

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/S/927/NR/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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Report No.: HZ20120037q

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

Review by:



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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/S/927/NR/DIM120V/H/BL**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
89.6	869.4	9.70	0.9661
CCT (K)	CRI	Stabilization Time (Light & Power)	
2716	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. 23, 2020
Date of Test	: Jan. 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 Track Light
Model	: ORB/S/927/NR/DIM120V/H/BL
Electrical Ratings	: 120V, 60Hz, 10W
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)	0.084
Power Factor	0.9661
Test Power (W)	9.70
THD A%	15.26
Luminous Efficacy (lm/W)	89.6
Total Luminous Flux (lm)	869.4
Color Rendering Index (CRI)	94.9
R9	70.5
Correlated Color Temperature (CCT)(K)	2716
Chromaticity Chroma x	0.4600
Chromaticity Chroma y	0.4131
Chromaticity Chroma u	0.2615
Chromaticity Chroma v	0.3522
Duv	0.0009
Chromaticity Chroma u'	0.2615
Chromaticity Chroma v'	0.5283

Special Color Rendering Indices	
R1	95.3
R2	97.2
R3	97.7
R4	95.7
R5	94.8
R6	96.9
R7	94.4
R8	86.8
R9	70.5
R10	92.5
R11	97
R12	83.8
R13	95.8
R14	97.8

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)	0.084
Power Factor	0.9677
Power (W)	9.78
Luminous Efficacy (lm/W)	97.1
Total Luminous Flux (lm)	949.7
Beam Angle (°)	26.9 (0°-180°) / 26.5 (90°-270°)
Center Beam Candle Power (cd)	3530
Maximum Beam Candle Power (cd)	3536 (At: C=20.0, Gamma=1.0)
Spacing Criteria	0.42 (0°-180°) / 0.44 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	98.89%
Zonal Lumens in the 60 °-90 °Zone	1.04%
Zonal Lumens in the 90 °-120 °Zone	0.00%
Zonal Lumens in the 120 °-180 °Zone	0.06%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

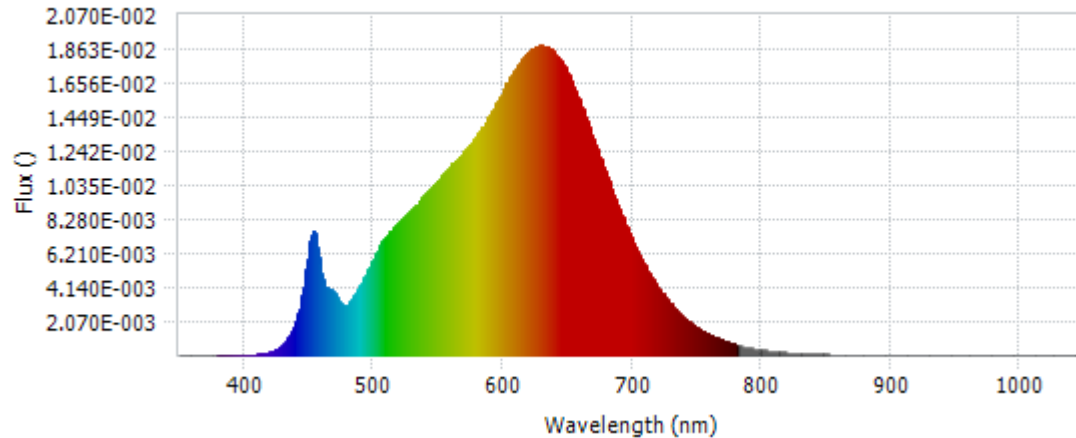
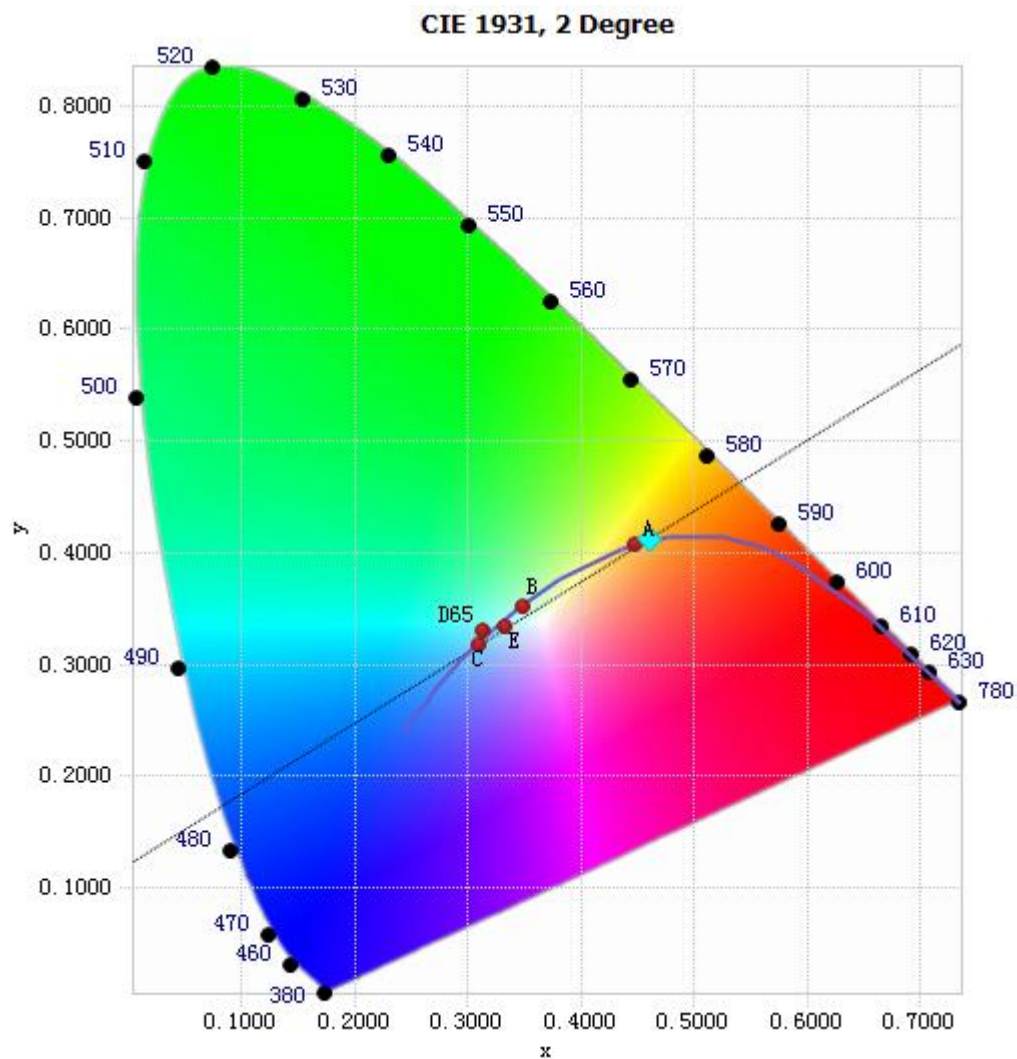


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	5.78E-05	485	3.62E-03	590	1.46E-02	695	7.96E-03
385	5.45E-05	490	4.28E-03	595	1.53E-02	700	7.07E-03
390	5.76E-05	495	5.06E-03	600	1.61E-02	705	6.23E-03
395	5.16E-05	500	5.91E-03	605	1.68E-02	710	5.45E-03
400	4.71E-05	505	6.65E-03	610	1.75E-02	715	4.79E-03
405	5.28E-05	510	7.22E-03	615	1.81E-02	720	4.18E-03
410	6.64E-05	515	7.71E-03	620	1.84E-02	725	3.62E-03
415	1.07E-04	520	8.12E-03	625	1.88E-02	730	3.13E-03
420	2.00E-04	525	8.51E-03	630	1.88E-02	735	2.69E-03
425	3.71E-04	530	8.89E-03	635	1.87E-02	740	2.32E-03
430	6.70E-04	535	9.33E-03	640	1.84E-02	745	2.00E-03
435	1.19E-03	540	9.78E-03	645	1.79E-02	750	1.72E-03
440	2.04E-03	545	1.02E-02	650	1.72E-02	755	1.48E-03
445	3.63E-03	550	1.07E-02	655	1.63E-02	760	1.27E-03
450	6.46E-03	555	1.11E-02	660	1.53E-02	765	1.09E-03
455	7.40E-03	560	1.15E-02	665	1.43E-02	770	9.32E-04
460	5.05E-03	565	1.19E-02	670	1.32E-02	775	7.93E-04
465	4.04E-03	570	1.24E-02	675	1.21E-02	780	6.76E-04
470	3.78E-03	575	1.28E-02	680	1.10E-02		
475	3.15E-03	580	1.34E-02	685	9.96E-03		
480	3.08E-03	585	1.40E-02	690	8.93E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4600, 0.4131)

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

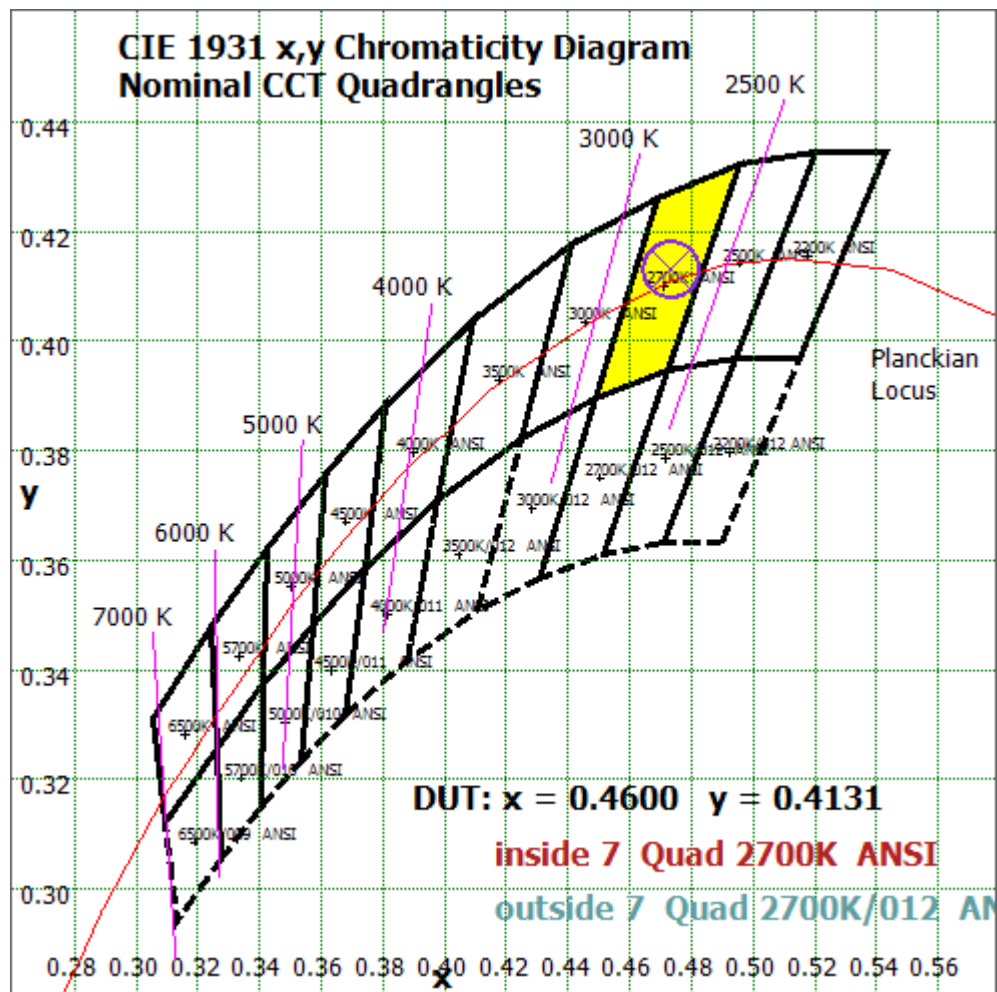


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

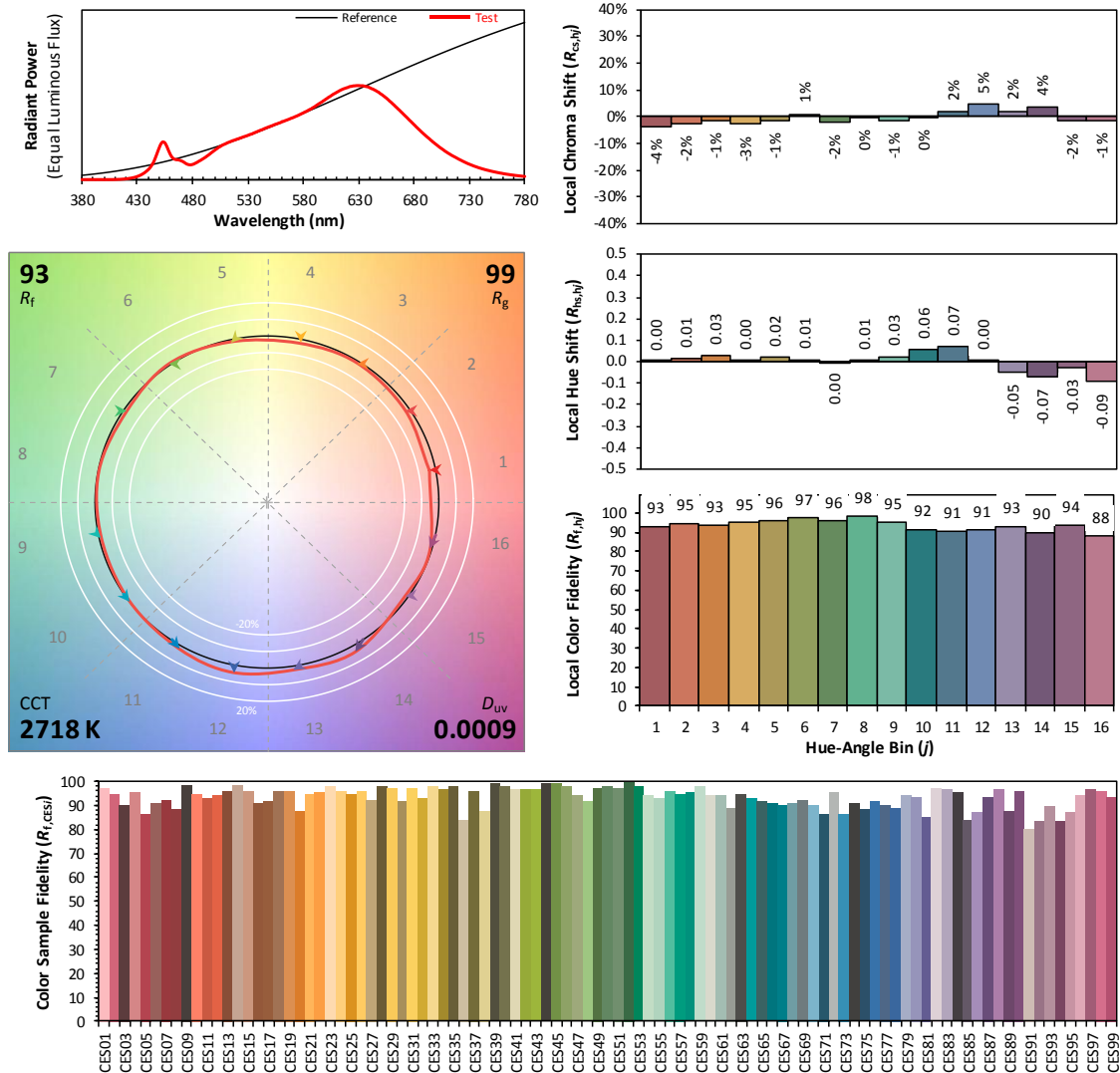
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2021/01/08

Model: ORB/S/927/NR/DIM120V/H/BL



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

x 0.4600
 y 0.4131
 u' 0.2615
 v' 0.5283

CIE 13.3-1995
(CRI)

R_a 95

R_g 71

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	280.008	29.48%
10- 20	390.699	41.14%
20- 30	153.127	16.12%
30- 40	63.954	6.73%
40- 50	34.336	3.62%
50- 60	17.105	1.80%
60- 70	7.815	0.82%
70- 80	2.077	0.22%
80- 90	0.007	0.00%
90-100	0	0.00%
100-110	0	0.00%
110-120	0	0.00%
120-130	0.004	0.00%
130-140	0.054	0.01%
140-150	0.139	0.01%
150-160	0.195	0.02%
160-170	0.167	0.02%
170-180	0.057	0.01%
Total	949.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	939.229	98.89%
60- 90	9.899	1.04%
0-90	949.128	99.94%
90- 180	0.616	0.06%
0- 180	949.7	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

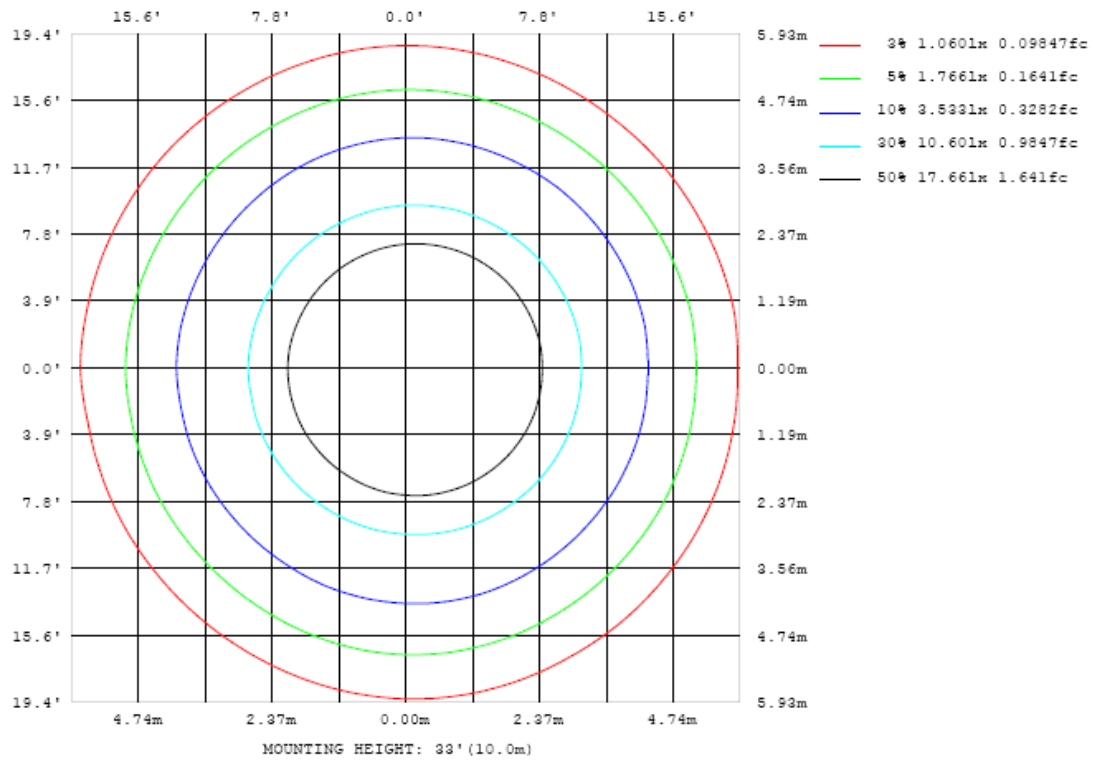


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

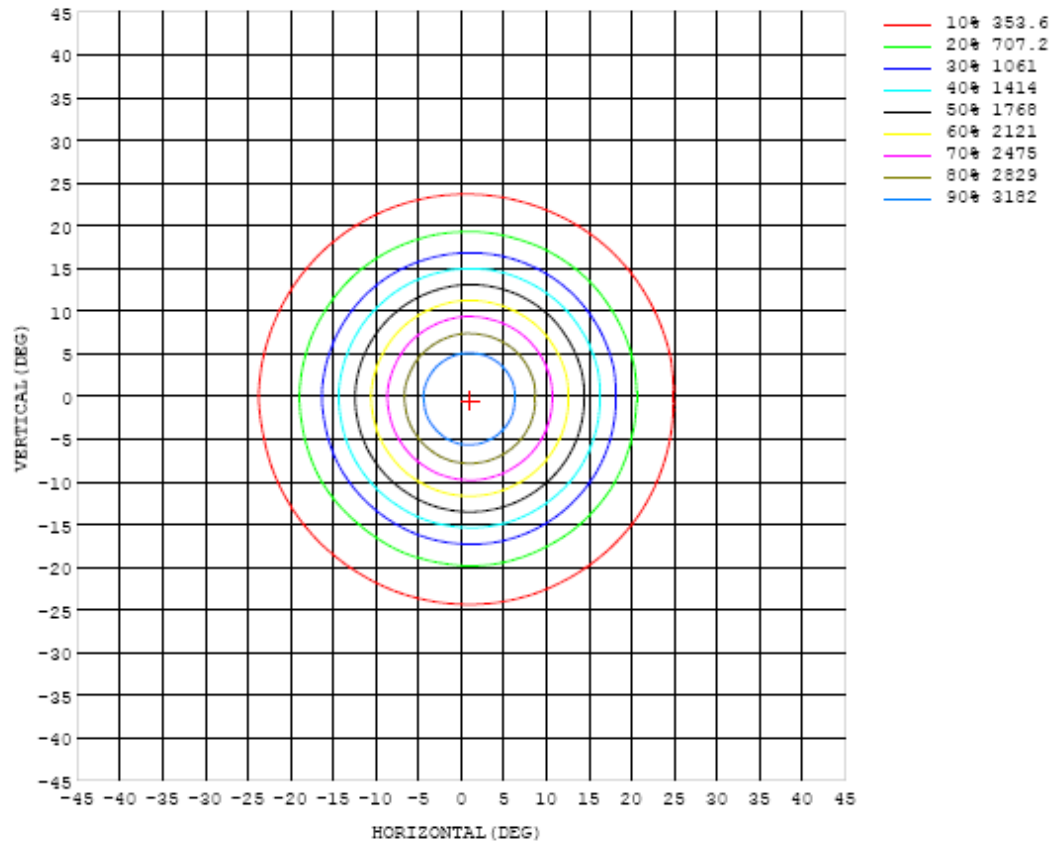


Chart 6: Isocandela Plot

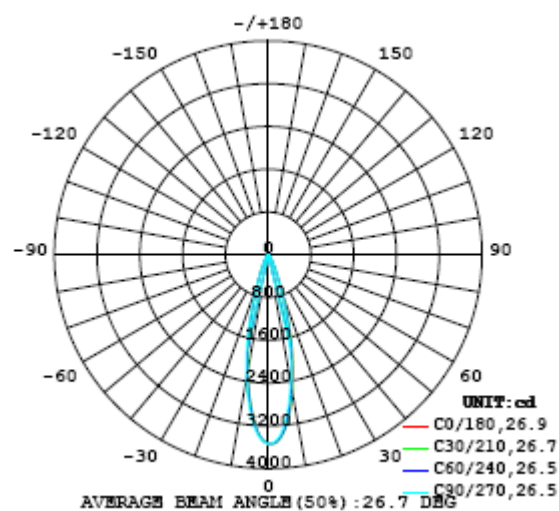


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530
5	3324	3330	3335	3332	3325	3314	3309	3293	3273	3256	3235	3211	3185	3166	3146	3132	3115	3098	3099
10	2595	2602	2600	2589	2575	2544	2522	2494	2464	2425	2389	2357	2325	2296	2272	2258	2242	2227	2231
15	1659	1660	1659	1646	1623	1592	1567	1541	1509	1472	1438	1410	1377	1357	1335	1323	1309	1295	1301
20	769	774	769	761	746	736	720	714	706	689	666	658	639	622	619	619	614	610	608
25	348	351	349	347	341	336	333	332	329	324	317	309	300	295	292	293	294	294	299
30	175	177	179	178	178	177	176	176	175	173	169	165	162	160	159	159	158	158	164
35	103	104	105	105	105	105	104	104	104	103	102	100	98.5	97.5	96.5	96.3	95.8	95.6	97.5
40	66.6	66.9	67.4	67.6	67.7	67.7	67.5	67.4	67.3	67.3	66.6	65.9	65.2	64.6	64.0	63.6	63.2	62.8	63.2
45	44.0	44.8	45.1	45.1	45.0	45.1	45.0	44.9	44.3	44.3	44.3	45.2	45.4	44.9	44.5	44.1	43.9	43.2	41.9
50	30.3	31.3	31.7	31.4	31.5	31.5	31.4	31.1	30.1	29.7	30.8	31.5	31.2	31.2	31.1	30.8	29.8	28.6	28.8
55	18.7	18.9	19.2	19.0	18.9	18.9	18.7	18.3	18.1	18.1	18.3	18.8	18.6	18.7	18.6	18.3	17.7	17.3	17.4
60	11.8	11.8	11.7	11.5	11.5	11.5	11.3	11.3	11.2	11.4	11.5	11.7	11.7	11.8	11.8	11.7	11.6	11.4	11.3
65	8.20	8.33	8.30	8.02	7.92	7.86	7.85	7.85	7.63	7.75	8.01	8.04	7.93	7.94	7.93	7.92	7.85	7.52	7.48
70	4.88	5.03	4.94	4.73	4.60	4.58	4.64	4.69	4.48	4.45	4.53	4.45	4.34	4.28	4.28	4.30	4.28	4.09	4.10
75	2.16	2.15	2.13	2.09	2.06	2.02	1.99	1.97	1.92	1.87	1.83	1.79	1.74	1.73	1.67	1.63	1.58	1.54	1.57
80	0.22	0.22	0.23	0.24	0.22	0.20	0.17	0.15	0.13	0.11	0.09	0.08	0.06	0.04	0.03	0.02	0.01	0.01	0.02
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	0.01	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	0.01	0.01	0.01	0.00
130	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	0.03	0.03	0.03	0.02
135	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08
140	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.15
145	0.20	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.22	0.25
150	0.29	0.29	0.28	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.36
155	0.40	0.39	0.39	0.39	0.39	0.40	0.40	0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.42	0.42	0.42	0.46
160	0.50	0.50	0.50	0.49	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.51	0.51	0.52	0.55
165	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.59	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.62
170	0.62	0.62	0.62	0.63	0.63	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.66
175	0.60	0.61	0.63	0.60	0.60	0.60	0.60	0.60	0.60	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.58
180	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530	3530		
5	3099	3099	3099	3107	3120	3130	3146	3165	3183	3202	3222	3245	3263	3284	3298	3310	3322		
10	2226	2214	2211	2218	2236	2255	2278	2306	2344	2374	2403	2444	2488	2523	2551	2576	2599		
15	1290	1282	1276	1289	1299	1318	1339	1368	1401	1435	1470	1501	1540	1579	1602	1634	1659		
20	601	593	587	586	590	593	601	613	626	639	650	672	694	719	735	758	777		
25	294	288	284	282	281	281	284	288	292	296	299	304	310	318	329	339	350		
30	161	159	158	157	156	155	155	156	157	157	157	158	161	165	169	173	178		
35	96.8	96.2	95.1	94.7	93.9	93.4	93.5	93.8	93.9	94.1	94.0	94.6	95.7	96.9	98.7	101	103		
40	62.9	62.5	62.3	62.0	61.7	61.2	61.0	61.0	61.2	61.3	61.2	61.7	62.4	63.3	64.0	65.1	66.3		
45	42.8	43.0	42.7	42.6	42.3	42.1	41.6	40.7	40.6	41.6	42.1	42.5	42.7	43.1	43.6	44.3	44.1		
50	29.9	30.5	30.2	30.2	30.2	30.0	29.3	28.2	28.4	29.4	30.4	30.7	30.9	31.2	31.4	31.1	30.3		
55	17.6	17.8	17.6	17.6	17.6	17.5	17.2	17.2	17.4	17.4	18.0	18.3	18.7	19.0	19.2	18.9	18.9		
60	11.4	11.4	11.2	11.2	11.2	11.1	11.1	11.1	11.2	11.4	11.4	11.5	11.7	11.8	11.8	11.8	11.8		
65	7.71	7.69	7.53	7.50	7.52	7.55	7.60	7.56	7.62	8.05	8.17	8.16	8.23	8.30	8.32	8.40	8.23		
70	4.22	4.16	4.07	4.04	4.10	4.25	4.38	4.38	4.46	4.81	4.88	4.90	4.92	5.00	5.05	5.11	4.97		
75	1.55	1.54	1.55	1.59	1.59	1.63	1.70	1.78	1.86	1.98	2.07	2.14	2.21	2.20	2.17	2.16	2.20		
80	0.02	0.02	0.02	0.02	0.03	0.05	0.07	0.08	0.10	0.12	0.14	0.17	0.19	0.22	0.22	0.23	0.24		
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	0.02	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	0.01		
135	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06		
140	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13		
145	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.22	0.22		
150	0.37	0.37	0.37	0.37	0.36	0.36	0.36	0.36	0.35	0.35	0.35	0.34	0.34	0.34	0.33	0.33	0.33		
155	0.47	0.47	0.47	0.47	0.46	0.46	0.46	0.46	0.46	0.45	0.45	0.45	0.45	0.44	0.45	0.44	0.44		
160	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54		
165	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.61		
170	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.65	0.65	0.66	0.65	0.65	0.65	0.65	0.65	0.65		
175	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.57	0.57	0.57	0.57	0.58	0.58	0.58	0.58		
180	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50		

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

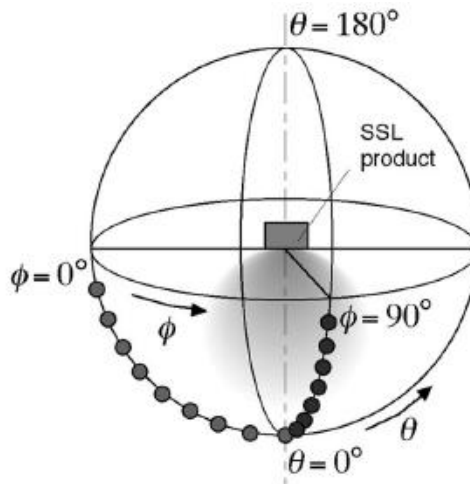
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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