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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-8090M40-G4,LED-8090-CW-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.

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

Test Note: *LED-8090M40-G4 and LED-8090-CW-E40-G4 are the same except for the model.*

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Nov. 13, 2018

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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-8090M40-G4,LED-8090-CW-E40-G4
Rated Inputs	120-277VAC, 50/60Hz
Rated Power	110W
Rated Light output	15000 lm
Declared CCT	4000K
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.	180920101003
Date of Receipt Samples	Sep. 20, 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	120.00 V~60Hz
Input Current(A)	0.928	0.928
Total Power(W)	111.26	111.24
Power Factor	0.999	0.999
Off-state Power(W)	-	-

3.2 Photometric data

Criteria Item	Result(Sphere)	Result(Goniophotometer)
Total Lumens(lm)	- ⁴	15430.58
Luminaire Efficacy(Lm/W)	-	138.71
Correlated Color Temperature (CCT)(K)	4119	-
Color Rendering Index (CRI)	84.2	-
R9	14	-
Chromaticity Coordinate (x,y)	x = 0.3752 y = 0.3732	-
Chromaticity Coordinate (u,v)	u = 0.2231 v = 0.3328	-
Chromaticity Coordinate (u',v')	u' = 0.2231 v' = 0.4992	-
Duv	0.0001	-
Zone Lumens between 0-60 °	-	79.26%

3.3 Color Rendering Details

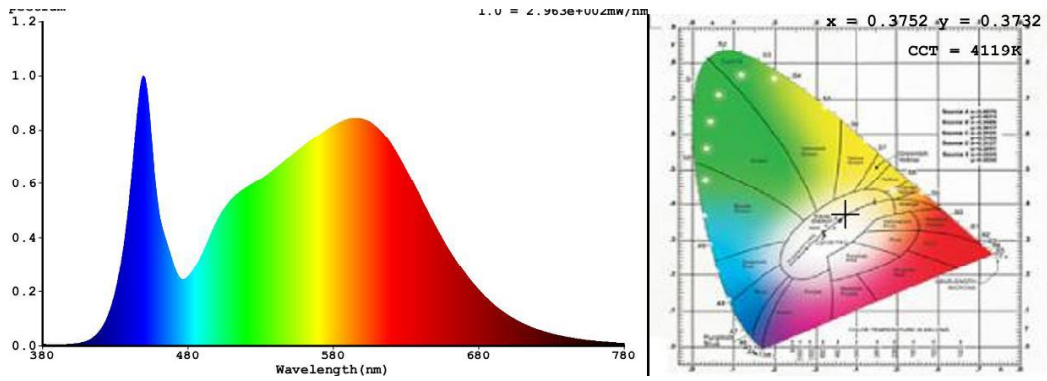
R1	R2	R3	R4	R5	R6	R7	R8
83	89	94	84	83	85	87	67
R9	R10	R11	R12	R13	R14	R15	-
14	75	84	67	84	97	77	-

Note:

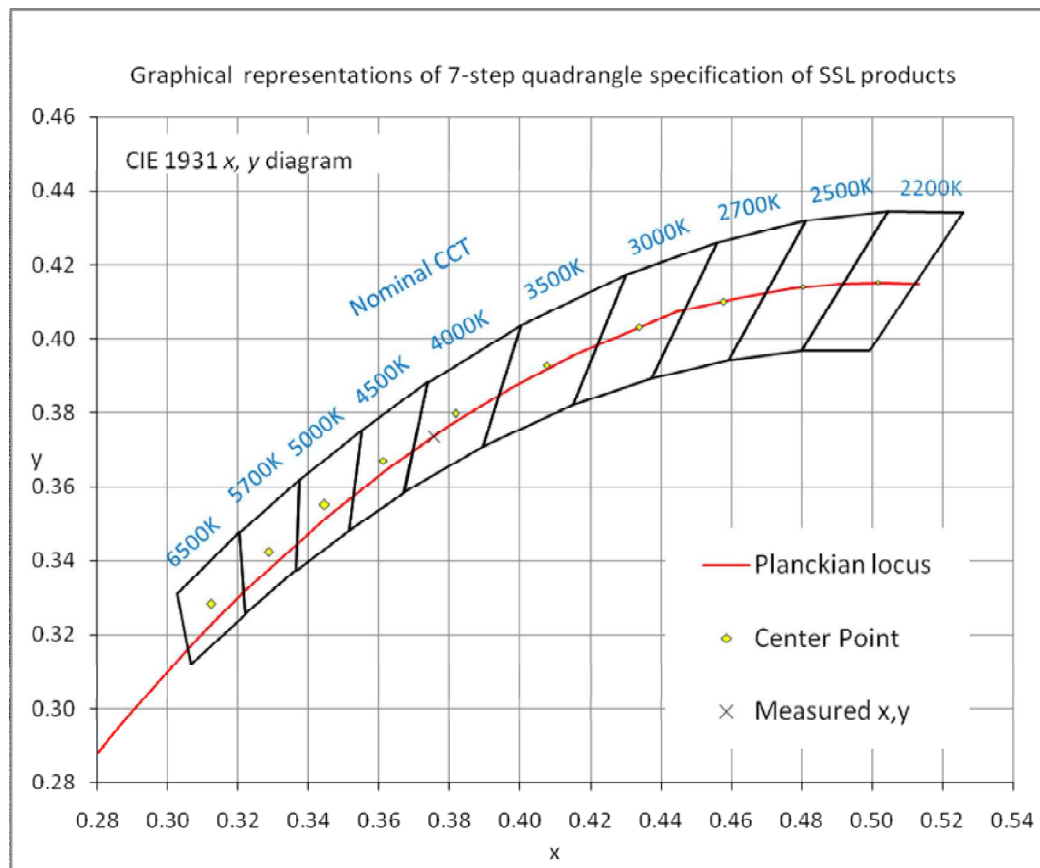
4, Self-absorption is 1.

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	1964.94	12.70	12.70
0-30	4186.24	27.10	27.10
0-40	6875.21	44.60	44.60
0-60	12230.43	79.30	79.30
0-80	15118.91	98.00	98.00
0-90	15358.85	99.50	99.50
10-90	14850.92	96.20	96.20
20-40	4910.27	31.80	31.80
20-50	7718.95	50.00	50.00
40-70	7251.68	47.00	47.00
60-80	2888.48	18.70	18.70
70-80	992.02	6.40	6.40
80-90	239.94	1.60	1.60
90-110	30.70	0.20	0.20
90-120	37.23	0.20	0.20
90-130	43.01	0.30	0.30
90-150	55.56	0.40	0.40
90-180	71.72	0.50	0.50
110-180	41.03	0.30	0.30
0-180	15430.57	100.00	100.00

Total Luminaire Efficiency = 100.00%

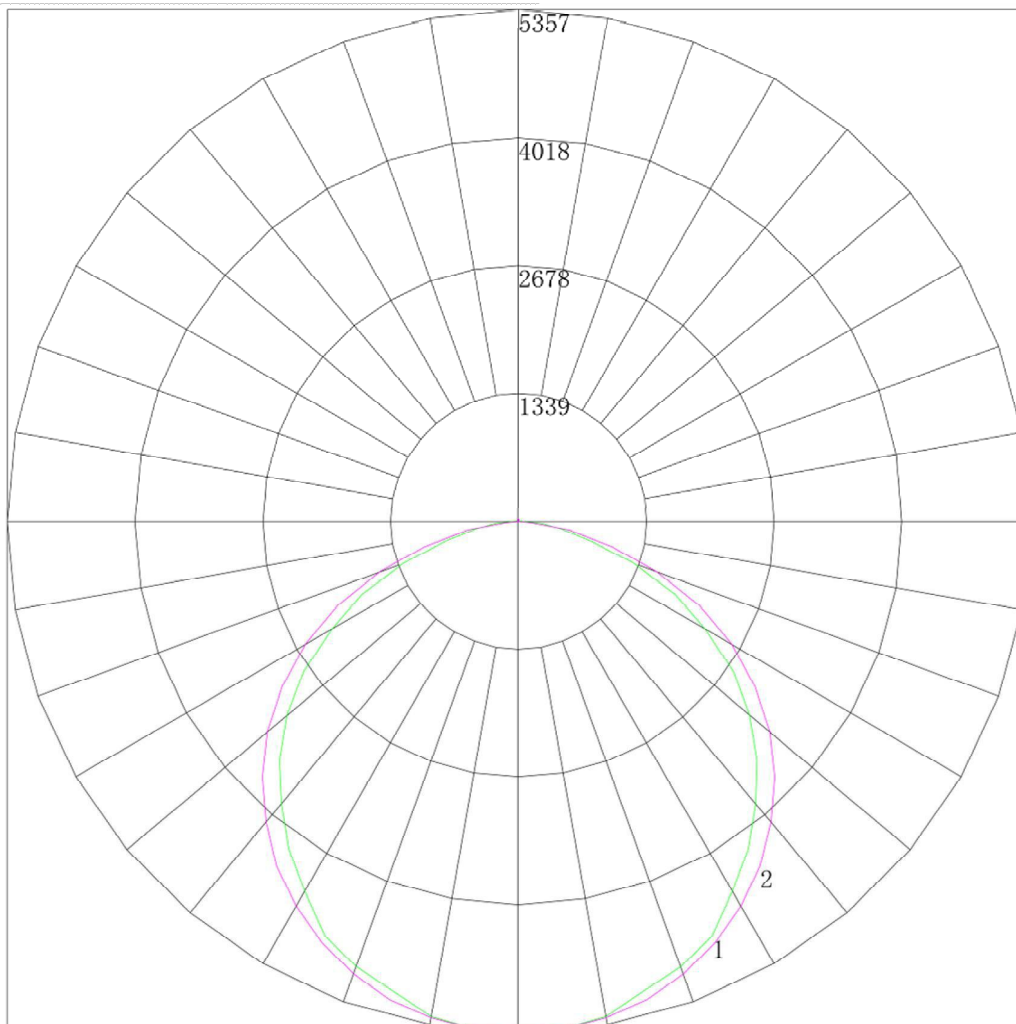
ZONAL LUMEN SUMMARY

Zone	Lumens
0-10	507.93
10-20	1457.01
20-30	2221.3
30-40	2688.97
40-50	2808.68
50-60	2546.54
60-70	1896.47
70-80	992.02
80-90	239.94
90-100	22.00
100-110	8.70
110-120	6.53
120-130	5.78
130-140	5.44
140-150	7.11
150-160	7.60
160-170	6.17
170-180	2.40



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4.5 Polar Curves



Maximum Candela = 5356.764 Located At Horizontal Angle = 0, Vertical Angle = 0

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

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

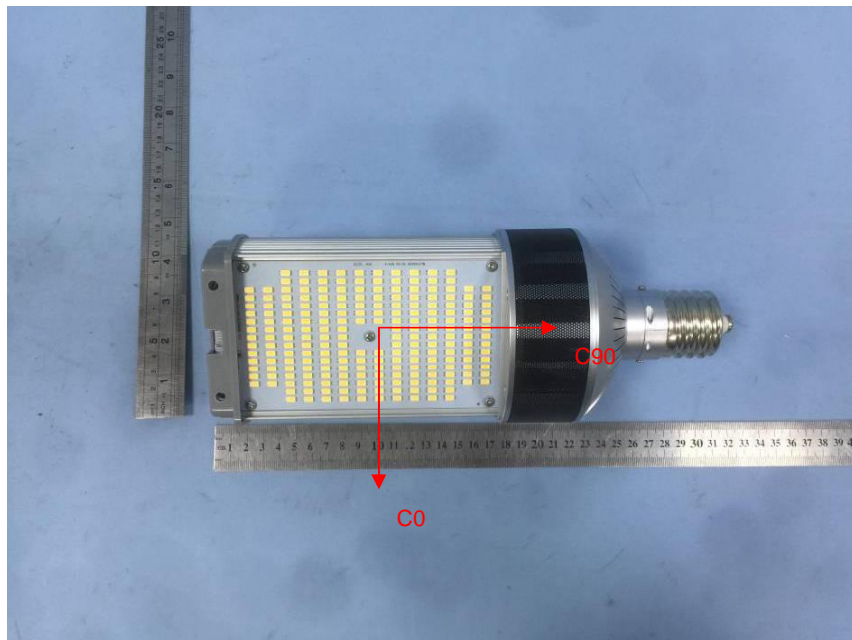
4.6 Candela Tabulation

	<u>0</u>	<u>15</u>	<u>30</u>	<u>45</u>	<u>60</u>	<u>75</u>	<u>90</u>
0	5356.764	5356.764	5356.764	5356.764	5356.764	5356.764	5356.764
5	5339.624	5343.448	5340.984	5338.070	5340.354	5339.704	5337.960
10	5271.063	5284.998	5284.187	5287.183	5287.315	5280.888	5283.331
15	5090.640	5115.285	5127.999	5179.771	5192.016	5185.260	5191.082
20	4969.305	4975.816	4972.044	4984.785	5049.518	5054.154	5048.233
25	4793.844	4798.421	4803.910	4802.409	4831.735	4883.542	4874.035
30	4479.908	4497.584	4533.675	4590.749	4600.027	4673.195	4659.980
35	4193.485	4210.296	4213.415	4291.715	4353.036	4416.153	4415.926
40	3865.566	3868.167	3914.573	3952.187	4066.254	4115.558	4118.135
45	3537.647	3561.018	3551.717	3615.540	3697.863	3777.480	3795.708
50	3162.818	3178.713	3187.504	3219.030	3292.867	3403.035	3436.116
55	2752.356	2763.683	2797.146	2832.607	2875.499	3003.896	3025.028
60	2251.005	2269.749	2310.140	2396.237	2434.307	2552.674	2578.555
65	1811.358	1799.361	1838.450	1920.380	1965.216	2053.208	2090.886
70	1283.801	1316.226	1394.192	1427.023	1490.536	1495.897	1546.929
75	778.977	862.734	919.367	931.143	947.103	977.247	1019.131
80	446.683	470.628	486.744	497.725	498.185	512.725	536.922
85	234.731	209.366	191.125	162.462	156.274	146.072	137.368
90	64.366	61.752	54.100	37.263	25.142	15.383	4.166
95	19.711	23.789	24.120	18.378	12.655	7.790	3.449
100	6.405	10.652	14.381	12.364	9.531	6.645	3.897
105	7.217	7.831	10.391	9.797	7.913	6.151	4.479
110	6.946	7.358	8.317	8.175	6.991	5.949	4.703
115	6.766	7.064	7.190	7.004	6.294	5.657	4.748
120	6.631	6.613	6.491	6.441	6.136	5.747	5.106
125	6.631	6.590	6.649	6.575	6.541	6.331	5.956
130	6.585	6.635	6.671	6.665	6.518	6.488	6.314
135	6.495	6.567	6.513	6.508	6.383	6.353	6.359
140	8.705	8.869	8.745	8.624	8.653	8.598	8.688
145	11.547	11.623	11.562	11.416	11.418	11.359	11.420
150	14.028	14.083	13.974	13.893	13.823	13.761	13.883
155	16.509	16.588	16.363	16.393	16.295	16.298	16.211
160	19.576	19.544	19.585	19.477	19.441	19.351	19.480
165	22.282	22.297	22.155	22.067	22.026	22.022	22.032
170	24.267	24.261	24.116	24.026	23.981	23.908	24.002
175	25.755	25.637	25.648	25.647	25.600	25.502	25.436
180	26.761	26.761	26.761	26.761	26.761	26.761	26.761

Appendix A Product Photo



Picture 1



Picture 2

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