

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

Vertically-Mounted Lamps

Model: 16.5PLV/840/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, Yuhang Dist,
Hangzhou, Zhejiang Province, China 311100


Tel: +86 571 86376106

www.ledtestlab.com

Report No.: HZ18050048f

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

Review by:



Engineer: April Zou
Jun. 04, 2018

Approved by:



Manager: Jim Zhang
Jun. 04, 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: 16.5PLV/840/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
117.3	1867.0	15.92	0.9633
CCT (K)	CRI	Stabilization Time (Light & Power)	
4015	86.0	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	: Vertically-Mounted Lamps
Model	: 16.5PLV/840/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 16.5W
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°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 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.138	0.060
Power Factor	0.9633	0.9610
Test Power (W)	15.92	16.05
THD A%	26.79	20.50
Luminous Efficacy (lm/W)	117.3	116.4
Total Luminous Flux (lm)	1867.0	1868.0
Color Rendering Index (CRI)	86.0	
R9	21.1	
Correlated Color Temperature (CCT)(K)	4015	
Chromaticity Chroma x	0.3790	
Chromaticity Chroma y	0.3740	
Chromaticity Chroma u	0.2253	
Chromaticity Chroma v	0.3334	
Duv	0.0016	
Chromaticity Chroma u'	0.2253	
Chromaticity Chroma v'	0.5001	

Special Color Rendering Indices	
R1	85.1
R2	92.9
R3	96.3
R4	84.1
R5	85.1
R6	89.4
R7	86.6
R8	68.3
R9	21.1
R10	82.5
R11	83.6
R12	67.5
R13	87.5
R14	98.6
Rf	84
Rg	95

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°C.

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)	0.139
Power Factor	0.9626
Test Power (W)	16.00
Luminous Efficacy (lm/W)	119.5
Total Luminous Flux (lm)	1912.1
Beam Angle (°)	97.2
Center Beam Candle Power (cd)	791
Spacing Criteria	1.20 (0°-180°)/ 1.19 (90°-270°)
Zonal Lumens in the 0°-60°Zone	83.25%
Zonal Lumens in the 60°-90°Zone	16.51%
Zonal Lumens in the 90°-120°Zone	0.15%
Zonal Lumens in the 120°-180°Zone	0.09%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

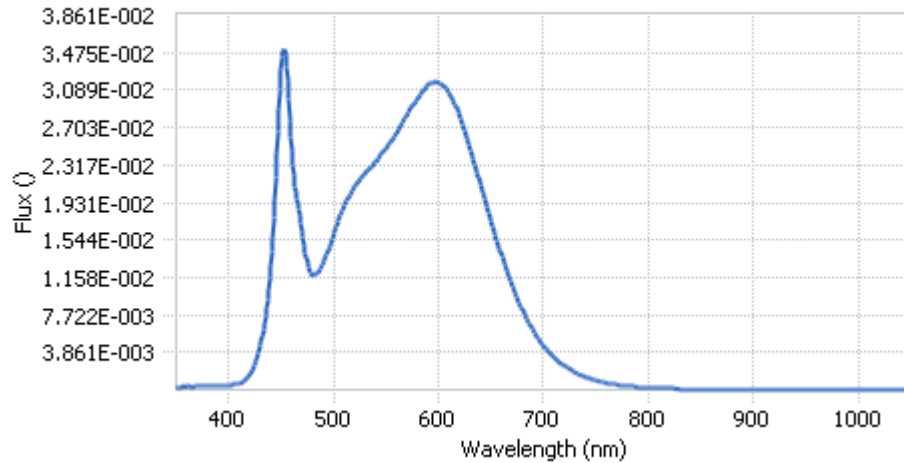


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.70E-04	485	1.21E-02	590	3.14E-02	695	5.29E-03
385	3.54E-04	490	1.30E-02	595	3.17E-02	700	4.56E-03
390	3.80E-04	495	1.44E-02	600	3.16E-02	705	3.90E-03
395	4.17E-04	500	1.61E-02	605	3.12E-02	710	3.35E-03
400	4.49E-04	505	1.77E-02	610	3.06E-02	715	2.87E-03
405	5.37E-04	510	1.89E-02	615	2.96E-02	720	2.47E-03
410	6.91E-04	515	2.01E-02	620	2.82E-02	725	2.12E-03
415	1.03E-03	520	2.10E-02	625	2.66E-02	730	1.80E-03
420	1.59E-03	525	2.16E-02	630	2.48E-02	735	1.54E-03
425	2.66E-03	530	2.22E-02	635	2.31E-02	740	1.31E-03
430	4.50E-03	535	2.29E-02	640	2.11E-02	745	1.13E-03
435	7.60E-03	540	2.35E-02	645	1.92E-02	750	9.73E-04
440	1.27E-02	545	2.43E-02	650	1.74E-02	755	8.32E-04
445	2.18E-02	550	2.48E-02	655	1.56E-02	760	7.19E-04
450	3.30E-02	555	2.57E-02	660	1.39E-02	765	6.06E-04
455	3.32E-02	560	2.65E-02	665	1.22E-02	770	5.25E-04
460	2.46E-02	565	2.74E-02	670	1.08E-02	775	4.50E-04
465	1.97E-02	570	2.83E-02	675	9.42E-03	780	3.96E-04
470	1.64E-02	575	2.93E-02	680	8.21E-03		
475	1.30E-02	580	3.01E-02	685	7.10E-03		
480	1.18E-02	585	3.08E-02	690	6.14E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method

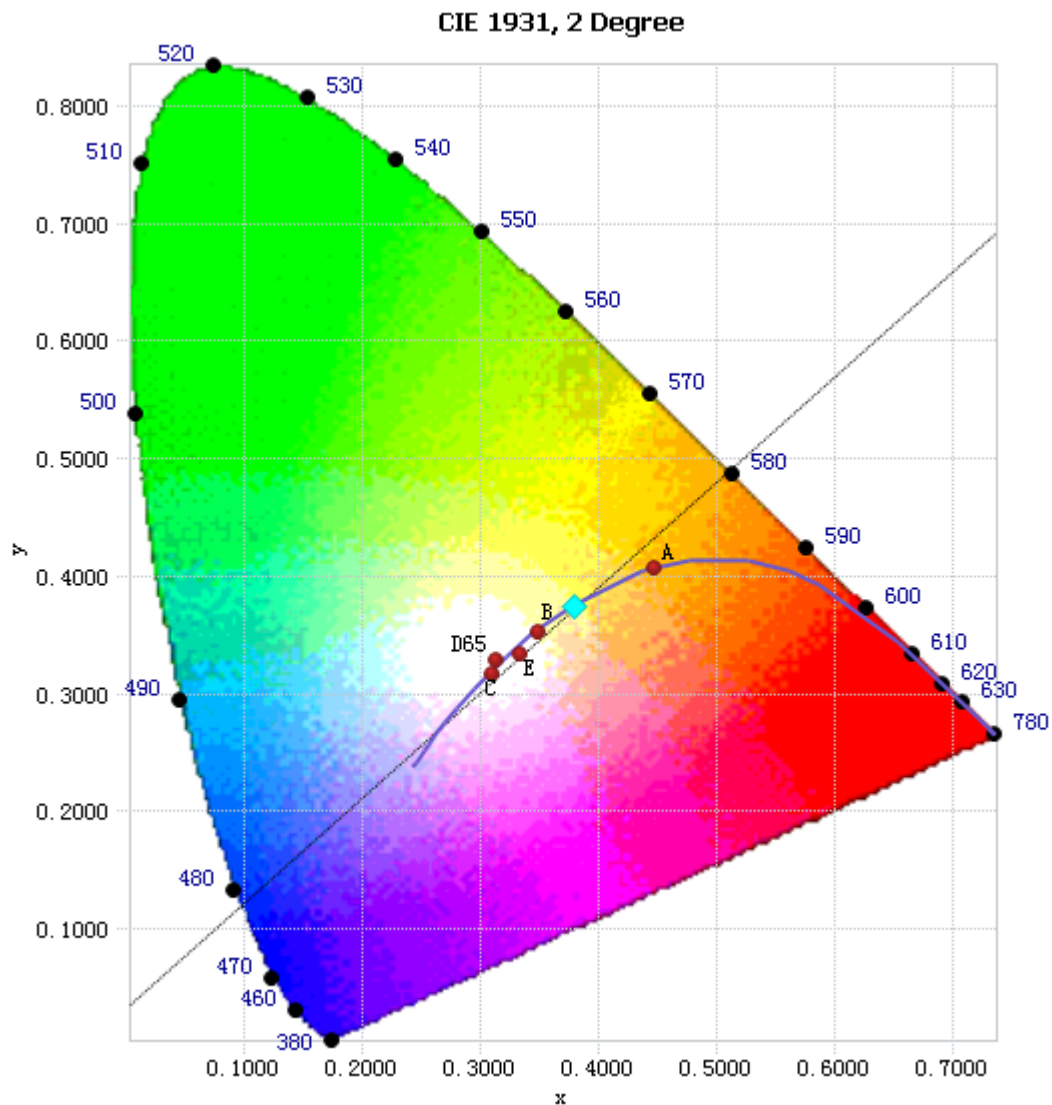


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

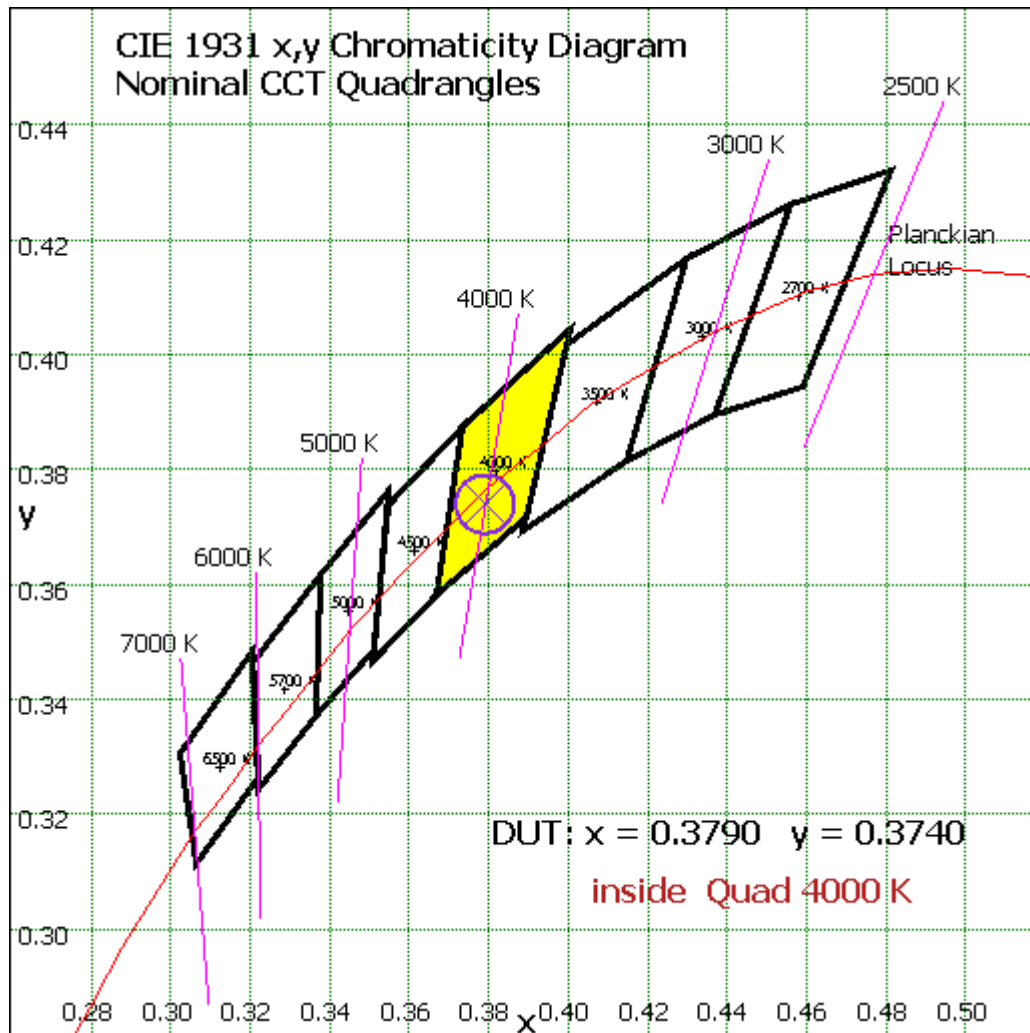


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	74.812	3.91%
10- 20	213.422	11.16%
20- 30	317.656	16.61%
30- 40	364.664	19.07%
40- 50	345.545	18.07%
50- 60	275.736	14.42%
60- 70	185.608	9.71%
70- 80	98.449	5.15%
80- 90	31.65	1.66%
90-100	2.581	0.13%
100-110	0.124	0.01%
110-120	0.194	0.01%
120-130	0.268	0.01%
130-140	0.354	0.02%
140-150	0.393	0.02%
150-160	0.345	0.02%
160-170	0.232	0.01%
170-180	0.08	0.00%
Total	1912.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1591.835	83.25%
60- 90	315.707	16.51%
0-90	1907.542	99.76%
90- 180	4.571	0.24%
0- 180	1912.1	100%

Table 5: Zonal Lumen Data

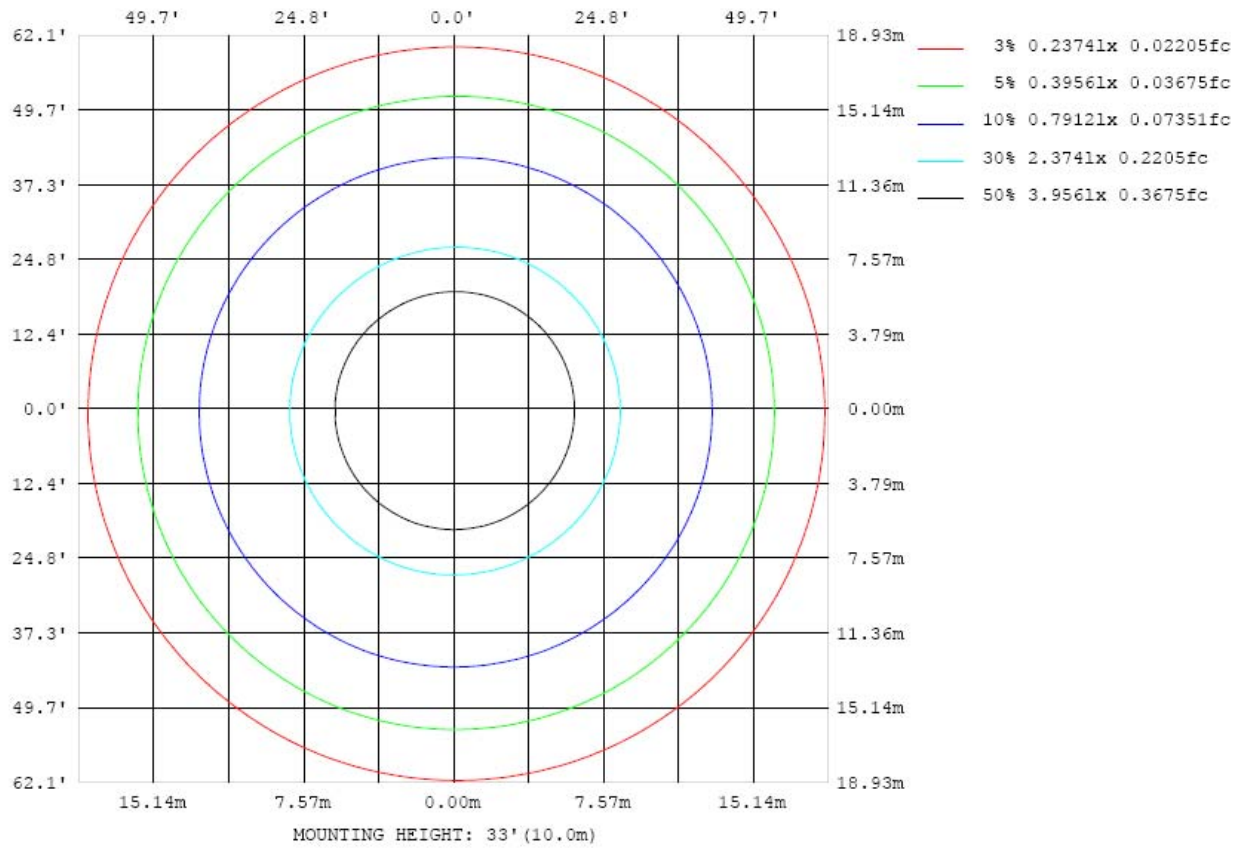


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

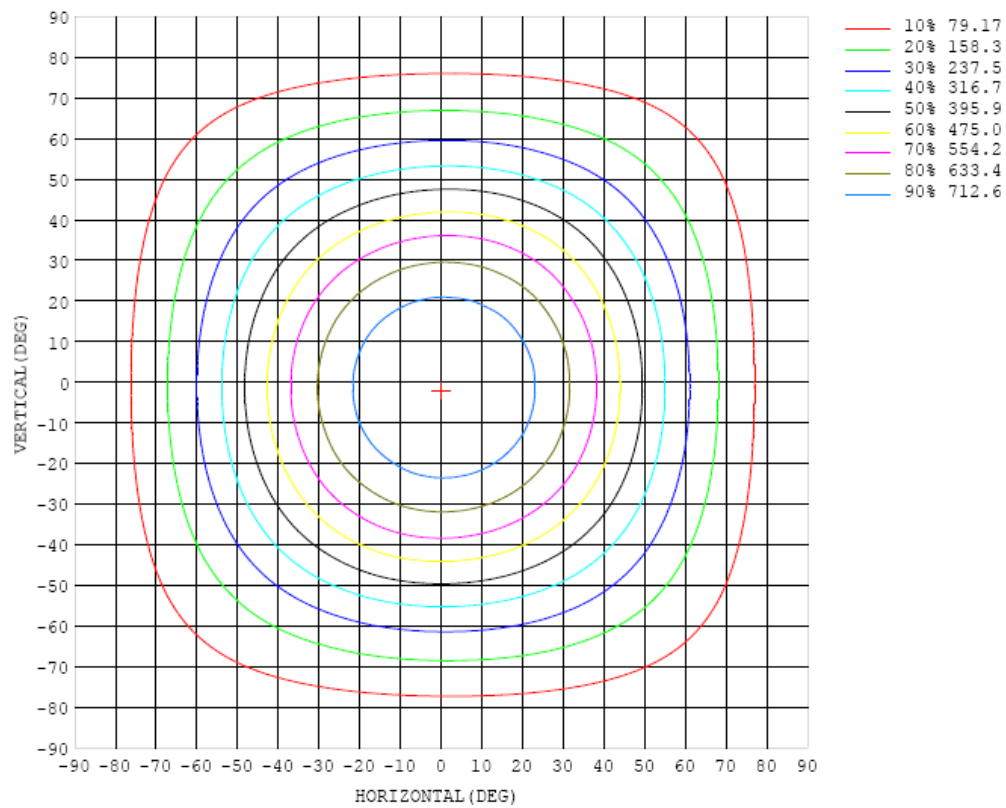


Chart 5: Isocandela Plot

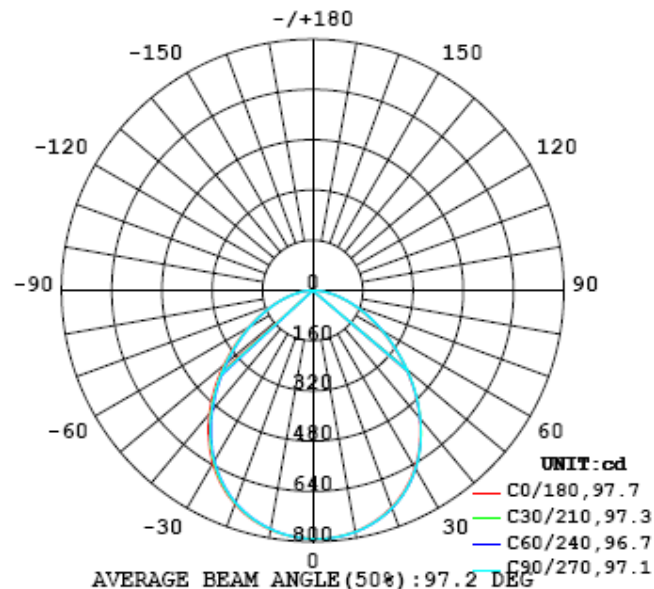


Chart 6: Polar Candela Distribution

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	791	791	791	791	791	791	791	791	791	791	791	791	791	791	791	791	791	791	791
5	788	790	790	789	789	790	790	790	790	790	789	789	789	788	788	788	788	786	785
10	779	779	780	780	781	781	781	781	781	780	780	779	778	777	777	777	776	776	774
15	761	762	763	764	764	764	764	764	764	763	762	760	760	759	758	758	756	756	754
20	734	735	737	738	737	738	738	738	737	737	736	736	734	732	732	730	727	726	725
25	697	699	700	702	702	702	702	702	701	701	700	699	697	695	694	692	690	688	686
30	650	652	654	655	655	656	656	655	655	655	654	653	650	648	647	644	641	639	637
35	594	596	598	599	598	598	598	598	598	598	598	597	594	591	590	587	584	581	579
40	530	533	534	534	533	532	532	532	533	533	533	532	529	526	524	521	518	516	513
45	460	463	464	464	463	462	462	462	462	463	463	462	459	456	453	450	448	446	443
50	388	390	392	392	391	391	391	391	391	391	390	390	387	384	381	378	375	374	371
55	317	319	321	322	322	322	321	321	321	320	319	316	314	311	308	306	304	302	
60	251	253	254	256	257	257	257	257	256	255	254	253	251	248	246	243	241	239	238
65	192	194	195	197	198	199	199	198	197	196	195	193	191	190	188	186	184	183	181
70	139	141	143	144	145	146	146	146	145	144	143	141	140	138	137	135	134	132	131
75	94.9	96.3	97.4	98.4	99.0	99.5	99.7	99.5	98.9	98.0	97.0	96.2	94.9	93.8	92.9	91.4	90.4	89.3	88.5
80	58.2	59.2	59.6	60.1	60.6	60.9	60.5	60.8	60.3	59.7	59.6	58.7	57.6	57.1	56.4	55.4	54.6	53.5	52.7
85	29.2	29.6	29.9	30.3	30.5	30.5	30.5	30.4	30.1	29.9	29.6	29.2	28.8	28.3	27.7	27.1	26.6	26.1	25.6
90	10.0	10.3	10.5	10.6	10.6	10.7	10.6	10.6	10.5	10.3	10.2	9.97	9.70	9.47	9.20	8.92	8.64	8.44	8.15
95	1.43	1.50	1.56	1.62	1.64	1.66	1.64	1.61	1.57	1.51	1.44	1.35	1.25	1.16	1.07	0.99	0.94	0.89	0.87
100	0.07	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	0.08	0.08	0.08	0.08	0.09
105	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.13
110	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.17
115	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.21
120	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.26
125	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.32
130	0.34	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.36	0.41
135	0.42	0.40	0.40	0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.42	0.42	0.42	0.42	0.44	0.52
140	0.51	0.47	0.47	0.47	0.47	0.47	0.48	0.48	0.48	0.48	0.48	0.48	0.49	0.49	0.49	0.49	0.49	0.52	0.63
145	0.59	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	0.54	0.54	0.55	0.55	0.54	0.59	0.73
150	0.66	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.59	0.59	0.59	0.59	0.60	0.59	0.59	0.65	0.80
155	0.73	0.62	0.63	0.63	0.63	0.63	0.64	0.64	0.64	0.64	0.64	0.65	0.64	0.65	0.65	0.65	0.64	0.72	0.85
160	0.81	0.67	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.69	0.69	0.69	0.69	0.69	0.68	0.78	0.89
165	0.87	0.71	0.72	0.72	0.72	0.72	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.74	0.73	0.72	0.83	0.90
170	0.89	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.87	0.88
175	0.86	0.86	0.81	0.81	0.82	0.82	0.82	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.84	0.85	0.85
180	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82

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	791	791	791	791	791	791	791	791	791	791	791	791	791	791	791	791	791		
5	786	785	786	785	786	785	784	785	785	785	785	787	787	787	788	787	788		
10	773	773	772	773	771	771	771	772	772	771	772	772	775	775	776	778	777		
15	753	752	751	751	749	749	749	749	750	750	752	752	755	756	756	759	759		
20	723	722	721	720	719	718	718	718	719	720	722	723	725	727	729	731	733		
25	684	682	681	679	678	677	677	677	679	680	683	684	687	689	690	693	695		
30	635	632	630	628	626	625	625	626	628	630	633	635	638	641	643	646	649		
35	576	573	570	567	565	563	564	565	568	570	574	577	580	584	586	589	592		
40	510	507	503	499	497	496	496	497	501	504	509	511	515	518	521	524	528		
45	440	436	432	429	427	425	426	427	430	434	438	441	444	448	450	454	458		
50	368	365	362	359	357	355	356	357	360	363	366	369	373	376	379	382	386		
55	299	297	295	292	291	290	290	291	293	295	298	300	303	306	309	312	315		
60	236	234	233	231	231	230	230	230	231	233	235	237	239	242	244	247	249		
65	179	178	177	177	176	176	176	176	177	177	179	180	182	184	186	189	190		
70	130	129	129	128	128	128	128	128	129	129	130	131	133	135	136	138	139		
75	87.7	86.9	86.4	86.0	85.8	85.6	85.7	85.9	86.4	87.0	87.8	88.7	89.8	91.3	92.5	93.7	94.9		
80	52.0	51.4	51.1	50.8	50.7	50.5	50.6	50.8	51.3	51.8	52.4	53.2	54.1	55.1	55.9	56.8	57.7		
85	25.2	24.8	24.5	24.3	24.2	24.1	24.2	24.4	24.7	25.1	25.6	26.1	26.6	27.3	27.8	28.3	28.9		
90	7.98	7.83	7.70	7.60	7.49	7.46	7.49	7.59	7.78	7.98	8.24	8.46	8.72	9.02	9.28	9.52	9.80		
95	0.85	0.84	0.82	0.80	0.79	0.80	0.81	0.84	0.88	0.92	0.97	1.02	1.10	1.18	1.26	1.33	1.39		
100	0.09	0.09	0.10	0.09	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		
105	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13		
110	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17		
115	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21		
120	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25		
125	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.31	0.32		
130	0.41	0.41	0.41	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.41		
135	0.51	0.51	0.51	0.51	0.51	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.52		
140	0.62	0.62	0.62	0.62	0.62	0.62	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.62	0.62	0.62	0.63		
145	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.73		
150	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.81		
155	0.85	0.85	0.85	0.85	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.87		
160	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.90	0.90	0.91		
165	0.90	0.90	0.90	0.91	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.91	0.92		
170	0.88	0.89	0.89	0.89	0.89	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90		
175	0.85	0.85	0.85	0.85	0.85	0.85	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86		
180	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82		

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 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

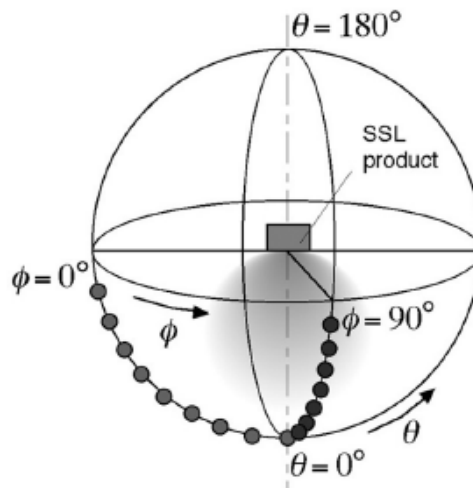
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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