EMC TEST REPORT

Report Number: 102463032LAX-005
Project Number: G102463032

Report Issue Date:	February 23, 2016
Model(s) Tested:	SC-ZWAVE5-ECO
FCC ID:	XQC-SCZ5
IC:	9863B-SCZ5

Standards:

FCC CFR47 Part 15 Subpart C
Intentional Radiator
§15.249, Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz

FCC CFR47 Part 15 Subpart B
Unintentional Radiator

Industry Canada RSS-210 Issue 8
License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
§A2.9, Bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz

Industry Canada ICES-003 Issue 6
Information Technology Equipment (ITE) - Limits and methods of measurement

Tested by:
Intertek
25791 Commercentre Drive
Lake Forest, CA 92630
USA

Client:
Ecolink
2055 Corte Del Nogal
Carlsbad, CA 92011
USA

Report prepared by

Grace Lin
EMC Staff Engineer

Report reviewed by

Krishna Vemuri
EMC Team Leader

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
6	Fundamental Field Strength (FCC §15.249(a), FCC §15.249(c); IC RSS-210 Issue 8 §A2.9)	Compliant
7	Occupied Bandwidth (FCC §15.215; IC RSS-Gen Issue 4 §6.6)	Compliant
8	Transmitter Radiated Emissions (FCC §15.249(a), FCC §15.249(c), FCC §15.249(d), FCC §15.209, FCC §15.205; IC RSS-210 Issue 8 §A2.9, IC RSS-Gen Issue 4 §8.9)	Compliant
9	Radiated Emissions (FCC §15.109; IC ICES-003 Issue 6 §6.2)	Compliant
10	AC Power Line Conducted Emissions (FCC §15.207; IC RSS-Gen Issue 4 §8.8) (FCC §15.107; IC ICES-003 Issue 6 §6.1)	Compliant

3 Client Information

This EUT was tested at the request of:

Client: Ecolink
2055 Corte Del Nogal
Carlsbad, CA 92011
USA

Contact: Mike Archbold
Telephone: (760) 431-8804
Fax:
Email: archbolm@discoverecolink.com

4 Description of Equipment Under Test and Variant Models

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
ZWAVE Siren and Chime	Ecolink	SC-ZWAVE5-ECO	908.42 MHz
ZWAVE Siren and Chime	Ecolink	SC-ZWAVE5-ECO	916.00 MHz
ZWAVE Siren and Chime	Ecolink	SC-ZWAVE5-ECO	Normal Operation

Receive Date:	02/16/2016
Received Condition:	Good
Type:	Production

Description of Equipment Under Test
The equipment under test (EUT) is a ZWAVE Siren and Chime operating at 908.4-908.42 MHz and/or 916.00 MHz. The EUT is AC powered and uses an integral antenna.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
100-240Vac	150mA	50/60 Hz	1

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	908.42 MHz, 9.6 kbps data rate, FSK Modulation
2	916.00 MHz, 100 kbps data rate, GFSK Modulation
3	Production Firmware

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	Modes 1 and 2 were programmed to transmit continuously during testing. Mode 3 was configured as normal operation.

Radio/Receiver Characteristics	
Frequency Band(s)	908.4 - 908.42 MHz; 916.00 MHz
Modulation Type(s)	FSK; GFSK
Test Channels	908.42 MHz, 916.00 MHz
Equipment Type	Standalone
Antenna Type and Gain	Integral

5 System Setup and Method

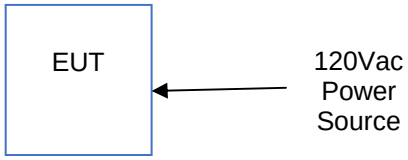
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	Power Cord	1.8 or 2.6	No	No	N/A

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None	N/A	N/A	N/A

5.1 Method:

Configuration as required by ANSI C63.10-2013.

5.2 EUT Block Diagram:



6 Fundamental Field Strength

6.1 Performance Requirement(s)

The field strength of emissions, measured at 3 meters, from intentional radiators operated within the frequency band shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500

6.2 Method

Tests are performed in accordance with ANSI C63.10-2013.

The EUT was placed on a non-conducting table 80 cm (below 1 GHz) or 1.5 meters (above 1 GHz) above the ground plane (turntable). The antenna to EUT distance was 3 meters.

The transmitter configured to transmit continuously. The turntable containing the EUT was rotated through 360 degrees and the receive antenna height was varied from 1 to 4 meters to locate the worst-case emissions levels. Measurements were made with the antenna in both the horizontal and vertical polarizations. EUT was tested at three orthogonal planes. The worst-case data is recorded in this report.

TEST SITE:

The test is performed in the 3 meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 3m	30-1000 MHz	4.2	6.3 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.

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

6.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
637	3m Semi-anechoic Chamber	Panashield	3 meter	25 331-D-Z	12/21/2015	12/21/2018
607A	EMI Receiver	HP	8546A	3625A00347	02/20/2015	02/20/2016
539	RF Filter Section	HP	85460A	3448A00265	02/20/2015	02/20/2016
1147	Bilog Antenna	TESEQ Gmbh	CBL 6112D	32852	10/28/2015	10/28/2016
798	Cable	Insulated wire	Cable	00828	04/03/2015	04/02/2016
1002	Lab Monitor	Omega	iBTHX-W	0440776	06/26/2015	06/26/2016

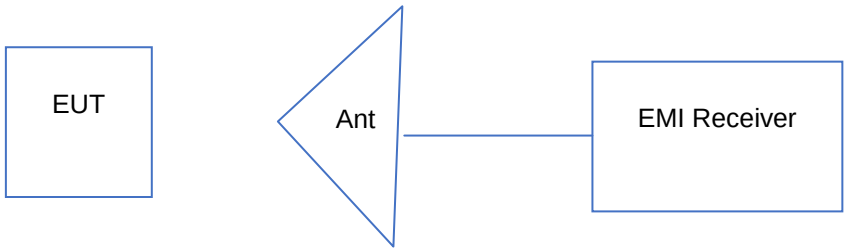
Software Utilized:

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

6.4 Results:

The sample tested was found to comply.

6.5 Setup Diagram:



6.6 Plots/Data:

908.42 MHz

Antenna Polarization	Frequency (MHz)	EUT Orientation	EUT Power Setting	Measured Data (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Turntable Degree	Antenna Height (cm)	Detector
H	908.42	XY	-4	93.81	94	-0.19	101.0	141.0	QP

916 MHz

Antenna Polarization	Frequency (MHz)	EUT Orientation	EUT Power Setting	Measured Data (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Turntable Degree	Antenna Height (cm)	Detector
H	916.00	XY	-4	92.36	94	-1.64	360.0	141.0	QP

Test Personnel:	Grace Lin	Test Date:	2/19/2016
Product Standard:	FCC 15.249, IC RSS-210	Limit Applied:	FCC 15.249, IC RSS-210
Input Voltage:	120Vac		
Pretest Verification w/ Ambient Signals or BB Source:	Yes	Ambient Temperature:	21.3 ºC
		Relative Humidity:	46.8 %
		Atmospheric Pressure:	993.9 mbars

Deviations, Additions, or Exclusions: None

7 Occupied Bandwidth

7.1 Performance Requirement(s)

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated. (FCC §15.215(c))

The transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured. (IC RSS-Gen Issue 4 §6.6)

7.2 Method

Tests are performed in accordance with ANSI C63.10-2013.

TEST SITE:

The test is performed in the 3 meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 3m	30-1000 MHz	4.2	6.3 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.

7.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
690	Spectrum Analyzer, 9 KHz - 40 GHz	Rohde & Schwarz	FSP40	100027	01/11/2016	01/11/2017
1147	Bilog Antenna	TESEQ Gmbh	CBL 6112D	32852	10/28/2015	10/28/2016
798	Cable	Insulated wire	Cable	00828	04/03/2015	04/02/2016
1002	Lab Monitor	Omega	iBTHX-W	0440776	06/26/2015	06/26/2016

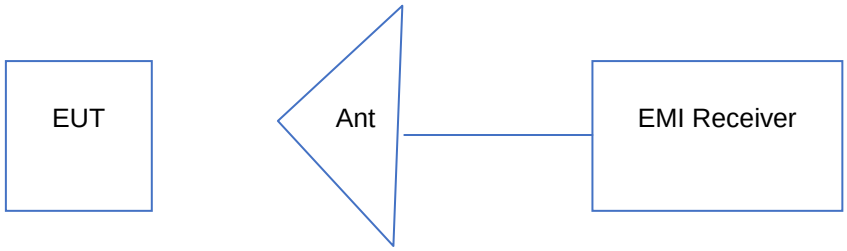
Software Utilized:

Name	Manufacturer	Version	Profile
N/A	N/A	N/A	N/A

7.4 Results:

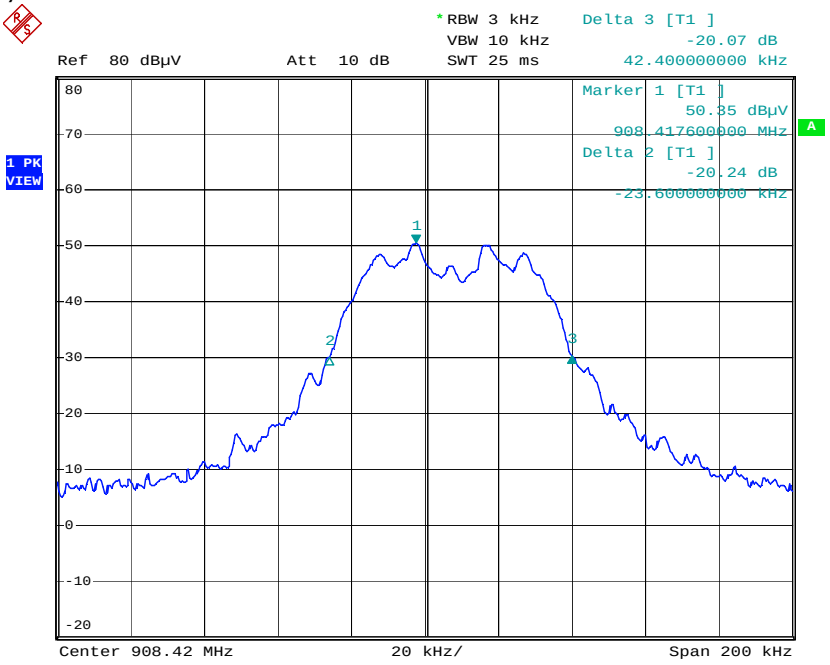
The sample tested was found to comply. The 20 dB and 99% bandwidth of the fundamental frequency remain inside the band of operation of 902-928 MHz.

7.5 Setup Diagram:



7.6 Plots/Data:

20 dB Bandwidth, 908.42 MHz:



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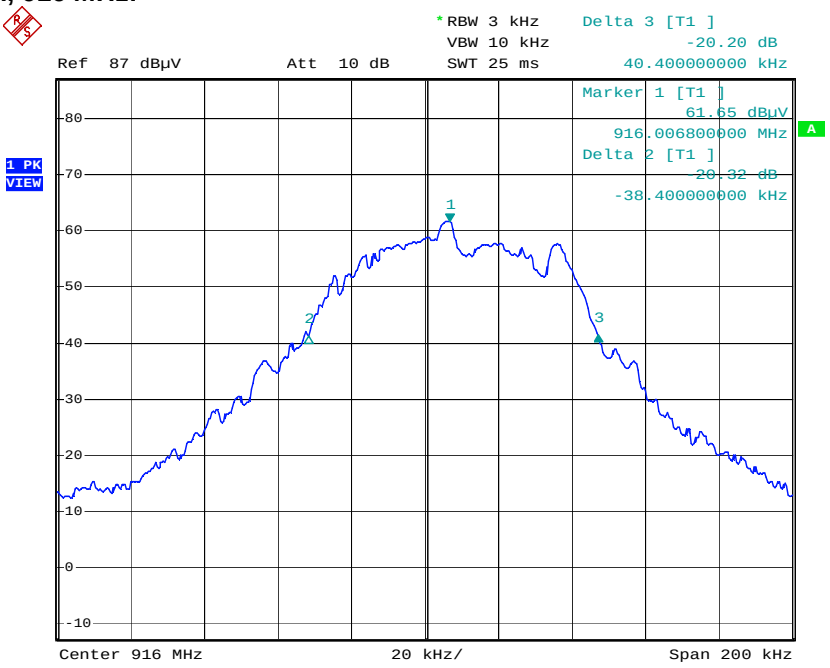
20 dB Bandwidth, 916 MHz:



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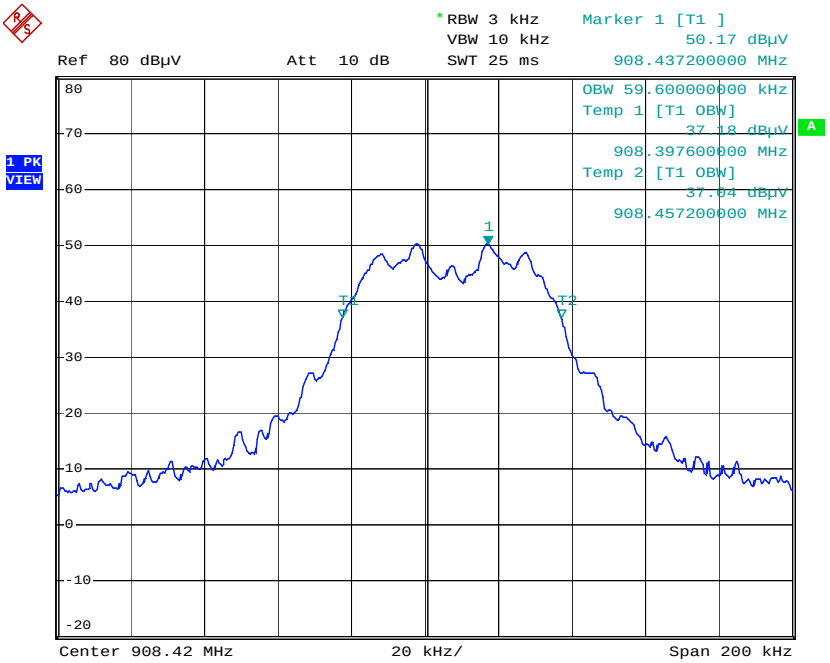
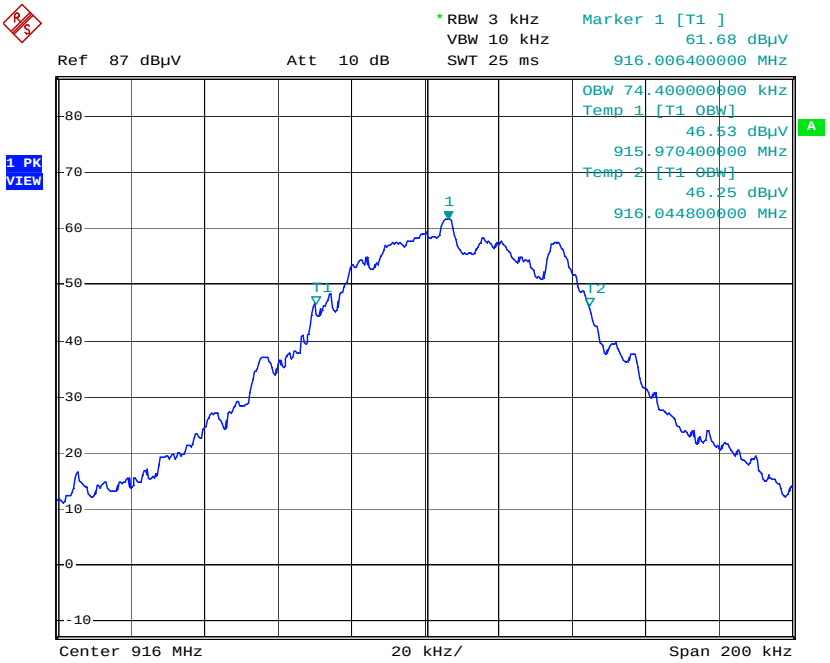
99% Bandwidth, 908.42 MHz:



Date: 20.FEB.2016 19:49:51

99% Bandwidth, 916 MHz:



Date: 20.FEB.2016 19:43:54

Test Personnel:	Grace Lin	Test Date:	02/20/2016
Product Standard:	FCC 15.215, IC RSS-Gen	Limit Applied:	FCC 15.215, IC RSS-Gen
Input Voltage:	120 Vac		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	17.7 ºC
		Relative Humidity:	48.8 %
		Atmospheric Pressure:	995.4 mbars

Deviations, Additions, or Exclusions: None

8 Transmitter Radiated Emissions

8.1 Performance Requirement(s)

The field strength of emissions from intentional radiators operated within the frequency band shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500

Field strength limits are specified at a distance of 3 meters. Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in FCC § 15.209 and IC RSS-Gen, whichever is the lesser attenuation. The peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

8.2 Method

Tests are performed according to the procedures in ANSI C63.10-2013.

The EUT was placed on a non-conducting table 80 cm (below 1 GHz) or 1.5 meters (above 1 GHz) above the ground plane (turntable). Radiated test was performed at an antenna to EUT distance of 3 meters.

The spectrum from 30 MHz to the 10th harmonic was investigated with the transmitter configured to continuously transmit. The turntable containing the EUT was rotated through 360 degrees and the receive antenna height was varied from 1 to 4 meters to locate the worst-case emissions levels. Measurements were made with the antenna in both the horizontal and vertical polarizations. EUT was tested at three orthogonal planes. The worst-case data is recorded in this report.

TEST SITE:

The test is performed in the 3 meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 3m	30-1000 MHz	4.2	6.3 dB
Radiated Emissions, 3m	1-10 GHz	4.4	5.2 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.

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

8.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
637	3m Semi-anechoic Chamber	Panashield	3 meter	25 331-D-Z	12/21/2015	12/21/2018
607A	EMI Receiver	HP	8546A	3625A00347	02/20/2015	02/20/2016
539	RF Filter Section	HP	85460A	3448A00265	02/20/2015	02/20/2016
690	Spectrum Analyzer, 9 KHz - 40 GHz	R&S	FSP40	100027	01/11/2016	01/11/2017
1147	Bilog Antenna	TESEQ Gmbh	CBL 6112D	32852	10/28/2015	10/28/2016
1569	Preamplifier	R&S	TS-PR1	102061	12/02/2015	12/02/2016
692	Horn Antenna	ETS-Lindgren	3115	00031626	05/06/2015	05/06/2016
1135	Preamplifier	Miteq	AMF-6D-00501800-24-10P	1685147	03/30/2015	03/30/2016
798	Cable	Insulated wire	Cable	00828	04/03/2015	04/02/2016
1517	Cable	R&S	TSPR-B7	101528	06/23/2015	06/23/2016
1002	Lab Monitor	Omega	iBTHX-W	0440776	06/26/2015	06/26/2016

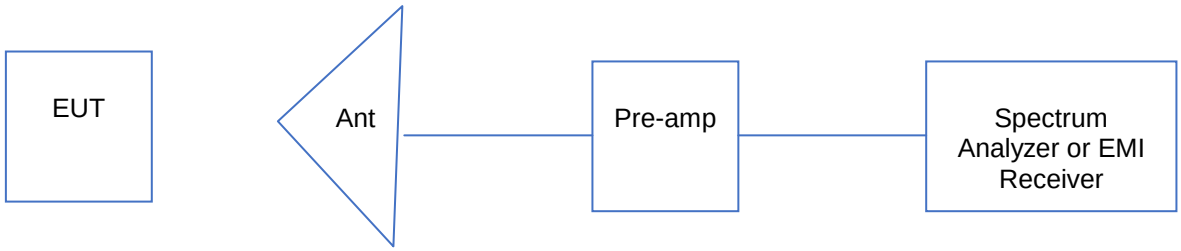
Software Utilized:

Name	Manufacturer	Version	Profile
Tile	Quantum Change	3.4.K.29	• ESCI_RE_30MHz-1GHz_Bilog_1147_6dB CISPR11 • FCC Part 15 FSP 1-10GHz

8.4 Results:

The sample tested was found to comply.

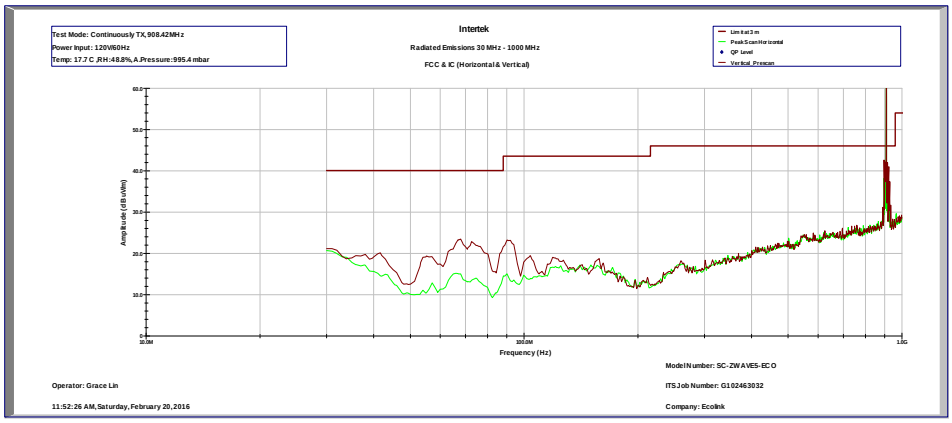
8.5 Setup Diagram:



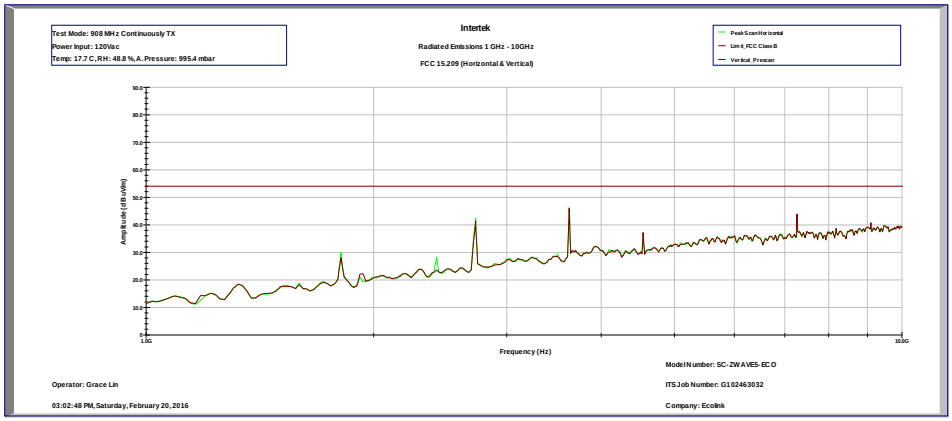
8.6 Plots/Data:

EUT Operating at 908.42 MHz

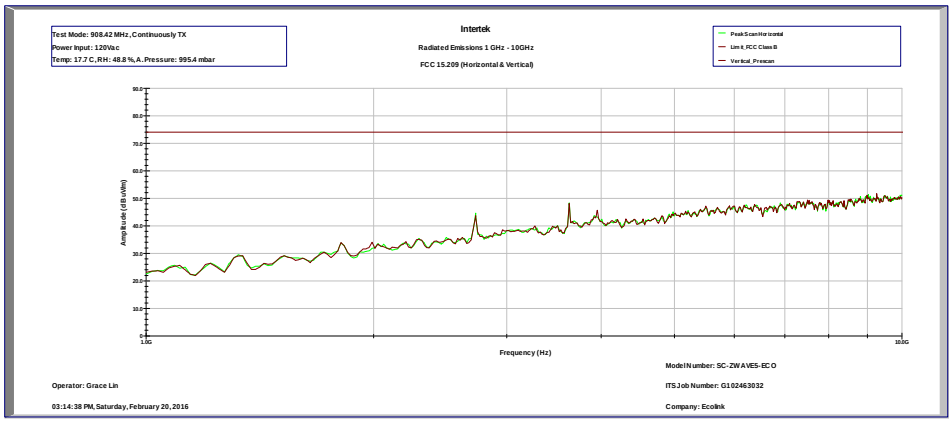
30 MHz – 1 GHz



1 – 10 GHz, Average



1 – 10 GHz, Peak

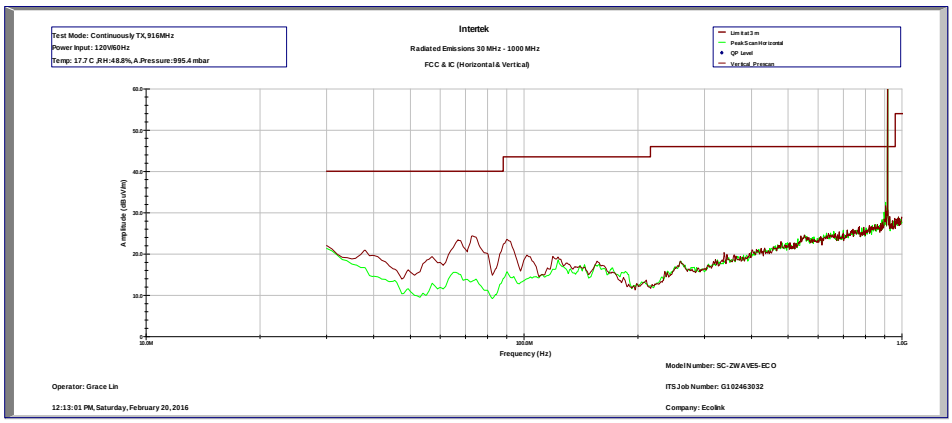


908.42 MHz

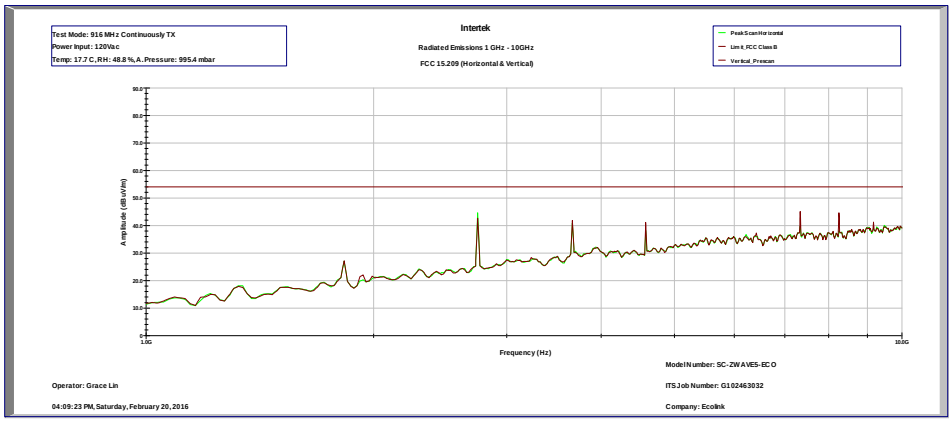
Antenna Polarization	Frequency (MHz)	EUT Orientation	Power Level	Measured Data (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Turntable Degree	Antenna Height (cm)	Detector
H	2725.26	XY	-4	43.91	54	-10.09	41.0	170.0	AVE
H	2725.26	XY	-4	46.93	74	-27.07	41.0	170.0	PK
H	3633.68	XY	-4	47.12	54	-6.89	44.0	212.0	AVE
H	3633.68	XY	-4	50.43	74	-23.58	44.0	212.0	PK
V	4542.10	XY	-4	38.74	54	-15.26	177.0	163.0	AVE
V	4542.10	XY	-4	46.16	74	-27.84	177.0	163.0	PK
V	7267.36	XY	-4	43.47	54	-10.53	180.0	227.0	AVE
V	7267.36	XY	-4	52.32	74	-21.68	180.0	227.0	PK

EUT Operating at 916 MHz

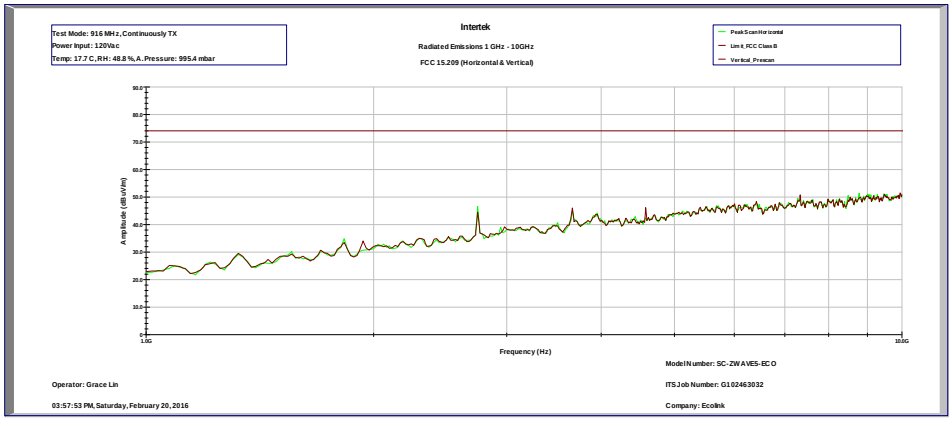
30 MHz – 1 GHz



1 – 10 GHz, Average



1 – 10 GHz, Peak



916 MHz

Antenna Polarization	Frequency (MHz)	EUT Orientation	EUT Power Level	Measured Data (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Turntable Degree	Antenna Height (cm)	Detector
H	2748.00	XY	-4	44.60	54	-9.40	51.0	228.0	AVE
H	2748.00	XY	-4	46.97	74	-27.03	51.0	228.0	PK
V	3664.00	XY	-4	41.23	54	-12.77	9.0	153.0	AVE
V	3664.00	XY	-4	46.59	74	-27.41	9.0	153.0	PK
V	4580.00	XY	-4	42.75	54	-11.25	186.0	199.0	AVE
V	4580.00	XY	-4	48.30	74	-25.70	186.0	199.0	PK
V	7328.00	XY	-4	44.24	54	-9.76	191.0	197.0	AVE
V	7328.00	XY	-4	52.65	74	-21.35	191.0	197.0	PK
V	8244.00	XY	-4	37.23	54	-16.77	195.00	0.00	AVE
V	8244.00	XY	-4	49.39	74	-24.61	195.00	0.00	PK

Test Personnel: Grace Lin

Product Standard: FCC 15.249, IC RSS-210

Input Voltage: 12Vac

Pretest Verification w/ Ambient Signals or BB Source: Yes

Test Date: 2/20/2016

Limit Applied: FCC 15.249, FCC 15.209, IC RSS-210, IC RSS-Gen

Ambient Temperature: 17.7 ºC

Relative Humidity: 48.8 %

Atmospheric Pressure: 995.4 mbars

Deviations, Additions, or Exclusions: None

9 Radiated Emissions

9.1 Performance Requirement(s)

Limits for Electromagnetic Radiated Emissions FCC Section 15.109(b), ICES-003*, RSS-Gen

Frequency (MHz)	Class A at 10m dB(uV/m)	Class B at 3m dB(uV/m)
30-88	39.0	40.0
88-216	43.5	43.5
216-960	46.4	46.0
Above 960	49.5	54.0

*According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub.22

9.2 Method

Tests are performed in accordance with ANSI C63.4-2014.

The EUT was placed on a non-conducting table 80 cm above the ground plane (turntable). The antenna to EUT distance was 3 meters.

The spectrum from 30 MHz to the 5th harmonic was investigated with the EUT configured to normal operation. The turntable containing the EUT was rotated through 360 degrees and the receive antenna height was varied from 1 to 4 meters to locate the worst-case emissions levels. Measurements were made with the antenna in both the horizontal and vertical polarizations. EUT was tested at three orthogonal planes. The worst-case data is recorded in this report.

TEST SITE:

The test is performed in the 3 meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 3m	30-1000 MHz	4.2	6.3 dB
Radiated Emissions, 3m	1-10 GHz	4.4	5.2 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.

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

9.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
637	3m Semi-anechoic Chamber	Panashield	3 meter	25 331-D-Z	12/21/2015	12/21/2018
607A	EMI Receiver	HP	8546A	3625A00347	02/20/2015	02/20/2016
539	RF Filter Section	HP	85460A	3448A00265	02/20/2015	02/20/2016
690	Spectrum Analyzer, 9 KHz - 40 GHz	R&S	FSP40	100027	01/11/2016	01/11/2017
1147	Bilog Antenna	TESEQ Gmbh	CBL 6112D	32852	10/28/2015	10/28/2016
1569	Preamplifier	R&S	TS-PR1	102061	12/02/2015	12/02/2016
692	Horn Antenna	ETS-Lindgren	3115	00031626	05/06/2015	05/06/2016
1135	Preamplifier	Miteq	AMF-6D-00501800-24-10P	1685147	03/30/2015	03/30/2016
798	Cable	Insulated wire	Cable	00828	04/03/2015	04/02/2016
1517	Cable	R&S	TSPR-B7	101528	06/23/2015	06/23/2016
1002	Lab Monitor	Omega	iBTHX-W	0440776	06/26/2015	06/26/2016

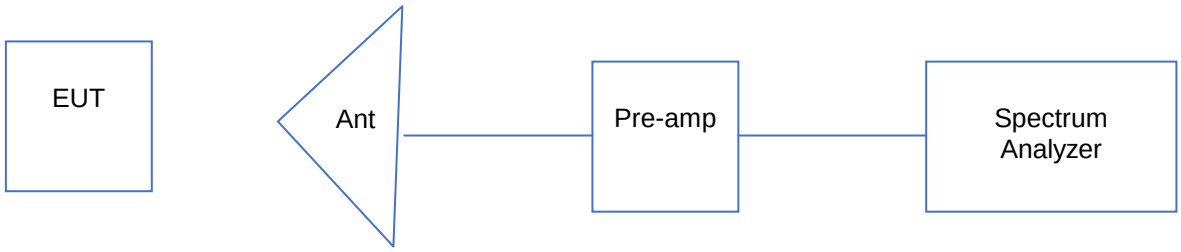
Software Utilized:

Name	Manufacturer	Version	Profile
Tile	Quantum Change	3.4.K.29	• ESCI_RE_30MHz-1GHz_Bilog_1147_6dB CISPR11 • FCC Part 15 FSP 1-10GHz

9.4 Results:

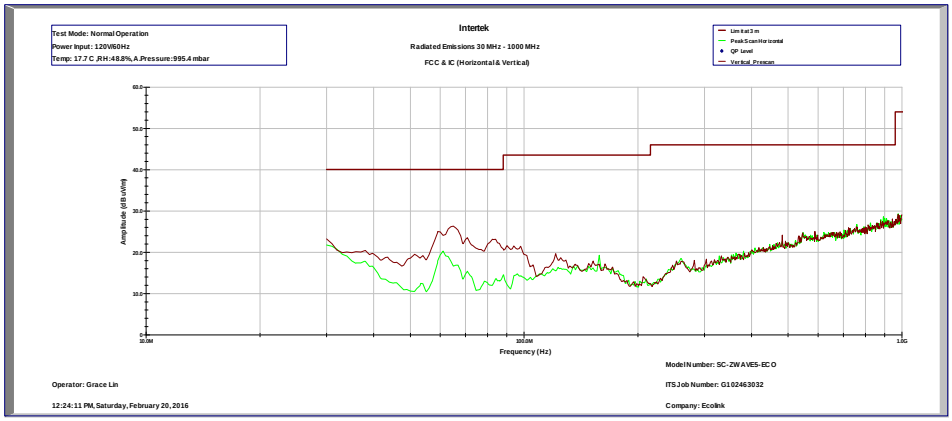
The sample tested was found to Comply.

9.5 Setup Diagram:

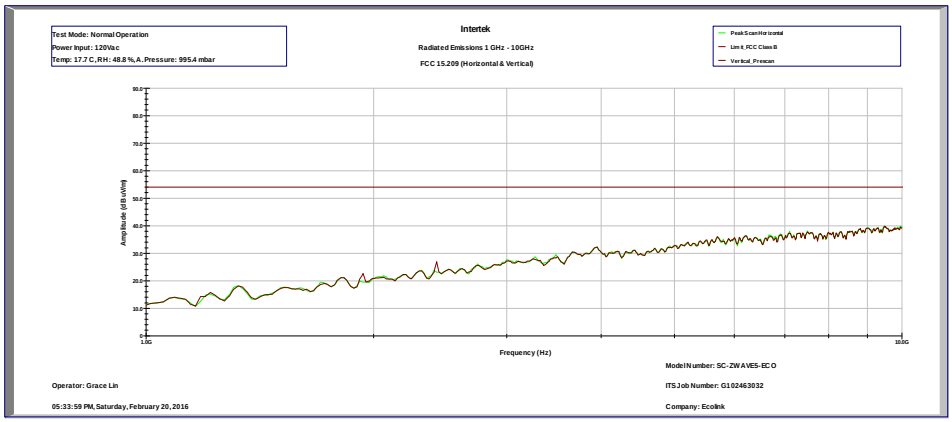


9.6 Plots/Data:

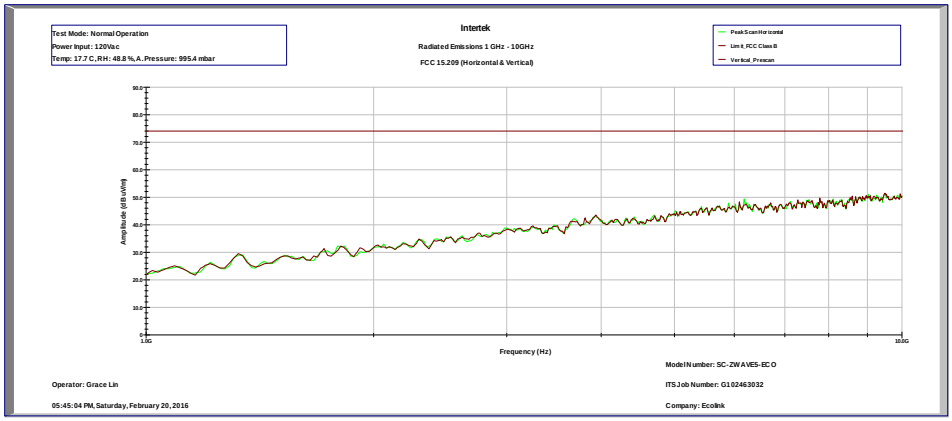
30 – 1000 MHz, Peak Scan – QP Limit



1 – 10 GHz Average



1 – 10 GHz Peak



Antenna	Frequency	Quasi Pk FS	Limit@3m	Margin	RA	AG	AF	CF	Ant Hgt	TT
Polarizatior	MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB(1/m)	dB	cm	deg
V	60.46	17.6	40.0	-22.4	34.7	30.4	11.9	1.4	100	0
V	64.82	19.6	40.0	-20.4	36.6	30.3	11.9	1.5	100	0

Test Personnel:	Grace Lin	Test Date:	2/20/2016
Product Standard:	FCC 15B, IC ICES-003	Limit Applied:	FCC 15.109, IC ICES-003
Input Voltage:	120 Vac		
Pretest Verification w/ Ambient Signals or BB Source:	Yes	Ambient Temperature:	17.7 ºC
		Relative Humidity:	48.8 %
		Atmospheric Pressure:	995.4 mbars

Deviations, Additions, or Exclusions: None

10 AC Mains Conducted Emissions

10.1 Method

Tests are performed in accordance with ANSI C63.4.

TEST SITE:

The test is performed in the 3 meter semi-anechoic chamber located at 25791 Commercentre Drive, Lake Forest, California 92630 USA. This test facility meets the requirements of CISPR 16-1-4 and has been accredited by A2LA.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
AC Line Conducted Emissions	150 kHz - 30 MHz	2.1 dB	3.4dB

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.

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

10.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
637	3m Semi-anechoic Chamber	Panashield	3 meter	25 331-D-Z	12/21/2015	12/21/2018
607A	EMI Receiver	HP	8546A	3625A00347	02/20/2015	02/20/2016
539	RF Filter Section	HP	85460A	3448A00265	02/20/2015	02/20/2016
666	LISN	Teseq	NNB 51	36058	10/28/2015	10/28/2016
798	Cable	Insulated wire	Cable	00828	04/03/2015	04/02/2016
1002	Lab Monitor	Omega	iBTHX-W	0440776	06/26/2015	06/26/2016

Software Utilized:

Name	Manufacturer	Version	Profile
Tile	Quantum Change	3.4.K.29	HP8546_Test_Line_Cond_150k-30MHz

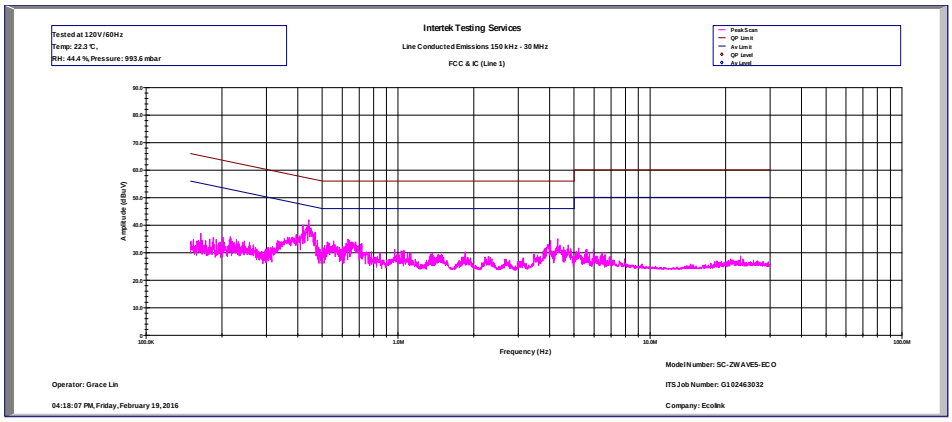
10.3 Results:

The sample tested was found to Comply.

10.4 Setup Diagram:

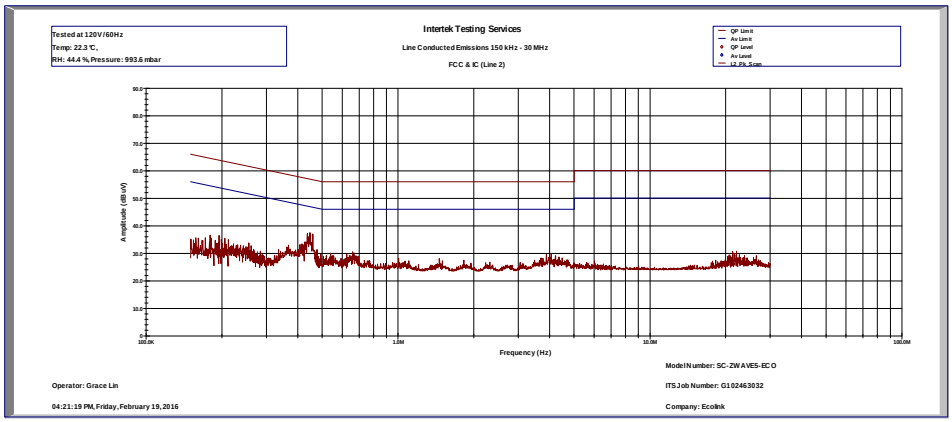
10.5 Plots/Data:

Line 1:



Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
MHz	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)
0.188	9.1	25.7	54.9	64.9	-45.8	-39.2
0.362	19.7	29.5	49.9	59.9	-30.3	-30.5
0.453	22.8	33.8	47.4	57.4	-24.5	-23.6
0.527	15.1	25.4	46.0	56.0	-30.9	-30.6
0.666	17.0	28.2	46.0	56.0	-29.0	-27.8
0.681	16.2	27.7	46.0	56.0	-29.8	-28.3

Line 2:



Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
MHz	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)
0.153	7.0	25.8	55.9	65.9	-48.9	-40.1
0.235	8.6	25.1	53.6	63.6	-45.0	-38.4
0.403	12.0	25.9	48.8	58.8	-36.7	-32.9
0.431	13.0	28.2	48.0	58.0	-34.9	-29.8
0.451	16.1	29.6	47.4	57.4	-31.3	-27.8
0.637	10.2	22.5	46.0	56.0	-35.8	-33.5

Test Personnel:	Grace Lin	Test Date:	2/19/2016
Product Standard:	FCC 15B, IC ICES-003	Limit Applied:	FCC 15.109, IC ICES-003
Input Voltage:	120 Vac		
Pretest Verification w/ Ambient Signals or BB Source:	Yes	Ambient Temperature:	22.3 ºC
		Relative Humidity:	44.4 %
		Atmospheric Pressure:	993.6 mbars

Deviations, Additions, or Exclusions: None

11 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	2/23/2016	102463032LAX-005	GL	KV	Initial Release