LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

Horizontally-Mounted Lamps

Model: 15.5PLH/827/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18050047a

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

Review by: April Zou

Engineer: April Zou
Jun. 05, 2018

Approved by:

Manager: Jim Zhang
Jun. 05, 2018

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: **15.5PLH/827/BYP**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
119.4	1794.0	15.02	0.9776

CCT (K)	CRI	Stabilization Time (Light & Power)
2714	83.2	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 : May 25, 2018

Date of Test : May 29, 2018

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

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Sample Photos

Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: Horizontally-Mounted Lamps
Model	: 15.5PLH/827/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 15.5W
Product Description	: 2700K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.0℃.

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 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.128	0.058
Power Factor	0.9776	0.9392
Test Power (W)	15.02	15.21
THD A%	19.79	14.74
Luminous Efficacy (lm/W)	119.4	118.1
Total Luminous Flux (lm)	1794.0	1797.0
Color Rendering Index (CRI)	83.2	
R9	12	
Correlated Color Temperature (CCT)(K)	2714	
Chromaticity Chroma x	0.4559	
Chromaticity Chroma y	0.4054	
Chromaticity Chroma u	0.2622	
Chromaticity Chroma v	0.3498	
Duv	0.0019	
Chromaticity Chroma u ’	0.2622	
Chromaticity Chroma v’	0.5248	

Special Color Rendering Indices	
R1	82.9
R2	94.6
R3	92.1
R4	80.1
R5	83.6
R6	94.4
R7	80
R8	57.9
R9	12
R10	88.1
R11	80.1
R12	80.1
R13	86
R14	96.4
Rf	84
Rg	94

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 24.7℃.

The photometric distance is 2.47m.

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)	0.129
Power Factor	0.9779
Test Power (W)	15.15
Luminous Efficacy (lm/W)	120.6
Total Luminous Flux (lm)	1827.5
Beam Angle (°)	107.4
Center Beam Candle Power (cd)	627
Spacing Criteria	1.22 (0°-180°)/ 1.26 (90°-270°)
Zonal Lumens in the 0°-60°Zone	75.22%
Zonal Lumens in the 60°-90°Zone	21.49%
Zonal Lumens in the 90°-120°Zone	2.82%
Zonal Lumens in the 120°-180°Zone	0.47%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

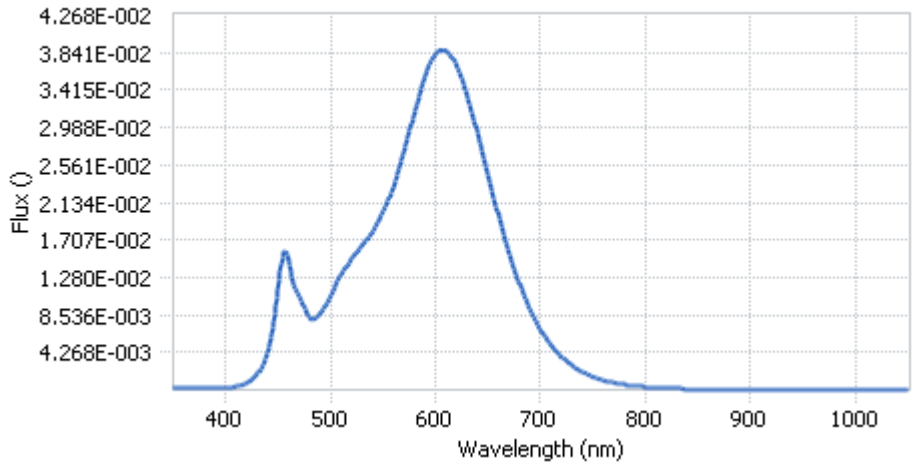
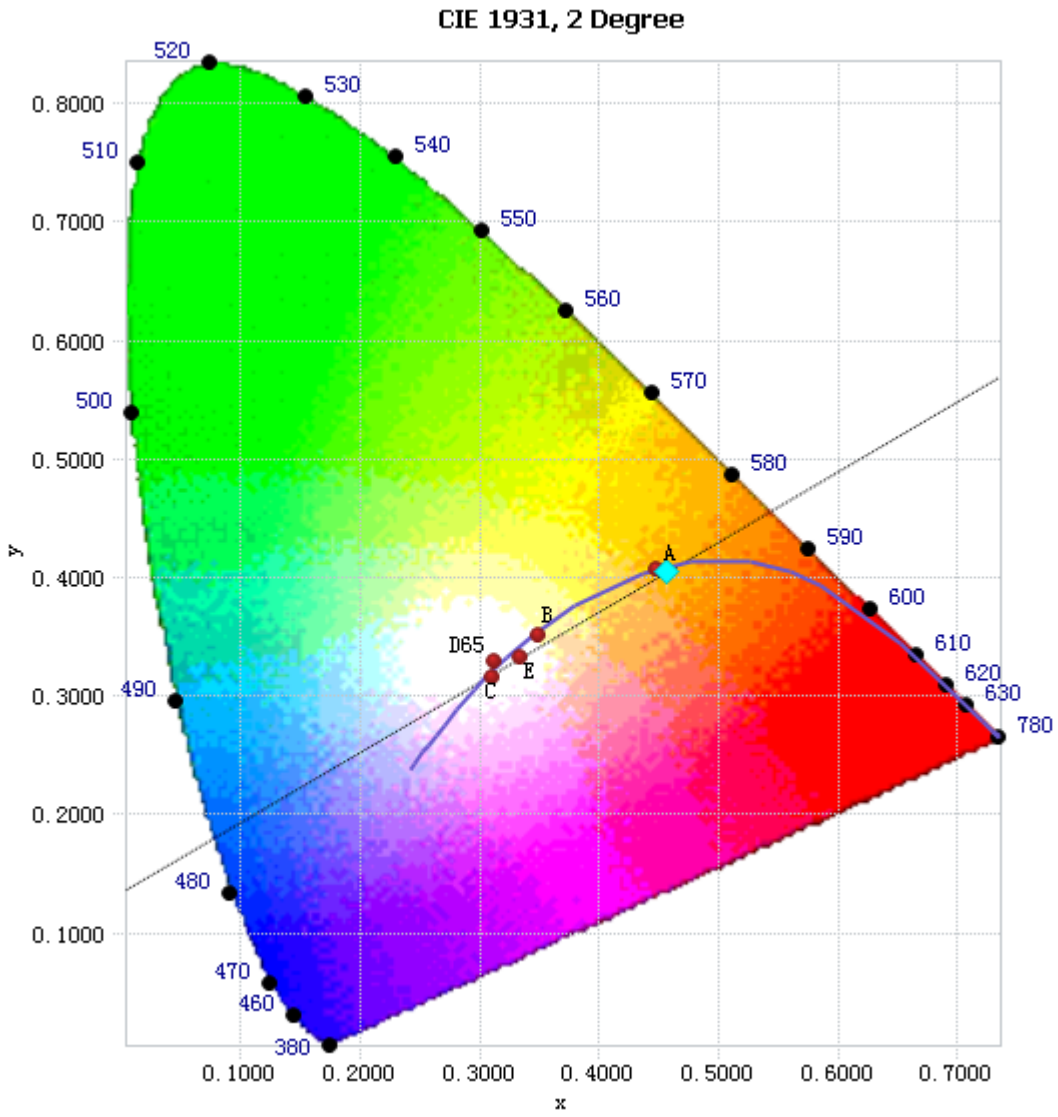


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.61E-04	485	8.13E-03	590	3.57E-02	695	7.93E-03
385	2.55E-04	490	8.71E-03	595	3.72E-02	700	6.87E-03
390	2.53E-04	495	9.56E-03	600	3.83E-02	705	5.90E-03
395	2.49E-04	500	1.07E-02	605	3.87E-02	710	5.08E-03
400	2.58E-04	505	1.20E-02	610	3.86E-02	715	4.37E-03
405	3.01E-04	510	1.31E-02	615	3.80E-02	720	3.77E-03
410	4.08E-04	515	1.41E-02	620	3.69E-02	725	3.23E-03
415	5.37E-04	520	1.50E-02	625	3.53E-02	730	2.78E-03
420	8.00E-04	525	1.57E-02	630	3.35E-02	735	2.39E-03
425	1.22E-03	530	1.65E-02	635	3.14E-02	740	2.02E-03
430	1.85E-03	535	1.72E-02	640	2.92E-02	745	1.73E-03
435	2.80E-03	540	1.81E-02	645	2.67E-02	750	1.48E-03
440	4.40E-03	545	1.91E-02	650	2.45E-02	755	1.29E-03
445	7.04E-03	550	2.02E-02	655	2.20E-02	760	1.10E-03
450	1.15E-02	555	2.16E-02	660	1.98E-02	765	9.51E-04
455	1.57E-02	560	2.32E-02	665	1.77E-02	770	8.11E-04
460	1.47E-02	565	2.52E-02	670	1.56E-02	775	6.98E-04
465	1.19E-02	570	2.72E-02	675	1.37E-02	780	5.98E-04
470	1.07E-02	575	2.94E-02	680	1.21E-02		
475	9.32E-03	580	3.17E-02	685	1.05E-02		
480	8.20E-03	585	3.39E-02	690	9.13E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4559, 0.4054)

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

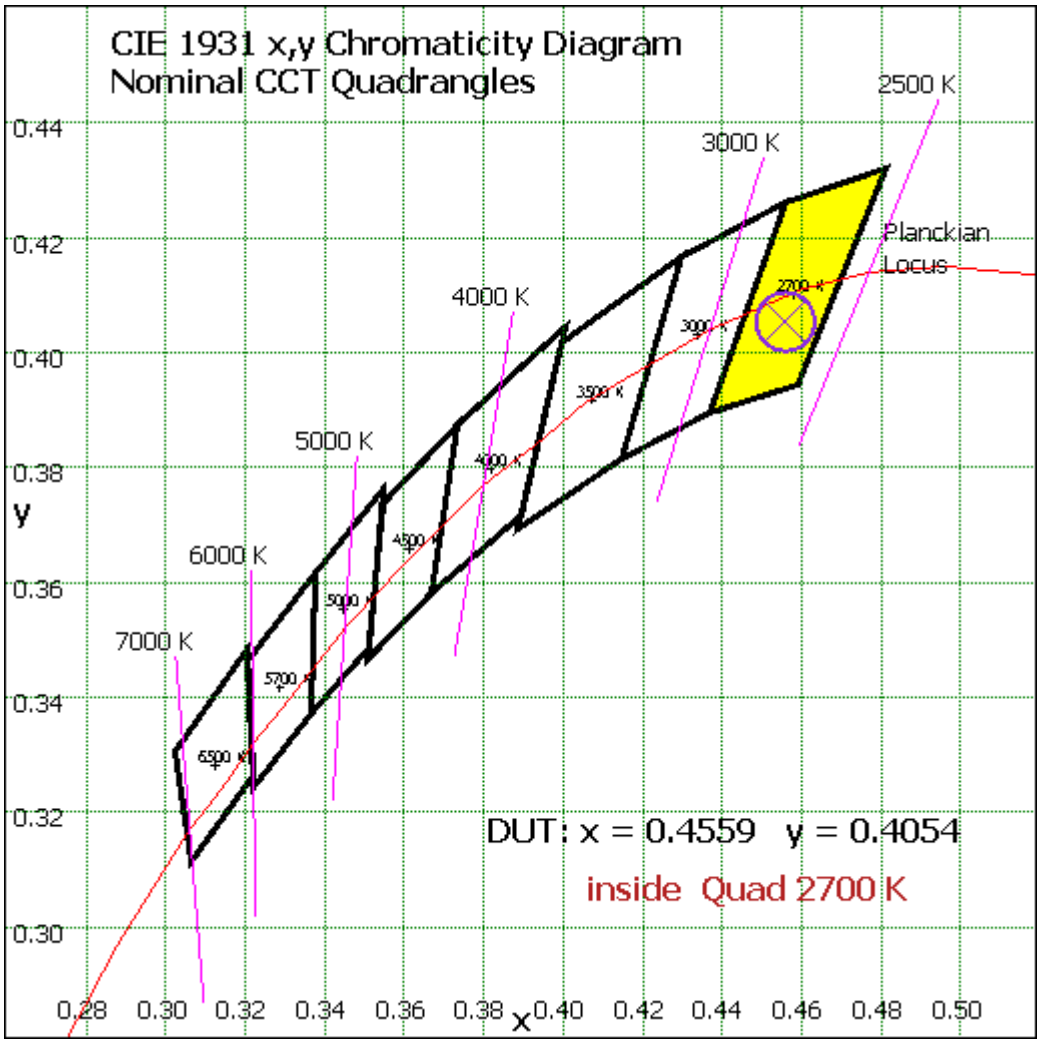


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	59.657	3.26%
10- 20	171.866	9.40%
20- 30	258.383	14.14%
30- 40	306.064	16.75%
40- 50	308.475	16.88%
50- 60	270.099	14.78%
60- 70	205.165	11.23%
70- 80	127.984	7.00%
80- 90	59.628	3.26%
90-100	27.311	1.49%
100-110	15.32	0.84%
110-120	8.947	0.49%
120-130	4.821	0.26%
130-140	2.29	0.13%
140-150	0.882	0.05%
150-160	0.321	0.02%
160-170	0.188	0.01%
170-180	0.066	0.00%
Total	1827.5	100%

γ(°)	Lumens	% Total
0- 60	1374.544	75.22%
60- 90	392.777	21.49%
0-90	1767.321	96.71%
90- 180	60.146	3.29%
0- 180	1827.5	100%

Table 5: Zonal Lumen Data

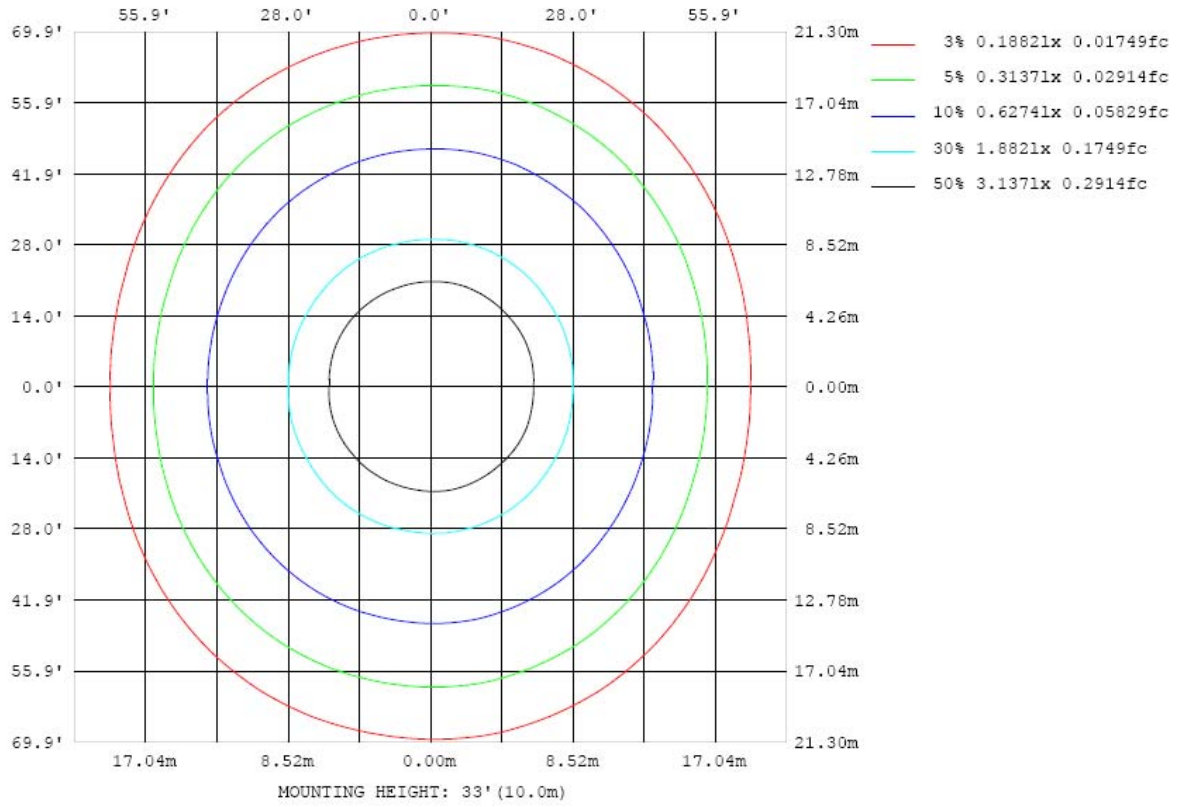


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

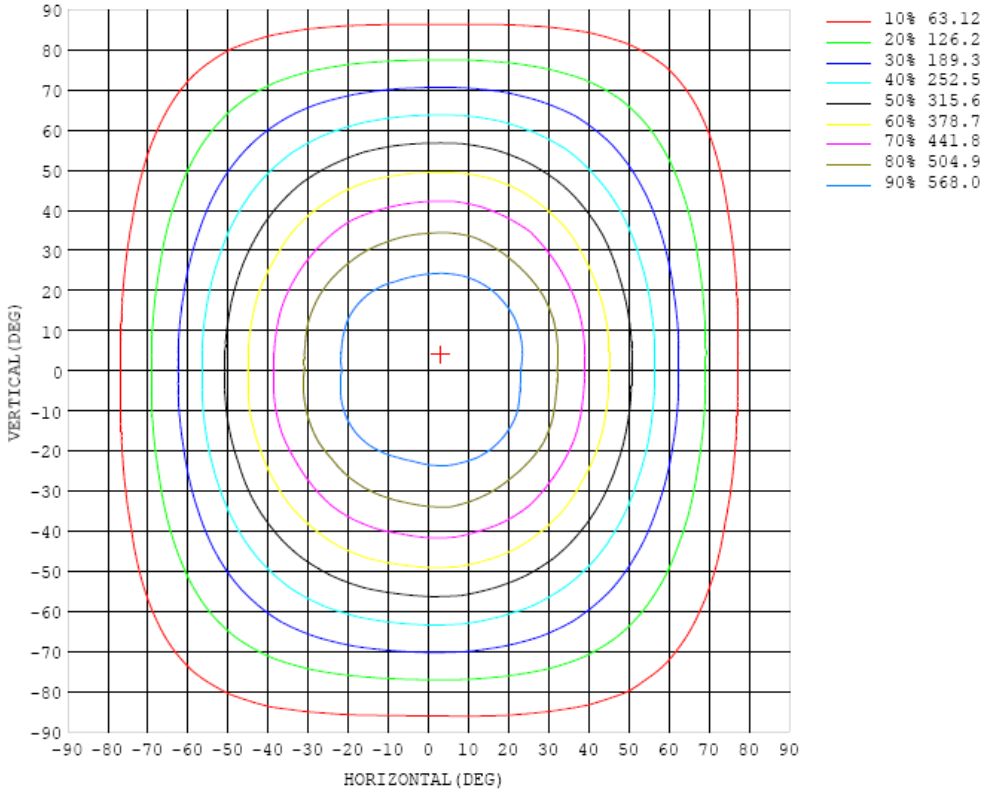


Chart 5: Isocandela Plot

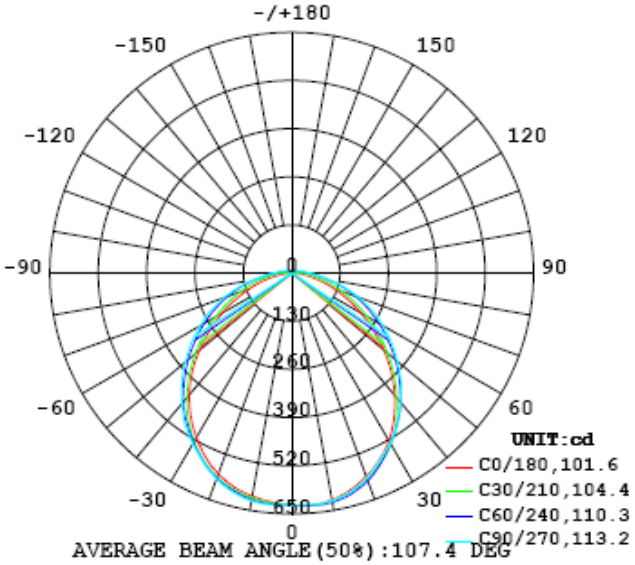


Chart 6: Polar Candela Distribution

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	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627
5	628	628	628	629	630	630	629	627	628	627	627	625	625	624	623	622	621	621	620
10	622	621	623	625	627	628	628	626	626	625	623	621	619	619	616	615	614	613	612
15	606	606	609	613	615	617	617	614	614	612	608	607	607	607	605	604	602	600	599
20	585	585	588	593	594	596	596	594	592	589	586	585	586	587	586	586	584	581	578
25	557	558	563	565	566	567	566	564	562	559	555	555	556	560	560	559	556	553	549
30	522	524	530	531	532	530	531	532	534	530	526	525	525	524	523	524	521	516	512
35	479	481	487	491	490	492	496	498	500	497	493	493	491	487	482	481	481	478	473
40	430	432	437	440	444	451	456	456	458	455	452	451	450	446	440	436	436	434	428
45	379	381	385	388	396	404	409	413	417	415	411	410	406	399	395	389	385	384	379
50	323	326	330	336	346	355	364	368	373	371	367	366	362	355	346	340	332	329	324
55	268	270	274	285	295	307	316	323	328	327	324	321	316	308	299	288	279	273	269
60	214	216	221	233	247	260	271	277	283	283	280	277	272	263	251	239	227	218	216
65	164	166	173	186	201	215	226	233	239	238	235	233	228	218	206	192	178	168	164
70	119	120	129	143	158	172	182	188	192	192	190	188	183	175	164	150	135	123	118
75	78.5	80.1	90.5	105	119	131	139	143	146	145	143	142	139	133	123	111	95.8	82.9	76.8
80	44.5	47.0	58.1	71.2	83.7	93.1	98.7	101	103	101	101	100	98.6	94.3	86.8	76.1	62.6	49.7	41.6
85	18.7	21.5	32.3	44.6	55.1	62.6	66.3	68.4	68.8	67.8	67.8	67.7	66.4	64.0	57.9	48.9	37.2	25.0	16.6
90	5.22	7.22	16.6	27.2	36.2	42.7	46.6	48.1	48.5	47.7	47.9	48.2	47.3	44.5	39.3	31.4	21.2	10.3	2.14
95	1.35	2.80	9.11	17.5	25.2	31.1	34.7	36.3	36.7	36.4	36.6	36.8	35.8	33.2	28.3	21.2	12.6	4.57	0.17
100	0.25	1.00	4.91	11.4	17.9	23.2	26.7	28.5	29.1	29.0	29.2	29.2	28.1	25.5	20.9	14.8	7.95	2.46	0.11
105	0.16	0.55	3.00	7.72	13.1	17.8	21.1	23.0	23.7	23.8	24.0	23.8	22.5	20.0	15.8	10.6	5.20	1.49	0.14
110	0.16	0.39	1.91	5.31	9.67	13.7	16.8	18.7	19.6	19.8	19.8	19.5	18.2	15.7	12.0	7.63	3.51	0.98	0.17
115	0.18	0.29	1.27	3.70	7.10	10.5	13.2	15.0	16.0	16.3	16.3	15.8	14.5	12.2	9.02	5.46	2.39	0.67	0.20
120	0.21	0.26	0.84	2.56	5.11	7.88	10.2	11.8	12.8	13.1	13.1	12.6	11.3	9.33	6.68	3.90	1.63	0.45	0.24
125	0.25	0.28	0.62	1.74	3.64	5.78	7.76	9.17	10.0	10.3	10.3	9.83	8.71	6.99	4.85	2.73	1.03	0.34	0.29
130	0.31	0.32	0.52	1.11	2.51	4.14	5.67	6.88	7.65	7.95	7.91	7.46	6.46	5.08	3.43	1.86	0.57	0.35	0.36
135	0.37	0.37	0.42	0.75	1.65	2.84	4.01	4.96	5.58	5.84	5.80	5.41	4.64	3.56	2.33	1.11	0.52	0.39	0.45
140	0.42	0.42	0.44	0.53	0.93	1.83	2.68	3.39	3.88	4.10	4.07	3.75	3.16	2.36	1.48	0.68	0.50	0.44	0.54
145	0.46	0.46	0.47	0.51	0.57	0.86	1.60	2.11	2.48	2.63	2.61	2.39	1.97	1.36	0.84	0.60	0.50	0.47	0.62
150	0.49	0.49	0.49	0.51	0.54	0.56	0.69	0.96	1.30	1.44	1.44	1.22	0.93	0.74	0.67	0.57	0.51	0.49	0.67
155	0.53	0.53	0.53	0.53	0.54	0.55	0.55	0.55	0.58	0.61	0.63	0.62	0.63	0.63	0.60	0.56	0.54	0.53	0.70
160	0.56	0.56	0.56	0.56	0.57	0.57	0.57	0.56	0.56	0.56	0.57	0.57	0.58	0.58	0.58	0.57	0.57	0.56	0.72
165	0.60	0.60	0.60	0.60	0.60	0.60	0.59	0.59	0.59	0.59	0.60	0.59	0.60	0.60	0.60	0.60	0.60	0.60	0.72
170	0.64	0.64	0.64	0.64	0.64	0.64	0.63	0.63	0.63	0.63	0.65	0.63	0.63	0.64	0.64	0.64	0.64	0.64	0.72
175	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.70	0.71	0.73	0.69	0.69	0.69	0.69	0.70	0.70	0.71
180	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68

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	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627	627		
5	620	621	623	623	625	625	626	628	628	630	630	631	631	631	630	629	629		
10	611	614	616	618	619	620	620	623	624	626	628	627	628	628	627	624	623		
15	599	602	605	606	608	608	608	610	612	613	617	618	618	616	615	613	610		
20	579	583	587	589	589	588	587	589	591	593	597	599	599	596	595	591	588		
25	550	555	560	562	562	562	559	560	563	565	568	569	570	569	568	565	561		
30	516	521	525	527	527	528	527	529	532	535	537	536	535	534	535	532	528		
35	476	481	484	485	488	493	494	497	501	503	504	501	496	494	494	490	485		
40	431	437	439	442	448	455	456	456	460	463	464	462	457	450	445	442	437		
45	383	387	390	396	404	409	412	416	419	421	420	415	411	405	394	390	385		
50	328	333	339	349	356	364	368	371	374	376	376	372	364	354	345	334	329		
55	272	278	288	298	309	317	324	328	331	334	331	323	315	304	293	280	274		
60	218	225	237	249	262	273	278	282	285	288	285	279	269	255	242	229	220		
65	168	176	189	203	216	226	234	239	241	243	240	233	223	210	195	181	170		
70	121	131	146	161	174	183	189	193	194	196	194	188	180	167	153	138	125		
75	79.8	91.3	106	121	132	140	145	147	148	150	149	145	138	128	114	99.0	85.9		
80	44.6	57.5	72.0	84.7	93.9	99.8	103	104	104	105	106	103	99.0	91.1	79.8	65.8	52.5		
85	16.6	30.7	44.5	55.2	62.7	67.3	69.3	70.0	69.6	70.4	70.9	69.6	66.3	60.3	51.2	39.3	26.9		
90	5.51	15.9	27.1	36.2	42.6	46.5	48.1	48.4	47.8	48.2	48.5	47.5	44.8	39.7	32.0	22.2	11.6		
95	1.94	8.41	17.5	25.4	31.3	34.9	36.4	36.6	36.0	36.2	36.4	35.4	33.0	28.3	21.6	13.2	5.51		
100	0.87	4.90	11.6	18.4	23.7	27.1	28.7	29.1	28.7	28.7	28.6	27.5	25.1	20.7	14.7	7.96	2.54		
105	0.49	3.08	8.01	13.5	18.3	21.6	23.3	23.8	23.6	23.5	23.2	22.0	19.5	15.6	10.4	5.16	1.48		
110	0.47	2.05	5.66	10.0	14.2	17.3	19.0	19.7	19.7	19.6	19.2	17.8	15.4	11.7	7.48	3.49	0.96		
115	0.31	1.25	4.02	7.47	10.9	13.6	15.5	16.2	16.3	16.2	15.7	14.3	11.9	8.85	5.42	2.40	0.67		
120	0.25	0.66	2.85	5.51	8.26	10.6	12.2	13.0	13.2	13.1	12.5	11.2	9.18	6.61	3.90	1.64	0.52		
125	0.31	0.56	1.95	4.00	6.18	8.10	9.46	10.2	10.4	10.3	9.75	8.62	6.93	4.85	2.77	1.07	0.44		
130	0.37	0.53	1.07	2.85	4.54	6.07	7.22	7.90	8.09	7.98	7.47	6.51	5.13	3.50	1.81	0.79	0.41		
135	0.46	0.54	0.56	1.70	3.23	4.43	5.35	5.91	6.10	6.00	5.57	4.78	3.69	2.43	1.17	0.57	0.47		
140	0.55	0.58	0.70	1.05	1.95	3.09	3.80	4.25	4.41	4.32	3.98	3.36	2.47	1.29	0.74	0.61	0.55		
145	0.62	0.64	0.71	0.81	0.97	1.69	2.32	2.87	2.99	2.92	2.60	1.83	1.28	0.87	0.71	0.65	0.62		
150	0.68	0.68	0.71	0.77	0.81	1.03	1.02	1.38	1.46	1.40	1.26	1.05	0.85	0.75	0.72	0.69	0.68		
155	0.72	0.71	0.71	0.71	0.76	0.71	0.78	0.79	0.80	0.81	0.79	0.75	0.75	0.74	0.73	0.72	0.71		
160	0.73	0.73	0.73	0.73	0.74	0.74	0.74	0.73	0.72	0.72	0.73	0.74	0.74	0.74	0.73	0.73	0.73		
165	0.74	0.74	0.74	0.74	0.74	0.74	0.73	0.72	0.72	0.72	0.72	0.73	0.73	0.73	0.73	0.74	0.73		
170	0.73	0.73	0.73	0.73	0.73	0.73	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.73	0.73	0.73		
175	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.72	0.72	0.71	0.70	0.70	0.71	0.71	0.71	0.71	0.71		
180	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	PF2010A	HZTE028-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	DPS1060	HZTE001-06	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	WY12010	HZTE004-03	Aug. 10, 2017	Aug. 09, 2018
Temperature recorder	JM624U	HZTE018-08	Aug. 17, 2017	Aug. 16, 2018
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 16, 2017	Aug. 15, 2018
Standard source	D908	HZTE012-01	Aug. 20, 2017	Aug. 19, 2018
Integrate Sphere system	2M	HZTE015-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	WT210	HZTE008-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	PCR 500L	HZTE001-07	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	IT6154	HZTE004-04	Aug. 10, 2017	Aug. 09, 2018
Standard source	SCL-1400	HZTE012-02	Aug. 20, 2017	Aug. 19, 2018
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 16, 2017	Aug. 15, 2018
Temperature Meter	TES1310	HZTE017-01	Aug. 17, 2017	Aug. 16, 2018

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 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

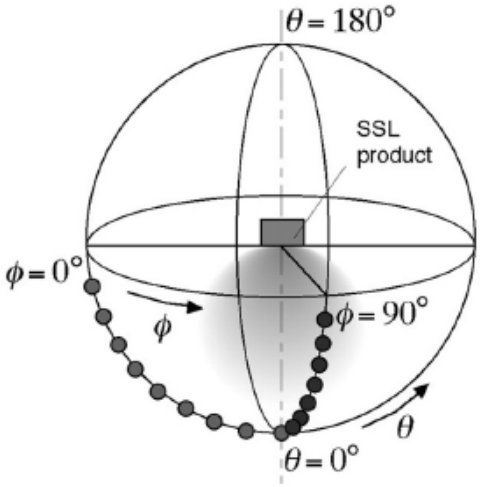
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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