Excellence in Compliance Testing

Certification Test Report

FCC ID: YNE-12357

FCC Rule Part: 15.249

ACS Report Number: 10-0107.W03.11.A

Manufacturer: Kichler Lighting
Model: 12357BK, 12357WH

Test Begin Date: July 15, 2010
Test End Date: July 28, 2010

Report Issue Date: January 24, 2011

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Reviewed by:

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This report contains 18 pages

TABLE OF CONTENTS

1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210.

1.2 Product Description

Models 12357BK and 12357WH are Z-Wave controllers designed to control the light level of the system that it is directly and remotely connected to. The controllers have a local function of being able to dim-up or dim-down the light level by providing a PrISM based output down the communication line of the bus system. These controllers can also be linked to each other in a Z-Wave network and have the capability of changing the light levels of under-cabinet systems that are powered by separate power supplies.

Models 12357BK and 12357WH operate on a single channel at 908.42 MHz.

Manufacturer Information:
Kichler Lighting
7711 East Pleasant Valley Rd.
Cleveland, OH 44131
USA

Test Sample Serial Number(s):
1

Test Sample Condition:
The test sample was provided in working order with no visible defects.

Operating Voltage:
120VAC

Detailed photographs of the EUT are filed separately with this filing.

1.3 Test Methodology and Considerations

Models 12357BK and 12357WH differ only in color therefore only 12357BK was evaluated for compliance. For radiated emissions the EUT was orientated in a position of typical use.

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200612-0. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number: 894540
Industry Canada Lab Code: IC 4175A-1
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

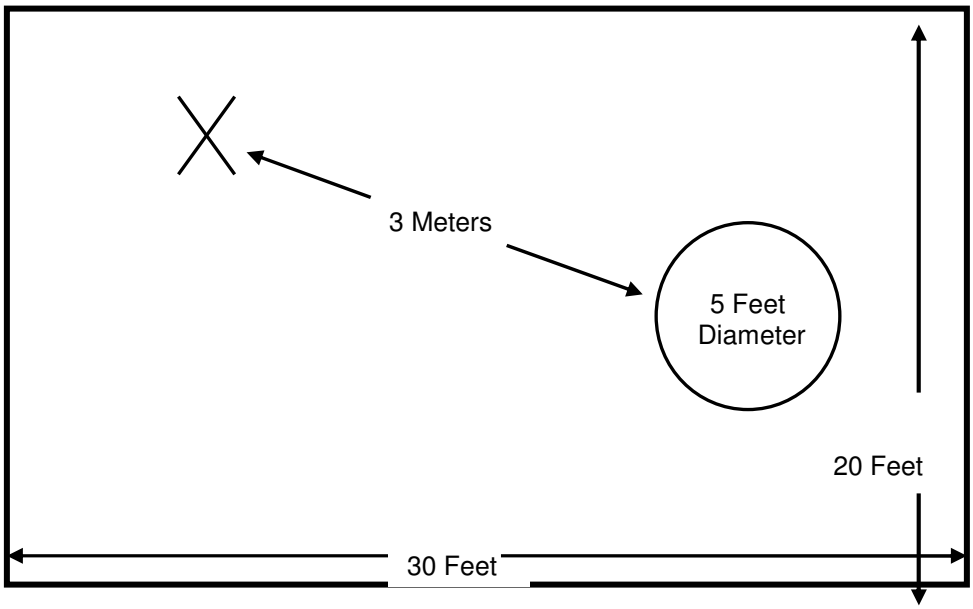

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

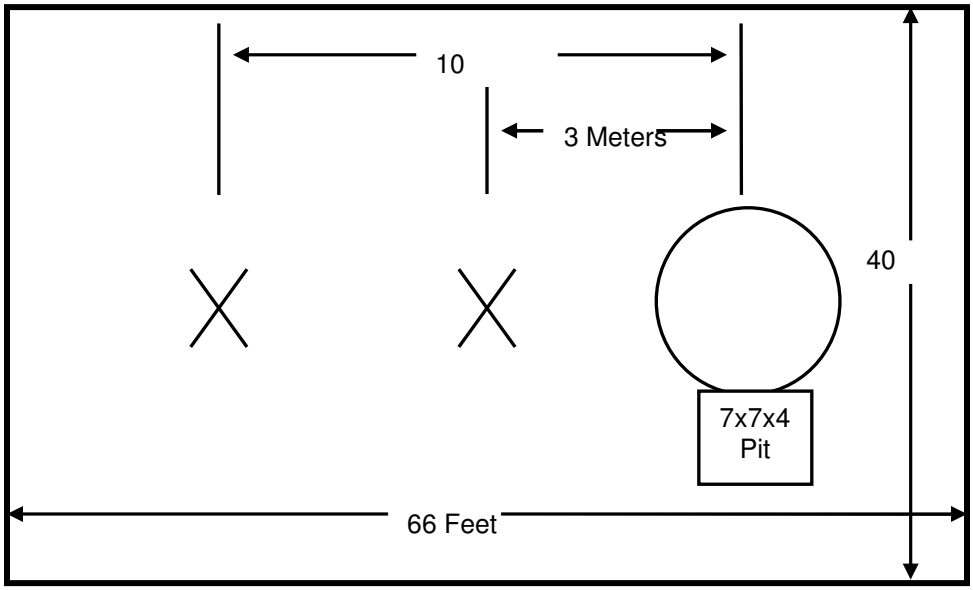

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal group reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the conducted emissions test site is shown below in figure 2.4-1:

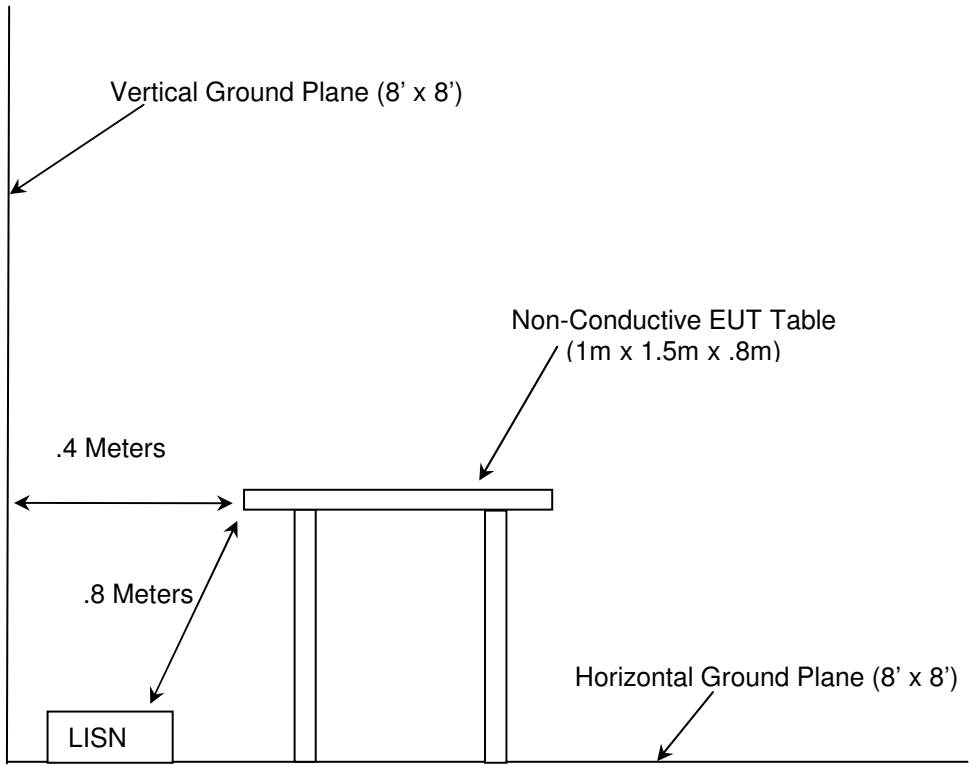

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2010
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2010
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8 Dec 2010
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3, Dec 2010.

4.0 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
1	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	833771/007	9/23/2010	9/23/2012
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	9/23/2010	9/23/2012
3	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	839379/011	2/2/2009	2/2/2011
4	Rohde & Schwarz	ESMI - Receiver	Spectrum Analyzers	833827/003	2/2/2009	2/2/2011
25	Chase	CBL6111	Antennas	1043	9/13/2010	9/13/2012
30	Spectrum Technologies	DRH-0118	Antennas	970102	5/8/2009	5/8/2011
73	Agilent	8447D	Amplifiers	2727A05624	5/26/2010	5/26/2011
153	EMCO	3825/2	LISN	9411-2268	1/11/2009	1/11/2011
167	ACS	Chamber EMI Cable Set	Cable Set	167	1/25/2010	1/25/2011
168	Hewlett Packard	11947A	Attenuators	44829	2/4/2010	2/4/2011
213	TEC	PA 102	Amplifiers	44927	12/23/2010	12/23/2011
277	Emco	93146	Antennas	9904-5199	8/25/2010	8/25/2012
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	8/31/2010	8/31/2011
291	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	None	12/7/2010	12/7/2011
292	Florida RF Cables	SMR-290AW-480.0-SMR	Cables	None	12/7/2010	12/7/2011
324	ACS	Belden	Cables	8214	7/9/2010	7/9/2011
329	A.H.Systems	SAS-571	Antennas	721	8/4/2009	8/4/2011
338	Hewlett Packard	8449B	Amplifiers	3008A01111	10/29/2010	10/29/2011
343	Florida RF Cables	SMRE-200W-12.0-SMRE	Cables	N/A	4/27/2010	4/27/2011
422	Florida RF Cables	SMS-200AW-72.0-SMR	Cables	805	12/29/2010	12/29/2011
430	Florida RF Cables	SMS-290AW-480-SMS	Cables	N/A	4/27/2010	4/27/2011

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Power Supply	Triad	TLD1020-24	NA
2	LED Strip Light	Kichler	N/A	N/A

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAMS

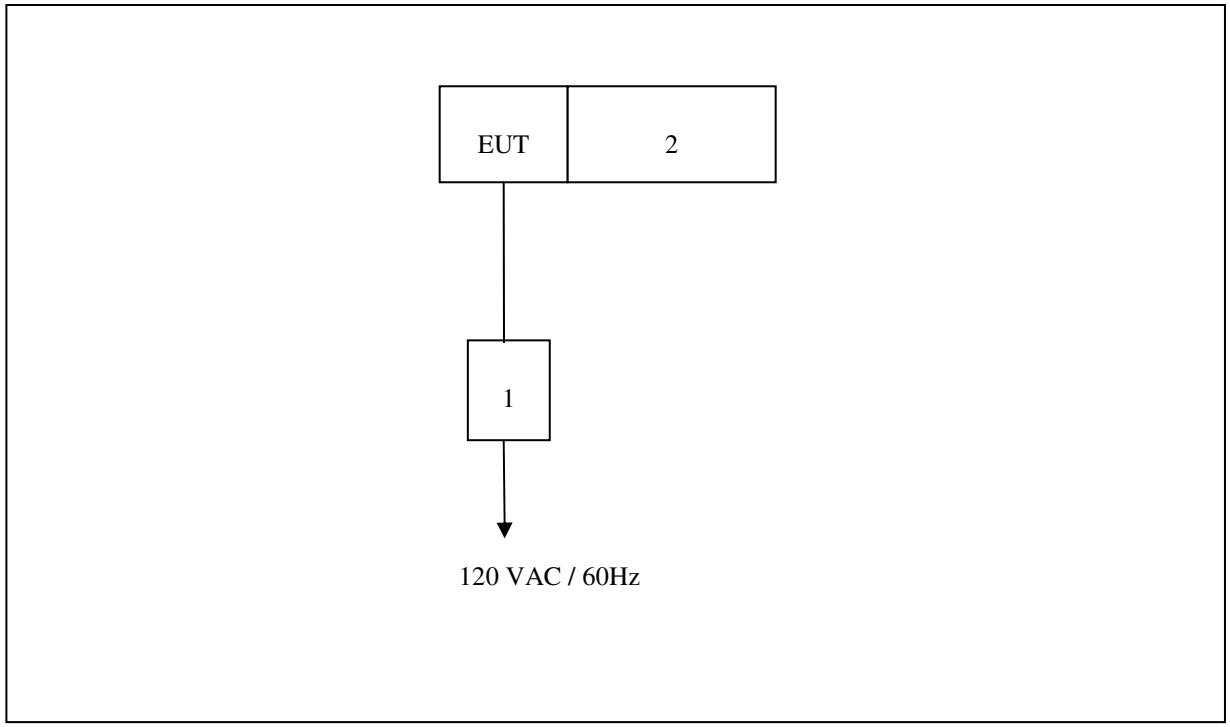

Figure 6-1: EUT Test Setup

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The antenna used for the models 12357BK and 12357WH is an etched trace on the printed circuit board. It is approximately ¼ wavelength at 908.42 MHz in free space. Maximum gain is 5.1dBi

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.4

7.2.1 Test Methodology

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.2.2 Test Results

Results of the test are shown below in and Tables 7.2.2-1 to 7.2.2-2.

Table 7.2.2-1: Line 1 Conducted EMI Results

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.162	53.1	9.9	65	12.2	L1	FLO	QP
0.318	41.7	10	60	18.1	L1	FLO	QP
0.516	36.4	10	56	19.6	L1	FLO	QP
0.636	38.9	10	56	17.1	L1	FLO	QP
0.792	36.9	10.1	56	19.1	L1	FLO	QP
0.954	35.5	10	56	20.5	L1	FLO	QP
1.11	35.9	10	56	20.1	L1	FLO	QP
1.272	34.3	10	56	21.7	L1	FLO	QP
1.428	28.6	10	56	27.4	L1	FLO	QP
1.632	26.2	10	56	29.8	L1	FLO	QP
0.162	42.3	9.9	55	13	L1	FLO	AVG
0.384	19.6	10.1	48	28.6	L1	FLO	AVG
0.54	16.6	10	46	29.4	L1	FLO	AVG
0.726	13.5	10.1	46	32.6	L1	FLO	AVG
0.762	18.1	10.1	46	27.9	L1	FLO	AVG
0.948	23.8	10	46	22.2	L1	FLO	AVG
1.14	17.8	10	46	28.2	L1	FLO	AVG
1.344	10.2	10	46	35.8	L1	FLO	AVG
1.446	11.7	10	46	34.3	L1	FLO	AVG
1.614	11.2	10	46	34.8	L1	FLO	AVG

Table 7.2.2-2: Line 2 Conducted EMI Results

Frequency (MHz)	Level (dBuV)	Transducer (dB)	Limit (dBuV)	Margin (dB)	Line	PE	Detector
0.162	56.5	9.9	65	8.9	L2	FLO	QP
0.318	40.2	10	60	19.6	L2	FLO	QP
0.498	27.3	10	56	28.7	L2	FLO	QP
0.906	20.2	10	56	35.9	L2	FLO	QP
1.17	23.8	10	56	32.2	L2	FLO	QP
1.314	23.8	10	56	32.2	L2	FLO	QP
1.56	18.9	10	56	37.1	L2	FLO	QP
2.334	15.5	10	56	40.5	L2	FLO	QP
11.544	22	9.8	60	38	L2	FLO	QP
12.75	21	9.9	60	39	L2	FLO	QP
0.162	45.7	9.9	55	9.7	L2	FLO	AVG
0.396	7.6	10.1	48	40.4	L2	FLO	AVG
0.54	11.2	10	46	34.8	L2	FLO	AVG
0.912	8.6	10	46	37.4	L2	FLO	AVG
1.146	9.9	10	46	36.1	L2	FLO	AVG
1.26	14.5	10	46	31.5	L2	FLO	AVG
1.578	13.7	10	46	32.3	L2	FLO	AVG
2.334	7.4	10	46	38.6	L2	FLO	AVG
11.55	12.6	9.8	50	37.4	L2	FLO	AVG
12.792	13.3	9.9	50	36.7	L2	FLO	AVG

7.3 Unintentional Radiated Emissions – FCC: Section 15.109 IC: RSS-210 2.5

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 5GHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements above 30MHz and below 1GHz were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz using a Quasi-peak detector. Above 1GHz, peak and average measurements are taken with the RBW and VBW were set to 1MHz and 3MHz respectively.

7.3.2 Test Results

Results of the test are given in Table 7.3.2-1 below:

Table 7.3.2-1: Radiated Emissions

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
39.7	---------	39.87	V	-11.37	---------	28.50	--------	40.0	---------	11.5
49.4	---------	40.73	V	-16.21	---------	24.52	--------	40.0	---------	15.5
74.18	---------	27.73	V	-18.78	---------	8.95	--------	40.0	---------	31.1
109.75	---------	38.14	H	-13.81	---------	24.34	--------	43.5	---------	19.2
148.55	---------	38.91	H	-14.21	---------	24.70	--------	43.5	---------	18.8
192.74	---------	36.19	H	-15.60	---------	20.59	--------	43.5	---------	22.9
957.96	---------	20.32	V	3.58	---------	23.90	--------	46.0	---------	22.1

* Note: All emissions above 957.96MHz were not detected above the noise floor of the measurement equipment and therefore attenuated below the permissible limit.

7.4 Occupied Bandwidth – FCC: Section 15.215 IC: RSS-GEN 4.6.1

7.4.1 Test Methodology

The spectrum analyzer span was set to 2 to 3 times the estimated bandwidth of the emission. The RBW was to ≥ 1% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. Bandwidth is determined at the points 20 dB down from the modulated carrier. The 99% bandwidth was also measured and reported in Section 7.4.2 below.

7.4.2 Test Results

The 20 dB bandwidth was determined to be 69.21 kHz. The frequency band designated under Part 15.249 is 902 - 928MHz, therefore the 20dB bandwidth is contained within the frequency band designated under this rule part. Results are shown below in Table 7.4.2-1 and Figures 7.4.2-1 through 7.4.2-2.

Table 7.4.2-1 – Occupied Bandwidth

Frequency (MHz)	20dB Bandwidth (kHz)	99% OBW (kHz)
908.42	69.21	75.80

Figure 7.4.2-1: 20dB Bandwidth

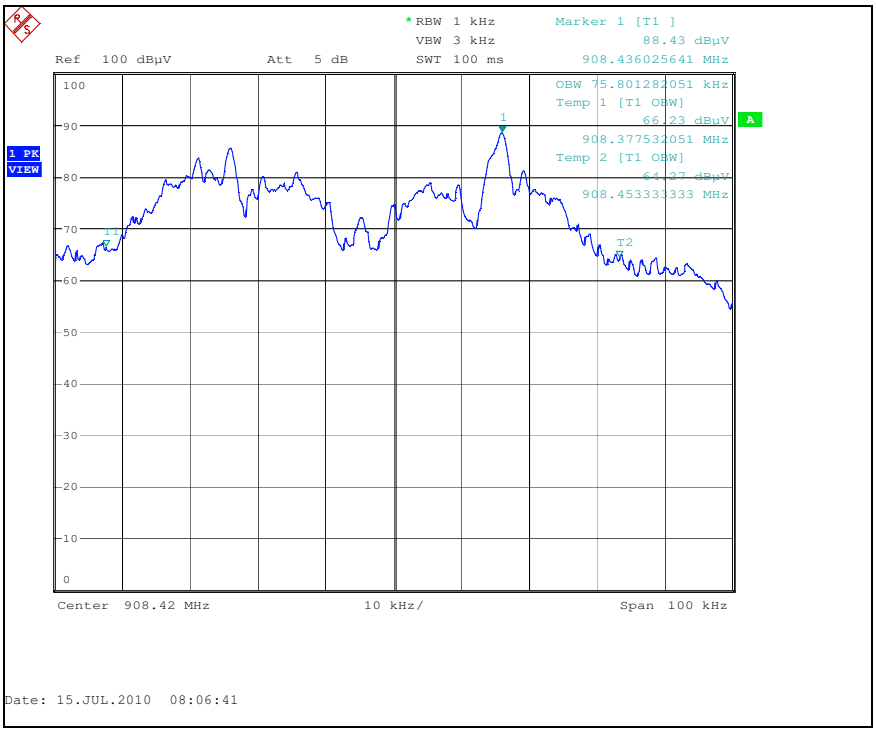

Figure 7.4.2-2: 99% Occupied Bandwidth

7.5 Fundamental Field Strength – FCC: Section 15.249(a) IC: RSS-210 A2.9(a)

7.5.1 Test Methodology

The fundamental field strength was evaluated at the single operating frequency of 908.42 MHz in the 902MHz to 928MHz frequency range.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For fundamentals below 1GHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For fundamentals above 1GHz, peak and average measurements were made using a resolution bandwidth (RBW) of 1 MHz and a video bandwidth (VBW) of 3 MHz.

7.5.2 Test Results

Results are shown below in table 7.5.2-1 below:

Table 7.5.2-1: Fundamental Field Strength

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
908.42	---------	90.78	H	1.41	---------	92.19	--------	94.0	---------	1.8
908.42	---------	91.05	V	1.41	---------	92.46	--------	94.0	---------	1.5

7.6 Band-Edge Compliance and Spurious Emissions – FCC: Section 15.249 IC: RSS-210 A2.9

7.6.1 Band-Edge Compliance – FCC: Section 15.249(d) IC: RSS-210 A2.9(b)

7.6.1.1 Test Methodology

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 § 15.209, whichever is the lesser attenuation.

The EUT was investigated at the low and high channels of operation to determine band-edge compliance. Compliance for the lower and upper band-edge was determined using the radiated mark-delta method as outlined in FCC DA 00-705. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions as compared to the emission limits of 15.209.

7.6.1.2 Test Results

Band-edge compliance is displayed in Table 7.6.1.2-1 and Figures 7.6.1.2-1 to 7.6.1.2-2.

Table 7.6.1.2-1: Band-edge Marker Delta Method

Frequency (MHz)	Uncorrected Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Level (dBuV/m)		Marker-Delta	Band-Edge Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
908.42	---------	90.78	H	1.41	---------	92.19	56.33	-------	35.86	---------	46	-------	10.14
908.42	---------	91.05	V	1.41	---------	92.46	57.22	-------	35.24	---------	46	-------	10.76

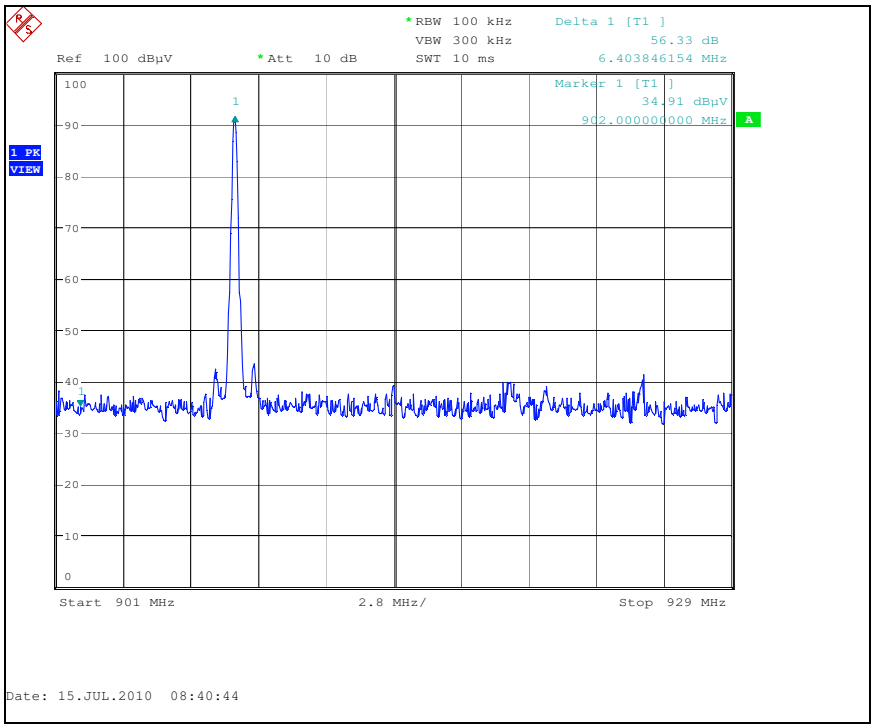

Figure 7.6.1.2-1 Band-edge – Hpol

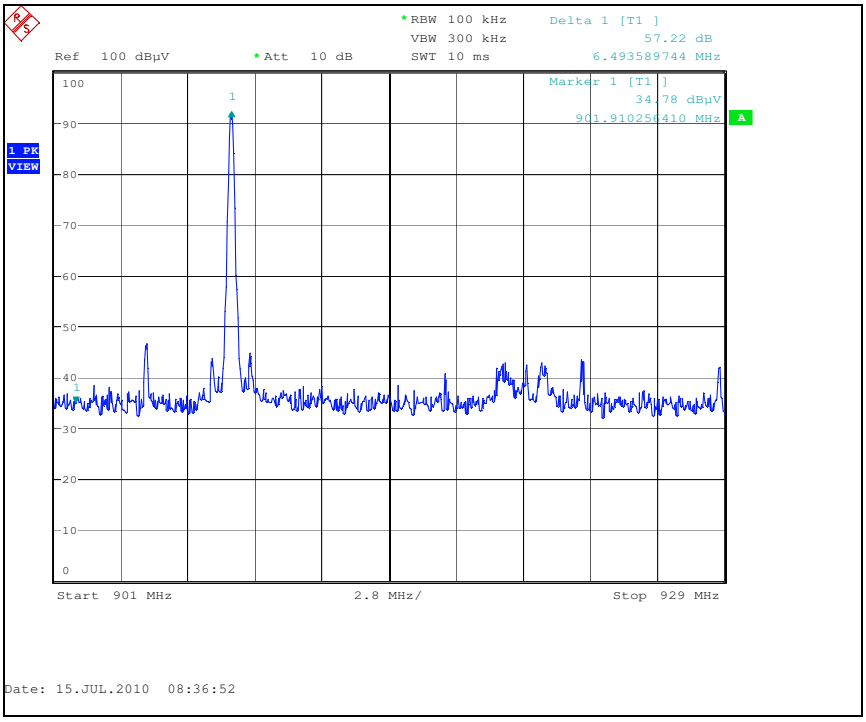

Figure 7.6.1.2-2 Band-edge - Vpol

7.6.2 Radiated Spurious Emissions – FCC: Section 15.249(a) & (d), (c); IC:RSS-210 A2.9(a) & (b)

7.6.2.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 10 GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For frequencies above 1000MHz, peak and average measurements were made using an RBW of 1 MHz and a VBW of 3MHz.

7.6.2.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 11.06dB to account for the duty cycle of the EUT. The worst case duty cycle was determined to be 28% or 28ms with a 100ms period. The duty cycle correction factor is determined using the formula: 20log (28/100) = -11.06dB. The duty cycle is shown below in figure 7.6.2.2-1.

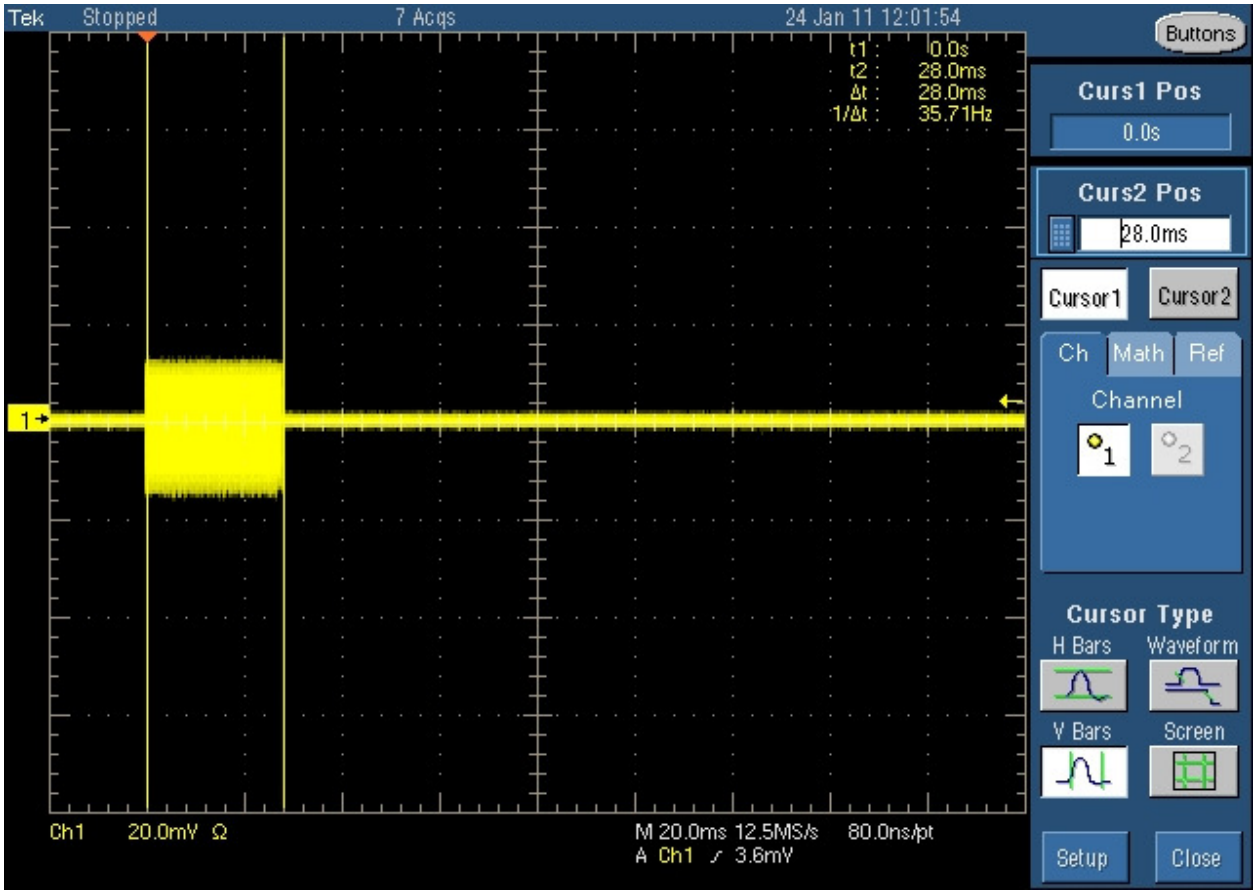

Figure 7.6.2.2-1 Duty Cycle

.

7.6.2.3 Test Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in Table 7.6.2.3-1.

Table 7.6.2.3-1: Radiated Spurious Emissions

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
1816.84	60.96	54.51	H	-7.95	53.01	35.50	74.0	54.0	21.0	18.5
1816.84	60.55	55.00	V	-7.95	52.60	35.99	74.0	54.0	21.4	18.0

** The magnitude of all emissions not reported were below the noise floor of the measurement system.*

7.6.2.4 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U = Uncorrected Reading
R_C = Corrected Level
AF = Antenna Factor
CA = Cable Attenuation
AG = Amplifier Gain
DC = Duty Cycle Correction Factor

Example Calculation

PEAK:
Corrected Level: 60.96 - 7.95 = 53.01dBuV
Margin: 74dBuV – 53.01dBuV = 21.0dB

AVERAGE:
Corrected Level: 54.51 - 7.95 - 11.06= 35.50dBuV
Margin: 54dBuV – 35.50dBuV = 18.5dB

8.0 CONCLUSION

In the opinion of ACS, Inc. the 12357BK and 12357WH manufactured by Kichler Lighting meet the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT