



LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

Horizontally-Mounted Lamps

Model: 14.5PLH/827/DIR

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18050045a

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

Review by:

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: 14.5PLH/827/DIR

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)/2	Power Factor
106.5	1822.0	17.12	0.9957
CCT (K)	CRI	Stabilization Time (Light & Power)	
2711	83.3	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

TABLE OF CONTENT

LM-79-08 Test Report.....	1
Test Summary.....	2
Sample Photos.....	4
TEST RESULTS	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Zonal Lumen Tabulation- Goniophotometer Method	10
Luminous Intensity Distribution Plots- Goniophotometer Method.....	12
Luminous Intensity Data- Goniophotometer Method.....	13
EQUIPMENT LIST	15
TEST METHODS	15
Seasoning of SSL Product.....	15
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	15
Goniophotometer Method	16
Photometric and Electrical Measurements.....	16
Color Characteristics Measurements.....	16
Color Spatial Uniformity	16

Sample Photos

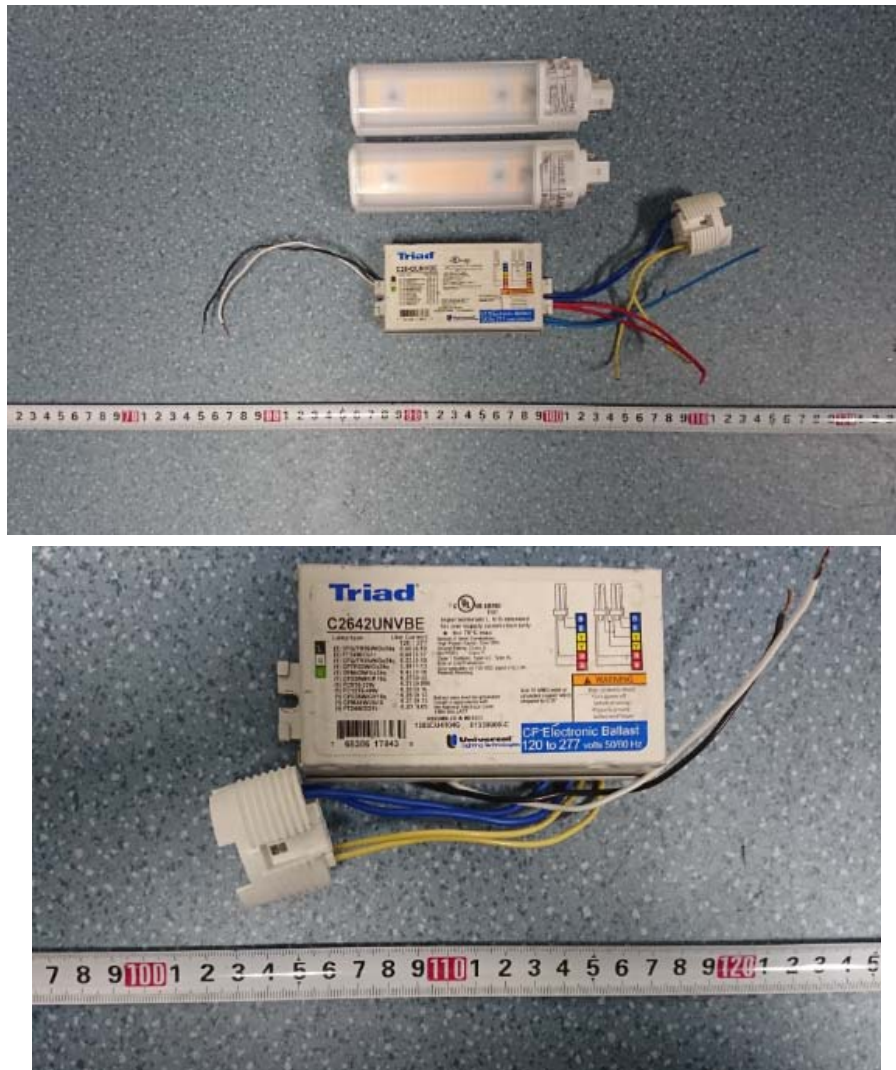


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: Horizontally-Mounted Lamps
Model	: 14.5PLH/827/DIR
Electrical Ratings	: 120-277V, 50/60Hz, 14.5W
Product Description	: 2700K LED Tubes supplied by a high frequency fluorescent lamp ballast:
	C2642UNVBE
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.0°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)	0.286	0.124
Power Factor	0.9957	0.9875
Test Power (W)/2	17.12	16.97
THD A%	6.38	7.44
Luminous Efficacy (lm/W)	106.5	107.3
Total Luminous Flux (lm)	1822.0	1821.0
Color Rendering Index (CRI)	83.3	
R9	12.5	
Correlated Color Temperature (CCT)(K)	2711	
Chromaticity Chroma x	0.4561	
Chromaticity Chroma y	0.4055	
Chromaticity Chroma u	0.2624	
Chromaticity Chroma v	0.3499	
Duv	0.0019	
Chromaticity Chroma u'	0.2624	
Chromaticity Chroma v'	0.5248	

Special Color Rendering Indices	
R1	83.1
R2	94.7
R3	92
R4	80.2
R5	83.8
R6	94.5
R7	80.1
R8	58.1
R9	12.5
R10	88.3
R11	80.3
R12	80.3
R13	86.2
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 24.9°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)	0.285
Power Factor	0.9955
Test Power (W)/2	17.04
Luminous Efficacy (lm/W)	109.3
Total Luminous Flux (lm)	1862.1
Beam Angle (°)	106.9
Center Beam Candle Power (cd)	648
Spacing Criteria	1.22 (0°-180°)/ 1.26 (90°-270°)
Zonal Lumens in the 0°-60°Zone	75.38%
Zonal Lumens in the 60°-90°Zone	21.42%
Zonal Lumens in the 90°-120°Zone	2.75%
Zonal Lumens in the 120°-180°Zone	0.45%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

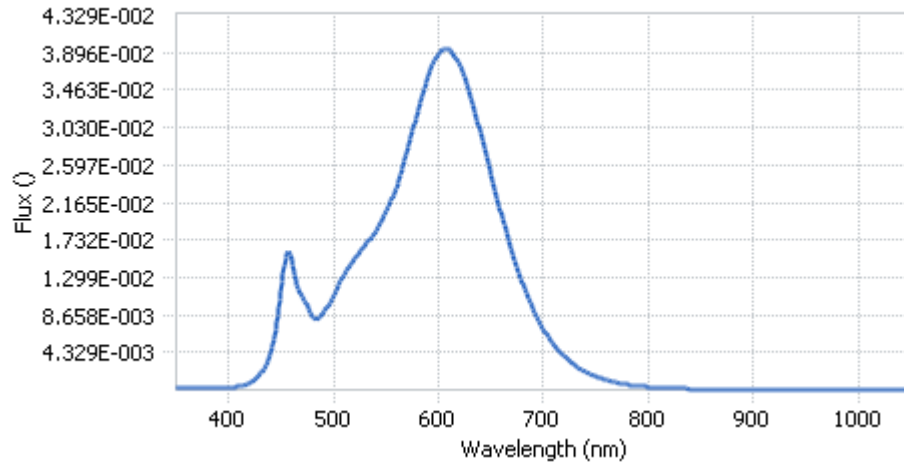


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.33E-04	485	8.26E-03	590	3.62E-02	695	8.11E-03
385	2.52E-04	490	8.84E-03	595	3.78E-02	700	7.01E-03
390	2.42E-04	495	9.76E-03	600	3.88E-02	705	6.03E-03
395	2.56E-04	500	1.10E-02	605	3.94E-02	710	5.19E-03
400	2.70E-04	505	1.22E-02	610	3.94E-02	715	4.46E-03
405	3.15E-04	510	1.33E-02	615	3.85E-02	720	3.84E-03
410	4.08E-04	515	1.43E-02	620	3.75E-02	725	3.31E-03
415	5.59E-04	520	1.52E-02	625	3.61E-02	730	2.84E-03
420	7.93E-04	525	1.59E-02	630	3.41E-02	735	2.43E-03
425	1.21E-03	530	1.67E-02	635	3.20E-02	740	2.07E-03
430	1.85E-03	535	1.74E-02	640	2.97E-02	745	1.77E-03
435	2.81E-03	540	1.83E-02	645	2.73E-02	750	1.53E-03
440	4.37E-03	545	1.94E-02	650	2.49E-02	755	1.31E-03
445	7.02E-03	550	2.05E-02	655	2.25E-02	760	1.13E-03
450	1.14E-02	555	2.19E-02	660	2.02E-02	765	9.67E-04
455	1.58E-02	560	2.35E-02	665	1.80E-02	770	8.36E-04
460	1.50E-02	565	2.55E-02	670	1.60E-02	775	7.13E-04
465	1.22E-02	570	2.76E-02	675	1.40E-02	780	6.15E-04
470	1.10E-02	575	2.98E-02	680	1.23E-02		
475	9.63E-03	580	3.21E-02	685	1.08E-02		
480	8.41E-03	585	3.44E-02	690	9.34E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method

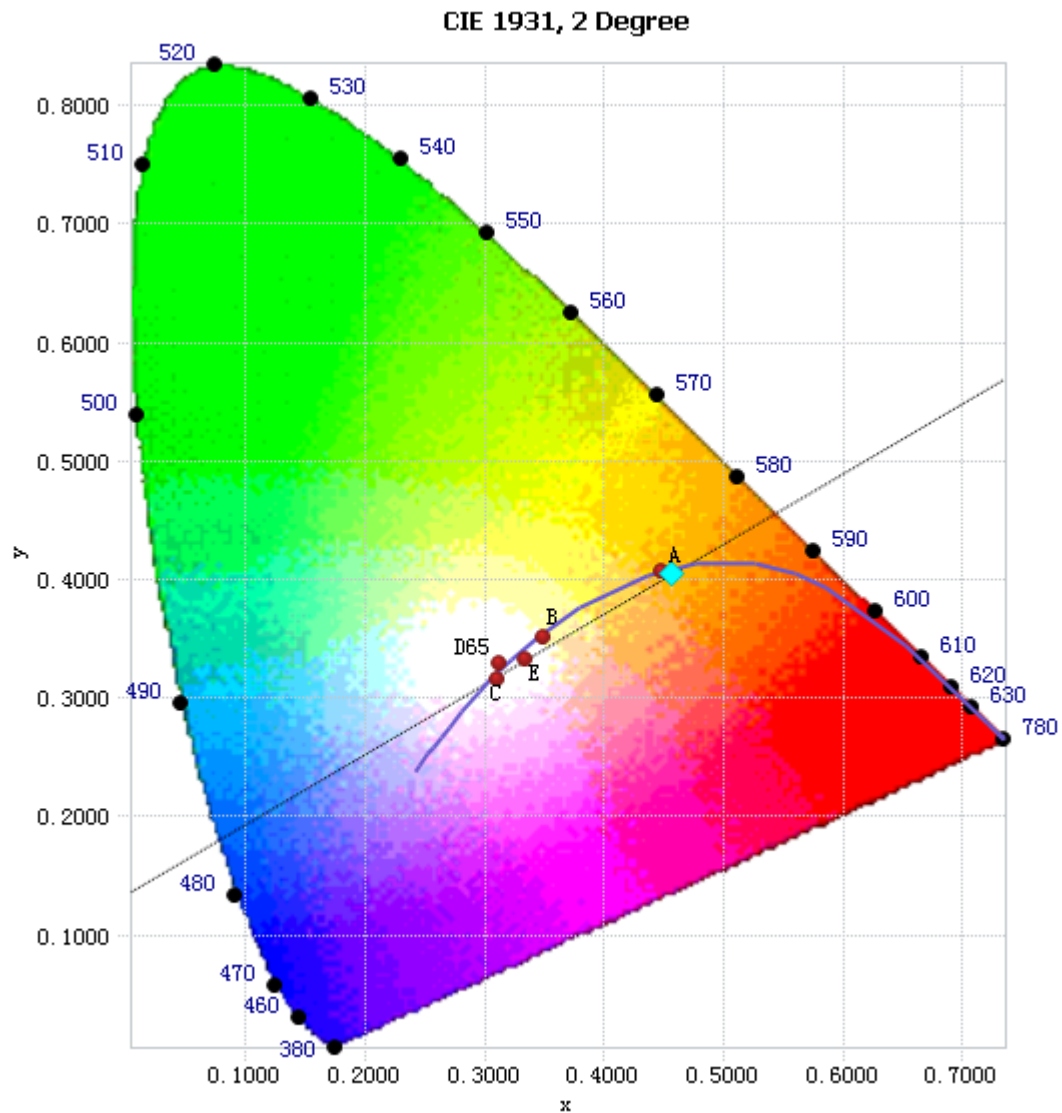


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

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

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

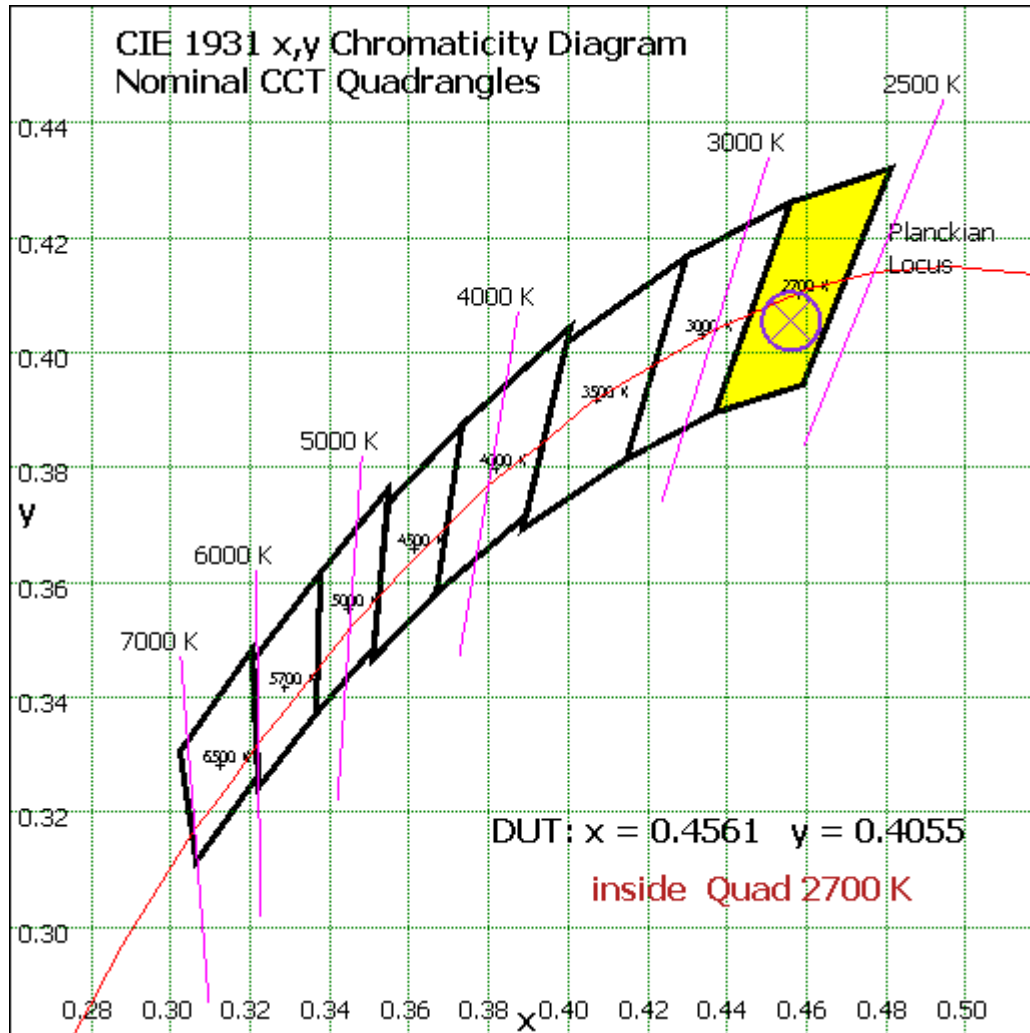


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	61.381	3.30%
10- 20	175.892	9.45%
20- 30	264.36	14.20%
30- 40	312.676	16.79%
40- 50	314.46	16.89%
50- 60	274.918	14.76%
60- 70	208.614	11.20%
70- 80	129.999	6.98%
80- 90	60.225	3.23%
90-100	27.184	1.46%
100-110	15.192	0.82%
110-120	8.832	0.47%
120-130	4.744	0.25%
130-140	2.224	0.12%
140-150	0.825	0.04%
150-160	0.326	0.02%
160-170	0.192	0.01%
170-180	0.067	0.00%
Total	1862.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1403.687	75.38%
60- 90	398.838	21.42%
0-90	1802.525	96.80%
90- 180	59.586	3.20%
0- 180	1862.1	100%

Table 5: Zonal Lumen Data

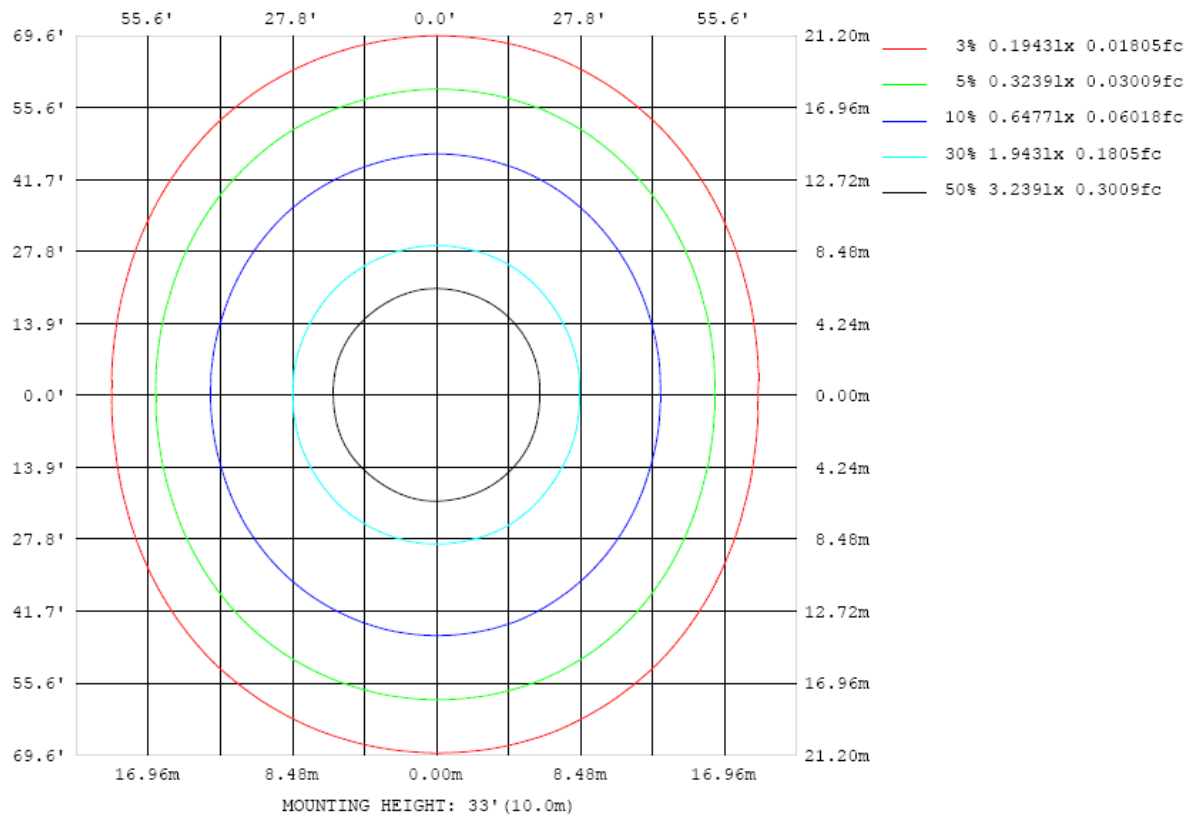


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

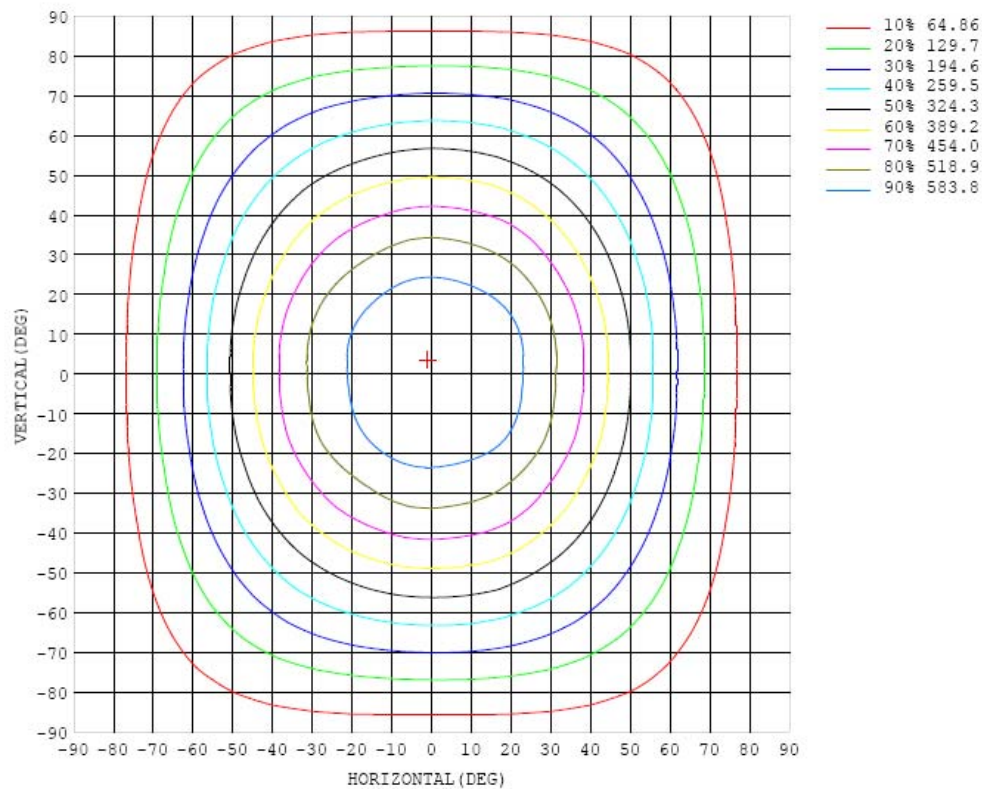


Chart 5: Isocandela Plot

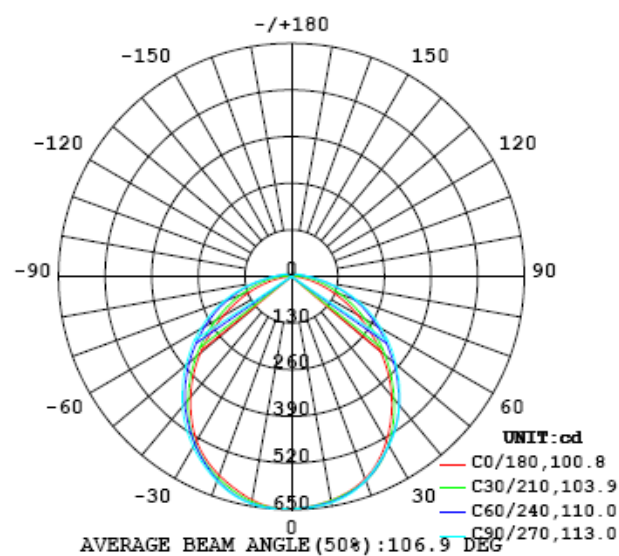


Chart 6: Polar Candela Distribution

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	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648
5	643	643	643	643	643	644	644	645	645	646	646	646	646	646	645	645	645	645	645
10	634	634	634	635	635	637	638	639	640	641	641	641	640	638	636	634	633	632	632
15	621	620	621	623	624	625	626	626	627	628	628	628	626	624	620	617	614	612	612
20	601	601	603	606	607	607	606	604	604	605	606	606	604	601	598	594	591	589	590
25	570	571	575	579	581	580	577	574	573	574	575	574	571	570	570	568	566	563	563
30	530	532	537	542	544	544	543	542	542	544	544	540	535	534	535	536	534	530	529
35	485	487	492	496	499	504	508	509	509	510	510	505	499	496	495	495	492	487	486
40	436	438	443	446	451	461	468	468	467	468	468	463	460	457	451	446	444	439	438
45	382	385	390	394	403	412	420	425	425	426	425	419	415	411	404	396	393	389	387
50	324	328	333	342	353	362	372	378	379	380	379	373	370	363	354	345	338	334	332
55	267	271	276	288	302	313	324	333	335	336	334	329	322	314	304	293	282	278	276
60	213	216	224	237	251	266	278	286	289	289	287	283	277	268	254	242	230	223	220
65	162	166	175	189	205	220	231	240	243	243	242	238	231	221	208	194	180	171	169
70	116	120	131	146	162	177	186	193	196	195	194	191	186	177	165	150	135	123	121
75	76.3	80.7	92.6	108	122	134	142	146	148	147	147	145	141	135	124	111	95.1	82.2	78.1
80	42.9	48.0	60.4	73.7	86.3	95.2	101	103	104	103	102	102	99.9	95.3	87.4	75.7	61.6	47.7	41.8
85	17.6	22.9	34.6	46.8	56.9	64.1	67.9	69.0	68.8	68.5	68.7	68.5	67.7	64.2	57.7	48.0	35.5	21.1	14.7
90	3.18	8.39	18.6	28.9	37.4	43.2	46.5	47.7	47.6	47.0	47.5	47.7	46.8	43.9	38.3	30.0	19.4	7.97	0.83
95	0.56	3.14	10.1	18.5	26.0	31.3	34.4	35.8	35.9	35.6	36.0	36.2	35.1	32.2	27.0	19.5	10.8	3.34	0.10
100	0.14	1.46	5.91	12.5	18.8	23.6	26.7	28.1	28.5	28.4	28.7	28.6	27.4	24.5	19.7	13.4	6.35	0.90	0.11
105	0.12	0.86	3.74	8.67	13.9	18.3	21.2	22.8	23.4	23.4	23.5	23.3	21.9	19.1	14.8	9.01	1.63	0.57	0.15
110	0.16	0.59	2.47	6.07	10.4	14.3	17.0	18.7	19.4	19.5	19.5	19.1	17.6	15.0	10.2	3.92	2.16	0.57	0.19
115	0.19	0.41	1.64	4.27	7.73	11.0	13.5	15.2	16.0	16.1	16.1	15.5	14.0	11.1	6.10	3.43	1.53	0.40	0.22
120	0.22	0.31	1.14	2.99	5.61	8.34	10.5	12.0	12.8	13.0	12.9	12.3	10.9	7.48	4.43	2.80	1.05	0.31	0.26
125	0.26	0.30	0.82	2.09	4.02	6.14	8.05	9.35	10.1	10.3	10.2	9.39	7.52	5.57	3.71	2.00	0.70	0.31	0.32
130	0.31	0.33	0.63	1.42	2.84	4.44	5.88	7.07	7.70	7.91	7.60	6.80	5.62	4.05	2.73	1.42	0.46	0.34	0.40
135	0.37	0.38	0.48	0.99	1.90	3.12	4.24	5.09	5.58	5.65	5.45	4.88	4.06	2.81	1.31	0.68	0.48	0.40	0.49
140	0.43	0.43	0.46	0.59	1.16	2.05	2.91	3.55	3.90	4.00	3.83	3.41	2.78	1.50	1.08	0.65	0.46	0.45	0.58
145	0.47	0.47	0.48	0.53	0.67	1.07	1.67	1.74	2.13	2.44	2.00	1.34	1.59	1.10	0.67	0.53	0.49	0.48	0.66
150	0.50	0.50	0.50	0.52	0.56	0.64	0.93	1.09	1.34	1.43	1.33	1.12	0.82	0.62	0.57	0.54	0.51	0.50	0.69
155	0.54	0.54	0.54	0.54	0.56	0.57	0.58	0.65	0.66	0.69	0.66	0.59	0.55	0.54	0.54	0.54	0.55	0.54	0.72
160	0.57	0.57	0.57	0.58	0.58	0.58	0.58	0.58	0.57	0.57	0.56	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.74
165	0.62	0.61	0.61	0.61	0.61	0.61	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.61	0.61	0.62	0.62	0.62	0.74
170	0.65	0.66	0.65	0.65	0.65	0.65	0.64	0.64	0.64	0.64	0.64	0.64	0.65	0.65	0.66	0.66	0.65	0.65	0.73
175	0.71	0.71	0.71	0.71	0.71	0.71	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.71	0.71	0.71	0.71	0.71	0.72
180	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70

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	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648		
5	645	646	647	647	648	648	648	648	648	648	647	647	646	645	645	644	644		
10	633	635	637	639	641	642	643	644	643	643	642	641	640	639	637	636	635		
15	614	617	620	623	626	628	629	630	630	629	628	628	627	627	626	624	622		
20	592	595	597	599	602	604	607	608	607	607	606	607	608	608	608	606	603		
25	566	569	571	571	571	574	577	579	580	579	578	579	581	582	581	578	574		
30	533	537	538	538	538	539	544	548	549	547	547	547	547	546	544	540	535		
35	490	495	497	499	500	502	507	512	513	512	511	511	509	504	499	495	490		
40	443	446	449	454	459	463	466	471	473	472	471	470	465	456	450	446	441		
45	392	395	399	407	414	418	422	427	429	428	427	424	417	407	398	392	388		
50	337	341	348	357	365	372	377	382	385	383	382	376	366	356	345	336	331		
55	280	285	295	306	317	325	331	336	339	338	335	328	317	305	292	280	274		
60	225	232	244	257	269	280	285	290	293	292	289	281	269	256	240	227	219		
65	173	182	196	210	223	234	240	244	247	246	244	235	223	208	193	179	168		
70	125	137	152	167	179	189	194	198	200	200	197	190	179	166	150	135	123		
75	83.2	95.7	112	126	137	145	149	151	153	153	151	146	138	126	111	95.7	83.2		
80	47.9	61.6	76.5	88.8	97.7	103	106	107	107	108	107	104	98.2	89.1	76.8	62.7	49.8		
85	21.3	35.4	48.3	58.4	65.4	69.5	71.2	71.3	71.1	71.6	71.4	69.5	65.5	58.5	48.4	36.2	24.4		
90	7.70	19.0	29.9	38.5	44.4	47.8	49.2	49.1	48.5	48.8	48.8	47.3	44.0	38.1	29.8	19.6	9.21		
95	3.18	10.5	19.4	27.1	32.6	35.8	37.1	37.1	36.6	36.7	36.5	35.1	32.0	26.7	19.3	10.8	3.66		
100	1.50	6.42	13.2	19.8	24.8	27.9	29.3	29.5	29.1	29.1	28.7	27.2	24.2	19.4	13.0	6.49	1.71		
105	0.96	4.07	9.28	14.8	19.4	22.4	23.9	24.2	23.9	23.8	23.3	21.8	18.9	14.4	9.19	4.15	1.08		
110	0.71	2.63	6.58	11.1	15.2	18.0	19.6	20.1	19.9	19.8	19.1	17.5	14.8	10.9	6.55	2.72	0.73		
115	0.53	1.52	4.66	8.28	11.7	14.3	16.0	16.6	16.5	16.3	15.6	13.9	11.4	8.14	4.68	1.84	0.56		
120	0.38	1.27	3.23	6.09	8.89	11.1	12.6	13.3	13.4	13.2	12.4	10.9	8.71	6.02	3.30	1.30	0.46		
125	0.40	0.73	1.82	4.37	6.64	8.53	9.83	10.5	10.6	10.4	9.68	8.39	6.54	4.38	2.20	0.92	0.38		
130	0.45	0.62	1.31	2.93	4.83	6.38	7.48	8.08	8.20	8.01	7.40	6.30	4.80	3.07	1.46	0.57	0.38		
135	0.53	0.65	0.94	1.79	3.29	4.62	5.54	6.05	6.16	6.01	5.49	4.60	3.35	1.73	0.82	0.55	0.46		
140	0.62	0.69	0.80	1.21	1.98	2.72	3.89	4.33	4.43	4.31	3.88	2.71	1.75	1.08	0.69	0.59	0.55		
145	0.69	0.74	0.82	0.93	1.24	1.72	2.05	2.25	2.33	2.22	1.89	1.51	1.11	0.80	0.70	0.65	0.63		
150	0.72	0.77	0.82	0.87	0.94	1.14	1.27	1.30	1.30	1.25	1.13	0.96	0.81	0.75	0.72	0.70	0.69		
155	0.74	0.74	0.74	0.74	0.73	0.76	0.79	0.82	0.83	0.81	0.78	0.76	0.76	0.75	0.74	0.73	0.72		
160	0.76	0.75	0.75	0.75	0.75	0.75	0.75	0.74	0.73	0.73	0.74	0.74	0.75	0.75	0.75	0.75	0.74		
165	0.76	0.76	0.75	0.75	0.75	0.75	0.74	0.74	0.73	0.73	0.74	0.74	0.77	0.78	0.77	0.76	0.75		
170	0.76	0.75	0.75	0.75	0.75	0.74	0.74	0.74	0.73	0.73	0.73	0.73	0.74	0.74	0.75	0.75	0.74		
175	0.73	0.73	0.73	0.73	0.73	0.73	0.72	0.72	0.71	0.71	0.71	0.72	0.72	0.72	0.73	0.73	0.73		
180	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70		

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

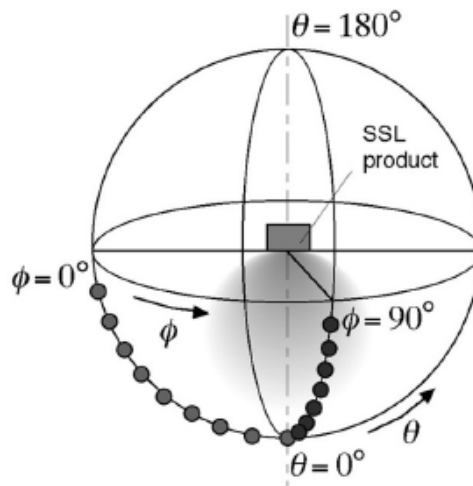
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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