Project	**IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>**
Title	**Draft PAR and Five Criteria from Greater Reliability In Disrupted Metropolitan Area Networks (GRIDMAN) Study Group**
Date Submitted	**18 March 2010**

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Abstract	The attached DRAFT PAR and five criteria is offered by the GRIDMAN study group for consideration by the IEEE 802.16 WG and IEEE 802 Executive Committee.

Purpose	This document is supporting the submission of the PAR to the IEEE 802 Executive Committee.
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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Patent Policy	The contributor is familiar with the IEEE-SA Patent Policy and Procedures: <http://standards.ieee.org/guides/bylaws/sect6-7.html#6> and <http://standards.ieee.org/guides/opman/sect6.html#6.3>. Further information is located at <http://standards.ieee.org/board/pat/pat-material.html> and <http://standards.ieee.org/board/pat>.

PAR FORM (DRAFT)

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Type of Project: Amendment to IEEE Standard 802.16-2009

1.1 Project Number: P802.16n
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: Higher Reliability Networks

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3.1 Working Group: Broadband Wireless Access Working Group (C/LM/WG802.16)
Contact Information for Working Group Chair
Name: Roger Marks
Email Address: r.b.marks@ieee.org
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Contact Information for Working Group Vice-Chair
None

3.2 Sponsoring Society and Committee: IEEE Computer Society/Local and Metropolitan Area Networks (C/LM)
Contact Information for Sponsor Chair
Name: Paul Nikolich
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Contact Information for Standards Representative
None

4.1 Type of Ballot: Individual
4.2 Expected Date of submission of draft to the IEEE-SA for Initial Sponsor Ballot: 01/2012
4.3 Projected Completion Date for Submittal to RevCom: 03/2013

5.1 Approximate number of people expected to be actively involved in the development of this project: 20
5.2 Scope: This amendment specifies protocol enhancements to the IEEE 802.16 MAC for enabling increased robustness and alternate radio path establishment in degraded network conditions. Limited OFDMA PHY extensions are included for enabling operation with radio path redundancy and direct communication between subscriber stations. Also mobile base stations and mobile relay stations are supported. Support for enabling application specific specialized security suites is also provided.

5.3 Is the completion of this standard dependent upon the completion of another standard: No
5.4 Purpose: This amendment is intended to address higher reliability requirements that are not supported by IEEE Std. 802.16 presently.

5.5 Need for the Project: Work undertaken within Land Mobile Radio, Aeronautic, Maritime and Government bodies, such as the TETRA Association, Eurocae, International Maritime Organization, and the US Department of Homeland Security and Federal Aviation Administration, regarding the deployment of IEEE 802.16 technology in Public Safety, Avionics, Airport Surface Communication, Maritime Safety, and Surveillance applications, has raised specific issues which may be addressed within IEEE 802.16. Recently introduced legislation in U.S. and other countries encourages and funds a wide range of activities in communications technologies supporting Smart Grid applications such as monitoring and control of generation, transmission, distribution and consumption of energy resources. This project is expected to support communication with higher reliability that may be used in some Smart Grid applications.
High data rates and long range are required for some of these applications. 802.16 technology is uniquely suitable for these purposes, due to its inherent longer range and high data rate capability compared to other wireless technologies.
The benefit of this particular project is to facilitate applications for those new markets. In particular, the new mechanisms will be advantageous for IEEE 802.16 when targeted to those applications.

5.6 Stakeholders for the Standard: Semiconductor manufacturers, network equipment manufacturers, mobile and wireless device manufacturers, network operators, utility companies, government agencies (e.g. US Department of Homeland Security, Department of Energy and the Federal Aviation Administration), non-government agencies with equivalent interest and the public safety and energy industries.

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

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7.1 Are there other standards or projects with a similar scope?: No
7.2 International Activities
a. Adoption
Is there potential for this standard (in part or in whole) to be adopted by another national, regional or international organization?: Do Not Know
Organization:
Technical Committee Name:
Technical Committee Number:
Contact Name:

Phone:
Email:

b. Joint Development

Is it the intent to develop this document jointly with another organization?: No

c. Harmonization

Are you aware of another organization that may be interested in portions of this document in their standardization development efforts?: Do Not Know

Organization:
Technical Committee Name:
Technical Committee Number:
Contact Name:
Phone:
Email:

8.1 Additional Explanatory Notes (Item Number and Explanation):

In Section 5.2 the following definitions and notes apply:

Degraded Network: The failure of one or more 802.16 network infrastructure nodes or network connectivity.
Robustness: The capability of the network to withstand and automatically recover from degradation to provide the required availability to support mission critical applications (essential to the core function of society and the economy). E.g. the ability to recover from a single point of failure.
Mobile Base Station: A base station which is capable of maintaining service while moving.
Radio Path Redundancy: The ability to provide alternative paths between base stations, relay stations, and subscriber stations.

Operation in licensed, unlicensed and lightly licensed spectrum bands below 6 GHz with means and mechanisms to coexist with other radio access technologies (RATs) is supported.

FIVE CRITERIA

Broad Market Potential

A standards project authorized by IEEE 802 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 amendment will be applicable to various classes of applications, including Land Mobile Radio (LMR), as well as Surveillance applications, Airport/Maritime Communication, Disaster Responder and Replacement. In those applications, a general demand for more sophisticated services (e.g. video streaming and video conference) has raised a need for a technology enhancement, while maintaining high requirements for resilience and reliability.
The amendment will enable real time monitoring and control of distribution and consumption of energy and other resources.
Support for these applications, within the IEEE 802.16 family of standards, will enhance the adoption of this family of standards in those applications by providing the users with additional capabilities.

b) The various companies and organizations participating in the IEEE 802.16 GRIDMAN Study Group and previous NRR WG Ad Hoc Committee demonstrate the broad interest in the proposed concept. Indeed the Committee has brought together semiconductor and equipment manufacturers, system integrators, research organizations and end users.
Furthermore the target applications are associated with a wide range of users such as public safety agencies (e.g. Police, firefighters and Emergency Medical Services), industrial and construction companies, utilities and transport (e.g. bus, rail, airport, harbor) providers and government organizations.

c) Incremental cost of the proposed amendment will be balanced between the network nodes based on their relative inherent cost and network prevalence.

Compatibility

IEEE 802 defines a family of standards. All standards shall be in conformance with the IEEE 802.1 Architecture, Management, and Interworking documents as follows: 802 Overview and Architecture, 802.1D, 802.1Q, and parts of 802.1f. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with 802.
Each standard in the IEEE 802 family of standards shall include a definition of managed objects which are compatible with systems management standards.

This amendment will be in conformance with IEEE 802.1 architecture, management, and inter-networking and be backward compatible with all relevant IEEE 802.16 specifications.

Distinct Identity

Each IEEE 802 standard shall have a distinct identity. To achieve this, each authorized project shall be:
a) Substantially different from other IEEE 802 standards.
b) One unique solution per problem (not two solutions to a problem).
c) Easy for the document reader to select the relevant specification.

a) There are no other standards in the IEEE 802 that provide reliable communication between stations, that may be either fixed or mobile, over a metropolitan area network (MAN), even when infrastructure is not present or partially available. Current projects in 802.16 may not offer both mobile and resilient operation far from any infrastructure.
There is a limited potential for overlap with p802.15.4g and 802.11 ("smart grid"); however 802.16 provides distinct advantages over those due to its inherent higher data rate and range.

b) This amendment will address a unique solution to the topic presented above.

c) The supplementary functions specified in this amendment will be clearly distinguishable from the existing IEEE 802.16 specifications.

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.
b) Proven technology, reasonable testing.
c) Confidence in reliability.

a) The IEEE 802.16 GRIDMAN Study Group and prior Network Robustness and Reliability (NRR) WG Ad Hoc Committee have reviewed several presentations indicating that the proposed functions are technically feasible. The technical reference documents and in particular the NRR report (802.16gman-10/0019r1) are available on the link: http://ieee802.org/16/sg/gridman/index.html#10_0019. Moreover there are examples of prototypes that have demonstrated that the goal of the project is achievable.

b) The project will be based on the 802.16 technology, which is mature and proven to work appropriately.

c) During the development of this amendment, the reliability will be addressed with significant attention since the resulting systems will have to be used in critical missions and rough environments.

Coexistence of 802 wireless standards specifying devices for unlicensed operation

The working group will create a CA document as part of the WG balloting process.

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.
b) Reasonable cost for performance.
c) Consideration of installation costs.

a) It is predicted that the cost of the resulting systems will be close to the cost of existing 802.16 technology, taking into account that the equipment and deployment costs of 802.16 systems are well known. The equipment cost may increase slightly due to the additional capabilities, but having no PHY changes will limit incremental cost of the amendment. In addition, the added network resilience can eliminate the need for redundant infrastructure with its inherent cost.

b) Based on the end users expectations, the additional capabilities are worth the slight increase in cost of the equipment.

c) The ability to operate with degraded infrastructure (e.g. limited backhaul capability or failing network nodes) will result in a significant reduction of installation costs.