LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Downlight

Model: GIMB1/927/FL/DIM120

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19020002p

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

Review by: April Zou

Engineer: April Zou
Feb. 21, 2019

Approved by: Jim Zhang

Manager: Jim Zhang
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: **GIMB1/927/FL/DIM120**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
69.3	363.9	5.25	0.9233

CCT (K)	CRI	Stabilization Time (Light & Power)
2784	97.4	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. 13, 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	: GIMB1/927/FL/DIM120
Electrical Ratings	: 120V, 60Hz, 5W
Product Description	: 2700K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 26.0℃.

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 70minutes.

Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.047
Power Factor	0.9233
Test Power (W)	5.25
THD A%	27.06
Luminous Efficacy (lm/W)	69.3
Total Luminous Flux (lm)	363.9
Color Rendering Index (CRI)	97.4
R9	84
Correlated Color Temperature (CCT)(K)	2784
Chromaticity Chroma x	0.4523
Chromaticity Chroma y	0.4077
Chromaticity Chroma u	0.2589
Chromaticity Chroma v	0.3501
Duv	0.0005
Chromaticity Chroma u ’	0.2589
Chromaticity Chroma v’	0.5251

Special Color Rendering Indices	
R1	99
R2	98.8
R3	96.8
R4	98.2
R5	98.7
R6	98.2
R7	96.7
R8	93.2
R9	84
R10	95.9
R11	96.8
R12	91.3
R13	99.2
R14	97.2
Rf	96
Rg	101

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 25.1℃.

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)	0.048
Power Factor	0.9242
Test Power (W)	5.28
Luminous Efficacy (lm/W)	69.9
Total Luminous Flux (lm)	369.2
Beam Angle (°)	40.6
Center Beam Candle Power (cd)	698
Spacing Criteria	0.59 (0 °-180 °)/ 0.64 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	98.32%
Zonal Lumens in the 60 °-90 °Zone	1.55%
Zonal Lumens in the 90 °-120 °Zone	0.00%
Zonal Lumens in the 120 °-180 °Zone	0.12%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

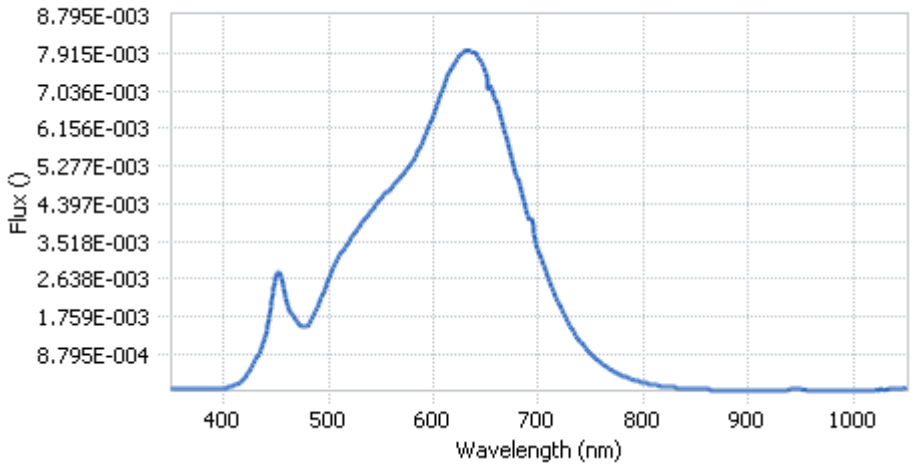
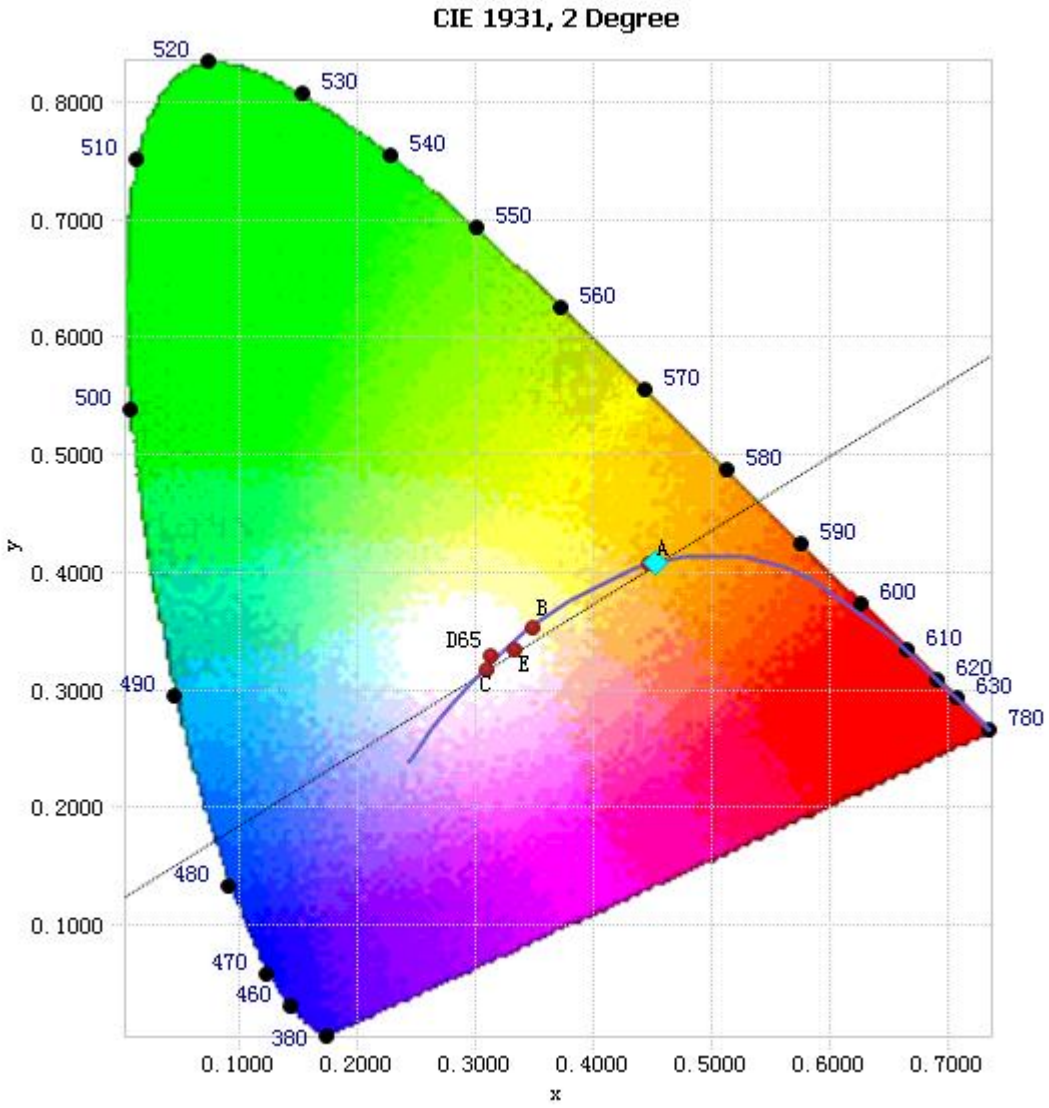


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	6.00E-05	485	1.74E-03	590	5.86E-03	695	3.86E-03
385	5.94E-05	490	2.01E-03	595	6.17E-03	700	3.29E-03
390	5.98E-05	495	2.32E-03	600	6.49E-03	705	2.93E-03
395	6.55E-05	500	2.64E-03	605	6.84E-03	710	2.59E-03
400	7.63E-05	505	2.92E-03	610	7.16E-03	715	2.30E-03
405	9.04E-05	510	3.16E-03	615	7.44E-03	720	2.02E-03
410	1.34E-04	515	3.37E-03	620	7.70E-03	725	1.76E-03
415	2.00E-04	520	3.55E-03	625	7.88E-03	730	1.54E-03
420	3.20E-04	525	3.72E-03	630	7.98E-03	735	1.34E-03
425	4.89E-04	530	3.89E-03	635	7.99E-03	740	1.16E-03
430	7.05E-04	535	4.04E-03	640	7.90E-03	745	1.01E-03
435	9.71E-04	540	4.21E-03	645	7.72E-03	750	8.75E-04
440	1.34E-03	545	4.38E-03	650	7.43E-03	755	7.56E-04
445	1.98E-03	550	4.51E-03	655	7.13E-03	760	6.57E-04
450	2.68E-03	555	4.66E-03	660	6.76E-03	765	5.68E-04
455	2.64E-03	560	4.78E-03	665	6.32E-03	770	4.90E-04
460	2.07E-03	565	4.90E-03	670	5.87E-03	775	4.20E-04
465	1.80E-03	570	5.06E-03	675	5.42E-03	780	3.64E-04
470	1.64E-03	575	5.21E-03	680	4.98E-03		
475	1.50E-03	580	5.39E-03	685	4.52E-03		
480	1.54E-03	585	5.64E-03	690	4.09E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4523, 0.4077)

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

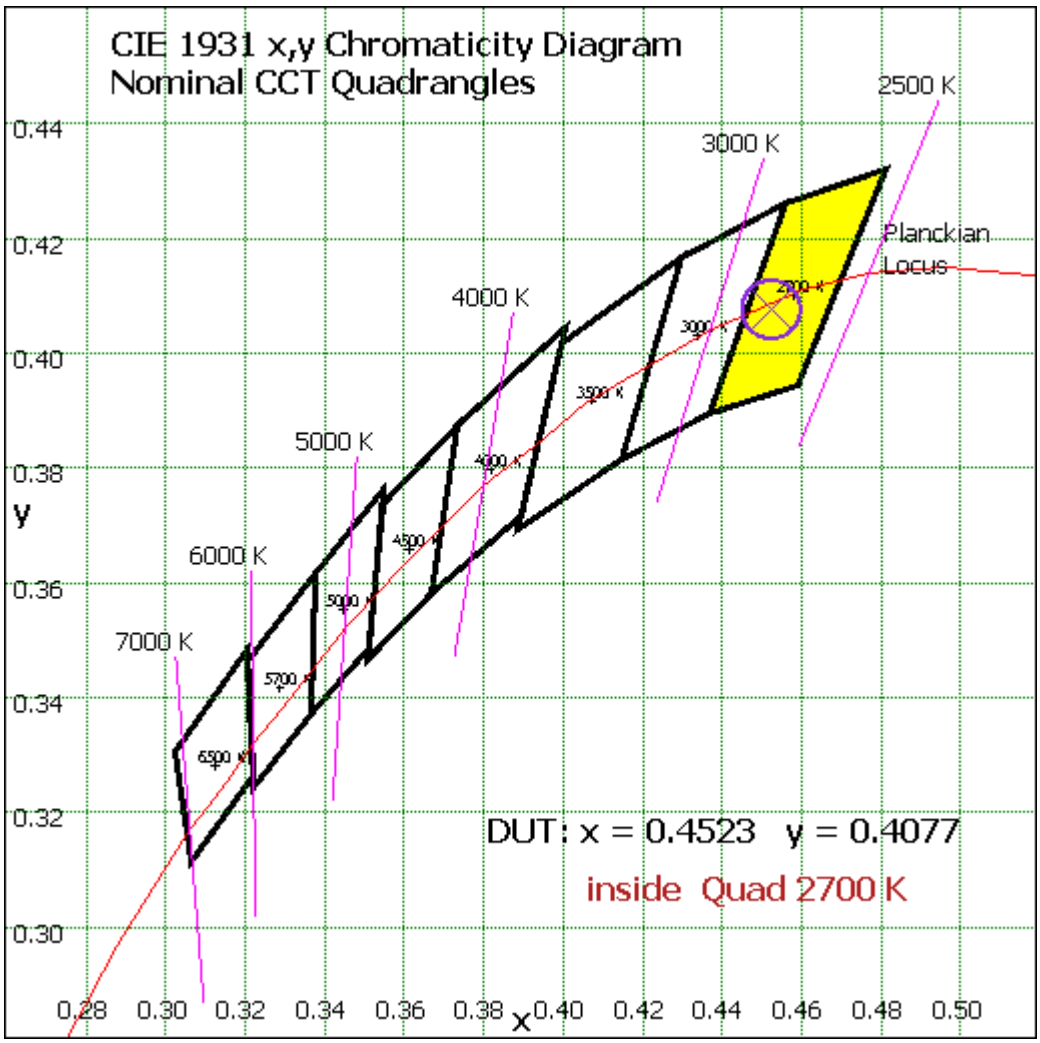


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Vector – Sphere Spectroradiometer Method

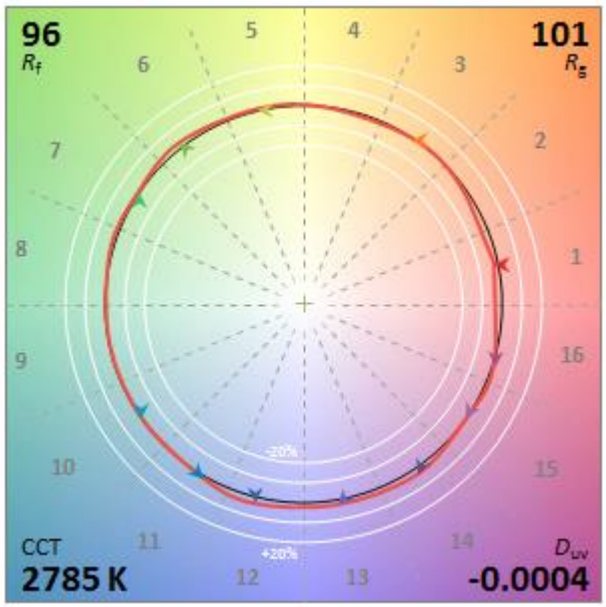


Chart 4: Color Vector Diagram of TM-30-18

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

γ(°)	Lumens	% Total
0- 10	62.887	17.03%
10- 20	137.676	37.29%
20- 30	101.125	27.39%
30- 40	40.038	10.84%
40- 50	14.628	3.96%
50- 60	6.676	1.81%
60- 70	3.642	0.99%
70- 80	1.664	0.45%
80- 90	0.424	0.11%
90-100	0.003	0.00%
100-110	0	0.00%
110-120	0	0.00%
120-130	0.008	0.00%
130-140	0.056	0.02%
140-150	0.115	0.03%
150-160	0.137	0.04%
160-170	0.106	0.03%
170-180	0.036	0.01%
Total	369.2	100%

γ(°)	Lumens	% Total
0- 60	363.03	98.32%
60- 90	5.73	1.55%
0-90	368.76	99.88%
90- 180	0.461	0.12%
0- 180	369.2	100%

Table 5: Zonal Lumen

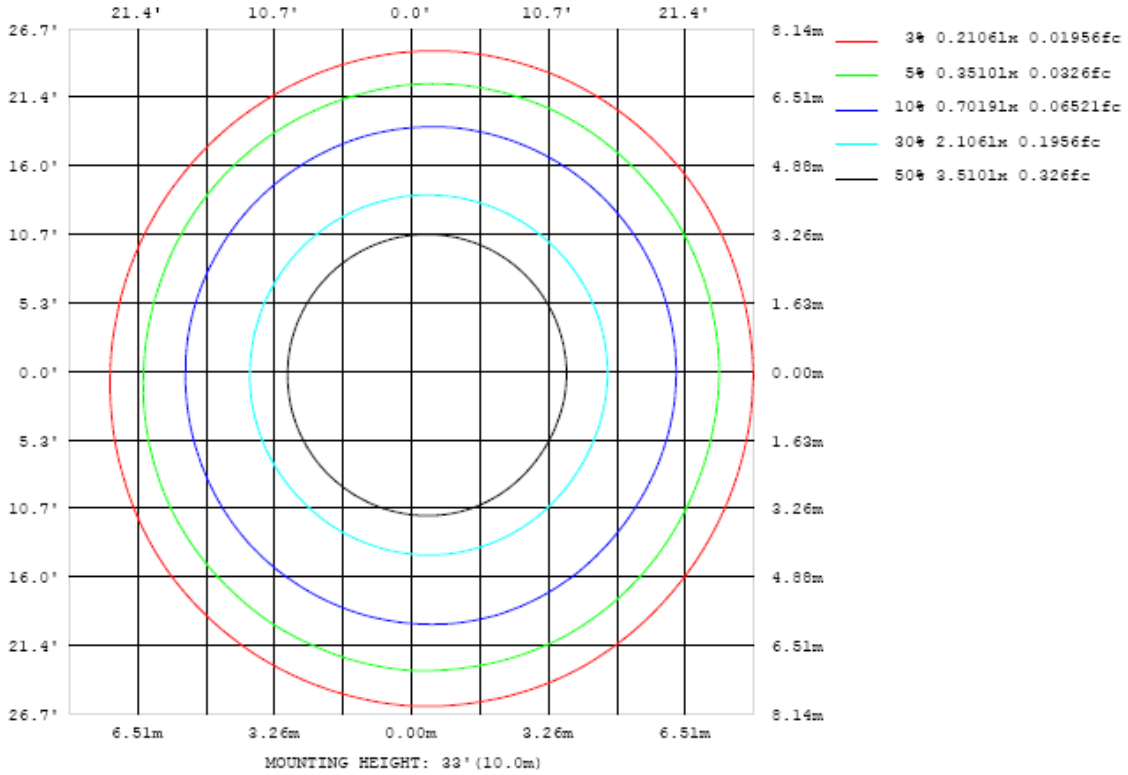


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

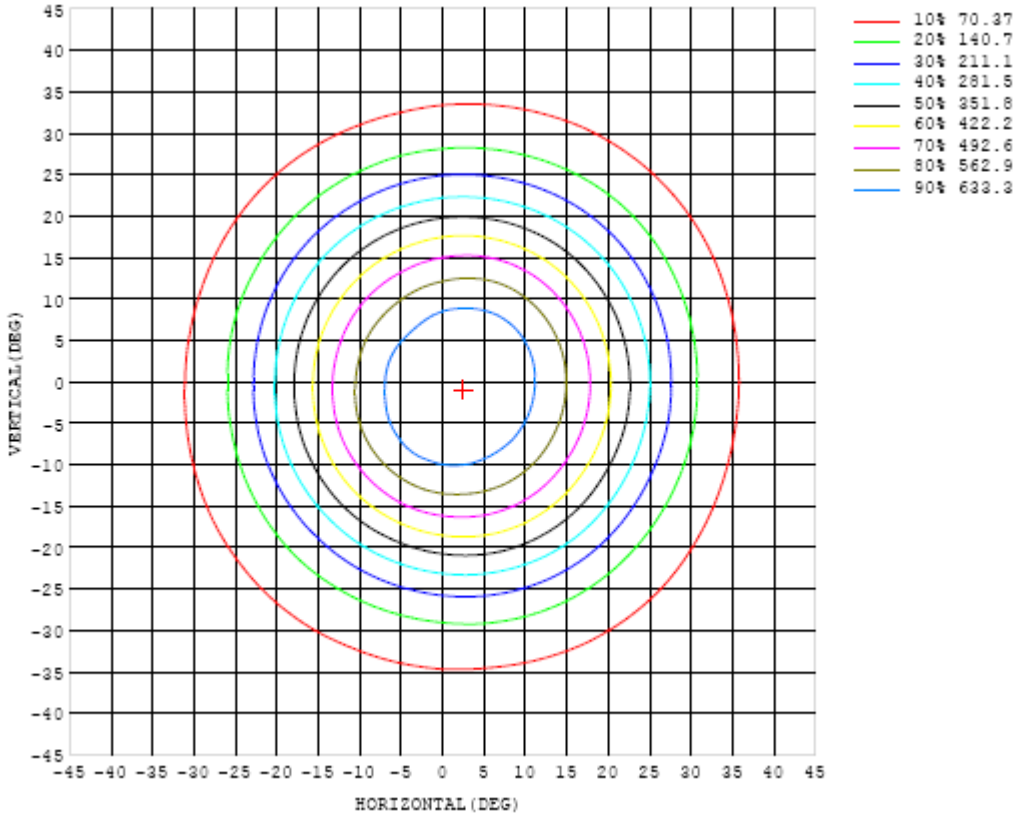


Chart 6: Isocandela Plot

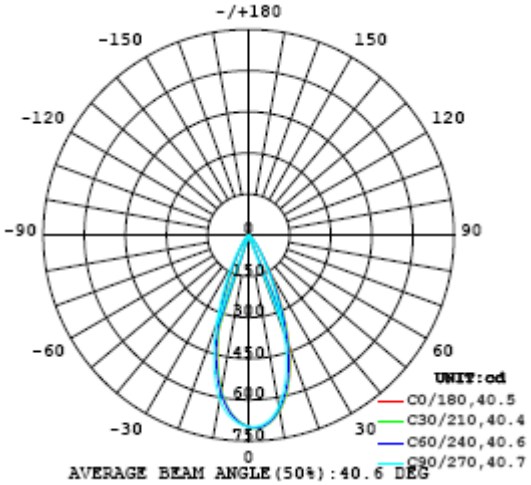


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C (DEG) / γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698
5	696	696	696	696	696	696	694	692	689	687	684	683	679	675	672	668	664	662	661
10	650	649	649	648	647	644	642	640	638	633	627	623	616	608	599	592	585	579	575
15	561	561	560	559	557	554	549	542	533	525	516	505	492	481	470	461	453	446	442
20	432	432	429	425	422	417	411	402	390	376	362	348	336	324	312	304	298	293	289
25	282	281	277	274	271	267	260	252	243	231	219	208	197	187	180	172	167	163	161
30	157	156	153	149	147	145	143	139	133	125	118	111	105	99.5	94.3	89.7	86.2	83.3	81.3
35	78.0	77.1	76.2	75.9	76.0	75.5	74.5	72.4	69.8	68.0	64.5	60.7	57.7	54.0	51.6	49.1	46.1	44.1	42.5
40	39.7	40.2	40.2	40.1	40.0	40.0	39.8	39.0	37.6	36.5	34.6	33.0	31.5	29.7	28.2	26.6	25.1	23.8	23.0
45	21.4	21.7	21.8	22.1	22.3	22.4	21.9	21.4	21.2	20.6	19.8	18.9	18.0	17.1	16.4	15.5	14.7	14.0	13.5
50	12.7	12.8	13.0	13.1	13.2	13.2	13.0	12.7	12.5	12.4	11.9	11.5	11.0	10.5	10.2	9.82	9.32	8.97	8.74
55	8.30	8.44	8.56	8.55	8.50	8.45	8.27	8.04	7.92	7.72	7.52	7.24	7.03	6.74	6.53	6.35	6.11	5.95	5.93
60	5.82	5.87	5.89	5.86	5.77	5.67	5.53	5.36	5.20	5.07	4.89	4.74	4.61	4.49	4.37	4.29	4.22	4.16	4.15
65	4.35	4.30	4.26	4.22	4.13	4.02	3.89	3.75	3.59	3.52	3.39	3.27	3.17	3.05	2.97	2.93	2.90	2.88	2.88
70	3.25	3.17	3.10	3.02	2.90	2.79	2.69	2.53	2.42	2.30	2.19	2.10	2.02	1.93	1.87	1.85	1.83	1.81	1.79
75	2.12	2.08	2.03	1.95	1.87	1.76	1.69	1.58	1.51	1.44	1.37	1.31	1.24	1.18	1.14	1.11	1.09	1.08	1.07
80	1.16	1.16	1.14	1.13	1.10	1.07	1.02	0.97	0.91	0.86	0.81	0.75	0.70	0.65	0.61	0.58	0.56	0.55	0.54
85	0.62	0.63	0.63	0.62	0.60	0.57	0.54	0.50	0.45	0.40	0.35	0.30	0.26	0.23	0.20	0.17	0.12	0.07	0.03
90	0.12	0.13	0.16	0.13	0.10	0.06	0.02	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	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	0.00
125	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
130	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	0.02	0.02	0.05
135	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.10
140	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.17
145	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.14	0.14	0.13	0.24
150	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.16	0.16	0.16	0.17	0.17	0.18	0.18	0.18	0.19	0.18	0.30
155	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.21	0.21	0.21	0.22	0.22	0.23	0.23	0.23	0.24	0.23	0.34
160	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.27	0.27	0.28	0.28	0.28	0.29	0.28	0.36
165	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.32	0.32	0.32	0.36
170	0.31	0.32	0.32	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	0.34	0.34
175	0.34	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.35	0.35	0.36	0.36	0.37	0.37
180	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

γ (DEG) \ C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698	698		
5	660	659	659	660	661	662	665	669	672	676	680	684	687	690	693	694	695		
10	573	573	575	577	579	583	591	599	607	615	624	632	640	645	649	651	651		
15	441	441	443	447	454	461	469	481	492	505	519	531	540	547	554	558	560		
20	288	289	292	297	304	312	322	332	344	356	368	381	393	404	414	422	428		
25	163	164	166	169	175	181	189	198	208	218	228	238	248	258	267	274	279		
30	80.7	80.8	82.4	84.7	88.0	91.7	96.8	103	109	116	122	128	135	142	147	152	156		
35	41.6	41.6	42.0	42.9	44.6	46.8	49.4	52.5	56.5	59.8	63.2	66.7	69.1	71.6	74.6	76.8	77.9		
40	22.7	22.6	22.6	23.0	23.7	24.5	25.8	27.5	29.0	30.7	32.3	33.8	35.3	36.7	37.8	38.6	39.0		
45	13.3	13.3	13.3	13.5	13.7	14.1	14.7	15.7	16.5	17.3	18.1	18.6	19.5	20.0	20.5	21.0	21.2		
50	8.62	8.64	8.64	8.72	8.85	9.04	9.31	9.72	10.2	10.7	11.0	11.4	11.7	12.0	12.3	12.5	12.6		
55	5.91	5.90	5.96	6.03	6.11	6.23	6.41	6.65	6.94	7.21	7.46	7.64	7.82	8.02	8.17	8.24	8.23		
60	4.17	4.20	4.28	4.33	4.40	4.51	4.66	4.80	4.99	5.20	5.36	5.48	5.55	5.68	5.80	5.82	5.78		
65	2.92	2.99	3.06	3.12	3.19	3.35	3.50	3.65	3.82	3.97	4.08	4.21	4.28	4.32	4.42	4.44	4.39		
70	1.80	1.84	1.89	1.96	2.05	2.18	2.33	2.49	2.71	2.89	3.07	3.19	3.26	3.32	3.38	3.34	3.28		
75	1.07	1.08	1.11	1.14	1.18	1.23	1.29	1.38	1.49	1.61	1.74	1.83	1.91	2.01	2.10	2.10	2.09		
80	0.54	0.55	0.57	0.59	0.62	0.66	0.70	0.75	0.80	0.85	0.89	0.93	0.97	1.03	1.08	1.13	1.15		
85	0.06	0.11	0.17	0.20	0.23	0.26	0.29	0.32	0.35	0.38	0.41	0.44	0.48	0.52	0.56	0.59	0.61		
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.08	0.11	0.13	0.14	0.12		
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	0.00	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		
125	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00		
130	0.05	0.05	0.06	0.05	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03		
135	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.08	0.08	0.07		
140	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.18	0.18	0.18	0.17	0.17	0.16	0.15	0.15	0.15	0.13		
145	0.29	0.28	0.28	0.28	0.28	0.27	0.27	0.26	0.26	0.25	0.25	0.24	0.24	0.23	0.23	0.23	0.20		
150	0.37	0.36	0.36	0.35	0.35	0.35	0.34	0.34	0.33	0.33	0.32	0.32	0.31	0.31	0.31	0.31	0.26		
155	0.43	0.41	0.41	0.41	0.41	0.40	0.40	0.39	0.39	0.39	0.38	0.38	0.38	0.37	0.37	0.38	0.31		
160	0.47	0.46	0.46	0.45	0.45	0.45	0.45	0.44	0.44	0.44	0.44	0.44	0.43	0.43	0.43	0.44	0.35		
165	0.48	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.48	0.35		
170	0.43	0.45	0.44	0.44	0.44	0.44	0.44	0.44	0.45	0.45	0.46	0.46	0.46	0.47	0.48	0.46	0.32		
175	0.37	0.38	0.39	0.39	0.39	0.39	0.39	0.40	0.40	0.41	0.42	0.42	0.43	0.44	0.41	0.34	0.34		
180	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39		

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.

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The uncertainty of integrating sphere system reported in this document is expended 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

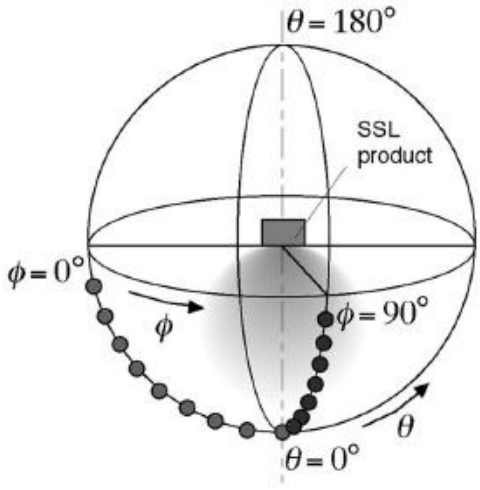
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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°/180° and C=90°/270°) 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, Δu'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 ***