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Test report of

IES LM-79-08

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

Rendered to:

Elec-Tech International Co., Ltd.

No.1 Jinfeng Road, Tangjiawan Town, Xiangzhou District,
Zhuhai City, Guangdong Province, P.R. China 519085

For products:

LED Downlight

Models No.:

538091##(##=00-99)

(The product is a color tunable luminaire, tunable to 3000K, 4000K, 5000K and ## can be 00-99 and represent different client and sales districts.)

Test Date: May. 17, 2018 to May. 19, 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: *This product is a tunable luminaire, this test was set on 2700K.*

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May. 25, 2018

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1. General

1.1 Product Information

Brand Name	-
Product Type	LED Downlight
Model Number	538091##(##=00-99)
Rated Inputs	120VAC, 60Hz
Rated Power	8.5W
Rated Light output	450lm
Declared CCT	2700K
Power Supply	LED Driver
LED Package, Array or Module	SPMWHX229AXXXXXXXX, SAMSUNG ELECTRONICS., LTD
Receipt Samples	1 unit
Sample Code of lab.	180515108004
Date of Receipt Samples	May. 15, 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-923	CHP-500	2018-01-10	2019-01-09
AC Power supply	LC-I-987	APW-110N	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	2017-08-08	2018-08-07
Photometric colorimetric electric system ¹ (2 meter sphere)	LC-I-900	SPR3000	Before use	Before use
Standard lamp ²	LC-PL-I-011	D204C	2017-09-07	2018-09-06
Luminous Flux Standard Lamp ³	LC-PL-I-003	24V100W	2017-09-22	2018-09-21
Goniophotometer(with mirror)	LC-I-902	GMS2000	2018-05-07	2019-05-06
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:

1, Bandwidth of spectroradiometer is 1 nm.

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

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

2. Test conducted and method

The luminaire 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 $25\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$; 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 both sphere-spectroradiometer system and 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.

Spectral radiant flux was measured by a sphere (2 meter)-spectroradiometer system, and the total luminous flux was calculated from these 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	120.07 V~60Hz
Input Current(A)	0.071	0.071
Total Power(W)	8.34	8.27
Power Factor	0.974	0.972
Off-state Power(W)	-	-

3.2 Photometric data

Criteria Item	Result(Sphere)	Result(Goniophotometer)
Total Lumens(lm)	514.44 ⁴	519.79
Luminaire Efficacy(Lm/W)	61.68	62.85
Correlated Color Temperature (CCT)(K)	2690	-
Color Rendering Index (CRI)	91.3	-
R9	56	-
Chromaticity Coordinate (x,y)	x = 0.4565 y = 0.4032	-
Chromaticity Coordinate (u,v)	u = 0.2636 v = 0.3493	-
Chromaticity Coordinate (u',v')	u' = 0.2636 v' = 0.5240	-
Duv	-0.0025	-
Zone Lumens between 0-60 °	-	81.01%

3.3 Color Rendering Details

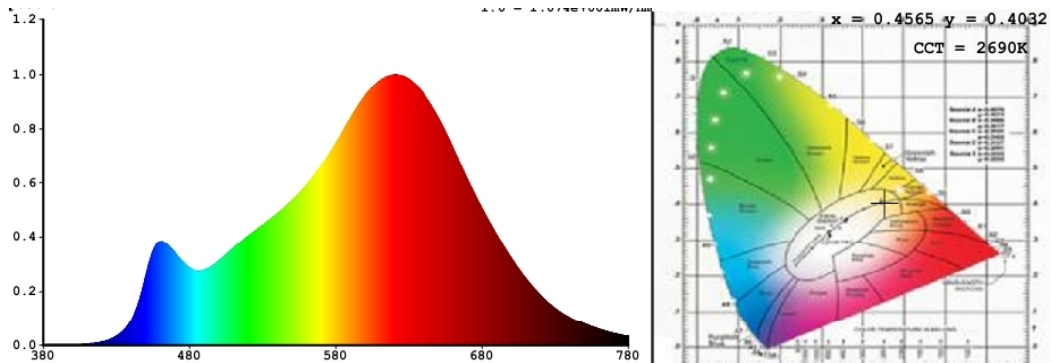
R1	R2	R3	R4	R5	R6	R7	R8
94	99	93	91	94	95	87	77
R9	R10	R11	R12	R13	R14	R15	-
56	99	92	85	96	97	89	-

Note:

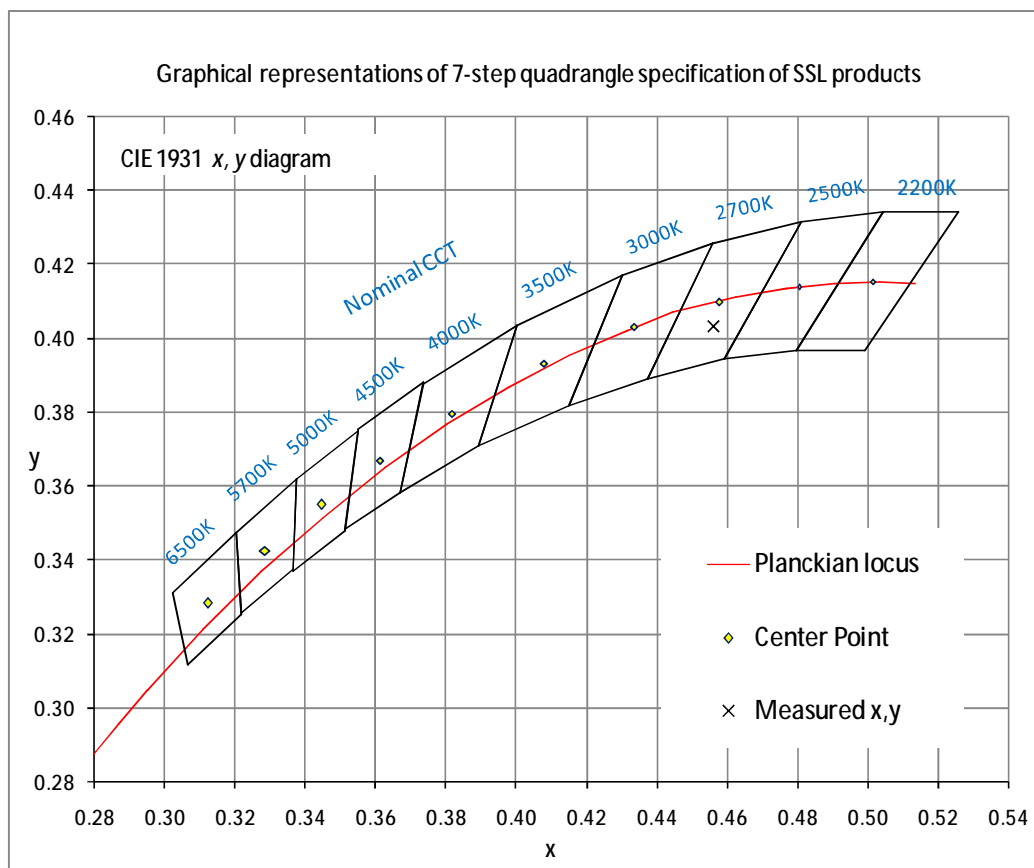
4, Self-absorption is 1.035.

4. Test Data

4.1 Spectral Distribution



4.2 ANSI Chromaticity Quadrangles Diagram



4.3 Goniometry Test Data

CIE Type	Direct	Basic Luminous Shape	Circular
Spacing Criteria (0-180)	1.24	Luminous Length	0.05 m (Diameter)
Spacing Criteria (90-270)	1.26	Luminous Width	0.05 m (Diameter)
Spacing Criteria (Diagonal)	1.36	Luminous Height	0.0 m
Test Distance	29.79 m		

4.4 Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixt
0-20	70.60	13.60	13.60
0-30	149.16	28.70	28.70
0-40	242.41	46.60	46.60
0-60	421.10	81.00	81.00
0-80	514.82	99.00	99.00
0-90	519.28	99.90	99.90
10-90	500.96	96.40	96.40
20-40	171.81	33.10	33.10
20-50	266.55	51.30	51.30
40-70	240.83	46.30	46.30
60-80	93.72	18.00	18.00
70-80	31.57	6.10	6.10
80-90	4.46	0.90	0.90
90-110	0.04	0.00	0.00
90-120	0.08	0.00	0.00
90-130	0.13	0.00	0.00
90-150	0.27	0.10	0.10
90-180	0.51	0.10	0.10
110-180	0.46	0.10	0.10
0-180	519.79	100.00	100.00

Total Luminaire Efficiency = 100.00%

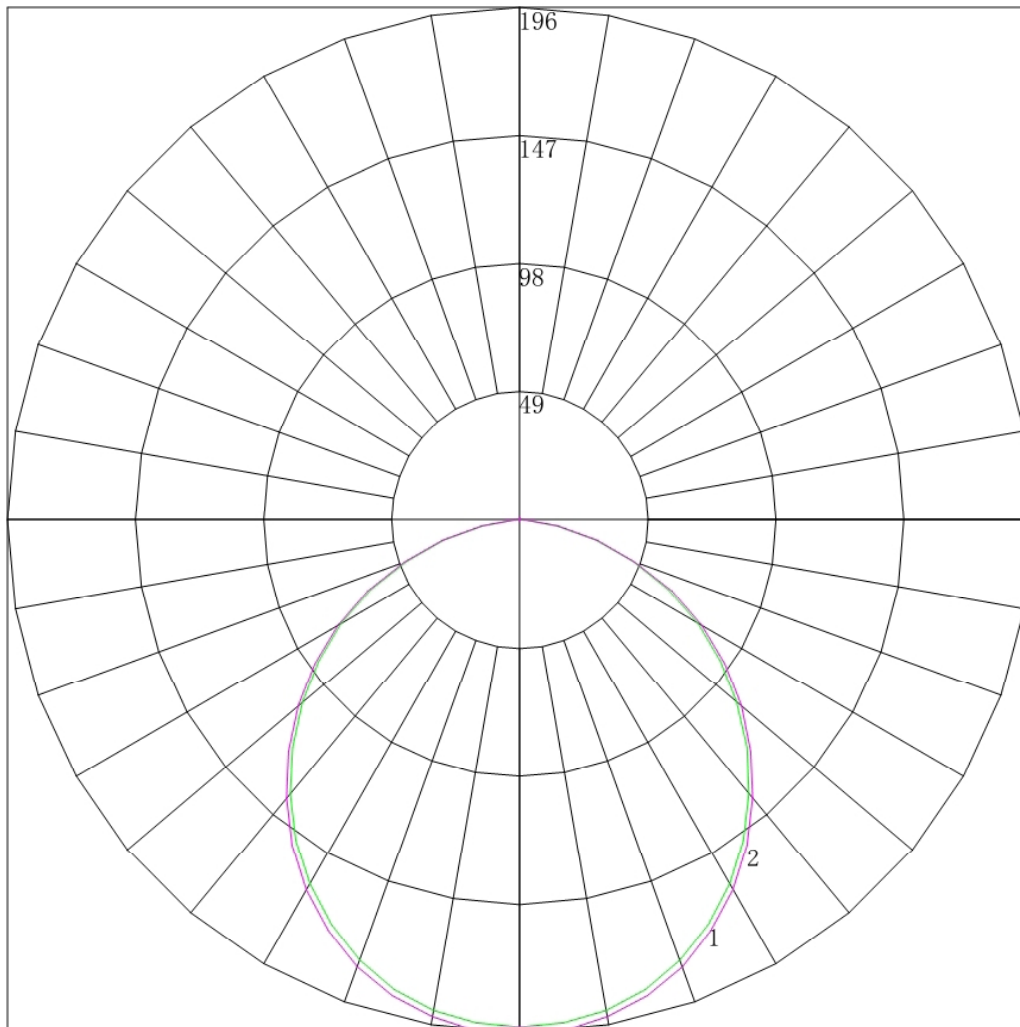
ZONAL LUMEN SUMMARY

Zone	Lumens
0-10	18.32
10-20	52.29
20-30	78.56
30-40	93.25
40-50	94.75
50-60	83.94
60-70	62.14
70-80	31.57
80-90	4.46
90-100	0.01
100-110	0.03
110-120	0.04
120-130	0.05
130-140	0.07
140-150	0.07
150-160	0.09
160-170	0.10
170-180	0.04



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4.5 Polar Curves



Maximum Candela = 195.65 Located At Horizontal Angle = 90, Vertical Angle = 5

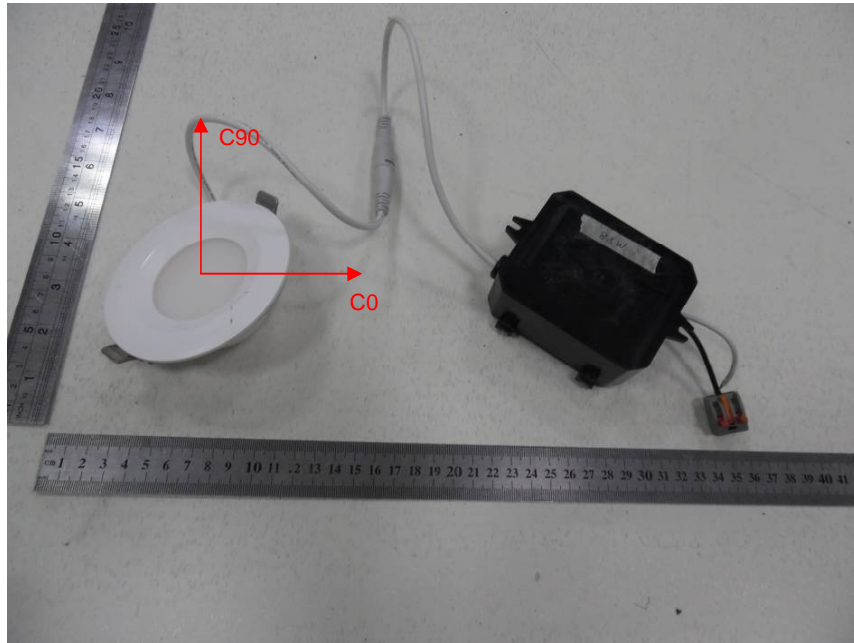
1 - Vertical Plane Through Horizontal Angles (0 - 180)

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

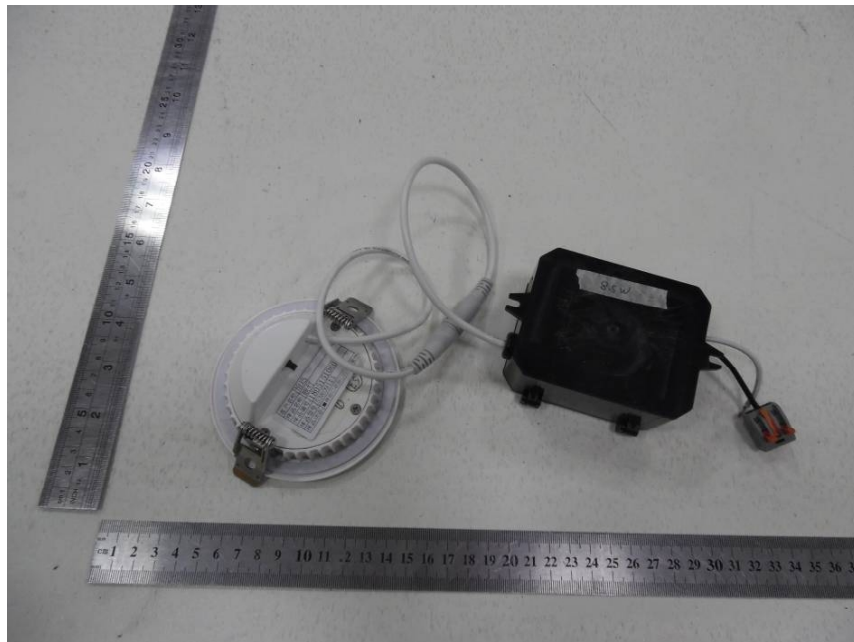
4.6 Candela Tabulation

	<u>0</u>	<u>15</u>	<u>30</u>	<u>45</u>	<u>60</u>	<u>75</u>	<u>90</u>
0	193.546	193.546	193.546	193.546	193.546	193.546	193.546
5	192.744	192.656	192.457	192.700	192.658	192.553	195.650
10	190.115	189.717	189.569	189.853	189.884	189.549	192.474
15	185.437	185.152	184.926	185.295	185.137	184.872	188.082
20	178.843	178.561	178.572	178.759	179.036	178.447	181.534
25	170.199	170.211	170.196	170.575	170.583	170.212	172.837
30	160.442	160.257	160.311	160.435	160.598	160.302	162.907
35	149.036	148.813	148.847	149.050	148.863	149.022	151.397
40	136.248	135.963	136.162	136.064	136.350	136.371	138.435
45	122.659	122.670	122.122	122.811	122.773	122.732	124.864
50	108.224	108.397	108.192	108.469	108.707	108.428	110.465
55	93.699	93.544	93.529	93.726	94.110	93.881	95.495
60	78.595	78.426	78.467	78.606	79.024	78.826	80.169
65	62.733	62.682	62.916	62.729	63.317	63.064	64.187
70	45.891	46.182	46.143	46.119	46.212	46.465	46.713
75	29.941	29.348	29.482	29.686	29.307	29.558	30.427
80	14.168	14.385	14.285	14.298	14.287	14.327	14.628
85	1.337	1.180	1.066	0.845	0.843	0.970	1.344
90	0.000	0.022	0.000	0.000	0.000	0.000	0.000
95	0.000	0.022	0.000	0.000	0.000	0.000	0.045
100	0.045	0.022	0.022	0.022	0.022	0.022	0.045
105	0.000	0.044	0.044	0.022	0.022	0.022	0.045
110	0.045	0.044	0.044	0.044	0.022	0.044	0.000
115	0.045	0.045	0.000	0.022	0.067	0.044	0.088
120	0.045	0.045	0.067	0.044	0.022	0.044	0.045
125	0.000	0.022	0.089	0.022	0.044	0.066	0.066
130	0.089	0.089	0.089	0.111	0.066	0.088	0.066
135	0.089	0.089	0.089	0.089	0.133	0.066	0.088
140	0.089	0.067	0.089	0.066	0.089	0.088	0.066
145	0.134	0.134	0.089	0.156	0.111	0.088	0.131
150	0.134	0.156	0.156	0.133	0.111	0.132	0.220
155	0.178	0.223	0.178	0.222	0.222	0.177	0.131
160	0.312	0.334	0.267	0.267	0.244	0.309	0.307
165	0.312	0.356	0.378	0.356	0.355	0.353	0.307
170	0.446	0.401	0.400	0.400	0.399	0.464	0.438
175	0.401	0.401	0.422	0.445	0.399	0.442	0.395
180	0.444	0.444	0.444	0.444	0.444	0.444	0.444

Appendix A Product Photo



Picture 1



Picture 2

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