
Agenda

• The Program
  • General Overview of the WiMAX and LTE Market Environment
  • The Evolving Technology and Market Landscape for LTE and WiMAX Chips
  • Opportunities for Growth

• Q & A
The Evolving Technology and Market Landscape

1. Wireless Broadband Demand has Skyrocketed
2. ‘Hot’ Web Devices Drive Subscriber & Revenue Growth
3. WiMAX IC Vendors First to Market with LTE: Vendors Racing into the Market
4. Multiple-Mode WiMAX/LTE Chips to Enter 2nd Half 2010
5. WiMAX Operators Shift to LTE
6. Migration Path to WiMAX 2, and LTE
WiMAX Industry

In 2009:

- Total WiMAX market size: US$1.36 billion
- 5 million WiMAX chipsets shipped (+332% Y-O-Y)
- 3.5 million new WiMAX CPEs deployed
- WiMAX Base Station Sectors: -10.9%

End-users want broadband wireless now
Operators confused by future evolution

Source: 4GCounts.com Quarterly Report - June 2010
Selected LTE and WiMAX Key Trends - 4Ggear™ Report

• **WiMAX chipset**
  - Vendors offer differentiated chipsets to address emerged markets
  - Aggressive chipset price: higher volume, optimized platforms

• **LTE chipset**
  - Early solutions support LTE only
  - Early suppliers may not be the long term winners

• **WiMAX device**
  - Diversified deployments of low cost CPEs, dual-mode USB dongles, and smartphones

• **LTE device**
  - Demonstrators = single-mode followed by dual-mode USB dongles

• **4G equipment**
  - WiMAX has established a beachhead for technological progress...
  - ...LTE will benefit from it
WiMAX Grows But LTE Looms
The Chip Market:

- Over 4.8 million devices were shipped in 2009 compared to 3.1 million in 2008, a 53% increase.
- Over 4.2 million WiMAX devices were shipped in 2009.
- Over 3.8 million 802.16e devices were shipped in 2009, a 147% increase from 2008.
- Over 3.5 million mobile WiMAX MIMO devices were shipped.
- Average selling price of MIMO Mobile WiMAX devices was $123 in 2009, a 15% decrease from 2008.
- Devices generated total revenues of $480 million in 2009, a 111% increase from 2008.

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Selected LTE and WiMAX Key Trends - 4Ggear™ Report

- **WiMAX chipset**
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  - Aggressive chipset price: higher volume, optimized platforms

- **LTE chipset**
  - Early solutions support LTE only, LTE/3G Now Enter the Market
  - Early suppliers may not be the long term winners

- **WiMAX device**
  - Diversified deployments of low cost CPEs, dual-mode USB dongles, and smartphones

- **LTE device**
  - Demonstrators = single-mode followed by dual-mode USB dongles

- **4G equipment**
  - WiMAX has established a beachhead for OFDMA technological progress…
  - …LTE will benefit from it

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Leading Vendor Beceem the First Major Supplier for WiMAX/LTE Multiple Mode

Levels of Integration Rise as Pricing Falls

WiMAX Prepares the Way for LTE – Experience and Lessons Learned in
• OFDMA
• MIMO
Asia Manufacturers Lead

Taiwan Leads as Chip Manufacturer

WiMAX Handsets Have Lagged, Indicating Why Momentum is Faltering
Plentiful WiMAX Chip Supply Sets Market Tone for LTE

• **Numerous WiMAX chipset Suppliers:**
  - Intel, Altair, Beceem, Comsys, Sequans, GCT, Samsung, Wavesat

• **WiMAX IPR Helps Even the Playing Field for LTE**
  - LTE IPR Shifts to OFDMA, MIMO – 4G Technologies
  - WiMAX Pressures Lower IPR for LTE

• **LTE chipset**
  - Early solutions support LTE only, LTE/3G Soon to Follow
  - WiMAX Suppliers First But Shares Fall
  - Qualcomm, ST
WiMAX-LTE Symbiosis

- Dual-mode WiMAX-LTE will be operator’s Path to Openness or LTE
  - HTC MAX 4G (Yota).
  - Too many bands when just considering LTE.

- WiMAX can take advantage of LTE’s economies of scale.
  - Beceem BCS500 WiMAX/LTE
  - Heterogeneous networks need area licenses
  - Femtocell/Home NodeB
  - SONs Microcell
LTE Spectrum Quagmire

- Rel 8 TDD Certification (GCF)
  - 2300-2400 MHz
  - 2570-2620 MHz (2496-2690 after Clearwire’s petition)
- 3.5 GHz band still pure WiMAX
- Semi-unlicensed WiMAX
  - 3.65 GHz
  - TV Whitespaces (700 MHz)

<table>
<thead>
<tr>
<th>E-UTRA Operating Band</th>
<th>Uplink (UL) operating band</th>
<th>Downlink (DL) operating band</th>
<th>Duplex Mode</th>
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<tr>
<td></td>
<td>BS receive</td>
<td>BS transmit</td>
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<tr>
<td></td>
<td>$F_{UL_{low}} - F_{UL_{high}}$</td>
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<td>1</td>
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<td>2110 MHz – 2170 MHz</td>
<td>FDD</td>
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<td>2</td>
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<td>880 MHz – 915 MHz</td>
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<td>1844.8 MHz – 1878.9 MHz</td>
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<td>FDD</td>
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<td>FDD</td>
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<td>22</td>
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<td>Confidential</td>
<td>FDD</td>
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<td>1800 MHz – 1920 MHz</td>
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<td>2010 MHz – 2030 MHz</td>
<td>2010 MHz – 2030 MHz</td>
<td>TDD</td>
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<td>25</td>
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<td>1800 MHz – 1910 MHz</td>
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<td>26</td>
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<td>27</td>
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<td>28</td>
<td>2570 MHz – 2620 MHz</td>
<td>2570 MHz – 2620 MHz</td>
<td>TDD</td>
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<td>29</td>
<td>1890 MHz – 1920 MHz</td>
<td>1890 MHz – 1920 MHz</td>
<td>TDD</td>
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<tr>
<td>30</td>
<td>2300 MHz – 2400 MHz</td>
<td>2300 MHz – 2400 MHz</td>
<td>TDD</td>
</tr>
</tbody>
</table>

Note 1: Band 0 is not applicable

Source: 3GPP TS 36.101 version 9.3.0 Release 9, April 2010
Multiple Suppliers Take to the Field:
- LTE Suppliers to Overshadow WiMAX – LTE Suppliers
- Qualcomm, ST-Ericsson, and Nokia
- LG and Samsung Electronics – Open Supply?
- MediaTek, Additional Low Cost Suppliers

Is IPR a Major Hurdle to Market Entry and Competition?

WiFi Multiple-Mode?
- De-emphasized due to High LTE BB
LTE Chip Supply Ramp

- Qualcomm to Lead the Market
- MDM6200™: supports HSPA+ data rates of up to 14.4 Mbps
- MDM6600™: supports HSPA+ data rates of up to 14.4 Mbps and CDMA2000® 1xEV-DO Rev. A/Rev. B
- MDM8200A™: supports HSPA+ data rates of up to 28 Mbps
- MDM8220™: supports dual-carrier HSPA+ for data rates of up to 42 Mbps
- MDM9200™: supports LTE data rates of up to 100 Mbps with full backward compatibility to dual carrier HSPA+
- MDM9600™: supports LTE data rates of up to 100 Mbps with full backward compatibility to dual carrier HSPA+ and EV-DO Rev. A/Rev. B

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Needs and Constraints

- Fit of Wireless Technology to Market Needs
  - Degree of Mobility and Roaming
  - Build or Migration to Flat IP
  - Response to Competition with 3G/LTE

- Device and Network Upgrades and Migration
  - How to Migrate Devices from WiMAX to LTE?
  - Changes in Core Networks
  - Impact of SONs, Femtocell Device Markets
Conclusions

- Those Who Will Follow the WiMAX Path:
  - Most of Greenfield, Local Requirements, Vertical Applications and Semi-unlicensed Operators Should Continue.
  - WiMAX 2.0 Opportunities Still Unclear

- 3GPP/2 Operators
  - Will Follow LTE Path, Deminishing Market for WiMAX Mobile
  - Low Probability to Adopt WiMAX 2.0
  - Degree of WiMAX Multiple Mode:
    - Need for Clearwire, YOTA, PacketOne to Roam and Convert to LTE

- LTE Chip Supply Will Ramp Quickly:
  - Qualcomm,
## Maravedis:
Your 4G Research Expert

<table>
<thead>
<tr>
<th>Experience</th>
<th>Leadership</th>
<th>Excellence</th>
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<tbody>
<tr>
<td>Eight years serving the BWA Industry</td>
<td>ONLY worldwide WiMAX &amp; LTE Operator Deployment Tracking Service: 4GCounts.com</td>
<td>Sound analysis based on primary research</td>
</tr>
<tr>
<td>Most experienced team of 4G analysts</td>
<td>Leadership in OFDM and 4G IPR</td>
<td>Consistent methodology</td>
</tr>
<tr>
<td>Wide range of research in broadband wireless</td>
<td>IN-DEPTH, RELIABLE &amp; TIMELY research and analysis</td>
<td>Unbiased insight</td>
</tr>
<tr>
<td>Global &amp; comprehensive perspective</td>
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<td>Value-added analyst support</td>
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<td>Quarterly Webinars for Clients</td>
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</table>
Industry Leaders Use Maravedis
Upcoming Research*

- 4GCounts Quarterly Report, Q2 2009 – Issue 9 (October 2009)
- The Top 20 LTE Operators (November 2009)
- WiMAX, LTE & Broadband Wireless Equipment Market Analysis & Trends (Published quarterly)
- VoIP over 4G: Opportunities & Challenges, 2nd Ed. (Q1 2009)
- India Broadband Wireless & WiMAX Market Analysis & Forecasts, 2010-2014, 4th Ed. (Q1 2010)
- Vertical Applications Using Broadband Wireless (Q2 2009)
- The Top 22: Operators Who Will Make or Break WiMAX, 2nd Ed. (Q3 2010)
- The Top 20 LTE Operators, 2nd Ed. (Q4 2010)
- WiMAX/LTE IPR & Litigation Market Impact, 3rd Ed. (Q4 2010)
- Broadband Services & Applications in the 4G Era, 2nd Ed. (Q4 2010)

*Projected – subject to change
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