PLUGLESS™ Level 2 EV Charging System (3.3 kW) by Evatran Group Inc.

Results from Laboratory Testing off-board the vehicle

**Description / Specifications**

- **System Input Voltage** operating Voltage: 208 to 240 VAC
- **Circuit Breaker Rating**: 30 A
- **Nominal gap between coils**: 100 mm
- **Rated maximum power output**: 3300 watts

- **Parking Pad** (Primary Coil system)
  - **Shape**: Approximately Circular
  - **Size**: 559 dia. x 470 long mm

- **Vehicle Adapter** (Secondary Coil system)
  - **Shape**: Rectangular
  - **Size**: 762 long x 457 wide mm

**Measured System Parameters during nominal, steady state conditions**

- **Input Power**
  - **Input Voltage**: 208 VAC
  - **Input Current RMS**: 28 Amps RMS
  - **Power Factor**: 0.60
  - **Voltage Total Harmonic Distortion (THD)**: 3 %
  - **Current Total Harmonic Distortion (THD)**: 132 %

- **Operating Frequency (kHz)**: 18 - 20 kHz (variable)

- **DC Output Power** (into programmable DC electronic load)
  - **Output Voltage**: 215 VDC
  - **Output Current**: 13.9 Amps
  - **Output Voltage Ripple Factor**: 0.75 %

- **Operating Temperature**
  - **Parking Pad**: Max observed surface temperature: 51 °C
  - **Vehicle Adapter**: Max observed surface temperature: 48 °C

---

2. Test conducted at nominal conditions (3.0 kW output, 100mm coil gap, coils aligned) unless otherwise specified
Measured System Efficiency

**Definition: Wireless Charging System Efficiency**

System Efficiency = \( \frac{\text{Energy out of PLUGLESS™ Vehicle Adapter into programmable DC Load}}{\text{Energy into PLUGLESS™ Control Panel from 208 VAC}} \)

**System Efficiency variation with coil misalignment**

<table>
<thead>
<tr>
<th>Misalignment (mm)</th>
<th>Maximum Efficiency (%)</th>
<th>Efficiency when aligned (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(80,20)</td>
<td>87.3%</td>
<td>86.9%</td>
</tr>
<tr>
<td>(0,0)</td>
<td>86.9%</td>
<td>86.9%</td>
</tr>
</tbody>
</table>

**Impact of Coil Gap on System Efficiency**

**System Efficiency at Various Output Power**
Measured Magnetic and Electric Field

Magnetic and Electric field Frequency Scan measurement (coils aligned)\(^2,3\)

Scan of the Magnetic & Electric fields around the rear side of the PLUGLESS system\(^2\)

<table>
<thead>
<tr>
<th>EM Field measurements(^2)</th>
<th>EM Field meter position (X,Z)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum measured H-field</td>
<td>(0,-50) between coil centers</td>
</tr>
<tr>
<td>Maximum measured E-field</td>
<td>(-50,80) above the vehicle adapter</td>
</tr>
<tr>
<td>H-field 0.6m from coil center</td>
<td>(-600,-50) at rear of system</td>
</tr>
<tr>
<td>E-field 0.6m from coil center</td>
<td>(101.5 V/m) at rear of system</td>
</tr>
</tbody>
</table>

\(^2\) EM field measurement is centered between the gap (50mm below secondary coil) 0.8m from Secondary Coil Center along X-axis

\(^3\) Page 3 1/7/2015