

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

Results from Full System Testing in a Laboratory environment

Description / Specifications¹

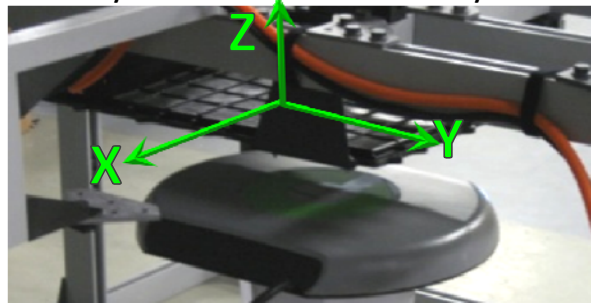
System Input Voltage operating Voltage	208 to 240 VAC
Circuit Breaker Rating	30 A
Nominal gap between coils	100 mm
Rated maximum power output	3300 watts
Parking Pad (Primary Coil system)	
Shape	Approximately Circular
Size	559 dia. x 470 long mm
Vehicle Adapter (Secondary Coil system)	
Shape	Rectangular
Size	464 long x 525 wide mm



Measured System Parameters during Laboratory Testing

Input Power Measurements (at 3.3 kW output, 100mm gap)	
Input Voltage	208 VAC
Input Current RMS	28 Amps RMS
Power Factor	0.65
Voltage Total Harmonic Distortion (THD)	4 %
Current Total Harmonic Distortion (THD)	112 %
Wireless Power Transfer Operation	
Operating Frequency (kHz)	19.5 kHz
DC Output Measurements (at 3.3 kW output, 100mm gap)	
Output Voltage	214 VDC
Output Current	15.4 Amps
Voltage Ripple Factor	0.75 %
Operating Temperatures at 3.3 kW output	
Parking Pad: Max observed surface temperature	51 °C
Vehicle Adapter: Max observed surface temperature	47 °C

Laboratory Test Measurement Coordinate System²



¹ Manufacturer's Specifications: http://www.pluglesspower.com/wp-content/uploads/2013/06/PluglessL2_Specs.pdf

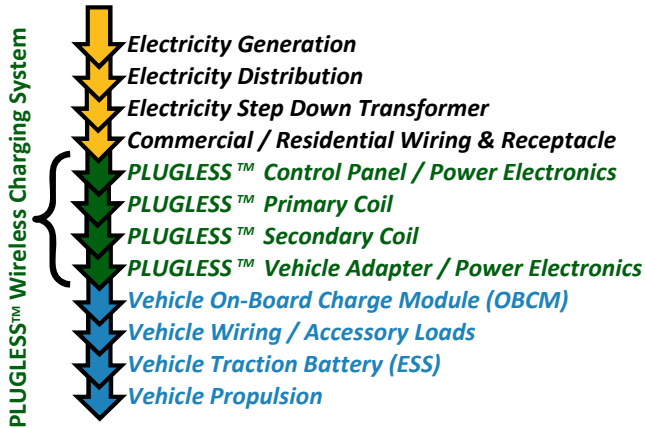
² Test Coordinates System Origin: Center of the Secondary Coil at the Bottom Surface of the Enclosure

Measured PLUGLESS™ System Efficiency

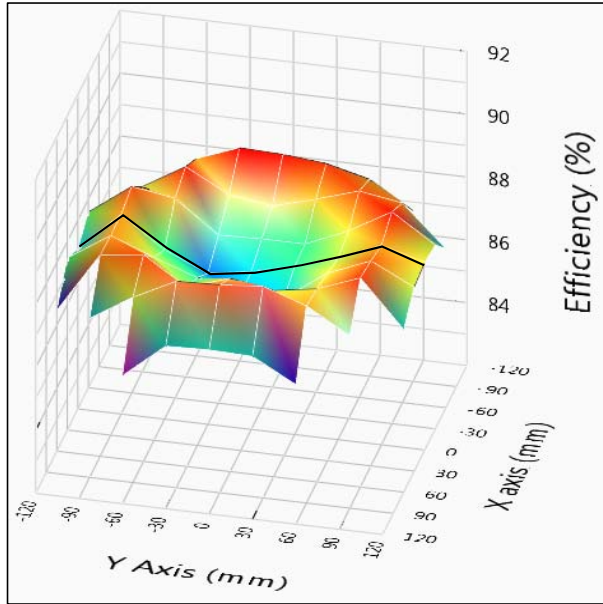
Definition: Wireless Charging System Efficiency

$$\text{System Efficiency} = \frac{\text{Energy out of PLUGLESS™ Vehicle Adapter}}{\text{Energy into PLUGLESS™ Control Panel}}$$

Power Flow from Generation to Vehicle Operation



System Efficiency at 100mm gap for 3.3kW output Primary Coil position relative to Secondary Coil (mm)



Efficiency Results (at 3.3 kW output with 100mm gap)

Maximum Efficiency (%)	88.8%
Nominal Efficiency (%)	87.0%
Minimum Efficiency (%)	86.1%

Primary Coil position relative to Secondary Coil (mm)²

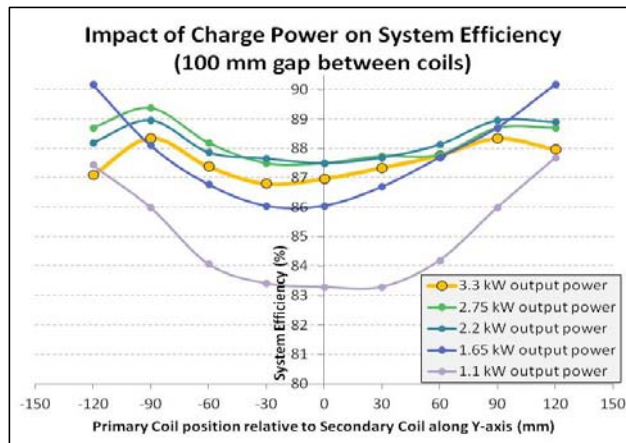
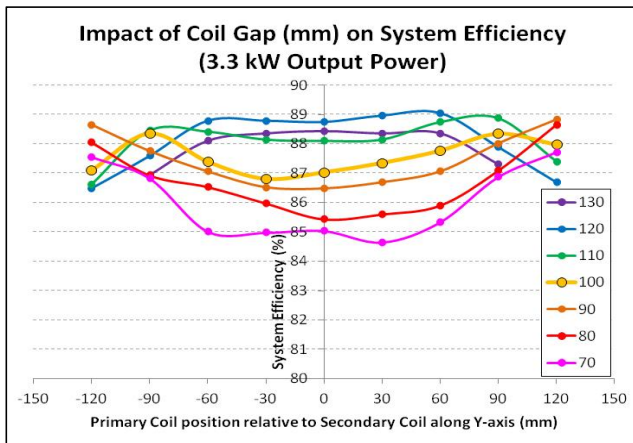
(-90,-30)
(0,0)
(120,-60)

Efficiency Results (at 3.3 kW output with 110mm gap)

Maximum Efficiency (%)	89.2%
Nominal Efficiency (%)	88.1%
Minimum Efficiency (%)	86.2%

Primary Coil position relative to Secondary Coil (mm)²

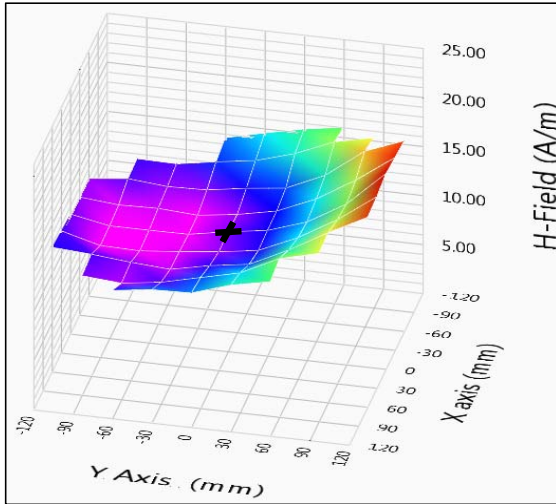
(-60,30)
(0,0)
(90,90)



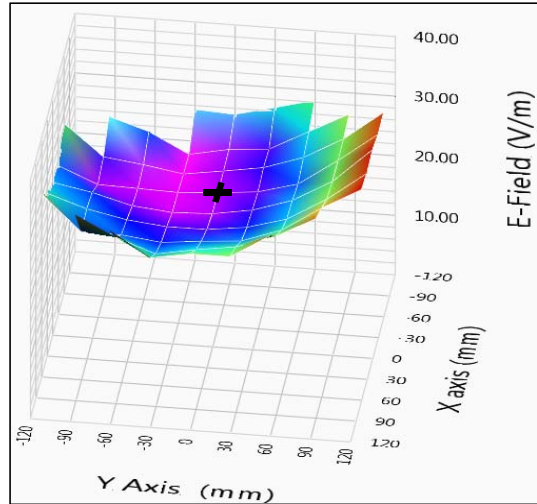
Measured PLUGLESS™ Magnetic and Electric Field

Peak Magnetic and Electric fields (100mm gap, 3.3 kW output) for Primary Coil position relative to Secondary Coil

Magnetic Field (H-field)³



Electric Field (E-field)³

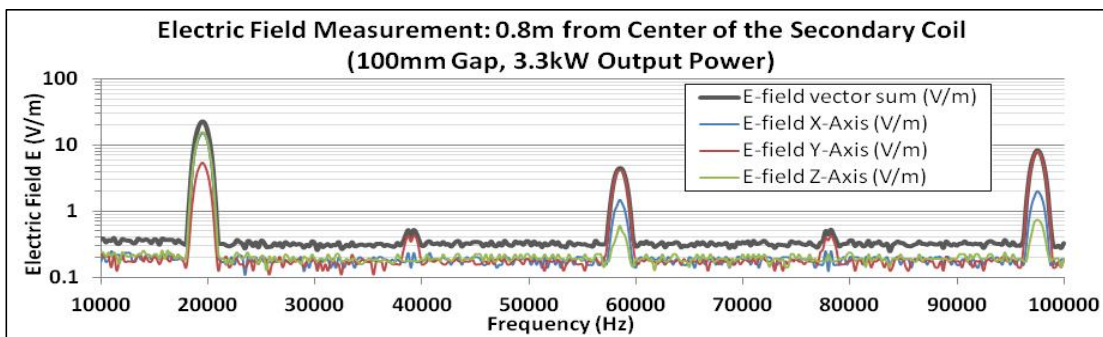
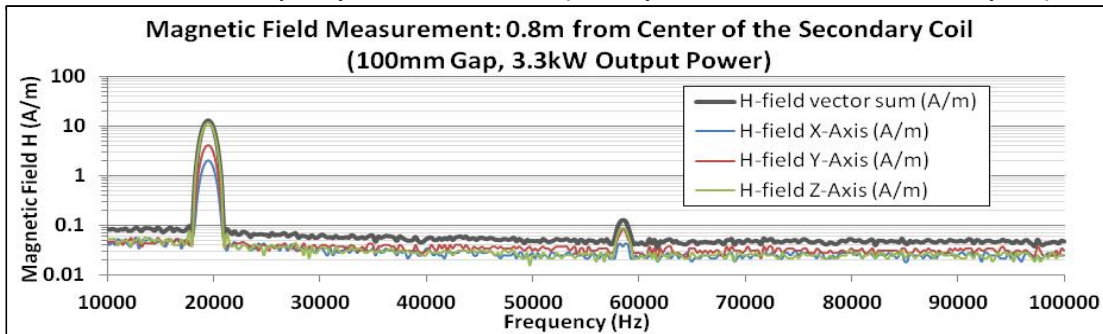


EM Field Results (at 3.3 kW output with 100mm gap)

Maximum H-field (A/m)	21.9	(0,120)
Nominal H-field (A/m)	12.9	(0,0)
Maximum E-field (V/m)	35.2	(60,120)
Nominal E-field (V/m)	22.1	(0,0)

Primary Coil position relative to Secondary Coil (mm)²

Magnetic and Electric field Frequency Scan measurement (Primary Coil at 0,0 relative to Secondary Coil)³



³ EM field measurement is centered between the gap (50mm below secondary coil) 0.8m from Secondary Coil Center along Y-axis