TEST REPORT

Report Number: 102731932DEN-001
Project Number: G102731932

Report Issue Date: October 12, 2016

Product Designation: **Model:** Power Pack

Standards: **FCC Part 15 Subpart C (15.207)**
FCC Part 15 Subpart C (15.209)
IC RSS-216, issue 2: 2016
IC RSS-GEN, Issue 4: 2014

Tested by:
Intertek Testing Services NA, Inc.
1795 Dogwood St. Suite 200
Louisville, CO 80027
USA

Client:
Sphero, Inc
4772 Walnut St, Suite 206
Boulder, CO 80301
USA

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Son La
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Report reviewed by

Michael Spataro
Engineering Team Leader

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TABLE OF CONTENTS

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded **the product tested complies with the requirements of the standard(s) indicated**. The results obtained in this test report pertain only to the item(s) tested.

General Test Methodology

All measurements were performed according to the procedures in the following documents:

- ANSI C63.10:2013 – ANSI Standard for Testing Unlicensed Wireless Devices

Test Facility

Intertek Denver's testing facilities are located at 1795 Dogwood St. Suite 200 Louisville, CO 80027. The testing facility is ISO17025:2005 accredited by A2LA, our lab code is 2506.02, our VCCI registration numbers are. R-1643, C-1752 and T-1558, our FCC designation no. US1121 and our IC lab no. 2042N.

Testing contained in this test report may not be covered under the laboratories scope of accreditation. A note will be placed in the specific test section for testing not coved under the laboratories scope.

2 Test Summary

Section	Test Specification	Test Description	Test Date	Result
5	15.31(e)	AC Supply Variation	10/3/2016	Pass
6	15.209(a) RSS-GEN 8.9	Maximum Peak Output Power - Radiated	10/3/2016	Pass
7	15.209(a)/RSS-GEN 8.9	Spurious and Emissions - Radiated	10/3/2016	Pass
8	RSS-GEN 6.6	Occupied Channel Bandwidth	10/3/2016	Pass
9	15.207/RSS-GEN 8.8	Transmitter Power Line Conducted Emissions.	10/4/2016	Pass
10		RF Exposure Requirements	10/4/2016	Pass

Notes: All testing was performed with SPRK+ robots completely discharged and charging, also without the SPRK+ robots on the charging base.

General Radio Test Notes:

- ANSI C63.10, Section 4.1.4/ FCC 15.35: Measurement detector functions and bandwidths utilized in this testing were per the preceding guidelines. 15.35(b): When an average limit is specified, the peak emission must also be measured to ensure the emissions is less than 20dB above the average limit and/or below the peak limit specified. This report includes both average and peak test data.

- ANSI C63.10, Section 5.3/ FCC 15.31: All radiated field strength measurements taken at an antenna-to-product test distance of 3-meters.

- ANSI C63.10, Section 5.5, Table 2/ FCC 15.33(a): The frequency range of measurement was per the requirements of the preceding standards. The product was tested from 0.1kHz to 1GHz.

- ANSI C63.10, Section 6.3.3/ FCC 15.35(b): Measurement bandwidths utilized for fundamental peak emissions were equal to or greater than the 6dB bandwidth of the emission.

- RSS-216, EUT tested as a Type 3 device per section1.2.

3 Description of Equipment Under Test

Model:	Power Pack
Type of EUT:	Wireless Induction Charger
Serial Number:	EMC
FCC ID:	SXO-PP01
Industry Canada ID:	10016A-PP01
Related Submittal(s) Grants:	NA
Company:	Sphero Inc.
Customer:	Andrew Jackson
Address:	4772 Walnut St, Suite 206 Boulder CO 80301
Phone:	(720) 938-2828
Fax:	
e-mail:	Andrew@sphero.com
Test Standards:	☒ 47 CFR, Part 15C:§15.207 ☒ 47 CFR, Part 15C:§15.209 ☒ RSS-GEN, Issue 4: 2014 ☒ RSS-216, Issue 2: 2016
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	10/3/2016
Test Work Started:	10/5/2016
Test Work Completed:	10/5/2016
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good

Product Description:	Wireless Induction Charger
Transmitter Type:	Wireless power transfer with data
Operating Frequency Range(s):	125 KHz
Number of Channels:	1
Modulation:	None
Emission Designator:	N0D
Antenna(s) Info:	Integral
Rated Power:	4 uW
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☐ Internal battery ☒ External power source
Special Test Arrangement:	The EUT was rotated and tested in one orthogonal axis between operating and standby mode to determine the maximum emissions.
Test Facility Accreditation:	A2LA (Certificate No. 2506.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10:2013

Description of Equipment Under Test (provided by client)
Power supply and power distribution of proprietary wirelss induction charging cradle system.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
110 – 240	1.5A	60Hz	1

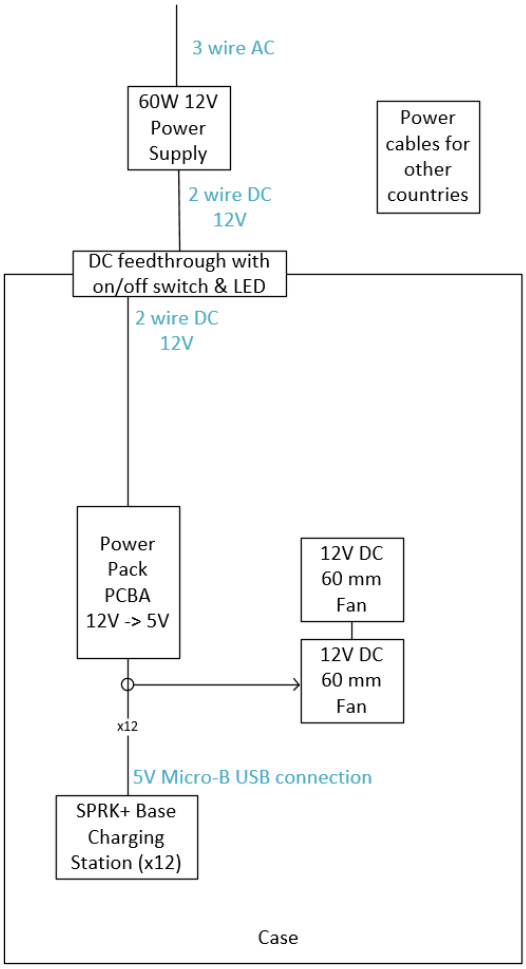
Descriptions of EUT Exercising
☒ Standby/Idle Mode
☒ Continuous transmission, un-modulated carrier (CW)
☐ Continuous transmission, modulated carrier (CW)
☐ Continuous Receive Mode

Note: The chosen mode of operation described above is dependent upon the specific test to be performed.

4 System setup including cable interconnection details, support equipment and simplified block diagram

Method:
Record the details of EUT cabling, document the support equipment, and show the interconnections in a block diagram.

EUT Block Diagram: EMC Perspective



Note:

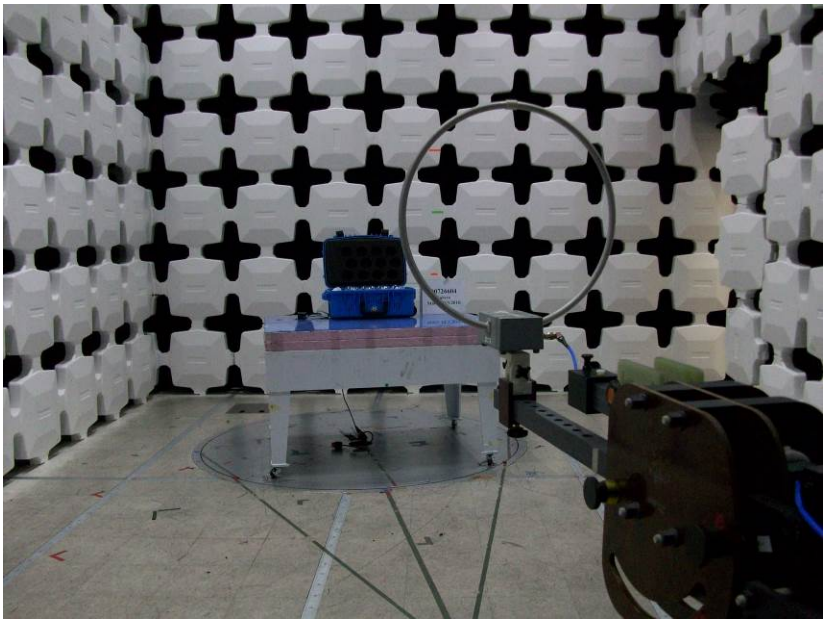
Support Data:

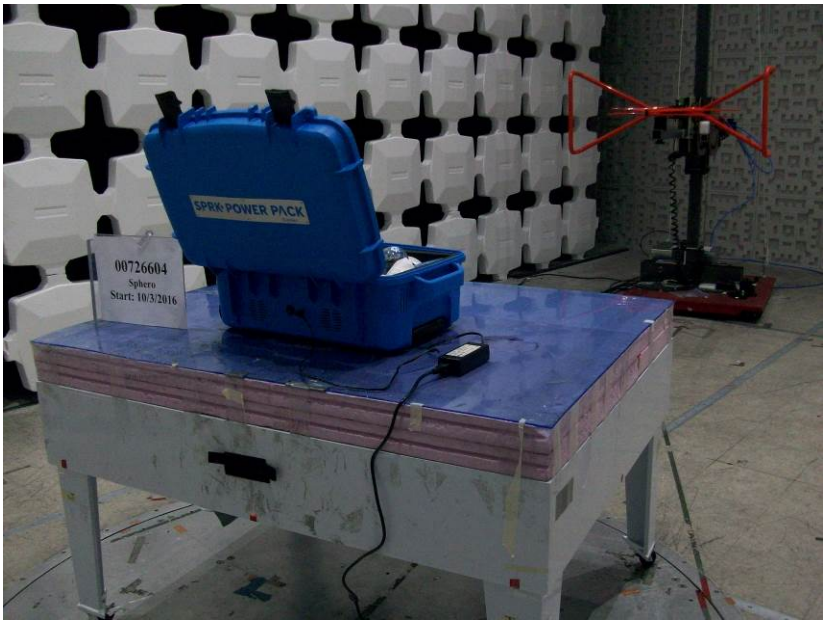
ID	Description/ Function	Shield Type	Length	Connector	Connection	Ferrites
	None					

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None			

Notes:

Photograph: Product Under Test





5 AC Supply Variation

Method:

The test methods used comply with ANSI C63.10.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

Test Requirement/Specification:

- ANSI C63.10: 2013, Section 6.2

Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	6/22/2016	6/22/2017
18897	Magnetic loop	EMCO	6502	9205-2738	11/12/2015	11/12/2016
18912	9 kHz- 1.3GHz Pre Amp	Hewlett-Packard	HP	5	3/31/2016	3/31/2017
DEN-073	EMI Receiver (10Hz – 26.5GHz)	RHODE & SCHWARZ	ESU 26	100265	12/19/2015	12/19/2016
CC1-E2	Radiated Cable	Teledyne	90-206-300; PN:F-130-S1S1-100; 90-206-072;	E2-A; 5026702 002; E2-C; E2-D	11/17/2015	11/17/2016
206	Humidity/Temperature	Extech Instruments	44580	958123	7/21/2016	7/21/2017

Software Utilized:

Name	Manufacturer	Version
SW-6: Software for Radiated and Conducted emissions.	Intertek	OATS cvi, V.1.0

Results: There is no significant difference in the radiated field strength of the fundamental frequency with respect to varying the ac voltage. Therefore, all measurements will be taken using the nominal rated voltage of the product.

Test Data:

Fundamental Frequency	LEVEL
MHz	dBm
AC @ Nominal Voltage – 120 VAC / 60 Hz	
0.125	76.71
AC @ 115% Nominal Voltage – 138 VAC / 60 Hz	
0.125	75.75
AC @ 85% Nominal Voltage – 102 VAC / 60 Hz	
0.125	76.26

6 Maximum Peak Output Power - Radiated

Method:

The test methods used comply with ANSI C63.10. Unless otherwise stated no deviations were made from FCC 15.209 or ICES-001.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

Test Requirement/Specification:

The maximum field strength limit

Frequency range (MHz)	Limit @ 3 meters (dBuV/m)
0.125 MHz	105.7

- FCC 15.209(a)
- RSS-GEN 8.9
- Limits are corrected to 3m by inverse distance square (40dB per decade of distance)

Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	6/22/2016	6/22/2017
18897	Magnetic loop	EMCO	6502	9205-2738	11/12/2015	11/12/2016
18912	9 kHz- 1.3GHz Pre Amp	Hewlett-Packard	HP	5	3/31/2016	3/31/2017
DEN-073	EMI Receiver (10Hz – 26.5GHz)	RHODE & SCHWARZ	ESU 26	100265	12/19/2015	12/19/2016
CC1-E2	Radiated Cable	Teledyne	90-206-300; PN:F-130-S1S1-100; 90-206-072;	E2-A; 5026702 002; E2-C; E2-D	11/17/2015	11/17/2016
206	Humidity/Temperature	Extech Instruments	44580	958123	7/21/2016	7/21/2017

Software Utilized:

Name	Manufacturer	Version
SW-6: Software for Radiated and Conducted emissions.	Intertek	OATS cvi, V.1.0

Results:

The sample tested was found to comply.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

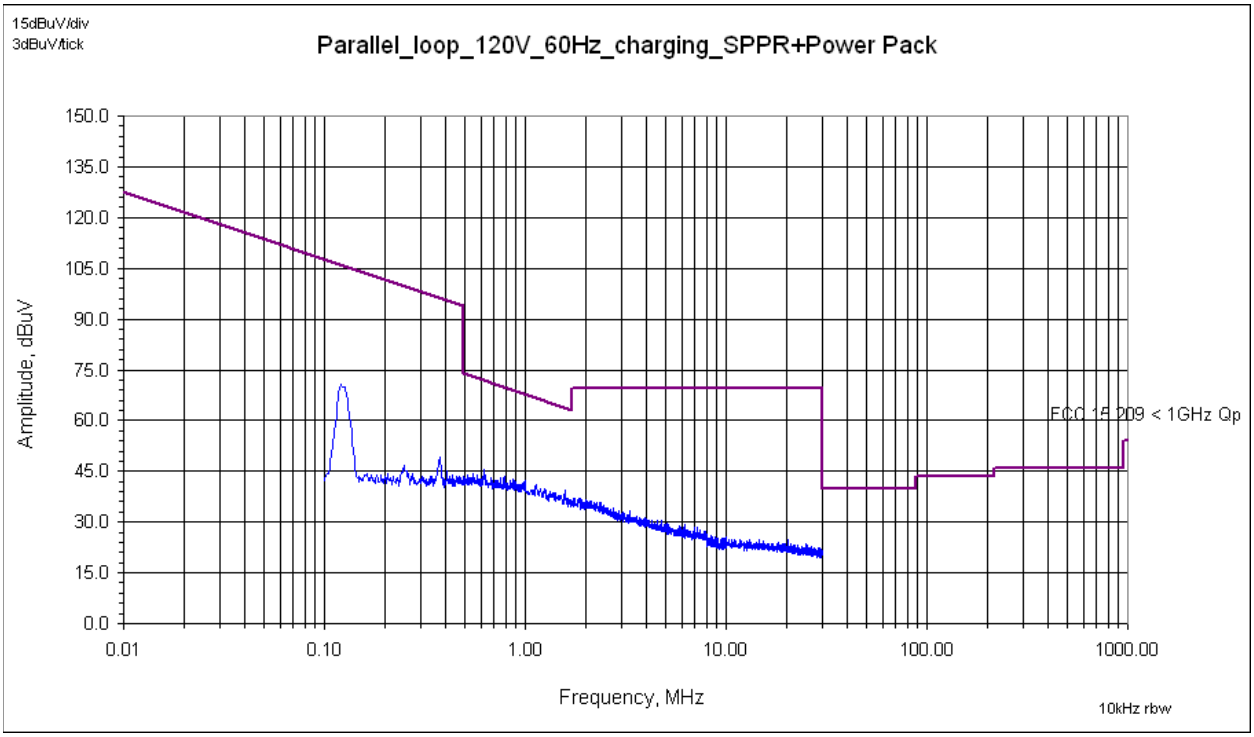
To convert from dBμV to μV or mV the following was used:

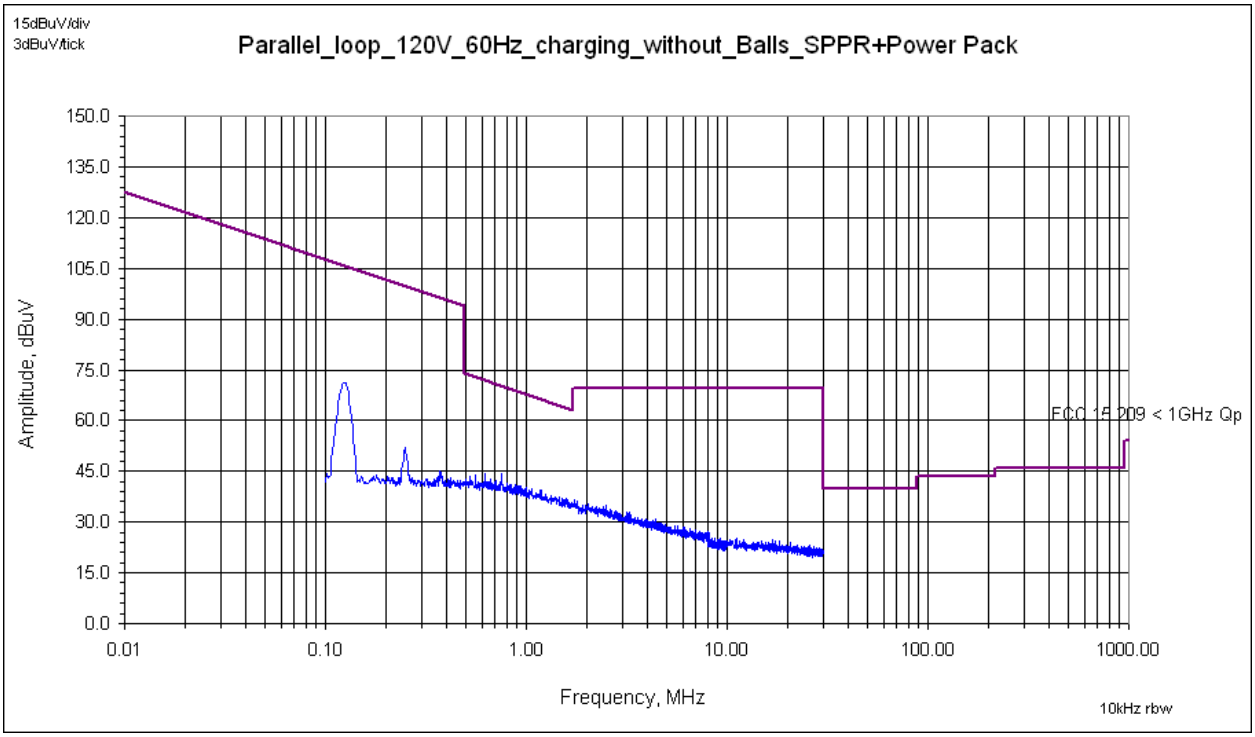
$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

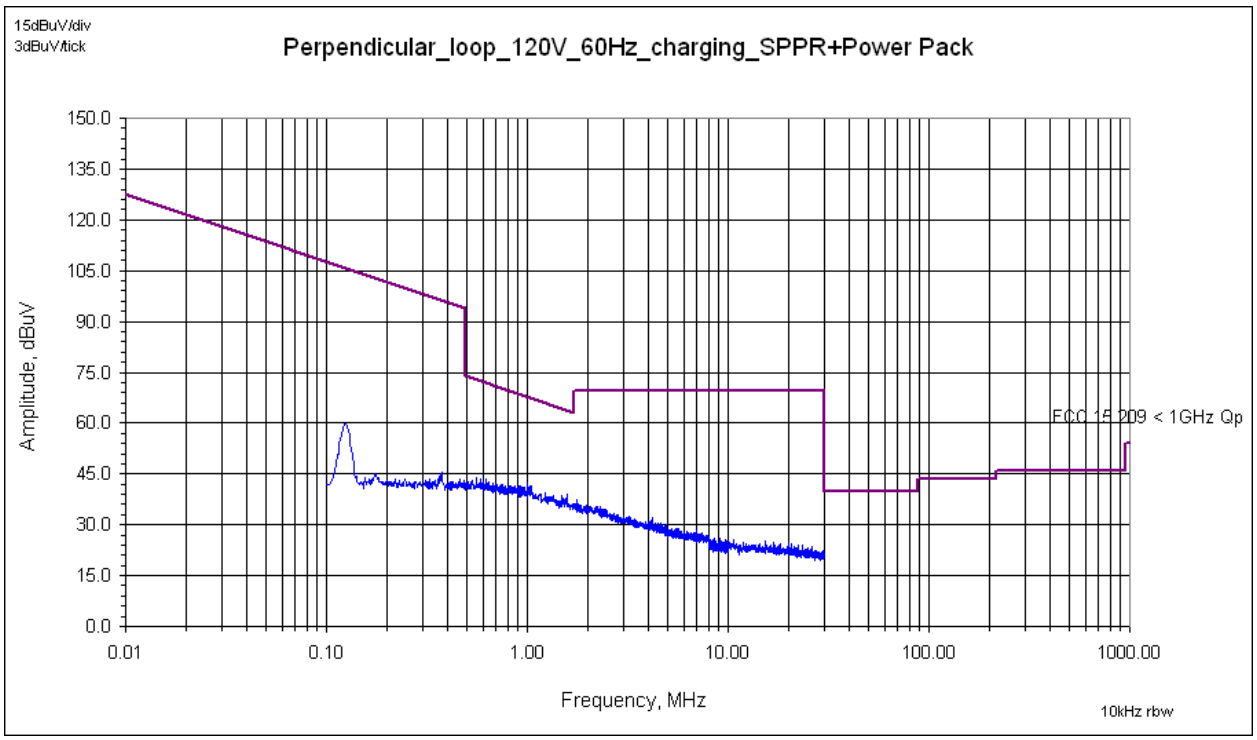
Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Plots:


15dBuV/div
3dBuV/tick
Parallel_loop_120V_60Hz_charging_SPPR+Power Pack
150.0
135.0
120.0
105.0
90.0
75.0
60.0
45.0
30.0
15.0
0.0
Amplitude, dBuV
FCC 15.209 < 1GHz Qp
0.01
0.10
1.00
10.00
100.00
1000.00
Frequency, MHz
10kHz rbw


15dBuV/div
3dBuV/tick
Parallel_loop_120V_60Hz_charging_without_Balls_SPPR+Power Pack
150.0
135.0
120.0
105.0
90.0
75.0
60.0
45.0
30.0
15.0
0.0
Amplitude, dBuV
FCC 15.209 < 1GHz Qp
0.01
0.10
1.00
10.00
100.00
1000.00
Frequency, MHz
10kHz rbw


15dBuV/div
3dBuV/tick
Perpendicular_loop_120V_60Hz_charging_SPPR+Power Pack
150.0
135.0
120.0
105.0
90.0
75.0
60.0
45.0
30.0
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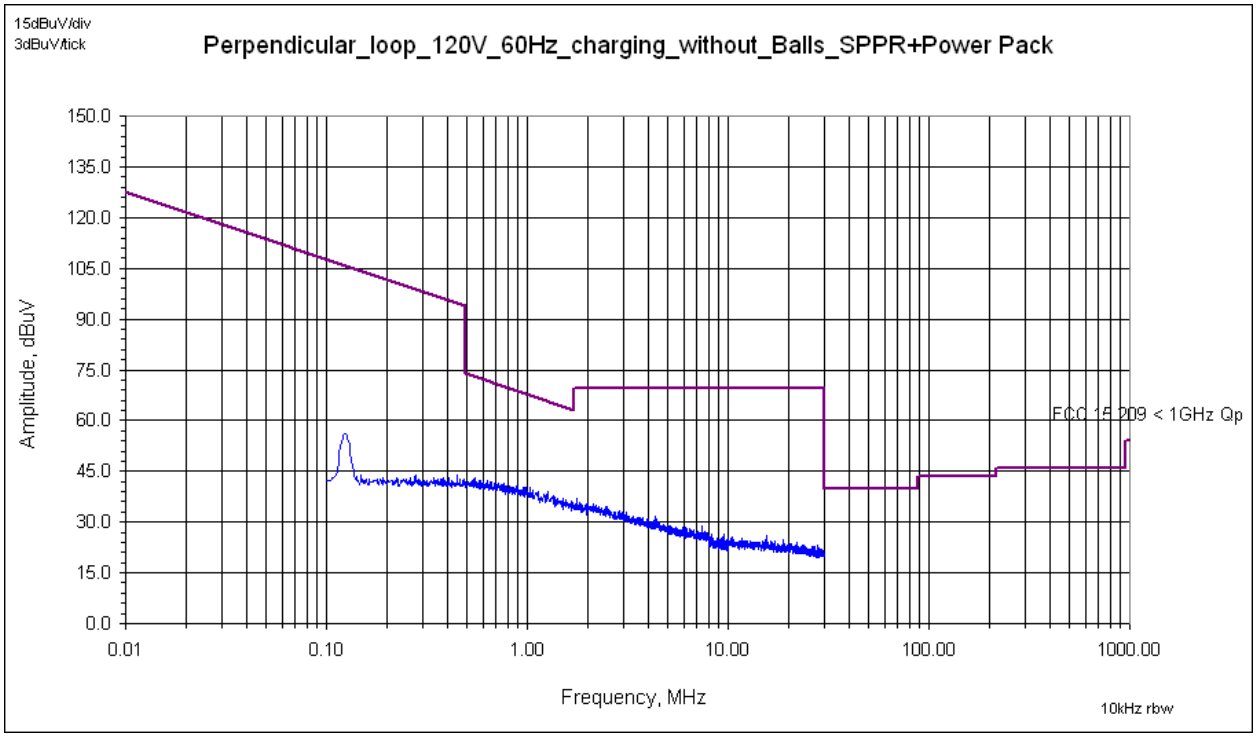
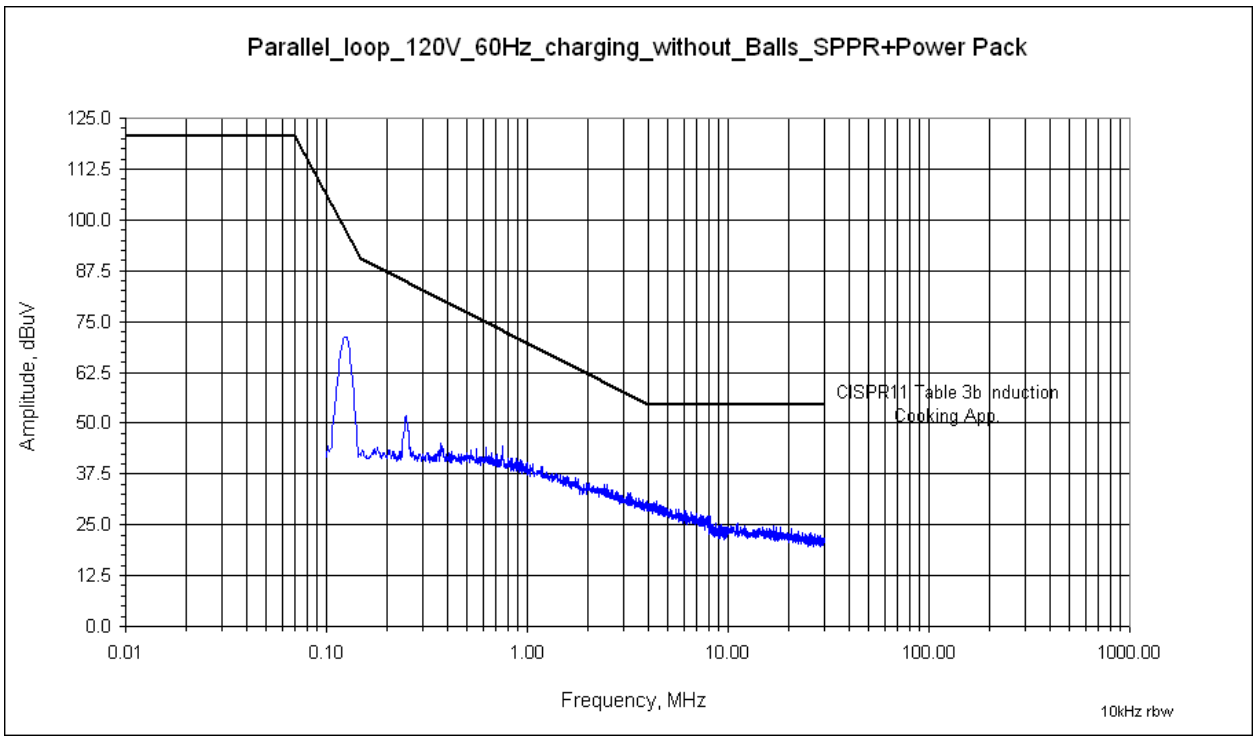
Amplitude, dBuV
0.01
0.10
1.00
10.00
100.00
1000.00
Frequency, MHz
FCC 15.209 < 1GHz Qp
10kHz rbw


15dBuV/div
3dBuV/tick
Perpendicular_loop_120V_60Hz_charging_without_Balls_SPPR+Power Pack
150.0
135.0
120.0
105.0
90.0
75.0
60.0
45.0
30.0
15.0
0.0
Amplitude, dBuV
0.01
0.10
1.00
10.00
100.00
1000.00
Frequency, MHz
FCC 15.209 < 1GHz Qp
10kHz rbw


Parallel_loop_120V_60Hz_charging_without_Balls_SPPR+Power Pack
125.0
112.5
100.0
87.5
75.0
62.5
50.0
37.5
25.0
12.5
0.0
Amplitude, dBuV
0.01
0.10
1.00
10.00
100.00
1000.00
Frequency, MHz
CISPR11 Table 3b nduction Cooking App
10kHz rbw

Data:

FREQ	LEVEL	DET	CABLE	ANT	FINAL	POL	HGT	AZ	DELTA1	RBW	Limit 1
MHz	dBuV	Qp Av Pk Rms	+ [dB]	+ [dB/m]	= [dBuV]	Parallel/ Perpendicular	(m)	(DEG)	FCC 15.209 < 30MHz Qp	(MHz)	FCC 15.209 < 30MHz Qp
Parallel_loop_120V_60Hz_Charging_With Balls											
0.125	15.92	**Qp**	0.04	10.28	26.24	Perpendicular	1.00	159.0	- 79.46	0.0002	105.7
Perpendicular_loop_120V_60Hz_Charging_With Balls											
0.125	50.06	**Qp**	0.04	10.28	60.38	Parallel	1.00	23.0	- 45.28	0.0002	105.7

Convert Field Strength to Power
$P=(E \times D)_2/(30 \times G)$

Where;

E = Volts/meter, in this case the maximum recorded amplitude of 60.38 dBuV/m = 0.0012V/m
D = Test distance in meters, in this case 3 meters
G = Linear gain of the antenna, in this case the EUT incorporates and integral antenna so 1 is used.
$P=(0.0012 \times 3)^2/(30 \times 1)$

P=4µW

FREQ	LEVEL	DET	CABLE	ANT	FINAL	POL	HGT	AZ	DELTA1	RBW	Limit 1
MHz	dBuV	Qp Av Pk Rms	+ [dB]	+ [dB/m]	= [dBuV]	Parallel/ Perpendicular	(m)	(DEG)	CISPR 11 Table 3b	(MHz)	CISPR 11 Table 3b
Parallel_loop_120V_60Hz_Charging_With Balls											
0.125	15.92	**Qp**	0.04	10.28	26.24	Perpendicular	1.00	159.0	- 71.14	0.0002	97.37
Perpendicular_loop_120V_60Hz_Charging_With Balls											
0.125	50.06	**Qp**	0.04	10.28	60.38	Parallel	1.00	23.0	- 37.0	0.0002	97.37

Limits in CISPR 11-04 were converted to dBuV from dBuA by adding 51.5 dB.

7 Spurious Radiated

Method:

The test methods used comply with ANSI C63.10. Unless otherwise stated no deviations were made from FCC 15.209 and ICES-001.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

Test Requirement/Specification:

- 15.209
- RSS-Gen 8.9
- Limits <30 MHz are corrected to 3m by inverse distance square (40dB per decade of distance)

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
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206	Humidity/Temperature	Extech Instruments	44580	958123	7/21/2016	7/21/2017

Software Utilized:

Name	Manufacturer	Version
SW-6: Software for Radiated and Conducted emissions.	Intertek	OATS cvi, V.1.0

Results:

The sample tested was found to comply.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

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To convert from dBμV to μV or mV the following was used:

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Example:

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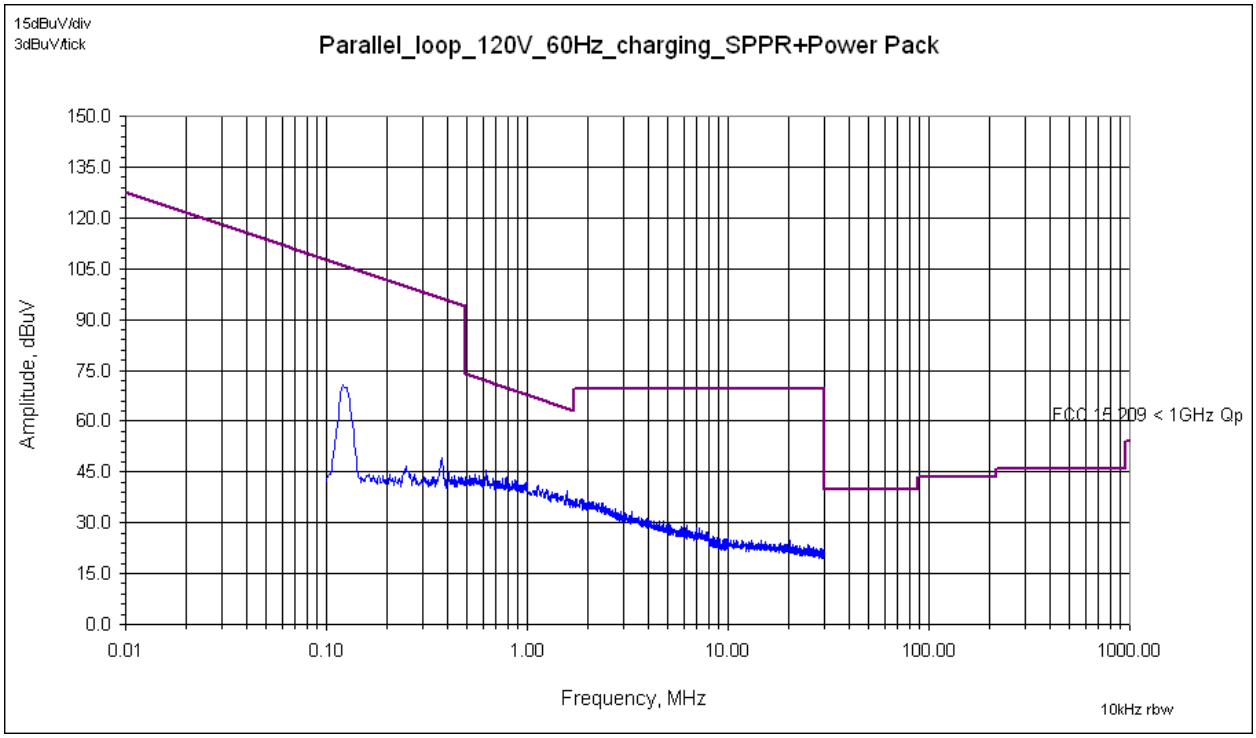
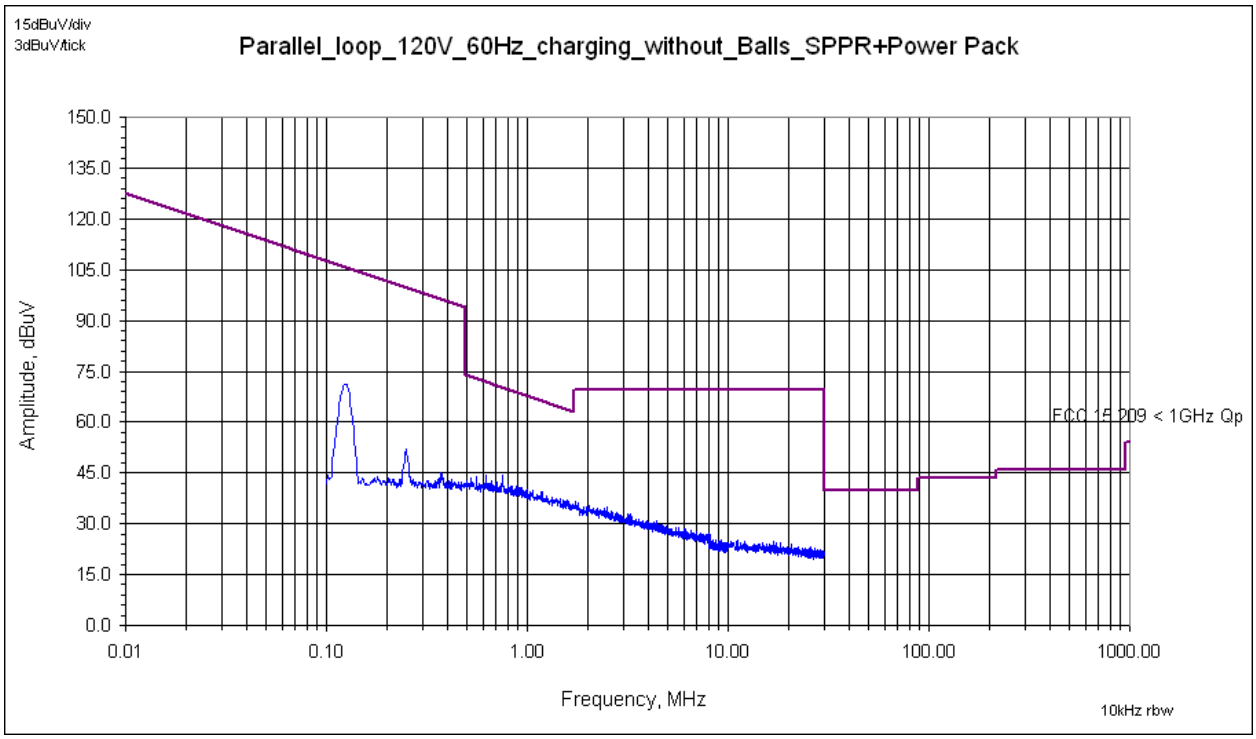
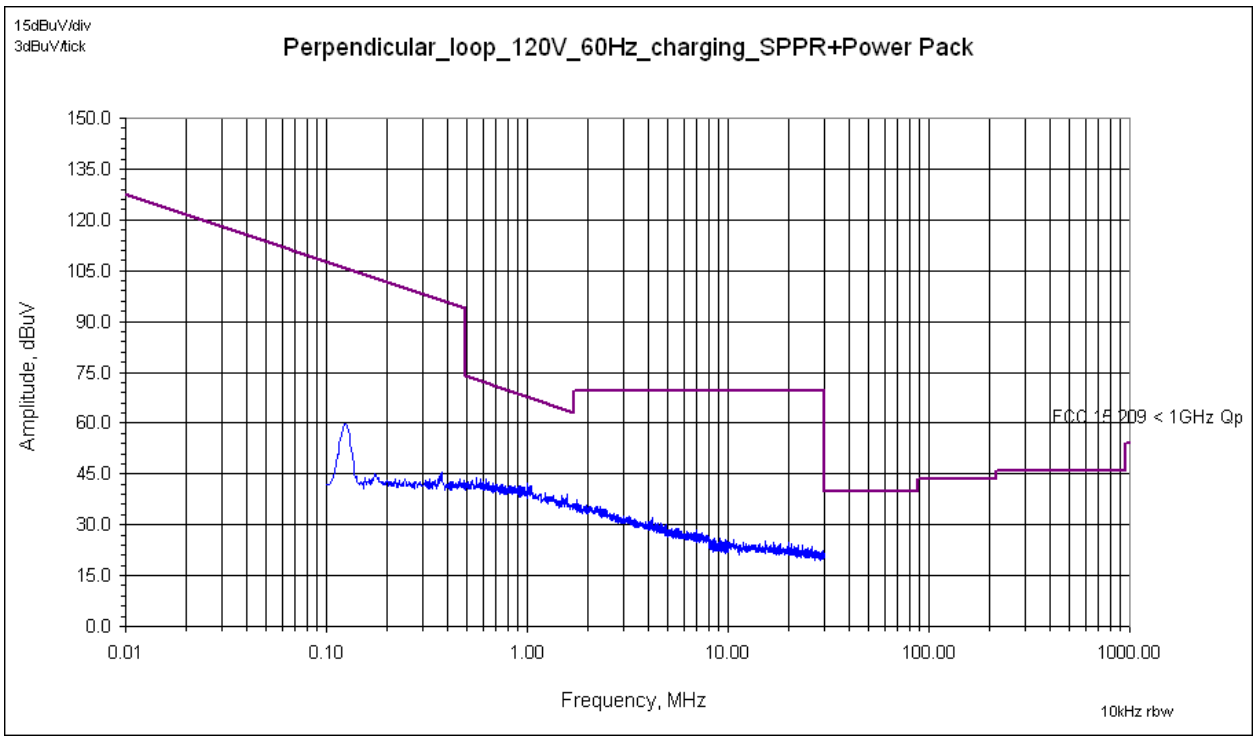
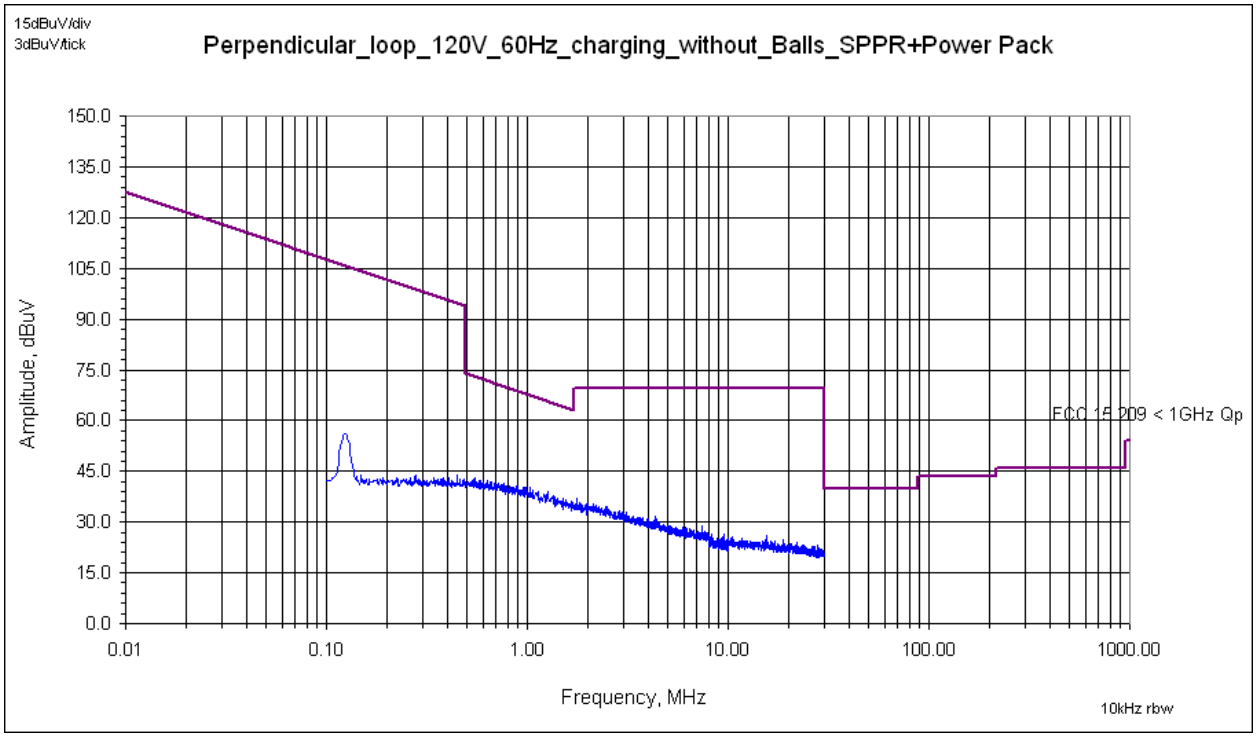
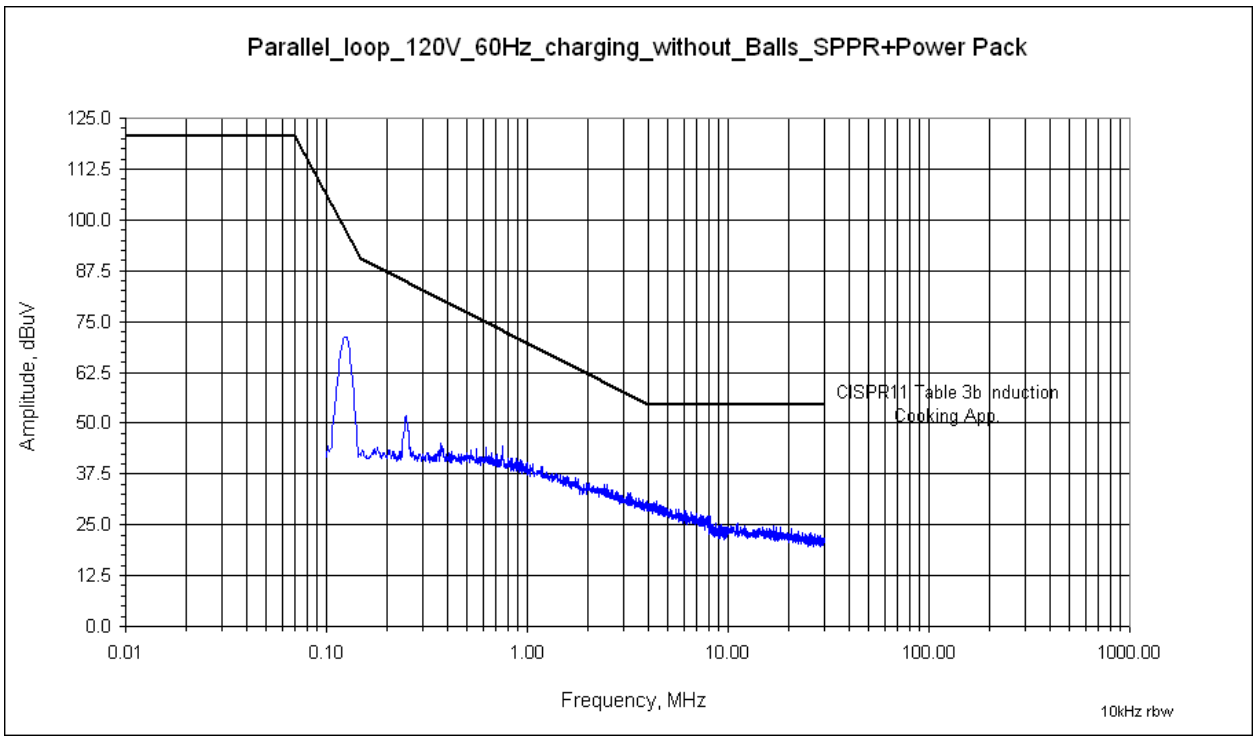
Plots: Prescan only






15dBuV/div
3dBuV/tick
Perpendicular_loop_120V_60Hz_charging_SPPR+Power Pack
150.0
135.0
120.0
105.0
90.0
75.0
60.0
45.0
30.0
15.0
0.0
Amplitude, dBuV
0.01
0.10
1.00
10.00
100.00
1000.00
Frequency, MHz
FCC 15.209 < 1GHz Qp
10kHz rbw


15dBuV/div
3dBuV/tick
Perpendicular_loop_120V_60Hz_charging_without_Balls_SPPR+Power Pack
150.0
135.0
120.0
105.0
90.0
75.0
60.0
45.0
30.0
15.0
0.0
Amplitude, dBuV
0.01
0.10
1.00
10.00
100.00
1000.00
Frequency, MHz
FCC 15.209 < 1GHz Qp
10kHz rbw


Parallel_loop_120V_60Hz_charging_without_Balls_SPPR+Power Pack
125.0
112.5
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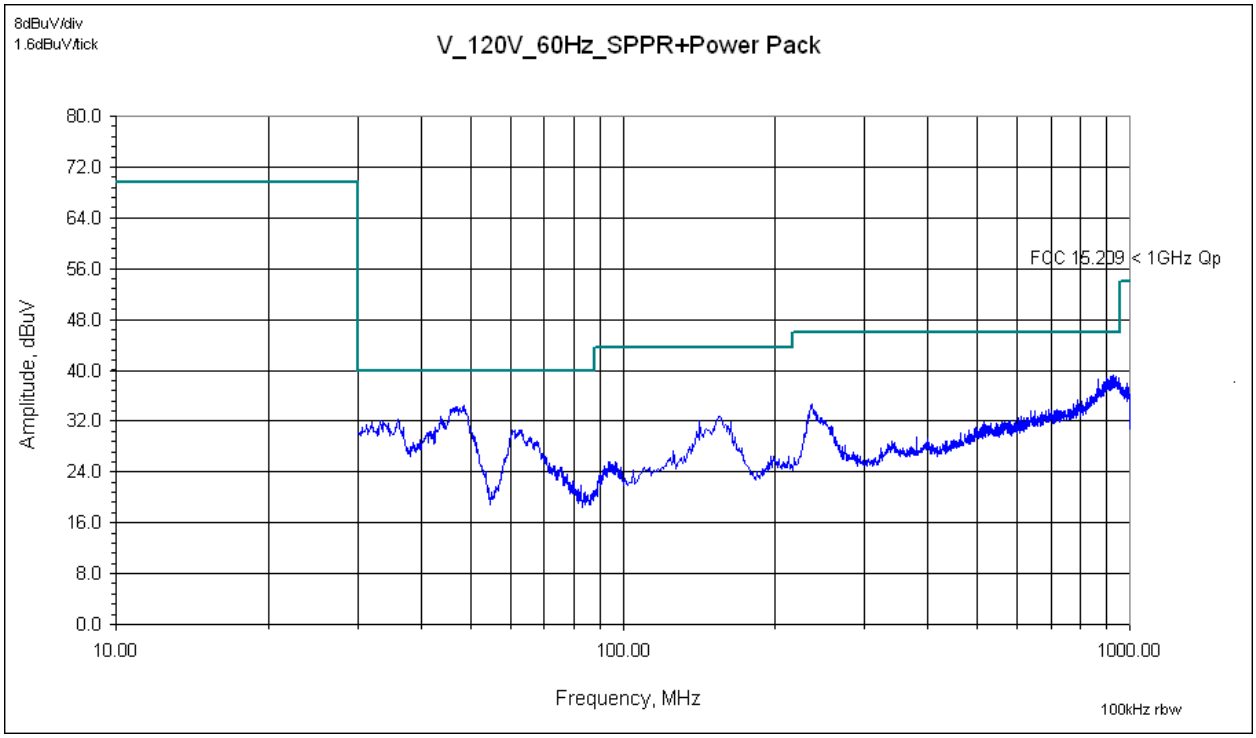
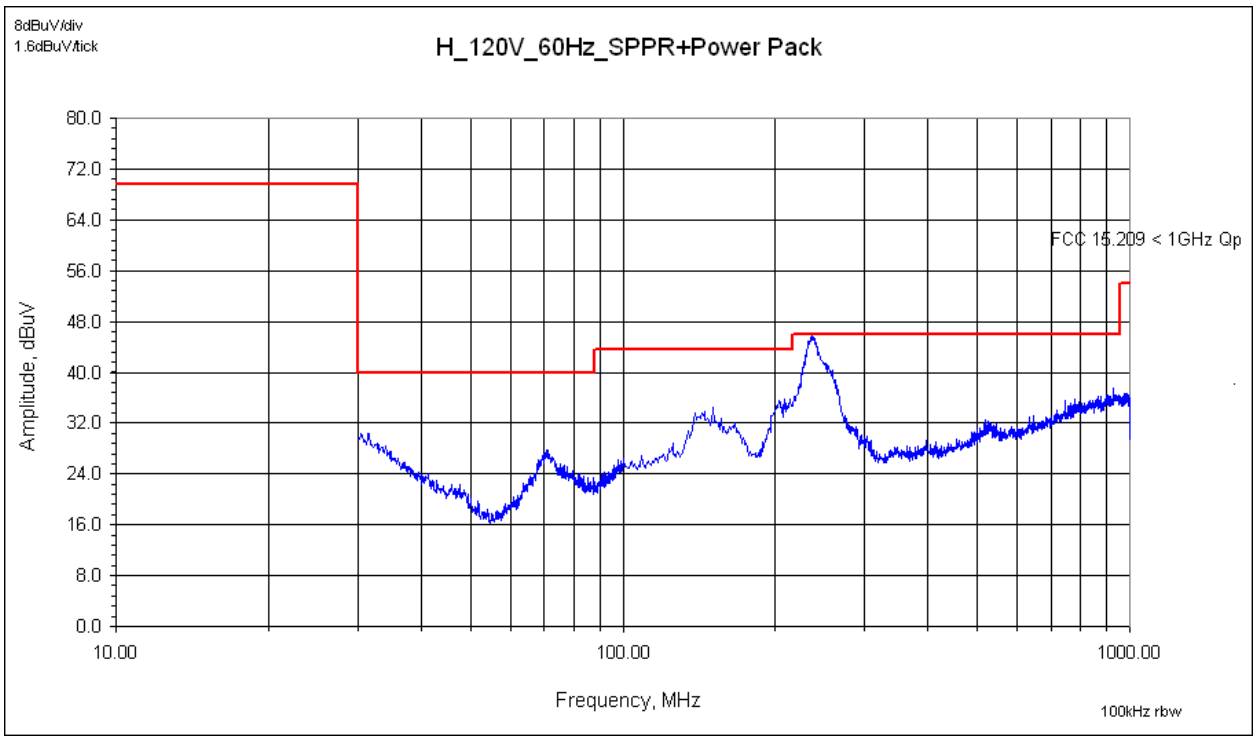
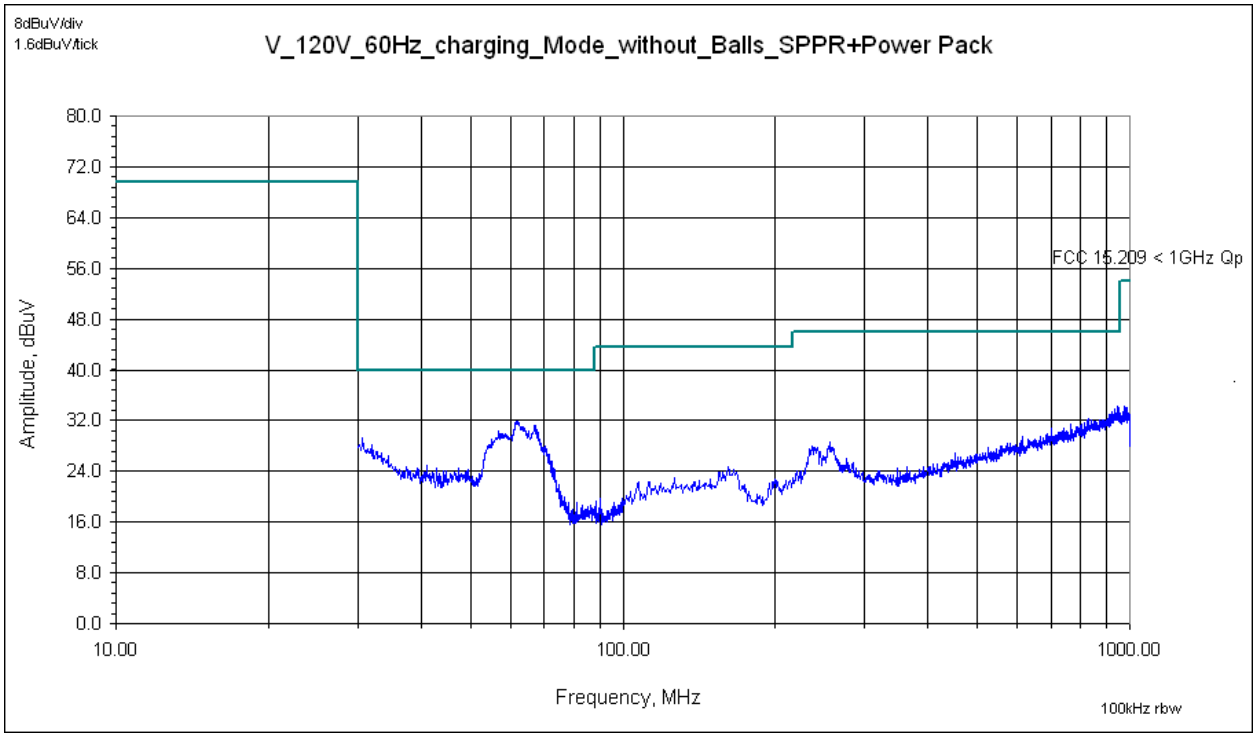
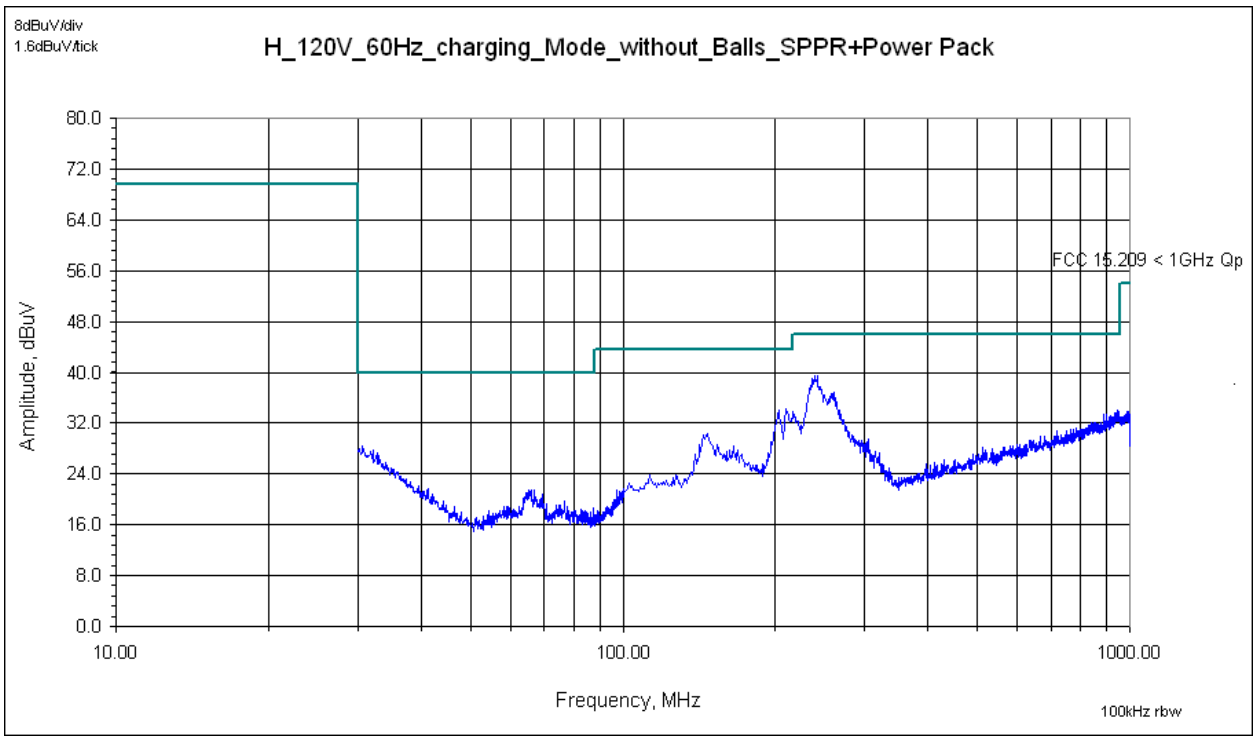
75.0
62.5
50.0
37.5
25.0
12.5
0.0
Amplitude, dBuV
0.01
0.10
1.00
10.00
100.00
1000.00
Frequency, MHz
CISPR11 Table 3b Induction Cooking App.
10kHz rbw


8dBuV/div
1.6dBuV/tick
V_120V_60Hz_SPPR+Power Pack
80.0
72.0
64.0
56.0
48.0
40.0
32.0
24.0
16.0
8.0
0.0
Amplitude, dBuV
10.00
100.00
1000.00
Frequency, MHz
FCC 15.209 < 1GHz Qp
100kHz rbw


8dBuV/div
1.6dBuV/tick
H_120V_60Hz_SPPR+Power Pack
80.0
72.0
64.0
56.0
48.0
40.0
32.0
24.0
16.0
8.0
0.0
Amplitude, dBuV
FCC 15.209 < 1GHz Qp
10.00
100.00
1000.00
Frequency, MHz
100kHz rbw


8dBuV/div
1.6dBuV/tick
V_120V_60Hz_charging_Mode_without_Balls_SPPR+Power Pack
80.0
72.0
64.0
56.0
48.0
40.0
32.0
24.0
16.0
8.0
0.0
Amplitude, dBuV
FCC 15.209 < 1GHz Qp
10.00
100.00
1000.00
Frequency, MHz
100kHz rbw


8dBuV/div
1.6dBuV/tick
H_120V_60Hz_charging_Mode_without_Balls_SPPR+Power Pack
80.0
72.0
64.0
56.0
48.0
40.0
32.0
24.0
16.0
8.0
0.0
Amplitude, dBuV
FCC 15.209 < 1GHz Qp
10.00
100.00
1000.00
Frequency, MHz
100kHz rbw

Data:

FREQ	LEVEL	DET	CABLE	ANT	FINAL	POL	HGT	AZ	DELTA1	RBW	Limit 1
MHz	dBuV	Qp Av Pk Rms	+ [dB]	+ [dB/m]	= [dBuV]	Parallel/ Perpendicular	(m)	(DEG)	FCC 15.209 < 30MHz Qp	(MHz)	FCC 15.209 < 30MHz Qp
Parallel_loop_120V_60Hz_Charging_With Balls											
0.250	37.84	**Qp**	0.05	10.15	48.03	Parallel	1.00	159.0	- 51.61	0.009	99.64
0.375	31.70	**Qp**	0.06	10.10	41.86	Parallel	1.00	159.0	- 54.26	0.009	96.12
0.625	28.81	**Qp**	0.07	10.20	39.08	Parallel	1.00	159.0	- 32.59	0.009	71.67
0.875	25.57	**Qp**	0.08	10.28	35.93	Parallel	1.00	159.0	- 32.81	0.009	68.74
1.201	21.16	**Qp**	0.09	10.40	31.65	Parallel	1.00	159.0	- 34.32	0.009	65.97
Perpendicular_loop_120V_60Hz_Charging_With Balls											
0.375	30.25	**Qp**	0.06	10.10	40.41	Perpendicular	1.00	23.0	- 55.71	0.009	96.12
0.582	24.20	**Qp**	0.07	10.22	34.49	Perpendicular	1.00	23.4	- 37.81	0.009	72.30
1.088	21.54	**Qp**	0.08	10.40	32.02	Perpendicular	1.00	102.1	- 34.80	0.009	66.82
8.494	6.64	**Qp**	0.25	10.50	17.40	Perpendicular	1.00	157.6	- 52.14	0.009	69.54
16.197	4.29	**Qp**	0.37	10.63	15.29	Perpendicular	1.00	186.4	- 54.25	0.009	69.54
Parallel_loop_120V_60Hz_charging_without_Balls											
0.251	33.09	**Qp**	0.05	10.15	43.28	Parallel	1.00	32.9	- 56.31	0.009	99.59
0.755	23.47	**Qp**	0.08	10.20	33.75	Parallel	1.00	138.2	- 36.28	0.009	70.03
2.403	15.57	**Qp**	0.12	10.40	26.09	Parallel	1.00	187.0	- 43.45	0.009	69.54
2.403	15.57	**Qp**	0.12	10.40	26.09	Parallel	1.00	194.6	- 43.45	0.009	69.54
17.500	4.42	**Qp**	0.38	10.55	15.35	Parallel	1.00	194.6	- 54.19	0.009	69.54
Perpendicular_loop_120V_60Hz_charging_without_Balls											
0.278	25.19	**Qp**	0.05	10.12	35.36	Perpendicular	1.00	64.0	- 63.37	0.009	98.73
0.551	24.34	**Qp**	0.07	10.25	34.65	Perpendicular	1.00	90.6	- 38.11	0.009	72.76
0.800	23.05	**Qp**	0.08	10.20	33.33	Perpendicular	1.00	122.2	- 36.18	0.009	69.51
1.212	20.64	**Qp**	0.09	10.40	31.13	Perpendicular	1.00	137.7	- 34.76	0.009	65.89

FREQ	LEVEL	DET	CABLE	ANT	PREAMP	FINAL	POL	HGT	AZ	Delta2	Limit	RBW
MHz	dBuV	Qp Av Pk Rms	+ [dB]	+ [dB/m]	- [dB]	= [dBuV]	(V/H)	(m)	(DEG)	FCC 15.109 B < 1GHz Qp	FCC 15.109 B < 1GHz Qp	(MHz)
V_120V_60Hz_SPPR+Power Pack												
47.75	40.52	**Qp**	0.61	15.10	28.14	28.09	V	1.00	39.8	- 11.91	40.00	0.120
62.69	39.09	**Qp**	0.70	13.70	28.09	25.40	V	1.00	88.4	- 14.60	40.00	0.120
156.38	32.72	**Qp**	1.12	18.80	27.66	24.98	V	1.07	122.6	- 18.54	43.52	0.120
236.13	36.61	**Qp**	1.39	17.62	27.17	28.45	V	1.14	209.6	- 17.57	46.02	0.120
647.83	25.46	**Qp**	2.28	25.60	28.31	25.02	V	1.30	245.1	- 21.00	46.02	0.120
958.83	25.17	**Qp**	2.78	28.72	27.34	29.33	V	1.10	287.0	- 16.69	46.02	0.120
H_120V_60Hz_SPPR+Power Pack												
71.39	32.60	**Qp**	0.74	14.00	28.07	19.28	H	1.50	209.1	- 20.72	40.00	0.120
144.50	38.92	**Qp**	1.07	18.70	27.72	30.97	H	1.98	191.6	- 12.56	43.53	0.120
241.00	39.93	**Qp**	1.38	17.70	27.14	31.87	H	1.75	167.6	- 14.15	46.02	0.120
528.38	25.93	**Qp**	2.06	24.17	28.33	23.82	H	1.56	195.0	- 22.20	46.02	0.120
757.59	26.36	**Qp**	2.47	26.70	28.07	27.46	H	1.81	168.7	- 18.57	46.03	0.120
955.10	23.88	**Qp**	2.77	28.80	27.35	28.10	H	2.04	145.8	- 17.92	46.02	0.120
V_120V_60Hz_charging_Mode_with_Balls_SPPR+Power Pack												
58.00	39.72	**Qp**	0.68	13.50	28.11	25.79	V	1.00	108.3	- 14.21	40.00	0.120
68.88	39.49	**Qp**	0.74	14.00	28.07	26.16	V	1.00	108.3	- 13.84	40.00	0.120
161.25	30.45	**Qp**	1.13	18.70	27.63	22.65	V	1.17	176.8	- 20.87	43.52	0.120
239.25	37.52	**Qp**	1.38	17.69	27.15	29.43	V	1.00	229.7	- 16.59	46.02	0.120
536.32	25.48	**Qp**	2.08	24.20	28.34	23.42	V	1.08	215.3	- 22.60	46.02	0.120
932.84	25.79	**Qp**	2.77	28.96	27.43	30.09	V	1.10	235.5	- 15.93	46.02	0.120
H_120V_60Hz_charging_Mode_with_Balls_SPPR+Power Pack												
72.25	30.53	**Qp**	0.75	13.97	28.06	17.20	H	1.36	306.6	- 22.80	40.00	0.120
72.38	27.69	**Qp**	0.75	13.96	28.06	14.35	H	1.44	274.2	- 25.65	40.00	0.120
100.00	28.91	**Qp**	0.89	16.50	27.95	18.35	H	1.57	290.0	- 25.17	43.52	0.120
144.75	34.47	**Qp**	1.07	18.70	27.72	26.52	H	1.69	276.4	- 17.00	43.52	0.120
237.00	43.84	**Qp**	1.39	17.64	27.16	35.70	H	1.58	262.2	- 10.32	46.02	0.120
520.43	24.09	**Qp**	2.04	24.10	28.31	21.92	H	1.58	249.2	- 24.10	46.02	0.120

8 Occupied Channel Bandwidth

Method:

The test methods used comply with ANSI C63.10.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

Test Requirement/Specification:

- RSS-GEN 6.6

Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
19936	Bilog Antenna 30MHz - 6GHz	Sunol Sciences	JB6	A050707-1	6/22/2016	6/22/2017
18897	Magnetic loop	EMCO	6502	9205-2738	11/12/2015	11/12/2016
18912	9 kHz- 1.3GHz Pre Amp	Hewlett-Packard	HP	5	3/31/2016	3/31/2017
DEN-073	EMI Receiver (10Hz – 26.5GHz)	RHODE & SCHWARZ	ESU 26	100265	12/19/2015	12/19/2016
CC1-E2	Radiated Cable	Teledyne	90-206-300; PN:F-130-S1S1-100; 90-206-072;	E2-A; 5026702 002; E2-C; E2-D	11/17/2015	11/17/2016
206	Humidity/Temperature	Extech Instruments	44580	958123	7/21/2016	7/21/2017

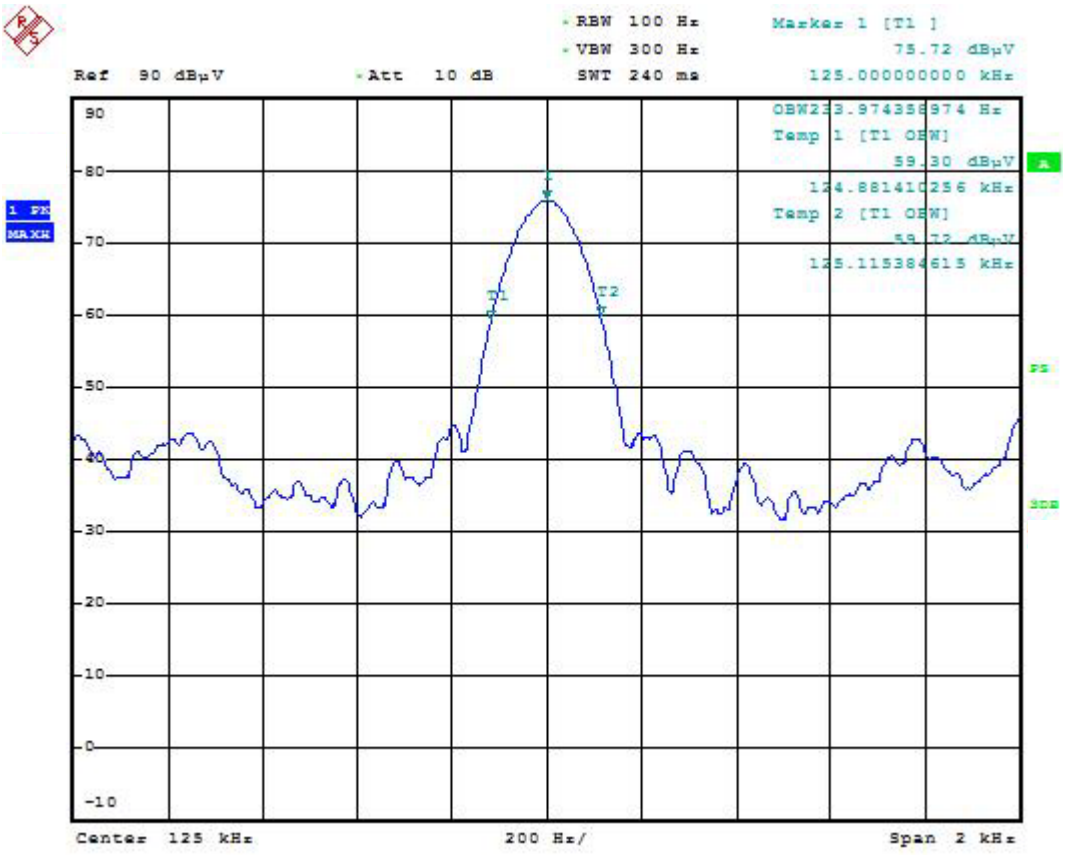
Software Utilized:

Name	Manufacturer	Version
SW-6: Software for Radiated and Conducted emissions.	Intertek	OATS cvi, V.1.0

Results:

The sample tested was found to comply.

Plots:


RBW 100 Hz
VBW 300 Hz
SWT 240 ms
Marker 1 [T1]
75.72 dBµV
125.000000000 kHz
Ref 90 dBµV
Att 10 dB
OBW233.974358974 Hz
Temp 1 [T1 OBW]
59.30 dBµV
124.881410256 kHz
Temp 2 [T1 OBW]
125.115384615 kHz
90
80
70
60
50
40
30
20
10
0
-10
T1
T2
Center 125 kHz
200 Hz/
Span 2 kHz

9 AC Mains Conducted Emissions – Wireless Induction Charger

Method:

The test methods used comply with ANSI C63.4. Unless otherwise stated no deviations were made from FCC 15.207 and RSS-GEN.

This testing was performed at Intertek Denver, located at 1795 Dogwood St. Suite 200, Louisville, CO 80027.

Test Requirement/Specification:

- FCC 15.207
- RSS-GEN 8.8

Results:

The sample tested was found to comply.

Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
18914	Single Phase LISN	EMCO	3816/NM	9408-1003	3/17/2016	3/17/2017
18729	Transient Limiter	Hewlett-Packard	11947A	3107A01975	5/11/2016	5/11/2017
DEN-073	EMI Receiver (10Hz – 26.5GHz)	RHODE & SCHWARZ	ESU 26	100265	12/19/2015	12/19/2016
CC1-001	50 Ohm Cable	Pasternak Enterprise	RG-223/U	N/A	5/23/2016	5/23/2017
206	Humidity/Temperature	Extech Instruments	44580	958123	7/21/2016	7/21/2017

Software Utilized:

Name	Manufacturer	Version
SW-6: Software for Radiated and Conducted emissions.	Intertek	OATS cvi, V.1.0

Sample Calculations

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN or ISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

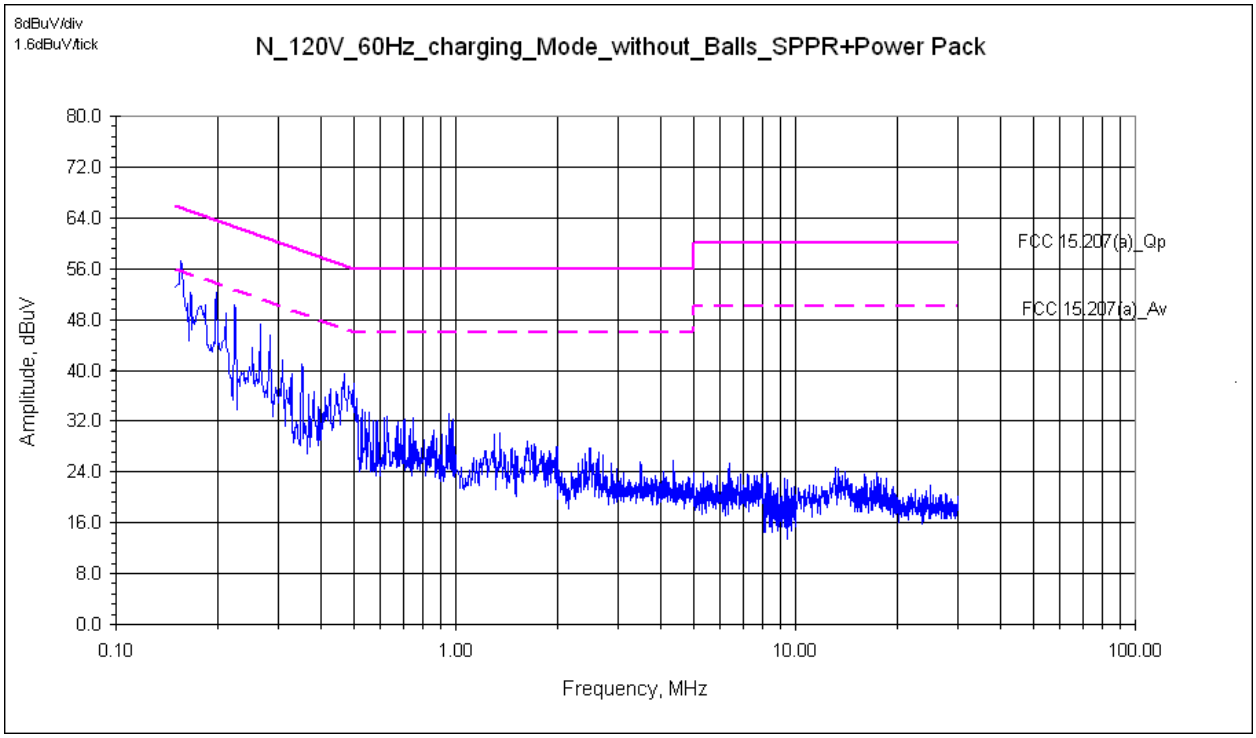
To convert from dBμV to μV or mV the following was used:

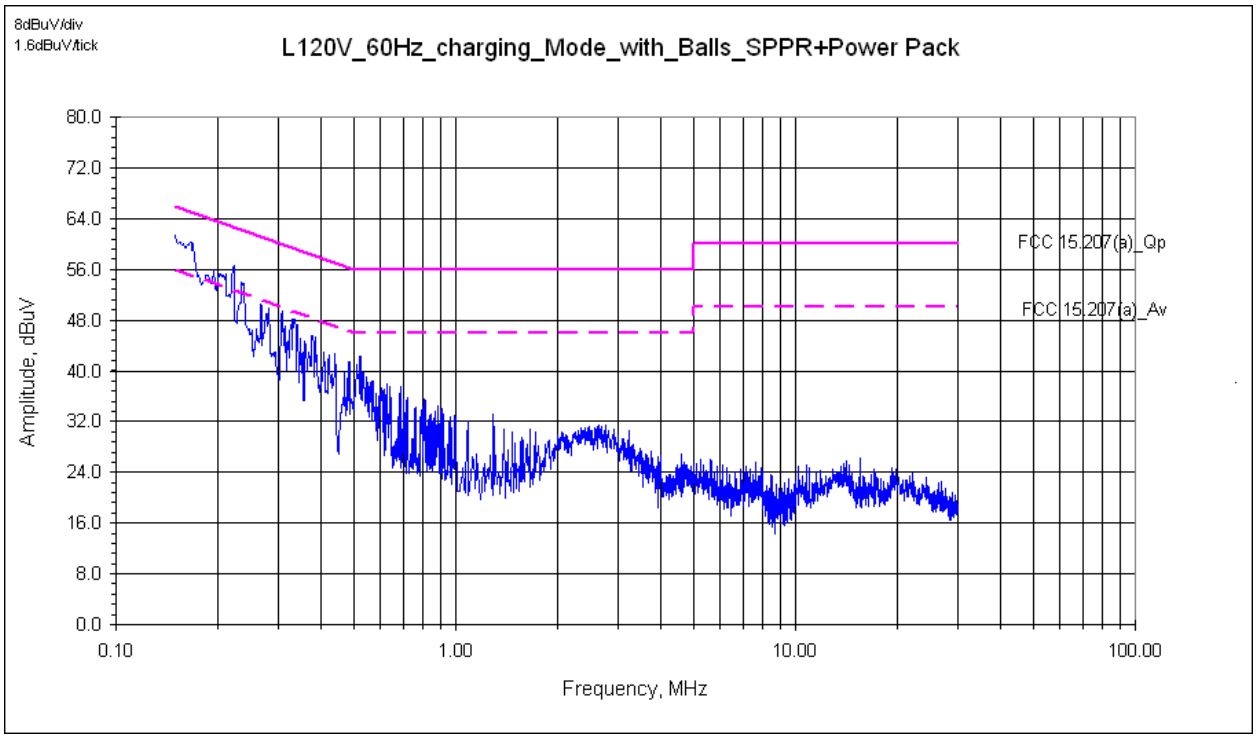
$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

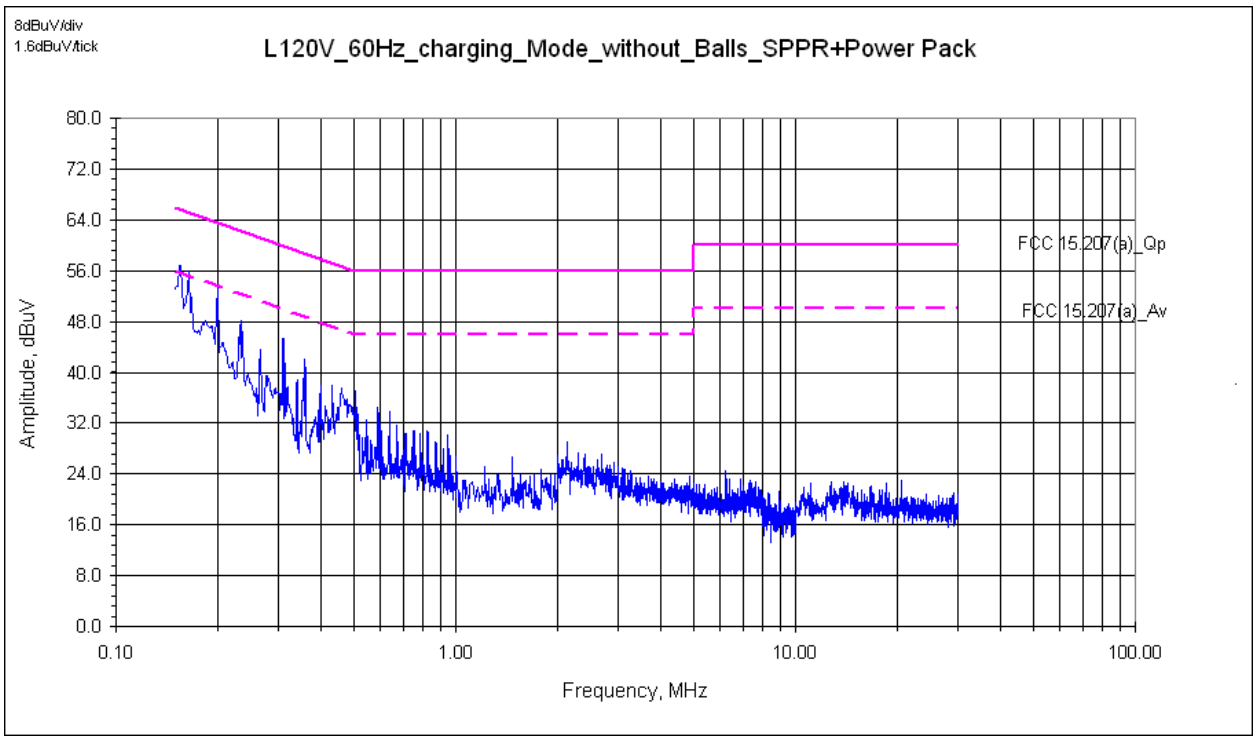
Example:

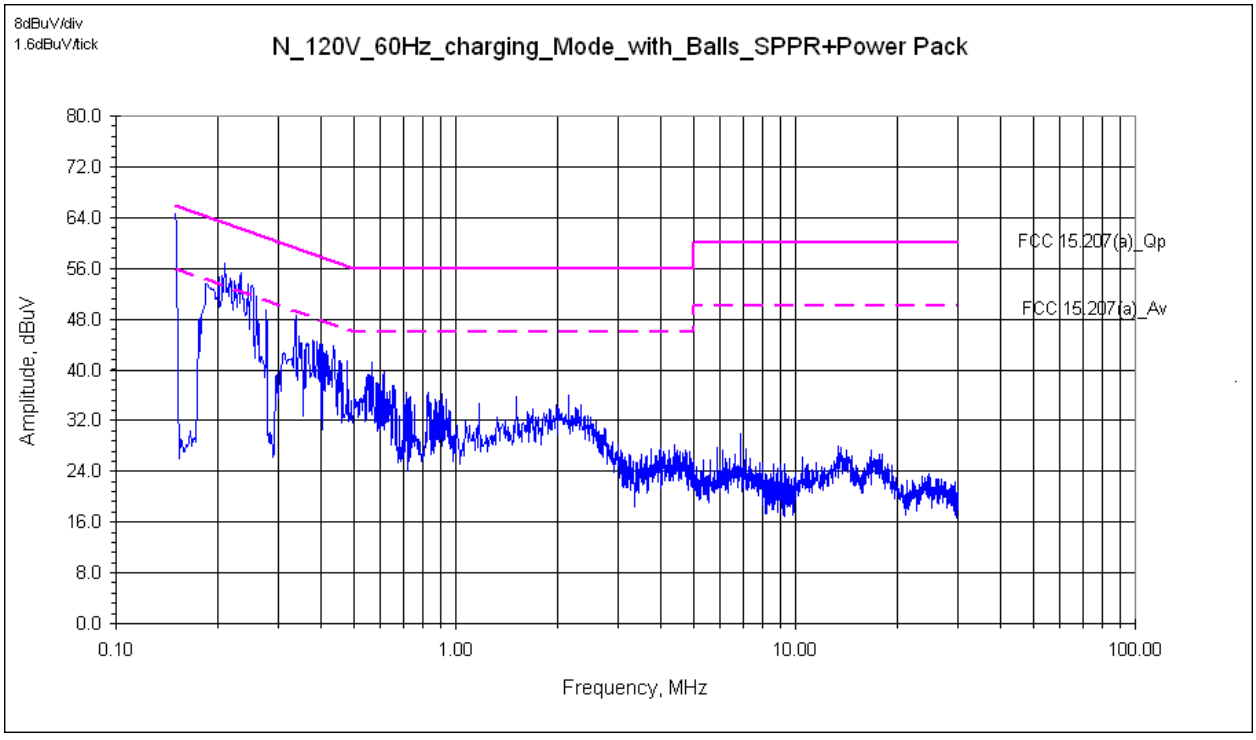
NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(49.1\ dB\mu V / 20)}$ = 285.1 μV/m

Plots:


8dBuV/div
1.6dBuV/tick
N_120V_60Hz_charging_Mode_without_Balls_SPPR+Power Pack
80.0
72.0
64.0
56.0
48.0
40.0
32.0
24.0
16.0
8.0
0.0
Amplitude, dBuV
0.10
1.00
10.00
100.00
Frequency, MHz
FCC 15.207(a)_Qp
FCC 15.207(a)_Av


8dBuV/div
1.6dBuV/tick
L120V_60Hz_charging_Mode_with_Balls_SPPR+Power Pack
80.0
72.0
64.0
56.0
48.0
40.0
32.0
24.0
16.0
8.0
0.0
Amplitude, dBuV
0.10
1.00
10.00
100.00
Frequency, MHz
FCC 15.207(a)_Qp
FCC 15.207(a)_Av


8dBuV/div
1.6dBuV/tick
L120V_60Hz_charging_Mode_without_Balls_SPPR+Power Pack
80.0
72.0
64.0
56.0
48.0
40.0
32.0
24.0
16.0
8.0
0.0
Amplitude, dBuV
0.10
1.00
10.00
100.00
Frequency, MHz
FCC 15.207(a)_Qp
FCC 15.207(a)_Av


8dBuV/div
1.6dBuV/tick
N_120V_60Hz_charging_Mode_with_Balls_SPPR+Power Pack
80.0
72.0
64.0
56.0
48.0
40.0
32.0
24.0
16.0
8.0
0.0
Amplitude, dBuV
0.10
1.00
10.00
100.00
Frequency, MHz
FCC 15.207(a)_Qp
FCC 15.207(a)_Av

Data:

FREQ	LEVEL	DET	CABLE	LISN	PREAMP	ATTEN	FINAL	TEST POINT	DELTA1	DELTA2	RBW
MHz	dBuV	Qp Av Pk	+ [dB]	+ [dB/m]	- [dB]	+ [dB]	= [dBuV]	Other - N - L1 - L2 - L3	FCC 15.207 Qp	FCC 15.207 Av	(MHz)
L120V_60Hz_charging_Mode_SPPR+Power Pack											
0.153	45.95	**Qp**	0.05	0.04	0.00	9.94	55.98	Line 1	- 9.87	NA	0.009
0.188	39.16	**Qp**	0.05	0.03	0.00	9.94	49.18	Line 1	- 14.97	NA	0.009
0.250	32.12	**Qp**	0.05	0.03	0.00	9.94	42.15	Line 1	- 19.61	NA	0.009
0.375	26.08	**Qp**	0.07	0.03	0.00	9.95	36.13	Line 1	- 22.26	NA	0.009
1.250	12.56	**Qp**	0.11	0.03	0.00	9.97	22.67	Line 1	- 33.33	NA	0.009
3.750	14.16	**Qp**	0.22	0.06	0.00	9.96	24.40	Line 1	- 31.60	NA	0.009
0.153	28.40	**Av**	0.05	0.04	0.00	9.94	38.43	Line 1	NA	- 17.42	0.009
0.188	20.50	**Av**	0.05	0.03	0.00	9.94	30.52	Line 1	NA	- 23.63	0.009
0.250	23.52	**Av**	0.05	0.03	0.00	9.94	33.55	Line 1	NA	- 18.21	0.009
0.375	16.59	**Av**	0.07	0.03	0.00	9.95	26.64	Line 1	NA	- 21.75	0.009
1.250	9.93	**Av**	0.11	0.03	0.00	9.97	20.04	Line 1	NA	- 25.96	0.009
3.750	10.83	**Av**	0.22	0.06	0.00	9.96	21.07	Line 1	NA	- 24.93	0.009
_120V_60Hz_charging_Mode_SPPR+Power Pack											
0.160	44.76	**Qp**	0.05	0.04	0.00	9.94	54.79	Neutral	- 10.68	NA	0.009
0.162	44.59	**Qp**	0.05	0.04	0.00	9.94	54.62	Neutral	- 10.76	NA	0.009
0.250	31.15	**Qp**	0.05	0.03	0.00	9.94	41.18	Neutral	- 20.58	NA	0.009
0.466	23.34	**Qp**	0.07	0.03	0.00	9.95	33.39	Neutral	- 23.20	NA	0.009
0.948	16.53	**Qp**	0.09	0.04	0.00	9.97	26.63	Neutral	- 29.37	NA	0.009
1.625	19.97	**Qp**	0.13	0.04	0.00	9.96	30.11	Neutral	- 25.89	NA	0.009
0.160	26.78	**Av**	0.05	0.04	0.00	9.94	36.81	Neutral	NA	- 18.66	0.009
0.162	26.68	**Av**	0.05	0.04	0.00	9.94	36.71	Neutral	NA	- 18.67	0.009
0.250	22.77	**Av**	0.05	0.03	0.00	9.94	32.80	Neutral	NA	- 18.96	0.009
0.466	13.35	**Av**	0.07	0.03	0.00	9.95	23.40	Neutral	NA	- 23.19	0.009
0.948	5.71	**Av**	0.09	0.04	0.00	9.97	15.81	Neutral	NA	- 30.19	0.009
1.625	13.93	**Av**	0.13	0.04	0.00	9.96	24.07	Neutral	NA	- 21.93	0.009
L120V_60Hz_charging_Mode_without_Balls_SPPR+Power Pack											
0.169	41.52	**Qp**	0.05	0.03	0.00	9.94	51.54	Line 1	- 13.46	NA	0.009
0.222	33.58	**Qp**	0.05	0.03	0.00	9.94	43.60	Line 1	- 19.14	NA	0.009
0.309	25.68	**Qp**	0.06	0.03	0.00	9.95	35.72	Line 1	- 24.28	NA	0.009
0.523	20.84	**Qp**	0.07	0.03	0.00	9.95	30.89	Line 1	- 25.11	NA	0.009
1.289	9.35	**Qp**	0.11	0.03	0.00	9.97	19.46	Line 1	- 36.54	NA	0.009
2.827	15.24	**Qp**	0.18	0.05	0.00	9.96	25.43	Line 1	- 30.57	NA	0.009
0.169	23.09	**Av**	0.05	0.03	0.00	9.94	33.11	Line 1	NA	- 21.89	0.009
0.222	15.71	**Av**	0.05	0.03	0.00	9.94	25.73	Line 1	NA	- 27.01	0.009
0.309	8.98	**Av**	0.06	0.03	0.00	9.95	19.02	Line 1	NA	- 30.98	0.009
0.523	9.92	**Av**	0.07	0.03	0.00	9.95	19.97	Line 1	NA	- 26.03	0.009
1.289	1.76	**Av**	0.11	0.03	0.00	9.97	11.87	Line 1	NA	- 34.13	0.009
2.827	6.62	**Av**	0.18	0.05	0.00	9.96	16.81	Line 1	NA	- 29.19	0.009

FREQ	LEVEL	DET	CABLE	LISN	PREAMP	ATTEN	FINAL	TEST POINT	DELTA1	DELTA2	RBW
MHz	dBuV	Qp Av Pk	+ [dB]	+ [dB/m]	- [dB]	+ [dB]	= [dBuV]	Other - N - L1 - L2 - L3	FCC 15.207 Qp	FCC 15.207 Av	(MHz)
N_120V_60Hz_charging_Mode_without_Balls_SPPR+Power Pack											
0.151	45.68	**Qp**	0.05	0.04	0.00	9.94	55.71	Neutral	- 10.21	NA	0.009
0.209	34.70	**Qp**	0.05	0.04	0.00	9.94	44.73	Neutral	- 18.53	NA	0.009
0.233	33.38	**Qp**	0.05	0.03	0.00	9.94	43.41	Neutral	- 18.93	NA	0.009
0.337	25.39	**Qp**	0.06	0.03	0.00	9.95	35.43	Neutral	- 23.85	NA	0.009
0.568	18.69	**Qp**	0.08	0.03	0.00	9.96	28.75	Neutral	- 27.25	NA	0.009
2.147	18.92	**Qp**	0.16	0.05	0.00	9.96	29.09	Neutral	- 26.91	NA	0.009
0.151	27.76	**Av**	0.05	0.04	0.00	9.94	37.79	Neutral	NA	- 18.13	0.009
0.209	18.62	**Av**	0.05	0.04	0.00	9.94	28.65	Neutral	NA	- 24.61	0.009
0.233	18.95	**Av**	0.05	0.03	0.00	9.94	28.98	Neutral	NA	- 23.36	0.009
0.337	12.02	**Av**	0.06	0.03	0.00	9.95	22.06	Neutral	NA	- 27.22	0.009
0.568	9.10	**Av**	0.08	0.03	0.00	9.96	19.16	Neutral	NA	- 26.84	0.009
2.147	11.13	**Av**	0.16	0.05	0.00	9.96	21.30	Neutral	NA	- 24.70	0.009

10 RF Exposure

Project #:	**G102731932**	Test Area:	Intertek Louisville
Test Method:	FCC CFR47 Part 1.1310	Test Date:	10/4/2016
EUT Model #:	Power Pack	FCC ID:	SXO-PP01
EUT Serial #:	EMC		
Manufacturer:	Sphero Inc,		
Notes:			

Requirements

According to KDB680106 D01 RF Exposure Wireless Charging Apps v02 (05/31/2013), the requirement of RF exposure for the Wireless Charging device shall be as follows.

The RF exposure requirements must be determined in conjunction with the device operating characteristics, according to the mobile and portable exposure requirements in Section 2.1091 and Section 2.1093 of the rules. SAR and MPE limits do not cover the frequency range for wireless power transfer applications which operate below 100 kHz and 300 kHz respectively; therefore, RF exposure compliance needs to be determined with respect to 1.1307 (c) and (d) of the FCC rules.

For devices designed for typical desktop applications, such a wireless charging pads, RF exposure evaluation should be conducted assuming a user separation distance of 10 cm. E and H field strength measurements or numerical modeling may be used to demonstrate compliance. Measurements should be made from all sides and the top of the primary/client pair, with the 10 cm measured from the center of the probe(s) to the edge of the device. Emissions between 100 kHz to 300 kHz should be assessed versus the limits at 300 kHz in Table 1 of Section 1.1310: 614 V/m and 1.63 A/m.

Test Data

Fundament Frequency = 125kHz

Magnetic Field

Measurement Point	Measurement Distance (cm)	Limit (A/m)	30% of Limit (A/m)	Measured Value (µT)	Convert (A/m)	Margin 30% Limit (A/m)
Ambient				0.037	0.030	
Front	10	1.63	0.489	0.273	0.236	-0.253
Back	10	1.63	0.489	0.190	0.153	-0.336
Left	10	1.63	0.489	0.255	0.218	-0.271
Right	10	1.63	0.489	0.150	0.113	-0.376
Top	10	1.63	0.489	0.407	0.370	-0.119
Top (Lid Closed)	10	1.63	0.489	0.294	0.257	-0.232

Conversion µT to A/m

A/m = (µT- ambient)/1.25

Electric Field

Measurement Point	Measurement Distance (cm)	Limit (V/m)	30% of Limit (V/m)	Measured Value (V/m)	Margin 30% Limit (V/m)
Front	10	614	184.2	1.56	-182.64
Back	10	614	184.2	2.32	-181.88
Left	10	614	184.2	2.12	-182.08
Right	10	614	184.2	1.32	-182.88
Top	10	614	184.2	5.27	-178.93
Top (Lid Closed)	10	614	184.2	2.75	-181.45

Test Equipment Used

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DEN-044	ELT-400 Exposure Level Tester	NARDA	2304/03	M-0356	8/23/2016	8/23/2017
51-2029784	Tape Measure	Stanley	5m	N/A	12/10/2015	12/10/2016
18707	RF Electric Field Probe	Amplifier Research	FP5000	20134	8/23/2016	8/23/2017
260	Humidity/Temperature Pen	Extech	445580	445580	7/21/2016	7/21/2017

11 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of k = 2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement uncertainty Table

Parameter	Uncertainty ±	Notes
Radiated emissions, 10kHz to 30 MHz	3.4 dB	
Radiated emissions, 30 to 200 MHz HP	2.2 dB	
Radiated emissions, 30 to 200 MHz VP	3.8 dB	
Radiated emissions, 200 to 1000 MHz HP	2.8 dB	
Radiated emissions, 200 to 1000 MHz VP	2.7 dB	
Radiated emissions, 1 to 18 GHz	5.2 dB	
Conducted port emissions 10kHz to 1000 MHz	1.0 dB	
Conducted port emissions 1 to 18 GHz	1.6 dB	
AC mains Conducted emissions, 9kHz to 30 MHz	3.14 dB	

12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	10/13/2016	102731932DEN-001	SL	MAS	Original Issue
1	11/29/2016	102731932DEN-001	SL	MAS	Page 1 and 6 changed RSS-210 to RSS216, page 5 added RSS-216 device Type.
2	12/5/2016	102731932DEN-001	MAS	KV	Page 13 and 19 added standard ICES-001. Page 17 and 23 added plots to show compliance to ICES-001. Page 18 added table to show compliance to ICES-001