10th Anniversary

GISC 2026

Global ICT Standards Conference 2026

Session 3 Towards a Space-Based Hyper-Connected Era

Japan's Vision for Space Integrated Connectivity toward 6G

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GISC 2026 3 November 2026 Seoul

ICT Standards and Intellectual Property:
Shaping the Physical AI

주최 과학기술정보통신부 지식재산처 주관 국립전파연구원 TTA IITP KEA kista ETRI

Abstract

What this presentation covers

ICT Standards

This presentation provides an overview of the current status and future outlook of satellite communication systems in Japan. Looking back on the satellite communication services KDDI has provided over the years, it focuses on the recent launch of direct-to-device satellite communications in Japan, the related domestic developments, and the prospects ahead toward space-integrated connectivity in the 6G era.

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01 Six decades of satellite at KDDI, and how Japan adopted LEO

02 Direct-to-device, and the international rule that is catching up

03 Toward 6G, where satellite is in scope from the start

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KDDI at a Glance

KDDI provides communication services in Japan and Global

Mobile in Japan

33 M ID

International Submarine cable

7 +1 Cables

Data Center

45 Sites

TELEHOUSE®

IoT

60 M ID

TOYOTA mazda BMW









History of Satellite Communications in KDDI

1960s – 1970s

- 60 First communication satellite launched in US
- 63 Ibaraki Space Communications Experimental Station
- 69 Yamaguchi Satellite Earth Station
- 71 Video transmission for Munich Olympics
- 77 Marine Satellite Communications Services
- 79 Video transmission from Antarctica



1963 JP-US TV transmission

1980s

1990s

- 90 Aviation Satellite Communications Service
- 98 Video transmission for Nagano Olympics



1998 Nagano Olympics

2000s

- 05 Iridium started
- 09 BGAN started
- 11 Recovery from Great East Japan Earthquake



2011 East Japan Earthquake

2010s

- 13 Maritime VSAT
- 16 Myanmar Ground Station

2020s

- 22 NGSO backhaul
- 25 D2D

Source: KDDI Corporate History

Examples of Satellite Communication Services

Satellite is an important communication method in case where terrestrial network is unavailable.

Maritime



Aviation



Japan Ground Self-Defense Force



Antarctic Base



Remote Islands



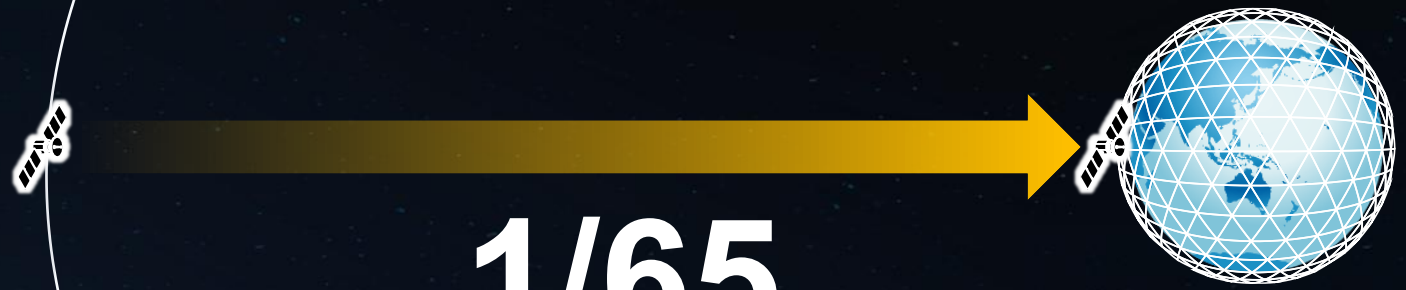
Disaster Recovery





GSO & NGSO

High capacity and low latency are achieved with NGSO.



1/65

	GSO (36,000km)	NGSO (550km, etc)
Pros	• 3 satellites can cover the entire globe • Easy tracking • Long satellite lifespan	• High capacity • low latency • Small device, low power consumption
Cons	• Large delay	• Large constellation needed

NGSO Rule making in Japan

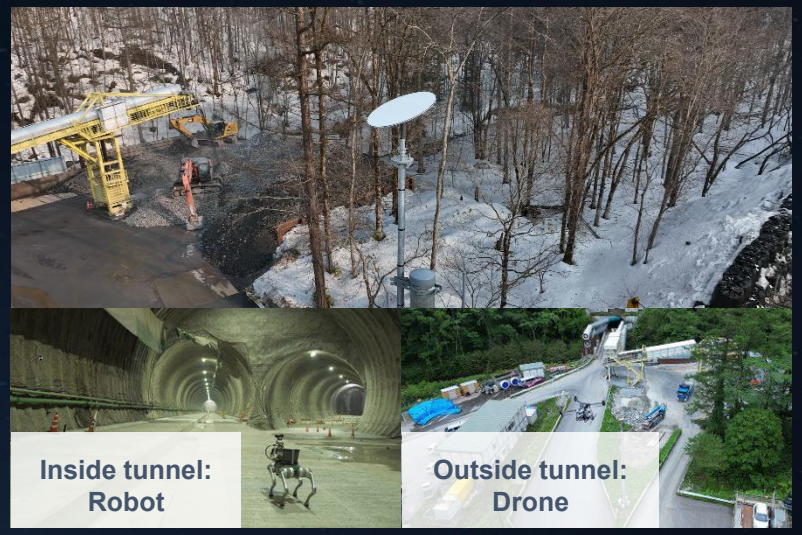
Draft rule for each NGSO constellation is made under Japanese government (MIC) committee through Spectrum sharing studies/Regulatory consideration process.



Use cases #1

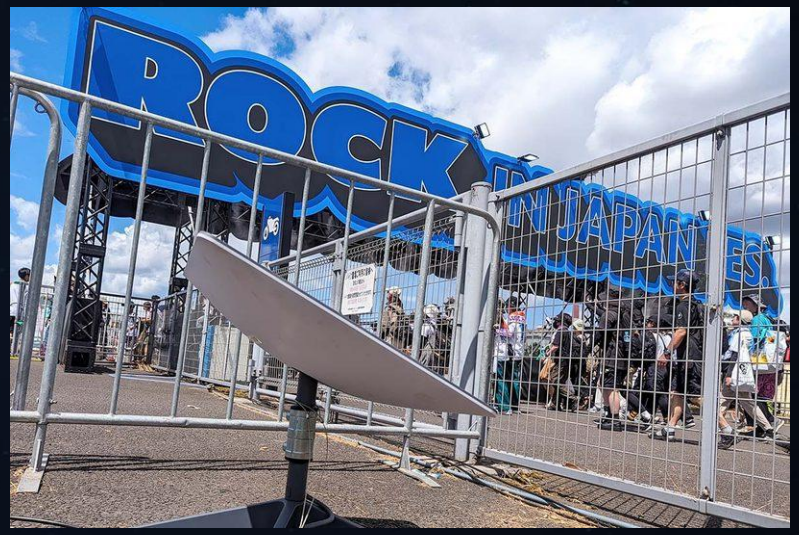
Solving social issues and promoting DX

Satellite Mobile Link



Establishing au mobile network area utilizing NGSO both inside and outside the tunnel.

Festival Wi-Fi



At large outdoor event areas, NGSO is utilized to establish Wi-Fi coverage.

Mountain huts Wi-Fi



NGSO Broadband Wi-Fi for safety, weather info, cashless payment, reservation

Use cases #2

Disaster response in Ishikawa Prefecture using NGSO

Recovery from sea



Ship-based antennas

https://news.kddi.com/kddi/corporate/newsrelease/2024/01/06/7170.html

Restoration from the sea.

Emergency restoration



Restoration of eNB

Using as backhaul instead of damaged fiber cables.

Support for medical sites



Supporting medical sites

https://news.kddi.com/kddi/corporate/newsrelease/2024/01/12/7179.html

Offering 350 units to evacuation centers and 200 units to disaster response agencies.

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01 Six decades of satellite at KDDI, and how Japan adopted LEO

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Mobile Area Coverage

60%



40% was out of coverage in Japan including mountainous areas and islands, but…

Direct satellite communication service covering all of Japan

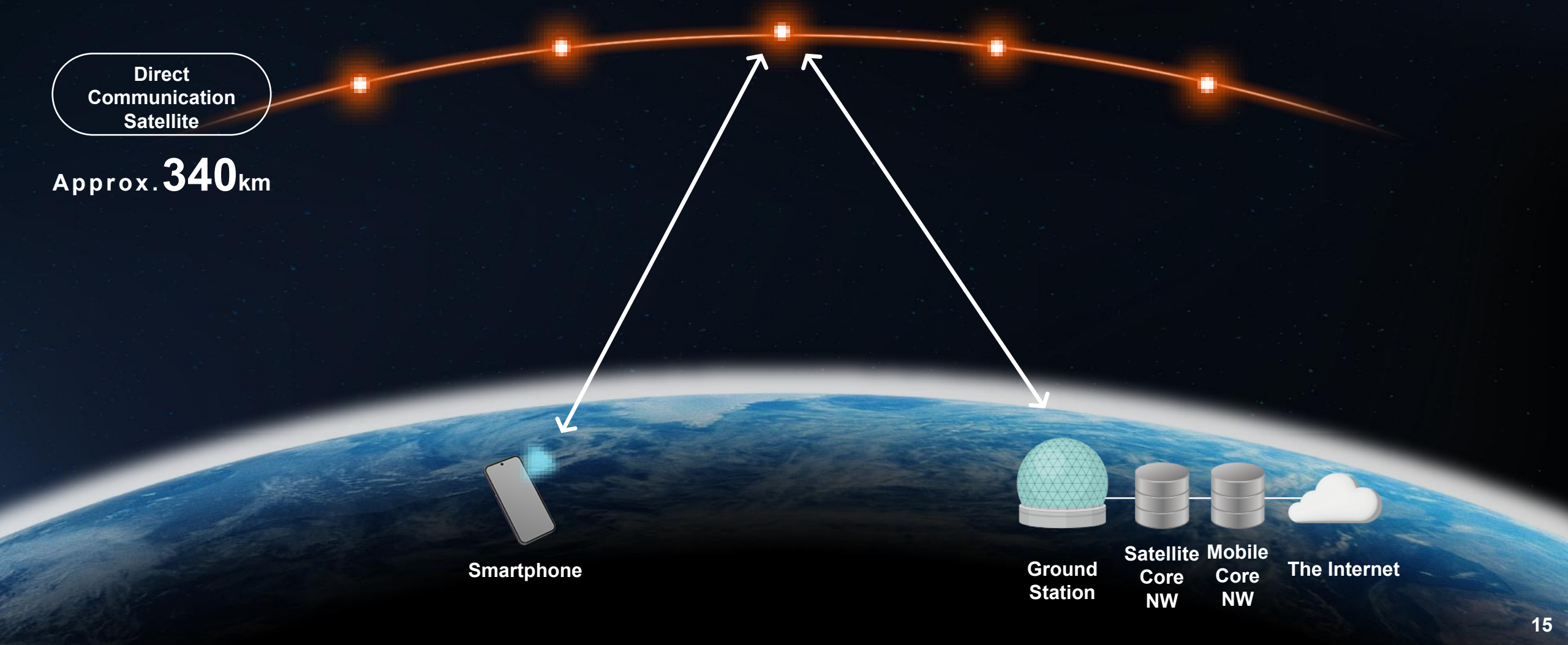
Launched on April 10, 2025

If you can see the sky, you're connected.

Voice calls and Internet communications not supported (as of March 2025) Connection may be limited depending on usage environment Voicemail and call forwarding functions not available when satellite is captured

Structure of Direct-to-Device

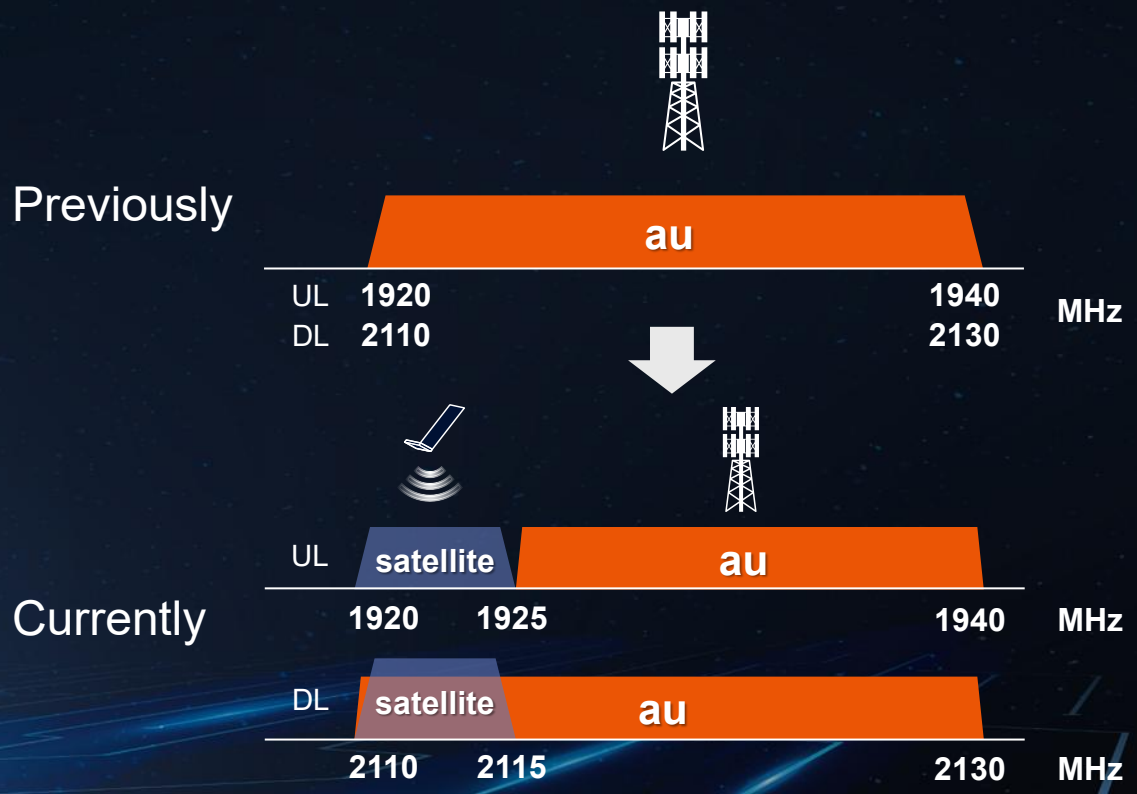
Direct Connection between smartphone and satellites



How to work?

Reuse of terrestrial bands

By utilizing frequencies already installed in existing smartphone, we can use satellite direct communication with our current device.



Satellite communication in terrestrial bands?

1 710-2 170 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
1 710-1 930	FIXED MOBILE 5.384A 5.388 5.388A 5.149 5.341 5.385 5.386 5.387	
1 930-1 970 FIXED MOBILE 5.388 5.388A	**1 930-1 970** FIXED MOBILE 5.388 5.388A Mobile-satellite (Earth-to-space)	**1 930-1 970** FIXED MOBILE 5.388 5.388A
1 970-1 980	FIXED MOBILE 5.388 5.388A	
1 980-2 010	FIXED MOBILE 5.388 MOBILE-SATELLITE (Earth-to-space) 5.351A 5.389A 5.389B 5.389F	
2 010-2 025 FIXED MOBILE 5.388 5.388A	**2 010-2 025** FIXED MOBILE 5.388 MOBILE-SATELLITE (Earth-to-space) 5.389C 5.389E	**2 010-2 025** FIXED MOBILE 5.388 5.388A
2 025-2 110	SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (Earth-to-space) (space-to-space) 5.392	
2 110-2 120	FIXED MOBILE 5.388 5.388A SPACE RESEARCH (deep space) (Earth-to-space)	
2 120-2 160 FIXED MOBILE 5.388 5.388A	**2 120-2 160** FIXED MOBILE 5.388 5.388A Mobile-satellite (space-to-Earth)	**2 120-2 160** FIXED MOBILE 5.388 5.388A
2 160-2 170 FIXED MOBILE 5.388 5.388A	**2 160-2 170** FIXED MOBILE 5.388 MOBILE-SATELLITE (space-to-Earth) 5.389C 5.389E	**2 160-2 170** FIXED MOBILE 5.388 5.388A

Radio Regulations Vol. 1 ARTICLE 5 Section IV Table of Frequency Allocations

Agenda for the ITU-R* WRC-27**

AI	Official Agenda Item Topic Name
1.1	Consideration of technical and operational conditions for aeronautical and maritime earth stations in motion communicating with GSO and non-GSO space stations in the FSS in the frequency bands 47.2-50.2 GHz and 50.4-51.4 GHz (E-s)
1.2	Use of FSS earth stations with smaller antennas in the 13.75-14 GHz (E-s) band
1.3	Use of the frequency band 51.4-52.4 GHz by FSS gateway earth stations
1.4	FSS (s-E) in 17.3-17.7 GHz and BSS (s-E) in 17.3-17.8 GHz in Region 3, and equivalent power flux-density limits in Regions 1 and 3
1.5	Additional primary allocations to the FSS (E-s) in parts of the 31-31.3 GHz and 31.8-33.4 GHz bands in Region 1
1.6	Equitable access to GSO and NGSO FSS systems in the Q/V frequency bands
1.7	Studies on sharing and compatibility and develop technical conditions for the use of IMT in the frequency bands 4 400-4 800 MHz, 7 125-8 400 MHz (or parts thereof), and 14.8-15.35 GHz
1.8	RLS above 231.5 GHz and identification of bands for high-frequency applications (275-700 GHz)
1.9	Consideration of appropriate regulatory measures concerning the updating of Radio Regulations Appendix 26 to support aeronautical mobile (OR) HF modernization
1.10	Limits in Article 21 for FSS, MSS, and BSS to protect FS and MS in 71-76 GHz and 81-86 GHz bands
1.11	Review of Appendix 15 for the amateur service and amateur-satellite service
1.12	Modernization of GMDSS and additional satellite providers
1.13	**Possible new allocations to the MSS for direct connectivity between space stations and IMT user equipment to complement terrestrial IMT network coverage**
1.14	Additional allocations to the MSS in Region 1 and Region 3 around 2 GHz
1.15	Frequency-related matters for future development of communications on the lunar surface and between lunar orbit and the lunar surface
1.16	Regulatory provisions to protect radio astronomy operating in specific Radio Quiet Zones
1.17	Regulatory provisions for receive-only space weather sensors and their protection
1.18	Regulatory measures regarding the protection of EESS (passive) and RAS in certain frequency bands above 76 GHz from unwanted emissions of active services
1.19	Possible new primary allocations in all Regions to the EESS (passive) in the frequency bands 4 200-4 400 MHz and 8 400-8 500 MHz
2	Review and update of ITU-R Recommendations incorporated by reference in the Radio Regulations
7	Satellite coordination and notification procedures (Standing Item)
8	Deletion of country footnotes in the RR (Standing Item)
10	Future WRC agenda items (Standing Item)

*ITU-R (International Telecommunication Union Radiocommunication Sector): The wireless communications division of the ITU, one of the specialized agencies of the United Nations, that distributes and standardizes the frequency of the wireless communication field.
** WRC (World Radiocommunication Conference): The largest ITU-R* conference, held approximately once every four years for the purpose of revisions of Radio Regulations.

What is agenda item 1.13? (1/2)

Resolution 253 of the Radio Regulations (RR) 2024 applies

RESOLUTION 253 (WRC-23)

Studies on possible new allocations to the mobile-satellite service for direct connectivity between space stations and International Mobile Telecommunications (IMT) user equipment to complement terrestrial IMT network coverage

The World Radiocommunication Conference (Dubai, 2023),

considering

a) that International Mobile Telecommunications (IMT) systems support terrestrial and satellite components, including the capability to enable direct communication to IMT user equipment;

b) that the mobile-satellite system may provide alternative network resilience and mobile connectivity to underserved communities and in rural and remote areas, in particular in the event of network failures of terrestrial IMT and natural disasters;

c) that the expected usage of the mobile-satellite service (MSS) in IMT frequency bands in specific service areas is based on the authorization by administrations within the territory under their jurisdiction,

noting

a) that Report ITU-R M.2077-0 indicated a shortfall of spectrum available for the satellite component of IMT and systems beyond IMT-2000 of more than 144 MHz (space-to-Earth) and more than 19 MHz (Earth-to-space);

b) that Report ITU-R M.2218-0 estimated the spectrum requirement in the frequency range 4-16 GHz for MSS broadband applications between 240 MHz and 355 MHz;

c) that Report ITU-R M.2514-0, on vision, requirements and evaluation guidelines for satellite radio interfaces of IMT-2020, defined the minimum technical requirements for satellite systems which can be part of the IMT-2020 ecosystem, including bandwidth requirements;

d) that Report ITU-R M.2041-0 addressed sharing and adjacent band compatibility in the 2.5 GHz band between the terrestrial and satellite components of IMT-2000;

e) that Recommendation ITU-R M.1182-1 considered the integration of terrestrial and satellite mobile communication systems;

f) that Recommendation ITU-R M.1036-6 addressed frequency arrangements for the implementation of the terrestrial component of IMT in the bands identified for IMT in the Radio Regulations;

g) that Recommendation ITU-R RA.769-2 contains the protection criteria used for radio astronomical measurements;

h) that Recommendation ITU-R RA.1513-2 provides the acceptable levels of data loss to radio astronomy observations and percentage-of-time criteria resulting from degradation by interference for frequency bands allocated to the radio astronomy service (RAS) on a primary basis;

i) that Recommendation ITU-R M.1808-1 also applies for the studies of frequency bands allocated for the mobile service below 960 MHz;

j) that Resolution **646 (Rev.WRC-19)** also applies in frequency bands below 960 MHz;

k) that the GE06 Agreement applies for countries in Region 1, except Mongolia, and including the Islamic Republic of Iran,

recognizing

a) that the growth in demand for mobile-satellite systems is making it difficult to sustain MSS services on a long-term basis in the existing bands;

b) that MSS systems may provide direct connectivity between space stations and IMT user equipment to complement terrestrial IMT network coverage;

c) that new allocations to the MSS would be consistent with the International Telecommunication Union's objective of promoting access to telecommunication services, particularly in remote and rural areas;

d) that there is a need to concentrate the studies on the frequency bands allocated to the mobile service on a primary basis and used for IMT or identified for IMT by country footnotes or on a regional or multi-regional basis;

e) that for the determination of the incumbent services, the relevant provisions of the Radio Regulations in force apply;

f) that unwanted emissions in the spurious domain may be considered regarding RAS frequency allocations,

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference

1 studies on possible allocations to the MSS in the frequency range between 694/698 MHz and 2.7 GHz, taking into account the IMT frequency arrangements addressed in the most recent version of Recommendation ITU-R M.1036;

2 studies on spectrum requirements and on technical, operational and regulatory matters related to the implementation of the mobile-satellite service for direct connectivity to the IMT user equipment to complement the terrestrial IMT network coverage,

further resolves

1 to conduct studies on sharing and compatibility between incumbent services, including in adjacent frequency bands, ensuring the protection of incumbent services in accordance with the Radio Regulations;

2 to study possible technical and operational measures to ensure that the stations in the MSS do not cause harmful interference to, or claim protection from, stations operating in the mobile service,

invites administrations

to participate actively in the studies and provide the information required for the studies listed in *resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference* by submitting contributions to the ITU Radiocommunication Sector,

invites the 2027 world radiocommunication conference

to consider, based on the results of studies, the appropriate regulatory actions, including possible new allocations to the MSS for direct connectivity between space stations and IMT user equipment to complement terrestrial IMT network coverage.

Radio Regulations (itu.int)

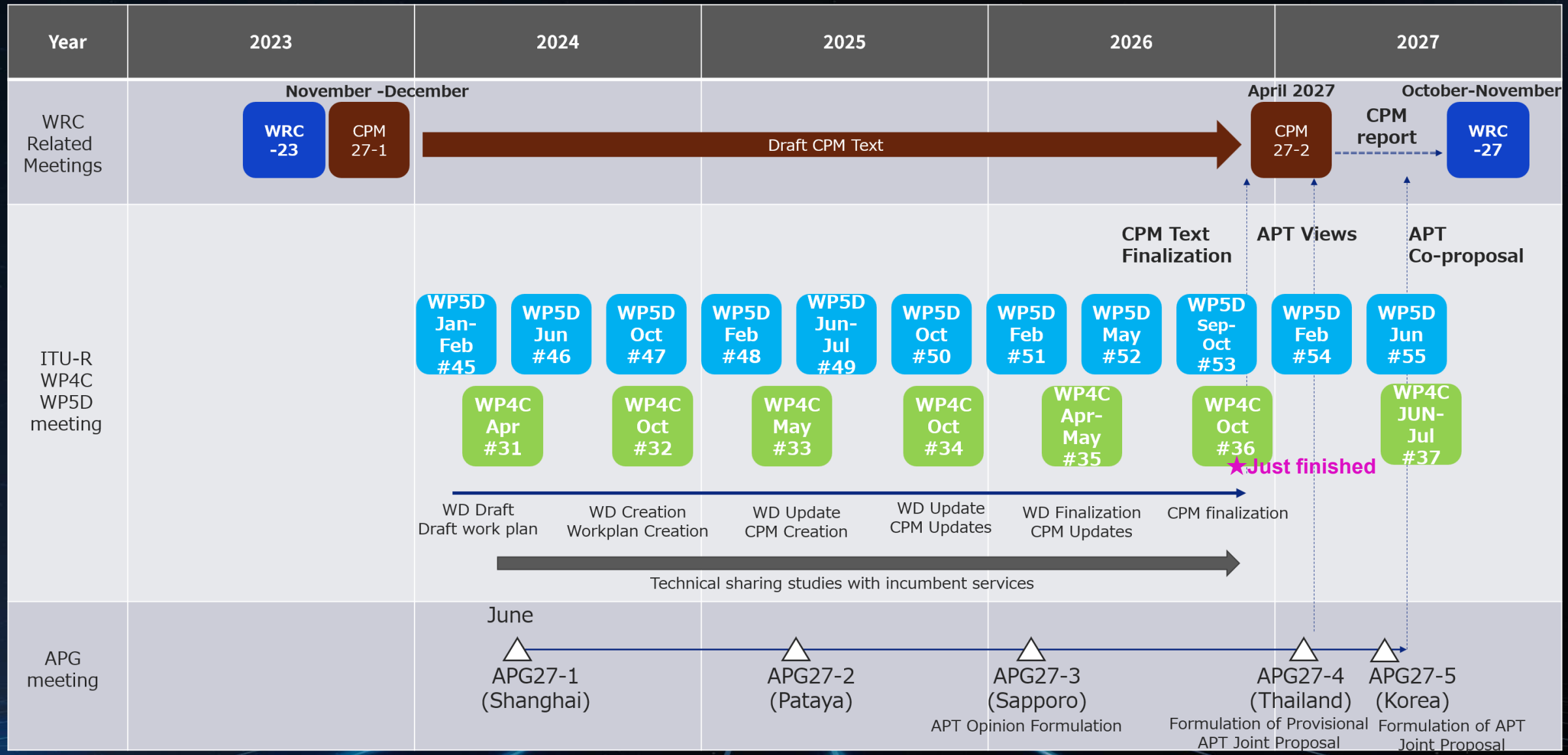
What is agenda item 1.13? (2/2)

Resolution 253 of the Radio Regulations (RR) 2024 applies

RESOLUTION 253
Studies on possible new allocations to the mobile-satellite service for direct connectivity between space stations and International Mobile Telecommunications (IMT) user equipment to complement terrestrial IMT network coverage

resolves to invite the ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference	
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Towards WRC-27 Shanghai



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NTN in IMT-2030 (6G)

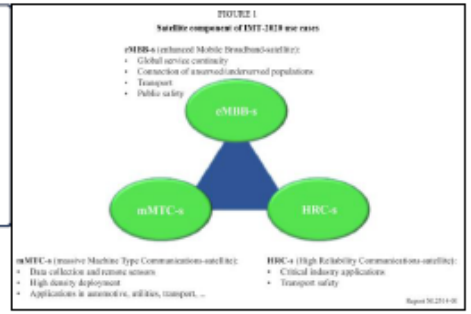
Committed to Connecting the World

NTN in the ITU-R "Framework" for IMT-2030 (Rec. ITU-R M.2160)

"The Non-Terrestrial Network (NTN) will complement existing terrestrial mobile networks and enhance the next generation of mobile networks and services, striving to improve connectivity for users in unserved and underserved areas, benefiting both consumers and industries."

From the very beginning of the IMT-development, a satellite component was part of the ITU-R work and a series of ITU-R Recommendations for the satellite component for the according IMT generation has been developed:

IMT-2000	Recommendations ITU-R M.818-2, M.1167, M.1182-1, M.1850-2 and M.2014-1
IMT-Advanced	Recommendation ITU-R M.2047
IMT-2020	• Report ITU-R M.2514 – Vision, requirements and evaluation guidelines for the satellite radio interface(s) of IMT-2020 • Ongoing work in **ITU-R WP 4B** regarding the according **IMT-process**, incl. the **evaluation of potential RIT-candidates**
IMT-2030	t.b.d.



UNIDIR's "Technology and security seminar on 6G" , 11. December 2024, Geneva

Source UNIDIR's "Technology and security seminar on 6G" , 11. December 2024, Geneva

Radio Spectrum Reallocation Action Plan (FY2026 edition) in Japan

Priority initiatives: Studies toward introducing 6G

WRC-27 IMT agenda: 4400–4800 MHz, 7125–8400 MHz and 14.8–15.35 GHz. Japan will accelerate studies and proposals for 5G and 6G, and reflect results in its WRC-27 position.

From FY2027: technical and sharing studies for mobile allocation in 4400–4800 MHz, 6425–8400 MHz and 14.8–15.35 GHz, considering ITU/3GPP standardization and overseas developments.

Priority initiatives: Advanced use of NTN

In FY2026: Ka-band sharing studies to enhance GSO and ~600 km NGSO systems and introduce ~8000 km NGSO systems.

In 2026: sharing studies and a regulatory framework for direct-to-device satellite systems in the 700 MHz band.

Annex: satellite direct communication R&D

Enable terrestrial/satellite spectrum sharing through narrow multi-beams from a large-aperture phased-array antenna formed by a cluster of very small satellites.

Develop a broadband technology base linking satellite and terrestrial networks while protecting terrestrial systems in the same or adjacent bands.

Chapter 4: 1.4–3.4 GHz

- 5. Issues to be addressed

In FY2026: begin domestic-use studies of the 2 GHz MSS band (1980–2010 / 2170–2200 MHz), considering international plans, user convenience and autonomy.

Chapter 4: 8.5–15.35 GHz

- 5. Issues to be addressed

In FY2026: begin sharing studies toward extending the frequency range of Ku-band VSAT earth stations. Also under way: an overall review of 14 GHz mobile satellite systems for vehicles, ships and aircraft, to allow more flexible operation.

Chapter 4: 15.35–36 GHz

- 3. Actions already set for regulatory development

In FY2026: begin Ka-band sharing studies with existing radio systems to enhance GSO and ~600 km NGSO systems and introduce ~8000 km NGSO systems, as set out in the NTN priority initiative.

Source: 総務省｜報道資料｜周波数再編アクションプラン（令和8年度版）（案）に対する意見募集

KDDI's Vision for the Evolution of Space Communications



1963～
Japan's First Satellite Communications

2024～
Direct Smartphone Connectivity

2028～
Lunar-Earth Communication



2030～
Lunar 5G

10th Anniversary

GISC 2026

Global ICT Standards Conference 2026

- Thank you -

Yusuke Fukui, Senior Expert, KDDI Corporation

ICT Standards and Intellectual Property:
Shaping the Physical AI

주최 과학기술정보통신부 지식재산처 주관 국립전파연구원 TTA IITP KEA kista ETRI