Project	**IEEE 802.16 Broadband Wireless Access Working Group**	
Title	**WirelessHUMAN PAR (Draft as Approved by 802.16, 2000-09-15)**	
Date	**2000-09-15**	
Source	Chair, WirelessHUMAN Study Group Durga Satapathy Sprint 7101 College Blvd, Suite 1436 B Overland Park, KS 66210	Voice: +1-913-534-6338 Fax: +1-913-534-6522 mailto:durga.satapathy@mail.sprint.com
Re:	WirelessHUMAN Study Group Report (Session #8) (IEEE 802.16hp-00/09)	
Abstract	In March 2000, IEEE 802.16 formed a Study Group to investigate establishing air interface specifications for Broadband Wireless Access in unlicensed frequency bands. The Study Group was to study the issue and prepare a Project Authorization Request, if appropriate. The Study Group (renewed in July 2000) met during the 802.16 May, July and September 2000 sessions, agreed that standardization was appropriate, and generated this draft PAR.	
Purpose	To submit a draft PAR for an Air Interface Standard for Fixed Broadband Wireless Access Systems for unlicensed frequency bands to the 802.16 Working Group for review and to request approval to forward the PAR to the IEEE 802 Executive Committee. This document is intended to be cooperative with other IEEE 802 Working Groups.	
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 text 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.	
IEEE Patent Policy	The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures (Version 1.0) <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, if there is technical justification in the opinion of the standards-developing committee and provided the IEEE receives assurance from the patent holder that it will license applicants under reasonable terms and conditions for the purpose of implementing 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:r.b.marks@ieee.org> as early as possible, in written or electronic form, of any patents (granted or under application) that may cover technology that is under consideration by or has been approved by IEEE 802.16. 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

1. Sponsor Date of Request 2000 March 10	2. Assigned Project Number 802.16.1b	3. PAR Approval Date 2000 December 07 (request)

{Copyright release must be submitted with appropriate signatures by postal mail or FAX (+1-732-562-1571)}

[ ] PAR Signature Page on File

4. Project Title, Recorder and Working Group/Sponsor for this Project

Document type and title:

- [x] **Standard for** {document stressing the verb "shall"}

- [ ] **Recommended Practice for** {document stressing the verb "should"}

- [ ] **Guide for** {document in which good practices are suggested}

Title: Telecommunications and Information Exchange Between Systems - MAN Specific Requirements - Air Interface for Fixed Broadband Wireless Access Systems in Unlicensed Frequency Bands

Name of Working Group (WG):		IEEE 802.16 Working Group on Broadband Wireless Access	
Name of Official Reporter (usually the WG Chair) who must be an SA member as well as an IEEE/Affiliate Member.		Roger B. Marks	
Title in WG:	Chair	IEEE/Affiliate Member #	[ ]
Company:	National Institute of Standards and Technology	Telephone:	+1-303-497-3037
Address:	325 Broadway, MC 813.00	FAX:	+1-303-497-7828
City/State/Zip:	Boulder, CO 80305-3328	Email:	r.b.marks@ieee.org

Name of Sponsoring Society and Committee:		Computer Society, LAN/MAN Standards Committee; Microwave Theory and Techniques Society	
Name of Committee Sponsor Chair:		Jim Carlo, LAN/MAN Standards Committee	
		IEEE/Affiliate Member #	[ ]
Company:	Texas Instruments	Telephone:	[ ]
Address:	9208 Heatherdale Drive	FAX:	[ ]
City/State/Zip:	Dallas, TX 75243-6332	Email:	jcarlo@ti.com

5. Describe This Project; *Answer each of four questions below:*

a. Update an existing PAR [No]

b. Choose one from the following:

- [ ] New Standard

- [ ] Revision of existing standard {number and year}

- [x] Amendment (Supplement) to an existing standard {number and year}

- [ ] Corrigenda to an existing standard {number and year}

c. Choose one from the following:

- [x] Full Use (5-year life cycle)

- [ ] Trial Use (2-year life cycle)

d. Choose one from the following:

- [x] Individual Sponsor Balloting

- [ ] Entity Sponsor Balloting

e. Fill in Target Completion Date to IEEE RevCom : 2002 Mar 31

---

6. Scope of Proposed Project:

This standard specifies the physical layer and media access control layer of the air interface of interoperable fixed broadband wireless metropolitan area network systems including point-to-multipoint. The standard enables access to data, video, and voice services with quality of service in unlicensed bands designated for public network access. It will focus on the 5-6 GHz range and may be applied to unlicensed bands between 2 and 11 GHz. The WirelessHUMAN standard will utilize or modify applicable elements from the following:

MAC: 802.16

PHY: 802.11a; HIPERLAN/2

The development of the WirelessHUMAN standard will follow the timeline as shown in Appendix A.

---

7. Purpose of Proposed Project:

To enable rapid worldwide deployment of innovative, cost-effective and interoperable multi-vendor broadband wireless metropolitan area network products operating in the unlicensed bands. To facilitate competition in broadband access by providing fixed wireless alternatives to wireline broadband access. Identify techniques to tolerate interference in the unlicensed bands, facilitate strategies for coexistence with other unlicensed band systems such as 802.11a, and maximize the carrying capacity of the unlicensed bands. Encourage consistent worldwide spectrum allocation, and accelerate the commercialization of unlicensed broadband wireless access spectrum. Utilization of unlicensed frequencies will address a market that includes residences, Small Office-Home Office (SOHO), telecommuters and Small and Medium Enterprises (SME).

---

8. Intellectual Property

a. Are you aware of any patents relevant to this project?
    [No] {Yes, with detailed explanation below / No}

b. Are you aware of any copyrights relevant to this project?
    [No]

c. Are you aware of any trademarks relevant to this project?
    [No]

d. Are you aware of any registration of objects or numbers relevant to this
    project?
    [No]

---

9. Are you aware of any other standards or projects with a similar scope?

[Yes] {Yes, with detailed explanation below / No}

IEEE 802.11, HIPERLAN/2 and 802.15 address primarily short range WLAN and WPAN applications, respectively.

PACS-UA and PACS-UB address unlicensed operation in the Unlicensed Personal Communication Services (UPCS) bands at 1910-1930MHz and 2390-2400MHz.

The WirelessHUMAN standard is specifically directed towards longer-range wireless point to multipoint MAN/WAN systems that provide access to core public networks using the unlicensed band spectrum. These systems typically serve large numbers of dispersed subscribers.

---

10. International Harmonization

Is this standard planned for adoption by another international organization?
[Yes]
If Yes: Which International Organization [ITU-R]
If Yes: Include coordination in question 13 below

---

11. Is this project intended to focus on health, safety or environmental issues?

[No]

---

12. Proposed Coordination/Recommended Method of Coordination

Mandatory Coordination:

	by DR	{Circulation of Drafts}
SCC 10 (IEEE Dictionary)		
IEEE Staff Editorial Review by	by DR	
SCC 14 (Quantities, Units and Letter symbols)	by DR	

Coordination requested by Sponsor:

		{Circulation of DRafts/Liaison memb/COmmon memb}
[IEEE802.11]	by [CO]	
[ETSI HIPERLAN/2]	by [LI]	{Circulation of DRafts/Liaison memb/COmmon memb}

Coordination requested by Others:
{added by staff}

13.Additional Explanation Notes: {Item Number and Explanation}

As required by the LAN/MAN Standards Committee, documentation of how of the project will address the Five Criteria for Standards Development is available.

The PAR Copyright Release and Signature Page must be submitted by FAX or physical delivery before this PAR will be sent on for NesCom and Standards Board

approval.

Appendix A

WirelessMAN Standard Timeline

- Call For Proposals for WirelessHUMAN PHY/MAC   (Nov 2000)

    – PHY: Modifications of 802.11a / HIPERLAN/2

    – MAC: Modifications of 802.16

- Review proposals: Jan 2001

- Select Candidate Proposals at Interim Meeting: Feb 2001

- Decision on specific modifications: March 2001

- First Draft Standard (May 2001)

- Comment Resolutions   (July 2001)

- Second Draft Standard (Sep 2001)

- Finalize WirelessHUMAN Standard   (Nov 2001)

802.16 WirelessHUMAN (Broadband Wireless Access Air Interface Standard In Unlicensed Bands from 2 to 11 GHz)

Meeting the Five Criteria

1. 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

Broadband Access networks in the unlicensed microwave region are a rapidly emerging technology worldwide. Such networks have the potential to compete with copper- and cable-based systems in terms of capacity, and they offer the advantages of quick nationwide deployment and not requiring the installation of wired infrastructure. This is particularly advantageous in countries where the infrastructure is not widely deployed. In the US, the FCC allocation of 300Mhz of spectrum for UNII applications and the popularity of unlicensed communication equipment in the ISM bands testifies to the growing level of interest in broadband wireless. Similar allocation of unlicensed frequencies in the microwave region (below 11 GHz) is occurring in many other countries with attendant interest by potential operators.

b) Multiple vendors and numerous users

The interest of many vendors and users is attested by the membership of the 802.16 WirelessHUMAN Study Group on Broadband Wireless Access below 11 GHz. Over 50 attendees, representing 34 companies, participated in the Study Groups sessions (see Appendix A). An additional 30 members, unable to attend the initial meetings, have also expressed interest in the group.

Although broadband wireless access networks have only recently been deployed, many users are already on-line using proprietary systems (see Appendix B). It is estimated that over 250 million dollars worth of equipment will be sold this year to address unlicensed MAN applications. Rapid growth of new operators and multiple unlicensed networks in many locations creates the need for coordination and coexistence through standards.

c) Cost considerations (unlicensed versus licensed spectrum)

The use of unlicensed spectrum for wireless MAN applications has the potential for reduced operating cost and end user costs relative to licensed systems due the costs incurred from the purchase of licensed spectrum. The use of unlicensed spectrum is pre-approved on a nationwide basis and facilitates rapid service deployment leading to large market potential.

2) 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 that are compatible with systems management standards.

The proposed standard will conform to the 802 Functional Requirements Document, with the possible exception of the Hamming distance.

3. Distinct Identity

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

a) Substantially different from other IEEE 802 standards.

The WirelessHUMAN standard occupies a distinct place in the family of standards. It is intended to provide public access to metropolitan area networks operated by a service provider on unlicensed spectrum. These providers include traditional providers such as a local or inter exchange carrier or an ISP. In addition, the unlicensed nature of this network is expected to create new classes of service providers who do not have access to licensed spectrum. It also provides licensed service providers opportunities to expand service coverage, as well as create novel services by utilizing licensed and unlicensed spectrum in concert.

Compared to the IEEE 802.11 wireless LAN standard, the WirelessHUMAN standard needs to accommodate greater range and a cell-based architecture. Key differences include the need for sectorization and frequency reuse, the unique design criteria for MAN channel characteristics (delay spread, multipath, frame synchronization, etc), user traffic characteristics, and provision for interference control in MAN environments.

The WirelessHUMAN standard is expected to differ from the IEEE 802.16.1 air interface specification currently under development for higher frequencies due to differing target markets, frequency, bandwidth, regulatory requirements and propagation conditions.

The WirelessHUMAN standard is expected to differ from IEEE 802.16.3 because unlicensed MAN networks will require unique interference mitigation techniques (e.g. dynamic frequency selection, clear channel assessment, UPCS spectrum etiquette, etc) that are not required for licensed band operation. Furthermore, the bandwidth and regulatory requirements differ significantly.

b) One unique solution per problem.

The unique requirements of the WirelessHUMAN standard are not currently met by any existing standard in its entirety. Hence the WirelessHUMAN standard will utilize or modify applicable elements from the following:

MAC: 802.16

PHY: 802.11a; HIPERLAN/2

4) Technical feasibility

For a project to be authorized, it shall be able to show its technical feasibility.

The feasibility of radio systems at 2-11GHz has been demonstrated by proprietary systems operating in unlicensed bands now in operation in many cities worldwide.

Commercial deployment of unlicensed point-to-point and point-to-multipoint systems at microwave frequencies is evidence of proven technology.

5) Economic feasibility

a) Equipment

The economic feasibility of the equipment has already been demonstrated at the level of proprietary systems now going into operation. Standardization will encourage additional economies of scale and provide an avenue for cost reduction.

b) Network

Use of the unlicensed spectrum minimizes market entry costs to the service providers. The nationwide footprint also allows wider service coverage.

The use of such methods as point-to-multipoint communication provides substantial economies relative to earlier point-to-point technologies, particularly in handling data, which is characterized by high peak demands but bursty requirements overall. As demonstrated in many IEEE 802 standards over the years, such shared-media systems effectively serve users whose requirements vary over time, within the constraints of the total available data rate. The cost of a single base station is amortized over a large number of users.

c) Installation

Installation of any wireless customer-site system is relatively simple in that no offsite cabling need be installed. In contrast, with wireline networks the plant expense to connect the customer to the network is a very substantial part of the total cost and must be incurred for the first user in a coverage area. With wireless, the expenses can be incurred as customers come on-line. The siting of base stations is a more complex issue, but since one base station supports many users; the costs involved are very nominal on a per-user basis.

Appendix A:

The 802.16 WirelessHUMAN Study Group on Unlicensed Broadband Wireless Access below 11 GHz

The WirelessHUMAN Study Group has had attendance by over 50 participants (see list).

Appendix B:

Unlicensed MAN Product Manufacturers and Providers

In order to meet market demands, at least 15 manufacturers have created and at least 16 providers have deployed unlicensed systems, accounting for well over $250 million dollars annually.