

Japan's Efforts to Promote the Prevalence of Local 5G

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What Is Local 5G?

- Local 5G refers to **licensed 5G communication networks for** buildings or premises, differing from nationwide networks operated by mobile phone service providers. **Various local entities such as enterprises and governments can flexibly develop Local 5G networks within their respective compounds** to meet local or industrial needs.

<Local 5G systems as compared with others>

- Unlike nationwide 5G networks operated by mobile phone service providers:
 - Local 5G networks can be developed **before mobile phone service providers launch 5G services** in areas where nationwide services are delayed.
 - Local 5G networks can **flexibly set necessary functions** in accordance with local needs.
 - A local 5G network in one region is invulnerable to communication breakdowns or disasters in other regions.**
- Local 5G networks based on radio station license can be used more stably** than Wi-Fi networks.

Introduced by stadium operators
e stadium



Introduced by healthcare organizations
Remote medical care



Introduced by cable TV companies
4K/6K videos



Introduced by general contractors at the site of construction
Remote control of construction machineries



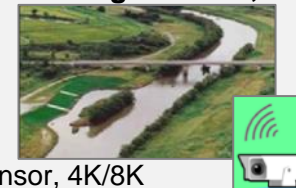
Introduction by business owners at factories
Smart factory



Municipalities' **telework**
environment development



Introduction by municipalities, etc.
Monitoring of rivers, etc.




Sensor, 4K/8K

Sophistication of agriculture by farms
Automatic farm management



Local 5G development

- Local 5G was partially institutionalized in December 2019 (28.2-28.3 GHz). In December 2020, Local 5G frequencies were expanded to cover 4.6-4.9 GHz and 28.3-29.1 GHz.
- Based on **development and demonstration** results, rules for using Local 5G have been gradually formulated.
- Tax incentives** have been used to promote the dissemination of Local 5G.

	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024
Acceleration of Local 5G development		Development and demonstration projects to realize problem-solving 5G systems				
						
		Institutionalization of Local 5G	Expansion of Local 5G frequencies	Based on development and demonstration results, rules for using Local 5G have been gradually formulated		
		★December Partial institutionalization	★December Frequency expansion			
		5G promotion tax incentives to promote the prevalence of Local 5G				

Number of applicants and licensees

121

(As of August 31, 2022)

Number of demonstration projects

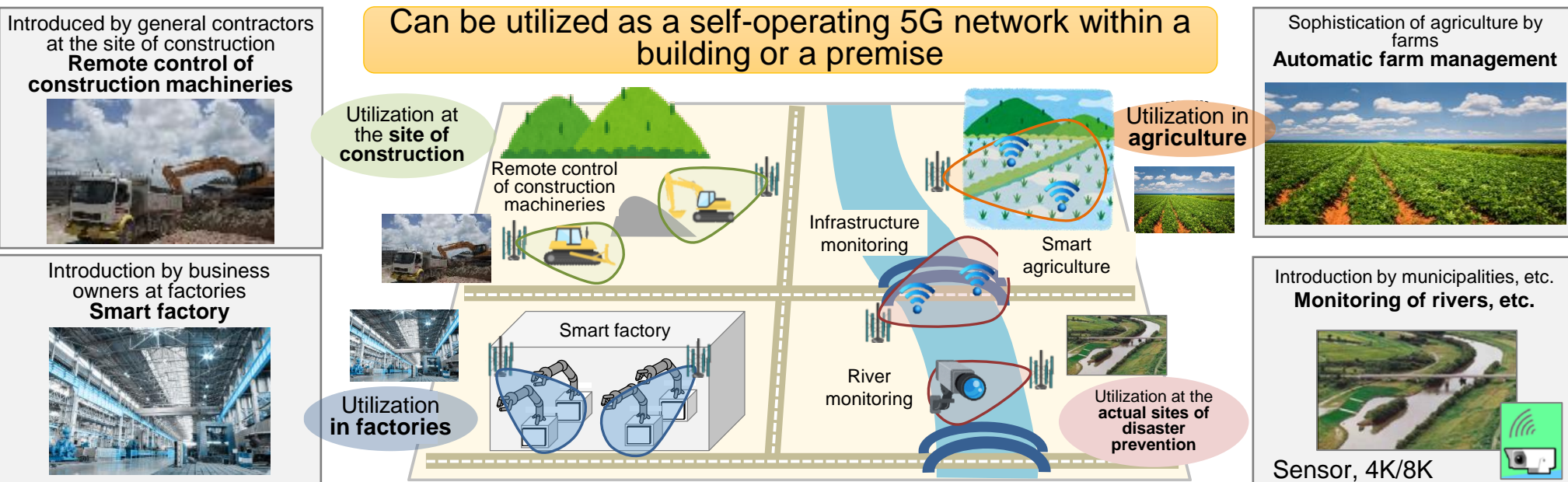
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(FY2020-2022)

■ Regarding Local 5G that allows enterprises and various other regional entities to develop their unique 5G systems flexibly to meet their respective needs, development and demonstration projects to solve various problems and create new values are implemented. Institutions for the flexible operation of Local 5G systems are developed along with mechanisms for their general and easy use.

FY2019 supplementary budget: 0.64 billion yen (general)
FY2020 initial budget: 3.74 billion yen (3.62 billion yen in user fees and 0.12 billion yen in general)
FY2021 initial budget: 6 billion yen (5 billion yen in user fees and 1 billion yen in general)
FY2021 supplementary budget: 0.8 billion yen (general)
FY2022 initial budget: 4 billion yen (user fees)

<Implementation of development and demonstration projects for specific usages>



Overview of adopted projects

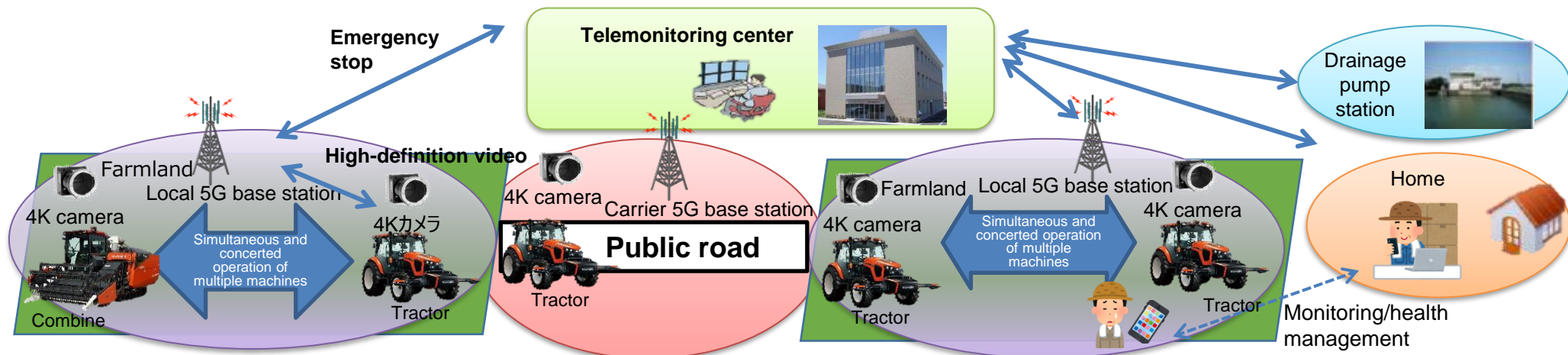
- A total of 45 demonstration projects were implemented in FY2020 and 2021. In FY2022, 24 projects were adopted.
- Development and demonstration achievements are compiled into reports, and videos showing demonstration are produced and published on a publicity homepage. [Go! 5G] <https://go5g.go.jp/>



	Agriculture, forestry and fisheries	Factories and power plants	Airports and seaports	Railways, roads and transportation	Tourism, culture and sports	Disaster prevention/reduction and crime prevention	Healthcare	Others	Total
FY2020	4	4	-	2	3	2	3	2	19
FY2021	4	5	3	5	3	3	1	3	26
FY2022 (*)	5	4	2	3	3	3	4	-	24

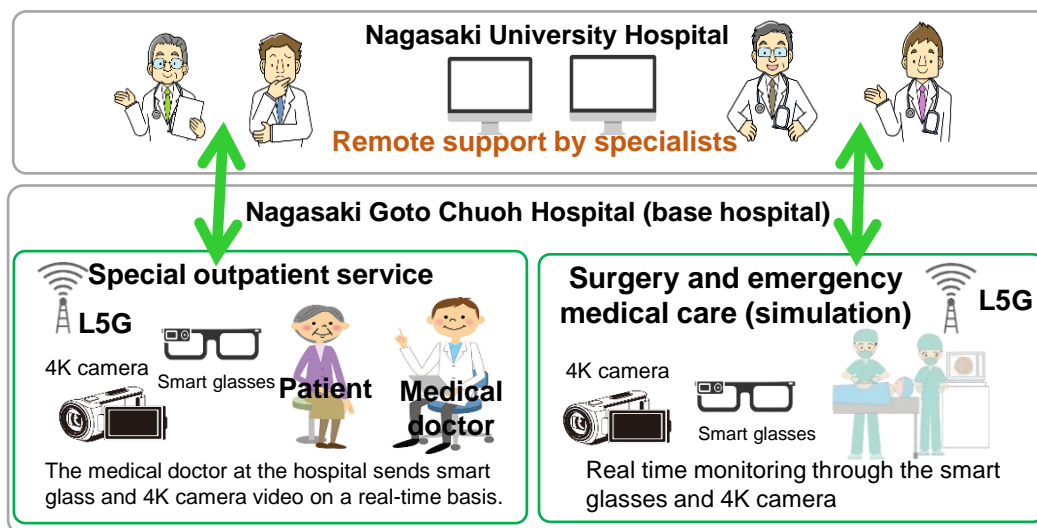
* The total covers development and demonstration projects (under the FY2022 initial budget) and demonstration projects in special environments (under the FY2021 supplementary budget)

Representative	Nippon Telegraph and Telephone East Corporation	Field	Agriculture (rice and dryland farming)
Demonstration area	Iwamizawa, Hokkaido	Consortium	Nippon Telegraph and Telephone East Corporation, Iwamizawa City, Hokkaido University, SmartLinkHOKKAIDO Inc., Kubota Corporation, Hitachi Solutions Ltd., NTT Docomo Inc., Hamanasu Information Co., Iwamizawa Agricultural Cooperative Association, Iwamizawachiiki ICT Nogyorikatsuyou Kenkyukai, Nippon Telegraph and Telephone Corporation, producers cooperating in demonstration
Overview of demonstration	<p>The aging of farmers and a decline in the number of new farmers have led to problems such as labor shortages, a skill succession crisis and a profitability decrease.</p> <ul style="list-style-type: none"> ➤ (1) The demonstration of remote supervisory control on multiple autonomous tractors (unattended operation of autonomous tractors: Level 3), (2) the demonstration of collection of big data acquired through various sensors about plant growth (formulation of optimum farming plans, etc.), (3) demonstration of utilization of networks combining multiple existing infrastructure systems, etc. were implemented. 		
Technology demonstration	<ul style="list-style-type: none"> ➤ Toward the outdoor use of the 4.7 GHz band in a rural environment, the project assessed the performance of Local 5G systems against shielding materials and considered the joint use of Local 5G and Carrier 5G networks, including their semi-synchronization. ➤ Frequency: 4.7 GHz band Configuration: System agent (SA) configuration Environment for use: Outdoor (farmland, public roads) 		

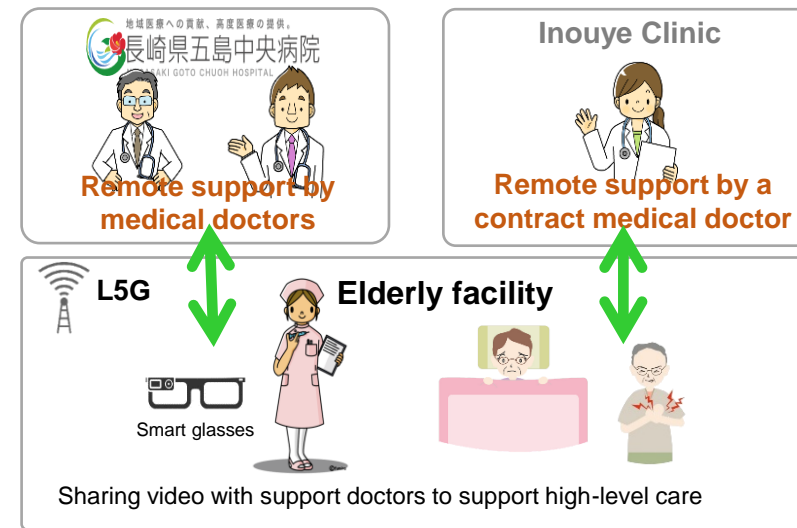


Representative	NTT Fieldtechno Corporation	Field	Healthcare
Demonstration area	Nagasaki and Goto, Nagasaki Prefecture	Consortium	NTT Fieldtechno Corporation, Nagasaki Prefecture, Nagasaki University Hospital, Nagasaki Goto Chuoh Hospital, Nagomikai, Inouye Clinic
Overview of demonstration	<p>Rapid population aging has led to the problem of an increase in the number of patients subjected to regular medical examination or care at elderly facilities or at home.</p> <ul style="list-style-type: none"> ➤ (1) The demonstration of highly specialized medical care provided at base hospitals on remote islands through specialists' remote support using smart glasses and 4K camera video and (2) the demonstration of nurses' remote medical care support through smart glass video at elderly facilities lacking permanently stationed medical doctors on remote islands were implemented. 		
Technology demonstration	<ul style="list-style-type: none"> ➤ The assessment of Local 5G performance and radio propagation characteristics and the verification of area building and system configuration were conducted along with the consideration of the uplink/downlink ratio and the verification of requirements for equipment configuration. ➤ Frequency: 4.7 GHz band Configuration: System agent (SA) configuration Environment for use: Indoor (hospital) 		

(1) Highly specialized medical care provided through specialists' remote support



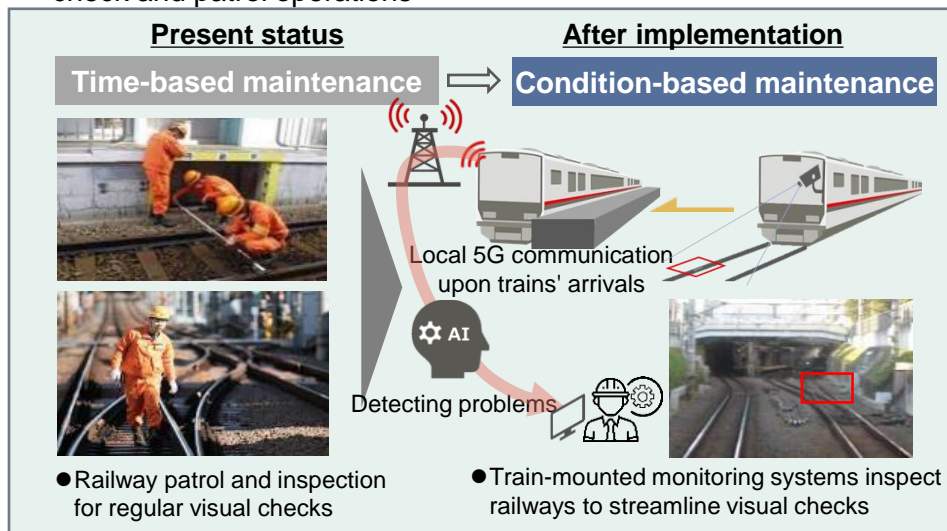
(2) Remote medical care services at elderly facilities



Representative	Sumitomo Corp.	Field	Railways/roads
Demonstration area	Meguro Ward, Tokyo (Tokyu Jiyugaoka Station)	Consortium	Sumitomo Corp., Tokyu Express Co., Fujitsu Ltd., SCSK Corporation, Panasonic System Solutions Japan Co., West Japan Railway Co., Tokyo Metro Co.*1, Insight Edge Inc., Tokyu Corp., Grape One Ltd. *1 Railway sector adviser
Overview of demonstration	<p>Railway infrastructure and train maintenance operations required for railway service safety are plagued with labor shortages due to the aging population and falling birthrates, and severe work environments.</p> <ul style="list-style-type: none"> ➤ A Local 5G environment was developed at the railway station to sophisticate railway patrol operations with train-mounted monitoring cameras and AI and upgrade door closing decisions with high-definition cameras and AI. ➤ Railway equipment patrol and inspection were automated to maintain safe, stable transportation and streamline and automate railway transportation services. 		
Technology demonstration	<ul style="list-style-type: none"> ➤ At a horizontally long, narrow railway station where urban indoor and outdoor environments are mixed, a radio propagation model was refined with consideration given to a building entry loss at the platform and environmental differences regarding propagation directions. ➤ Frequency: 4.8-4.9 GHz band (100MHz) Configuration: Stand-alone type Environment for use: Outdoor 		

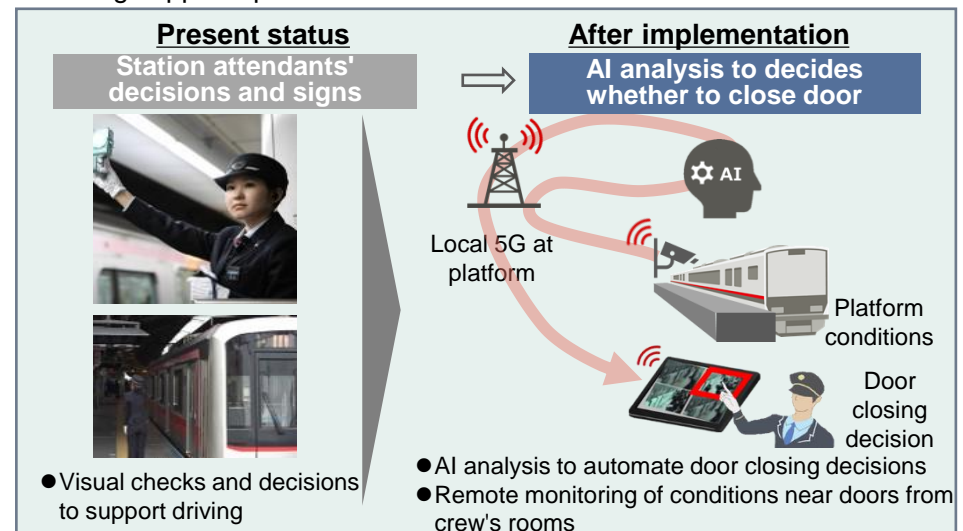
Using train-mounted monitoring cameras and AI to sophisticate railway patrol operations

- ✓ Problems are detected automatically to streamline visual railway check and patrol operations



High-definition cameras and AI are used to upgrade door closing decisions.

- ✓ Door closing decisions are automated to save labor and improve safety for driving support operations



- The importance is growing of developing, providing and introducing 5G networks as indispensable infrastructure for realizing Society 5.0 while securing cybersecurity.
- The government will promote the intensive development of rural base stations over three years from FY2022 as the development accelerates towards the realization of the Vision for a Digital Garden City Nation.

Nationwide Carrier and Local 5G licensees

Submitting plans

Plans to introduce specific sophisticated information and communication technology systems
(Certification by the competent minister holding jurisdiction over licensees' business operations)

<Certification standards> **(1) Safety/reliability**
(2) Stable supply **(3) Openness**

After certification

Introducing 5G equipment according to certified plans

Tax incentives (tax credit, etc.) for investment in relevant 5G equipment

<Details of tax incentives>

(1) Corporation and income taxes

[Expiration: End of FY2024]

Tax credit	or	special depreciation
FY2022: 15%		30%
FY2023: 9%		
FY2024: 3%		
<small>of acquisition costs</small>		

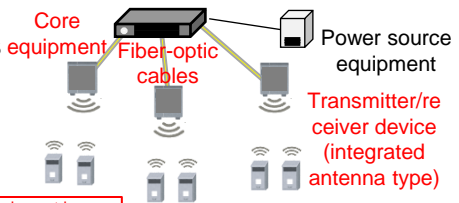
(2) Fixed asset tax on relevant equipment*

[Expiration: End of FY2023]

The tax base will be halved for three years.

* **Relevant equipment** (limited to equipment used for advanced digitalization initiatives)

- Radio equipment for base stations
- Exchange installations
- Transmission equipment (using fiber-optic cables)
- Communication modules



Red equipment is subject to tax incentives.

(1) How to use Local 5G is unknown

(2) Local 5G terminals are limited

(3) Local 5G introduction costs are high

- To promote the diffusion of local digital transformation and accelerate the consideration of solutions using Local 5G and other wireless telecommunication systems, the government helps enterprises and other local organizations formulate introduction and utilization plans.

In FY2022, the scope for government support is expanded from Local 5G stand alone to wireless communication systems as local digital infrastructure including Local 5G, Wi-Fi and low-power wide area (LPWA) networks.

(Overview of FY2022 operations)



Details of support

Applicants for the introduction and utilization of Local 5G and other wireless communication systems receive support from consultants for formulating relevant plans.

- Sorting out specific introduction and utilization methods towards solutions and proposing optimum wireless communication systems
- Working out and clarifying targets and backgrounds for introduction and target business forms to be pursued after the introduction
- Working out measures and schedules for the introduction and utilization



Support targets

Enterprises and other organizations planning or considering the introduction and utilization of Local 5G and other wireless communication systems to solve local problems

- Private enterprises (including stock companies, general partnership companies, limited partnership companies and limited liability companies), specified non-profit corporations, etc.
- Prefectural and municipal governments and organizations equivalent to them



Flow of support

Seminars and consulting services are free

STEP1: September 30

Online seminar

Learning basic knowledge about Local 5G and other wireless communication systems

STEP2: Multiple solicitations and implementations from October

Support for formulating plans to introduce and utilize Local 5G and other systems

Formulating plans to introduce and utilize Local 5G and other wireless communication systems

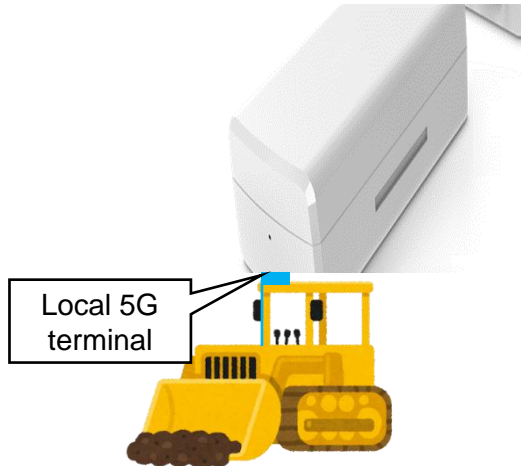
- After specific feasible scenes for Local 5G utilization are assumed to satisfy Local 5G utilization needs in various environments, terminal systems will be fabricated, with radio propagation characteristics being measured, tested and analyzed.

Small camera



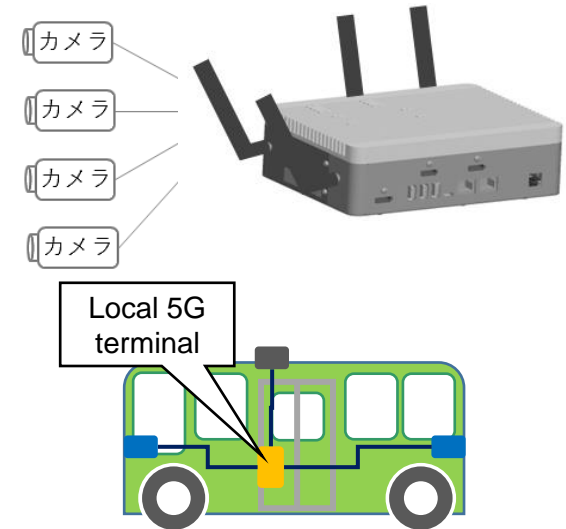
- ✓ Guidance on remote operations through high-definition video transmission at the eye level of operators
- An all-in-one edge AI camera that is **small**, compatible with 5G and **easy to be worn by robots and humans**
- The camera, even though being small, can operate for **more than two hours (target) for streaming communication of full high-definition video** thanks to specially designed heat dissipation function.
- The camera meets the IP68 waterproof and dustproof standard and can be mounted on outdoor moving objects and fixed for surveillance.

Waterproof/dustproof



- ✓ The Local 5G network may be connected to a personal computer in a heavy machinery cabin for remote control and be combined with cameras for checking surroundings.
- The **USB dongle terminal**, though being **small**, complies with the IPX7 **waterproof** standard, the IP6X **dustproof** standard and 14 of the **MIL standards**.
- The terminal is available for uplink high-speed data communication (complying with 2×2MIMO) and features **specially designed heat dissipation to limit an internal temperature rise**.

Encoder type



Driverless bus

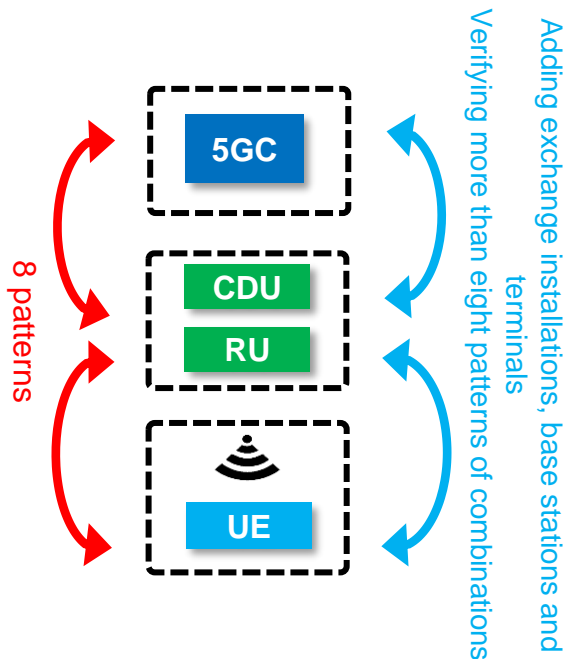
- The **small-sized (some 50% smaller than conventional ones) router terminal** integrates video encoder/decoder and Local 5G transmitter functions.
- The terminal realizes stable **24-hour continuous operation** and **low-latency (150 ms or less)** transmission between video encoders and decoders and responds to semi-synchronization.
- The terminal features resistance to heat and vibration and takes advantage of video QoS (quality of service) control to achieve **uninterrupted video transmission** during traffic for different communication networks.

Multi-vendor Local 5G equipment

(Verifying interconnection and shared use of exchange installations made by different companies)

- As rules have not been established for interconnection of machines made by different companies for Local 5G networks, such rules will be established for system configuration covering installations made by various companies to meet user needs.
- As individual users' on-premises management of systems is burdensome, standard rules will be established for the shared use of exchange installations to mitigate users' burdens and make Local 5G introduction easier.

Verifying interconnection of installations made by different companies



Verifying shared use of exchange installations

Demonstration in FY2021

Demonstration in FY2022

	(1) On-premises type	(2) Shared use of exchange installations	(3) Shared use of UPFs	(4) Shared use of CUs
Center hub		5GC	5GC UPF MEC	5GC UPF MEC CU
End hub	5GC UPF MEC CDU RU	UPF MEC CDU RU UE	CDU RU UE	MEC UPF DU RU UE
Overview	All core and other network functions are installed at the end hub like a user facility in a non-core shared use pattern.	The core control component is installed at the center hub while the UPF is separately installed at the end hub.	The base station (CDU/RU) is installed at the end hub, while the core, UPF and MEC are installed at the center hub.	The CU as well as the UPF and MEC are installed at the center hub, while the DU and RU are separately installed at the end hub.
	Less frequent	Shared use of equipment at the center hub		More frequent

- To promote Local 5G introduction for various areas such as manufacturing, farming transportation, healthcare, construction sites and disaster sites in the stage of Local 5G diffusion, government agencies and organizations for these areas and regional Local 5G promotion organizations form a public-private coordination committee to share administrative information, cooperate with each other and implement nationwide campaigns.



Fifth Generation Mobile Communications
Promotion Forum (5GMF)

Local 5G Promotion Public-Private Coordination Committee

Organization

- Participants
- Relevant government agencies
Ministry of Internal Affairs and Communications, Ministry of Economy, Trade and Industry, Ministry of Agriculture, Forestry and Fisheries, Ministry of Land, Infrastructure, Transport and Tourism, Ministry of Health, Labor and Welfare, National Police Agency
- Relevant organizations
30 organizations including ARIB, CIAJ, TCA, JEITA, RMK, JCTA, 5GMF, Association of Prefectural Governors, JA-ZENCHU (Central Union of Agricultural Co-operatives), National Federation of Forest Owners' Cooperative Associations
- Regional Local 5G diffusion promotion organizations
Regional Bureaus of Telecommunications, Regional Bureaus of Economy, Trade and Industry

- Secretariat: ARIB
- Support organizations: CIAJ, JEITA, RMK

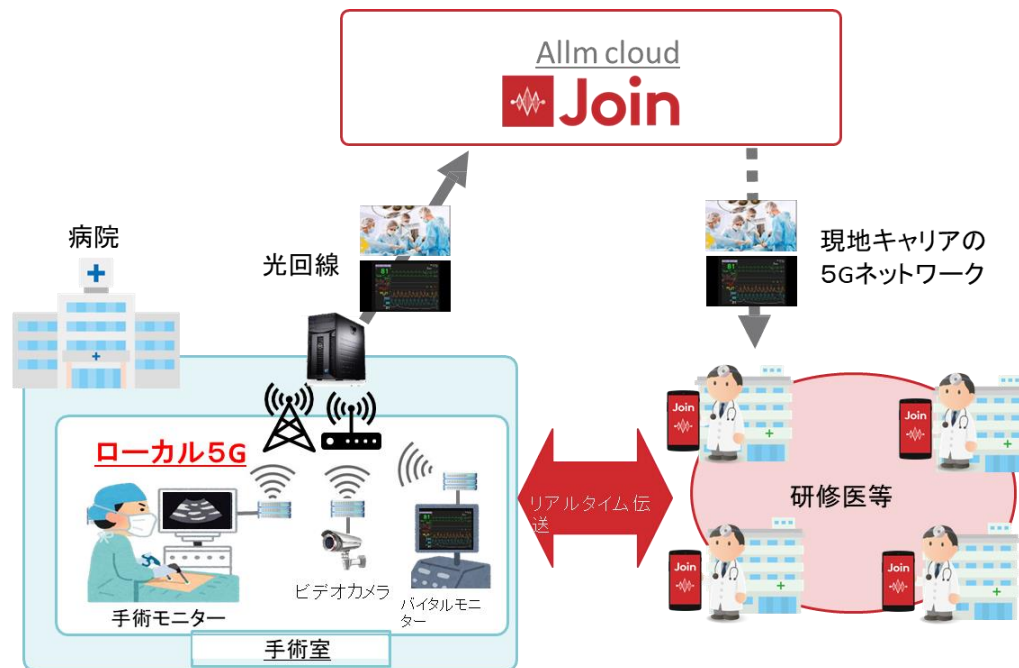
Activities

- (1) Consulting and business matching**
Information contacts for responding to basic questions and business matching service
- (2) Portal site operation**
Operation of a portal site for collecting and disseminating information
- (3) Dispatching lecturers to events**
Dispatching lecturers to seminars on Local 5G
- (4) 5G/loT Design Girl**
Holding workshops to foster human resources for creating new businesses using 5G/loT

<Others (FY2021 results)>

- Holding guidance and case introduction seminars
- Visiting laboratories

- Japan will seek to spread open radio access network (O-RAN), virtual radio access network (vRAN), Local 5G and other systems and their use cases by taking advantage of Japan's strengths.
- Chile is interested in introducing telemedicine systems to improve rural healthcare conditions including medical doctor shortages.
- Japan is demonstrating the effectiveness of O-RAN systems taking advantage of Allm Inc.'s Join healthcare application introduced in Latin America and 5G characteristics (ultrahigh speed, ultralow latency, etc.), as well as telemedicine systems using Local 5G, in Chile in FY2021-2022 to achieve their commercialization around 2023.



FY2022 project

Contractor: NTT Communications Corporation
Project period: 9/6/2022-3/31/2023

Demonstrating 5G networks using traffic lights and video analysis systems in the U.S.

- Japan has an advantage regarding knowhow for introducing 5G networks using traffic lights and video analysis applications.
 - * Under the Public/Private R&D Investment Strategic Expansion Program (PRISM) run by the Cabinet Office, research toward the development of fifth generation mobile communication system networks using traffic lights has been implemented as a domestic demonstration project. The Digital Agency, the Ministry of Internal Affairs and Communications and the National Police Agency have cooperated in promoting the research.
- The United States, one of countries that are proactive about the introduction of intelligent transport systems, has implemented research projects for the deployment of cutting-edge technologies. Japan is implementing demonstration tests to (1) contribute to the deployment in the United States of 5G networks using traffic lights and video analysis applications for which Japan has the advantage and (2) develop best practices using O-RAN systems.

FY2022 MIC demonstration project

[Contractor] NEC Corporation
[Project period] 9/6/2022-3/31/2023

Demonstration test plan: Verification of applications and use cases utilizing 5G networks

In a bid to participate in a smart city project led by U.S. state governments, Japan will demonstrate the following:

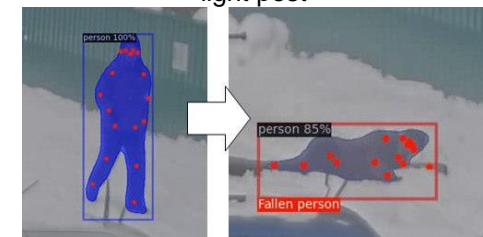
- (1) Understanding traffic conditions (automatic identification of vehicles at crossings and visualization of traffic statistics)
- (2) 5G radio capacity and latency
- (3) Detection and notification of dangers at crossings (automatic detection of animals entering crossings and detection of humans falling down at crossings)
- (4) Video data privacy protection

Japan will cooperate with the Virginia Tech Transportation Institute (VTTI), which is proactive about research into advanced intelligent transport systems, in conducting demonstration tests at a test course, contributing to furthering Japan-U.S. cooperation.

*A base station for a Local 5G network complies with the 3GPP and O-RAN Alliance specifications. The station uses the 5G frequency defined by the 3GPP.



Installation of a device on a traffic light post



Automatic detection of a human falling down at a crossing

Formulating a demonstration test plan

From October 2022

Installing a demonstrate test system

December 2022

Implementing demonstration tests

From January 2023

Data analysis

From January 2023

Final report

March 2023

5G demonstration project at a Thai factory site

- In FY2021, the Japanese project cooperated with a Thai telecommunications carrier in developing a Local 5G network using O-RAN 5G equipment and conducting demonstration tests for Local 5G applications. At a factory in an industrial park, the project implemented remote operation support and equipment checks using cameras and AI analysis and assessment of camera footage and machinery operation sound.
- Based on demonstration results in FY2021, the project will conduct technological and operational demonstration to sophisticate the development and operation of the Local 5G network and Local 5G applications in FY2022.

