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| Project | **IEEE 802.16 Broadband Wireless Access Working Group <**<http://ieee802.org/16>**>** | |
| Title | **Standardization of Mobile Wireless Small Cell Backhaul : Proposed draft PAR and CSD** | |
| Date Submitted | **2014-11-03** | |
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| Re: | Call for Contribution (16-14-0064-01-000r) | |
| Abstract | This document proposes a draft PAR and CSD for Mobile Wireless Small Cell Backhaul | |
| Purpose | This proposal requests that the 802.16 WG reviews the proposal | |
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**Annex 1: Proposed Draft PAR for Development of Mobile Wireless Small Cell Backhaul**

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Type of Project: Amendment to IEEE Standard 802.16-2012

PAR Request Date:

PAR Approval Date:

PAR Expiration Date:

Status: Unapproved PAR, PAR for an Amendment to an existing IEEE Standard

1.1 Project Number: P802.16r

1.2 Type of Document: Standard

1.3 Life Cycle: Full Use

2.1 Title: Standard for Air Interface for Broadband Wireless Access Systems Amendment for Mobile Wireless Small Cell Backhaul

3.1 Working Group: Broadband Wireless Access Working Group (C/LM/WG802.16)

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None

3.2 Sponsoring Society and Committee: IEEE Computer Society/LAN/MAN Standards Committee (C/LM) Contact Information for Sponsor Chair Name: Paul Nikolich

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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: 07/2015

4.3 Projected Completion Date for Submittal to RevCom:

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 mobile wireless small cell backhaul (MWSCB). The MAC is structured to support the WirelessMAN-SC, WirelessMAN-OFDM, WirelessMAN-OFDMA, and MWSCB PHY specifications, each suited to a particular operational environment.

5.2.b. Scope of the project: This project will develop a standard specifying the air interface for effective use in mobile wireless Ethernet transport, including MWSCB applications supporting small cells moving at speeds of up to 400km/h, providing core network services to radio access networks. It will focus on backhaul operating in licensed or unlicensed bands from 20 to 40 GHz, in which the backhaul radio operates with wide bandwidth of up to 1GHz, and far enough outside the band of the small cells that interference is negligible, along with further enhancements that address MWSCB network capacity. The functionalities required for MWSCB support will be specified explicitly.

5.3 Is the completion of this standard dependent upon the completion of another standard: No

5.4 Purpose: The purpose of this project is to provide a standard that supports a variety of moving cells to remain connected with data rates of Giga bit per second (bps) while they keep moving with very high speeds of up to 400 km/h. -The standard can encourage consistent worldwide spectrum allocation, facilitate competition in the related industries, and accelerate the commercialization of MWSCBs. Accordingly, it enables rapid worldwide deployment of innovative, cost-effective, and interoperable multivendor BWA products for MWSCBs.

5.5 Need for the Project: According to Cisco’s market forecast, mobile data traffic is predicted to increase 11-fold between 2013 and 2018. It also reads that proliferation of smart phones will lead the traffic increase. Consequently, this will explosively increase the number of end users of smart devices accessing the mobile Internet on the fast moving vehicles such as the high-speed trains, subways, and buses. However, there are no existing standards or projects that support multi-gigabit data throughput and mobility of up to 400 km/h simultaneously. The evolution of mobile networks is impeded by major obstacles: the scarcity of the spectrum resources below 6 GHz and very low spectral efficiency for high mobility. In this regard, the project is necessary to provide solutions tackling these problems and satisfying the rapidly expanding demand of end users in the fast moving vehicles.

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

8.1 Additional Explanatory Notes (Item Number and Explanation):

**Annex 2: Proposed Draft CSD for Development of Mobile Wireless Small Cell Backhaul**

**1.1 Project process requirements**

**1.1.1 Managed objects**

Describe the plan for developing a definition of managed objects. The plan shall specify one of the following:

1. The definitions will be part of this project.

Yes

1. The definitions will be part of a different project and provide the plan for that project or anticipated future project.
2. The definitions will not be developed and explain why such definitions are not needed.

**1.1.2 Coexistence**

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

1. Will the WG create a CA document as part of the WG balloting process as described in Clause 13? (yes/no)

Yes

1. If not, explain why the CA document is not applicable.

**1.2 5C requirements**

**1.2.1 Broad Market Potential**

Each proposed IEEE 802 LMSC standard shall have broad market potential. At a minimum, address the following areas:

1. Broad sets of applicability.

Cisco’s market forecast predicts that global mobile data traffic will increase nearly 11-fold between 2013 and 2018, reaching 15.9 exabytes per month by 2018. Meanwhile, the pattern of mobile Internet usage vs. mobility reflects that high-speed users soar as well as nomadic users. Since this project is to specify an air interface suitable for multi-gigabit backhauling moving small cells such as the high-speed trains, subways, and buses, broad sets of applications are foreseen. In addition, the standard supports nearly any air interface, which facilitates the deployment of small. The small cell air interface could be, for example, WirelessMAN-OFDMA, WirelessMAN-Advanced, IEEE 802.11a/b/g/n/ac, or 3GPP LTE/LTE-Advanced.

1. Multiple vendors and numerous users.

Currently, small cell backhaul attracts a lot of interest from multiple vendors. This standard will have positive impact on extending the small cell markets and strengthen the competition among the world-wide vendors, which will benefit numerous end users inside the moving small cells to access mobile Internet.

**1.2.2 Compatibility**

Each proposed IEEE 802 LMSC standard should be in conformance with IEEE Std 802, IEEE 802.1AC, and IEEE 802.1Q. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1 WG prior to submitting a PAR to the Sponsor.

1. Will the proposed standard comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q?

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

1. If the answer to a) is no, supply the response from the IEEE 802.1 WG.

The review and response is not required if the proposed standard is an amendment or revision to an existing standard for which it has been previously determined that compliance with the above IEEE 802 standards is not possible. In this case, the CSD statement shall state that this is the case.

**1.2.3 Distinct Identity**

Each proposed IEEE 802 LMSC standard shall provide evidence of a distinct identity. Identify standards and standards projects with similar scopes and for each one describe why the proposed project is substantially different.

There are no existing standards or projects developing the air interface for MWSCB supporting multi-gigabit data transfers between base stations and moving small cells with high mobility. Although existing standards such as UWB, IEEE 802.11ac, and IEEE 802.11ad address the specification of providing high data rate service using wide spectrum, it is not applicable to high-speed case. Furthermore, other existing standards that meet IMT-Advanced requirement for high-speed case, WirelessMAN-Advanced and 3GPP LTE providing far less than 1Gbps, are still not enough to satisfy the rapidly growing traffic demands. Therefore, this project is to provide a unique standard that supports multi-gigabit data throughput for MWSCBs with mobility of up to 400 km.

**1.2.4 Technical Feasibility**

Each proposed IEEE 802 LMSC standard shall provide evidence that the project is technically feasible within the time frame of the project. At a minimum, address the following items to demonstrate technical feasibility:

1. Demonstrated system feasibility.

The air interface for MWSCB should support both wide-band management and high-mobility simultaneously. The wide-spectrum handling technologies are well established in IEEE standards such as IEEE 802.11ac and 802.11ad. The high-mobility support is well established in IMT-Advanced compliant standards such as LTE-Advanced and WirelessMAN-Advanced. The standard will be specified on the basis of these proven technologies, which can guarantee the system feasibility.

1. Proven similar technology via testing, modeling, simulation, etc.

Proven technologies of IEEE 802.11ac, 802.11ad, LTE-Advanced, and WirelessMAN-Advanced will be the bases for the specification of the air interface for MWSCB.

**1.2.5 Economic Feasibility**

Each proposed IEEE 802 LMSC standard shall provide evidence of economic feasibility. Demonstrate, as far as can reasonably be estimated, the economic feasibility of the proposed project for its intended applications. Among the areas that may be addressed in the cost for performance analysis are the following:

1. Balanced costs (infrastructure versus attached stations).

Implementation complexities and the costs thereof will be balanced between the base stations and the mobile stations.

1. Known cost factors.

The cost factors of deployment of base stations and small cells are well known in the industries including vendors and network operators. Other cost factors related to the beam forming technologies, i.e. those for the radio frequency devices and antennas at the higher frequency and the corresponding hardware to process them in digital domain are quite reasonable.

1. Consideration of installation costs.

Installation costs for the MWSCBs will be substantially smaller than those for wired backhaul due to the reduced need for cabled infrastructure.

1. Consideration of operational costs (e.g., energy consumption).

In consideration of operational costs, the project has adopted a goal to support optional energy saving modes, which will help reduce operational costs and ecological footprint.

1. Other areas, as appropriate.

No

**References:**

NGMN Alliance, “[NGMN Optimized Backhaul Requirements](http://www.ngmn.org/uploads/media/NGMN_Optimised_Backhaul_Requirements.pdf),” August 2008

NGMN Alliance, “[Small Cell Backhaul Requirements](http://www.ngmn.org/uploads/media/NGMN_Whitepaper_Small_Cell_Backhaul_Requirements.pdf),” June 2012

Metro Ethernet Forum, “[Microwave Technologies For Carrier Ethernet Services](http://metroethernetforum.org/PDF_Documents/MEF_Microwave_Technology_for_Carrier_Ethernet_Final_110318_000010_000.pdf),” January 2011

Metro Ethernet Forum, Implementation Agreement MEF 22.1, “[Mobile Backhaul Phase 2](http://www.metroethernetforum.org/PDF_Documents/technical-specifications/MEF_22.1.pdf),” January 2012

Metro Ethernet Forum, Implementation Agreement MEF 23.1, “[Carrier Ethernet Class of Service – Phase 2](http://www.metroethernetforum.org/PDF_Documents/technical-specifications/MEF_23.1.pdf),” January 2012

Small Cell Forum, “[W-CDMA Open Access Small Cells: Architecture, Requirements and Dependencies](http://smallcellforum.org/smallcellforum_resources/pdfsend01.php?file=038%20Open%20Access%20paper%20final.pdf),” May 2012

Small Cell Forum, “[Small Cell Market Status, Issue 2](http://smallcellforum.org/smallcellforum_resources/pdfsend01.php?file=Small_Cells_2012Q2_Market_Update.pdf),” June 2012

Paul Trubridge and Roger Marks, “Need for Small-Cell Backhaul (SCB) Enhancements to WirelessMAN-OFDMA” ([IEEE 802.16-12-0451-00-Shet](http://doc.wirelessman.org/12-0451)), July 2012

White Paper, “Cisco Visual Networking Index Global Mobile Data Forecast, 2013-2018,” February 2014