

## LM-79-08 TEST REPORT

for

### GREEN CREATIVE LTD

Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL,  
Hong Kong

### LED Lamp

**Model: 11BR30DIM/930**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ21120007h

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

Review by:



Engineer: April Zou

Dec. 15, 2021

Approved by:



Manager: Jim Zhang

Dec. 15, 2021

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: **11BR30DIM/930**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
101.7	1043.3	10.26	0.8182
CCT (K)	CRI	Stabilization Time (Light & Power)	
3012	96.5	60	

Table 1: Executive Data Summary

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

### Test specifications:

<b>Date of Receipt</b>	: Dec. 03, 2021
<b>Date of Test</b>	: Dec. 08, 2021
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

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## SAMPLE PHOTO



Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Lamp
<b>Model</b>	: 11BR30DIM/930
<b>Electrical Ratings</b>	: 120V, 60Hz, 11W
<b>Product Description</b>	: 3000K
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong

## TEST RESULTS

Test ambient temperature was 26.0 °C.

Base orientation was horizontal. 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 65 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.104
Power Factor	0.8182
Test Power (W)	10.26
THD A%	57.07
Luminous Efficacy (lm/W)	101.7
Total Luminous Flux (lm)	1043.3
Color Rendering Index (CRI)	96.5
R9	90.3
Correlated Color Temperature (CCT)(K)	3012
Chromaticity Chroma x	0.4344
Chromaticity Chroma y	0.4006
Chromaticity Chroma u	0.2505
Chromaticity Chroma v	0.3464
Duv	-0.0011
Chromaticity Chroma u'	0.2505
Chromaticity Chroma v'	0.5196

Special Color Rendering Indices	
R1	96.5
R2	99.3
R3	92.8
R4	94.4
R5	97.8
R6	96.3
R7	97.6
R8	97.5
R9	90.3
R10	95.5
R11	91.3
R12	88.4
R13	97.5
R14	94.1

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 °C.

The photometric distance is 2.47 m.

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)	0.105
Power Factor	0.8149
Power (W)	10.29
Luminous Efficacy (lm/W)	104.0
Total Luminous Flux (lm)	1069.9
Beam Angle ( ° )	108.0 (0°-180°) / 108.1 (90°-270°)
Center Beam Candle Power (cd)	346
Maximum Beam Candle Power (cd)	347.0 (At: C=280.0, Gamma=1.5)
Spacing Criteria	1.23 (0°-180°) / 1.25 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	70.06%
Zonal Lumens in the 60 °-90 °Zone	24.42%
Zonal Lumens in the 90 °-120 °Zone	4.81%
Zonal Lumens in the 120 °-180 °Zone	0.70%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

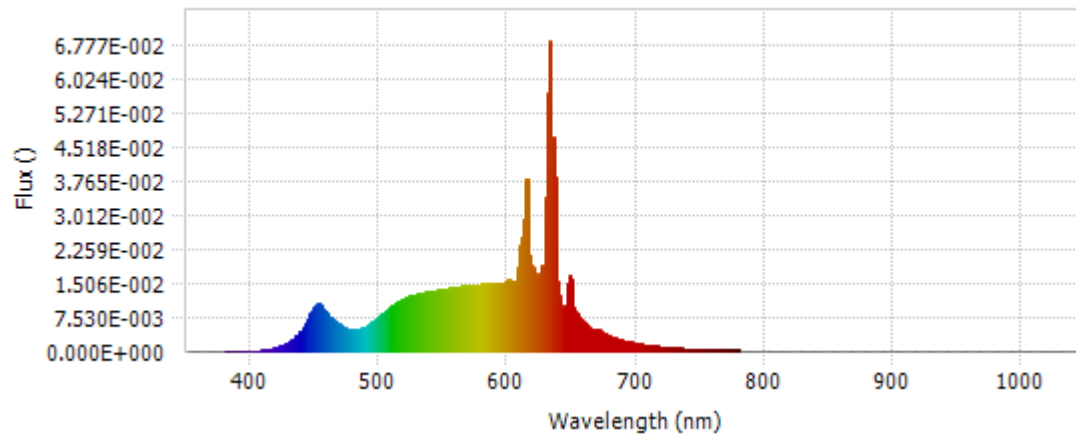
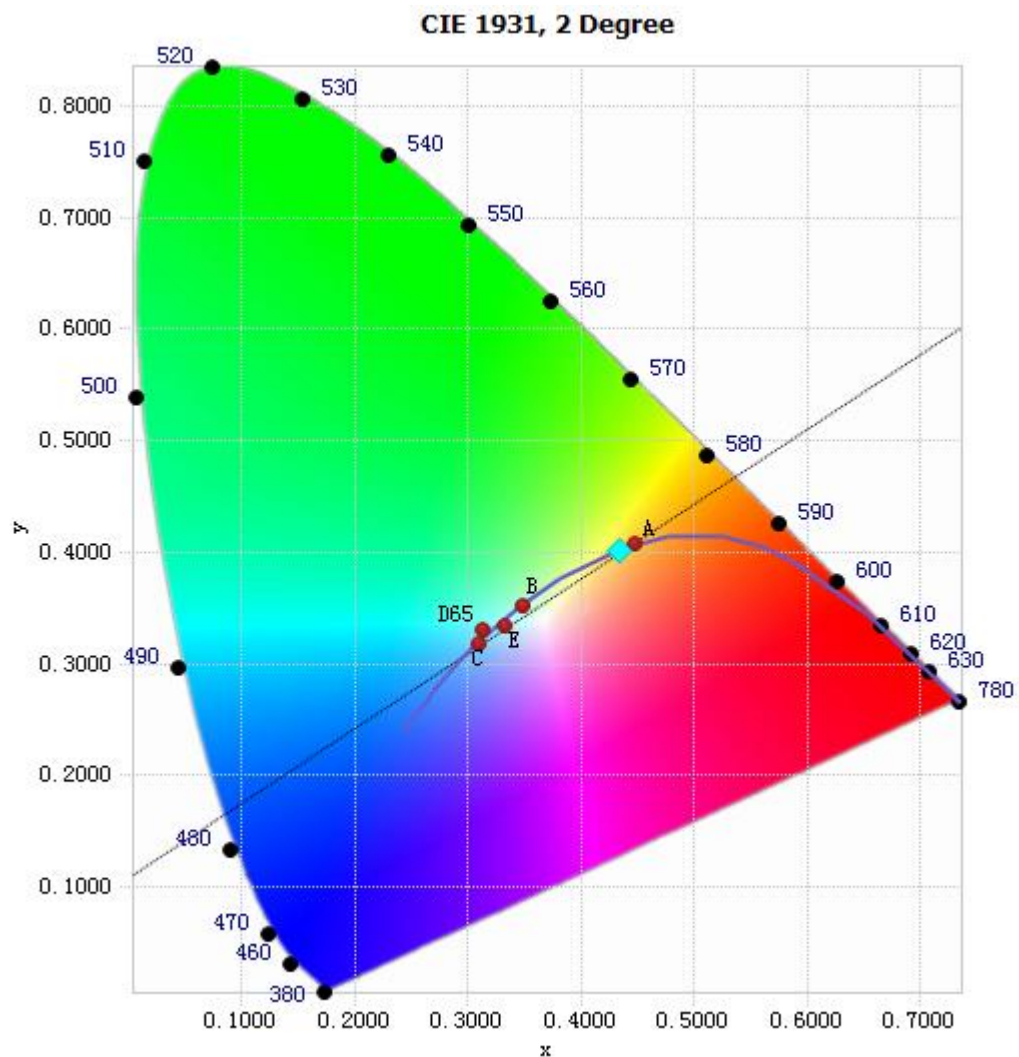


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	7.33E-05	485	4.97E-03	590	1.50E-02	695	2.03E-03
385	7.98E-05	490	5.66E-03	595	1.48E-02	700	1.76E-03
390	4.46E-05	495	6.58E-03	600	1.59E-02	705	1.48E-03
395	4.15E-05	500	7.74E-03	605	1.54E-02	710	1.28E-03
400	7.03E-05	505	8.96E-03	610	2.54E-02	715	1.11E-03
405	7.12E-05	510	1.00E-02	615	3.81E-02	720	9.62E-04
410	2.19E-04	515	1.10E-02	620	1.87E-02	725	8.26E-04
415	4.78E-04	520	1.17E-02	625	1.71E-02	730	7.10E-04
420	8.88E-04	525	1.22E-02	630	3.41E-02	735	5.97E-04
425	1.46E-03	530	1.27E-02	635	4.19E-02	740	5.13E-04
430	2.18E-03	535	1.30E-02	640	1.24E-02	745	4.42E-04
435	3.27E-03	540	1.33E-02	645	1.01E-02	750	3.82E-04
440	5.00E-03	545	1.35E-02	650	1.23E-02	755	3.31E-04
445	7.73E-03	550	1.37E-02	655	7.56E-03	760	2.78E-04
450	1.02E-02	555	1.40E-02	660	6.14E-03	765	2.41E-04
455	9.79E-03	560	1.42E-02	665	4.99E-03	770	2.19E-04
460	7.84E-03	565	1.43E-02	670	4.79E-03	775	1.90E-04
465	6.65E-03	570	1.46E-02	675	3.86E-03	780	1.56E-04
470	5.63E-03	575	1.47E-02	680	3.23E-03		
475	4.84E-03	580	1.48E-02	685	2.75E-03		
480	4.72E-03	585	1.52E-02	690	2.37E-03		

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

# Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4344, 0.4006)

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

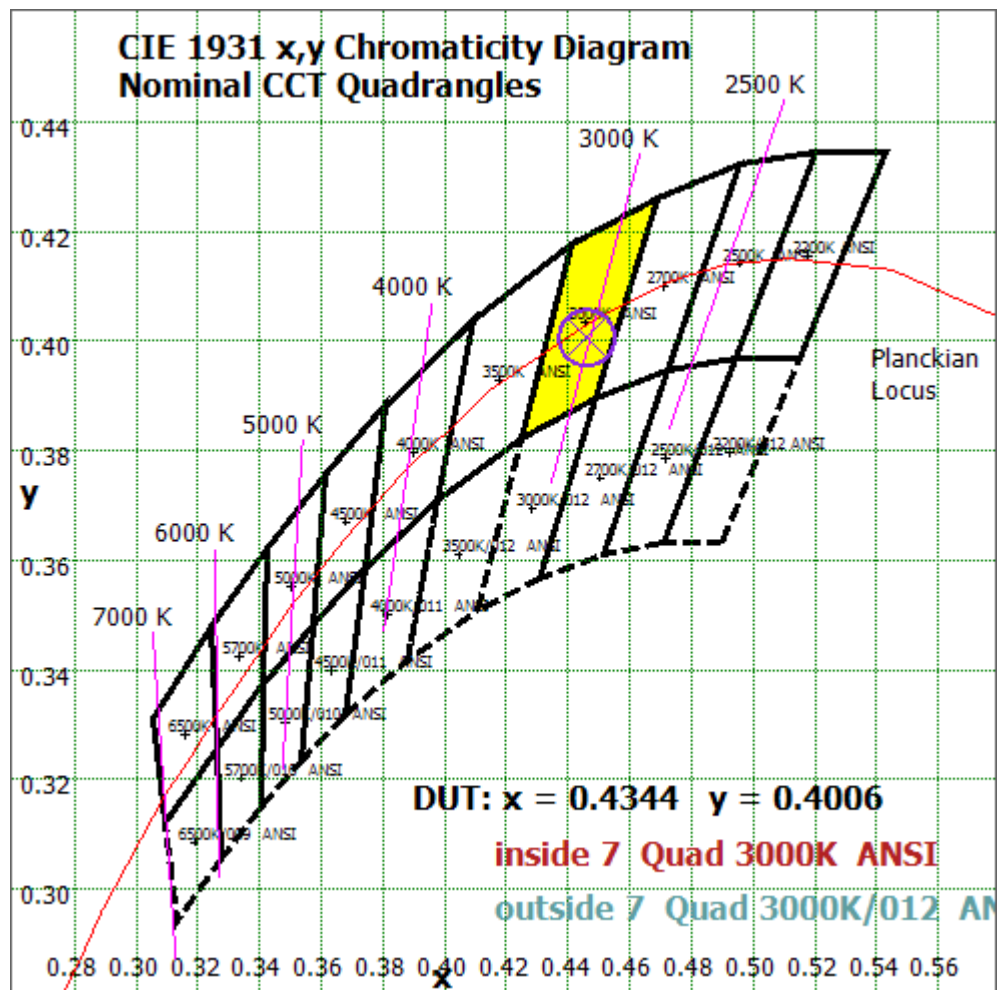


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Rendition Report – Sphere Spectroradiometer Method

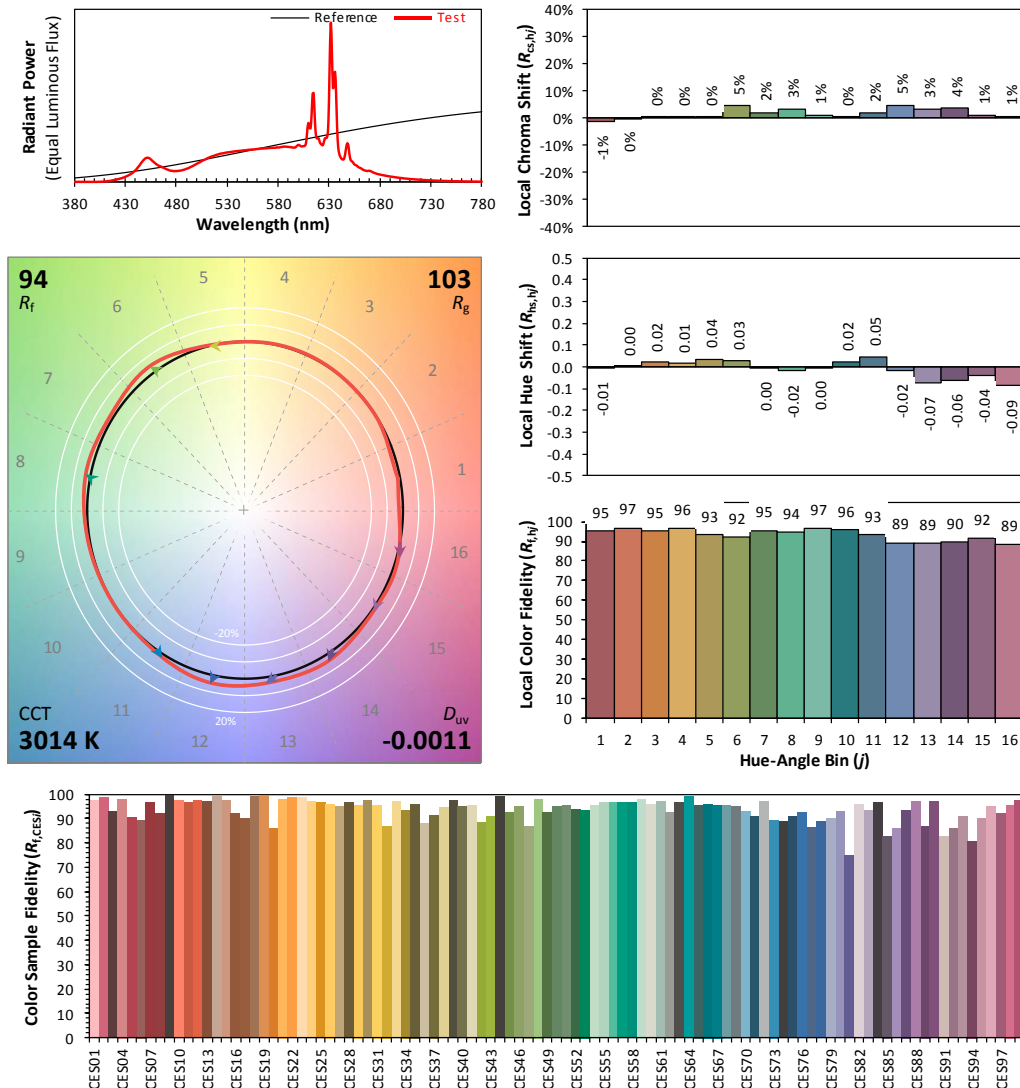
### ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2021/12/08

Model: 11BR30DIM/930



**Notes:** This is a recommended method for displaying ANSI/IES TM-30-18 information.

$x$  0.4344  
 $y$  0.4006  
 $u'$  0.2505  
 $v'$  0.5196

CIE 13.3-1995  
 (CRI)  
 $R_a$  97  
 $R_g$  91

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

Chart 4: Full Report Created with the IES TM-30 Calculator

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	32.721	3.06%
10- 20	93.156	8.71%
20- 30	139.502	13.04%
30- 40	165.203	15.44%
40- 50	168.023	15.70%
50- 60	150.991	14.11%
60- 70	121.338	11.34%
70- 80	86.204	8.06%
80- 90	53.752	5.02%
90-100	28.947	2.71%
100-110	14.607	1.37%
110-120	7.915	0.74%
120-130	4.245	0.40%
130-140	2.059	0.19%
140-150	0.837	0.08%
150-160	0.267	0.02%
160-170	0.099	0.01%
170-180	0.035	0.00%
Total	1069.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	749.596	70.06%
60- 90	261.294	24.42%
0-90	1010.89	94.48%
90- 180	59.011	5.52%
0- 180	1069.9	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

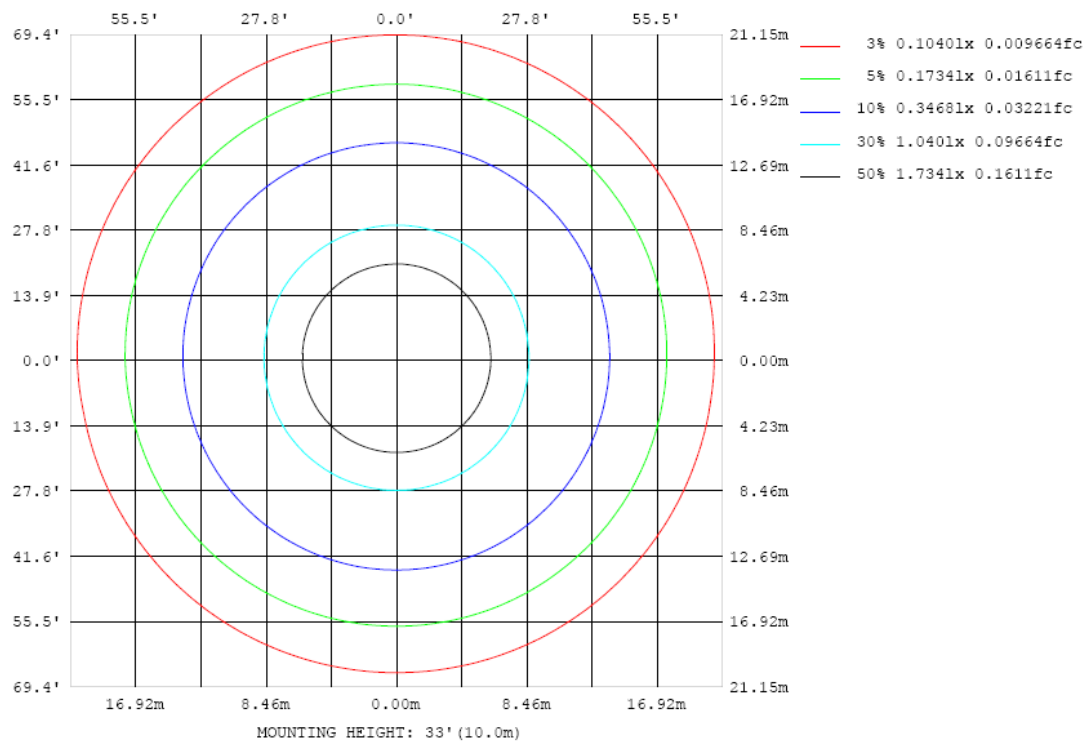


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

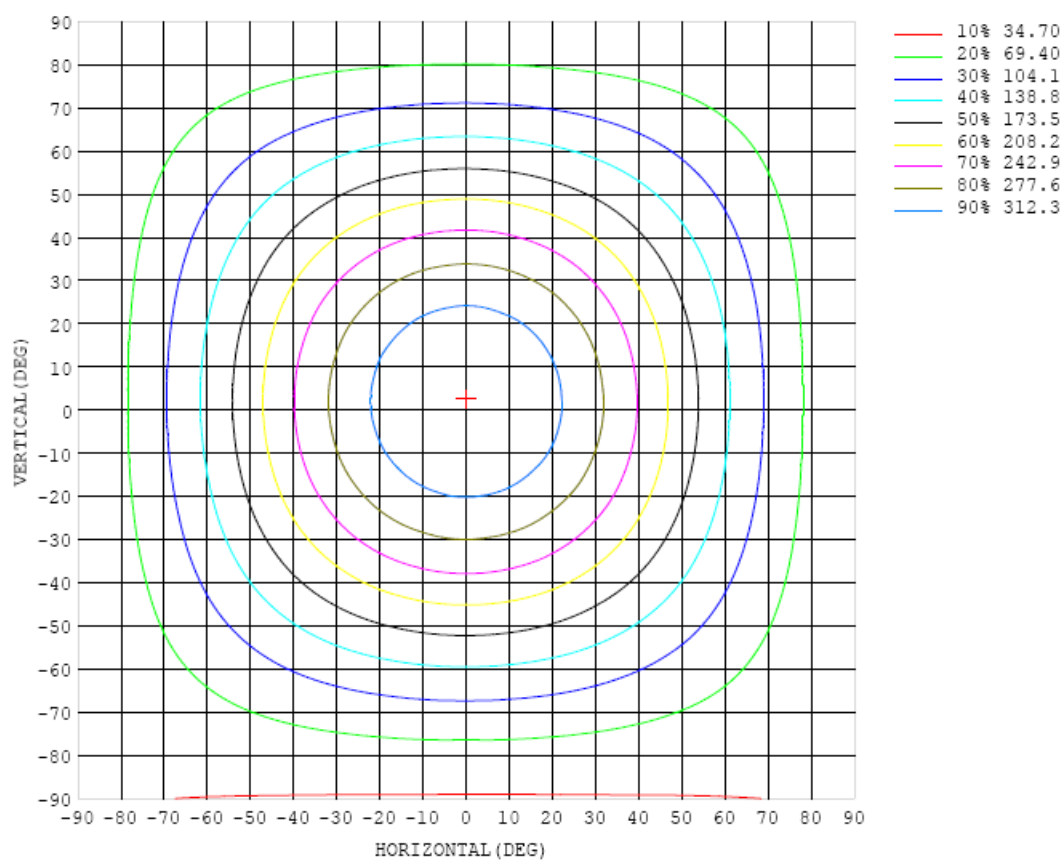


Chart 6: Isocandela Plot

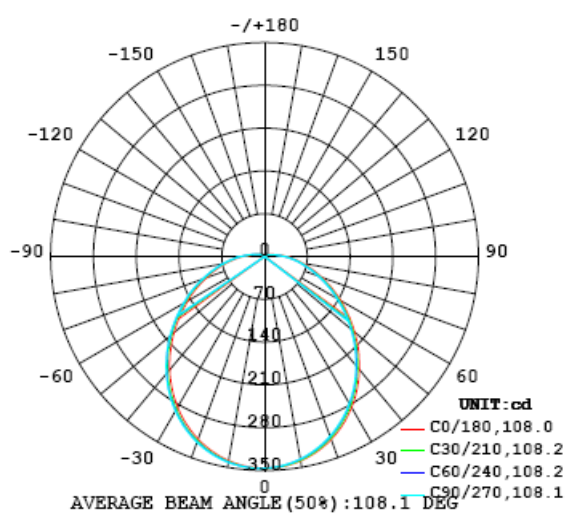


Chart 7: Polar Candela Distribution

## 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	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346
5	345	345	344	344	344	344	343	343	343	343	343	343	343	343	344	344	344	344	344
10	339	339	339	339	338	337	337	337	336	336	336	337	336	337	337	338	338	339	339
15	331	330	329	329	328	327	327	326	326	326	326	327	327	327	328	328	328	330	330
20	318	318	316	316	315	314	314	313	313	313	313	313	314	314	315	315	316	317	318
25	303	302	301	300	299	298	297	297	296	297	297	297	297	297	298	299	301	302	303
30	285	284	282	281	280	279	278	278	277	277	278	278	278	278	279	280	281	282	285
35	264	263	261	260	259	258	257	257	256	256	256	256	257	258	259	260	261	263	264
40	241	240	238	237	236	235	234	234	233	233	233	234	234	235	236	237	239	240	242
45	217	216	214	213	212	211	210	209	209	209	209	210	210	211	212	213	215	217	218
50	192	191	189	188	187	186	185	185	185	184	185	185	186	186	188	189	191	192	194
55	168	166	165	164	163	162	161	161	160	160	160	161	161	162	163	165	166	168	169
60	144	142	141	140	139	138	137	137	137	137	137	137	138	139	140	141	142	144	146
65	121	120	118	118	116	116	115	115	114	114	114	115	115	116	117	118	120	121	123
70	99.8	98.4	97.3	96.4	95.4	94.8	94.2	93.8	93.4	93.4	93.6	94.0	94.5	95.3	96.2	97.1	98.2	99.3	102
75	80.3	79.2	78.2	77.3	76.5	75.9	75.4	75.0	74.6	74.7	74.9	75.2	75.6	76.3	77.1	77.9	78.9	79.9	81.9
80	62.6	62.2	61.5	60.8	60.0	59.6	59.0	58.7	58.6	58.6	59.1	58.9	59.4	59.9	60.3	61.1	61.8	62.8	64.2
85	48.6	47.8	47.1	46.4	45.9	45.4	44.9	44.7	44.5	44.5	44.6	44.8	45.1	45.5	46.0	46.6	47.3	48.1	48.9
90	36.0	35.3	34.8	34.2	33.6	33.4	33.0	32.8	32.7	32.6	32.7	32.8	33.1	33.4	33.8	34.3	34.8	35.4	36.1
95	26.0	25.5	25.1	24.6	24.3	24.0	23.8	23.6	23.5	23.4	23.5	23.5	23.7	23.9	24.2	24.6	25.0	25.4	25.9
100	18.6	18.2	17.9	17.7	17.4	17.2	17.0	16.9	16.8	16.7	16.7	16.8	16.9	17.1	17.3	17.5	17.8	18.1	18.5
105	13.5	13.3	13.1	12.9	12.7	12.6	12.5	12.4	12.3	12.3	12.3	12.3	12.3	12.4	12.6	12.7	12.9	13.1	13.3
110	10.2	10.1	9.94	9.81	9.71	9.62	9.53	9.47	9.41	9.40	9.38	9.40	9.43	9.47	9.56	9.66	9.76	9.91	9.99
115	7.93	7.83	7.74	7.64	7.55	7.48	7.41	7.35	7.32	7.29	7.31	7.31	7.33	7.36	7.45	7.51	7.60	7.70	7.78
120	6.11	6.03	5.97	5.89	5.81	5.74	5.68	5.64	5.62	5.60	5.61	5.63	5.65	5.67	5.73	5.78	5.86	5.94	6.04
125	4.67	4.61	4.56	4.50	4.42	4.37	4.31	4.28	4.26	4.25	4.26	4.28	4.30	4.32	4.36	4.41	4.48	4.55	4.63
130	3.52	3.48	3.43	3.37	3.31	3.26	3.21	3.18	3.17	3.16	3.18	3.20	3.22	3.24	3.27	3.31	3.36	3.42	3.51
135	2.59	2.56	2.52	2.47	2.42	2.37	2.33	2.30	2.29	2.30	2.32	2.34	2.36	2.37	2.40	2.42	2.47	2.53	2.61
140	1.85	1.82	1.79	1.75	1.70	1.66	1.62	1.59	1.59	1.60	1.62	1.64	1.66	1.68	1.70	1.72	1.75	1.81	1.90
145	1.26	1.23	1.21	1.17	1.14	1.10	1.06	1.04	1.05	1.06	1.08	1.10	1.12	1.13	1.15	1.17	1.19	1.24	1.33
150	0.81	0.79	0.76	0.73	0.71	0.68	0.66	0.65	0.65	0.65	0.67	0.68	0.70	0.72	0.74	0.75	0.77	0.81	0.89
155	0.50	0.48	0.46	0.44	0.42	0.41	0.41	0.41	0.41	0.40	0.40	0.41	0.43	0.44	0.47	0.49	0.50	0.51	0.57
160	0.35	0.34	0.32	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.33	0.34	0.35	0.35	0.36	0.39
165	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.36
170	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.38
175	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.39
180	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38

Table 6: Luminous Intensity Data

Table--2		UNIT: cd																		
C (DEG) γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350			
0	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346			
5	345	345	345	345	346	346	346	346	346	346	346	346	346	346	345	345	345			
10	339	340	341	341	341	341	342	342	342	342	342	342	342	342	341	340	341	340		
15	331	332	332	333	334	333	334	334	334	334	334	334	334	333	332	332	331			
20	319	320	321	322	322	323	323	323	323	324	323	323	322	322	321	320	319			
25	304	305	307	307	308	308	309	309	310	309	309	309	308	307	306	305	304			
30	286	287	289	290	291	291	292	292	293	292	292	291	290	290	288	287	286			
35	266	267	269	270	271	272	272	272	272	272	272	271	270	269	268	267	265			
40	243	245	247	248	249	250	250	250	250	250	250	249	248	247	245	244	243			
45	220	221	223	224	225	226	227	227	227	227	226	225	224	223	221	220	219			
50	195	197	199	200	201	201	202	202	202	202	201	200	199	198	197	196	194			
55	171	172	174	175	176	177	177	178	178	177	177	176	175	174	172	171	169			
60	147	149	150	151	152	153	153	153	153	153	153	152	150	150	148	147	146			
65	125	126	128	129	130	130	131	131	131	131	130	129	128	127	126	125	123			
70	103	104	106	107	107	108	108	109	109	108	108	107	106	105	104	103	102			
75	83.2	84.4	85.5	86.4	87.0	87.5	87.9	88.1	88.1	88.0	87.5	86.8	86.1	85.2	84.1	83.2	82.1			
80	65.4	66.4	67.3	68.1	68.6	69.1	69.5	69.7	69.6	69.6	69.1	68.6	68.0	67.2	66.3	65.5	64.6			
85	49.9	50.7	51.4	52.1	52.6	53.0	53.4	53.5	53.5	53.5	53.1	52.7	52.1	51.5	50.8	50.1	49.3			
90	36.8	37.5	38.1	38.7	39.1	39.5	39.8	39.9	39.9	39.9	39.6	39.2	38.8	38.3	37.8	37.2	36.6			
95	26.5	27.0	27.5	27.9	28.3	28.6	28.8	28.8	28.9	28.9	28.7	28.4	28.1	27.7	27.3	26.9	26.4			
100	18.9	19.2	19.6	19.9	20.1	20.4	20.5	20.6	20.6	20.6	20.5	20.3	20.1	19.8	19.5	19.2	18.9			
105	13.6	13.8	14.1	14.3	14.5	14.6	14.8	14.8	14.8	14.9	14.8	14.7	14.5	14.4	14.2	13.9	13.7			
110	10.1	10.3	10.4	10.6	10.7	10.8	10.9	10.9	10.9	11.0	10.9	10.9	10.8	10.7	10.6	10.4	10.3			
115	7.88	7.99	8.11	8.21	8.29	8.36	8.42	8.45	8.46	8.48	8.47	8.42	8.35	8.28	8.20	8.11	8.00			
120	6.12	6.21	6.30	6.38	6.44	6.49	6.53	6.56	6.58	6.59	6.59	6.55	6.49	6.43	6.35	6.28	6.19			
125	4.71	4.78	4.85	4.91	4.95	4.99	5.03	5.04	5.06	5.09	5.08	5.05	5.00	4.94	4.87	4.81	4.75			
130	3.57	3.64	3.69	3.74	3.77	3.79	3.82	3.84	3.86	3.88	3.88	3.85	3.81	3.75	3.70	3.64	3.59			
135	2.68	2.73	2.77	2.80	2.82	2.84	2.86	2.88	2.90	2.92	2.92	2.90	2.86	2.81	2.75	2.70	2.66			
140	1.95	2.00	2.03	2.05	2.06	2.07	2.09	2.10	2.13	2.15	2.15	2.13	2.09	2.05	2.00	1.95	1.91			
145	1.37	1.41	1.43	1.44	1.45	1.46	1.47	1.49	1.51	1.53	1.53	1.51	1.48	1.44	1.39	1.35	1.31			
150	0.92	0.95	0.96	0.97	0.98	0.98	0.99	1.01	1.03	1.04	1.04	1.03	1.00	0.97	0.93	0.90	0.86			
155	0.59	0.61	0.62	0.63	0.63	0.64	0.65	0.66	0.68	0.68	0.68	0.67	0.65	0.63	0.60	0.58	0.56			
160	0.39	0.40	0.41	0.42	0.44	0.45	0.46	0.46	0.46	0.45	0.45	0.44	0.43	0.42	0.42	0.42	0.41			
165	0.36	0.36	0.36	0.37	0.38	0.38	0.38	0.38	0.38	0.37	0.37	0.36	0.36	0.37	0.37	0.37	0.36			
170	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38			
175	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			
180	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38			

Table 7: Luminous Intensity Data



## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 05, 2021	Aug. 04, 2022
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2021	Aug. 04, 2022
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2021	Aug. 04, 2022
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2021	Aug. 04, 2022
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2021	Aug. 04, 2022
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2021	Aug. 04, 2022
Standard source	D908	HZTE012-01	Aug. 05, 2021	Aug. 04, 2022
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2021	Aug. 04, 2022
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2021	Aug. 04, 2022
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2021	Aug. 04, 2022
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2021	Aug. 04, 2022
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2021	Aug. 04, 2022
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2021	Aug. 04, 2022
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2021	Aug. 04, 2022

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  $4\pi$ . 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  $10^\circ$  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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