Submission Title: [Preliminary 60 GHz Channel Measurements]
Date Submitted: [18 July 2005]
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Re: [Response to the TG3c channel model subgroup call for 60 GHz channel measurements and modeling]
Abstract: [Preliminary 60 GHz channel measurements on desktops]
Purpose: [Contribution to 802.15 TG3c at November 2005 meeting in Vancouver, Canada]
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Purpose

• Channel model sub-committee requires a common channel model for evaluation of PHY layer proposals.

Proposed measurement campaign to
• Determine an appropriate channel model with AoA
• Determine the set of parameters that accurately describes the 60 GHz channel for indoor situations
Desktop measurements

• (very) preliminary measurements to indicate typical results and model

• Gives some idea of work required to develop channel model

• Short range (~1-2m) measurements on typical office ‘cube farm’ desk with “walls” on three sides
Desktop Measurements
Example Desktop Measurements
Notice clustering in time and angle
Notice clustering in time and angle
Proposed Channel Model

S-V Model with AoA extension* 

$$h(t, \varphi) = \sum_{l=0}^{L-1} \sum_{k=0}^{K_l-1} \alpha_{k,l} \delta(t - T_l - \tau_{k,l}, \varphi - \Psi_l - \psi_{k,l})$$

$L = \text{number of clusters};$
$K_l = \text{number of multipath components (number of rays) in the } l\text{-th cluster};$
$\alpha_{k,l} = \text{multipath gain coefficient of the } k\text{-th ray in the } l\text{-th cluster};$
$T_l = \text{arrival time of the first ray of the } l\text{-th cluster};$
$\tau_{k,l} = \text{delay of the } k\text{-th ray within the } l\text{-th cluster relative to the first path arrival time, } T_l;$

$\Psi_l = \text{mean angle of arrival of } l\text{-th cluster};$
$\psi_{k,l} = \text{angle of arrival of the } k\text{-th ray within the } l\text{-th cluster}.$

* See IEEE Doc 05-0412-00
Model Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Lambda_l$</td>
<td>cluster arrival rate</td>
</tr>
<tr>
<td>$\lambda_l$</td>
<td>ray arrival rate</td>
</tr>
<tr>
<td>$\Gamma$</td>
<td>cluster decay factor</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>ray decay factor</td>
</tr>
<tr>
<td>$\sigma_1$, $\sigma_2$, ...</td>
<td>multipath gain distribution factor(s)</td>
</tr>
<tr>
<td>$\sigma_{\psi}$</td>
<td>AoA distribution standard deviation</td>
</tr>
</tbody>
</table>
Data Processing Issues

- Propagation channel (deconvolving?)
- Cluster identification
  - visual vs statistical?
- Parameter extraction
  - brute force searches (time consuming)
- Gain and AoA distributions?
  - Kolmogorov-Smirnov test and/or Chi-Square test etc.

Expect similar results from room measurements