ITU World Radiocommunication Conference (WRC-19) Report

Takeo Ichikawa, Kazuyoshi Saito, Junichi Iwatani, and Shinya Otsuki

Abstract

Because radio waves travel through space across national borders, there can be harmful radio interference between neighboring countries if each country determines how to use radio services on its own, such as in telecommunication and broadcasting. For this reason, the International Telecommunication Union (ITU), the United Nations organization specialized in telecommunication, sets forth the Radio Regulations (RR), a set of international rules for using radio at each frequency and in each region of the world. To revise the RR, concerned parties from all over the world gather at an international conference held about every four years called the ITU World Radiocommunication Conference (WRC). In Japan, the RR revised at the WRC will be reflected in laws such as the Radio Law. This makes the WRC an extremely important conference for the NTT Group, which provides customers with wireless services and wireless systems, such as mobile telecommunication and wireless local area network (LAN), and uses fixed microwave communication systems, satellite communication systems for remote islands, and disaster-response radio systems for its own networks. In this article, we report on the ITU World Radiocommunication Conference 2019 (WRC-19).

Keywords: wireless LAN (WLAN), International Mobile Telecommunications (IMT), Radio Regulations (RR)

1. ITU World Radiocommunication Conference 2019 (WRC-19)

WRC-19 was held in the city of Sharm El Sheikh, Egypt from October 28 to November 22, 2019. **Figure 1** shows the opening ceremony, which was attended by the President of Egypt. About 3300 people from 166 countries participated and discussed agenda items concerning revisions to the Radio Regulations (RR), as shown in **Table 1**. The Japanese delegation sent about 90 people to participate in discussions, representing the Ministry of Internal Affairs and Communications, as well as telecommunication carriers, broadcasters, manufacturers, research institutes, and other organizations (From NTT Group, this included NTT Access Network Service Systems Laboratories, NTT DOCOMO, NTT Advanced Technology, NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, and NTT Technology Planning Division). The agenda items in blue in Table 1 are mainly related to the NTT Group. NTT Access Network Service Systems Laboratories and NTT Technology Planning Division were in charge of agenda items concerning wireless local area network (LAN) and wireless use by NTT EAST/NTT WEST, while NTT DOCOMO were in charge of agenda items concerning mobile telecommunication and wireless use by NTT DOCOMO. **Figure 2** shows the deliberation system of WRC-19. Agenda items related to wireless LAN and mobile telecommunication were discussed at COM 4. For the RR revisions to be approved, they must receive final approval at a plenary session attended by all participating countries.

1.1 Additional frequency allocation to 5-GHz-band wireless LAN for outdoor use

Discussions were held regarding agenda item 1.16, primarily concerning regulatory measures for wireless

Fig. 1. WRC-19 meeting at the opening ceremony.

access systems including wireless LAN in the 5-GHz band (5.15–5.925 GHz), meaning studies of the revisions to the RR to expand the use of 5-GHz band wireless LAN. Studies to enable outdoor use of wireless LAN and higher transmission power in the 5.2-GHz band (5.15–5.25 GHz) are especially relevant to Japan. In the RR, use of wireless LAN indoors and outdoors in the 5.6-GHz band was already permitted under certain conditions, but the 5.2-GHz band was restricted to indoor use only. Maximum equivalent isotropically radiated power (EIRP) was allowed up to 1 W in the 5.6-GHz band, while limited to 200 mW in the 5.2-GHz band. The reason for this was that the 5.2-GHz band was already in use internationally by other systems, such as satellite communications, so there was concern that there could be harmful radio interference if wireless LAN was used outdoors.

In Japan, the Information and Communications Council conducted technical studies with participation from NTT Access Network Service Systems Laboratories to discuss the possibility of sharing the 5.2-GHz band with satellite telecommunications under outdoor use of wireless LAN. One purpose of these studies is to facilitate the provision of wireless LAN services at venues for international sport competitions to be held in Tokyo. As a result of these studies, under the condition of increasing the maximum transmission power to the same level as the 5.6-GHz band that can already be used outdoors, it can be shared without harmful interference by limiting the number of wireless LAN access points used outdoors and limiting the elevation angle of the antenna. In 2018, Japanese laws and regulations were amended (wireless LAN access points for outdoor use were required to be registered to limit the number of access points, etc.), allowing for trial use of the 5.2-GHz band outdoors. NTT Broadband Platform and others are using the 5.2-GHz band outdoors in addition to the 5.6-GHz band.

At WRC-19, NTT Access Network Service Systems Laboratories took the lead, calling for the outdoor use of 5.2-GHz band wireless LAN and high transmission power under conditions equal to or higher than those in Japan. They succeeded in revising the RR by holding discussions until the last day of the conference with the countries using this band for satellite telecommunications. As a result, wireless LAN will continue to be available outdoors in the 5.2-GHz band under certain conditions, in addition to the 5.6-GHz band in Japan. Details of this matter will be published in the June 2020 issue of this journal.

1.2 Additional allocation to mobile telecommunications

In Japan, the 3.7-, 4.5-, and 28-GHz bands have already been allocated to mobile telecommunication operators as fifth-generation mobile communication system (5G) frequencies in April 2019, and 5G is being introduced in other countries as well. From this background, agenda item 1.13 included studies of

Table 1. Agenda items of WRC-19.

No.	Agenda item
1.1	Allocation of the frequency band 50–54 MHz to the amateur service in Region 1
1.2	Establishment of in-band power limits for earth stations operating in mobile-satellite service, meteorological-satellite service, and Earth exploration-satellite service in the frequency bands 401–403 MHz and 399.9–400.05 MHz
1.3	Consideration of possible upgrading of the secondary allocation to the meteorological-satellite service (space-to-Earth) to primary status and a primary allocation to the Earth exploration-satellite service (space-to-Earth) in the frequency band 460–470 MHz
1.4	Consideration of possible revision of Annex 7 to Appendix 30 of the RR
1.5	Use of the frequency bands 17.7–19.7 GHz (space-to-Earth) and 27.5–29.5 GHz (Earth-to-space) by earth stations in motion communicating with geostationary space stations in the fixed-satellite service
1.6	Studies of technical, operational issues, and regulatory provisions for non-geostationary fixed-satellite services satellite systems in the frequency bands 37.5–39.5 GHz (space-to-Earth), 39.5–42.5 GHz (space-to-Earth), 47.2–50.2 GHz (Earth-to-space) and 50.4–51.4 GHz (Earth-to-space)
1.7	Studies to accommodate spectrum requirements in the space operation service for non-geostationary satellites with short duration missions
1.8	Consideration of regulatory provisions for updating and modernization of the Global Maritime Distress and Safety System
1.9	1. Autonomous maritime radio devices operating in the frequency band 156–162.05 MHz
	2. Consideration of regulatory provisions and spectrum allocations to the maritime mobile-satellite service to enable the satellite component of the VHF Data Exchange System and enhanced maritime radiocommunication
1.10	Studies on spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System
1.11	Railway radiocommunication systems between train and trackside
1.12	Intelligent Transport Systems applications
1.13	Studies on frequency-related matters for International Mobile Telecommunications identification including possible additional allocations to the mobile services on a primary basis in portion(s) of the frequency range between 24.25 and 86 GHz for the future development of International Mobile Telecommunications for 2020 and beyond
1.14	Facilitating access to broadband applications delivered by high-altitude platform stations
1.15	Studies towards an identification for use by administrations for land-mobile and fixed services applications operating in the frequency range 275–450 GHz
1.16	Studies concerning Wireless Access Systems including radio local area networks in the frequency bands between 5150 MHz and 5925 MHz
2	Revision of references to the text of ITU-R Recommendations incorporated by reference in the Radio Regulations/Use of incorporation by reference in the RR
4	General review of the Resolutions and Recommendations of world administrative radio conferences and world radiocommunication conferences
7	Implementation of Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference
8	Footnotes to the Table of Frequency Allocations in Article 5 of the RR
9.1	1. Implementation of International Mobile Telecommunications in the frequency bands 1885–2025 MHz and 2110–2200 MHz (Issue 9.1.1)
	2. Compatibility of International Mobile Telecommunications and broadcasting-satellite service (sound) in the frequency band 1452–1492 MHz in Regions 1 and 3 (Issue 9.1.2)
	3. Study of technical and operational issues and regulatory provisions for new non-geostationary-satellite orbit systems in the 3700–4200 MHz, 4500–4800 MHz, 5925–6425 MHz and 6725–7025 MHz frequency bands allocated to the fixed-satellite service (Issue 9.1.3)
	4. Stations on board sub-orbital vehicles (Issue 9.1.4)
	5. Consideration of the technical and regulatory impact of referencing Recommendations ITU-R M.1638-1 and ITU-R M.1849-1 in Nos. 5.447F and 5.450A of the RR (Issue 9.1.5)
	6. Studies concerning Wireless Power Transmission (WPT) for electric vehicles (Issue 9.1.6)
	7. Studies to examine: whether there is a need for possible additional measures to limit uplink transmissions of terminals to those authorized terminals, etc. (Issue 9.1.7)
	8. Studies on the technical and operational aspects of radio networks and systems for machine-type communication infrastructures (Issue 9.1.8)
	9. Studies relating to spectrum needs and possible allocation of the frequency band 51.4–52.4 GHz to the fixed-satellite service (Earth-to-space) (Issue 9.1.9)
9.2	Report of the Director on any difficulties or inconsistencies encountered in the application of the RR and comments from administrations
9.3	Action in response to Resolution 80 (Rev.WRC-07)
10	Preliminary agenda for the 2023 World Radiocommunication Conference

ITU-R: ITU Radiocommunication Sector
VHF: very high frequency

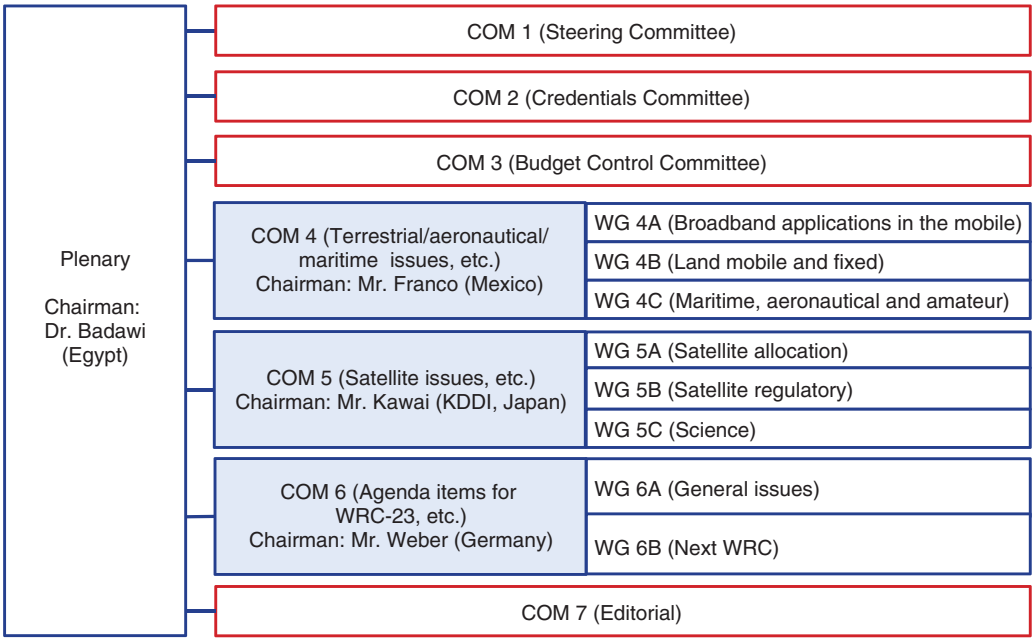


Fig. 2. Structure of WRC-19.

frequencies in the submillimeter and millimeter wave bands for the future development of International Mobile Telecommunications (IMT), which is to say studies of the revisions to the RR to add frequencies for mobile telecommunications such as 5G. At WRC-19, NTT DOCOMO and other mobile telecommunication operators and parties who are involved in existing wireless systems in Japan, such as earth exploration satellites, participated in discussions of these systems, which lasted from early morning to late at night for several days. Almost exactly as requested by Japan, the RR were successfully revised to add a 15.75-GHz bandwidth of new frequencies for IMT: 24.25–27.5, 37–43.5, 45.5–47, 47.2–48.2, and 66–71 GHz (45.5–47 GHz is not applicable to Japan). Of these bands, 26.6–27 and 39.5–43.5 GHz are undergoing technical studies by the Information and Communications Council in preparation for the next allocation of frequencies for 5G in Japan. The details of this topic will be published in the July 2020 issue of NTT DOCOMO Technical Journal.

1.3 Other agenda items

With regard to other agenda items, we focused on those that were mainly related to the NTT Group and acted to avoid the harmful effects on existing NTT Group wireless systems. No amendments to the RR agreed upon at WRC-19 have any harmful effects on wireless systems for the NTT Group.

1.4 Agenda items of ITU World Radiocommunication Conference 2023 (WRC-23)

At WRC-19, the agenda items for the WRC-23 were discussed and decided upon, as shown in **Table 2**. There is no agenda item concerning wireless LAN. With regard to mobile telecommunications, agenda item 1.2 is to consider IMT identification in multiple candidate frequency bands. Among the candidate frequency bands, the 7.025–7.125-GHz band is considered for IMT identification worldwide, which concerns Japan. Other candidate frequency bands are considered for IMT identification for the regions other than Asia-Pacific, and Japan is not involved. Agenda item 1.4 is to consider High Altitude Platform Station (HAPS) as IMT Base Stations (HIBS) in the frequency bands specified for IMT in the 2.7-GHz band or lower. It is aimed at mounting IMT base stations on high-altitude flying vehicles in the stratosphere to provide services of IMT to ground areas.

Table 2. Agenda items of WRC-23.

No.	Agenda item
1.1	to consider, based on the results of the ITU-R studies, possible measures to address, in the frequency band 4800–4990 MHz, protection of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories and to review the pfd criteria in No. 5.441B in accordance with Resolution 223 (Rev.WRC-19)
1.2	to consider identification of the frequency bands 3300–3400 MHz, 3600–3800 MHz, 6425–7025 MHz, 7025–7125 MHz, and 10.0–10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 245 (WRC-19)
1.3	to consider primary allocation of the band 3 600–3800 MHz to mobile service within Region 1 and take appropriate regulatory actions, in accordance with Resolution 246 (WRC-19)
1.4	to consider, in accordance with Resolution 247 (WRC-19), the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT on a global or regional level
1.5	to review the spectrum use and spectrum needs of existing services in the frequency band 470–960 MHz in Region 1 and consider possible regulatory actions in the frequency band 470–694 MHz in Region 1 on the basis of the review in accordance with Resolution 235 (WRC-15)
1.6	to consider, in accordance with Resolution 772 (WRC-19), regulatory provisions to facilitate radiocommunications for sub-orbital vehicles;
1.7	to consider a new aeronautical mobile-satellite (R) service (AMS(R)S) allocation in accordance with Resolution 428 (WRC-19) for both the Earth-to-space and space-to-Earth directions of aeronautical VHF communications in all or parts of the frequency band 117.975–137 MHz, while preventing any undue constraints on existing VHF systems operating in the AM(R)S, the ARNS, and in adjacent frequency bands
1.8	to consider, on the basis of ITU-R studies in accordance with Resolution 171 (WRC-19), appropriate regulatory actions, with a view to reviewing and, if necessary, revising Resolution 155 (Rev.WRC-19) and No. 5.484B to accommodate the use of fixed-satellite service (FSS) networks by control and non-payload communications of unmanned aircraft systems
1.9	to review Appendix 27 of the RR and consider appropriate regulatory actions and updates based on ITU-R studies to accommodate digital technologies for commercial aviation safety-of-life applications in existing HF bands allocated to the aeronautical mobile (route) service and ensure coexistence of current HF systems alongside modernized HF systems, in accordance with Resolution 429 (WRC-19)
1.10	to conduct studies on spectrum needs, coexistence with radiocommunication services and regulatory measures for possible new allocations for the aeronautical mobile service for the use of non-safety aeronautical mobile applications, in accordance with Resolution 430 (WRC-19)
1.11	to consider possible regulatory actions to support the modernization of the Global Maritime Distress and Safety System and the implementation of e navigation, in accordance with Resolution 361 (Rev.WRC-19)
1.12	to conduct, and complete in time for WRC-23, studies for a possible new secondary allocation to the Earth exploration-satellite (active) service for spaceborne radar sounders within the range of frequencies around 45 MHz, taking into account the protection of incumbent services, including in adjacent bands, in accordance with Resolution 656 (Rev.WRC-19)
1.13	to consider a possible upgrade of the allocation of the frequency band 14.8–15.35 GHz to the space research service, in accordance with Resolution 661 (WRC-19)
1.14	to review and consider possible adjustments of the existing or possible new primary frequency allocations to EESS (passive) in the frequency range 231.5–252 GHz, to ensure alignment with more up-to-date remote-sensing observation requirements, in accordance with Resolution 662 (WRC-19)
1.15	to harmonize the use of the frequency band 12.75–13.25 GHz (Earth-to-space) by earth stations on aircraft and vessels communicating with geostationary space stations in the fixed-satellite service globally, in accordance with Resolution 172 (WRC-19)
1.16	to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 17.7–18.6 GHz, 18.8–19.3 GHz, 19.7–20.2 GHz (space-to-Earth), 27.5–29.1 GHz, and 29.5–30 GHz (Earth-to-space) by non-GSO FSS earth stations in motion while ensuring due protection of existing services in those frequency bands, in accordance with Resolution 173 (WRC-19)
1.17	to determine and carry out, on the basis of the ITU-R studies in accordance with Resolution 773 (WRC-19), the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, by adding an inter-satellite service allocation where appropriate
1.18	to consider studies relating to spectrum needs and potential new allocations to the mobile-satellite service for future development of narrowband mobile-satellite systems, in accordance with Resolution 248 (WRC-19)
1.19	to consider a new primary allocation to the fixed-satellite service in the space-to-Earth direction in the frequency band 17.3–17.7 GHz in Region 2, while protecting existing primary services in the band, in accordance with Resolution 174 (WRC-19)
2	to examine the revised ITU-R Recommendations incorporated by reference in the RR communicated by the Radiocommunication Assembly, in accordance with further resolves of Resolution 27 (Rev.WRC-19), and to decide whether to update the corresponding references in the RR, in accordance with the principles contained in resolves of that Resolution
4	in accordance with Resolution 95 (Rev.WRC-19), to review the Resolutions and Recommendations of previous conferences with a view to their possible revision, replacement, or abrogation
7	to consider possible changes, in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference, on advance publication, coordination, notification, and recording procedures for frequency assignments pertaining to satellite networks, in accordance with Resolution 86 (Rev.WRC 07), to facilitate the rational, efficient, and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit
8	to consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution 26 (Rev.WRC-19);
9.1	a) In accordance with Resolution 657 (Rev.WRC-19), review the results of studies relating to the technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors with a view to describing appropriate recognition and protection in the Radio Regulations without placing additional constraints on incumbent services
	b) Review of the amateur service and the amateur-satellite service allocations in the frequency band 1240–1300 MHz to determine if additional measures are required to ensure protection of the radionavigation-satellite (space-to-Earth) service operating in the same band in accordance with Resolution 774 (WRC-19)
	c) Study the use of International Mobile Telecommunications system for fixed wireless broadband in the frequency bands allocated to the fixed services on primary basis, in accordance with Resolution 175 (WRC-19)
	d) Protection of EESS (passive) in the frequency band 36–37 GHz from non-GSO FSS space stations
9.2	on any difficulties or inconsistencies encountered in the application of the RR
9.3	on action in response to Resolution 80 (Rev.WRC-07)
10	to recommend to the Council items for inclusion in the agenda for the next WRC, and items for the preliminary agenda of future conferences, in accordance with Article 7 of the Convention and Resolution 804 (Rev.WRC-19)

EESS: Earth exploration-satellite service
Non-GSO: non-geostationary satellite orbits

SG 1 (Spectrum management)
Chairman: Mr. Sayed (Egypt)
Vice-chairmen: 17 persons

SG 3 (Radiowave propagation)
Chairman: Ms. Wilson (Australia)
Vice-chairmen: 10 persons

SG 4 (Satellite services)
Chairman: Mr. Strelets (Russian Federation)
Vice-chairmen: Mr. Kono (SKY Perfect JSAT, Japan); 18 other persons

SG 5 (Terrestrial services)
Chairman: Mr. Fenton (UK)
Vice-chairmen: Dr. Atarashi (NTT DOCOMO, Japan); 19 other persons

SG 6 (Broadcasting service)
Chairman: Dr Nishida (NHK, Japan)
Vice-chairmen: 12 persons

SG 7 (Science services)
Chairman: Mr. Zuzek (USA)
Vice-chairmen: 12 persons

Fig. 3. Study Group structure and chairmen and vice-chairmen for 2019–2023.

2. ITU Radiocommunication Assembly 2019 (RA-19)

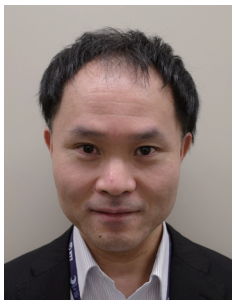
Prior to WRC-19, RA-19 was held in Sharm El Sheikh, Egypt from October 21 to 25, 2019. RA is a general meeting of ITU-Radiocommunication Sector (ITU-R) held about every four years, the same as the WRC. At the RA, the chair and vice-chair of the Study Groups (SGs) of ITU-R are appointed, and study items are approved. About 511 people from 88 countries participated in RA-19, including 36 people from Japan, with representatives from the Ministry of Internal Affairs and Communications. As shown in **Fig. 3**, the chair and vice-chair of various SGs were appointed, and from NTT Group, Dr. Hiroyuki Atarashi of NTT DOCOMO was appointed as one of the SG 5 vice-chairs responsible for study on terrestrial services including fixed, mobile, and radiodetermination systems. The study results from each SG will be published as recommendations or reports from ITU-R and will be referred to during the WRC discussions.

3. Future activities

In preparation for WRC-23, NTT aims to add more frequencies for wireless systems for the NTT Group and protect existing NTT Group wireless systems from harmful radio interference. To that end, we will continue our work at ITU-R, WRC preparatory meetings in the Asia-Pacific region, and related meetings in Japan.

Takeo Ichikawa
Senior Manager, Radio Division, NTT Technology Planning Department.
He received an M.E. from Waseda University, Tokyo, in 1993 and joined NTT the same year. He participated in the research and development of personal handy-phone system (PHS)-based packet systems and high-speed wireless LAN systems. He received the Young Researcher's Award from the Institute of Electronics, Information and Communication Engineers (IEICE) in 1999. He is a member of the Institute of Electrical and Electronics Engineers (IEEE) and IEICE.

Kazuyoshi Saito
Senior Manager, Radio Division, NTT Technology Planning Department.
He received a B.E. and M.E. in electronics engineering from Tohoku University, Miyagi, in 1996 and 1998 and joined NTT in 1998. From 1998 to 2004, he studied wireless LAN systems. In 2004, he joined NTT EAST, where he was involved in developing "Hotpot" services. Since 2018, he has been with Radio Division, Technology Planning Department, NTT.



Junichi Iwatani
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He received a B.E. and M.E. in electronics engineering from the University of Tokyo in 1994 and 1996. Since joining NTT Wireless Systems Laboratories in 1996, he has been engaged in research and development of wireless access systems. From 2006 to 2008, he researched next-generation networks in NTT Service Integration Laboratories. In 2010, he joined NTT Communications, where he was involved in developing global network services. Since 2013, he has been with NTT Access Network Service Systems Laboratories, where he has been engaged in research and standardization of wireless LAN systems. Since 2017, he has been involved in activities to revise the Radio Regulations of 5-GHz-band wireless LAN for WRC-19 at ITU-R meetings. He received the ITU-AJ Encouragement Award in 2018. He is a member of IEICE.

Shinya Otsuki
Senior Research Engineer, Wireless Access System Project, NTT Access Network Service Systems Laboratories.
He received a B.E., M.E., and Ph.D. in communication engineering from Osaka University in 1993, 1995, and 1997 and joined NTT in 1997. From 1997 to 2008, he studied wireless access systems, wireless LAN systems, and wireless systems for Internet services in trains. From 2008 to 2011, he was involved in international standardization efforts in evolved packet core and services using Internet Protocol multimedia subsystems at NTT Service Integration Laboratories. He has been with NTT Access Network Service Systems Laboratories since 2011. Since 2011, he has been contributing to the activities of the Working Parties 5A and 5C in the SG 5 of ITU-R. He received the ITU-AJ International Activity Encouragement Award in 2014. He is a member of IEEE and IEICE.