

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/927

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ21120007g

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/927

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
102.1	1024.6	10.04	0.8196
CCT (K)	CRI	Stabilization Time (Light & Power)	
2677	93.8	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	: Dec. 03, 2021
Date of Test	: Dec. 08, 2021
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 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)

Name	: LED Lamp
Model	: 11BR30DIM/927
Electrical Ratings	: 120V, 60Hz, 11W
Product Description	: 2700K
Manufacturer	: GREEN CREATIVE LTD
Address	: 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)	0.102
Power Factor	0.8196
Test Power (W)	10.04
THD A%	56.92
Luminous Efficacy (lm/W)	102.1
Total Luminous Flux (lm)	1024.6
Color Rendering Index (CRI)	93.8
R9	59
Correlated Color Temperature (CCT)(K)	2677
Chromaticity Chroma x	0.4640
Chromaticity Chroma y	0.4151
Chromaticity Chroma u	0.2631
Chromaticity Chroma v	0.3531
Duv	0.0013
Chromaticity Chroma u'	0.2631
Chromaticity Chroma v'	0.5297

Special Color Rendering Indices	
R1	95.2
R2	96.6
R3	96.2
R4	96
R5	94.5
R6	97.3
R7	92.3
R8	82.4
R9	59
R10	89.7
R11	97.5
R12	84.5
R13	95.4
R14	96.3

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 25.0 °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)	0.103
Power Factor	0.8175
Power (W)	10.08
Luminous Efficacy (lm/W)	104.2
Total Luminous Flux (lm)	1050.2
Beam Angle (°)	108.3 (0°-180°) / 108.3 (90°-270°)
Center Beam Candle Power (cd)	340
Maximum Beam Candle Power (cd)	340.0 (At: C=250.0, Gamma=2.0)
Spacing Criteria	1.23 (0°-180°) / 1.24(90°-270°)
Zonal Lumens in the 0 °-60 °Zone	69.94%
Zonal Lumens in the 60 °-90 °Zone	24.51%
Zonal Lumens in the 90 °-120 °Zone	4.82%
Zonal Lumens in the 120 °-180 °Zone	0.73%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

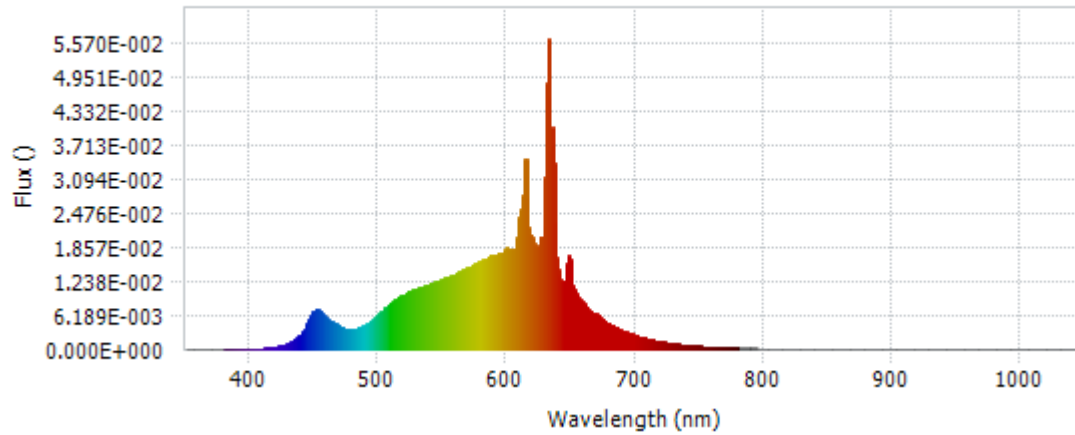
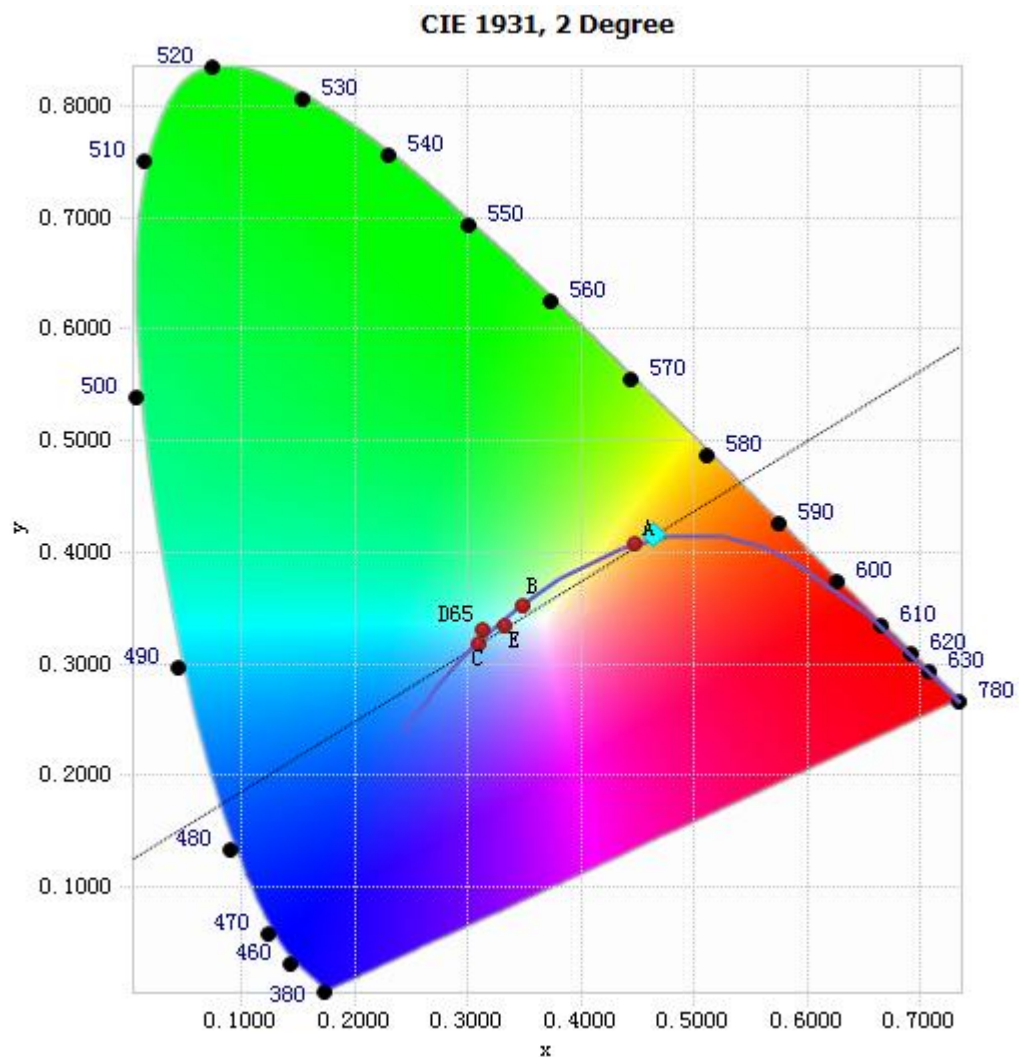


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.65E-05	485	3.86E-03	590	1.72E-02	695	2.96E-03
385	4.99E-05	490	4.48E-03	595	1.73E-02	700	2.53E-03
390	6.60E-05	495	5.31E-03	600	1.84E-02	705	2.16E-03
395	5.76E-05	500	6.33E-03	605	1.82E-02	710	1.85E-03
400	6.44E-05	505	7.43E-03	610	2.53E-02	715	1.58E-03
405	6.55E-05	510	8.38E-03	615	3.44E-02	720	1.38E-03
410	1.19E-04	515	9.26E-03	620	2.04E-02	725	1.19E-03
415	2.44E-04	520	9.96E-03	625	1.91E-02	730	1.01E-03
420	3.93E-04	525	1.05E-02	630	3.12E-02	735	8.58E-04
425	6.80E-04	530	1.10E-02	635	3.66E-02	740	7.25E-04
430	1.10E-03	535	1.14E-02	640	1.45E-02	745	6.16E-04
435	1.79E-03	540	1.18E-02	645	1.24E-02	750	5.27E-04
440	2.96E-03	545	1.23E-02	650	1.36E-02	755	4.56E-04
445	5.05E-03	550	1.27E-02	655	9.73E-03	760	3.95E-04
450	7.03E-03	555	1.32E-02	660	8.20E-03	765	3.37E-04
455	6.80E-03	560	1.37E-02	665	6.93E-03	770	2.92E-04
460	5.44E-03	565	1.42E-02	670	6.42E-03	775	2.46E-04
465	4.79E-03	570	1.48E-02	675	5.38E-03	780	2.11E-04
470	4.09E-03	575	1.55E-02	680	4.58E-03		
475	3.54E-03	580	1.60E-02	685	3.97E-03		
480	3.59E-03	585	1.67E-02	690	3.40E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4640, 0.4151)

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

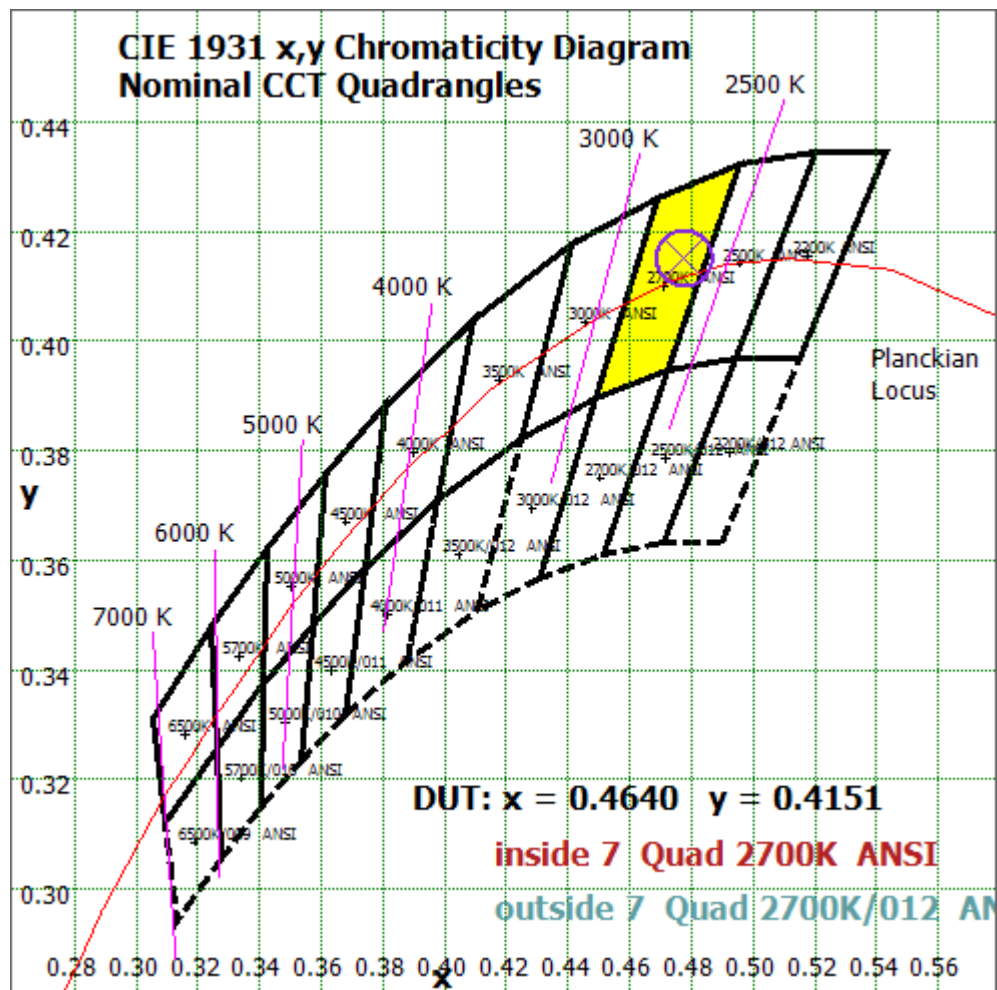


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

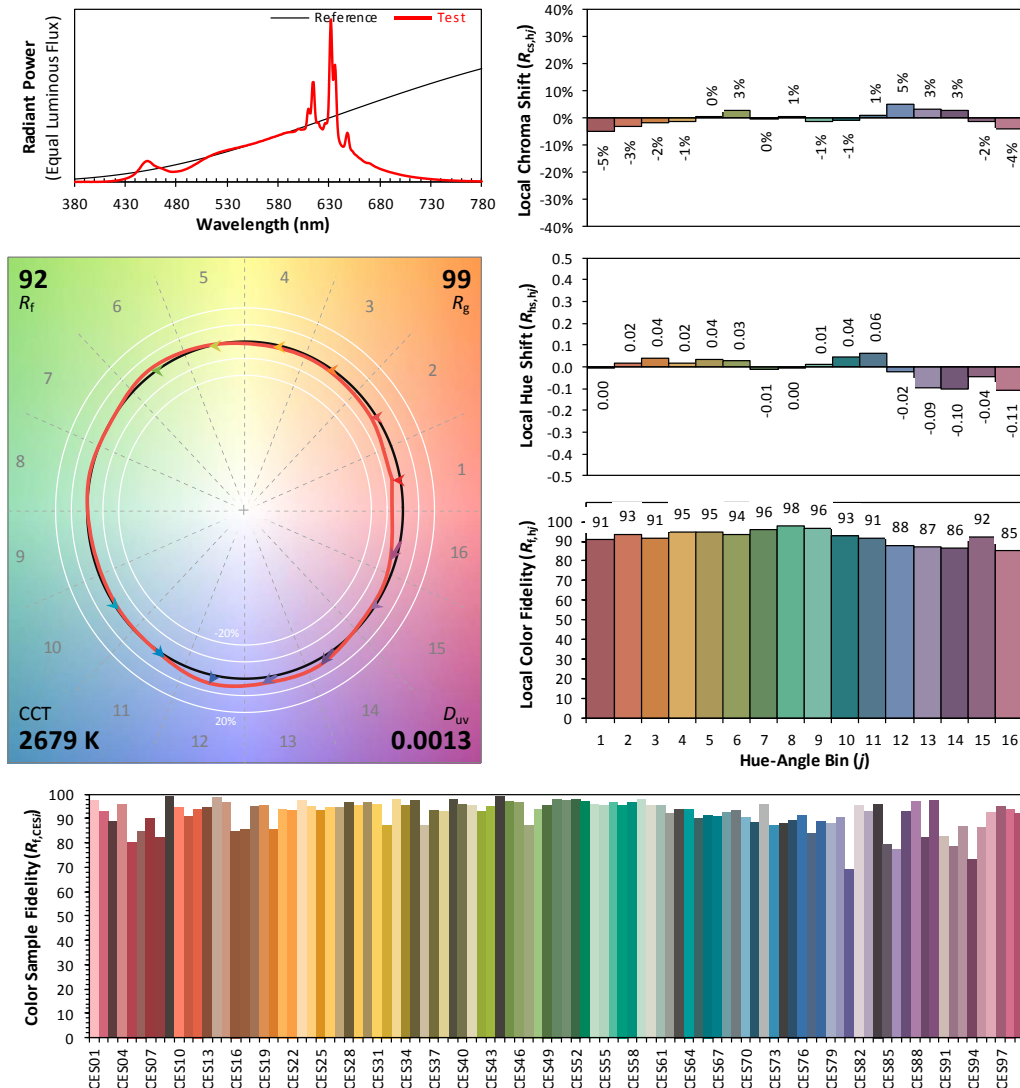
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2021/12/08

Model: 11BR30DIM/927



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

x 0.4640
 y 0.4151
 u' 0.2631
 v' 0.5297

CIE 13.3-1995
(CRI)
 R_a 94
 R_g 59

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	32.068	3.05%
10- 20	91.243	8.69%
20- 30	136.54	13.00%
30- 40	161.692	15.40%
40- 50	164.649	15.68%
50- 60	148.331	14.12%
60- 70	119.548	11.38%
70- 80	84.991	8.09%
80- 90	52.913	5.04%
90-100	28.435	2.71%
100-110	14.333	1.36%
110-120	7.82	0.74%
120-130	4.241	0.40%
130-140	2.091	0.20%
140-150	0.874	0.08%
150-160	0.287	0.03%
160-170	0.1	0.01%
170-180	0.034	0.00%
Total	1050.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	734.523	69.94%
60- 90	257.452	24.51%
0-90	991.975	94.46%
90- 180	58.215	5.54%
0- 180	1050.2	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

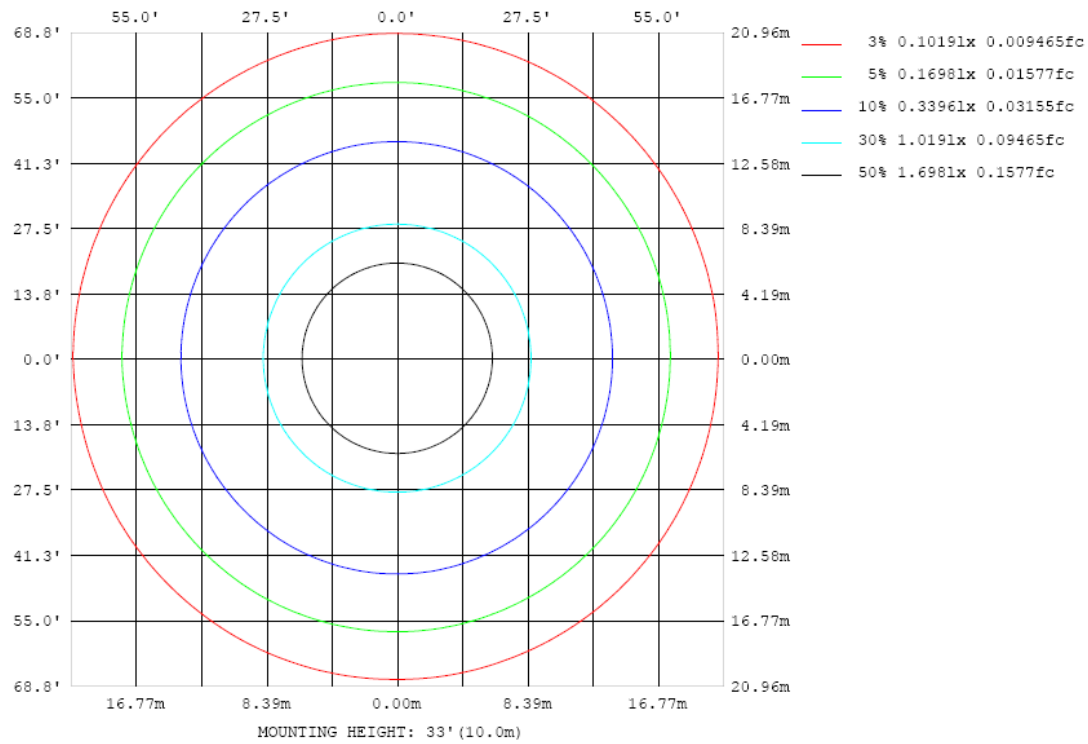


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

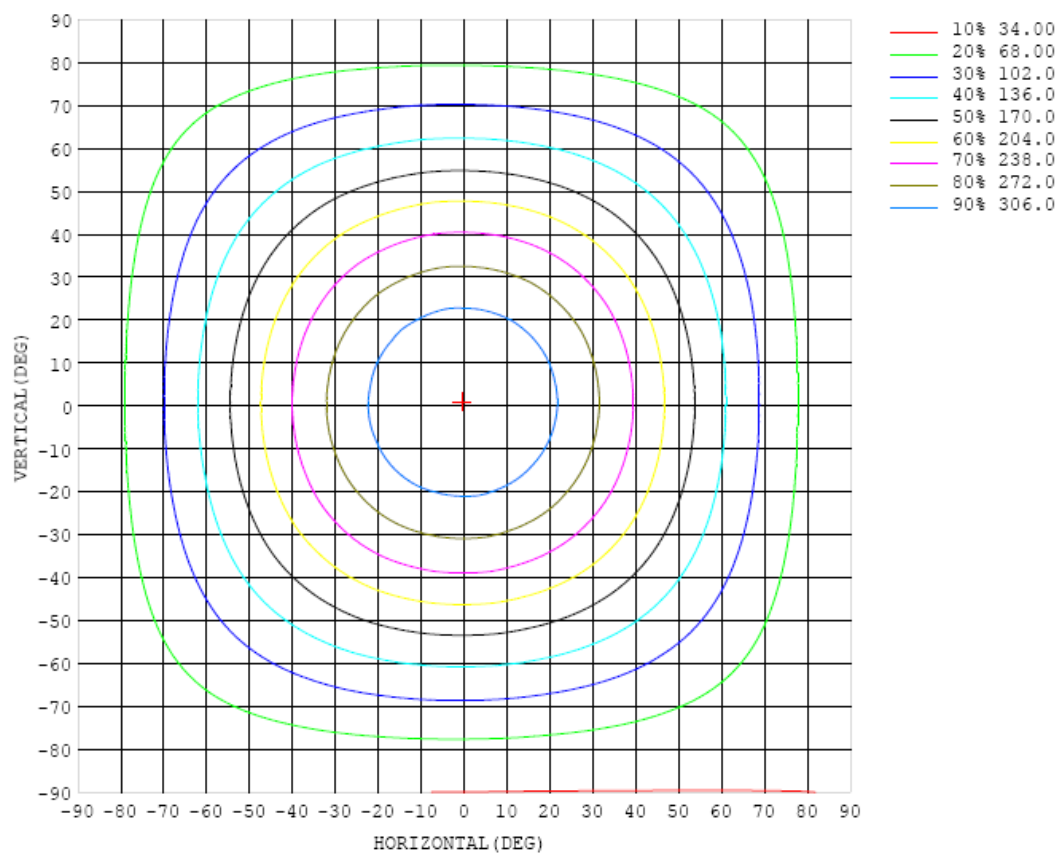


Chart 6: Isocandela Plot

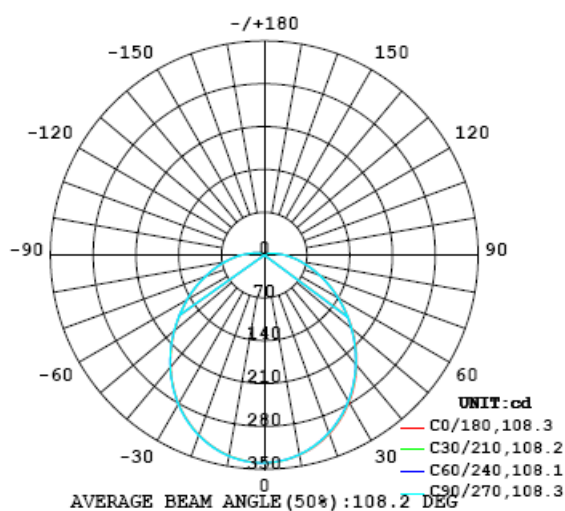


Chart 7: Polar Candela Distribution

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	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340
5	337	338	337	337	337	337	337	337	338	337	337	337	337	338	338	338	338	338	338
10	332	332	331	331	331	331	331	331	331	331	331	331	332	332	332	332	333	333	333
15	323	323	322	322	321	321	321	321	322	322	322	322	322	323	323	324	324	324	325
20	311	310	310	309	309	309	309	309	309	309	309	309	310	311	311	312	312	312	313
25	296	295	295	294	294	293	293	293	294	294	294	294	295	296	296	297	297	297	298
30	278	277	277	276	275	275	275	275	276	275	276	276	277	278	278	279	279	280	280
35	258	257	256	256	255	255	255	255	256	255	256	256	257	258	258	259	259	260	260
40	235	235	234	234	233	233	233	233	233	233	234	234	235	236	236	237	237	238	238
45	212	211	211	210	210	210	210	209	210	210	211	211	212	212	212	213	214	214	215
50	188	187	187	186	186	186	186	186	187	186	187	187	188	188	188	189	190	191	191
55	164	163	163	163	162	162	162	162	163	163	163	164	164	164	165	166	166	167	168
60	141	140	139	139	139	139	139	139	140	139	140	140	141	141	142	142	143	144	145
65	118	117	117	117	117	117	117	117	117	117	118	118	119	119	119	120	121	121	123
70	97.0	96.4	96.2	96.0	95.8	95.8	95.8	96.0	96.3	96.4	96.9	97.3	97.8	98.0	98.5	99.1	99.5	100	102
75	77.7	77.3	77.0	76.8	76.7	76.7	76.7	76.8	77.2	77.3	77.7	78.0	78.5	78.8	79.3	79.9	80.3	81.0	82.4
80	61.0	60.6	60.4	60.2	60.1	60.6	60.2	60.1	60.4	60.6	61.3	61.5	61.7	61.5	62.3	62.8	63.2	63.8	64.9
85	46.5	46.2	46.0	45.8	45.6	45.6	45.6	45.7	46.0	46.1	46.4	46.7	47.1	47.4	47.8	48.3	48.6	49.1	49.6
90	34.2	33.9	33.7	33.5	33.4	33.4	33.4	33.5	33.7	33.8	34.1	34.3	34.6	34.9	35.2	35.6	35.9	36.3	36.7
95	24.5	24.3	24.2	24.0	23.9	23.9	23.9	23.9	24.1	24.2	24.4	24.6	24.8	25.1	25.3	25.6	25.9	26.2	26.5
100	17.4	17.3	17.2	17.0	17.0	16.9	16.9	17.0	17.1	17.2	17.3	17.4	17.6	17.8	18.0	18.3	18.5	18.7	19.0
105	12.6	12.5	12.4	12.3	12.3	12.3	12.3	12.3	12.4	12.4	12.5	12.6	12.8	12.9	13.1	13.2	13.4	13.6	13.8
110	9.55	9.46	9.38	9.33	9.29	9.27	9.24	9.26	9.32	9.35	9.43	9.51	9.62	9.74	9.86	9.99	10.1	10.2	10.4
115	7.44	7.38	7.32	7.27	7.23	7.21	7.20	7.20	7.25	7.28	7.35	7.42	7.50	7.60	7.69	7.80	7.90	8.01	8.11
120	5.77	5.71	5.66	5.62	5.59	5.57	5.55	5.55	5.59	5.63	5.68	5.74	5.81	5.88	5.96	6.05	6.13	6.21	6.33
125	4.43	4.38	4.35	4.32	4.28	4.27	4.25	4.25	4.28	4.32	4.37	4.42	4.48	4.54	4.60	4.67	4.73	4.80	4.90
130	3.35	3.31	3.29	3.27	3.24	3.22	3.21	3.20	3.23	3.26	3.31	3.36	3.41	3.46	3.50	3.56	3.61	3.67	3.75
135	2.48	2.46	2.44	2.43	2.40	2.39	2.37	2.36	2.39	2.42	2.46	2.50	2.55	2.59	2.62	2.66	2.70	2.75	2.83
140	1.78	1.77	1.76	1.75	1.73	1.71	1.69	1.68	1.70	1.74	1.77	1.81	1.85	1.88	1.90	1.93	1.97	2.01	2.09
145	1.23	1.22	1.21	1.20	1.19	1.18	1.16	1.15	1.17	1.19	1.23	1.26	1.29	1.32	1.34	1.36	1.38	1.42	1.50
150	0.80	0.80	0.79	0.78	0.78	0.77	0.75	0.75	0.75	0.78	0.81	0.83	0.86	0.88	0.90	0.91	0.94	0.96	1.03
155	0.50	0.50	0.49	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.50	0.52	0.55	0.56	0.58	0.60	0.62	0.64	0.70
160	0.33	0.33	0.32	0.31	0.31	0.32	0.33	0.34	0.34	0.33	0.33	0.34	0.36	0.38	0.40	0.42	0.44	0.44	0.47
165	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.32	0.33	0.33	0.34	0.34	0.37
170	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.33	0.34
175	0.35	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35
180	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37

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	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340	340		
5	338	338	338	339	338	338	339	339	338	338	338	338	338	338	338	338	337		
10	333	333	333	333	334	334	334	334	334	334	333	333	333	333	333	332	332		
15	324	325	325	325	325	325	325	326	325	325	325	325	325	324	324	324	323		
20	313	313	313	313	314	314	314	314	314	314	313	313	313	312	312	312	311		
25	298	298	298	299	299	299	299	300	299	299	299	299	299	298	297	297	296		
30	280	281	281	281	282	281	281	282	281	281	281	281	280	280	280	279	278		
35	260	261	261	261	262	261	262	262	262	261	261	261	260	260	260	258	258		
40	239	239	239	239	240	240	240	240	240	240	239	239	238	238	237	236	236		
45	215	216	216	216	217	217	217	217	217	216	216	216	215	214	214	213	212		
50	192	192	192	192	193	193	193	193	193	193	192	192	191	190	190	189	188		
55	168	169	169	169	169	169	169	169	169	169	168	168	167	166	166	165	164		
60	145	146	146	146	146	146	146	146	146	146	145	145	144	143	143	142	141		
65	123	124	124	124	124	124	124	124	124	124	123	123	122	121	121	120	119		
70	102	103	103	103	103	103	103	103	103	102	102	101	101	100	99.4	98.6	98.1		
75	82.7	83.1	83.4	83.6	83.8	83.7	83.7	83.7	83.3	82.9	82.5	81.9	81.3	80.6	80.1	79.3	78.9		
80	65.2	65.5	65.8	66.0	66.1	66.1	66.1	66.1	65.8	65.3	64.9	64.5	63.9	63.4	62.8	62.1	61.7		
85	49.9	50.2	50.4	50.6	50.7	50.7	50.7	50.8	50.4	50.1	49.7	49.3	48.8	48.3	47.8	47.2	46.9		
90	37.0	37.3	37.5	37.6	37.8	37.8	37.8	37.8	37.5	37.3	36.9	36.6	36.1	35.8	35.3	34.9	34.6		
95	26.8	27.0	27.2	27.3	27.4	27.4	27.4	27.4	27.2	27.0	26.7	26.4	26.1	25.8	25.4	25.1	24.8		
100	19.2	19.4	19.5	19.6	19.6	19.6	19.6	19.6	19.5	19.3	19.1	18.9	18.6	18.4	18.1	17.9	17.7		
105	14.0	14.1	14.2	14.2	14.3	14.3	14.3	14.3	14.2	14.0	13.9	13.7	13.4	13.2	13.1	12.9	12.7		
110	10.5	10.6	10.6	10.7	10.7	10.7	10.7	10.7	10.6	10.5	10.4	10.3	10.1	10.0	9.88	9.74	9.63		
115	8.20	8.28	8.33	8.37	8.40	8.40	8.38	8.36	8.29	8.22	8.13	8.04	7.93	7.82	7.71	7.60	7.51		
120	6.41	6.47	6.51	6.54	6.56	6.55	6.53	6.52	6.45	6.40	6.33	6.25	6.16	6.08	5.99	5.90	5.83		
125	4.96	5.01	5.05	5.07	5.08	5.07	5.05	5.03	4.98	4.94	4.88	4.82	4.75	4.68	4.61	4.54	4.48		
130	3.81	3.85	3.88	3.89	3.90	3.88	3.86	3.84	3.79	3.76	3.72	3.67	3.61	3.55	3.50	3.44	3.39		
135	2.88	2.92	2.94	2.94	2.94	2.93	2.90	2.88	2.84	2.81	2.78	2.75	2.70	2.65	2.61	2.56	2.52		
140	2.13	2.16	2.17	2.17	2.17	2.15	2.12	2.10	2.07	2.05	2.03	2.00	1.97	1.93	1.89	1.85	1.82		
145	1.53	1.55	1.56	1.55	1.54	1.52	1.50	1.47	1.45	1.43	1.42	1.40	1.38	1.35	1.32	1.29	1.26		
150	1.07	1.08	1.08	1.07	1.06	1.04	1.01	0.99	0.97	0.96	0.94	0.94	0.92	0.90	0.87	0.86	0.84		
155	0.72	0.73	0.73	0.72	0.70	0.69	0.66	0.64	0.62	0.61	0.60	0.59	0.58	0.57	0.55	0.55	0.54		
160	0.50	0.51	0.50	0.50	0.49	0.48	0.46	0.45	0.44	0.42	0.40	0.39	0.37	0.37	0.38	0.38	0.37		
165	0.41	0.40	0.40	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.37	0.37	0.36	0.36	0.36	0.35	0.35		
170	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.37		
175	0.36	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.36		
180	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37		

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 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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