LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

Horizontally-Mounted Lamps

Model: 15.5PLH/830/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18050047b

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/830/BYP**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
121.1	1834.0	15.15	0.9780

CCT (K)	CRI	Stabilization Time (Light & Power)
3019	83.5	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	: 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/830/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 15.5W
Product Description	: 3000K
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)	0.129	0.058
Power Factor	0.9780	0.9431
Test Power (W)	15.15	15.26
THD A%	19.79	15.44
Luminous Efficacy (lm/W)	121.1	120.1
Total Luminous Flux (lm)	1834.0	1832.0
Color Rendering Index (CRI)	83.5	
R9	12.5	
Correlated Color Temperature (CCT)(K)	3019	
Chromaticity Chroma x	0.4327	
Chromaticity Chroma y	0.3977	
Chromaticity Chroma u	0.2505	
Chromaticity Chroma v	0.3455	
Duv	0.0020	
Chromaticity Chroma u ’	0.2505	
Chromaticity Chroma v’	0.5182	

Special Color Rendering Indices	
R1	83.3
R2	94.7
R3	92.7
R4	80.1
R5	83.8
R6	93.3
R7	80.9
R8	59.5
R9	12.5
R10	87.5
R11	79.6
R12	75.9
R13	86.5
R14	96.8
Rf	83
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)	0.131
Power Factor	0.9773
Test Power (W)	15.30
Luminous Efficacy (lm/W)	122.2
Total Luminous Flux (lm)	1870.0
Beam Angle (°)	107.9
Center Beam Candle Power (cd)	645
Spacing Criteria	1.23 (0°-180°)/ 1.26 (90°-270°)
Zonal Lumens in the 0°-60°Zone	75.12%
Zonal Lumens in the 60°-90°Zone	21.63%
Zonal Lumens in the 90°-120°Zone	2.80%
Zonal Lumens in the 120°-180°Zone	0.46%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

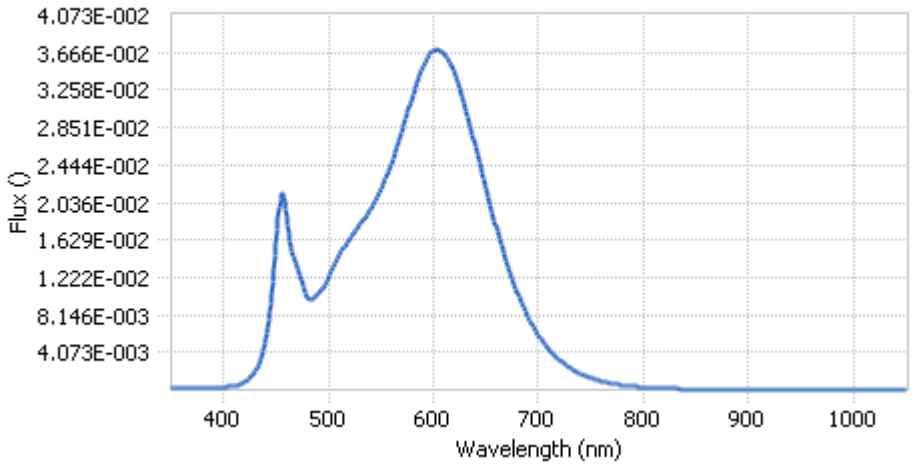
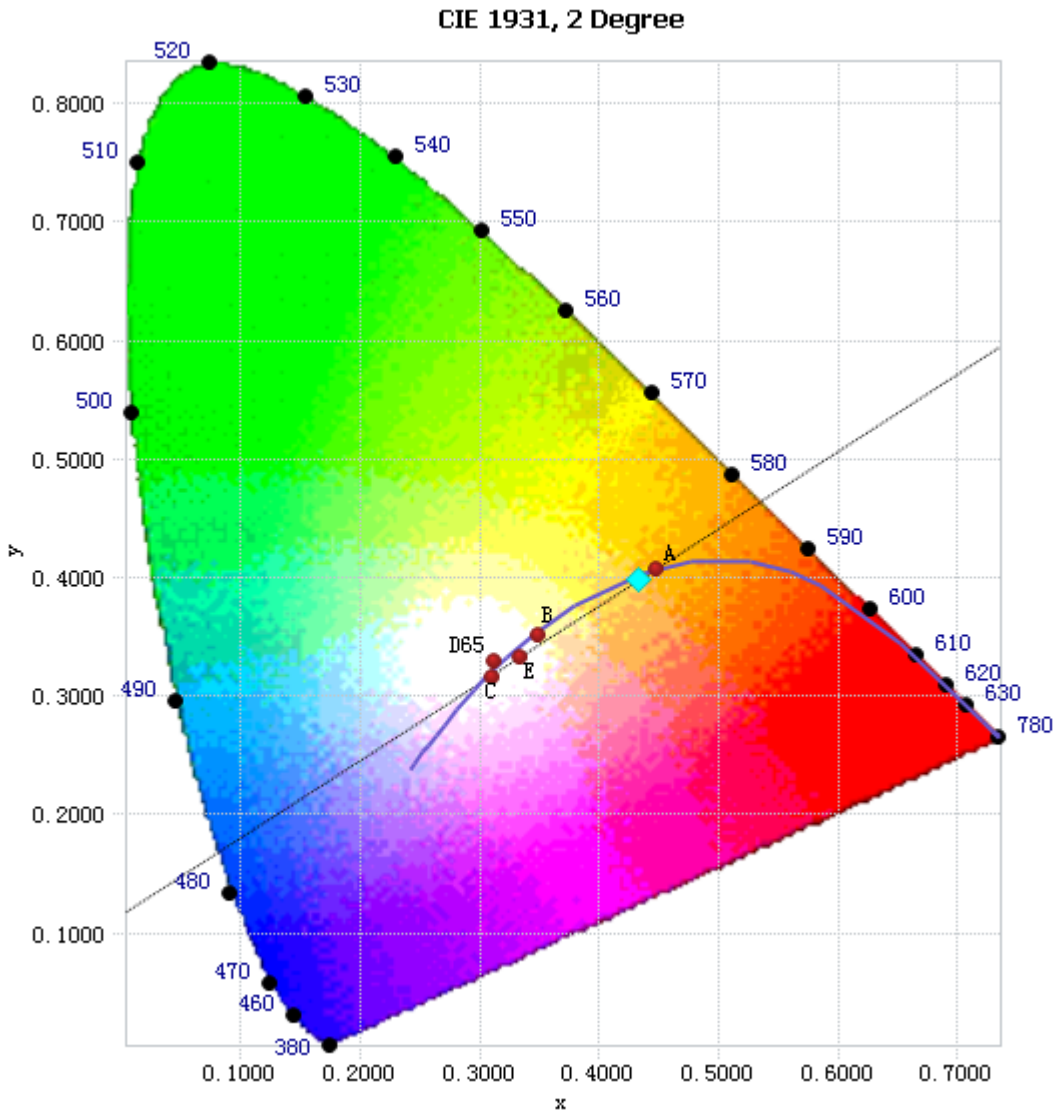


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.92E-04	485	9.85E-03	590	3.52E-02	695	6.88E-03
385	2.74E-04	490	1.04E-02	595	3.63E-02	700	5.94E-03
390	2.81E-04	495	1.11E-02	600	3.69E-02	705	5.12E-03
395	3.01E-04	500	1.23E-02	605	3.70E-02	710	4.39E-03
400	3.13E-04	505	1.35E-02	610	3.65E-02	715	3.78E-03
405	3.61E-04	510	1.46E-02	615	3.57E-02	720	3.25E-03
410	4.28E-04	515	1.55E-02	620	3.44E-02	725	2.79E-03
415	5.84E-04	520	1.64E-02	625	3.26E-02	730	2.40E-03
420	8.49E-04	525	1.72E-02	630	3.08E-02	735	2.06E-03
425	1.31E-03	530	1.81E-02	635	2.86E-02	740	1.75E-03
430	2.07E-03	535	1.88E-02	640	2.64E-02	745	1.49E-03
435	3.34E-03	540	1.97E-02	645	2.41E-02	750	1.28E-03
440	5.58E-03	545	2.07E-02	650	2.19E-02	755	1.11E-03
445	9.45E-03	550	2.18E-02	655	1.96E-02	760	9.47E-04
450	1.60E-02	555	2.32E-02	660	1.76E-02	765	8.14E-04
455	2.13E-02	560	2.46E-02	665	1.56E-02	770	7.01E-04
460	1.88E-02	565	2.64E-02	670	1.37E-02	775	6.00E-04
465	1.50E-02	570	2.82E-02	675	1.20E-02	780	5.17E-04
470	1.35E-02	575	3.01E-02	680	1.05E-02		
475	1.14E-02	580	3.20E-02	685	9.16E-03		
480	9.92E-03	585	3.38E-02	690	7.94E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4327, 0.3977)

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

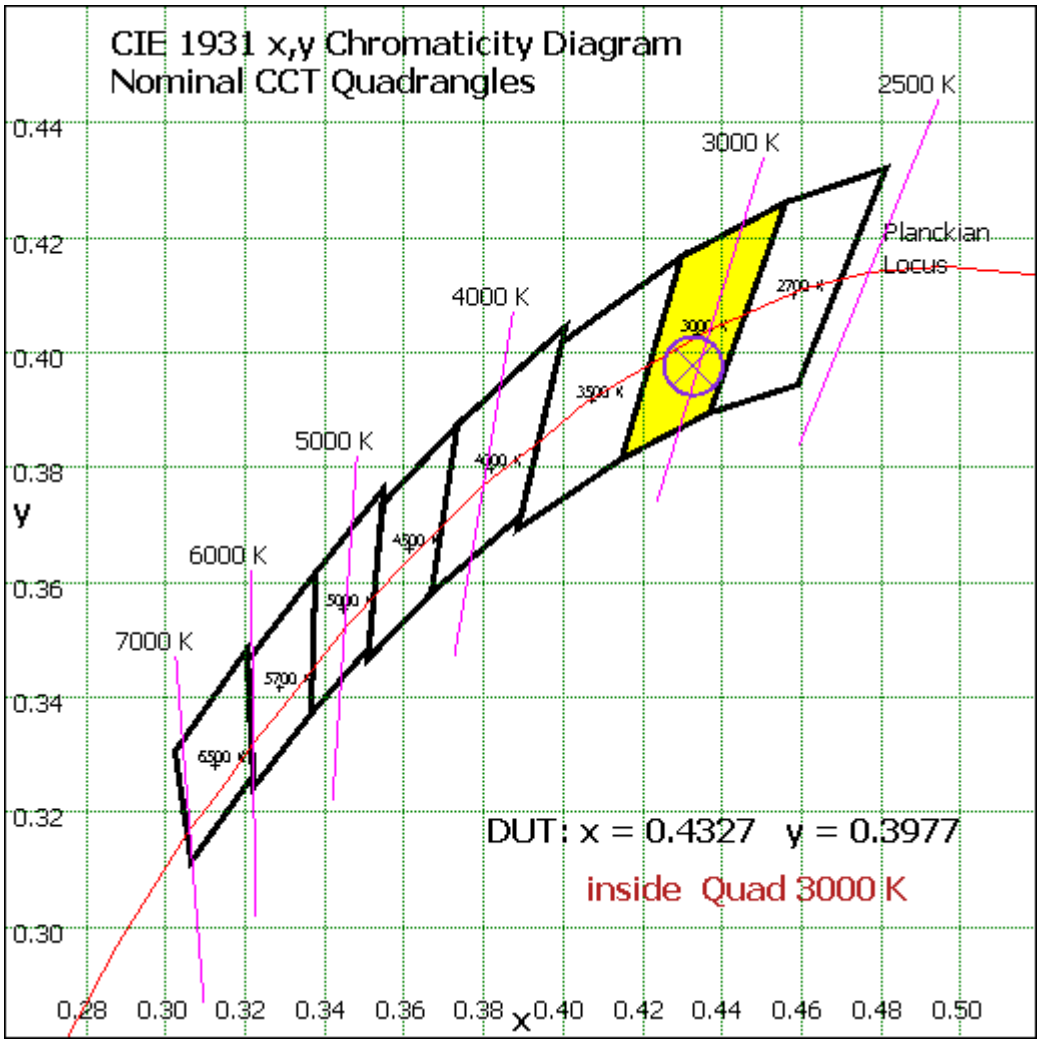


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	61.022	3.26%
10- 20	174.744	9.34%
20- 30	263.632	14.10%
30- 40	312.605	16.72%
40- 50	315.775	16.89%
50- 60	276.977	14.81%
60- 70	210.785	11.27%
70- 80	132.045	7.06%
80- 90	61.595	3.29%
90-100	27.824	1.49%
100-110	15.483	0.83%
110-120	9.009	0.48%
120-130	4.828	0.26%
130-140	2.27	0.12%
140-150	0.844	0.05%
150-160	0.328	0.02%
160-170	0.187	0.01%
170-180	0.065	0.00%
Total	1870.0	100%

γ(°)	Lumens	% Total
0- 60	1404.755	75.12%
60- 90	404.425	21.63%
0-90	1809.18	96.75%
90- 180	60.838	3.25%
0- 180	1870.0	100%

Table 5: Zonal Lumen Data

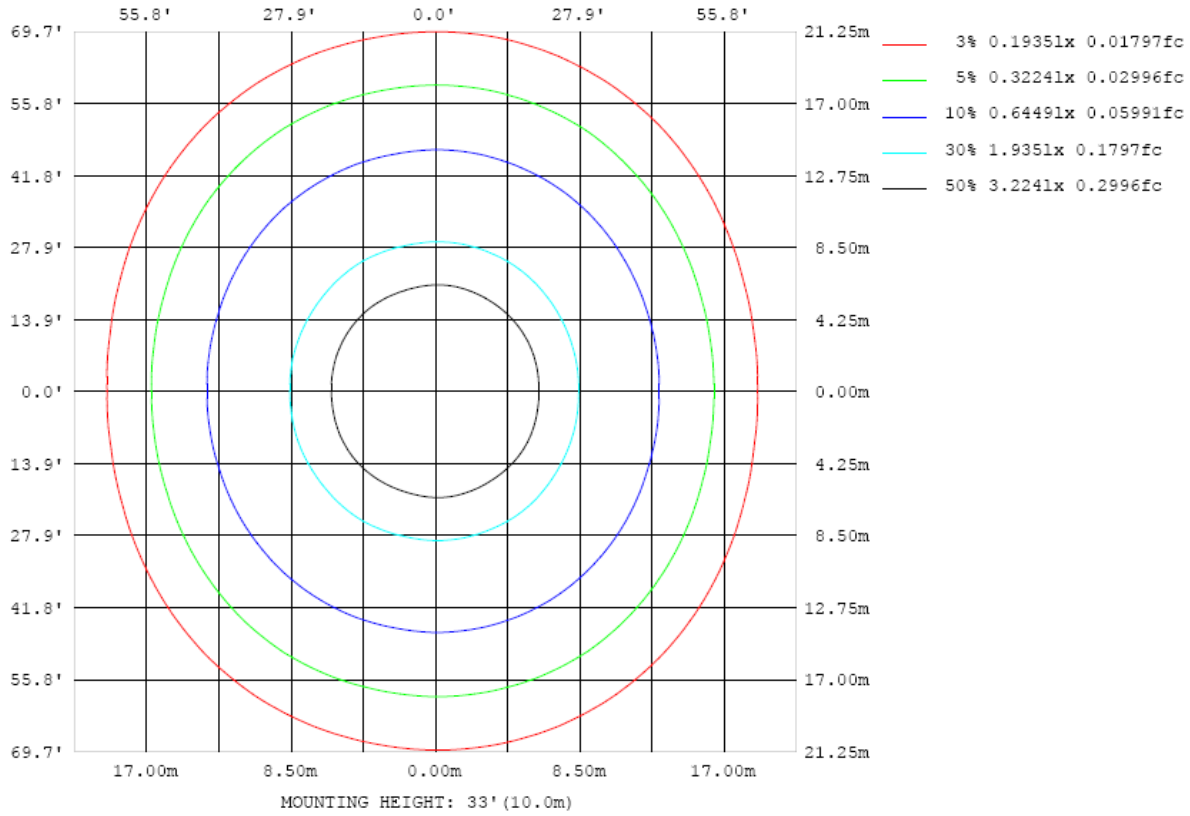


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

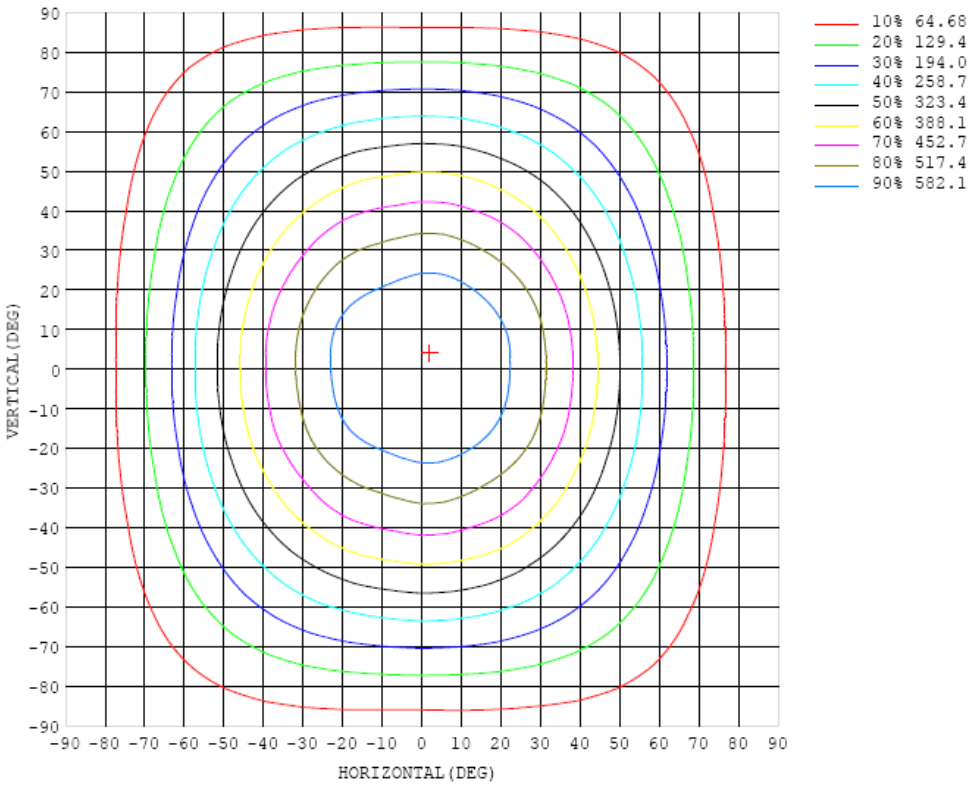


Chart 5: Isocandela Plot

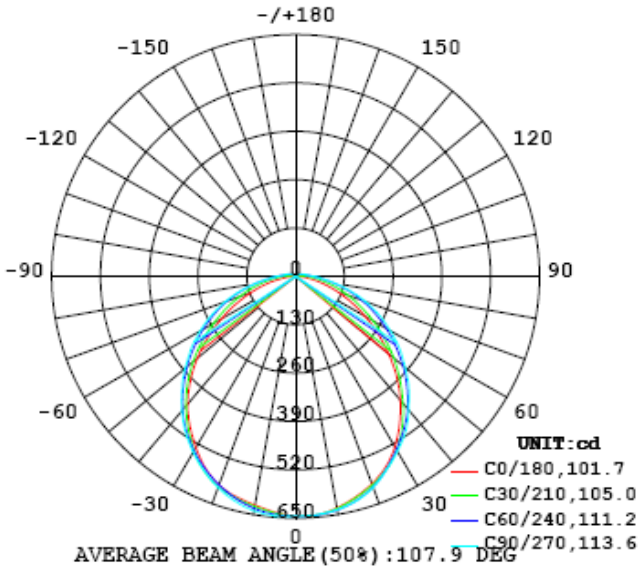


Chart 6: Polar Candela Distribution

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	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645
5	644	644	644	644	644	644	644	644	643	643	642	641	640	638	638	637	636	636	637
10	632	632	633	634	636	637	638	638	638	637	635	633	631	628	627	625	625	624	625
15	615	614	616	617	620	622	624	626	626	625	622	619	616	615	614	613	613	613	613
20	594	594	595	597	599	600	603	605	605	604	600	597	596	597	597	598	597	597	597
25	567	567	570	572	573	573	572	574	575	574	570	567	569	573	575	574	572	569	569
30	529	531	535	539	540	538	538	541	544	543	538	535	537	540	542	540	536	532	532
35	483	485	490	495	498	501	503	506	510	510	505	502	503	501	499	498	495	492	492
40	434	436	441	445	452	460	465	466	469	469	464	464	465	460	453	452	451	448	448
45	381	384	388	393	403	413	419	422	427	428	423	421	419	414	408	403	401	398	397
50	323	326	331	342	352	364	374	377	380	381	377	376	374	366	359	352	346	343	342
55	267	270	276	288	302	314	325	333	337	338	334	332	326	318	309	300	290	287	285
60	213	216	225	238	252	267	279	286	290	291	287	285	281	271	259	247	237	230	228
65	163	166	176	190	206	221	233	241	245	246	243	240	234	225	213	198	185	177	175
70	117	121	133	148	163	177	188	195	198	198	196	194	190	181	168	154	139	128	126
75	76.6	82.0	94.4	110	124	135	144	149	150	150	150	148	146	138	127	113	97.7	85.7	82.7
80	43.1	49.5	61.9	76.0	88.1	96.8	102	105	106	105	105	105	104	98.6	90.0	77.6	63.2	50.3	45.8
85	17.7	24.6	36.7	48.9	58.8	65.1	68.5	70.3	70.3	69.7	70.3	70.6	69.4	65.9	59.3	49.0	36.1	23.8	19.4
90	4.52	10.1	20.3	30.6	38.8	44.3	47.3	48.6	48.5	48.0	48.8	49.2	48.1	45.0	38.9	30.0	18.8	8.15	3.04
95	1.52	4.60	11.9	20.3	27.4	32.3	35.2	36.4	36.4	36.2	36.8	37.0	35.9	32.8	27.3	19.4	10.3	2.81	0.11
100	0.20	1.89	6.93	13.6	19.8	24.4	27.2	28.5	28.7	28.7	29.1	29.1	27.8	24.7	19.7	13.0	6.02	1.40	0.07
105	0.13	1.11	4.37	9.53	14.7	18.9	21.6	23.1	23.5	23.5	23.8	23.5	22.1	19.1	14.5	8.97	3.76	0.85	0.11
110	0.14	0.75	2.88	6.72	11.0	14.8	17.3	18.8	19.4	19.5	19.6	19.2	17.6	14.8	10.8	6.22	2.45	0.53	0.14
115	0.16	0.53	1.96	4.77	8.23	11.4	13.8	15.4	16.0	16.2	16.1	15.5	14.0	11.3	7.95	4.38	1.64	0.36	0.16
120	0.20	0.39	1.34	3.37	6.02	8.66	10.8	12.2	12.9	13.1	12.9	12.2	10.8	8.55	5.75	3.05	1.11	0.28	0.21
125	0.25	0.35	0.94	2.35	4.35	6.41	8.21	9.43	10.1	10.3	10.1	9.44	8.18	6.28	4.12	2.09	0.78	0.29	0.27
130	0.30	0.37	0.71	1.60	3.07	4.65	6.06	7.13	7.70	7.86	7.69	7.10	6.00	4.52	2.87	1.40	0.43	0.28	0.35
135	0.37	0.40	0.57	1.06	2.08	3.26	4.35	5.17	5.64	5.77	5.62	5.13	4.27	3.13	1.91	0.92	0.45	0.36	0.43
140	0.44	0.44	0.51	0.77	1.32	2.15	2.96	3.59	3.97	4.07	3.94	3.54	2.89	2.04	1.21	0.57	0.42	0.42	0.50
145	0.48	0.48	0.50	0.58	0.84	1.30	1.85	2.30	2.58	2.66	2.55	2.26	1.78	1.23	0.79	0.57	0.48	0.46	0.56
150	0.50	0.50	0.52	0.54	0.57	0.71	1.00	1.26	1.44	1.49	1.43	1.23	0.96	0.72	0.63	0.55	0.50	0.48	0.59
155	0.54	0.54	0.54	0.55	0.56	0.56	0.57	0.62	0.68	0.70	0.68	0.63	0.61	0.61	0.58	0.55	0.53	0.52	0.61
160	0.58	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.56	0.56	0.57	0.58	0.59	0.59	0.58	0.57	0.57	0.56	0.61
165	0.61	0.60	0.60	0.60	0.59	0.59	0.59	0.58	0.58	0.58	0.58	0.58	0.59	0.59	0.59	0.60	0.60	0.60	0.60
170	0.65	0.65	0.65	0.65	0.64	0.64	0.63	0.63	0.63	0.63	0.62	0.63	0.63	0.64	0.64	0.65	0.65	0.65	0.64
175	0.70	0.69	0.68	0.67	0.66	0.66	0.66	0.65	0.65	0.65	0.65	0.65	0.66	0.66	0.67	0.67	0.68	0.69	0.70
180	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71

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	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645	645
5	637	638	639	640	641	642	644	645	646	646	647	647	646	646	645	645	644
10	626	627	628	630	632	633	636	638	640	641	641	641	640	639	636	635	633
15	615	617	617	617	617	618	620	623	625	627	627	626	624	623	620	618	616
20	599	601	601	600	598	597	598	601	604	606	606	604	602	601	599	598	595
25	572	576	577	576	574	571	570	573	577	579	578	575	574	573	573	572	569
30	535	539	541	543	544	542	539	541	546	548	545	542	541	540	539	536	532
35	495	497	499	502	506	508	506	507	512	513	509	505	503	499	496	491	486
40	451	453	455	458	464	469	468	467	472	472	469	465	460	453	446	441	437
45	401	404	407	412	418	424	425	425	429	429	424	420	413	403	394	389	384
50	346	350	357	364	371	378	382	381	385	385	380	373	363	352	341	332	327
55	289	295	305	314	324	330	336	337	341	339	333	325	315	301	288	277	270
60	232	240	253	266	276	286	290	291	294	293	287	280	265	252	237	224	216
65	180	190	204	218	230	240	245	246	248	247	242	233	220	205	189	175	166
70	132	144	159	174	186	194	198	200	200	200	195	188	176	162	147	132	121
75	89.2	103	118	133	143	149	152	153	153	152	150	144	135	123	108	92.8	81.1
80	53.2	67.3	81.9	93.7	102	106	108	108	107	107	106	103	96.2	86.9	74.2	59.9	47.7
85	26.5	39.3	51.9	61.6	67.8	71.1	72.2	71.7	71.0	71.4	70.9	68.7	64.1	57.0	46.6	34.3	22.6
90	10.5	21.7	32.5	40.8	46.3	49.2	50.1	49.7	48.9	49.2	48.9	47.1	43.5	37.4	28.7	18.2	8.41
95	4.22	12.4	21.5	29.0	34.1	36.9	37.8	37.6	36.9	37.0	36.6	35.0	31.6	26.2	18.7	10.3	3.74
100	2.20	7.64	14.8	21.2	25.9	28.7	29.8	29.8	29.3	29.3	28.7	27.1	23.8	18.8	12.3	5.84	1.44
105	1.34	4.98	10.4	15.9	20.2	22.9	24.2	24.4	24.0	23.9	23.2	21.5	18.4	13.8	8.55	3.71	0.86
110	0.75	3.36	7.46	11.9	15.9	18.5	19.8	20.2	19.9	19.7	18.9	17.2	14.3	10.3	6.05	2.48	0.59
115	0.62	2.33	5.39	8.97	12.2	14.7	16.2	16.6	16.5	16.2	15.4	13.6	11.0	7.70	4.33	1.69	0.44
120	0.36	1.42	3.83	6.69	9.36	11.5	12.8	13.3	13.3	13.0	12.1	10.6	8.35	5.70	3.08	1.11	0.35
125	0.37	0.66	2.48	4.88	7.07	8.81	9.97	10.5	10.5	10.2	9.45	8.11	6.28	4.12	1.92	0.83	0.33
130	0.40	0.65	1.34	3.41	5.25	6.66	7.63	8.11	8.15	7.89	7.21	6.11	4.58	2.72	1.32	0.63	0.36
135	0.46	0.60	0.98	1.85	3.56	4.89	5.70	6.11	6.15	5.93	5.37	4.42	2.93	1.63	0.82	0.56	0.45
140	0.56	0.63	0.81	1.22	2.00	2.83	3.86	4.42	4.47	4.24	3.45	2.37	1.65	1.06	0.71	0.61	0.53
145	0.64	0.66	0.73	0.91	1.33	1.72	2.03	2.23	2.21	2.07	1.80	1.46	1.11	0.84	0.71	0.66	0.59
150	0.70	0.69	0.69	0.69	0.84	1.05	1.20	1.29	1.30	1.25	1.14	0.98	0.84	0.76	0.72	0.71	0.62
155	0.73	0.72	0.72	0.72	0.75	0.80	0.83	0.85	0.85	0.83	0.80	0.77	0.76	0.75	0.73	0.74	0.64
160	0.75	0.74	0.74	0.74	0.75	0.76	0.76	0.75	0.73	0.72	0.73	0.74	0.74	0.74	0.74	0.75	0.63
165	0.74	0.75	0.75	0.75	0.75	0.75	0.74	0.74	0.73	0.73	0.73	0.73	0.74	0.74	0.74	0.74	0.62
170	0.68	0.75	0.74	0.74	0.74	0.73	0.73	0.72	0.72	0.72	0.72	0.72	0.73	0.74	0.75	0.70	0.65
175	0.70	0.70	0.71	0.72	0.72	0.72	0.71	0.71	0.70	0.70	0.71	0.71	0.72	0.72	0.71	0.71	0.71
180	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71

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

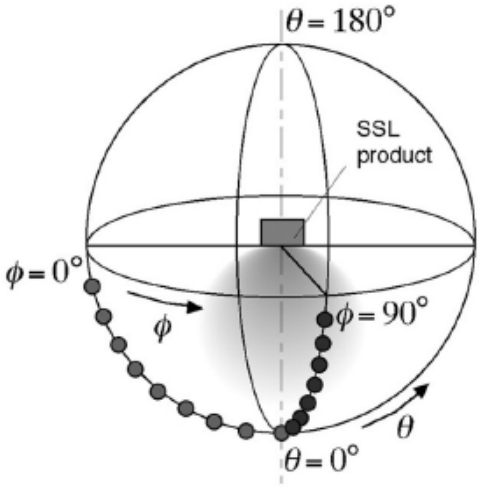
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

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