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| **Radiocommunication Study Groups** |  |
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| Received: 6 July 2012  Subject: [Question ITU-R 229-3/5](http://www.itu.int/pub/R-QUE-SG05.229-3-2012) | **Document 5D/65-E** |
| **6 July 2012** |
| **English only**  **TECHNOLOGY ASPECTS** |
| Institute of Electrical and Electronics Engineers, Inc. | |
| IMT-2000 OFDMA TDD WMAN submission toward revision 11 of recommendation itu-r m.1457 (meeting x+2) | |

# 1 Source information

This contribution was developed by IEEE Project 802®, the Local and Metropolitan Area Network Standards Committee (“IEEE 802”), an international standards development committee organized under the IEEE and the IEEE Standards Association (“IEEE-SA”).

The content herein was prepared by a group of technical experts in IEEE 802 and industry and was approved for submission by the IEEE 802.16™ Working Group on Wireless Metropolitan Area Networks, the IEEE 802.18 Radio Regulatory Technical Advisory Group, and the IEEE 802 Executive Committee, in accordance with the IEEE 802 policies and procedures, and represents the view of IEEE 802.

# 2 Discussion

Following Documents 5D/908 and 5D/1117, this contribution contains updated material on IMT‑2000 OFDMA TDD WMAN for Revision 11 of Recommendation ITU-R M.1457 in line with Circular Letter 8/LCCE/95 and the schedule received from ITU-R Working Party 5D contained in Att. 5.2 of Document 5D/870. This material represents the update for approval at the final (“X+2”) meeting addressing the development of Revision 11.

In particular, the material required as specified in the update procedure for revisions of Recommendation ITU-R M.1457 (8/LCCE/95) is addressed in the following annexes:

[Annex 1](#a1): Update of Section 5.6.2

[Annex 2](#a2): Modifications to Section 5.6.1

[Annex 3](#a3): Updated GCS

[Annex 4](#a4): Summary and rationale of the proposed update

[Annex 5](#a5): Self-evaluation of the proposed update against the evaluation criteria (identical   
to Annex 5 of Document 5D/1117)

[Annex 6](#a6): Self-declaration that the proposed amendments are self-consistent between   
Section 5.6.1, Section 5.6.2, and the GCS.

Please note that content referenced in 5D/1117 as “IEEE Std 802.16m” is being introduced into a new standalone standard IEEE Std 802.16.1, with the content accordingly removed from IEEE Std 802.16 in the current revision IEEE Std 802.16-2012. Accordingly, both IEEE Std 802.16-2012 and IEEE Std 802.16.1-2012 are being proposed for the GCS.

# 3 Proposal

We propose that the information contained in this contribution, including electronic attachments in Annexes 1 and 2, be agreed for incorporation in Revision 11 of Recommendation ITU-R M.1457.

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Annex 1  
  
Update of Section 5.6.2

The content of the electronic attachment is to replace Section 5.6.2 of Rec. ITU-R M.1457-10.



Annex 2  
  
Modifications to Section 5.6.1

The content of the electronic attachment is to replace Section 5.6.1 of Rec. ITU-R M.1457-10.



Annex 3  
  
Updated GCS

The updated set of the Global Core Specifications (GCS) for IMT-2000 OFDMA TDD WMAN will be provided separately per established procedures.

Annex 4  
  
Summary and rationale of the proposed update

The main purpose of this update is to align Recommendation ITU-R M.1457 to the most updated versions of the specifications underlying the radio interface IMT-2000 OFDMA TDD WMAN. The main enhancements are the additions of a license-exempt coexistence specification as well as the WirelessMAN-Advanced specification.

Annex 5  
  
Self-evaluation of the proposed update against the evaluation criteria

The self-evaluation of the “total” radio interface update of IMT-2000 OFDMA TDD WMAN has been made against all evaluation criteria listed in the update procedure contained in Circular Letter 8/LCCE/95. The results are that the proposed updates meet the evaluation criteria as follows:

## 7.1 “The Evaluation criteria” (Section 7.1 in Circular Letter 8/LCCE/95)

The “requirements and objectives of IMT-2000” and the “Minimum performance capabilities for IMT-2000” as per Attachments 4 and 6 of Circular Letter 8/LCCE/47 were considered. The values included in Circular Letter 8/LCCE/47 were used. The proposed update consists of enhancements to the existing IMT-2000 OFDMA TDD WMAN radio interface. The evaluation of the proposed update was done in the context of the “total” radio interface. As shown in the tables below, the conclusion is that the IMT-2000 OFDMA TDD WMAN radio interfaces with the proposed enhancements continue to meet all evaluation criteria in “Requirements and objectives of IMT‑2000” and “Minimum performance capabilities for IMT-2000”.

TABLE 1

Requirements and objectives relevant to the evaluation   
of candidate radio transmission technologies

| IMT-2000 Item Description | Obj/Req | Source | Meets |
| --- | --- | --- | --- |
| Voice and data performance requirements | | | |
| 1. One-way end to end delay less than 40 ms | Req | G.174, § 7.5 | Yes |
| 2. For mobile videotelephony services, the IMT-2000 terrestrial component should operate so that the maximum overall delay  (as defined in Recommendation ITU-T F.720) should not exceed 400 ms, with the one way delay of the transmission path not exceeding 150 ms | Req | Suppl. F.720, F.723, G.114 | Yes |
| 3. Speech quality should be maintained during < 3% frame erasures over any 10 second period. The speech quality criterion is a reduction of < 0.5 mean opinion score unit (5 point scale) relative to the error-free condition (G.726 at 32 kbit/s) | Req | G.174, § 7.11 and M.1079 § 7.3.1 | Yes |
| 4. DTMF signal reliable transport (for PSTN is typically less than one DTMF error signal in 104) | Req | G.174, § 7.11 and M.1079 § 7.3.1 | Yes |
| 5. Voiceband data support including G3 facsimile | Req | M.1079 § 7.2.2, | Yes |
| 6. Support packet switched data services as well as circuit switched data; requirements for data performance given in Recommendation ITU-T G.174 | Req | M.1034 §§ 10.8, 10.9 | Yes |

| IMT-2000 Item Description | Obj/Req | Source | Meets |
| --- | --- | --- | --- |
| **Radio interfaces and subsystems, network related performance requirements** | | | |
| 7. Network interworking with PSTN and ISDN in accordance  with Q.1031 and Q.1032 | Req | M.687-1. § 5.4 | Yes |
| 8. Meet spectral efficiency and radio channel performance requirements of Recommendation ITU-R M.1079 | Req | M.1034. § 12.3.3/4 | Yes |
| 9. Provide phased approach with data rates up to 2 Mbit/s in phase 1 | Obj | M.687, § 1.1.14 | Yes |
| 10. Maintain bearer channel bit-count integrity (e.g. synchronous data services and many encryption techniques) | Obj | M.1034, § 10.12 | Yes |
| 11. Support for different cell sizes, for example:  Mega cell Radius~100-500 km  Macro cell Radius < 35 km, Speed < 500 km/h  Micro cell Radius < 1 km, Speed < 100 km/h  Pico cell Radius < 50 m, Speed < 10 km/h | Obj | M.1035, § 10.1 | Yes |
| **Application of IMT-2000 for fixed services and developing countries** | | | |
| 12. Circuit noise- idle noise levels in 99% of the time about 100 pWp | Obj | M.819-1, § 10.3 | Yes |
| 13. Error performance – as specified in Recommendation ITU‑R F.697 | Obj | M.819-1, § 10.4 | Yes |
| 14. Grade of service better than 1% | Obj | M.819-1, § 10.5 | Yes |

TABLE 2

Generic requirements and objectives relevant to the evaluation of   
candidate radio transmission technologies

| IMT-2000 Item Description | Obj/Req | Source | Meets |
| --- | --- | --- | --- |
| Radio interfaces and subsystems, network related performance requirements | | | |
| 1. Security comparable to that of PSTN/ISDN | Obj | M.687-1, § 4.4 | Yes |
| 2. Support mobility, interactive and distribution services | Req | M.816, § 6 | Yes |
| 3. Support UPT and maintain common presentation to users | Obj | M.816, § 4 | Yes |
| 4. Voice quality comparable to the fixed network (applies to both mobile and fixed service) | Req | M819-1, Table 1, M.1079, § 7.1 | Yes |
| 5. Support encryption and maintain encryption when roaming and during handover | Req | M.1034 § 11.3 | Yes |
| 6. Network access indication similar to PSTN (e.g. dialtone) | Req | M.1034 §§ 11.5 | Yes |
| 7. Meet safety requirements and legislation | Req | M.1034, § 11.6 | Yes |
| 8. Meet appropriate EMC regulations | Req | M.1034, § 11.7 | Yes |
| 9. Support multiple public/private/residential IMT-2000 operators in the same locality | Req | M.1034, § 12.1.2 | Yes |
| 10. Support multiple mobile station types | Req | M.1034, § 12.1.4 | Yes |
| 11. Support roaming between IMT-2000 operators and between different IMT-2000 radio interfaces/environments | Req | M.1034, § 12.2.2 | Yes |
| 12. Support seamless handover between different IMT-2000 environments such that service quality is maintained and signaling is minimized | Req | M.1034, § 12.2.3 | Yes |
| 13. Simultaneously support multiple cell sizes with flexible base location, support use of repeaters and umbrella cells as well as deployment in low capacity areas | Req | M.1034, § 12.2.5 | Yes |
| 14. Support multiple operator coexistence in a geographic area | Req | M.1034, § 12.2.5 | Yes |
| 15. Support different spectrum and flexible band sharing in different countries including flexible spectrum sharing between different IMT-2000 operators (see Recommendation ITU-R M.1036) | Req | M.1034, § 12.2.8 | Yes |
| 16. Support mechanisms for minimizing power and interference between mobile and base stations | Req | M.1034, § 12.2.8.3 | Yes |
| 17. Support various cell types dependent on environment  (Recommendation ITU-R M.1035 § 10.1) | Req | M.1034, § 12.2.9 | Yes |
| 18. High resistance to multipath effects | Req | M.1034, § 12.3.1 | Yes |
| 19. Support appropriate vehicle speeds (as per § 7) NOTE − Applicable to both terrestrial and satellite proposals | Req | M.1034. § 12.3.2 | Yes |
| 20. Support possibility of equipment from different vendors | Req | M.1034, § 12.1.3 | Yes |
| 21. Offer operational reliability at least as good as 2nd generation mobile systems | Req | M.1034, § 12.3.5 | Yes |
| 22. Ability to use terminal to access services in more than one environment, desirable to access services from one terminal in all environments | Obj | M.1035, § 7.1 | Yes |
| 23. End-to-end quality during handover comparable to fixed services | Obj | M.1034-1 § 11.2.3.4 | Yes |
| 24. Support multiple operator networks in a geographic area without requiring time synchronization | Obj |  | Yes |
| 25. Layer 3 contains functions such as call control, mobility management and radio resource management some of which are radio dependent. It is desirable to maintain layer 3 radio transmission independent as far as possible | Obj | M.1035, § 8 | Yes |
| 26. Desirable that transmission quality requirements from the upper layer to physical layers be common for all services | Obj | M.1035, § 8.1 | Yes |
| 27. The link access control layer should as far as possible not contain radio transmission dependent functions | Obj | M.1035, § 8.3 | Yes |
| 28. Traffic channels should offer a functionally equivalent capability to the ISDN B channels | Obj | M.1035, § 9.3.2 | Yes |

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| --- | --- | --- | --- |
| **IMT-2000 Item Description** | **Obj/Req** | **Source** | **Meets** |
| 29. Continually measure the radio link quality on forward and reverse channels | Obj | M.1035, § 11.1 | Yes |
| 30. Facilitate the implementation and use of terminal battery saving techniques | Obj | M.1035, § 12.5 | Yes |
| 31. Accommodate various types of traffic and traffic mixes | Obj | M.1036, § 1.10 | Yes |
| **Application of IMT-2000 for fixed services and developing countries** | | | |
| 32. Repeaters for covering long distances between terminals and base stations, small rural exchanges with wireless trunks etc. | Req | M.819-1, Table 1 | Yes |
| 33. Withstand rugged outdoor environment with wide temperature and humidity variations | Req | M.819-1, Table 1 | Yes |
| 34. Provision of service to fixed users in either rural or urban areas | Obj | M.819-1, § 4.1 | Yes |
| 35. Coverage for large cells (terrestrial) | Obj | M.819-1, § 7.2 | Yes |
| 36. Support for higher encoding bit rates for remote areas | Obj | M.819-1, § 10.1 | Yes |
| **Satellite component (Not required for RTT submission)** | | | |
| 37. Links between the terrestrial and the satellite control elements for handover and exchange of other information | Req | M.818-1, § 3.0 | N/A |
| 38. Take account for constraints for sharing frequency bands with other services (WARC-92) | Obj | M.818-1, § 4.0 | N/A |
| 39. Compatible multiple access schemes for terrestrial and satellite components | Obj | M.818-1, § 6.0 | N/A |
| 40. Service should be comparable quality to terrestrial component as far as possible | Obj | M.818-1, § 10.0 | N/A |
| 41. Use of satellites to serve large cells for fixed users | Obj | M.819-2, § 7.1 | N/A |
| 42. Key features (e.g. coverage, optimization, number of systems) | Obj | M.1167, § 6.1 | N/A |
| 43. Radio interface general considerations | Req | M.1167, § 8.1.1 | N/A |
| 44. Doppler effects | Req | M.1167, § 8.1.2 | N/A |

TABLE 3

Subjective requirements and objectives relevant to the evaluation of candidate   
radio transmission technologies

|  |  |  |  |
| --- | --- | --- | --- |
| IMT-2000 Item Description | Obj/Req | Source | Meets |
| 1. Fixed service – Power consumption as low as possible for solar and other sources | Req | M.819-1. Table 1 | Yes |
| 2. Minimize number of radio interfaces and radio sub-system complexity, maximize commonality (Recommendation ITU‑R M.1035, § 7.1) | Req | M.1034, § 12.2.1 | Yes |
| 3. Minimize need for special interworking functions | Req | M.1034, § 12.2.4 | Yes |
| 4. Minimum of frequency planning and inter-network coordination and simple resource management under time‑varying traffic | Req | M.1034, § 12.2.6 | Yes |
| 5. Support for traffic growth, phased functionality, new services  or technology evolution | Req | M.1034, § 12.2.7 | Yes |
| 6. Facilitate the use of appropriate diversity techniques avoiding significant complexity if possible | Req | M.1034, § 12.2.10 | Yes |
| 7. Maximize operational flexibility | Req | M.1034, § 12.2.11 | Yes |
| 8. Designed for acceptable technological risk and minimal  impact from faults | Req | M.1034, § 12.2.12 | Yes |
| 9. When several cell types are available, select the cell that  is the most cost and capacity efficient | Obj | M.1034, § 10.3.3 | Yes |
| 10. Minimize terminal costs, size and power consumption,  where appropriate and consistent with other requirements | Obj | M.1036, § 1.12 | Yes |

TABLE 4

Minimum performance capabilities

|  |  |  |  |
| --- | --- | --- | --- |
| Test environments | Indoor office | Outdoor to indoor and pedestrian | Vehicular |
| **Mobility considerations** | mobility type (low) | mobility type (medium) | mobility type (high) |
| Handover | Yes | Yes | Yes |
| **Support of general service capabilities** |  |  |  |
| Packet data | Yes | Yes | Yes |
| Asymmetric services | Yes | Yes | Yes |
| Multimedia | Yes | Yes | Yes |
| Variable bit rate | Yes | Yes | Yes |

## 8.1 Compatibility with the existing IMT-2000 radio interfaces

The proposed update fits well within the framework of the existing IMT-2000 OFDMA TDD WMAN radio interface. All features supported in the existing IMT-2000 OFDMA TDD WMAN are still supported in the proposed update.

## 8.2 Harmonization within multiple proposals

See Section 9.2.

“Other considerations” (Section 9 in Circular Letter 8/LCCE/95)

## 9.1 Benefits of the proposed enhancement

The proposed enhancements improve the performance of IMT-2000 OFDMA TDD WMAN radio interface.

## 9.2 Harmonization and consensus building

Through their membership and through liaison communications, the SDO stakeholders, the IEEE and the WiMAX Forum, have established harmonization and consensus building. IEEE expects that the system profile submitted by the WiMAX Forum will be fully consistent with IEEE Std 802.16.

9.3 Enhanced performance capabilities

The proposed update is fully in line with the ongoing activities on the vision for the enhancements of IMT-2000, also reflected in the Roadmap for the future updates of Recommendation ITU‑R M.1457.

Annex 6  
  
Self-declaration that the proposed amendments are self-consistent  
between Section 5.6.1, Section 5.6.2, and the GCS

The proposed amendments are self-consistent between Sections 5.6.1, 5.6.2, and the GCS.

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