Wireless Communications Forum: A glimpse of the future of wireless

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mm-Wave and sub-mm-Wave offers Orders of Magnitude more Spectrum

United States Frequency Allocations

AM Radio
FM Radio
TV Broadcast
Cellular
Wi-Fi
60GHz Spectrum
77GHz Vehicular Radar
Active mm-Wave CMOS IC Research

Shaded Areas = Equivalent Spectrum!
mm-Wave and sub-mm-Wave THz Propagation

- 60 GHz, 120 GHz, 183 GHz, 325 GHz, and 380 GHz for shorter-range applications
- World-wide governmental agreement on 60 GHz!
- 100 GHz and 240 GHz for longer-range applications

mm-Wave & sub-mm-Wave Short Range Applications

- 60 GHz band products ready for release: TV set top boxes available soon

- Applications: Information Showers, Wireless Interconnects, magnetic media & hard-drive replacement

Information Showers

Inexpensive Ubiquitous Integrated Transceivers
Probe Station for mmWave RFICs and On-Chip Antennas

- mmWave Anechoic Chamber to measure 3D on-chip antenna patterns


mm-Wave Long Range Applications

- Tremendous data rate growth for cellular systems
  - 10% of 2.85 Billion users w/data in 2007 → Growing Exponentially
- Wireless mm-Wave and sub-mm-wave backhaul Required!
- 60 GHz backhaul already in limited use
- Highly directional antennas

## 60 GHz Current mm-Wave Standards

<table>
<thead>
<tr>
<th>Name</th>
<th>Forum Type</th>
<th>Status</th>
<th>Maximum Data Rate (Gbps)</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>WirelessHD</td>
<td>Industry Consortium</td>
<td>Spec. 1.0, Jan 2008</td>
<td>4</td>
<td>Uncompressed HD video</td>
</tr>
<tr>
<td>ECMA-387</td>
<td>International Standard</td>
<td>Draft 1.0, Dec 2008</td>
<td>4.032, 6.35</td>
<td>Bulk data transfer and HD streaming</td>
</tr>
<tr>
<td>802.15.3c (TG3c)</td>
<td>International Standard</td>
<td>Released October 2009*</td>
<td>5.7, 5.2</td>
<td>Portable point-to-point file transfer and streaming</td>
</tr>
<tr>
<td>802.11ad (TGad)</td>
<td>International Standard</td>
<td>Target completion Dec 2012</td>
<td>&gt;1</td>
<td>Rapid upload/download, wireless display, networking distribution of HDTV</td>
</tr>
<tr>
<td>WiGig</td>
<td>Industry Consortium</td>
<td>Released May 2010*</td>
<td>7 Gpbs*</td>
<td>File transfers, wireless display and docking, and streaming high definition</td>
</tr>
</tbody>
</table>


Properties at THz

**Frequency Range**
Terahertz region – 0.3-10THz  
But loosely – 100GHz and upwards  
**Wavelengths**  
3 mm to 30 μm

**Properties**

- Behaves partly as light - Can be focused with a lens
- Behaves partly as Radio Frequency waves for propagation – we can use antennas and metal structures for radiation and guidance at these frequencies
- Thought to be Non-ionizing (health wise safer)

**Material Properties**

- Good penetration cloth, wood, concrete, plastics, paper
- Absorbed heavily by water in various frequency bands within the THz range
- Reflected by metals
- A lot of naturally occurring compounds have resonances and interactions in this regime
For more information on this topic

- “Broadband Wireless Personal Area Networks – 60 GHz and Beyond”
- 10 – 11am Thursday Dec 9, 2010 in Riverfront South Hall
- Business and Tech Forum
- Speakers:
  - Ted Rappaport, University of Texas WNCG
  - Marco Corsi, Texas Instruments
  - Robert Heath, University of Texas WNCG