Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Draft IEEE 802.16m Requirements**
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Source(s)		
	Mark Cudak Motorola	mark.cudak@motorola.com
	Michael Webb BRN Phoenix Inc.	mwebb@brnphoenix.com
	Phil Orlik Mitsubishi Electric Research Laboratories	porlik@merl.com
	Avi Freedman Hexagon System Engineering Ltd	avif@hexagonltd.com
	Ronny (Yong-Ho) Kim LG Electronic Inc.	ronnykim@lge.com

Re:	Call for initial input regarding P802.16m project, 12/26/06
Abstract	This document combines the various input submitted to TGm including contributions IEEE 802.16m-07/001r1, IEEE 802.16m-07/003, IEEE 802.16m-07/004r1, IEEE 802.16m-07/005, IEEE 802.16m-07/007 and IEEE 802.16m-07/008. Based on these contributions, an overall outline has been defined and respective requirements have been incorporated as bracketed text. Where there was consensus, harmonized text was drafted for approval to replace the bracket text. In other cases, the requirements were in clear conflict and the bracketed text was left in. Given the time constraints, not all topics were addressed and therefore some remaining bracketed text may still be harmonized by the working group.
Purpose	For discussion and approval by TGm
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.
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Patent Policy and Procedures	The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:chair@wirelessman.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.

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1.0 Overview

The IEEE 802.16m amendment provides an advanced air interface to meet the requirements of next generation mobile networks. This standard is intended for incorporation into the IMT-Advanced standardization activity being conducted by International Telecommunications Union – Radio Communications Sector (ITU-R). The amendment is based on the WirelessMAN-OFDMA specification and provides continuing support for legacy subscriber stations.

The purpose of this standard is to update the WirelessMAN-OFDMA air interface in accordance with the requirements defined for the internationally agreed radio interface standards for next generation mobile networks such as IMT-Advanced.

This document captures the high-level requirements for the proposed IEEE 802.16m amendment as envisioned by the working group.

2.0 References

[1] WiMAX Forum™ Mobile System Profile, Release 1.0 Approved Specification (Revision 1.2.2: 2006-11-17) (see http://www.wimaxforum.org/technology/documents).
[2] IEEE Std 802.16-2004: IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems, June 2004
[3] IEEE Std 802.16e-2005: IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems Amendment for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands, December 2005.
[4] Recommendation ITU-R M.1645: Framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000, January 2003

3.0 Definitions

[Editorial additions]

4.0 Abbreviations and Acronyms

[Editorial additions]
[CALEA Communications Assistance for Law Enforcement Act of 1994]

5.0 General Requirements

5.1 Legacy Support

The IEEE 802.16m amendment is based on the WirelessMAN-OFDMA specification.

The amendment provides continuing support for legacy subscriber stations. This continuing support shall be limited to only a “harmonized sub-set” of IEEE 802.16e OFDMA features. This harmonized

sub-set is captured by the WiMAX Forum™ definition of OFDMA mobile system profiles [1]. These WiMAX mobile system profiles shall serve as the *IEEE 802.16e reference system*.

A legacy 16e terminal, compliant with the IEEE 802.16e reference system, shall be able to operate with a new 16m BS with no degradation of performance.

A new 16m terminal shall be able to operate with a 16e BS, compliant with the IEEE 802.16e reference system, at a level of performance that is no worse than the 16e terminal.

5.2 Complexity

PHY/MAC should enable a variety of hardware platforms with different performance/complexity requirements.

5.3 Services

IEEE 802.16m architecture shall be flexible in order to support required services from ITU-R.

IMT-Advanced QoS requirements shall be supported including end-to-end latency, throughput, and error performance.

IEEE 802.16m system shall provide powerful and efficient security mechanism to protect the network, system, and user.

6.0 Functional Requirements

6.1 Peak Data Rate

State of the art modulation, coding, scheduling and multiplexing should be employed to achieve higher spectral efficiency at a reasonable complexity

Additional transmit and receive antennas may be considered but should not be required of subscriber devices. Size and power considerations continue to dictate that no more than two transmit and receive antennas be required of hand-held devices.

[The 802.16 m TG should include enhancements to the 802.16 MIMO and AAS modes within the scope of the project for the explicit purpose of increasing the capacity, aggregate link rates and spectral efficiency]

[Peak useful data rates up to 100 Mbit/sec for mobiles users]

[Peak useful data rates up to 1 Gb/s for stationary users]

[Interference Management/Avoidance]

6.2 Latency

Latency should be further reduced as compared to the IEEE 802.16e reference system for all aspects of the system including the air link, state transition delay, access delay, and handover.

6.3 QoS

Relative to IMT-2000 systems, the 16m amendment shall

- have a greater ability to simultaneously support a wide range of multimedia services,

- provide enhanced management of different quality of service levels, and
- provide support for applications requiring IMT-Advanced system end user QoS requirements.

6.4 Radio Resource Management

[IEEE 802.16m amendment shall support functions such as priority and preemption.]

[IEEE 802.16m amendment shall support regional regulatory needs including CALEA.]

6.5 Security

[Requirements for Secrecy and Privacy: More powerful, enhanced (high-speed/small-size and low-power) confidentiality and integrity protection for traffic transmission, control information; More efficient, robust user/device authentication scheme; Location privacy scheme; and Reliable and flexible service availability protection scheme]

[Requirements for Inter-working Security: Delay constrained handover and roaming support without changing the security level (Especially, seamless mobility across heterogeneous networks with the negotiation of security mechanisms/algorithms); and Minimum performance/capacity degradation due to the security feature provisioning]

7.0 Performance requirements

[Performance goals should be specified in terms of relative performance relative to that of 802.16e reference systems]

7.1 User throughput

[The average user-throughput in the downlink/uplink should be at least 2x enhancement over 802.16e reference system]

[95% of users should receive a 2x greater throughput over the 802.16e reference system]

7.2 Spectrum efficiency

The IEEE 802.16m amendment shall provide enhancements to the existing standard to reduce the amount of PHY and MAC layer overhead, particularly in cases of large numbers of users with small or sporadic bandwidth demands, in order to make more efficient use of available capacity.

[Spectral efficiency in the range of 8-10 bps/second/Hz/cell will be required to achieve the subscriber penetration rates and aggregate data rates needed to ensure commercial success for these networks, given the bandwidth-intensive multimedia services they must support.]

[Average downlink/uplink sector throughput should be at least 2 x 802.16e reference systems]

7.3 Mobility

[The IEEE 802.16m amendment shall include air-interface features that would enable the Seamless Mobility with legacy 802.16e reference systems. Handoff with other IMT-2000 standards shall also be given consideration. This requirement is intended to address additional air-link requirements beyond those covered by the IEEE 802.21 working group. For example, specific methods for scanning and system discovery should be considered as part of the 16m MAC. Finally, requirements for handoff of broadcast services shall also be defined.]

[IEEE 802.16m system shall provide seamless interworking with legacy radio access systems including legacy 802.16 systems.]

[The expectations for performance should tiered based on mobility speeds and prioritized in order to achieve the optimum overall performance]

7.4 Coverage

[Enhanced cell-edge coverage]

[Support for increased user and service penetration rates]

7.5 Enhanced Multicast-Broadcast

[System wide broadcast performance should be evaluated independently of unicast service]

[A specific performance target of 2x appears appropriate]

8.0 Deployment-related requirements

8.1 Legacy Support

[Backward compatibility is required in all existing spectrum bands where 16e systems might be deployed.]

8.2 Spectrum Requirements

[Frequency is expected to be decided in WRC07]
[Support the frequency bands within the current 802.16d/e/j framework that do not interfere with the other technologies that are part of IMT.]
[Scalable bandwidth including 5, 7, 8.75, 10 MHz]
[Support for existing bandwidths in both paired and unpaired spectrum.]
[Legacy OFDMA bandwidths described 802.16e reference system should be supported.]
[Larger bandwidths beyond those in the 802.16e reference system should be considered as a 16m specific enhancement.]
[Performance in all bandwidths should be optimized for both TDD and FDD]

8.3 System Architecture

[The IEEE 802.16m amendment shall support multi-hop topologies.]
[IEEE 802.16m system shall support different cell sizes which are expected for cellular layer systems.]
[Cell radius and coverage requirements:
16m must support legacy cell sizes allowing for co-location of 16m deployments. In addition, larger cell sizes will also be considered. 30 km cells should be supported with limited degradation. 100 km cells should not be precluded from the standard. Support for these larger cell sizes should **not** compromise the performance of smaller cells

8.4 System Migration

[802.16m and 802.16e reference system shall be deployable on the same RF carriers: performance should be appropriate for the mix of 16e and 16m terminals attached to a RF carrier; and the 802.16m enhancements shall be transparent to 16e terminals and BS.]

9.0 Usage Models