

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

LED Tube

Model: 5.5PLH/835/BYP/E26

5.5PLH/835/BYP/GU24

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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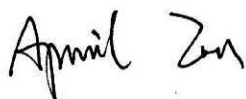
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Report No.: HZ19060003b

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

Review by:



Engineer: April Zou
Jun. 10, 2019

Approved by:



Manager: Jim Zhang
Jun. 10, 2019

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: 5.5PLH/835/BYP/E26

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
106.7	599.9	5.62	0.9712
CCT (K)	CRI	Stabilization Time (Light & Power)	
3441	83.9	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	: Jun. 04, 2019
Date of Test	: Jun. 05, 2019
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



5.5PLH/835/BYP/E26



5.5PLH/835/BYP/GU24

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 5.5PLH/835/BYP/E26
Electrical Ratings	: 120-277V, 60Hz, 5.5W
Product Description	: 3500K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

Note: 5.5PLH/835/BYP/E26 is identical with 5.5PLH/835/BYP/GU24 except its base type;

5.5PLH/835/BYP/E26 is E26 base and 5.5PLH/835/BYP/GU24 is GU24 base.

TEST RESULTS

Test ambient temperature was 25.0 °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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.048	0.023
Power Factor	0.9712	0.8928
Test Power (W)	5.62	5.74
THD A%	18.95	21.10
Luminous Efficacy (lm/W)	106.7	104.4
Total Luminous Flux (lm)	599.9	599.5
Color Rendering Index (CRI)	83.9	
R9	11.9	
Correlated Color Temperature (CCT)(K)	3441	
Chromaticity Chroma x	0.4086	
Chromaticity Chroma y	0.3925	
Chromaticity Chroma u	0.2371	
Chromaticity Chroma v	0.3417	
Duv	0.0002	
Chromaticity Chroma u'	0.2371	
Chromaticity Chroma v'	0.5125	

Special Color Rendering Indices	
R1	82.3
R2	91.4
R3	96.5
R4	81.8
R5	82.5
R6	88.8
R7	84.7
R8	63
R9	11.9
R10	79.8
R11	81
R12	69.7
R13	84.6
R14	98.6

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 24.8 °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)	0.048
Power Factor	0.9731
Power (W)	5.62
Luminous Efficacy (lm/W)	108.4
Total Luminous Flux (lm)	609.0
Beam Angle (°)	102.6 (0°-180°) / 127.4 (90°-270°)
Center Beam Candle Power (cd)	181
Maximum Beam Candle Power (cd)	180.9 (At: C=60.0, Gamma=1.0)
Spacing Criteria	1.19 (0°-180°) / 1.29 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	66.26%
Zonal Lumens in the 60 °-90 °Zone	25.18%
Zonal Lumens in the 90 °-120 °Zone	7.35%
Zonal Lumens in the 120 °-180 °Zone	1.21%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

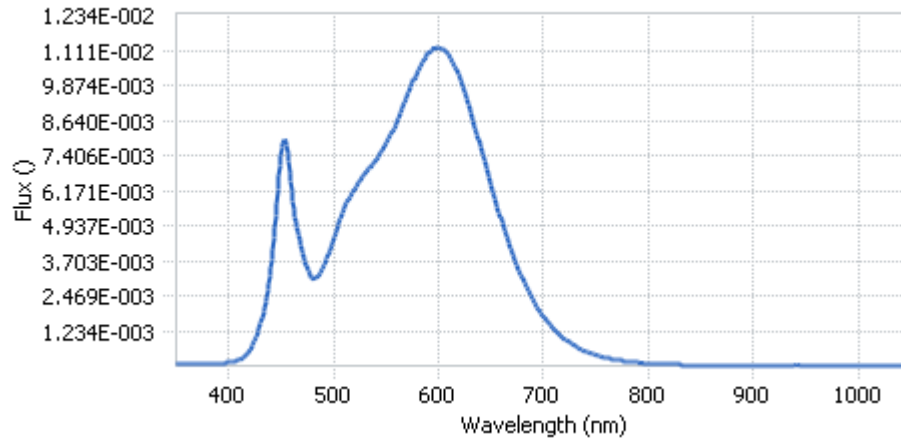
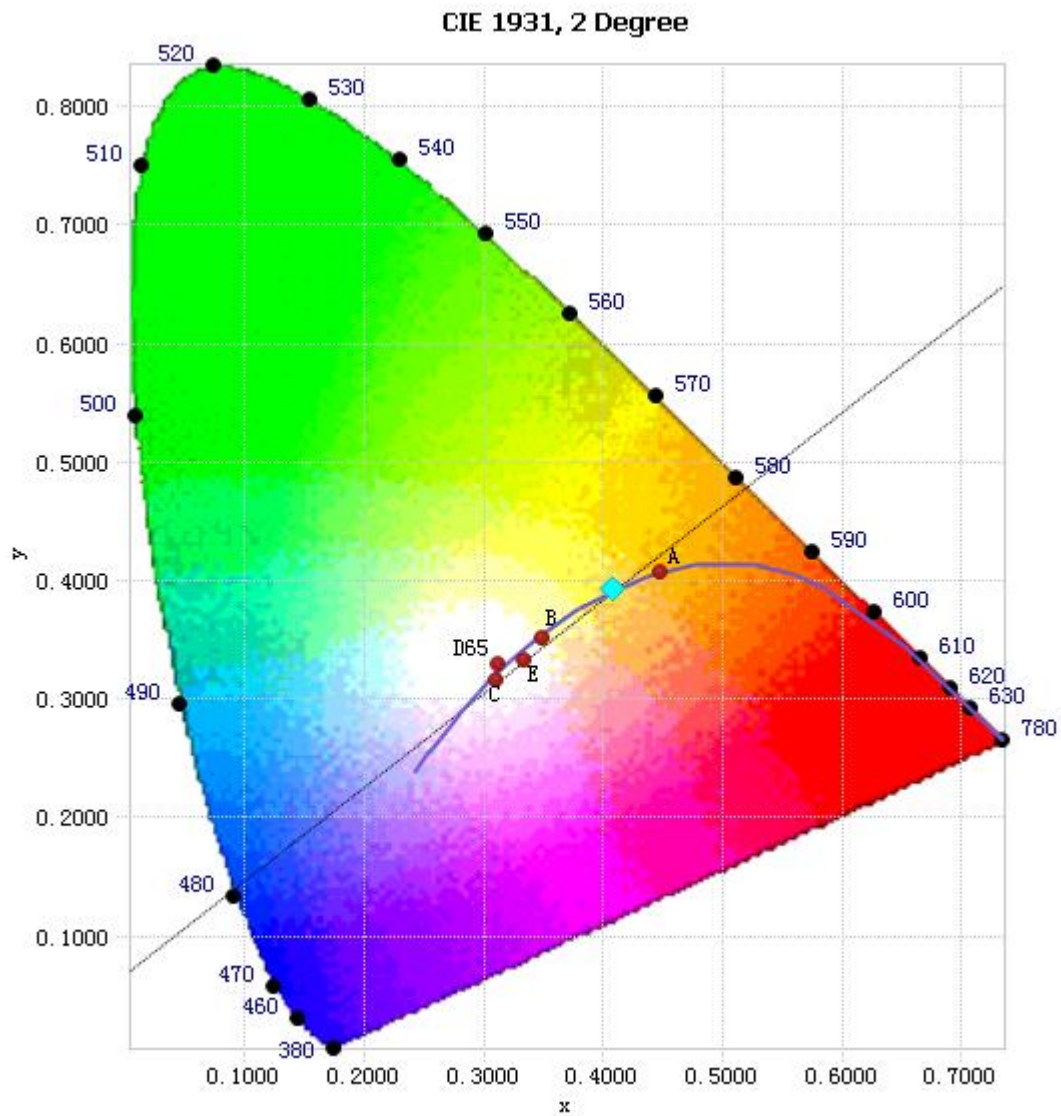


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	8.81E-05	485	3.17E-03	590	1.10E-02	695	2.02E-03
385	8.92E-05	490	3.46E-03	595	1.12E-02	700	1.75E-03
390	1.01E-04	495	3.96E-03	600	1.12E-02	705	1.50E-03
395	1.05E-04	500	4.52E-03	605	1.12E-02	710	1.29E-03
400	1.23E-04	505	5.08E-03	610	1.09E-02	715	1.11E-03
405	1.51E-04	510	5.53E-03	615	1.06E-02	720	9.59E-04
410	2.19E-04	515	5.93E-03	620	1.01E-02	725	8.24E-04
415	3.31E-04	520	6.25E-03	625	9.61E-03	730	7.11E-04
420	5.46E-04	525	6.53E-03	630	9.00E-03	735	6.05E-04
425	9.07E-04	530	6.75E-03	635	8.36E-03	740	5.17E-04
430	1.46E-03	535	6.98E-03	640	7.71E-03	745	4.46E-04
435	2.24E-03	540	7.26E-03	645	7.03E-03	750	3.85E-04
440	3.43E-03	545	7.55E-03	650	6.38E-03	755	3.33E-04
445	5.26E-03	550	7.83E-03	655	5.73E-03	760	2.88E-04
450	7.41E-03	555	8.20E-03	660	5.14E-03	765	2.47E-04
455	7.75E-03	560	8.61E-03	665	4.54E-03	770	2.12E-04
460	6.13E-03	565	9.03E-03	670	4.00E-03	775	1.84E-04
465	4.87E-03	570	9.50E-03	675	3.51E-03	780	1.61E-04
470	4.09E-03	575	9.95E-03	680	3.08E-03		
475	3.41E-03	580	1.03E-02	685	2.68E-03		
480	3.08E-03	585	1.07E-02	690	2.33E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4086, 0.3925)

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

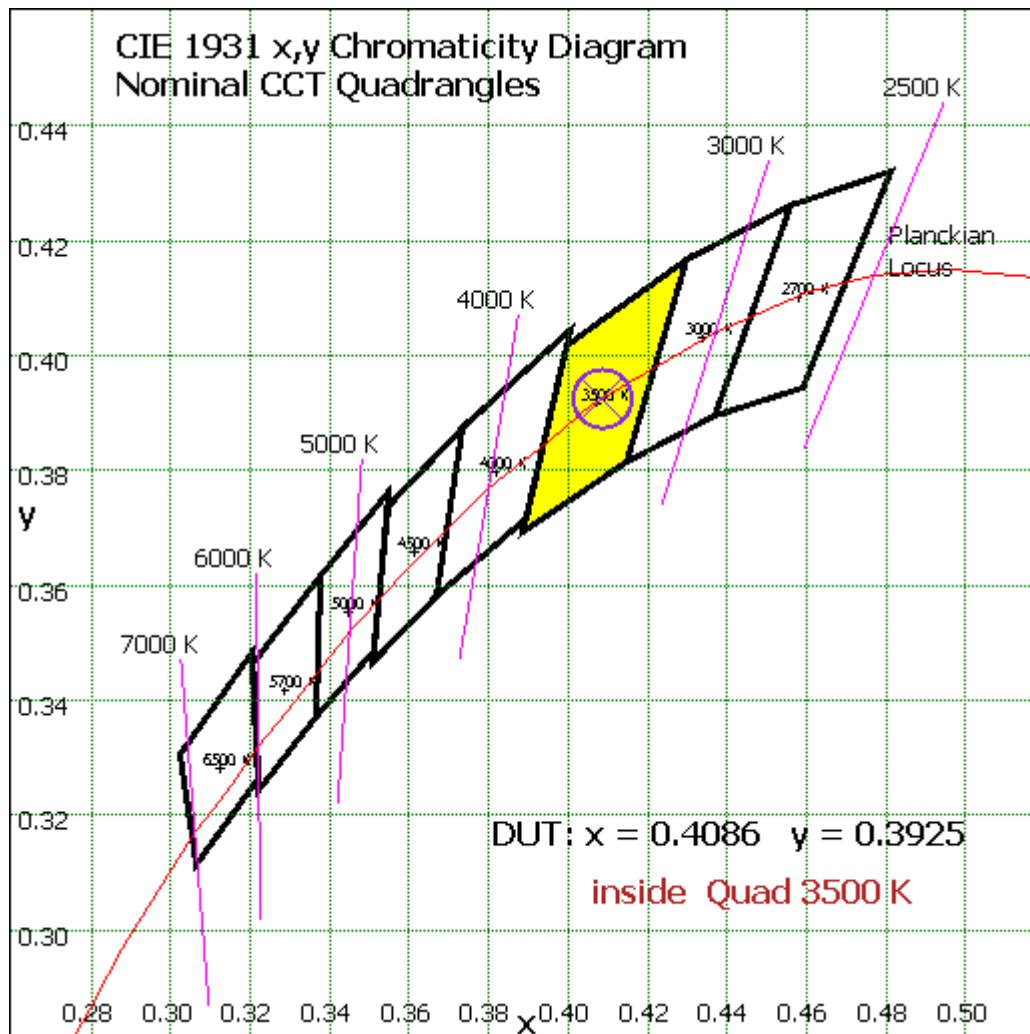
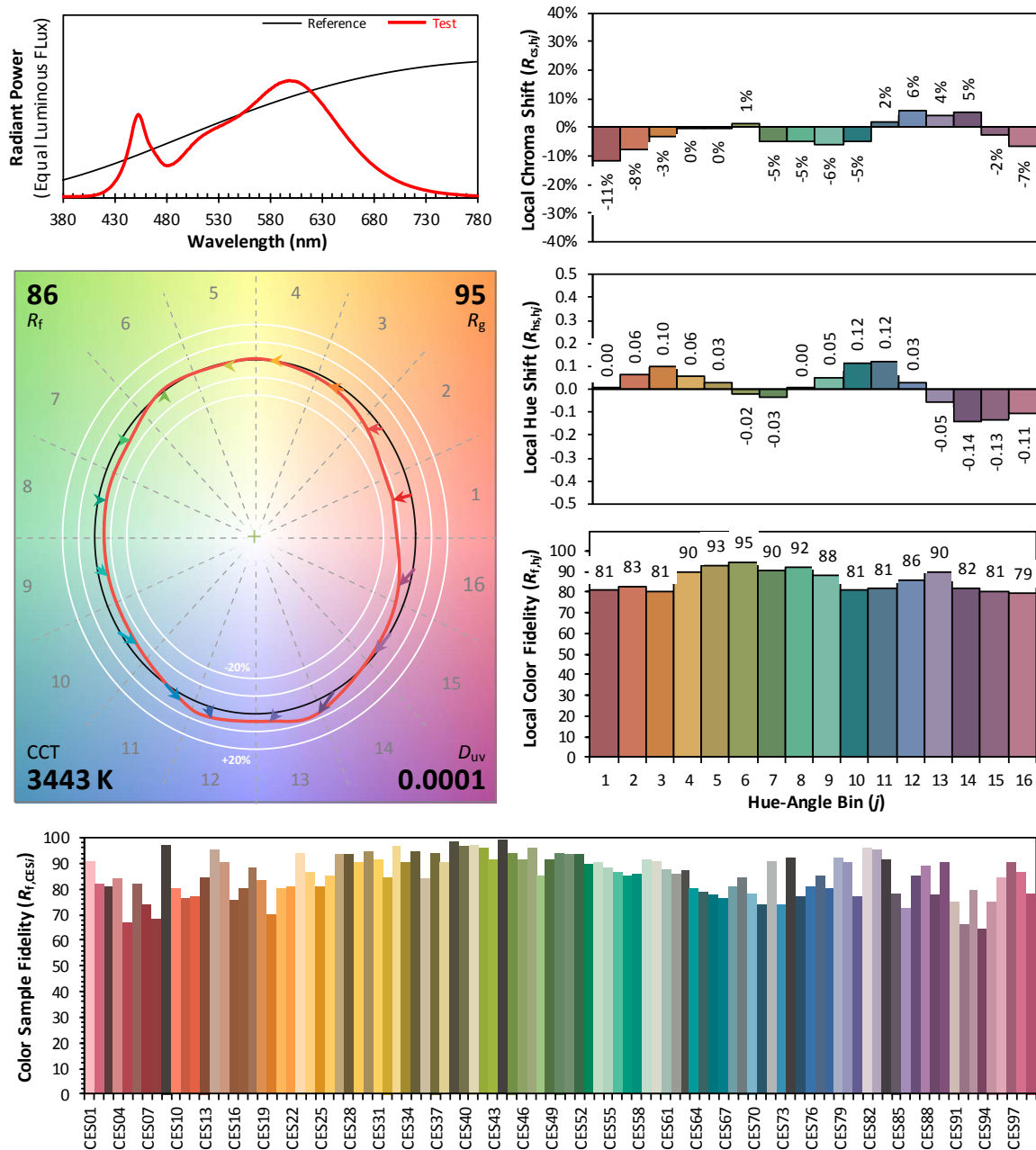


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4086
 y 0.3925
 u' 0.2371
 v' 0.5125

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	17.065	2.80%
10- 20	48.644	7.99%
20- 30	73.285	12.03%
30- 40	87.91	14.44%
40- 50	91.531	15.03%
50- 60	85.075	13.97%
60- 70	70.505	11.58%
70- 80	50.645	8.32%
80- 90	32.182	5.28%
90-100	21.141	3.47%
100-110	14.492	2.38%
110-120	9.137	1.50%
120-130	4.522	0.74%
130-140	1.712	0.28%
140-150	0.701	0.12%
150-160	0.294	0.05%
160-170	0.114	0.02%
170-180	0.027	0.00%
Total	609.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	403.51	66.26%
60- 90	153.332	25.18%
0-90	556.842	91.44%
90- 180	52.14	8.56%
0- 180	609.0	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

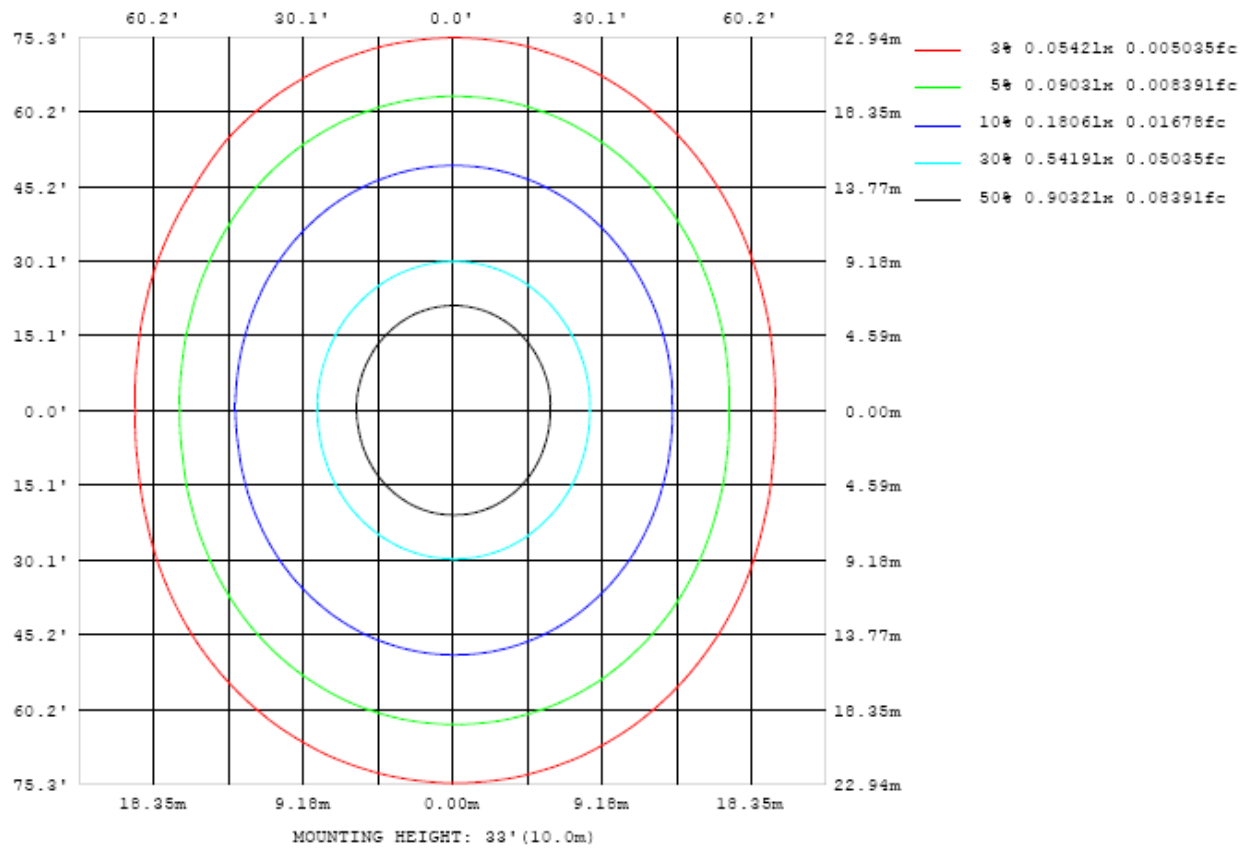


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

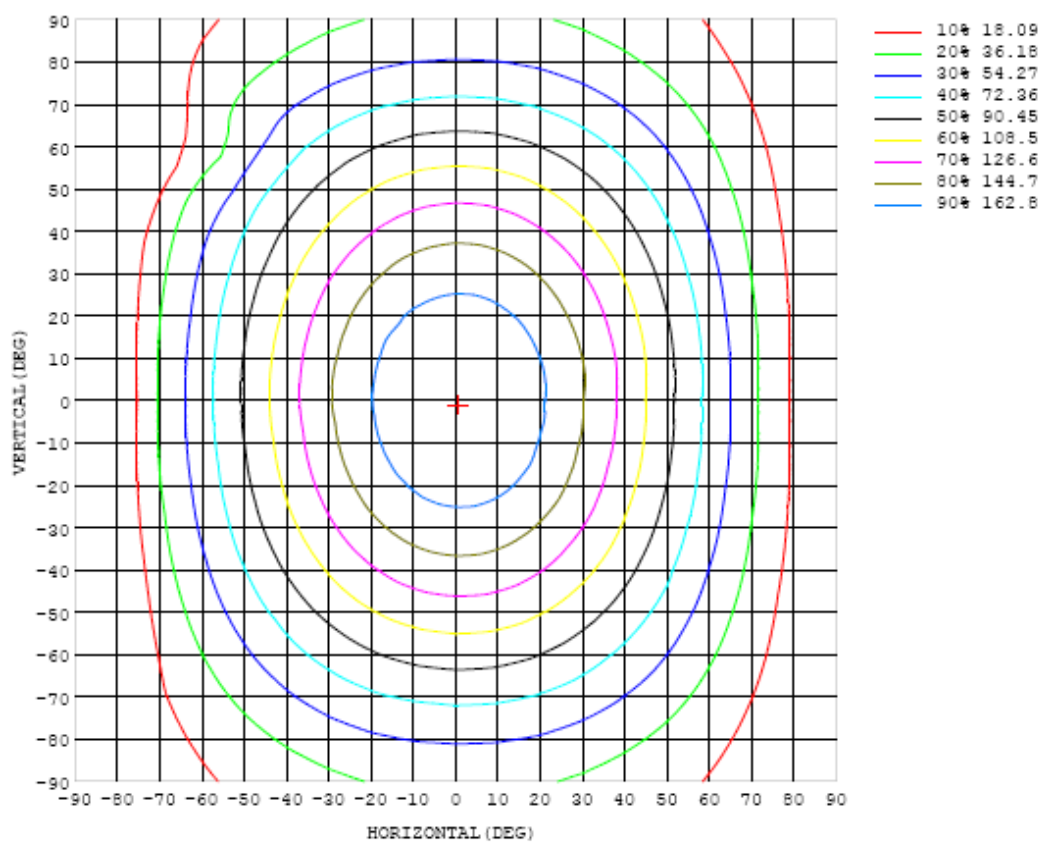


Chart 6: Isocandela Plot

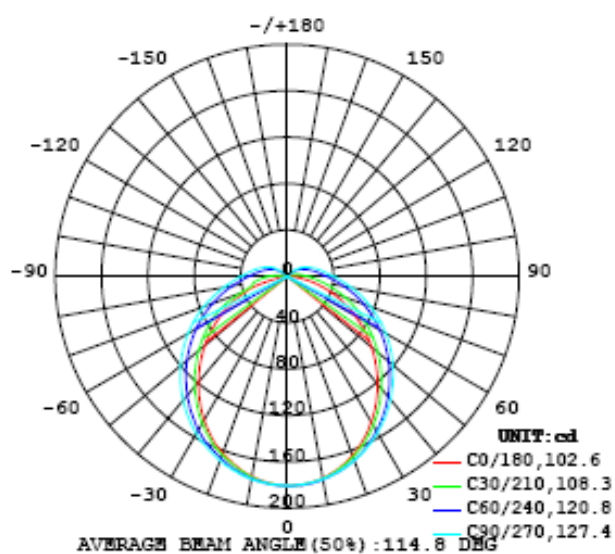


Chart 7: Polar Candela Distribution

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	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181
5	180	180	180	180	180	180	180	180	179	180	180	180	180	179	179	179	179	179	179
10	177	177	177	177	178	178	178	178	178	178	177	177	177	177	176	176	176	175	175
15	172	172	172	172	173	173	174	174	174	174	174	173	173	172	171	170	170	170	170
20	165	165	165	166	167	168	169	169	169	169	169	168	167	166	165	163	163	162	162
25	155	156	157	158	160	161	162	163	163	163	162	161	160	158	157	155	154	153	154
30	145	146	147	149	150	152	154	155	156	156	155	154	152	150	147	145	144	143	143
35	134	135	136	138	140	143	145	147	148	148	147	145	143	140	137	135	132	131	131
40	122	122	124	126	129	132	136	137	139	139	138	136	133	130	126	123	120	119	119
45	108	109	111	114	118	122	125	128	129	129	128	126	122	119	115	111	108	106	106
50	95.1	96.2	98.6	102	106	111	114	117	119	119	118	116	112	108	103	98.7	95.1	92.5	92.4
55	81.3	82.6	85.5	89.7	94.5	99.1	103	107	108	109	107	105	101	96.2	91.2	86.3	82.1	79.0	78.8
60	67.9	69.4	72.4	77.1	82.5	87.5	92.2	95.8	97.9	98.2	96.7	94.2	89.9	84.8	79.4	73.9	69.5	66.0	65.1
65	54.1	55.9	59.9	65.4	70.7	76.1	81.1	84.7	87.0	87.4	86.2	83.3	78.9	73.6	68.2	62.2	56.7	52.6	51.2
70	40.4	42.6	47.3	53.3	59.7	65.5	70.4	73.9	76.2	76.7	75.4	72.7	68.6	63.2	56.9	50.4	44.3	39.4	37.6
75	27.5	30.1	35.5	42.0	48.5	54.6	59.9	63.8	66.2	66.6	65.5	62.7	58.3	52.7	46.3	39.4	32.7	25.8	19.4
80	15.9	19.0	24.9	31.7	38.6	44.6	49.8	53.8	56.0	56.4	55.4	52.7	48.4	43.0	36.5	29.6	22.5	10.1	1.12
85	6.86	10.1	16.3	23.2	30.0	35.9	41.1	44.9	47.0	47.4	46.4	43.9	39.8	34.5	28.3	21.5	14.4	1.85	0.01
90	0.51	4.60	10.5	17.0	23.5	29.1	34.1	37.7	39.6	40.0	39.2	36.8	33.0	27.9	22.1	15.7	9.16	0.47	0.02
95	0.24	2.31	7.14	13.0	19.0	24.2	28.7	32.1	33.9	34.2	33.5	31.3	27.8	23.1	17.7	11.9	6.09	0.23	0.03
100	0.28	1.49	5.10	10.2	15.6	20.4	24.5	27.6	29.4	29.7	29.0	27.0	23.7	19.4	14.4	9.22	4.23	0.54	0.05
105	0.24	1.18	3.66	7.98	12.7	17.2	21.0	23.8	25.4	25.8	25.1	23.2	20.2	16.3	11.8	7.02	2.80	0.70	0.07
110	0.19	0.60	2.36	5.92	10.2	14.3	17.7	20.3	21.8	22.2	21.5	19.8	17.1	13.5	9.40	5.04	2.03	0.44	0.14
115	0.07	0.30	1.46	3.65	7.79	11.6	14.8	17.1	18.5	18.8	18.2	16.7	14.2	11.0	6.96	2.53	1.34	0.39	0.20
120	0.09	0.24	0.93	2.24	4.56	8.73	11.9	14.0	15.3	15.6	15.1	13.7	11.4	8.16	3.66	2.11	0.97	0.41	0.26
125	0.11	0.22	0.70	1.58	2.76	5.02	8.26	10.8	12.1	12.4	11.9	10.5	7.90	4.37	2.77	1.50	0.77	0.43	0.37
130	0.13	0.21	0.55	1.17	1.97	3.29	4.83	6.37	7.66	8.15	7.65	6.04	4.47	3.27	1.95	1.12	0.63	0.43	0.45
135	0.15	0.21	0.45	0.89	1.45	2.36	3.37	4.18	4.67	4.84	4.62	4.11	3.27	2.34	1.49	0.89	0.56	0.38	0.42
140	0.17	0.22	0.39	0.69	1.08	1.67	2.38	2.89	3.22	3.31	3.17	2.85	2.34	1.74	1.19	0.73	0.48	0.28	0.21
145	0.19	0.23	0.35	0.55	0.81	1.26	1.72	2.06	2.26	2.30	2.19	1.94	1.59	1.18	0.83	0.46	0.28	0.19	0.22
150	0.21	0.24	0.32	0.46	0.62	0.93	1.25	1.47	1.59	1.61	1.53	1.37	1.14	0.87	0.63	0.40	0.26	0.20	0.24
155	0.24	0.25	0.30	0.39	0.52	0.72	0.91	1.04	1.11	1.12	1.07	0.97	0.83	0.66	0.50	0.38	0.27	0.22	0.26
160	0.26	0.27	0.30	0.35	0.47	0.59	0.67	0.73	0.77	0.77	0.73	0.68	0.60	0.51	0.41	0.34	0.28	0.24	0.28
165	0.30	0.31	0.35	0.40	0.47	0.49	0.50	0.52	0.54	0.53	0.51	0.48	0.44	0.40	0.35	0.31	0.27	0.25	0.29
170	0.29	0.30	0.31	0.32	0.33	0.35	0.36	0.37	0.38	0.37	0.37	0.36	0.35	0.33	0.32	0.30	0.27	0.25	0.28
175	0.26	0.26	0.26	0.26	0.27	0.28	0.29	0.30	0.30	0.30	0.30	0.29	0.29	0.26	0.25	0.25	0.25	0.25	0.25
180	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

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	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181	181		
5	179	179	179	180	179	180	180	180	180	180	180	180	180	180	180	180	180		
10	176	175	176	177	176	177	177	178	178	178	178	178	178	178	177	177	177		
15	170	170	171	172	172	173	173	174	174	174	174	174	173	173	173	172	172		
20	163	163	164	165	166	167	168	169	169	169	169	169	168	167	166	166	165		
25	154	155	156	158	159	161	162	163	163	163	163	162	161	160	159	158	157		
30	144	144	146	149	151	153	155	156	157	157	156	155	153	151	149	148	147		
35	132	133	136	138	141	144	146	148	149	149	147	146	143	141	139	137	136		
40	120	121	124	128	131	134	137	139	140	139	138	136	133	130	127	125	123		
45	107	109	112	116	120	124	127	129	130	130	128	125	122	119	115	112	110		
50	93.5	95.9	99.3	104	108	113	116	119	120	120	118	115	111	107	103	99.4	97.1		
55	79.9	82.8	87.0	91.9	97.0	102	105	108	109	109	107	103	99.1	94.5	89.9	86.1	83.5		
60	66.4	69.8	74.4	79.8	85.4	90.7	94.7	97.4	98.7	98.2	95.9	92.2	87.4	82.3	77.3	72.8	69.7		
65	52.9	56.8	60.7	66.4	74.1	79.5	83.6	86.6	87.6	87.1	84.7	80.7	75.8	70.2	64.7	59.7	56.0		
70	39.7	44.2	43.0	53.3	62.9	68.4	72.8	75.5	76.6	76.0	73.5	69.5	64.4	58.6	52.6	47.0	42.7		
75	25.4	25.0	31.1	46.1	52.3	57.8	62.0	64.7	65.7	65.1	62.7	58.8	53.6	47.6	41.3	35.1	30.1		
80	8.10	9.20	28.5	36.5	42.7	48.0	52.1	54.7	55.5	55.0	52.7	48.8	43.7	37.7	31.2	24.6	19.0		
85	3.52	9.25	21.5	28.5	34.5	39.7	43.6	46.0	46.7	46.3	44.1	40.3	35.4	29.4	22.9	16.2	9.88		
90	1.16	6.12	15.2	22.6	28.3	33.1	36.8	39.1	39.8	39.3	37.3	33.8	29.1	23.4	17.1	10.4	4.48		
95	0.76	3.70	10.1	18.3	23.6	28.2	31.6	33.7	34.4	33.9	32.0	28.7	24.3	19.0	13.0	7.13	2.21		
100	0.98	2.76	5.73	14.9	20.0	24.1	27.3	29.3	29.9	29.5	27.7	24.6	20.5	15.7	10.3	5.16	1.64		
105	0.89	1.30	4.78	12.2	16.8	20.7	23.5	25.4	26.0	25.5	23.8	21.1	17.4	12.8	8.03	3.81	1.17		
110	0.51	0.81	3.02	9.65	13.8	17.5	20.2	21.8	22.4	22.0	20.4	17.9	14.3	10.2	5.87	2.52	0.61		
115	0.43	0.59	1.82	6.54	11.1	14.4	17.0	18.6	19.1	18.7	17.2	14.8	11.5	7.19	3.65	1.46	0.27		
120	0.45	0.36	0.74	3.74	7.23	11.2	13.8	15.3	15.8	15.4	14.0	11.6	7.54	4.14	2.23	0.89	0.20		
125	0.48	0.54	0.41	2.51	4.44	6.45	9.53	11.4	11.9	11.4	9.65	6.77	4.14	2.70	1.54	0.64	0.18		
130	0.49	0.56	0.56	1.64	3.00	4.36	5.58	6.43	6.72	6.46	5.58	4.31	2.78	1.91	1.12	0.49	0.19		
135	0.44	0.54	0.59	1.41	2.18	3.01	3.77	4.25	4.37	4.19	3.68	2.90	1.95	1.38	0.83	0.40	0.20		
140	0.27	0.34	0.56	1.03	1.55	2.05	2.47	2.82	2.96	2.87	2.55	2.03	1.40	1.02	0.64	0.35	0.23		
145	0.23	0.29	0.43	0.67	1.04	1.41	1.72	1.96	2.07	2.02	1.81	1.48	1.05	0.79	0.51	0.33	0.25		
150	0.25	0.28	0.34	0.54	0.77	1.02	1.22	1.37	1.45	1.43	1.32	1.14	0.81	0.59	0.43	0.32	0.27		
155	0.26	0.29	0.32	0.39	0.58	0.74	0.86	0.95	0.99	1.02	0.96	0.86	0.69	0.53	0.41	0.33	0.30		
160	0.28	0.26	0.34	0.34	0.44	0.53	0.60	0.65	0.67	0.67	0.64	0.58	0.50	0.43	0.38	0.34	0.32		
165	0.29	0.30	0.31	0.29	0.35	0.39	0.43	0.45	0.46	0.46	0.46	0.43	0.41	0.36	0.34	0.32	0.32		
170	0.28	0.29	0.26	0.30	0.29	0.32	0.33	0.33	0.34	0.34	0.35	0.34	0.34	0.34	0.33	0.31	0.30		
175	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.25	0.26	0.28	0.28	0.28	0.28	0.28	0.26	0.26	0.26		
180	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

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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