



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

## MEASUREMENT AND TEST REPORT

For

### L-TECH CORPORATION

Shaogangtou District, Qiaotou Town Dongguan City, Guangdong, China

**Model: LRKT488 2700K**

<b>Report Type:</b> Original Report		<b>Product Type:</b> SSL Downlight Retrofit	
<b>Test Engineer:</b>	Hexy He	<i>Hexy He</i>	
<b>Report Number:</b>	RSZ160526515-10-1		
<b>Test Date:</b>	2016-06-03 to 2017-11-15		
<b>Report Date:</b>	2017-11-20		
<b>Reviewed By:</b>	Blake Zhang / EE Engineer	<i>Blake Zhang</i>	
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<b>Accreditation:</b>	The IAS Accreditation Number TL-460.		

**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 LRKT488 2700K, Samples were numbered RSZ160526515-S01 through RSZ160526515-S03. The samples were received on 2016-05-26, in undamaged condition.

Model Tested:	LRKT488 2700K
Manufacturer:	L-TECH CORPORATION
Product Designation:	SSL downlight retrofit
Classification:	Directional
Rated Voltage/Frequency:	120V 60Hz
Rated Power:	10W
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	9
Type of LED Components:	LED Package
Model of LED Components:	2835S Series
Light Source Manufacturer:	EVERLIGHT ELECTRONICS CO., LTD
LM-80 Report:	Yes
The Number of LED Driver:	1
Rated Maximum TMP <sub>C</sub> :	90 °C
Replaceability of Driver:	Inseparable
Model of Dimmer Used During Test:	Cat.NO.6684
Brand of Dimmer:	LEVITON
Type of Dimmer:	Continuous dimmer

### 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)	71.43	PASS	$\geq 60$ lm/W
Aperture(inch)	2.13	N/A	N/A
Light Output(lm)	609.309	PASS	For Aperture $\leq 4.5''$ : $\geq 345$ lm For Aperture $> 4.5''$ : $\geq 575$ lm
Luminaire Zonal Lumen Density	84.48%	PASS	Luminaire shall deliver a minimum of 75% of total initial lumens within the $0^\circ - 60^\circ$ zone (axially symmetric about the nadir).
CCT (K)	2759	PASS	The luminaire shall fall within the corresponding 7-step chromaticity quadrangles as defined in ANSI/NEMA/ANSLG C78.377-2011.
$R_a$	92.2	PASS	$R_a \geq 80$
$R_9$	54	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 <sup>ii</sup>	$> 54,000$ hours See Attachment A	PASS	$\geq 25,000$ hours (for indoor)
Color Maintenance <sup>iii</sup>	See Attachment A	PASS	$\leq 0.007$ (In LM-80 test report)
Start Time(ms)	148.0	PASS	Light source shall remain continuously illuminated within 750 milliseconds of application of electrical power.
Power Factor	0.9841	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 <sup>iv</sup>	PASS	Luminaires shall not draw power in the off state.
Operating Frequency (Hz) <sup>i</sup>	120.05	PASS	$\geq 120$ Hz
Dimming <sup>i</sup>	See tables	PASS	Provide continuous dimming from 100% to 20%
Noise(dBA) <sup>i</sup>	22.2	PASS	$\leq 24$ dBA at 1 meter or less at the minimum output
Driver Case Temperature( $^\circ C$ )	57.0	PASS	The measured driver case temperature at thermal equilibrium shall not exceed the driver manufacturer's maximum recommended temperature $90^\circ C$ 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.

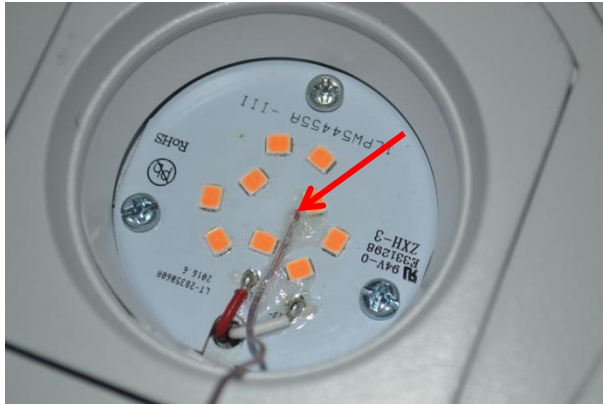
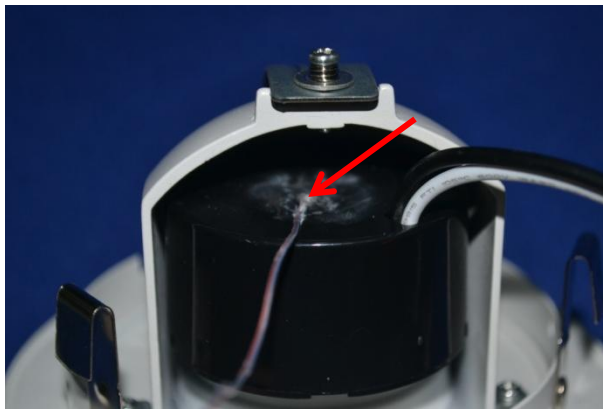
Thermocouples were attached at locations described in the results by means of a cement made of water glass and Fuller's earth, solder, or epoxy. The drive current of LED package/module/ array was calculated as the total output current of the driver measured by multimeter, divided by the number of branches 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	2017-03-03	2018-03-03
Hybrid Recorder	YOKOGAWA	DR240	10#	N/A	2017-07-07	2018-07-07
AC POWER SUPPLY	HengPu	HPA 1103	0003394	3KVA	2017-03-03	2018-03-03

##### Uncertainty:

The uncertainty of the temperature is  $U=0.8\text{ }^{\circ}\text{C}$  ( $K=2$ ), at the 95% confidence level.

**Test Data:****Temperature measurement point of LED light source (TMP<sub>LED</sub>)****Temperature measurement point of driver (TMP<sub>c</sub>)**

<b>Sample No.</b>	RSZ160526515-S01
<b>Type of Thermocouples:</b>	T
<b>Test Duration</b>	≥3.5 hours
<b>Maximum Recommended Driver Case Temperature</b>	90 °C
<b>Test Location</b>	<b>Test Result</b>
TMP <sub>LED</sub>	64.3 °C
TMP <sub>c</sub>	57.0 °C
<b>Driver Current of LED</b>	<b>Test Result</b>
IF (mA)	141mA

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:  $\geq 60$  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  $0-60^\circ$  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 no more than 5 nm intervals over the range 380 to 780 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: H25ICAT

Manufacturer: Cooper Lighting, LLC

#### Test Equipment:

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
2.0m integrating sphere	EVERFINE	R98	11010018	R98	2016-11-18	2017-11-18
spectroradiometer	EVERFINE	HAAS-2000	20140912	380-780nm	2016-11-18	2017-11-18
Digital Power Meter	EVERFINE	PF2010A	1011004	600V/20A	2017-07-29	2018-07-29

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Digital CC&CV DC Power Supply	EVERFINE	WY305-V1	1101047	30V/5A	2017-07-07	2018-07-07
Rapid Recording Photometer	EVERFINE	PHOTO-2000F	1007010	0.1lm—200klm	2016-11-18	2017-11-18
Standard Light Source	SENSING	N/A	LSD090808	N/A	2016-12-05	2017-12-05
Special zero-voltage synchronous switching AC	EVERFINE	DPS1010-YF	1011001T	0-150V, 0-300V	2017-03-03	2018-03-03
AC POWER SUPPLY	EVERFINE	VPS1030 PWM	1012017	0-150V, 0-300V	2017-03-03	2018-03-03
Digital CC&CV DC Power Supply	EVERFINE	WY12010	1009009	30V/5A	2017-03-03	2018-03-03
Digital power meter	YOKOGAWA	WT-210	91j926132	15/30/60/150/300/600 V	2017-03-03	2018-03-03
full-field speed goniophotometer	EVERFINE	GO-R5000	YG108492N10120001	1600mm,3000W/10A	2017-03-09	2018-03-09
Wireless Remote Sensor	N/A	433MHz	N/A	0 °C~50 °C;-20 °C~60 °C	2017-03-20	2018-03-20
Standard Light Source	EVERFINE	D908	1012003	N/A	2016-12-17	2017-12-17

**Uncertainty:**

The uncertainty of the light output (luminous flux) measurements is  $U=1.9\%$  ( $K=2$ ), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is  $U=25K$  ( $K=2$ ), at the 95% confidence level. The uncertainty of the CRI is  $U=1.9(K=2)$ , at the 95% confidence level.

The uncertainty of power meter AC current  $U=0.19\%$  of rdg, AC Voltage  $U=0.18\%$  of rdg, Power  $U=0.46\%$  ( $K=2$ ), 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

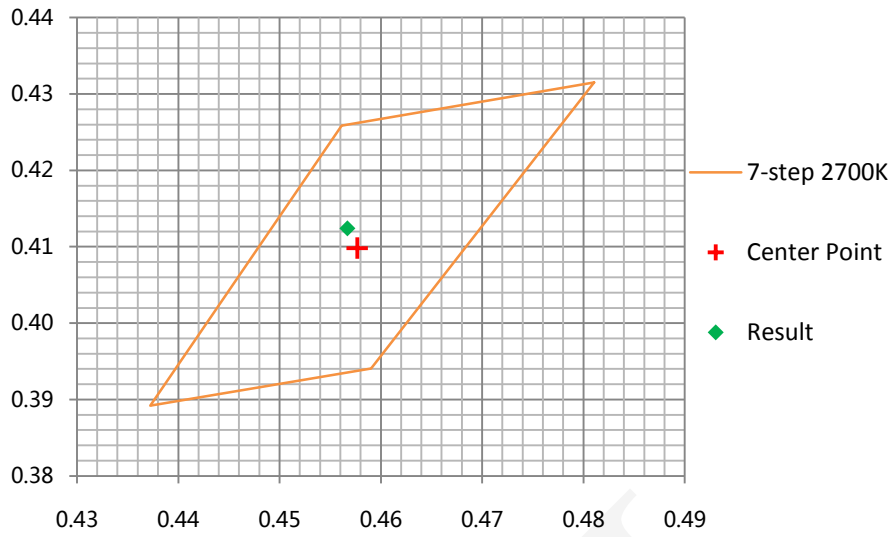
Test data from goniophotometer system:

Sample No.	Voltage(V)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/ W)	Beam Angle(°)	I <sub>max</sub> (cd)
RSZ160526515-S01	120.1	0.0722	8.530	0.9841	609.309	71.43	96.8	260.8

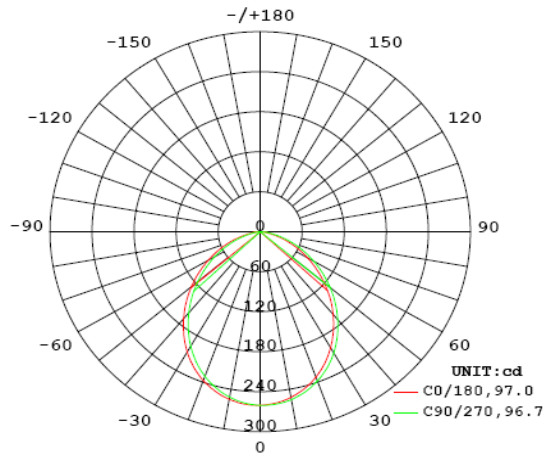
Test data from Integrating Sphere system:

Sample No.	CCT(K)	R <sub>a</sub>	R <sub>9</sub>	x	y	u'	v'	Duv
RSZ160526515-S01	2759	92.2	54	0.4567	0.4124	0.2597	0.5276	0.00094





Luminous Intensity Distribution Diagram



Zonal Lumen Density

Deg	Flux (lm)	%
0-5	6.2	1.02
0-10	24.5	4.03
0-15	54.2	8.89
0-20	93.8	15.39
0-25	141.6	23.24
0-30	195.4	32.08
0-35	252.9	41.50
0-40	311.5	51.12
0-45	369.0	60.56
0-50	423.2	69.46
0-55	472.3	77.51
0-60	514.8	84.48
0-65	549.7	90.21
0-70	576.2	94.56
0-75	594.1	97.51
0-80	604.0	99.13
0-85	607.9	99.77
0-90	608.8	99.91

Deg	Flux (lm)	%
0-95	608.8	99.91
0-100	608.8	99.92
0-105	608.8	99.92
0-110	608.8	99.92
0-115	608.9	99.93
0-120	608.9	99.93
0-125	608.9	99.93
0-130	608.9	99.94
0-135	609.0	99.95
0-140	609.0	99.95
0-145	609.1	99.96
0-150	609.1	99.97
0-155	609.2	99.98
0-160	609.2	99.99
0-165	609.3	99.99
0-170	609.3	100.00
0-175	609.3	100.00
0-180	609.3	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', v') diagram.

**Test Procedure:**

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

Model: H25ICAT

Manufacturer: Cooper Lighting,LLC

Color Distribution was measured by goniophotometer system at  $25\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ . 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	2017-03-03	2018-03-03
Digital CC&CV DC Power Supply	EVERFINE	WY12010	1009009	30V/5A	2017-03-03	2018-03-03
Digital power meter	YOKOGAWA	WT-210	91j926132	15/30/60/150/300/600 V	2017-03-03	2018-03-03
full-field speed goniophotometer	EVERFINE	GO-R5000	YG108492N10120001	1600mm,3000W/10A	2017-03-09	2018-03-09
Wireless Remote Sensor	N/A	433MHz	N/A	0 °C~50 °C;-20 °C~60 °C	2017-03-20	2018-03-20
Standard Light Source	EVERFINE	D908	1012003	N/A	2016-12-17	2017-12-17

**Uncertainty:**

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

**Test Data:**

Sample Number: RSZ160526515-S01  
 Color Spatial Uniformity

**Average Weighted**  
**u': 0.2615, v': 0.5268**

$\gamma \setminus C0-180$	u'	v'	Du'v'	$\gamma \setminus C90-270$	u'	v'	Du'v'
-50	0.2612	0.5268	0.0003	-50	0.2612	0.5266	0.0004
-49	0.2612	0.5268	0.0003	-49	0.2612	0.5266	0.0004
-48	0.2612	0.5268	0.0003	-48	0.2612	0.5266	0.0004
-47	0.2612	0.5269	0.0003	-47	0.2612	0.5267	0.0003
-46	0.2613	0.5269	0.0002	-46	0.2612	0.5267	0.0003
-45	0.2613	0.5269	0.0002	-45	0.2614	0.5267	0.0001
-44	0.2613	0.5268	0.0002	-44	0.2614	0.5267	0.0001
-43	0.2613	0.5269	0.0002	-43	0.2614	0.5267	0.0001
-42	0.2615	0.5269	0.0001	-42	0.2614	0.5267	0.0001
-41	0.2614	0.5269	0.0001	-41	0.2614	0.5267	0.0001
-40	0.2614	0.5269	0.0001	-40	0.2614	0.5267	0.0001
-39	0.2614	0.5269	0.0001	-39	0.2614	0.5267	0.0001
-38	0.2615	0.5269	0.0001	-38	0.2616	0.5267	0.0001
-37	0.2615	0.5269	0.0001	-37	0.2615	0.5267	0.0001
-36	0.2615	0.5269	0.0001	-36	0.2616	0.5267	0.0001
-35	0.2615	0.5269	0.0001	-35	0.2616	0.5267	0.0001
-34	0.2615	0.5269	0.0001	-34	0.2616	0.5268	0.0001
-33	0.2615	0.5269	0.0001	-33	0.2616	0.5268	0.0001
-32	0.2616	0.5269	0.0001	-32	0.2615	0.5268	0.0000
-31	0.2616	0.5269	0.0001	-31	0.2616	0.5268	0.0001
-30	0.2616	0.5269	0.0001	-30	0.2615	0.5268	0.0000
-29	0.2616	0.5269	0.0001	-29	0.2615	0.5268	0.0000
-28	0.2616	0.5269	0.0001	-28	0.2617	0.5268	0.0002
-27	0.2615	0.5269	0.0001	-27	0.2617	0.5268	0.0002
-26	0.2615	0.5269	0.0001	-26	0.2617	0.5268	0.0002
-25	0.2616	0.5269	0.0001	-25	0.2617	0.5268	0.0002
-24	0.2616	0.5269	0.0001	-24	0.2617	0.5268	0.0002
-23	0.2616	0.5269	0.0001	-23	0.2617	0.5268	0.0002
-22	0.2616	0.5269	0.0001	-22	0.2617	0.5268	0.0002
-21	0.2616	0.5269	0.0001	-21	0.2617	0.5268	0.0002
-20	0.2616	0.5269	0.0001	-20	0.2617	0.5268	0.0002
-19	0.2615	0.5268	0.0000	-19	0.2616	0.5268	0.0001
-18	0.2615	0.5268	0.0000	-18	0.2617	0.5268	0.0002
-17	0.2615	0.5268	0.0000	-17	0.2616	0.5268	0.0001
-16	0.2615	0.5268	0.0000	-16	0.2616	0.5268	0.0001
-15	0.2615	0.5268	0.0000	-15	0.2616	0.5268	0.0001
-14	0.2616	0.5268	0.0001	-14	0.2616	0.5267	0.0001
-13	0.2616	0.5268	0.0001	-13	0.2616	0.5267	0.0001
-12	0.2616	0.5268	0.0001	-12	0.2616	0.5267	0.0001
-11	0.2616	0.5268	0.0001	-11	0.2616	0.5267	0.0001
-10	0.2616	0.5268	0.0001	-10	0.2615	0.5267	0.0001
-9	0.2616	0.5268	0.0001	-9	0.2615	0.5267	0.0001
-8	0.2616	0.5268	0.0001	-8	0.2615	0.5267	0.0001
-7	0.2615	0.5268	0.0000	-7	0.2615	0.5267	0.0001
-6	0.2615	0.5268	0.0000	-6	0.2615	0.5267	0.0001
-5	0.2615	0.5268	0.0000	-5	0.2615	0.5267	0.0001
-4	0.2616	0.5268	0.0001	-4	0.2615	0.5267	0.0001
-3	0.2615	0.5268	0.0000	-3	0.2615	0.5267	0.0001
-2	0.2615	0.5268	0.0000	-2	0.2615	0.5267	0.0001
-1	0.2615	0.5268	0.0000	-1	0.2615	0.5267	0.0001
0	0.2615	0.5268	0.0000	0	0.2615	0.5268	0.0000
1	0.2616	0.5268	0.0001	1	0.2615	0.5267	0.0001
2	0.2615	0.5268	0.0000	2	0.2615	0.5267	0.0001
3	0.2615	0.5268	0.0000	3	0.2615	0.5268	0.0000
4	0.2616	0.5268	0.0001	4	0.2615	0.5267	0.0001

**Average Weighted**  
**u': 0.2615, v': 0.5268**

$\gamma \setminus$ C0-180	u'	v'	Du'v'
5	0.2616	0.5268	0.0001
6	0.2616	0.5268	0.0001
7	0.2616	0.5268	0.0001
8	0.2616	0.5268	0.0001
9	0.2616	0.5268	0.0001
10	0.2616	0.5268	0.0001
11	0.2616	0.5268	0.0001
12	0.2617	0.5268	0.0002
13	0.2617	0.5268	0.0002
14	0.2617	0.5268	0.0002
15	0.2617	0.5268	0.0002
16	0.2617	0.5269	0.0002
17	0.2617	0.5268	0.0002
18	0.2617	0.5269	0.0002
19	0.2617	0.5269	0.0002
20	0.2618	0.5269	0.0003
21	0.2618	0.5269	0.0003
22	0.2618	0.5269	0.0003
23	0.2618	0.5269	0.0003
24	0.2618	0.5269	0.0003
25	0.2618	0.5269	0.0003
26	0.2618	0.5269	0.0003
27	0.2616	0.5268	0.0001
28	0.2616	0.5268	0.0001
29	0.2616	0.5268	0.0001
30	0.2616	0.5268	0.0001
31	0.2617	0.5268	0.0002
32	0.2617	0.5268	0.0002
33	0.2617	0.5268	0.0002
34	0.2617	0.5268	0.0002
35	0.2617	0.5268	0.0002
36	0.2615	0.5268	0.0000
37	0.2615	0.5268	0.0000
38	0.2615	0.5268	0.0000
39	0.2615	0.5268	0.0000
40	0.2615	0.5268	0.0000
41	0.2615	0.5268	0.0000
42	0.2615	0.5268	0.0000
43	0.2615	0.5268	0.0000
44	0.2613	0.5268	0.0002
45	0.2613	0.5267	0.0002
46	0.2613	0.5267	0.0002
47	0.2613	0.5267	0.0002
48	0.2613	0.5267	0.0002
49	0.2611	0.5267	0.0004
50	0.2611	0.5267	0.0004

$\gamma \setminus$ C90-270	u'	v'	Du'v'
5	0.2615	0.5268	0.0000
6	0.2615	0.5268	0.0000
7	0.2616	0.5268	0.0001
8	0.2616	0.5268	0.0001
9	0.2616	0.5268	0.0001
10	0.2616	0.5267	0.0001
11	0.2616	0.5268	0.0001
12	0.2616	0.5268	0.0001
13	0.2616	0.5268	0.0001
14	0.2616	0.5268	0.0001
15	0.2617	0.5268	0.0002
16	0.2617	0.5268	0.0002
17	0.2615	0.5268	0.0000
18	0.2616	0.5268	0.0001
19	0.2616	0.5268	0.0001
20	0.2616	0.5268	0.0001
21	0.2616	0.5268	0.0001
22	0.2616	0.5268	0.0001
23	0.2616	0.5269	0.0001
24	0.2616	0.5269	0.0001
25	0.2617	0.5269	0.0002
26	0.2615	0.5269	0.0001
27	0.2615	0.5269	0.0001
28	0.2616	0.5269	0.0001
29	0.2616	0.5269	0.0001
30	0.2616	0.5269	0.0001
31	0.2616	0.5269	0.0001
32	0.2615	0.5269	0.0001
33	0.2615	0.5269	0.0001
34	0.2615	0.5269	0.0001
35	0.2615	0.5269	0.0001
36	0.2616	0.5269	0.0001
37	0.2616	0.5269	0.0001
38	0.2614	0.5269	0.0001
39	0.2615	0.5268	0.0000
40	0.2615	0.5269	0.0001
41	0.2615	0.5269	0.0001
42	0.2615	0.5269	0.0001
43	0.2615	0.5269	0.0001
44	0.2615	0.5269	0.0001
45	0.2615	0.5269	0.0001
46	0.2615	0.5268	0.0000
47	0.2615	0.5268	0.0000
48	0.2611	0.5268	0.0004
49	0.2612	0.5268	0.0003
50	0.2612	0.5268	0.0003

### 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 were 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 was  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$  for at least two hours immediately prior to the test. Luminaires were tested at rated voltage/frequency in an ambient temperature of  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ . The start time is defined as, the time between the application of power to the DUT and the point where the light source is continuously illuminated, and the light output is either constant or increasing.

##### Test Equipment:

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
2.0m integrating sphere	EVERFINE	R98	11010018	R98	2016-11-18	2017-11-18
Digital Power Meter	EVERFINE	PF2010A	1011004	600V/20A	2017-07-29	2018-07-29
Digital Oscilloscope	Tektronix	TDS 220	C033131	N/A	2017-08-31	2018-08-31
Photometric detector	EVERFINE	V-10111	A8331337	N/A	2017-03-03	2018-03-03
thermometer	Anymetre	JR900A	N/A	N/A	2017-03-20	2018-03-20
Special zero-voltage synchronous switching AC	EVERFINE	DPS1010-YF	1011001T	0-150V, 0-300V	2017-03-03	2018-03-03

##### Uncertainty:

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

##### Test Data:

Test date: 2017-11-08; Test voltage AC 120 V 60 Hz.

Sample No.	Time base (ms/div)	Start Time(ms)
RSZ160526515-S01	50.0	148.0



### 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	2017-03-03	2018-03-03
MODULAR IMPULSE GENERATOR	EMC-PARTNER	MIG0603IN1 IEC-ANSI	593	N/A	2017-03-03	2018-03-03

#### 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
RSZ160526515-S01	PASS



### 3.6. Operating Frequency

These test method was not accredited by the IAS

#### Test Method and ENERGY STAR Requirements:

##### ENERGY STAR Requirements:

$\geq 120$  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	2016-11-18	2017-11-18
2.0m integrating sphere	EVERFINE	R98	11010018	R98	2016-11-18	2017-11-18
Digital Power Meter	EVERFINE	PF2010A	1011004	600V/20A	2017-07-29	2018-07-29
thermometer	Anymetre	JR900A	N/A	N/A	2017-03-20	2018-03-20
Special zero-voltage synchronous switching AC	EVERFINE	DPS1010-YF	1011001T	0-150V, 0-300V	2017-03-03	2018-03-03

##### Uncertainty:

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

##### Test Data:

Sample No.	Operating Frequency (Hz)
RSZ160526515-S01	120.05

**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
spectroradiometer	EVERFINE	HAAS-2000	20140912	380-780nm	2016-11-18	2017-11-18
Rapid recording photometer	EVERFINE	PHOTO-2000F	1007010	0.1lm—200klm	2016-11-18	2017-11-18
2.0m integrating sphere	EVERFINE	R98	11010018	R98	2016-11-18	2017-11-18
Digital Power Meter	EVERFINE	PF2010A	1011004	600V/20A	2017-07-29	2018-07-29
Special zero-voltage synchronous switching AC	EVERFINE	DPS1010-YF	1011001T	0-150V, 0-300V	2017-03-03	2018-03-03
Standard Light Source	SENSING	N/A	LSD090808	N/A	2016-12-05	2017-12-05
Thermal Meter	Anymetre	JR900A	N/A	N/A	2017-03-20	2018-03-20
Precision frequency power supply	ALL Power	APW-105N	970613	220V±10% 50Hz	2017-03-03	2018-03-03
Sound Insulation Box	N/A	N/A	01#	N/A	2016-11-25	2017-11-25
Sound Level Meter	Hangzhou Aihua	AWA5661	88071	12~112dB	2017-09-27	2018-09-27

**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
RSZ160526515-S01	Light output (Lumen)	593.26	27.353
	Percentage	100%	4.6%
	Noise(dBA)	/	22.2

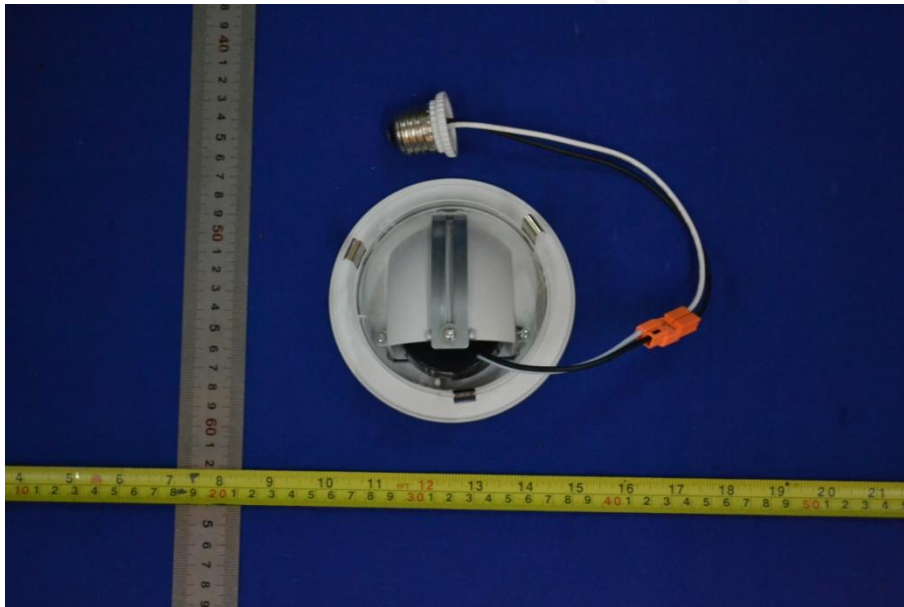
FINAL

## 4. EUT Photo

### 4.1. EUT Photo



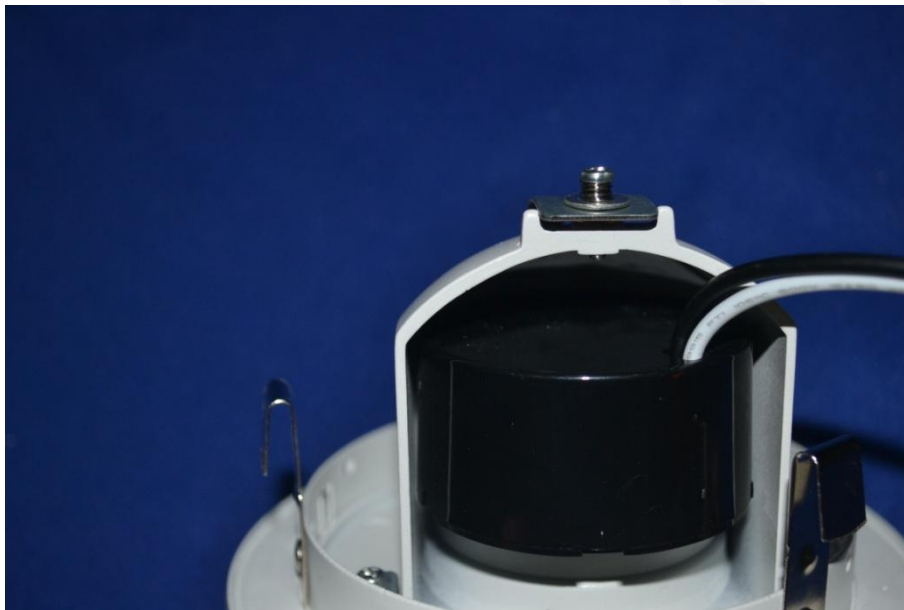
### 4.2. EUT Photo



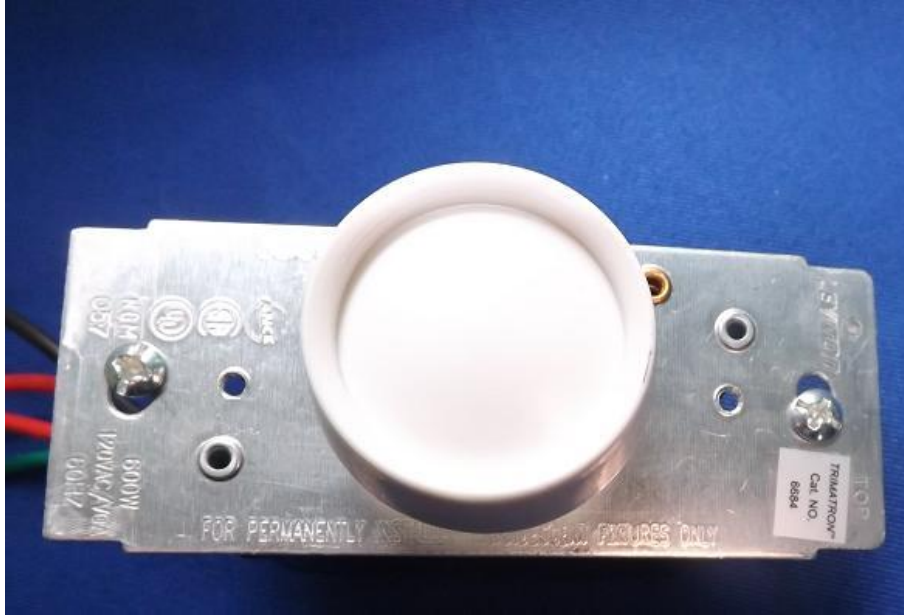
**4.3. LED Source Photo**



**4.4. LED Driver Photo**



**4.5. Dimmer Photo**



FINAL

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

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