

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: 11BR40DIM/930

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,
Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ21120007k

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: **11BR40DIM/930**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
112.9	1097.5	9.72	0.8184
CCT (K)	CRI	Stabilization Time (Light & Power)	
3036	94.9	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. 09, 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

TABLE OF CONTENT

LM-79-08 TEST REPORT	1
TEST SUMMARY	2
SAMPLE PHOTO	4
TEST RESULTS	5
Sphere-Spectroradiometer Method.....	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Color Rendition Report – Sphere Spectroradiometer Method	10
Zonal Lumen Tabulation- Goniophotometer Method	11
Illuminance Plots- Goniophotometer Method	12
Luminous Intensity Distribution Plots- Goniophotometer Method.....	13
Luminous Intensity Data- Goniophotometer Method	14
EQUIPMENT LIST	16
TEST METHODS	16
Seasoning of SSL Product.....	16
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	16
Goniophotometer Method	17
Photometric and Electrical Measurements	17
Color Characteristics Measurements.....	17
Color Spatial Uniformity	17

SAMPLE PHOTO



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Lamp
Model	: 11BR40DIM/930
Electrical Ratings	: 120V, 60Hz, 11W
Product Description	: 3000K
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)	0.099
Power Factor	0.8184
Test Power (W)	9.72
THD A%	57.10
Luminous Efficacy (lm/W)	112.9
Total Luminous Flux (lm)	1097.5
Color Rendering Index (CRI)	94.9
R9	67
Correlated Color Temperature (CCT)(K)	3036
Chromaticity Chroma x	0.4337
Chromaticity Chroma y	0.4018
Chromaticity Chroma u	0.2494
Chromaticity Chroma v	0.3467
Duv	-0.0004
Chromaticity Chroma u'	0.2494
Chromaticity Chroma v'	0.5200

Special Color Rendering Indices	
R1	97.1
R2	97.2
R3	95.4
R4	96.6
R5	96.1
R6	96.5
R7	93.6
R8	86.6
R9	67
R10	90.9
R11	96.5
R12	82.8
R13	97
R14	96

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)	0.100
Power Factor	0.8136
Power (W)	9.75
Luminous Efficacy (lm/W)	115.4
Total Luminous Flux (lm)	1125.4
Beam Angle (°)	107.9 (0°-180°) /107.7(90°-270°)
Center Beam Candle Power (cd)	367
Maximum Beam Candle Power (cd)	367.4 (At: C=250.0, Gamma=2.5)
Spacing Criteria	1.21 (0°-180°) / 1.23 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	69.54%
Zonal Lumens in the 60 °-90 °Zone	24.83%
Zonal Lumens in the 90 °-120 °Zone	4.89%
Zonal Lumens in the 120 °-180 °Zone	0.73%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

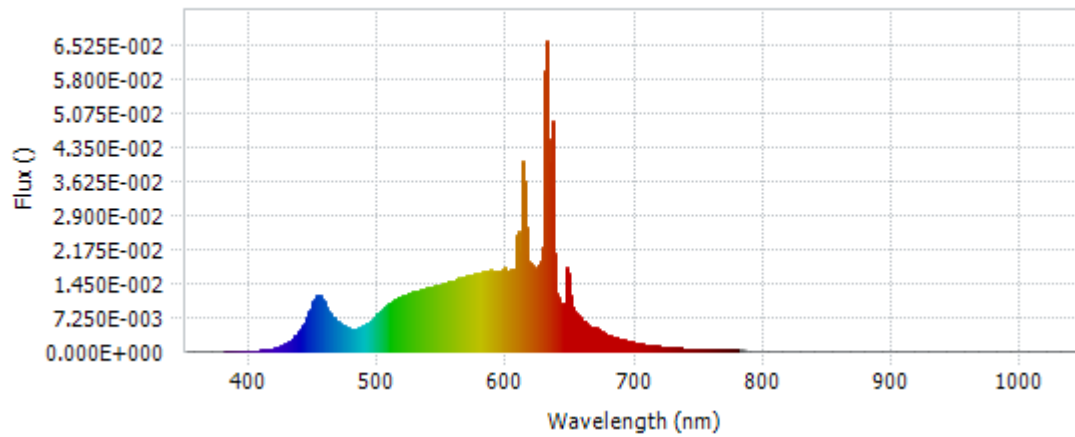
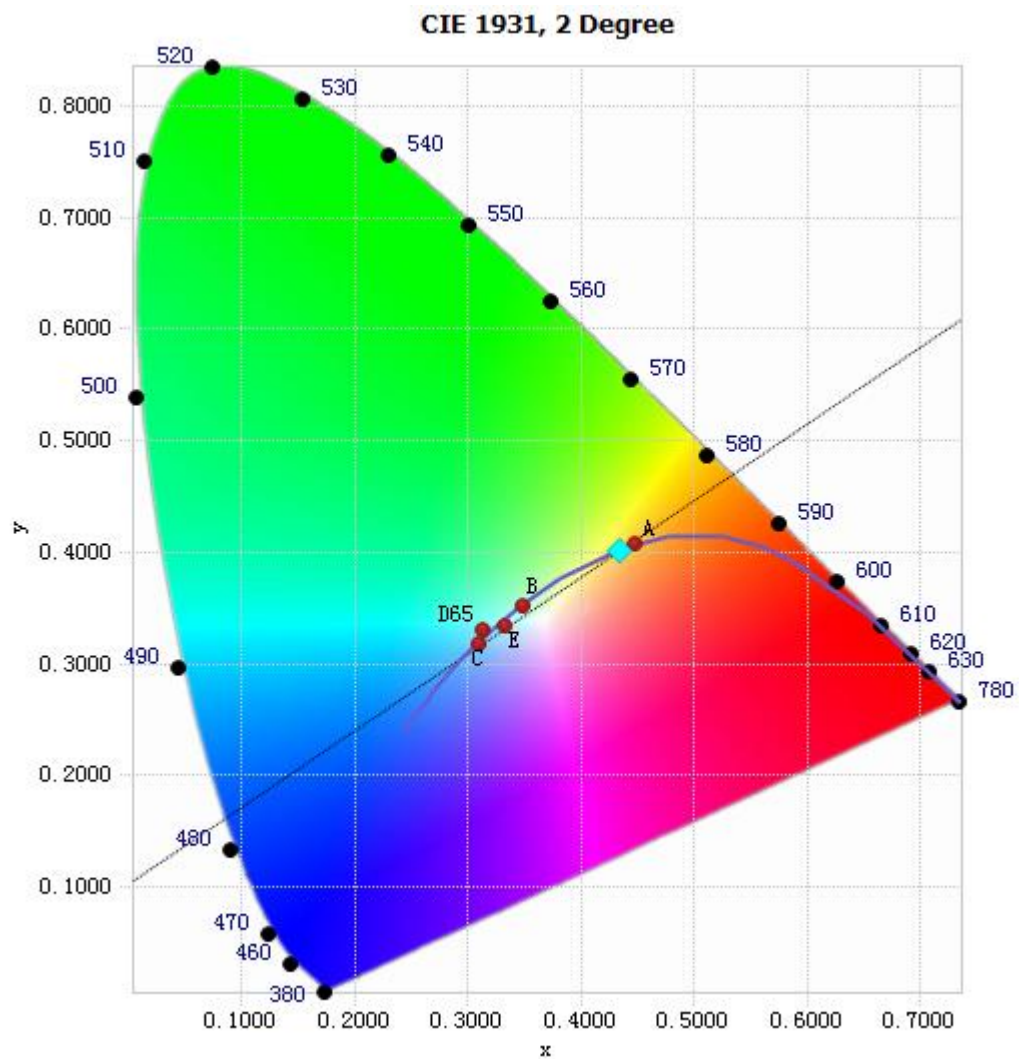


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	9.54E-05	485	4.89E-03	590	1.71E-02	695	2.04E-03
385	2.40E-05	490	5.67E-03	595	1.68E-02	700	1.74E-03
390	5.91E-05	495	6.76E-03	600	1.72E-02	705	1.48E-03
395	8.38E-05	500	8.09E-03	605	1.72E-02	710	1.26E-03
400	4.51E-05	505	9.33E-03	610	2.12E-02	715	1.08E-03
405	7.42E-05	510	1.03E-02	615	2.65E-02	720	9.43E-04
410	1.71E-04	515	1.13E-02	620	1.83E-02	725	7.82E-04
415	3.36E-04	520	1.18E-02	625	1.84E-02	730	6.71E-04
420	6.29E-04	525	1.23E-02	630	5.98E-02	735	5.63E-04
425	1.15E-03	530	1.28E-02	635	4.87E-02	740	4.89E-04
430	1.99E-03	535	1.32E-02	640	1.13E-02	745	4.35E-04
435	3.20E-03	540	1.35E-02	645	1.02E-02	750	3.49E-04
440	4.97E-03	545	1.39E-02	650	9.86E-03	755	3.14E-04
445	7.67E-03	550	1.42E-02	655	7.62E-03	760	2.55E-04
450	1.09E-02	555	1.47E-02	660	6.33E-03	765	2.31E-04
455	1.14E-02	560	1.51E-02	665	5.14E-03	770	1.95E-04
460	8.72E-03	565	1.56E-02	670	4.89E-03	775	1.68E-04
465	6.97E-03	570	1.60E-02	675	3.87E-03	780	1.40E-04
470	5.88E-03	575	1.64E-02	680	3.27E-03		
475	4.91E-03	580	1.67E-02	685	2.80E-03		
480	4.57E-03	585	1.71E-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): (0.4337, 0.4018)

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

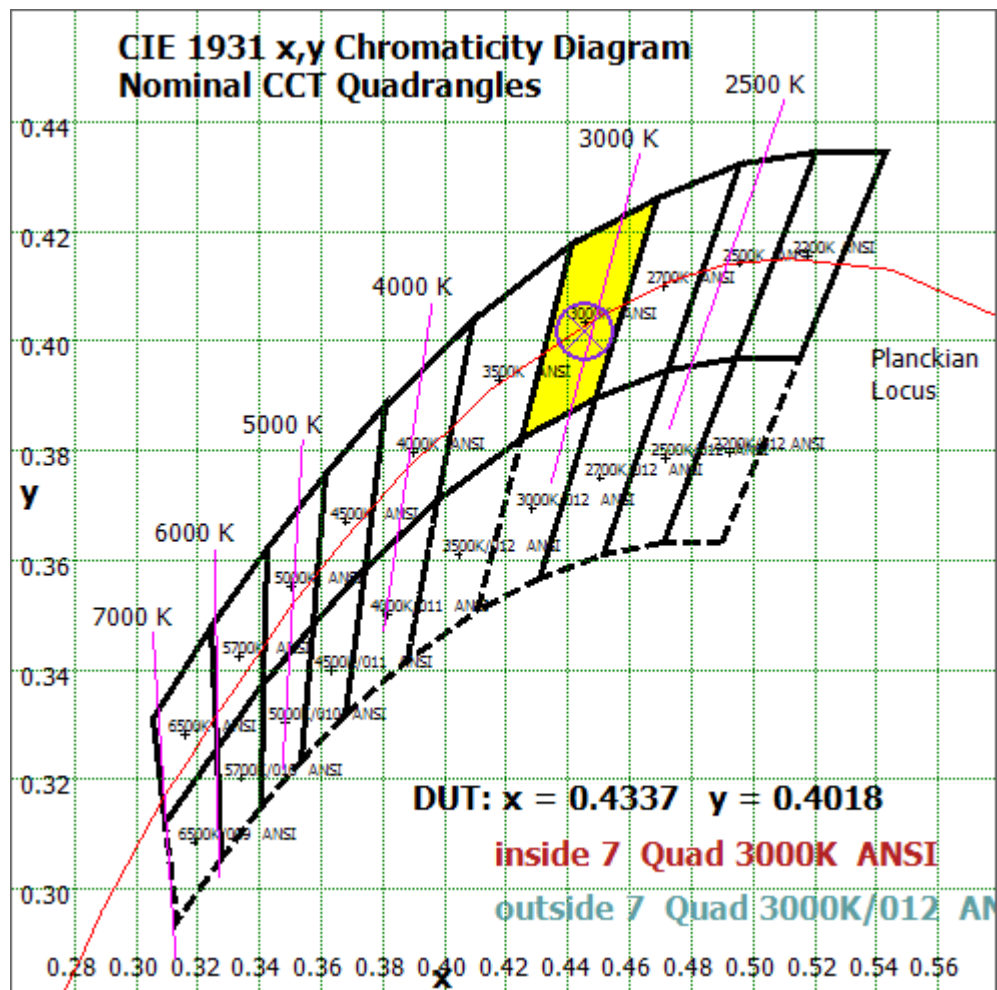


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

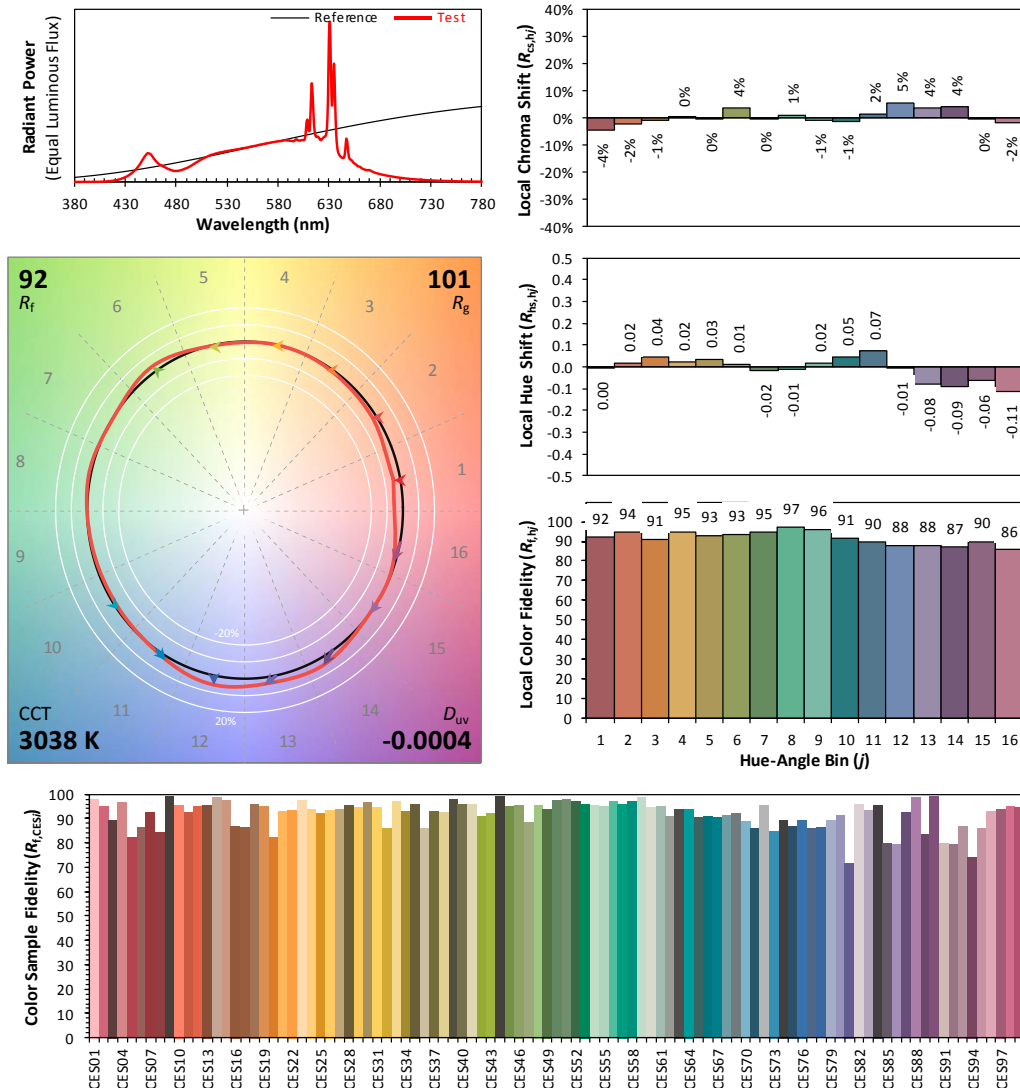
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2021/12/09

Model: 11BR40DIM/930



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

x 0.4337
 y 0.4018
 u' 0.2494
 v' 0.5200

CIE 13.3-1995
(CRI)
 R_a 95
 R_9 67

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	34.595	3.07%
10- 20	97.872	8.70%
20- 30	145.209	12.90%
30- 40	170.929	15.19%
40- 50	174.581	15.51%
50- 60	159.451	14.17%
60- 70	130.12	11.56%
70- 80	92.501	8.22%
80- 90	56.828	5.05%
90-100	30.523	2.71%
100-110	16.041	1.43%
110-120	8.505	0.76%
120-130	4.429	0.39%
130-140	2.247	0.20%
140-150	1.028	0.09%
150-160	0.387	0.03%
160-170	0.124	0.01%
170-180	0.037	0.00%
Total	1125.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	782.637	69.54%
60- 90	279.449	24.83%
0-90	1062.09	94.37%
90- 180	63.321	5.63%
0- 180	1125.4	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

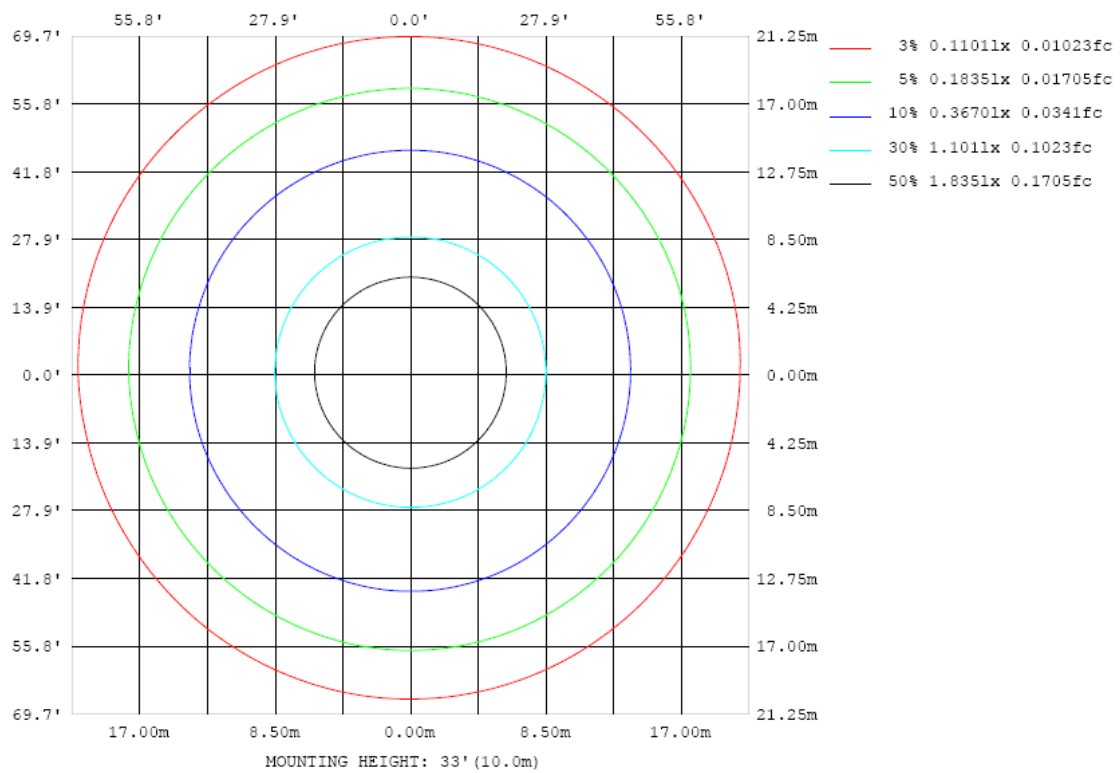


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

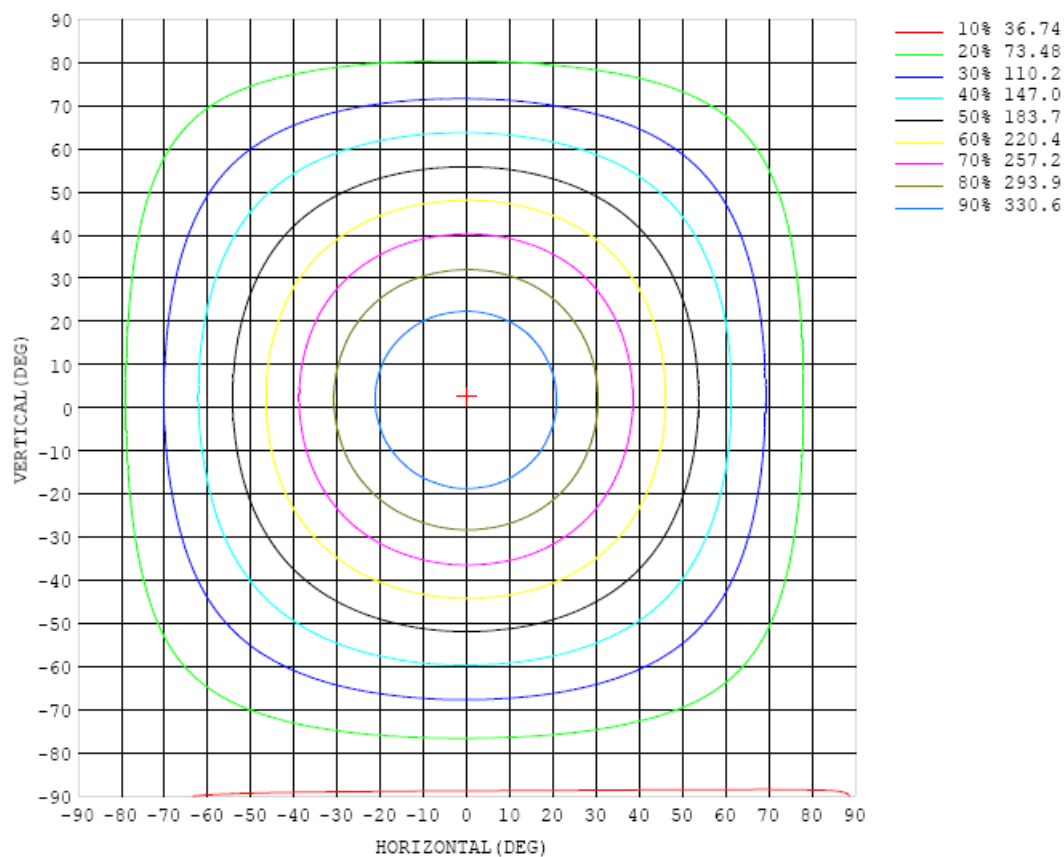


Chart 6: Isocandela Plot

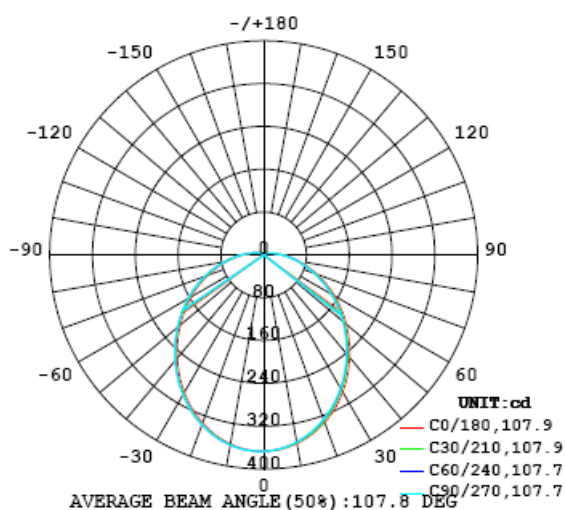


Chart 7: Polar Candela Distribution

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	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367
5	365	364	364	364	364	363	363	363	363	363	363	363	363	363	364	364	364	365	365
10	358	357	357	356	356	356	355	355	355	354	355	355	355	356	356	357	357	358	359
15	347	347	346	345	344	344	343	343	342	342	342	343	343	344	344	345	346	347	348
20	333	332	331	330	329	328	328	327	327	326	326	327	327	328	329	330	332	332	334
25	316	314	313	312	311	310	309	309	308	308	307	308	309	310	311	312	314	315	317
30	295	294	292	291	290	289	288	288	287	287	287	287	287	289	290	292	293	295	297
35	273	272	270	269	268	267	265	265	264	264	264	264	265	266	268	269	271	273	275
40	250	248	246	245	244	243	242	242	241	241	240	241	241	242	244	245	247	249	251
45	226	224	222	221	220	219	218	218	217	217	217	217	218	218	220	221	223	225	227
50	201	200	198	197	196	195	194	193	193	193	193	193	194	194	196	197	199	201	204
55	177	175	174	173	171	171	170	169	169	169	169	169	170	170	172	173	175	177	180
60	153	151	150	149	147	147	146	146	146	146	146	146	146	147	148	150	152	154	156
65	129	128	126	125	124	123	123	123	122	122	122	123	123	124	125	127	129	131	134
70	107	105	104	103	102	101	101	100	100	100	100	101	101	102	103	104	106	108	111
75	85.3	84.0	82.8	81.8	81.0	80.5	80.0	79.9	79.8	79.8	79.9	80.3	80.8	81.6	82.3	83.6	85.2	86.7	89.4
80	66.0	65.5	64.8	63.8	63.4	62.6	62.4	62.2	62.1	62.2	62.4	62.7	63.0	63.7	64.7	65.4	66.5	68.3	69.8
85	50.3	49.4	48.6	47.9	47.5	46.9	46.7	46.6	46.5	46.6	46.8	47.1	47.5	48.1	48.8	49.7	50.7	51.8	52.9
90	36.8	36.1	35.5	35.0	34.6	34.3	34.1	34.0	34.0	34.0	34.2	34.4	34.8	35.2	35.8	36.5	37.3	38.1	38.9
95	26.5	26.1	25.6	25.3	24.9	24.7	24.6	24.5	24.5	24.6	24.7	24.9	25.1	25.5	25.9	26.4	27.0	27.5	28.2
100	19.4	19.0	18.7	18.5	18.2	18.1	18.0	17.9	18.0	18.0	18.0	18.2	18.4	18.6	18.9	19.2	19.6	20.0	20.5
105	14.5	14.2	14.0	13.8	13.7	13.6	13.5	13.5	13.5	13.5	13.6	13.7	13.8	14.0	14.2	14.4	14.7	15.0	15.4
110	10.9	10.7	10.5	10.4	10.3	10.2	10.2	10.1	10.1	10.2	10.2	10.3	10.4	10.5	10.7	10.9	11.1	11.3	11.5
115	8.17	8.04	7.94	7.85	7.74	7.69	7.65	7.64	7.64	7.68	7.70	7.77	7.85	7.95	8.06	8.20	8.35	8.50	8.66
120	6.15	6.06	5.98	5.90	5.84	5.80	5.77	5.77	5.77	5.79	5.81	5.87	5.92	5.99	6.08	6.18	6.30	6.41	6.57
125	4.68	4.61	4.54	4.49	4.44	4.42	4.40	4.40	4.40	4.41	4.42	4.47	4.52	4.57	4.63	4.71	4.79	4.88	5.01
130	3.57	3.52	3.47	3.43	3.40	3.38	3.37	3.36	3.36	3.38	3.39	3.42	3.46	3.51	3.55	3.62	3.68	3.75	3.85
135	2.72	2.68	2.64	2.61	2.59	2.57	2.56	2.55	2.55	2.56	2.58	2.61	2.64	2.68	2.72	2.77	2.82	2.88	2.97
140	2.04	2.00	1.97	1.95	1.93	1.92	1.91	1.90	1.90	1.90	1.92	1.94	1.97	2.01	2.05	2.09	2.13	2.17	2.26
145	1.49	1.46	1.43	1.42	1.41	1.40	1.39	1.38	1.38	1.38	1.39	1.41	1.44	1.47	1.50	1.54	1.57	1.61	1.69
150	1.05	1.02	1.01	1.00	0.99	0.98	0.98	0.97	0.96	0.96	0.96	0.98	1.01	1.04	1.06	1.09	1.12	1.15	1.23
155	0.72	0.70	0.69	0.68	0.68	0.67	0.67	0.66	0.65	0.64	0.64	0.65	0.68	0.70	0.72	0.75	0.76	0.79	0.86
160	0.48	0.48	0.48	0.47	0.47	0.46	0.45	0.44	0.44	0.43	0.43	0.43	0.43	0.45	0.47	0.49	0.50	0.52	0.59
165	0.36	0.36	0.36	0.36	0.35	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.36	0.37	0.45
170	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.34	0.34	0.34	0.34	0.34	0.34	0.40
175	0.38	0.38	0.38	0.38	0.37	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.41
180	0.40	0.40	0.41	0.42	0.41	0.42	0.41	0.42	0.42	0.41	0.42	0.42	0.42	0.40	0.41	0.40	0.40	0.40	0.40

Table 6: Luminous Intensity Data

C (DEG) γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367	367		
5	365	365	366	366	366	366	367	366	366	366	366	366	366	365	365	365	364		
10	359	360	360	361	361	361	361	361	361	361	361	360	360	360	359	359	358		
15	349	350	350	351	351	351	352	352	351	351	351	351	350	350	349	349	348		
20	335	336	337	337	338	338	338	338	338	337	338	337	337	336	336	335	334		
25	318	319	320	321	321	321	321	321	321	321	321	321	320	320	319	318	317		
30	298	299	300	301	301	302	302	302	302	302	302	302	301	300	299	298	297		
35	276	278	279	280	280	280	281	281	281	281	281	280	280	279	278	276	275		
40	253	254	256	257	257	257	258	258	258	258	258	258	257	256	255	253	251		
45	229	231	232	233	233	234	235	235	235	235	235	234	234	233	231	229	227		
50	205	207	208	209	210	210	211	211	211	211	211	210	209	208	207	205	203		
55	182	183	184	186	186	187	187	187	187	187	187	186	185	184	183	181	179		
60	158	160	161	162	163	163	164	164	163	163	162	162	161	160	158	157	155		
65	136	137	138	139	140	140	141	141	141	140	140	139	138	137	135	134	132		
70	112	114	115	116	117	117	118	118	117	117	116	115	114	113	112	110	109		
75	90.8	92.1	93.2	94.0	94.7	95.2	95.4	95.4	95.0	94.6	93.9	92.9	92.0	90.9	89.8	88.7	87.3		
80	71.0	72.2	73.1	73.9	74.4	74.8	75.1	75.0	74.7	74.2	73.5	72.8	71.9	71.0	70.0	68.9	67.9		
85	53.9	54.8	55.6	56.4	56.8	57.1	57.2	57.1	56.8	56.5	55.9	55.3	54.6	53.7	53.0	52.1	51.2		
90	39.8	40.5	41.1	41.7	42.0	42.3	42.4	42.3	42.1	41.8	41.3	40.8	40.2	39.6	38.9	38.2	37.5		
95	28.8	29.3	29.8	30.2	30.5	30.7	30.7	30.6	30.5	30.2	29.9	29.5	29.1	28.6	28.1	27.6	27.0		
100	20.9	21.3	21.6	21.9	22.1	22.2	22.3	22.2	22.1	21.9	21.7	21.4	21.1	20.8	20.4	20.1	19.7		
105	15.6	15.9	16.1	16.3	16.4	16.5	16.5	16.5	16.4	16.3	16.1	15.9	15.7	15.5	15.2	15.0	14.7		
110	11.7	11.9	12.0	12.2	12.3	12.3	12.3	12.3	12.2	12.1	12.0	11.9	11.7	11.5	11.4	11.2	11.0		
115	8.83	8.96	9.08	9.17	9.24	9.26	9.30	9.27	9.21	9.14	9.04	8.92	8.80	8.66	8.53	8.40	8.26		
120	6.69	6.79	6.88	6.94	6.99	7.02	7.04	7.01	6.97	6.91	6.83	6.74	6.65	6.55	6.45	6.35	6.24		
125	5.10	5.18	5.25	5.30	5.33	5.36	5.36	5.34	5.30	5.25	5.19	5.13	5.06	4.98	4.91	4.83	4.75		
130	3.92	3.98	4.04	4.08	4.11	4.12	4.12	4.10	4.07	4.03	3.98	3.93	3.88	3.82	3.76	3.70	3.64		
135	3.03	3.08	3.12	3.15	3.18	3.18	3.18	3.17	3.14	3.11	3.07	3.03	2.99	2.94	2.89	2.84	2.79		
140	2.31	2.36	2.39	2.42	2.44	2.44	2.44	2.42	2.40	2.37	2.34	2.31	2.28	2.24	2.20	2.16	2.11		
145	1.74	1.77	1.80	1.83	1.85	1.85	1.84	1.82	1.80	1.78	1.76	1.73	1.70	1.67	1.64	1.61	1.56		
150	1.27	1.30	1.33	1.35	1.36	1.37	1.36	1.34	1.32	1.30	1.28	1.26	1.24	1.22	1.19	1.16	1.12		
155	0.89	0.92	0.95	0.97	0.98	0.98	0.98	0.96	0.95	0.93	0.91	0.89	0.88	0.86	0.84	0.81	0.78		
160	0.62	0.65	0.67	0.69	0.70	0.70	0.70	0.69	0.68	0.66	0.65	0.63	0.61	0.60	0.58	0.56	0.54		
165	0.46	0.48	0.49	0.50	0.51	0.51	0.52	0.51	0.51	0.50	0.49	0.48	0.46	0.44	0.43	0.41	0.41		
170	0.40	0.40	0.41	0.41	0.42	0.43	0.43	0.43	0.44	0.43	0.43	0.42	0.42	0.41	0.41	0.40	0.40		
175	0.41	0.41	0.41	0.41	0.41	0.41	0.42	0.42	0.42	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41		
180	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40		

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

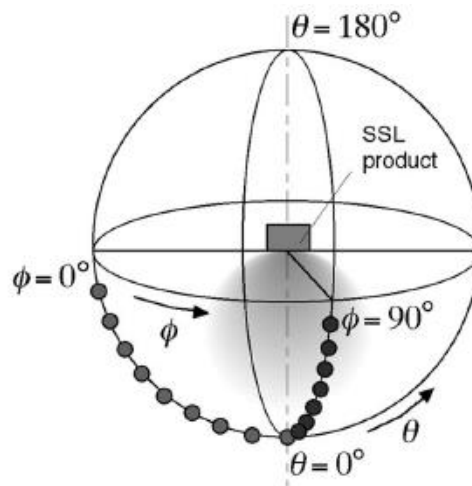
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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 ***

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.