

Private 5G in Korea 2023

Private 5G spectrum has been available in South Korea since 2021, and since 2022, numerous organizations have begun to deploy private 5G networks for their digital transformation.

In Korea, 48 sites have built the private 5G networks as of December 2023.

The present status of private 5G network deployment in Korea, major applications, and private 5G network architecture are all examined in this research.

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2023.03.14

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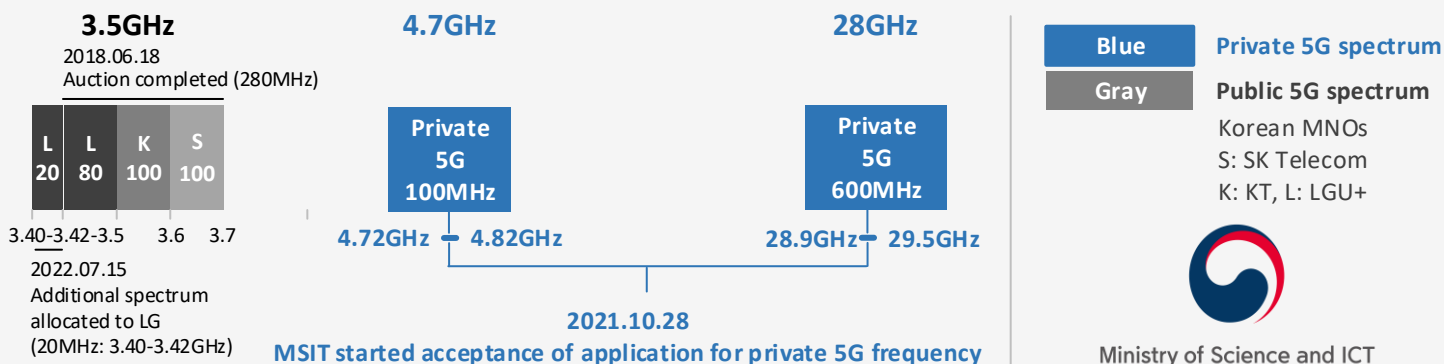
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Private 5G Frequency Allocation Status in Korea



On October 28, 2021, the South Korean government (Ministry of Science and ICT: MSIT) started offering private 5G frequencies (100MHz@4.7GHz, 600MHz@28GHz) in an effort to deploy private 5G, a crucial infrastructure for enterprises' digital transformation, across a variety of industries in South Korea.



This private 5G frequencies provided by the MSIT can be used in two ways.

- 1. Private 5G Operator:** Approved by MSIT as a private 5G common carrier and assigned private 5G frequencies by MSIT to provide private 5G network services to enterprise customers.
- 2. Enterprise DIY:** Enterprises are assigned private 5G frequencies by MSIT to build their own private wireless networks.

Mobile network operators (SK Telecom, KT, and LG U+) in South Korea are not permitted to become private 5G operators. Because of antitrust issues, the government has barred MNOs from operating as private 5G operators.

1. Private 5G Operator	Customer Location	Private 5G Frequency	Date*	5G Vendor
POSCO DX	POSCO Gwangyang Steel Plant (Gwangyang)	4.7GHz (100MHz)	'23.09.11	
	Customer's Logistics Center (Incheon)	4.7GHz (100MHz)	'23.10.04	
LG Electronics	LG Digital Park (Pyeongtaek)	4.7GHz (100MHz)	'23.06.27	
	Riman Korea (Daegu)	4.7GHz (100MHz)	'23.06.27	Nokia
LS Electric	LS Electric Cheonan Factory (Cheonan)	4.7GHz (100MHz)	'23.05.02	
Hyundai Autoever	Hyundai R&D Center (Uiwang)	4.7GHz (100MHz)	'23.05.02	
Newgens	Daeduk University (Daejeon)	4.7GHz (100MHz), 28GHz (600MHz)	'23.09.25	Ericsson
	Lotte World (Seoul), Newgens Building (Anyang)	4.7GHz (100MHz), 28GHz (600MHz)	'22.11.28	Ericsson
Wizcore	Yonsei University (Seoul)	4.7GHz (100MHz)	'23.05.02	
	Wi.lab (YongIn)	4.7GHz (100MHz)	'22.10.28	Ericsson
Sejong Telecom	HD Hyundai Heavy Industries, Hyundai Mipo Dockyard (Ulsan)	4.7GHz (100MHz)	'23.10.04	
	TLB cluster (Banwolshihwa Industrial Complex)	4.7GHz (100MHz)	'22.10.06	Samsung
KT MOS	Private 5G Convergence Testbed (Daegu)	4.7GHz (100MHz)	'23.12.28	HFR
	Samsung Medical Center (Seoul)	4.7GHz (100MHz), 28GHz (600MHz)	'23.09.25	Samsung
	Seoul National University Bundang Hospital (Bundang)	4.7GHz (100MHz), 28GHz (600MHz)	'22.10.06	Nokia
CJ Olive Networks	Samsung Medical Center (Seoul)	4.7GHz (100MHz), 28GHz (600MHz)	'22.10.06	Samsung
	CJ Logistics Icheon Distribution Center (Icheon)	4.7GHz (100MHz)	'23.05.02	Ericsson
Nable Communications	CJ Songdo IDC (Incheon)	4.7GHz (100MHz), 28GHz (600MHz)	'22.08.30	
	Nable Communications H/Q (Seongnam)	4.7GHz (100MHz)	'23.05.02	
SK networks service	Ewha womans university medical center (Seoul)	4.7GHz (100MHz)	'22.08.10	Samsung
	Aviation Industrial Complex (Sacheon)	4.7GHz (100MHz)	'24.01	HFR
	Smart Agricultural Products Processing Center (Iksan)	4.7GHz (100MHz)	(planned)	HFR
	Gyeongnam RobotLand Foundation (Changwon), Foodpolis: Korea National Food Cluster (Iksan)	4.7GHz (100MHz)	'22.11.28	Flectory
LG CNS	Central's Changwon Factory (Changwon)	4.7GHz (100MHz), 28GHz (400MHz)	'22.05.26	Ericsson
	Kyung Hee Univ. (Global Campus in Yongin)	4.7GHz (100MHz)	'22.12.22	
	Add 2 factories	4.7GHz (100MHz)	'22.06.03	
Naver Cloud	LG Innotek Gumi Factory 2 (Gumi)	4.7GHz (100MHz), 28GHz (500MHz)	'22.03.31	
	The 2nd head office building of Naver (Bundang)	4.7GHz (100MHz), 28GHz (600MHz)	'21.12.28	Samsung

* Private 5G frequency acquisition date

Private 5G Frequency Allocation Status in Korea



2. Enterprise DIY	Customer Location	Private 5G Frequency	Date*	5G Vendor
ETRI	ETRI Campus (Daejeon)	4.7GHz (100MHz)	'23.10.04	
Coontec	Coontec H/Q (Seongnam)	4.7GHz (100MHz)	'23.06.08	NextEPC
CAMTIC	CAMTIC (Jeonju)	4.7GHz (100MHz)	'23.02.xx	
LG Electronics	LG Digital Park (Pyeongtaek)	4.7GHz (100MHz)	'22.12.22	
Government Building Management Office	Government Complex Sejong (Sejong)	4.7GHz (100MHz)	'22.12.22	
KAI	Jongpo Business Site (Sacheon)	4.7GHz (100MHz)	'22.12.22	Nokia
UANGEL	UANGEL H/Q (Bundang)	4.7GHz (100MHz)	'22.11.28	UANGEL
KHNP (Energy)	Hanul Nuclear Power Plant (Uljin)	4.7GHz (100MHz)	'22.11.28	HFR
K-Water	Busan Echo Delta Smart Village (Busan)	4.7GHz (100MHz)	'22.10.28	Samsung
KT	KT Research and Development Center (Seoul)	4.7GHz (100MHz)	'22.10.06	Nokia
Republic of Korea Navy	ROK Joint Chiefs of Staff	4.7GHz (100MHz)	'23.06.22	
	Republic of Korea Navy Headquarters (Gyeryong)	4.7GHz (100MHz)	'22.10.06	Nokia
KEPCO (Energy)	Shin-Jungbu Substation (Cheongju)	4.7GHz (100MHz)	'22.10.06	Samsung

* Private 5G frequency acquisition date

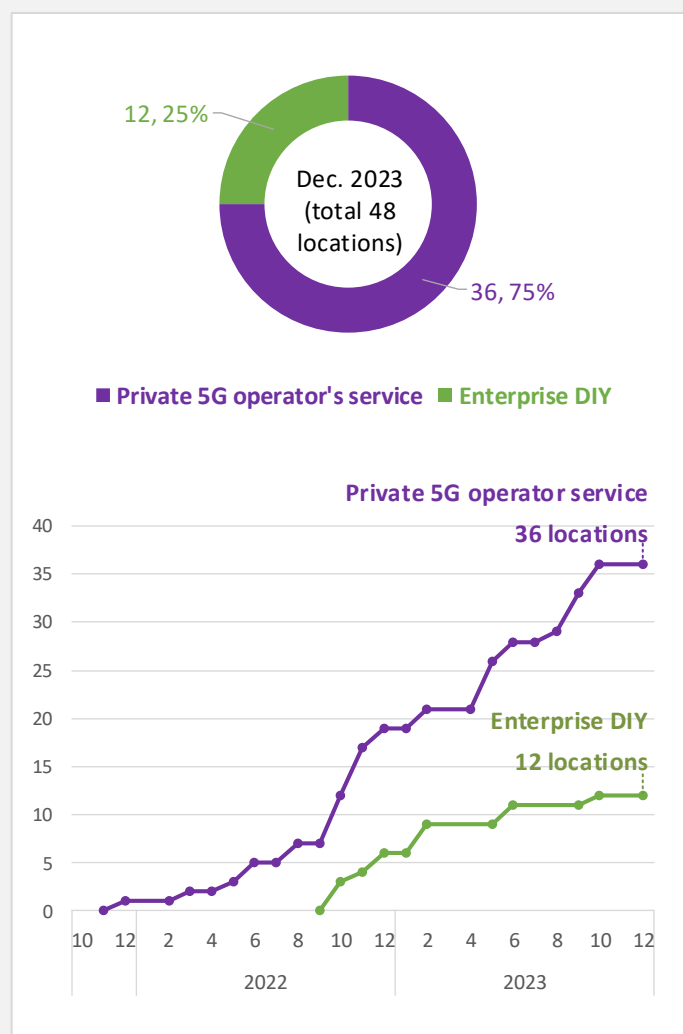
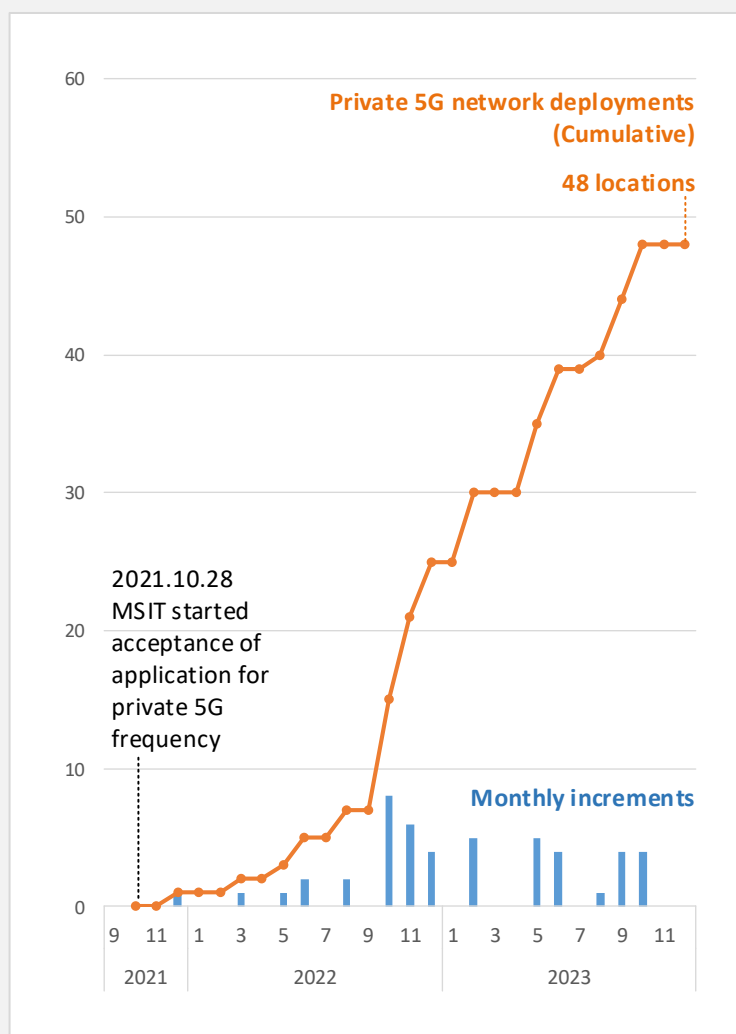
KAI: Korea Aerospace Industries

KHNP: Korea Hydro & Nuclear Power

K-Water: Korea Water Resources Corporation

KEPCO: Korea Electric Power Corporation

In Korea, there is an increasing trend in the number of businesses that have implemented private 5G networks at their premises.



Primary Use Cases of Private 5G deployments in Korea



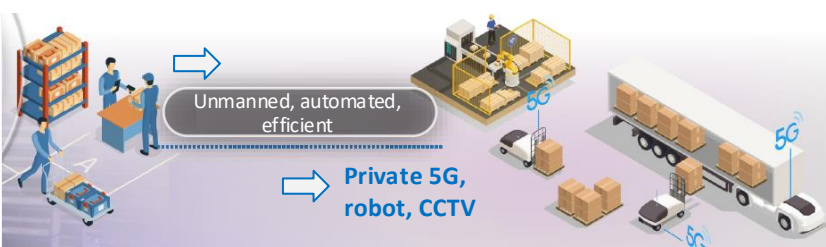
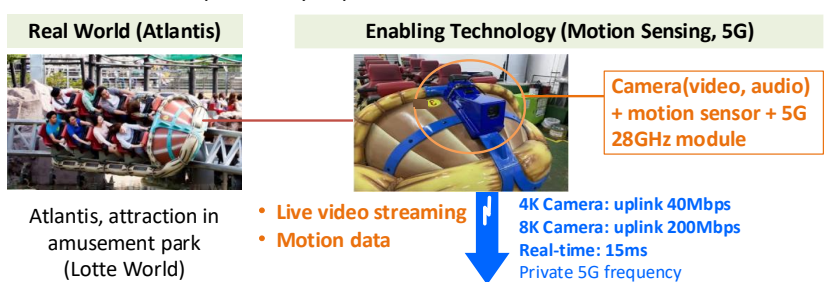
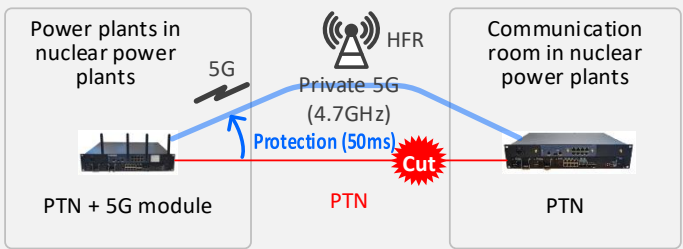
In South Korea, private 5G spectrum became available in late 2021, and private 5G networks have been deployed in various industries since 2022. Various digital transformation applications based on private 5G networks are emerging and we will summarize them.

Enterprises	Sector	Primary Use Cases	Connected Devices	Date	Ecosystem
Hyundai Mipo Dockyard	Shipbuilding	<ul style="list-style-type: none"> [uplink] Remote monitoring (tens of 4K CCTV cameras on 6 Goliath cranes) + AI video analytics [downlink] Transferring large amounts of data to tablet (3D drawings, Visual 3D process management) 	CCTV, Tablet [4.7GHz]	2023 10.04	Sejong Telecom (SP), Nokia (V)
Logistics Center at Incheon	Logistics	Smart logistics service that allows autonomous mobile robots (AMRs) to load goods to be shipped from storage shelves, deliver the goods to inspection stations	AMR [4.7GHz]	2023 10.04	LG Electronics (SP)
ETRI	Research Institute	Intelligent search for missing persons through autonomous flight of swarm drones, crop control and growth management, and inspection of wireless stations in mountainous areas.	Drone swarm [4.7GHz]	2023 10.04	
Daeduk University	Training	Military (combat) training based on realistic virtual augmented reality using 28 GHz at Daeduk University's Military Training Experience Center	VR headset [4.7GHz, 28GHz]	2023 09.25	Newgens (SP)
Samsung Medical Center	Healthcare	In 2022, Samsung Medical Center utilized 5G in the 28 GHz band to provide realistic medical training services such as remote collaborative surgery. This time, the service will be expanded to include pediatric and adolescent wards, ophthalmology and ENT wards, and urology faculty rooms, and will actively utilize the 28GHz band for rounds of education for medical students.	Robot, camera [4.7GHz, 28GHz]	2023 09.25	KT MOS (SP), Samsung (V)
POSCO Gwangyang Steel Plant	Steel	Automate operations and manage worker safety by linking autonomous locomotives and railroad control systems based on a private 5G network.	Camera, Lidar [4.7GHz]	2023 09.11	POSCO DX (SP)
Riman Korea	Logistics	Intelligent logistics system that transmits CCTV images and sensor data to the cloud through a private 5G network and analyzes them with cloud AI	CCTV, sensor [4.7GHz]	2023 06.27	Megazone Cloud (SP), Nokia (V)
LG Digital Park	Manufacturing	CCTV, AMR, and Cloud AI testbed based on private 5G network	CCTV, AMR [4.7GHz]	2023 06.27	LG Electronics (SP)
Hyundai R&D Center	Manufacturing	Hyundai Autoever built an automobile production performance testbed at Hyundai Motor's Uiwang Research Center that combines various technologies such as AI, AMR, and AR with a private 5G network.	AMR, CCTV, quadruped robots, AR glass [4.7GHz]	2023 05.02	Hyundai Autoever (SP)
LS Electric Cheonan Factory	Factory	LS ELECTRIC has built an intelligent factory to manufacture factory automation control devices using CCTV, robots, sensors, and private 5G at LS Electric Cheonan Factory.	CCTV, robot, sensor [4.7GHz]	2023 05.02	LS Electric (SP)

SP: Private 5G Service Provider, V: Vendor)

Primary Use Cases of Private 5G deployments in Korea



Enterprises	Sector	Primary Use Cases	Connected Devices	Date	Ecosystem
CJ Logistics Icheon Fulfillment Center	Logistics	Use a private 5G-enabled PDA or tablet to scan boxes, pick items, and manage shipping and receiving. 	PDA, Tablet, AMR/AGV, packaging robot, CCTV [4.7GHz]	2023 05.02	CJ Olive Networks (SP), Ericsson (V)
KAI Jongpo Business Site	Defense	A private 5G network is used to digitize aviation manufacturing processes such as next-generation fighter jets (KF-21)	Tablet [4.7GHz]	2022 12.22	Nokia (V)
Government Complex Sejong	Government	Integrated building management through the operation of patrol robots, IoT sensors and intelligent cameras using private 5G networks.	Camera, sensor, robot [4.7GHz]	2022 12.22	
Kyung Hee University	R&D	A system for real-time prediction and maintenance of motor conditions in the factory: Kyung Hee University will conduct an empirical experiment to collect data such as current, temperature, and vibration from motors mounted on robots and conveyor belts in smart factories and analyze them with AI. The main role of the solution is to analyze the data to detect abnormal patterns in advance and diagnose motor failures in advance.	IoT sensor [4.7GHz]	2022 12.22	LG CNS (SP)
Lotte World Amusement park	Amusement park	Newgens built a 28GHz private 5G network in the area where the Atlantis attraction is located in Lotte World, and Lotte World will provide an immersive parallel reality experience service using motion sensors, cameras, and motion simulators. The use of private 5G technology in the 28GHz band enabled real-time large-capacity video (4K: uplink 40Mbps, 8K: 200Mbps) and motion data transmission of rides, which was previously impossible with conventional Wi-Fi. 	Camera and motion sensor at Atlantis attraction [4.7GHz, 28GHz]	2022 11.28	Newgens (SP), Ericsson (V)
Korea Hydro & Nuclear Power	Energy	① Transmission equipment redundancy: Automatically switches to the private 5G network when the wired network between the main communication room and the power plant is disconnected. Automatic switching within 50ms ② Emergency command communication (MC-PTT): Uses the private 5G network as a stand-alone, autonomous command network for the Hanul nuclear power plant in the event that the commercial mobile communication network is down. 	Transport equipment and 5G router in one, 360° Camera, PTT terminal [4.7GHz]	2022 11.28	HFR (V)
UANGEL H/Q	R&D	Private 5G testbed (Intelligent Factory, Collaborative Robots)	Camera, robot [4.7GHz]	2022 11.28	UANGEL (SP)

Primary Use Cases of Private 5G deployments in Korea



Enterprises	Sector	Primary Use Cases	Connected Devices	Date	Ecosystem
Korea National Food Cluster	Logistics	<p>AI-based Robotic Logistics Transportation Solution</p> <p>Vision AI scans and identifies irregularly shaped and differently sized boxes on the conveyor with a 3D camera, calculates the path of the robot arm to move the boxes on the conveyor to the pallet, and delivers it to the robot. The 3D camera scan data and robot control commands are transmitted through a private 5G network.</p> <p>It is expected to reduce the labor load of warehouse workers engaged in the logistics industry and improve stability and productivity through automation and unmanned operation of high-intensity simple labor in the logistics system. It can replace manual labor and operate 24 hours a day, 365 days a year.</p>	Picking robot, 3D camera [4.7GHz]	2022 11.28	SK networks (SP), Flectory (5G core), Innwireless (5G smallcell)
					
Busan Echo Delta Smart Village	Energy	Implementation of an intelligent water purification plant virtual model linking intelligent CCTV and IoT sensors.	Camera, IoT sensor [4.7GHz]	2022 10.28	Samsung (V)
Seoul National University Bundang Hospital	Healthcare	<p>Autonomous self-driving electric wheelchair, AMR (unmanned transport of medical materials/drugs/linen), Smart simulation (3D camera)</p> 	Camera, sensor, robot [4.7GHz, 28GHz]	2022 10.06	KT MOS (SP), Samsung (V)
Samsung Medical Center	Healthcare	<p>5G-based remote surgical training</p> <p>The surgeon's operation room is captured utilizing high-definition immersive video such as AR glasses, an endoscope, and a 360-degree camera, and then streamed to a medical education platform through a private 5G network.</p> <p>In the professor's office, a specialist watches the video and guides the surgery (remote cooperative surgery). Students in the seminar room can see the live surgical video while also learning from the specialist's guidance (real-time remote surgical training).</p>	360° camera, AR glass [4.7GHz, 28GHz]	2022 10.06	KT MOS (SP), Samsung (V)
					
KT R&D Center	R&D	Validate solutions for services such as robots, security, and control	Robot, gate, 5G office [4.7GHz]	2022 10.06	Nokia (V)

Primary Use Cases of Private 5G deployments in Korea

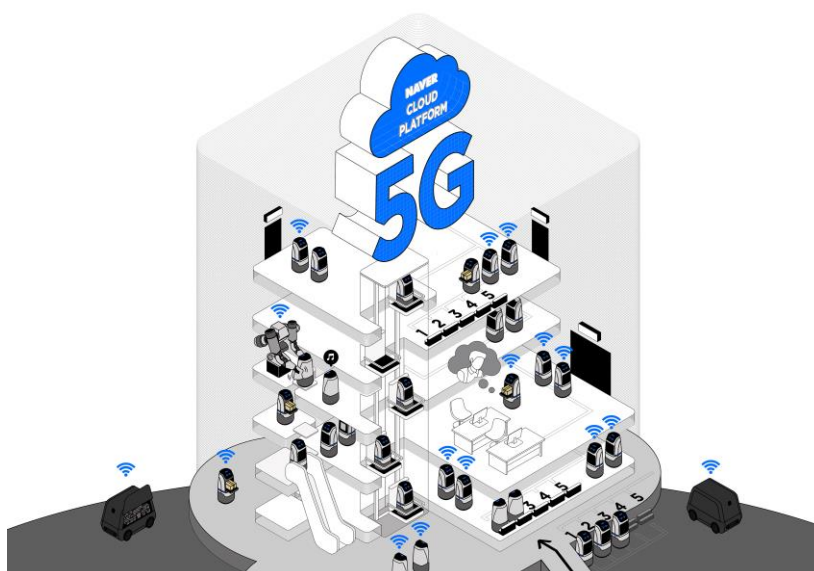


Enterprises	Sector	Primary Use Cases	Connected Devices	Date	Ecosystem
Shin-Jungbu Substation	Energy	<p>① IoT-based predictive maintenance Partial discharge sensor, bushing sensor</p> <p>② Maintenance inspection using quadruped robots</p> <p>GIS: Gas Insulated Switchgear M.TR: Main Transformer</p>	IoT sensor, quadruped robot [4.7GHz]	2022 10.06	Samsung (V)
TLB Cluster	Manufacturing	<p>Industrial safety services prevent various accidents such as workers entering the workplace without protective gear, harmful gas leaks, and overloading or speeding of mobile equipment in the workplace.</p> <p><Predictive Maintenance> Predict equipment malfunctions and failures and estimate useful life Real-time monitoring: Collect real-time current, voltage, and ground fault current data (0.1 second intervals)</p> <p><Geo-fencing> Live streaming (HFD, 60fps)</p>	Camera, IoT sensor [4.7GHz]	2022 10.06	Samsung (V)
Republic of Korea Navy Headquarters	Defense	<p>① Unmanned patrol A driverless autonomous vehicle patrols predefined routes and sends real-time driving information (location coordinates, vehicle status) and outside-vehicle video to the autonomous driving control system on the MEC through a private 5G network. The system displays the vehicle's location, vehicle status, and outside-vehicle video on the monitoring screen.</p> <p>② Remote driving If an emergency occurs during an unmanned patrol, the driving mode is switched from autonomous driving to remote driving. For example, if AI Vision detects birds, the remote driver in the remote cockpit drives the vehicle to the bird infestation area, and the vehicle emits ultrasonic waves to repel the birds (the bird repeller is mounted on the vehicle).</p> <p>③ AI Vision CCTV camera video is streamed in real time over a private 5G network to the AI Vision application on the MEC, which detects birds, fires, and access to unauthorized areas and sends an alarm to the monitoring and control center.</p>	Autonomous vehicle, camera [4.7GHz, 28GHz]	2022 10.06	Nokia (V)

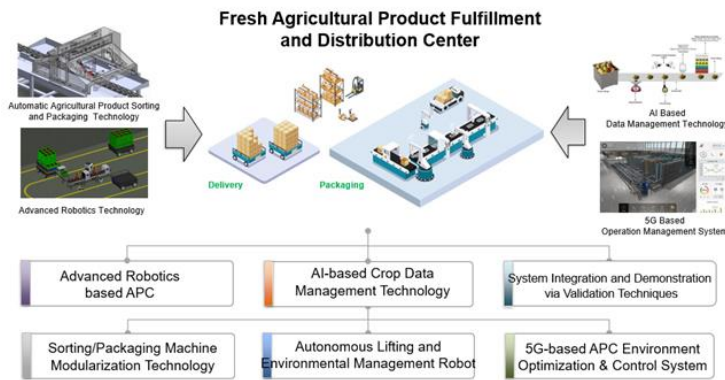
Primary Use Cases of Private 5G deployments in Korea



Enterprises	Sector	Primary Use Cases	Connected Devices	Date	Ecosystem
CJ Songdo IDC	R&D	Testing the performance of private 5G in the fields of smart logistics, entertainment, and media, and promoting the business of providing corporate-customized wireless networks to CJ Group affiliates and external industrial sites.	Robot, drone, AR/VR [4.7GHz, 28GHz]	2022 08.30	CJ Olive Networks (SP)
Ewha womans university medical center	Healthcare	<p>Customized surgical AR guide for each patient using augmented reality: 3D scanning and modeling of the patient's body</p> <p>Real-time non-face-to-face collaboration service: Sharing of medical images in the limited operating room space to medical staff in the hospital</p>	Tablet, Camera [4.7GHz]	2022 08.10	Nable Communications (SP), Samsung (V)
<p>Operating room</p> <p>4.7GHz Samsung Private 5G</p> <p>3D modeling of CT/MRI data</p>					
Central's Changwon Factory	Factory	SK networks service automates factory logistics by operating autonomous mobile robots (AMR) and provides digital twin-based management and control services to monitor and simulate real-time manufacturing processes to realize a flexible production system.	AMR [4.7GHz, 28GHz]	2022 05.26	SK networks (SP), Ericsson (V)
LG Innotek Gumi Factory 2	Factory	Inspection of defective products through AI vision camera, operation of unmanned guided vehicles, provision of VR/AR drawings to workers	Camera, AMR [4.7GHz, 28GHz]	2022 03.31	LG CNS (SP)
The 2nd head office building of Naver	Office	<p>5G Brainless Robot: Cloud-based autonomous driving robot powered by a 5G private network</p> <ul style="list-style-type: none"> - High-performance processing such as indoor positioning, object recognition, and avoidance control is not performed in the robot, but is processed in the cloud through a private 5G network with ultra-low latency. - Since the robot has fewer processing units, it lowers manufacturing costs and runs longer with less battery consumption. 	Robot [4.7GHz, 28GHz]	2021 12.28	Naver Cloud (SP), Samsung (V)



Private 5G News in Korea: 2023



HFR builds Private 5G Network for "Smart Agricultural Product Distribution and Storage Technology Development Project"

2023.12.14 | By NETMANIAS
(tech@netmanias.com)

Related Companies



HFR, a communication equipment company, announced that it has built a private 5G network for the "Smart Agricultural Product Distribution and Storage Technology Development Project" (Lime CSI, Easepark, Ucast, RANET, Yujin Robot, Korea Robotics Convergence Institute) organized by the Korea Communications Agency (KCA).

This project aims to build and demonstrate an Agricultural Products Processing Center (APC) that enables distributed operations for multi-variety crops by developing automatic sorting and packaging management technologies for agricultural products using robots, sensing, autonomous driving, and 5G.

The first phase is to develop automatic agricultural product sorting and packaging management technology for smart APCs from 2022 to 2023, and to develop optimization and control technology for the operating environment in APCs using 5G technology.

The second phase will promote modularization and commercialization of unit technologies and products through system integration verification and demonstration, technology

advancement and stabilization from 2024 to 2026.

In this project, HFR built a private 5G network solution based on its own technology in Iksan, Jeollabuk-do, and completed performance test certification by an accredited testing laboratory in October.

A KCA official said, "By utilizing the private 5G network built in Iksan, Jeollabuk-do to automate facilities and control robots, we will derive analysis verification and improvement measures, and promote verification and development support for 5G convergence services, which will be used in the future in the fields of smart manufacturing and concentrated food."

"HFR emphasized that private 5G networks are the key to building communication infrastructure in the domestic industrial ecosystem as part of the government's policy, and HFR hopes that the private 5G built in Iksan, Jeollabuk-do will serve as a base for the Honam region and expand to many businesses in the future through the supply of high-quality private 5G networks as a digital innovation (DX) partner for SMEs and public institutions," said Cho Bum-geun, head of HFR. ■



Private 5G to control Dozens of Robots in Warehouses - MSIT allocates Private 5G Spectrum for Warehouses and Shipyards

2023.10.04 | By NETMANIAS
(tech@netmanias.com)

Related Companies



The Ministry of Science and ICT (MSIT) announced on October 4 that it has completed the process of supplying private 5G spectrum to LG Electronics, Sejong Telecom, and ETRI. The private 5G network will be utilized for simultaneous control of dozens of robots at logistics sites and process and safety management at shipyards.

LG Electronics plans to use private 5G spectrum to operate dozens of autonomous robots (AMRs) at a customer's logistics center in Incheon. This will provide a smart logistics service in which autonomous robots will load goods to be shipped from storage stand and move them to inspection stand to deliver goods.

In response to the demand for various customized 5G services, LG Electronics said it will consider introducing private 5G in the 28 GHz band for large-capacity ultra-connected services that deliver high-precision images from multiple robots and cameras.

Sejong Telecom plans to provide large-capacity data transmission services to HD Hyundai Heavy Industries and Hyundai Mipo

Shipbuilding in Ulsan using private 5G frequencies.

Through this, 3D drawings can be transmitted and viewed on personal terminals, and the current status of all processes, safety, logistics, quality, materials, etc. in the workshop can be visualized.

In addition, it is expected to improve work efficiency and safety by providing integrated control services by transmitting work crane operation information in real time through a private 5G network.

ETRI plans to demonstrate services such as intelligent search for missing persons, crop control and growth management, and inspection of wireless stations in mountainous areas through autonomous flight of clustered drones.

"It is impressive that private 5G technology can be used to improve utilization efficiency at logistics sites and identify shipyards at a glance," said Choi Woo-hyuk, head of MSIT's Radio Policy Bureau. "We will actively support the spread of private 5G to various industrial sites to provide large-capacity ultra-connected services" ■

Private 5G News in Korea: 2023



HFR leads 6G Global Standardization as Co-chair of the Open RAN Industry Alliance

2023.08.23 | By NETMANIAS
(tech@netmanias.com)

Related Companies



Leading the Open RAN Market through Participation in the Open RAN Industry Alliance

HFR, Inc. (KOSDAQ 230240), a leading telecommunications equipment manufacturer, today announced it is participating in the Open RAN Industry Alliance (ORIA) as a co-chairman.

ORIA is a recently launched public-private consultant body by the South Korean government and prominent leaders in the mobile industry to strengthen national competitiveness in the area of Open RAN. ORIA endeavors to create a global collaborative ecosystem by encouraging domestic Open RAN technology and product development while providing influence over international standards.

A total of 30 companies, including 11 co-chaired companies such as HFR, Samsung Electronics, LG Electronics, KT, and SKT, and 19 member companies at home and abroad, will participate in this alliance.

Open RAN is a technology that standardizes the interface of mobile network equipment to increase compatibility among equipment

from different manufacturers. Through this, the fronthaul interface is opened, and the RAN section is virtualized based on software.

In this way, a new mobile network can be built and operated with an AI based RIC (RAN Intelligent Controller). As technologically advanced countries have recently established policies for introducing Open RAN, it is now recognized as a major paradigm in the mobile telecommunications market.

HFR has Baseband (vCU/DU) software and O-RAN Radio Units (O-RU) that support Virtualized Radio Access Network (vRAN) for private 5G networks. These products can resolve hardware dependency and utilize radio units from various domestic and foreign suppliers whose products are based on Open RAN technology.

Jung HaeKwan, Head of HFR's Private 5G Business Group said, "We will actively contribute to improving wireless network technology and vitalizing the ecosystem through participation in the public-private joint Open RAN Industry Alliance (ORIA)." He added, "We will do our best to become a global leader in the upcoming 5G/6G market." ■



KT and HFR collaborate to expand the Private 5G Business Area

2023.07.18 | By NETMANIAS
(tech@netmanias.com)

Related Companies



The two companies will jointly create a program to deploy private 5G networks in small and medium-sized enterprises, local governments, and public enterprises to demonstrate the effectiveness of introducing digital transformation (DX) solutions in advance.

By doing so, the companies expect to provide customers with a reliable and competitive way to introduce private 5G and transform the private 5G ecosystem toward domestic equipment manufacturers.

It is also expected to provide fast DX launch support for customers who have deployed or are considering deploying private 5G networks.

"We will contribute to the development of industry and society by providing economic solutions suitable for each situation to small and medium-sized companies, and Korean-style solutions that can realize security and smart society to public enterprises, including local governments," said Jeong Jung-kwan, head of the Private 5G Business Group at HFR.

"As the nascent market for private 5G networks is forming, the expansion and activation of the ecosystem will directly benefit customers," said Min Hye-byung, Head of KT Enterprise Service DX. "We will continue to develop competitive private 5G services through our cooperation." ■

Private 5G News in Korea: 2023



HFR, Inc. supplies Japanese Railway with my5G, Private 5G Network Solution and AI Technology, to enhance Railway Safety

2023.07.12 | By NETMANIAS
(tech@netmanias.com)

Related Companies

HANSHIN ELECTRIC RAILWAY
HANSHIN ELECTRIC RAILWAY CO., LTD



HFR, Inc. (KOSDAQ 230240), the leading ICT solutions provider in Korea, today announced deployment of my5GTM as an end-to-end private 5G solution to the Japanese Railway to improve safety while also increasing operations efficiency. HFR's my5G solution incorporates key components such as a robust Service Management Platform (SM Platform), vCore, vCU/DU, fronthaul multiplexer and high-power radio units (RUs).

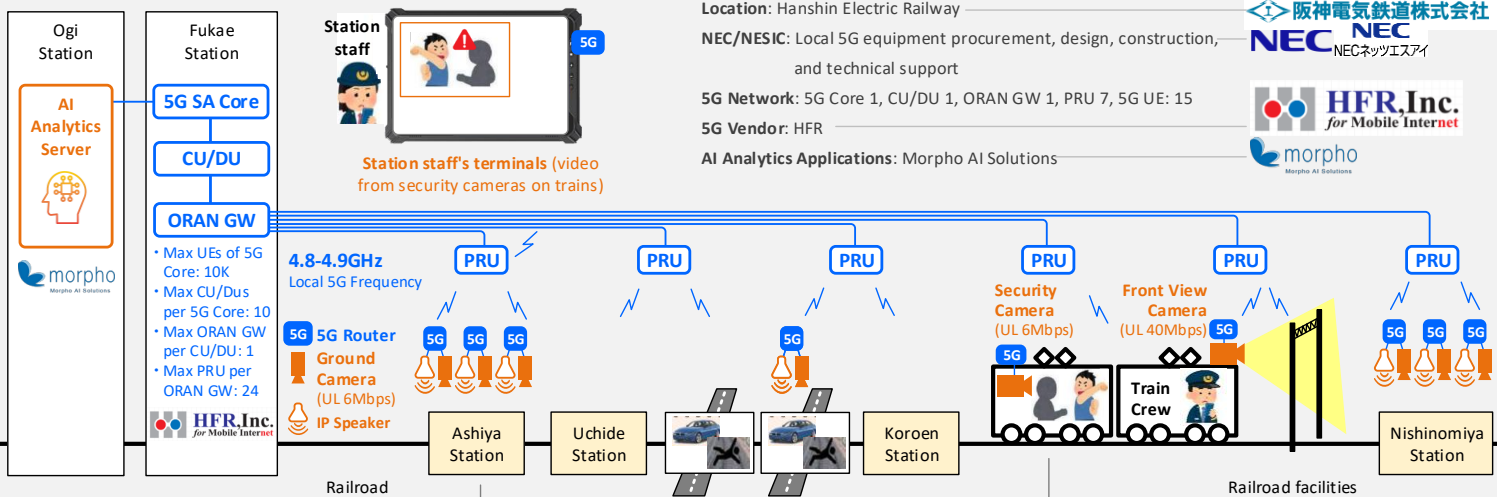
The goal of the deployment was to proactively prevent accidents by utilizing cameras and artificial intelligence (AI) image recognition to enable the real-time monitoring of railway and cabin conditions to more efficiently manage resources for continuous safety monitoring and proactive maintenance optimization.

HFR's innovative my5G solution employed high-power base stations on railway lanes to provide services to railway tracks and stations, including managing data between network terminals and trains to ensure uninterrupted 5G communications, even when trains are operating at their highest speed.

"Reflecting upon the successful completion of another HFR private 5G deployment, we are proud to have assisted in advancing the level of safety at these mission-critical railway sites," stated Han Jae-hyuk, Head of HFR's Global Business Division. "As a follow on to this project, we expect that HFR's my5G deployments will continue to expand by meeting specific connectivity requirements of various private businesses throughout Japan." ■

As in Korea, the railway industry in Japan faces problems from manpower shortages caused by a decline in the working-age population and from improving passenger transportation safety. To address these challenges, Hanshin conducted a local 5G demonstration test on the Hanshin Main Line in January-February 2023 to prevent safety accidents at train stations and railroad crossings, respond to in-vehicle emergencies, and instantly inspect facilities between train stations. The test utilized local 5G, AI video analytics, and cameras (ground cameras at train stations/crossings, in-vehicle security cameras, and vehicle front cameras).

Hanshin Electric Railway's Local 5G Network



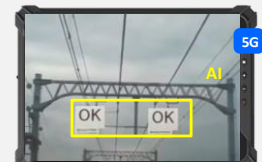
Hanshin Electric Railway's Main Line

Fall accidents in train stations

Stalled cars at railroad crossings

Incidents in train cabins (assaults, etc.)

Abnormalities in facilities located between stations



Train crew's terminals (video from cameras on station)

Train crew's terminals (video from cameras on station)

Train crew's terminals (video from security cameras in train cabins)

Maintenance worker's terminal (video from front view camera in tra

Private 5G News in Korea: 2023



LG Electronics and Megazone Cloud become Private 5G Operators in Korea

2023.07.09 | By NETMANIAS
(tech@netmanias.com)

Related Companies

 LG Electronics

 MEGAZONE CLOUD

The Ministry of Science and ICT (MSIT) announced on June 27 that it has completed the allocation of private 5G frequencies and registration as private 5G common carriers for LG Electronics and Mega Zone Cloud.

With this frequency allocation and private 5G common carrier registration, LG Electronics, a leading Korean digital company that has accumulated technology in robots and home appliances, and Mega Zone Cloud, Asia's largest Internet-based cloud management and operation provider and the first Korean startup in the Internet-based cloud industry, will promote new businesses in various fields such as manufacturing, logistics, and hospitals through private 5G.

As of July 1, 2023, private 5G frequencies have been assigned to 39 locations in 23 companies.

LG Electronics will build a performance testbed for artificial intelligence (AI), autonomous mobile robots (AMR), intelligent surveillance cameras (CCTV), and the cloud based on a private 5G network at LG Digital Park in Pyeongtaek, Gyeonggi-do, to verify its products. In the future, it is expected to spread its services to various fields such as domestic and overseas manufacturing, logistics, and medical care.

Mega Zone Cloud will provide customers with an intelligent logistics system that analyzes and manages information collected from intelligent surveillance cameras (CCTV) and sensors through a private 5G network to the Internet-based cloud, and plans to introduce various services such as robot-human collaboration and the prevention of human safety accidents through the convergence of the Internet-based cloud and private 5G in the future. ■



Samsung Electronics and NAVER Cloud to provide Private 5G Network Services for Hoban Construction

2023.06.02 | By NETMANIAS
(tech@netmanias.com)

Related Companies

SAMSUNG

NAVER Cloud

In expanded collaboration, Samsung and NAVER Cloud launch Korea's first private 5G network in the construction sector

Samsung Electronics Co., Ltd. has announced an expansion of its collaboration with **NAVER Cloud** to launch a private 5G network for **Hoban Construction**, a leading construction, property development and manufacturing company.

This network will be the first of its kind in the Korean construction sector, enabling the three companies to combine various 5G applications to enhance worksite safety and efficiency.

This expanded private 5G network collaboration follows Samsung's announcement with NAVER Cloud in 2022, when the companies launched a private 5G network at NAVER's new headquarters to power autonomous mobile robots.

Wireless communication is an essential part of environments supporting highly mobile workers and machinery. Samsung and NAVER Cloud's collaboration underlines 5G networks' ability to significantly improve worksite operations, and will include a variety of next-generation applications to enhance Hoban Construction's workflow. New construction industry-specific 5G applications that will be utilized at the company's worksite include:

Drone-based high-resolution monitoring will provide live inspection videos, reducing the need for on-site visits and enabling issues to be

detected earlier.

IoT concrete strength sensors will support real-time monitoring of concrete temperature and strength, providing real-time, accurate information during the curing phase.

Construction site management solutions will help keep track of construction progress and optimize project outcomes. They will allow workers both on- and off-site to track progress, view floor plans and share updates through visual dashboards.

Smart safety jackets are equipped with gas detection sensors, 140-degree full HD cameras and safety buttons, creating a safer working environment by enabling potential safety risks to be detected earlier.

Real-time CCTV video monitoring will help reduce on-site hazards and errors with 4K video streaming capabilities. With wireless transmission support, CCTV cameras can be easily installed throughout worksites.

These 5G applications will streamline communications for human-to-human, machine-to-machine and human-to-machine interactions, helping Hoban Construction improve on-site collaboration and allocate resources more effectively. ■

Private 5G News in Korea: 2023



Hyundai Motor, LS Electric to launch Private 5G Networks at Factories

2023.05.02 | By NETMANIAS
(tech@netmanias.com)

The Ministry of Science and ICT announced that it has finalized frequency allocation and common carrier registration, allowing Hyundai Autoever, LS ELECTRIC, and others to use private 5G frequencies beginning May 1.

Related
Companies

HYUNDAI
AutoEver

LS
ELECTRIC

MSIT is encouraging the nationwide deployment of private 5G, a critical infrastructure for digital transformation, in order to develop an innovation network that is one step ahead of the 'Korea Digital Strategy,' and is going to great lengths to assure a timely supply of frequencies.

It is worth noting that Hyundai Autoever is the first company in Korea to implement private 5G in the field of automotive production.

With this frequency supply, private 5G frequencies were allocated to 36 locations in 21 companies.

Hyundai Autoever plans to build an automobile production performance testbed at Hyundai Motor's Uiwang Research Center that combines various technologies such as artificial intelligence (AI), autonomous robots (AMR), and augmented reality (AR) with a private 5G network. Based on this, it is expected to build a private

5G network at Hyundai Motor America's dedicated electric vehicle factory, and it is encouraging that private 5G is expected to spread across automobile factories in Korea in the future.

In addition, **LS ELECTRIC** plans to build an intelligent factory that manufactures factory automation control devices using private 5G networks, CCTV, robots, and sensors.

Hyundai Autoever	4.7GHz (100MHz)	AMR, Robot, AR Glass, CCTV
LS Electronic	4.7GHz (100MHz)	Robot, CCTV, Sensor

"It is significant that private 5G has been introduced to core industries such as automobile production through the supply of private 5G frequencies," said MSIT Director General Choi Woo-hyuk. "In the future, we will actively support the application of private 5G to various industries in order to promote exports and employment, as well as to create more added value." ■



KT commercializes AI-based 'Private 5G Intelligent Monitoring and Control Solution'

2023.04.26 | By NETMANIAS
(tech@netmanias.com)

KT announced on the 26th that it has developed and commercialized a 'private 5G intelligent monitoring and control solution' that enables easy control of private 5G infrastructure based on AI technology. The 'private 5G intelligent monitoring

Related
Companies

kt

and control solution' developed by KT is characterized by greatly enhancing the operational efficiency, convenience, and stability of private 5G by combining public 5G commercial network operation know-how and AI technology.

The solution uses AI technology to detect abnormalities by checking network and equipment status in real time. By comparing and analyzing dozens of equipment quality data in real time with pre-learned data, it is possible to identify equipment abnormalities with just one indicator.

In addition, KT displayed the status of access and core equipment in five stages, allowing users to intuitively check which equipment has an abnormality and the extent of the abnormality.

KT's private 5G intelligent monitoring and control solution enables companies and organizations to operate private 5G networks

without network experts.

This allows customers to proactively respond before the quality of service is degraded due to equipment anomalies in private 5G. Even in the event of an actual failure, it is easy to respond as it meticulously analyzes the problems of the entire network (end-to-end) from the terminal to the core and informs the customer on how to take action.

KT is currently applying the 'private 5G intelligent monitoring and control solution' to four organizations, including Bundang Seoul National University Hospital, Samsung Medical Center, Korea Aerospace Industries, and Navy Headquarters, where private 5G infrastructure has been established through the '5G Convergence Service Public Sector Leading Application Project' promoted by the government. ■

Private 5G News in Korea: 2023



CJ Logistics launches Korea's First Private 5G Network in a Logistics Center Sector

2023.04.20 | By NETMANIAS
(tech@netmanias.com)

CJ Logistics, an innovative technology company, has built a private 5G network for its logistics center. This is the first case where a private 5G network has been built in a logistics center in Korea. The wireless network speed is 1,000 times faster than conventional Wi-Fi, increasing productivity and leading the era of smart logistics 4.0.

Related Companies



CJ Logistics, in collaboration with **CJ Olive Networks**, today announced that it has deployed the first private 5G network in a distribution center in Korea at its Icheon 2 Fulfillment Center, scheduled to open in May.

Private 5G is a network in which companies or institutions, rather than mobile operators, are directly assigned 5G frequencies and build 5G networks in buildings or factories to utilize them on-site. It is characterized by Δ high speed, Δ ultra-low latency, Δ ultra-high density, etc.

Most logistics centers use Wi-Fi wireless networks. However, Wi-Fi has been cited as one of the causes of low productivity in logistics centers due to frequency channel interference and low speed.

CJ Logistics collaborated with CJ Olive Networks, a private 5G operator, to build a private 5G environment in the entire space of the newly opened Icheon 2 fulfillment center.

CJ Olive Networks was granted a private 5G spectrum and 'common carrier change registration' by the Ministry of Science and ICT in August last year, and is embarking on a full-scale private 5G business. In particular, it is developing the 5G market by focusing on the smart logistics, entertainment, and media industries.

The Icheon 2 fulfillment center, which has three floors and 12,000 square meters, uses private 5G frequencies of 4.72 to 4.82 GHz. Since the private 5G network utilizes dedicated frequencies, there is no channel interference.

The wireless network speed is expected to be 1,000 times faster

than conventional Wi-Fi, increasing the productivity of the logistics center. Since private 5G has a range of radio waves that is more than three times wider than existing Wi-Fi, the number of wireless network equipment is reduced, making it easier to manage the infrastructure.

The private 5G will first be used for wireless terminals used by workers. Workers at logistics centers typically use PDAs or tablets to scan boxes, pick goods, and manage incoming and outgoing shipments.

The introduction of 5G-only terminals along with the establishment of a private 5G network is expected to improve work speed compared to the existing Wi-Fi environment, as well as facilitate logistics data management and processing. The two companies plan to expand the scope of private 5G application to robots, facilities, and CCTV after the pilot application to wireless terminals.

"A smooth network environment is essential for fulfillment centers with advanced technologies such as transportation robots and AI," said Ryu Sang-cheon, Head of IT Solutions at CJ Logistics. "With the launch of private 5G, we will deepen our cooperation to introduce advanced technologies in logistics centers so that we can provide better services to consumers."

"It is meaningful to launch 5G at CJ Logistics' fulfillment center as the first project after entering the 5G business," said Lee Ju-young, Head of DT 1, CJ Olive Networks. "We will continue to work together to introduce advanced technologies that drive logistics innovation."



Starting to build Private 5G in Changwon National Industrial Complex in Korea

2023.03.20 | By NETMANIAS (tech@netmanias.com)

Gyeongsangnam-do(province) will begin building private 5G networks in the Changwon National Industrial Complex at the end of this month. According to Gyeongsangnam-do and Gyeongnam Technopark on the 20th, Gyeongnam Technopark supports the deployments of private 5G by companies in the Changwon National Industrial Complex, starting with Central, an automobile parts manufacturer.

An official from Gyeongnam Techno Park said, "If we start building private 5G in Central within this month, it will be completed around June," adding, "Starting with this, we are trying to spread private 5G to manufacturing companies in Changwon National Industrial Complex." There are about 3,000 companies in Changwon National Industrial Complex, including large manufacturing companies such as LG Electronics, Hyundai Wia, Hyundai Rotem, Hanwha Aerospace, Doosan Heavy Industries & Construction, Doosan Infracore, and Hyosung Heavy Industries & Construction. Gyeongsangnam-do aims to build 890 smart factories here by 2025. ■

Private 5G News in Korea: 2023



Ministry of Science and ICT (MSIT) presents a Strategy to spread Private 5G in Korea.

2023.03.14 | By NETMANIAS
(tech@netmanias.com)

Related Companies



MSIT plans to create a representative private 5G service leading model in various industries such as manufacturing, medical care, logistics, and safety.

According to the industry on the 14th, MSIT will announce its private 5G network expansion strategy next month at the earliest. Existing private 5G policies focused on industrial frequency allocation and demonstration projects. Through this new strategy, it is expected that private 5G will be able to spread to the market in earnest and discover industrial services.

MSIT especially supports the development of demand markets for private 5G.

It plans to find industries that can apply private 5G, such as Δ energy Δ manufacturing Δ medical Δ logistics Δ safety Δ defense Δ water management, and list applicable sources of demand.

Through this, MSIT supports the connection between the consumer and suitable private 5G operators.

Some are also discussing the possibility of applying financial support and tax benefits recently introduced by the Ministry of Science and ICT to apply to new 28GHz operators to private 5G operators.

An MSIT official said, "We are at the stage of thinking about various things to spread private 5G," and "we will disclose it when the final strategy is completed." ■



KT-Nokia-Megazon Cloud collaborates to revitalize AWS Cloud-based Private 5G Market

2023.03.02 | By NETMANIAS
(tech@netmanias.com)

Related Companies



KT announced on the 2nd that it had agreed with Nokia and Megazone Cloud on a plan to develop a private 5G business using the cloud of AWS at MWC 2023 held in Barcelona, Spain.

Through this cooperation, KT, Nokia, and Megazone Cloud will join forces to establish a private 5G business strategy with AWS, develop management solutions, and build and operate cloud network infrastructure.

In detail, AWS Cloud-based,

- ▲ Establishment of an end-to-end private 5G service platform
- ▲ Development of 5G network functions running in the cloud for private 5G
- ▲ Expansion of software as a service (SaaS)
- ▲ Development of network operation management system for customers
- ▲ Promotion of joint demonstration project
- ▲ Discovering business opportunities for small businesses and securing

a sales cooperation system ▲ strengthening professional manpower and capabilities.

At MWC2023, KT exhibited safety solutions that can be used in industrial sites using mobile cameras and private 5G network consisting of AWS cloud and Nokia equipment.

In addition, the ultra-lightweight mprivate 5G core technology developed through joint research between Korean local vendor and the KT Convergence Technology Institute was also introduced.

"KT will take the lead in revitalizing the private 5G market by establishing a service platform that supports customers to easily introduce and operate the solutions and networks they want without restrictions," said Min Hye-byeong, executive director of KT Service DX. ■

Private 5G Case Study in Korea: (1) KHNP



Hanul Nuclear Power Plant

Korea Hydro & Nuclear Power (KHNP)'s Private 5G Network and Applications: Rapid response to disaster situations

2023.04.28 | By NETMANIAS (tech@netmanias.com)

Enterprise DIY

On-premise type

Related Companies



KHNP has deployed a private 5G network and applications at the Hanul Nuclear Power Plant in December 2022, enabling rapid response to disaster situations.

Why did KHNP build a private 5G network?

- **Security:** There have been 1,463 hacking attempts to KHNP in the last 10 years, and a closed network completely separate from the commercial communication network is needed (such as the leak of internal data at KHNP in 2014).
- **Disaster response:** Even when nuclear power plants are isolated from public networks due to natural disasters such as forest fires, typhoons, and earthquakes, a stable private network that operates normally without being affected by them is needed (in 2022, a large wildfire in Uljin caused the loss of some sections of the public mobile communication network near the Hanul nuclear power plant).
- **Full Control:** If KHNP uses the MNO's private 5G service, the MNO's public 5G network is managed by the MNO, so KHNP cannot change the 5G network configuration.

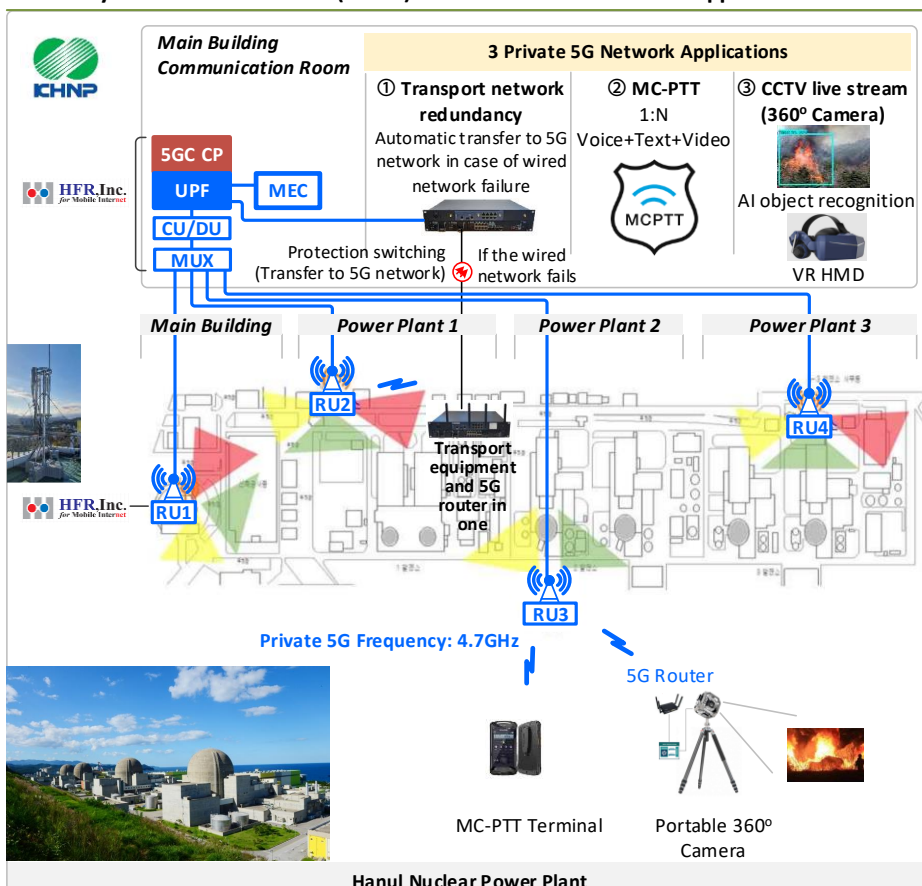
Private 5G network built by KHNP

- KHNP builds a full set of 5G network at Hanul nuclear power plant (**on-premise model**)
 - 5G Core, CU/DU, MEC, and application server are installed in the communication room of the main building of Hanul Nuclear Power Plant.
 - RU is installed in the main building and power plants 1, 2, and 3
- KHNP was allocated a **private 5G frequency (4.72-4.82 GHz)** by the government in November 2022.
- KHNP begins private 5G planning in July 2022 and completes private 5G network deployment in December 2022
- Private 5G vendor: **HFR** (Korean vendor HFR provides KHNP with service operation management platform, 5G SA core, 5G CU/DU, fronthaul mux, RU)

Private 5G network solution

In order to build and operate a private 5G network, a service operation management platform, core network (vCore), base station (vCU/DU), fronthaul Mux and high power/low power RU (Radio Unit) are required, and **HFR** integrates and supplies all of these equipment for KHNP.

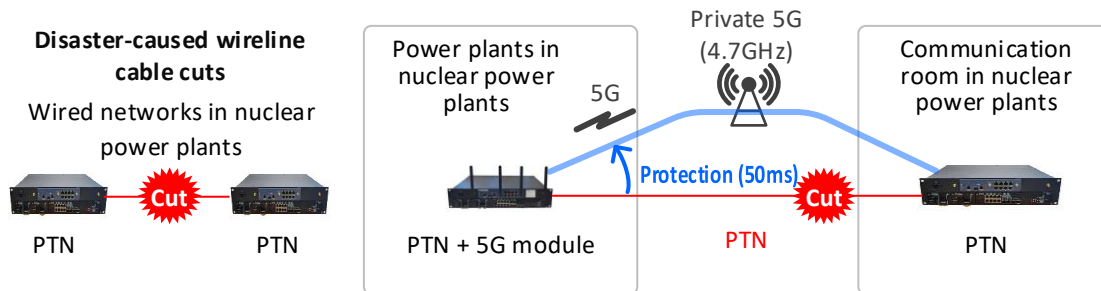
Korea Hydro & Nuclear Power (KHNP)'s Private 5G Network and Applications



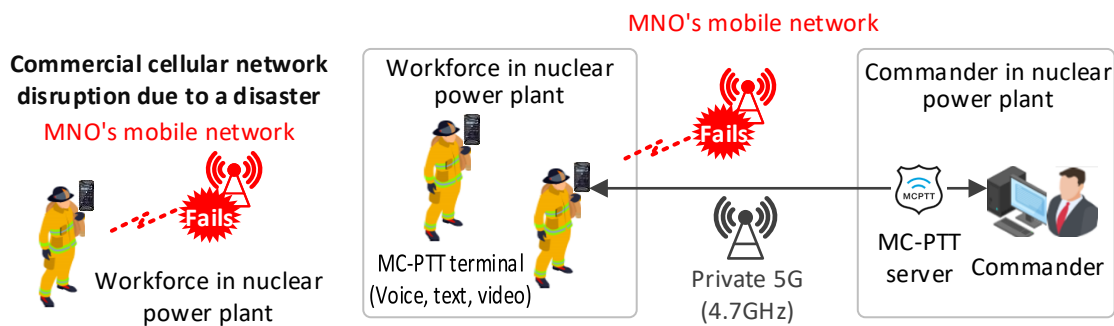
Private 5G Case Study in Korea: (1) KHNP

KHNP's Private 5G applications

① **Transmission equipment redundancy:** automatically switches to the private 5G network when the wired network between the main communication room and the power plant is disconnected. Automatic switching within 50ms.



② **Emergency command communication (MC-PTT):** uses the private 5G network as a stand-alone, autonomous command network for the Hanul nuclear power plant in the event that the commercial mobile communication network is down.



③ **On-site Situation Relay:** In a disaster situation, mobile 360° cameras installed near the disaster site and VR (3D) and AI (object recognition) are applied. Commander can monitor and direct disaster situations from the communications room in the main building without going to the field

HFR, Inc.
for Mobile Internet

HFR's presentation of MWC2023 : What is the difference in HFR private 5G?

▶

What is the difference in HFR private 5G?

by Peter Cho, HFR Networks
14:00, Tuesday, February 28

Private 5G Case Study in Korea: (2) KEPCO



KEPCO's Shin-Jungbu Power Plant in Korea

Korea Electric Power Corporation (KEPCO)'s Private 5G Network and Applications: IoT-based predictive maintenance, robot-based maintenance inspection, and safety management

2023.11.30 | By NETMANIAS (tech@netmanias.com)

Enterprise DIY

5G Core CP Sharing

Related Companies



SAMSUNG

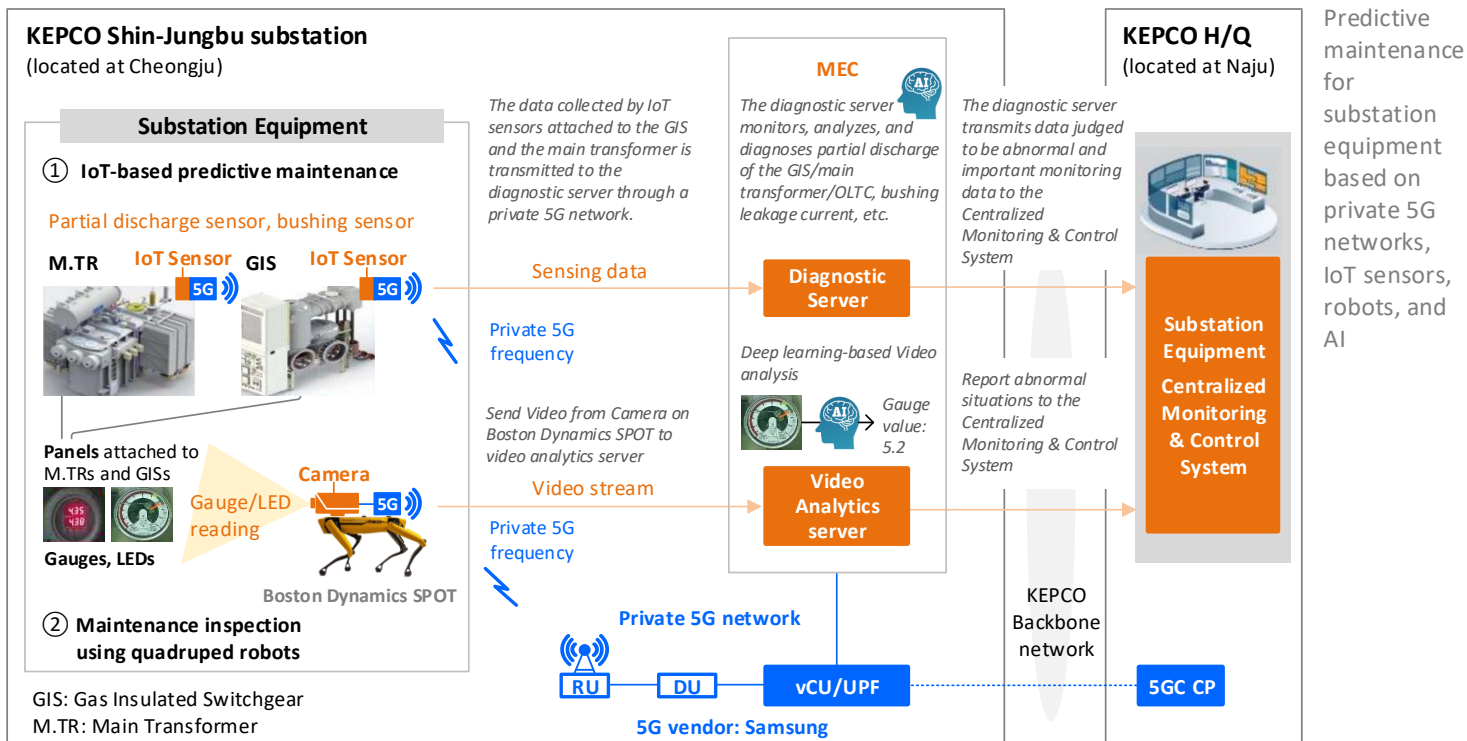
In this article, we will look at KEPCO's case of IoT-based predictive maintenance, unmanned maintenance inspection, safety and access control by introducing wireless IoT sensors, quadruped robots, CCTV, private 5G network, and AI at substations.

1. KEPCO's need for a private 5G network

Preventing accidents in advance is important due to the aging of power facilities in substations:

KEPCO has more than 900 substations, and more than 50% of the facilities in substations are over 20 years old, so it is necessary to take preventive measures against accidents. Transformers and gas-insulated switchgear in substations are the core facilities of the power grid, and in the event of a breakdown or failure, large-scale power outages occur, causing national damage (e.g., KEPCO's fire at a substation in Daejeon in 2021 caused 67,000 households to lose power).

In December 2022, KEPCO deployed private 5G in substations, and based on this, introduced wireless IoT sensors, quadruped robots, wireless CCTV, and AI servers to build a smart facility management system that monitors facilities in real time and predicts and prevents failures through AI analysis.



Private 5G network of Korea Electric Power Corporation (KEPCO)

- Private 5G network architecture structure: build 5G core control plane at KEPCO headquarters and install 5G RAN and UPF at Shinjungbu substation (5G core control Plane sharing type)
- Private 5G spectrum: : 4.7GHz, 28GHz (NR-DC) • SI: Samsung SDS • 5G Vendor: Samsung

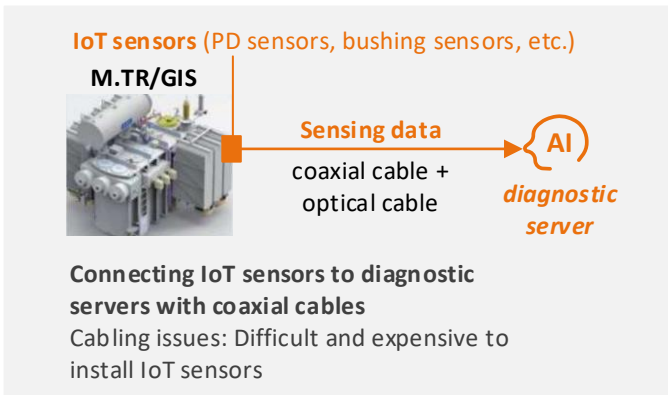
Private 5G Case Study in Korea: (2) KEPCO

2. IoT-based predictive maintenance (Wired sensors → Wireless sensors)

Like most power companies, KEPCO attaches various IoT sensors such as partial discharge sensors, bushing sensors, and oil and gas sensors to its facilities to monitor fault signals and operating conditions that occur inside the facilities (transformers, gas insulated switchgear, etc.) in substations.

Through this, sensing data is monitored, collected, and analyzed to detect potential defects in real time to provide real-time predictive maintenance of facility conditions.

Problem: Wired cabling between sensors and diagnostic servers



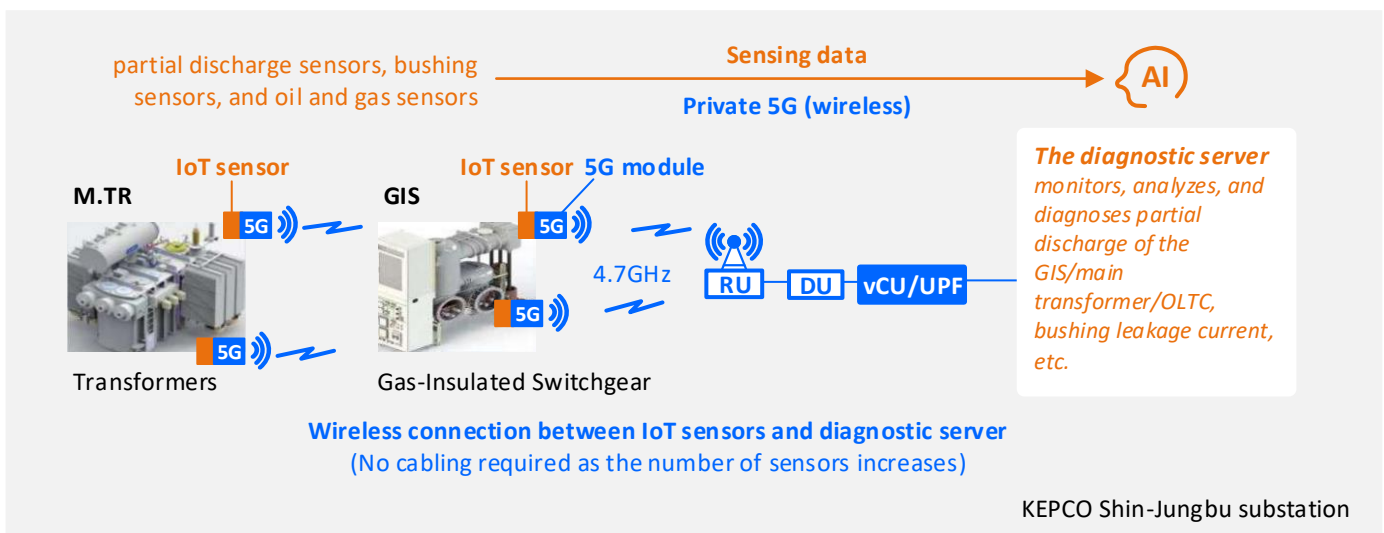
The more sensors that can monitor the status of facilities in a substation, the more advanced safety diagnostics are possible. However, currently, the data collected from the sensors attached to the equipment is transmitted to the diagnostic server through the wired infrastructure (coaxial cable + optical cable).

According to KEPCO, "Currently, more than 400 sensors are installed in a single 765 kV substation, and the construction of wired cable facilities costs more than 1 billion won (about \$1million) per substation," and it is impossible to apply various sensing technologies to all 900 KEPCO substations in this way.

The sensor industry also says that sensor and diagnostic server technologies that can predict potential failures and diagnose abnormalities in the operation of facilities have existed for many years, but the wired connection between sensors and diagnostic servers has prevented the universal adoption of such solutions in practice.

Solution: Acquiring sensing data through a private 5G network

KEPCO built a private 5G network in December 2022 at the Shin-Jungbu substation and attached IoT sensors (including 5G modules) to the facilities, and the data collected from the sensors is delivered to the diagnostic server through the private 5G network.



<Wireless IoT sensor-based predictive maintenance solution using KEPCO's private 5G network>

This eliminates the cost of wired construction by eliminating the need for wired cable construction to transmit sensor data to the diagnostic server, and also makes it possible to operate power facility management very efficiently by eliminating not only the cost but also the time required for wired facility construction and easy sensor installation.

By cost-effectively building a large-scale wireless sensing network through a private 5G network, KEPCO has smartened the operation of power facilities such as predicting the lifespan of facilities by performing diagnosis and fault analysis using AI and big data, and improved the accuracy of real-time facility diagnosis.

Private 5G Case Study in Korea: (2) KEPCO

3. Maintenance inspection based on quadruped robot (human → unmanned)

Problem



Maintenance inspections by humans on foot/with the naked eye/record the results manually



Wheeled Robotic Vehicle + Camera

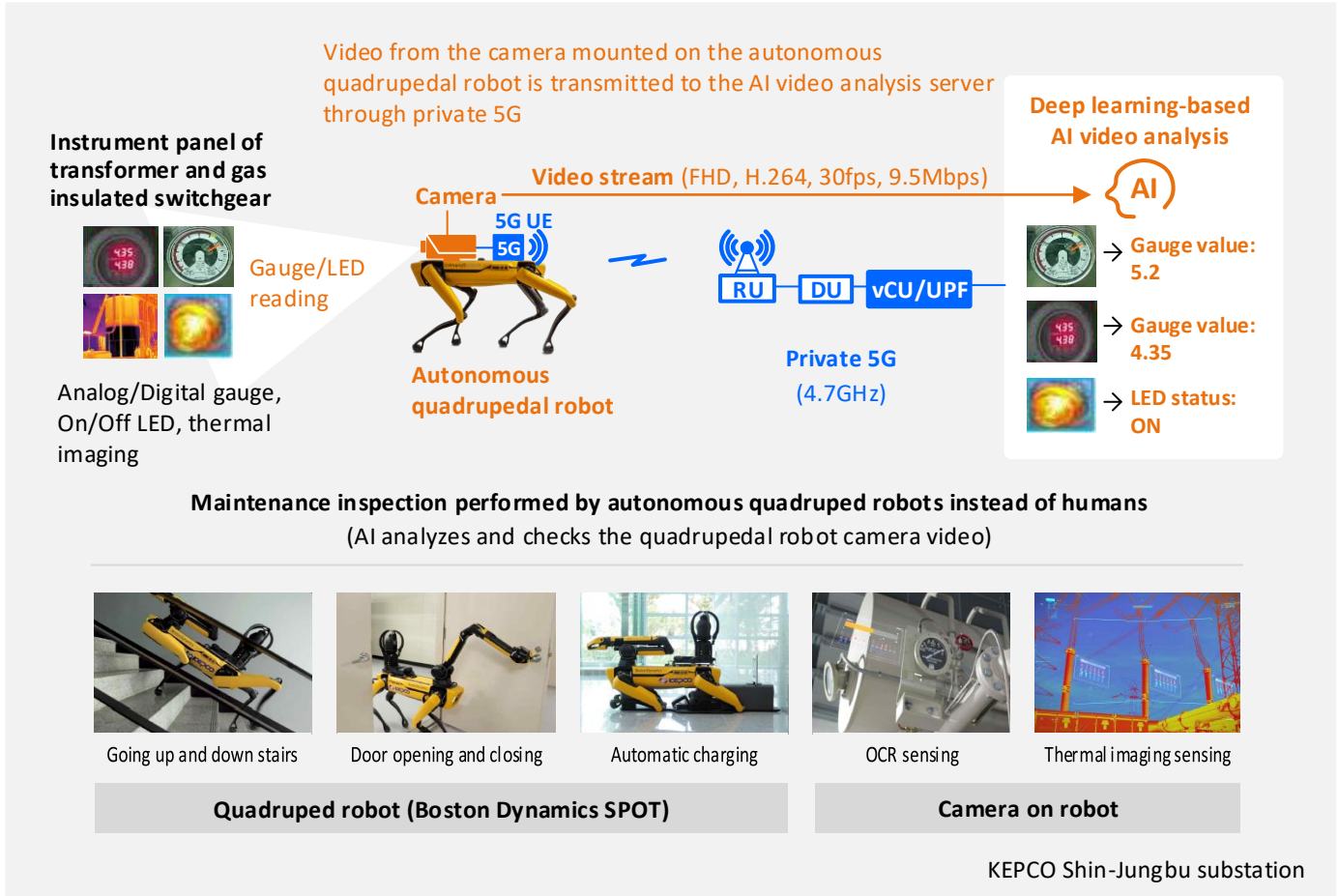
Currently, humans walk around twice a day to visually check the operating status of substation facilities (analog/digital gauges, temperature of facilities, leaks, cracks, etc.) and record the results manually, resulting in inaccurate result management.

In addition, safety accidents are always occurring at substation sites, which are dangerous, and unmanned maintenance inspections that incorporate new ICT technologies such as robots and AI are required. Recently, there have been many cases of unmanned inspections using wheeled robot vehicles, cameras, and AI, but the problem is that wheeled robot vehicles have difficulty navigating steep slopes, climbing stairs, and opening and closing doors. Therefore, they are limited to facilities with horizontal or gentle slopes.

Solution: Dynamic sensing using quadruped robots

In complex indoor and outdoor environments (steep slopes, stair climbing, door opening and closing, etc.) where wheeled vehicles are difficult/impossible to operate, autonomous quadrupedal robots walk to predefined facilities to be inspected.

The robot's camera captures facility images (analog/digital gauges, LEDs, valves, lamps, thermal images, etc.) and streams them to the AI server via a private 5G network (FHD, H.264, 30fps, 9.5Mbps). A high capacity uplink is required to deliver the camera images, which is why a private 5G network is required.



<KEPCO's unmanned maintenance inspection using private 5G network and quadruped robots>

Private 5G Case Study in Korea: (2) KEPCO

Based on the received video, the AI server reads the status values of gauges, etc. to detect facility abnormalities in real time and sends an alarm to the manager when a problem occurs.

The quadruped robot returns to the station after completing the designated facility inspection and is automatically recharged

In this way, there is no human intervention in the entire process of moving the quadruped robot to the facilities to be inspected, taking video of the facilities, delivering the video through the private 5G network, analyzing the video on the AI server, and automatically charging the quadruped robot.

In other words, the entire process of maintenance inspection of substation facilities has been unmanned.

KEPCO has converted maintenance inspections previously performed by humans to unmanned inspections using camera-equipped quadruped robots and AI technology. As a result, KEPCO improved the working environment by minimizing the simple tasks of field workers and preventing the occurrence of safety accidents in the field.

In addition, by establishing an environment for collecting facility inspection history and status information, the company plans to utilize big data to predict the failure and life of power facilities.

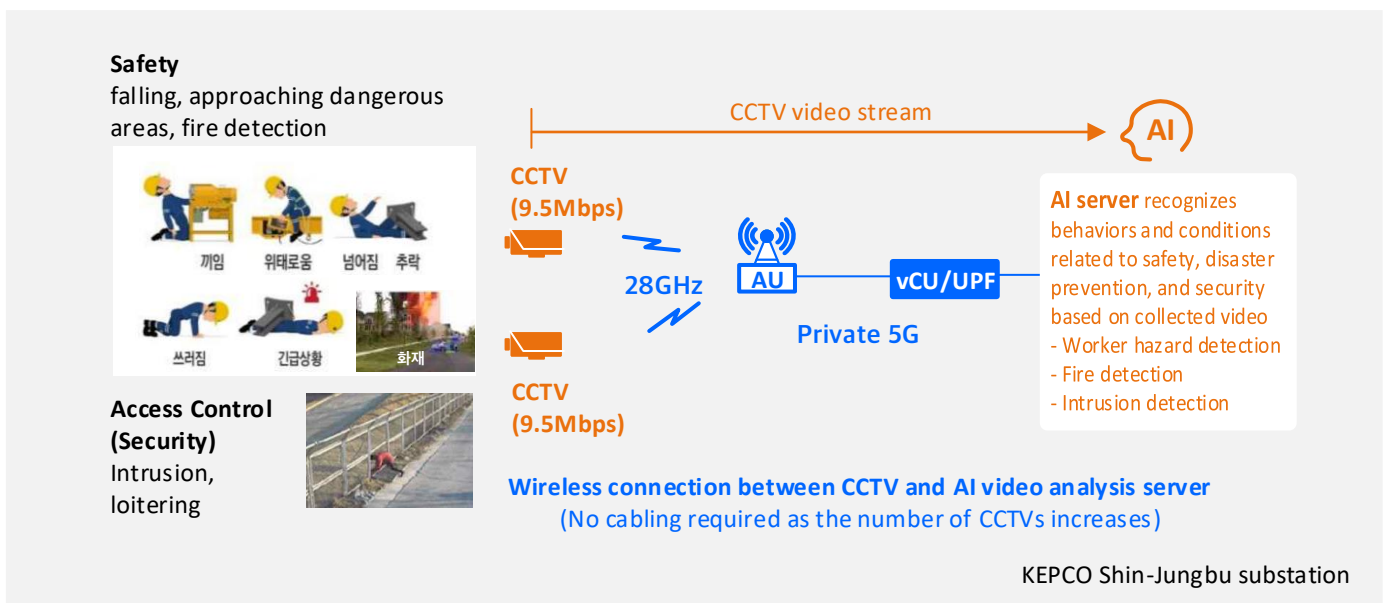
Dynamic Sensing has a major advantage in that it does not require a communication module on the sensor and does not require a wired communication network between the sensor and the AI application, as a mobile device equipped with a camera captures the values/status of sensors located in various places and sends them through a mobile network, and the AI reads the image to read the sensor values/status.

This provides strong scalability by not requiring additional communication costs even when adding more sensors.

The advantage of Dynamic Sensing over the existing "fixed camera + AI method" is that it does not require a large number of cameras to eliminate blind spots.

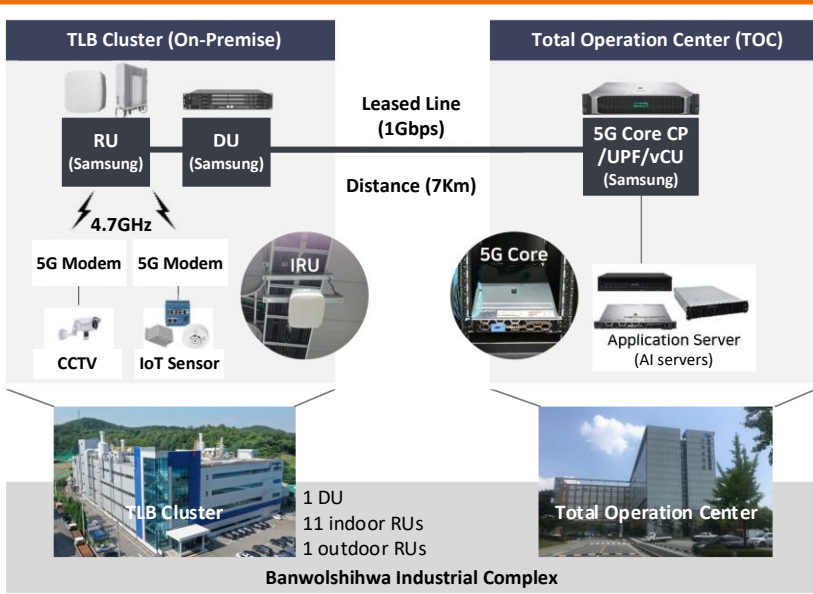
4. Safety & access control

High-definition CCTV is installed outside the substation, and CCTV images are transmitted to the AI server in real time through a private 5G network. The AI server automatically detects dangerous situations (falls, collapses, access to dangerous areas, etc.), fires, intrusions, etc. through deep learning video analysis and sends alarms to managers. No need for cabling even as the number of CCTVs increases.



<KEPCO's safety and access monitoring (security) through AI real-time analysis of CCTV images>

Private 5G Case Study in Korea: (3) TLB Cluster



TLB Cluster's Private 5G Network and Applications: Predictive maintenance, geo-fencing

2023.04.28 | By NETMANIAS (tech@netmanias.com)

Private 5G Operator: Sejong Telecom

5G Core Sharing

Related Companies



In October 2022, Sejong Telecom was approved by the government as a private 5G common carrier, allowing it to provide private 5G services to corporate customers.

Currently, nine private 5G common carriers (Naver Cloud, LG CNS, SK Networks Service, Nable Communications, CJ Olive Networks, KT MOS, Sejong Telecom, Wizcore, Newgens) are registered in South Korea.

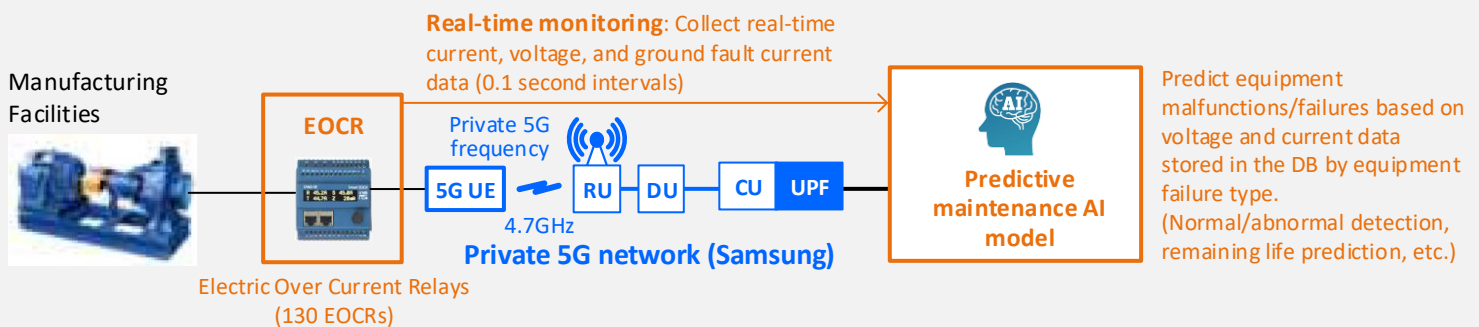
Sejong Telecom was allocated a private 5G frequency of 4.7GHz (4.72-4.82GHz) by the government and built a private 5G network at TLB Cluster in Banwolshihwa Industrial Complex in December 2022. Based on this private 5G network, Sejong Telecom is providing predictive maintenance and industrial safety services.

Industrial safety services prevent various accidents such as workers entering the workplace without protective gear, harmful gas leaks, and overloading or speeding of mobile equipment in the workplace.

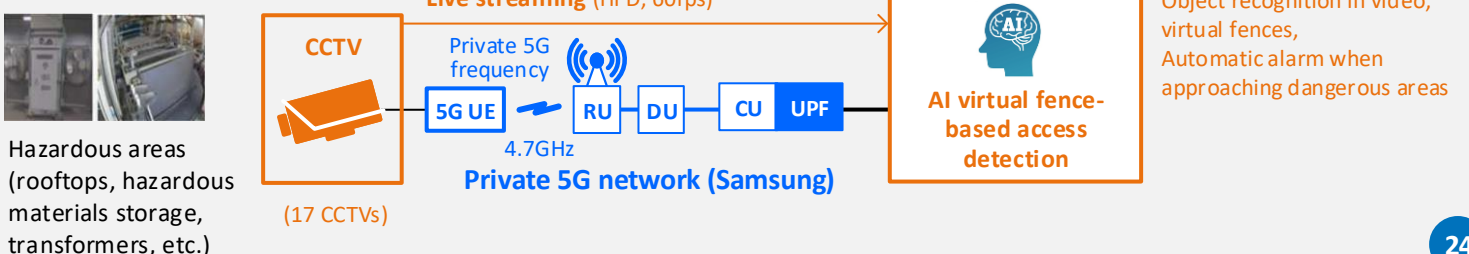
- Commercial model: A mix of purchase and subscription types
- Private 5G network deployment model: 5G Core Sharing
 - Customer premise (TLB cluster): DU, indoor RU, outdoor RU
 - Cloud (Total operation center): 5GC CP/UPF/vCU, MEC
- Private 5G Customers: TLB Cluster (11 companies)
- Private 5G vendor: Samsung

Sejong Telecom installs only RUs and DUs at enterprise customer sites, while 5G cores and CUs are placed in the Cloud(TOC) to be shared and used by multiple customers. This reduces the investment cost of building a private 5G network per customer site compared to building a full set of 5G networks at each customer site. Sejong Telecom's strategy is to deploy only RUs and DUs at new customer sites in the future.

<Use case: predictive maintenance> Predict equipment malfunctions and failures and estimate useful life



<Use case: geo-fencing>



Private 5G Case Study in Korea: (4) FOODPOLIS



Korea Food Industry Cluster (Foodpolis)'s Private 5G Network and Applications: AI-based robotic logistics transportation

2023.05.02 | By NETMANIAS (tech@netmanias.com)

Private 5G Operator: SK networks

On-premise type

Related Companies



In May 2022, SK networks service was approved by the government (MSIT: Ministry of Science and ICT) as a private 5G common carrier, becoming the third private 5G operator in South Korea after NAVER CLOUD (December 2021) and LG CNS (March 2022).

On the same day, SK networks service was allocated private 5G frequencies of 4.7GHz (4.72-4.82GHz) and 28GHz (28.9-29.3GHz) for Central (manufacturing company), and began building a private 5G network with Ericsson EP5G solution at Central's Changwon Factory. SK networks service provides AMR-based logistics automation services and digital twin-based monitoring and control services to the Central factory.

Subsequently, SK networks service was allocated a private 5G frequency of 4.7 GHz (4.72-4.82GHz) in November 2022 and completed the deployment of a private 5G network with Flectory (5G Core) and Innowireless (5G Small cell) equipment at the Korea Food Industry Cluster (Foodpolis) in Iksan in December 2022.

SK networks service's Private 5G service: Korea National Food Cluster (Foodpolis) Case

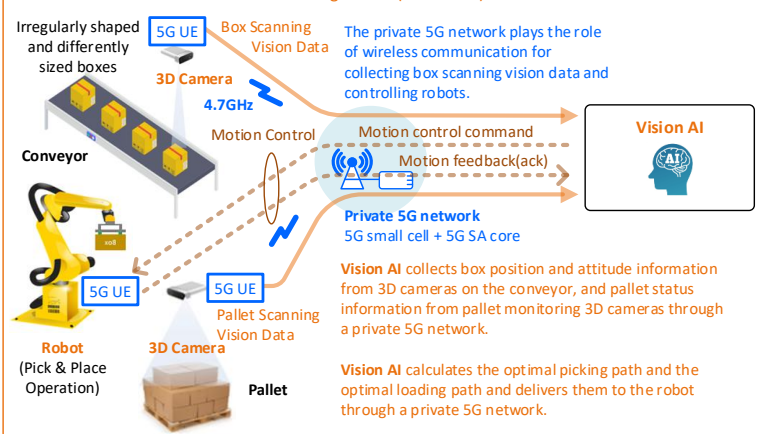


Private 5G Use Cases

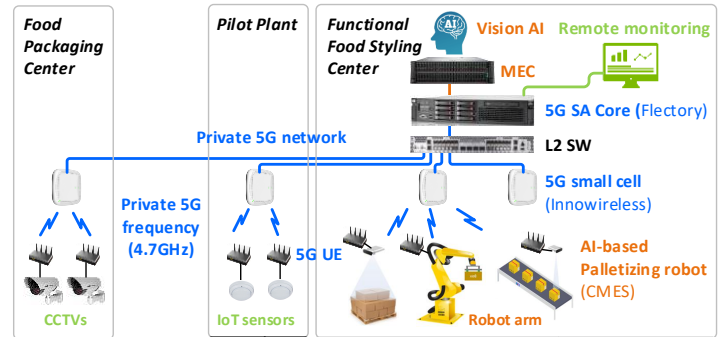
<AI-based Robotic Logistics Transportation Solution>



Palletizing robots (robot arm) use case



Private 5G Network Architecture



Korea National Food Cluster (Foodpolis): On-premise private 5G network

Private 5G network

- Private 5G Customers: Korea Food Industry Cluster (Foodpolis)
- Private 5G network deployment model: On-premise type
- Customer premise: 5G Small cell, 5G SA Core, MEC
- Private 5G vendor: 5G Small cell (Innowireless), 5G SA Core (Flectory)

Private 5G Applications: AI-based Robotic Logistics Transportation

Vision AI scans and identifies irregularly shaped and differently sized boxes on the conveyor with a 3D camera, calculates the path of the robot arm to move the boxes on the conveyor to the pallet, and delivers it to the robot. The 3D camera scan data and robot control commands are transmitted through a private 5G network. It is expected to reduce the labor load of warehouse workers engaged in the logistics industry and improve stability and productivity through automation and unmanned operation of high-intensity simple labor in the logistics system. It can replace manual labor and operate 24 hours a day, 365 days a year.

Private 5G Case Study in Korea: (5) Samsung Medical Center



Samsung Medical Center's Private 5G Network and Applications: 5G-based remote surgical training

2023.05.04 | By NETMANIAS (tech@netmanias.com)

Private 5G Operator: KT MOS

On-premise type

Related Companies

kt MOS

SAMSUNG

In October 2022, KT MOS, an affiliate of KT, was approved as a private 5G common carrier by the government (Ministry of Science and ICT), becoming the sixth private 5G operator in South Korea.

The government assigned KT MOS private 5G frequencies of 4.7 GHz (4.72-4.82 GHz) and 28 GHz (28.9-29.5 GHz) for Samsung Medical Center in October 2022, and KT MOS completed the building of a private 5G network with Samsung's 5G equipment at Samsung Medical Center in December 2022.

Samsung Medical Center offers remote cooperative surgery and real-time remote surgical training services over the private 5G network.

Case Study : Samsung Medical Center in Seoul

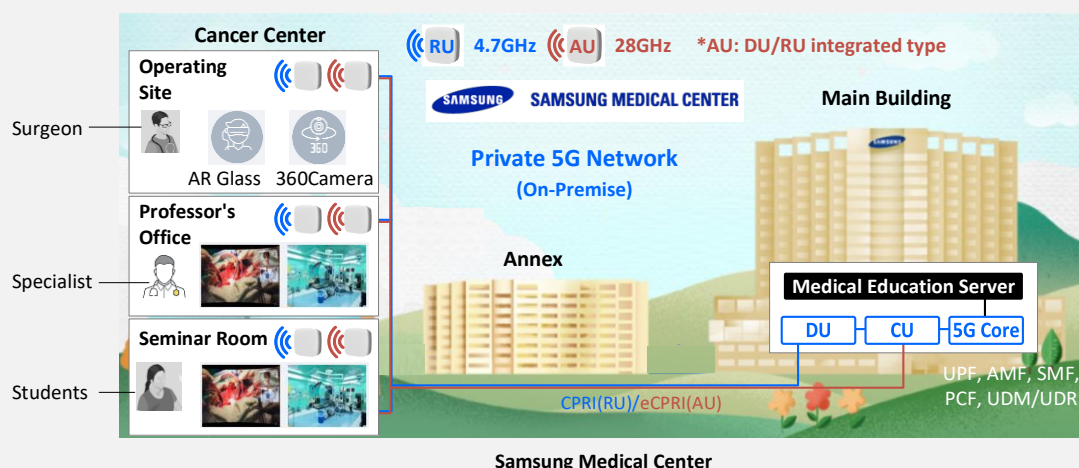
Problems with surgical education at Samsung Medical Center: When conducting on-site training for medical school students and trainee medical staff, faculty members were concerned that it would be difficult to conduct the training effectively due to space issues in which the surgeon, supporting nurses, and surgical equipment were all located in an inconvenient location.



Solution: 5G-based remote surgical training

The surgeon's operation room is captured utilizing high-definition immersive video such as AR glasses, an endoscope, and a 360-degree camera, and then streamed to a medical education platform through a private 5G network.

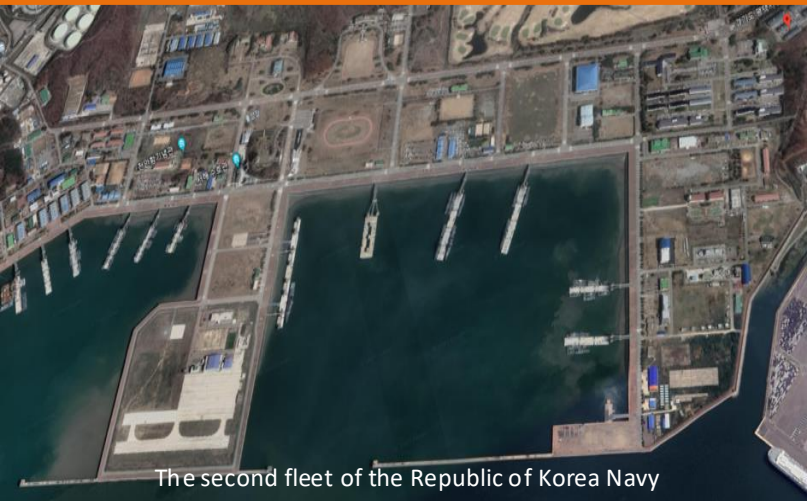
In the professor's office, a specialist watches the video and guides the surgery (remote cooperative surgery). Students in the seminar room can see the live surgical video while also learning from the specialist's guidance (real-time remote surgical training).



Private 5G network

- Private 5G network deployment model: On-premise type (Customer premise: 5G RU, DU, CU, 5G SA Core)
- Private 5G frequency: 4.7GHz (4.72-4.82GHz), 28GHz(28.9-29.5GHz)
- Private 5G frequency acquisition date: 2022.10.06
- Private 5G vendor: Samsung

Private 5G Case Study in Korea: (6) Republic of Korea Navy



The second fleet of the Republic of Korea Navy

Republic of Korea Navy's Private 5G Network and Applications: Unmanned patrol, remote driving, AI vision

2023.05.25 | By NETMANIAS (tech@netmanias.com)

Enterprise DIY

On-premise type

Related Companies



The Republic of Korea Navy deployed a private 5G network and MEC (Unmanned patrol, remote driving and AI Vision) at the second fleet in December 2022.

Why did the Republic of Korea Navy build a private 5G network?

- **Security:** a closed network fully independent from the commercial communication network is required to prevent external leakage of internal data.
- **Low-latency:** the Navy deploys a 5G network and MEC on-premise to support ultra-low latency applications such as remote driving (vehicle control via remote cockpit).
- **Full Control:** applications utilized by the Navy, such as remote driving and AI Vision, necessitate a substantial uplink capacity. Because MNOs' public 5G networks are intended for services such as video streaming and gaming, they feature high downlink capabilities. Because the Navy is unable to adjust the uplink/downlink ratio of public 5G, it cannot implement a private 5G network based on the public network. A private 5G network deployed with private 5G frequencies, on the other hand, allows the Navy to boost uplink capacity by altering the uplink and downlink ratio by itself (2:8→4:6).

Private 5G network built by the Republic of Korea Navy

- builds a full set of 5G network at the Navy site (on-premise model): One 5G Core, 2 DUs, 20 RUs, and MEC are installed
- The Navy was allocated a private 5G frequency (4.7GHz: 4.72-4.82 GHz) by the government in October 2022.
- The Navy begins private 5G planning in April 2022 and completes private 5G network deployment in December 2022.
- System Integration (design, build 5G network): KT
- Private 5G vendor: Nokia (5G Core, 5G RAN), Mexus (5G Router), Eluon (MEC)

Private 5G applications of the Republic of Korea Navy

① Unmanned patrol

A driverless autonomous vehicle patrols predefined routes and sends real-time driving information (location coordinates, vehicle status) and outside-vehicle video to the autonomous driving control system on the MEC through a private 5G network. The system displays the vehicle's location, vehicle status, and outside-vehicle video on the monitoring screen.

② Remote driving

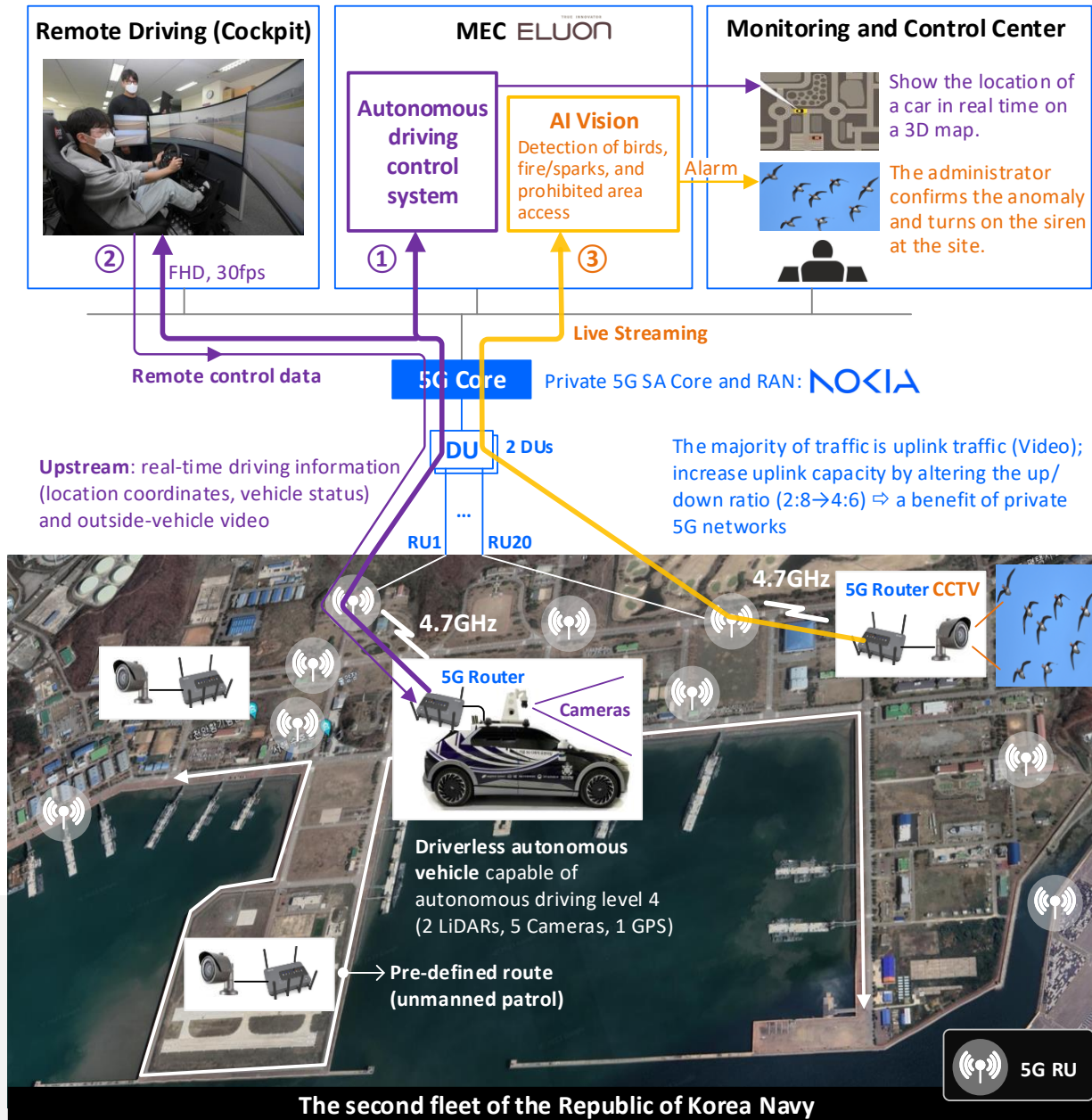
If an emergency occurs during an unmanned patrol, the driving mode is switched from autonomous driving to remote driving. For example, if AI Vision detects birds, the remote driver in the remote cockpit drives the vehicle to the bird infestation area, and the vehicle emits ultrasonic waves to repel the birds (the bird repeller is mounted on the vehicle).

③ AI Vision

CCTV camera video is streamed in real time over a private 5G network to the AI Vision application on the MEC, which detects birds, fires, and access to unauthorized areas and sends an alarm to the monitoring and control center.

Private 5G Case Study in Korea: (6) Republic of Korea Navy

Private 5G Network and Applications of the Republic of Korea Navy



- ① Unmanned patrol
- ② Remote driving
- ③ AI Vision

Private 5G Case Study in Korea: (7) Lotte World



< Atlantis in Lotte World: Speed 72km/h >

Lotte World's Private 5G Network and Applications: Immersive parallel reality experience service

2023.05.12 | By NETMANIAS (tech@netmanias.com)

Private 5G Operator: Newgens On-premise type

Related Companies



In November 2022, Newgens (Korean SI company) was approved by the government as a private 5G common carrier, allowing it to provide private 5G services to corporate customers.

Newgens was allocated a private 5G frequency of 4.7 GHz (4.72-4.82GHz), 28GHz (28.9-29.5GHz) by the government and built a private 5G network at Lotte World, South Korea's largest amusement park in December 2022.

Newgens built a 28GHz private 5G network in the area where the Atlantis attraction is located in Lotte World, and Lotte World will provide an immersive parallel reality experience service using motion sensors, cameras, and motion simulators.

The use of private 5G technology in the 28GHz band enabled real-time large-capacity video (4K: uplink 40Mbps, 8K: 200Mbps) and motion data transmission of rides, which was previously impossible with conventional Wi-Fi.

Real World (Atlantis)



Atlantis

Atlantis, attraction in amusement park (Lotte World)

Enabling Technology (Motion Sensing, 5G)



① Camera(video, audio) + motion sensor + 5G 28GHz module

5G 28GHz transmission module with built-in camera and motion sensor

- Live video streaming
- Motion data

②



4K Camera: uplink 40Mbps
8K Camera: uplink 200Mbps
Real-time: 15ms
Private 5G frequency

Virtual Atlantis Experience Center



The elderly, who were previously unable to enjoy offline attractions, can now ride, and children can ride without height restrictions.

Provide customers with the same immersive and tangible services as on-site.

- Live video streaming
- Motion data

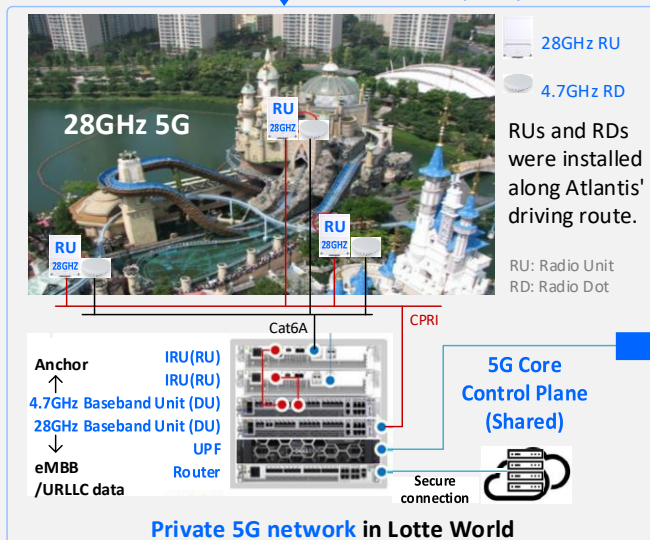


③ Motion simulator

Atlantis virtual experience center in Lotte World

Immersive parallel reality experience service

- Atlantis, a ride at Lotte World, is equipped with a 5G 28GHz transmission module with built-in camera and motion sensor.
- The transmission module sends video and motion data to the motion simulator through a private 5G network.
- Visitors seated in the motion simulator can virtually experience the realistic attraction.



Private 5G network

- Deployment model: 5G Core Control Plane Sharing (Customer premise(at Lotte World): RU-DU-CU-UPF, Cloud: 5G CP)
- Private 5G frequency: 4.7GHz (4.72-4.82GHz: for Anchor/Coverage) and 28GHz (28.9-29.5GHz: for eMBB/URLLC Data)
- Private 5G frequency acquisition date: 2022.11.28
- Private 5G vendor: Ericsson EP5G
- Private 5G applications: an immersive parallel reality experience service

The South Korean Government's Regulations on Private 5G and KT's Strategy for entering the Market in Response

2023.06.08 | By Harrison J. Son (son@netmanias.com)

In this article, we will discuss the Korean government policy on private 5G and KT's private 5G network strategy (3 business models) in response to this policy.

On October 28, 2021, the South Korean government (Ministry of Science and ICT: MSIT) started offering private 5G frequencies (100MHz@4.7GHz, 600MHz@28GHz) in an effort to deploy private 5G, a crucial infrastructure for enterprises' digital transformation, across a variety of industries in South Korea.

With the availability of these private 5G frequencies, enterprises in Korea can now deploy private 5G networks independently from the public 5G networks of mobile operators.

As of June 7, 2023, private 5G frequencies have been assigned to 36 locations in 21 companies. See the list of operators and enterprises to which the MSIT has assigned private 5G frequencies.

1. Advantages of building a private 5G network using private 5G frequencies

(compared to building a private 5G network using public 5G networks)

An enterprise private 5G network can also be built with a fraction of the MNO's public 5G network capacity (network slicing). In this case, the uplink and downlink capacity is shared with public 5G traffic, which means that the quality of private 5G network traffic may be affected by public 5G network traffic (smartphones).

On the other hand, a private 5G network built using private 5G frequencies (4.7 GHz, 28 GHz) is independent of the MNO's public 5G network (public 5G frequency: 3.5 GHz). Therefore, a single enterprise can exclusively use 5G's high-capacity up and down links independent of public 5G network traffic.

In addition, the MNO's public 5G network is designed for downlink applications like video streaming and games, so the downlink capacity is set to be high. However, in the enterprise private network environment, there are many camera uplink applications like remote monitoring, remote driving, and AI vision, so the uplink capacity must be high.

In the public 5G network used by all citizens, the ratio of uplink and downlink capacity cannot be adjusted for a specific company. On the other hand, the private network using private 5G frequencies are used by a single company alone, so the uplink and downlink ratio can be changed as desired by the company.

	5G Network		
	Public 5G Network	Private 5G Network	
User	Consumer	Enterprise	
Device	Phone	Phone, Robot, Camera, Sensor, etc.	
Network Deployment	deploy public 5G networks using public 5G frequency	deploy private 5G networks reusing public 5G network resource (network equipment, frequency) : Network Slicing	deploy private 5G networks using private 5G frequencies
5G Frequency	MNO's Licensed/Public 5G Frequency [3.5GHz, in Korea]	MNO's Licensed/Public 5G Frequency [3.5GHz, in Korea]	Private 5G Frequency [4.7GHz, 28GHz, in Korea]

In the following sections, the private 5G network will be explained only in the context of private networks established using private 5G frequencies (not MNO's network slicing).

The South Korean Government's Regulations on Private 5G and KT's Strategy for entering the Market in Response

2. Private 5G spectrum policy and regulation of the Korean government (MSIT)

This private 5G frequencies provided by the MSIT can be used in two ways.

Private 5G Operator: An organization that wants to provide private 5G network services to enterprise customers must be approved by MSIT as a private 5G common carrier. The private 5G operator applies to MSIT for a private 5G frequency to be utilized at the customer's workplace and uses this frequency to provide enterprise customers with private 5G network services.

- This case is referred to by the government as "private 5G frequency use type: Type 3 (frequency allocation)".
- As of June 7, 2023, there are 11 private 5G operators in Korea.
- Private 5G operators build private 5G networks for enterprise customers and charge a fee for the service. Typically, 5G equipment is provided free of charge or at a minimal cost, and a monthly subscription fee is charged to keep upfront costs down.

Enterprise DIY: Enterprises apply to MSIT for private 5G frequencies to use at their locations and use these frequencies to build their own private 5G networks.

- This case is referred to by the government as "private 5G frequency use type: Type 1 (frequency designation)".
- As of June 7, 2023, 10 enterprises in Korea have built their own 5G networks
- Typically, enterprises purchase 5G network equipment (base stations, cores, MECs) from SIs or vendors, and the equipment is the property of the company (purchase type).
- Enterprises can only use the private 5G network for their own employees and not for other enterprises.

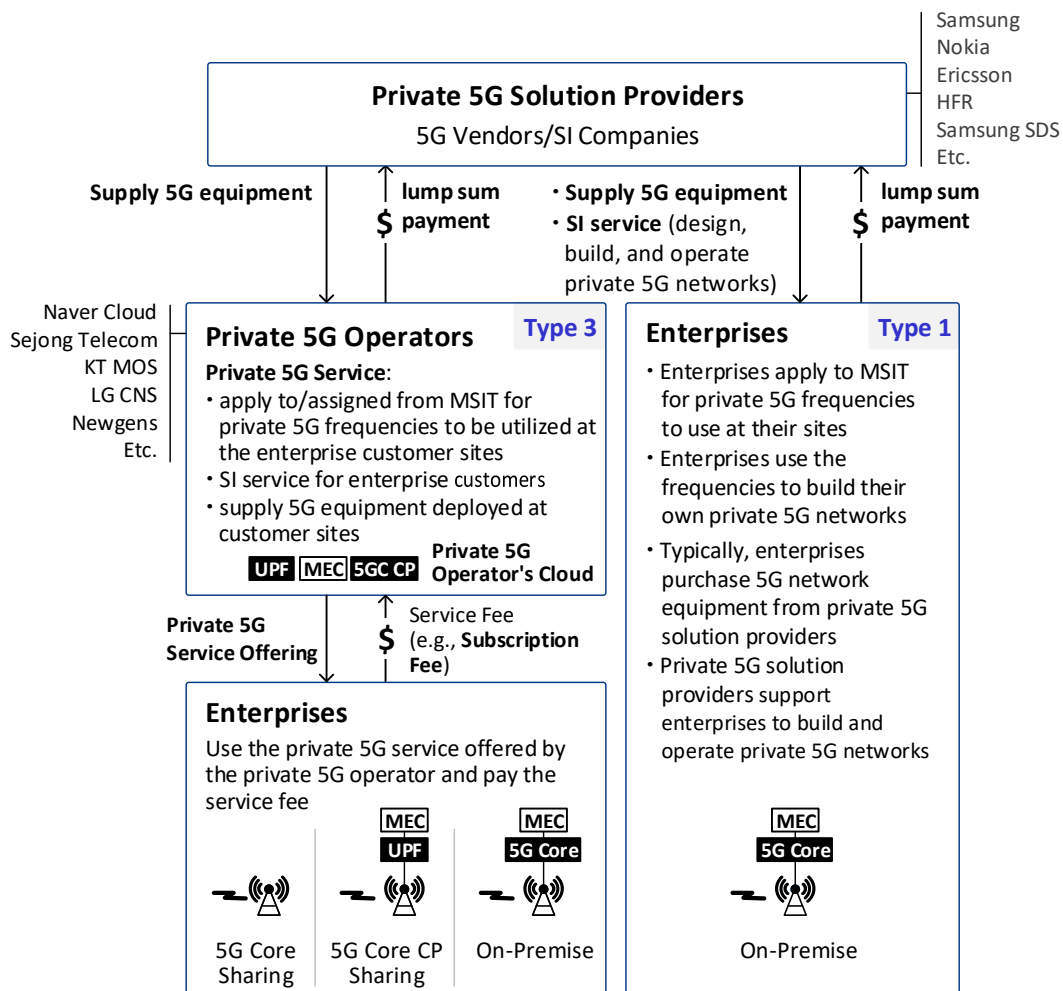


Figure 1. Private 5G Market Players in Korea
Private 5G Solution Provider, Private 5G Operator, and Enterprise

The South Korean Government's Regulations on Private 5G and KT's Strategy for entering the Market in Response

In Japan, which made private 5G (local 5G in Japanese) frequencies available to the market in 2019, two years earlier than Korea, MNOs such as NTT Docomo and KDDI are not allowed to become private 5G network operators.

In South Korea, as in Japan, MNOs (public 5G network operators: SK Telecom, KT, and LG U+) are not allowed to become private 5G operators.

The Korean government (MSIT) prohibits MNOs from entering the market as private 5G operators due to monopoly concerns.

If MNOs are allowed to participate as private 5G operators, it is obvious that mobile operators who have already designed, built, and operated public 5G networks for several years will monopolize the private 5G network market, just as they monopolize the public 5G market today.

In this case, it is difficult to expect the expansion of the private 5G network market and ecosystem through competition in the B2B market with the emergence of various new private 5G operators expected by the government, and the government loses the justification for institutionalizing private 5G frequency.

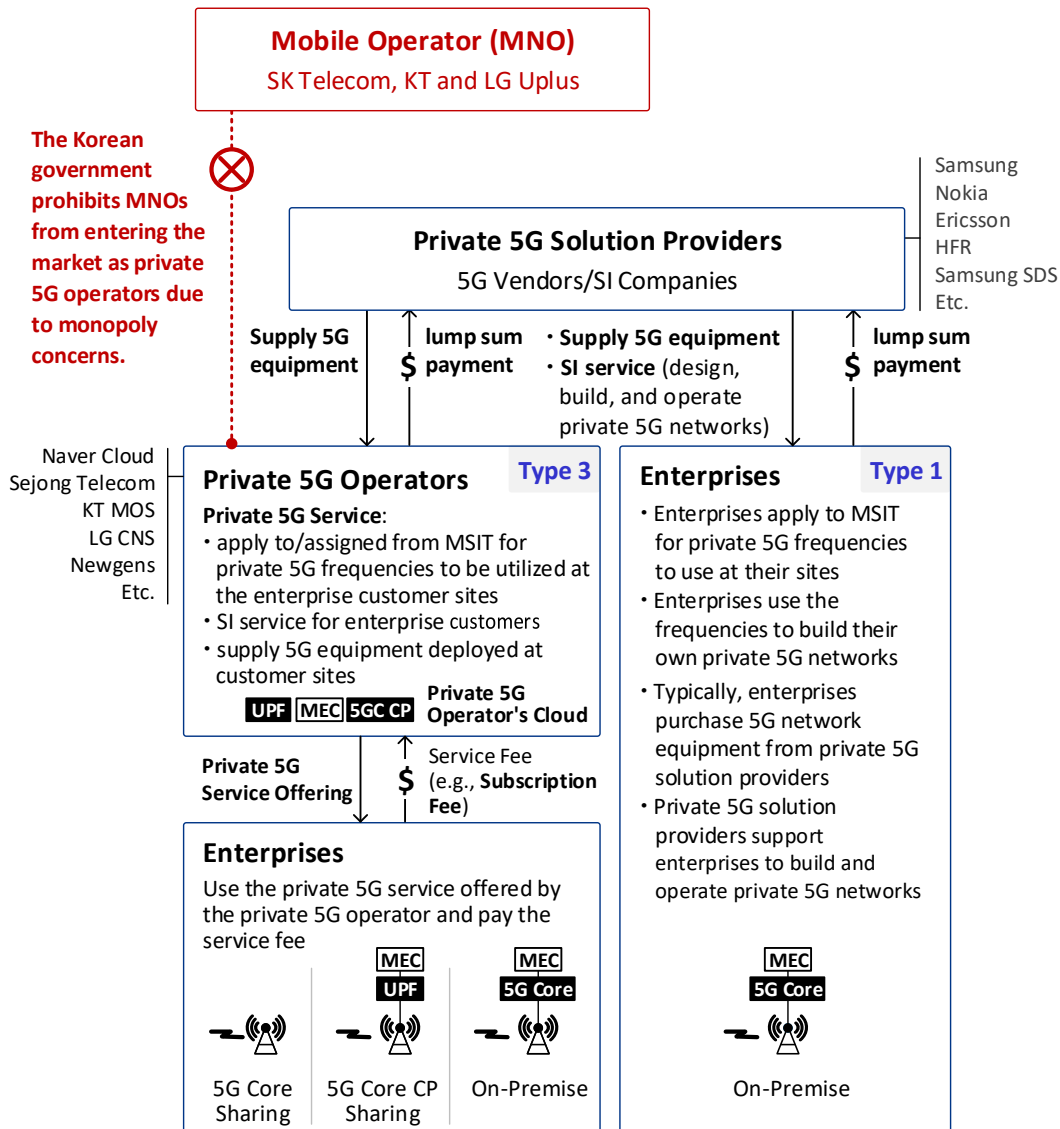


Figure 2. Private 5G Regulation in Korea

In South Korea, mobile operators (MNOs: SK Telecom, KT, and LG U+) are not allowed to become private 5G operators.

The South Korean Government's Regulations on Private 5G and KT's Strategy for entering the Market in Response

3. KT's strategy for entering the private 5G market (3 Business Models)

As mentioned above, MNOs cannot become private 5G operators and generate revenue by providing private 5G services directly to enterprise customers. However, MNOs are preparing various business models in anticipation of private 5G as the next new source of revenue in addition to B2C public 5G services (5G phones), and KT is the most active among the three MNOs.

• KT's experience in building and operating private 5G networks

In 2022, KT built private 5G networks in four organizations: Bundang Seoul National University Hospital, Samsung Medical Center, Republic of Korea Navy, and Korea Aerospace Industries.

The private 5G networks at Bundang Seoul National University Hospital and Samsung Medical Center were built by KT's subsidiary KT MOS as a private 5G operator (Type 3: KT MOS applies for and is allocated private 5G frequencies by the Ministry of Science and ICT. KT MOS provides private 5G network services to enterprises), and KT performed the System Integration of private 5G network.

The Republic of Korea Navy and Korea Aerospace Industries built their own private 5G networks (Type 1: The two organizations applied for and received private 5G frequencies from the Ministry of Science and ICT), and KT performed the System Integration of private 5G network.

* System Integration: Design, equipment procurement/supply, construction, and operation of a customer's private 5G network.

• KT's experience in verifying a cloud-based private 5G testbed

In October 2022, KT, in partnership with AWS and Nokia, built a private 5G testbed at KT Research and Development Center that provides a cloud-based private 5G core to enterprises. On this testbed, KT validated various solutions for services such as robotics, security, and remote monitoring.

• Although KT cannot become a private 5G operator, it is planning several business models to make money in the private 5G market based on the experience of building four locations and verifying the cloud-based private 5G testbed in 2022.

Let's take a look at 3 Business Models one by one.

① Provide SI services to enterprises that want to build their own private 5G network (Type 1): for large enterprises

This is a business in which KT provides SI services (system integration: 5G network design, equipment supply, construction, and operation) to companies that want to build their own private 5G networks, such as the Navy Headquarters and Korea Aerospace Industries.

In this case, the private 5G network is mostly built as an on-premise type, in which the 5G base station, 5G core, and MEC (enterprise application) are all installed at the enterprise site. Private 5G network equipment is purchased by an enterprise and becomes an enterprise asset. This business targets large enterprises with abundant capital.

⇒ In this case, KT raises SI service revenue from large enterprises.

② Provide cloud 5G core subscription services to enterprises that want to build their own private 5G network (Type 1): for SMEs

To accelerate the deployment of private 5G, KT announced its cloud-based private 5G network deployment strategy in cooperation with AWS and Nokia at the AWS Seoul Summit on May 3, 2023.

The key feature is that the 5G Core is hosted in AWS Seoul Region, which is a public cloud.

Only the 5G RAN is deployed at the enterprise site, while the 5G Core is hosted in the cloud and shared by different enterprises (5G Core Sharing).

Based on this, KT offers cloud 5G core subscription services to enterprises, particularly small and medium-sized firms, which want to establish their own 5G networks.

The South Korean Government's Regulations on Private 5G and KT's Strategy for entering the Market in Response

Because it is too expensive for small and medium-sized enterprises to purchase and build a full set of 5G, KT offers cloud 5G core as a service.

This means that enterprises do not need to buy 5G core, which is the most expensive 5G equipment.

Enterprises apply for and receive private 5G frequencies, build their own base stations (enterprise assets), and pay a subscription fee to access KT's cloud 5G core.

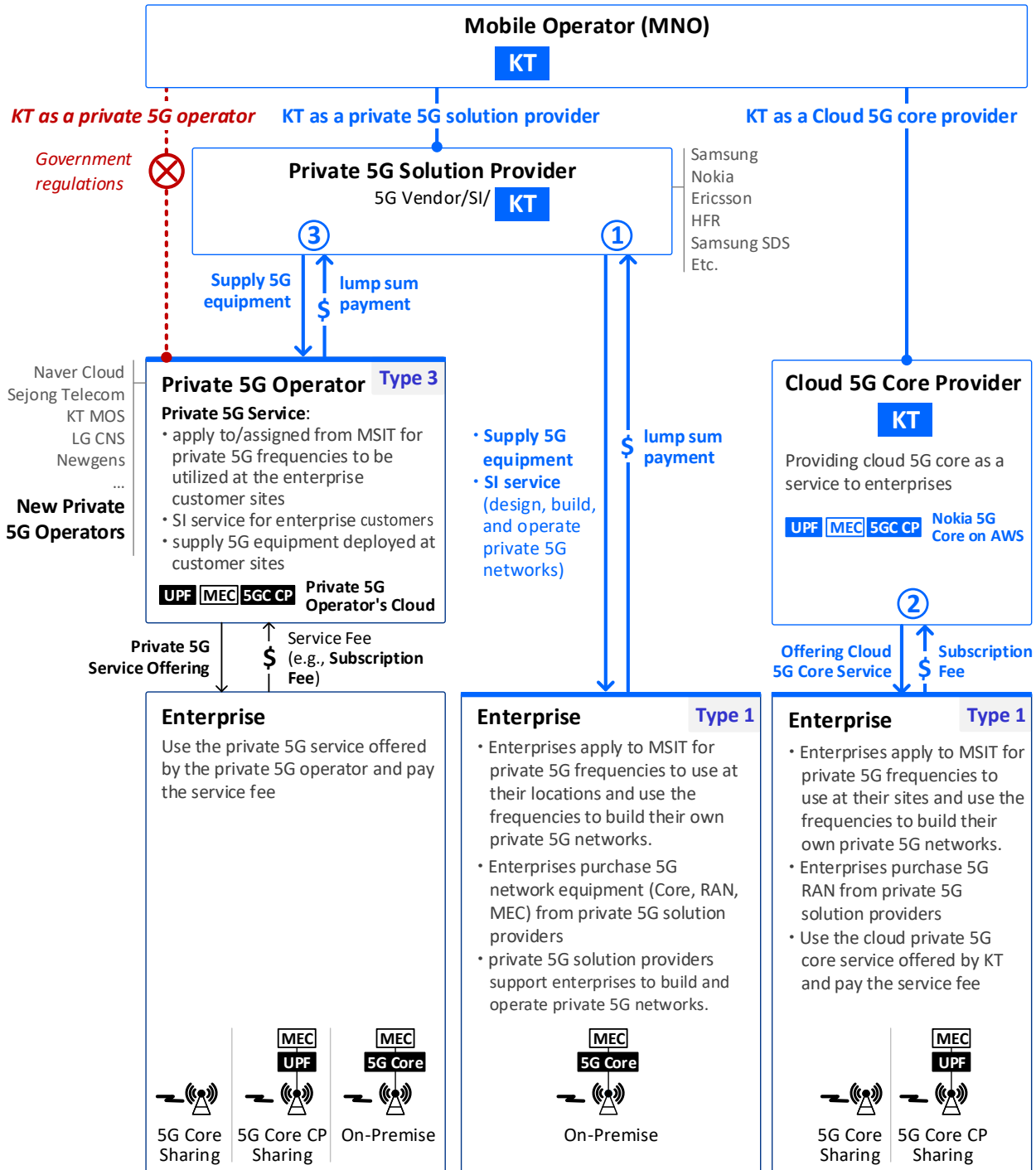


Figure 3. KT's strategy for entering the private 5G market
 KT plans to monetize private 5G by targeting large enterprises, SMEs, and private 5G operators.

The South Korean Government's Regulations on Private 5G and KT's Strategy for entering the Market in Response

Because it is too expensive for small and medium-sized enterprises to purchase and build a full set of 5G, KT offers cloud 5G core as a service.

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Enterprises apply for and receive private 5G frequencies, build their own base stations (enterprise assets), and pay a subscription fee to access KT's cloud 5G core.

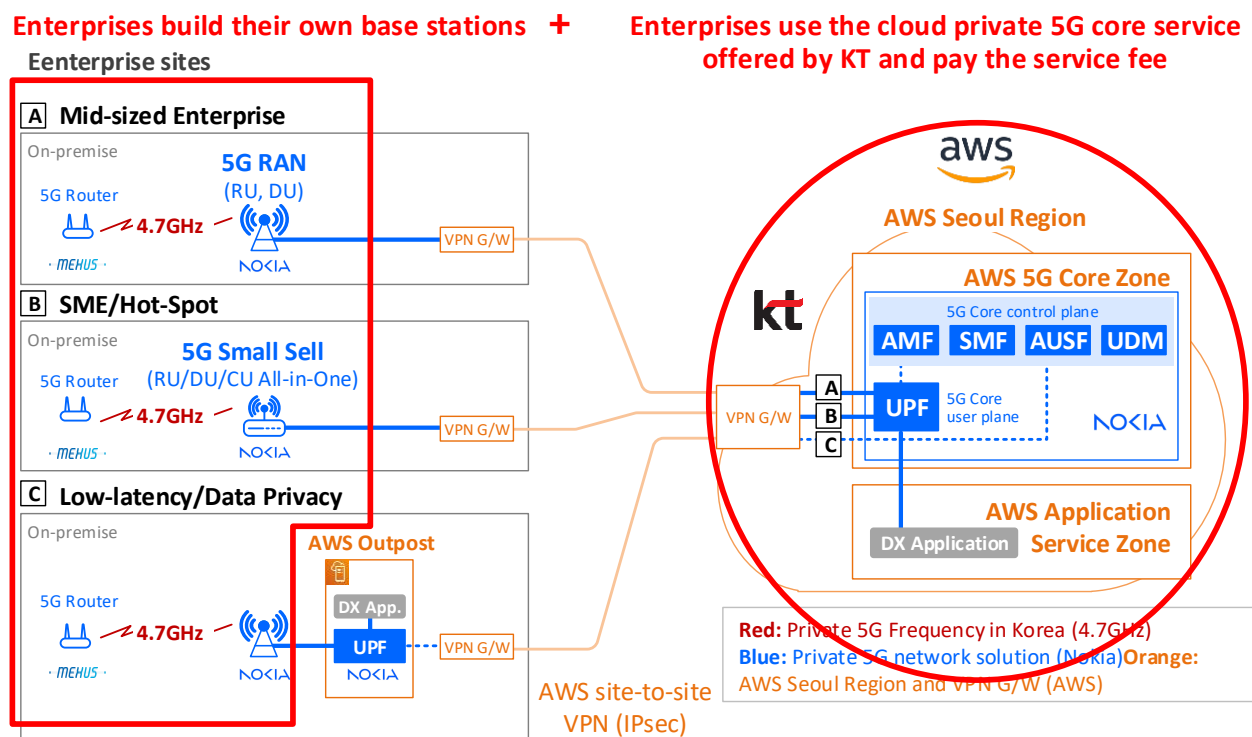


Figure 4. KT's AWS cloud-based private 5G network deployment in Korea

In this model, KT offers cloud 5G core as a service and receives service fees from enterprises.

However, isn't KT behaving as a private 5G operator in this case? Isn't it illegal for KT to behave as a private 5G operator because it is a mobile operator?

I contacted the Ministry of Science and ICT, the ministry in charge of private 5G networks. The answer from MSIT was, "It seems that it is possible for a private telecommunication facility installer to use a portion of a common carrier's (e.g., KT's) network for its own telecommunications".

In other words, KT cannot be assigned private 5G frequencies from MSIT and then provide private 5G services to enterprises while collecting service fees (Type 3).

However, KT may supply cloud 5G core services to enterprises (Type 1) that have been given private 5G frequencies by MSIT and are building their own private 5G networks.

⇒ In this case, KT raises revenue from cloud 5G core subscription fees from SMEs.

③ Selling private 5G network solutions to 5G specialized network operators (Type 3): for private 5G operators

As a private 5G solution provider, KT sells private 5G solutions (5G equipment, terminals, OSS systems, etc.) to new private 5G operators.

⇒ In this case, KT earns revenue from the sale of solutions to new private 5G operators.

The South Korean Government's Regulations on Private 5G and KT's Strategy for entering the Market in Response

4. Summary

Despite the government's restrictions on KT becoming a private 5G operator and receiving private 5G spectrum to provide private 5G services to enterprises, we can see from the above that KT is working creatively to enter the private 5G market by developing alternative business models.

The cloud 5G core subscription services (② in Figure 3) will be an important breakthrough in the proliferation of private 5G networks since it will provide a cost-effective way for many small and medium-sized businesses who cannot afford to invest in pricey 5G equipment.

It is expected that KT will capture a significant portion of the private 5G network market pie in the future, and it is desirable that competition between MNOs, including KT, and new private 5G operators will promote the introduction of private 5G networks, resulting in a rapid digital transformation of the domestic industrial sector.

However, we believe that institutional safeguards are also required to prevent existing MNOs from dominating the private 5G market, allowing a new ecosystem of private 5G operators to emerge in the realm of private 5G networks.

Major 5G Players in Korea

5G Operators (MNOs) in Korea





Private 5G Operators in Korea















5G Vendors in Korea






4 Deployment Models for Private 5G Networks

2023.03.14 | By Harrison J. Son (son@netmanias.com)

In this article, we look at the background of the emergence of private 5G and private 5G operators, and examine four models for enterprises to deploy private 5G networks.

In 2019, Germany's BNetzA, Japan's Ministry of Internal Affairs and Communications, and Ofcom in the UK opened 5G frequencies for the industry to promote digital transformation, enabling enterprises to build and operate private 5G networks independent of mobile carriers' public 5G networks. In 2021, Ministry of Science and ICT in Korea opened private 5G frequencies (100MHz@4.7GHz and 600MHz@28GHz).

It has become possible to establish a carrier-grade quality wireless private network in enterprise workplaces.

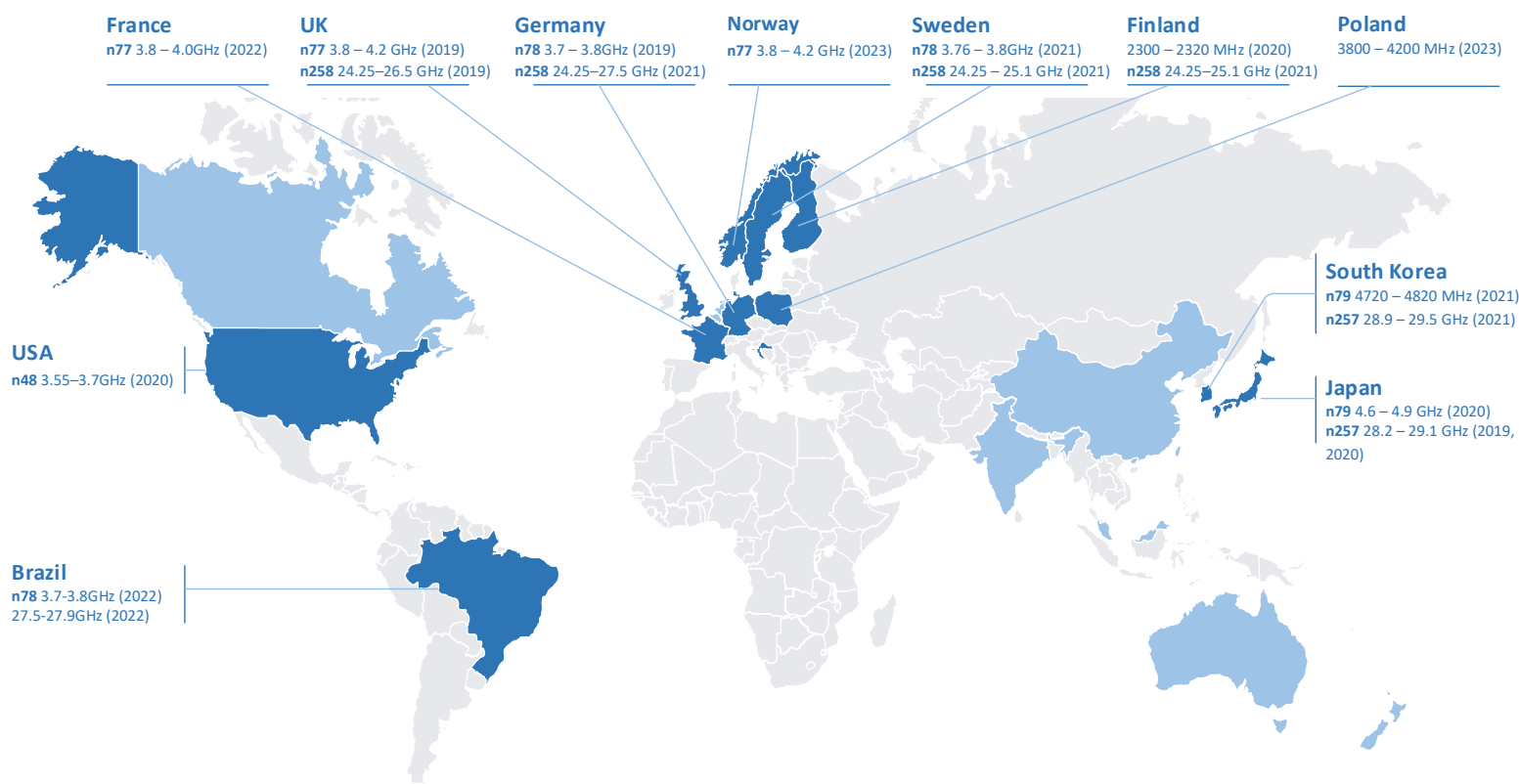


Figure 1. Current Status of Commercialization of Private 5G Frequencies in Countries around the World (As of 2023.10.01)

Unlike wired Ethernet and Wi-Fi, which are existing private network technologies, private 5G networks provide unprecedented wireless connectivity with mobility, large capacity (10Gbps), ultra-low latency (up to 1ms), and ultra-connectivity (10^6 devices/Km²).

As a result, enterprises can implement various types of industrial applications/use cases with different requirements in terms of mobility, capacity, latency, and number of concurrent access terminals, such as camera and AI-based image analysis, robot motion control, and asset tracking.

The Private 5G network is expected to be used in various industrial fields as a key infrastructure for industrial digital innovation.

4 Deployment Models for Private 5G Networks

In December 2019, big companies in Germany began to build a private 5G network.

In Germany, which opened the Sub-6 5G frequency (3.7-3.8GHz) to the industry first in the world in 2019, German big companies such as Bosch, Volkswagen, Porsche, Rohde & Schwarz, and KUKA began building their own private 5G networks (They design/procurement/build/operate their own private 5G network).

They self-develop a completely closed private network (on-premise type) that is ideal in terms of high security in that data and terminal information generated by the company are distributed only inside the workplace, 5G performance such as large capacity/low latency, and stability regardless of the external network environment.

These companies operate their own private 5G networks with an organization dedicated to designing/constructing/operating 5G networks in-house.

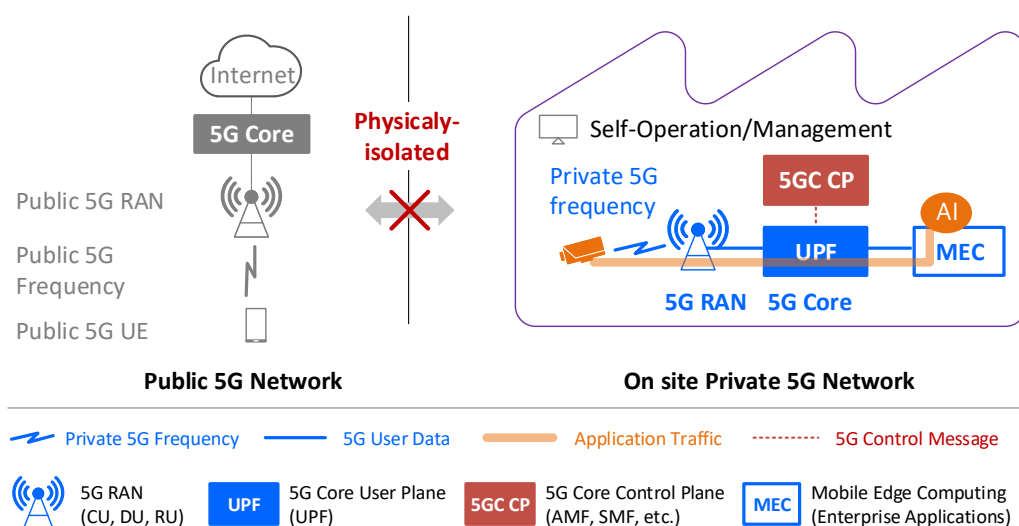


Figure 2. Isolated Private 5G network built by the Enterprises

Obstacles to enterprise's deployment of private 5G networks

However, unlike the large companies mentioned above, which have been preparing to build a private 5G private network for several years, the situation of general companies that are not familiar with 5G technology is different from them.

The lack of expertise in 5G mobile communication technology and the high cost of purchasing 5G equipment are acting as major obstacles to enterprise's deployment of private 5G networks.

Lack of expertise: without expertise, it is almost impossible for most companies to understand difficult and complex 5G to design customized 5G networks for themselves, select 5G core and base station vendors, integrate 5G equipment from multiple vendors, and operate themselves.

Expensive equipment cost: all 5G elements in the workplace must be purchased and built. Unlike existing wired LANs or WLANs, 5G equipment is very expensive because it is originally used for mobile communication. In the case of products from major 5G vendors, purchasing one 5G core control unit, one UPF, one 5G CU, one DU, and a few RUs costs nearly \$800K.

For private 5G to be successful in the market, it must solve the problem that private 5G equipment is very expensive because it is 3GPP cellular, the long and costly problem of companies integrating equipment from multiple vendors, and the difficulty of existing network operators to operate 5G networks like Wi-Fi and wired Ethernet.

In particular, these problems are more serious in small and medium-sized enterprises (SMEs) rather than large corporations with abundant capital and manpower, which is a major obstacle to the rapid spread of private 5G around the world.

4 Deployment Models for Private 5G Networks

Emergence of private 5G operators

In order to solve these difficulties and realize the rapid introduction of private 5G, private 5G operators* that provide private 5G network design, construction and operation services to enterprises are appearing all over the world.

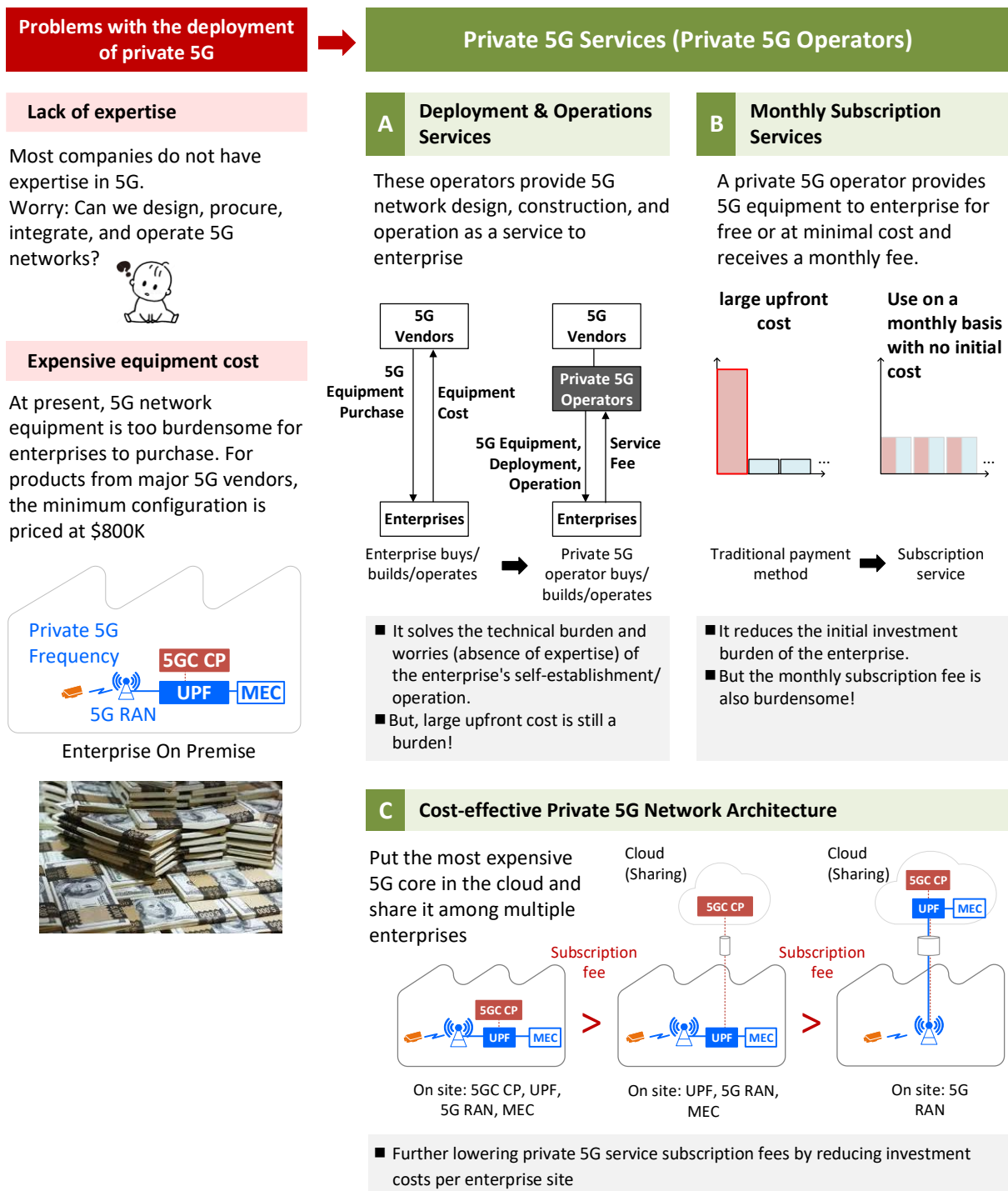
* Private 5G operator: An operator that provides private 5G service to enterprises using private 5G frequencies (SI company, Telco/CATV operator, cloud service provider, mobile operator, etc.).

Japan: NSSOL, Fujitsu, Hitachi, NTT East Japan, NTT Com, NEC, NESIC, Ehime CATV, Mitsubishi Real Estate, Okinawa Cable TV, etc.

Germany: DT, Vodafone Germany, Telefonica Germany, Becon, Siticom, Cocus, Umlaut, etc.

USA: AT&T, Verizon, AWS, Google Cloud, Microsoft, Beta.com, etc.

Korea: Naver Cloud, LG CNS, SK Networks Service, Nable Communications, CJ Olive Networks, KT MOS, Sejong Telecom, Wizcore, etc.



Private 5G Frequency



Enterprise On Premise

Figure 3. Private 5G Services (Private 5G Operators)

4 Deployment Models for Private 5G Networks

These operators provide 5G network design, construction, and operation as a service to enterprises that are struggling to build due to lack of expertise (Figure 3 - A).

In addition, in order to facilitate the introduction of private 5G networks,

(Figure 3 - B) It also provides monthly subscription services to lower the initial investment cost of enterprises.

(Figure 3 - C) 5G core, which is the most expensive of 5G network components, is placed in the cloud of a private 5G operator rather than located at each enterprise site, and multiple enterprises share the 5G core (network slicing), reducing the investment cost per enterprise site. This further lowers the subscription service fee.

The components of the private 5G network are the same as the public 5G network used by general consumers mainly for smartphones, and are largely composed of 5G core control units (AMF, SMF, etc.), 5G core data units (UPF), 5G base stations (CU, DU, RU), and 5G terminals (UE).

Depending on the physical distribution location of these 5G network components inside and outside the enterprise site, various deployment models for private 5G network are possible.

There are four major private 5G network deployment models that have emerged in the market

Private 5G deployment models can be classified into four major categories as follows, depending on the builder and the physical location of 5G components.

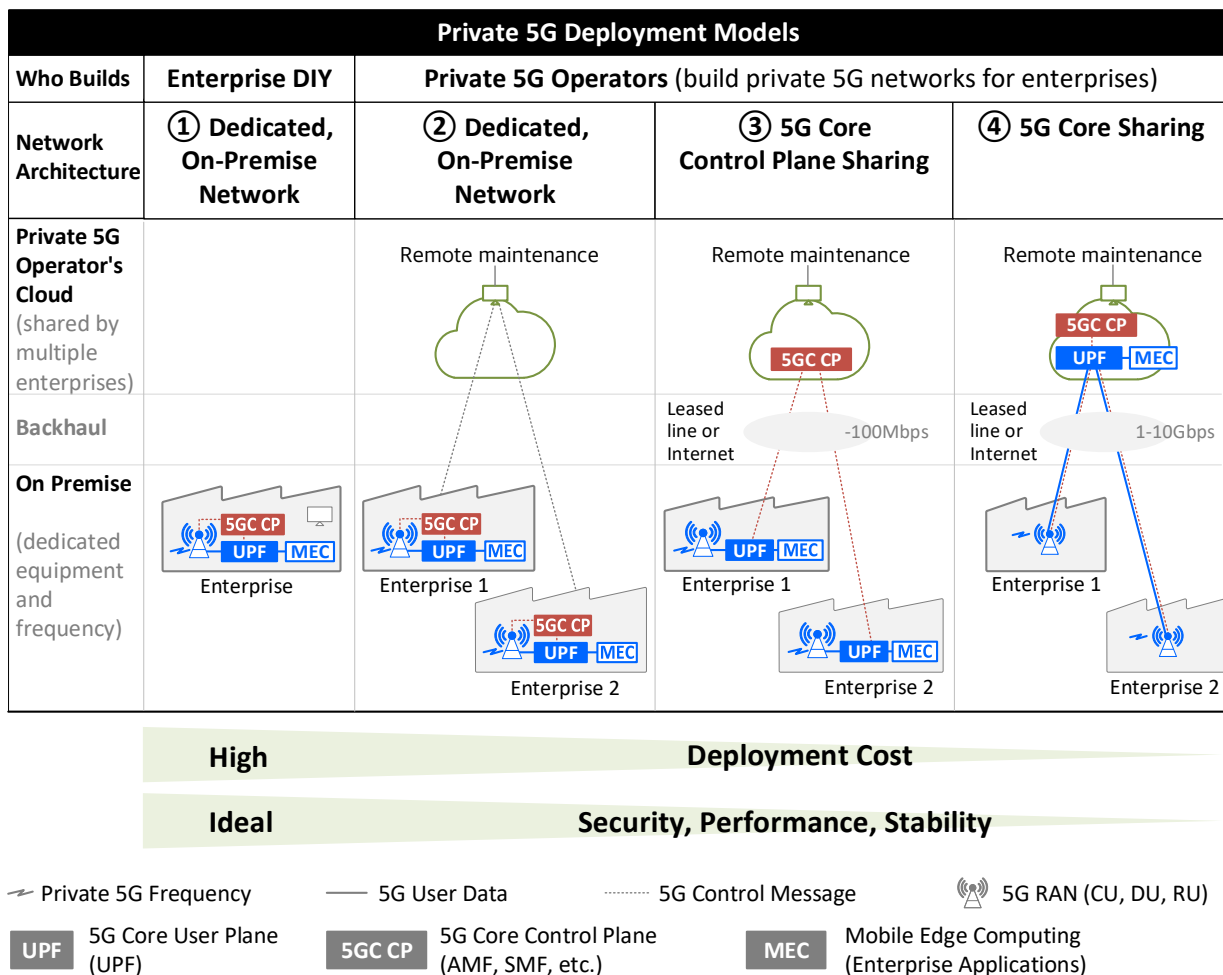


Figure 4. Private 5G Network Deployment Models

4 Deployment Models for Private 5G Networks

- ① **Enterprise DIY (Dedicated, on-premise network):** enterprise builds all components of the 5G network on enterprise site
- ② **Private 5G Service (Dedicated, on-premise network):** private 5G operator builds all components of the 5G network on enterprise site
- ③ **Private 5G Service (5G Core Control Plane Sharing):** private 5G operator builds only 5G user plane within the enterprise site
- ④ **private 5G service (5G Core Sharing):** private 5G operator builds only 5G RAN within the enterprise site

Depending on the private 5G network deployment models, there are advantages and disadvantages in terms of deployment/operation costs, low-latency application support capabilities, large-capacity application support capabilities, stability, enterprise data privacy, and full control (see Table 1).

Enterprises that want to introduce private 5G networks can build private 5G networks by themselves by purchasing equipment from 5G vendors (on-premise type), or use private 5G network deployment and operation services (on-premise type, 5G core control plane sharing, and 5G core sharing) in consideration of their security policies, major applications, and secured budgets.

Table 1. Comparison of private 5G network deployment models

Who Builds	Enterprise DIY		Private 5G Operators	
Network Architecture	① Dedicated, On-Premise Network	② Dedicated, On-Premise Network	③ 5G Core Control Plane Sharing	④ 5G Core Sharing
Cloud of Private 5G Operator	-	-	5G Core CP	UPF, 5G Core CP, MEC
On Site	5G UE, 5G RAN, 5G Core, MEC	5G UE, 5G RAN, 5G Core, MEC	5G UE, 5G RAN, UPF, MEC	5G UE, 5G RAN
Security (Data Privacy)	No data leakage outside the enterprise			All data in the enterprise is externally leaked. Only for enterprises that allow data leakage.
eMBB Performance	Excellent support for large-capacity applications with a data plane established in the enterprise site.			Requires large-capacity backhaul link. Internet VPN is also possible.
URLLC Performance	Excellent support for low-latency applications with a data plane established in the enterprise site.			Applicable only if the backhaul transmission delay due to distance is lower than the allowable delay of the application. Expensive quality guaranteed backhaul line required.
Stability	Independent of enterprise external network failure		Affected by a communication failure/disaster outside the workplace (Communication/service interruption)	
Backhaul	No need for backhaul lines		Since only control messages are carried, low-capacity, best-effort lines are also possible.	Because user data is also carried, low-latency applications require expensive quality-guaranteed lines. High-capacity applications require best-effort high-capacity lines.

4 Deployment Models for Private 5G Networks

Table 1. Comparison of private 5G network deployment models (Continued)

Who Builds	Enterprise DIY	Private 5G Operators		
Network Architecture	① Dedicated, On-Premise Network	② Dedicated, On-Premise Network	③ 5G Core Control Plane Sharing	④ 5G Core Sharing
Access to the enterprise network in the workplace	Access to the enterprise network from UPF in the workplace			A leased line is required between the UPF of the cloud and the enterprise network in the workplace
Network Slicing	Sufficient number of slices can be created (e.g. slices for each department/application within the enterprise)			Depends on the private 5G service provider, but usually provides a few slices for each enterprise
Full Control	Enterprises can fully control private 5G networks, such as up/down speed adjustment, network slice creation, access authority control for each slice, device addition, and QoS/permission settings	Enterprise control over the private 5G network is also possible within the range provided according to the service policy of the private 5G operator.		
CAPEX	An enterprise purchases base stations and cores. The initial investment cost of the company is very high.	The service fee is high due to the operator's large investment cost (base station, UPF, 5GC CP) for each enterprise site.	Low service fee due to reduced investment cost (base station, UPF) for each enterprise site.	The service fee is the lowest because the operator's investment cost (base station) of each enterprise site is the lowest.
In-house 5G experts	Need for 5G experts inside the enterprise	Possible without 5G experts inside the enterprise		

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Services	AI																														
	IoT																														
	MEC																														
	OTT: YouTube/Netflix																														
	eMBMS/Mobile IPTV																														
	CDN/Mobile CDN																														
	Transparent Caching																														
	BSS/OSS																														
	Cable TPS																														
	Voice/Video Quality																														
	IMS																														
	Policy Control/PCRF																														
IPTV/TPS/UHD																															
Mobile Network	Private 5G																														
	5G																														
	C-RAN/Fronthaul/O-RAN																														
	LTE/LTE Advanced																														
	Mobile WiMAX																														
	Carrier Wi-Fi																														
Wireline Network	LTE Backhaul/Fronthaul																														
	SDN/NFV																														
	Data Center Migration																														
	Carrier Ethernet																														
	FTTH/DSL/ Broadband?																														
	Data Center																														
	Metro Ethernet																														
	MPLS																														
	IP Routing																														
	Network Protocol																														
SONET/SDH/MSPP																															

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