LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

Horizontally-Mounted Lamps

Model: 15.5PLH/840/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18050047d

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/840/BYP**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
128.0	1947.0	15.21	0.9771

CCT (K)	CRI	Stabilization Time (Light & Power)
3991	83.7	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 30, 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/840/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 15.5W
Product Description	: 4000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 24.9℃.

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)	0.130	0.059
Power Factor	0.9771	0.9418
Test Power (W)	15.21	15.22
THD A%	20.04	16.91
Luminous Efficacy (lm/W)	128.0	127.9
Total Luminous Flux (lm)	1947.0	1946.0
Color Rendering Index (CRI)	83.7	
R9	10.2	
Correlated Color Temperature (CCT)(K)	3991	
Chromaticity Chroma x	0.3817	
Chromaticity Chroma y	0.3804	
Chromaticity Chroma u	0.2245	
Chromaticity Chroma v	0.3356	
Duv	0.0013	
Chromaticity Chroma u ’	0.2245	
Chromaticity Chroma v’	0.5034	

Special Color Rendering Indices	
R1	82.2
R2	92
R3	95.9
R4	80.3
R5	82.1
R6	88.5
R7	84.9
R8	63.8
R9	10.2
R10	80.6
R11	79.2
R12	64.4
R13	85.1
R14	98.3
Rf	82
Rg	93

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)	0.132
Power Factor	0.9771
Test Power (W)	15.43
Luminous Efficacy (lm/W)	129.1
Total Luminous Flux (lm)	1991.5
Beam Angle (°)	108.2
Center Beam Candle Power (cd)	682
Spacing Criteria	1.24 (0°-180°)/ 1.26 (90°-270°)
Zonal Lumens in the 0°-60°Zone	75.33%
Zonal Lumens in the 60°-90°Zone	21.50%
Zonal Lumens in the 90°-120°Zone	2.72%
Zonal Lumens in the 120°-180°Zone	0.45%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

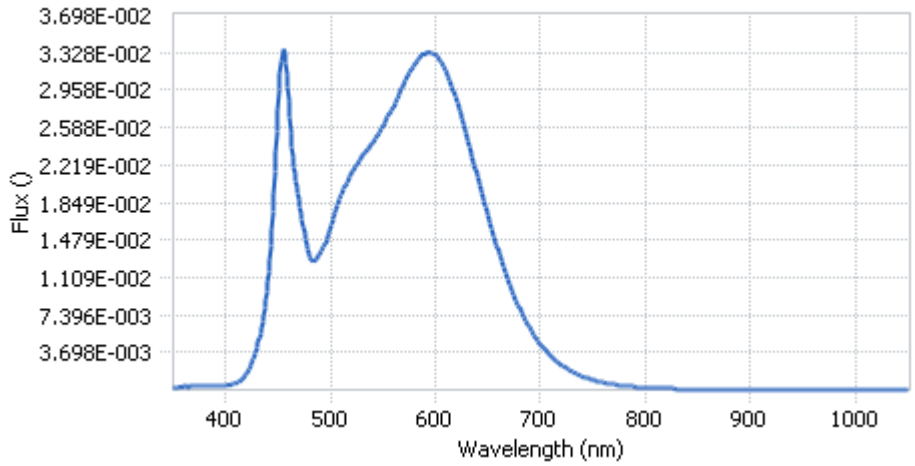
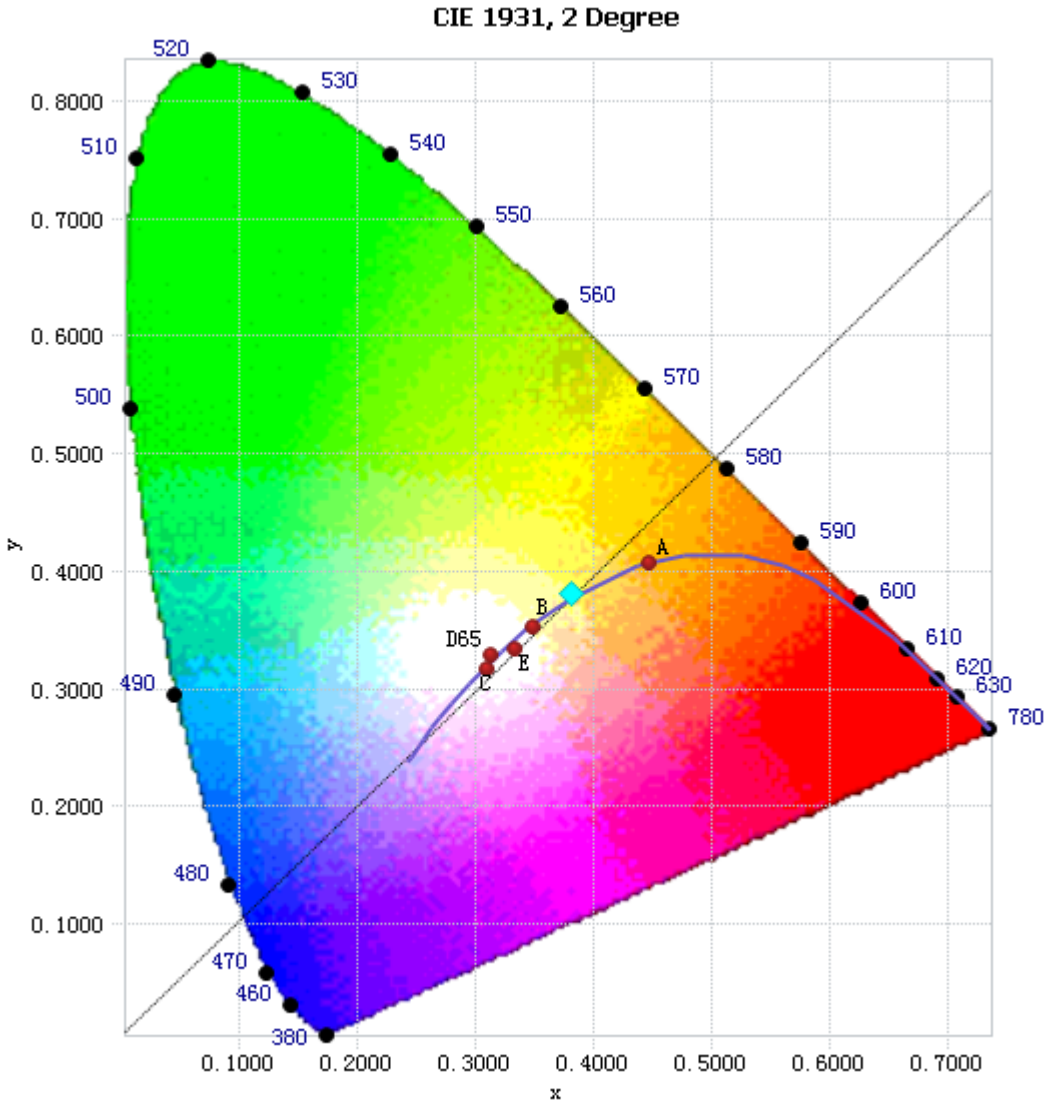


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.62E-04	485	1.28E-02	590	3.32E-02	695	5.24E-03
385	3.67E-04	490	1.34E-02	595	3.33E-02	700	4.53E-03
390	3.80E-04	495	1.45E-02	600	3.31E-02	705	3.88E-03
395	4.13E-04	500	1.62E-02	605	3.24E-02	710	3.34E-03
400	4.46E-04	505	1.78E-02	610	3.14E-02	715	2.87E-03
405	5.30E-04	510	1.92E-02	615	3.01E-02	720	2.47E-03
410	7.00E-04	515	2.05E-02	620	2.86E-02	725	2.13E-03
415	1.05E-03	520	2.15E-02	625	2.68E-02	730	1.83E-03
420	1.65E-03	525	2.22E-02	630	2.50E-02	735	1.56E-03
425	2.69E-03	530	2.31E-02	635	2.30E-02	740	1.33E-03
430	4.24E-03	535	2.37E-02	640	2.10E-02	745	1.15E-03
435	6.74E-03	540	2.44E-02	645	1.90E-02	750	9.83E-04
440	1.07E-02	545	2.52E-02	650	1.72E-02	755	8.49E-04
445	1.75E-02	550	2.60E-02	655	1.53E-02	760	7.31E-04
450	2.76E-02	555	2.70E-02	660	1.36E-02	765	6.27E-04
455	3.36E-02	560	2.80E-02	665	1.20E-02	770	5.45E-04
460	2.84E-02	565	2.91E-02	670	1.06E-02	775	4.70E-04
465	2.20E-02	570	3.02E-02	675	9.25E-03	780	4.02E-04
470	1.88E-02	575	3.13E-02	680	8.07E-03		
475	1.54E-02	580	3.22E-02	685	6.98E-03		
480	1.31E-02	585	3.29E-02	690	6.07E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3817, 0.3804)

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

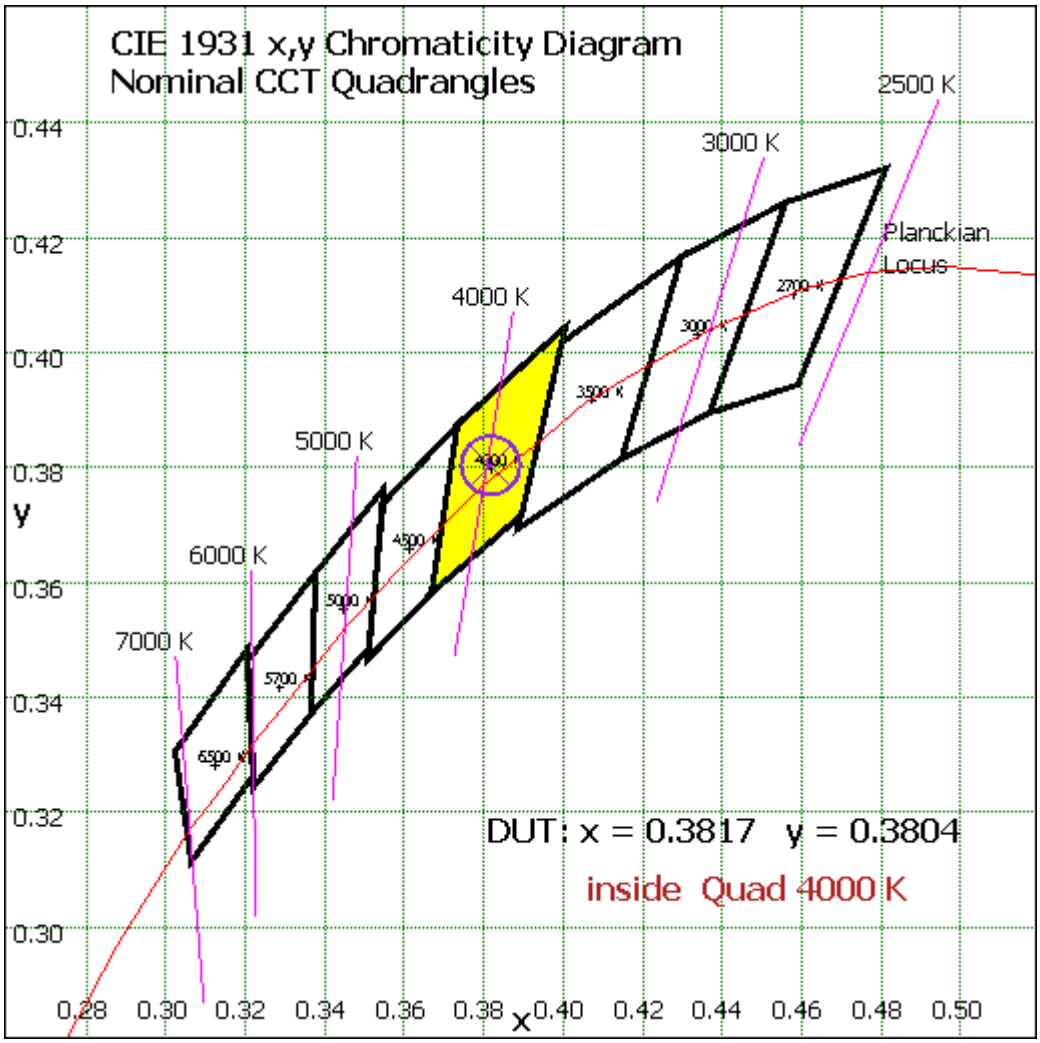


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	64.712	3.25%
10- 20	186.088	9.34%
20- 30	281.118	14.12%
30- 40	334.207	16.78%
40- 50	337.962	16.97%
50- 60	296.161	14.87%
60- 70	224.424	11.27%
70- 80	139.369	7.00%
80- 90	64.388	3.23%
90-100	28.843	1.45%
100-110	16.055	0.81%
110-120	9.341	0.47%
120-130	5.005	0.25%
130-140	2.361	0.12%
140-150	0.895	0.04%
150-160	0.35	0.02%
160-170	0.2	0.01%
170-180	0.07	0.00%
Total	1991.5	100%

γ(°)	Lumens	% Total
0- 60	1500.248	75.33%
60- 90	428.181	21.50%
0-90	1928.429	96.83%
90- 180	63.12	3.17%
0- 180	1991.5	100%

Table 5: Zonal Lumen Data

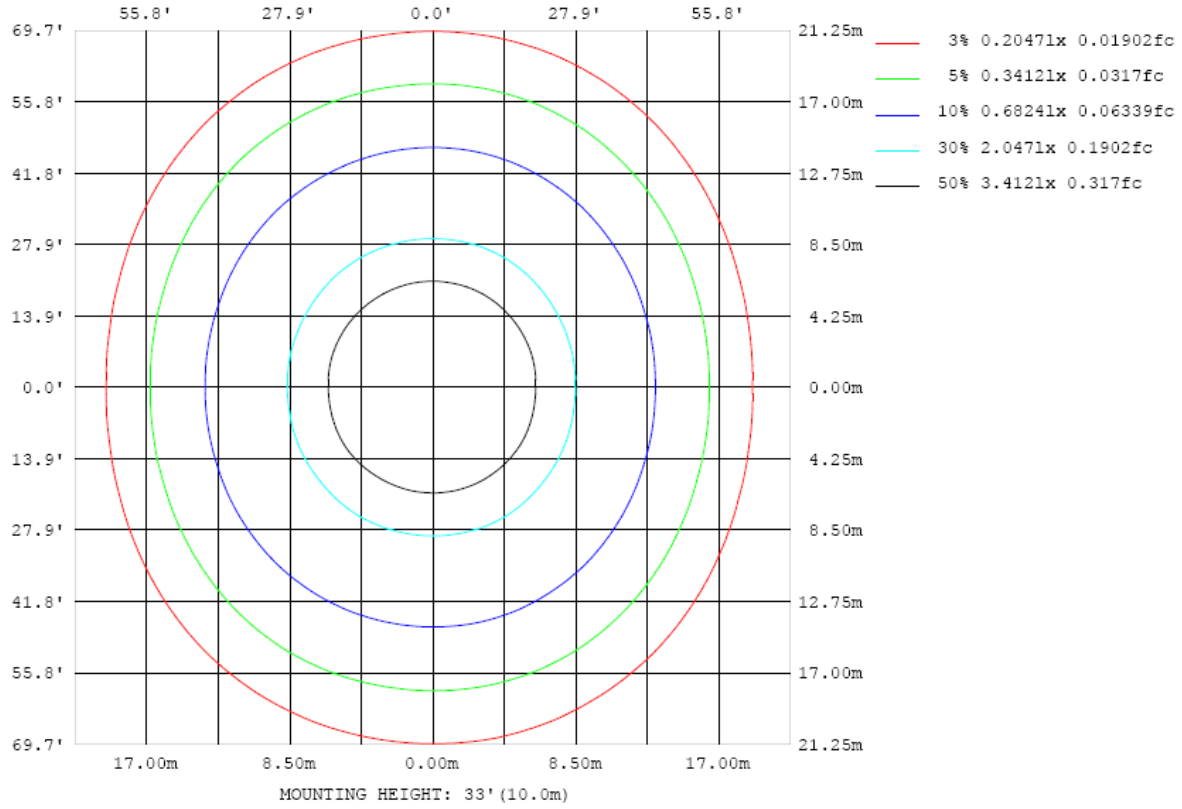


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

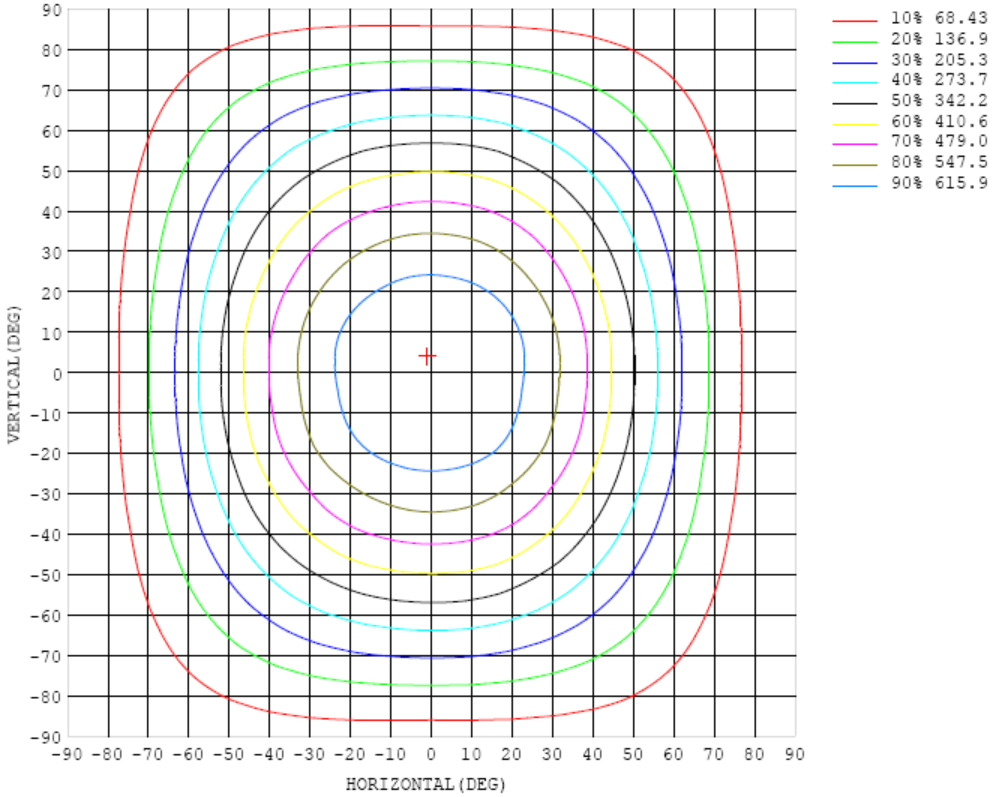


Chart 5: Isocandela Plot

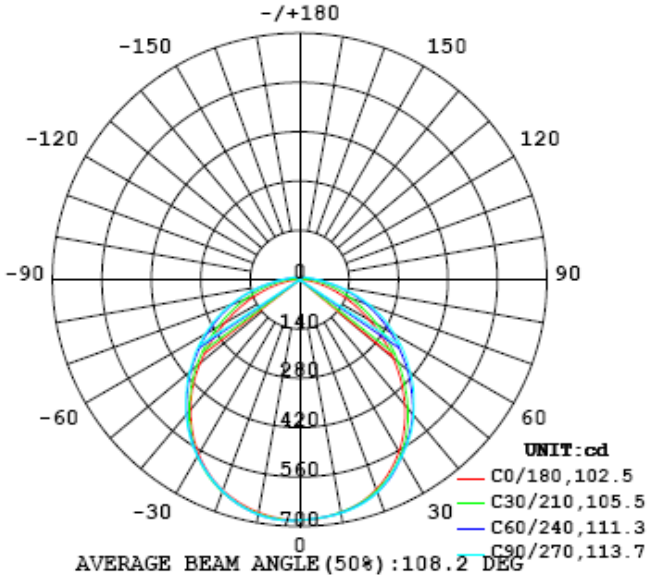


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C(DEG) / γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682
5	679	679	678	678	678	678	678	678	678	678	679	678	678	678	678	678	678	679	679
10	671	670	670	670	670	671	672	672	673	673	673	672	672	671	670	669	669	669	671
15	657	656	656	657	659	660	660	661	661	662	662	661	660	658	657	656	654	654	656
20	633	632	634	637	640	642	642	642	642	642	642	642	641	640	639	637	635	634	636
25	602	601	605	609	613	615	614	613	612	611	612	612	613	614	614	612	609	607	608
30	563	563	567	573	576	578	578	578	578	578	578	577	577	579	580	579	575	571	572
35	516	517	522	528	531	535	540	543	544	544	543	541	539	538	537	537	533	529	529
40	463	465	471	476	482	490	498	502	502	502	501	501	500	495	490	488	486	481	481
45	406	408	415	420	430	441	448	454	457	457	456	454	452	448	441	435	434	429	428
50	345	349	355	364	377	388	399	406	408	408	407	406	404	396	389	381	375	371	368
55	285	289	295	308	321	336	346	356	361	361	360	357	352	345	335	325	314	309	306
60	227	231	239	253	268	284	297	307	311	311	310	308	303	294	281	268	256	248	245
65	173	177	187	202	219	235	247	257	262	262	261	259	253	244	230	215	201	191	187
70	124	128	140	156	173	188	199	207	212	212	211	209	204	196	182	166	150	138	135
75	81.3	86.2	98.7	115	130	143	152	158	161	161	161	160	157	149	138	123	106	92.2	87.7
80	45.5	51.1	64.0	78.9	92.1	102	108	112	113	113	113	113	111	106	97.3	84.2	68.3	54.4	48.1
85	18.6	24.6	37.1	50.3	61.5	67.9	72.2	74.4	74.7	74.2	75.1	75.6	74.4	70.7	63.8	53.4	39.5	26.0	19.8
90	4.43	9.45	20.0	31.0	39.9	46.0	49.5	51.1	51.2	50.8	51.7	52.3	51.3	48.1	42.1	32.8	21.0	9.12	1.98
95	1.41	4.13	11.4	20.1	27.8	33.3	36.6	38.1	38.3	38.1	38.8	39.2	38.1	35.0	29.4	21.2	11.6	3.44	0.07
100	0.20	1.71	6.58	13.5	20.1	25.1	28.3	29.8	30.2	30.2	30.7	30.8	29.5	26.5	21.4	14.4	7.06	1.76	0.09
105	0.12	0.99	4.14	9.41	14.9	19.5	22.5	24.1	24.7	24.7	25.1	25.0	23.6	20.6	15.9	10.1	4.45	1.06	0.13
110	0.14	0.67	2.74	6.66	11.2	15.2	18.0	19.7	20.4	20.6	20.8	20.4	18.9	16.1	11.9	7.14	2.93	0.72	0.16
115	0.18	0.48	1.86	4.71	8.33	11.7	14.4	16.1	16.9	17.1	17.2	16.6	15.0	12.4	8.85	5.04	1.98	0.50	0.19
120	0.22	0.37	1.29	3.33	6.09	8.91	11.2	12.7	13.6	13.8	13.8	13.2	11.7	9.38	6.46	3.56	1.36	0.35	0.24
125	0.27	0.35	0.90	2.34	4.42	6.63	8.55	9.90	10.7	10.9	10.8	10.2	8.90	6.98	4.68	2.48	0.95	0.32	0.29
130	0.33	0.37	0.70	1.60	3.13	4.82	6.33	7.51	8.16	8.36	8.27	7.72	6.58	5.05	3.30	1.70	0.60	0.33	0.37
135	0.40	0.42	0.58	1.08	2.14	3.40	4.57	5.48	6.02	6.19	6.09	5.62	4.75	3.56	2.25	1.14	0.53	0.39	0.47
140	0.47	0.47	0.52	0.78	1.40	2.28	3.15	3.84	4.28	4.42	4.33	3.94	3.26	2.38	1.47	0.78	0.50	0.45	0.55
145	0.51	0.51	0.53	0.59	0.85	1.41	2.00	2.50	2.83	2.93	2.86	2.57	2.08	1.48	0.90	0.64	0.53	0.49	0.62
150	0.54	0.54	0.54	0.57	0.60	0.73	1.12	1.43	1.64	1.71	1.67	1.47	1.17	0.82	0.68	0.60	0.54	0.51	0.67
155	0.57	0.57	0.57	0.58	0.59	0.60	0.61	0.69	0.80	0.84	0.81	0.72	0.66	0.65	0.62	0.59	0.57	0.55	0.69
160	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.60	0.60	0.61	0.62	0.63	0.62	0.62	0.61	0.61	0.59	0.70
165	0.65	0.64	0.64	0.64	0.64	0.63	0.63	0.63	0.62	0.62	0.62	0.62	0.63	0.63	0.63	0.64	0.64	0.63	0.69
170	0.69	0.69	0.69	0.69	0.69	0.68	0.68	0.68	0.68	0.67	0.67	0.68	0.68	0.68	0.69	0.69	0.69	0.69	0.69
175	0.75	0.75	0.74	0.74	0.73	0.72	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.72	0.72	0.73	0.74	0.74	0.75
180	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75

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	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682	682		
5	680	681	682	682	683	683	684	684	684	684	684	684	683	682	682	681	680		
10	672	673	675	676	676	677	677	677	677	677	677	676	676	676	675	674	673		
15	658	660	661	661	661	661	662	661	661	661	661	662	662	662	662	661	659		
20	639	640	640	640	639	639	639	639	638	638	639	640	640	641	640	639	637		
25	612	613	613	612	611	610	611	611	611	611	611	611	612	611	610	608	605		
30	576	578	578	578	577	577	578	579	579	579	579	578	576	573	571	570	567		
35	533	534	535	537	539	540	542	543	543	542	542	540	535	530	526	523	520		
40	485	485	487	491	496	498	499	499	500	499	499	496	490	481	475	471	467		
45	431	433	435	441	447	451	453	454	455	455	453	447	439	430	420	414	410		
50	372	375	381	389	395	403	405	406	407	406	405	397	386	375	364	354	349		
55	310	315	325	335	344	351	356	360	361	360	354	345	335	320	308	295	289		
60	249	256	268	282	293	302	307	309	310	309	304	296	282	268	252	239	231		
65	191	202	216	230	243	252	258	259	260	259	255	246	233	218	202	188	177		
70	139	152	167	182	194	203	207	209	209	209	205	197	186	172	156	141	129		
75	93.5	107	123	138	148	154	157	157	158	157	155	150	142	130	115	99.4	87.0		
80	54.9	69.0	84.2	96.4	104	109	111	110	110	110	109	106	100	91.1	78.8	64.4	51.4		
85	26.5	39.6	52.7	62.8	69.4	72.8	73.8	73.2	72.4	72.8	72.5	70.6	66.6	59.6	49.6	37.1	24.8		
90	9.43	21.2	32.6	41.5	47.3	50.4	51.4	50.9	49.9	50.3	50.1	48.6	45.2	39.3	30.8	20.2	9.56		
95	3.69	11.7	21.2	29.1	34.6	37.6	38.7	38.4	37.7	37.8	37.5	36.0	32.8	27.4	20.0	11.4	4.25		
100	1.89	7.16	14.5	21.3	26.3	29.2	30.5	30.4	29.9	29.9	29.4	27.9	24.7	19.8	13.3	6.56	1.76		
105	1.12	4.59	10.1	15.8	20.4	23.3	24.7	24.9	24.4	24.3	23.8	22.2	19.2	14.7	9.26	4.16	1.00		
110	0.75	3.04	7.13	11.8	15.9	18.7	20.1	20.5	20.2	20.1	19.4	17.7	14.9	10.9	6.55	2.75	0.67		
115	0.54	2.04	5.08	8.76	12.2	14.8	16.3	16.8	16.7	16.5	15.7	14.0	11.4	8.12	4.65	1.85	0.50		
120	0.33	1.23	3.57	6.45	9.24	11.4	12.9	13.4	13.4	13.2	12.4	10.9	8.67	5.99	3.28	1.20	0.40		
125	0.34	0.72	2.15	4.64	6.91	8.75	9.99	10.6	10.6	10.4	9.65	8.33	6.49	4.31	2.06	0.86	0.36		
130	0.40	0.60	1.24	3.17	5.05	6.55	7.60	8.12	8.20	7.98	7.34	6.23	4.73	2.95	1.38	0.64	0.40		
135	0.49	0.61	0.91	1.68	3.38	4.75	5.62	6.07	6.15	5.97	5.43	4.52	3.16	1.70	0.85	0.60	0.49		
140	0.59	0.65	0.77	1.12	1.87	2.73	3.86	4.34	4.41	4.26	3.68	2.50	1.70	1.09	0.74	0.65	0.58		
145	0.67	0.69	0.77	0.88	1.20	1.59	1.93	2.17	2.25	2.09	1.83	1.48	1.12	0.85	0.75	0.71	0.65		
150	0.74	0.73	0.75	0.77	0.84	0.99	1.12	1.22	1.26	1.23	1.13	0.99	0.86	0.81	0.77	0.76	0.70		
155	0.78	0.77	0.77	0.77	0.76	0.76	0.81	0.83	0.84	0.83	0.81	0.80	0.81	0.79	0.78	0.79	0.72		
160	0.80	0.79	0.79	0.79	0.79	0.79	0.80	0.79	0.78	0.78	0.79	0.79	0.79	0.79	0.79	0.80	0.73		
165	0.80	0.80	0.79	0.79	0.79	0.79	0.79	0.78	0.78	0.77	0.78	0.78	0.79	0.79	0.79	0.80	0.72		
170	0.78	0.79	0.79	0.79	0.79	0.78	0.78	0.77	0.77	0.77	0.77	0.77	0.78	0.78	0.79	0.79	0.69		
175	0.75	0.76	0.77	0.77	0.77	0.77	0.76	0.76	0.75	0.75	0.76	0.76	0.77	0.77	0.77	0.76	0.75		
180	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75		

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

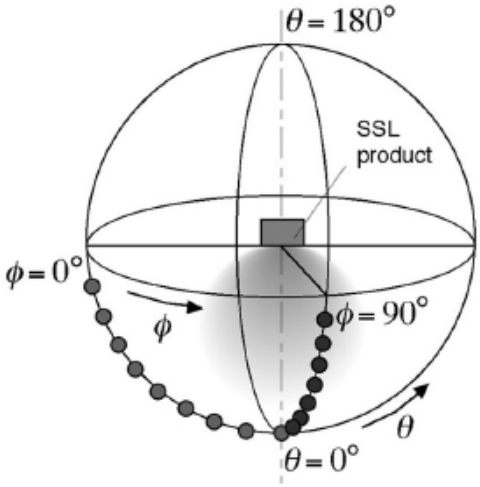
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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