Multi Mode Receiver Design

To Accelerate Wireless Power Market Adoption

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Wireless Power Solutions | MediaTek
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Several WP ecosystems coexist now, fighting for market share, confusing customers with “I am the best…” statements.
But Each Standard Has Benefits

<table>
<thead>
<tr>
<th>Feature/Benefit</th>
<th>Qi</th>
<th>PMA</th>
<th>A4WP</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market maturity, lowest cost today</td>
<td>++</td>
<td>++</td>
<td></td>
<td>Qi &amp; PMA have been in the market for years, Qi has the highest volume</td>
</tr>
<tr>
<td>Coil Area (e.g. 5W Phones)</td>
<td>X</td>
<td>X</td>
<td>2-3X</td>
<td>A4WP coil size will scale with the power requirement</td>
</tr>
<tr>
<td>Power control</td>
<td>IB</td>
<td>IB</td>
<td>BLE</td>
<td>IB = In Band, potentially lower cost</td>
</tr>
<tr>
<td>Efficiency</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Freedom of placement</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>Tolerance for low coupling</td>
</tr>
<tr>
<td>Interoperability of different size coils / power levels</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>Tolerance for low coupling which accommodates mismatch in Rx/Tx sizes more easily</td>
</tr>
<tr>
<td>Charging continuity in presence metals</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>Sensitivity to metals causes FOD schemes to interrupt or prevent charging</td>
</tr>
<tr>
<td>Multiple device support</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>With a single Tx coil</td>
</tr>
<tr>
<td>Distance Charging</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>Low = ~ 5mm, High = ~35mm</td>
</tr>
</tbody>
</table>

*Based on existing standards Qi 1.1.2, PMA 1.0, A4WP 1.2*
Can We Bring Wireless Charging Under One Umbrella of Solutions?
<table>
<thead>
<tr>
<th>Feature</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comms Protocols</td>
<td>This is just a language. The essential algorithm for power transfer is similar.</td>
</tr>
<tr>
<td>Power Transfer</td>
<td>All systems are resonant, the difference is whether we choose to operate on-resonance (Rezence) or slightly off-resonance (Qi)</td>
</tr>
<tr>
<td>Operating Frequency</td>
<td>Qi/PMA are of similar frequencies, and A4WP is a very different frequency</td>
</tr>
</tbody>
</table>
We Could Define The Ecosystem Based on Frequency

**Low Frequency (LF) Ecosystem**
- Inductive LF
- Operating Frequency Fence: 100-300kHz

**High Frequency (HF) Ecosystem**
- Highly Resonant HF
- Operating Frequency Fence: 6.78 MHz

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We Can Use Frequency To Our Advantage

- **Low cost approach w/single:**
  - Coil
  - Matching network
  - Power path

- **Matching circuit delivers power at the desired frequency**
MT3188 Multi Standard Module

- **Device, MT3188**
  - In Mass Production

- **Certification**
  - WPC 1.1.2 → Mar, 2014
  - PMA 1.0 → Dec, 2014
  - A4WP 1.2 → Feb, 2015

- **Module Supplier**
  - Various; contact MediaTek
Considerations for Rx or Tx for Multimode Implementation

- The A4WP standard is 1:many charging (Tx/Rx)
- The Qi standard has Tx options for multiple coils for 1:1 charging (Rx/Tx)
  - Rx: Simple coil design
  - Tx: More complicated coil design
To Date Companies are Moving Towards Rx Implementations

- Companies have announced Rx solutions first including...
  - MediaTek MT3188
  - Broadcom BCM59350
  - IDT P9700

- The infrastructure market is asking for multimode transmitters; none are announced
Summary

- The diversity of Wireless-Power Ecosystems does not promote global adoption

- Technology can support Multi-Frequency solutions for both transmitters and receivers

- Multi-Frequency, Multi-Standard Products are already Emerging on the Market. Let’s welcome them.

- *Multi-Standard Wireless Power Products can be a contemporary approach to promote World Wide acceptance of Wireless Charging*