Semiconductor Strategies for 4G Mobile Broadband

Lars Johnsson
ComSoc - May 13, 2009
Discussion Topics

• The path to undisputed WiMAX Leadership

• What it takes to get to the top in Wireless

• Comparing the Panelists
2004 – 2007: establishing leadership and credibility
A HISTORY OF MOBILE WiMAX LEADERSHIP

Mar 2008
ZTE Chooses Beceem’s Chipset for Its WiMAX Products

Jun 2008
Beceem Among First to Receive WiMAX Certification

Apr 2008
BCSM250: World’s First Fully Integrated 65nm Wave 2 Solution

Jun 2008
Acer Laptop with WiMAX from Beceem Shown at Computex

Sep 2008
BCS5200: World’s First Single Chip WiMAX + VoIP CPE Solution

Jan 2009
World’s First Dual-Mode 3G CDMA/4G WiMAX USB Modem

Feb 2009
Beceem’s Chip Included in First 4G Service to Launch in Japan

Feb 2009
Clear Chooses Beceem’s High-Performance WiMAX Chip for 4G Mobile WiMAX Service

2008 + : enabling & driving the Mobile Broadband market
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Mobile Broadband – the challenge starts with constantly changing signal strength

- Beceem solutions are optimized for high performance and robust operation at low SNR
- Our channel estimation excels in all conditions
  - Propagation loss over distance
  - Delay spread (freq selective fading)
  - Doppler spread (time selective fading)
  - Angle spread (space selective fading)
  - Interference (users in same/other sectors)
Beceem’s Algorithms – the Secret Sauce behind our Mobile Performance Leadership

1. Maximum Likelihood Receiver
   - Increases receive sensitivity

2. Improved Channel Estimation
   - Better channel estimation allows for better decoding. BCSM250 receiver can estimate this channel more than 200 times per second to decode the data

3. LLR Truncation
   - Improvements in adaptive algorithms allows the receiver to have higher performance at lower power

4. Interference Cancellation
   - Improves handoff in ‘Frequency Reuse 1’ scenarios
   - BCSM250 decodes the data stream of both the desired signal and the strongest interferer, then eliminate the strongest interferer
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# 4G/WiMAX Chip Provider Comparison

<table>
<thead>
<tr>
<th>Corporate</th>
<th>Beceem</th>
<th>GCT</th>
<th>Sequans</th>
<th>Wavesat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td>All companies are VC funded fabless semcos, CF negative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Funding</td>
<td>Raised $20M in early 09 - fully funded</td>
<td>Raised $10M late 08 – Challenged</td>
<td>Raised $28M early 08 - need more $$ in 09</td>
<td>Raised $12M in early 09</td>
</tr>
<tr>
<td>Employees</td>
<td>170</td>
<td>~100</td>
<td>~125</td>
<td>&lt;50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Products</th>
<th>Mobile WiMAX terminals</th>
<th>Other products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beceem</td>
<td>Wavesat</td>
</tr>
<tr>
<td></td>
<td>BCSM250 PHY/MAC/RF 65nm chip</td>
<td>Odyssey 8500 Programmable PHY/MAC</td>
</tr>
<tr>
<td></td>
<td>GDM7215 PHY/MAC/RF 90nm + WiFi</td>
<td>•WiMAX BTS</td>
</tr>
<tr>
<td></td>
<td>SQN 1210 PHY/MAC/RF 65nm chip</td>
<td>•Fixed WiMAX</td>
</tr>
<tr>
<td></td>
<td>Odyssey 8500 Programmable PHY/MAC</td>
<td>•X-PHS</td>
</tr>
</tbody>
</table>

| Other products | •None | •CMOS RF | •WiMAX BTS |
|                |       | •DMB chips | •Fixed WiMAX |
|                |       | •LTE in dev. | •LTE in dev. |

<table>
<thead>
<tr>
<th>SWOT</th>
<th>Strength</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clear WiMAX performance leader</td>
<td>Success based on WiMAX</td>
</tr>
<tr>
<td></td>
<td>Diversified product line</td>
<td>Resource dilution</td>
</tr>
<tr>
<td></td>
<td>Basestation products</td>
<td>Resource dilution</td>
</tr>
<tr>
<td></td>
<td>Programmable</td>
<td>Programmable, no RF</td>
</tr>
</tbody>
</table>
Beceem WiMAX Summary

• Beceem Summary
  - Exclusively focused on Mobile WiMAX 16e terminal chips
    ➢ The only company dedicated to making WiMAX Work!
  - Unmatched Mobile WiMAX Expertise
    ➢ Best hand-off performance and 3.5GHz mobility pioneer
  - Technology & Product Leadership
    ➢ >30 Mbps throughput; 65nm single chip
  - Broad ecosystem of capable device partners
    ➢ Modems, CPEs, embedded computing and media devices, handhelds
  - Key enabler of the MOBILE Market
    ➢ Handoff performance, multi-mode support and co-existence
  - Leading supplier to Clearwire and UQ
    ➢ Will drive >>50% market share in Mobile WiMAX in 2009
  - Emerging leader in the FIXED Market
    ➢ Integrated CPE chip raises performance and lowers cost
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