MIC
Ministry of Internal Affairs and Communications

Collaboration in Asia for Spectrum for 5G

# Japan's Radio Policy to realize 5G in 2020

June 28, 2016


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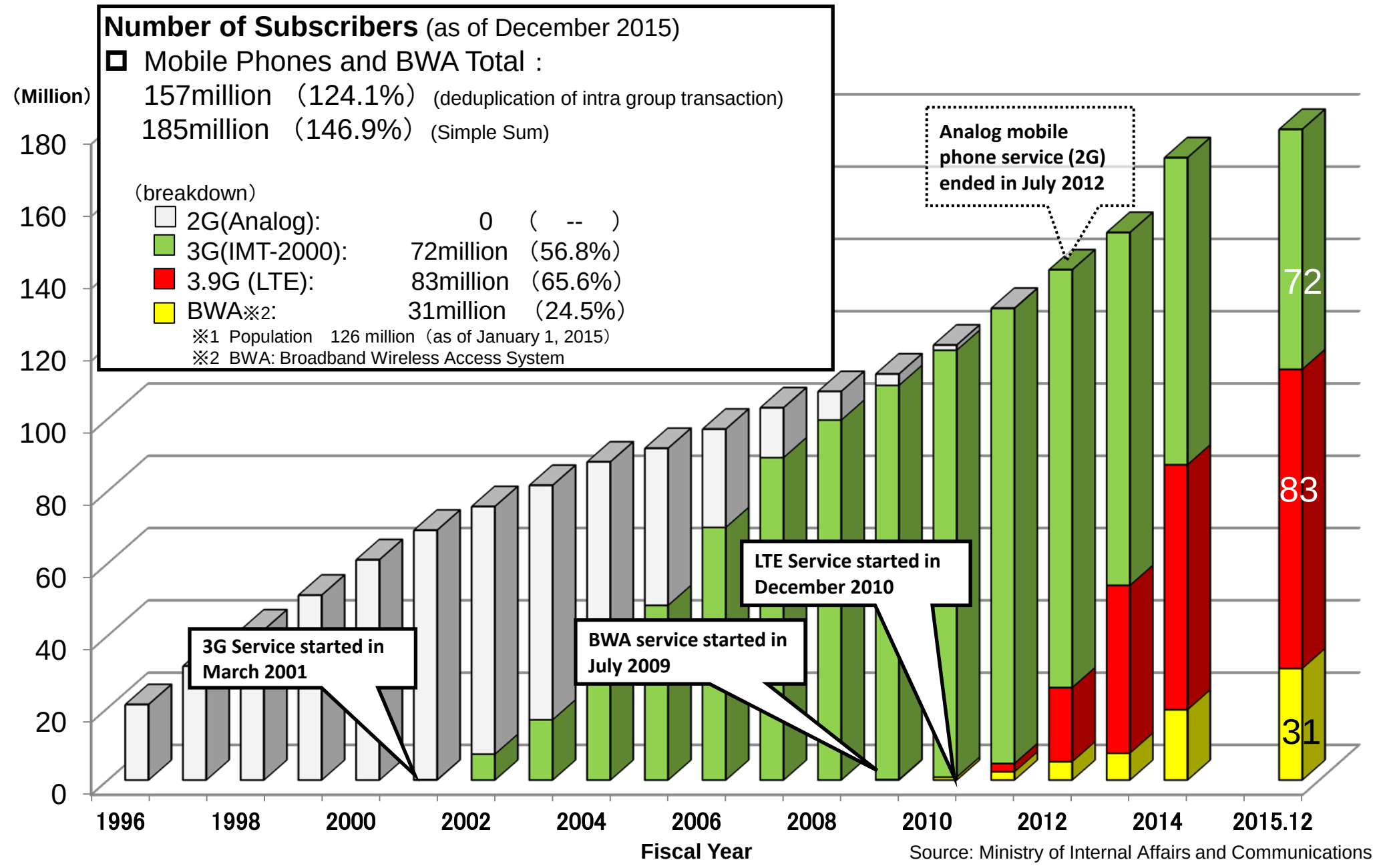
# Transition of Mobile Phones and BWA Subscribers

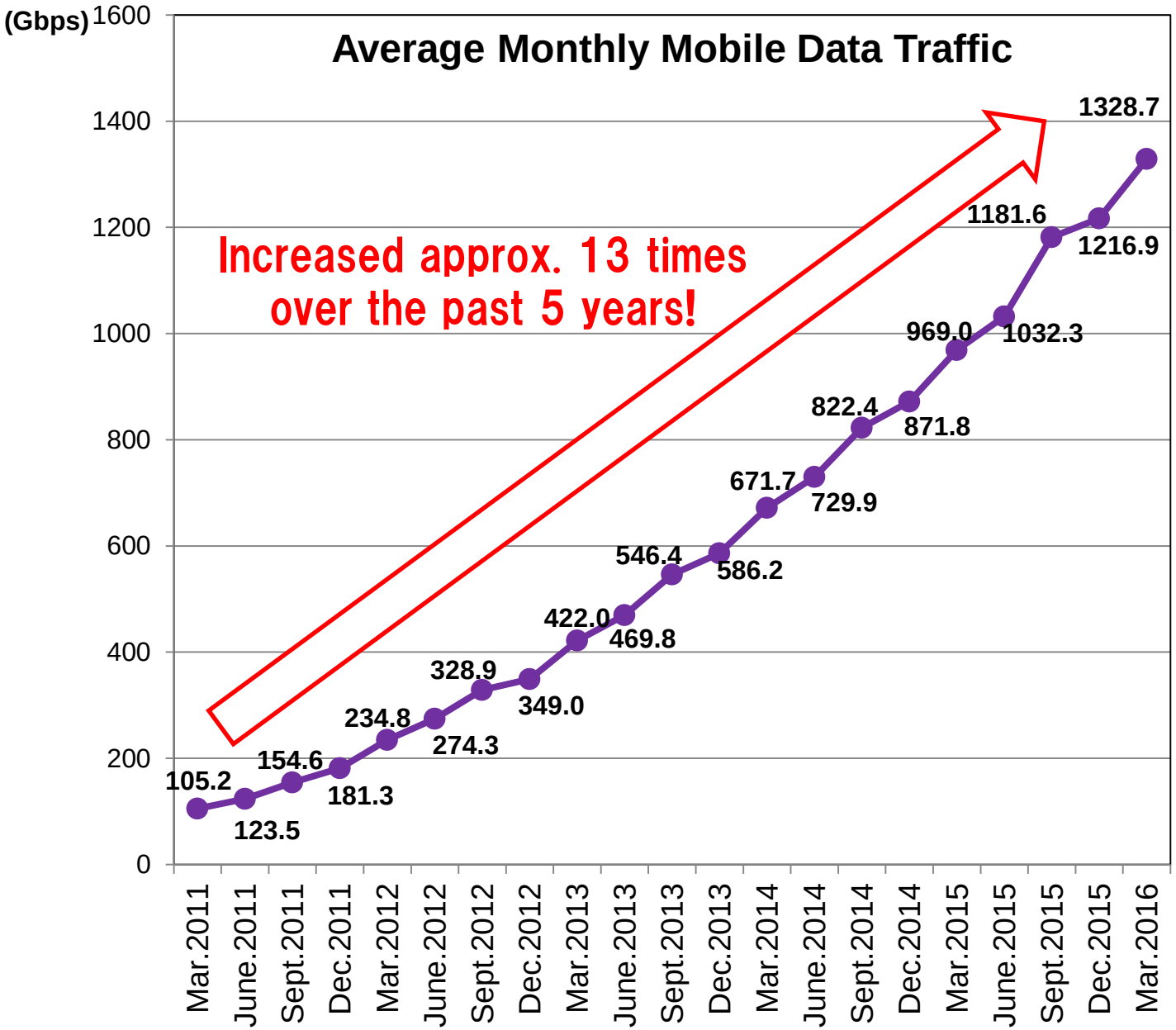





Source: Ministry of Internal Affairs and Communications

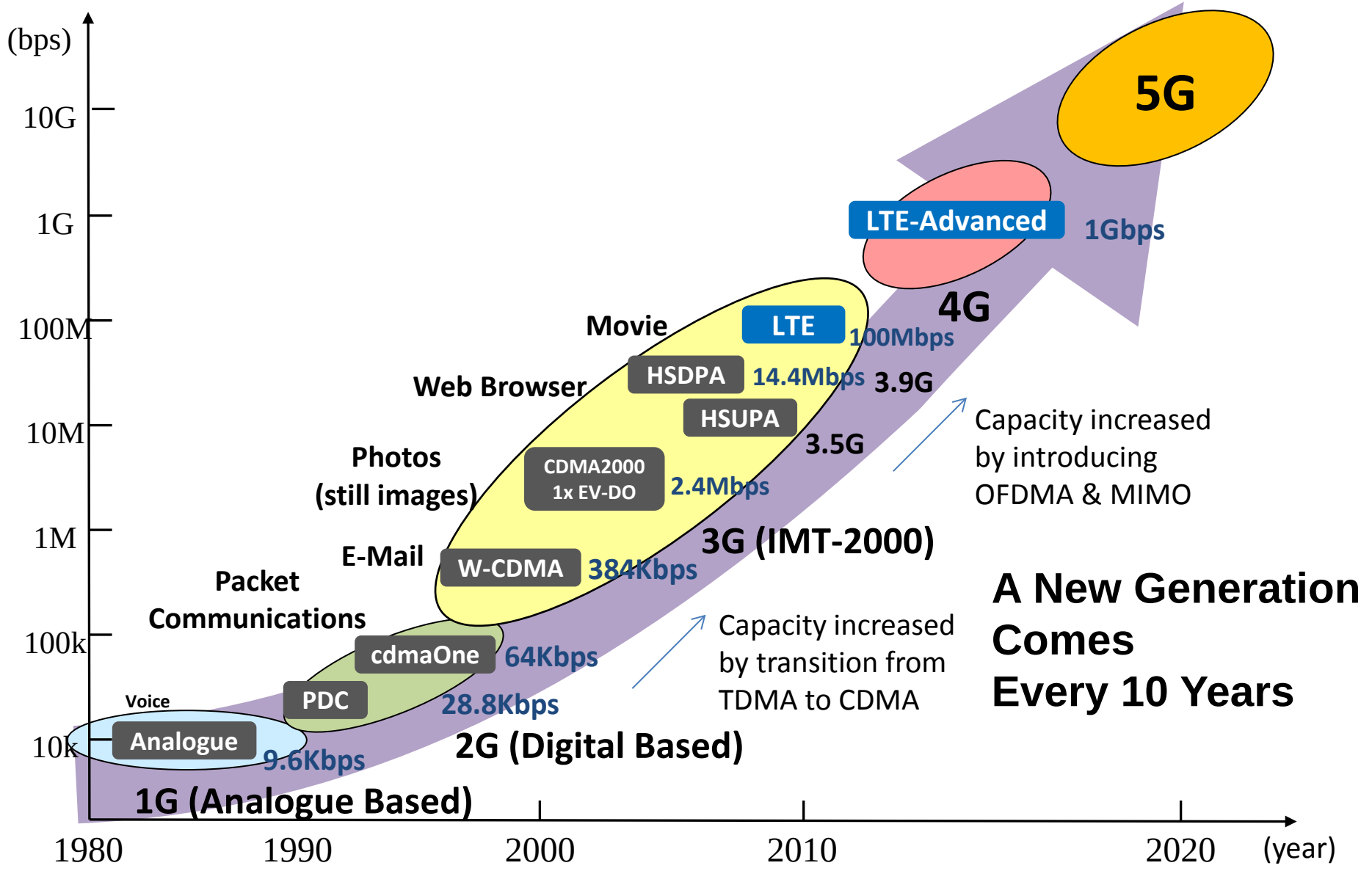
# Increase of Mobile Data Traffic





# Evolution of Mobile Communications Systems

## Traffic speed will be 10,000 times faster in 30 years




5G: The Fifth Generation mobile Communications Systems

# Frequency Allocation for Mobile Communication Systems (As of June 2016)



| Company | Total | | Bands | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 700 MHz | 800 MHz | 900 MHz | 1.5 GHz | 1.7 GHz | 2 GHz* | 2.5 GHz | 3.5 GHz |
| | | | FDD 30MHz x 2 | FDD 30MHz x 2 | FDD 15MHz x 2 | FDD 35MHz x 2 | FDD 35MHz x 2 | FDD 60MHz x 2 TDD 31.2MHz | TDD 100MHz** | TDD 120MHz |
| NTT docomo | 200 MHz | 200 MHz | LTE 20MHz | 3G/LTE 30MHz | — | LTE 30MHz | 3G/LTE 40MHz Only in some areas | 3G/LTE 40MHz | — | LTE 40MHz |
| au | 150 MHz | 200 MHz | LTE 20MHz | 3G/LTE 30MHz | — | LTE 20MHz | — | 3G/LTE 40MHz | — | LTE 40MHz |
| UQ Communications | 50 MHz | | — | — | — | — | — | — | WiMAX /WiMAX R2.1 50MHz | — |
| SoftBank | 211.2MHz | 241.2 MHz | LTE 20MHz | — | 3G/LTE 30MHz | 3G/LTE 20MHz | 3G/LTE 30MHz | 3G/LTE 40MHz PHS 31.2MHz | — | LTE 40MHz |
| Wireless City Planning | 30MHz | | — | — | — | — | — | — | AXGP 30MHz | — |

* Others, such as pending systems (2GHz-MSS:60MHz, 2GHz –TDD:15MHz)

** including Regional WiMAX(20MHz)

Total : 641.2MHz

# Radio Policy Vision towards 2020s：New Goals for Frequency Allocations

○ **Below 6 GHz**

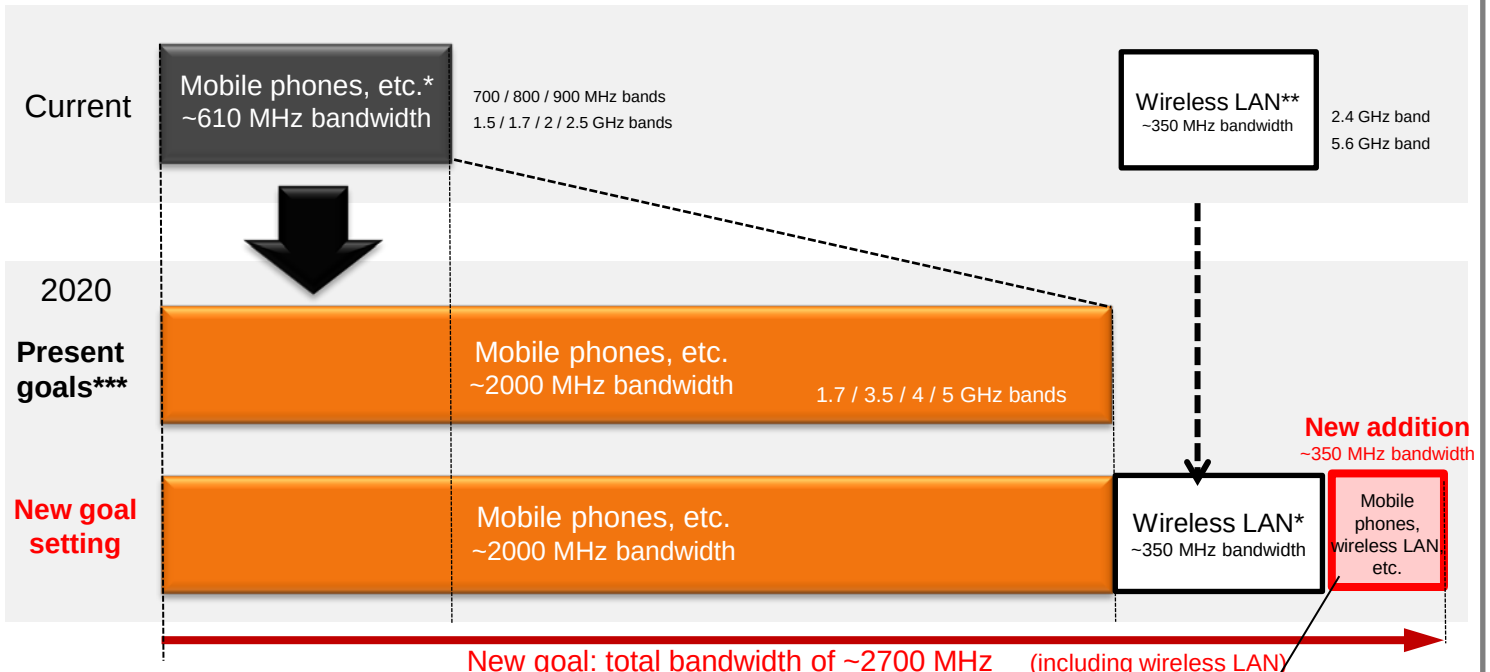
Promote **frequency sharing with public service** system**s** and others and to **ensure a total bandwidth of 2700 MHz,** Including bandwidth for wireless LAN, by 2020.

○ **Above 6 GHz**

Push ahead with **R&D** and **international standardization** while targeting a total bandwidth of about 23 GHz

Revisions to frequency allocation goals for mobile communication systems

## Below 6 GHz




*Mobile phones, etc. includes PHS and BWA.
**Excluding frequencies for indoor use only.
***Action Plan for Wireless Broadband Implementation (November 2010)

## Above 6 GHz

Current

- No set goals

**Clarify additional frequency band candidates as subject to examinations**

Promote R&D targeting the following frequency bands **(a total bandwidth of about 23 GHz)** looking ahead to the 2020s.

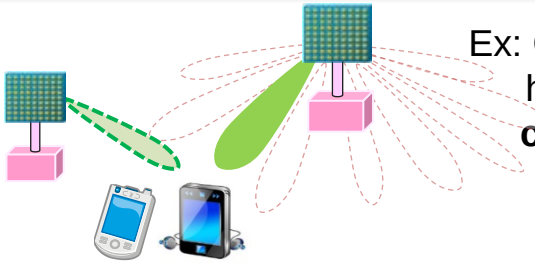
8.4 / 14 / 28 / 40 / 48 / 70 / 80 GHz bands

# Key Capabilities of 5G



✓ Key Capabilities for 5G (IMT-2020) :
1 Ultra high speed data **(eMBB)** ➡ Peak data rate **10Gbps** (100 x current LTE)
2 Ultra Low Latency **(URLLC)** ➡ Ultra Low Latency **1ms** (1/10 of current LTE system)
3 Massive Machine Type Connections **(mMTC):**
➡ Connection Density **100 devices/km²** (100 x current LTE)

✓ 5G is expected to **create a new market as a key infrastructure of IoT**

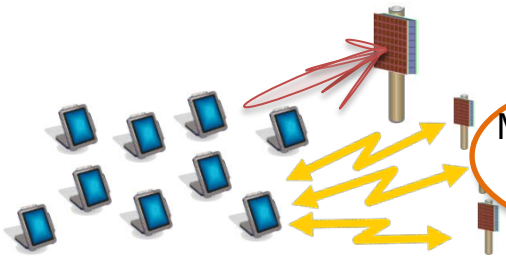


Ex: Quick transmission of Ultra high definition TV (4K/8K). **comparable to optic fiber**

**Ultra High Speed Data (eMBB)**

Key Capabilities for 5G

Large numbers of devices, sensors and terminals



Massive Machine Type Connections **(mMTC)**

Ultra Low Latency **(URLLC)**

Self Driving Cars

Ex: Massive Simultaneous **Connections for sensor networks** in small area, Smart Meters, Infrastructure Maintenance etc.

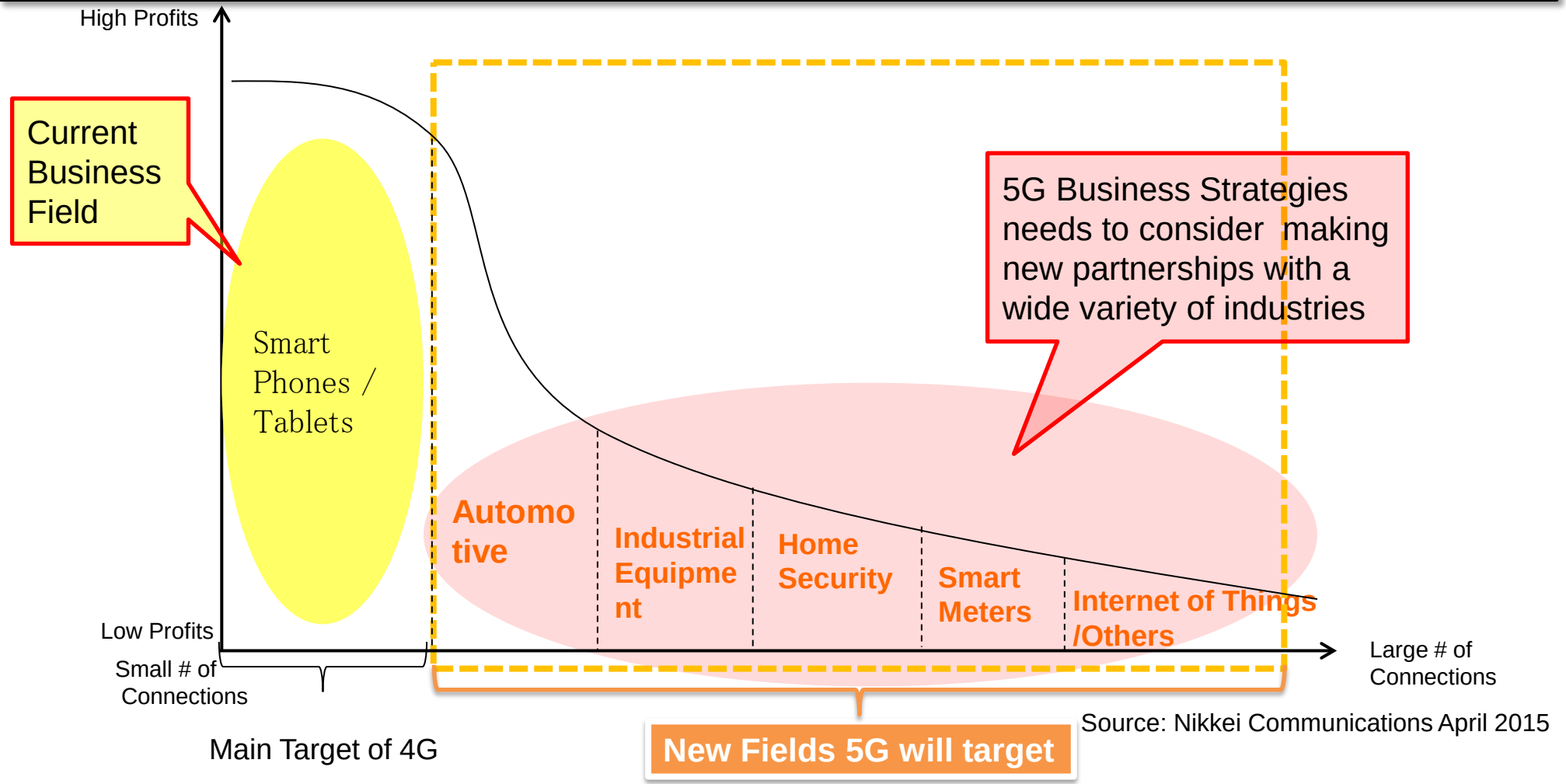
Ex: Self Driving, Remote control Robots (**real-time remote control**, IoT for mission critical)

Source: MIC, Nikkei Communications 4/2015

# Changes in the industrial structure in the age of 5G



- ✓ Once 5G arrives, new markets will be created for the Internet of Things such as cars, industrial devices, and smart meters rather than in businesses in traditional devices such as smartphones
- ✓ There will be a need to make new partnerships with a wide variety of industries to deal with the changes in profit structures that will come about due to 5G mobile

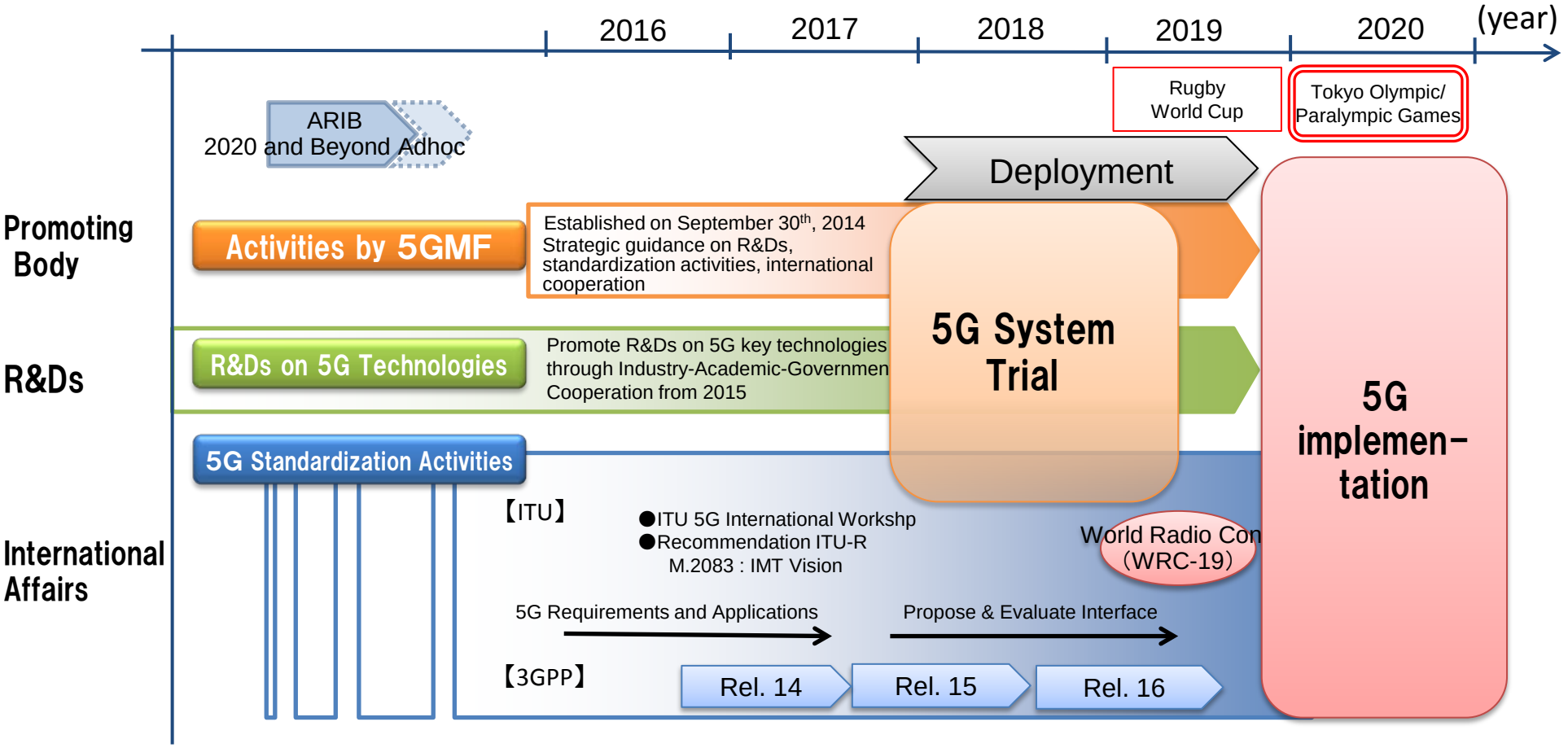



Source: Nikkei Communications April 2015

# 5G Roadmap towards 2020



- ✓ Promote three activities to support 5G realization for 2020 and beyond
  1. Support activities by Fifth Generation Mobile Forum (5GMF)
  2. R&Ds on 5G Technologies through Industry-Academic-Government Cooperation
  3. Standardization Activities at the ITU and 3GPP
- ✓ The 5G System Trial to test radio access, networks, and applications for 5G will be started in Tokyo and other cities in Japan in FY2017



# Comprehensive Promotion Strategies for 5G



## Strategic R&D and Trials

- **Promotion of R&D focusing** on key technologies
- **Strategic cooperation with countries** in R&D and Trial
  (expanding activities like the EU and Japan 5G cooperation declaration (May, 2015))

## Improvement Business Environment

- **Improvement of laws and regulations**
- **Spectrum allocation** in considering of international harmonization and deployment
- **Promote cooperation among the 5GMF and various industries**（Ex. collaboration with an IoT Promotion Consortium）

## Projects for 5G Realization

| Ultra-broadband Projects | Wireless IoT Project | Next-Gen ITS Project |
|---|---|---|
| ・High-speed Simultaneous Delivery | ・Heterogeneous Wireless Network | ・Next-Gen Connected Car |
| ・Wireless Presence | ・Massive Simultaneous Connections | ・Low Latency V2V Communications |
| ・High Performance Image Sensors | ・Wireless Platform | ・High Mobility Broadband System |

**Implementation by user participation**

## Expansion to Local Regions for local revitalization

- **Establishment of open testbeds not only in Tokyo but in local regions**, for a large number of participants
- **Contribution to local revitalization** through working on hardware as well as software.

## International Standardization / International Business Promotion

- Promotion of strategic international standardization and expansion by industrial, academic, and government officials through 5GMF
- **International business promotion** on comprehensive 5G systems with key technologies and services

# Promotion of 5G Projects and Application Fields for 5G



① Sports (Fitness)

② Entertainment (Games / Tourism)

③ Office / Workplace

④ Medical (Health / Welfare)

⑤ Smart house/Life (Daily Goods/Communications)

⑥ Retail (Finance / Payments)

⑦ Agriculture, Forestry, Fishery

⑧ Smart Cities/Areas (Construction/Maintainance)

⑨ Transport (Commute / Logistics)

## Three Project Areas

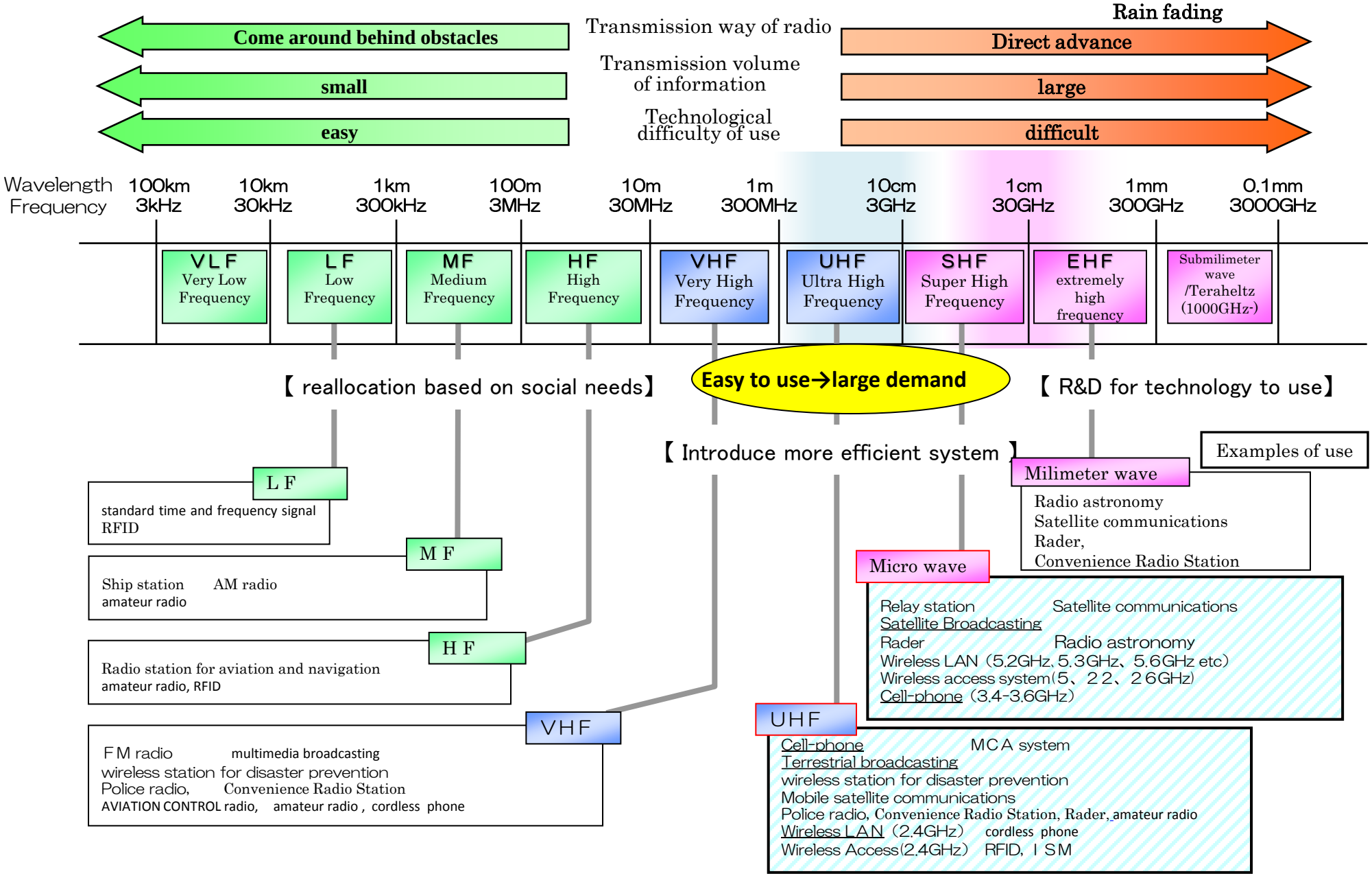
### Ultra-broadband

### Wireless IoT

### Next-Gen ITS

# Use of Spectrum





# Strategy to secure necessary spectrum for 5G



## Key elements

### 1. Harmonization and Cooperation with Other Countries

- International harmonization and cooperation with major countries who share their views about the frequency demands of 5G
- Start consideration in accordance with global trends without waiting for WRC-19
- Utilize chances such as international conferences on standardization/bilateral consultations/international events

### 2. Frequency sharing with existing systems and promoting reallocation

- Consider frequency reallocation or frequency sharing with existing systems, in IMT / 3GPP Bands which are currently allocated for other systems
- Draw out the scheme to promote efficient frequency sharing

### 3. R&D Promotion

- Promote the leading technology R&D of the effective utilization of frequency
- Promote R&D in the comprehensive demonstration experiment environment

### 4. Enhancement of Wireless LAN (WLAN) frequency

- Promote sharing frequency among 5GHz WLAN and other systems

## Strategy for Each Frequency

### Below 3.6GHz(IMT/3GPP Band)

- 1.7GHz band, 2.3GHz band
  Consider frequency sharing with or reallocation of public services
- 2.6GHz band
  Promote consideration of frequency sharing with the next mobile satellite communication systems
- 3.4GHz band
  Consider the use of promotion of termination acceleration measures

### 3.6GHz-4.9GHz

- 3.6GHz-4.2GHz
- 4.4GHz-4.9GHz
  Promote comprehensive consideration in accordance with international harmonization, domestic/ international R&D trends, and frequency sharing with existing systems

### 5GHz(WLAN)

- 5.15GHz-5.35GHz
  Promote frequency sharing with other systems outdoors in accordance with global trend
- LAA, LTE-U, MulteFire etc.
  Observe global trend

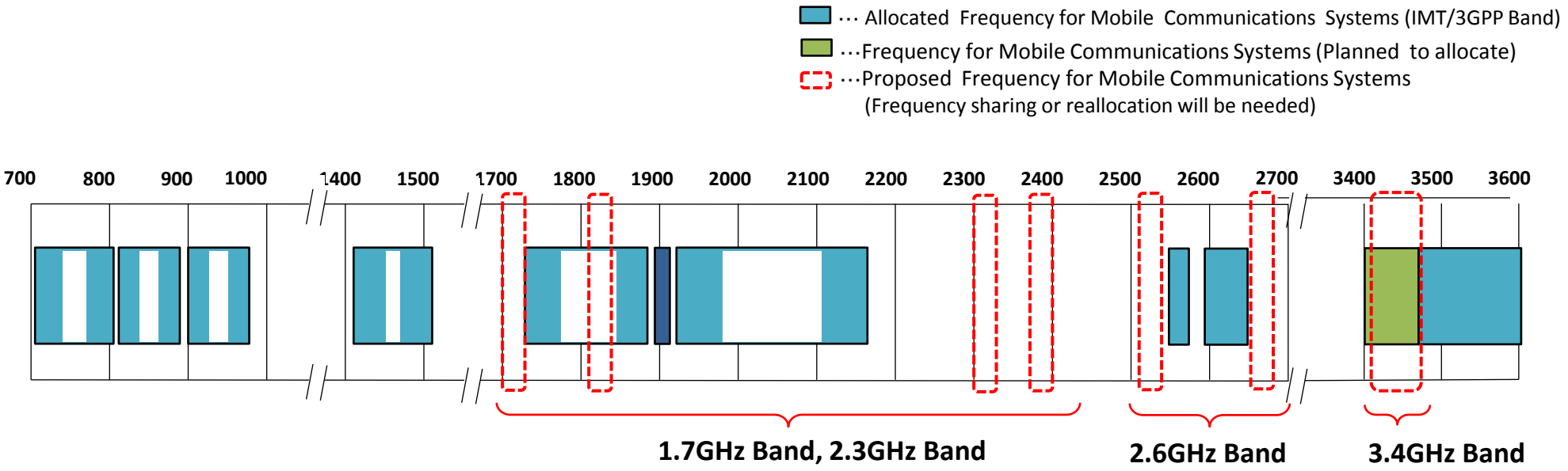
### Above 6GHz

- 24.25GHz-86GHz（11bands*）
  *Frequency considered in WRC-19 (IMT-2020)
  Promote comprehensive consideration in accordance with international harmonization, domestic/international R&D trends and frequency sharing with existing systems
- 27.5GHz-29.5GHz
  Promote comprehensive consideration in accordance with U.S and Korea etc.

# Below 3.6GHz (IMT / 3GPP Band)



- It is necessary to promote frequency sharing with other systems, migration or frequency reallocation of other systems toward assigning new IMT / 3GPP bands for mobile communication systems.
  - 1.7GHz Band, 2.3GHz Band: To enable frequency assignment for mobile communication system, promote consideration of frequency sharing or reallocation of other systems including government use.
  - 2.6GHz Band：When it is considered to introduce the next mobile satellite communication system, promote consideration of the possibility of frequency sharing with mobile satellite communication system from a technical perspective.
  - 3.4GHz Band：While existing systems have to migrate by the end of November 2022, promote consideration of applying termination acceleration measures etc. to migrate other systems earlier
- To enhance frequency sharing with other systems, MIC promotes consideration of specific plans and formulate schemes to promote the advance coordination process efficiently and surely.



# International Cooperation on Frequency Allocation for 5G①



- Toward 5G realization by 2020, we need to consider and identify candidate frequencies for 5G in order that telecom equipment manufacturers can start to develop new devices and equipment.
- We need to cooperate with major countries who share their views about frequency demands for 5G and to consider and identify candidate frequencies towards 5G deployment by 2020.

**<Frequency bands used to realize 5G under consideration>**

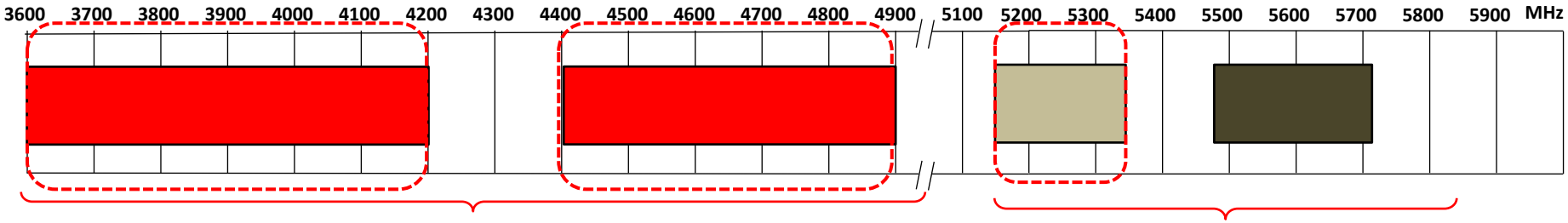
| Bands | | Attitude |
|---|---|---|
| 1 . Below 6GHz<br>[3.6 ~ 4.2 GHz, 4.4 ~ 4.9 GHz] | | Promote consideration in terms of making frequencies which have features such as wide coverage etc. below 6GHz available toward 5G realization in accordance with international harmonization, the prospect of procuring devices and the status of considering frequency sharing with existing systems<br>(Ref.) ・ 3.6GHz-3.8GHz band： 3GPP bands and is identified for IMT in U.S. etc. However it is necessary to share the frequencies with satellite communication systems in Japan<br>・4.4GHz-4.9GHz band: It is desirable to consider securing frequency and to promote international harmonization and cooperation |
| 2. Above 24GHz | (1)Frequencies to be considered at WRC-19 (IMT-2020)<br>[24.25 GHz ~ 86 GHz (11bands)] | Ensure enough bandwidth for mobile communication system securing international harmonization in accordance with the progress of R&D and frequency sharing with existing systems |
| | (2)Frequencies considered in U.S. and Korea etc.<br>[27.5 GHz ~ 29.5 GHz] | Encourage international harmonization, promotes consideration in accordance with progress of R&D and capability of securing wide band toward early 5G realization |

# International Cooperation on Frequency Allocation for 5G②



## Below 6GHz

… Proposed Frequencies for IMT at WRC-15
…Wireless LAN
…Wireless LAN (indoor use only)
…Proposed Frequency for Mobile Communications Systems




3.6 ~ 4.2 GHz Band, 4.4 ~ 4.9 GHz Band

Wireless LAN

## Above 24GHz (Frequencies to be considered at WRC-19 and 28GHz)

… Frequencies to be considered at WRC-19
… Frequencies considered in U.S. and Korea etc.

| | 6-10GHz | 10-20GHz | 20-30GHz | 30-40GHz | 40-50GHz | 50-60GHz | 60-70GHz | 70-80GHz | 80-90GHz |
|---|---|---|---|---|---|---|---|---|---|
| Japan Proposals* Includes joint proposals with APT | 6 8.5 | 10 10.5 14.4 15.35 | 25.25 25.5 29.5 31.8 33.4 | 37 39 | 47 47.2 50.2 50.4 52.6 | | 66 76 | 81 86 | |
| CEPT Proposals* (Europe) | | | 24.5 27.5 | 31.8 33.4 | 40.5 43.5 45.5 48.9 | | 66 76 | 81 86 | |
| CITEL Proposals* (USA) | | 10 10.45 | 23.15 23.6 27.5 | 31.8 33 37 | 40.5 45.5 47 47.2 50.2 50.4 52.6 | | 59.3 76 | | |
| **Candidate Frequencies** | | | 24.25 27.5 29.5 | 31.8 33.4 37 | 40.5 42.5 43.5 45.5 47 47.2 50.2 50.4 52.6 | | 66 76 | 81 86 | |

Sources: Radio Policy 2020 Vision Committee Mobile Service TF (volume 1)

* At WRC-15

MIC
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# Thank you !


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