P802.16r

Submitter Email: r.b.marks@ieee.org
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PAR Expiration Date: 31-Dec-2016
Status: PAR for an Amendment to an existing IEEE Standard
Root Project: 802.16-2012

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

2.1 Title: IEEE Standard for Air Interface for Broadband Wireless Access Systems - Amendment for Small Cell Backhaul (SCB)

3.1 Working Group: Broadband Wireless Access Working Group (C/LM/WG802.16)
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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: 07/2013
4.3 Projected Completion Date for Submittal to RevCom: 05/2014

5.1 Approximate number of people expected to be actively involved in the development of this project: 20

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, including backhaul. The MAC is structured to support the WirelessMAN-SC, WirelessMAN-OFDM, and WirelessMAN-OFDMA PHY specifications, each suited to a particular operational environment.

Changes in scope: 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, including backhaul. 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 project will develop an amendment specifying enhancements to the WirelessMAN-OFDMA air interface for effective use in wireless fixed and nomadic Ethernet transport, including small cell backhaul applications, providing core network services to radio access networks. It will focus on backhaul operating in licensed bands below 6 GHz, in which the backhaul radio operates far enough outside the band of the small cells that interference is negligible. It will add 256QAM, 512QAM, and 1024QAM options in both uplink and downlink, with optional 4x4 MIMO in both directions, along with

further enhancements that address small cell backhaul efficiency. Significant latency improvements will be attained. Enhancements to the Convergence Sublayer specifications will be incorporated as necessary for support of Carrier Ethernet 2.0 backhaul requirements. The functionalities required for small cell backhaul support, including new functionalities but not necessarily all those included the baseline standard, will be specified explicitly.

5.3 Is the completion of this standard dependent upon the completion of another standard: No
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 cooperation among base stations must increase in order to further improve network capacity and efficiently manage radio resources. Multi-tier access network architecture consisting of macrocells and a variety of overlaid smaller cells provides an approach towards solving the problem, allowing low cost per bit and efficiently utilizing all spectral resources in the system. Some such systems will be deployed using radio access technology outside the realm of IEEE 802.16. In such cases, IEEE Std 802.16, as enhanced, can provide out-of-band wireless backhaul to the small cells, allowing those cells to be positioned for optimal performance without regard to the local availability of high-capacity wired backhaul. The resulting system design will offer improvements in spectral efficiency needed to support the rapidly expanding demand for mobile broadband access.

5.6 Stakeholders for the Standard: Wireless network operators and potential operators, manufacturers of small cells, manufacturers of fixed wireless products, the WiMAX Forum, the Metro Ethernet Forum, the Small Cell Forum, the NGMN Alliance, and 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

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8.1 Additional Explanatory Notes (Item Number and Explanation):

Annex 2: *Five Criteria for the Development of an IEEE Std 802.16 Amendment on Small-Cell Backhaul (SCB)*

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 has a broad market potential. It will specify an air interface suitable for backhauling stationary wireless cells that support nearly any air interface. The small cell air interface could be, for example, WirelessMAN-OFDMA, WirelessMAN-Advanced, IEEE 802.11, or 3GPP LTE.
(b) Specifying the air interface provides an opportunity for multiple vendors to implement the system. In particular, designers of small cells will be empowered by the standardized interoperable backhaul, so they can focus their innovation on optimizing the cell to support the end users.
(c) The capital and operating expense of the backhaul network is a demonstrably significant element of a small cell deployment. Considering the cost and complexity of providing wired backhaul to many small cells, this standardized wireless approach is expected to result in improved balance by lowering the expense of the backhaul network with respect to the cost of the attached cells.

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?

(a) The standard will comply with IEEE Std 802, IEEE Std 802.1D, and IEEE Std 802.1Q.

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.

The WirelessMAN-OFDMA air interface in the base IEEE Std 802.16-2012 is capable of supporting small-cell backhaul applications. This amendment will provide a unique solution to the problem of refining the WirelessMAN-OFDMA air interface to address the specific issues involved in small-cell backhaul. The title and scope of the standard will aid the reader in identifying the specification and its application.

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 technical feasibility of the system is well established through the successful deployment of existing systems based on the WirelessMAN-OFDMA air interface. The fundamental operation of the system will be unchanged.

(b) Proven technology, reasonable testing.
The enhancements to be developed within the scope of the project are well understood technically and have been successfully deployed in other air interfaces. The testing of the new features will not introduce fundamental complications, although higher MIMO orders can be expected to introduce new testing complexity.

(c) Confidence in reliability.

Because the enhancements to be developed within the scope of the project are well understood technically and have been successfully deployed in other air interfaces, no clear reliability risk factors are apparent.

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 a Coexistence Assurance (CA) document because the amended air interface will be specified for licensed bands.

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.

Higher order modulation is an additional cost factor and may require more demanding specifications on linearity in radio components. However, since the radio will operated in a fixed or nomadic location, presumably with a larger power source than commonly available in mobile applications, the demands on power efficiency can be somewhat relaxed, keeping the component costs feasible. Likewise, higher order MIMO adds marginally to the cost of antenna and processing hardware.

(b) Reasonable cost for performance.

All of the marginal costs of the enhanced radio system are expected to be moderate in comparison to the added value of a more spectrally efficient air interface. Currently, licensed radio spectrum suitable for broadband wireless use is scarce and costly. Straightforward technology to improve spectral efficiency is expected to prove highly cost effective.

(c) Consideration of installation costs.

Installation costs for this wireless backhaul solution will be substantially smaller than installation costs for wired backhaul due to the reduced need for a cabled infrastructure.

References:

NGMN Alliance, "NGMN Optimized Backhaul Requirements," August 2008

NGMN Alliance, "Small Cell Backhaul Requirements," June 2012

Metro Ethernet Forum, "Microwave Technologies For Carrier Ethernet Services," January 2011

Metro Ethernet Forum, Implementation Agreement MEF 22.1, "Mobile Backhaul Phase 2," January 2012

Metro Ethernet Forum, Implementation Agreement MEF 23.1, "Carrier Ethernet Class of Service – Phase 2," January 2012

Small Cell Forum, "W-CDMA Open Access Small Cells: Architecture, Requirements and Dependencies," May 2012

Small Cell Forum, "Small Cell Market Status, Issue 2," June 2012

Paul Trubridge and Roger Marks, "Need for Small-Cell Backhaul (SCB) Enhancements to WirelessMAN-OFDMA" (IEEE 802.16-12-0451-00-Shet), July 2012

Annex 3: *Work plan for the development of managed object definitions*

The amendment will update the managed object definitions of the baseline standard as necessary to support the new protocol specifications.