Ministry of Internal Affairs and Communications, JAPAN

Japan's government policy and promotion on mm wave

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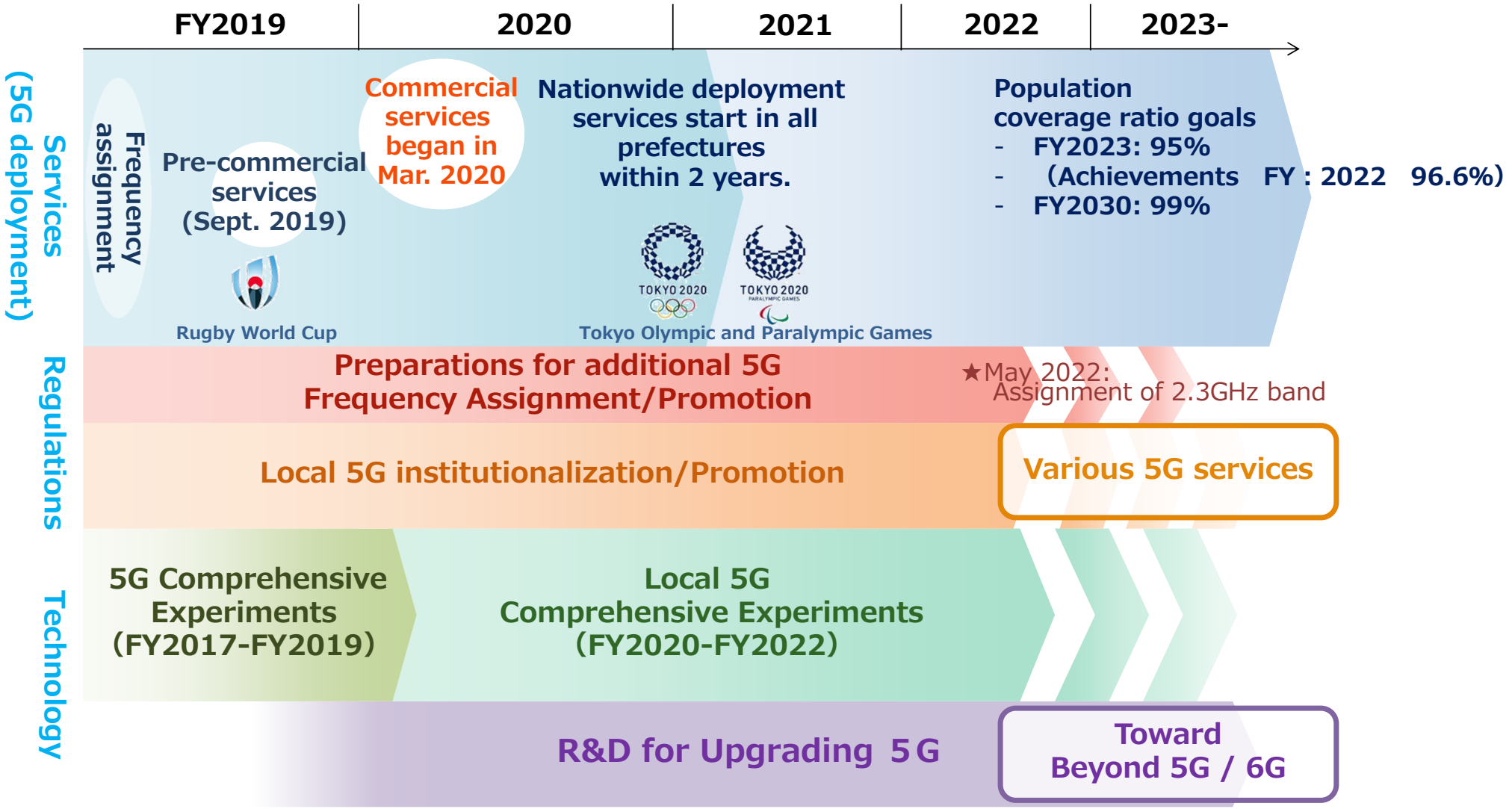
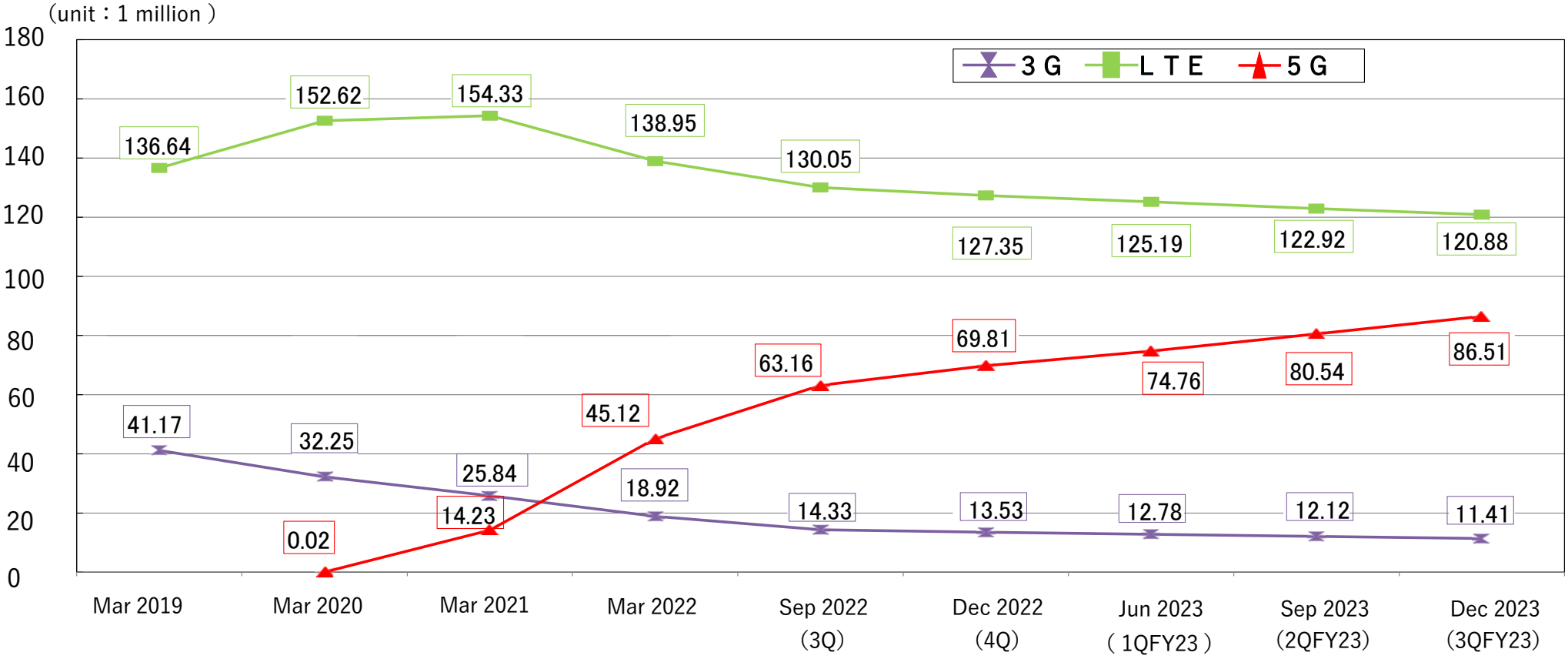
5G Services and Policies

Overview of 5G Services and Policies in Japan



Trends in the number of mobile subscribers in Japan

- 5G subscribers in Japan is about 81 mil., 37% of total subs., over 60% population penetration.
- 5G population coverage is 96.6%(FY2022). Aiming at 99.9% by the end of FY2030.

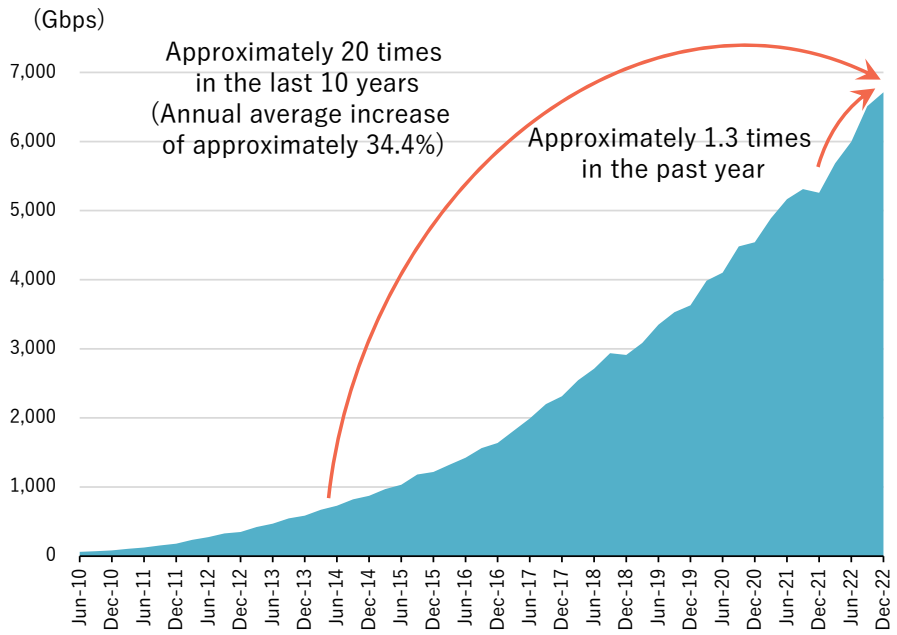


Note 1: The number of LTE subscribers includes the number of cell phone subscribers for which both 3G and LTE are available.
Note 2: The number of 5G subscribers includes the number of cell phone subscribers for which both LTE and 5G are available.

Increase in mobile communications traffic

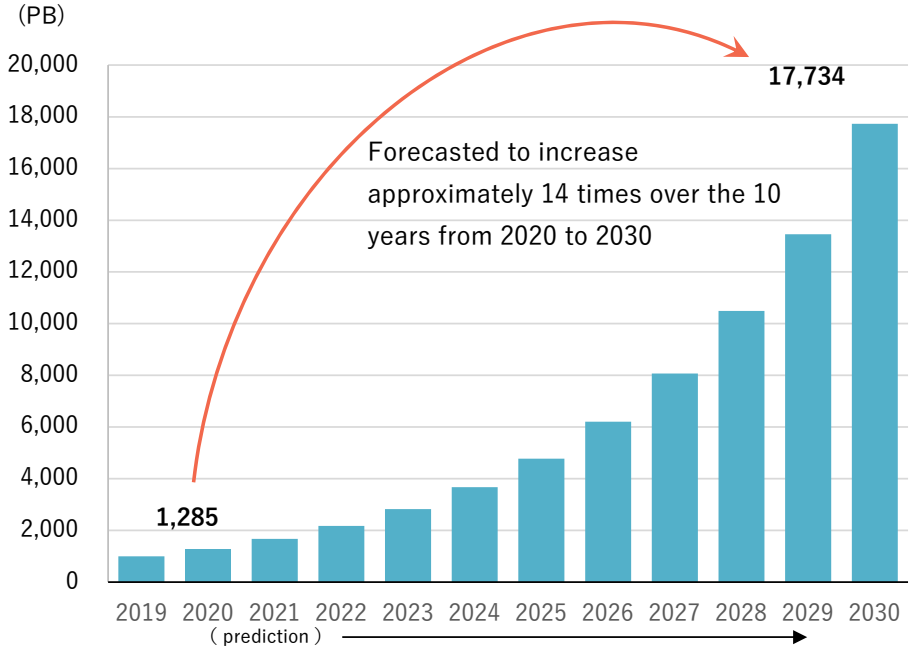
- **Further spread of 5G is required, including the use of high frequency bands that can secure a wide band.**

Trends in Japan's mobile communications traffic (monthly average)



（Source）Ministry of Internal Affairs and Communications
：Mobile communication traffic in Japan（December 2020）

Forecast of future mobile communication traffic in Japan (annual total)



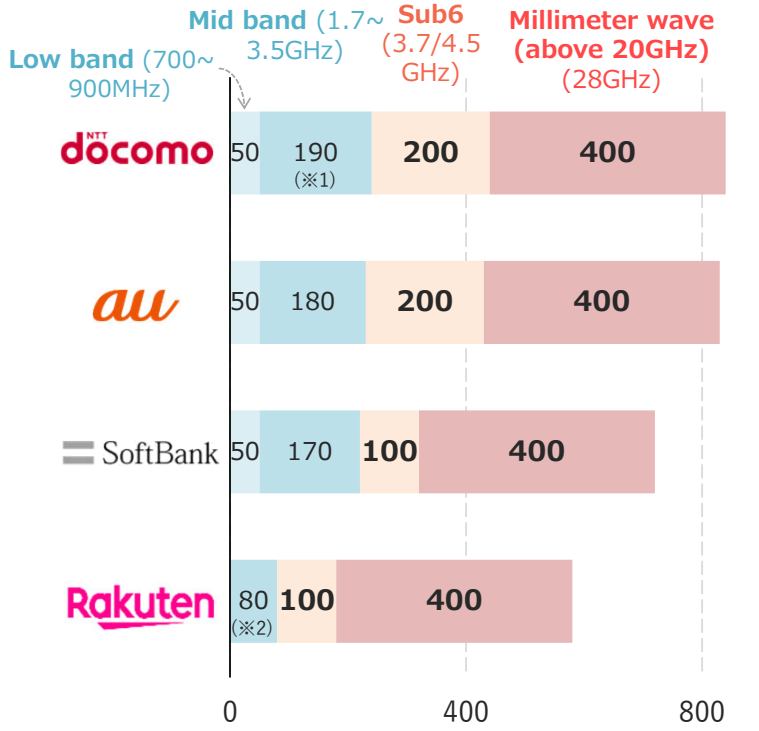
（Source）Beyond 5G Promotion Consortium White Paper Subcommittee
：Beyond 5G White Paper

5G frequency allocation status

- **In Japan, Sub6 (3.7/4.5GHz band) and millimeter wave (28GHz band) was allocated in 2019 to secure wide bands for 5G.**
- **Various countries have also allocated a wide range of frequencies for 5G, but there are variations in millimeter waves.**

Status of mobile phone frequency allocation in Japan

As of May 2023 （unit ：MHz）



※1 Of these, 40MHz is only for the Tokyo, Nagoya, and Osaka areas.
※2 Of these, 40MHz is only for areas other than Tokyo, Nagoya, and Osaka.

5G frequency allocation status in major countries

(Source)Mitsubishi Research Institute

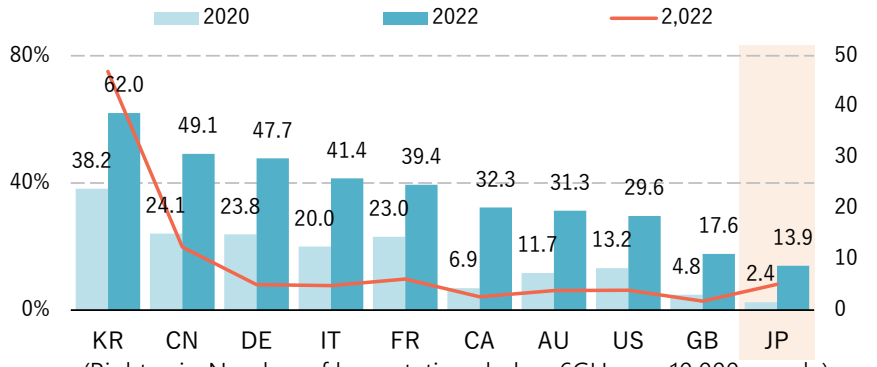
	Low band (1GHz or less)		Mid band・Sub6 (More than 1GHz and less than 6GHz)		Millimeter wave (above 20GHz)	
	Frequency band	Average per company	Frequency band	Average per company	Frequency band	Average per company
JP			1.7GHz、2.3GHz、3.7GHz、4.5GHz	**164MHz**	28GHz	**400MHz**
US			2.5GHz、3.45GHz、3.5GHz、3.7GHz	**181MHz**	24GHz、28GHz、39GHz	**1426MHz**
UK	700MHz	**20MHz**	2.3GHz、3.4GHz-3.6GHz、3.6GHz-3.8GHz	**78MHz**	26GHz*、40GHz*	**1563MHz***
FR			3.4GHz-3.8GHz	**78MHz**		
DE			2GHz、3.6GHz	**123MHz**		
KR			3.4GHz-3.7GHz	**93MHz**	26GHz-28GHz	**800MHz**
CN			2.6GHz and many others	**140MHz**		
AU	900MHz	**18MHz**	3.6GHz	**44MHz**	26GHz、28GHz	**741MHz**
CA	600MHz	**20MHz**	2.5GHz、3.5GHz	**15MHz**	26GHz*、28GHz*、38GHz*	**1417MHz***

＊:Scheduled to be allocated. The average of the four major companies in the UK and the three major companies in Canada.
Note 1: Extracted the main bands since 2018, when frequency allocation for 5G began.
Note 2: If the allocation width varies by region, a weighted average of bandwidth is calculated based on the population of each region.

Usage status of 5G frequencies (international comparison)

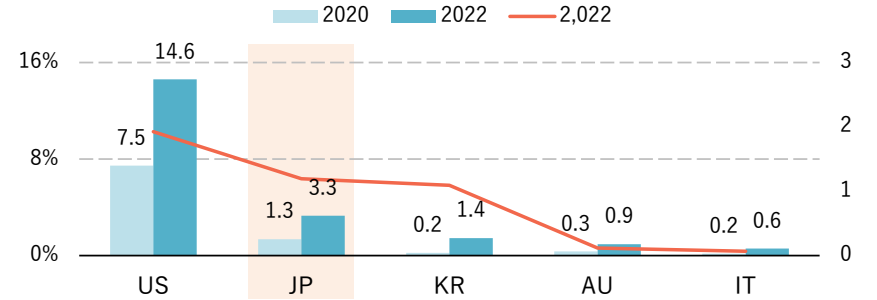
- The development of 5G base stations(BS) is progressing rapidly in each country. Regarding millimeter wave BS, Japan has the second highest rate after the United States.
- Population coverage is around 90% in many major countries, but actual usage (traffic) is limited.

Percentage of BS below 6GHz



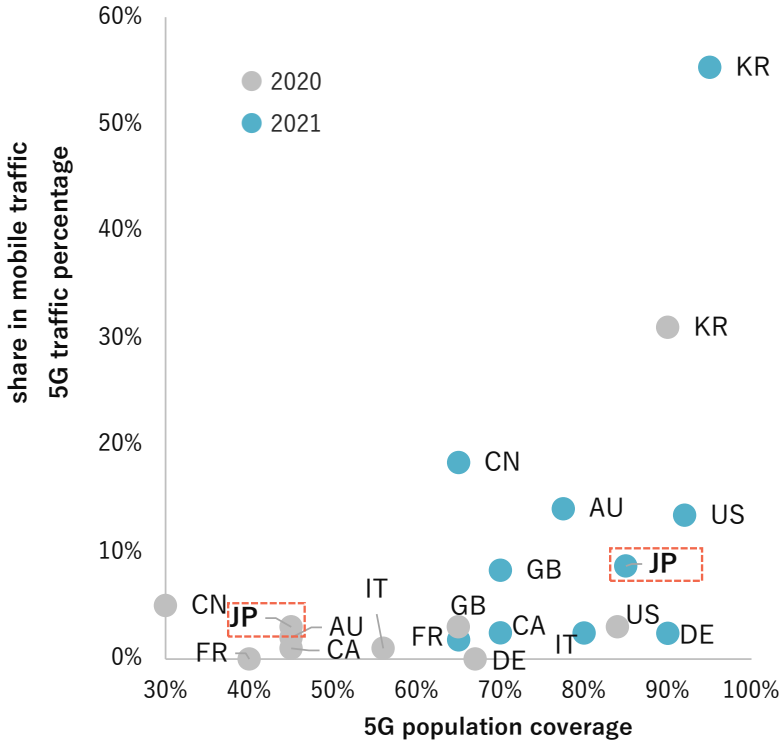
(Right axis: Number of base stations below 6GHz per 10,000 people)

Percentage of millimeter wave band BS



(Right axis: Number of millimeter wave base stations per 10,000 people)

5G coverage and traffic

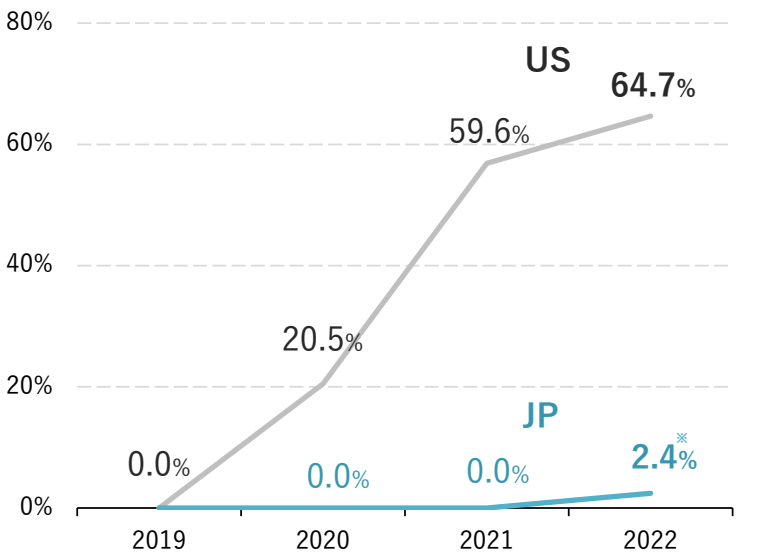


(Source) All created by Mitsubishi Research Institute based on Omdia data

Dissemination status of millimeter wave compatible terminals

- In the US, 65% of devices are millimeter wave compatible.
- In Japan, the rate is only 2.4%, partly because the iPhone series, which has a high market share, does not support millimeter waves.

Percentage of sales of millimeter wave compatible terminals



※Estimated value

(source) Created by Mitsubishi Research Institute from data from Omdia

Compatible frequencies by smartphone sales country

Vendor name	Product name	5G compatible					
					Millimeter wave compatible		
		JP	US	AU	JP	US	AU
Apple	iPhone14/Pro/ Pro Max/plus	○	○	○		○	
	iPhone13	○	○	○		○	
	iPhone12	○	○	○		○	
	iPhone SE (3rd)	○	○	○			
OPPO	OPPO Find X3 Pro	○	○	○			
Google	Google Pixel 7 Pro	○	○	○	○	○ (※)	○
	Google Pixel 7	○	○	○		○ (※)	
Samsung	Galaxy S22 Ultra	○	○	○	○	○	
	Galaxy S22	○	○	○	○	○	
Sharp	AQUOS zero6	○	—	—	○	—	—
	AQUOS sense7	○	—	—		—	—
Sony	Xperia Pro	○	○	—	○	○	—
	Xperia 1 IV	○	○	—		○	—

○：compatible —：not clear（There is no sales page on the local website, etc.）
※Millimeter wave compatible models and non-millimeter wave compatible models coexist

(source) Created by Mitsubishi Research Institute from each company's website

“5G Business Design Action Plan” - List of initiatives by the MIC to expand 5G business based on the discussions of the “5G Business Design Working Group”

Infrastructure development

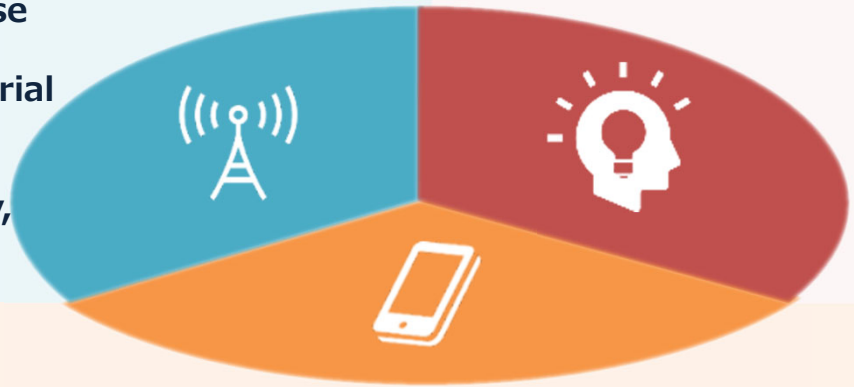
Developing infrastructure that allows users to experience the features of 5G by utilizing a wide range of frequency bands

- **Promoting investment related to the development of 5G base stations**
- **Promoting non-terrestrial network (NTN) service deployment**
- **Ensuring cybersecurity, safety, and reliability**

Use case creation

Promoting social implementation of 5G more than just a demonstration experiment

- **Promoting 5G social implementation**
- **BtoC, BtoBtoC market expansion**



- **Promoting the advancement of 5G compatible equipment**
- **Promoting the spread of 5G compatible terminals and millimeter wave compatible terminals**

Promote the spread of advanced and inexpensive equipment and terminals

Popularization of devices and terminals

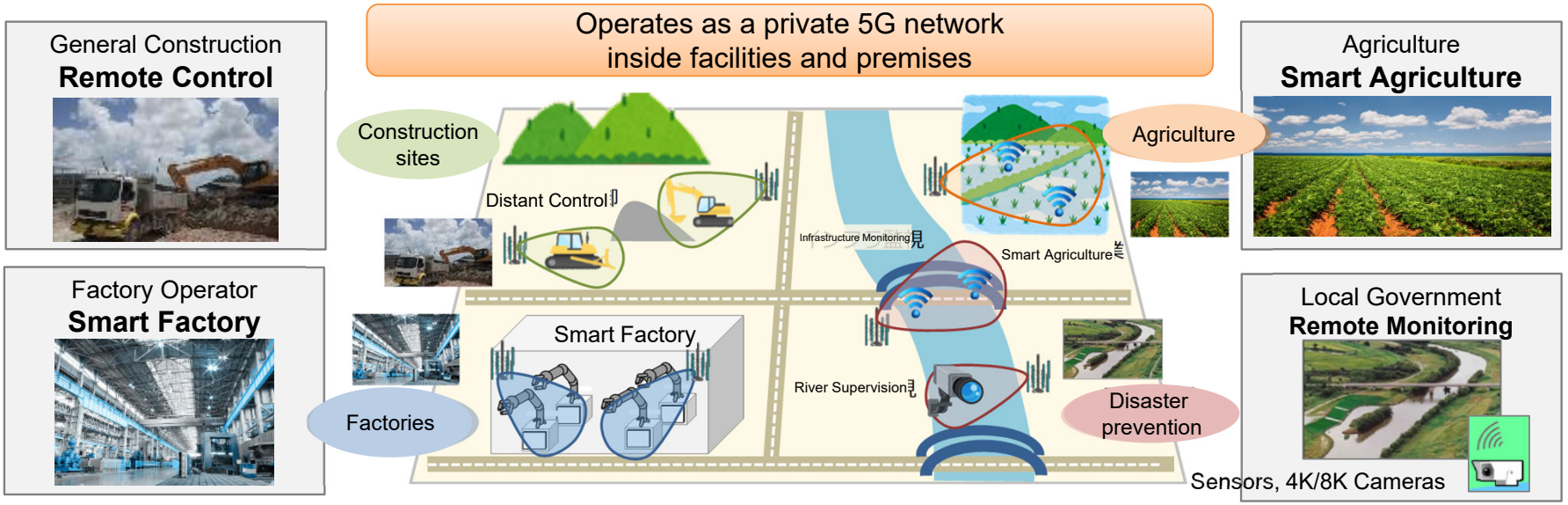
Designing a conditional auction system to meet diverse needs

Establishment of a “conditional auction” system to encourage the participation of diverse players and promote innovation and new service creation in the new allocation of millimeter wave bands (26/40 GHz bands) by the end of FY2025

Deployment of Local 5G

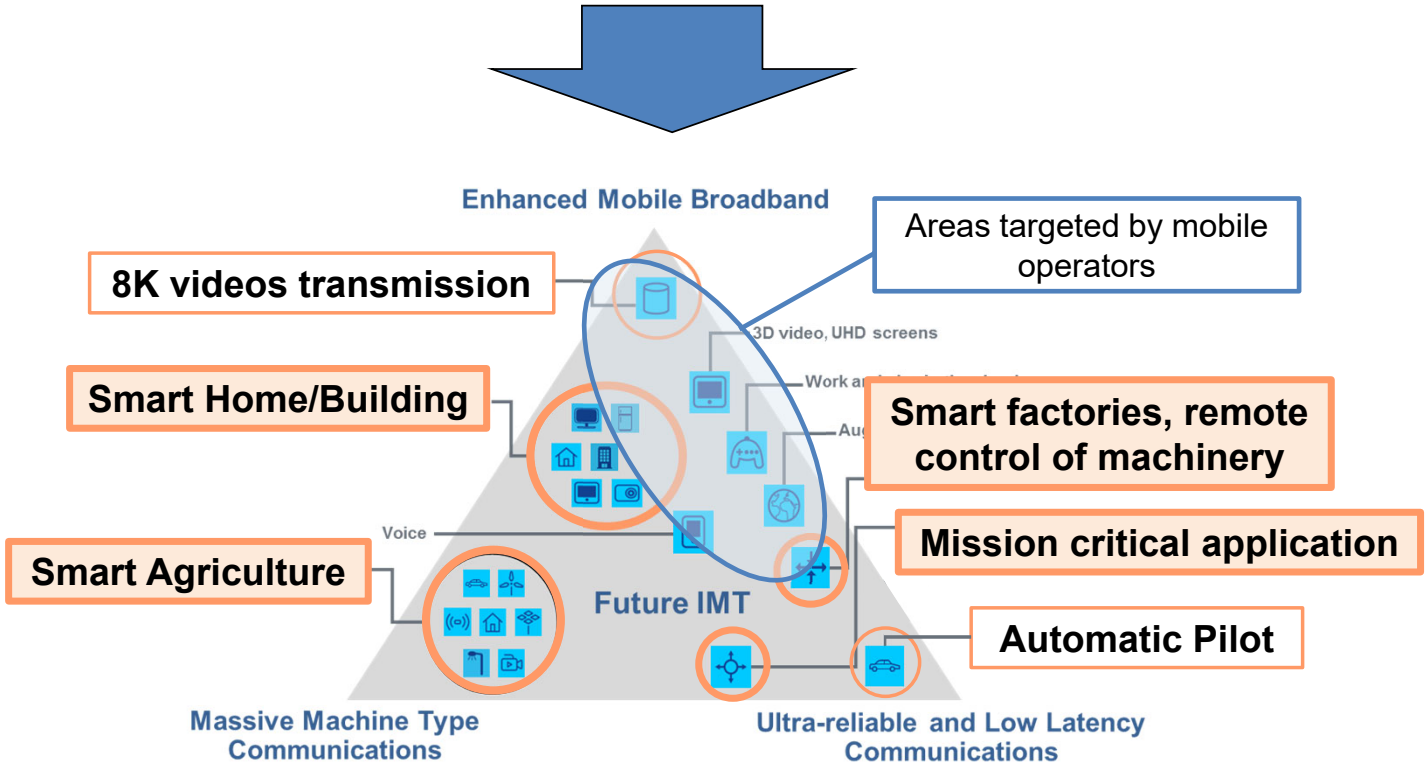
Local 5G

- “Local 5G” is private network using 5G technology installed/operated by various entities, such as local enterprises or governments, to flexibly establish their own networks within their own facilities and premises.
- 28GHz band was allocated to Local 5G network for the first time in December 2019 and sub6 band was allocated in December 2020.
- Local 5G, unlike carrier 5G services, provides:
  - **Customized networks** with flexible specifications that meet users’ needs
  - **More secure** networks with **less latency**



Local 5G Scenarios

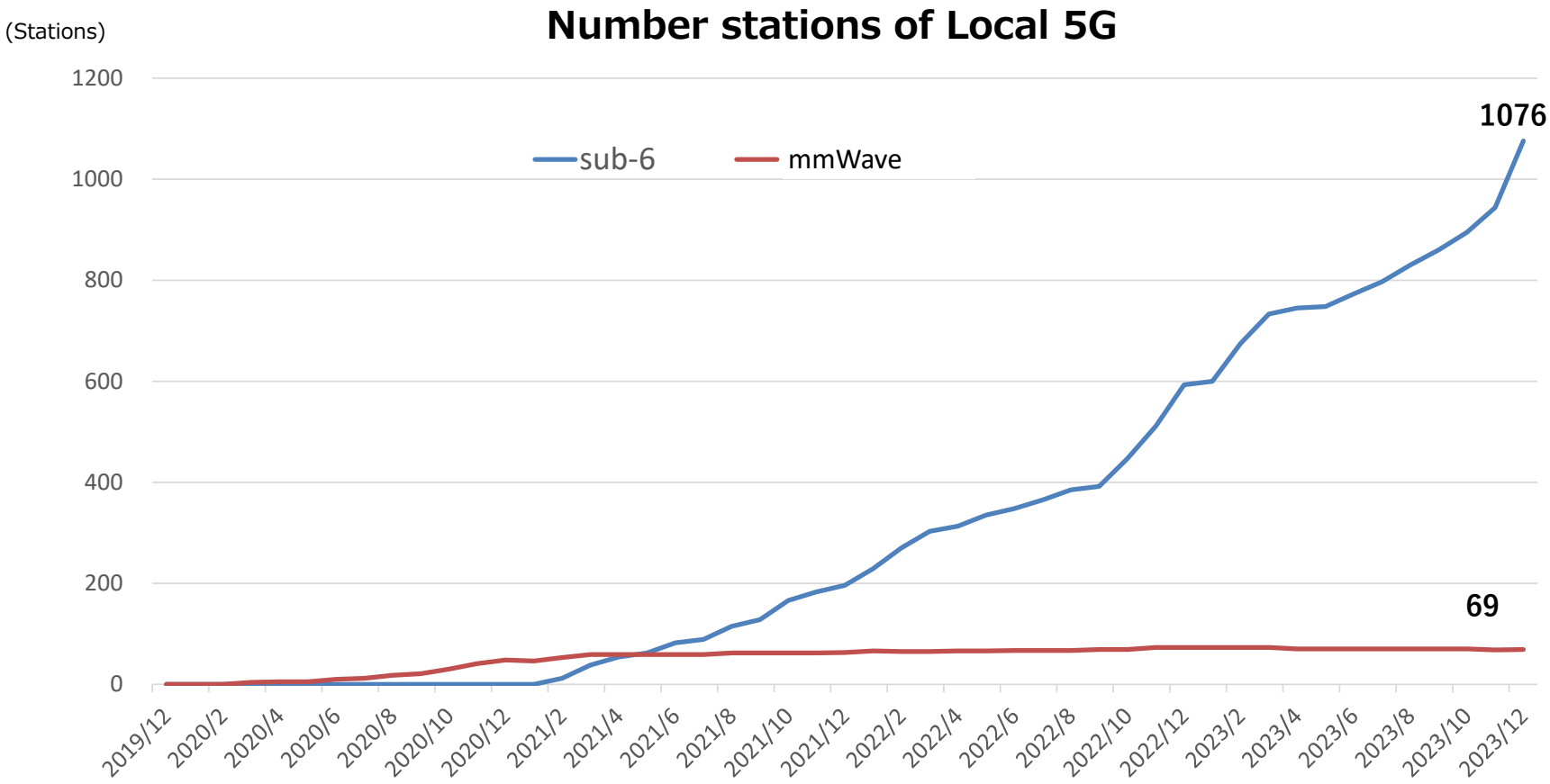
- **Local 5G network allows the flexible change of the following 5G specifications to meet the users' use cases.**
  - eMBB; enhanced Mobile Broadband
  - URLLC; Ultra Reliable and Low Latency Communications
  - mMTC; machine Type Communications



Reference: Recommendation ITU-R M.2083 "IMT Vision" in September 2015

Current Status of Local 5G

- **170 entities have been licensed as of April 2024 including 165 using sub6 band, 27 using mmWave.**

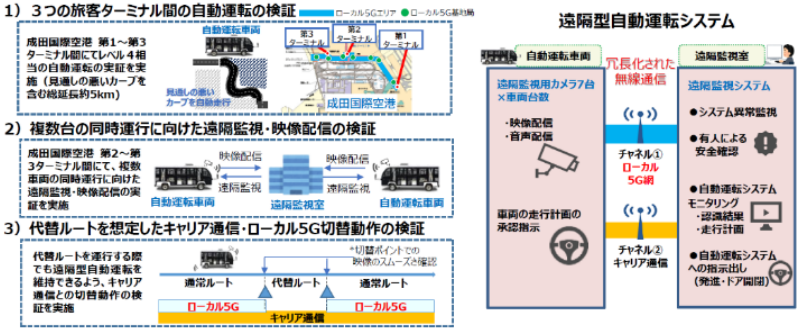


(Source) MIC : The Radio Use Web Site

Examples of Local 5G use case

Sub 6 Band

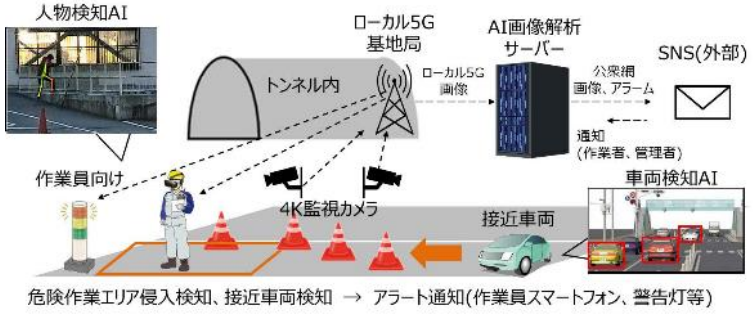
- Autonomous terminal shuttle bus operation (equivalent to Level 4) in airport restricted areas. (Narita Airport)



- Efficient and labor-saving snow removal and grassland management in vast pastures utilizing drones and unmanned robotic tractors controlled by Local 5G network.

mmWave Band

- Improvement of efficiency and safety of maintenance work in expressway tunnels utilizing 4K camera, AI, and Local 5G network.



- Realization of remote work support using HMD,MR technology, and Local 5G network.

Promotion of Local 5G

Promotion of Local 5G

✓ Guidelines for the Introduction of Local 5G MIC

The overview of Local 5G, the license application procedure, the concept of cooperation with nation wide operators and others, rule to use on premises of others

✓ Local 5G License Application Assistance Manual 5GMF

Technology Development

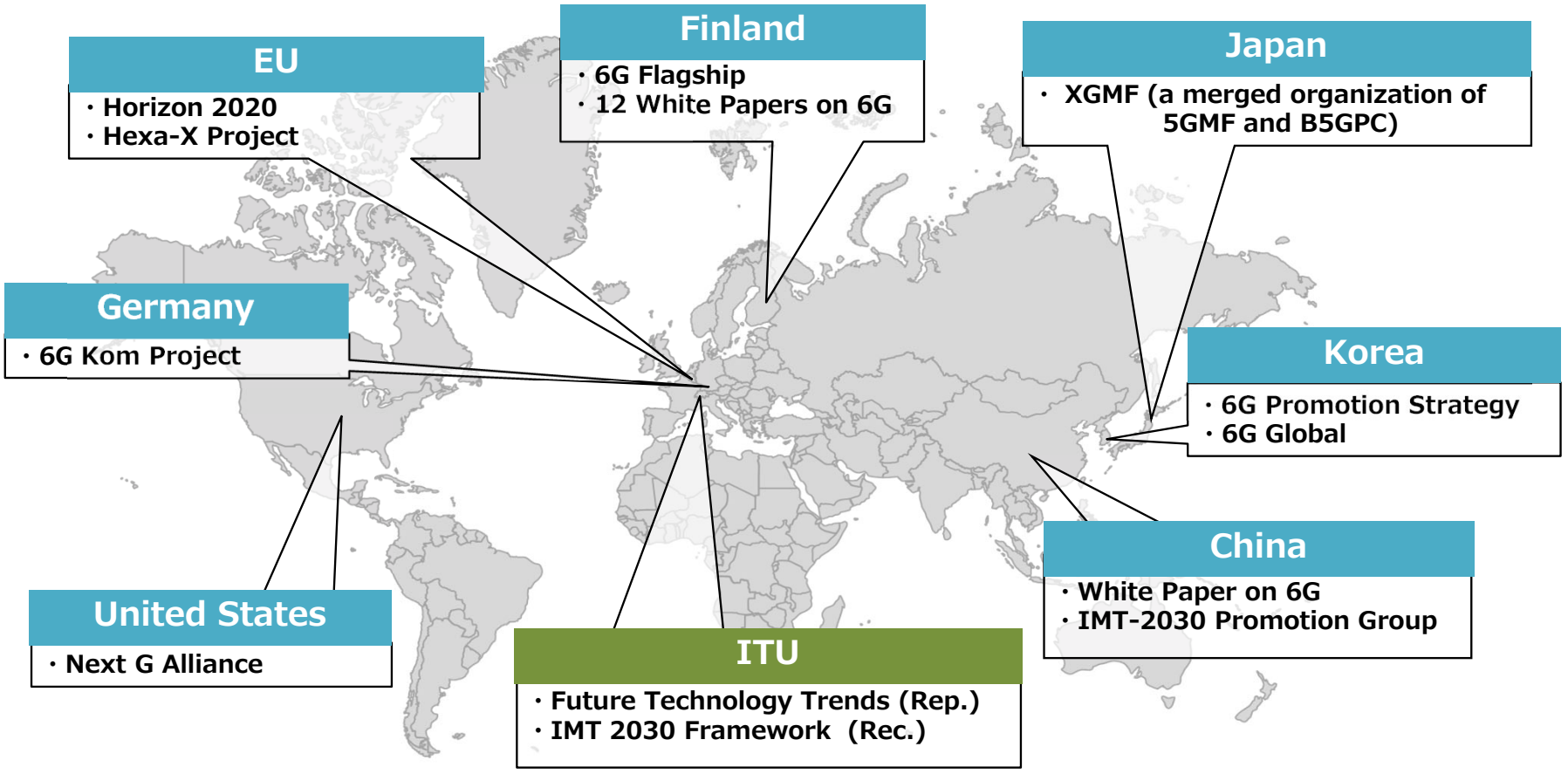
✓ Field trials for Local 5G Deployment（FY2020 - 2022）MIC

To acquire radio wave propagation characteristics in an environment with a large number of base stations and terminals in order to create solutions for utilizing local 5G, etc.

Toward Beyond 5G

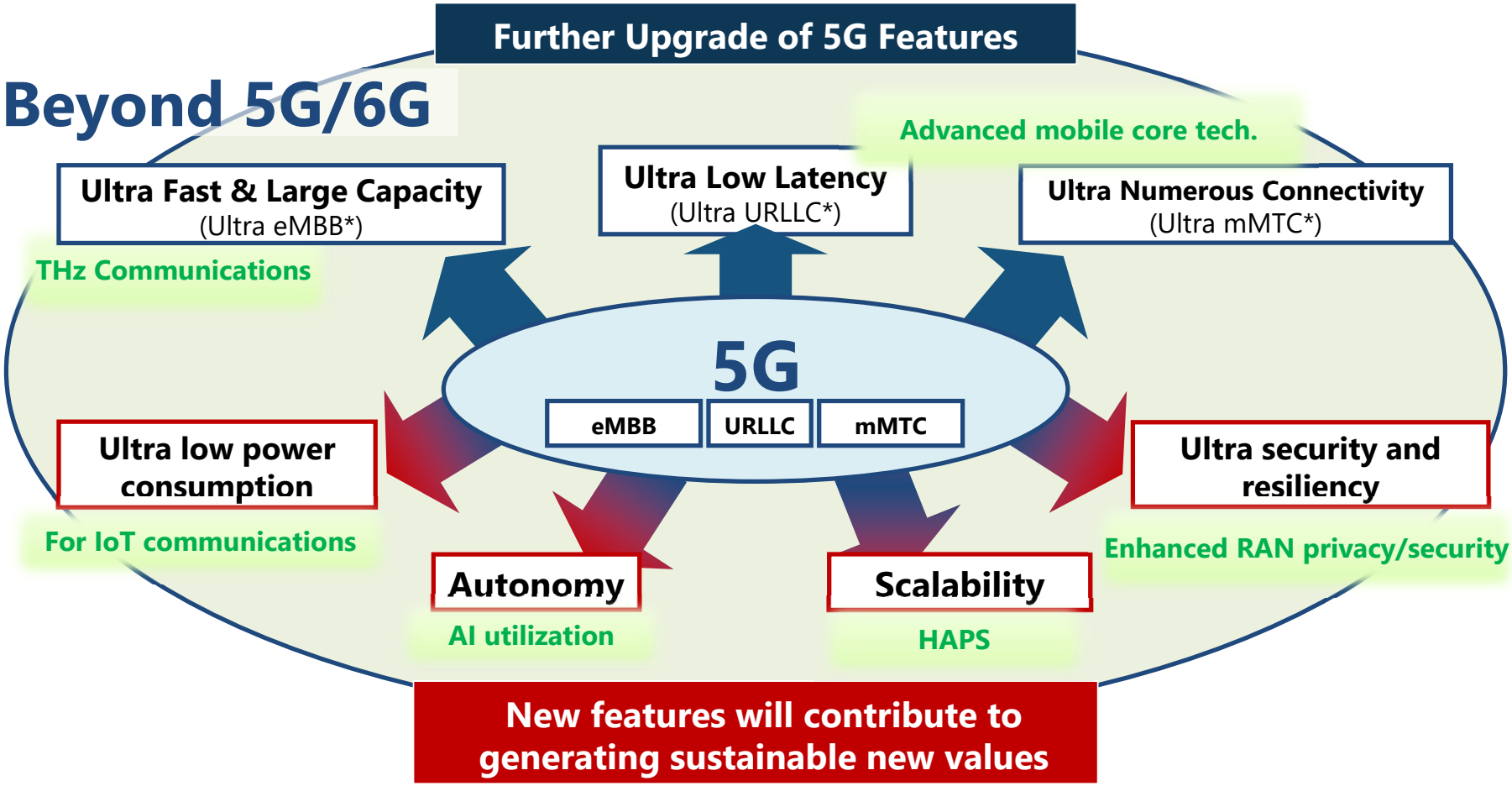
Efforts on Beyond 5G/6G

- Many countries have issued 6G white papers and have started to conduct R&D on 6G.
- ITU has started discussing standardization on IMT-2030 (Beyond 5G/6G).



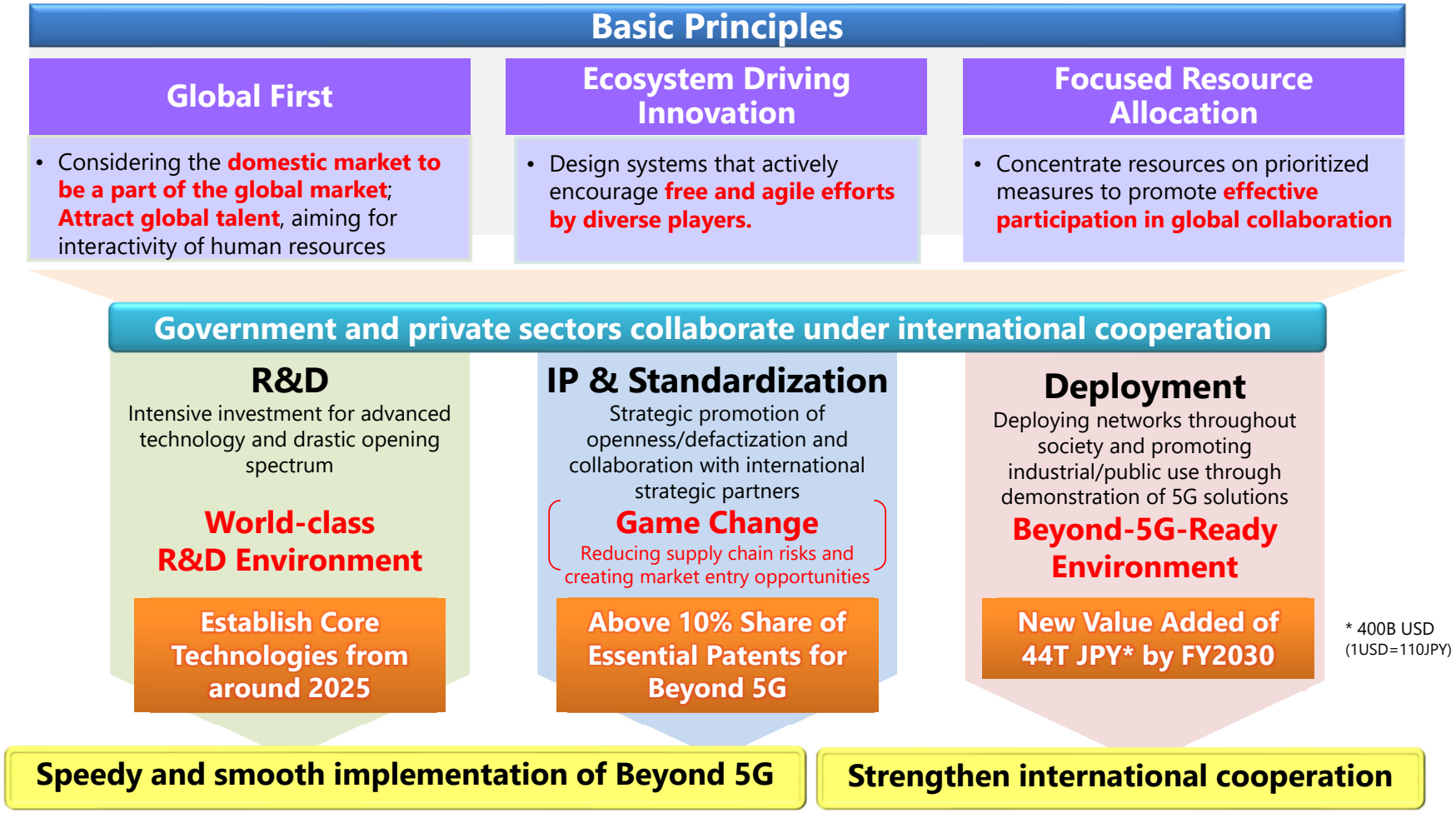
Key Features for Beyond 5G

- Use cases for Beyond 5G: XR, telepresence, Digital Twin, etc.
- Beyond 5G/6G has further upgraded functionality from 5G and will have new features such as ultra low power consumption, autonomy, scalability and ultra security and resiliency.



Beyond 5G Promotion Strategy

- **The Beyond 5G Promotion Strategy** features:
  ① **Realize Society 5.0**, toward an **Inclusive**, **Sustainable**, and **Dependable** society expected in 2030s.
  ② **Emergency measures against COVID-19** and **measures for post-COVID-19**, backcasting from Society 5.0.



“Beyond 5G ready showcase” at Expo 2025 Osaka, Kansai, Japan

“Beyond 5G ready showcase”

- Schedule : **Approximately 2 weeks in late May 2025 (TBD)**
- Overview :

  Large-scale exhibition where people from around the world can experience Japanese Beyond 5G technology.

  The exhibits that enable visitors to experience and imitate how their lives will change with Beyond 5G in various themes, including daily life scenes such as home, school, and work, transportation by car or airplane, sports and art appreciation, underwater, and outer space.

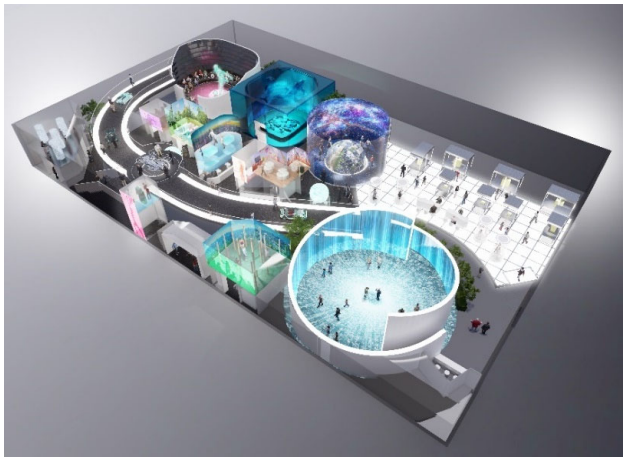


Image of "Beyond 5G ready showcase"

Expo 2025 Osaka, Kansai, Japan

- Schedule : 184 days from April 13 to October 13, 2025
- Venue : Yumeshima, Osaka

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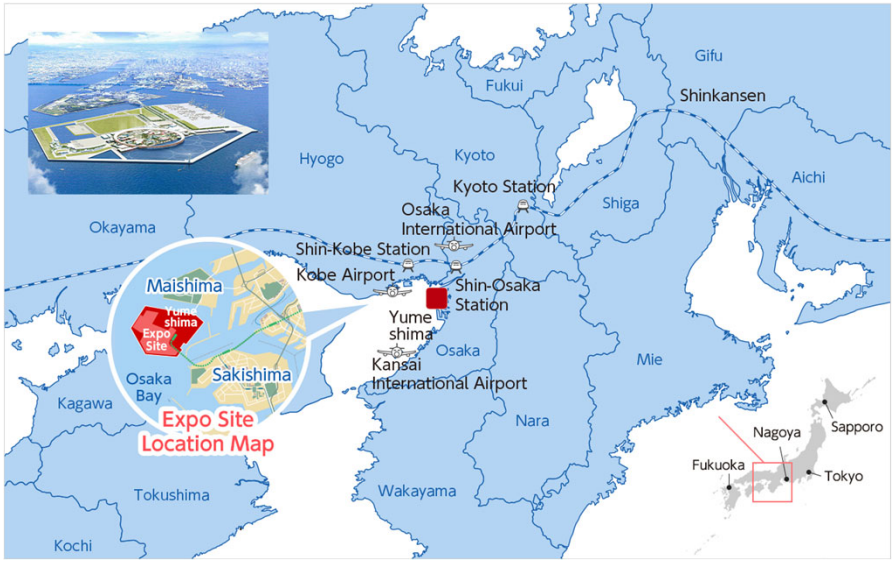

THANK YOU FOR YOUR ATTENTION