Enterprise and Metro Cell Deployment
Requirements and Techniques

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Executive Summary

• **Power & interference management is required for a successful self-organizing Femto network**
  - TX power calibration
  - UL interference management

• **Beacons provide seamless mobility & enhances Femto / Macro user experience**
  - Inter-frequency Femtocell discovery in idle mode
  - Reliable triggering of inter-frequency active hand-in to Femtocell
  - Works for pre-Rel-9 and Rel-9 UEs

• **Qualcomm chipsets offer complete WiFi & small cell solution**
  - Residential, enterprise, metro
  - UltraSON™ interference & mobility management suite optimized for FSM
  - Qualcomm Atheros portfolio offers WiFi, PLC and other connectivity solutions
## UltraSON™: Comprehensive Interference & Mobility Management

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefits</th>
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<tbody>
<tr>
<td><strong>Tx Power Calibration Suite</strong></td>
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<tr>
<td>Network Listen Based Tx Power Calibration <em>(NLPC)</em></td>
<td>Location aware Tx power calibration</td>
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<tr>
<td>Supervised Mobile Assisted Range Tuning <em>(SMART)</em></td>
<td>Optimized enterprise / metro Tx power calibration</td>
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<tr>
<td>Guest Mobile Protection <em>(GUMP)</em></td>
<td>Tx power throttling based on UL RSSI measurements</td>
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<td><strong>UL Interference Management Suite</strong></td>
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<tr>
<td>Controlled Limit on UE Power <em>(CLIP)</em></td>
<td>Dynamic capping of Femto mobile Tx power</td>
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<td>Macro Aware Rise Setting <em>(MARS)</em></td>
<td>Protect femto/macro mobiles UL throughput</td>
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<tr>
<td>Rx Diversity</td>
<td>Counters single path slow fading and reduces FUE transmit power</td>
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<tr>
<td><strong>Mobility Management Suite</strong></td>
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<tr>
<td>Idle Mode Femtocell Discovery</td>
<td>Provides Fast and reliable Femtocell discovery via beacon</td>
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<td>Active Hand-in</td>
<td>Based on reliable macro to Femto handover</td>
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<tr>
<td>Mobile Assisted Self Configuration <em>(MASC)</em></td>
<td>Enhancement of Femto neighbor cell list configuration</td>
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<tr>
<td>Tx Diversity</td>
<td>Reduces number of handovers and improve voice quality</td>
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</table>
SMART Provides Excellent Indoor Coverage

Femto Coverage at Cell Site

Femto Coverage at Cell Edge

NLPC: PL_edge = 100 dB

Excessive Leakage

Coverage holes

NLPC: PL_edge = 80 dB

SMART Provides Excellent Indoor Coverage
CPICH Ec/Io > -16 dB

Close toMarco NodeB

Near Marco cell edge
Rx Diversity Improves Uplink Performance & Reduces Interference

• FUEs transmit at lower power
  – Less interference to macro and other Femtocells

• Significantly reduces the chance of UL power racing between neighboring Femtocells

• Mitigates deep fades caused by slow single path fading indoors

• Increase UL throughput for Femto UEs by 75%
Seamless Mobility is Expected & Needs to be Addressed

Idle and Active Hand in:

- Prevents call drops
- Provides consistent user experience and allows robust Femtocell deployment
- Maximized capacity and signaling offload & improved Femto – zone services
- Key requirements for enterprise, metro and dense residential Femto deployments
Reliable Femtocell Discovery

- Femtocell transmits beacon on macro frequencies
  - Trigger inter-frequency search by UE
- Beacon power is calibrated based on Femtocell location inside macro coverage area
- Active calls (connected state UEs) are not affected by enhanced Beacon
Robust Active Hand-in

- Beacon is transmitted by Femtocell on macro-only carriers
- Beacon carries pilot and overhead channels
- **Beacon-based active hand-in solution:**
  - Reliable triggering of inter-frequency hand-over
  - Required for residential and enterprise / metro deployments
  - No Macro impact
  - Work for pre-Rel-9 and Rel-9 UEs

UE detects and reports femto Beacon transmitted on Macro carrier F1 to trigger inter-frequency handover to Femto carrier F2.
FSM: Complete Systems Solution for Small Cells

- Highest level of integration enables very small form factors
  - Baseband, RF
  - Dedicated network listen
  - Snapdragon based GHZ Applications processor
  - Ethernet
  - A-GPS

- Common platform for all segments
  - Multimode
  - Residential through Metro

- System’s approach to chipset design
  - Optimized for UltraSON™ Interference & mobility management

- Powerful RF subsystem
  - Tx/Rx diversity
  - Beacon
  - MIMO
  - High Receive Sensitivity

- Very low power consumption across all segments
  - POE compliant

- GHz processor enables MIPS intensive Femto zone apps

- Best-in-class A-GPS

- Secure boot and execution environment

- IOT with Qualcomm MSM based UEs
A Complete Chipset Solution for All Deployments

Residential / SOHO

Dense Residential

SMB / Enterprise

Metrocell

Integrated Small Cell Solution

+ AR 93xx
Atheros

WLAN SoC
Qualcomm Atheros Connectivity Portfolio

- PON next-generation access to homes & multi-dwelling units
- PLC amplifies home networks, connects Internet of Things
- Industry-leading GPS enhances functionality
- Bluetooth for computing and mobile platforms
- Ethernet for Computing, Networking & CE
- Built on leading WLAN
Summary

• **Qualcomm provides a highly integrated Femto & small cell solution**
  – Dedicated Network Listen
  – Tx/Rx diversity
  – Snapdragon based GHz application processor
  – Integrated GPS
  – WiFi integration

• **UltraSON™ Suite on QC FSM enables a successful self-organizing Femto deployment & superior user experience**
  – TX power calibration
  – UL interference management
  – Seamless mobility for Rel-9 and legacy UEs

• **Qualcomm – Atheros Extends Connectivity Portfolio**
  – Complete 802.11 solutions
  – Power line, PON, Ethernet and other connectivity solutions
Thank You!