LM-79-08 Test Report

for

GREEN CREATIVE LTD

Room 1206-07 New Victory House
93-103 Wing Lok Street, Central Hongkong, Hongkong

Vertically Mounted Lamps

Model: 17PLV/840/DIR

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.: HZ18070009d

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

Review by: April Zou

Engineer: April Zou
Jul. 12, 2018

Approved by: Jim Zhang

Manager: Jim Zhang
Jul. 12, 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: **17PLV/840/DIR**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
96.8	2019.0	20.85	0.9965

CCT (K)	CRI	Stabilization Time (Light & Power)
3987	85.8	60

Table 1: Executive Data Summary

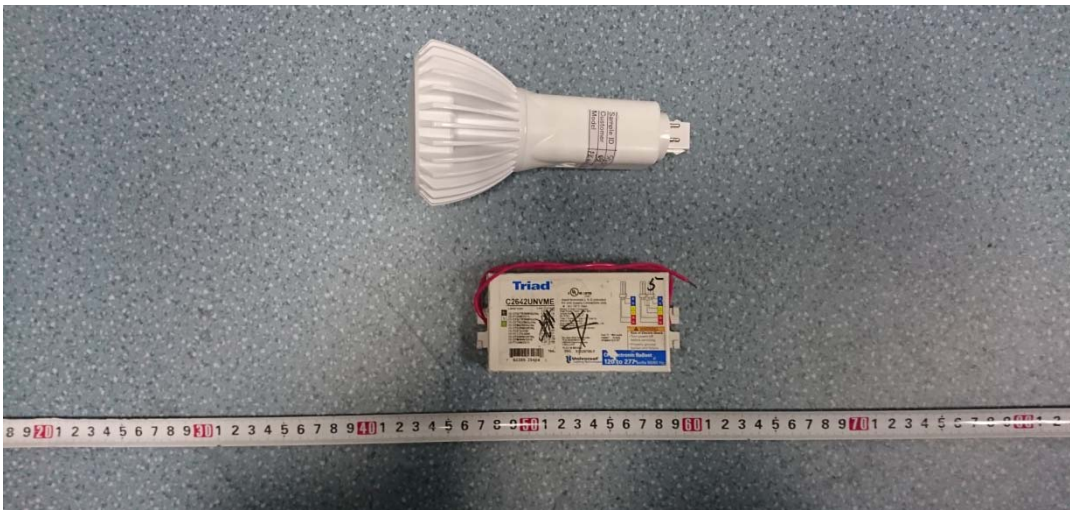
Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

Test specifications:

Date of Receipt	: May 09, 2018
Date of Test	: May 11, 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

TABLE OF CONTENT

Sample Photo



Sample view

Equipment Under Test (EUT)	
Name	: Vertically Mounted Lamps
Model	: 17PLV/840/DIR
Electrical Ratings	: 120-277VAC, 60Hz
Product Description	: G24Q base, 4000K LED Tubes supplied by a high frequency fluorescent lamp ballast: C2642UNVME
Manufacturer	: WING (SHANGHAI) INTERNATIONAL TRADE CO., LTD
Address	: NO.118, LANE 6045, HUTAI ROAD, BAOSHAN 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 65 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.174	0.078
Power Factor	0.9965	0.9753
Test Power (W)	20.85	21.05
THD A%	7.51	6.97
Luminous Efficacy (lm/W)	96.8	95.8
Total Luminous Flux (lm)	2019.0	2017.0
Color Rendering Index (CRI)	85.8	
R9	20.3	
Correlated Color Temperature (CCT)(K)	3987	
Chromaticity Chroma x	0.3803	
Chromaticity Chroma y	0.3748	
Chromaticity Chroma u	0.2258	
Chromaticity Chroma v	0.3338	
Duv	0.0009	
Chromaticity Chroma u ’	0.2258	
Chromaticity Chroma v’	0.5007	

Special Color Rendering Indices	
R1	84.9
R2	92.8
R3	96.3
R4	84
R5	84.9
R6	89.3
R7	86.5
R8	67.9
R9	20.3
R10	82.2
R11	83.4
R12	67.5
R13	87.2
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 25.1℃.

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)	0.176
Power Factor	0.9949
Test Power (W)	20.98
Luminous Efficacy (lm/W)	98.3
Total Luminous Flux (lm)	2061.5
Beam Angle (°)	97.5 (0°-180°)/ 97.2 (90°-270°)
Center Beam Candle Power (cd)	850
Maximum Beam Candle Power (cd)	851.6 (At: C=0.0, Gamma=0.5)
Spacing Criteria	1.19 (0°-180°)/ 1.20 (90°-270°)
Zonal Lumens in the 0°-60°Zone	82.87%
Zonal Lumens in the 60°-90°Zone	16.86%
Zonal Lumens in the 90°-120°Zone	0.18%
Zonal Lumens in the 120°-180°Zone	0.09%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

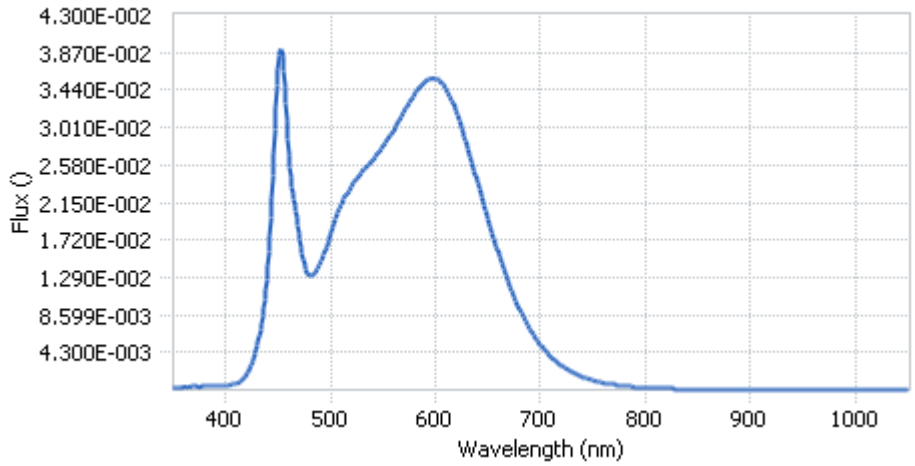
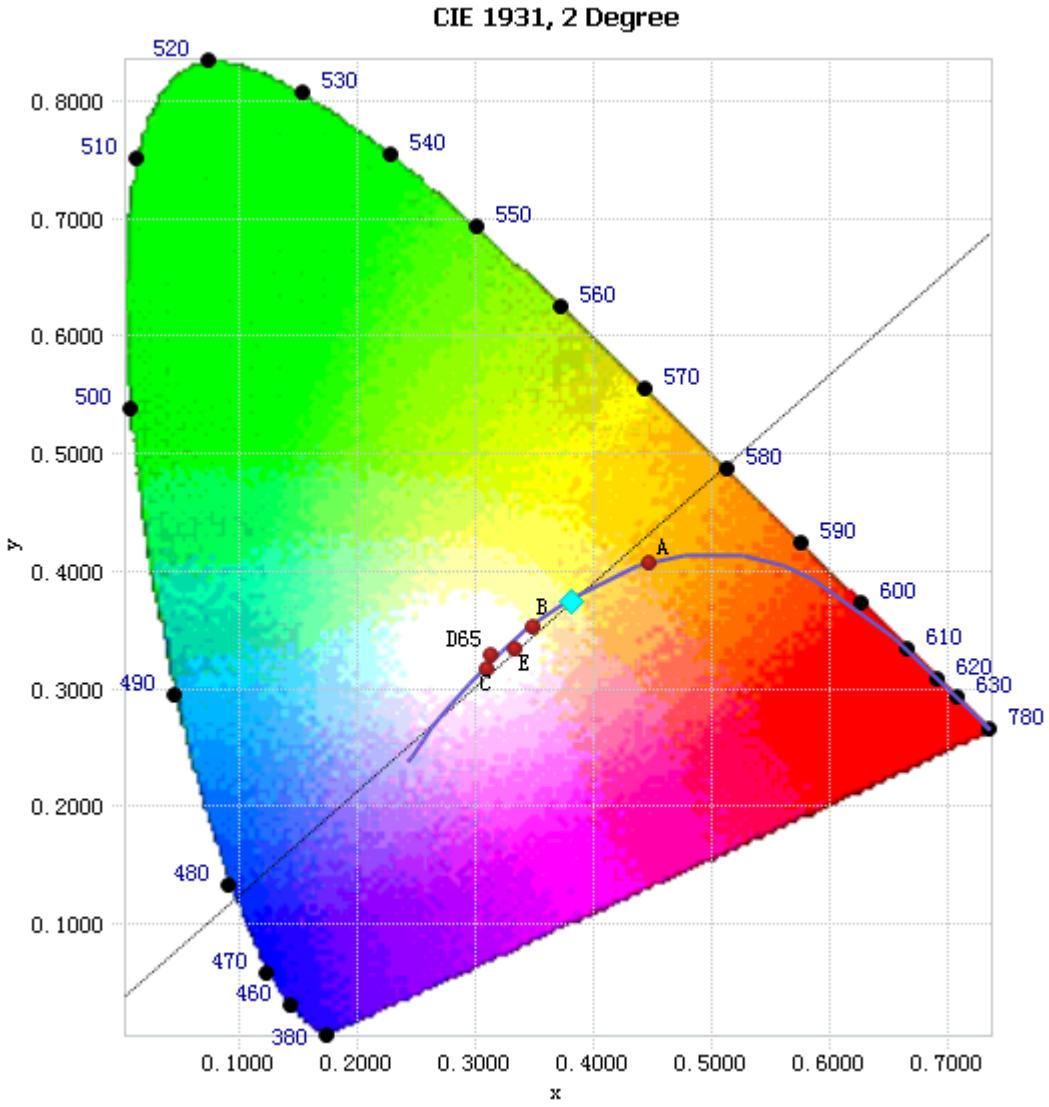


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.94E-04	485	1.29E-02	590	3.40E-02	695	5.76E-03
385	3.80E-04	490	1.39E-02	595	3.44E-02	700	4.96E-03
390	4.05E-04	495	1.54E-02	600	3.43E-02	705	4.26E-03
395	4.45E-04	500	1.73E-02	605	3.39E-02	710	3.63E-03
400	4.87E-04	505	1.90E-02	610	3.33E-02	715	3.12E-03
405	5.66E-04	510	2.04E-02	615	3.21E-02	720	2.67E-03
410	7.22E-04	515	2.16E-02	620	3.05E-02	725	2.30E-03
415	1.10E-03	520	2.25E-02	625	2.88E-02	730	1.98E-03
420	1.73E-03	525	2.33E-02	630	2.70E-02	735	1.67E-03
425	2.88E-03	530	2.40E-02	635	2.49E-02	740	1.43E-03
430	4.89E-03	535	2.47E-02	640	2.29E-02	745	1.23E-03
435	8.18E-03	540	2.54E-02	645	2.08E-02	750	1.05E-03
440	1.38E-02	545	2.61E-02	650	1.88E-02	755	9.12E-04
445	2.36E-02	550	2.69E-02	655	1.69E-02	760	7.84E-04
450	3.54E-02	555	2.78E-02	660	1.51E-02	765	6.76E-04
455	3.52E-02	560	2.86E-02	665	1.33E-02	770	5.83E-04
460	2.60E-02	565	2.97E-02	670	1.17E-02	775	5.01E-04
465	2.09E-02	570	3.08E-02	675	1.03E-02	780	4.31E-04
470	1.74E-02	575	3.17E-02	680	8.95E-03		
475	1.38E-02	580	3.27E-02	685	7.74E-03		
480	1.25E-02	585	3.35E-02	690	6.70E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y) : (0.3803, 0.3748)

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

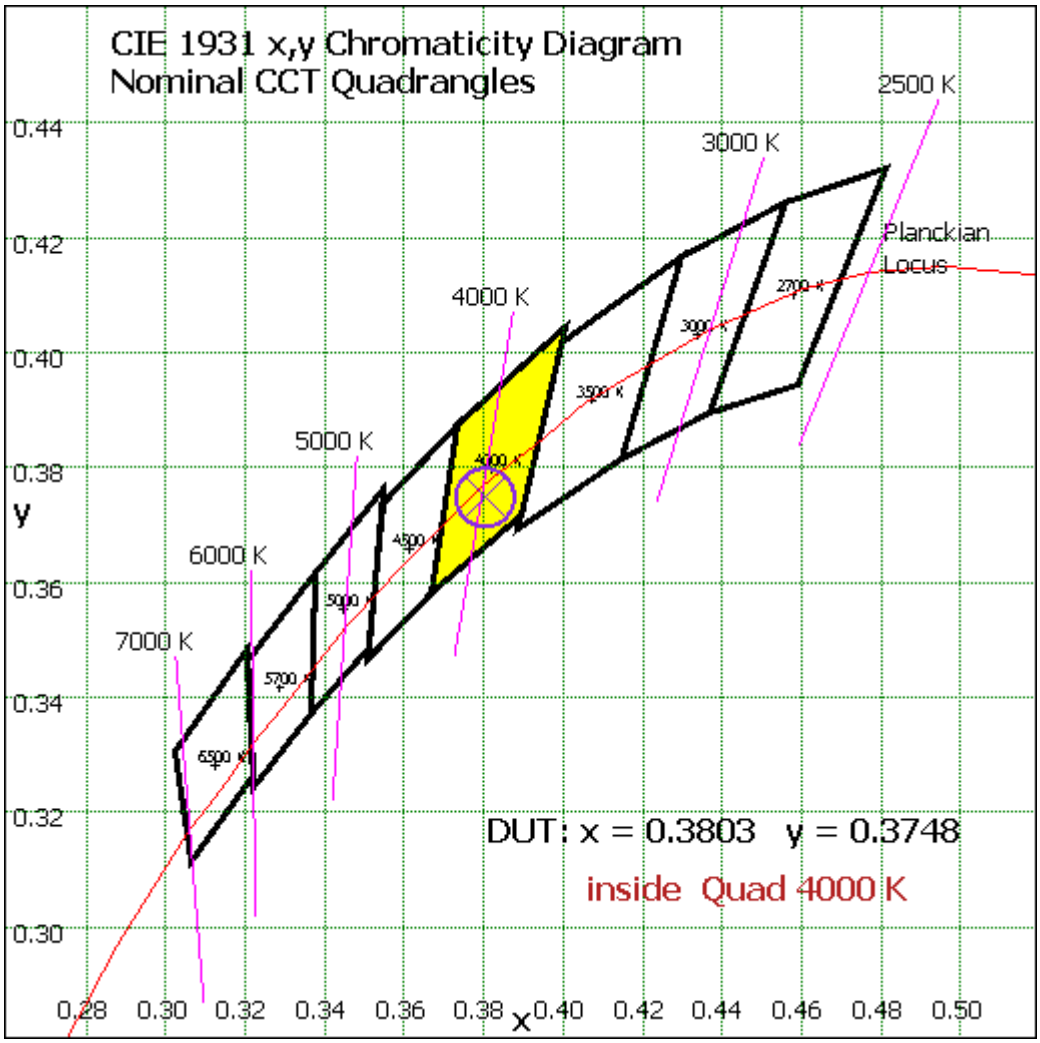


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	80.447	3.90%
10- 20	229.201	11.12%
20- 30	340.426	16.51%
30- 40	390.24	18.93%
40- 50	370.408	17.97%
50- 60	297.599	14.44%
60- 70	202.498	9.82%
70- 80	109.091	5.29%
80- 90	36.069	1.75%
90-100	3.331	0.16%
100-110	0.135	0.01%
110-120	0.204	0.01%
120-130	0.287	0.01%
130-140	0.387	0.02%
140-150	0.428	0.02%
150-160	0.371	0.02%
160-170	0.247	0.01%
170-180	0.084	0.00%
Total	2061.5	100%

γ(°)	Lumens	% Total
0- 60	1708.321	82.87%
60- 90	347.658	16.86%
0-90	2055.979	99.73%
90- 180	5.474	0.27%
0- 180	2061.5	100%

Table 4: Zonal Lumen Data

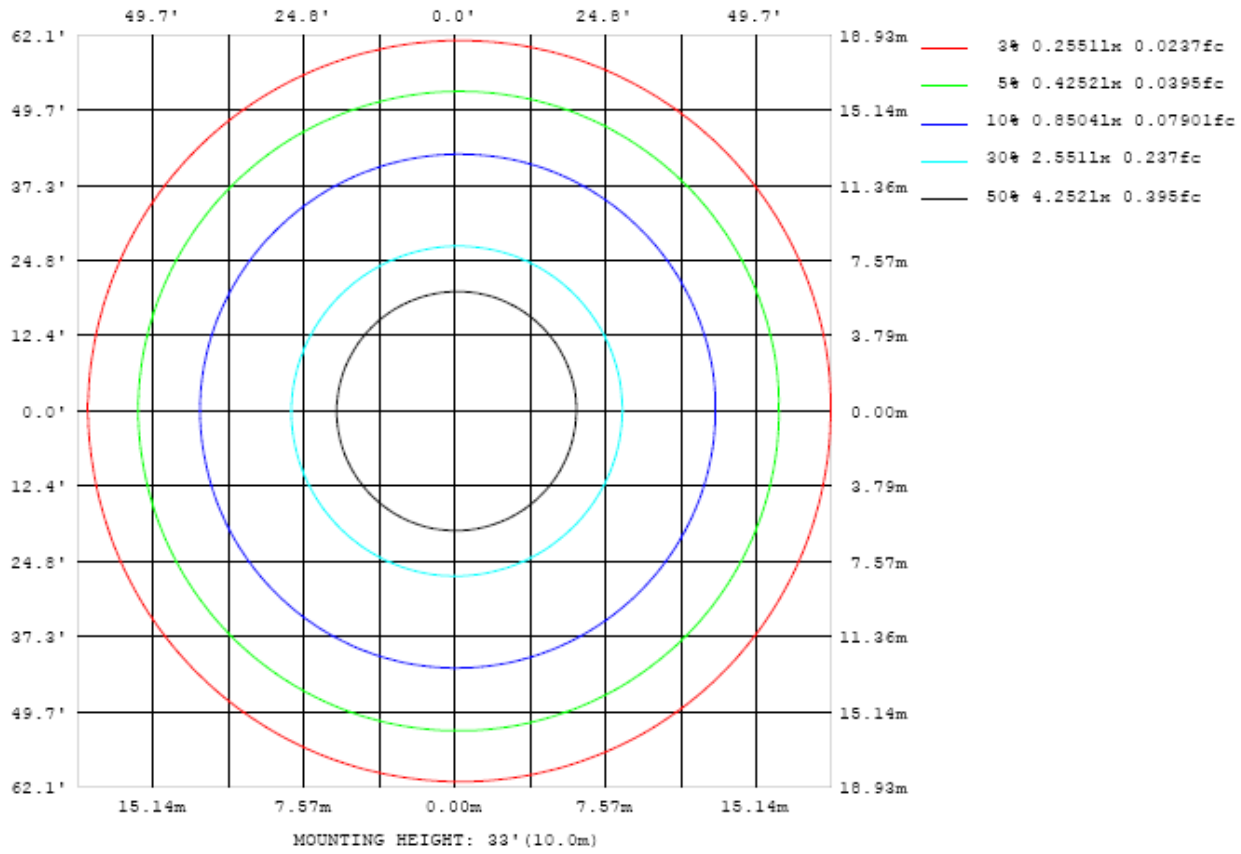


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

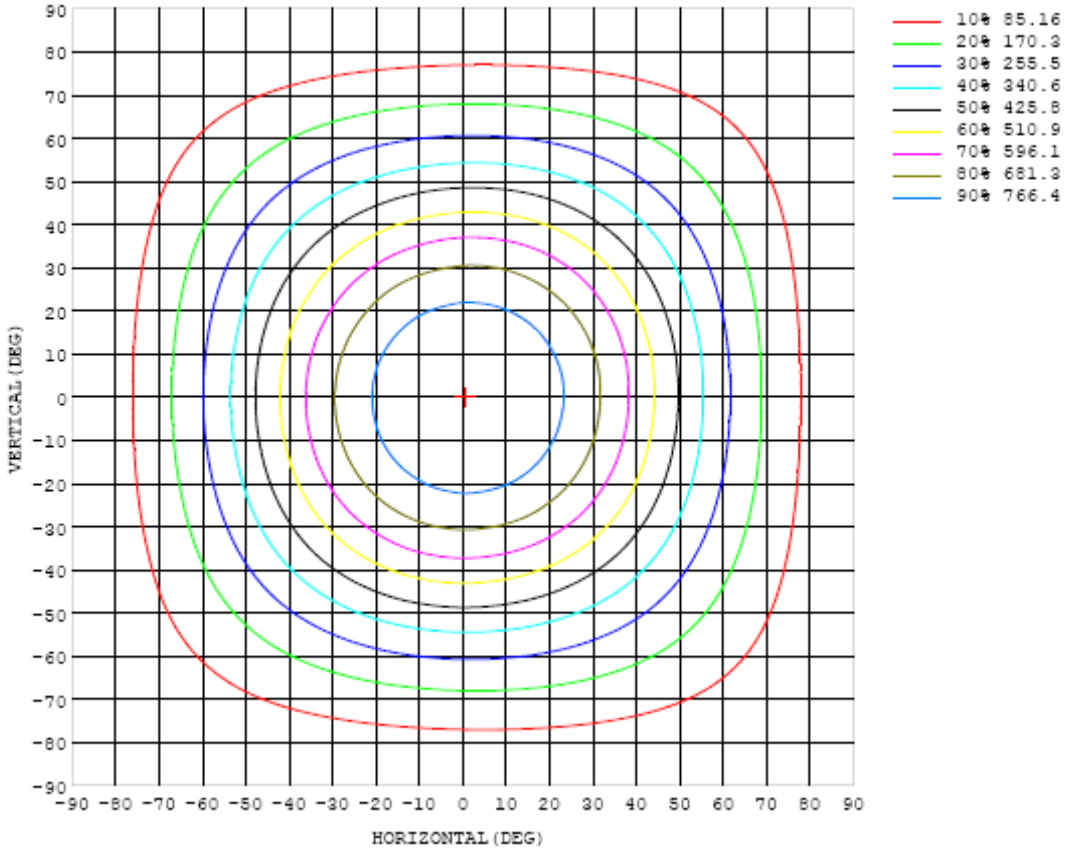


Chart 5: Isocandela Plot

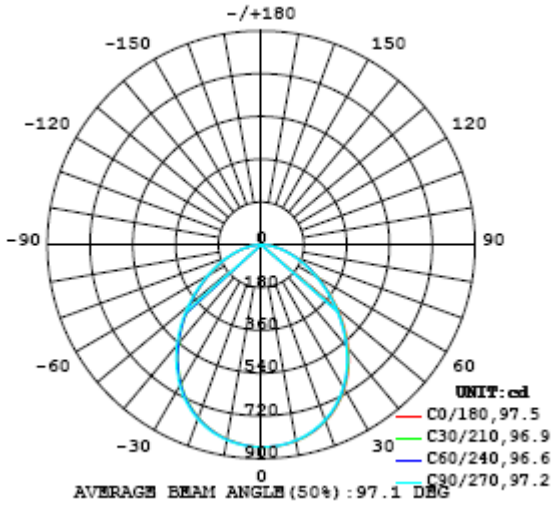


Chart 6: Polar Candela Distribution

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	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850
5	849	849	849	848	848	848	848	848	847	847	847	846	846	845	846	845	845	845	845
10	839	838	838	838	837	837	837	836	835	835	834	834	832	832	831	831	831	830	830
15	820	819	819	818	818	817	816	816	814	814	813	812	810	809	808	808	807	807	807
20	791	790	789	789	788	787	786	785	784	784	781	780	779	778	776	775	774	774	774
25	751	750	749	748	747	746	745	743	742	742	740	739	737	735	734	732	731	730	731
30	700	699	699	697	696	694	693	691	691	690	688	686	684	683	681	678	677	676	677
35	640	639	637	635	633	631	630	628	628	628	626	624	621	619	617	616	615	614	614
40	571	569	567	564	562	559	558	558	557	557	555	554	551	549	547	545	544	543	544
45	497	495	493	490	487	485	484	483	482	482	481	479	477	474	472	471	469	469	470
50	421	419	417	414	412	410	409	407	407	406	405	403	400	398	396	395	394	393	394
55	345	344	344	342	341	338	337	336	334	333	331	329	327	325	323	322	320	319	321
60	276	276	275	275	274	272	270	269	267	265	263	261	259	257	255	254	253	252	254
65	213	213	213	213	213	211	210	208	206	203	201	200	198	196	195	193	192	192	194
70	158	158	158	158	158	156	155	153	151	149	147	146	144	142	142	141	140	139	141
75	109	109	109	109	109	108	107	105	103	102	100	98.9	97.6	96.6	95.6	94.7	93.8	93.3	95.0
80	68.5	68.3	68.1	68.7	67.5	66.7	65.7	64.8	63.3	62.5	61.3	60.2	59.2	58.4	57.7	56.9	56.3	55.8	56.4
85	35.9	35.7	35.5	35.3	34.9	34.4	33.7	32.9	32.2	31.4	30.6	29.8	29.2	28.5	27.9	27.3	26.8	26.5	27.0
90	13.9	13.9	13.8	13.5	13.2	12.9	12.5	12.1	11.6	11.1	10.6	10.1	9.64	9.20	8.82	8.52	8.33	8.10	8.35
95	2.93	2.95	2.91	2.86	2.74	2.61	2.42	2.20	1.96	1.68	1.43	1.21	1.01	0.85	0.73	0.65	0.60	0.57	0.67
100	0.15	0.19	0.22	0.21	0.19	0.14	0.10	0.08	0.08	0.08	0.08	0.09	0.08	0.09	0.09	0.09	0.09	0.09	0.10
105	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.11	0.12	0.12	0.12	0.12	0.12	0.14
110	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.18
115	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.22
120	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.27
125	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.31	0.33
130	0.36	0.35	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.37	0.38	0.38	0.38	0.43
135	0.44	0.44	0.44	0.43	0.43	0.43	0.44	0.44	0.44	0.44	0.44	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.55
140	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.52	0.52	0.52	0.52	0.52	0.53	0.53	0.53	0.52	0.66
145	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	0.59	0.59	0.59	0.59	0.58	0.75
150	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.63	0.82
155	0.68	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	0.69	0.69	0.68	0.86
160	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.74	0.73	0.88
165	0.78	0.78	0.78	0.78	0.77	0.77	0.78	0.78	0.77	0.77	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.77	0.87
170	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	0.81	0.84
175	0.88	0.87	0.87	0.86	0.86	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.86	0.86	0.87	0.87	0.87
180	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92

Table 5: 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	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850
5	845	845	845	845	846	846	846	846	848	848	848	848	848	848	849	849	849
10	830	830	831	831	831	832	832	833	835	835	836	836	837	837	838	838	839
15	807	807	807	808	809	810	810	811	814	813	815	816	816	817	819	819	820
20	774	774	774	775	775	777	777	780	781	783	784	786	787	788	790	790	791
25	730	729	729	730	731	733	734	736	740	741	743	746	747	749	750	751	752
30	676	676	674	676	677	679	680	683	687	689	692	694	697	699	700	702	702
35	612	611	610	611	611	613	616	619	624	627	631	633	636	638	640	641	642
40	542	541	539	539	540	542	545	549	554	558	562	565	567	569	571	572	572
45	468	466	465	465	466	468	471	474	480	484	488	490	492	494	497	498	499
50	393	393	392	391	392	394	396	400	404	408	412	414	416	419	420	422	423
55	320	320	320	321	322	323	325	328	331	334	337	340	342	344	345	347	348
60	254	254	255	255	256	258	259	261	264	266	269	271	273	275	276	277	278
65	194	194	195	196	197	198	199	201	203	205	207	209	210	212	213	214	215
70	141	142	142	143	144	145	147	148	150	151	153	154	156	157	158	159	160
75	94.9	95.2	95.8	96.5	97.3	98.3	99.4	101	102	103	105	106	108	109	110	110	111
80	56.2	56.2	56.5	57.0	57.7	58.5	59.4	60.5	61.8	63.1	64.3	65.5	66.6	67.6	68.3	68.8	69.3
85	26.8	26.8	26.9	27.2	27.6	28.3	29.0	29.9	31.0	31.9	32.9	33.8	34.7	35.4	35.9	36.3	36.5
90	8.27	8.26	8.29	8.42	8.71	9.07	9.57	10.1	10.7	11.3	11.9	12.5	13.1	13.6	14.1	14.4	14.7
95	0.69	0.73	0.79	0.87	0.98	1.09	1.24	1.38	1.54	1.70	1.88	2.07	2.28	2.53	2.76	2.93	3.04
100	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	0.10	0.10	0.11	0.14
105	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13
110	0.19	0.19	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	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
120	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25
125	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.33	0.33	0.33	0.33	0.32	0.32
130	0.44	0.44	0.44	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.44	0.44	0.44	0.43	0.43	0.43	0.42
135	0.57	0.57	0.57	0.57	0.58	0.58	0.58	0.58	0.58	0.57	0.57	0.57	0.56	0.56	0.56	0.55	0.54
140	0.69	0.69	0.69	0.69	0.70	0.70	0.70	0.70	0.69	0.69	0.69	0.69	0.68	0.68	0.68	0.68	0.65
145	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.79	0.79	0.79	0.78	0.79	0.75
150	0.89	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.87	0.87	0.87	0.87	0.87	0.82
155	0.94	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.87
160	0.99	0.98	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.96	0.96	0.96	0.97	0.89
165	0.99	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.97	0.97	0.98	0.89
170	0.96	0.96	0.96	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.96	0.96	0.85
175	0.89	0.93	0.93	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.90	0.88
180	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92

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 TYPE B LED TUBEs) 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 TYPE B LED TUBEs) 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

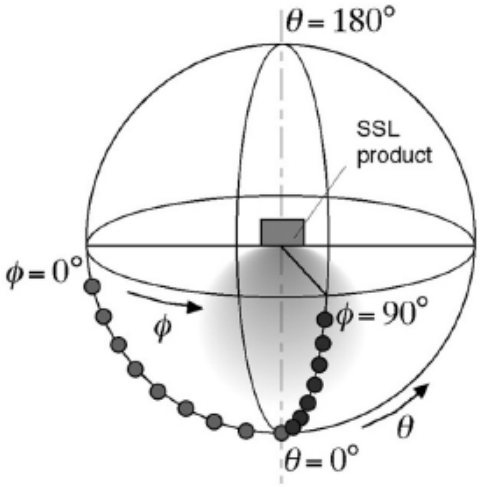
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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