



ENERGY STAR PROGRAM REQUIREMENTS FOR LUMINAIRES (LIGHT FIXTURES) (VERSION 2.0)

MEASUREMENT AND TEST REPORT

For

IGT LIGHTING INC.

3755 Lincoln St. Suite B, Riverside, CA 92503

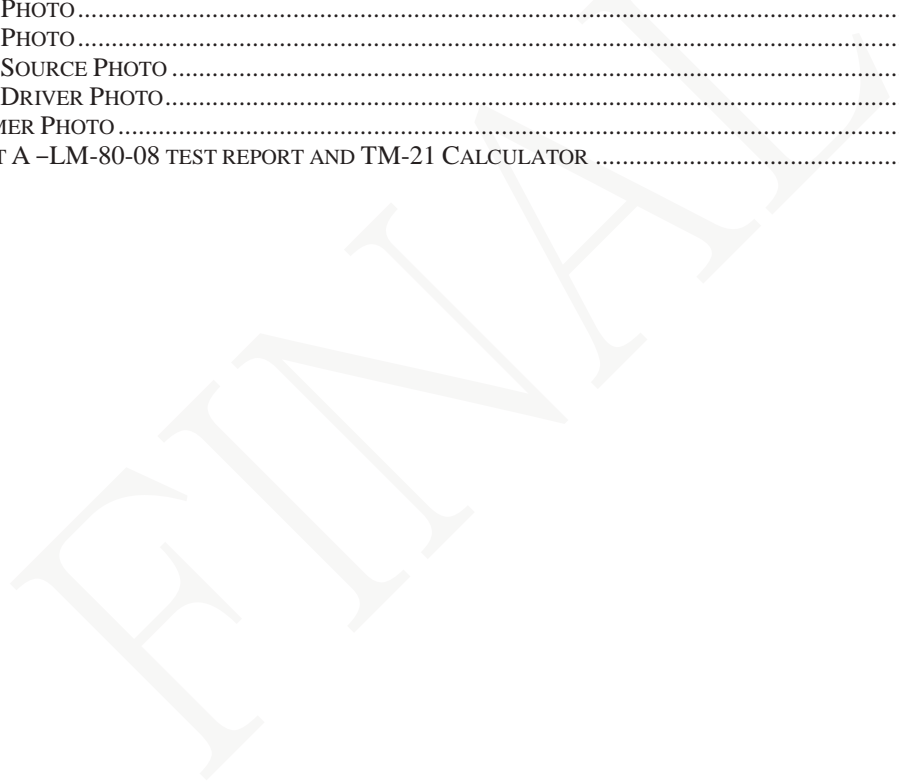
Model: IGTDL-15012WWFD-6

Report Type: Original Report		Product Type: SSL Downlight Retrofit	
Test Engineer:	Daniel Duan	<i>Daniel Duan</i>	
Report Number:	RSZ160308510-10		
Test Date:	2016-03-16 to 2016-05-03		
Report Date:	2016-05-04		
Reviewed By:	Jeanne Han / EE Manager	<i>Jeanne Han</i>	
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Note: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan). (Rev. 2.0, 2012-10-05 effected) This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

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1. GENERAL INFORMATION

1.1. Product Description for Equipment under Test (EUT)

The client submitted 3 samples of model UE-D19012W2703, Samples were numbered RSZ160308510-S01 through RSZ160308510-S03. The samples were received on 2016-03-08, in undamaged condition.

Model Tested:	IGTDL-15012WWFD-6
Manufacturer:	IGT LIGHTING INC.
Product Designation:	SSL downlight retrofit
Classification:	Directional
Rated Voltage/Frequency:	120V 60Hz
Rated Power:	12W
Nominal CCT:	2700K
Rated Life:	50000 hrs
Dimming:	Yes
Dimming Range:	10% - 100%
Indoor and Outdoor:	Indoor Use Only
Connected Product:	No
Color Tunable:	No
Number of LED Components	72
Type of LED Components:	LED Package
Model of LED Components:	IGTDL-15012WWFD-6
Light Source Manufacturer:	IGT Lighting Inc.
LM-80 Report:	Yes
The Number of LED Driver:	1
Rated Maximum TMP _C :	50°C
Replaceability of Driver:	Inseparable
Model of Dimmer Used During Test:	Cat.NO.6684
Brand of Dimmer:	LEVITON
Type of Dimmer:	Continuous dimmer

Family Products for ENERGY STAR Certification:

According to ENERGY STAR product certification requirements for family products from ENERGY STAR Program Requirements, Products Specification for Luminaires (Light Fixtures) Version 2.0, section 6.1- Product Families, and the declaration from manufacturer, the following model(s) can be covered by this report with or without additional test (additional test would be also included in this report, if any):

Covered Models	Variations	Additional Test
IGTDL-15012WWFD-6	CCT: 3000K	None
IGTDL-15012WWFD-6	CCT: 4000K	
IGTDL-15012WWFD-6	CCT: 5000K	

1.2. Statement of Traceability:

Bay Area Compliance Laboratories Corp. (Dongguan) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

2. SUMMARY OF TEST RESULT

Item	Measured	Verdict	Requirement
Luminous Efficacy (lm/W)	77.51	PASS	≥ 60 lm/W
Aperture(inch)	4.70	N/A	N/A
Light Output(lm)	920.077	PASS	For Aperture $\leq 4.5''$: ≥ 345 lm For Aperture $>4.5''$: ≥ 575 lm
Luminaire Zonal Lumen Density	87.23%	PASS	Luminaire shall deliver a minimum of 75% of total initial lumens within the 0° - 60° zone (axially symmetric about the nadir).
CCT (K)	2808	PASS	The luminaire shall fall within the corresponding 7-step chromaticity quadrangles as defined in ANSI/NEMA/ANSI C78.377-2011.
R_a	96.3	PASS	$R_a \geq 80$
R_9	83	PASS	$R_9 > 0$
Luminaire Color Angular Uniformity	Complied	PASS	Throughout the beam angle, the variation of chromaticity shall be within a total linear distance of 0.006 from the weighted average point on the CIE 1976(u',v') diagram.
Lumen Maintenance Life ⁱⁱ	$>54,000$ hours See Attachment A	PASS	$\geq 25,000$ hours (for indoor)
Color Maintenance ⁱⁱⁱ	See Attachment A	PASS	≤ 0.007 (In LM-80 test report)
Start Time(ms)	730.0	PASS	Light source shall remain continuously illuminated within 750 milliseconds of application of electrical power.
Power Factor	0.9780	PASS	For power $\leq 5W$; $PF \geq 0.5$ For Power $>5W$, $PF \geq 0.7$
Transient Protection	See tables	PASS	Sample shall survive after seven strikes
Standby Power (W)	N/A ^{iv}	PASS	Luminaires shall not draw power in the off state.
Operating Frequency (Hz) ⁱ	120.19	PASS	≥ 120 Hz
Dimming ⁱ	See tables	PASS	Provide continuous dimming from 100% to 20%
Noise(dBA) ⁱ	23.8	PASS	≤ 24 dBA at 1 meter or less at the minimum output
Driver Case Temperature($^\circ$ C)	48.7	PASS	The measured driver case temperature at thermal equilibrium shall not exceed the driver manufacturer's maximum recommended temperature 50° C during in situ operation.

Note:

- i. Operating frequency, Dimming and noise test are not accredited by the IAS.
- ii. TM-21 calculator is used to calculate the L_{70} life. Test data from LM-80 test report of LED light source was used.
- iii. Color Maintenance referenced to LM-80 test report of LED light source.
- iv. According to IEC 62301-2011, This *Type A* product has no secondary function load and no power switch.

3. TEST RESULT

3.1. Driver Case Temperature and in Situ TMP_{LED} Temperature Test

Test Method and ENERGY STAR Requirements:

ANSI/UL 1598C-2014: Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits

ENERGY STAR Requirements:

In the sample luminaire, the in situ TMP_{LED} temperature is less than or equal to the temperature specified in the LM-80 test report for the corresponding or higher drive current, within the manufacturer's specified operating current range.

The drive current measured in the luminaire is less than or equal to the drive current specified in the LM-80 test report at the corresponding temperature or higher.

At the temperature measurement point for the hottest location on the driver case (TMP_c as detailed by the driver manufacturer), the measured driver case temperature at thermal equilibrium shall not exceed the driver manufacturer's maximum recommended temperature during in situ (installed in the luminaire) operation.

Test Procedure:

One sample was mounted according to ANSI/UL 1598C and operated until constant temperatures were obtained. A temperature was considered constant if the sample was operating for at least three hours and upon three successive readings - taken at 15 minute intervals - were within one degree and were not rising. The sample was connected to a 120V, 60 Hz source of supply.

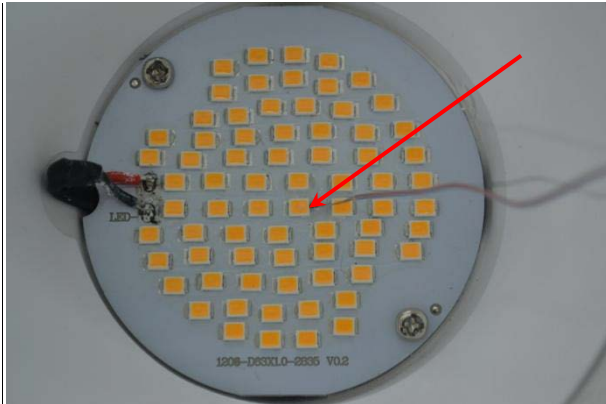
Thermocouples were attached at locations described in the results by means of a cement made of water glass and Fuller's earth, solder, or epoxy. The drive current of LED package/module/ array was calculated as the total output current of the driver measured by multimeter, divided by the number of branches in parallel of LEDs.

Test Equipment:

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Multimeter	FLUKE	17B	1573 1328	400nV~4000nV, 4V~1000V	2016-03-04	2017-03-03
Hybrid Recorder	YOKOGAWA	DR240	10#	N/A	2016-03-04	2017-03-03
Power Supply	HengPu	HPA 1103	0003394	3KVA	2016-03-04	2017-03-03

Uncertainty:

The uncertainty of the temperature is $U=0.9^{\circ}C$ ($K=2$), at the 95% confidence level.

Test Data:**Temperature measurement point of LED light source (TMP_{LED})****Temperature measurement point of driver (TMP_c)**

Sample No.	RSZ160308510-S01
Type of Thermocouples:	T
Test Duration	≥ 3.5 hours
Maximum Recommended Driver Case Temperature	50°C
Test Location	Test Result
TMP _{LED}	66.2°C
TMP _c	48.7°C
Driver Current of LED	Test Result
IF (mA)	49.67mA

See attachment A: LM-80 test report and TM-21 calculator.

3.2. Photometric, Electrical and Luminous Intensity Distribution Measurements

Test Method and ENERGY STAR Requirements:

IES LM-79-08: Approved Method: Electrical & Photometric Measurement of Solid-state Lighting Products

ANSI C82.77-10:2014: Harmonic Emission Limits - Related Power Quality Requirements for Lighting Equipment

CIE Pub. No. 13.3-1995: Method of Measuring and Specifying Color Rendering of Light Sources

CIE Pub. No. 15:2004: Colorimetry

ENERGY STAR Requirement:

Luminaire Efficacy: For SSL Downlight Retrofit: ≥ 60 lm/W;

Luminaire Minimum Light Output: For SSL Downlight Retrofit: $\leq 4.5''$ aperture: 345 lumens; $> 4.5''$ aperture: 575 lumens

CCT Requirements: fall within a 7-step chromaticity quadrangles for CCT: 2700K, 3000K, 3500K, 4000K, 5000K

CRI Requirements: $R_a \geq 80$, $R_9 > 0$

Power Factor Requirements: $\leq 5W, PF \geq 0.5$; $> 5W, PF \geq 0.7$

Luminaire Zonal Lumen Density: For Directional SSL Downlight retrofits Luminaires: Luminaire shall deliver a minimum of 75% of total initial lumens within the 0-60° zone (axially symmetric about the nadir)

Test Procedure:

According to IES LM-79-08, luminaires were tested at ambient temperature $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ with no seasoning. Spectral radiant flux measurements are made using Spectroradiometer attached to the detector port of the integrating sphere. Each luminaire is operated at rated voltage in its designated orientation. Each luminaire is allowed to stabilize from 30 min to 2 or more hours before measurements are made. Luminous flux, chromaticity coordinates, correlated color temperature, u' , v' and color rendering index for each luminaire are calculated from the spectral radiant flux measurements taken at 5 nm intervals over the range 380 to 800 nm. The calibration of the sphere photometer-spectroradiometer system is traceable to The National Metrology Institute of China, NIM. Luminaire efficacy (lumens per watts) for each luminaire model is computed based on this luminous flux result. Electrical measurements including voltage, current, power, power factor and harmonic analysis are measured using the Digital Power Analyzer.

Luminous Intensity was measured by goniophotometer system at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$. One sample was measured and operated at downward orientation. Sample was operated at rated voltage and was tested after stabilized. System was calibrated by standard light source before measurement. The calibration of the system and the standard light source is traceable to National Primary Standards and International System of Units (SI).

The retrofit was tested in a can, and the information of the can was below:

Model: H71CT

Manufacturer: Cooper Lighting, LLC

Test Equipment:

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Integrating Sphere	SENSING	SPR-600	S09008	25~50°C	2016-03-10	2017-03-09
Spectral photometer	SENSING	SPR3000	90902027	350nm~800nm	2016-03-10	2017-03-09
Power Meter	YOKOGAWA	WT-210	91j926132	15/30/60/150/300/600 V	2016-03-04	2017-03-03

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
AC Power Supply	ALL Power	APW-105N	970663	220V±10% 50HZ	2016-03-04	2017-03-03
Standard Light Source	EVERFINE	D204	01331191	24V/100W	2015-08-27	2016-08-26
Thermal Meter	SENSING	N/A	N/A	25、50°C	2016-03-10	2017-03-09
DC Power Supply	ITECH	IT6154	0061 0417 6471 0010 19	0~32V	2016-03-04	2017-03-03
AC Power Supply	EVERFINE	VPS1030 PWM	1012017	0-150V, 0- 300V	2016-03-04	2017-03-03
DC Power Supply	EVERFINE	WY12010	1009009	30V/5A	2016-03-04	2017-03-03
Power Meter	YOKOGAWA	WT-210	91KB35700	15/30/60/150/3 00/600 V	2016-03-04	2017-03-03
Goniophotometer	EVERFINE	GO-R5000	YG108492N10 120001	1600mm,3000 W/10A	2016-03-10	2017-03-09
Wireless Remote Sensor	N/A	433MHz	N/A	0°C~50°C;- 20°C~60°C	2016-03-21	2017-03-20
Standard Light Source	EVERFINE	D908	1012003	N/A	2015-09-08	2016-09-07

Uncertainty:

The uncertainty of the light output (luminous flux) measurements is $U=2.1\%$ ($K=2$), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is $U=32K$ ($K=2$), at the 95% confidence level. The uncertainty of the CRI is $U=2.1$ ($K=2$), at the 95% confidence level.

The uncertainty of power meter AC current $U=0.19\%$ of rdg, AC Voltage $U=0.15\%$ of rdg, Power $U=0.20\%$ ($K=2$), at the 95% confidence level.

The uncertainty of the luminous intensity is $U=2.82\%$ ($K=2$), at the 95% confidence level.

Test Data:

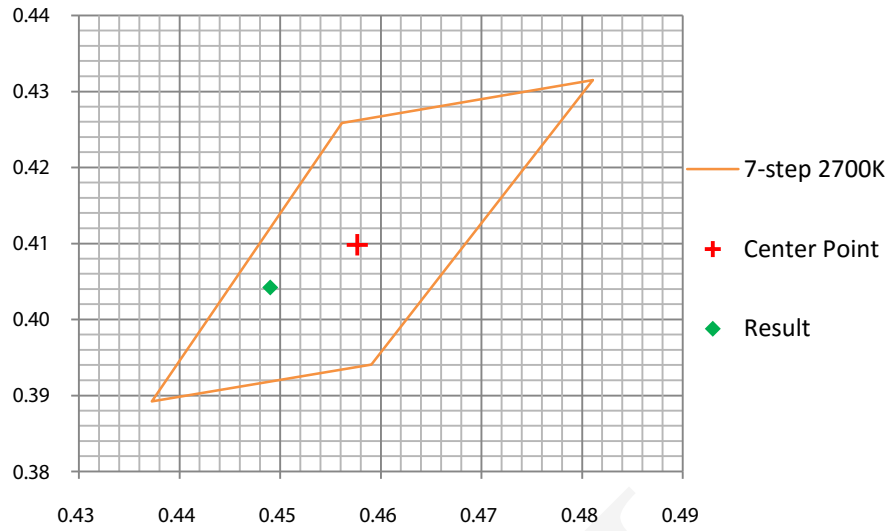
Photometric and Electrical Measurements at 25°C

Test data from goniophotometer system:

Sample No.	Voltage(V)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/ W)	Beam Angle(°)	I _{max} (cd)
RSZ160308510-S01	120.1	0.1011	11.87	0.9780	920.077	77.51	94.6	415.5

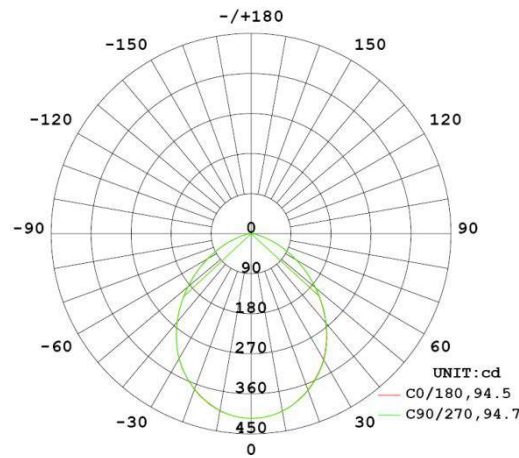
Test data from Integrating Sphere system:

Sample No.	CCT(K)	R _a	R _g	x	y	u'	v'	Duv
RSZ160308510-S01	2808	96.3	83	0.4490	0.4042	0.2583	0.5232	-0.00140



FINAL

Luminous Intensity Distribution Diagram



Zonal Lumen Density

Deg	Flux (lm)	%
0-5	9.9	1.07
0-10	39.1	4.25
0-15	86.3	9.38
0-20	149.2	16.22
0-25	225.2	24.48
0-30	310.9	33.79
0-35	402.3	43.72
0-40	494.8	53.78
0-45	584.6	63.54
0-50	667.8	72.58
0-55	741.3	80.57
0-60	802.5	87.23
0-65	850.0	92.38
0-70	883.1	95.98
0-75	903.0	98.14
0-80	912.8	99.20
0-85	917.2	99.69
0-90	918.3	99.81

Deg	Flux (lm)	%
0-95	918.4	99.82
0-100	918.6	99.84
0-105	918.7	99.85
0-110	918.8	99.86
0-115	918.9	99.88
0-120	919.1	99.89
0-125	919.2	99.90
0-130	919.3	99.91
0-135	919.4	99.93
0-140	919.5	99.94
0-145	919.6	99.95
0-150	919.7	99.96
0-155	919.8	99.97
0-160	919.9	99.98
0-165	920.0	99.99
0-170	920.0	100.00
0-175	920.1	100.00
0-180	920.1	100.00

3.3. Color Spatial Uniformity

Test Method and ENERGY STAR Requirements:

IES LM-79-08: Approved Method: Electrical & Photometric Measurement of Solid-state Lighting Products

IES LM-58-13: Method for Spectroradiometric Measurement Methods for Light Sources

CIE Pub. No. 15:2004: Colorimetry

ENERGY STAR Requirements:

Throughout the beam angle, the variation of chromaticity shall be within a total linear distance of 0.006 from the weighted average point on the CIE 1976 (u'y') diagram.

Test Procedure:

The retrofit was tested in a can, and the information of the can was below:

Model: H71CT

Manufacturer: Cooper Lighting,LLC

Color Distribution was measured by goniophotometer system at $25^{\circ}\text{C}\pm 1^{\circ}\text{C}$. One sample was measured and operated at downward orientation. Sample was operated at rated voltage and was tested after stabilized. System was calibrated by standard light source before measurement.

Test Equipment:

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
AC Power Supply	EVERFINE	VPS1030 PWM	1012017	0-150V, 0-300V	2016-03-04	2017-03-03
DC Power Supply	EVERFINE	WY12010	1009009	30V/5A	2016-03-04	2017-03-03
Power Meter	YOKOGAWA	WT-210	91KB35700	15/30/60/150/300/600 V	2016-03-04	2017-03-03
Goniophotometer	EVERFINE	GO-R5000	YG108492N10120001	1600mm,3000W/10A	2016-03-10	2017-03-09
Wireless Remote Sensor	N/A	433MHz	N/A	0°C~50°C;-20°C~60°C	2016-03-21	2017-03-20
Standard Light Source	EVERFINE	D908	1012003	N/A	2015-09-08	2016-09-07

Uncertainty:

The uncertainty of the luminous intensity is $U=2.82\%$ ($K=2$), at the 95% confidence level.

Test Data:

Sample Number: RSZ160308510-S01
 Color Spatial Uniformity

Average Weighted
u': 0.2558, v': 0.5205

$\gamma \setminus C0-180$	u'	v'	Du'v'	$\gamma \setminus C90-270$	u'	v'	Du'v'
-50	0.2552	0.5205	0.0006	-50	0.2553	0.5204	0.0005
-49	0.2552	0.5205	0.0006	-49	0.2553	0.5205	0.0005
-48	0.2552	0.5205	0.0006	-48	0.2554	0.5205	0.0004
-47	0.2552	0.5205	0.0006	-47	0.2555	0.5205	0.0003
-46	0.2553	0.5205	0.0005	-46	0.2555	0.5205	0.0003
-45	0.2553	0.5205	0.0005	-45	0.2555	0.5205	0.0003
-44	0.2553	0.5205	0.0005	-44	0.2555	0.5205	0.0003
-43	0.2554	0.5205	0.0004	-43	0.2557	0.5205	0.0001
-42	0.2554	0.5206	0.0004	-42	0.2557	0.5205	0.0001
-41	0.2554	0.5206	0.0004	-41	0.2557	0.5206	0.0001
-40	0.2554	0.5206	0.0004	-40	0.2557	0.5206	0.0001
-39	0.2555	0.5206	0.0003	-39	0.2557	0.5205	0.0001
-38	0.2555	0.5206	0.0003	-38	0.2557	0.5206	0.0001
-37	0.2555	0.5206	0.0003	-37	0.2557	0.5206	0.0001
-36	0.2555	0.5206	0.0003	-36	0.2559	0.5206	0.0001
-35	0.2557	0.5206	0.0001	-35	0.2559	0.5206	0.0001
-34	0.2557	0.5206	0.0001	-34	0.2559	0.5206	0.0001
-33	0.2557	0.5206	0.0001	-33	0.2559	0.5206	0.0001
-32	0.2557	0.5206	0.0001	-32	0.2559	0.5206	0.0001
-31	0.2557	0.5206	0.0001	-31	0.2559	0.5206	0.0001
-30	0.2558	0.5206	0.0001	-30	0.2559	0.5206	0.0001
-29	0.2558	0.5206	0.0001	-29	0.2559	0.5206	0.0001
-28	0.2558	0.5206	0.0001	-28	0.2559	0.5206	0.0001
-27	0.2558	0.5206	0.0001	-27	0.2561	0.5206	0.0003
-26	0.2558	0.5206	0.0001	-26	0.2561	0.5206	0.0003
-25	0.2558	0.5206	0.0001	-25	0.2561	0.5206	0.0003
-24	0.2558	0.5205	0.0000	-24	0.2561	0.5206	0.0003
-23	0.2559	0.5206	0.0001	-23	0.2561	0.5205	0.0003
-22	0.2559	0.5206	0.0001	-22	0.2561	0.5205	0.0003
-21	0.2559	0.5206	0.0001	-21	0.2561	0.5205	0.0003
-20	0.2559	0.5206	0.0001	-20	0.2561	0.5205	0.0003
-19	0.2559	0.5206	0.0001	-19	0.2561	0.5205	0.0003
-18	0.2559	0.5205	0.0001	-18	0.2561	0.5205	0.0003
-17	0.2559	0.5205	0.0001	-17	0.2561	0.5205	0.0003
-16	0.2559	0.5205	0.0001	-16	0.2561	0.5205	0.0003
-15	0.2559	0.5205	0.0001	-15	0.2561	0.5205	0.0003
-14	0.2559	0.5205	0.0001	-14	0.2560	0.5205	0.0002
-13	0.2559	0.5205	0.0001	-13	0.2561	0.5205	0.0003
-12	0.2560	0.5205	0.0002	-12	0.2561	0.5205	0.0003
-11	0.2560	0.5205	0.0002	-11	0.2561	0.5205	0.0003
-10	0.2560	0.5205	0.0002	-10	0.2561	0.5205	0.0003
-9	0.2560	0.5205	0.0002	-9	0.2560	0.5205	0.0002
-8	0.2560	0.5205	0.0002	-8	0.2561	0.5204	0.0003
-7	0.2560	0.5205	0.0002	-7	0.2560	0.5204	0.0002
-6	0.2560	0.5205	0.0002	-6	0.2560	0.5204	0.0002
-5	0.2560	0.5205	0.0002	-5	0.2560	0.5204	0.0002
-4	0.2560	0.5205	0.0002	-4	0.2560	0.5204	0.0002
-3	0.2560	0.5205	0.0002	-3	0.2560	0.5204	0.0002
-2	0.2560	0.5205	0.0002	-2	0.2560	0.5204	0.0002
-1	0.2560	0.5205	0.0002	-1	0.2560	0.5204	0.0002
0	0.2562	0.5206	0.0004	0	0.2562	0.5206	0.0004
1	0.2560	0.5205	0.0002	1	0.2560	0.5204	0.0002
2	0.2560	0.5205	0.0002	2	0.2560	0.5204	0.0002
3	0.2560	0.5205	0.0002	3	0.2560	0.5204	0.0002
4	0.2560	0.5205	0.0002	4	0.2560	0.5204	0.0002

Average Weighted
u': 0.2558, v': 0.5205

$\gamma \setminus C0-180$	u'	v'	Du'v'
5	0.2560	0.5205	0.0002
6	0.2560	0.5205	0.0002
7	0.2561	0.5205	0.0003
8	0.2560	0.5205	0.0002
9	0.2560	0.5205	0.0002
10	0.2561	0.5205	0.0003
11	0.2561	0.5205	0.0003
12	0.2561	0.5205	0.0003
13	0.2560	0.5205	0.0002
14	0.2561	0.5205	0.0003
15	0.2561	0.5206	0.0003
16	0.2561	0.5205	0.0003
17	0.2561	0.5205	0.0003
18	0.2561	0.5206	0.0003
19	0.2561	0.5206	0.0003
20	0.2561	0.5206	0.0003
21	0.2561	0.5206	0.0003
22	0.2561	0.5206	0.0003
23	0.2561	0.5206	0.0003
24	0.2561	0.5206	0.0003
25	0.2561	0.5206	0.0003
26	0.2561	0.5206	0.0003
27	0.2559	0.5206	0.0001
28	0.2559	0.5206	0.0001
29	0.2559	0.5206	0.0001
30	0.2559	0.5206	0.0001
31	0.2559	0.5206	0.0001
32	0.2559	0.5206	0.0001
33	0.2559	0.5206	0.0001
34	0.2559	0.5206	0.0001
35	0.2559	0.5206	0.0001
36	0.2559	0.5206	0.0001
37	0.2557	0.5206	0.0001
38	0.2557	0.5206	0.0001
39	0.2557	0.5206	0.0001
40	0.2557	0.5206	0.0001
41	0.2557	0.5206	0.0001
42	0.2557	0.5206	0.0001
43	0.2555	0.5205	0.0003
44	0.2555	0.5206	0.0003
45	0.2555	0.5205	0.0003
46	0.2555	0.5206	0.0003
47	0.2555	0.5205	0.0003
48	0.2555	0.5205	0.0003
49	0.2553	0.5205	0.0005
50	0.2553	0.5205	0.0005

$\gamma \setminus C90-270$	u'	v'	Du'v'
5	0.2560	0.5204	0.0002
6	0.2561	0.5204	0.0003
7	0.2560	0.5204	0.0002
8	0.2560	0.5204	0.0002
9	0.2560	0.5205	0.0002
10	0.2560	0.5205	0.0002
11	0.2560	0.5205	0.0002
12	0.2560	0.5205	0.0002
13	0.2561	0.5205	0.0003
14	0.2561	0.5205	0.0003
15	0.2559	0.5205	0.0001
16	0.2559	0.5205	0.0001
17	0.2559	0.5205	0.0001
18	0.2559	0.5205	0.0001
19	0.2559	0.5205	0.0001
20	0.2559	0.5205	0.0001
21	0.2560	0.5205	0.0002
22	0.2560	0.5205	0.0002
23	0.2559	0.5205	0.0001
24	0.2559	0.5205	0.0001
25	0.2558	0.5205	0.0000
26	0.2558	0.5205	0.0000
27	0.2558	0.5205	0.0000
28	0.2558	0.5205	0.0000
29	0.2558	0.5205	0.0000
30	0.2558	0.5206	0.0001
31	0.2558	0.5205	0.0000
32	0.2557	0.5205	0.0001
33	0.2557	0.5205	0.0001
34	0.2557	0.5205	0.0001
35	0.2557	0.5205	0.0001
36	0.2557	0.5205	0.0001
37	0.2557	0.5205	0.0001
38	0.2557	0.5205	0.0001
39	0.2557	0.5205	0.0001
40	0.2557	0.5205	0.0001
41	0.2557	0.5205	0.0001
42	0.2557	0.5205	0.0001
43	0.2554	0.5205	0.0004
44	0.2554	0.5205	0.0004
45	0.2554	0.5205	0.0004
46	0.2554	0.5205	0.0004
47	0.2553	0.5204	0.0005
48	0.2553	0.5204	0.0005
49	0.2553	0.5204	0.0005
50	0.2553	0.5204	0.0005

3.4. Start Time

Test Method and ENERGY STAR Requirements:

Test Method

ENERGY STAR Test Method: Start Time Test

ENERGY STAR Requirement:

Light source shall remain continuously illuminated within 750 ms (1 second for connected product) of application of electrical power.

Test Procedure:

Integrating sphere, oscilloscope, photocell were used during start time test.

Luminaires shall be stored at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for a minimum of 16 hours prior to the test, after which the temperature range shall be $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ for at least two hours immediately prior to the test. Luminaires were tested at rated voltage. The start time is defined that the time between the application of power to the device and the point where light output reaches 98% of the luminaire's initial plateau.

Test Equipment:

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
2.0m integrating sphere	EVERFINE	R98	11010018	R98	2015-11-09	2016-11-08
Digital Power Meter	EVERFINE	PF2010A	1011004	600V/20A	2015-07-24	2016-07-23
Digital real-time oscilloscope	Tektronix	TDS 220	C033131	N/A	2015-07-09	2016-07-08
Sensor	EVERFINE	V-10111	A8331337	N/A	N/A	N/A
Thermal Meter	Anymetre	JR900A	N/A	N/A	2016-01-12	2017-01-11
AC Power Supply	EVERFINE	DPS1010-YF	1011001T	30V/5A	2016-03-04	2017-03-03

Uncertainty:

The uncertainty of Start time $U=0.6\%$ ($K=2$), at the 95% confidence level.

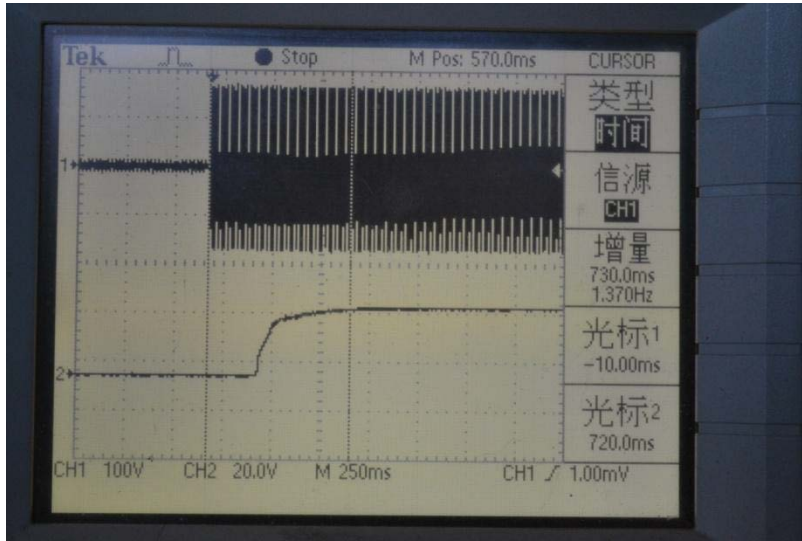
Test Data:

Test date: 2016-05-03 Test voltage AC 120 V 60 Hz.

Sample No.	Time base (ms/div)	Start Time(ms)
RSZ160308510-S01	250	730.0

Figure of Input voltage and light output waveforms

RSZ160308510-S01



3.5. Transient Protection

Test Method and ENERGY STAR Requirements:

ANSI/IEEE C62.41.1-2002: IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits

ANSI/IEEE C62.41.2-2002: IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits

ENERGY STAR Requirement:

Ballast or driver shall comply with ANSI/IEEE C62.41.1-2002 and ANSI/IEEE C62.41.2-2002, Category A operation. The line transient shall consist of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode.

Test Procedure:

Seven strikes were performed on luminaire base in accordance with ANSI/IEEE C62.41 (Category A). The line transient shall consist of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode. Samples should be fully operational after seven strikes.

Test Equipment:

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
AC Power source	HengPu	HPA 1103	0003394	3KVA	2016-03-04	2017-03-03
MODULAR IMPULSE GENERATOR	EMC-PARTNER	MIG0603IN1 IEC-ANSI	593	N/A	2016-03-04	2017-03-03

Uncertainty:

The uncertainty of voltage $U=1.07\%$ ($K=2$), at the 95% confidence level.

The uncertainty of time $U=0.6\%$ ($K=2$), at the 95% confidence level.

Test Data:

Sample No.	Transient Protection Test
RSZ160308510-S01	PASS

3.6. Operating Frequency

These test method was not accredited by the IAS

Test Method and ENERGY STAR Requirements:

ENERGY STAR Requirements:

≥ 120 Hz

Test Procedure:

The sample was operated at rated voltage in its designated orientation during the test. Luminaire was measured by a photodetector, integrating sphere and rapid recording photometer. For dimmable luminaires, test was performed with dimmer at three levels: full light output level, medium output level and minimum output level. The final result would be the minimum of the three test results.

Test Equipment:

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Rapid recording photometer	EVERFINE	PHOTO-2000F	1007010	0.1lm—200klm	2015-12-31	2016-12-30
2.0m integrating sphere	EVERFINE	R98	11010018	R98	2015-11-09	2016-11-08
Digital Power Meter	EVERFINE	PF2010A	1011004	600V/20A	2015-07-24	2016-07-23
Thermal Meter	Anymetre	JR900A	N/A	N/A	2016-01-12	2017-01-11
Special zero-voltage synchronous switching AC	EVERFINE	DPS1010-YF	1011001T	30V/5A	2016-03-04	2017-03-03

Uncertainty:

The uncertainty of Operating Frequency U=0.6% (K=2), at the 95% confidence level.

Test Data:

Sample No.	Operating Frequency (Hz)
RSZ160308510-S01	120.19

3.7. Dimming and noise Test

This test method was not accredited by the IAS

Test Method and ENERGY STAR Requirements:

IES LM-79-08: Approved Method: Electrical & Photometric Measurement of Solid-state Lighting Products

ENERGY STAR Requirements:

The luminaire and its components shall provide continuous dimming from 100% to 20% of light output. Luminaire shall not emit noise above 24dBA at 1 meter or less at the minimum output.

Test Procedure:

The photometric measurement test was performed with dimmer specified by manufacturer and detailed as below. For continuous dimmer, the dimmer was set maximum level and minimum level output for photometric measurement.

Sample was transferred to sound insulation chamber to measure the noise level at the lowest dimmable level.

Test Equipment:

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Rapid recording photometer	EVERFINE	PHOTO-2000F	1007010	0.1lm—200klm	2015-12-31	2016-12-30
2.0m integrating sphere	EVERFINE	R98	11010018	R98	2015-11-09	2016-11-08
Digital Power Meter	EVERFINE	PF2010A	1011004	600V/20A	2015-07-24	2016-07-23
Special zero-voltage synchronous switching AC	EVERFINE	DPS1010-YF	1011001T	30V/5A	2016-03-04	2017-03-03
Standard Light Source	SENSING	N/A	LSD090808	N/A	2015-09-25	2016-09-24
Thermal Meter	Anymetre	JR900A	N/A	N/A	2016-01-12	2017-01-11
AC Power source	ALL Power	APW-105N	970613	220V±10% 50Hz	2016-03-04	2017-03-03
Sound Insulation Box	N/A	N/A	01#	N/A	2015-11-06	2016-11-05
Sound Level Meter	Hangzhou Aihua	AWA5661	88071	12~112dB	2015-10-26	2016-10-25

Uncertainty:

The uncertainty of the light output (luminous flux) measurements is $U=2.1\%$ ($K=2$), at the 95% confidence level.

The uncertainty of noise $U=0.5$ dB ($K=2$), at the 95% confidence level.

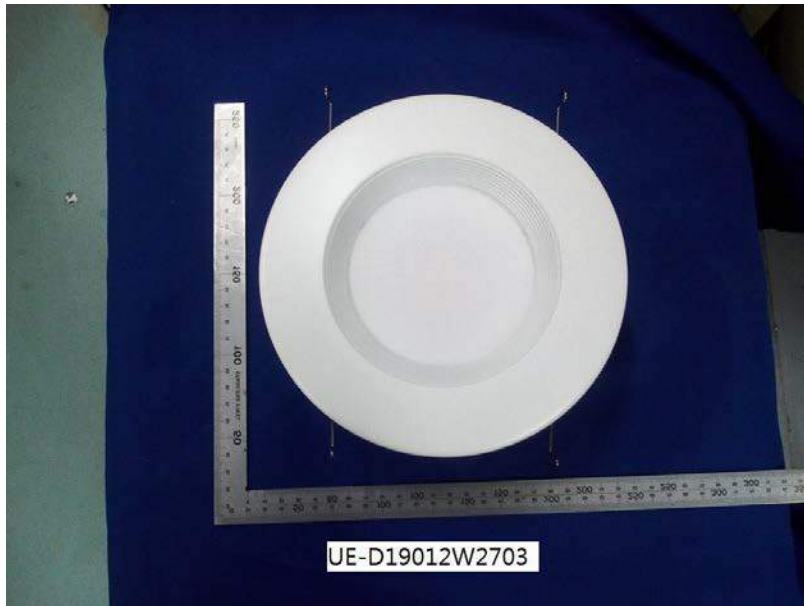
Test Data:

Sample No.		Maximum Level	Minimum Level
RSZ160308510-S01	Light output (Lumen)	906.57	14.44
	Percentage	100%	1.6%
	Noise(dBA)	/	23.8

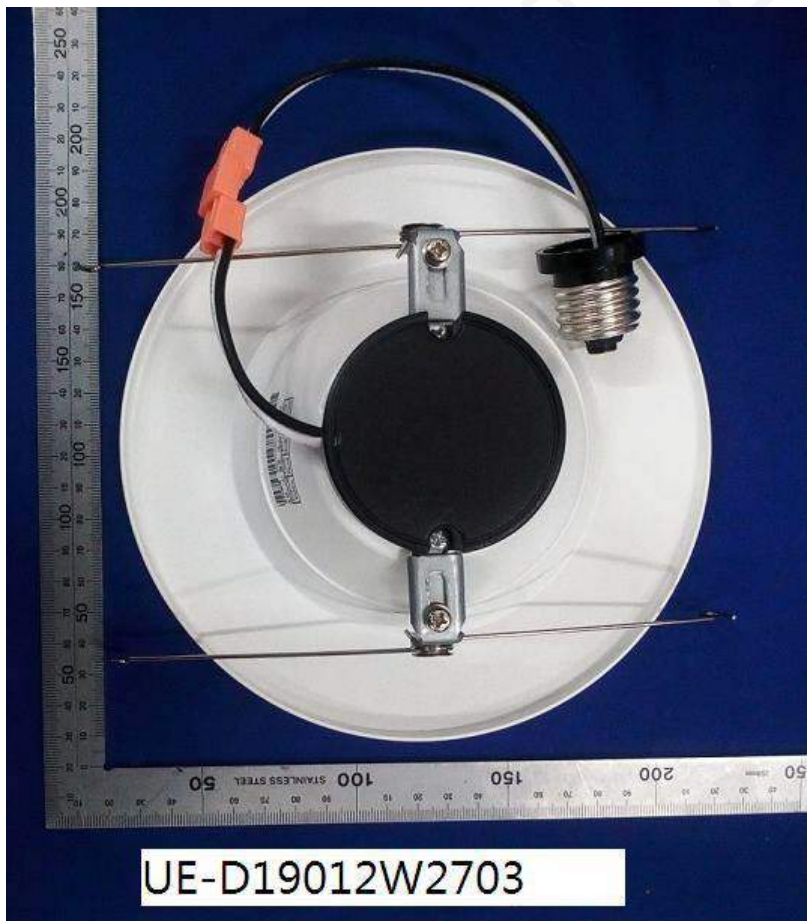
FINAL

4. EUT Photo

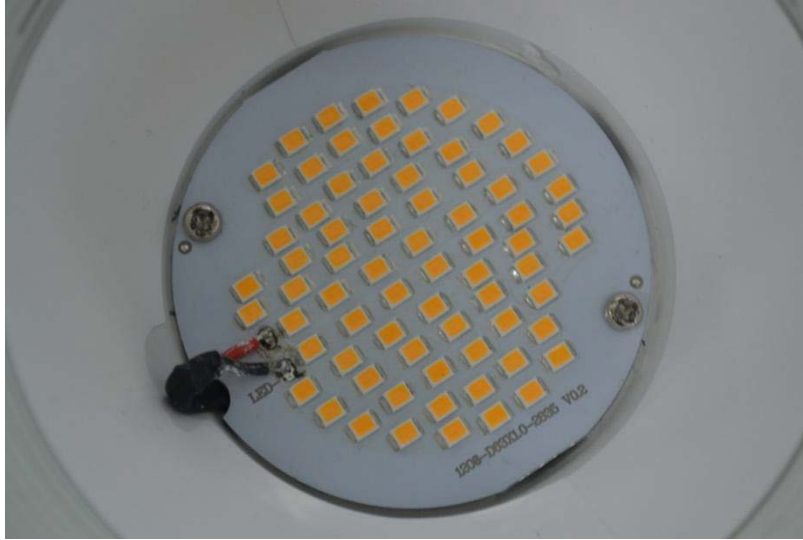
4.1. EUT Photo



4.2. EUT Photo



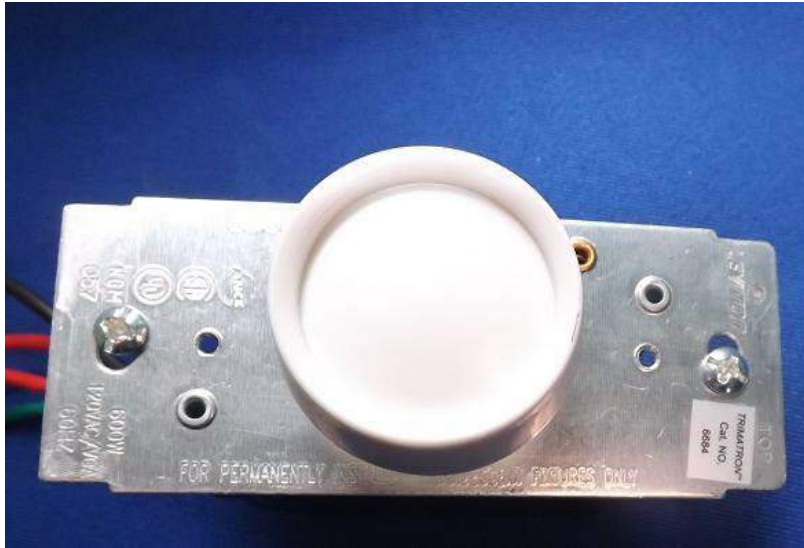
4.3. LED Source Photo



4.4. LED Driver Photo



4.5. Dimmer Photo



FULL

Attachment A –LM-80-08 test report and TM-21 Calculator

*****END OF REPORT*****