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Private 5G Market: 2025 – 2030 – Opportunities, Challenges, Strategies & Forecasts

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Abstracts

Private LTE networks are a well-established market and have been around for more than a decade, albeit as a niche segment of the wider cellular infrastructure sector – iNET's (Infrastructure Networks) 700 MHz LTE network in the Permian Basin, Tampnet's offshore 4G infrastructure in the North Sea, Rio Tinto's private LTE network for its Western Australia mining operations, and other initial installations date back to the early 2010s. However, private cellular networks or NPNs (Non-Public Networks) based on 3GPP-defined 5G specifications are just on the cusp of becoming a mainstream technology, with a market potential exceeding that of private LTE. Over the last 12 months, there has been a noticeable increase in production-grade deployments of private 5G networks by household names and industrial giants such as Airbus, Aker BP, Boliden, CIL (Coal India Limited), Equinor, Etihad, Ford, Hutchison Ports, Hyundai, Jaguar Land Rover, John Deere, LG Electronics, Lufthansa, Newmont, POSCO, Tesla, Toyota, and Walmart, paving the way for Industry 4.0 and advanced application scenarios.

Compared to LTE technology, private 5G networks – also referred to as 5G MPNs (Mobile Private Networks), 5G campus networks, P5G, local 5G, or e-Um 5G systems depending on geography – can address far more demanding performance requirements in terms of throughput, latency, reliability, availability, and connection density. In particular, 5G's URLLC (Ultra-Reliable, Low-Latency Communications) and mMTC (Massive Machine-Type Communications) capabilities, along with a future-proof transition path to 6G networks in the 2030s, have positioned it as a viable alternative to physically wired connections for industrial-grade communications between machines, robots, and control systems. Furthermore, despite its relatively higher cost of ownership, 5G's wider coverage radius per radio node, scalability, determinism, security features, and mobility support have stirred strong interest in its potential as a replacement for

interference-prone unlicensed wireless technologies in IIoT (Industrial IoT) environments, where the number of connected sensors and other endpoints is expected to increase significantly over the coming years.

China remains the most mature national market thanks to state-funded directives aimed at accelerating the adoption of 5G connectivity in industrial settings such as factories, warehouses, mines, power plants, substations, oil and gas facilities, and ports. To provide context, the largest private 5G installations in China can comprise hundreds to even thousands of dedicated RAN (Radio Access Network) nodes supported by on-premise or edge cloud-based core network functions depending on specific latency, reliability, and security requirements. Several Chinese private 5G adopters – including State Grid, Midea, and Wanhua Chemical – are also among the front-runners in utilizing cost-efficient 5G RedCap (Reduced Capability) modules, primarily to support video surveillance and IoT sensor use cases. In addition, some of the most technically advanced features of 5G-Advanced – 5G's next evolutionary phase – have been implemented over private wireless installations in the country. For example, steel manufacturer Baosteel is leveraging DetNet (Deterministic Networking) enhancements for real-time coordination of multiple automated processes within its factories; China Huaneng Group relies on a tri-band (700 MHz, 2.6 GHz & 4.9 GHz) 5G-Advanced network to connect a fleet of 100 autonomous electric mining trucks at its Yimin open pit coal mine in Inner Mongolia; and automaker Great Wall Motor is using an indoor 5G-Advanced network for time-critical industrial control within a car roof production line to prevent wire abrasion in mobile application scenarios – an issue that had previously resulted in production interruptions averaging 60 hours of downtime per year. Recently, Chinese mobile operators and vendors have expanded beyond their domestic market in pursuit of private 5G business opportunities abroad, from Thailand's manufacturing sector to mining in South Africa.

As end user organizations in the United States, Canada, Germany, United Kingdom, France, Japan, South Korea, Taiwan, Australia, Brazil, and other countries ramp up their digitization and automation initiatives, private 5G networks are progressively being implemented to support use cases as diverse as wirelessly connected machinery for the rapid reconfiguration of production lines, distributed PLC (Programmable Logic Controller) environments, AMRs (Autonomous Mobile Robots) and AGVs (Automated Guided Vehicles) for intralogistics, connected workers with mobile and paperless workflows, AR (Augmented Reality)-assisted guidance and troubleshooting, machine vision-based quality control, wireless software flashing of manufactured vehicles, remote-controlled cranes, unmanned mining equipment, digital twin models of complex industrial systems, virtual visits for parents to see their infants in NICUs (Neonatal

Intensive Care Units), live broadcast production in locations not easily accessible by traditional solutions, operations-critical communications during major sporting events, precision agriculture and livestock farming, BVLOS (Beyond Visual Line-of-Sight) operation of drones, ATO (Automatic Train Operation), video analytics for railway crossing and station platform safety, remote visual inspections of aircraft engine parts, real-time collaboration for flight line maintenance, XR (Extended Reality)-based training, autonomous and remote operations at military bases, and missile field communications.

With non-smartphone device availability, end user conservatism, and other teething problems continuing to wane, early adopters are affirming their faith in the long-term potential of private 5G by investing in networks built in collaboration with specialist integrators, through traditional mobile operators, or independently via direct procurement from 5G equipment suppliers – made possible by the availability of new shared and local area licensed spectrum options in many national markets. As SNS Telecom & IT highlighted last year, some private 5G installations have progressed to a stage where practical and tangible benefits – particularly efficiency gains, cost savings, and worker safety – are becoming increasingly evident. Notable examples, featuring new additions this year, include but are not limited to:

> Tesla's deployment of a private 5G network at its Gigafactory Texas facility in Austin has eliminated AGV (Automated Guided Vehicle) stoppages, previously caused by unstable Wi-Fi connections, within the 12 million square foot facility. Another private 5G implementation on the shop floor of its Gigafactory Berlin-Brandenburg plant in Germany has helped in overcoming up to 90% of the overcycle issues for a particular process in the factory's GA (General Assembly) shop. The electric automaker is integrating private 5G network infrastructure to address high-impact use cases in production, intralogistics, and quality operations across its global manufacturing facilities.
>
> Rival luxury automaker Jaguar Land Rover's installation of a private 5G network at its Solihull plant in England, United Kingdom, has established connectivity for sensors and data within the plant's five-story paint shop, which had previously been left unconnected due to the cost and complexity of wired Ethernet links. The network has also resolved Wi-Fi-related challenges, including limited device connections, poor signal penetration in the metal-heavy environment, and unstable handovers between access points along the production line.
>
> Lufthansa's private 5G network at its LAX (Los Angeles International Airport) cargo facility has resulted in a 60% reduction in processing time per item by

eliminating latency spikes and dropped connections from Wi-Fi and public cellular networks, which had previously delayed logistics operations and forced an occasional return to manual pen-and-paper processes. Another 5G campus network at the Lufthansa Technik facility in Hamburg, Germany, has removed the need for civil aviation customers to physically attend servicing by providing reliable, high-resolution video access for virtual parts inspections, and borescope examinations at both of its engine overhaul workshops. Previous attempts to implement virtual inspections using unlicensed Wi-Fi technology proved ineffective due to the presence of large metal structures.

At VINCI Airports’ Lyon-Saint Exup?ry Airport in the southeast of France, Stanley Robotics is using a standalone private 5G network to provide reliable and low-latency connectivity for autonomous valet parking robots, which have increased parking efficiency by 50%. Efforts are also underway to leverage 5G’s precise positioning capabilities to further enhance the localization accuracy of the robots' control system.

Since adopting a private 5G network for public safety and smart city applications, the southern French city of Istres has reduced video surveillance camera installation costs from $34,000 to less than $6,000 per unit by eliminating the need for ducts, civil works, and other infrastructure-related overhead costs typically associated with fiber-based connections in urban environments.

HavelPort Berlin has increased its annual weighing capacity by up to 60% through automated weighing processes managed via tablets in lorry cabs using an Open RAN-compliant private 5G network. The network also supports drone-based inventory control for bulk goods monitoring and autonomous transportation within the inland port in Wustermark (Brandenburg), Germany.

John Deere is steadily progressing with its goal of reducing dependency on wired Ethernet connections from 70% to 10% over the next five years by deploying private 5G networks at its industrial facilities in the United States, South America, and Europe. Two of the most recent deployments are at the heavy machinery giant's 2.2 million square foot Davenport Works manufacturing complex in Iowa and its Horizontina factory in Rio Grande do Sul, Brazil, which is in the midst of continued expansion. In a similar effort, automotive aluminum die-castings supplier IKD has replaced 6 miles of cables connecting 600 pieces of machinery with a private 5G network, thereby reducing cable maintenance costs to near zero and increasing the product yield rate by 10%.

Newmont's implementation of one of Australia's first production-grade private 5G networks at its Cadia gold-copper underground mine in New South Wales has enabled remote-controlled operation of its entire dozer fleet across the full 2.5 kilometer width of the mine's tailings works construction area. Previously, the mining company was unable to connect more than two machines at distances of no more than 100 meters over Wi-Fi, with unstable connectivity causing up to six hours of downtime per shift. Newmont plans to leverage private 5G connectivity to roll out more teleremote and autonomous machines in its tier-one underground and surface mines worldwide.

The U.S. Marine Corps' private 5G network at MCLB (Marine Corps Logistics Base) in Southwest Georgia has significantly improved warehouse management and logistics operations, including 98% accuracy in inventory reordering, a 65% increase in goods velocity, and a 55% reduction in labor costs. Currently under a $6 million sustainment contract for the next three years, the purpose-built 5G network was deployed to enhance automation and overcome the challenges posed by complex fiber optic installations and unreliable Wi-Fi systems in the logistics hub’s demanding physical environment.

The Liverpool 5G Create network in the inner city area of Kensington has demonstrated substantial cost savings potential for digital health, education and social care services, including an astonishing $10,000 drop in yearly expenditure per care home resident through a 5G-connected fall prevention system and a $2,600 reduction in WAN (Wide Area Network) connectivity charges per GP (General Practitioner) surgery – which represents $220,000 in annual savings for the United Kingdom's NHS (National Health Service) when applied to 86 surgeries in Liverpool.

The EWG (East-West Gate) Intermodal Terminal's private 5G network has increased productivity from 23-25 containers per hour to 32-35 per hour and reduced the facility's personnel-related operating expenses by 40% while eliminating the possibility of crane operator injury due to remote-controlled operation with a latency of less than 20 milliseconds.

NEC Corporation has improved production efficiency by 30% through the introduction of a local 5G-enabled autonomous transport system for intralogistics at its new factory in Kakegawa (Shizuoka Prefecture), Japan. The manufacturing facility's on-premise 5G network has also resulted in an elevated degree of freedom in terms of the factory floor layout, thereby allowing NEC to flexibly respond to changing customer needs, market demand fluctuations, and production adjustments.

A local 5G installation at Ushino Nakayama's Osumi farm in Kanoya (Kagoshima Prefecture), Japan, has enabled the Wagyu beef producer to achieve labor cost savings of more than 10% through reductions in accident rates, feed loss, and administrative costs. The 5G network provides wireless connectivity for AI (Artificial Intelligence)-based image analytics and autonomous patrol robots.

CJ Logistics has achieved a 20% productivity increase at its Ichiri center in Icheon (Gyeonggi), South Korea, following the adoption of a private 5G network to replace the 40,000 square meter warehouse facility's 300 Wi-Fi access points for Industry 4.0 applications, which experienced repeated outages and coverage issues.

Delta Electronics – which has installed private 5G networks for industrial wireless communications at its plants in Taiwan and Thailand – estimates that productivity per direct labor and output per square meter have increased by 69% and 75% respectively following the implementation of 5G-connected smart production lines.

Yawata Electrode has improved the efficiency of its goods transportation processes – involving the movement of raw materials, semi-completed goods, and finished products between production floors – by approximately 24% since adopting a private 5G network for autonomous mobile robots at its electrode manufacturing plant in Nakhon Ratchasima, Thailand.

An Open RAN-compliant standalone private 5G network in Taiwan's Pingtung County has facilitated a 30% reduction in pest-related agricultural losses and a 15% boost in the overall revenue of local farms through the use of 5G-equipped UAVs (Unmanned Aerial Vehicles), mobile robots, smart glasses and AI-enabled image recognition.

JD Logistics – the supply chain and logistics arm of online retailer JD.com – has achieved near-zero packet loss and reduced the likelihood of connection timeouts by an impressive 70% since migrating AGV communications from unlicensed Wi-Fi systems to private 5G networks at its logistics parks in Beijing and Changsha (Hunan), China.

Risun Group has deployed a private 5G network at its Risun Zhongran Park facility in Hohhot (Inner Mongolia), China, to provide industrial-grade wireless connectivity for both wheeled and rail-mounted transport machinery, typically measuring tens of meters in height and length. Since transitioning from Wi-Fi to private 5G, the coke producer has increased production efficiency by nearly 20% and reduced labor costs by approximately 30%.

Baosteel – a business unit of the world's largest steelmaker China Baowu Steel Group – credits its 43-site private 5G deployment at two neighboring factories with reducing manual quality inspections by 50% and achieving a steel defect detection rate of more than 90%, which equates to $7 million in annual cost savings by reducing lost production capacity from 9,000 tons to 700 tons.

Dongyi Group Coal Gasification Company ascribes a 50% reduction in manpower requirements and a 10% increase in production efficiency – which translates to more than $1 million in annual cost savings – at its Xinyan coal mine in Lvliang (Shanxi), China, to private 5G-enabled digitization and automation of underground mining operations.

Sinopec's (China Petroleum & Chemical Corporation) explosion-proof 5G network at its Guangzhou oil refinery in Guangdong, China, has reduced accidents and harmful gas emissions by 20% and 30% respectively, resulting in an annual economic benefit of more than $4 million. The solution is being replicated across more than 30 refineries of the energy giant.

Since adopting a hybrid public-private 5G network to enhance the safety and efficiency of urban rail transit operations, the Guangzhou Metro rapid transit system has reduced its maintenance costs by approximately 20% using 5G-enabled digital perception applications for the real-time identification of water logging and other hazards along railway tracks.

Although the vast majority of the networks referenced above have been built using 5G equipment supplied by traditional wireless infrastructure players – from incumbents Ericsson, Nokia, Huawei, and ZTE to the likes of Samsung and NEC – alternative suppliers are continuing to gain traction in the private 5G market. Noteworthy examples include Celona – whose 5G LAN solution has been deployed by over 100 customers; Globalstar – which has developed a 3GPP Release 16-compliant multipoint terrestrial RAN system optimized for dense private wireless deployments in Industry 4.0 automation environments; Airspan Networks – a well-known Open RAN and small cell technology provider; Mavenir – an end-to-end provider of Open RAN and converged packet core solutions; GXC – a private cellular technology provider recently acquired by Motive Companies; Baicells – a 4G and 5G NR access equipment manufacturer; JMA Wireless – an American RAN equipment vendor; HFR Mobile – the private 5G business unit of Korean telecommunications equipment maker HFR; Ataya – a private 5G startup focused on unifying and simplifying enterprise connectivity; Moso Networks – a U.S.-based provider of private 5G radio products backed by Taiwanese small cell pioneer Sercomm; Abside Networks – an American manufacturer of military-grade 5G infrastructure; Radisys – a RAN software vendor for many private network deployments; Druid Software – whose mobile core platform has been deployed for private networks worldwide; HPE (Hewlett Packard Enterprise) – which is transitioning from a mobile core specialist to end-to-end private 5G network provider; Cisco Systems – a mobile core and transport network technology provider for both public and private 5G networks; Pente Networks – a mobile core and orchestration solution provider; Highway 9 Networks – which has developed a cloud-based platform to simplify private 5G deployments; Neutroon Technologies – another private 5G orchestration specialist; Qucell – a Korean manufacturer specializing in 5G small cell equipment; Askey Computer – a Taiwanese telecommunications equipment manufacturer; QCT (Quanta Cloud Technology) – a Taiwanese data center and 5G solutions provider; G REIGNS – a business unit of HTC specializing in portable private 5G network solutions; Pegatron – a Taiwanese manufacturer that has recently entered the Open RAN-compliant 5G infrastructure market; AsiaInfo Technologies – a Chinese provider of lightweight mobile core software and end-to-end private 5G solutions; Siemens – which has developed an in-house private 5G network solution for use at its own plants as well as those of industrial customers; Firecell – a French startup specializing in industrial-grade private 5G solutions; CampusGenius – which has developed a customizable 5G core solution for small and medium-sized enterprises; Blackned – a German developer of tactical core middleware for defense communications; Cumucore – a provider of mobile core software for private networks; Accelleran – a Belgian provider of Open RAN software solutions; IS-Wireless – a Polish Open RAN software vendor; Benetel – an Irish Open RAN radio developer; and Wireless Excellence – a British 5G equipment vendor.

SNS Telecom & IT projects that annual investments in private 5G networks for vertical industries will grow at a CAGR of approximately 41% between 2025 and 2028, eventually surpassing $5 billion by the end of 2028. Much of this growth will initially be driven by highly localized 5G networks covering geographically limited areas for Industry 4.0 applications in manufacturing and process industries. Industrial giants experiencing patchy Wi-Fi coverage, cabling-related inflexibility, and network scalability limitations at their facilities are championing the private 5G movement for local area networking. Additionally, sub-1 GHz wide area critical communications networks for public safety, utility, and railway communications are anticipated to accelerate their transition from LTE, GSM-R, and other legacy narrowband technologies to 5G towards the latter half of the forecast period, as 5G-Advanced technology reaches commercial maturity. Among other features for mission-critical networks, 3GPP Release 18 – which defines the first set of 5G-Advanced specifications – adds support for 5G NR equipment operating in dedicated spectrum with less than 5 MHz of bandwidth, paving the way for private 5G networks operating in sub-500 MHz, 700 MHz, 850 MHz, and 900 MHz bands for public safety broadband, smart grid modernization, and FRMCS (Future Railway Mobile Communication System).

The “Private 5G Market: 2025 – 2030 – Opportunities, Challenges, Strategies & Forecasts” report presents an in-depth assessment of the private 5G network market, including the value chain, market drivers, barriers to uptake, enabling technologies, operational and business models, vertical industries, application scenarios, key trends, future roadmap, standardization, spectrum availability and allocation, regulatory landscape, case studies, ecosystem player profiles, and strategies. The report also presents global and regional market size forecasts from 2025 to 2030. The forecasts cover three infrastructure submarkets, 16 vertical industries, and five regional markets.

The report comes with an associated Excel datasheet suite covering quantitative data from all numeric forecasts presented in the report, as well as a database of over 8,300 global private cellular engagements – including more than 3,700 private 5G installations – as of Q3’2025.

Topics Covered

The report covers the following topics:

Introduction to private 5G networks

Value chain and ecosystem structure

Market drivers and challenges

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System architecture and key elements of private 5G networks

Operational and business models, network size, geographic reach, and other practical aspects of private 5G networks

Industry 4.0-driven wireless connectivity requirements, critical communications broadband evolution, enterprise transformation, and other themes shaping the adoption of private 5G networks

Enabling technologies and concepts, including 3GPP-defined URLLC, TSC, DetNet, NR-U, SNPN and PNI-NPN, MCX, RedCap/eRedCap, cellular IoT, high-precision positioning, network slicing, edge computing, and network automation capabilities

Key trends such as the emergence of new classes of specialized network operators, shared and local area spectrum licensing, private NaaS (Network-as-a-Service) offerings, IT/OT convergence, Open RAN, vRAN, and rapidly deployable 5G systems

Analysis of vertical industries and application scenarios such as reconfigurable wireless production lines, collaborative mobile robots, autonomous transport systems, untethered AR/VR/MR (Augmented, Virtual & Mixed Reality), UHD (Ultra High-Definition) video transmission, machine vision, digital twins, and mission-critical group communications

Future roadmap of private 5G networks

Review of private 5G network installations worldwide, including 125 case studies spanning 16 verticals

Database tracking more than 3,700 private 5G installations in over 60 countries across the globe

Spectrum availability, allocation, and usage across the global, regional, and national domains

Standardization, regulatory, and collaborative initiatives

Profiles and strategies of more than 1,800 ecosystem players

Strategic recommendations for 5G equipment and chipset suppliers, system integrators, private network specialists, mobile operators, and end user organizations

Market analysis and forecasts from 2025 to 2030

Forecast Segmentation

Market forecasts are provided for each of the following submarkets and their subcategories:

Infrastructure Submarkets

- 5G NR RAN (Radio Access Network)
  - Base Station RUs (Radio Units)
  - DUs/CUs (Distributed & Centralized Baseband Units)
- 5GC (5G Core)
  - UPF (User Plane Function)
  - Control Plane Functions
- 5G Transport (Fronthaul, Midhaul & Backhaul)
  - Fiber & Wireline
  - Microwave
  - Satellite Communications

Cell Sizes

Small Cells

Indoor

Outdoor

Macrocells

Frequency Ranges

Sub-6 GHz

mmWave (Millimeter Wave)

End User Markets

Vertical Industries

Agriculture

Aviation

Broadcasting

Construction

Education

Forestry

Healthcare

Manufacturing

Military

Mining

Oil & Gas

Ports & Maritime Transport

Public Safety

Railways

Utilities

Warehousing & Others

Offices, Buildings & Public Venues

Regional Markets

North America

Asia Pacific

Europe

Middle East & Africa

Latin & Central America

Key Questions Answered

The report provides answers to the following key questions:

How big is the private 5G network opportunity?

What trends, drivers, and challenges are influencing its growth?

What will the market size be in 2028 and at what rate will it grow?

Which submarkets, verticals, and regions will see the highest percentage of growth?

What is the status of private 5G network adoption in each country and what are the primary application scenarios of these networks?

How is private 5G connectivity facilitating the digital transformation of agriculture, manufacturing, mining, oil and gas, transportation, utilities, warehousing, and other vertical industries?

What are the practical and quantifiable benefits of private 5G networks in terms of productivity improvement, cost reduction, and worker safety?

What are the key characteristics of standalone private 5G connectivity and when will URLLC, TSC, RedCap/eRedCap, and other 3GPP-defined IIoT features be widely employed?

Where does network slicing for differentiated service requirements fit in the private cellular networking space?

How can private edge computing accommodate latency-sensitive applications while enhancing data sovereignty and security?

What are the existing and candidate frequency bands for the operation of private 5G networks?

How are CBRS and other coordinated shared/local spectrum licensing frameworks accelerating the uptake of private 5G networks?

What are the prospects of private 5G networks operating in mmWave spectrum?

What is the outlook for 5G NR-U (NR in Unlicensed Spectrum) deployments?

How do private 5G networks compare with Wi-Fi 6/6E/7 systems in industrial settings?

When will sub-1 GHz critical communications LTE networks begin their transition to 5G technology?

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How can satellite backhaul and direct-to-device NTN access expand the reach of private 5G networks in remote environments?

How are telecommunications infrastructure giants, national mobile operators, and other incumbents asserting their presence in the private 5G market?

What opportunities exist for managed private 5G service providers, neutral host operators, global system integrators, hyperscalers, and other new entrants?

Who are the key ecosystem players and what are their strategies?

What strategies should 5G equipment suppliers, system integrators, private network specialists, and mobile operators adopt to remain competitive?

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