



FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

Wireless Charger

MODEL NUMBER: BEX4755-XX

REPORT NUMBER: 11436518I

FCC ID: 2AJX5-BEX4755

ISSUE DATE: November 6, 2016

Prepared for
Byrne Electrical Specialists Inc.
320 Byrne Industrial Dr.
Rockford, MI 49341
USA

Prepared by
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NVLAP Lab code: 100414-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--		Initial Issue	

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Byrne Electrical Specialists Inc.
320 Byrne Industrial Dr.
Rockford, MI 49341
USA

EUT DESCRIPTION: Wireless Charger

MODEL: BEX4755-XX

SERIAL NUMBER: non-serialized

DATE TESTED: September 26, 2016 – November 6, 2016

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Pass

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL LLC based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL LLC By:



Bob DeLisi
WiSE Principal Engineer
UL LLC

Tested By:



Bart Mucha
WiSE Staff Engineer
UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL 60062 USA.

UL NBK is accredited by NVLAP, Laboratory Code 100414-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/>

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Sample Calculations

Radiated Field Strength and Conducted Emissions data contained within this report is calculated on the following basis:

Field Strength (dBuV/m) = Meter Reading (dBuV) + AF (dB/m) - Gain (dB) + Cable Loss (dB)

Conducted Voltage (dBuV) = Meter Reading (dBuV) + Cable Loss (dB) + LISN IL (dB)

Conducted Current (dBuA) = Meter Reading (dBuV) + Cable Loss (dB) - Transducer Factor (dBohms)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test	Range	Equipment	Uncertainty k=2
Conducted Emissions	9k-150kHz	LISN	3.84dB
Conducted Emissions	150k-30MHz	LISN	3.65dB
Radiated Emissions	9k-30MHz	H-Field Loop	3.15dB
Radiated Emissions	30-200MHz	Bicon 10m Horz	4.48dB
Radiated Emissions	30-200MHz	Bicon 10m Vert	4.49dB
Radiated Emissions	200-1000MHz	LogP 10m Horz	3.79dB
Radiated Emissions	200-1000MHz	LogP 10m Vert	3.84dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Wireless Qi Charger with single charging coil and single USB 5V output (maximum 1A). Device is installed in single orientation only as part of a desk / table.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak radiated output level as follows:

Frequency Range (MHz)	Mode	Output Field Strength dBuV/m	Measurement Distance (meters)
0.110 - 0.205	Charging	84.24	3.00

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an coil antenna

5.4. TEST CONFIGURATIONS

The following configurations were investigated:

EUT Configuration	Description
1	EUT with wireless load (receiving coil with resistors and maximum power) and with USB loads (1A each).
2	EUT without loads

5.5. MODE(S) OF OPERATION

Mode	Description
1	EUT putting out full maximum power to wireless loads and resistors on USB ports
2	EUT powered but not charging (no loads)

5.6. SOFTWARE AND FIRMWARE

None

5.7. WORST-CASE CONFIGURATION AND MODE

EUT was tested with receiving coil terminated into resistors providing maximum load.

5.8. MODIFICATIONS

No modifications were made during testing.

5.9. TION OF TEST SETUP

DESCRIP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Qi Loads	Byrne Electrical Specialists.	None	none	none
Resistive Loads - 50Hm resistor	-	-	-	-

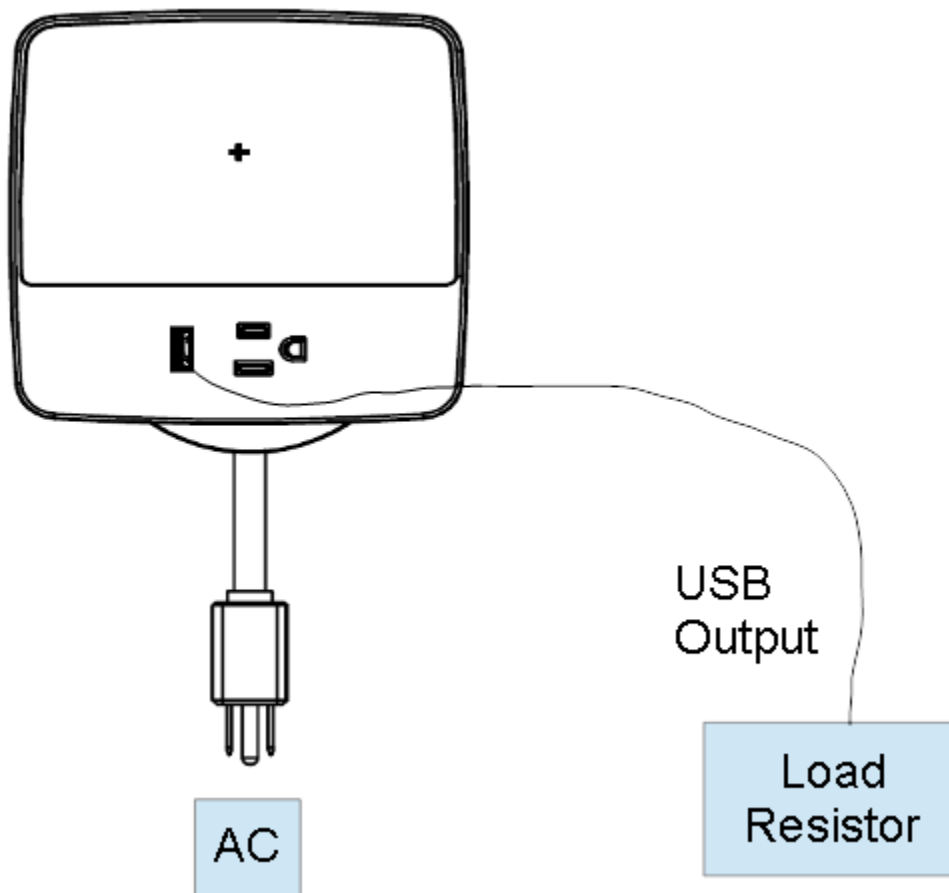
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC Input	1	-	3-wire	1.5m	none
2	AC Outputs	1	-	-	-	none
3	USB Outputs	1	SUB	USB	-	Terminated with resistors

TEST SETUP

The EUT was installed in a typical configuration. Refer to the following diagram.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List					
Description	Manufacturer	Model	Eq. No.	Cal Date	Cal Due
Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014		
Conducted Software	UL	UL EMC	Ver 9.5, May 17 2012		
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	20151118	20161118
Bicon Antenna	Chase	VBA6106A	EMC4078	20151228	20161231
Log-P Antenna	Chase	UPA6109	EMC4313	20160122	20170131
Loop Antenna	EMCO	6502/1	EMC4026	20160722	20170731
EMI Test Receiver	Rohde & Schwarz	ESR	EMC4377	20160426	20170426
Transient Limiter	Electro-Metrics	EM7600-2	EMC4224	N/A	N/A
HighPass Filter	Solar Electronics	2803-150	885551	N/A	N/A
Attenuator	HP	8494B	2831A00838	N/A	N/A
LISN - L1	Solar	8602-50-TS-50-N	EMC4052	20160216	20170228
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	20160216	20170228

7. RADIATED EMISSION TEST RESULTS

7.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.209 (a)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (m)	Limit dBuV/m
0.009–0.490	2400/F(kHz)	300	128.5 – 93.8 @3m
0.490–1.705	24000/F(kHz)	30	73.8 – 63.0 @ 3m
1.705–30.0	30	30	69.5 – 69.5 @ 3m
30–88	100	3	40.0 @ 3m
88 to 216	150	3	43.5 @ 3m
216 to 960	200	3	46.0 @ 3m
Above 960 MHz	500	3	54.0 @ 3m
Note: The lower limit shall apply at the transition frequency.			

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz measurements. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 120 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements for the 30-1000 MHz range, 9 kHz for peak detection measurements or 9 kHz for quasi-peak detection measurements for the 0.15-30 MHz range and 200 Hz for peak detection measurements or 200 Hz for quasi-peak detection measurements for the 9 to 150 kHz range. Peak detection is used unless otherwise noted as quasi-peak.

The spectrum from 9kHz to 1 GHz is investigated with the transmitter constantly transmitting into a fixed load to ensure maximum current draw from the charger.

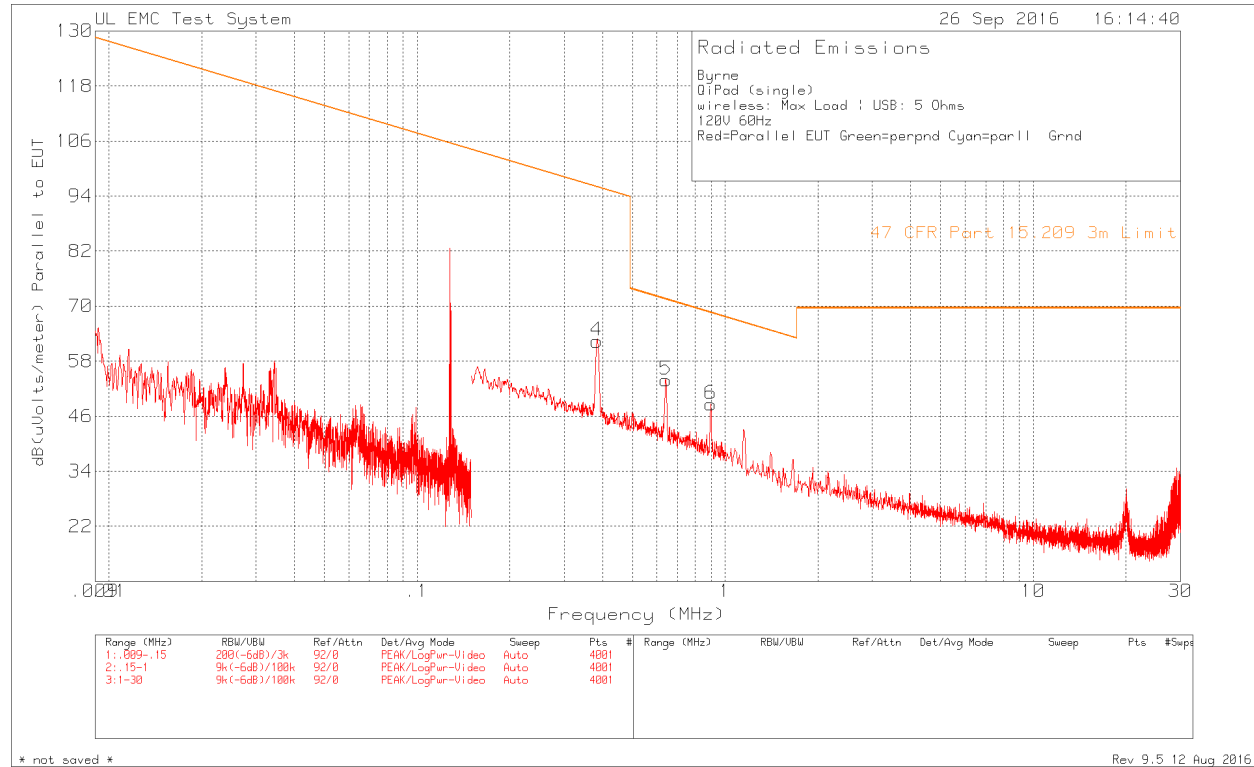
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. Measurements are made with the antenna positioned at 0° and 90° in vertical polarization and in a horizontal polarization to the ground plane.

Although measurements were made on a test site other than an open area site, comparisons between an open area site and the chamber have been made to show that measurements in the chamber correlate to those on an open area site.

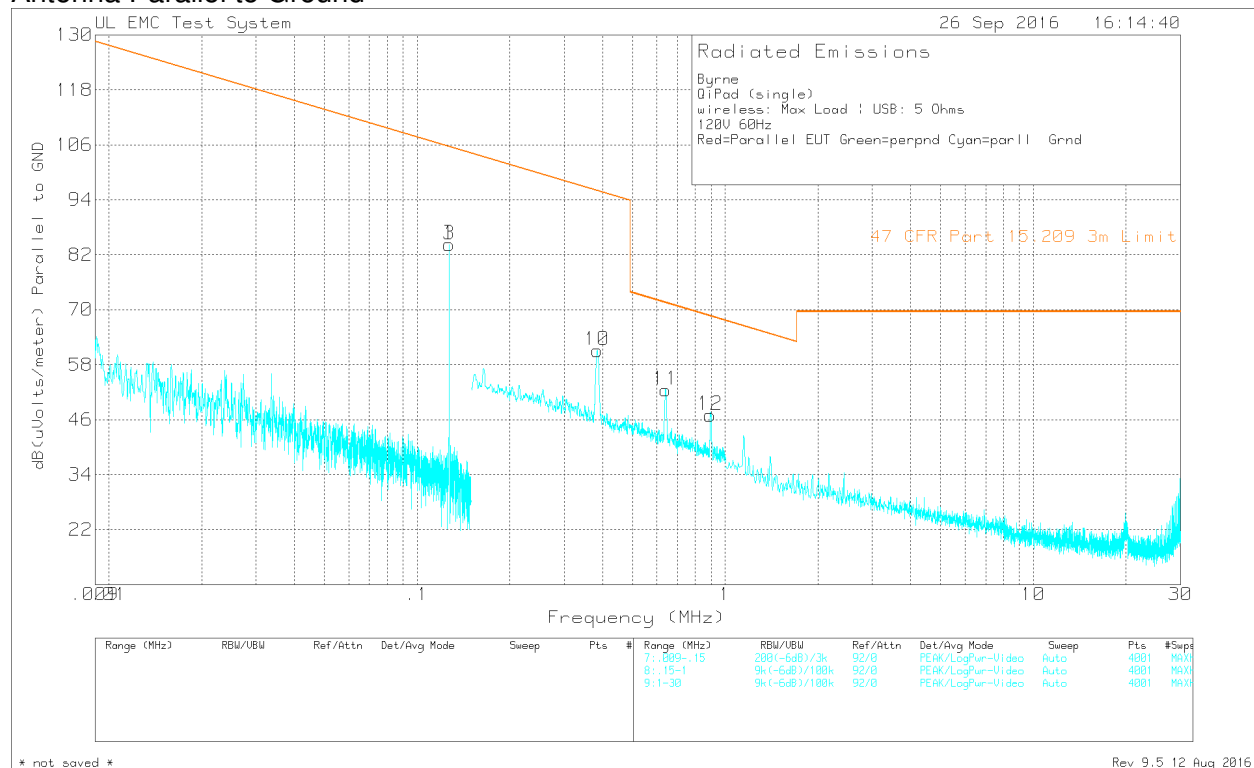
RESULTS

TX FUNDAMENTAL AND SPURIOUS EMISSIONS 0.009kHz TO 30 MHz Charging Mode

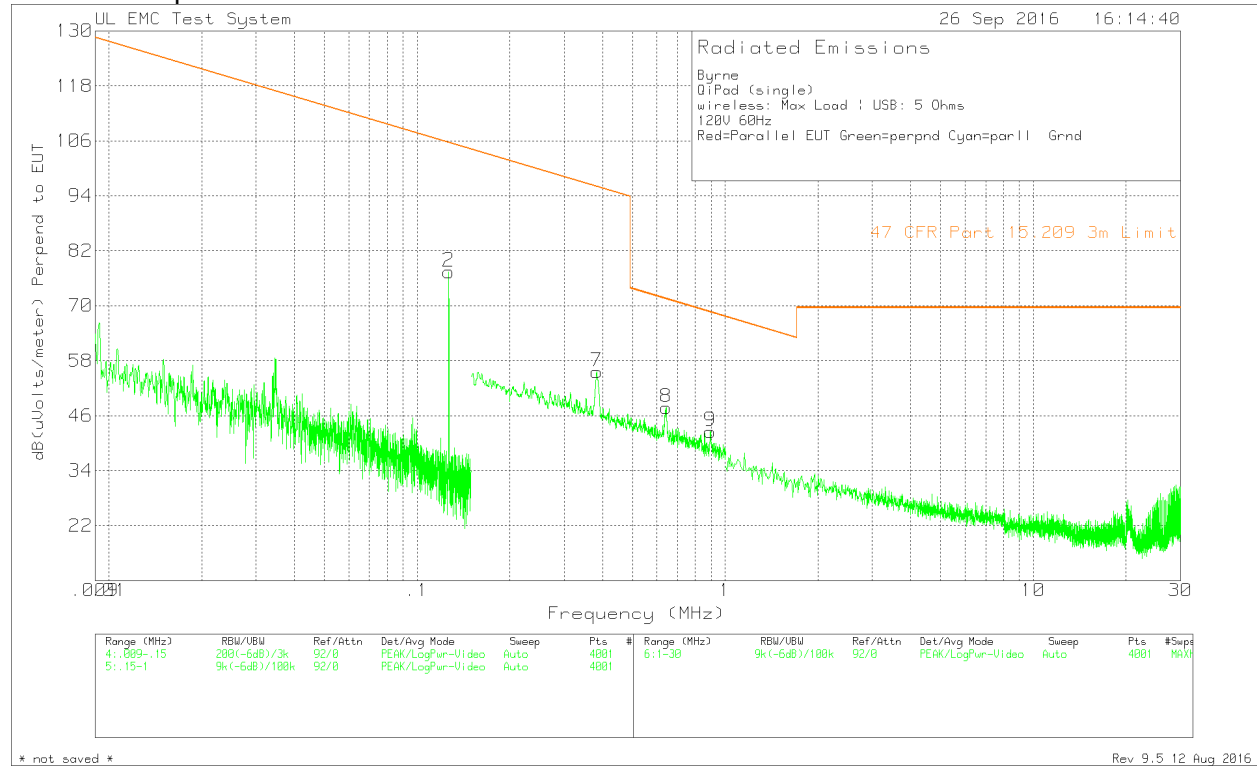
Antenna Parallel to EUT



Antenna Parallel to Ground



Antenna Perpendicular to EUT



Byrne
QiPad (single)
wireless: Max Load | USB: 5 Ohms
120V 60Hz
Red=Parallel EUT Green=perpnd Cyan=par11 Grnd

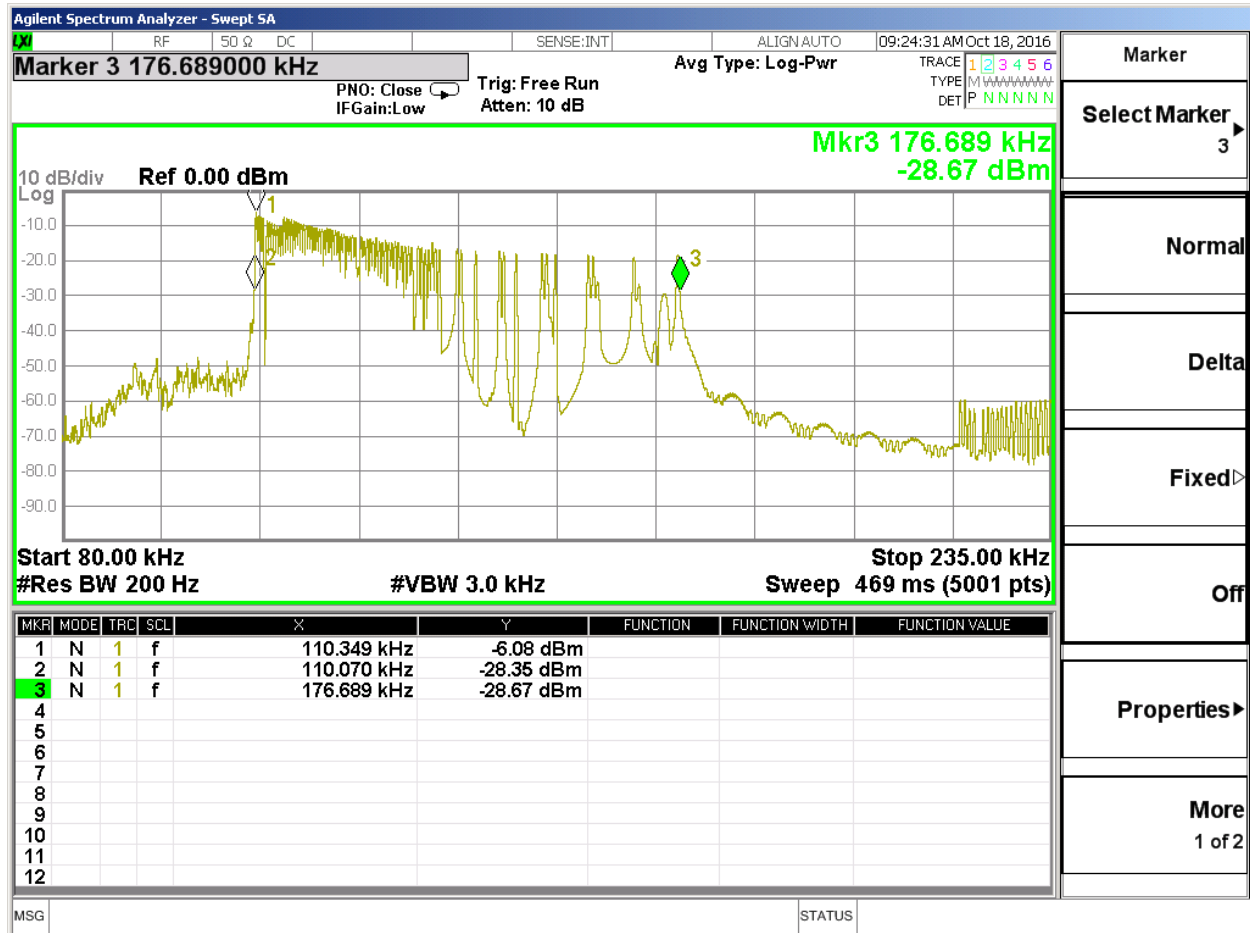
Trace Markers

Test No.	Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading dB (uVolts/meter)	Limit:1
=====						
Parallel to EUT						
4	.38302	51.07dBuV Pk	11.3	0	62.37	95.94
		Azimuth:0-360	Height:101		Margin (dB)	-33.57
5	.64182	42.5dBuV Pk	11.4	0	53.9	71.46
		Azimuth:0-360	Height:101		Margin (dB)	-17.56
6	.89752	37.13dBuV Pk	11.4	.1	48.63	68.54
		Azimuth:0-360	Height:101		Margin (dB)	-19.91
Perpend to EUT						
2	.12657	66.03dBuV Pk	11.4	0	77.43	105.55
		Azimuth:0-360	Height:101		Margin (dB)	-28.12
7	.38302	44.31dBuV Pk	11.3	0	55.61	95.94
		Azimuth:0-360	Height:101		Margin (dB)	-40.33
8	.6431	36.34dBuV Pk	11.4	0	47.74	71.44
		Azimuth:0-360	Height:101		Margin (dB)	-23.7
9	.89486	31.06dBuV Pk	11.4	.1	42.56	68.57
		Azimuth:0-360	Height:101		Margin (dB)	-26.01
Parallel to GND						
1	.12702	72.84dBuV Pk	11.4	0	84.24	105.52
		Azimuth:0-360	Height:101		Margin (dB)	-21.28
3	.12702	72.84dBuV Pk	11.4	0	84.24	105.52
		Azimuth:0-360	Height:101		Margin (dB)	-21.28
10	.38419	49.79dBuV Pk	11.3	0	61.09	95.91
		Azimuth:0-360	Height:101		Margin (dB)	-34.82
11	.64075	41.09dBuV Pk	11.4	0	52.49	71.47
		Azimuth:0-360	Height:101		Margin (dB)	-18.98
12	.89294	35.48dBuV Pk	11.4	.1	46.98	68.59
		Azimuth:0-360	Height:101		Margin (dB)	-21.61

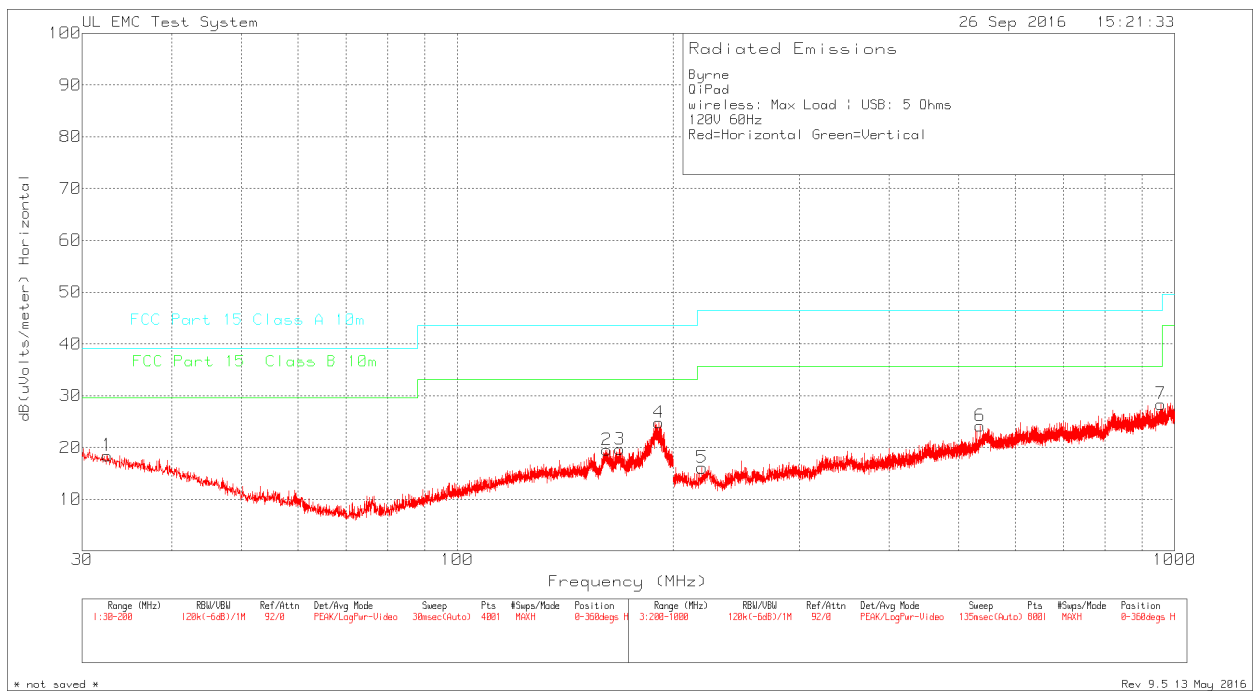
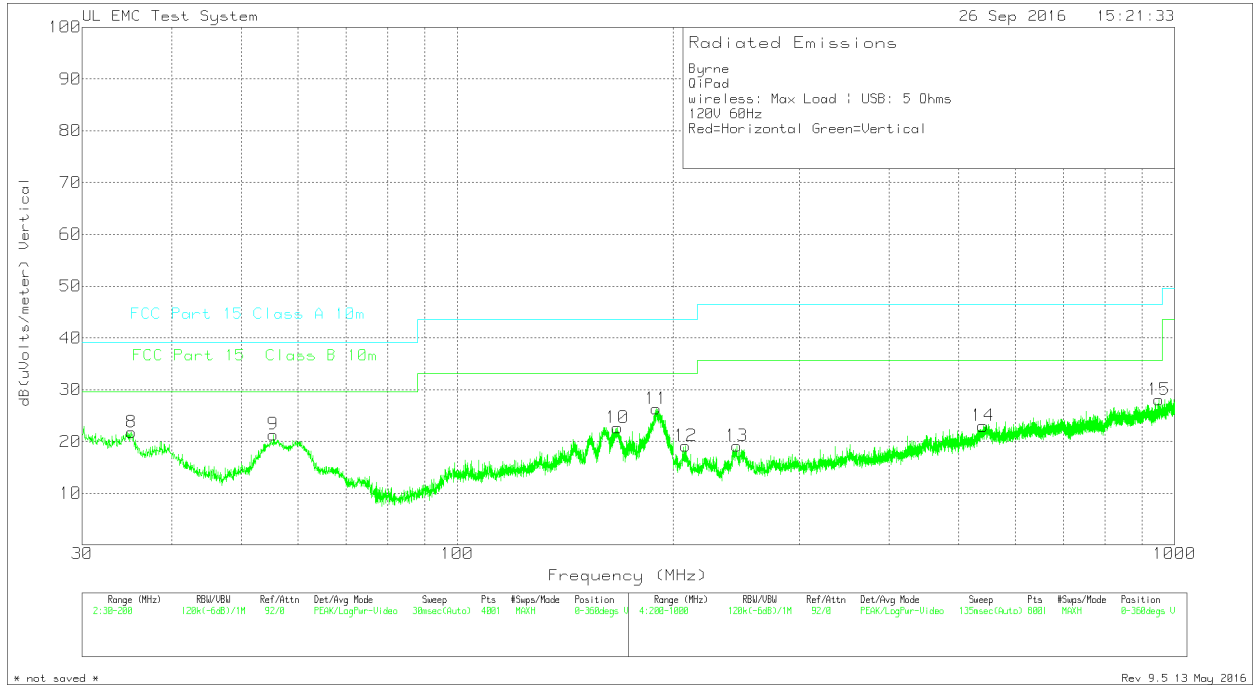
LIMIT 1: 47 CFR Part 15.209 3m Limit
Pk - Peak detector

RESTRICTED BANDEDGE EMISSIONS

Bandedge measurements were conducted using radiated field strength and 20dBc points. Attempt was made to move the device up and down and around the charging pad. This caused the impedance of the load to change and maximum range of frequencies was used. Special Attention was paid to 110kHz.



TX SPURIOUS EMISSIONS 30MHz TO 1GHz Charging Mode



Byrne
QiPad
wireless: Max Load | USB: 5 Ohms
120V 60Hz
Red=Horizontal Green=Vertical

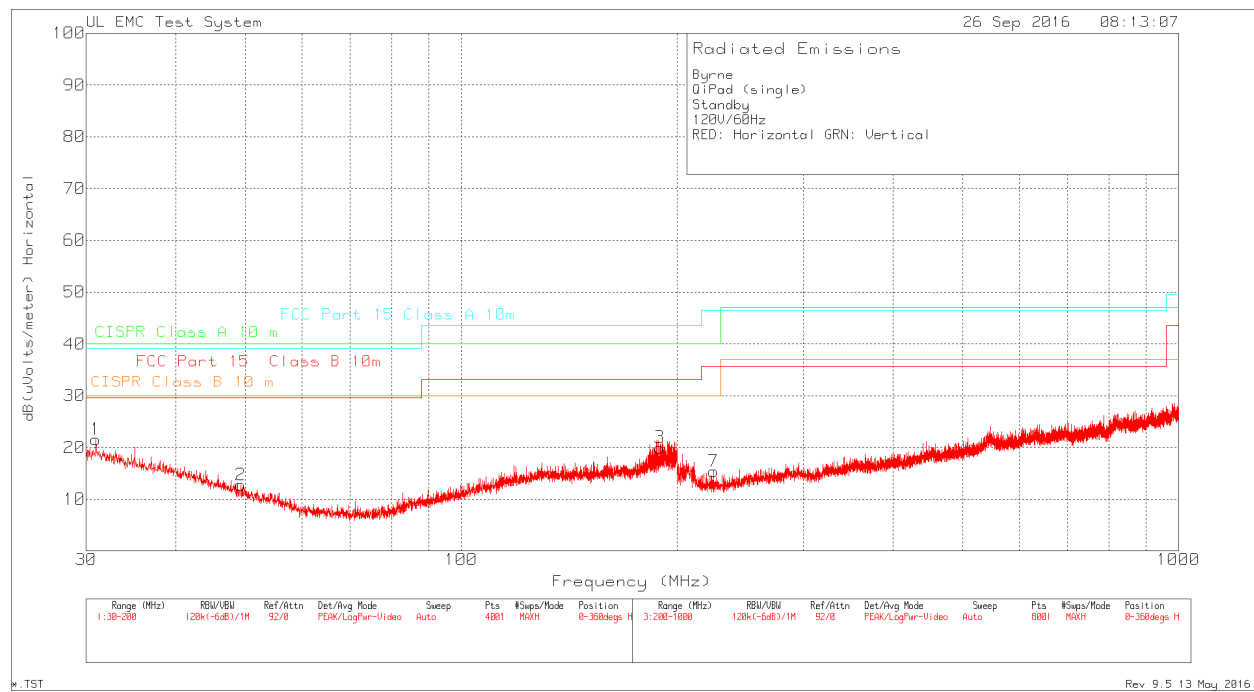
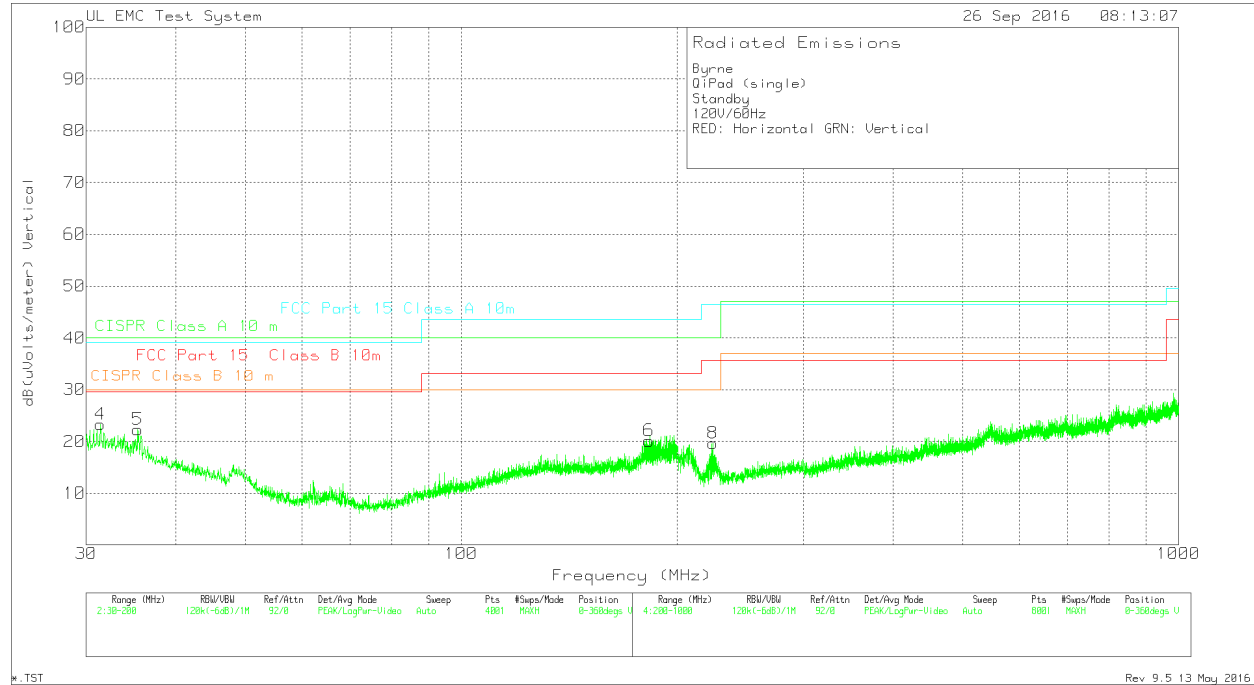
Trace Markers

Test No.	Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading dB(uVolts/meter)	Limit:1	2
1	32.55	31.34dBuV Pk	17.1	-30	18.44	39.08	29.55
		Azimuth:0-360	Height:101	Horz	Margin (dB)	-20.64	-11.11
2	161.495	34.02dBuV Pk	15	-29.5	19.52	43.52	33.07
		Azimuth:0-360	Height:398	Horz	Margin (dB)	-24	-13.55
3	168.5075	34.17dBuV Pk	14.9	-29.4	19.67	43.52	33.07
		Azimuth:0-360	Height:249	Horz	Margin (dB)	-23.85	-13.4
4	190.9475	37.71dBuV Pk	16	-28.9	24.81	43.52	33.07
		Azimuth:0-360	Height:398	Horz	Margin (dB)	-18.71	-8.26
8	35.1425	35.5dBuV Pk	16.2	-29.9	21.8	39.08	29.55
		Azimuth:0-360	Height:101	Vert	Margin (dB)	-17.28	-7.75
9	55.415	42.95dBuV Pk	8.4	-30	21.35	39.08	29.55
		Azimuth:0-360	Height:251	Vert	Margin (dB)	-17.73	-8.2
10	167.275	37.18dBuV Pk	14.9	-29.4	22.68	43.52	33.07
		Azimuth:0-360	Height:101	Vert	Margin (dB)	-20.84	-10.39
11	189.375	39.3dBuV Pk	16	-29	26.3	43.52	33.07
		Azimuth:0-360	Height:101	Vert	Margin (dB)	-17.22	-6.77
5	219.4	34.29dBuV Pk	11.2	-29.4	16.09	46.44	35.57
		Azimuth:0-360	Height:299	Horz	Margin (dB)	-30.35	-19.48
6	535.5	32.77dBuV Pk	19.1	-27.7	24.17	46.44	35.57
		Azimuth:0-360	Height:199	Horz	Margin (dB)	-22.27	-11.4
7	957.5	32.09dBuV Pk	23.6	-27.3	28.39	46.44	35.57
		Azimuth:0-360	Height:99	Horz	Margin (dB)	-18.05	-7.18
12	208.2	37.25dBuV Pk	11.4	-29.5	19.15	43.52	33.07
		Azimuth:0-360	Height:99	Vert	Margin (dB)	-24.37	-13.92
13	245.4	36.71dBuV Pk	11.7	-29.3	19.11	46.44	35.57
		Azimuth:0-360	Height:99	Vert	Margin (dB)	-27.33	-16.46
14	540.7	30.9dBuV Pk	19.8	-27.7	23	46.44	35.57
		Azimuth:0-360	Height:99	Vert	Margin (dB)	-23.44	-12.57
15	950.4	31.93dBuV Pk	23.5	-27.4	28.03	46.44	35.57
		Azimuth:0-360	Height:399	Vert	Margin (dB)	-18.41	-7.54

LIMIT 1: FCC Part 15 Class A 10m
LIMIT 2: FCC Part 15 Class B 10m

Pk - Peak detector

DIGITAL RADIATED EMISSIONS 30 MHz TO 1GHz Charging Mode



* no emissions within 6dB from the limit, measurements not needed.

8. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207 (a)

Frequency of emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50
* Decreases with the logarithm of the frequency.		

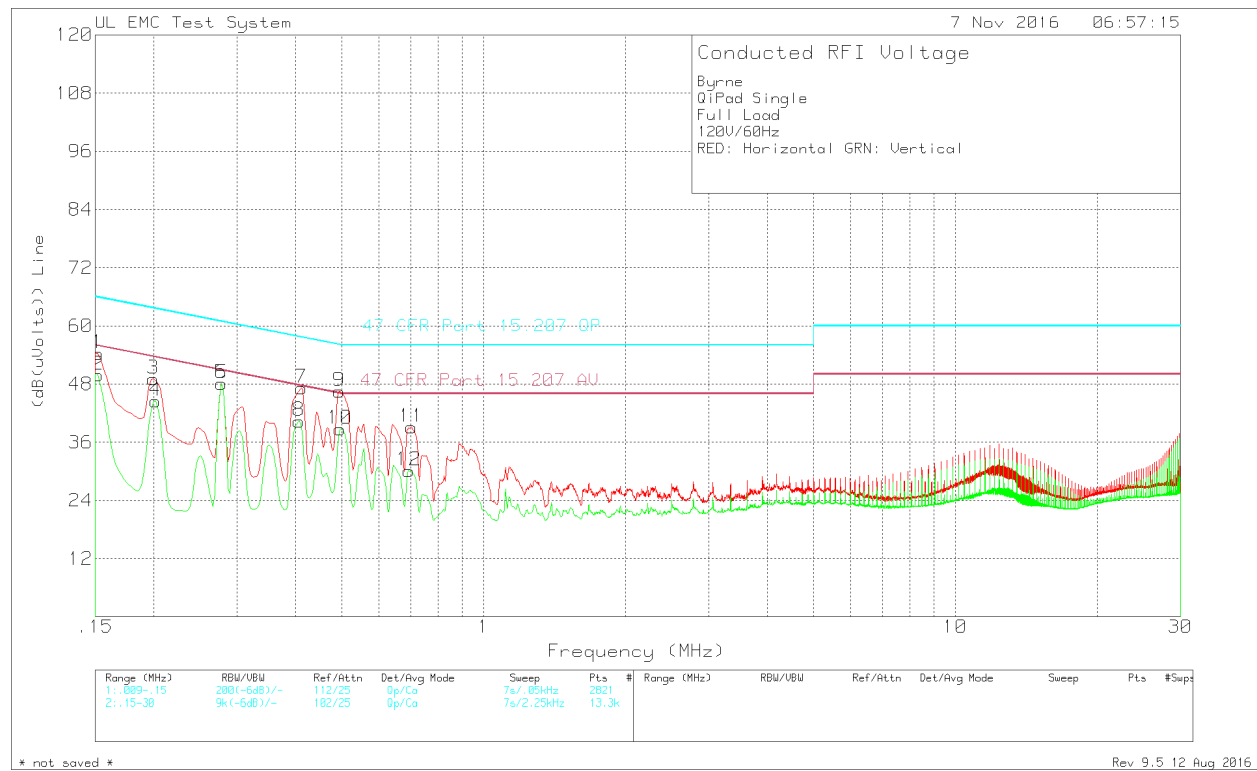
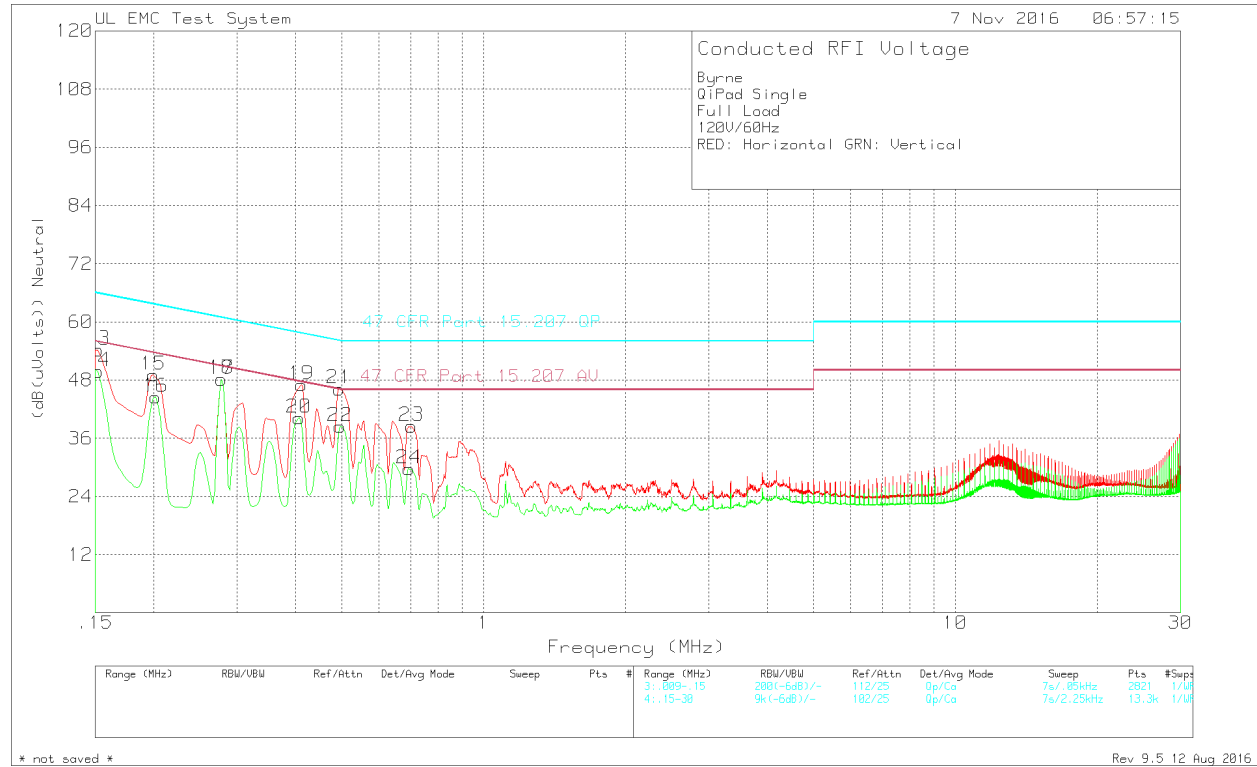
TEST PROCEDURE

ANSI C63.10

RESULTS

No non-compliance noted:

Line Conducted Emissions – Charging Mode



Byrne
QiPad Single
Full Load
120V/60Hz
RED: Horizontal GRN: Vertical

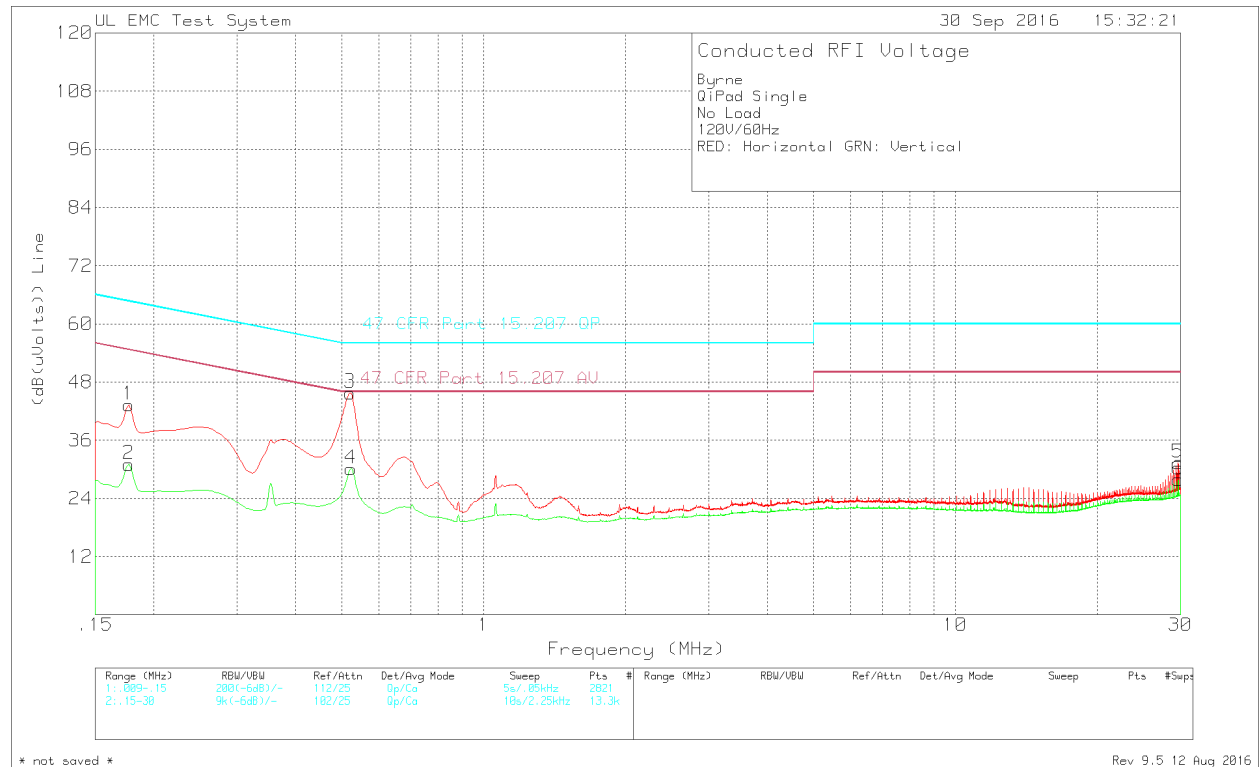
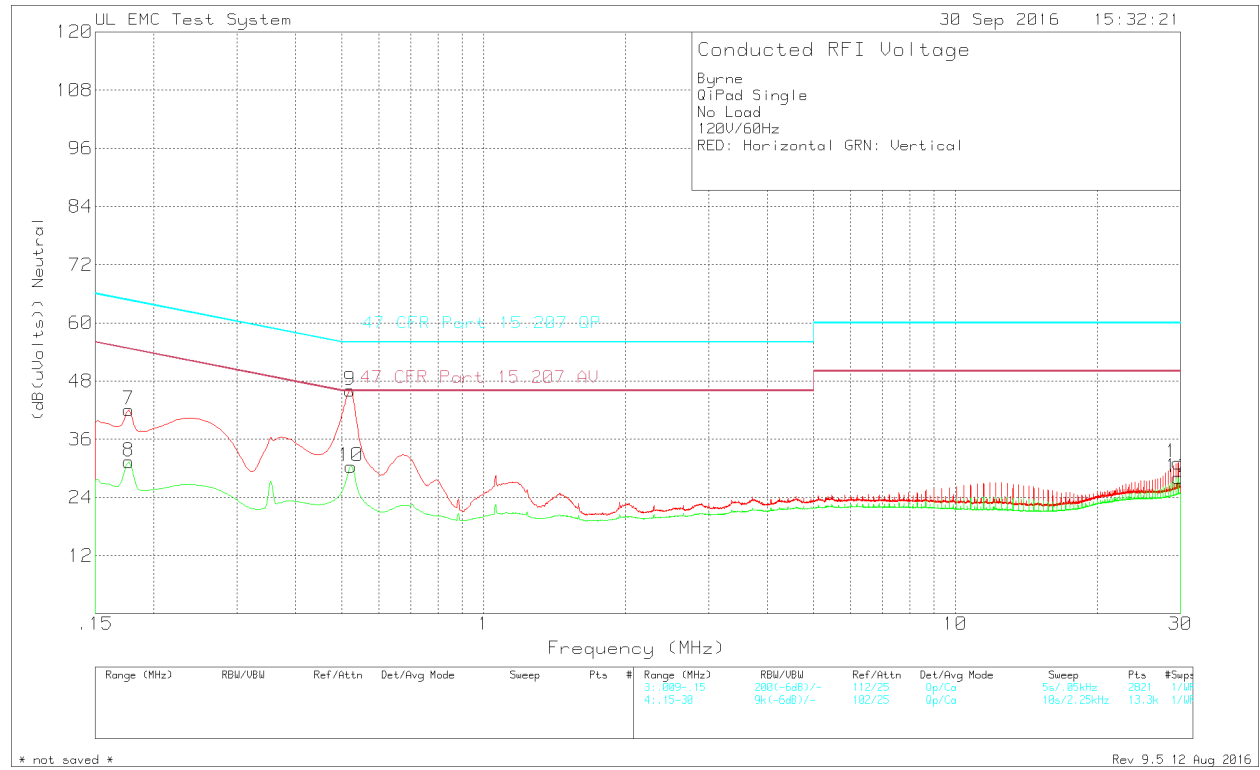
Trace Markers

Test No.	Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2
=====							
Line							
1	.15225	43.89dBuV Qp	.1	10.3	54.29	65.88	55.88
					Margin (dB)	-11.59	-1.59
2	.15225	39.44dBuV Ca	.1	10.3	49.84	65.88	55.88
					Margin (dB)	-16.04	-6.04
3	.1995	38.66dBuV Qp	.1	10.3	49.06	63.63	53.63
					Margin (dB)	-14.57	-4.57
4	.20175	34.17dBuV Ca	0	10.3	44.47	63.54	53.54
					Margin (dB)	-19.07	-9.07
5	.27825	37.83dBuV Qp	0	10.3	48.13	60.87	50.87
					Margin (dB)	-12.74	-2.74
6	.27825	37.82dBuV Ca	0	10.3	48.12	60.87	50.87
					Margin (dB)	-12.75	-2.75
7	.411	36.91dBuV Qp	0	10.3	47.21	57.63	47.63
					Margin (dB)	-10.42	-4.42
8	.4065	30.07dBuV Ca	0	10.3	40.37	57.72	47.72
					Margin (dB)	-17.35	-7.35
9	.49425	36.18dBuV Qp	0	10.3	46.48	56.1	46.1
					Margin (dB)	-9.62	-.38
10	.4965	28.44dBuV Ca	0	10.3	38.74	56.06	46.06
					Margin (dB)	-17.32	-7.32
11	.7035	28.78dBuV Qp	0	10.3	39.08	56	46
					Margin (dB)	-16.92	-6.92
12	.6945	19.84dBuV Ca	0	10.3	30.14	56	46
					Margin (dB)	-25.86	-15.86
Neutral							
13	.15225	43.83dBuV Qp	.1	10.3	54.23	65.88	55.88
					Margin (dB)	-11.65	-1.65
14	.15225	39.4dBuV Ca	.1	10.3	49.8	65.88	55.88
					Margin (dB)	-16.08	-6.08
15	.1995	38.62dBuV Qp	.1	10.3	49.02	63.63	53.63
					Margin (dB)	-14.61	-4.61
16	.20175	34.18dBuV Ca	0	10.3	44.48	63.54	53.54
					Margin (dB)	-19.06	-9.06
17	.27825	37.88dBuV Qp	0	10.3	48.18	60.87	50.87
					Margin (dB)	-12.69	-2.69
18	.27825	37.88dBuV Ca	0	10.3	48.18	60.87	50.87
					Margin (dB)	-12.69	-2.69
19	.411	36.74dBuV Qp	0	10.3	47.04	57.63	47.63
					Margin (dB)	-10.59	-5.59
20	.4065	29.91dBuV Ca	0	10.3	40.21	57.72	47.72
					Margin (dB)	-17.51	-7.51
21	.49425	35.89dBuV Qp	0	10.3	46.19	56.1	46.1
					Margin (dB)	-9.91	-.09
22	.4965	28.16dBuV Ca	0	10.3	38.46	56.06	46.06
					Margin (dB)	-17.6	-7.6
23	.7035	28.21dBuV Qp	0	10.3	38.51	56	46
					Margin (dB)	-17.49	-7.49
24	.6945	19.43dBuV Ca	0	10.3	29.73	56	46
					Margin (dB)	-26.27	-16.27

LIMIT 1: 47 CFR Part 15.207 QP
LIMIT 2: 47 CFR Part 15.207 AV

Qp - Quasi-Peak detector
Ca - CISPR Average detection

Line Conducted Emissions – Standby Mode



Byrne
QiPad Single
No Load
120V/60Hz
RED: Horizontal GRN: Vertical

Trace Markers

Test No.	Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2
=====							
Line							
1	.177	32.87dBuV Qp	.1	10.3	43.27	64.63	54.63
					Margin (dB)	-21.36	-11.36
2	.177	20.62dBuV Ca	.1	10.3	31.02	64.63	54.63
					Margin (dB)	-33.61	-23.61
3	.52125	35.47dBuV Qp	0	10.3	45.77	56	46
					Margin (dB)	-10.23	-.23
4	.5235	19.8dBuV Ca	0	10.3	30.1	56	46
					Margin (dB)	-25.9	-15.9
5	29.68125	19.2dBuV Qp	-.1	12.2	31.3	60	50
					Margin (dB)	-28.7	-18.7
6	29.68125	15.81dBuV Ca	-.1	12.2	27.91	60	50
					Margin (dB)	-32.09	-22.09
Neutral							
7	.177	31.71dBuV Qp	.1	10.3	42.11	64.63	54.63
					Margin (dB)	-22.52	-12.52
8	.177	21dBuV Ca	.1	10.3	31.4	64.63	54.63
					Margin (dB)	-33.23	-23.23
9	.52125	35.77dBuV Qp	0	10.3	46.07	56	46
					Margin (dB)	-9.93	.07
10	.5235	20.05dBuV Ca	0	10.3	30.35	56	46
					Margin (dB)	-25.65	-15.65
11	29.6835	18.95dBuV Qp	-.1	12.3	31.15	60	50
					Margin (dB)	-28.85	-18.85
12	29.6835	15.91dBuV Ca	-.1	12.3	28.11	60	50
					Margin (dB)	-31.89	-21.89

LIMIT 1: 47 CFR Part 15.207 QP
LIMIT 2: 47 CFR Part 15.207 AV

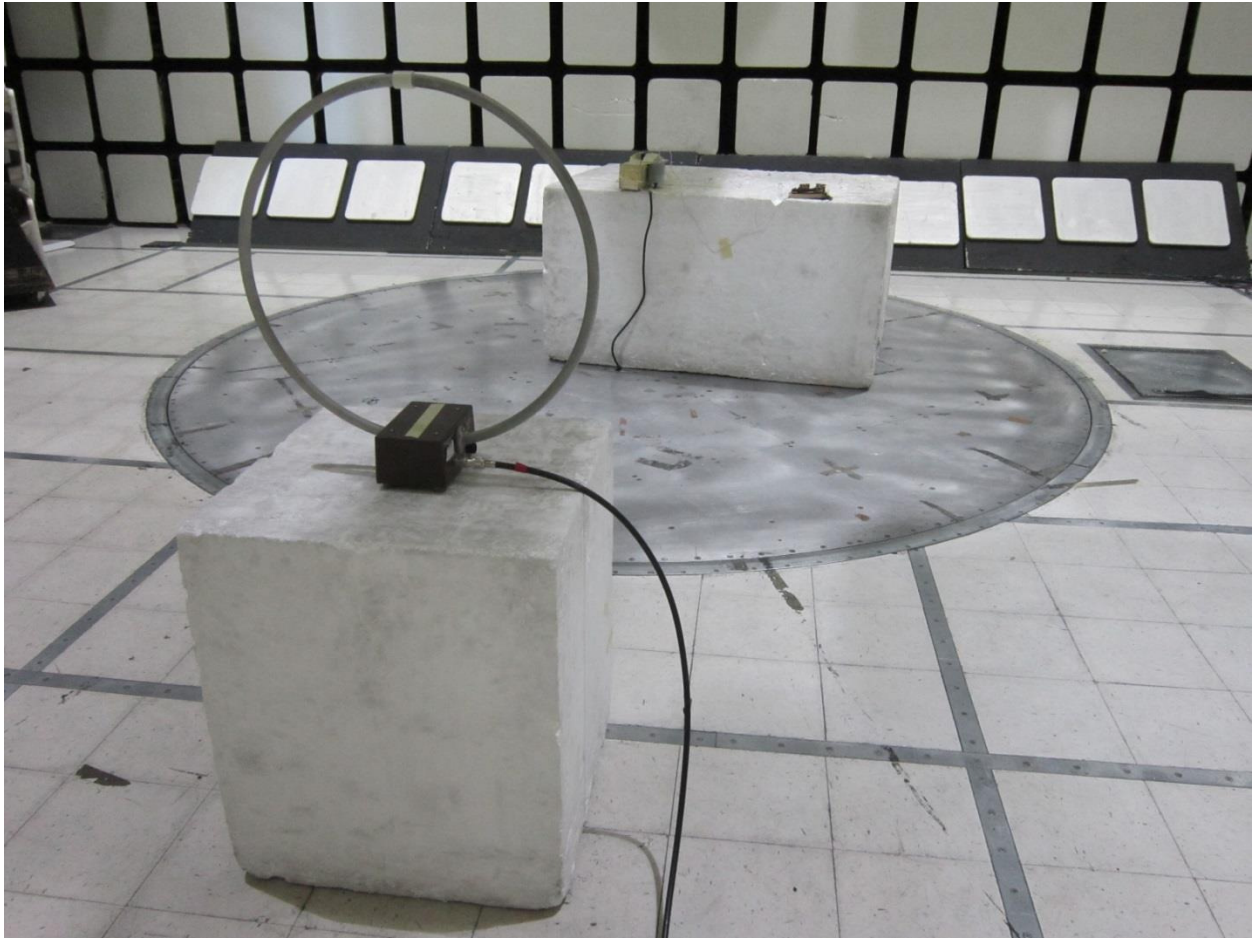
Qp - Quasi-Peak detector
Ca - CISPR Average detection

9. SETUP PHOTOS

RADIATED EMISSION Above 30 MHz



Radiated Emissions Below 30MHz



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Line Conducted Emissions



END OF REPORT