Next Generation Ultra Low Loss PCB Materials

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Background

• There has been much discussion on C2M channel budgets, and what is required for a practical fixed “pizza” box switch system

• This presentation details background information to assist with these discussions:
  – Trace lengths from a 1RU 256 lane system
  – Measured Losses from new ultra-low loss PCB materials

• The dB loss numbers are of course not a full channel simulation, or COM model, but are provided as guidance
Trace Lengths in a 256-lane 1 RU Switch System

- 32 front-panel module cages
- Min Trace Length: 1.7”
- Max Trace Length: 9.5”

256 Tx + Rx Pair 1RU System Trace Lengths
Next Generation Ultra Low Loss PCB materials

- In addition to the existing PCB materials, new materials are becoming available which enable insertion losses of $< 1\text{dB/inch}$ at 27 GHz
  - Suitable for high layer count PCB fabrication as used in switch systems
- Examples of such materials are presented here, data shared with permission.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Material Name</th>
<th>Dk</th>
<th>Df</th>
<th>IL (dB / inch) @ 28 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rogers</td>
<td>RO1200</td>
<td>3.05 (10 GHz)</td>
<td>0.0017 (10 GHz)</td>
<td>0.74$^1$</td>
</tr>
<tr>
<td>ITEQ</td>
<td>IT-988G SE</td>
<td>3.24 (28 GHz)</td>
<td>0.0014 (28 GHz)</td>
<td>0.95$^2$</td>
</tr>
<tr>
<td>ITEQ</td>
<td>IT-998G</td>
<td>3.0 (28 GHz)</td>
<td>0.001 (28 GHz)</td>
<td>0.7$^3$</td>
</tr>
</tbody>
</table>

$^1$ 6 mil trace, rolled copper foil, grounded coplanar stripline
$^2$ differential stripline measurement, test vehicle
$^3$ simulated performance
XtremeSpeed™ RO1200™ Material Stripline Insertion Loss

Stripline Insertion Loss, Grounded Coplanar Signal Layer, Differential Phase Length Method using Smil XtremeSpeed™ RO1200™ Laminate and Smil RO1200BP™ Bondply

Data shared with kind permission
Summary

• Next Generation volume PCB materials suitable for 802.3ck applications will become available within 12 – 24 mo with losses < 1 dB
• This will enable PCB loss budgets < 10dB, for 1RU switch platforms which fits within the proposed 16dB ball – ball VSR target (from lim_3ck_01b_0718)
• We should adopt the 16dB proposed budget
Thank You