



LM-79-08 Test Report

for

GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

LED Downlight

Model: GIMB2/940/FL/DIM120

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19020002o

The laboratory that conducted the testing detailed in this report has been accredited for SSL by NVLAP.

Review by:

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Feb. 21, 2019

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Jim Zhang

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Feb. 21, 2019

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Test Summary

Sample Tested: **GIMB2/940/FL/DIM120**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
90.4	710.8	7.86	0.9539
CCT (K)	CRI	Stabilization Time (Light & Power)	
3943	91.8	60	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

Test specifications:

Date of Receipt	: Feb. 01, 2019
Date of Test	: Feb. 12, 2019
Test item	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
Reference Standard	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

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Sample Photo



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Downlight
Model	: GIMB2/940/FL/DIM120
Electrical Ratings	: 120V, 60Hz, 8W
Product Description	: 4000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.0°C.

Base orientation was Light down. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 60 minutes, and the total operating time including stabilization was 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.069
Power Factor	0.9539
Test Power (W)	7.86
THD A%	20.02
Luminous Efficacy (lm/W)	90.4
Total Luminous Flux (lm)	710.8
Color Rendering Index (CRI)	91.8
R9	59.5
Correlated Color Temperature (CCT)(K)	3943
Chromaticity Chroma x	0.3837
Chromaticity Chroma y	0.3811
Chromaticity Chroma u	0.2255
Chromaticity Chroma v	0.3360
Duv	0.0010
Chromaticity Chroma u'	0.2255
Chromaticity Chroma v'	0.5040

Special Color Rendering Indices	
R1	91.7
R2	95.6
R3	97.3
R4	90.2
R5	90.5
R6	92.7
R7	93.1
R8	83.5
R9	59.5
R10	88.1
R11	89.8
R12	71.5
R13	92.9
R14	98.3
Rf	90
Rg	97

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u',v') diagram, $u' = u = 4x/(-2x+12y+3)$, $v' = 3v/2 = 9y/(-2x+12y+3)$.

Goniophotometer Method

Test ambient temperature was 24.8°C.

The photometric distance is 2.47m.

Luminous data was taken at 0.5 °vertical intervals and 10 °horizontal intervals.

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.071
Power Factor	0.9346
Test Power (W)	7.96
Luminous Efficacy (lm/W)	90.9
Total Luminous Flux (lm)	723.7
Beam Angle (°)	37.5
Center Beam Candle Power (cd)	1440
Spacing Criteria	0.60 (0 °-180 °)/ 0.60 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	97.00%
Zonal Lumens in the 60 °-90 °Zone	2.88%
Zonal Lumens in the 90 °-120 °Zone	0.00%
Zonal Lumens in the 120 °-180 °Zone	0.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

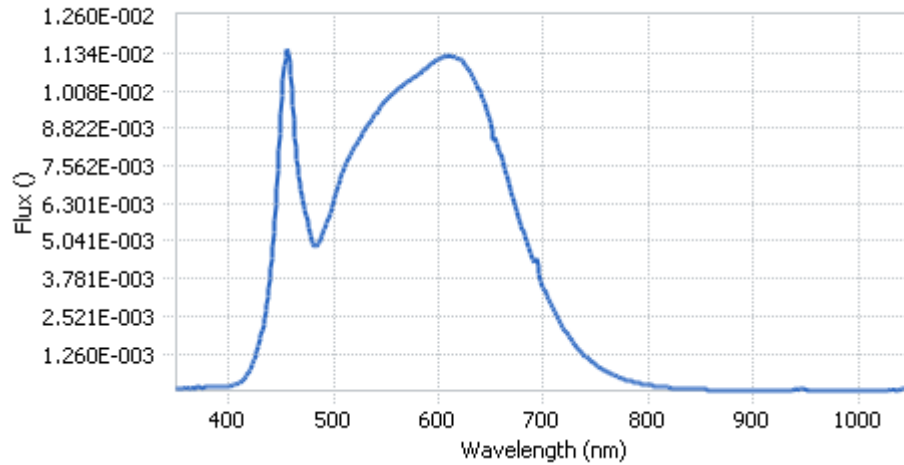
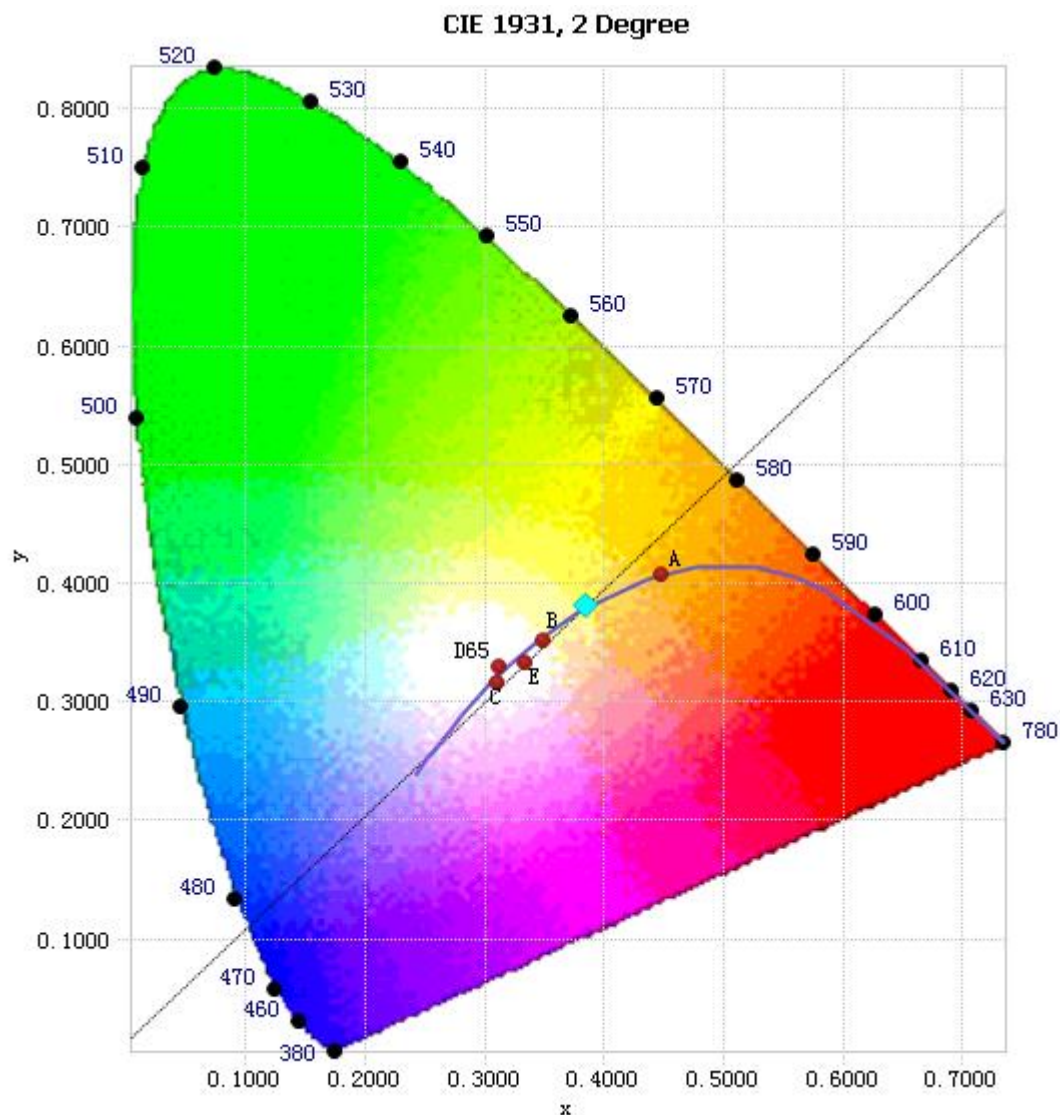


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.29E-04	485	4.91E-03	590	1.09E-02	695	4.22E-03
385	1.24E-04	490	5.32E-03	595	1.10E-02	700	3.45E-03
390	1.30E-04	495	5.81E-03	600	1.11E-02	705	3.05E-03
395	1.46E-04	500	6.40E-03	605	1.12E-02	710	2.68E-03
400	1.63E-04	505	6.97E-03	610	1.13E-02	715	2.37E-03
405	2.04E-04	510	7.48E-03	615	1.12E-02	720	2.05E-03
410	2.88E-04	515	7.88E-03	620	1.11E-02	725	1.79E-03
415	4.31E-04	520	8.23E-03	625	1.09E-02	730	1.55E-03
420	6.96E-04	525	8.51E-03	630	1.07E-02	735	1.34E-03
425	1.12E-03	530	8.80E-03	635	1.04E-02	740	1.16E-03
430	1.74E-03	535	9.03E-03	640	9.99E-03	745	1.01E-03
435	2.68E-03	540	9.32E-03	645	9.51E-03	750	8.72E-04
440	4.11E-03	545	9.56E-03	650	8.96E-03	755	7.54E-04
445	6.26E-03	550	9.76E-03	655	8.39E-03	760	6.54E-04
450	9.35E-03	555	9.94E-03	660	7.82E-03	765	5.63E-04
455	1.15E-02	560	1.01E-02	665	7.20E-03	770	4.87E-04
460	1.01E-02	565	1.02E-02	670	6.58E-03	775	4.19E-04
465	7.78E-03	570	1.04E-02	675	6.00E-03	780	3.65E-04
470	6.57E-03	575	1.05E-02	680	5.44E-03		
475	5.66E-03	580	1.06E-02	685	4.89E-03		
480	4.96E-03	585	1.08E-02	690	4.37E-03		

Table 4: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3837, 0.3811)

Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

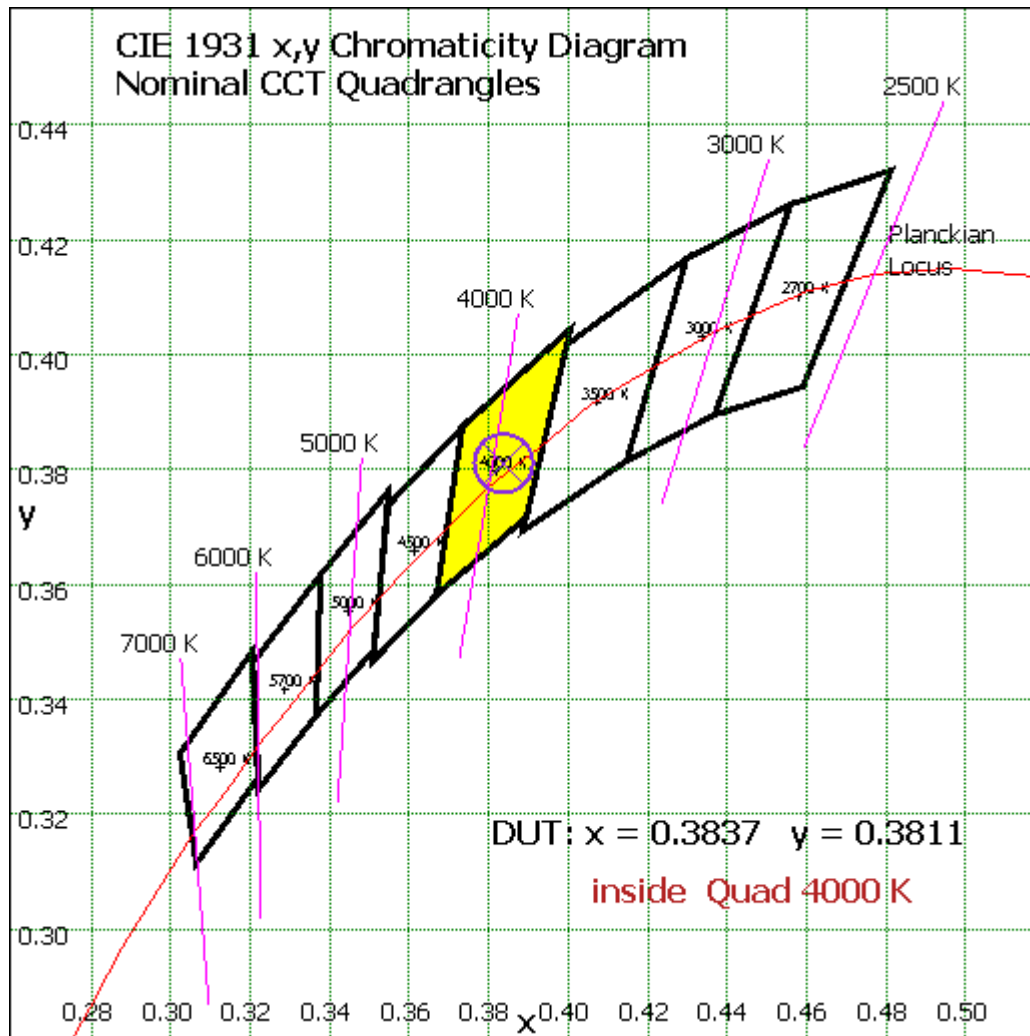


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Vector – Sphere Spectroradiometer Method

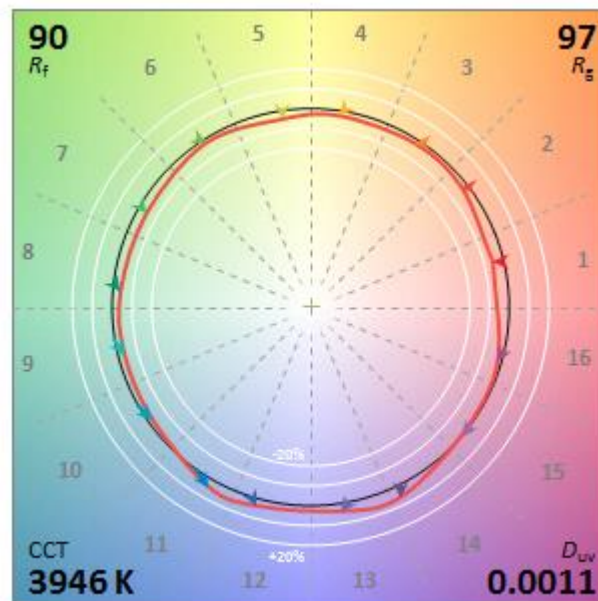


Chart 4: Color Vector Diagram of TM-30-18

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	123.929	17.13%
10- 20	250.313	34.59%
20- 30	195.944	27.08%
30- 40	86.741	11.99%
40- 50	29.127	4.02%
50- 60	15.875	2.19%
60- 70	11.634	1.61%
70- 80	6.943	0.96%
80- 90	2.241	0.31%
90-100	0.004	0.00%
100-110	0	0.00%
110-120	0.001	0.00%
120-130	0.03	0.00%
130-140	0.119	0.02%
140-150	0.226	0.03%
150-160	0.264	0.04%
160-170	0.202	0.03%
170-180	0.068	0.01%
Total	723.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	701.929	97.00%
60- 90	20.818	2.88%
0-90	722.747	99.87%
90- 180	0.914	0.13%
0- 180	723.7	100%

Table 5: Zonal Lumen

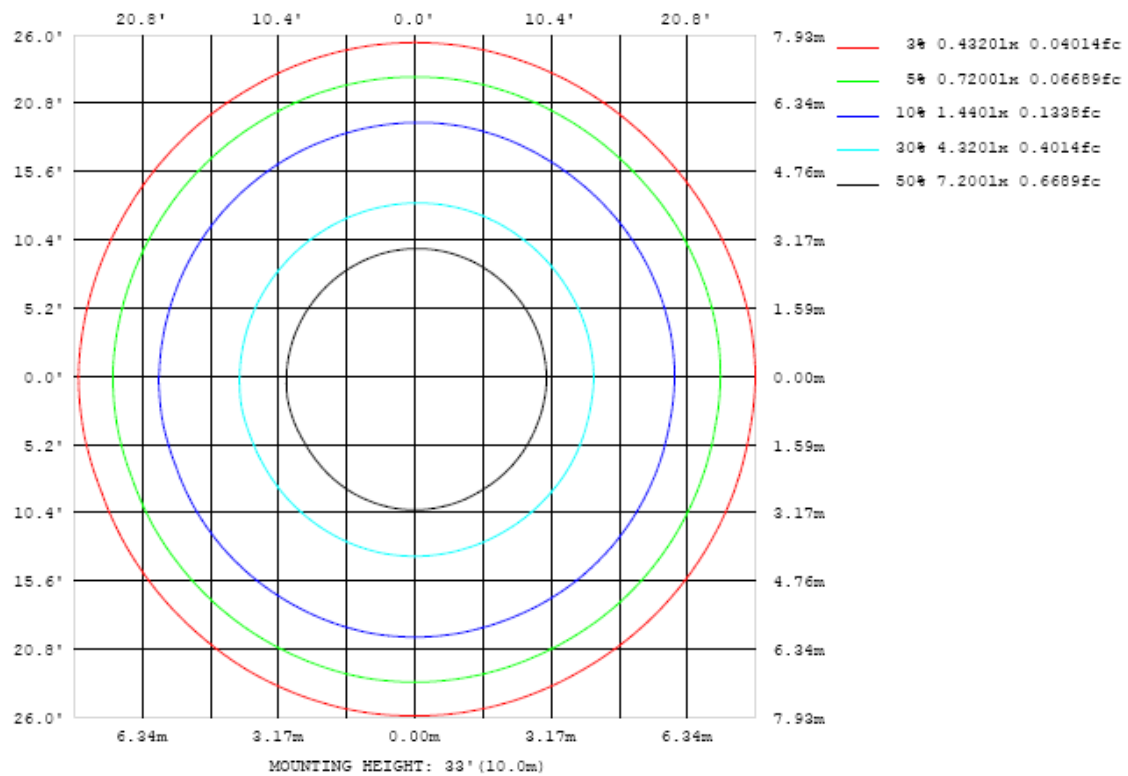


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

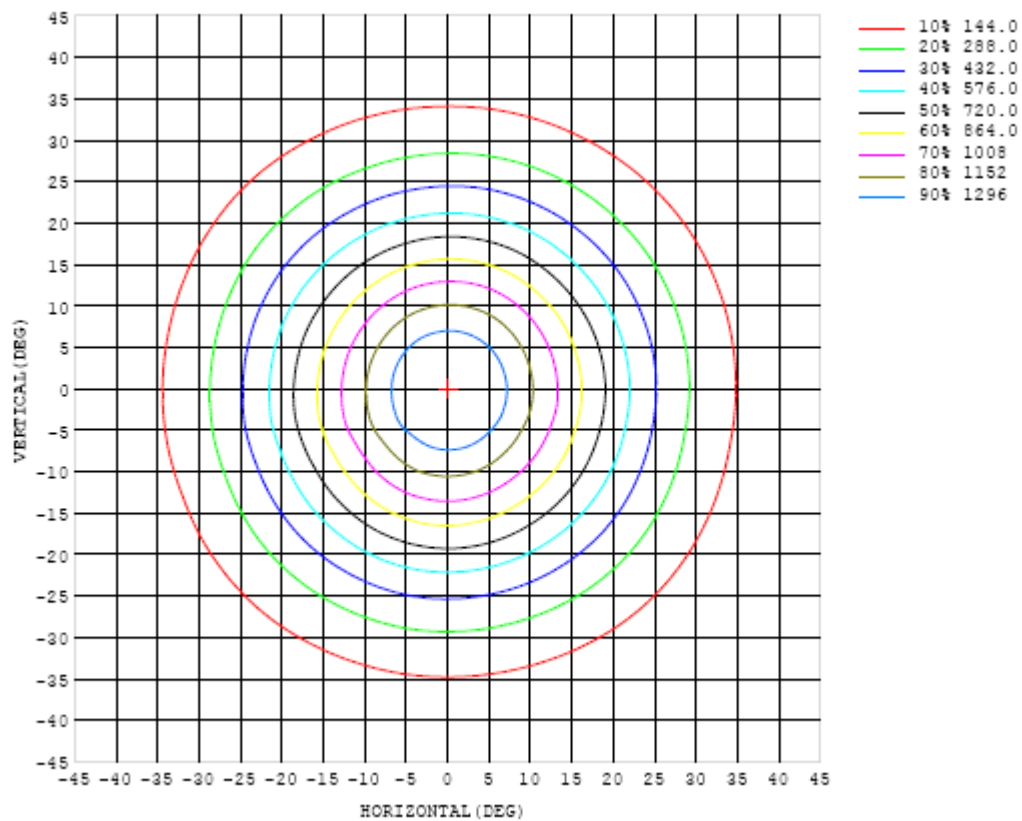


Chart 6: Isocandela Plot

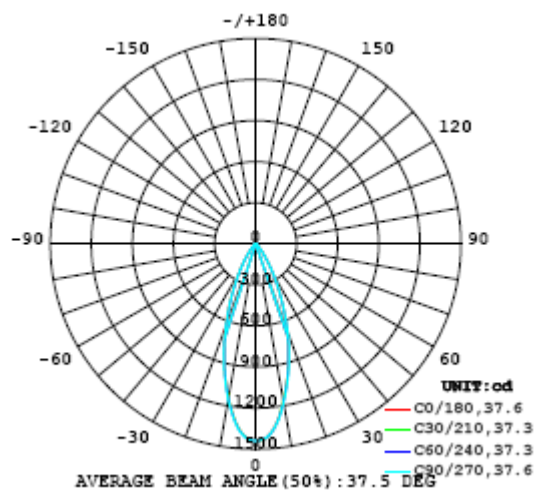


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440
5	1372	1373	1375	1378	1379	1379	1378	1378	1376	1374	1373	1374	1375	1372	1369	1367	1364	1363	1361
10	1167	1167	1167	1163	1166	1169	1174	1178	1180	1181	1180	1179	1171	1162	1155	1158	1155	1148	1144
15	923	925	920	924	926	926	929	933	938	939	938	935	929	920	910	904	910	907	900
20	673	670	670	672	673	675	676	679	683	684	681	678	671	663	656	650	649	653	647
25	442	438	439	443	443	442	443	444	446	448	447	442	437	434	429	425	421	426	421
30	263	259	261	263	264	264	264	264	265	266	266	262	259	256	254	251	247	250	248
35	140	138	138	139	139	139	138	139	139	140	140	137	135	134	133	132	130	133	133
40	71.4	70.6	70.5	69.8	69.5	68.6	68.8	69.2	70.6	70.7	70.8	69.9	69.0	67.6	66.6	65.8	65.4	66.9	66.9
45	37.0	36.5	36.4	35.8	35.8	35.4	35.2	35.9	36.3	36.5	36.4	35.6	34.9	34.1	33.6	33.4	33.0	33.9	34.7
50	24.6	24.4	24.2	24.1	23.8	23.7	23.7	24.1	24.4	24.4	24.8	24.6	24.2	23.3	22.9	22.7	22.6	23.2	23.6
55	17.7	17.7	17.7	17.5	17.2	16.9	16.8	16.9	17.4	17.3	17.5	17.4	17.4	17.0	16.8	16.6	16.8	17.1	17.3
60	15.3	15.1	14.6	14.4	14.3	14.0	13.9	13.9	14.2	13.9	13.9	14.0	14.1	14.0	14.0	13.8	13.9	14.0	14.0
65	13.8	13.9	13.5	12.4	11.9	11.7	11.6	11.7	11.8	11.6	11.5	11.8	11.9	11.9	11.8	11.6	11.6	11.7	11.9
70	10.4	10.6	10.4	10.1	9.61	9.37	9.41	9.46	9.36	9.25	9.10	9.32	9.42	9.47	9.37	9.20	9.24	9.37	9.65
75	7.07	7.25	7.14	7.01	6.95	6.89	6.99	7.02	6.92	6.76	6.71	6.87	6.98	6.97	6.88	6.70	6.68	6.68	7.01
80	4.30	4.40	4.38	4.36	4.39	4.42	4.51	4.55	4.49	4.36	4.34	4.45	4.51	4.49	4.41	4.27	4.21	4.18	4.41
85	2.29	2.36	2.41	2.40	2.43	2.46	2.51	2.52	2.47	2.39	2.37	2.45	2.49	2.46	2.40	2.32	2.28	2.20	2.24
90	0.00	0.00	0.00	0.02	0.05	0.13	0.21	0.27	0.34	0.37	0.38	0.39	0.38	0.31	0.25	0.17	0.10	0.04	0.04
95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
125	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.04
130	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.09
135	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.10	0.16
140	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.17	0.17	0.18	0.18	0.17	0.25
145	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.25	0.32
150	0.32	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.40
155	0.42	0.42	0.42	0.42	0.41	0.41	0.42	0.42	0.42	0.43	0.43	0.43	0.44	0.44	0.45	0.45	0.46	0.46	0.47
160	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.52	0.52	0.53	0.53	0.54	0.54	0.55	0.55	0.56	0.56	0.54
165	0.58	0.58	0.58	0.58	0.59	0.59	0.59	0.59	0.60	0.60	0.61	0.61	0.61	0.62	0.62	0.63	0.63	0.64	0.63
170	0.63	0.63	0.63	0.63	0.64	0.64	0.64	0.64	0.65	0.65	0.66	0.66	0.67	0.67	0.67	0.68	0.68	0.68	0.68
175	0.65	0.65	0.66	0.66	0.66	0.67	0.67	0.67	0.67	0.68	0.68	0.68	0.69	0.69	0.69	0.70	0.70	0.72	0.73
180	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) Y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440	1440		
5	1361	1362	1362	1364	1365	1367	1368	1369	1371	1371	1371	1371	1371	1372	1373	1373	1372		
10	1142	1141	1141	1143	1146	1150	1152	1155	1158	1160	1162	1164	1164	1164	1162	1163	1164		
15	896	892	887	886	886	887	891	895	899	903	905	907	908	909	912	916	920		
20	643	639	633	628	626	626	628	630	634	637	640	642	644	648	654	661	667		
25	417	414	410	407	404	403	404	406	410	413	414	414	417	421	427	432	438		
30	245	242	240	238	236	236	236	237	240	242	242	241	243	247	252	257	261		
35	131	129	127	126	125	125	126	127	127	127	126	126	126	128	132	136	139		
40	65.6	64.2	62.8	61.9	61.7	61.6	62.9	64.1	64.2	64.4	63.3	62.4	62.3	63.1	64.8	66.9	69.8		
45	34.4	33.7	32.9	32.6	32.4	32.7	33.4	34.1	34.5	34.6	34.1	33.5	33.0	33.0	33.6	34.6	36.1		
50	23.3	23.2	23.2	22.9	22.8	22.7	23.2	23.8	24.3	24.6	24.4	24.0	23.5	23.3	23.4	23.7	24.4		
55	16.8	16.9	16.8	16.9	16.6	16.5	16.7	17.2	17.5	17.8	17.8	17.6	17.2	17.0	17.2	17.4	17.6		
60	13.7	13.8	13.7	13.8	13.5	13.3	13.4	13.7	13.9	14.2	14.3	14.3	14.1	14.0	14.1	14.4	14.9		
65	11.8	11.7	11.4	11.3	11.1	10.9	10.9	11.1	11.2	11.3	11.5	11.6	11.5	11.4	11.6	12.3	13.0		
70	9.44	9.12	8.77	8.69	8.53	8.37	8.41	8.43	8.43	8.51	8.70	8.78	8.83	8.79	8.98	9.46	9.85		
75	6.83	6.51	6.21	6.15	5.99	5.86	5.85	5.85	5.80	5.83	5.93	6.01	6.08	6.10	6.21	6.42	6.62		
80	4.24	4.01	3.81	3.73	3.63	3.52	3.52	3.50	3.46	3.44	3.51	3.54	3.58	3.59	3.70	3.86	4.05		
85	1.95	1.68	1.58	1.72	1.77	1.75	1.72	1.70	1.66	1.65	1.67	1.71	1.74	1.78	1.85	1.99	2.13		
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
120	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
125	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.03		
130	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.09	0.07		
135	0.23	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.21	0.20	0.20	0.15		
140	0.36	0.35	0.35	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.35	0.34	0.34	0.34	0.25		
145	0.50	0.49	0.49	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.51	0.50	0.50	0.50	0.49	0.50	0.34		
150	0.63	0.63	0.63	0.63	0.63	0.64	0.64	0.64	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.66	0.41		
155	0.72	0.75	0.75	0.75	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.78	0.76	0.46		
160	0.75	0.85	0.84	0.85	0.85	0.86	0.86	0.86	0.86	0.87	0.87	0.87	0.87	0.87	0.89	0.79	0.52		
165	0.68	0.90	0.88	0.88	0.89	0.89	0.90	0.90	0.91	0.92	0.92	0.92	0.92	0.92	0.94	0.69	0.58		
170	0.67	0.70	0.83	0.82	0.83	0.84	0.86	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.73	0.62	0.63		
175	0.74	0.76	0.77	0.78	0.79	0.78	0.77	0.78	0.79	0.78	0.74	0.69	0.68	0.66	0.65	0.65	0.65		
180	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

Table 8: Test Equipment List

TEST METHODS

Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning. Therefore, no seasoning was performed.

Sphere-Spectroradiometer Method- Photometric and Electrical Measurements

A Labsphere Model CDS 2100 Spectroradiometer and Two Meter Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit. The coating reflectance of each sphere is 98%. The measure geometry is 4π . Self-absorption correction is conducted in testing. Bandwidth of spectroradiometer is 350nm-1050nm.

Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Yokogawa Power Analyzer.

The standard reference of the integrated sphere system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Standards and Technology.

The uncertainty of integrating sphere system reported in this document is expanded uncertainty is 2.1% with a coverage factor $k=2$.

Goniophotometer Method

Photometric and Electrical Measurements

An EVERFINE Type C Model GO-R5000 Goniophotometer was used to measure the intensity at each angle of distribution for each sample. The photometric distance is 2.475m for near-field measurement or 30m for far-field measurement. Bandwidth of spectroradiometer is 380nm-780nm.

Ambient temperature was measured at the same height of the sample mounted on the Goniophotometer equipment. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Everfine Digital Power Meter.

Some graphics were created with Photometric Plus software.

The standard reference of the Goniophotometer system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Metrology P.R. China.

The uncertainty of goniophotometer system reported in this document is expanded uncertainty is 2.3% with a coverage factor $k=2$.

Color Characteristics Measurements

The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as values that are spatially average, weighted to intensity, over the angular range where light is intentionally emitted from the SSL product. The color characteristics measurements are using gonio-spectroradiometer.

Color Spatial Uniformity

The characteristics of SSL products may be spatially non-uniform, the chromaticity coordinate shall be measured at two vertical planes ($C=0^\circ/180^\circ$ and $C=90^\circ/270^\circ$) and at 10° or less intervals for vertical angle until the light output dropped to below 10% of the peak intensity. The averaged weighted chromaticity coordinate

was calculated from these points. The data was then analyzed to check for delta color differences of the u' , v' chromaticity coordinates. The spatial non-uniformity of chromaticity, $\Delta u'v'$, is determined as the maximum deviation (distance on the CIE (u' , v') diagram) among all measured points from the spatially averaged chromaticity coordinate.

The geometry for the chromaticity measurement using gonio-spectroradiometer is shown as following.



*** End of Report ***

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