

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 Track Light

Model: ORB/L/927/SP/DIM120V/xx/yy

Where xx mean different type of Adaptor, could be J, H, L, CM, GES, TEK.

Where yy mean different color of product, could be WH, SV, BL.

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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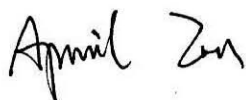
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www.ledtestlab.com

Report No.: HZ20120037v

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

Review by:



Engineer: April Zou

Feb. 03, 2021

Approved by:



Manager: Jim Zhang

Feb. 03, 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: **ORB/L/927/SP/DIM120V/H/BL**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
85.4	3415.0	39.99	0.9804
CCT (K)	CRI	Stabilization Time (Light & Power)	
2718	92.0	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. 23, 2020
Date of Test	: Jan. 19, 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 Track Light
Model	: ORB/L/927/SP/DIM120V/H/BL
Electrical Ratings	: 120V, 60Hz, 40W
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 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 65 minutes.

Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.340
Power Factor	0.9804
Test Power (W)	39.99
THD A%	14.26
Luminous Efficacy (lm/W)	85.4
Total Luminous Flux (lm)	3415.0
Color Rendering Index (CRI)	92
R9	57.3
Correlated Color Temperature (CCT)(K)	2718
Chromaticity Chroma x	0.4577
Chromaticity Chroma y	0.4093
Chromaticity Chroma u	0.2617
Chromaticity Chroma v	0.3510
Duv	-0.0003
Chromaticity Chroma u'	0.2617
Chromaticity Chroma v'	0.5265

Special Color Rendering Indices	
R1	92.3
R2	95.2
R3	96.7
R4	92.7
R5	91.9
R6	94.6
R7	91.7
R8	80.8
R9	57.3
R10	88.1
R11	93.9
R12	83.7
R13	92.9
R14	97.4

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)	0.345
Power Factor	0.9824
Power (W)	40.71
Luminous Efficacy (lm/W)	89.1
Total Luminous Flux (lm)	3625.7
Beam Angle (°)	16.9 (0°-180°) / 16.9 (90°-270°)
Center Beam Candle Power (cd)	29710
Maximum Beam Candle Power (cd)	29793 (At: C=330.0, Gamma=1.0)
Spacing Criteria	0.27 (0°-180°) / 0.31 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	98.80%
Zonal Lumens in the 60 °-90 °Zone	1.12%
Zonal Lumens in the 90 °-120 °Zone	0.00%
Zonal Lumens in the 120 °-180 °Zone	0.07%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

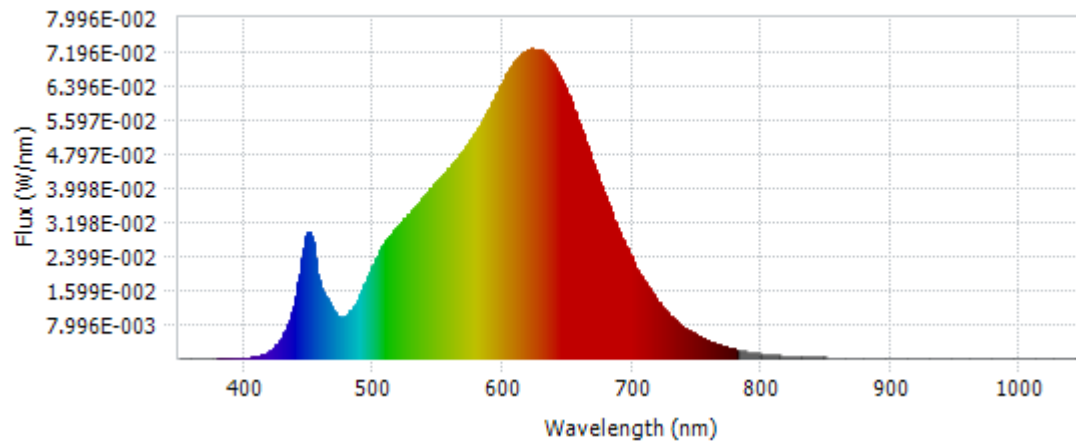
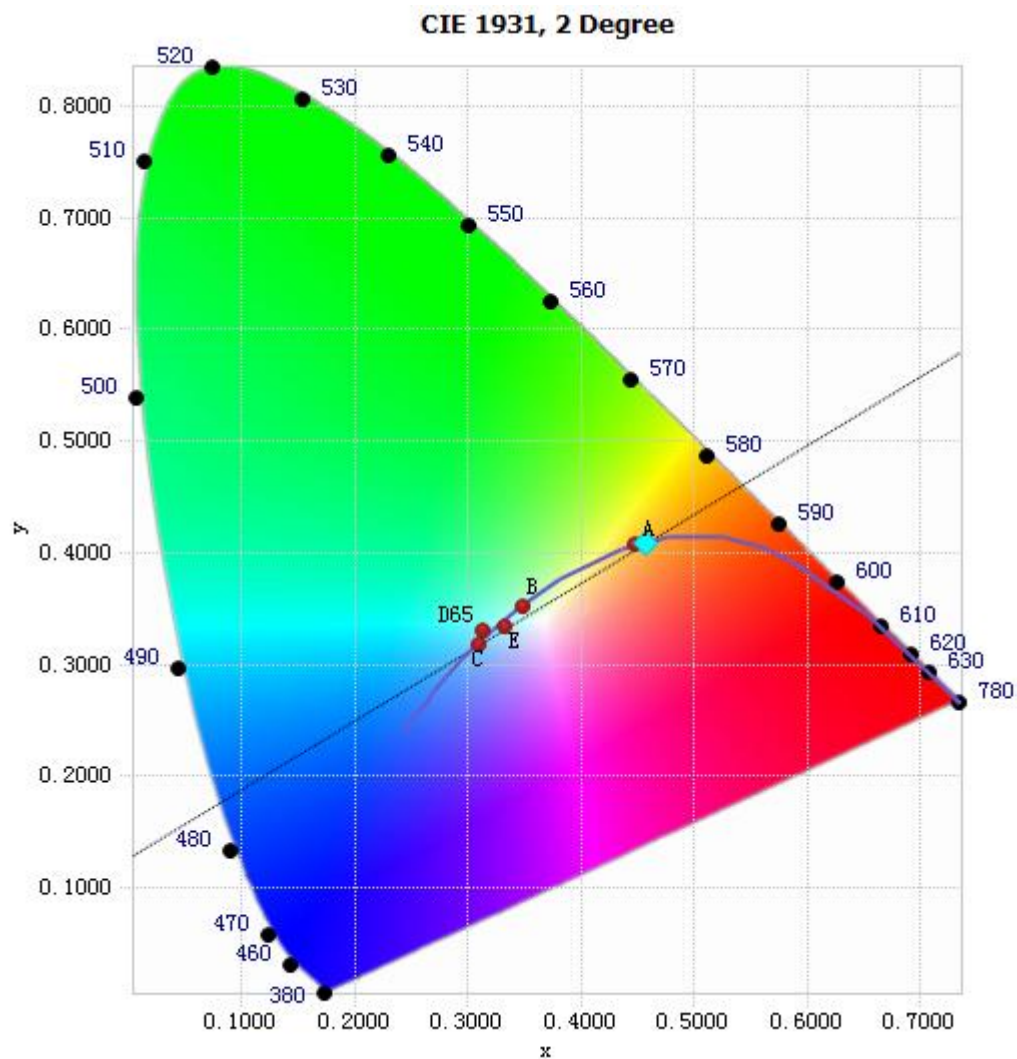


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.84E-04	485	1.23E-02	590	5.90E-02	695	2.63E-02
385	1.91E-04	490	1.51E-02	595	6.20E-02	700	2.31E-02
390	1.82E-04	495	1.88E-02	600	6.50E-02	705	2.03E-02
395	1.56E-04	500	2.22E-02	605	6.77E-02	710	1.77E-02
400	1.62E-04	505	2.53E-02	610	7.00E-02	715	1.54E-02
405	2.44E-04	510	2.77E-02	615	7.15E-02	720	1.34E-02
410	4.52E-04	515	2.99E-02	620	7.23E-02	725	1.15E-02
415	9.03E-04	520	3.14E-02	625	7.27E-02	730	9.88E-03
420	1.73E-03	525	3.31E-02	630	7.22E-02	735	8.48E-03
425	3.14E-03	530	3.49E-02	635	7.07E-02	740	7.27E-03
430	5.38E-03	535	3.65E-02	640	6.87E-02	745	6.27E-03
435	8.94E-03	540	3.82E-02	645	6.55E-02	750	5.44E-03
440	1.47E-02	545	4.01E-02	650	6.23E-02	755	4.67E-03
445	2.37E-02	550	4.18E-02	655	5.85E-02	760	3.99E-03
450	2.98E-02	555	4.35E-02	660	5.43E-02	765	3.41E-03
455	2.34E-02	560	4.52E-02	665	5.00E-02	770	2.91E-03
460	1.64E-02	565	4.71E-02	670	4.58E-02	775	2.49E-03
465	1.35E-02	570	4.91E-02	675	4.15E-02	780	2.12E-03
470	1.09E-02	575	5.12E-02	680	3.75E-02		
475	9.52E-03	580	5.36E-02	685	3.34E-02		
480	1.03E-02	585	5.63E-02	690	2.97E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4577, 0.4093)

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

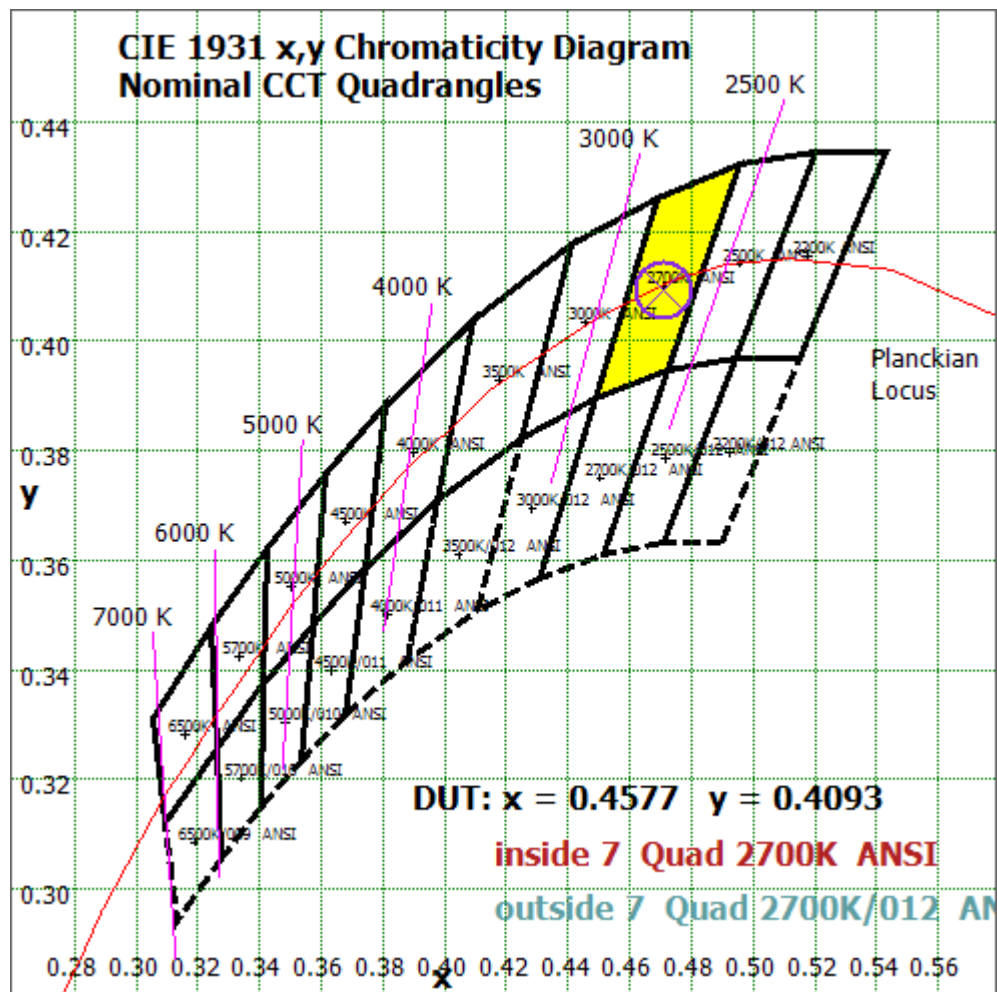


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

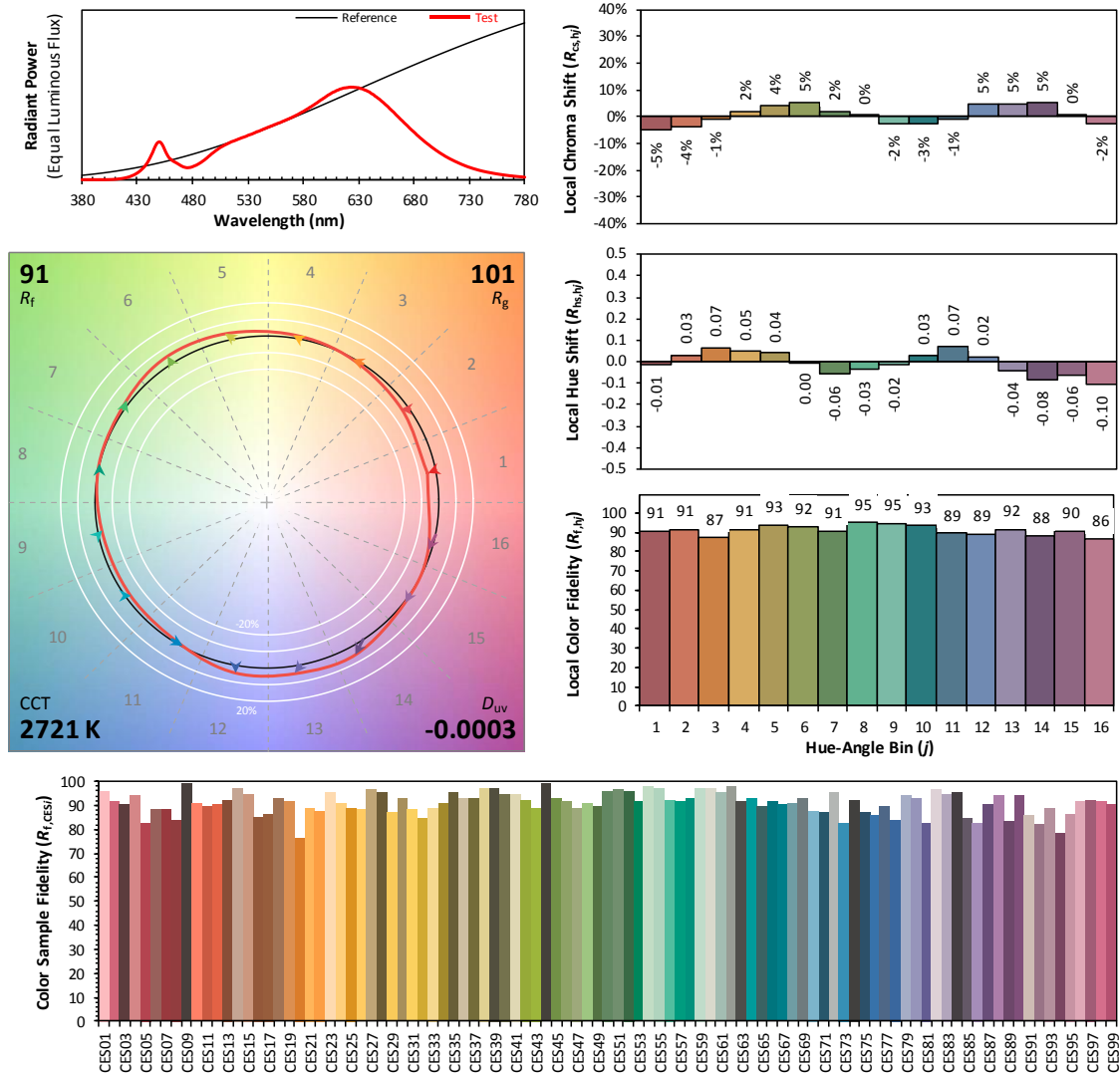
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2021/01/19

Model: ORB/L/927/SP/DIM120V/H/BL



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

x 0.4577
 y 0.4093
 u' 0.2617
 v' 0.5265

CIE 13.3-1995
(CRI)

R_a 92
 R_g 58

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	1861.2	51.33%
10- 20	1170.414	32.28%
20- 30	334.389	9.22%
30- 40	103.887	2.87%
40- 50	62.543	1.73%
50- 60	49.874	1.38%
60- 70	32.412	0.89%
70- 80	8.187	0.23%
80- 90	0.1	0.00%
90-100	0	0.00%
100-110	0.001	0.00%
110-120	0.01	0.00%
120-130	0.035	0.00%
130-140	0.165	0.00%
140-150	0.558	0.02%
150-160	0.894	0.02%
160-170	0.749	0.02%
170-180	0.256	0.01%
Total	3625.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	3582.307	98.80%
60- 90	40.699	1.12%
0-90	3623.006	99.93%
90- 180	2.668	0.07%
0- 180	3625.7	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

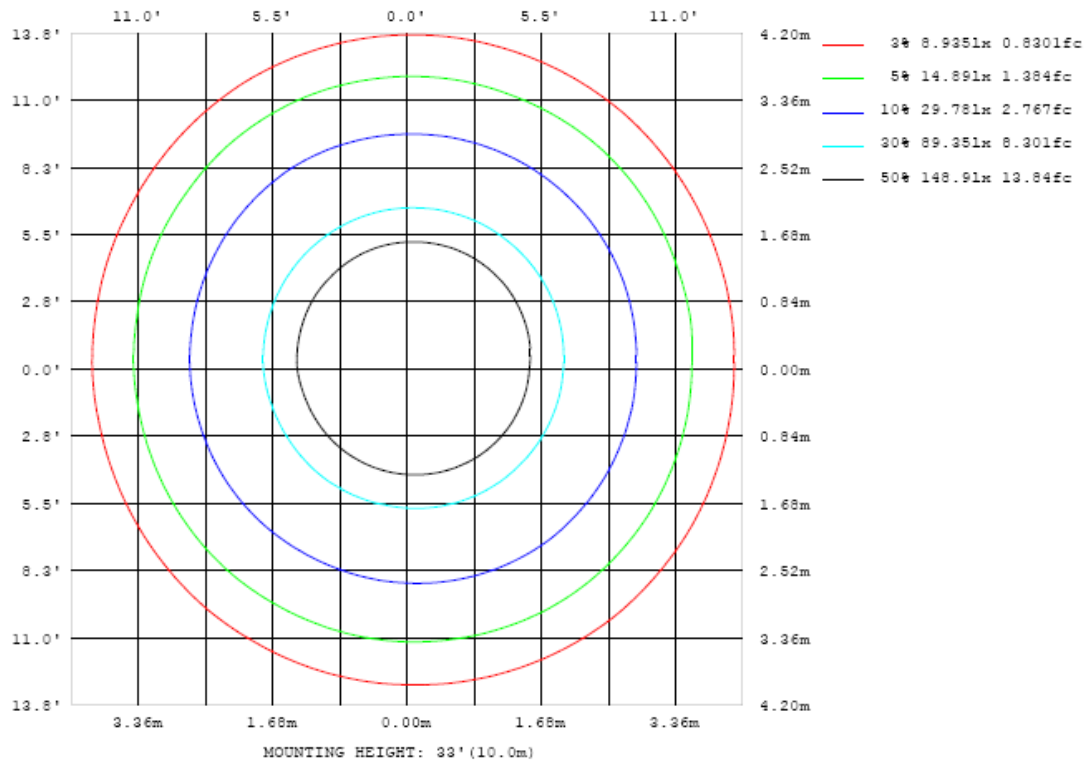


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

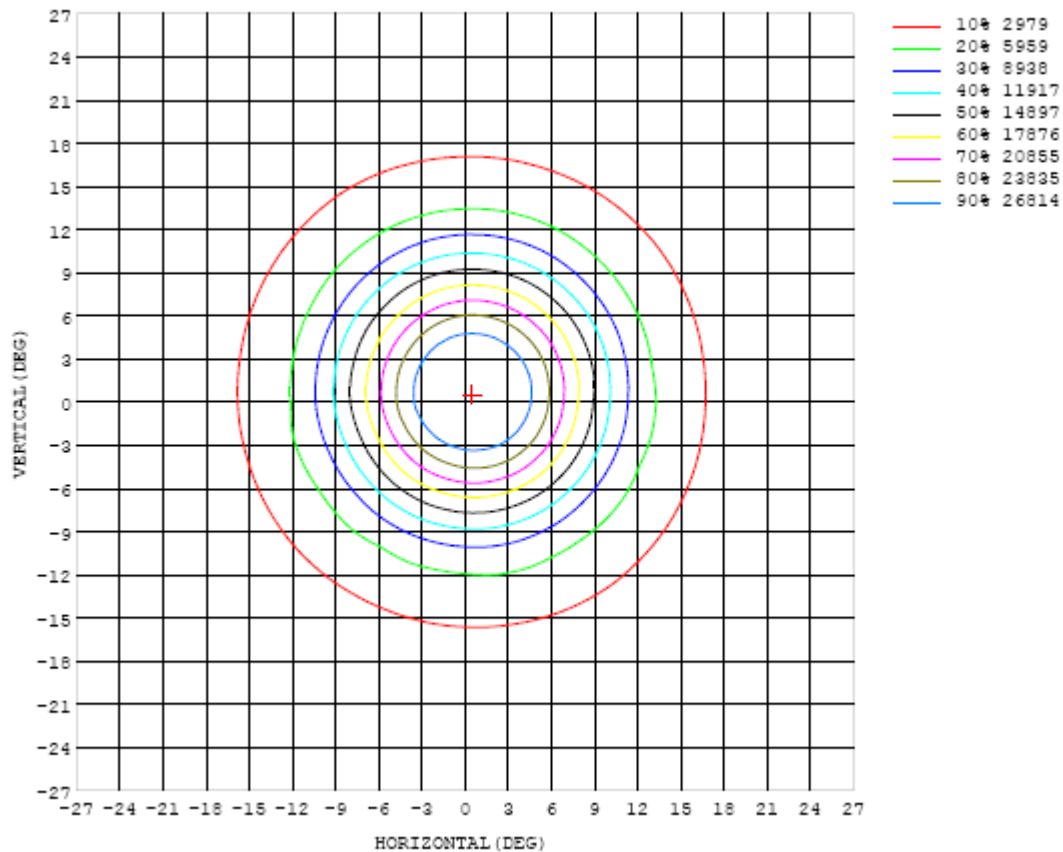


Chart 6: Isocandela Plot

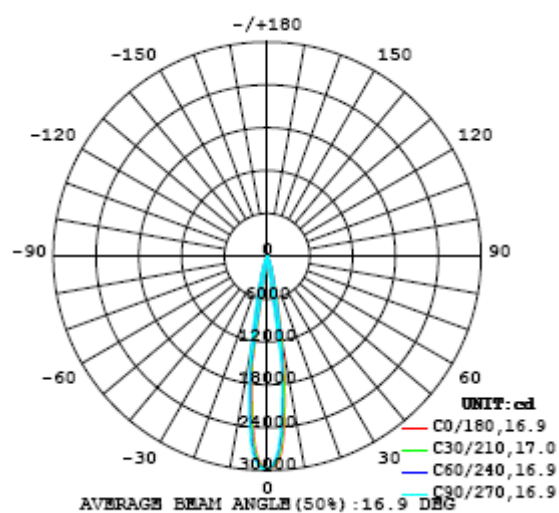


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: $\times 10\text{cd}$

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971
5	2588	2563	2529	2495	2450	2411	2365	2323	2289	2256	2232	2218	2216	2219	2218	2232	2252	2288	2321
10	1204	1174	1138	1099	1056	1022	986	957	930	903	883	876	871	875	876	890	911	943	984
15	405	397	387	379	371	364	354	345	337	330	324	319	318	320	323	326	330	336	344
20	167	165	163	161	159	157	154	150	147	144	142	140	139	139	139	139	139	141	146
25	71.1	71.1	70.0	69.0	67.8	66.2	66.0	64.3	63.2	61.6	61.0	60.9	60.5	60.3	59.6	59.1	59.2	59.7	60.0
30	30.2	29.9	29.5	29.1	28.5	28.1	27.5	27.2	27.4	27.6	27.6	27.4	27.1	26.9	26.6	26.2	26.2	26.2	26.8
35	15.8	15.6	15.2	14.7	14.5	14.3	14.1	14.2	14.5	14.7	14.9	14.9	14.8	14.6	14.4	14.4	14.4	14.7	15.3
40	10.8	10.6	10.3	10.1	9.68	9.33	9.10	9.20	9.33	9.53	9.72	9.78	9.80	9.68	9.72	9.89	10.2	10.4	10.9
45	8.66	8.59	8.23	8.03	7.52	7.23	7.10	7.15	7.15	7.23	7.41	7.33	7.37	7.33	7.38	7.59	7.99	7.98	8.50
50	7.00	6.96	6.79	6.43	6.15	5.98	5.90	5.93	5.99	6.10	6.12	6.04	6.05	6.01	6.00	6.10	6.33	6.61	6.85
55	5.92	5.92	5.80	5.53	5.34	5.16	5.20	5.23	5.26	5.33	5.32	5.23	5.18	5.10	5.08	5.17	5.32	5.61	5.76
60	4.83	4.82	4.69	4.51	4.35	4.23	4.25	4.26	4.30	4.35	4.36	4.28	4.23	4.15	4.09	4.15	4.29	4.49	4.72
65	3.62	3.63	3.45	3.32	3.16	3.01	3.05	3.10	3.14	3.20	3.21	3.12	3.06	2.98	2.89	2.97	3.10	3.24	3.49
70	2.21	2.21	2.07	1.97	1.82	1.63	1.74	1.76	1.80	1.82	1.81	1.73	1.67	1.61	1.48	1.63	1.74	1.87	2.04
75	0.77	0.76	0.70	0.65	0.58	0.51	0.50	0.50	0.51	0.52	0.52	0.48	0.42	0.40	0.41	0.42	0.50	0.58	0.64
80	0.11	0.10	0.09	0.08	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.05	0.06	0.08
85	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
90	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
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	0.00
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	0.01	0.01	0.01	0.01	0.01	0.01	0.01
135	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
140	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
145	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10
150	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.17
155	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.22
160	0.21	0.21	0.21	0.21	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	0.27
165	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.29
170	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.29
175	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.25
180	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16

Table 6: Luminous Intensity Data

Table--2

UNIT: $\times 10\text{cd}$

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971	2971		
5	2349	2387	2425	2467	2504	2546	2582	2613	2637	2655	2665	2673	2669	2670	2660	2644	2618		
10	1011	1046	1080	1122	1158	1196	1231	1262	1284	1303	1324	1330	1327	1322	1299	1276	1245		
15	352	363	373	387	400	412	420	427	433	439	441	443	442	438	433	425	414		
20	149	155	159	164	170	175	179	181	183	184	184	184	185	183	180	176	174		
25	60.8	61.9	63.4	65.7	68.1	70.5	72.3	73.5	74.3	75.3	75.7	76.1	75.9	75.2	74.3	73.3	72.2		
30	27.1	27.5	28.0	28.6	29.4	30.5	31.4	32.0	32.5	32.6	32.4	32.4	32.2	32.0	31.7	31.4	31.0		
35	15.3	15.3	15.3	15.6	15.9	16.5	16.9	17.4	17.6	17.7	17.6	17.3	16.9	16.8	16.7	16.3	16.2		
40	10.9	10.8	10.8	10.6	10.6	10.6	10.9	11.1	11.2	11.3	11.2	11.0	10.8	10.8	10.8	10.9	10.8		
45	8.63	8.52	8.31	8.02	7.92	7.91	8.11	8.28	8.45	8.48	8.37	8.32	8.22	8.24	8.36	8.70	8.65		
50	7.09	7.03	6.69	6.53	6.48	6.53	6.71	6.87	6.98	7.00	6.84	6.76	6.66	6.63	6.65	6.81	6.92		
55	5.91	5.84	5.67	5.56	5.55	5.66	5.79	5.94	6.06	6.10	5.98	5.84	5.71	5.59	5.68	5.79	6.00		
60	4.82	4.74	4.66	4.55	4.54	4.66	4.78	4.93	5.06	5.07	4.96	4.83	4.66	4.52	4.56	4.65	4.80		
65	3.56	3.44	3.38	3.27	3.21	3.31	3.43	3.55	3.65	3.70	3.60	3.50	3.38	3.28	3.33	3.43	3.51		
70	2.09	2.02	1.99	1.91	1.79	1.96	2.05	2.18	2.28	2.32	2.23	2.15	2.06	1.90	2.02	2.10	2.15		
75	0.67	0.64	0.63	0.60	0.59	0.63	0.68	0.75	0.82	0.85	0.81	0.76	0.71	0.67	0.69	0.73	0.75		
80	0.08	0.09	0.10	0.11	0.11	0.12	0.13	0.14	0.16	0.16	0.16	0.15	0.14	0.14	0.13	0.13	0.12		
85	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		
90	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		
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	0.00	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		
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	0.01	0.01	0.01	0.01	0.01		
135	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02		
140	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04		
145	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09		
150	0.17	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15		
155	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22		
160	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27		
165	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29		
170	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.30	0.29	0.30	0.31	0.31		
175	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.25	0.26	0.29	0.29	0.30	0.29	0.30	0.33	0.33	0.34		
180	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16		

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, 2020	Aug. 04, 2021
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2020	Aug. 04, 2021
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2020	Aug. 04, 2021
Standard source	D908	HZTE012-01	Aug. 05, 2020	Aug. 04, 2021
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2020	Aug. 04, 2021
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2020	Aug. 04, 2021
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2020	Aug. 04, 2021
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2020	Aug. 04, 2021

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

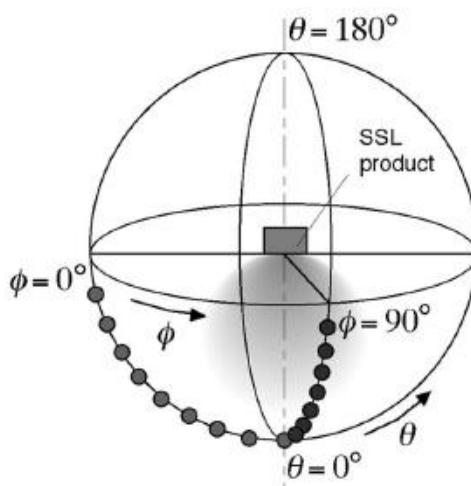
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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