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Test report of

IES LM-79-08

Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

Rendered to:

Light Efficient Design, LLC

188 S. Northwest Highway , Cary, IL 60013, USA

For products:

LED Lamps

Models No.:

LED-8090M50-G4,LED-8090-DL-E40-G4

Test Date: Sep. 20, 2018 to Nov. 12, 2018

Test Item: Total luminous flux, Luminous Efficacy, Electrical values, Luminous Intensity Distribution, Chromaticity coordinates, CCT and CRI, Spectral Power Distribution.

Test Lab.: **LCTECH (Zhongshan) Testing Service Co., Ltd**

2/F., Technology and Enterprise Development Center, Guangyuan Road, Xiaolan, Zhongshan, Guangdong, China

Tel:+86-760-22833366

Fax:+86-760-22833399

E-mail:Service@lccert.com

<http://www.lccert.com>

Template No.: LC-RT-PL-001 Rev.1.1

Test Note: *LED-8090M50-G4 and LED-8090-DL-E40-G4 are the same except for the model.*

Complied by:

Ray He

Project Engineer

Nov. 13, 2018

Reviewed by:

Richard Li

Technical Manager

Nov. 13, 2018

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1. General

1.1 Product Information

Brand Name	Light Efficient Design
Product Type	LED Lamp
Model Number	LED-8090M50-G4,LED-8090-DL-E40-G4
Rated Inputs	120-277VAC, 50/60Hz
Rated Power	110 W
Rated Light output	14500 lm
Declared CCT	5000K
Power Supply	Integrated in lamp
LED Package, Array or Module	Model: SPMWHT541MXXXXXXX, manufactured by SAMSUNG ELECTRONICS CO.,LTD.
Receipt Samples	1 unit
Sample Code of lab.	180828102006
Date of Receipt Samples	Aug. 28, 2018
Note	-

1.2 Standards or methods

The following standards are partly or totally used or referenced for test:

No.	Name
ANSI/NEMA/ ANSLG C78.377-2015	Specifications for the Chromaticity of Solid State Lighting Products
ANSI C82.77-2002	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
IES LM-79-08	Electrical and Photometric Measurements of Solid-State Lighting Products

1.3 Equipment list

Instrument	ID	Model name	Cal. date	Next cal. Date
AC Power supply	LC-I-987	APW-120N	2018-01-10	2019-01-09
AC Power supply	LC-I-989	APW-120N	2018-01-10	2019-01-09
Power analyzer	LC-I-928	WT210	2018-01-05	2019-01-05
Power analyzer	LC-I-954	WT210	2018-01-10	2019-01-09
Multimeter	LC-I-972	Fluke 17B	2018-08-01	2019-07-31
Photometric colorimetric electric system [*] (2 meter sphere)	LC-I-956	HAAS-2000	Before use	Before use
Standard lamp ^{**}	LC-PL-I-011	D204C	2018-08-09	2019-08-08
Luminous Flux Standard Lamp ^{***}	LC-PL-I-003	24V100W	2018-08-09	2019-08-08
Goniophotometer(with mirror)	LC-I-902	GMS2000	2018-05-06	2019-05-05
Wireless temperature transmitter	LC-I-978	DWRF-B	2018-02-11	2019-02-10
Wireless temperature transmitter	LC-I-979	DWRF-B	2018-02-11	2019-02-10

Note:

* Bandwidth of spectroradiometer is 1 nm.

** halogen lamp, 100W, omni-directional type, and its traceability to NIM.

*** halogen lamp, 100W, omni-directional type, and its traceability to NIM.

2. Test conducted and method

The lamp was operated at least 2 hours to reach stabilization and temperature equilibrium before test.

2.1 Ambient Condition

The ambient temperature in which measurements are being taken was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$; the air flow around the sample(s) being tested did not affect the performance.

2.2 Power Supply Characteristics

The AC power supply had a sinusoidal voltage wave shape at the prescribed frequency (60 Hz) such that the RMS summation of the harmonic components does not exceed 3 percent of the fundamental during operation of the test item.

The voltage of AC power supply (RMS voltage) applied to the device under test was regulated to within ± 0.2 percent under load.

2.3 Seasoning and Stabilization

No seasoning was performed in accordance with IESNA LM-79-08. And before the measurement, the sample was stabilized until the light output and power variations were less than 0.5% in 30 minutes intervals (3 readings, 15 minutes apart).

2.4 Electrical Instrumentation

The calibration uncertainties of the instruments for AC voltage and current were less than 0.2 percent, and the calibration uncertainty of the AC power meter was less than 0.5 percent (95 % confidence interval, $k=2$).

2.5 Color Measurement Method

Spectral radiant flux was measured by a sphere (2 meter)-spectroradiometer system, and the color characteristics (Color rendering index, correlated color temperature, chromaticity coordinate) were calculated from these by software automatically.

2.6 Total Luminous Flux Measurement Method

Total luminous flux was measured by type C goniophotometer system.

Light intensity distribution was measured by a type C goniophotometer (with mirror) which can keep the sample in burn position when the tests conduct, and the total luminous flux was calculated from the intensity data by software automatically.

2.7 Luminous Intensity Distribution Measurement Method

Luminous intensity distribution was measured by a mirror-type goniophotometer (Type C) which can keep the sample in burn position when the tests conduct, and the kinds of graph were generated by software automatically.

2.8 Spatial Non-uniformity of Chromaticity

The customer did not require this measurement.

3. Test Result Summary

3.1 Electrical data

Criteria Item	Result(Sphere)	Result(Goniophotometer)
Input Voltage & Frequency	120.00 V~60Hz	120.05 V~60Hz
Input Current(A)	0.915	0.915
Total Power(W)	109.68	109.67
Power Factor	0.999	0.999
Off-state Power(W)	-	-

3.2 Photometric data

Criteria Item	Result(Sphere)	Result(Goniophotometer)
Total Lumens(lm)	- ⁴	14566.56
Luminaire Efficacy(Lm/W)	-	132.82
Correlated Color Temperature (CCT)(K)	5292	-
Color Rendering Index (CRI)	84.3	-
R9	13	-
Chromaticity Coordinate (x,y)	x = 0.3373 y = 0.3431	-
Chromaticity Coordinate (u,v)	u' = 0.2094 v' = 0.3195	-
Chromaticity Coordinate (u',v')	u' = 0.2094 v' = 0.4793	-
Duv	-0.0011	-
Zone Lumens between 0-60 °	-	79.58%

3.3 Color Rendering Details

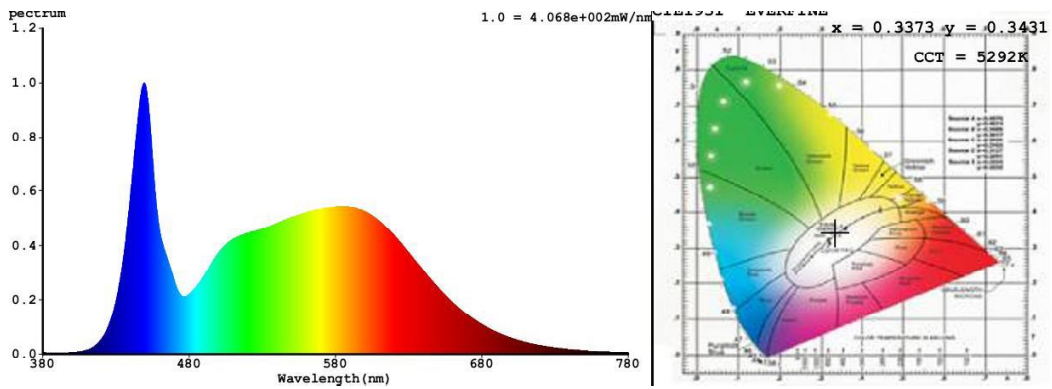
R1	R2	R3	R4	R5	R6	R7	R8
83	88	92	85	85	84	87	70
R9	R10	R11	R12	R13	R14	R15	-
13	72	86	68	84	95	79	-

Note:

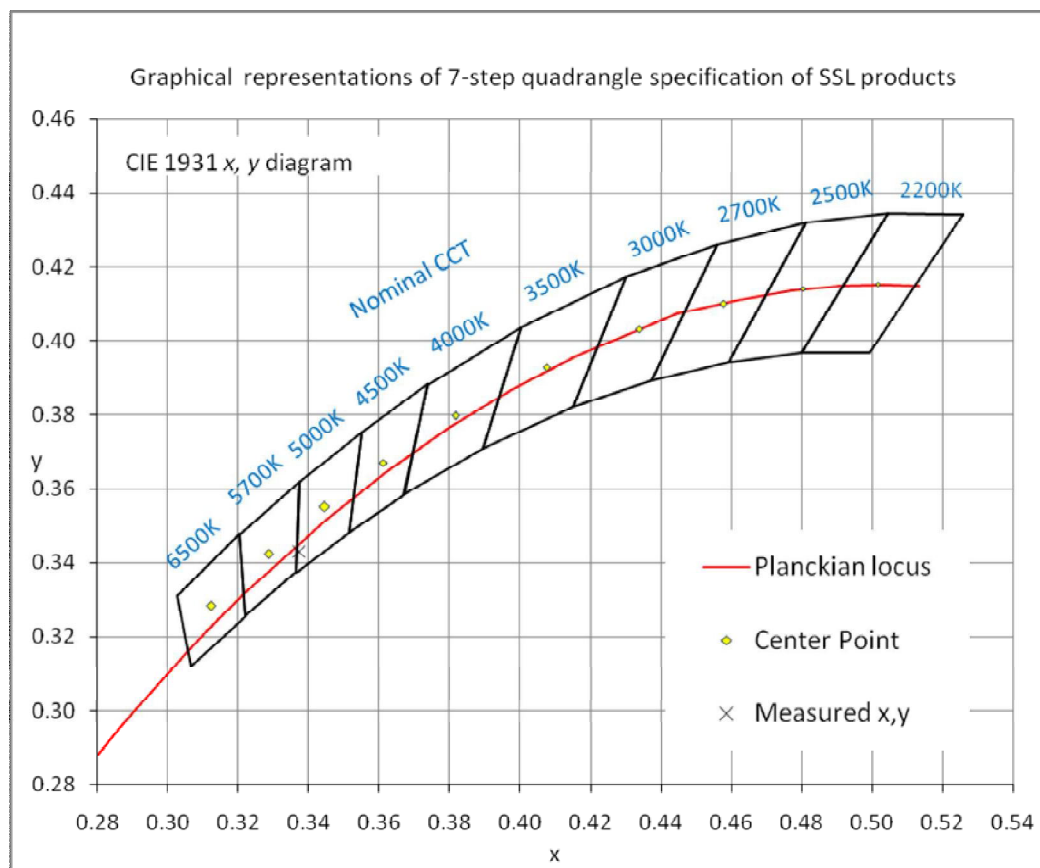
4, Self-absorption is 1.

4. Test Data

4.1 Spectral Distribution



4.2 ANSI Chromaticity Quadrangles Diagram



4.3 Goniometry Test Data

CIE Type	Direct	Basic Luminous Shape	Rectangular
Spacing Criteria (0-180)	1.26	Luminous Length	0.14 m
Spacing Criteria (90-270)	1.30	Luminous Width	0.09 m
Spacing Criteria (Diagonal)	1.40	Luminous Height	0.00 m
Test Distance	30.00 m		

4.4 Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixt
0-20	1865.72	12.80	12.80
0-30	3973.59	27.30	27.30
0-40	6526.88	44.80	44.80
0-60	11591.6	79.60	79.60
0-80	14286.73	98.10	98.10
0-90	14497.1	99.50	99.50
10-90	14015.62	96.20	96.20
20-40	4661.16	32.00	32.00
20-50	7324.11	50.30	50.30
40-70	6841.02	47.00	47.00
60-80	2695.12	18.50	18.50
70-80	918.82	6.30	6.30
80-90	210.37	1.40	1.40
90-110	29.55	0.20	0.20
90-120	36.27	0.20	0.20
90-130	42.12	0.30	0.30
90-150	54.30	0.40	0.40
90-180	69.46	0.50	0.50
110-180	39.91	0.30	0.30
0-180	14566.56	100.00	100.00

Total Luminaire Efficiency = 100.00%

ZONAL LUMEN SUMMARY

Zone	Lumens
0-10	481.48
10-20	1384.24
20-30	2107.87
30-40	2553.29
40-50	2662.95
50-60	2401.78
60-70	1776.3
70-80	918.82
80-90	210.37
90-100	20.59
100-110	8.97
110-120	6.71
120-130	5.85
130-140	5.36
140-150	6.82
150-160	7.15
160-170	5.77
170-180	2.24



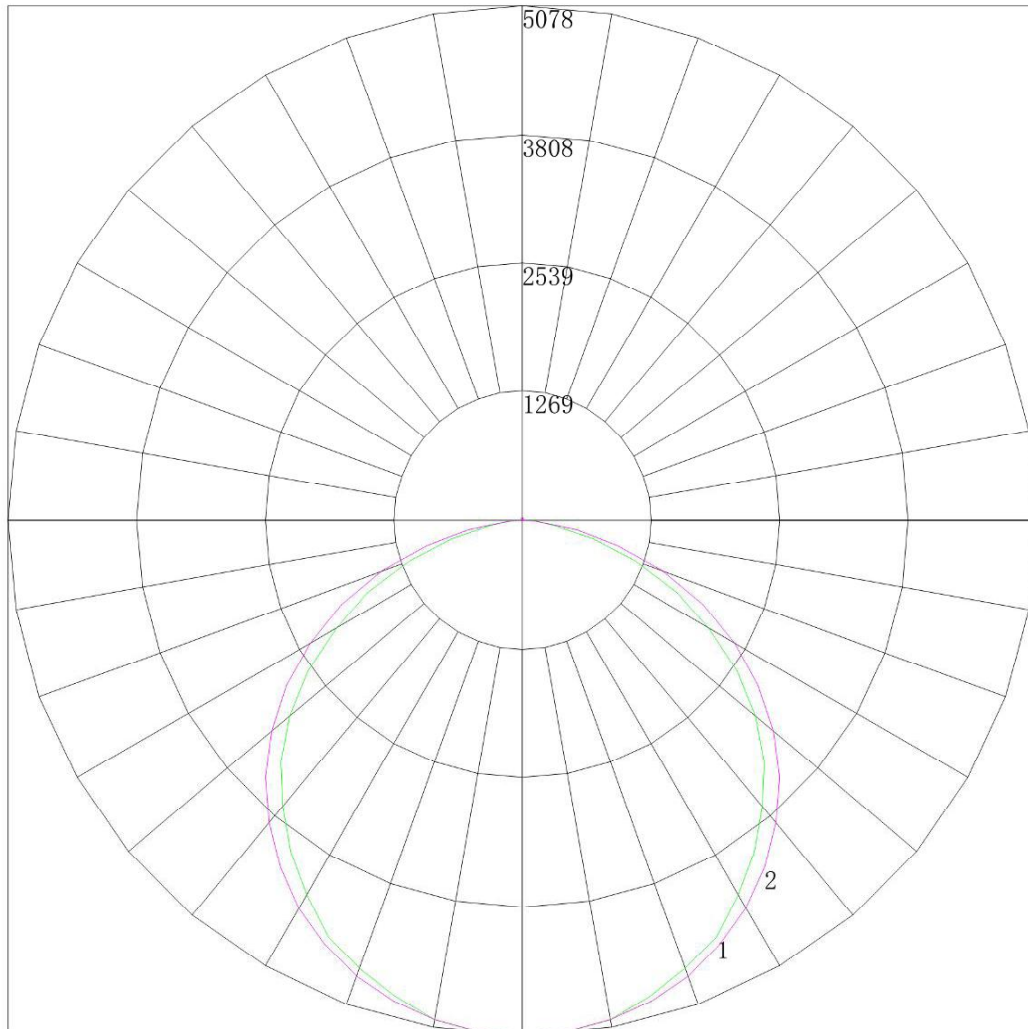
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4.5 Polar Curves

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Maximum Candela = 5077.652 Located At Horizontal Angle = 0, Vertical Angle = 0

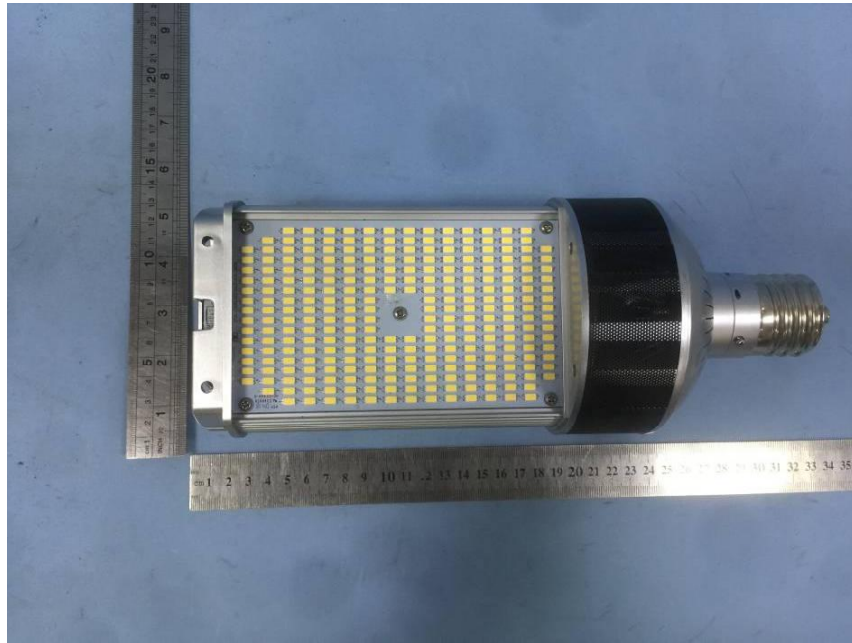
1 - Vertical Plane Through Horizontal Angles (0 - 180)

2 - Vertical Plane Through Horizontal Angles (90 - 270)

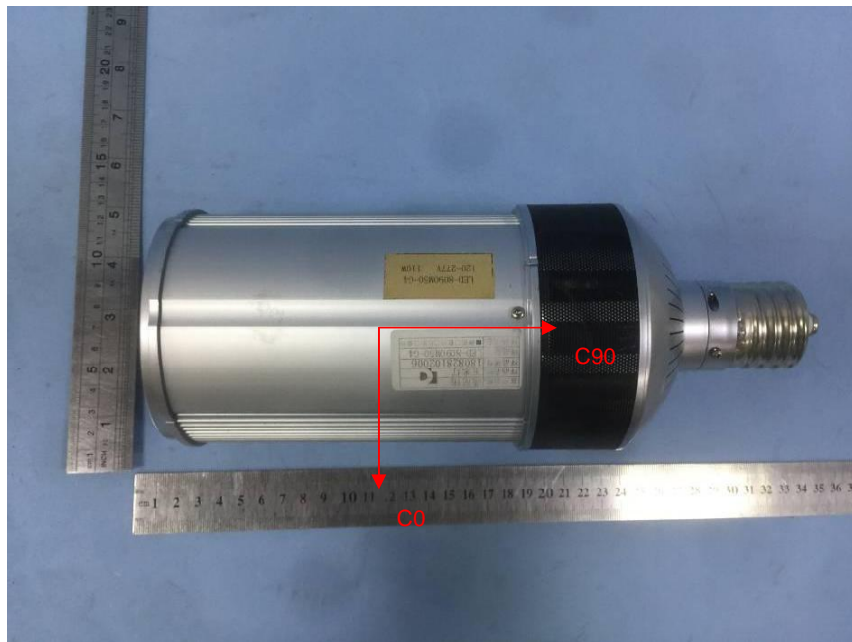
4.6 Candela Tabulation

	<u>0</u>	<u>15</u>	<u>30</u>	<u>45</u>	<u>60</u>	<u>75</u>	<u>90</u>
0	5077.652	5077.652	5077.652	5077.652	5077.652	5077.652	5077.652
5	5058.257	5065.231	5065.703	5061.668	5056.977	5059.031	5059.261
10	4998.722	5020.549	5017.228	5011.909	5007.313	5002.710	5000.506
15	4860.708	4881.742	4908.531	4928.620	4920.350	4911.614	4909.026
20	4703.300	4708.889	4722.297	4759.347	4798.106	4785.738	4784.362
25	4535.067	4543.915	4545.557	4554.304	4616.756	4623.513	4615.751
30	4256.333	4274.462	4324.994	4348.805	4374.742	4428.305	4412.607
35	3989.777	4002.104	4009.339	4087.007	4121.041	4184.181	4170.461
40	3683.079	3699.909	3725.266	3753.867	3837.675	3901.246	3890.208
45	3376.381	3374.739	3374.656	3430.204	3496.779	3573.435	3587.092
50	3004.736	3006.219	3034.635	3056.309	3112.969	3209.490	3233.293
55	2583.928	2609.670	2645.495	2666.901	2727.361	2813.466	2841.833
60	2119.913	2139.656	2186.554	2232.530	2301.077	2380.642	2426.157
65	1687.334	1695.047	1723.630	1789.100	1836.315	1923.433	1969.236
70	1185.477	1203.614	1274.886	1329.464	1390.716	1429.191	1471.450
75	722.995	753.181	824.681	875.207	883.446	940.004	971.589
80	333.759	380.857	421.588	463.695	487.201	512.010	539.705
85	117.943	132.500	148.397	145.818	152.884	154.681	149.333
90	39.420	46.566	46.903	34.946	26.317	20.057	9.412
95	12.539	18.510	23.365	20.082	15.034	10.007	5.514
100	7.307	10.540	13.736	12.990	10.270	7.516	4.662
105	7.758	8.801	10.239	9.906	7.865	6.170	4.393
110	7.758	8.373	8.660	8.217	6.922	5.744	4.527
115	7.713	7.832	7.511	6.911	6.135	5.362	4.527
120	7.758	7.516	6.834	6.348	5.978	5.452	4.841
125	7.487	7.245	6.833	6.506	6.292	5.968	5.605
130	7.171	6.996	6.765	6.618	6.292	6.148	5.964
135	6.720	6.680	6.539	6.505	6.202	6.058	5.964
140	8.795	8.733	8.658	8.464	8.270	8.167	8.026
145	11.501	11.306	11.228	10.939	10.809	10.703	10.761
150	13.801	13.473	13.416	13.213	13.056	12.902	12.823
155	15.696	15.662	15.468	15.351	15.326	15.101	15.155
160	18.402	18.460	18.443	18.323	18.067	18.062	17.981
165	21.063	20.988	20.811	20.686	20.584	20.463	20.493
170	22.687	22.703	22.570	22.397	22.337	22.258	22.197
175	23.859	23.944	23.923	23.860	23.797	23.672	23.497
180	24.867	24.867	24.867	24.867	24.867	24.867	24.867

Appendix A Product Photo



Picture 1



Picture 2

****End of test report****