

Standardization Status of IMT-2000 & Systems beyond: ITU-R WP8F Meetings Report (4th through 7th Meetings)

The WP 8F of ITU-R, responsible for the standardization of IMT-2000 system and Systems beyond IMT-2000 (including the 4th -generation mobile communications system), is currently developing the Preliminary Draft New Recommendation: "Vision framework and overall objectives of the future development of IMT-2000 and of Systems beyond IMT-2000". WP8F has also produced Conference Preparatory Meeting Report texts on Agenda Item 1.22 for WRC-2003 pertaining to the future development of IMT-2000 and Systems beyond IMT-2000. On the other hand, for the existing IMT-2000 system, WP8F has completed and approved Recommendations for global circulation aimed at implementing international roaming on a global basis. It has also approved the revision of Recommendation ITU-R M.1457 "Detailed Specifications on the Radio Interfaces of IMT-2000." This article reports some major outcomes of the recent WP8F activities.

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1. Introduction

The Working Party (WP) 8F of the International Telecommunication Union Radiocommunication sector (ITU-R) is primarily responsible for the standardization of International Mobile Telecommunications-2000 (IMT-2000), which is known as the 3rd-generation (3G) mobile communications system, and Systems beyond IMT-2000. As for IMT-2000, ITU-R has already completed the development of Recommendation ITU-R M.1457 "Detailed Specifications on the Radio Interfaces of IMT-2000," and countries worldwide are currently deploying IMT-2000 systems to commercially launch their services based on the Recommendation. In Japan, NTT DoCoMo commercially launched the world's first IMT-2000 service called FOMA (Freedom Of Mobile multimedia Access) in 2001.

As the next step, WP8F is currently developing the Preliminary Draft New Recommendation (PDNR): "Vision framework and overall objectives of the future develop-

ment of IMT-2000 and of Systems beyond IMT-2000" (Vision PDNR), including the 4th-generation (4G) mobile communications system. In regard to this Recommendation currently being developed, WP8F is studying the positioning of enhanced IMT-2000 systems and Systems beyond IMT-2000, the objectives and requirements of these systems that ought to be developed further in the future, and the timeframe of the implementation of these systems. Intensive discussions are taking place within WP8F with the aim to complete the Recommendation at the Ottawa meeting due to be held in June 2002. Furthermore, WP8F produced and approved the draft text of the Conference Preparatory Meeting (CPM) Report for the World Radiocommunication Conference 2003 (WRC-2003), which is to be convened in Venezuela in 2003. WP8F has primary responsibility for preparing the text of the draft CPM Report on Agenda Item 1.22 (spectrum-related matters on the future development of IMT-2000 and Systems beyond IMT-2000). The draft CPM Report will be

reviewed and may be revised, and then will be approved to be the Final CPM Report at the CPM in November 2002. The Final CPM Report to WRC-2003 will be distributed to administrations worldwide as preliminary reference materials for consideration of each agenda item of WRC-2003. Spectrum requirement consideration at ITU-R for implementing broadband mobile communications will gradually go into full swing as a result.

On the other hand, WP8F is still engaged in studies on the existing IMT-2000 system. One of the basic concepts of IMT-2000 is the implementation of international roaming on a global basis. In order to achieve this, WP8F conducted studies on global circulation, which resulted in the completion and approval of one Recommendation for specifying the requirements for global circulation and two Recommendations for specifying the unwanted spurious emission limit required for global circulation at the Tokyo meeting in October 2001. Based on these Recommendations, it is hoped that in the near future, users will be able to take their mobile phones with them on overseas trips and use them wherever they are in the world without taking any special procedures. Also, WP8F deliberated on how to revise Recommendation ITU-R M.1457 "Detailed Specifications on the Radio Interfaces of IMT-2000" and agreed on the procedures for regularly revising the Recommendation in the future. According to the agreed-upon procedures, Recommendation ITU-R M.1457 was revised and approved to be Rev.2, which reflects new technical specifications that enable high-speed packet transmission from base stations to mobile terminals.

This article reports the key outcomes of the deliberations that took place at the WP8F meetings (4th through 7th meetings) on IMT-2000 and Systems beyond IMT-2000.

2. Meetings Overview

WP8F has held four meetings since the meeting in Geneva in October 2000, which was reported in the previ-

Table 1 WP8F Schedule

| Meeting | Period | Venue |
|-------------|---------------------------------------|--------------------------|
| 1st Meeting | March 7, 2000 – March 10, 2000 | Switzerland (Geneva) |
| 2nd Meeting | August 21, 2000 – August 25, 2000 | USA (San Diego) |
| 3rd Meeting | October 23, 2000 – October 27, 2000 | Switzerland (Geneva) |
| 4th Meeting | February 21, 2001 – February 27, 2001 | Morocco (Rabat) |
| 5th Meeting | June 27, 2001 – July 3, 2001 | Sweden (Stockholm) |
| 6th Meeting | October 10, 2001 – October 16, 2001 | Japan (Tokyo) |
| 7th Meeting | February 27, 2002 – March 5, 2002 | New Zealand (Queenstown) |
| 8th Meeting | May 29, 2002 – June 5, 2002 | Canada (Ottawa) |
| 9th Meeting | September 25, 2002 – October 2, 2002 | Switzerland (Geneva) |

ous edition of the NTT DoCoMo Technical Journal [1].

Table 1 shows the WP8F meeting schedule. Every meeting was attended by more than 200 participants from countries worldwide, reflecting the considerable attention paid by ITU member nations, including administrations and industries, to mobile communications in recent years. From Japan, about 20 people participated in each meeting (of which 4 or 5 participants were from NTT DoCoMo). In each meeting, the number of input documents contributed from participating nations to be deliberated ranged between 82 and 134, and that of the output documents ranged between 44 and 55.

3. WP8F Meetings Deliberations

3.1 The Future Development of IMT-2000 and Systems beyond IMT-2000

(1) Preparation for Vision PDNR

WP8F meetings are involved in the development of the vision framework of the future development of IMT-2000 and Systems beyond IMT-2000. In order to develop such a vision framework, WP8F investigates and studies the market trends in mobile communications, the technology trends, the requirements of future mobile systems and the relationship with other wireless systems, and clarifies new mobile radio systems that should be developed and standardized. In the past, countries had differed greatly in their views on the definition of the future mobile communications systems and the relationship between the systems. The situation changed at the 6th WP8F meeting held in Tokyo, where WP8F members reached a common under-

standing, and at the 7th WP8F meeting convened in Queenstown, where they more or less agreed on the vision of the future development of IMT-2000 and Systems beyond IMT-2000, including target transmission speed, the timeframe of their implementation and other matters in concrete terms. The process is now in the final stages, towards the completion and approval of the Recommendation at the 8th WP8F meeting in Ottawa (June 2002).

The vision framework and objectives of the future development of IMT-2000 and Systems beyond IMT-2000 can be summarized as follows based on the consensus reached hitherto [2].

① Future Development of IMT-2000

The enhanced IMT-2000 system will have the capabilities to support a steady and continuous evolution of new applications, new products and new services. Its communication speed will be on the order of 30Mbit/s by around 2005.

② Relationship of Future Development of IMT-2000 with Other Wireless Access Systems

There will be an increasing inter-relationship with other radio access systems, for example, wireless Local Area

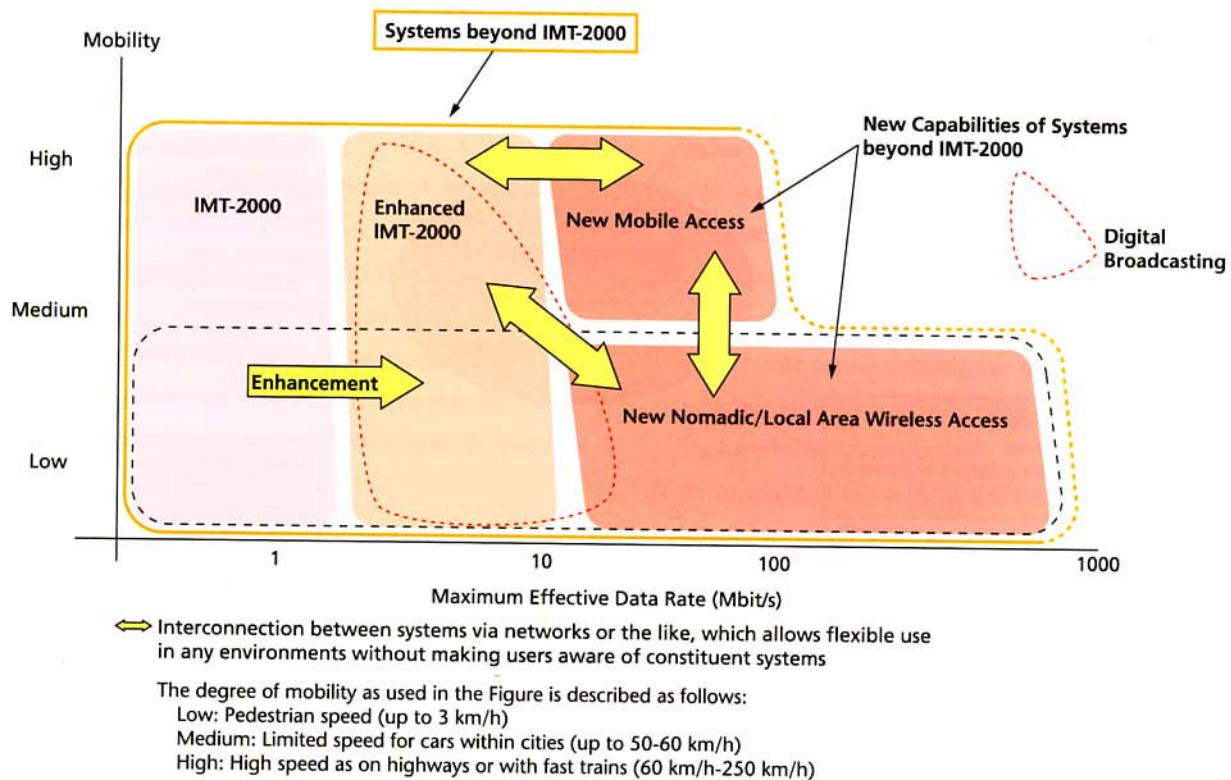
Networks (LANs) and digital broadcasting, etc.

③ Systems beyond IMT-2000

Systems beyond IMT-2000 are realized by functional fusion of existing, enhanced and newly-developed elements of cellular systems, nomadic wireless access systems and so forth with high commonality and seamless interworking. They will serve as systems that can inter-work in a seamless manner, and support the steady, continuous evolution of new applications, new products and new services.

Around 2010, there may be a requirement for a new wireless access technology for terrestrial component. This will complement the enhanced IMT-2000 system and other radio systems. The new radio interface is to support a communication speed of up to 100 Mbit/s in a mobile environment and up to 1 Gbit/s in a quasi-stationary environment by around 2010.

Figure 1 illustrates the capabilities of IMT-2000 and Systems beyond IMT-2000. According to the vision framework that is currently being developed at ITU-R, Systems beyond IMT-2000 are defined as the aggregate of future mobile communications systems, including the existing IMT-2000 system.



IMT-2000: International Mobile Telecommunications-2000

Figure 1 Capabilities of IMT-2000 and Systems beyond IMT-2000

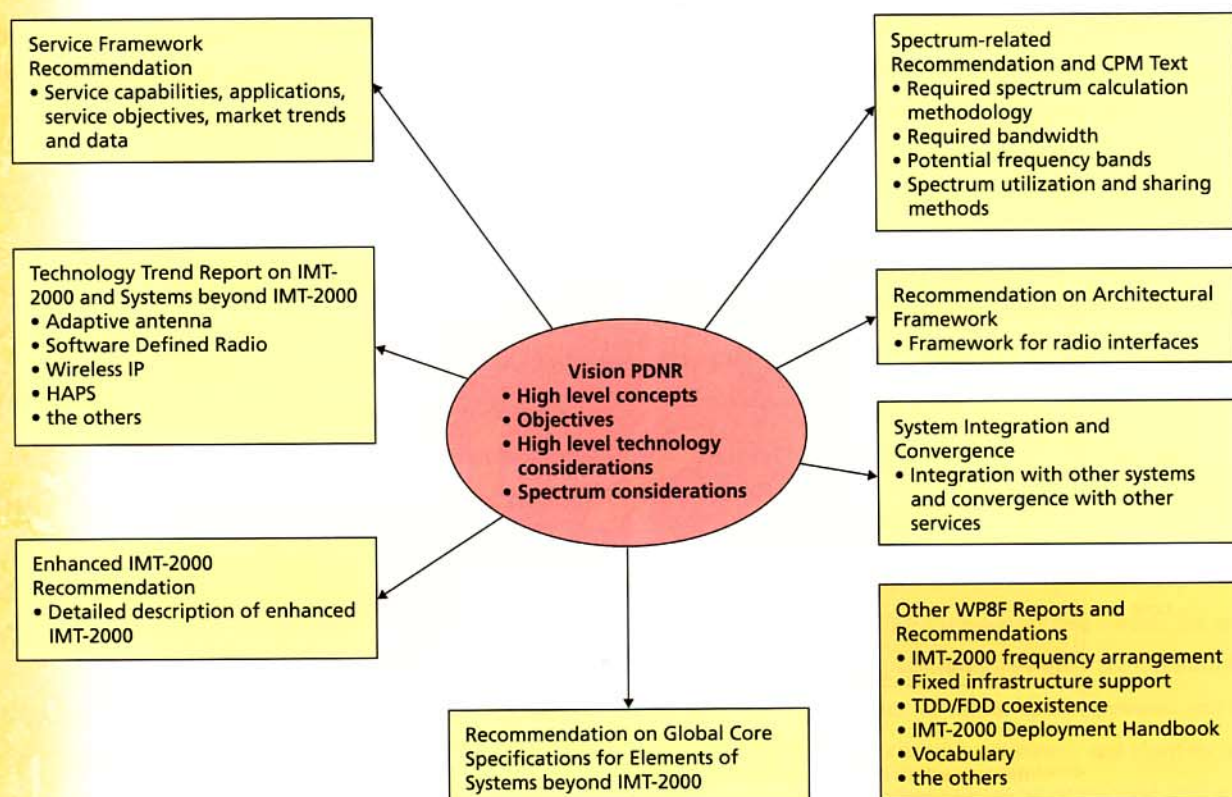
In addition to the future development of IMT-2000, WP8F has identified the new elements of Systems beyond IMT-2000 to be developed further; New Mobile Access element and Nomadic/Local Area Wireless Access element. Among them, the New Mobile Access element corresponds to the 4G mobile communications system that has positively been advocated by Japan. At ITU-R, most countries agree that it will be necessary to develop and standardize a new radio interface based on new technology in order to implement high-speed communications provided by these new elements. In the operation scenario of Systems beyond IMT-2000, as indicated by the arrows in Figure 1, the enhanced IMT-2000 system, the New Mobile Access element and the Nomadic/Local Area Wireless Access element will inter-work so that users can be connected seamlessly via networks without being aware of them. As described above, Systems beyond IMT-2000 presume that various wireless communications systems will be selected for use, accord-

ing to services and environment to which they are adapted.

The results of these studies on the vision framework and the objectives are to be compiled in form of an ITU-R Recommendation by June 2002. WP8F also plans to identify the system & service requirements, the objectives and the spectrum requirements for the mobile communications systems that ought to be newly developed and standardized according to this vision. **Figure 2** shows the relationship of Vision PDNR and other relevant Recommendations to be developed in the future. WP8F considers the Vision PDNR as the nucleus of a WP8F long-range work program, and plans to produce a series of Recommendations, including a service framework Recommendation, a technology trend Report and spectrum-related Recommendations.

(2) Approval of draft CPM text for WRC-2003

WRC is an international radio-communication conference which may revise the Radio Regulations (RR) and any associated Frequency Assignment and Allotment



CPM: Conference Preparatory Meeting
 FDD: Frequency Division Duplex
 HAPS: High Altitude Platform Stations
 IMT-2000: International Mobile Telecommunications-2000
 IP: Information Provider
 TDD: Time Division Duplex
 WP: Working Party

Figure 2 Vision PDNR forming the nucleus of WP8F Long-range Work Plan

Plans. At WRC-2000, which was held in 2000, Japan's proposal led to the resolution of the establishment of Agenda Item 1.22 "to consider progress of the ITU-R studies concerning future development of IMT-2000 and Systems beyond IMT-2000 in accordance with Resolution 228 (WRC-2000)", i.e., WRC-2000 resolved that WRC-2003 review the results of ITU-R studies presented to it, and that WRC-2006 review requirements including spectrum-related matters. Accordingly, WP8F is invited to report the results of its studies on the future development of IMT-2000 and Systems beyond IMT-2000 to WRC-2003.

The CPM Report is a report to be distributed to administrations of ITU Member States as a reference material for their preliminary studies on the progress of ITU-R studies relevant to the WRC-2003 agenda. WP8F was primarily responsible for preparing the draft text on Agenda Item 1.22 in this Report.

The draft text of the CPM Report was developed based on the document contributed by Japan at the 6th WP8F meeting held in Tokyo, and was compiled on the basis of the work done at the WP8F meeting in Tokyo and over the ITU e-mail reflector thereafter, and the final work done at the subsequent WP8F meeting in Queenstown. Following its approval at the WP8F meeting held in Queenstown in March 2002, the draft CPM text was sent to the CPM Chapter Rapporteur. The approved CPM text states that the spectrum requirements should be reviewed and any necessary action should be taken at WRC-2006. An agreement was reached to advise on the revision of Resolution 228 (WRC-2000), and the draft revision text of the Resolution was sent together with the draft CPM text.

In order for spectrum to be identified/allocated at WRC-2006 for future broadband mobile communications use, WRC-2003 must decide to include an appropriate agenda item for WRC-2006. The agreed draft CPM text is favorable for a decision at WRC-2003 to ensure this agenda item towards spectrum consideration at WRC-2006.

3.2 IMT-2000 Related Matters

(1) The approval of Recommendations for Global Circulation

One of the basic concepts of IMT-2000 is the implementation of international roaming on a global basis. Global Circulation of terminal is the right of users to carry their personal terminals into a visited country, and the ability to use them wherever possible, provided that they have already been used under permission in their home country. In order to implement

global circulation, WP8F has been studying how to simplify the regulations concerning such mobile terminals (visiting terminals) and usage permissions, including, specifically, studies on matters to be observed when a user takes his/her mobile terminal into another country, the technical characteristics of the terminals, the reciprocal agreement on visiting terminals among countries, and unwanted spurious emission limits. Visiting terminals subject to global circulation refer to personal terminals to which usage permission has already been issued (i.e. those already authorized and operated as radio stations) and have been taken into visited country on a temporary basis, and do NOT include mobile terminals imported/exported for the purpose of being used permanently in another country.

At the 6th WP8F meeting in Tokyo, the draft Recommendation [IMT. RCIRC] was produced and approved, which specified the requirements for implementing the global circulation of IMT-2000 terminals [3]. The approved draft Recommendation consists of the following three key recommendations, considering or recognizing that (i) no extra regulatory procedures will be required such as additional individual licenses and/or certificates of compliance with technical regulations, and (ii) mobile terminals will be exempted from all customs duties and procedures.

- ① The visiting terminals should fulfill the requirement for avoiding harmful interference in any country where they circulate:
 - by conforming to the IMT-2000 standards referred to in Recommendation ITU-R M.1457 and ;
 - by complying with unwanted emission limits according to the Recommendation ITU-R [IMT. UNWANT-MS];
- ② The visiting terminal should use the receive-before-transmit principle, or when available, other technical means of avoiding harmful interference; and
- ③ In the event of faults being detected that results in harmful interference, IMT-2000 equipment is designed, where possible, to minimize this.

In addition to the above, WP8F approved, at the meeting in Tokyo, draft Recommendations concerning the unwanted emission characteristics of IMT-2000 mobile terminals [IMT. UNWANT-MS] and base stations [IMT. UNWANT-BS], which are applicable to the use of the 2 GHz-band identified for IMT-2000. The unwanted emission limit is set with respect to each of the five radio interfaces in the terrestrial IMT-2000 family spec-

ified in Recommendation ITU-R M.1457 "Detailed Specifications on the Radio Interfaces of IMT-2000" [4, 5].

The technical basis for global circulation of IMT-2000 terminals was established by the approval of these draft Recommendations for global circulation. Also, it was recognized that the use of Electric Equipment Identity (EEI) is an effective way to make it possible to uniquely identify individual terminal equipment in order to check its conformity to the specified technical characteristics. Based on the technical requirements set forth by ITU-R, regulatory and/or procedural matters will be considered outside ITU (e.g. administrations) to implement global circulation.

(2) The completion of Recommendation M.1457 Rev.2

Recommendation ITU-R M.1457 "Detailed Specifications on the Radio Interfaces of IMT-2000" specifies the details of radio interfaces with respect to the five terrestrial radio interfaces in the IMT-2000 family. Rev.2 was completed and finalized at the WP8F Tokyo meeting in October 2001, after the completion of individual revisions to the five IMT-2000 terrestrial radio interfaces in Recommendation ITU-R M.1457. Up until then, the revision of Recommendation ITU-R M.1457 was performed and approved at each meeting individually with respect to each radio interface. **Table 2** shows the radio interfaces revised and approved at each meeting.

Due to the latest revision, Recommendation ITU-R M.1457 will incorporate High Speed Downlink Packet Access (HSDPA) and other new technologies in Code Division Multiple Access Direct Spread (CDMA DS), which is the radio interface used by NTT DoCoMo's FOMA. HSDPA is the technical specification of a radio interface that enables high-speed packet-switched communications in downlink (the communication link from the base station to the mobile terminal) in the future.

The specifications of HSDPA and 1X EVolution-Data and Voice (1X EV-DV), which had been still underway at the 3rd Generation Partnership Project (3GPP) and 3GPP2 respectively as at the time of the convocation of the WP8F meeting in Tokyo in October 2001, were approved at the WP8F meeting in Tokyo based on the recognition that the specifications will be completed by the end of May 2002 i.e. the final deadline for submitting the specifications to the ITU Secretariat. Work on the revision of

Table 2 Sequence of Individual Approvals within WP8F up until the Finalization of Recommendation ITU-R M.1457 Rev. 2

| Approval Meeting | Approval Date | Revised Radio Interface Approved Individually |
|-------------------------|-------------------|--|
| 4th Meeting (Rabat) | February 27, 2001 | • TDMA SC (UWC136) |
| 5th Meeting (Stockholm) | July 3, 2001 | • CDMA MC 1X EV-DO |
| 6th Meeting (Tokyo) | October 16, 2001 | • CDMA DS e.g. High-Speed Downlink Packet Access (W-CDMA) • CDMA MC 1X EV-DV • CDMA TDD • FDMA/TDMA (DECT) |

1X EV-DV: 1X EVolution-Data and Voice
 CDMA DS: Code Division Multiple Access Direct Spread
 DECT: Digital European Cordless Telecommunication
 FDMA: Frequency Division Multiple Access
 MC: Multi Carrier
 SC: Single Carrier
 TDD: Time Division Duplex
 TDMA: Time Division Multiple Access
 UWC: Universal Wireless Communication
 W-CDMA: Wideband Code Division Multiple Access

Recommendation ITU-R M.1457 is to be done on a regular basis in the future, for the preparation of Rev.3.

4. Conclusion

This article reported on the status of deliberations at the four most recent WP8F meetings and the key outcomes.

WP8F is currently developing Vision PDNR for the future development of IMT-2000 and Systems beyond IMT-2000. This article reported that the participating countries reached an agreement on ITU's vision for future development of IMT-2000 and systems beyond IMT-2000, in most aspects before the meeting in Queenstown in February 2002. It also explained that 4G mobile communications advocated by Japan hitherto will be regarded a new mobile access element of Systems beyond IMT-2000 in ITU's vision. The countries are expected to make further refinement to the content in detail with the aim to complete and approve Vision PDNR at the meeting to be held in Ottawa in June 2002.

For WRC-2003, WP8F has also prepared and approved the draft text of the CPM Report on the agenda pertaining to the future development of IMT-2000 and Systems beyond IMT-2000 (Agenda Item 1.22). Discussions are

due to take place at CPM in November 2002 based on the draft text of the CPM Report, and the final version of the CPM Report is to be produced thereat.

In relation to the global circulation of IMT-2000, three draft Recommendations were approved, namely, [IMT. RCIRC], [IMT. UNWANT-MS] and [IMT. UNWANT-BS]. These draft Recommendations were approved by WP8F and subsequently adopted by Study Group 8 (SG8) in November 2001. The regulatory and/or procedural matters to implement global circulation will be considered outside ITU, primarily by administrations of the ITU Member States, based on the technical requirements specified in these Recommendations.

As for the revision of Recommendation ITU-R M.1457 "Detailed Specifications on the Radio Interfaces of IMT-2000", WP8F reached an agreement on the procedures for revisions to be performed in the future on a regular basis, and Rev.2 was finalized and approved according to those agreed-upon proce-

dures. For the future, WP8F is expected to engage in activities towards the preparation of Rev.3.

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- [4] ITU-R WP8F: "Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-2000," Document 8F/TEMP/171-E Rev.2, Oct. 2001.
- [5] ITU-R WP8F: "Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-2000," Document 8F/TEMP/172-E Rev.2, Oct. 2001.