# Activities to Revise the Radio Regulations on 5-GHz-band Wireless LANs at WRC-19 and ITU-R

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**Abstract**

The World Radiocommunication Conference 2019 (WRC-19) organized by the International Telecommunication Union (ITU) was held from October 28 to November 22, 2019 in Egypt to discuss the revision of the Radio Regulations (RR). The RR specifies international rules for using radio worldwide. At this conference regarding the agenda item on 5-GHz-band wireless local area networks (LANs), especially for outdoor use and higher transmission power of the 5.2-GHz band (5150–5250 MHz), an agreement was successfully reached to revise the RR with conditions consistent with the national regulations in Japan. NTT had been engaged in activities on technical studies, proposal for the revision of the RR, and building consensus for the revision. NTT has also been responsible for this agenda item at WRC-19, ITU-R (ITU Radiocommunication Sector) and the related meetings as delegation members of Japan for three years. This article describes the process and results of the activities to revise the RR on 5-GHz-band wireless LANs and the revised RR.

*Keywords: wireless LAN (WLAN), Radio Regulations (RR), WRC*

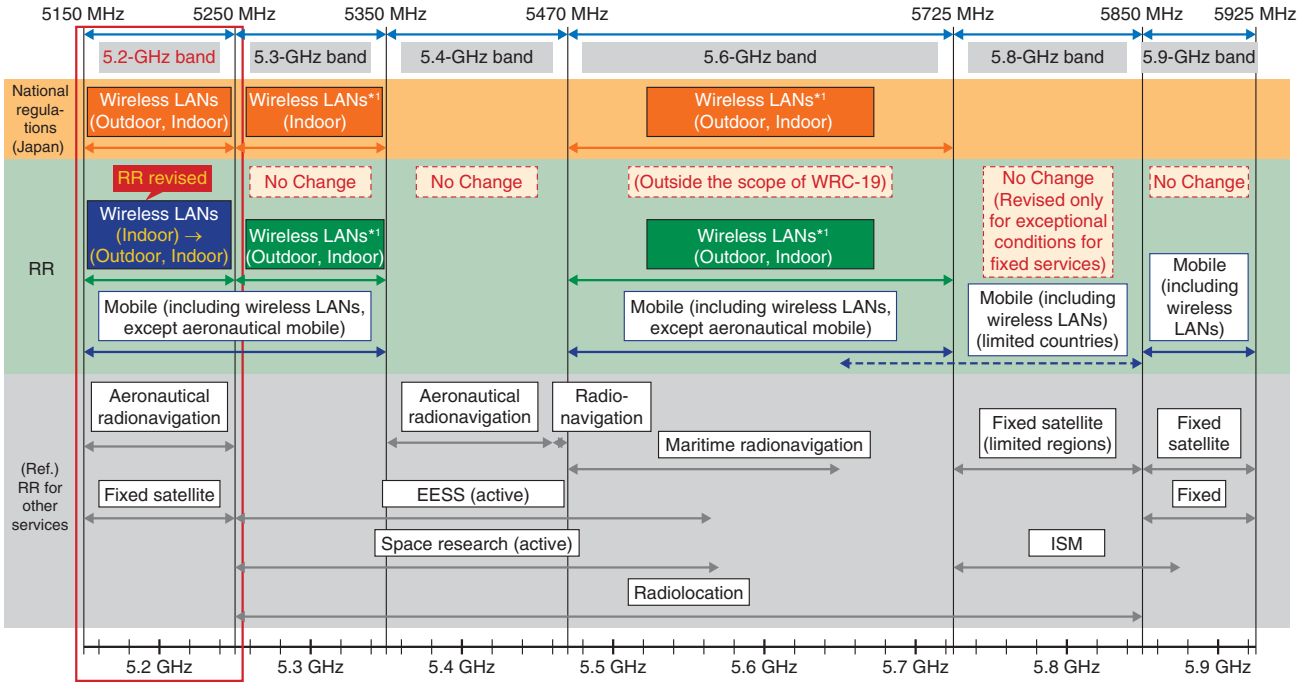
## 1. Modification of the Radio Regulations (RR) on 5-GHz-band wireless local area networks (LANs)

### 1.1 Regulations on 5-GHz-band wireless LANs

There had been concerns about the lack of frequency resources for wireless LANs due to the rapid increase in demand for them as a result of the widespread use of smartphones and tablet terminals. The results of studies in the International Telecommunication Union - Radiocommunication Sector (ITU-R) towards the World Radiocommunication Conference 2015 (WRC-15) showed that an additional 300–425 MHz frequency bandwidth was needed for 5-GHz-band wireless LANs. **Figure 1** shows the available frequency bands for 5-GHz-band wireless LANs.

Under the previous RR, for the 5.3-GHz band (5250–5350 MHz) and 5.6-GHz band (5470–5725 MHz), outdoor use is allowed with higher transmission power with the maximum equivalent isotropically radiated power (EIRP) of 1 W. However, for these frequency bands, the restriction of dynamic frequency selection (DFS) is required which changes the frequency band of wireless LANs when a radar signal was detected. This causes termination of data transmission when a radar system is used. For the 5.3-GHz band, national governments are required to ensure that predominant use is limited to indoors. For the 5.2-GHz band, while DFS is not applied, only indoor use is allowed with lower transmission power with the maximum EIRP of 200 mW.

With regard to Japan's national regulations, outdoor use is allowed only in the 5.6-GHz band with DFS, and only indoor use is allowed in the 5.3-GHz band with DFS. Outdoor use in the 5.2-GHz band is allowed only provisionally. For these reasons, relaxation of the conditions for 5-GHz-band wireless LANs is required, especially for outdoor use of the




*1 Restrictions of DFS (to detect and avoid radar signals) are applied to 5250–5350 MHz and 5470–5725 MHz. For 5250–5350 MHz, predominant use is limited to indoors.

EESS: earth exploration-satellite service
ISM: industry science and medical

Fig. 1. Frequency bands for 5-GHz-band wireless LANs.

5.2-GHz band since this frequency band is available without the restriction of DFS.

Based on this background, as agenda item 1.16 of WRC-19, revision of the RR was discussed in ITU-R and related meetings from 2016 to 2019 for (1) relaxation of the conditions of the 5.2-GHz and 5.3-GHz bands, and (2) additional frequencies of the 5.4-GHz band (5350–5470 MHz), 5.8-GHz band (5725–5850 MHz), and 5.9-GHz band (5850–5925 MHz) for wireless LANs.

### 1.2 National regulations in Japan and the activities of NTT

This section explains the relationship between the RR and national regulations. Usually, national regulations, such as the Radio Law in each country, are modified based on the revision of the RR. However, with regard to 5.2-GHz-band wireless LANs in Japan, the national regulations were provisionally modified to allow outdoor use with higher transmission power, which was led by NTT in 2018 prior to the revision of the RR. The modified regulations were planned to be reviewed based on the results of WRC-19. Therefore, to ensure that the 5.2-GHz band is available for outdoor use under the modified national regulations, it was necessary to revise the RR to have the conditions be consistent with these national regulations.

One of the NTT Group companies, NTT Broadband Platform, has been deploying wireless LANs to stadiums after the modification of the national regulations in 2018, and it has been imperative that the national regulations be maintained to allow outdoor use in the 5.2-GHz band. For these reasons, NTT has been engaged in WRC-19, ITU-R, and the APG (Asia-Pacific Telecommunity (APT) Conference Preparatory Group for WRC) meetings to revise the RR to maintain consistency with national regulations. These activities are coordinated with the Ministry of Internal Affairs and Communications (MIC) and the Association of Radio Industries and Businesses (ARIB) to collect opinions from the relevant companies in Japan.

## 2. Discussions at ITU-R and APG meetings

### 2.1 Plan for revision of the RR

From 2016 to 2019, the authors on behalf of Japan

Table 1. Options for the revision of the RR in the preparatory document for WRC-19 (February 2019).

| Frequency band | Options | Proposal for the revision of the RR | Remarks |
|---|---|---|---|
| 5150–5250 MHz | Method A1 | No Change | |
| | Method A2 | Outdoor use is allowed with the maximum EIRP of 4 W and a relaxed EIRP mask with an antenna elevation angle. Conditions for unwanted emissions are added. | Proposed by the US |
| | Method A3 | Outdoor use is allowed with the same conditions as specified for 5250–5350 MHz (maximum EIRP of 1 W and the same EIRP mask with an antenna elevation angle with a limited number of wireless LAN devices). | Proposed by Japan |
| | Method A4 | In-car use with the maximum EIRP of 40 mW, in-train use with the maximum EIRP of 200 mW, and use within unmanned systems (e.g. drones) with the maximum EIRP of 200 mW are allowed. | Proposed by France |
| | Method A5 | In-car use with the maximum EIRP of 40 mW is allowed if an additional propagation loss of a car hull is at least 15 dB. | Proposed by Russia |
| | Method A6 | More specified conditions on unwanted emissions are added to Method A2. | Proposed by Canada |
| 5250–5350 MHz | Method B | No Change | |
| 5350–5470 MHz | Method C | No Change | |
| 5725–5850 MHz | Method D1 | No Change | |
| | Method D2 | Mobile use (including wireless LANs) is allowed except in North and South America (wireless LAN use is limited to indoor only with DFS). | Proposed by the UK |
| | Method D3 | Countries are added where mobile use (including wireless LANs) is allowed exceptionally. | Proposed by the UK |
| 5850–5925 MHz | Method E | No Change | |

focused on the following three activities, (1) technical studies at ITU-R, (2) making a proposal in the preparatory document for WRC-19, and (3) building consensus at APG meetings.

In Japan's national regulations, in addition to outdoor use and high transmission power (maximum EIRP of 1 W), the conditions of an EIRP mask with an antenna elevation angle (the same conditions specified for 5250–5350 MHz) and the registration procedures for outdoor access points are included to reduce interference to other services [1]. Therefore, Japan focused on building consensus for the revision of the RR with the same or more relaxed conditions compared with the national regulations in Japan.

### 2.2 Technical studies at ITU-R

The discussions at the ITU-R meeting were mainly on whether more relaxed conditions are feasible for the 5.2-GHz band. Since outdoor use or higher transmission power may increase interference to other services, such as satellite feeder links or aeronautical radionavigation services, the discussions focused on the effect of increased interference and how to reduce it. The discussions were based on the results of technical studies for three years from several countries, such as Japan, the United States, China, France, Russia, and Globalstar (a satellite company in the US). However, no consensus was reached on the conclusions of the discussions, and several of these technical studies were included in the technical report. NTT on behalf of Japan presented the results of technical studies that show sharing is feasible under conditions consistent with the national regulations in Japan, which were also included in the technical report. This technical report was not finalized as an ITU-R Report for publication as initially planned, and it was to be referred to as a temporary version at WRC-19.

### 2.3 Making a proposal in the preparatory document for WRC-19

The preparatory document for WRC-19 (CPM Report: Conference Preparatory Meeting Report) was created at ITU-R in 2019 and was intended to be referred to at WRC-19, in which several options for the revision of the RR are included. The authors on behalf of Japan successfully added an option that is consistent with the national regulations in Japan. This document contains six options for the revision of the RR for the 5.2-GHz band (5150–5250 MHz) including Method A3 from Japan, as shown in **Table 1**.

### 2.4 Building consensus at APG meetings

The purpose of APG is to discuss the common proposals and views of APT for WRC, and five APG meetings were held towards WRC-19. The goal for Japan at the APG meetings was to complete an APT

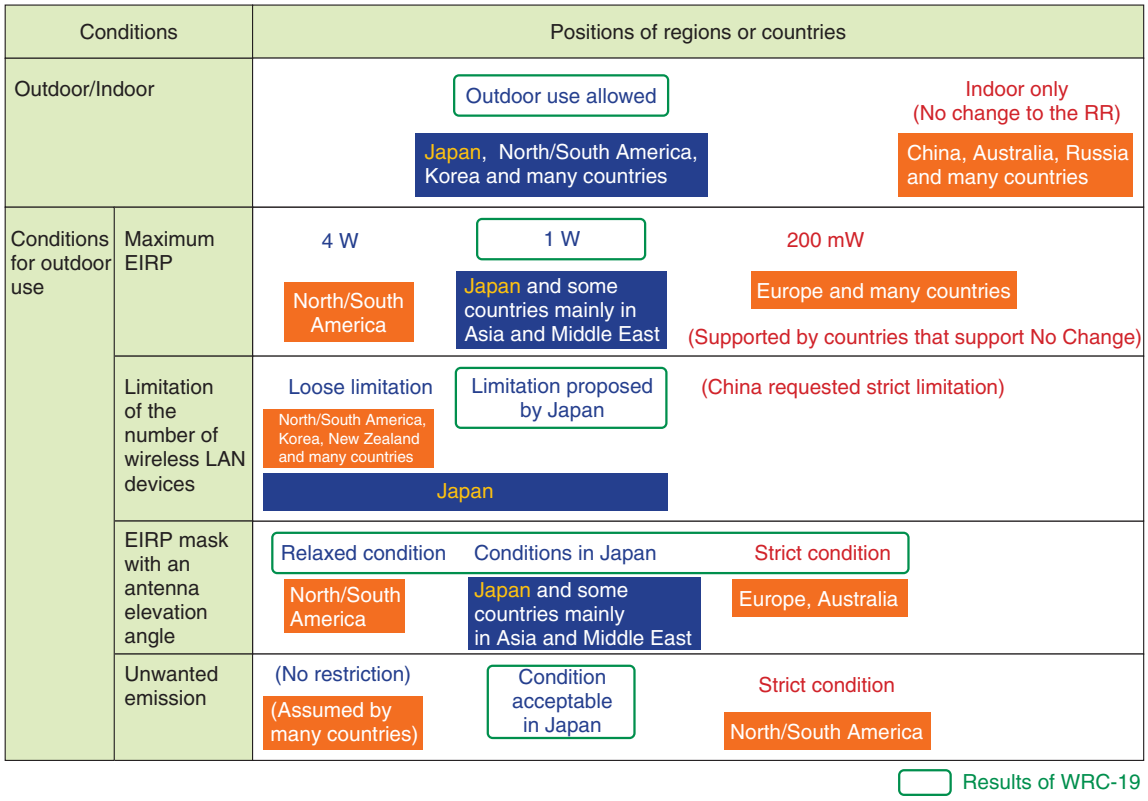



Fig. 2. Positions of regions or major countries for 5.2-GHz-band wireless LANs before WRC-19.

Common Proposal based on Method A3 it proposed. However, China and Australia supported No Change to the RR and strongly opposed the proposal due to concerns about interference to satellite services. Finally, neither any revision of the RR nor No Change was agreed as an APT Common Proposal. However, among the five options for the revision of the RR for the 5.2-GHz band, except No Change, the APT members agreed that the possible option should be limited to Method A3 proposed by Japan, and this agreement was included in the output document of the last APG meeting as an APT Common View. After the APG meetings, Japan took the lead to draft a multi-country proposal by nine APT countries for WRC-19 based on Method A3 and submitted a contribution to WRC-19.

## 3. Discussions at WRC-19

### 3.1 Situations before WRC-19

WRC-19 was held from October 28 to November 22, 2019 at Sharm el-Sheikh in Egypt to discuss the revision of the RR [2]. Thirty-one contributions were submitted regarding 5-GHz-band wireless LANs. **Figure 2** shows region or major country positions on the 5.2-GHz band based on the contributions. Many countries, such as China, Australia, and Russia, opposed to allow outdoor use, and the acceptable conditions among countries that support outdoor use, such as Japan, North and South America, Europe, and the Republic of Korea, significantly differed. As mentioned above, the ITU-R technical report was not finalized, and the common proposal was not agreed in several regions including APT. Accordingly, it was quite difficult to reach a unanimous agreement with regard to the revisions of the RR based on any proposal from Japan or other countries including the proposal for No Change.

The authors have coordinated with the MIC on the plan for the discussions on the 5.2-GHz band and set the primary goal of revising the RR for all regions under the conditions that cover Method A3 proposed by Japan or the conditions that are equivalent to Method A3 without any concern on implementation. However, the authors and the MIC realized that this primary goal was extremely difficult to achieve after

analyzing the contributions from other countries or regions. The authors also coordinated with the MIC and prepared several plans on compromise before and during the conference.

### 3.2 Discussions at WRC-19

The discussions on 5.2-GHz-band wireless LANs, which started at the beginning of the conference, had been complicated and continued until the last day of the conference including weekends and late evenings.

During the first and second weeks, the countries or regions repeatedly argued their proposals, and there was no progress in the discussions with no prospect for consensus. The authors considered a compromise solution that allows outdoor use with the maximum EIRP of 1 W only for APT regions and had discussions with China and Australia as APT members since they opposed the revision of the RR. However, their position did not accept the maximum EIRP over 200 mW; thus, no consensus was reached during these discussions.

In the third week, as a result of tough negotiations, Japan and China reached a consensus to allow outdoor use with the maximum EIRP of 1 W under the condition that limits the number of wireless LAN devices with a certain outdoor use ratio. However, the Republic of Korea and New Zealand, who supported Method A3 proposed by Japan, were concerned about the limitation of the number of wireless LAN devices since it was difficult for them to implement such a limitation in their countries. This means that it was difficult to include the compromise solution between Japan and China in the revised RR even as an exceptional condition applied only in the APT region.

In the last week, a compromise proposal to allow outdoor use with the maximum EIRP of 200 mW was presented by the countries that supported No Change to the RR, and many countries supported this proposal. However, Japan did not agree to it since the condition was not consistent with the national regulations in Japan. The authors explained that outdoor use with the maximum EIRP of 1 W was already implemented for operation in several countries including Japan and that the interference to satellite services is less compared with the case of 200 mW if an EIRP mask with an antenna elevation angle is used. The authors continued to persuade the countries that did not accept the maximum EIRP of 1 W to accept the proposals from Japan.

On the second-to-last day of the conference, the chair of this agenda item determined that there was no prospect for consensus at the official sessions, and an unofficial meeting was held among the delegates from the regions and major countries including Japan to discuss and finalize the draft of the revised RR. At this unofficial meeting, no consensus was reached with regard to more relaxed conditions, such as Method A2 proposed by the US, due to concerns about increased interference to other services. With regard to Method A3 proposed by Japan, however, there was a discussion that interference would be less than that of Method A2 and the results of technical studies for the proposal, which were continuously discussed in ITU-R meetings, would be reliable. Accordingly, a consensus was successfully reached on the final draft of the revision of the RR, which was slightly modified from Method A3 proposed by Japan.

On the last day of the conference, at the plenary session of WRC-19, this agenda item was discussed as the last agenda item, and the revision of the RR was approved without any explicit objection. While several countries, such as the US and the Republic of Korea, made reservations since they may use more relaxed conditions than the revised RR, this does not affect the revision of the RR or the national regulations in Japan.

### 3.3 Results of WRC-19

The results of the revision of the RR for 5-GHz-band wireless LANs are as follows [3]:

- 5.2-GHz band: The revision of the RR was approved with the conditions consistent with the national regulations in Japan, as shown in **Table 2.**
- 5.8-GHz band: No change to the RR with regard to wireless LANs (The current RR allows the use of mobile services—including wireless LANs—in limited countries, and there were proposals to add several countries to the list of the limited countries. However, they were added only for fixed services under the revised RR.).
- 5.3-GHz, 5.4-GHz, and 5.9-GHz bands: No change to the RR (There was no proposal to revise the RR for these frequency bands).
- 5.6-GHz band: No change to the RR (This frequency band was outside the scope of the agenda item of WRC-19).

## 4. Future plans

The revision of the RR at WRC-19 expands the frequency band for outdoor use of wireless LANs globally not only for Japan, and this enables deployment

Table 2. The revised RR for 5.2-GHz-band wireless LANs.

| Item | Previous RR | Revised RR | (Reference) Current national regulations in Japan |
|---|---|---|---|
| Indoor/Outdoor | Indoor only | Outdoor use is allowed. | Outdoor use is allowed. |
| Maximum EIRP | 200 mW | • 200 mW (Indoor, Outdoor)<br>• 1 W (Indoor, Outdoor) (The conditions below(*1) are applied with EIRP over 200 mW.) | 1 W (Indoor, Outdoor) |
| Limitation of the number of wireless LAN devices | – | (*1) The number of outdoor devices is limited and controlled if EIRP is over 200 mW. The outdoor use ratio is up to 2%. | Registration is required for access points with EIRP over 200 mW. |
| EIRP mask with an antenna elevation angle | – | (*1) One of the following conditions is applied for EIRP over 200 mW:<br>• the same condition as specified for 5250–5350 MHz in the RR<br>• EIRP up to 1 W with 5 degrees or less, and up to 200 mW otherwise<br>• EIRP up to 1 W with 30 degrees or less, and up to 125 mW otherwise | The same condition as specified for 5250–5350 MHz in the RR |
| Unwanted emission | – | (*1) The restrictions in each country for EIRP of 200 mW are applied even if EIRP is over 200 mW. | Restrictions are defined. |
| Others | – | In-train use with EIRP of 200 mW and in-car use with EIRP of 40 mW are allowed. | In-train use is regarded as indoor use with the maximum EIRP of 200 mW. |

of wireless LANs for a large coverage area with higher throughput. The authors expect the use of outdoor wireless LANs to increase with many use cases such as sports stadiums, information or video transmission in outdoor event or concert venues, information sharing for damage or evacuation during a disaster, and cameras for crime-prevention or monitoring with high-quality images. The use cases for broadband transmission of Wi-Fi offload may also be promising to reinforce the 5G (fifth-generation) mobile services and could provide telecommunication carriers worldwide, including NTT Group companies, with more business opportunities.

Moreover, sharing and compatibility among different wireless systems are important not only for 5-GHz-band wireless LANs; therefore, NTT Access Network Service Systems Laboratories will study efficient frequency-sharing mechanisms in the long term and engage in activities to revise national and international regulations.

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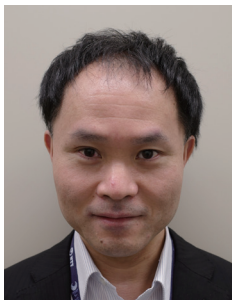

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