

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: 7R20DIM/940

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ21120007c

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: **7R20DIM/940**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
98.8	683.4	6.92	0.7979
CCT (K)	CRI	Stabilization Time (Light & Power)	
3816	90.5	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	: 7R20DIM/940
Electrical Ratings	: 120V, 60Hz, 7W
Product Description	: 4000K
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)	0.072
Power Factor	0.7979
Test Power (W)	6.92
THD A%	60.15
Luminous Efficacy (lm/W)	98.8
Total Luminous Flux (lm)	683.4
Color Rendering Index (CRI)	90.5
R9	53.8
Correlated Color Temperature (CCT)(K)	3816
Chromaticity Chroma x	0.3895
Chromaticity Chroma y	0.3841
Chromaticity Chroma u	0.2281
Chromaticity Chroma v	0.3374
Duv	0.0009
Chromaticity Chroma u'	0.2281
Chromaticity Chroma v'	0.5061

Special Color Rendering Indices	
R1	91.2
R2	92.6
R3	92.5
R4	91.8
R5	90.2
R6	90.1
R7	92.9
R8	82.8
R9	53.8
R10	81
R11	91.8
R12	72
R13	91.2
R14	95.1

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)	0.073
Power Factor	0.7926
Power (W)	6.95
Luminous Efficacy (lm/W)	101.4
Total Luminous Flux (lm)	704.7
Beam Angle (°)	113.6 (0°-180°) /114.3(90°-270°)
Center Beam Candle Power (cd)	205
Maximum Beam Candle Power (cd)	206.0 (At: C=190.0, Gamma=2.0)
Spacing Criteria	1.29 (0°-180°) / 1.24 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	65.10%
Zonal Lumens in the 60 °-90 °Zone	26.24%
Zonal Lumens in the 90 °-120 °Zone	7.23%
Zonal Lumens in the 120 °-180 °Zone	1.43%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

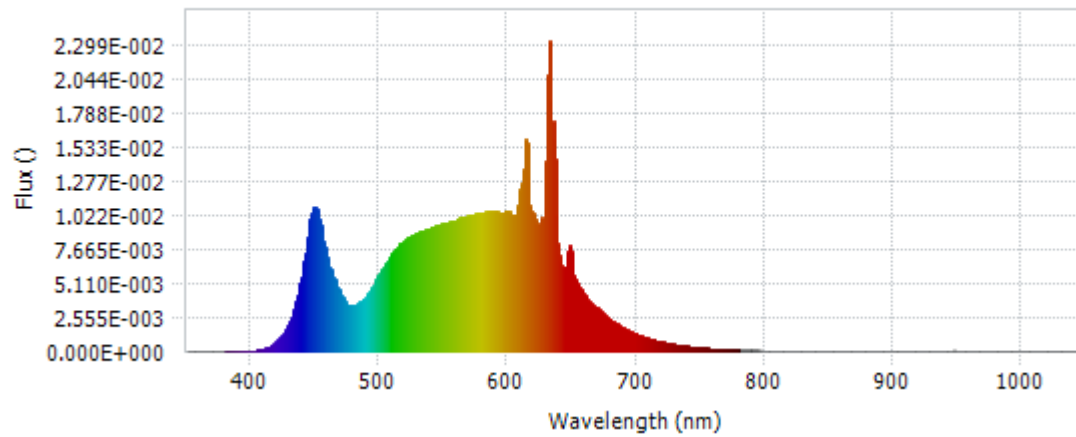
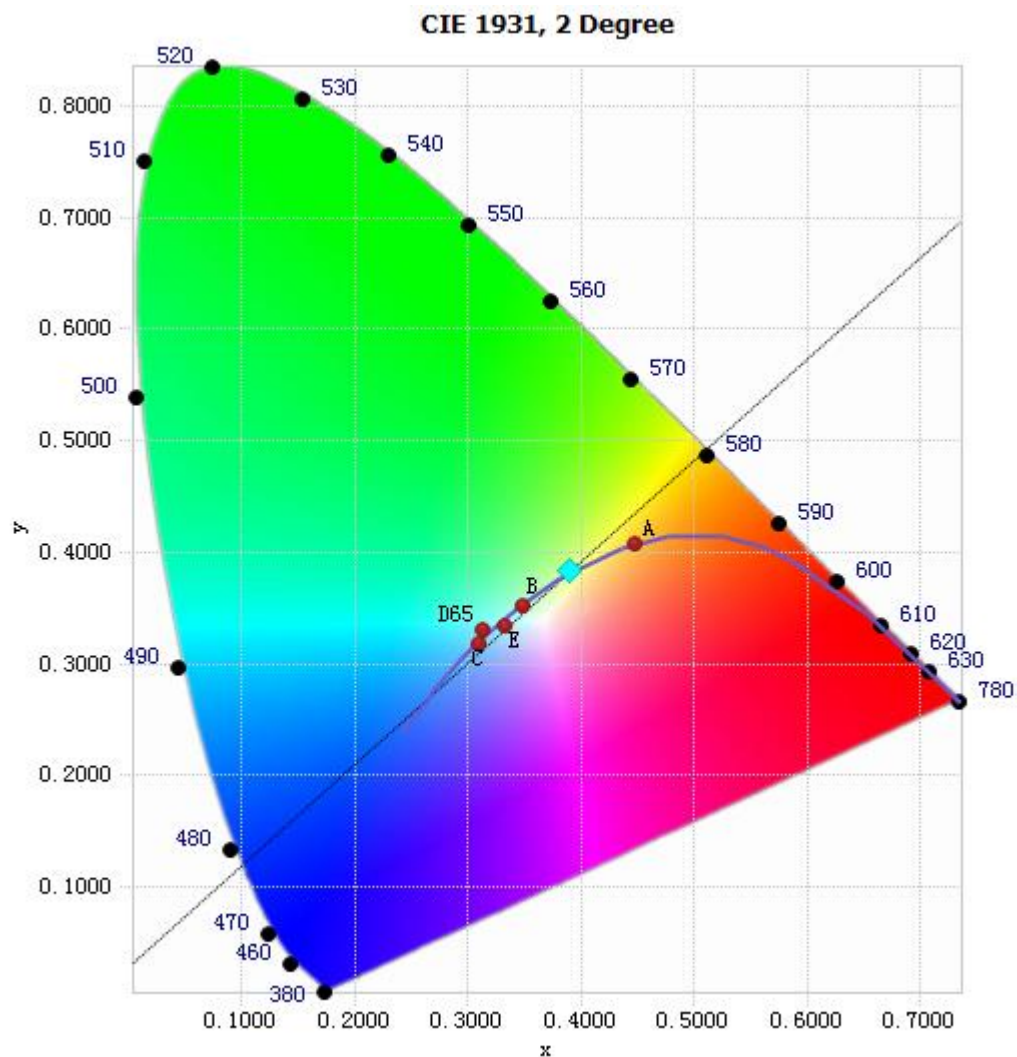


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	6.03E-05	485	3.68E-03	590	1.05E-02	695	1.51E-03
385	3.45E-05	490	4.25E-03	595	1.03E-02	700	1.28E-03
390	6.11E-05	495	4.99E-03	600	1.05E-02	705	1.10E-03
395	4.35E-05	500	5.83E-03	605	1.02E-02	710	9.41E-04
400	5.23E-05	505	6.68E-03	610	1.26E-02	715	8.07E-04
405	7.76E-05	510	7.34E-03	615	1.57E-02	720	7.00E-04
410	2.02E-04	515	7.96E-03	620	1.03E-02	725	6.00E-04
415	4.02E-04	520	8.36E-03	625	9.67E-03	730	5.09E-04
420	7.77E-04	525	8.67E-03	630	1.42E-02	735	4.33E-04
425	1.38E-03	530	8.90E-03	635	1.57E-02	740	3.68E-04
430	2.31E-03	535	9.06E-03	640	7.24E-03	745	3.16E-04
435	3.81E-03	540	9.24E-03	645	6.33E-03	750	2.73E-04
440	6.11E-03	545	9.42E-03	650	6.51E-03	755	2.31E-04
445	9.27E-03	550	9.57E-03	655	4.89E-03	760	2.01E-04
450	1.08E-02	555	9.73E-03	660	4.19E-03	765	1.72E-04
455	8.90E-03	560	9.84E-03	665	3.59E-03	770	1.49E-04
460	6.65E-03	565	1.00E-02	670	3.24E-03	775	1.23E-04
465	5.36E-03	570	1.02E-02	675	2.74E-03	780	1.09E-04
470	4.18E-03	575	1.03E-02	680	2.36E-03		
475	3.52E-03	580	1.03E-02	685	2.04E-03		
480	3.46E-03	585	1.05E-02	690	1.75E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3895, 0.3841)

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

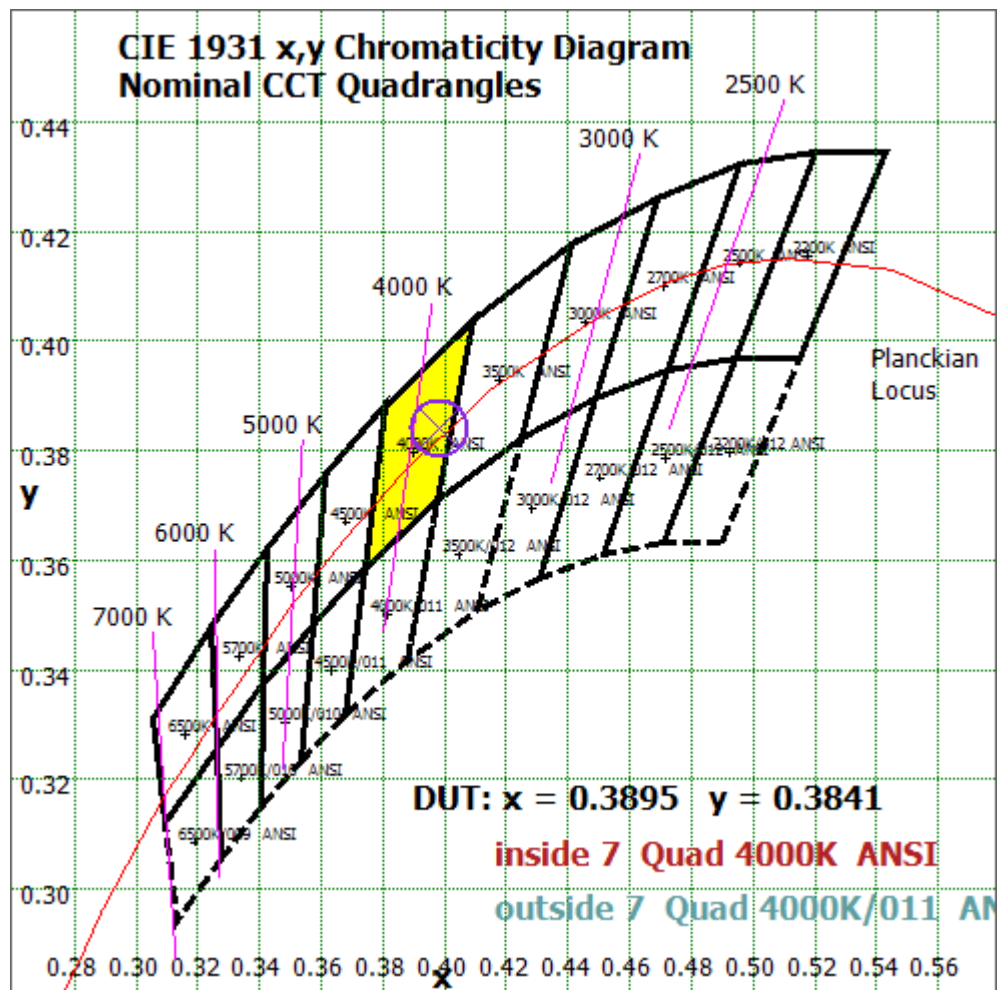


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

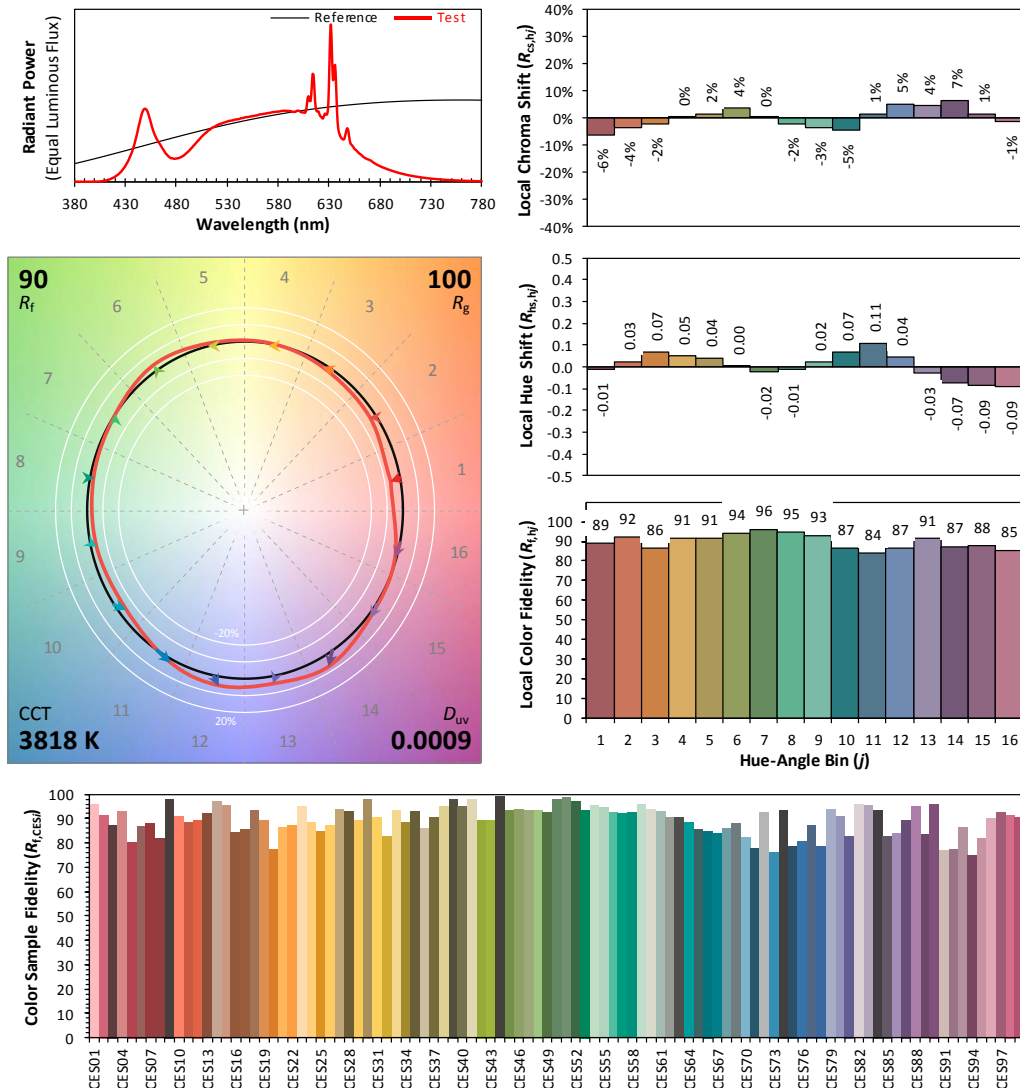
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2021/12/08

Model: 7R20DIM/940



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

x 0.3895
 y 0.3841
 u' 0.2281
 v' 0.5061

CIE 13.3-1995
(CRI)
 R_a 91
 R_9 54

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	19.409	2.75%
10- 20	55.341	7.85%
20- 30	83.247	11.81%
30- 40	99.786	14.16%
40- 50	104.078	14.77%
50- 60	96.878	13.75%
60- 70	81.348	11.54%
70- 80	61.688	8.75%
80- 90	41.881	5.94%
90-100	25.932	3.68%
100-110	15.572	2.21%
110-120	9.459	1.34%
120-130	5.447	0.77%
130-140	2.826	0.40%
140-150	1.241	0.18%
150-160	0.419	0.06%
160-170	0.099	0.01%
170-180	0.021	0.00%
Total	704.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	458.739	65.10%
60- 90	184.917	26.24%
0-90	643.656	91.34%
90- 180	61.016	8.66%
0- 180	704.7	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

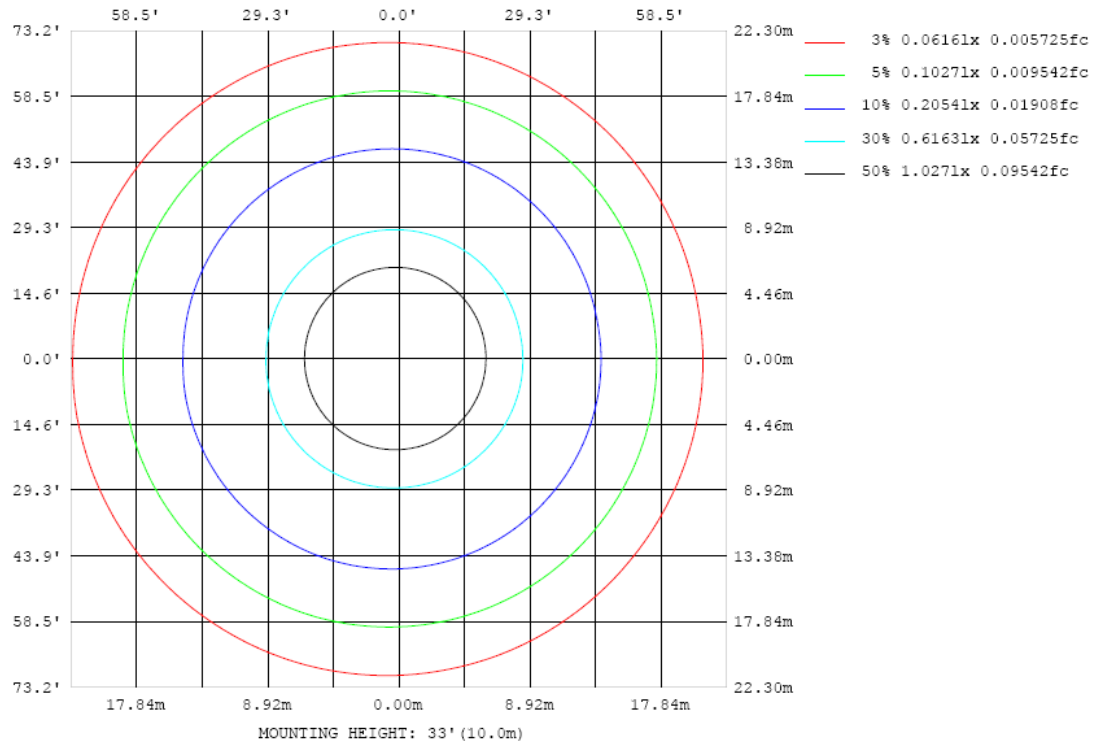


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

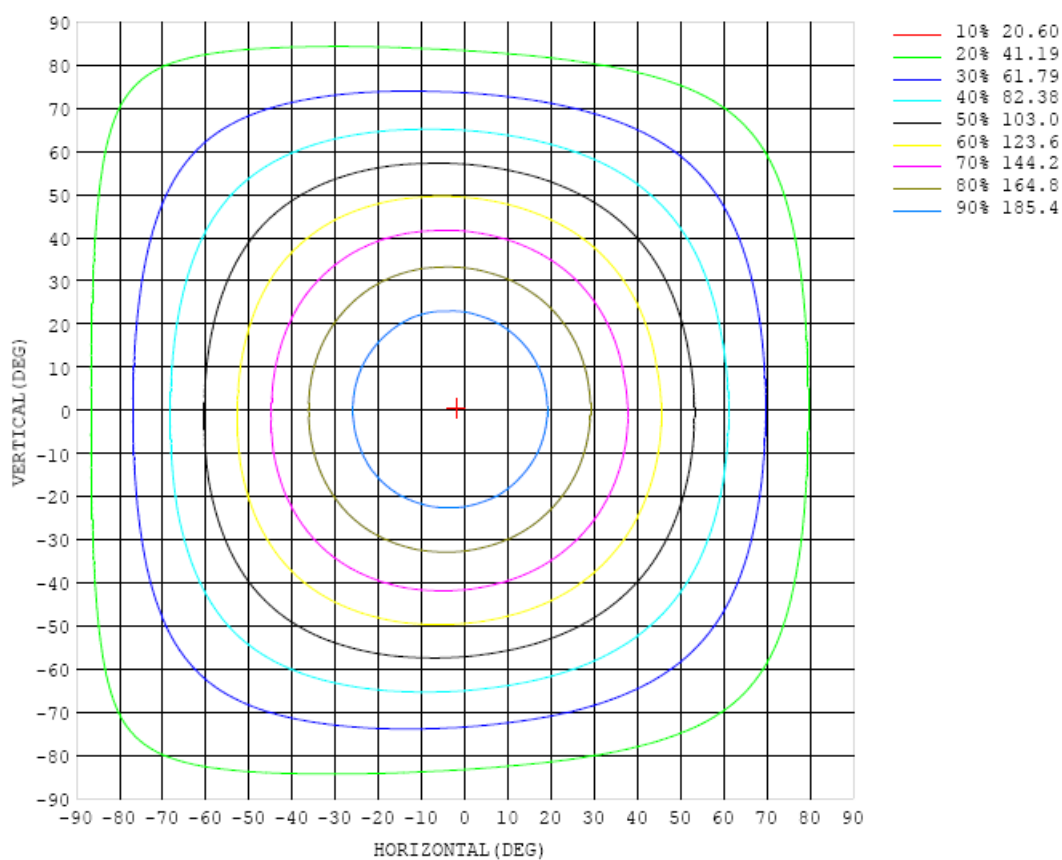


Chart 6: Isocandela Plot

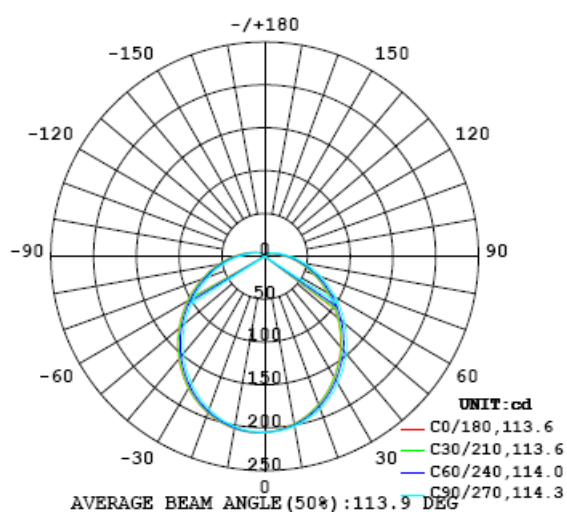


Chart 7: Polar Candela Distribution

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	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205
5	203	203	203	203	203	204	204	204	204	204	205	205	205	205	205	206	206	206	206
10	198	198	199	199	199	199	200	200	201	201	202	202	202	203	203	204	204	204	204
15	192	192	192	193	193	193	194	195	195	196	197	198	198	199	199	200	200	200	200
20	184	184	184	184	185	186	186	187	188	189	190	191	192	193	193	194	194	194	194
25	174	174	174	175	175	176	177	178	179	181	182	183	184	185	186	186	187	187	187
30	163	163	163	164	164	165	167	168	169	171	172	173	174	175	176	177	177	178	178
35	151	151	151	152	153	153	155	156	158	159	161	162	164	165	166	167	167	167	167
40	138	139	139	140	141	142	143	145	147	148	150	151	152	153	154	155	156	156	156
45	125	125	126	126	127	129	130	132	134	135	137	139	140	142	143	144	145	145	144
50	112	112	112	113	114	115	117	118	120	122	124	126	127	129	130	131	132	132	131
55	98.3	98.6	98.8	99.5	100	102	103	105	107	109	110	112	114	115	117	117	118	118	117
60	85.3	85.5	85.8	86.4	87.3	88.6	90.2	91.9	93.5	95.4	97.2	99.0	101	102	103	104	105	105	104
65	72.7	73.0	73.2	73.8	74.7	76.0	77.4	79.0	80.6	82.4	84.1	85.8	87.3	88.6	89.8	90.7	91.4	91.6	90.7
70	61.1	61.1	61.4	62.0	62.8	63.9	65.3	66.8	68.3	69.9	71.5	73.1	74.5	75.8	76.9	77.8	78.4	78.6	77.8
75	50.2	50.2	50.5	51.0	51.8	52.8	54.0	55.4	56.7	58.2	59.7	61.2	62.4	63.6	64.6	65.4	66.0	66.3	66.3
80	40.5	40.5	40.8	41.2	41.9	42.8	43.9	45.0	46.2	47.5	48.9	50.2	51.3	52.3	53.3	54.0	54.5	54.8	54.8
85	32.0	32.1	32.3	32.7	33.3	34.0	35.0	35.9	37.0	38.1	39.2	40.3	41.3	42.2	43.1	43.7	44.2	44.4	44.4
90	25.0	25.1	25.3	25.6	26.0	26.7	27.4	28.2	29.1	30.0	30.9	31.9	32.7	33.5	34.2	34.7	35.1	35.3	35.3
95	19.5	19.5	19.7	19.9	20.3	20.8	21.3	22.0	22.7	23.4	24.1	24.9	25.6	26.2	26.8	27.2	27.5	27.7	27.6
100	15.3	15.4	15.5	15.6	15.9	16.3	16.7	17.2	17.7	18.3	18.9	19.4	19.9	20.4	20.9	21.2	21.4	21.6	21.5
105	12.2	12.2	12.3	12.4	12.6	12.9	13.2	13.6	14.0	14.5	14.9	15.3	15.7	16.1	16.4	16.6	16.8	16.9	16.9
110	9.96	9.98	10.0	10.1	10.3	10.5	10.7	11.0	11.3	11.6	11.9	12.2	12.5	12.7	13.0	13.2	13.3	13.4	13.4
115	8.06	8.08	8.13	8.23	8.36	8.53	8.74	8.96	9.19	9.43	9.66	9.90	10.1	10.3	10.5	10.7	10.8	10.8	10.8
120	6.46	6.47	6.53	6.61	6.72	6.87	7.04	7.22	7.40	7.59	7.78	7.98	8.16	8.32	8.47	8.59	8.67	8.71	8.72
125	5.11	5.13	5.17	5.24	5.34	5.47	5.61	5.75	5.90	6.05	6.19	6.35	6.49	6.63	6.75	6.84	6.90	6.93	6.92
130	3.98	4.00	4.04	4.10	4.18	4.29	4.40	4.52	4.63	4.75	4.86	4.99	5.10	5.21	5.30	5.37	5.42	5.44	5.41
135	3.05	3.06	3.10	3.15	3.23	3.31	3.40	3.49	3.58	3.67	3.76	3.85	3.94	4.02	4.10	4.15	4.18	4.20	4.16
140	2.28	2.29	2.33	2.37	2.43	2.50	2.57	2.64	2.70	2.77	2.84	2.90	2.97	3.04	3.09	3.14	3.16	3.17	3.13
145	1.65	1.66	1.69	1.73	1.78	1.84	1.89	1.94	1.98	2.03	2.08	2.13	2.18	2.23	2.27	2.30	2.31	2.31	2.28
150	1.12	1.16	1.18	1.22	1.26	1.30	1.34	1.38	1.40	1.44	1.47	1.50	1.53	1.57	1.60	1.62	1.62	1.62	1.58
155	0.70	0.75	0.79	0.82	0.85	0.88	0.91	0.93	0.95	0.97	0.99	1.00	1.02	1.04	1.06	1.07	1.07	1.07	1.03
160	0.46	0.46	0.50	0.53	0.55	0.57	0.59	0.60	0.61	0.62	0.63	0.63	0.64	0.64	0.65	0.66	0.65	0.64	0.62
165	0.32	0.32	0.31	0.33	0.35	0.37	0.38	0.39	0.39	0.40	0.40	0.39	0.39	0.38	0.38	0.37	0.37	0.36	0.35
170	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.25	0.24	0.24
175	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
180	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22

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	0	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	
5	5	206	206	205	205	205	205	205	205	205	204	204	204	204	203	203	203	203	
10	10	204	204	204	203	203	203	202	202	202	201	201	200	200	199	199	199	198	
15	15	200	200	200	199	199	199	198	197	197	196	195	194	194	193	193	192	192	
20	20	194	194	194	193	193	192	192	191	190	189	188	187	186	185	185	184	184	
25	25	187	187	186	186	185	184	184	182	181	180	179	178	177	176	175	175	174	
30	30	178	178	177	176	176	175	174	173	171	170	169	167	166	165	164	163	163	
35	35	167	167	167	166	165	164	163	161	160	159	157	156	154	153	152	151	151	
40	40	156	156	155	154	153	152	151	149	148	146	145	143	142	140	139	138	138	
45	45	144	143	143	142	141	140	138	137	135	133	132	130	129	127	126	125	125	
50	50	131	130	130	129	128	126	125	123	122	120	118	117	115	114	113	112	111	
55	55	117	117	116	115	114	113	112	110	108	106	105	103	102	100	99.4	98.5	97.9	
60	60	104	104	103	102	101	99.7	98.3	96.5	95.0	93.2	91.6	90.0	88.6	87.3	86.3	85.5	84.9	
65	65	90.5	90.2	89.6	88.7	87.7	86.5	85.1	83.4	81.9	80.3	78.8	77.2	75.9	74.7	73.8	72.9	72.3	
70	70	77.7	77.4	76.7	75.8	74.8	73.7	72.4	70.8	69.4	68.0	67.0	65.6	64.5	63.5	62.6	61.9	61.3	
75	75	66.3	65.5	65.2	64.4	63.5	62.4	61.2	59.7	58.4	57.0	55.7	54.4	53.3	52.3	51.5	50.9	50.4	
80	80	54.7	54.2	53.7	53.0	52.2	51.2	50.1	48.8	47.6	46.4	45.2	44.1	43.2	42.3	41.6	41.1	40.7	
85	85	44.3	43.9	43.5	42.8	42.1	41.2	40.3	39.1	38.1	37.1	36.1	35.1	34.3	33.6	33.0	32.5	32.2	
90	90	35.2	34.9	34.5	34.0	33.3	32.6	31.8	30.8	30.0	29.1	28.3	27.5	26.8	26.3	25.8	25.4	25.2	
95	95	27.6	27.3	27.0	26.6	26.0	25.5	24.8	24.1	23.4	22.7	22.1	21.5	20.9	20.5	20.1	19.8	19.6	
100	100	21.5	21.3	21.1	20.7	20.3	19.9	19.4	18.8	18.3	17.8	17.3	16.8	16.4	16.1	15.8	15.6	15.4	
105	105	16.8	16.7	16.5	16.3	16.0	15.6	15.3	14.9	14.5	14.1	13.7	13.4	13.1	12.8	12.7	12.5	12.4	
110	110	13.4	13.3	13.2	13.0	12.8	12.5	12.3	12.0	11.7	11.4	11.1	10.9	10.6	10.4	10.3	10.1	10.1	
115	115	10.8	10.7	10.6	10.5	10.3	10.1	9.90	9.66	9.43	9.20	8.97	8.77	8.59	8.43	8.31	8.21	8.13	
120	120	8.68	8.60	8.51	8.38	8.25	8.09	7.91	7.72	7.53	7.33	7.16	6.99	6.83	6.71	6.62	6.55	6.49	
125	125	6.87	6.80	6.71	6.61	6.49	6.37	6.23	6.06	5.91	5.76	5.62	5.49	5.38	5.30	5.22	5.17	5.13	
130	130	5.36	5.31	5.23	5.15	5.05	4.95	4.84	4.71	4.59	4.46	4.36	4.26	4.17	4.10	4.06	4.02	3.99	
135	135	4.12	4.06	4.00	3.92	3.84	3.76	3.67	3.57	3.48	3.38	3.30	3.22	3.16	3.11	3.08	3.06	3.05	
140	140	3.08	3.02	2.97	2.90	2.85	2.78	2.71	2.63	2.56	2.48	2.42	2.37	2.33	2.30	2.28	2.27	2.27	
145	145	2.22	2.17	2.12	2.07	2.02	1.97	1.92	1.86	1.80	1.75	1.70	1.64	1.59	1.50	1.47	1.55	1.61	
150	150	1.52	1.48	1.44	1.40	1.36	1.33	1.29	1.24	1.20	1.16	1.12	1.06	1.03	1.08	1.11	1.10	0.94	
155	155	0.98	0.94	0.91	0.87	0.84	0.82	0.79	0.76	0.73	0.70	0.66	0.56	0.55	0.66	0.72	0.72	0.71	
160	160	0.57	0.54	0.52	0.49	0.46	0.44	0.42	0.40	0.39	0.39	0.37	0.34	0.35	0.41	0.44	0.45	0.47	
165	165	0.30	0.28	0.27	0.26	0.25	0.23	0.21	0.20	0.21	0.22	0.23	0.23	0.24	0.26	0.27	0.28	0.30	
170	170	0.23	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.21	0.21	0.23	0.24	
175	175	0.23	0.23	0.22	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	
180	180	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	

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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