activity reflects this momentum. More than **22,200 patent applications** grouped into over **10,600 patent families** (inventions) have been identified worldwide, including more than **2,800 core patent families** that demonstrate a high degree of relevance to the imaging radar domain. This strong intellectual property (IP) dynamic demonstrates that imaging radar is transitioning from a complementary sensor to a primary perception modality, shaping the future of autonomy and driving one of the most competitive IP battlefields in advanced sensing.



Global IP Trends and Strategic Players

The patent landscape for imaging radar has experienced an unprecedented acceleration. From 2015 to 2024, imaging radar patent family publications grew from 145 to 1,790, an increase of over **1100%** and a CAGR of **32%** marking a period of explosive innovation. This surge reflects the technological transition toward 4D imaging radar, AI-driven perception and multi-sensor fusion. The **United States** and **China** dominate the field, together accounting for more than half of global filings, while Europe maintains a strong position through Tier-1 suppliers such as Bosch, ZF and Valeo. Established players including **Intel-Mobileye, Bosch, General Motors, Alphabet - Waymo, Huawei-Yinwang** and **Magna** hold diversified patent portfolios that span radar hardware, perception software and sensor fusion. At the same time, specialized innovators such as **Arbe Robotics, Uhnder, Aptiv** and **Metawave** are building targeted portfolios in 4D radar chipsets, point cloud processing and real-time environmental perception. Academic institutions, notably **Xidian University, UESTC, BUAA** and **AIRCAS**, continue to shape foundational innovation in waveforms, antenna design and beamforming. This complex interplay of industrial leaders, startups and research institutes defines one of the most competitive IP domains in advanced sensing.



USEFUL PATENT DATABASE

This report includes an extensive **Excel database** with all patents analyzed in this study, including:

- Key patent information (numbers, dates, assignees, titles, abstracts, etc.)
- Hyperlinks to an up-to-date online database (original documents, legal status, etc.)
- Structured classification by applications (*terrestrial, aerial, robotics, space, marine, defense*) and technological segments (*FMCW, MIMO, beamforming, 4D imaging radar, SAR, ISAR, calibration, point cloud, SLAM, tracking, AI and sensor fusion*)



INTERACTIVE DASHBOARD (optional)

Optional add-on: One-year access to the interactive dashboard for unlimited authorized users within your organization.

This solution transforms the analysis into a true decision-support tool.

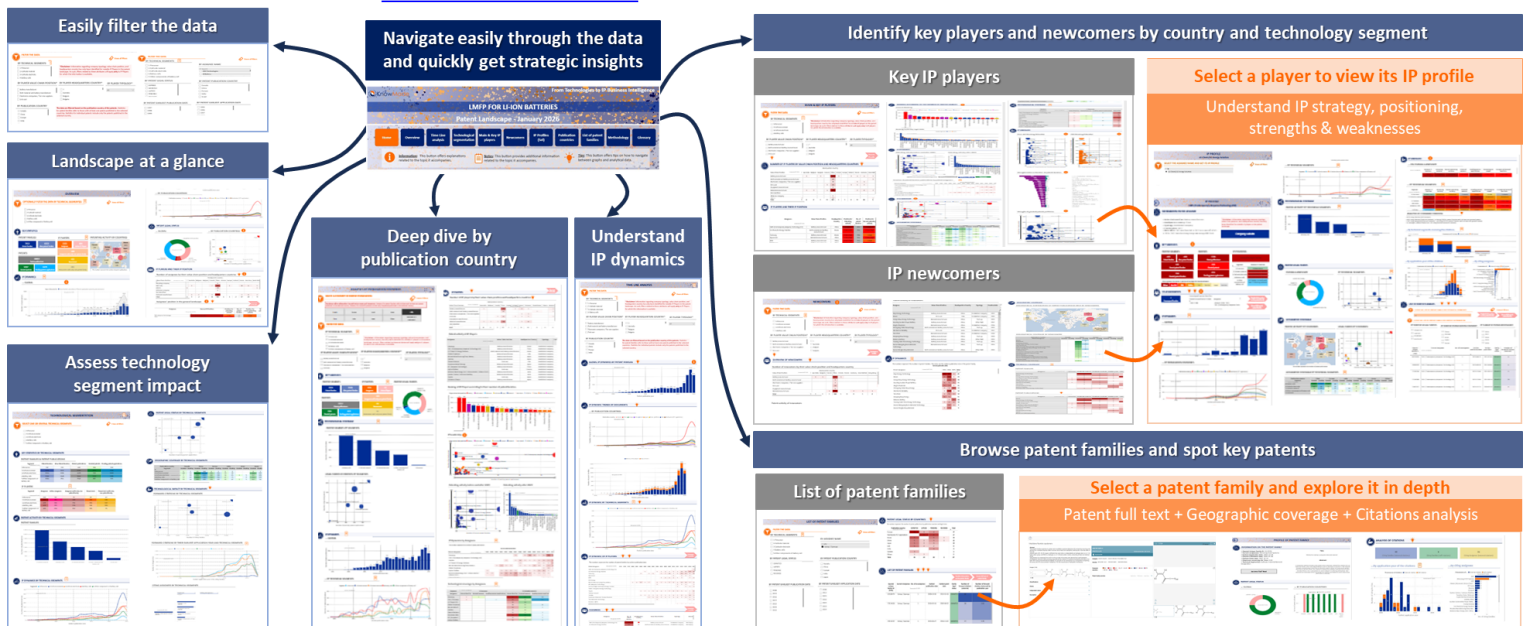
Key features:

- Dynamically explore the patent landscape based on your priorities
- Access clear, interactive visualizations for immediate insights
- Filter and analyze data by players, technologies, countries, dates, and legal status
- Drill down instantly from high-level trends to specific players, technologies, and patents
- Tailor insights to the needs of each team (R&D, IP, strategy, business development)

Benefits:

- Get immediate answers to your key questions
- Save time and accelerate decision-making
- Focus on the insights that matter most

Discover the dashboard



Companies mentioned in the report (non-exhaustive)

General Motors, Bosch, Toyota, Huawei - Yinwang, Sony, Denso, Intel - Mobileye, Aurora, Honda, Continental, Amazon - Zoox, Alphabet - Waymo, Volkswagen, Raytheon Technologies, ZF, Hyundai, Valeo, Ford, Magna, Aptiv, Mitsubishi, Baidu, Infineon, Samsung, Qualcomm, DJI Technology, Motional, LG, Mercedes-Benz, NXP, Boeing, Geely - Volvo Cars, Hitachi, HERE, Nvidia, Panasonic, BMW, Honeywell, FAW Group, Kia, Stellantis - PSA, Mando, Changan Automobile, Xaircraft (XAG), Subaru, Forvia - Hella, IBM, NEC, Pony.ai, Micron, BAE Systems, Geometrical-PAL, Metawave, Calterah Semiconductor, ICAN Technology, Kyocera, LIG Nex1, Texas Instruments, Desay SV, IAI - Israel Aerospace Industries, Nissan, Siemens, State Grid Corporation of China, SITRICK DAVID H., Apple, Xiaomi Technology, Tata Motors, Weifu, Airbus, Cheng-Tech, Dongfeng Motor, Korean Agency for Defense Development, US Navy, BYD, Great Wall Motor, Autoroad Tech, Nidec, Renault, MBDA UK, Nuro, Arbe Robotics, Lockheed Martin, Microsoft, Volvo, Beta Technologies, CAIC - China Automotive Innovation Corporation, Five AI, Thales, Bitsensing, Daihen, Fuxia hangzhou intelligent science & technology, Hawkeye, NIO, Secom, Vivo, Wuxi Tongchun New Energy Technology, China Southern Power Grid, DiDi, Mazda, Seres, Tencent, Uhnder, Yupiteru, Alibaba, Deere, dSPACE Technologies, L3Harris Technologies, Lyft, Northrop Grumman, SAAB, Sick, State Farm Insurance, TuSimple, Veoneer, Voyah, Zadar Labs, Elwha LLC, GAC Group, iRobot, Jingdong Qianshi Technology, Keysight, Novasky Electronic, NTT Docomo, Symeo, Teledyne, Toshiba, Uber, Vayyar, Ericsson, Fujitsu, Hanwha, Kodiak Robotics, Koito Manufacturing, STMicroelectronics, US Army, WHST, Ambarella - Oculii, Bayer, Chery Automobile, Chuhang Technology, Eagle Sense Technology, Furukawa Electric, XPENG, Zendar, Alps Alpine, Zongmu, and more.

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ABOUT KNOWMADE

KnowMade is a technology intelligence and IP strategy firm specializing in the analysis of patents and scientific publications. We assist innovative companies, investors, and research organizations in understanding the competitive landscape, anticipating technological trends, identifying opportunities and risks, improving their R&D, and shaping effective IP strategies.

KnowMade’s analysts combine their strong technology expertise and in-depth knowledge of patents with powerful analytics tools and methodologies to transform patent and scientific data into actionable insights to support decision-making in R&D, innovation, investment, and intellectual property.

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Imaging Radar for Autonomous Systems

Patent Landscape Analysis – September 2025

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For price in dollars, please use the day's exchange rate.
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“Buyer”: Any business user (i.e. any person acting in the course of its business activities, for its business needs) entering into the following general conditions to the exclusion of consumers acting in their personal interests.

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“Seller”: Based in Sophia Antipolis (France headquarters), KnowMade is a technology intelligence company specialized in the research and analysis of scientific and technical information. We provide patent landscapes and scientific state of the art with high added value to businesses and research laboratories. Our intelligence digests play a key role to define your innovation and development strategy.

1. Scope

1.1 The Contracting Parties undertake to observe the following general conditions when agreed by the Buyer and the Seller. Any additional, different, or conflicting terms and conditions in any other documents issued by the buyer at any time are hereby objected to by the seller, shall be wholly inapplicable to any sale made hereunder and shall not be binding in any way on the seller.

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1.3 Orders are deemed to be accepted only upon written acceptance and confirmation by the Seller, within [7 days] from the date of order, to be sent either by email or to the Buyer’s address. In the absence of any confirmation in writing, orders shall be deemed to have been accepted.

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BIC or SWIFT code: CCBPFRPPMAR

IBAN: : FR76 1460 7003 6360 6214 5695 139

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b) any claim attributable to errors, omissions or other inaccuracies in the Product or interpretations thereof.

4.4 All the information contained in the Products has been obtained from sources believed to be reliable. The Seller does not warrant the accuracy, completeness adequacy or reliability of such information, which cannot be guaranteed to be free from errors.

4.5 All the Products that the Seller sells may, upon prior notice to the Buyer from time to time be modified by or substituted with similar Products meeting the needs of the Buyer. This modification shall not lead to the liability of the Seller, provided that the Seller ensures the substituted Product is similar to the Product initially ordered.

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4.8 The Seller does not make any warranties, express or implied, including, without limitation, those of saleability and fitness for a particular purpose, with respect to the Products. Although the Seller shall take reasonable steps to screen Products for infection of viruses, worms, Trojan horses or other codes containing contaminating or destructive properties before making the Products available, the Seller cannot guarantee that any Product will be free from infection.

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6.2 The Buyer agreed not to disclose, copy, reproduce, redistribute, resell or publish the Product, or any part of it to any other party other than employees of its company. The Buyer shall have the right to use the Products solely for its own internal information purposes. In particular, the Buyer shall therefore not use the Product for purposes such as:

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