RA WRC ITU-R

Standardization

RA-12 and WRC-12 Reports

The RA and WRC of the ITU were held in Geneva, Switzerland from January to February 2012. In these conferences, there were discussions on issues closely related to mobile communications, including the approval of the IMT-Advanced radio interface Recommendation and the establishment of new agenda items for IMT frequency expansion.

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1. Introduction

From January to February 2012, the Radiocommunication Assembly 2012 (RA-12) and World Radiocommunication Conference 2012 (WRC-12) were held.

RA is a high-level meeting of the International Telecommunication Union Radiocommunication Sector (ITU-R)[*1] which is held for the purpose of approving ITU-R Recommendations and Resolutions, approving Questions for the next study period, reviewing the working methods and appointing Chairmen and Vice-Chairmen to Study Groups (SGs). WRC is a conference held with the purpose of revising the Radio Regulations (RR). RR covers a wide range of regulatory areas including allocations of frequency bands, use of satellite orbits, and various technical regulations related to radio station operations and sets down rules for international radiocommunications for the ITU Member States to observe. RA and WRC are normally convened once every three to four years. At the time, however, it had been four and a half years since the last RA and WRC were held in late 2007.

In this article, we report on the main decisions and discussions of RA-12 and WRC-12.

2. RA-12 Report

2.1 Conference Overview

RA-12 was held in Geneva, Switzerland from 16th to 20th January 2012. The meeting was chaired by Mr. Alan Jamieson of New Zealand, and was attended by 526 people from 102 administrations, telecommunication operators and manufacturers. The Japanese delegation of 28 people, including the four authors of this article from NTT DOCOMO also attended, headed by Mr. Kubota, Director-General for Policy Coordination for the Minister's Secretariat, Ministry of Internal Affairs and Communications. Regarding the primary outcomes of RA-12, this article focuses on the issues of SG5, which is responsible for mobile communications.

2.2 Approval of Recommendations

There were a total of five new and revised draft recommendations discussed at the RA-12. Among these, four recommendations submitted by SG5, which deals with the terrestrial services, were approved, and one recommendation submitted from SG7, which deals with the science services, was sent back to SG7 for further con-

*1 **ITU-R**: The radiocommunication sector of the ITU, which is an international organization in the telecommunications field. It conducts technical and operational studies required to revise international regulations for radiocommunications and develop Recommendations. It also conducts practical works on international frequency assignments and registrations.

sideration. An overview of the discussions on the main Recommendations is as follows.

1) Draft New Recommendation on Detailed Specifications of the Terrestrial Radio Interface of IMT-Advanced

Studies on International Mobile Telecommunications-Advanced (IMT-Advanced) were first initiated in 2000 as the successor mobile communication system to IMT-2000. In 2003, Recommendation ITU-R M.1645 was developed to lay down a framework for IMT-Advanced to achieve data rates of 100 Mbps for high-mobility and 1 Gbps for low-mobility as study targets. After that, minimum technical performance requirements were established for IMT-Advanced, and on this basis, the development of radio interfaces for IMT-Advanced was continued. As the candidate interface technologies that met the minimum requirements, the "LTE-Advanced[*2]," technology based on 3GPP specifications, and the "WirelessMAN-Advanced" based on IEEE specifications were proposed, and included in the Recommendation after the evaluation process. The major technical features of these technologies are shown in **Table 1** (see [1] for more details). While ITU-R was developing the IMT-Advanced Recommendation, the mobile market using IMT-2000 and its enhancements grew rapidly. Thus, the new radio interface technologies had long been expected for further market advancement. At this RA-12, the discussions of this Recommendation gained a lot of attention from many concerned countries and industries, as this is the final stage of the long-term IMT-Advanced development. At the meeting Mr. Hashimoto, Chairman of SG5 and one of the authors of this article, presented details of the draft Recommendation, which was approved without any modification. The RA chairman praised the approval of this Recommendation as one of the major achievements of the current ITU-R study cycle, and honored the great efforts made by the relevant participants in reaching a new milestone in the ITU.

2) Draft Revision of the Recommendation to Eliminate the "Leap Second"

Currently, as stipulated in the ITU-R Recommendation, the leap second is inserted into the atomic clock-based Universal Time, Coordinated (UTC) to maintain a difference within ± 0.9 seconds from Universal Time (astronomical time) that results from the rotation of the Earth. However, because there was a concern that technical problems would arise with systems that run according to UTC by inserting the leap second, the draft revision of the Recommendation to eliminate the leap second was submitted, based on the studies done by SG7. Regarding this proposal, many administrations expressed a wide range of opinions such as their agreement or disagreement, or that they required more information to make a decision. At the end of the dis-

Table 1 IMT-Advanced radio interfaces

Name of the Technology	LTE-Advanced	WirelessMAN-Advanced
Basic specifications	3GPP LTE	IEEE WiMAX (IEEE802.16)
Modulation/ access method	Downlink: OFDM Uplink: N-Times DFT-Spread OFDM	Downlink: OFDM Uplink: OFDMA
Principal technologies	· Wide bandwidth (max 100 MHz) · Advanced MIMO technology · Heterogeneous networks · Coordinated Multi-Point transmission/reception · Relay transmission	

DFT: Discrete Fourier Transform
MIMO: Multiple Input Multiple Output
OFDM: Orthogonal Frequency Division Multiplexing
OFDMA: Orthogonal Frequency Division Multiple Access

*2 **LTE-Advanced**: The name for IMT-Advanced in 3GPP. IMT-Advanced is the successor system to IMT-2000, the 3rd-Generation mobile communication system.

cussion, the draft revised Recommendation was sent back to SG7 for further study. In addition, it was proposed that WRC-12 adopt a new WRC-15 agenda item to consider the results of the studies to be conducted by SG7. This new agenda item was approved by WRC-12.

2.3 Approval of ITU-R Resolutions

Six new Resolutions, 26 revised Resolutions and the suppression of one Resolution were approved. The main outcomes of revised Resolutions are as follow.

In Resolution ITU-R 1, working methods were defined for the RA, SGs and Radiocommunication Advisory Group (RAG). The principal revisions made at this Assembly are described below.

- It has been clarified in the Resolution provisions that SGs could conduct studies for "topics" separately from those identified as Questions, and that Recommendations could also be developed under such topics.
- Regarding the recommendation approval process, there exists both a two-stage process for adoption and subsequent approval, and another process where these procedures are performed simultaneously. It was agreed to change the voting period for these procedures from three to two months. Furthermore, a provision was added stipulating that whenever there is an opposition to adoption/approval, the reason for the opposition must be clearly stated.

The following 4 draft revised Resolutions were submitted from SG5, which were all approved.

- Resolution ITU-R 17 (Integration of International Mobile Telecommunications (IMT 2000 and IMT-Advanced) with existing networks)
- Resolution ITU-R 50 (Role of the Radiocommunication Sector in the ongoing development of IMT)
- Resolution ITU-R 56 (Naming for International Mobile Telecommunications)
- Resolution ITU-R 57 (Principles for the process of development of IMT Advanced)

2.4 Approval of Questions

223 Questions for all SGs were approved for the next study period. All SG5 questions were approved including the following three IMT-related questions, which were directly submitted to RA-12.

- Consideration of the needs of developing countries in the development and implementation of IMT
- Further development of the terrestrial component of IMT
- Technical and operational aspects of passive and active base station antennas for IMT systems

2.5 Appointment of Chairmen and Vice-Chairmen to SGs

The SG Chairmen and Vice-Chairmen were appointed for the next study period. From Japan, Mr. Akira Hashimoto (NTT DOCOMO, 2nd term) was appointed as SG5 Chairman, Mr. Nobuyuki Kawai (KDDI, 1st term) was appointed as SG4 (satellite services) Vice-Chairman, Mr. Yukihiro Nishida (NHK, 2nd term) was appointed as SG6 (broadcasting service) Vice-Chairman. The scope of SGs, and their Chairmen and Vice-Chairmen for the next study period are shown in **Table 2**.

3. WRC-12 Report

3.1 Conference Overview

WRC-12 was held in Geneva, Switzerland over a four-week period from January 21st to February 18th, 2012. The conference was chaired by Mr. Tariq Al Awadhi (UAE). WRC-12 was the largest WRC ever, with approximately 3,000 attendees from 170 countries. The Japanese delegation consisted of approximately 70 people, including the four authors of this arti-

Table 2 Scope and Chairmen of the ITU-R SGs

SG#	Scope	Chairman
SG1	Spectrum Management	Mr. S. Y. Psatukh (Russia)
SG3	Radiowave propagation	Mr. B. Arbesser-Rastburg (European Space Agency)
SG4	Satellite Services	Mr. C. Hofer (USA) (Vice-Chairmen: Mr. Nobuyuki Kawai (Japan, KDDI), others)
SG5	Terrestrial Services	Mr. Akira Hashimoto (Japan, NTT DOCOMO)
SG6	Broadcasting Service	Mr. C. Dosch (Germany) (Vice-Chairmen: Mr. Yukihiro Nishida (Japan, NHK), others)
SG7	Science Services	Mr. V. Meens (France)

cle from NTT DOCOMO. The head of the delegation was Mr. Suzuki, Director General of the Radio Department, Ministry of Internal Affairs and Communications.

At WRC, discussions are held on the agenda items established at the previous WRC, taking into account the study results within ITU-R. Following this practice, WRC-12 considered the 30 agenda items established during WRC-07. Previously at WRC-07, the issue of additional IMT spectrum was discussed, however there was no agenda item about IMT frequencies at WRC-12. Nevertheless, with the rapid increase in mobile communication traffic in recent years, there is a global demand to quickly increase IMT frequencies, and as such, one of the biggest issues at this conference was the adoption of a new agenda item to consider the expansion of IMT frequencies at next WRC-15.

Aside from this discussion, there were proposals from African and Arab nations to allocate the 700 MHz frequency band to mobile services and to identify this band for IMT directly at this Conference. Although no agenda item was specifically set for WRC-12 regarding this issue, it was discussed in an exceptional case at the insistence of African and Arab nations. In the following sections, we report on the main discussions held at WRC-12 focusing on the above two issues.

3.2 Agenda Item on Additional IMT Spectrum

The discussion on the next WRC agenda item (WRC-15 Agenda Item 1.1) was held under WRC-12 Agenda Item 8.2. There were proposals from all of the regional groups regarding the establishment of a new agenda item for the next WRC to discuss IMT spectrum expansion. Consensus was reached to adopt the agenda item itself at the early stage of the discussion. However, each country had different views on the scope of the agenda item, the target frequency bands and the responsible group for the preparatory studies. Thus, there were heated discussions about these issues.

1) Scope of the Agenda Item

About the targeted systems for additional frequency bands to be considered in this agenda item, to ensure the expansion of IMT spectrum, a number of countries including Japan proposed to limit the target system to IMT only. In contrast, to give discussions flexibility, the United States and some other countries proposed to include other systems such as wireless LAN. Therefore, according to them, the targeted systems should be "mobile broadband" systems. After a long debate, the wording of the agenda item and related resolutions were coordinated, and in the end, it was finally agreed that the scope of the agenda item should include other systems such as wireless LAN and not be limited to IMT. However, a common recognition that IMT should be the main focus of this agenda item was affirmed.

2) Targeted Frequency Bands

Regarding the frequency bands to

be considered, Iran expressed its opinion that these should be clarified at the stage of setting the agenda item, however, no region or country included specific target frequency bands in their proposals. Therefore, WRC-12 did not specify the range of target frequency bands, and left the issue for discussion at WRC-15. Furthermore, countries that place particular importance on fixed-satellite services such as Thailand, Indonesia and Vietnam insisted that 3.4 to 4.2 GHz band used for those services should be excluded from the scope of this agenda item, as the band was subject to heated debates on IMT identification at the previous WRC-07. Regarding this point, following the basic principle not to repeat the same discussion as WRC-07, it was agreed that if new factors such as technical advancements emerge, this band can also be subject to discussion under WRC Agenda Item 1.1.

3) Responsible Groups

Responsible groups within the ITU-R SGs need to be assigned to carry out preparatory studies for each WRC agenda item. Responsible groups are decided by the Conference Preparatory Meeting (CPM)[*3] held right after the WRC. However, there were related discussions during WRC-12 about the new IMT agenda items based on proposals from the United States.

Many frequency bands below around 6 GHz under discussion are already in use by a wide range of services. Therefore, to expand the IMT frequency bands, it is presumed that these bands will be shared with other existing services. For this reason, assignment of a responsible group to conduct "sharing studies" was important. The side aiming for broad IMT frequency expansion was in favor of the group mandated with IMT (i.e. Working Party 5D (WP 5D) in SG5) to be the responsible group, however the other side protecting existing services proposed that a new and separate group should be established as the responsible group.

Although it was debated whether the WRC should discuss this issue and how WRC could convey the result to the CPM, no agreement was made, deferring the decision on this issue to the CPM.

At the first session of the CPM (CPM 15-1) held directly after WRC-12, considering the importance of new Agenda Items 1.1 and 1.2 (mentioned later), it was decided to establish a joint task group, JTG 4-5-6-7 as the responsible group for these agenda items, to enable efficient discussions among experts across the fields of terrestrial, satellite, broadcasting and science services.

As a result of the above discussions, it was formally decided to consider additional IMT spectrum at WRC-15, which was certainly one of the biggest achievements of WRC-12. Therefore, IMT spectrum issues will be studied in the relevant groups in ITU-R from now on. For reference, **Figure 1** shows the current status of frequency bands identified for IMT in the latest RR.

3.3 Agenda Item on 700 MHz Band Allocation to the Mobile Service and Identification of IMT in Region 1

WRC-12 Agenda Item 1.17 was to conduct the sharing studies between IMT and other services in the 790 to 862 MHz band. In relation to this agenda item, African and Arab countries proposed to expand the allocation of mobile services below 790 MHz and to identify this expanded band for IMT in Region 1[*4]. Because this proposal contained the frequency bands different to those handled by Agenda Item 1.17, Russia and European countries opposed this proposal, but due to the insistence of African and Arab countries, an ad-hoc group[*5] was established to discuss the issue separately from Agenda Item 1.17.

In the ad-hoc meeting, the argu-

*3 **CPM**: The Conference Preparatory Meeting. A meeting to develop a report for consideration by the WRC, which summarizes ITU-R SG study results and other WRC-related discussions.

*4 **Region 1**: European, African, Arab countries and Russia.

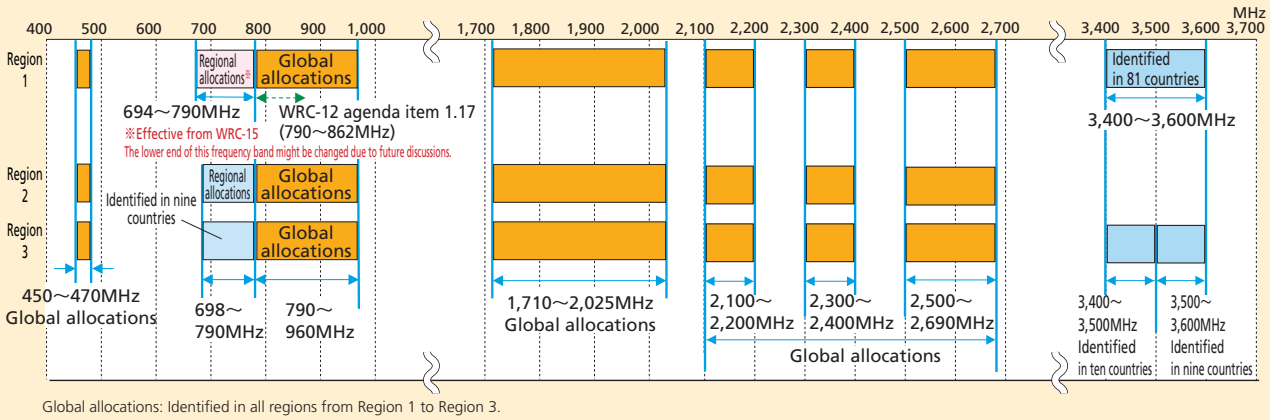

Figure 1 Frequency bands currently identified for IMT in the RR

ments between Russia and the European countries on one side and the African and Arab countries on the other continued, and no conclusion was reached. Further informal discussions were held afterwards among the countries concerned, and in the end, primary allocation[*6] was given to mobile services in the 694 to 790 MHz band in Region 1 with identification for IMT. The lower end of the frequency band will be reconsidered at WRC-15. This new allocation and IMT identification will become effective from WRC-15. The agenda item was therefore established to conduct studies such as frequency sharing with other services and the spectrum requirements of this band (WRC-15 Agenda Item 1.2). This decision was exceptional in that new spectrum was allocated and identified for a specific application at the WRC without any agenda item having been set.

In addition to Region 2[*7] and Region 3[*8], now that the 700 MHz band has also been allocated for mobile service in Region 1 and identified for IMT it has become a global IMT band. (For Region 3, it has been identified in nine countries.) Although WRC-15 Agenda Item 1.2 has direct relevance to Region 1, Japan should also pay close attention to this agenda item since the 700 MHz band has been newly assigned to mobile operators for IMT use in Japan.

3.4 Other Agenda Items

1) Sharing Study between the Mobile and Other Services in the 790-862 MHz Band in Regions 1 and 3 (WRC-12 Agenda Item 1.17)

This agenda item was set in light of the fact that when the 790-862 MHz band was allocated to mobile services (and identified for IMT) in Region 1 at WRC-07, sharing studies with existing broadcasting services and aeronautical radionavigation services became necessary. This agenda item was intended to protect existing services from new mobile services (i.e. actually IMT) in Region 1. However, since this agenda item included the involvement of Region 3 countries bordering Region 1 countries, many Region 3 countries including Japan which have been using this band for mobile services since long before WRC-07 have consistently opposed the potential imposition of new restrictions on mobile services due to this agenda item.

*5 **Ad-hoc group**: An interim group that is formed to solve a specific issue by coordinating different opinions.
*6 **Primary allocation**: Allocation of frequencies to a primary service in the Radio Regulations. Services to which frequencies are allocated are classified as primary or secondary services. Primary services are services that can be protected from harmful interference from other primary services or secondary services. Conversely, secondary services cannot cause harmful interference to the operation of primary services, nor claim protection from primary service interference.
*7 **Region 2**: North and South American Continents
*8 **Region 3**: Oceania and Asian countries east of and including Iran.

In this agenda item, the adoption of a new WRC Recommendation about the use of this frequency band in Regions 1 and 3 was discussed. This Recommendation was not adopted because it included the regulatory aspect for protection of other services from mobile services, so Region 3 countries were strongly opposed to it. Furthermore, the revision of Resolution 749 (WRC-07), specifying the use of the 790-862 MHz band by mobile services and other services was also discussed. Since this revised Resolution requires further sharing studies to protect existing services in this frequency band in Regions 1 and 3, many Region 3 countries proposed to limit the application of this Resolution to only Region 1 and Iran. This proposal was accepted.

Thus, additional mobile service restrictions will not be imposed on Region 3 countries including Japan.

2) Considerations on Regulatory Items for Implementation of Software Defined Radio (SDR)[*9] and Cognitive Radio Systems (CRS)[*10] (WRC-12 Agenda Item 1.19).

Taking into account the recent developments in wireless systems using software defined radio and cognitive radio technologies, this agenda item considers necessary regulatory measures and their relevance in accordance with Resolution 956 (WRC-07).

Regarding SDR, it was agreed that SDR was not a service, but a technology commonly applied to many radio services. Therefore a discussion on regulatory measures was not required.

Regarding CRS, a WRC Recommendation was adopted calling for ITU-R studies on CRS taking into account protections of existing passive services etc. Also, in RA-12 mentioned earlier, the ITU-R Resolution calling for the study on CRS was approved. Thus, ITU-R will continue to facilitate studies on CRS.

4. Conclusion

We have reported on the discussions and primary outcomes of RA-12 and WRC-12, held in Geneva, Switzerland, over a period of more than one month.

At RA-12, the ITU-R Recommendations which drew global attention were discussed. These included the approval of the IMT-Advanced Recommendation and reconsideration of the leap-second Recommendation which was then sent back to SG7. Regarding IMT systemsÅCsince all the proposed Resolutions and Questions were approved, studies and development of IMT are set to accelerate even further.

It was also a major achievement for Japan that all the SG Chairman and Vice-Chairman candidates from Japan were elected.

At WRC-12, an agenda item was adopted for the next WRC as Agenda Item 1.1, to consider additional spectrum allocations to mobile services and identification of additional frequency bands for IMT. Regarding this agenda item, JTG 4-5-6-7 was formed as the group responsible for effectively coordinating efforts across the four SGs responsible for terrestrial, satellite, broadcasting and science services to study spectrum requirements, sharing & compatibility between IMT and existing services and so on. Toward the goal of the new allocations to mobile services and identification for IMT at WRC-15, Japan must take proactive steps for international standardization by coordinating with countries around the world.

Reference

[1] T. Nakamura et al.: "Special Articles on LTE-Advanced Technology —Ongoing Evolution of LTE toward IMT-Advanced—" NTT DOCOMO Technical Journal, Vol.12, No.2, pp.4-36, Sep. 2010.

*9 **SDR**: Radio communication technology in which RF operating parameters such as frequency band, modulation type and output power can be set by software.

*10 **CRS**: Radio communications systems that can select optimal radio parameters and radiocommunication methods to suit the radio wave environment.