Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Draft for 802.16 Mobile Multi-hop Replay Study Group Draft PAR and Five Criteria**
Date Submitted	**2006-01-12**
Source(s)	Mitsuo Nohara Mobile Multi-hop Relay SG Chair KDDI Corporation 10-10, Iidabashi 3-chome, Chiyoda-ku Tokyo 102-8460, Japan Voice: +81 3 6678 3599 Fax: +81 3 6678 0279 mailto: mi-nohara@kddi.com
Re:	
Abstract	
Purpose	Recommendation of IEEE802.16j PAR and 5 Criteria by 802.16 MMR SG
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.
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.
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>.

IEEE-SA STANDARDS BOARD

PROJECT AUTHORIZATION REQUEST (PAR) FORM – 2005

The submittal deadlines are available at http://standards.ieee.org/board/nes/index.html.
(See NesCom Convention - Item #14)

Prior to submitting your PAR, please review the NesCom Conventions.

1. ASSIGNED PROJECT NUMBER

P ***802.16j*** (Please leave blank if not available)
(see NesCom Convention – Item #19)

2. SPONSOR DATE OF REQUEST

Day: ***17*** Month: ***02*** Year: ***2006***

3. TYPE OF DOCUMENT

(Please check one.)

☒ Standard for {document stressing the verb "shall"}

☐ Recommended Practice for {document stressing the verb "should"}

☐ Guide for {document in which good practices are suggested, stressing the verb "may"}

4. TITLE OF DOCUMENT

(See NesCom Conventions – Item #5, Item #7)

Draft

Amendment to IEEE Standard for Local and Metropolitan Area Networks – Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems – Physical and Medium Access Control Layers for Mobile Multihop Relay

5. LIFE CYCLE

☒ Full-Use

☐ Trial-Use

6. TYPE OF PROJECT

☒ New document

☐ Revision of an existing document (indicate number and year existing document was approved in box to the right):

☒ Amendment to an existing document (indicate number and year existing document was approved in box to the right): ***IEEE Std 802.16-2004(as subsequently amended)*** (####-YYYY)

☐ Corrigendum to an existing document (indicate number and year existing document was approved in box to the right):

☐ Modified PAR (indicate PAR Number and Approval Date here: P___ Day: ___ Month: ___ Year: ___)

Is this project in ballot now? ☐ Yes ☐ No

State reason for modifying the PAR in Item #21.

7. WORKING GROUP INFORMATION:

Name of Working Group (WG) : ***IEEE 802.16 Working Group on Broadband Wireless Access***

Approximate Number of Expected Working Group Members: ***300***

8. CONTACT INFORMATION FOR WORKING GROUP CHAIR

(must be an IEEE-SA member as well as an IEEE and/or Affiliate Member)
(See NesCom Convention Item #3, Item #4)

Name of Working Group Chair: First Name: ***Roger*** Last Name: ***Marks***
Telephone: ***+1 303 497 7837*** FAX: ___ E-mail: ***r.b.marks@ieee.org***

9. CONTACT INFORMATION FOR CO-CHAIR/OFFICIAL REPORTER,

Project Editor or Document Custodian if different from the Working Group Chair (must be an IEEE-SA member as well as an IEEE and/or Affiliate Member)
(See NesCom Convention Item #3)

Name of Co-Chair/Official Reporter (if different than Working Group Chair): First Name: ___ Last Name: ___
Telephone: ___ FAX: ___ E-mail:___

10. CONTACT INFORMATION FOR SPONSORING SOCIETY OR STANDARDS COORDINATING COMMITTEE

(See NesCom Convention Item #1, Item #3)

Sponsoring Society and Committee: ***C/LM***
(Please choose the correct acronym for your Sponsor Society/Technical Committee or SCC. For an acronym list, please click here.)
Sponsor Committee Chair: First Name: ***Paul*** Last Name: ***Nikolich***
Telephone: ***+1 857 205 0050*** FAX: ___ E-mail: ***p.nikolich@ieee,org***

Standards Coordinator (Power Engineering Society Only):
Standards Coordinator: First Name: ___ Last Name: ___
Telephone: ___ FAX: ___ E-mail: ___

IF THIS PROJECT IS BEING SPONSORED BY TWO SPONSORS, PLEASE COMPLETE THE INFORMATION BELOW
Sponsoring Society and Committee: ***MTT***
(Please choose the correct acronym for your Sponsor Society/Technical Committee or SCC. For an acronym list, please click here.)
Sponsor Committee Chair: First Name: ***Richard*** Last Name: ***Snyder***
Telephone: ***+ 1 973 492 1207, ext 23***
FAX: ___ E-mail: ***r.snyder@ieee.org***

Standards Coordinator (Power Engineering Society Only):
Standards Coordinator: First Name: ___ Last Name: ___
Telephone: ___ FAX: ___ E-mail: ___

11. SPONSOR BALLOTING INFORMATION

(Please choose one of the following):
☒ Individual Balloting
☐ Entity Balloting
☐ Mixed Balloting (combination of Individual and Entity Balloting)
Expected Date of Submission for Initial Sponsor Ballot: Month: ***3*** Year: ***2007***

Please review the PAR form three months prior to submitting your draft for ballot to ensure that the title, scope, and purpose on the PAR form match the title, scope, and purpose of the draft. If they do not match, you will probably need to submit a modified PAR.

Additional communication and input from other organizations or other IEEE Standards Sponsors should be encouraged through participation in the working group or the invitation pool.

(See NesCom Conventions - Item #20)

12. PROJECTED COMPLETION DATE FOR SUBMITTAL TO REVCOM:

Month: ***9*** Year: ***2007***

If this is a MODIFIED PAR and the completion date is being extended past the original four-year life of the PAR, please answer the following questions. If this is not a modified PAR, please go to Question #13.
(See NesCom Conventions - Item #18)

a. Statement of why the extension is required: ___
b. How many working group members are working on the project? ___
c. How many times a year does the working group meet: ___
    1. In person? ___
    2. Via teleconference? ___
d. How many times a year is a draft version circulated to the working group via electronic means? ___
e. What percentage of the Draft is stable? ___%

f. How many significant working revisions has the Draft been through? ___
g. Balloting History - If the draft has gone to ballot, please provide a history of all IEEE Sponsor ballots under this project in the box to the right. Please include the: ___
_Ballot Close Date (or scheduled Close Date)
_Ballot Draft Number
_Ballot Results (% affirmative, % negative, % abstain)
h. Is this the first request for an extension? [X] Yes [X] No
If no, when was the previous extension approved? ___ (DD-MMM-YYYY)

13. SCOPE OF PROPOSED PROJECT

(See NesCom Conventions – Item #6, Item #16, Item #17)

Briefly detail the projected output including technical boundaries.
FOR MODIFIED PROJECTS/REVISION DOCUMENTS - Only detail the projected output including the scope of the project or last published document to be modified and any amendments and/or additions.

This document specifies OFDMA physical layer and medium access control layer enhancements to IEEE Std 802.16 for licensed bands to enable the operation of relay stations. Subscriber station specifications are not changed.

Is the completion of this document contingent upon the completion of another document?
[ ] Yes (with detailed explanation below) [X] No

14. PURPOSE OF PROPOSED PROJECT

Briefly, clearly and concisely explain "why" the document is being created.
(See NesCom Conventions - Item #16)

FOR MODIFIED PROJECTS/REVISION DOCUMENTS - Only include the purpose of the project or last published document and any amendments and/or additions.

This amendment provides specifications for mobile multihop relay features, functions and interoperable relay stations to enhance coverage, throughput and system capacity of 802.16 networks.

15. REASON FOR THE PROPOSED PROJECT

Give the specific reason for the standardization project. Focus on explaining the problem being addressed, the benefit to be provided and the stakeholders for the project.

The multihop relay is a promising solution to expand coverage, enhance throughput and system capacity to IEEE 802.16 systems. It is expected that the complexity of relay stations will be considerably less than the complexity of legacy IEEE 802.16 base stations. The gains in coverage & throughput can be leveraged to reduce total deployment cost for a given system performance requirement and thereby improve the economic viability of IEEE802.16 systems. Relay functionality enables rapid deployment and reduces the cost of system operation. These advantages will expand the market opportunity for Broadband Wireless Access.

This project aims to enable exploitation of such advantages by adding appropriate relay functionality to IEEE Std 802.16 through the proposed amendment.

16. INTELLECTUAL PROPERTY

(Please answer each of the questions below)

a. Has the IEEE-SA policy on intellectual property been presented to those responsible for preparing/submitting this PAR prior to the PAR submittal to the IEEE-SA Standards Board? [X] Yes [ ] No

If yes, state date: Day: ___ Month: ___ Year: ___
If no, please explain: ___

b. Is the Sponsor aware of copyright permissions needed for this project? [ ] Yes [X] No

If yes, please explain: ___

c. Is the Sponsor aware of trademarks that apply to this project? [ ] Yes [X] No

If yes, please explain: ___

d. Is the Sponsor aware of possible registration activity related to this project? [ ] Yes [X] No

If yes, please explain: ___

17. ARE THERE OTHER DOCUMENTS OR PROJECTS WITH A SIMILAR SCOPE?

[X] Yes (with detailed explanation below) [ ] No

If Yes, please answer the following:
Sponsor Organization: ___
Project/Document Number: ___

Project/Document Date: _ (DD-MMM-YYYY)
Project/Document Title:

18. FUTURE ADOPTIONS

Is there potential for this document (in part or in whole) to be adopted by another national, regional or international organization? ***Yes***

If Yes, the following questions must be answered:
Technical Committee Name and Number: ***ITU*** TC ___ SC ___ WG ___
Other Organization Contact Information:
Contact Name - First Name: ***Jose*** Contact Name - Last Name: ***Costa***
Contact Telephone Number: ***+1 613 763 7574***
Contact FAX Number: ***+1 613 765 1225***
Contact Email address: ***j.costa@ieee.org***

19. WILL THIS PROJECT RESULT IN ANY HEALTH, SAFETY, OR ENVIRONMENTAL GUIDANCE THAT AFFECTS OR APPLIES TO HUMAN HEALTH OR SAFETY?

☐ Yes ☒ No
If yes, please explain: ___

20. SPONSOR INFORMATION

a. Is the scope of this project within the approved scope/definition of the Sponsor's Charter? ☒ Yes ☐ No

If no, please explain: ___

b. Have the Sponsor's procedures been accepted by the IEEE-SA Standards Board Audit Committee? ☒ Yes ☐ No
(See NesCom Convention Item #2)

21. ADDITIONAL EXPLANATORY NOTES

(Item Number and Explanation)

Item 13. The relay station is controlled by the base station.

☒ I acknowledge having read and understood the IEEE Code of Ethics. I agree to conduct myself in a manner which adheres to the IEEE Code of Ethics when engaged in official IEEE business.

The PAR Copyright Release and Signature Page must be submitted by FAX to +1 732-875-0695 to the NesCom Administrator before this PAR will be forwarded to NesCom and the Standards Board for approval.

(See NesCom Conventions - Item #8, Item #9, Item #10

FIVE CRITERIA FOR IEEE 802.16 MOBILE MULTI-HOP RELAY PAR

IEEE P802.16mmr Five Criteria
CRITERIA FOR STANDARDS DEVELOPMENT (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) IEEE Std. 802.16 will compete with, and provide alternative services to, xDSL, Cable, T1 and fiber optic broadband technologies. It will also provide wireless access at a higher data rate compared with conventional cellular services. The amendment through relay stations will be applicable to the already existing IEEE Std 802.16 which itself already has a broad set of applicability as stated above, and through this amendment the applications of this standard will be further broadened due to the amendment enabling lower cost deployments. This is because the amendment will provide a cost effective way for multi-media traffic to considerably increase in range. In addition, this amendment will most likely improve throughput,
b) IEEE802.16's higher data rate and wide coverage for Wireless MAN, attract many commerce leaders. The approval of MMR (Mobile Multihop Relay)-SG by 77 members including various manufacturers and telecom operators, signifies the possibility of multiple vendors. Furthermore, during the first two meetings of the SG, forty-three contributions from more than fifteen organizations were received.
High density of base stations to enhance coverage in shadowed or underserved area is not a feasible solution, resulting in considerably higher deployment costs. The relay capabilities will be able to overcome this issue, and increase the possible number of users.
Consequently, given that the multi-hop relay technology meets at least part of the current expectations, it is likely that these same companies will support this enhancement of the existing standard.
The IEEE Std. 802.16 with relay stations may be used in products manufactured by existing and future vendors and support a wide range of network users including individual mobile subscribers and broadcast groups,
c) The support for relay stations enables extended coverage through their addition to existing or future networks, and the relay stations with the point-to-multipoint (PMP) mode can provide wireless relay function with simpler and more compact station configuration when compared to the base station, thus at lower cost. It is well known that it is possible to use cost effective relay stations to improve coverage, and probably increase throughput as an alternative to using more costly base stations. Thus, an MMR system is a more cost effective solution to accommodating many mobile subscribers, establishing wide area coverage and providing higher data rates.

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.

The amendment will conform to the IEEE 802 family of standards as required.
IEEE802.16 recognizes that relay function provides potential to interfere with bridging, spanning tree and other IEEE802.1 bridging and routing conventions. IEEE802.16 will take special precaution, including close interactions with IEEE802.1 working group, to ensure continuing compatibility with IEEE802.1 family of architectural features.

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 is no other standard for defining an IEEE Std. 802.16 compatible relay station,***
- ***b) The MMR extension to the standard will provide a unique solution to increase coverage areas along with a possible throughput enhancement in an easy to manage and cost effective manner,***
- ***c) The project will produce an interoperable and distinguishable extension to the IEEE Std 802.16 so that users can easily distinguish the amendment from the original standard.***

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
d) Coexistence of 802 wireless standards specifying devices for unlicensed operation

a) One purpose of some wireless relay or mesh systems such as IEEE 802.11 TGs, which is being developed, is to extend coverage areas. Furthermore, the performance of wireless relay systems has been examined and revealed by theoretical analyses and computer simulations. In addition, wireless networks employing MMR are already operational albeit using other physical layer technologies. Wireless ad-hoc networks have been

under development by the military for more than two decades. Consequently, the feasibility of potential improvements that are offered by the use of relaying has been clearly demonstrated,
b) MMR technology is an extension of the existing standard which is already a proven and tested technology. The fundamental concepts of MMR technology have been proven in analytical studies and simulations and also proven in operational systems. The application of MMR to IEEE802.16 while not a completely proven technology, is considered to have a high likelihood of success,
c) MMR technology leverages IEEE Std 802.16 technologies and signaling,
d) not applicable since the project is only for licensed operation.

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) ***The economic viability of IEEE 802.16 systems has been analyzed within the industry and a number of development efforts are ongoing. The existence of these development efforts indicates that IEEE 802.16 systems are expected to have a cost that is consistent with reasonable business strategies. The proposed application of MMR will reduce overall system costs thereby enhancing the economic viability of IEEE 802.16 systems. The deployment costs of IEEE Std 802.16, such as radio and base-band architecture, are well known and the addition of a relay station class is a low risk extension,***

b) MMR technology provides a more cost effective solution to extending a service area than deploying more base stations because relay stations will be of lower cost than base stations due to their lesser complexity and they do not need the backhaul communication cabling cost for themselves,
c) Relay stations will be installed more easily than base stations due to their smaller size, lower power consumption and elimination of backhaul communication cable. Furthermore, antenna structures for relay stations are expected to be less costly than antenna structures for conventional base stations, and as they can incorporate intelligent algorithms such that once deployed they self-configure, the cost associated with planning a deployment of base stations and relay stations is significantly reduced compared to an all base stations deployment.