

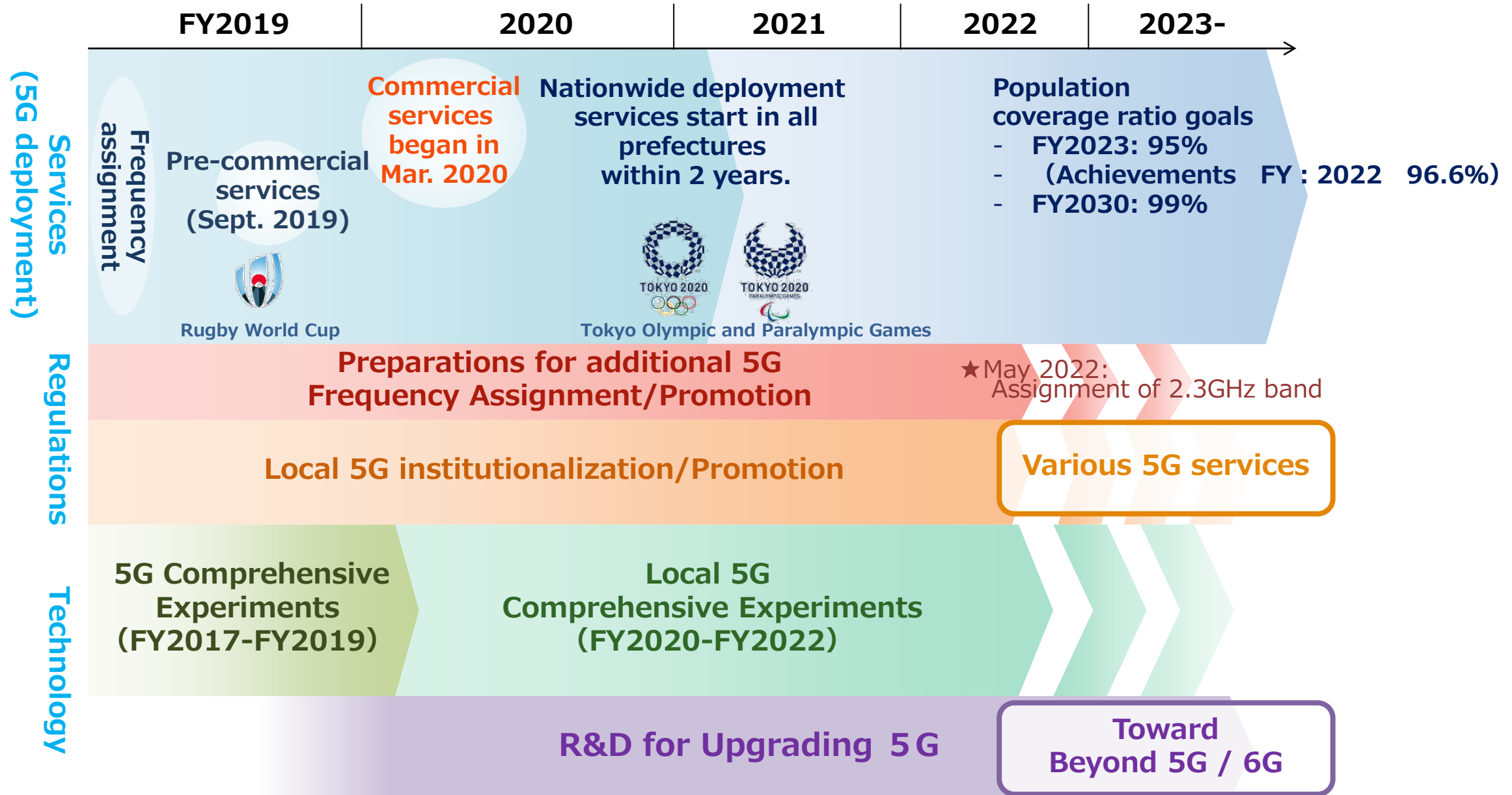
# **5G Progress in Japan**

CEATEC 2023: 5G Special Day

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18<sup>th</sup> October 2023

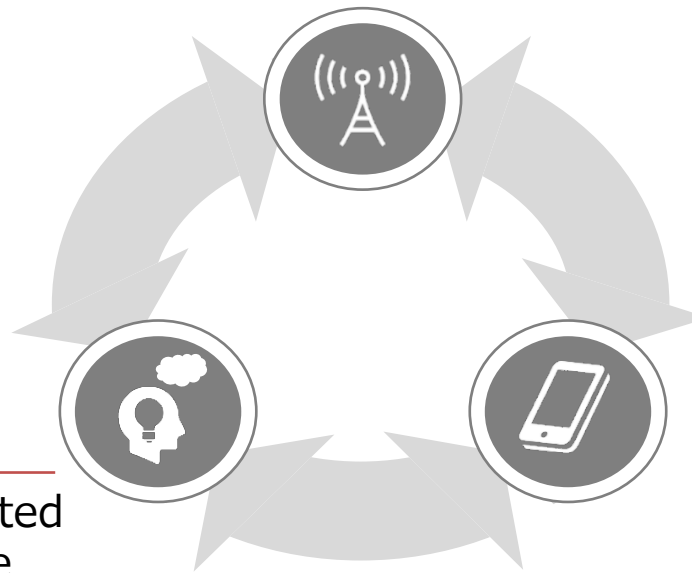
# Overview of 5G Services and Policies in Japan



- 5G-related infrastructure development, devices/terminals, and use cases are all in a "chicken and egg" relationship.
- The 5G business is not sufficiently developed, therefore the challenge is how to progress it.

## Infrastructure development

Little incentive to invest in infrastructure development due to Few devices/terminals, Limited use cases



## Use Case

Use cases are not created due to the small usable area and few devices/terminals.

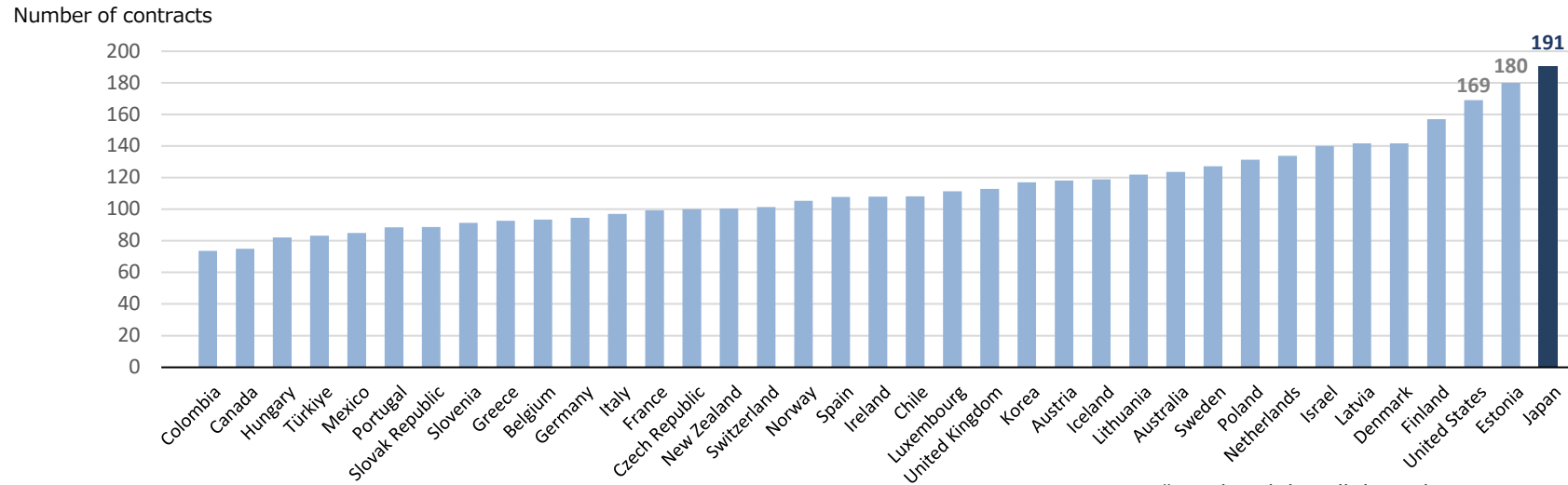
## Device/Terminal

Devices and terminals are not widespread and costs remain high due to the small usable area and limited use cases.

# Mobile Networks in Japan

- Number of cell phone subscriptions per inhabitants in Japan is the highest in the world
- Number of subscriptions continues to increase.

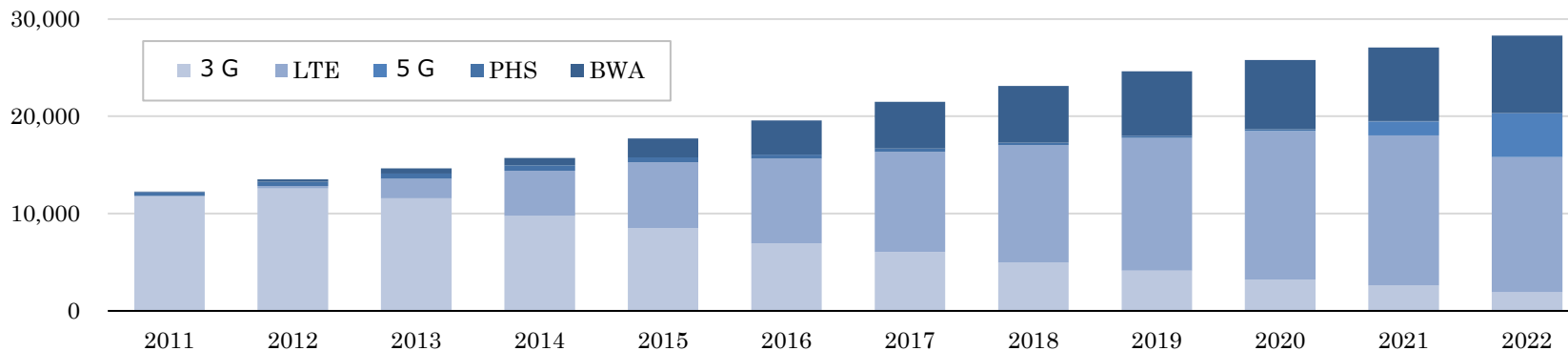
Mobile cellular subscriptions per 100 inhabitants (2021)



Source: OECD.stat "Total mobile cellular subscriptions per 100 inhabitants"

## Number of cell phone subscriptions in Japan

Number of contracts (million)

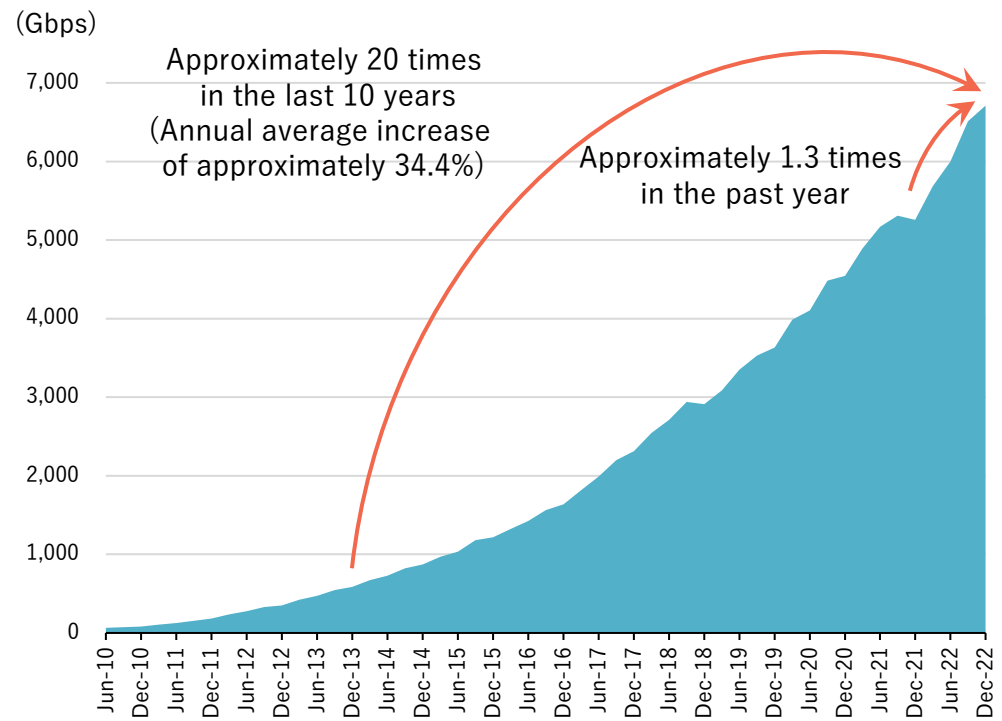


Source: Ministry of Internal Affairs and Communications

# Increase in mobile communications traffic

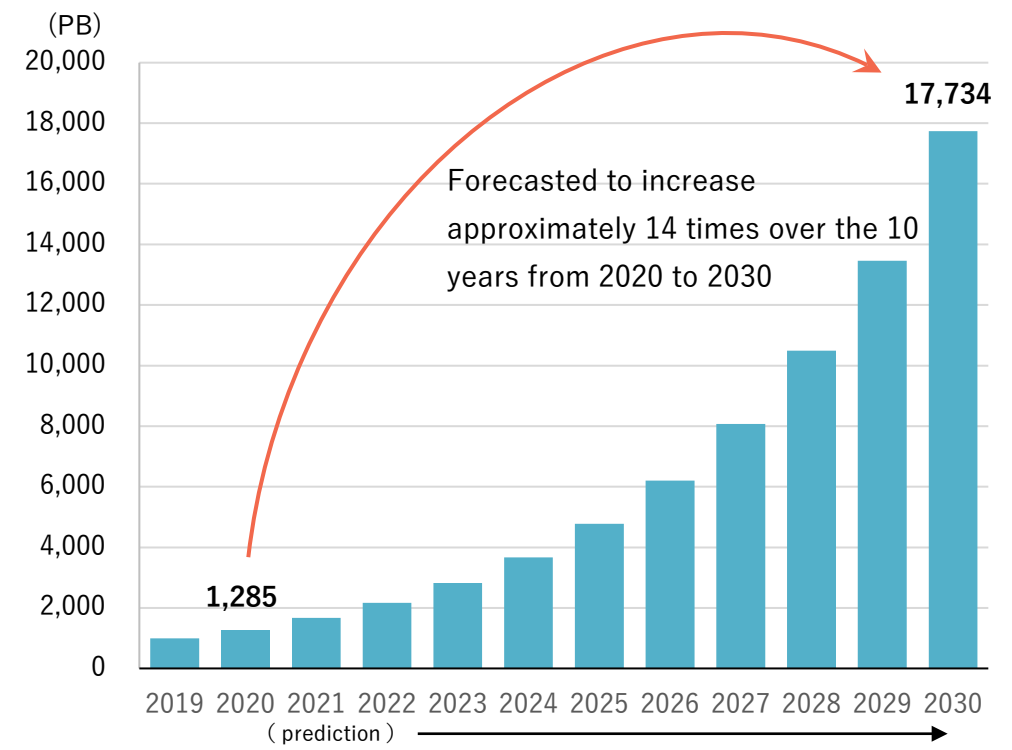
- Mobile communication traffic is currently increasing at about 1.3 times per year. In the future, explosive increase is expected.
- Further spread of 5G is required, including the use of high frequency bands that can secure a wide band.

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

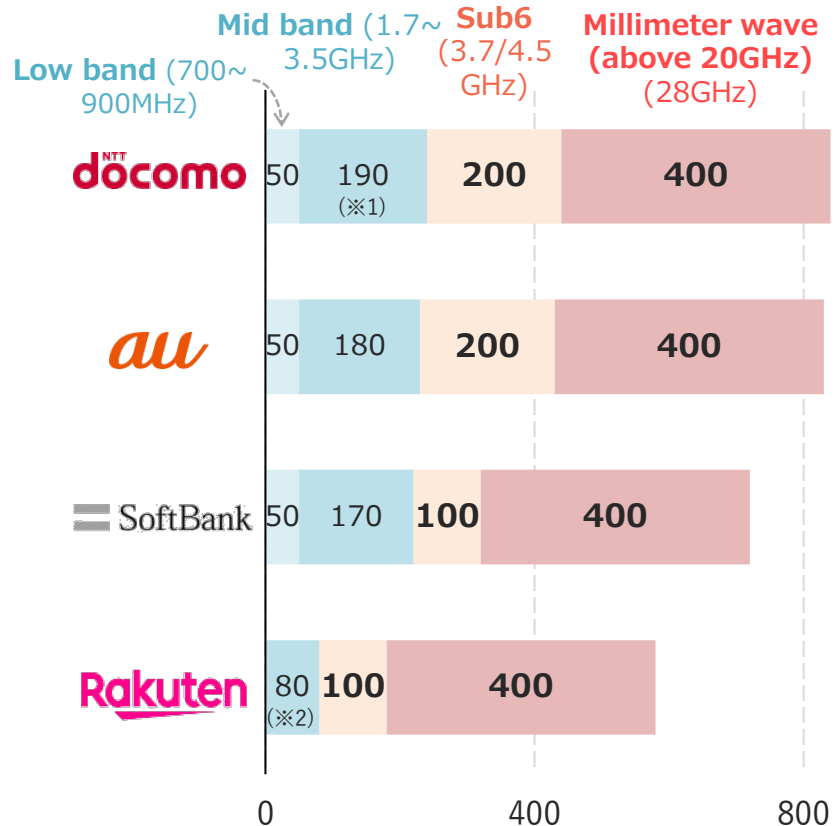
- In Japan, Sub6 (3.7/4.5GHz band) and millimeter wave (28GHz band) was allocated in 2019 to secure wide bands for 5G.
- Various countries have also allocated a wide range of frequencies for 5G, but there are variations in millimeter waves.

## 5G frequency allocation status in major countries

(Source)Mitsubishi Research Institute

### 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.

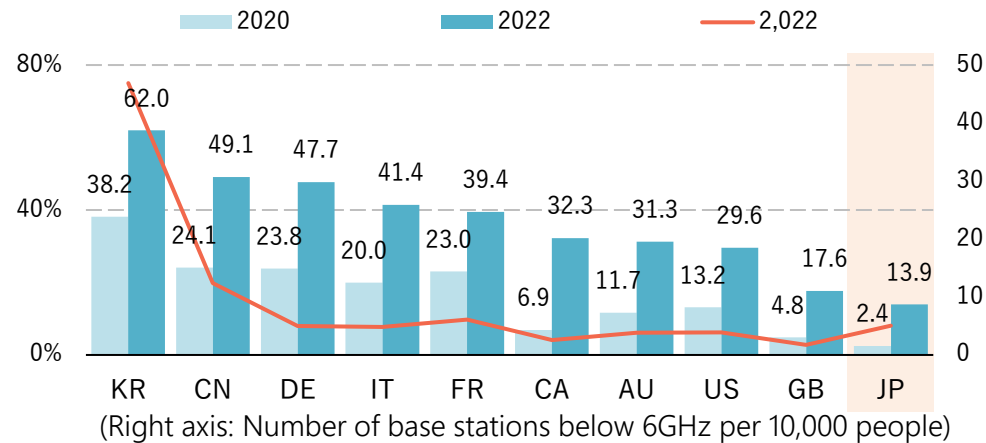
Country	Low band (1GHz or less)		Mid band · Sub6 (More than 1GHz and less than 6GHz)		Millimeter wave (above 20GHz)	
	Frequency band	Average per company	Frequency band	Average per company	Frequency band	Average per company
JP			1.7GHz、 2.3GHz、 3.7GHz、 4.5GHz	164MHz	28GHz	400MHz
US			2.5GHz、 3.45GHz、 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.

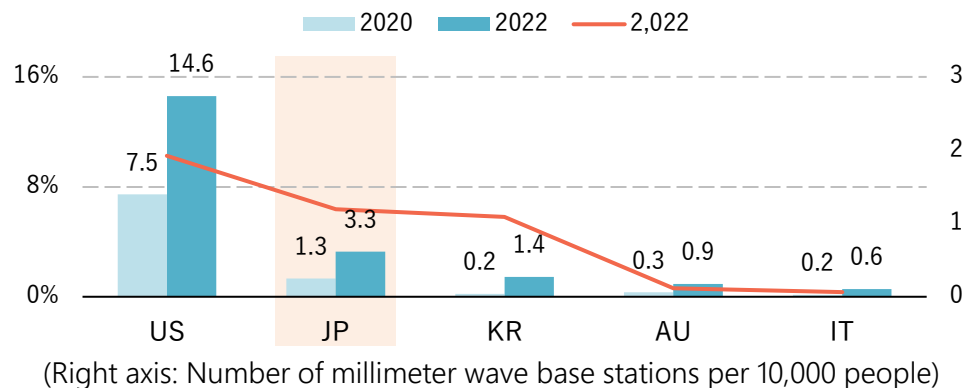
# Usage status of 5G frequencies (international comparison)

- 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.

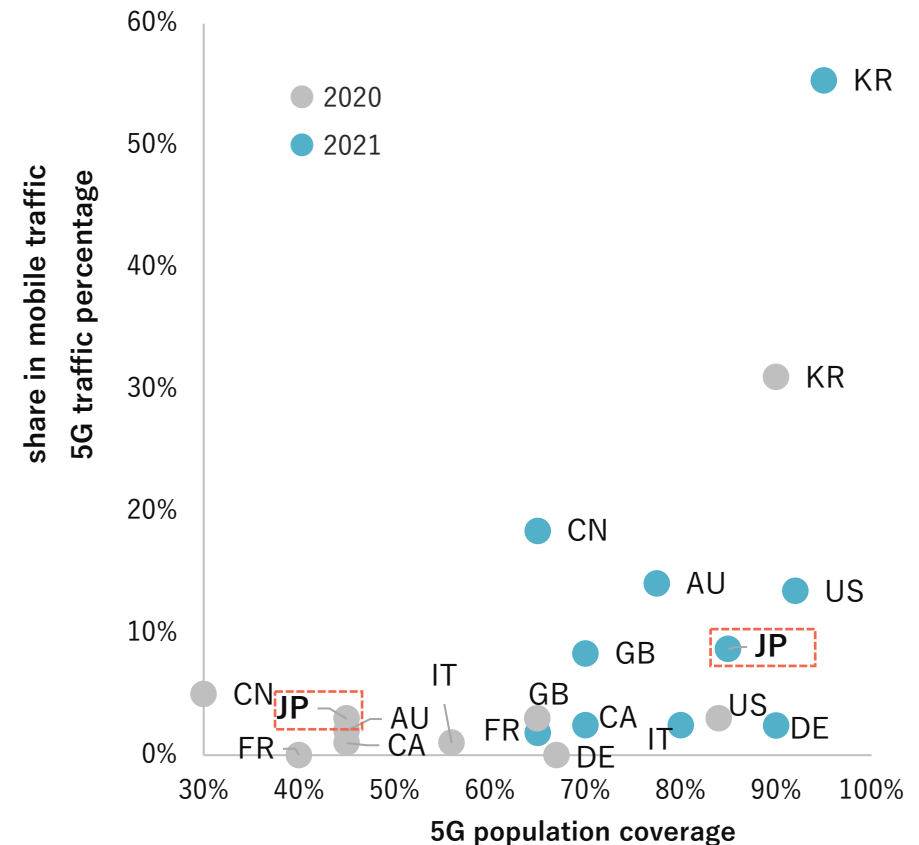
## Percentage of BS below 6GHz



## Percentage of millimeter wave band BS



## 5G coverage and traffic

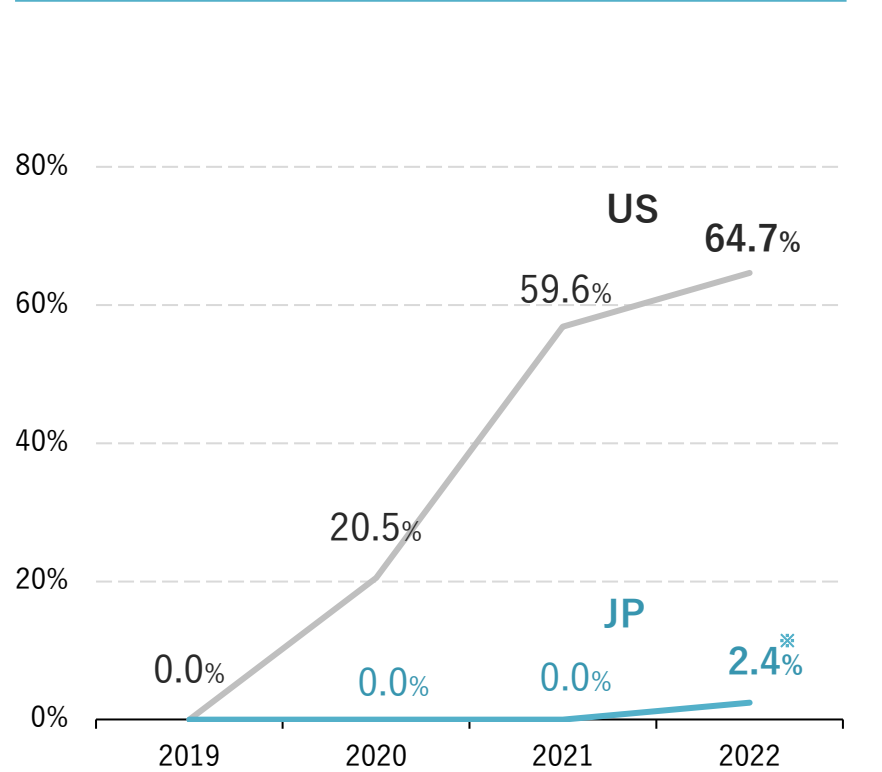


(Source) All created by Mitsubishi Research Institute based on Omdia data

# 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

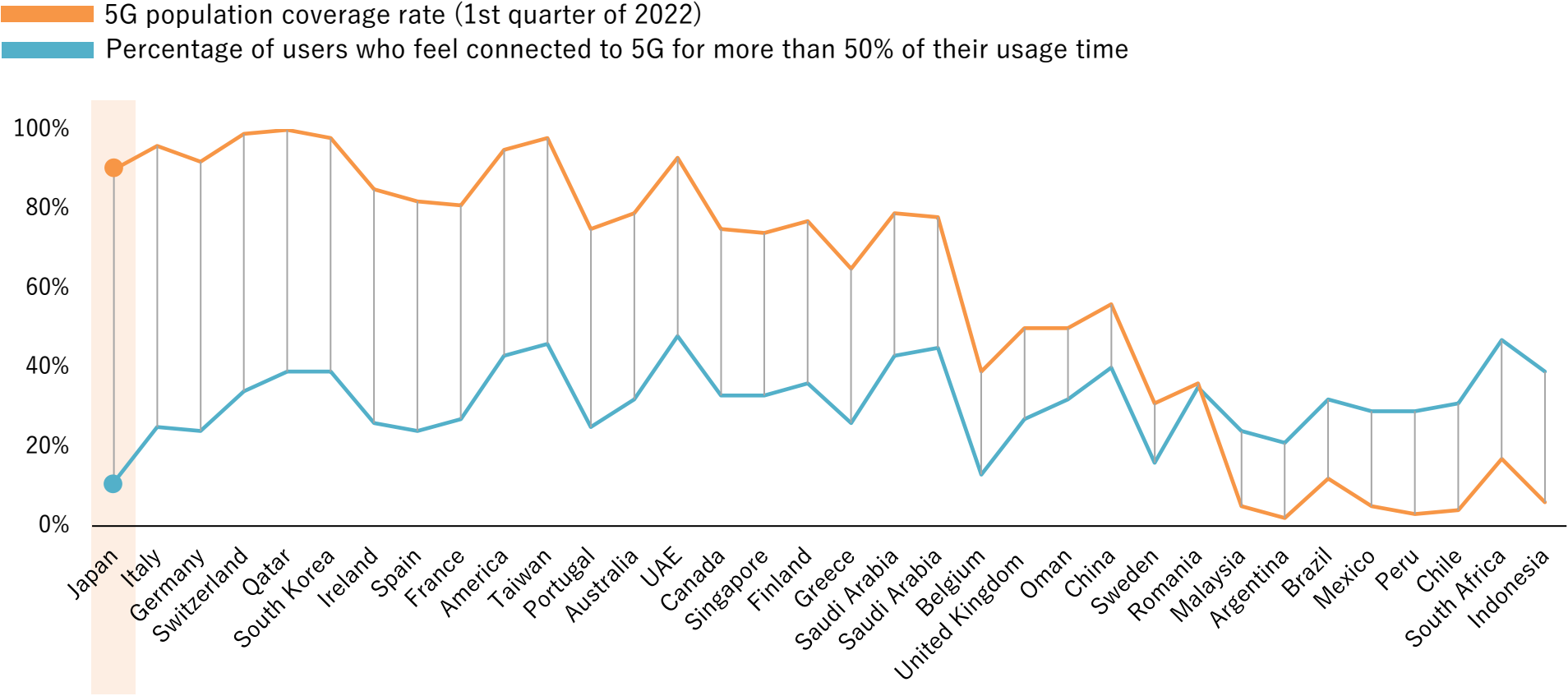
(source) Created by Mitsubishi Research Institute from each company's website



# 5G experience

- Although 5G population coverage rate in Japan is high, the percentage of user experience that being connected to 5G is low.
- There is a large gap between coverage and user experience compared to other countries.

## 5G population coverage rate and user experience



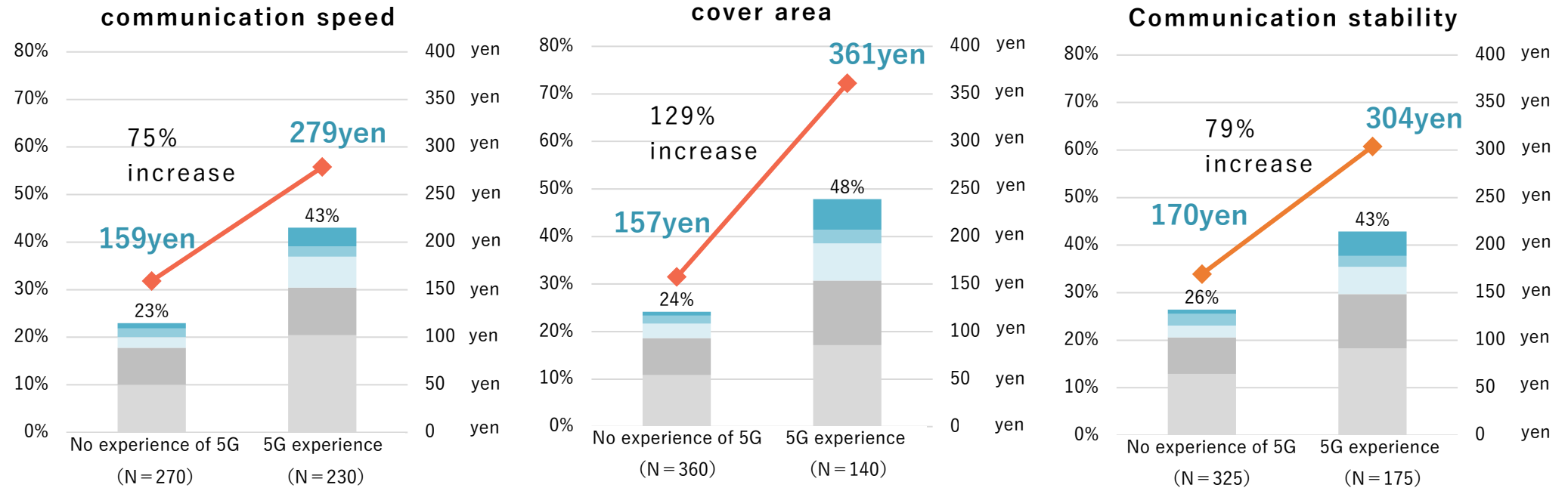
( Source ) Ericsson : What do next wave 5G consumers want?

# Consumer expectations for 5G

- **Consumers are willing to pay extra for improved speed, coverage, and stability.**

(It should be noted that those who have an experience of 5G usage are more willing to bear the additional costs than those who don't.)

## Willingness to pay for improving the communication environment (results of a survey conducted by Mitsubishi Research Institute)



### Examples of attributes for 5G experiences

- Use video calls (web conferencing, etc.) outdoors
- Subscribe to a plan with 3GB or more

### Example of attribute for "No experience of 5G"

- Time spent using a smartphone outdoors is less than 1 hour
- Subscribe to a plan less than 3GB

※ Survey targeted at 5G users (aged 20 to 79, who know about 5G, have a 5G device, have a 5G contract, and use 5G on a daily basis)  
 ※ 5G experiences: Selected 5G as "very good compared to 4G" or "slightly better compared to 4G".  
 No experience of 5G": Selected 5G as "not different from 4G", "a little worse than 4G", "very bad compared to 4G"

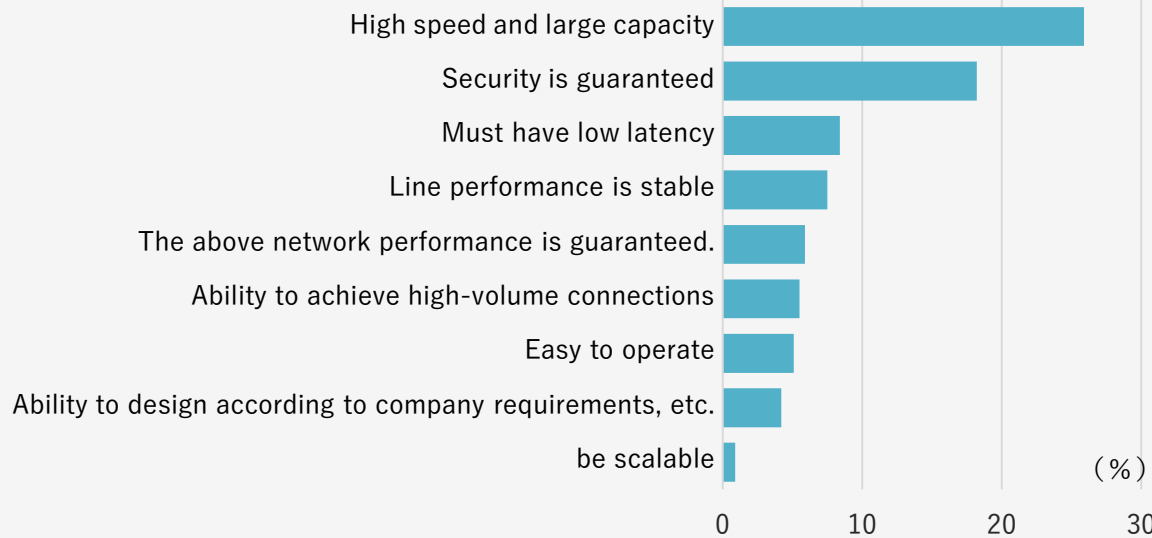
■ 100-300 Yen ■ 300-500 Yen ■ 500-1000 Yen  
 ■ 1000-2000 Yen ■ More than 2000 Yen — Average willingness to pay

# Corporate expectations for 5G

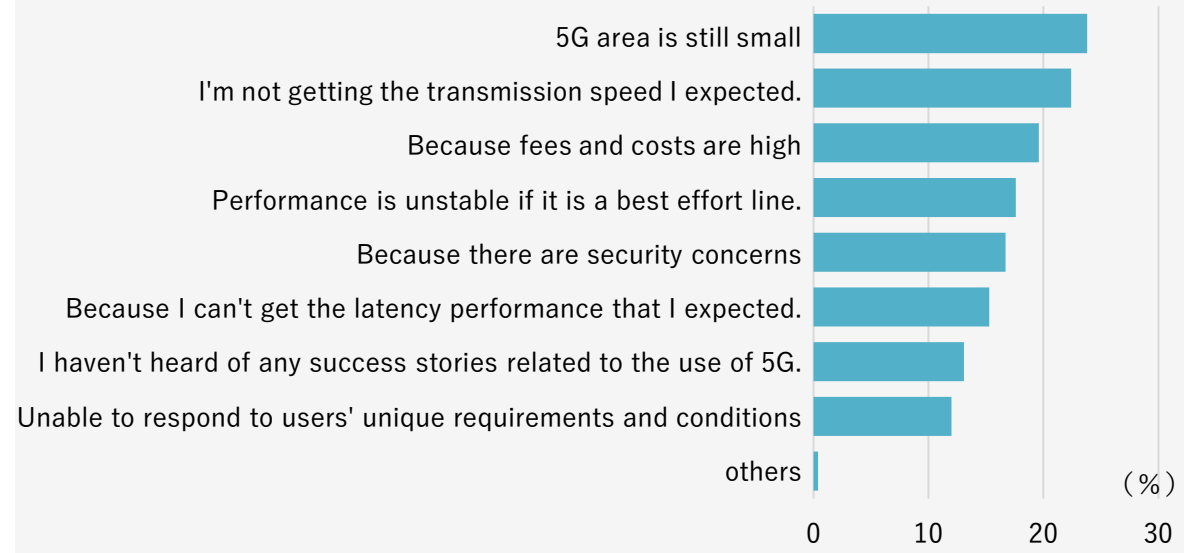
- Companies place particular emphasis on 5G's high speed, large capacity, and security.
- On the other hand, it is recognized that the required level has not been achieved, mainly due to the small coverage, transmission speed, and cost.

## Results of a survey for companies (by Mitsubishi Research Institute)

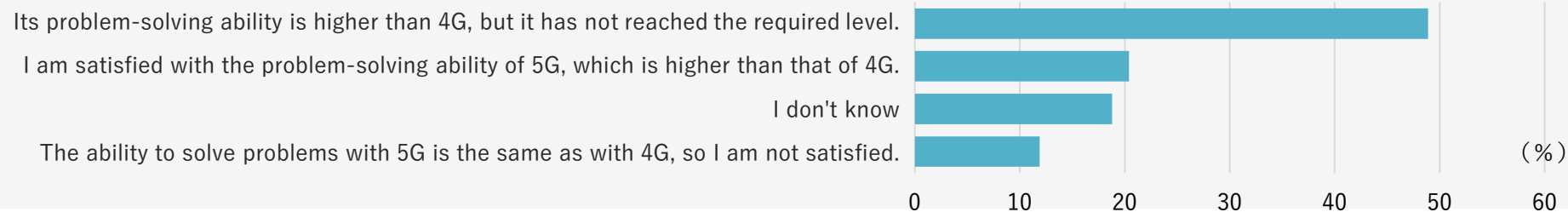
Network performance and requirements that are particularly important and expected



Reasons why 5G networks/lines are not used/difficult to use



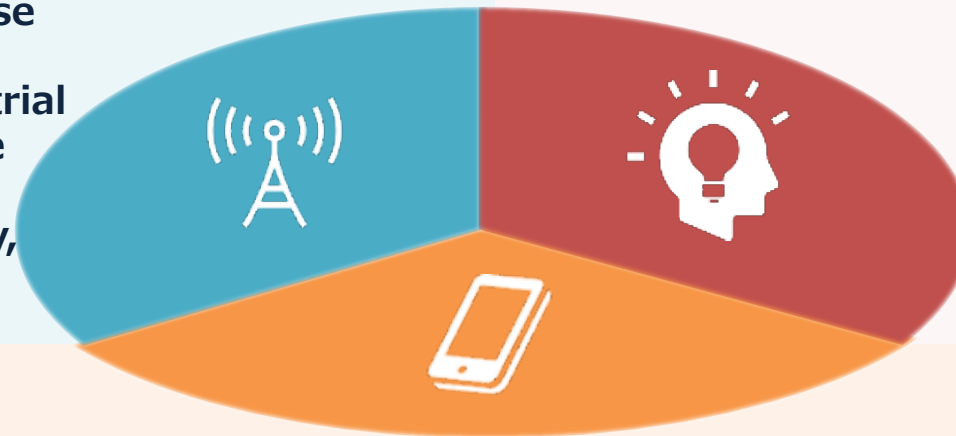
Do you feel the difference in problem-solving ability with 5G (carrier 5G/local 5G) compared to 4G?



### 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



**THANK YOU FOR YOUR ATTENTION**