WirelessHUMAN™ Study Group Activities at 802.16 Session #7

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Venue:
IEEE 802.16 Session #7 (1-5 May 2000 in Gaithersburg, MD, USA): First WirelessHUMAN™ meeting

Purpose:
To report WirelessHUMAN™ Study Group Activities at 802.16 Session #7.

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WirelessHUMAN™ SG
WirelessHUMAN™ Goals

• Identify license exempt bands suitable for fixed broadband MAN access – e.g. 5-6 GHz bands
• Investigate feasibility of developing an Air Interface Standard for the identified bands
• Investigate feasibility of using common MACPHY with IEEE 802.11 / IEEE 802.16.3
• Investigate relationship with 802.11, 802.15 and other standards groups
Key Issues

- What are the existing regulations in the various unlicensed bands, and what unlicensed bands may be appropriate for WirelessHUMAN systems?
- What mechanisms for interference avoidance/suppression, resource sharing, and ensuring adequate performance exist in unlicensed bands?
- What are the unique system design issues/requirements of WirelessHUMAN systems from a MAC/PHY layer perspective?
- Should the Study Group write a PAR to proceed with a standard? If so, should we try for July or wait until November?
<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>2-May</td>
<td>8:00</td>
<td>Joint meeting 802.16.3 &amp; WHUMAN SG</td>
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<tr>
<td></td>
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<td>Introductions and member sign up</td>
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<td></td>
<td></td>
<td>Review of Goals and Objectives</td>
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<td>Discussion and Acceptance of Agendas</td>
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<td></td>
<td>10:00</td>
<td>Discussion of Key Issues (Chair)</td>
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<td></td>
<td>10:15</td>
<td>Study Group Operating Procedures (Secretary)</td>
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<td></td>
<td>11:00</td>
<td>The Path Towards Efficient Coexistence in Unlicensed Spectrum</td>
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<td>- 802.16hc-00/03 Contribution from Jon Peha</td>
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<td>12:30</td>
<td>Lunch Break</td>
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<td>1:30</td>
<td>Joint Session with 802.16.3</td>
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<td>3-May</td>
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<td>Lunch</td>
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<td>1:30</td>
<td>Requirements for WirelessHUMAN Systems</td>
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<td>- 802.16hc-00/01 Contribution from Mika Kasslin ai</td>
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<td>2:30</td>
<td>Requirements for Broadband Wireless Access systems in the UNII bands</td>
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<td>- 802.16hc-00/02 Contribution from Vijaya Gallager</td>
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<td></td>
<td>3:30</td>
<td>Break</td>
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<td></td>
<td>3:45</td>
<td>Discuss CEPT Proposal</td>
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<td>4:15</td>
<td>Discuss Report to 802.11/802.15</td>
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<td>5:30</td>
<td>Dinner Break</td>
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<tr>
<td>4-May</td>
<td>8:00</td>
<td>802.16hc-00/04 Overview of UNII Regulations</td>
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<td>Contribution from Jamie Cornelius</td>
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<td></td>
<td>9:00</td>
<td>Discussion of WirelessHUMAN Milestones &amp; PAR</td>
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<tr>
<td></td>
<td>12:00</td>
<td>Lunch Break</td>
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</tbody>
</table>
The Path Towards Efficient Coexistence in Unlicensed Spectrum

Contribution No: 802.16hc-00/03
Prof. Jon M. Peha
Carnegie Mellon University
Key Points

• Greedy Devices: little incentive to share spectrum
• Greed escalates => terrible performance
• Solutions: Low Utilization / Etiquette Modifications
Requirements for WirelessHUMAN™ Systems

Contribution No: 802.16hc-00/03
Mika Kasslin & Nico Van Waes
Key Points

• Need for coexistence
• UNII characteristics => limited range/large antennae; severe multipath
• Coexistence with 802.11: Dynamic frequency selection + power control + adaptive modulation
• 802.16.1 => different market & frequency => Not appropriate
• 802.16.3 => licensed, higher tolerated EIRP
• 802.15 => Small range; not applicable
• 802.11a => coexistence discussions mutually beneficial
  – PHY suitable for multipath; applicable (comment: coexistence with OFDM with high no. of carriers may be an issue - needs study)
  – MAC designed for ISM; not applicable
• System Reqs: coexistence with 802.11; low cost; high coverage; QoS support (in-system & external interference); standardized authentication; easy installation
• Flexible network; various topologies => complexity is an issue
  – PMP system only or mesh architecture
  – Delay architecture choice discussion for later
• July PAR
Requirements for Broadband Wireless Access systems in the UNII bands

Contribution No: 802.16hc-00/02
Vijaya Gallager
Key Points

- 802.11 MAC - not applicable => flexible architecture/mobile/roaming/range mismatch
- 802.16.1 MAC - not applicable => frequency/applications
- 802.16.1 PHY - not applicable => interference issues
- 802.11a PHY - not applicable => multipath; mobile; OFDM cost
- 802.16.3 PHY: not applicable => interference issues
- 802.15 PHY: not applicable => range mismatch
- System Req: No mandate on protocols; low cost; simplicity
- PAR => try for July
Key Points

• Spread Spectrum requirement in ISM bands
• 1 Watt max power
• Minimum of 75 hopping channels
CEPT Proposal

• Impact on 5250-5350 MHz UNII band
• Exclusive to radio lans
PAR discussion

- July
  - Broad statement
  - Avoid delay
  - Timing important to be effective
  - not enough study
  - Strong need for differentiation from existing standards
  - discuss par timeline after joint meeting (11 & 15)
  - discuss with Roger
Next Steps

• Email Reflector
• Conference Calls
  – 802.11/802.15/HIPERACCESS tutorials
  – PAR discussion
• Interim Meeting
• Call for contribution on SG report/assessment
WirelessHUMAN™ System Characteristics

- Metropolitan Area Network
- 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)
- standardized registration/authentication
- ease of use & installation
Preliminary Assessment

• 802.16.3 PHY
  – TBD
  – Commonality in propagation characteristics

• 802.16.3 MAC
  – TBD
  – Potential synergies
Preliminary Assessment

• **802.11a PHY**
  – Optimized for LAN peer-to-peer traffic and bandwidth requirements
  – Optimized for indoor multipath; needs evaluation for outdoors
  – No provision for dynamic frequency selection and power control

• **802.11 MAC**
  • MAC designed for ISM bands (Needs Evaluation)
    – assumption of negligible propagation delay
    – enforces Listen Before Talk (LBT) rule
    – Designed for bursty traffic, not for voice/CBR applications
  • Centralized control (suitable for WirelessHUMAN)
Preliminary Assessment

• **802.15 PHY**
  – Frequency Hopping
  – Current limitations on bit rates (1 Mbps)
  – Designed for 2.4 GHz ISM bands

• **802.15 MAC**
  – Optimized for ad-hoc networking
  – Includes support for CBR
  – Designed for limited range applications
Preliminary Assessment

• **802.16.1 MAC**
  – Not designed for interference in unlicensed bands
  – Designed for enterprise applications
  – Potential synergies based on common MAN requirements

• **802.16.1 PHY**
  – Not designed for interference in unlicensed bands
  – Designed for above 11 GHz
  – Designed for LOS scenarios only
Preliminary Assessment

• **HiperAccess PHY**
  – Single carrier approach
  – Above 11 GHz
  – 28 MHz channel bandwidth

• **HiperAccess MAC**
  – TDMA based
  – Connection-oriented
  – guaranteed QoS
  – fixed length frame size and transmission slots
  – Supports FDD mainly, allows TDD for unpaired bands
  – Supports dynamic asymmetry for TDD
  – Adaptive modulation
  – Uses Convergence Layer to support multiple protocols
Preliminary Assessment

• HIPERLAN-2 PHY
  – Similar to 802.11a

• HIPERLAN-2 MAC
  – TDD based
  – ATM based solution
  – Support multiple CoS
  – Centralized control
  – Assumes short propagation delay
  – Includes power control and dynamic frequency selection
  – Includes ARQ mechanism
  – Uses Convergence Layer to support multiple protocols