Project	**IEEE 802.16 Broadband Wireless Access Working Group**
Title	**Proposed PAR for Broadband Wireless Systems Operating Below 11 GHz - Five Criteria**
Date Submitted	**2000-01-13**
Source	**Sub10 Working Group Study Group** Chair Brian G. Kiernan InterDigital Communications Corp. 781 Third Ave., King of Prussia, PA 19406 Voice: (610) 8787-5637 Fax: (610) 878-7842 E-mail: brian.kiernan@interdigital.com
Re:	IEEE 802.16 Broadband Wireless Access Project Authorization Request (sub10 GHz)
Abstract	The November 1999 IEEE 802.16 Closing Plenary formed a Study Group to investigate establishing air interface specifications for Broadband Wireless Access at frequencies below 10 GHz. The Study Group's goal was to study and then prepare a Project Authorization Request, if appropriate. Document 802.16sub10-00/02r2 is the proposed PAR. This document is the Five Criteria required to accompany the PAR to the IEEE 802 Executive Committee.
Purpose	To submit the five criteria for the proposed PAR to the 802.16 Working Group for review and approval to forward the document to the IEEE 802 Executive Committee.
Notice	This document has been prepared to assist the 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 acknowledges and accepts that this contribution may be made public by 802.16.
IEEE Patent Policy	The contributor is familiar with the IEEE Patent Policy, which is set forth in the IEEE-SA Standards Board Bylaws <http://standards.ieee.org/guides/bylaws> and includes 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."

Rationale for a Broadband Wireless Access Air Interface Standard

For Frequencies Below 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

Access networks in the microwave region are a rapidly emerging technology on a worldwide basis. Such networks have the potential to compete with copper- and cable-based systems in terms of capacity, and they offer the advantage of not requiring the installation of buried or pole-based infrastructure. This is particularly advantageous in countries where the infrastructure is not widely deployed. In the US, the recent action by the FCC to permit two-way operation in the MDS frequency bands testifies to the level of interest in providing communication facilities based on broadband wireless. Similar allocation of 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 Working Group Study Group on Broadband Wireless Access below 10 GHz. Over 100 attendees, representing over 70 companies, participated in the Study Groups initial sessions (see Appendix A). An additional 22 members, unable to attend the initial meeting, have also expressed interest in the group. One of the attending Companies is a fixed wireless access trade association representing many more Companies.

Although broadband wireless access networks have only recently been deployed, many users are already on-line using proprietary systems.

c) Balanced costs (LAN versus attached stations)

Given that a base station in a point-to-multipoint network can serve many user stations, and a single user station can serve one or many users in the building, the cost of the equipment can easily be amortized over many users. Typically it will represent a small fraction of the total investment in computing and telecommunications hardware.

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 BWA standard occupies a distinct place in the family of standards. It is intended to provide for public access networks operated by a third party, where the user typically makes use of a wide-area network through an access network. It differs also from a wireless LAN, which typically is operated by a single organization over smaller distances and has less-stringent requirements for system integrity and resistance to unauthorized usage.

The access network is optimized for distances comparable with the propagation of microwaves through the atmosphere, which typically limits the distance between base stations and users to metropolitan dimensions. The new air interface specification for access systems operating below 11 GHz is expected to differ from the 802.16.1 air interface specification currently under development for LMDS frequencies due to differing target markets, frequency, bandwidth, regulatory requirements and propagation conditions.

b) One unique solution per problem (not two solutions to a problem).

It is envisioned that the standard will provide protocols sufficiently flexible to provide efficiently for a variety of services, some of which may have stringently bounded delay requirements. Hence it will not be necessary to have a multiplicity of different and incompatible versions. An effort will be made to utilize the 802.16.1 MAC or applicable elements thereof.

c) Easy for the document reader to select the relevant specification.

It is anticipated that the document will be easily selectable by the reader.

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 feasibility of such systems has been demonstrated by proprietary systems covering some if not all of the capability intended for this standard and now going into operation in many cities worldwide.

b) Proven technology, reasonable testing

The radio technology in microwave systems has been demonstrated for decades in both point-to-point and point-to-multipoint systems, as used in commercial and military environments. Many systems are now in commercial use.

c) Confidence in reliability

Commercial deployment of point-to-point and point-to-multipoint systems at microwave frequencies by carriers is evidence of proven reliability.

5) Economic feasibility

a) Known cost factors, reliable data

The economic feasibility of the equipment has already been demonstrated at the level of proprietary systems now going into operation. The willingness of investors to spend large sums to acquire spectrum rights, plus the large additional investment required for hardware in public networks, attests to the economic viability of the wireless access industry as a whole.

b) Reasonable cost for performance.

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) Consideration of installation costs.

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 Working Group Study Group on Broadband Wireless Access below 10 GHz

The Working Group Study Group had 101 participants (from 72 companies) at the January 10-11, 2000 meeting in Richardson, Texas. The Study Group Membership List is below:

	Name	Company	Monday	Tuesday
Adnan	Abu-Dayya	AT&T Wireless Services	x	x
Mohammad	Akhter	Centre for Wireless Communications	x	x
Ramakrishna	Anne	Compaq Computer Corp.		x
Reza	Arefi	WFI	x	x
Jori	Arrakoski	Nokia	x	x
Arun V.	Arunachalam	Nortel Networks	x	x
Paolao	Baldo	Siemens Information & Comm. Ntwks	x	x
Boyd	Bangerter	Intel Corporation		
Behshad	Baseghi	Malibu Networks		x
Carlos	Belfiore	Digital Microwave Corp.	x	x
Paul	Bensen	Motorola, Inc.	x	x
Richard C.	Bernhardt	Harris Corp		
Dave	Beyer	Nokia		
Ray	Blasing	Endgate Corp	x	
Carl	Busche	Sprint	x	x
Rebecca	Chan	Industry Canada-Terrestrial	x	x

Dean	Chang	BNA Systems	x	x
Naftali	Chayat	Breezecom		x
Remi	Chayer	Harris Corp	x	x
Omar	Cherkaoui	Univ. of Quebec in Monteal	x	x
James	Cornelius	Hardin & Associates	x	x
Jose	Costa	Nortel Networks	x	x
Cliff	Davidow	ADC Telecom		
Keith	Doucet	Newbridge Networks	x	x
Roger	Durand	Cabletron Systems	x	x
Farid	Elwailly	Newbridge Networks		x
Kamran	Etemad	WFI	x	x
Allen	Evans	Netro Corp.	x	x
David	Falconer	Carleton University	x	x
Steve	Farrell	Newbridge Networks		
George	Fischel	Comm. Consulting Services	x	x
Jeffrey	Foerster	Newbridge Networks	x	
Stu	Froelich	NextNet, Inc	x	
G. Jack	Garrison	DRJ & Associates	x	x
Alan	Gatherer	Texas Instruments	x	x
Marianna	Goldhammer	BreezeCOM	x	x
Conrad	Grell	TurboNet Communications	x	
Phil	Guillemette	Spacebridge Networks Corp.	x	
Zion	Hadad	Run.com	x	x
Roger	Hammons	Hughes Network Systems	x	x
Baya	Hatim	WFI		
Joel	Holyoak	Andrew Corp.	x	x

Wayne	Hunter	Raytheon Telecommunications	x	x
Steve	Jasper	Motorola, Inc.		
Vladan	Jevremovic	US West Advanced Technologies		x
Jacob W.	Jorgensen	Malibu Networks	x	x
Inchul	Kang	Malibu Networks		x
Mika	Kasslin	Nokia Research Center	x	x
Amarpal (Paul)	Khanna	Agilent Technologies		
Brian	Kiernan	InterDigital Communications Corp	x	x
Jay	Klein	Ensemble Communications, Inc		x
Thomas	Kolze	Broadcom Corp	x	x
Doron	Koren	TelesciCOM, Ltd		
Demos	Kostas	Adaptive Broadband	x	x
Andrew	Kreig	Wireless Comm. Assoc. Int'l	x	
Tomoaki	Kumagai	NTT	x	x
J. Leland	Langston	Crosspan, A Raytheon Comp.	x	
Phil	Lau	Toshiba		x
Yigal	Leiba	Breezecom	x	x
Sergio	Licardie	Digital Microwave Corp.	x	x
John	Liebetreu	Sicom, Inc	x	x
Mark	Lindsey	IBM Microelectronics		
Stacy	Lindsey	IBM Microelectronics		
Jim	Lord	Sprint		
Willie	Lu	Infineon Technologies	x	x
Fred	Lucas	3Com Corp		

Mohan	Maghera	Infineon Technologies	x	x
Scott	Marin	SpectraPoint Wireless	x	
Roger	Marks	National Institute of Stds and Tech. (NIST)	x	x
Shawn	McCann	Agilent Technologies	x	x
Andy	McGregor	Nortel Networks	x	x
Mark	Mertsching	ComTier, Inc.		
Ronald	Meyer	Crosspan Network Access Tech.		x
Nader	Moayeri	NIST		x
Sanjay	Moghe	ADC Telecommunications	x	x
Anton	Monk	Conexant Systems	x	x
Yutaka	Morikawa	NEC Corp	x	x
Duane	Mortensen	Alcatel USA, Inc	x	x
Simon	Nawrot	Lucent Technologies		
Nicholas	Oros	Motorola Labs	x	x
Jianping	Pan	CommQuest	x	
Yunsang	Park	Hughes Network Systems	x	x
Brian	Petry	3Com Corp	x	x
Vicente	Quilez	Alcatel Espana		
Moshe	Ran	TelesciCOM, Ltd	x	x
Javad	Razavilar	3Com Corp	x	x
Valentine	Rhodes	Intel Corporation	x	x
David B.	Ribner	Analog Devices		
Gene	Robinson	E.A. Robinson Consulting, Inc	x	
Lucille	Rouault	NIST	x	x
Ray W.	Sanders	CircuitPath Network Systems	x	x

Carl	Scarpa	Hitachi America Ltd		
Marcus	Schaefer	Alcatel USA, Inc	x	x
Menashe	Shahar	Phasecom Inc.		
Tie-Jun	Shan	Lucent Tech. - Bell Labs		x
Chet	Shirali	Phasecom Inc.	x	x
Victor	Shtrom	Gigabit Wireless	x	x
George	Stamatelos	Nortel Networks	x	x
Karl	Stambaugh	Motorola, Inc.		
Paul	Struhsaker	World Access R&D	x	x
David	Sumi	Wireless, Inc.	x	x
Andrew	Sundelin	iSKY, Inc.	x	
Kimiya	Tateishi	NEC America, Inc	x	x
Paul	Thompson	Paul Thompson Associates	x	x
Karl	Triebes	Stanford Wireless Broadband		
David	Trinkwon	Transcomm, Inc.	x	x
Jack	Van Der Star	Belstar		
Nico	van Waes	Nokia Networks	x	x
Subir	Varma	BNA Systems	x	x
Benoit	Verbaere	NIST	x	x
Francois	Vigneron	Alcatel USA, Inc	x	
Phuong	Vu	Industry Canada-Terrestrial	x	x
Chao-chun	Wang	Malibu Networks	x	x
Philip	Whitehead	Radiant Networks PLC		x
Robert	Whiting	Gabriel electronics, Inc	x	
Tom	Williams	Holtzmam, Inc.	x	x
Steve	Winslow	Alcatel USA, Inc	x	x

Bill	Xenakis	Intel Corporation	x	x
Jung	Yee	Newbridge Networks		x
Erol	Yurtkuran	Integrity Communications	x	
Chaoming	Zeng	Digital Microwave Corp.	x	x
Wei	Zhang	NIST	x	x
Juan Carlos	Zuniga	Harris Corporation	x	x