EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 103573640BOX-001
Project Number: G103573640

Report Issue Date: 07/10/2018

Model(s) Tested: Qi Wireless Charging Station
Model(s) Partially Tested: None
Model(s) Not Tested but declared equivalent by the client: None

Standards: FCC Part 15 Subpart C (15.209): 07/2018
FCC Part 15 Subpart B: 07/2018
RSS-216 Issue 2 January 2016
ICES-003 Issue 6 Published: January 2016 Updated: April 2017
RSS-102 Issue 5 March 2015
RSS-Gen Issue 5 April 2018
ISED SPR-002 Issue 1 September 2016
Supplementary Procedure for Assessing Compliance with RSS-102 Nerve Stimulation Exposure Limits

Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
Byrne Electrical Specialists Inc.
320 Byrne Industrial Dr
Rockford, MI 49341-1083
USA

Report prepared by Vathana Ven

Vathana Ven/EMC Staff Engineer

Report reviewed by Kouma Sinn

Kouma Sinn/EMC Staff Engineer

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. 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. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	--
6	Radiated Emissions and Human RF Exposure FCC Part 15 Subpart C (15.209): 07/2018 FCC Part 15 Subpart B: 07/2018 RSS-216 Issue 2 January 2016 ICES-003 Issue 6 Published: January 2016 Updated: April 2017 RSS-102 Issue 5 March 2015 ISED SPR-002 Issue 1 September 2016	Pass
7	Occupied Bandwidth RSS-Gen Issue 5 April 2018	Pass
8	AC Mains Conducted Emissions FCC Part 15 Subpart C (15.209): 07/2018 FCC Part 15 Subpart B: 07/2018 RSS-216 Issue 2 January 2016 ICES-003 Issue 6 Published: January 2016 Updated: April 2017	Pass
9	Revision History	--

3 Client Information

This EUT was tested at the request of:

Client: Byrne Electrical Specialists Inc.
320 Byrne Industrial Dr
Rockford, MI 49341-1083
USA

Contact: Craig Klem
Telephone: (616) 866-3461
Fax: None
Email: klemc@byrne.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Byrne Electrical Specialists Inc.
320 Byrne Industrial Dr
Rockford, MI 49341-1083
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Wireless Charging Receiver	Byrne Electrical Specialist Inc.	TSDMRX-19V20W	FW161201a_0023
Wireless Charging Transmitter	Byrne Electrical Specialists Inc.	Not labeled	Not provided – BOX1806201351-003*

*Issued by Intertek Boxborough for sample tracking purposes only.

Receive Date:	06/20/2018
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
Wireless Charging Station

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
5 VDC	0.5 A	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	The wireless charger set for charging a load during testing. The wireless transmitter transmitting at maximum power.

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	N/A

Radio/Receiver Characteristics	
Frequency Band(s)	110-205 kHz
Modulation Type(s)	CW
Maximum Output Power	N/A, Electric field strength of the fundamental is Magnetic field strength of the fundamental
Test Channels	N/A
Occupied Bandwidth	40.13 Hz
Frequency Hopper: Number of Hopping Channels	N/A
Frequency Hopper: Channel Dwell Time	N/A
Frequency Hopper: Max interval between two instances of use of the same channel	N/A
MIMO Information (# of Transmit and Receive antenna ports)	N/A
Equipment Type	Standalone host device
ETSI LBT/Adaptivity	N/A
ETSI Adaptivity Type	N/A
ETSI Temperature Category (I, II, III)	N/A
ETSI Receiver Category (1, 2, 3)	N/A
Antenna Type and Gain	N/A

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 System Setup and Method

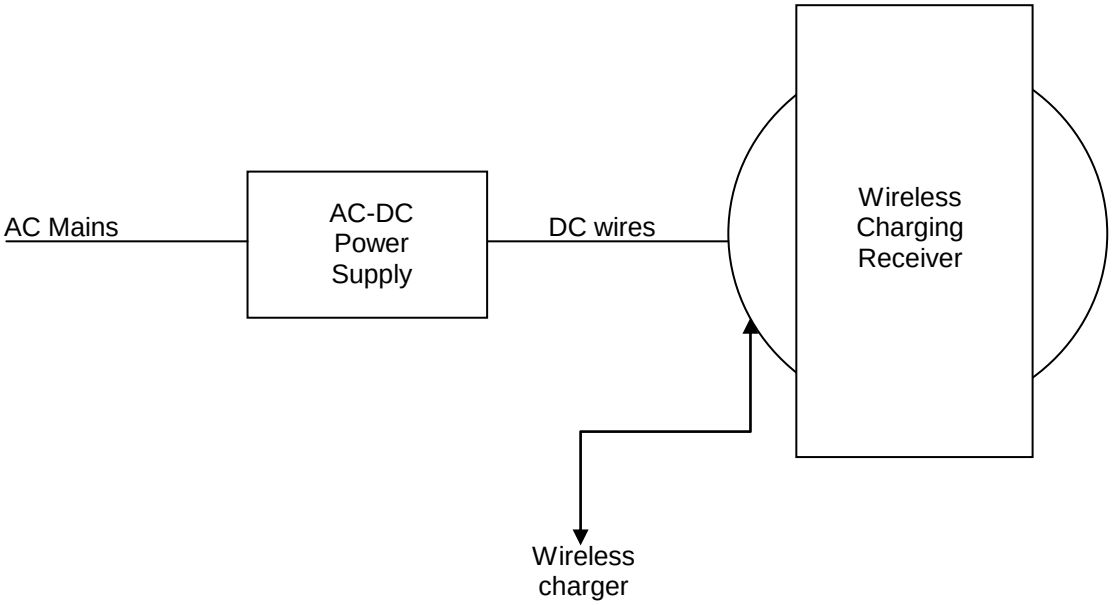
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	DC Power wires	1	None	None	DC supply

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
DC Power supply	Electro Industries	DIGI 35A	M12/EM 1127-01

5.1 Method:

Configuration as required by FCC Part 15 Subpart C (15.209): 07/2018; FCC Part 15 Subpart B: 07/2018; RSS-216 Issue 2 January 2016; ICES-003 Issue 6 Published: January 2016 Updated: April 2017; RSS-102 Issue 5 March 2015; RSS-Gen Issue 5 April 2018; ISED SPR-002 Issue 1 September 2016; ANSI C 63.10: 2013; and ANSI C 63.4: 2014.

5.2 EUT Block Diagram:



6 Radiated Emissions and Human RF Exposure

6.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C (15.209), FCC Part 15 Subpart B, RSS 216, ICES 003, RSS 102, ANSI C 63.10, ANSI C 63.4, and ISED SPR-002 Issue 1 September 2016.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

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

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
BAR1'	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	04/30/2018	04/30/2019
145019'	Active Loop Antenna (9 KHz to 30 MHz)	EMCO	6502/1	9902-3267	06/28/2017	06/28/2018
CBLBNC2012-2'	50 Ohm Coaxial Cable	Pomona	RG-58 C/U	CBLBNC2012-2	01/05/2018	01/05/2019
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2017	07/25/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2017	07/25/2018
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/16/2018	05/16/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/22/2018	03/22/2019
PRE11'	50dB gain pre-amp	Keith H	PRE11	PRE11	12/02/2017	12/02/2018
SCH6'	Electromagnetic Radiation Meter Set	Schaffner	EMC-20	AP-0183	05/22/2018	05/22/2019
NAR011'	Exposure Level Tester ELT-400	NARDA	2304/04	N-0024	03/29/2018	03/29/2019
NAR012'	B-Field Probe 100 cm2	NARDA	2300/90.10	M-0466	03/29/2018	03/29/2019

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	3.16.0.69

6.3 Results:

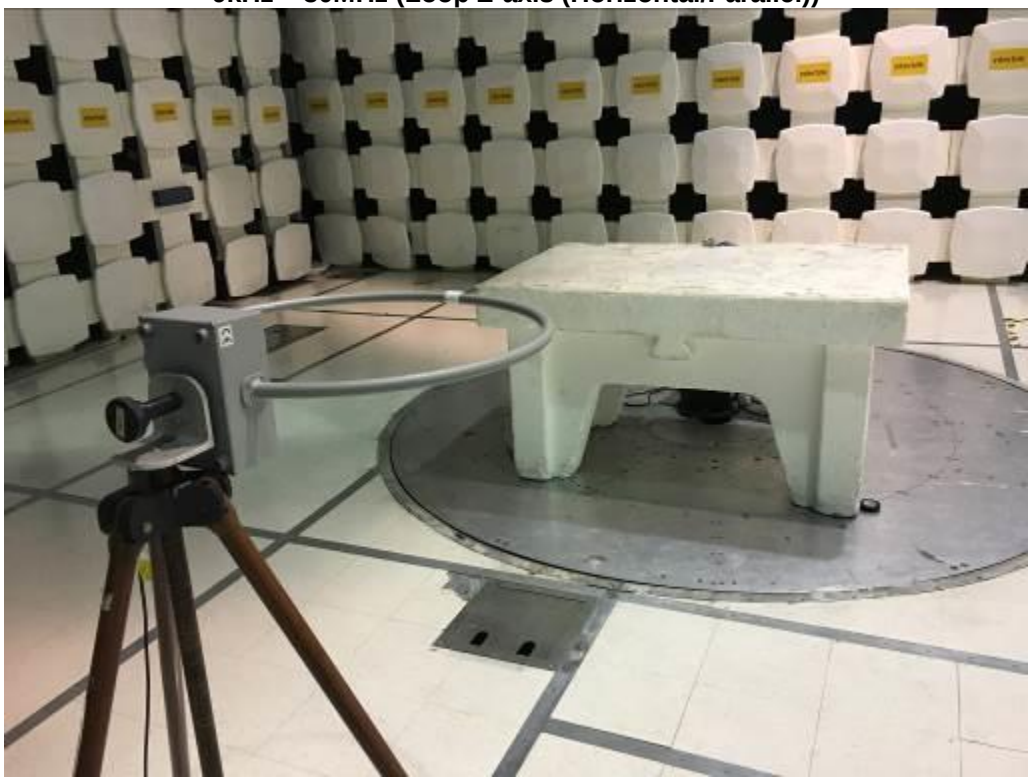
The sample tested was found to Comply.

6.4 Setup Photographs:

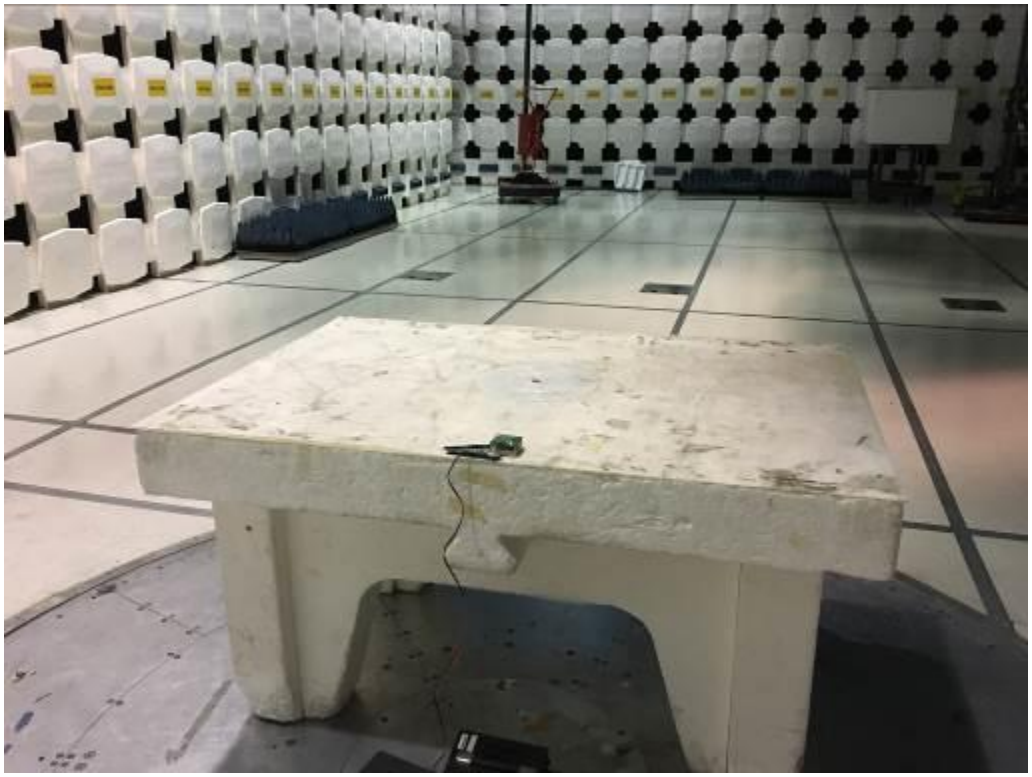
9kHz – 30MHz (Loop X-axis (Vertical/Perpendicular))

9kHz – 30MHz (Loop Y-axis (Vertical/Perpendicular))

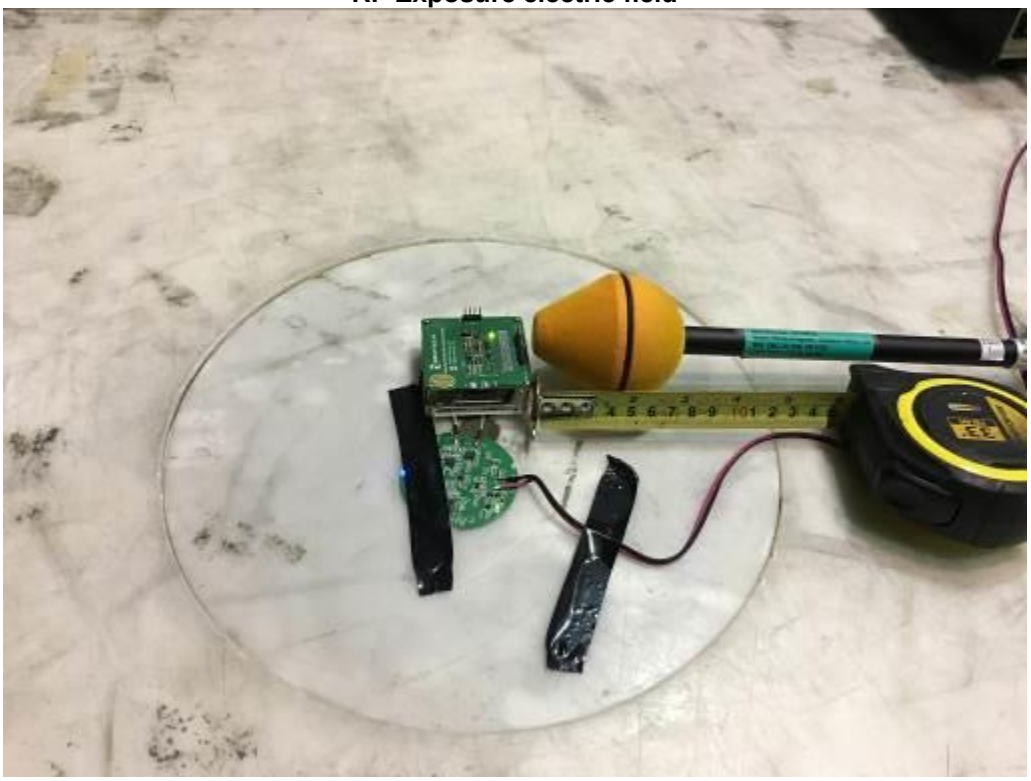
9kHz – 30MHz (Loop Z-axis (Horizontal/Parallel))

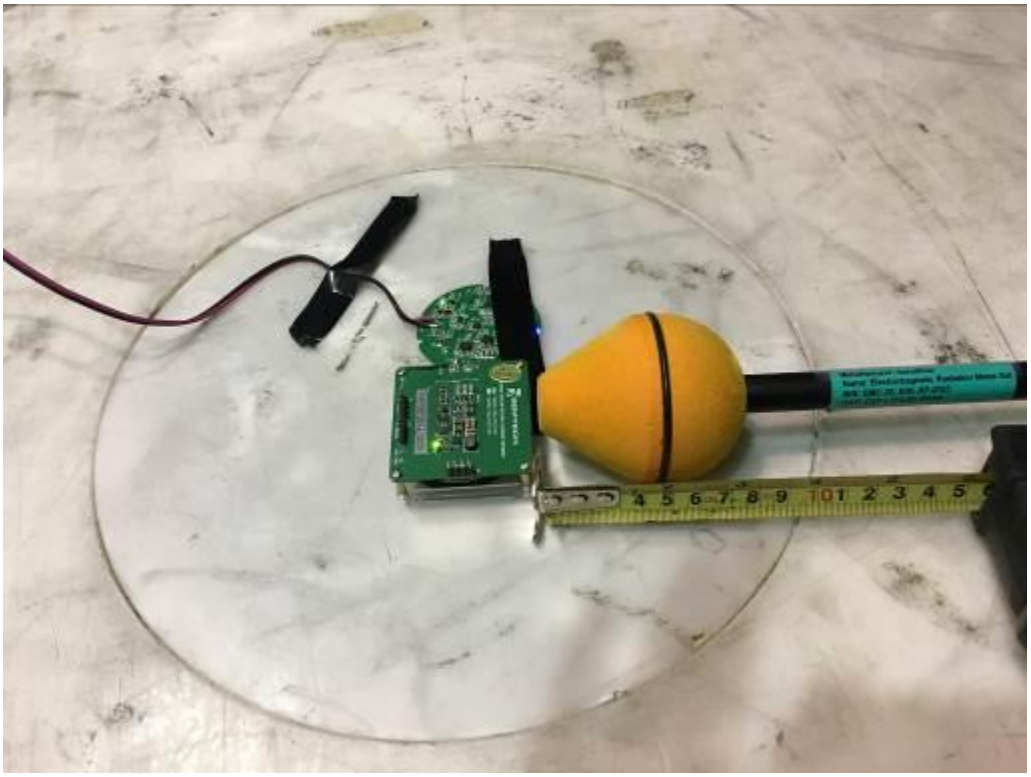


30-1000 MHz

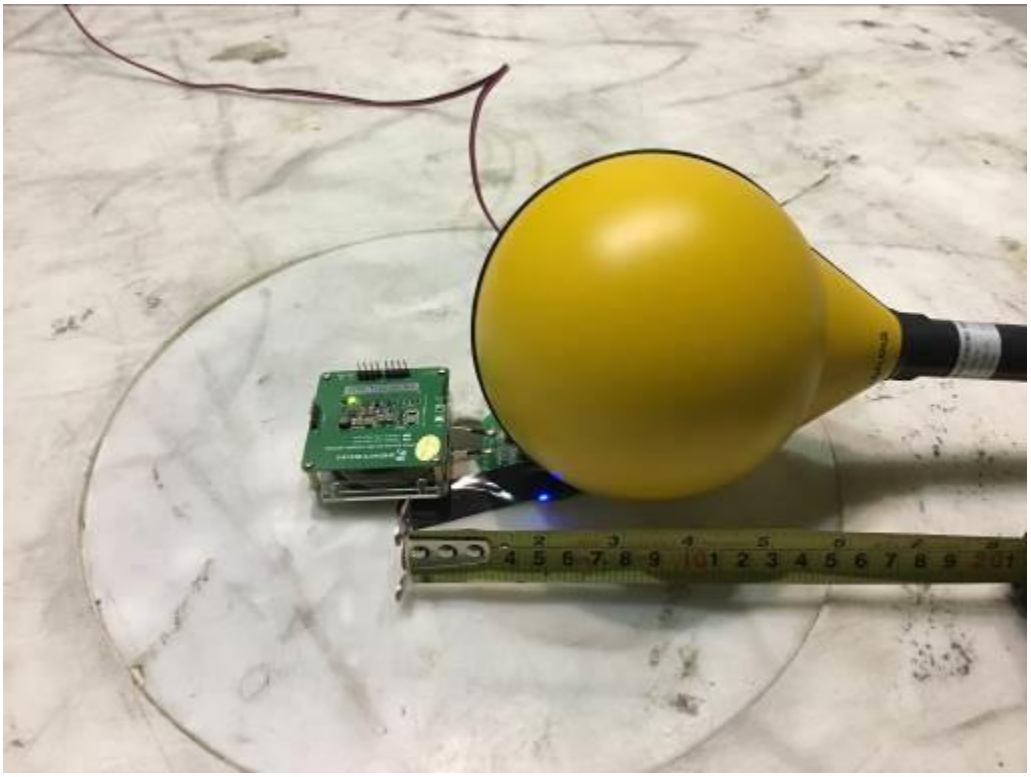


RF Exposure electric field





RF Exposure magnetic field



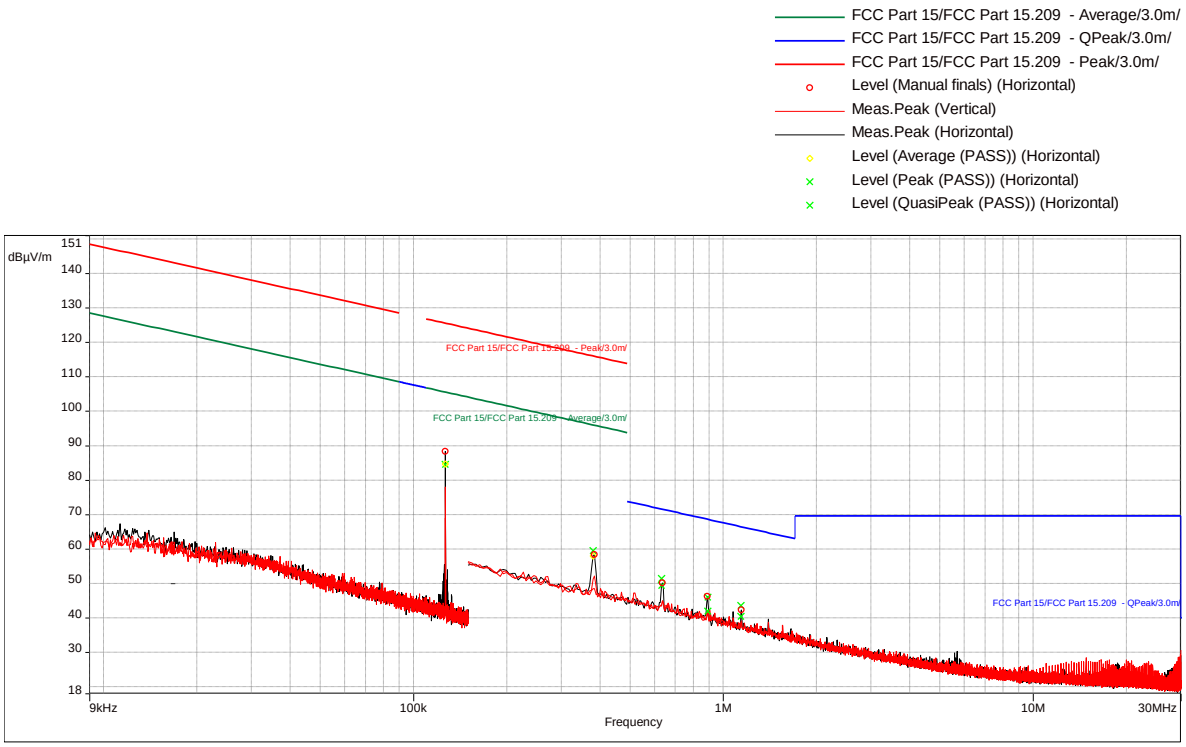
6.5 Plots/Data:

9kHz – 30MHz Electric field per FCC 15.209

Test Information:

Date and Time	6/27/2018 6:20:10 PM
Client and Project Number	Byrne Electrical Specialists, Inc._G103573640
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	59%
Atmospheric Pressure	998 mB
Comments	RE 9kHz-30MHz_5VDC_Loop antenna, Electric Field, 3M Location

Graph:



Results:

QuasiPeak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
0.6336315789	49.41	71.60	-22.18	261.00	1.00	Horizontal	9000.00	11.29
0.8903684211	41.95	68.59	-26.64	338.00	1.00	Horizontal	9000.00	11.40
1.142131579	40.40	66.47	-26.07	357.00	1.00	Horizontal	9000.00	11.54

Peak (PASS) (5)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
0.1267526316	84.53	125.55	-41.02	308.00	1.00	Horizontal	200.00	13.83
0.3792631579	59.51	116.02	-56.51	306.00	1.00	Horizontal	9000.00	11.06
0.6336315789	51.44	71.60	-20.16	261.00	1.00	Horizontal	9000.00	11.29
0.8903684211	45.92	68.59	-22.68	338.00	1.00	Horizontal	9000.00	11.40
1.142131579	43.58	66.47	-22.88	357.00	1.00	Horizontal	9000.00	11.54

Average (PASS) (2)

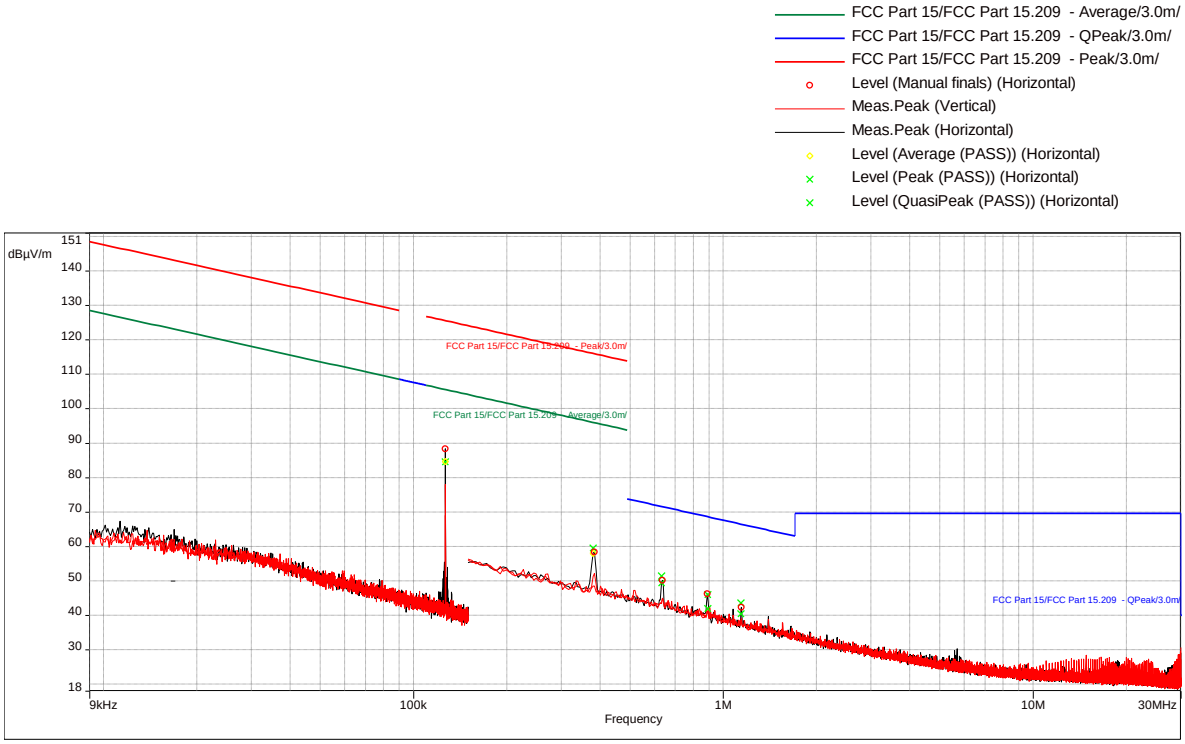
Frequency (MHz)	SR	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
0.1267526316	5	84.65	105.55	-20.90	308.00	1.00	Horizontal	200.00	13.83
0.3792631579	6	57.93	96.02	-38.09	306.00	1.00	Horizontal	9000.00	11.06

9kHz – 30MHz Magnetic field per RSS 216

Test Information:

Date and Time	6/27/2018 6:20:10 PM
Client and Project Number	Byrne Electrical Specialists, Inc._G103573640
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	59%
Atmospheric Pressure	998 mB
Comments	RE 9kHz-30MHz_5VDC_Loop antenna, Magnetic Field, 3M Location

Graph:



dBuV/m was converted to dBuV/m in the table

Results:

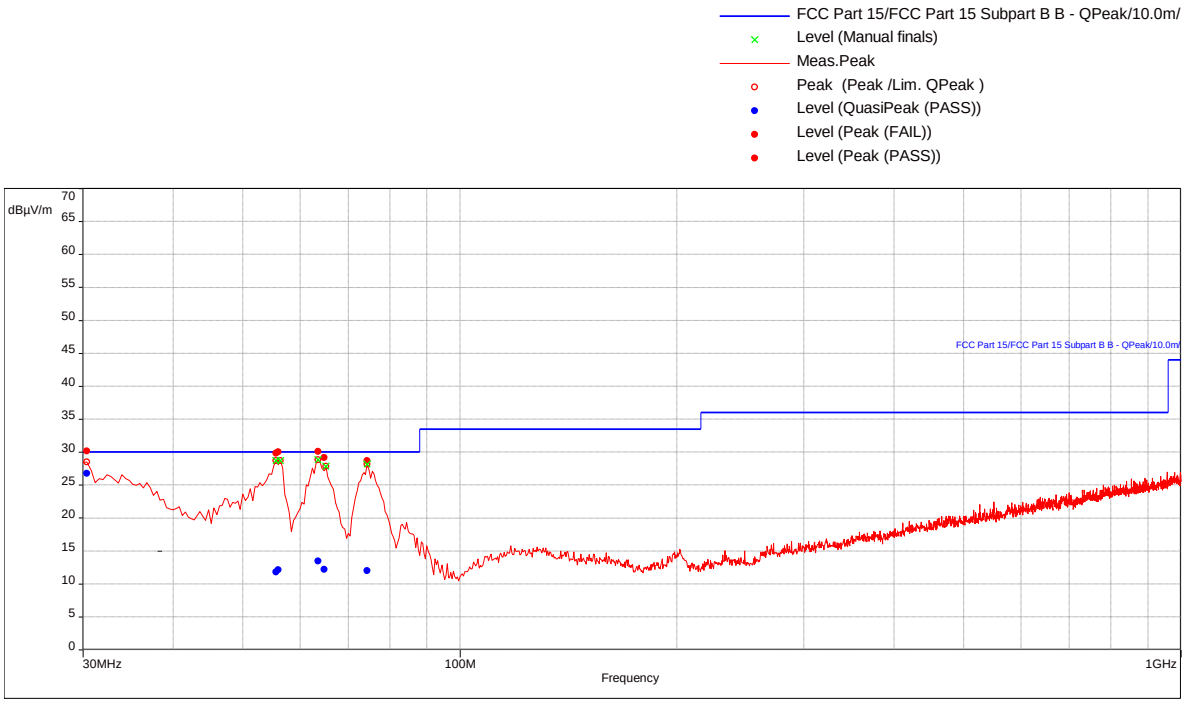
Frequency (MHz)	Level (dBµA/m)	Limit (dBµA/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
0.1267526316	32.96	40.05	-7.09	308.00	1.00	Horizontal	200.00	13.83
0.3792631579	8.05	40.05	-32.00	306.00	1.00	Horizontal	9000.00	11.06
0.6336315789	-0.83	20.05	-20.88	261.00	1.00	Horizontal	9000.00	11.29
0.8903684211	-5.79	20.05	-25.84	338.00	1.00	Horizontal	9000.00	11.40
1.142131579	-14.46	20.05	-34.51	357.00	1.00	Horizontal	9000.00	11.54

30-1000 MHz per RSS 216, FCC 15.209, FCC Part 15 Subpart B, and ICES 003

Test Information:

Date and Time	6/28/2018 8:51:45 PM
Client and Project Number	Byrne Electrical Specialists, Inc._G103573640
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	59%
Atmospheric Pressure	998 mB
Comments	RE 30-1000MHz_5VDC

Graph:



Results:

QuasiPeak (PASS) (6)

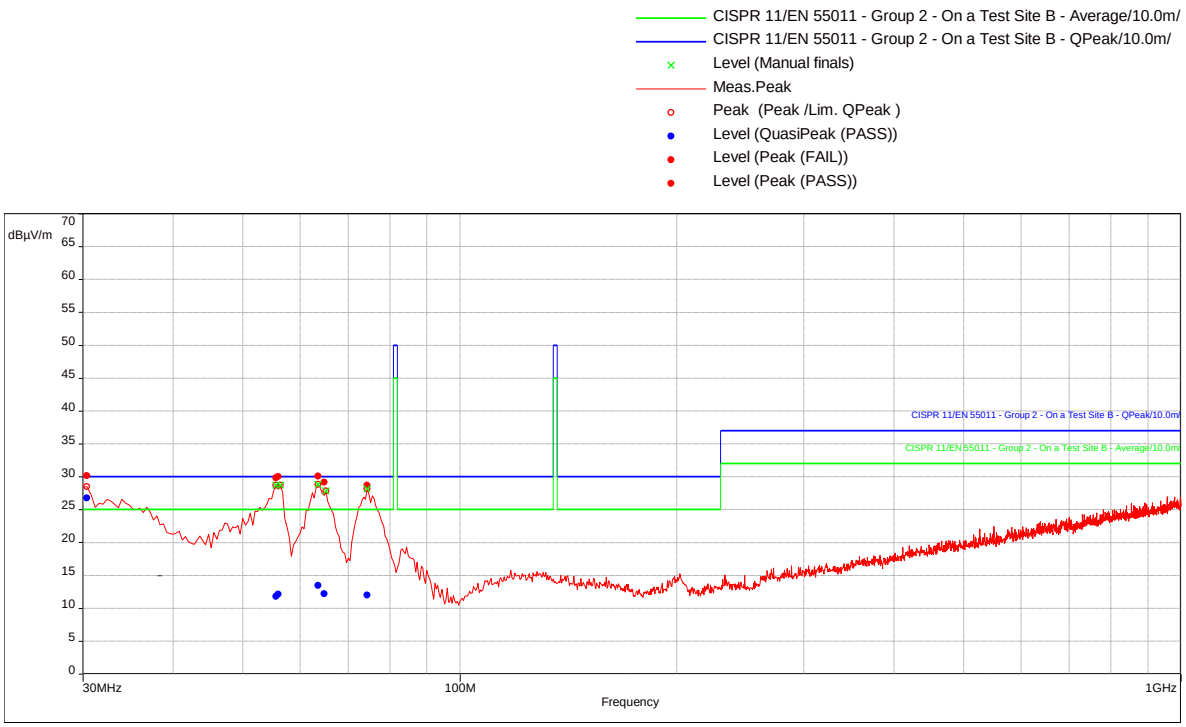
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
30.4	26.78	30.00	-3.22	233.00	1.00	Vertical	120000.00	-22.09
55.63157895	11.79	30.00	-18.21	210.00	1.60	Vertical	120000.00	-35.93
56.17894737	12.11	30.00	-17.89	307.00	2.03	Vertical	120000.00	-35.89
63.72631579	13.46	30.00	-16.54	167.00	2.27	Vertical	120000.00	-35.55
64.69473684	12.16	30.00	-17.84	321.00	2.32	Vertical	120000.00	-35.45
74.46315789	11.97	30.00	-18.03	194.00	2.05	Vertical	120000.00	-35.13

30-1000 MHz per RSS 216 (CISPR 11 Group 2 limits)

Test Information:

Date and Time	6/27/2018 8:51:45 PM
Client and Project Number	Byrne Electrical Specialists, Inc._G103573640
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	59%
Atmospheric Pressure	998 mB
Comments	RE 30-1000MHz_5VDC_CISPR 11

Graph:



Results:

QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
30.4	26.78	30.00	-3.22	233.00	1.00	Vertical	120000.00	-22.09
55.63157895	11.79	30.00	-18.21	210.00	1.60	Vertical	120000.00	-35.93
56.17894737	12.11	30.00	-17.89	307.00	2.03	Vertical	120000.00	-35.89
63.72631579	13.46	30.00	-16.54	167.00	2.27	Vertical	120000.00	-35.55
64.69473684	12.16	30.00	-17.84	321.00	2.32	Vertical	120000.00	-35.45
74.46315789	11.97	30.00	-18.03	194.00	2.05	Vertical	120000.00	-35.13

The average limits apply to magnetron driven equipment only. If magnetron driven equipment exceeds the quasi–peak limit at certain frequencies, then the measurement shall be repeated at these frequencies with the average detector and the average limits specified in this table apply.

6.6 Human RF Exposure

Electric Field

The field strength limits are established in Health Canada's RF exposure guideline, Safety Code 6.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10	83	90	-	Instantaneous

EUT Location (worst-case)	Measured Value (V/m rms)	Limit (V/m rms)
Top	13.19	83

The sample tested was found to Comply at 5 cm from the probe.

Magnetic Field

The field strength limits are established in Health Canada's RF exposure guideline, Safety Code 6.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10	83	90	-	Instantaneous

EUT Location (worst-case)	Measured Value (uT)	Measured Value (A/m rms)	Limit (A/m rms)
Bottom	1.638	1.3	90

The sample tested was found to Comply at 5 cm from the probe.

Calculated Value (A/m) = Measured Value (uT) /1.26

Test Personnel: Vathana Ven VSV
Test Date: 06/27/2018, 06/28/2018
Supervising/Reviewing Engineer: (Where Applicable) N/A
Product Standard: FCC Part 15 Subpart C (15.209); FCC Part 15 Subpart B; RSS 216; ICES 003; RSS 102
Limit Applied: As specified in section 6.5 and 6.6
Input Voltage: 120VAC 60Hz
Pretest Verification w/ Ambient Signals or BB Source: BB Source
Ambient Temperature: 22, 22 ºC
Relative Humidity: 59, 36 %
Atmospheric Pressure: 998, 1002 mbars

Deviations, Additions, or Exclusions: None

7 Occupied Bandwidth

7.1 Method

Tests are performed in accordance with RSS Gen.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

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

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
BAR1'	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	04/30/2018	04/30/2019
145019'	Active Loop Antenna (9 KHz to 30 MHz)	EMCO	6502/1	9902-3267	06/28/2017	06/28/2018
CBLBNC2012-2'	50 Ohm Coaxial Cable	Pomona	RG-58 C/U	CBLBNC2012-2	01/05/2018	01/05/2019
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2017	07/25/2018
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/22/2018	03/22/2019

Software Utilized:

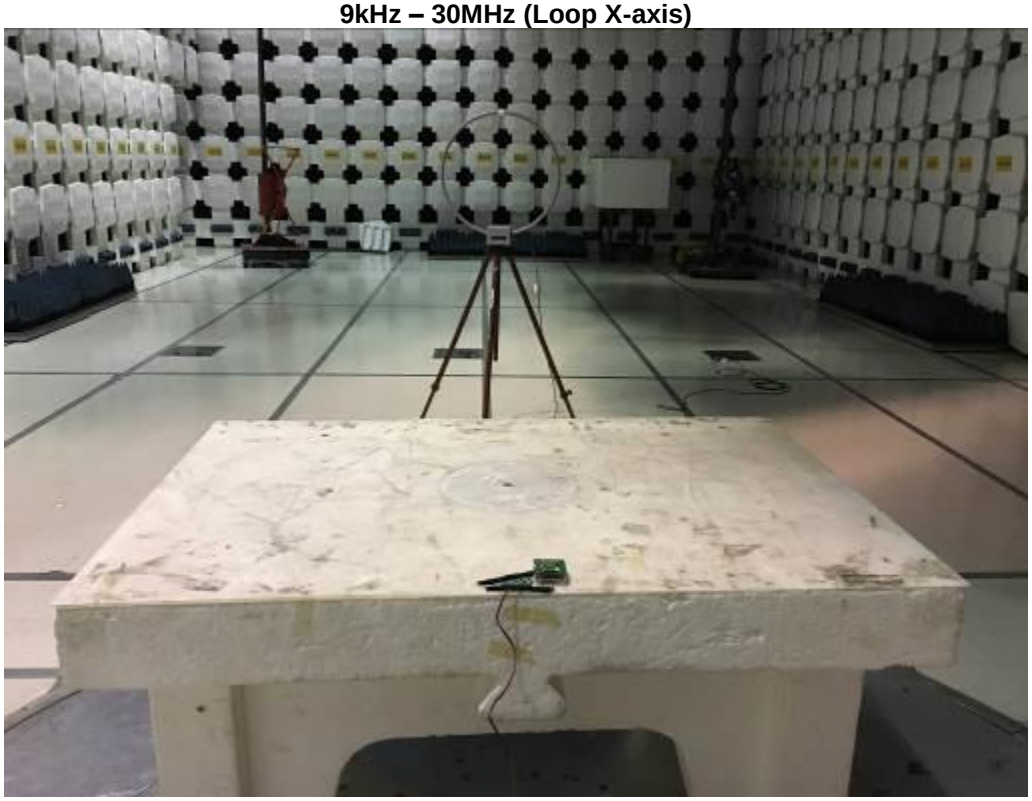
Name	Manufacturer	Version
BAT-EMC	Nexio	3.16.0.69

7.3 Results:

The sample tested was found to Comply.

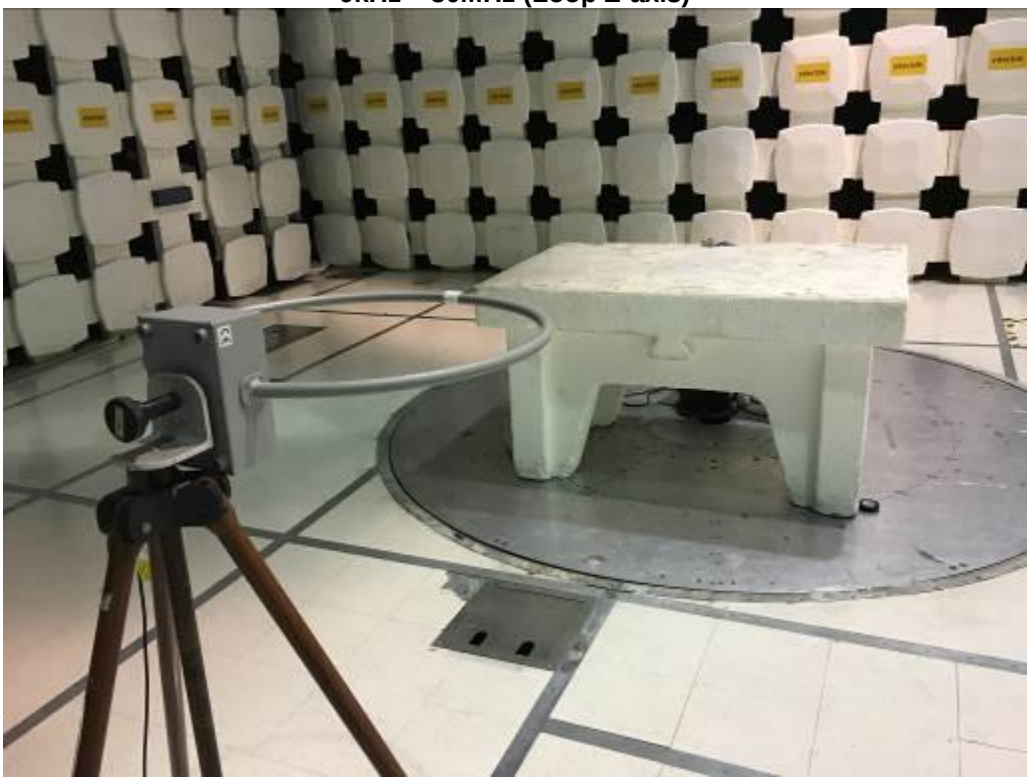
7.4 Setup Photographs:

9kHz – 30MHz (Loop X-axis)

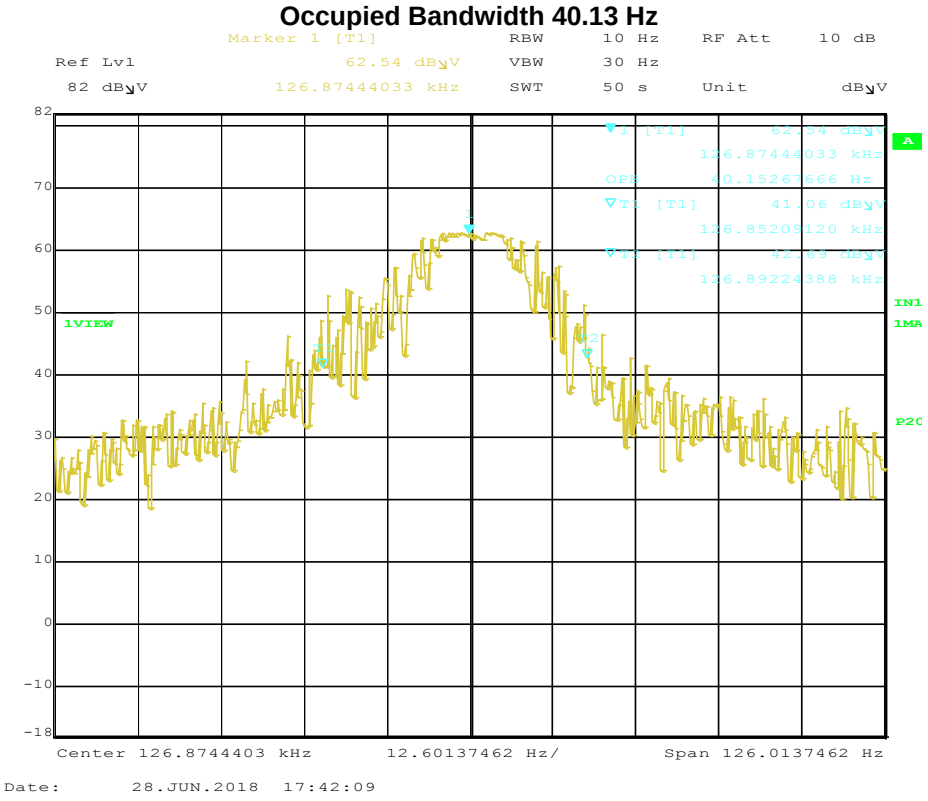


9kHz – 30MHz (Loop Y-axis)

9kHz – 30MHz (Loop Z-axis)



7.5 Plots/Data:



Test Personnel:	Vathana Ven VSV	Test Date:	06/27/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	RSS Gen	Limit Applied:	As specified in section 7.5
Input Voltage:	5 VDC	Ambient Temperature:	22 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	36 %
		Atmospheric Pressure:	102 mbars

Deviations, Additions, or Exclusions: None

8 AC Mains Conducted Emissions

8.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C (15.209), FCC Part 15 Subpart B, RSS 216, RSS Gen, ICES 003, and ANSI C63.4.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
AC Line Conducted Emissions	150 kHz - 30 MHz	2.8dB	3.4dB
Telco Port Emissions	150 kHz - 30 MHz	3.2dB	5.0dB

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

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

Alternately, when C5 Software is used, the "Level" includes all losses and gains and is compared directly in the "Margin" column to the "Limit". "TF" is the Transducer Factor; in this case LISN or ISN loss.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	12/07/2017	12/07/2018
ROS002'	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	08/03/2017	08/03/2018
CBLBNC2012-2'	50 Ohm Coaxial Cable	Pomona	RG-58 C/U	CBLBNC2012-2	01/05/2018	01/05/2019
DS25'	Attenuator, 20dB	Mini Circuits	20dB, 50 ohm	DS25	10/17/2017	10/17/2018
LISN32'	LISN - CISPR16 Compliant 9kHz-30MHz	Com-Power	LI-215A	191955	05/03/2018	05/03/2019

Software Utilized:

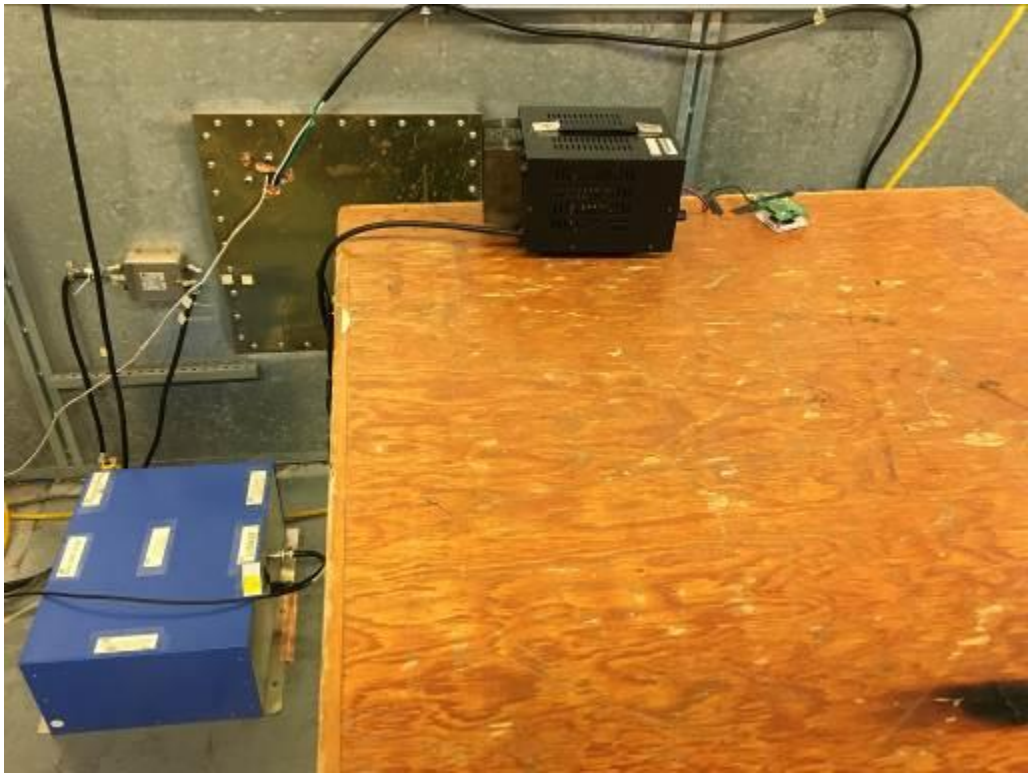
Name	Manufacturer	Version
Compliance 5	Teseq	5.26.46.46

8.3 Results:

The sample tested was found to Comply.

8.4 Setup Photographs:

9kHz – 30 MHz Conducted Emissions



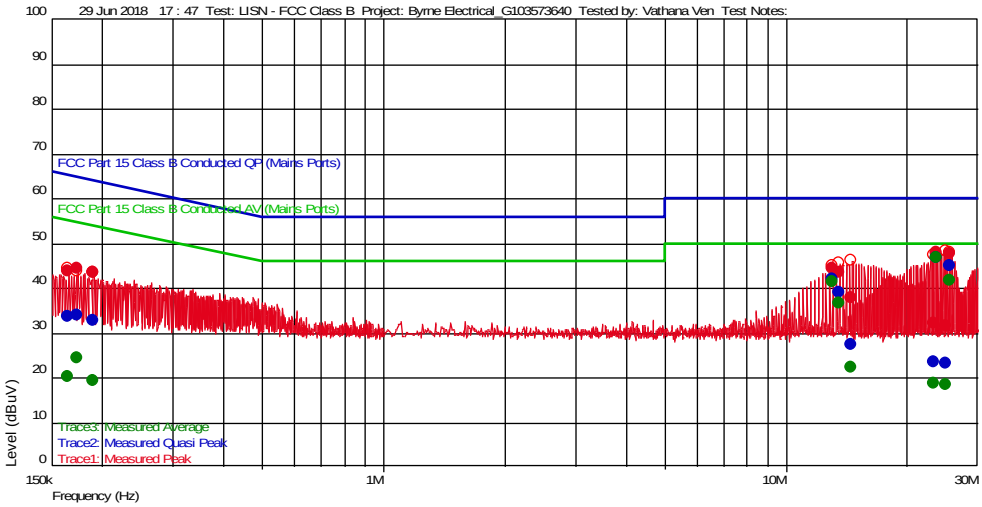
8.5 Plots/Data:

150kHz – 30MHz @ 120VAC 60Hz

Test Information

Test Details	User Entry	Additional Information
Test:	LISN - FCC Class B	
Project:	Byrne Electrical_G103573640	
Test Notes:	120VAC 60Hz, charging mode	
Temperature:	20 deg C	
Humidity:	59%, 1002 mB	
Tested by:	Vathana Ven	
Test Started:	29 Jun 2018 17 : 47	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace2: Measured Quasi Peak

Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
25.14 M	23.11	0.360	20.480	60.000	-36.89	9 k		N
23.32 M	23.50	0.357	20.461	60.000	-36.50	9 k		N
14.62 M	27.27	0.350	20.372	60.000	-32.73	9 k		N
165.3 k	33.60	1.520	20.075	65.193	-31.59	9 k		N
190.8 k	32.62	1.270	20.076	64.002	-31.38	9 k		N
173.8 k	33.90	1.437	20.075	64.777	-30.88	9 k		L1
13.6 M	38.95	0.350	20.361	60.000	-21.05	9 k		N
13.08 M	42.05	0.350	20.356	60.000	-17.95	9 k		N
25.64 M	44.83	0.361	20.485	60.000	-15.17	9 k		N
23.82 M	46.72	0.358	20.466	60.000	-13.28	9 k		N

Trace3: Measured Average

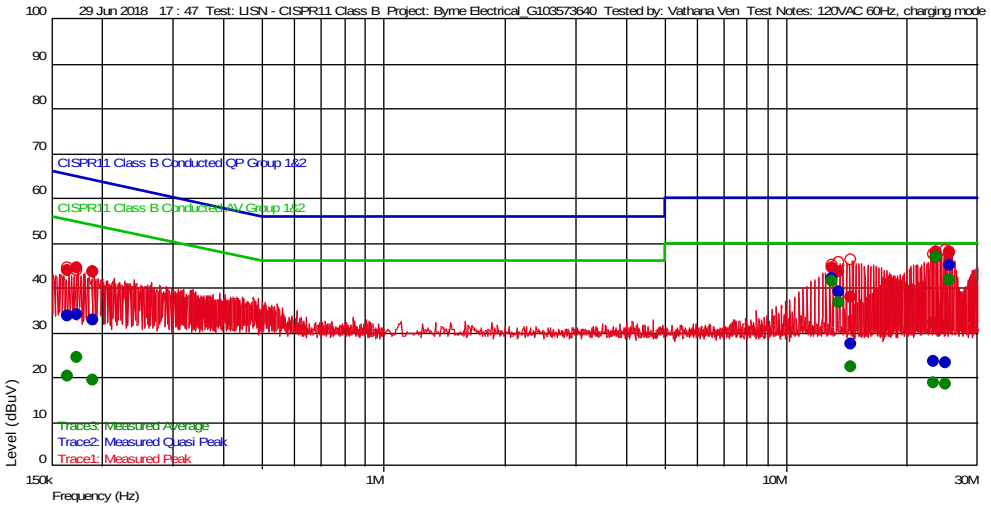
Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
165.3 k	20.08	1.520	20.075	55.193	-35.11	9 k		N
190.8 k	19.16	1.270	20.076	54.002	-34.84	9 k		N
25.14 M	18.37	0.360	20.480	50.000	-31.63	9 k		N
23.32 M	18.68	0.357	20.461	50.000	-31.32	9 k		N
173.8 k	24.26	1.437	20.075	54.777	-30.52	9 k		L1
14.62 M	22.35	0.350	20.372	50.000	-27.65	9 k		N
13.6 M	36.52	0.350	20.361	50.000	-13.48	9 k		N
13.08 M	41.23	0.350	20.356	50.000	-8.77	9 k		N
25.64 M	41.50	0.361	20.485	50.000	-8.50	9 k		N
23.82 M	46.65	0.358	20.466	50.000	-3.35	9 k		N

9kHz – 30MHz @ 120VAC 60Hz

Test Information

Test Details	User Entry	Additional Information
Test:	LISN - CISPR11 Class B	
Project:	Byrne Electrical_G103573640	
Test Notes:	120VAC 60Hz, charging mode	
Temperature:	20 deg C	
Humidity:	59%, 1002 mB	
Tested by:	Vathana Ven	
Test Started:	29 Jun 2018 17 : 47	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace2: Measured Quasi Peak

Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
25.14 M	23.11	0.360	20.480	60.000	-36.89	9 k		N
23.32 M	23.50	0.357	20.461	60.000	-36.50	9 k		N
14.62 M	27.27	0.350	20.372	60.000	-32.73	9 k		N
165.3 k	33.60	1.520	20.075	65.193	-31.59	9 k		N
190.8 k	32.62	1.270	20.076	64.002	-31.38	9 k		N
173.8 k	33.90	1.437	20.075	64.777	-30.88	9 k		L1
13.6 M	38.95	0.350	20.361	60.000	-21.05	9 k		N
13.08 M	42.05	0.350	20.356	60.000	-17.95	9 k		N
25.64 M	44.83	0.361	20.485	60.000	-15.17	9 k		N
23.82 M	46.72	0.358	20.466	60.000	-13.28	9 k		N

Trace3: Measured Average

Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
165.3 k	20.08	1.520	20.075	55.193	-35.11	9 k		N
190.8 k	19.16	1.270	20.076	54.002	-34.84	9 k		N
25.14 M	18.37	0.360	20.480	50.000	-31.63	9 k		N
23.32 M	18.68	0.357	20.461	50.000	-31.32	9 k		N
173.8 k	24.26	1.437	20.075	54.777	-30.52	9 k		L1
14.62 M	22.35	0.350	20.372	50.000	-27.65	9 k		N
13.6 M	36.52	0.350	20.361	50.000	-13.48	9 k		N
13.08 M	41.23	0.350	20.356	50.000	-8.77	9 k		N
25.64 M	41.50	0.361	20.485	50.000	-8.50	9 k		N
23.82 M	46.65	0.358	20.466	50.000	-3.35	9 k		N

Test Personnel:	Vathana Ven VSV	Test Date:	06/29/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 15 Subpart C FCC Part 15 Subpart B RSS 216 RSS Gen ICES 003	Limit Applied:	As specified in section 8.5
Input Voltage:	120VAC 60Hz		
Pretest Verification w/ Ambient Signals or BB Source:	Yes	Ambient Temperature:	20 ºC
		Relative Humidity:	59 %
		Atmospheric Pressure:	1002 mbars

Deviations, Additions, or Exclusions: None

9 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	07/10/2017	103573640BOX-001	VFV	KPS	Original Issue