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/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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Report No.: HZ20120037p

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

Review by: April Zou

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/S/927/SP/DIM120V/H/BL**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
91.3	875.2	9.59	0.9663

CCT (K)	CRI	Stabilization Time (Light & Power)
2714	95.5	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. 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

TABLE OF CONTENT

SAMPLE PHOTO

Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Track Light
Model	: ORB/S/927/SP/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 ℃.

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)	0.083
Power Factor	0.9663
Test Power (W)	9.59
THD A%	15.45
Luminous Efficacy (lm/W)	91.3
Total Luminous Flux (lm)	875.2
Color Rendering Index (CRI)	95.5
R9	73
Correlated Color Temperature (CCT)(K)	2714
Chromaticity Chroma x	0.4577
Chromaticity Chroma y	0.4088
Chromaticity Chroma u	0.2619
Chromaticity Chroma v	0.3509
Duv	-0.0005
Chromaticity Chroma u ’	0.2619
Chromaticity Chroma v’	0.5263

Special Color Rendering Indices	
R1	96.3
R2	98.2
R3	98.4
R4	96.1
R5	96
R6	97.4
R7	94
R8	87.5
R9	73
R10	94.8
R11	97.3
R12	85.3
R13	97
R14	98.2

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 ℃.

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)	0.083
Power Factor	0.9680
Power (W)	9.64
Luminous Efficacy (lm/W)	97.6
Total Luminous Flux (lm)	941.1
Beam Angle (°)	16.9 (0^o-180^o) / 16.8 (90^o-270^o)
Center Beam Candle Power (cd)	7516
Maximum Beam Candle Power (cd)	7546 (At: C=350.0, Gamma=1.0)
Spacing Criteria	0.26 (0^o-180^o) / 0.28 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	99.12%
Zonal Lumens in the 60 °-90 °Zone	0.82%
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

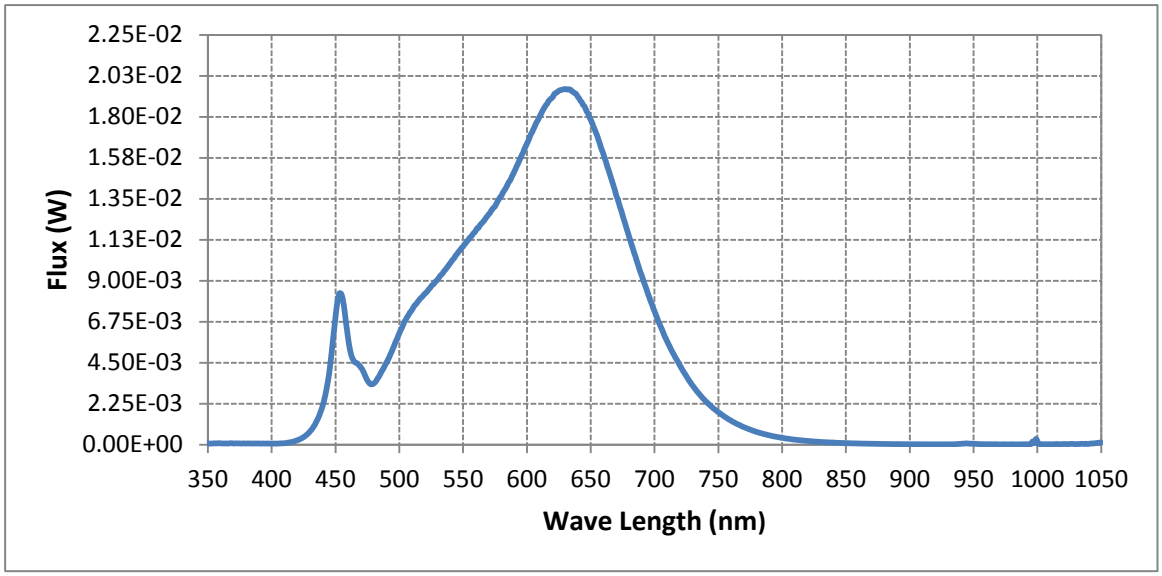
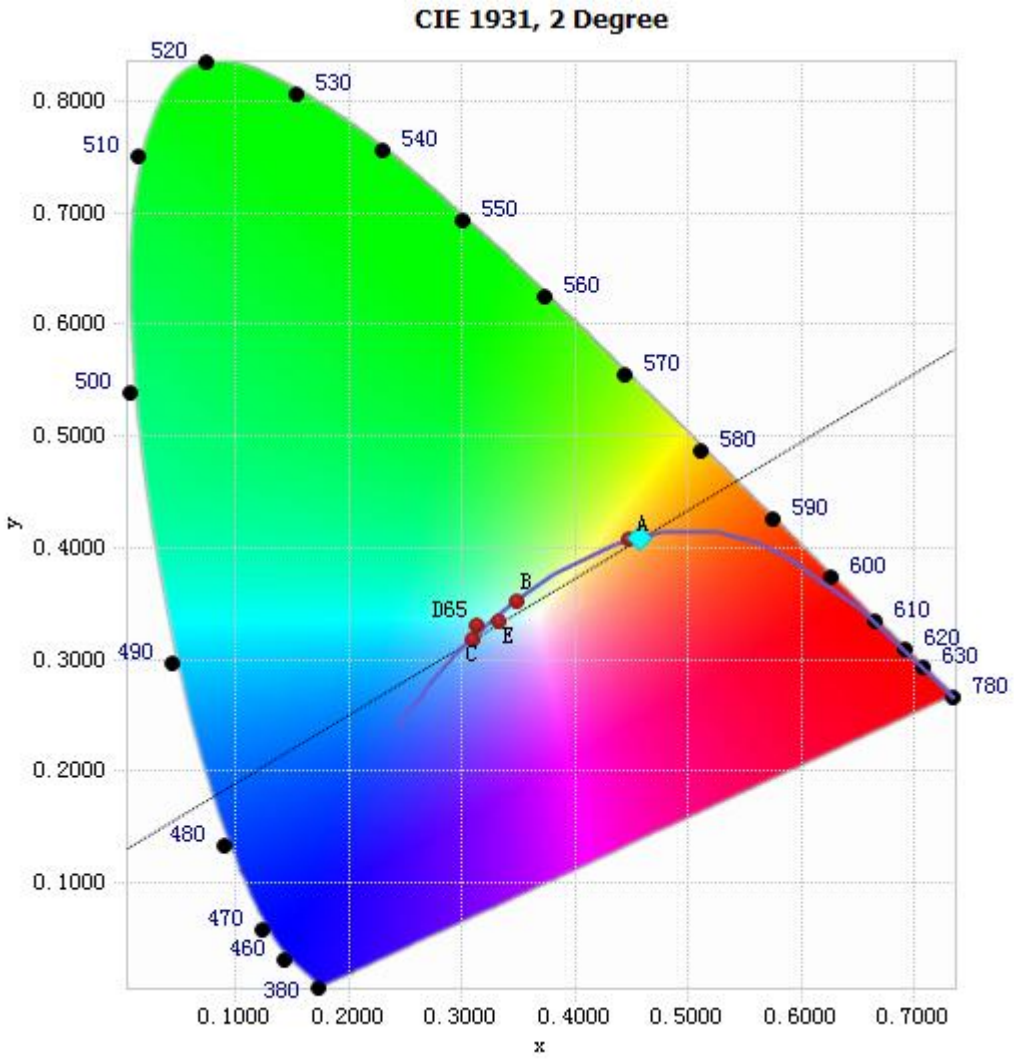


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	6.01E-05	485	3.86E-03	590	1.50E-02	695	8.25E-03
385	5.97E-05	490	4.51E-03	595	1.57E-02	700	7.32E-03
390	6.27E-05	495	5.28E-03	600	1.65E-02	705	6.45E-03
395	5.67E-05	500	6.11E-03	605	1.73E-02	710	5.65E-03
400	5.50E-05	505	6.85E-03	610	1.80E-02	715	4.96E-03
405	5.93E-05	510	7.40E-03	615	1.87E-02	720	4.33E-03
410	7.61E-05	515	7.89E-03	620	1.91E-02	725	3.75E-03
415	1.37E-04	520	8.28E-03	625	1.94E-02	730	3.23E-03
420	2.43E-04	525	8.69E-03	630	1.95E-02	735	2.78E-03
425	4.12E-04	530	9.06E-03	635	1.94E-02	740	2.39E-03
430	7.22E-04	535	9.52E-03	640	1.91E-02	745	2.07E-03
435	1.26E-03	540	9.97E-03	645	1.86E-02	750	1.78E-03
440	2.14E-03	545	1.04E-02	650	1.78E-02	755	1.53E-03
445	3.88E-03	550	1.09E-02	655	1.70E-02	760	1.32E-03
450	6.99E-03	555	1.13E-02	660	1.59E-02	765	1.13E-03
455	8.19E-03	560	1.18E-02	665	1.48E-02	770	9.61E-04
460	5.78E-03	565	1.22E-02	670	1.37E-02	775	8.22E-04
465	4.53E-03	570	1.26E-02	675	1.26E-02	780	7.00E-04
470	4.23E-03	575	1.31E-02	680	1.14E-02		
475	3.53E-03	580	1.37E-02	685	1.03E-02		
480	3.35E-03	585	1.43E-02	690	9.28E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4577, 0.4088)

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

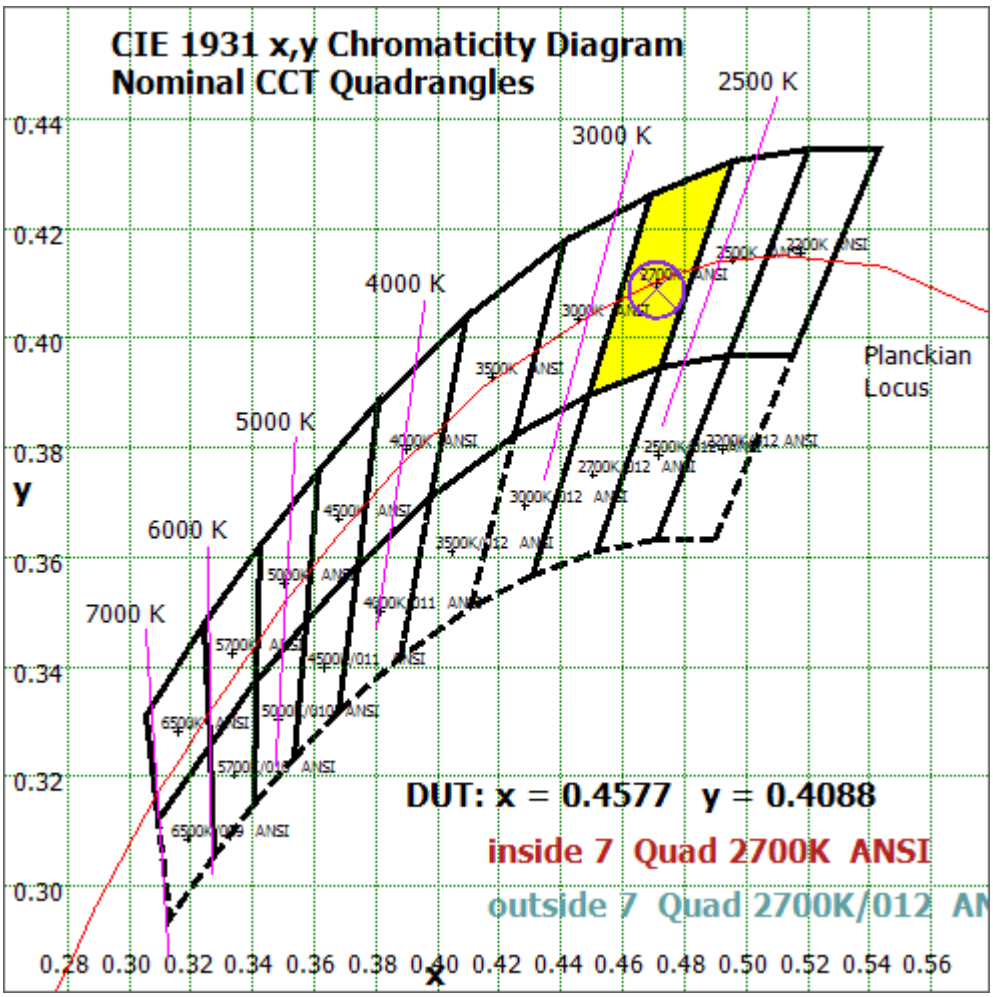


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

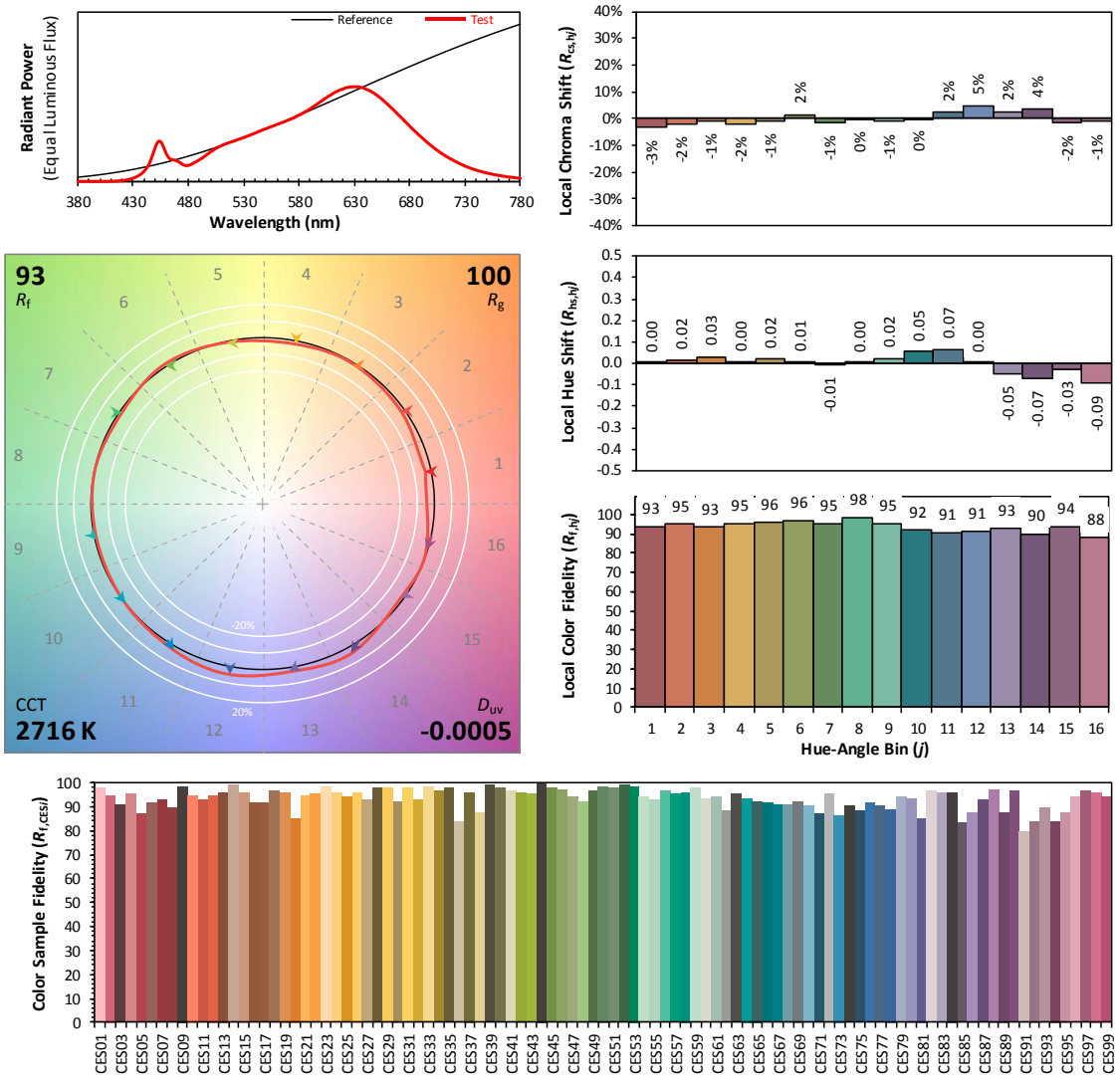
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2021/01/08

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



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

x	0.4577
y	0.4088
u'	0.2619
v'	0.5263

CIE 13.3-1995 (CRI)	
R_a	96
R_9	73

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

γ(°)	Lumens	% Total
0- 10	481.912	51.21%
10- 20	302.452	32.14%
20- 30	90.457	9.61%
30- 40	27.884	2.96%
40- 50	18.248	1.94%
50- 60	11.868	1.26%
60- 70	6.15	0.65%
70- 80	1.517	0.16%
80- 90	0.007	0.00%
90-100	0	0.00%
100-110	0	0.00%
110-120	0	0.00%
120-130	0	0.00%
130-140	0.028	0.00%
140-150	0.126	0.01%
150-160	0.21	0.02%
160-170	0.178	0.02%
170-180	0.061	0.01%
Total	941.1	100%

γ(°)	Lumens	% Total
0- 60	932.821	99.12%
60- 90	7.674	0.82%
0-90	940.495	99.94%
90- 180	0.603	0.06%
0- 180	941.1	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

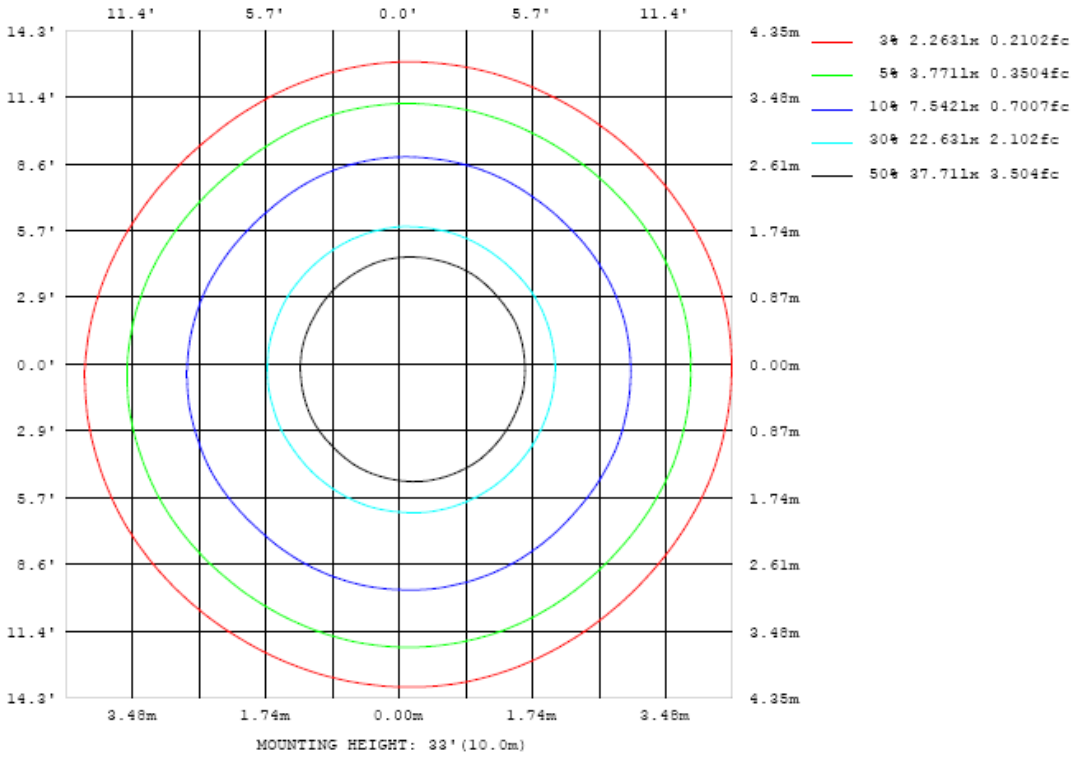


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

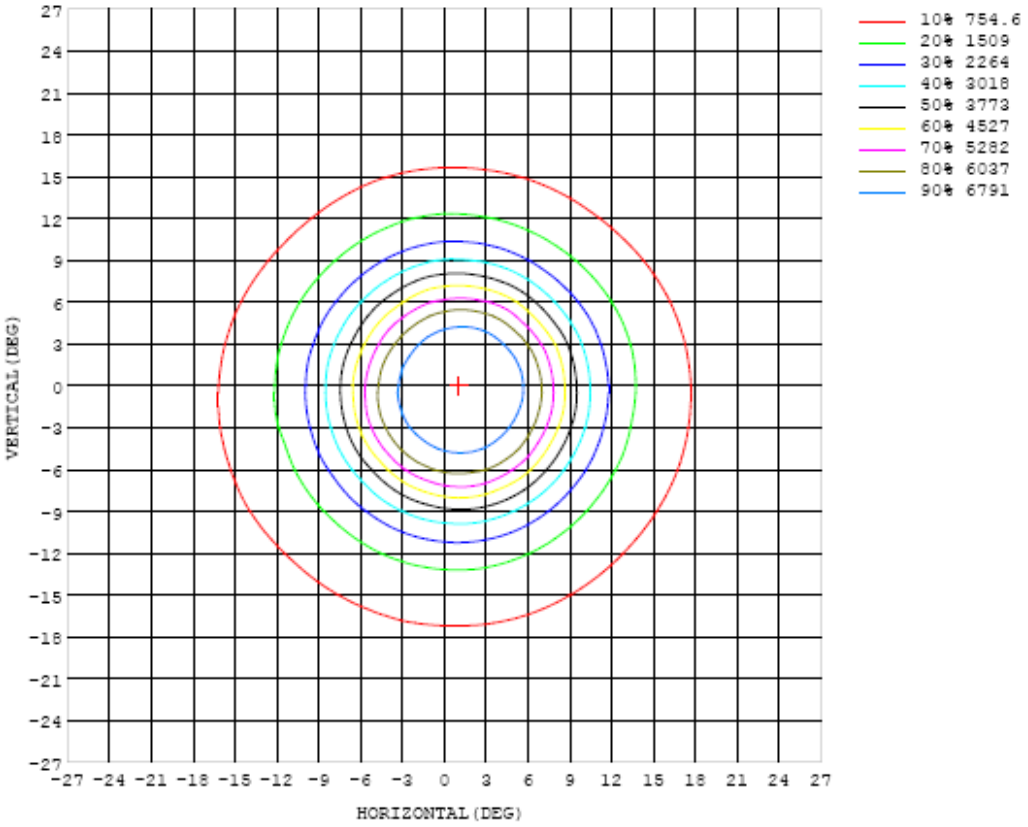


Chart 6: Isocandela Plot

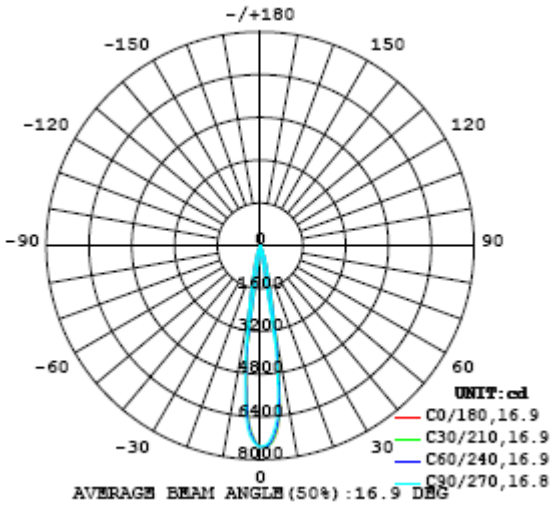


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516
5	7030	7031	7013	6976	6955	6922	6875	6828	6754	6675	6580	6469	6374	6303	6193	6109	6048	5953	5843
10	3350	3393	3396	3369	3342	3285	3199	3118	3033	2896	2800	2685	2574	2481	2401	2366	2310	2280	2246
15	1161	1174	1184	1165	1148	1140	1136	1119	1097	1077	1054	1024	994	968	958	954	935	924	905
20	529	531	530	521	505	497	496	491	484	477	464	449	438	432	431	433	429	427	418
25	225	224	221	212	203	198	198	200	201	199	193	189	186	187	188	190	189	187	184
30	93.2	92.5	90.5	87.1	84.0	81.0	80.2	81.7	83.7	84.5	82.3	79.2	78.3	79.7	81.4	83.5	83.6	82.1	79.1
35	48.5	48.3	47.4	46.0	44.9	44.2	43.8	44.0	43.7	43.7	43.1	43.0	43.2	43.7	44.2	44.9	44.7	43.8	42.5
40	32.6	32.7	32.5	32.0	31.5	31.0	30.8	30.4	30.3	30.3	30.3	30.2	30.0	30.1	30.3	30.6	30.6	29.9	29.2
45	25.0	25.8	26.0	25.9	25.6	25.7	25.6	25.3	25.4	23.9	25.2	25.5	25.1	25.0	24.9	25.0	24.5	23.6	21.9
50	18.8	19.7	19.8	19.8	19.7	19.6	19.8	20.0	19.4	18.0	19.5	19.8	19.8	19.7	19.6	19.6	19.3	18.5	17.2
55	13.9	14.2	14.4	14.5	14.4	14.2	13.9	13.6	13.0	13.0	12.9	12.9	12.9	12.7	12.6	12.5	12.4	12.1	11.7
60	9.34	9.48	9.56	9.60	9.65	9.56	9.52	9.44	9.33	9.18	9.14	9.10	9.06	9.03	8.97	8.97	8.98	8.81	8.62
65	6.35	6.75	6.80	6.76	6.80	6.77	6.69	6.67	6.53	6.11	6.41	6.39	6.30	6.29	6.19	6.17	6.13	5.97	5.53
70	3.65	4.07	4.10	4.07	4.06	4.01	4.01	3.95	3.93	3.46	3.78	3.70	3.67	3.61	3.57	3.56	3.49	3.40	3.05
75	1.50	1.51	1.53	1.52	1.52	1.50	1.50	1.48	1.44	1.42	1.39	1.37	1.33	1.29	1.24	1.20	1.18	1.15	1.14
80	0.18	0.20	0.20	0.22	0.23	0.22	0.21	0.19	0.17	0.15	0.14	0.13	0.11	0.09	0.07	0.06	0.04	0.03	0.03
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	0.00	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	0.01	0.01	0.01	0.00
135	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04
140	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.10	0.11
145	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.18	0.18	0.19	0.19	0.20	0.20	0.20	0.23
150	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.30	0.31	0.31	0.32	0.32	0.32	0.37
155	0.41	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.41	0.41	0.42	0.42	0.43	0.43	0.44	0.45	0.45	0.49
160	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.52	0.52	0.53	0.53	0.54	0.54	0.55	0.58
165	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.61	0.61	0.61	0.61	0.62	0.62	0.63	0.63	0.64	0.64	0.65	0.65
170	0.68	0.68	0.68	0.68	0.68	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.70	0.70	0.70	0.70	0.70	0.70	0.71
175	0.65	0.66	0.66	0.67	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.65	0.65	0.65	0.64
180	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

γ (DEG) \ C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516	7516		
5	5792	5765	5748	5776	5830	5894	6013	6158	6294	6448	6577	6681	6776	6839	6907	6975	7017		
10	2225	2192	2198	2180	2199	2234	2287	2353	2435	2483	2589	2698	2807	2932	3048	3190	3277		
15	884	859	828	801	792	804	823	837	853	866	891	916	941	983	1041	1094	1135		
20	401	382	361	344	335	336	343	350	357	364	376	388	407	432	463	492	517		
25	174	161	148	138	133	134	138	144	152	155	159	164	172	184	197	210	220		
30	72.9	66.6	62.0	59.0	57.5	57.2	58.2	60.2	62.0	63.0	64.1	65.6	69.3	73.8	80.2	87.9	92.6		
35	40.3	38.2	36.4	35.1	34.8	34.7	34.9	35.5	36.4	37.1	37.9	38.7	39.6	41.1	43.0	45.5	47.7		
40	28.1	27.1	26.4	25.8	25.6	25.6	25.7	26.1	26.7	27.2	28.2	28.6	29.0	29.9	30.7	31.7	32.4		
45	21.7	21.4	20.7	20.6	20.6	20.6	21.2	21.3	20.5	22.3	23.2	23.7	24.2	24.8	25.1	25.6	25.9		
50	17.4	17.5	17.1	17.1	17.1	17.1	17.3	17.3	16.4	18.1	19.1	19.4	19.9	20.1	20.2	20.2	19.7		
55	11.5	11.4	11.2	11.2	11.1	11.1	11.3	11.3	11.5	11.9	12.5	13.0	13.4	13.6	13.8	13.9	13.7		
60	8.52	8.43	8.28	8.19	8.12	8.13	8.21	8.31	8.34	8.43	8.57	8.66	8.85	8.98	9.10	9.26	9.31		
65	5.80	5.69	5.53	5.48	5.43	5.41	5.53	5.63	5.26	5.87	6.02	6.12	6.32	6.41	6.50	6.64	6.67		
70	3.24	3.12	3.00	2.86	2.79	2.80	2.83	2.99	2.83	3.24	3.37	3.50	3.66	3.80	3.93	4.02	4.08		
75	1.11	1.09	1.05	1.05	1.05	1.05	1.07	1.07	1.11	1.14	1.22	1.27	1.33	1.38	1.44	1.48	1.49		
80	0.02	0.02	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.08	0.11	0.13	0.15	0.16	0.17	0.19		
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	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
135	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03		
140	0.11	0.11	0.12	0.12	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.08		
145	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.23	0.23	0.23	0.22	0.22	0.21	0.21	0.20	0.20	0.19		
150	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.39	0.39	0.38	0.38	0.37	0.37	0.36	0.36	0.36	0.34		
155	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.52	0.52	0.52	0.51	0.51	0.51	0.47		
160	0.61	0.61	0.61	0.62	0.62	0.62	0.62	0.62	0.63	0.62	0.62	0.62	0.62	0.62	0.61	0.62	0.56		
165	0.64	0.65	0.65	0.65	0.66	0.66	0.67	0.67	0.67	0.68	0.68	0.68	0.68	0.68	0.67	0.67	0.63		
170	0.65	0.65	0.65	0.65	0.65	0.65	0.66	0.66	0.66	0.67	0.67	0.68	0.68	0.68	0.68	0.68	0.68		
175	0.65	0.57	0.52	0.51	0.53	0.57	0.56	0.57	0.59	0.60	0.60	0.61	0.62	0.60	0.61	0.65	0.65		
180	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49		

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.

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The uncertainty of integrating sphere system reported in this document is expended 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

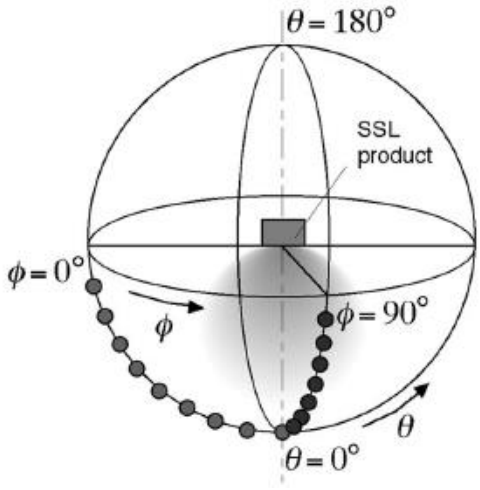
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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 °/180 ° and C=90 °/270 °) 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, Δu'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 ***