Implications of the proposed WirelessHUMAN™ PAR on the 802 Wireless Program

Implications of the proposed WirelessHUMAN™ PAR on the 802 wireless program

Roger Marks, Moderator

IEEE 802 Plenary Session

6 November 2000

8:00-9:30 pm

Questions

- Can we identify a prescription to ensure that WirelessHUMAN systems, as described in the draft PAR, can coexist with nearby 802.11a systems?
- If not, should 802 reject the WirelessHUMAN PAR, and what will be the ramifications?
- Would it be wise to radically transform the WirelessHUMAN PAR?
- Is there a procedural mechanism to ensure that the WirelessHUMAN standard development accounts for the interests of 802.11 (and possibly 802.15) members?

Goals

- Explain the WirelessHUMAN Study Group conclusions and the PAR
- Air concerns of 802.11
- Air concerns of 802.15
- Reach consensus on the the issues of concern
- Consider means of addressing the concerns

What Next

- **WG comments due to 802.16 by 5 pm Tuesday**
  - **WGs invited to send delegates to WirelessHUMAN meeting**
- **Revised PAR due Wednesday**
  - **WirelessHUMAN may consult with WG delegates**

WirelessHUMAN Background and Current Issues

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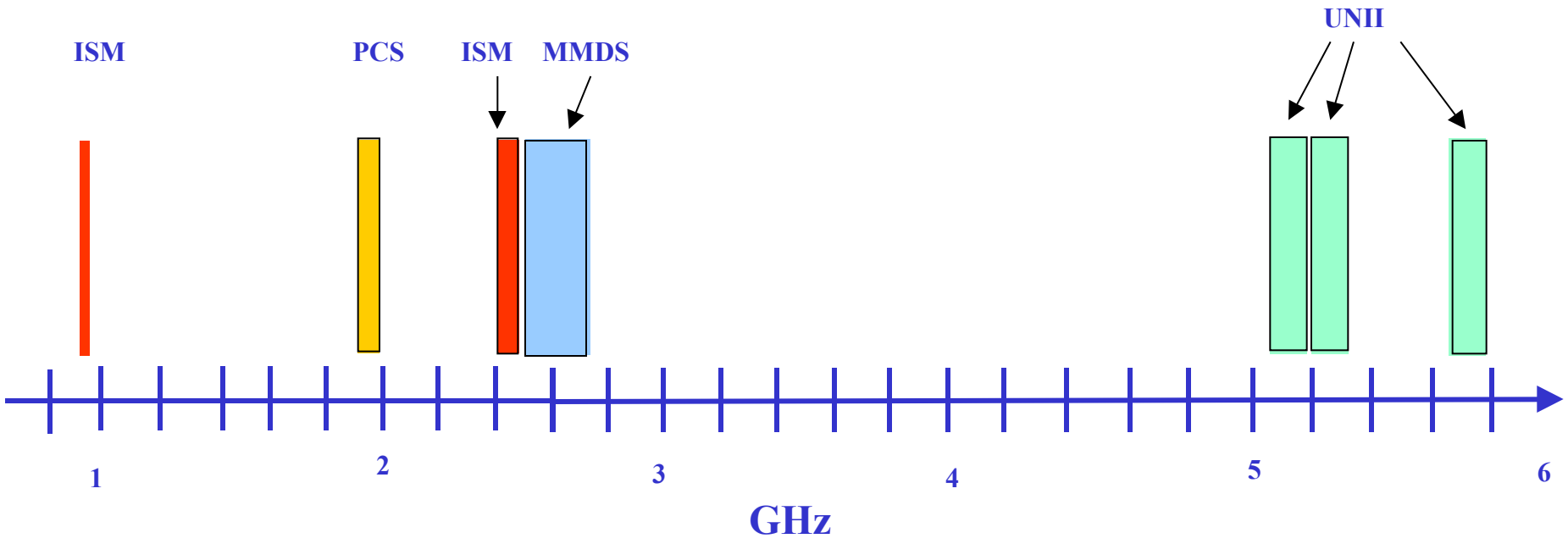
Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:r.b.marks@ieee.org> 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/letters>.

WirelessHUMAN Background and Current Issues

Durga Satapathy
Sprint

Chair
IEEE 802.16 WirelessHUMAN™ Study Group
(Wireless High-Speed
Unlicensed Metropolitan Area Networks)

Spectrum View



ISM: Industry, Science & Medicine

PCS: Personal Communication Services

MMDS: Multi-channel Multipoint Distribution System

UNII: Unlicensed National Information Infrastructure

Unlicensed Bands	Spectrum	Typical Applications
ISM: Industry Science and Medicine 902-928 MHz, 2.4-2.4835 GHz & 5.725-5.85 GHz)	234.5 MHz	Cordless Phones, Wireless LANs (WLAN) and Wireless PBXs (WPBX)
UPCS: Unlicensed PCS Asynchronous:1910-1920, 2390-2400 MHz Isochronous: 1920-1930 MHz	 20 MHz 10 MHz	 WLAN WPBX
UNII: Unlicensed National Information Infrastructure UNII (5.15-5.25 GHz) UNII (5.25-5.35 GHz) UNII (5.725-5.825 GHz)	 100 MHz 100 MHz 100 MHz	 Indoor applications WLAN,WPBX Short outdoor links, campus applications Long outdoor links, Point-To-Point links
Millimeter Wave (59-64 GHz)	5 GHz	Home networking applications

WirelessHUMAN Background

- The IEEE 802.16 WirelessHUMAN Study Group was approved at the March IEEE 802 Plenary meeting
  - 802 began a 2-11 GHz project
  - Split off unlicensed bands partly because of 802.11 overlap
- The charter is to investigate the feasibility of providing High-speed Unlicensed MAN access (focus on UNII bands)
- First meeting held at IEEE 802.16 May 2000 meeting with over 30 participants
- Coordinated with 802.11 and 802.15
  - e.g., Participated in 802.11/802.15 Joint Meeting (May 2000)
- After study of existing work, Study group proposed PAR (at the IEEE 802.16 Sep 2000) with a narrow focus and short development time to meet industry needs

What's Different?

- IEEE 802.11 – designed for LANs primarily using ISM bands requiring spread-spectrum => not optimized for MAN access using 5-6 GHz (e.g. UNII bands)
- IEEE 802.15 - designed for PANs (relatively small range) and focused on ISM bands
- IEEE 802.16.3 – designed for licensed bands from 2 to 11 GHz
- The WirelessHUMAN Study Group addresses public network access in license exempt bands.

WirelessHUMAN™ System Characteristics

- Metropolitan Area Network
  - Need for Point-To-Multipoint Systems
  - Typically cellular; sectorized with frequency reuse
  - Typically needs backhaul architectures capable of reliable broadband transport
  - Connectivity to wired infrastructure/ core networks
- Services: voice, video & data
- Fixed/Nomadic Wireless Service Provider Application
- Operate in Unlicensed Frequency Bands (initial focus on outdoor UNII bands)
- Operation in presence of other unlicensed devices
- MAC/PHY efficiency to support MAN environment
- Cost and performance for residential/SOHO/SME/ customers
- QoS support (in-system & external interference)

WirelessHUMAN™ PAR Scope

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.

WirelessHUMAN™ 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

WirelessHUMAN Study Group Participants

Sprint
Intel
Nokia
Ericsson
Lucent
Intracom
Proxim
WaveIP
N Band Com
Coreon Inc
Runcom
Innowave ECI

RF Solutions
Breezecom
Transcomm Inc.
BNA Systems
Escape
Malibu Networks
Ultracom
Harris Corporation
Wireless Inc.
Cabletron systems
Magnolia Broadband
Clearwire Technologies

Agilent Technologies
Adaptive Broadband
Cabletron
WirelessHome
Carleton University
Carnegie Mellon University
Georgia Institute of Technology
HRL Laboratories, LLC
Western Multiplex
Communications Research Center
Yokogawa Electric Co.

5 Criteria: Distinct Identity

- The WirelessHUMAN standard is intended to provide public access to metropolitan area networks operated by a service provider in 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.

Distinct Market Need

- Unlicensed MAN industry has shown phenomenal growth of late, especially in the UNII bands
- Sales of unlicensed equipment over next 5 years was estimated at over 4 billion (Red Herring, Oct 2000)
- Opens opportunities for service providers to provide nationwide services, and is especially attractive if used in concert with licensed spectrum

Conclusions

- WirelessHUMAN fills a unmet market need
- Regulators have made spectrum available for WirelessHUMAN applications
- MANs **are** being deployed in unlicensed spectrum
- Development of a WirelessHUMAN standards gives 802 the opportunity to address coexistence with WLANS & WPANS

IEEE 802 Tutorial 2
WirelessHUMAN MAC

Mika Kasslin

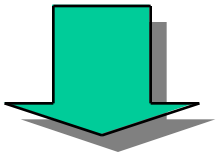
Nokia Research Center

Outline

- WirelessHUMAN MAC
  - From system deployment to requirements
  - Required functionality
  - Access scheme?

WirelessHUMAN System deployment

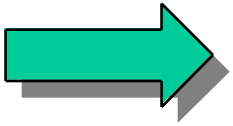
Outdoor MAN with range up to several miles



Scattered customer equipments
Cellular-like deployment

MAC for WirelessHUMAN Deployment => Features

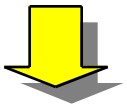
Outdoor MAN with range up to several miles



- Traffic profile different from WLAN
- Propagation delays up to tens of μs (6 km ≈ 20 μs)

Scattered CPEs | Cellular-like deployment

- CPEs don't hear each other and contention based access scheme inefficient



- Need for sectorization

Need for PMP with flexibility

MAC for WirelessHUMAN 802.16 or 802.11

802.16

☺Designed for PMP MAN access
☺Flexibility in providing access
☺Provides for various core networks via CLs
☹Interference mitigation techniques missing

802.11

☺Channel sharing with other systems in the band
☹CSMA inefficient in scattered "range limited" MAN networks
☹Designed for traffic from portable WLAN terminals

MAC for WirelessHUMAN
Why 802.16?

- Suitable for outdoor MAN access
  - Fixed user equipments with traffic patterns different from the WLAN terminals
  - Provides for cellular deployment with spatially scattered CPEs
  - Bandwidth efficiency through ranging
- Provides for flexibility in
  - sharing bandwidth
  - core networks (various CLs)
  - network topologies

Key Issues

- Choice of PHY and MAC
- Impact of Wireless MANs on Wireless LANs
- Strong potential for effective co-existence solutions if WirelessHUMAN is an IEEE 802 standard

Key Concerns from 802.11 as Understood by WirelessHUMAN Study Group

- Should the WirelessHUMAN standard exist at all?
- Where does WirelessHUMAN belong? 802.16 or 802.11?
- Will WirelessHUMAN systems cause significant interference to 802.11 devices?
- Can the interference be migitated?

Should the WirelessHUMAN standard exist at all? YES!

- Unlicensed MAN equipment is already being deployed
  - Huge Market Need
  - Cost-Effective
  - Nationwide Footprint
- It will be easier for 802.11 to develop co-existence strategies with WirelessHUMAN in the IEEE 802 environment

Where does WirelessHUMAN belong?

- 802.16 standards address MAN markets
  - Cellular
  - Sectorization
  - Presentation from Mika Kasslin

Will WirelessHUMAN systems cause significant interference to 802.11 devices?

- Possibly

Can the interference be mitigated?

- Yes

- Develop an etiquette for co-existence
  - Dynamic Channel Allocation; Adaptive power control
  - Different Frequency bands
  - Other solutions developed jointly

Some Suggestions from 802.16

- Work with 802.11/802.15 to develop strategies to mitigate mutual interference
- Cooperate to develop mutually beneficial scenarios (or new standards)
  - Use 802.16 systems to interconnect/trunk 802.11 systems
  - Use LANs to extend MAN services cost-effectively

IEEE 802 LMSC
OFFICIAL TUTORIAL REQUEST FORM

TUTORIAL SPONSOR (WG Chair):	**Roger Marks**
DATE SUBMITTED:	**5 October 2000**
Requester Name & Email:	**Roger B. Marks (Chair, IEEE 802.16) <r.b.marks@ieee.org>**

1. TITLE OF TUTORIAL:

Implications of the proposed WirelessHUMAN™ PAR on the 802 wireless program

2. NAME OF PRESENTERS, THEIR AFFLIATIONS AND CONTACT INFO:

To be drawn from 802.16, 802.11, and (possibly) 802.15 participants.

3. ABSTRACT: (a brief paragraph describing content of the presentation)

This meeting, organized with a more interactive format than a traditional tutorial, covers the implications of 802.16's proposed Wireless High-Speed Unlicensed Metropolitan Area Network (WirelessHUMAN) PAR <http://ieee802.org/16/human/par> on 802's wireless program. The WirelessHUMAN PAR targets operation in the unlicensed bands between 5 and 6 GHz, where 802.11 already supports a physical layer and 802.15 may be considering operation. While the draft PAR proposes a PHY based on 802.11a, the intent is to base the MAC on 802.16, which the Study Group believes is more suitable. Questions to be addressed include:

- **Can we identify a prescription to ensure that WirelessHUMAN systems, as described in the draft PAR, can coexist with nearby 802.11a systems?**
- **If not, should 802 reject the WirelessHUMAN PAR, and what will be the ramifications?**
- **Would it be wise to radically transform the WirelessHUMAN PAR?**
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4. ALLOCATED DAYS AND TIMES: (Please indicate your 1st and 2nd choices below. All tutorials are scheduled on a first come first basis).

DAY/TIME:		Enter 1 or 2:
Monday	6:30-8:00 p.m.	[ ]
Monday	8:00-9:30 p.m.	[**1**]
Tuesday	6:30-8:00 p.m.	[ ]
Tuesday	8:00-9:30 p.m.	[ ]
*Other:	_____	(*Must be approved by 802 Executive Committee)

5. DEADLINE DATE:

   All official tutorial request forms must be submitted at least 45 days prior to the start of the next IEEE 802 LMSC Plenary Meeting. Please refer to the future meetings list on the IEEE 802 Web Site at: http://grouper.ieee.org/groups/802/meeting

6. APPROVAL AND CONFIRMATION:

   All official tutorial requests must sent to Dawn Slykhouse at 802info@ieee.org for final approval and confirmation with copies to Buzz Rigsbee everett.o.rigsbee@boeing.com and to Jim Carlo jcarlo@ti.com. A confirmation of your request indicating time slot assigned will be sent within 10 days of your submission.