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| Project | **IEEE 802.16 Broadband Wireless Access Working Group <**<http://ieee802.org/16>**>** |
| Title | **Standardization of Multi-tier Networks:** **Proposed PAR and Five Criteria** |
| Date Submitted | **2012-05-15** |
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| Re: | Solicitation of input contributions by IEEE 802.16’s HetNet Study Group <<http://ieee802.org/16/sg/met>> for IEEE 802.16’s Session #79 of 14-17 May 2012 |
| Abstract | This document proposes a draft PAR for a project within the IEEE 802.16 Working Group on Multi-tier networks. |
| Purpose | This proposal requests that the HetNet Study Group review the proposal and forward it as a draft PAR. |
| Notice | *This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups*. It represents only the views of the participants listed in the “Source(s)” field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein. |
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Proposed DRAFT PAR

**P802.16q**

**Submitter Email:** r.b.marks@ieee.org
**Type of Project:** Amendment to IEEE Standard 802.16-2009
**PAR Request Date:** 15-May-2012
**PAR Approval Date:**
**PAR Expiration Date:**
**Status:** Unapproved PAR, PAR for an Amendment to an existing IEEE Standard

**1.1 Project Number:** P802.16q
**1.2 Type of Document:** Standard
**1.3 Life Cycle:** Full Use

**2.1 Title:** Standard for Local and metropolitan area networks Part 16: Air Interface for Broadband Wireless Access Systems Amendment for Multi-tier Networks

**3.1** **Working Group:** Broadband Wireless Access Working Group (C/LM/WG802.16)
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None

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**3.3** **Joint Sponsor:** IEEE Microwave Theory and Techniques Society/Standards Coordinating Committee (MTT/SCC)
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**4.1 Type of Ballot:** Individual
**4.2 Expected Date of submission of draft to the IEEE-SA for Initial Sponsor Ballot:** 03/2014
**4.3 Projected Completion Date for Submittal to RevCom:** 02/2015

**5.1 Approximate number of people expected to be actively involved in the development of this project:** 30

**5.2.a. Scope of the complete standard:** This standard specifies the air interface, including the medium access control layer (MAC) and physical layer (PHY), of combined fixed and mobile point-to-multipoint broadband wireless access (BWA) systems providing multiple services. The MAC is structured to support the WirelessMAN-SC, WirelessMAN-OFDM, and WirelessMAN-OFDMA PHY specifications, each suited to a particular operational environment.

**5.2.b. Scope of the project:** This amendment specifies medium access control (MAC) enhancements and minimal WirelessMAN-OFDMA physical layer (PHY) modifications to enhance interference mitigation, mobility management, and power management cooperation among base stations in multi-tier networks. The MAC and PHY management entities are correspondingly amended.

**5.3 Is the completion of this standard dependent upon the completion of another standard:** Yes
**If yes please explain:** IEEE Std 802.16-2012

**5.4 Purpose:** This standard enables rapid worldwide deployment of innovative, cost-effective, and interoperable multivendor broadband wireless access products, facilitates competition in broadband access by providing alternatives to wireline broadband access, encourages consistent worldwide spectrum allocation, and accelerates the commercialization of broadband wireless access systems.

**5.5 Need for the Project:** As the spectral efficiency of wireless links approaches its theoretical limits, and with the data traffic requirements continuing to grow rapidly, cell density and inter-cell cooperation must increase in order to further improve network capacity and efficiently manage radio resources. Multi-tier network architecture consisting of macrocells and a variety of smaller cells provides an approach towards solving the problem, allowing low cost per bit and efficiently utilizing all spectral resources in the system. The current IEEE Std 802.16 and the amendments under development do not address the requirements for radio resource management based on inter-cell cooperation in multi-tier network architecture. This project will address these needs, enabling cost-effective improvements in system capacity and user quality of service with interoperable and efficient management of network resources, mobility, and spectrum.

**5.6 Stakeholders for the Standard:** Vendors developing IEEE 802.16 products, carriers using IEEE 802.16 products, the WiMAX Forum(TM), ARIB, and TTA, and participants in ITU-R Working Party 5D.

**Intellectual Property**
**6.1.a. Is the Sponsor aware of any copyright permissions needed for this project?:** No
**6.1.b. Is the Sponsor aware of possible registration activity related to this project?:** No

**7.1 Are there other standards or projects with a similar scope?:** No
**7.2 Joint Development**
   **Is it the intent to develop this document jointly with another organization?:** No

**8.1 Additional Explanatory Notes (Item Number and Explanation):**

**Proposed Draft Criteria for the Development of a Standard on** **Multi-tier Networks**

**1 Broad Market Potential**

A standards project authorized by IEEE 802 LMSC shall have a broad market potential. Specifically, it shall have the potential for:

(a) Broad sets of applicability.

(b) Multiple vendors and numerous users.

(c) Balanced costs (LAN versus attached stations).

(a) The standard will be broadly applicable to IEEE Std 802.16 based systems which have been deployed in the market place worldwide.

(b) The technologies specified in the standard can be enabled by a variety of base station and mobile device vendors, and chipsets can be developed by a variety of vendors.

(c) The technologies specified in the standard will be implemented in firmware or software, so the cost will be low. In addition, the multi-tier structure using small cells allows a service provider to add capacity in cost-effective way.

**2 Compatibility**

IEEE 802 LMSC defines a family of standards. All standards should be in conformance with IEEE Std 802, IEEE Std 802.1D, and IEEE Std 802.1Q. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with the IEEE 802.1 Working Group. In order to demonstrate compatibility with this criterion, the Five Criteria statement must answer the following questions:

(a) Does the PAR mandate that the standard will comply with IEEE Std 802, IEEE Std 802.1D, and IEEE Std 802.1Q?

(b) If not, how will the Working Group ensure that the resulting draft standard is compliant or, if not, receives appropriate review from the IEEE 802.1 Working Group?

The PAR does not mandate that the standard will comply with IEEE Std 802, IEEE Std 802.1D, and IEEE Std 802.1Q. However, it will not conflict with those standards in any way. There is no specific technology feature anticipated in this amendment that could preclude this compliance.

**3 Distinct Identity**

Each IEEE 802 LMSC standard shall have a distinct identity. To achieve this, each authorized project shall be:

Substantially different from other IEEE 802 LMSC standards.

(a) One unique solution per problem (not two solutions to a problem).

(b) Easy for the document reader to select the relevant specification.

(a) This amendment is unique in its objective of providing enhancements for 802.16 multi-tier networks using licensed bands. Such capabilities are clearly distinct in terms of what’s provided in other standards because it requires tight inter-cell cooperation to provide enhanced interference mitigation, mobility management, BS power management, etc

(b) The title of this amendment and the scope is distinct enough for document readers to discern the application of this standard.

**4 Technical Feasibility**

For a project to be authorized, it shall be able to show its technical feasibility. At a minimum, the proposed project shall show:

(a) Demonstrated system feasibility.

The IEEE 802.16 PPC (Project Planning Committee) has reviewed several presentations indicating that the proposed functions are technically feasible. The technical study report on multi-tier networks (16-12-0136-00-Gdoc) is are available on the link; <https://mentor.ieee.org/802.16/>. Moreover there are examples of prototypes that have demonstrated that the goal of the project is achievable.

(b) Proven technology, reasonable testing.

Several IEEE Std 802.16 based systems have been deployed in the market place worldwide

(c) Confidence in reliability.

Reliability has been proven for several IEEE Std 802.16 based systems in the market place worldwide. This amendment is expected to be built on those features and maintain reliability in 802.16 multi-tier networks.

***4.1 Coexistence of IEEE 802 LMSC wireless standards specifying devices for unlicensed operation***

A WG proposing a wireless project is required to demonstrate coexistence through the preparation of a Coexistence Assurance (CA) document unless it is not applicable.

(a) The WG will create a CA document as part of the WG balloting process.

(b) If the WG elects not to create a CA document, it will explain to the Sponsor the reason the CA document is not applicable.

The Working Group will not create Coexistence Assurance (CA) document because only licensed band devices will be supported. Hence the co-existence requirement does not apply.

**5 Economic Feasibility**

For a project to be authorized, it shall be able to show economic feasibility (so far as can reasonably be estimated) for its intended applications. At a minimum, the proposed project shall show:

(a) Known cost factors, reliable data.

The incremental cost of implementing this amendment over systems based on IEEE Std 802.16 are nominal and within the realm of economic feasibility because the solution is expected to operate in firmware or software.

(b) Reasonable cost for performance.

There is no expectation of significant costs incurred to support multi-tier networks in a device or a base station beyond a reasonable amount that is actually feasible. Nevertheless, the project will attempt to minimize the burden on the device and base station, consistent with an overall optimized solution. The standard will provide for control of the tradeoff between cost and performance, so that cost-driven users can reduce the number of functions depending on their requirements

(c) Consideration of installation costs.

Seeing the wide economic feasibility of IEEE Std 802.16 based systems deployed in the field today worldwide, the additional installation costs incurred for supporting this standard are within reasonable bounds