LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

PLH LAMP

Model: 9.5PLH/835/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ17030069e

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

Review by: April Zou

Engineer: April Zou

Mar. 24, 2017

Approved by: Zhang

Manager: Jim Zhang

Mar. 24, 2017

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: **9.5PLH/835/BYP**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
115.4	1088.0	9.43	0.9736

CCT (K)	CRI	Stabilization Time (Light & Power)
3523	82.8	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 : Mar. 21, 2017

Date of Test : Mar. 23, 2017

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	: PLH LAMP
Model	: 9.5PLH/835/BYP
Electrical Ratings	: 120-277Vac, 60Hz, 9.5W
Product Description	: G24D base, 3500K, CRI80
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 Base up. 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)	0.081	0.038
Power Factor	0.9736	0.8895
Test Power (W)	9.43	9.47
THD A%	21.31	26.73
Luminous Efficacy (lm/W)	115.4	114.8
Total Luminous Flux (lm)	1088.0	1087.0
Color Rendering Index (CRI)	82.8	
R9	7.3	
Correlated Color Temperature (CCT)(K)	3523	
Chromaticity Chroma x	0.4034	
Chromaticity Chroma y	0.3887	
Chromaticity Chroma u	0.2353	
Chromaticity Chroma v	0.3401	
Duv	0.0006	
Chromaticity Chroma u ’	0.2353	
Chromaticity Chroma v’	0.5101	

Special Color Rendering Indices	
R1	81.6
R2	92.4
R3	95
R4	79.2
R5	81.7
R6	89.5
R7	82.8
R8	60.5
R9	7.3
R10	81.8
R11	77.8
R12	67.9
R13	84.6
R14	98
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 24.6℃.

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)	0.081
Power Factor	0.9730
Test Power (W)	9.46
Luminous Efficacy (lm/W)	118.1
Total Luminous Flux (lm)	1117.4
Beam Angle (°)	110.3
Center Beam Candle Power (cd)	351
Spacing Criteria	1.15 (0°-180°)/ 1.24 (90°-270°)
Zonal Lumens in the 0°-60°Zone	67.99%
Zonal Lumens in the 60°-90°Zone	24.32%
Zonal Lumens in the 90°-120°Zone	6.38%
Zonal Lumens in the 120°-180°Zone	1.30%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

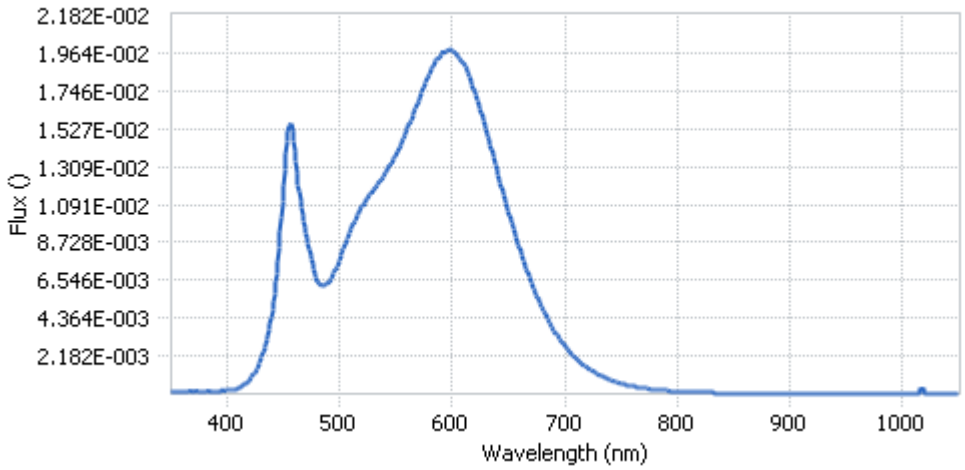
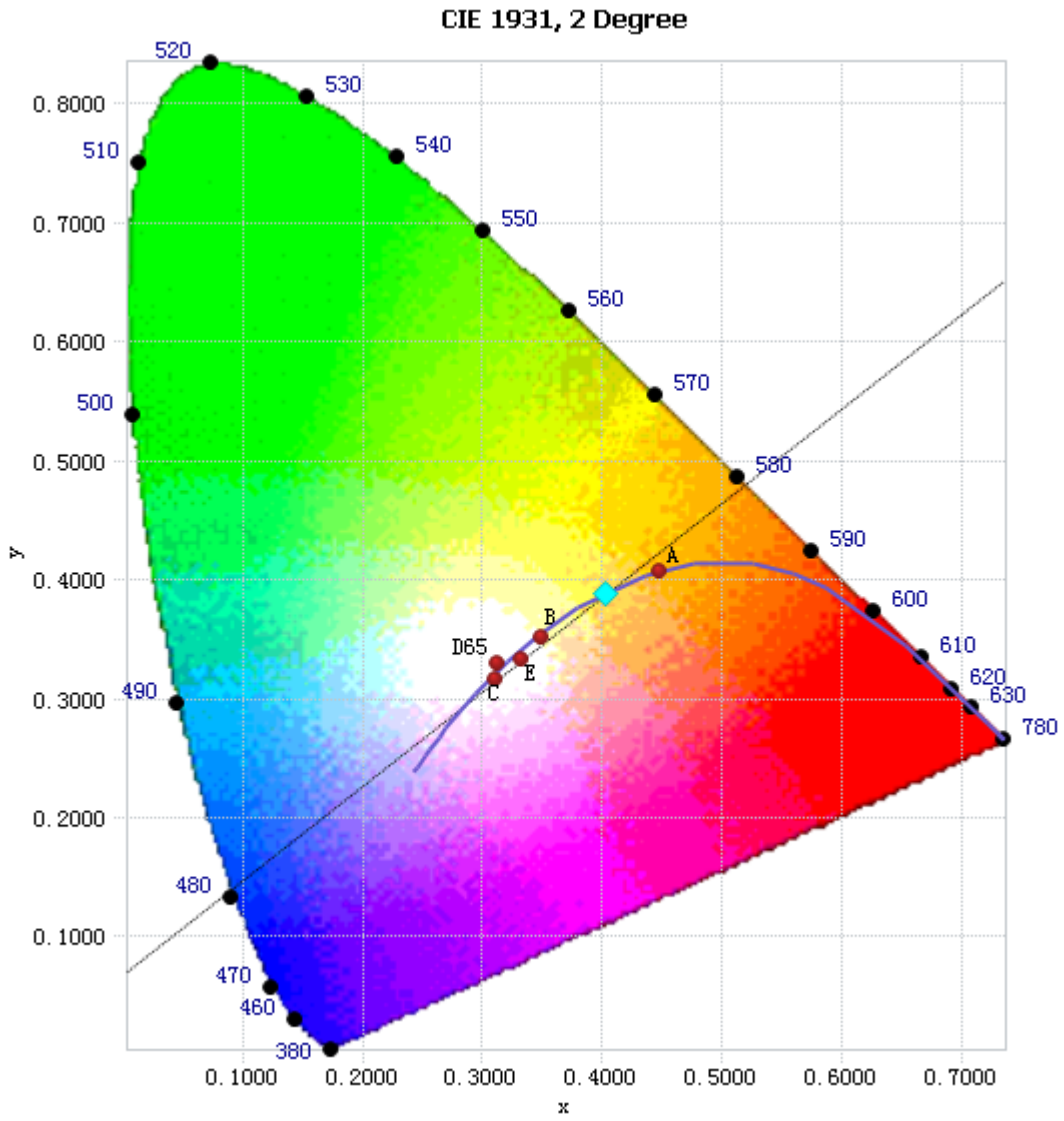


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.59E-04	485	6.22E-03	590	1.95E-02	695	3.21E-03
385	1.65E-04	490	6.42E-03	595	1.98E-02	700	2.79E-03
390	1.71E-04	495	7.00E-03	600	1.98E-02	705	2.39E-03
395	1.88E-04	500	7.77E-03	605	1.94E-02	710	2.03E-03
400	1.94E-04	505	8.68E-03	610	1.90E-02	715	1.77E-03
405	2.52E-04	510	9.48E-03	615	1.84E-02	720	1.52E-03
410	3.31E-04	515	1.02E-02	620	1.74E-02	725	1.31E-03
415	5.30E-04	520	1.08E-02	625	1.64E-02	730	1.11E-03
420	8.18E-04	525	1.13E-02	630	1.53E-02	735	9.59E-04
425	1.31E-03	530	1.18E-02	635	1.41E-02	740	8.17E-04
430	2.06E-03	535	1.22E-02	640	1.29E-02	745	7.03E-04
435	3.16E-03	540	1.27E-02	645	1.17E-02	750	6.07E-04
440	4.84E-03	545	1.32E-02	650	1.05E-02	755	5.23E-04
445	7.62E-03	550	1.38E-02	655	9.42E-03	760	4.49E-04
450	1.20E-02	555	1.45E-02	660	8.39E-03	765	3.90E-04
455	1.55E-02	560	1.53E-02	665	7.39E-03	770	3.33E-04
460	1.40E-02	565	1.60E-02	670	6.50E-03	775	2.87E-04
465	1.11E-02	570	1.69E-02	675	5.69E-03	780	2.48E-04
470	9.27E-03	575	1.77E-02	680	4.98E-03		
475	7.71E-03	580	1.85E-02	685	4.31E-03		
480	6.50E-03	585	1.92E-02	690	3.74E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4034, 0.3887)

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

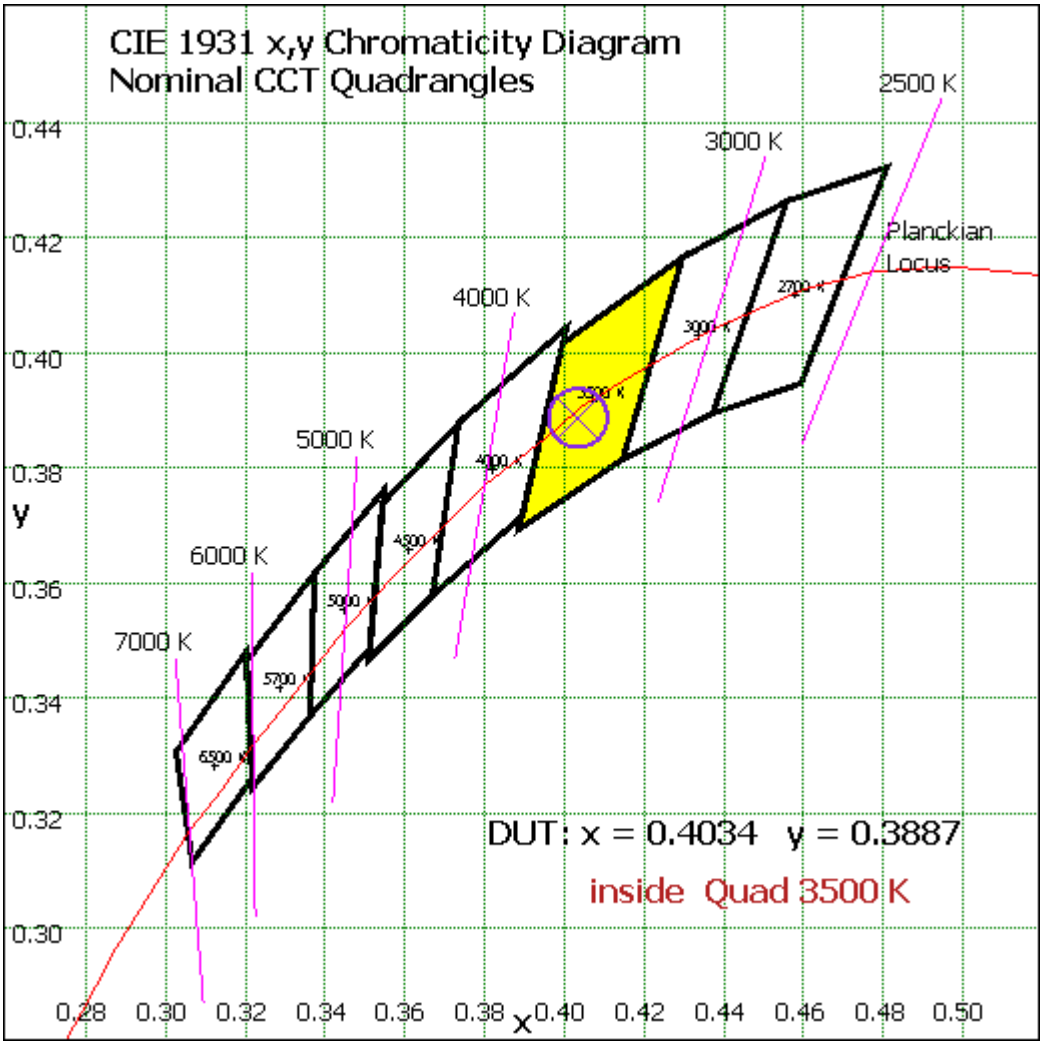


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	33.106	2.96%
10- 20	94.014	8.41%
20- 30	140.276	12.55%
30- 40	166.121	14.87%
40- 50	170.425	15.25%
50- 60	155.815	13.94%
60- 70	126.943	11.36%
70- 80	89.792	8.04%
80- 90	55.024	4.92%
90-100	34.079	3.05%
100-110	22.799	2.04%
110-120	14.45	1.29%
120-130	7.866	0.70%
130-140	3.734	0.33%
140-150	1.786	0.16%
150-160	0.792	0.07%
160-170	0.29	0.03%
170-180	0.06	0.01%
Total	1117.4	100%

γ(°)	Lumens	% Total
0- 60	759.757	67.99%
60- 90	271.759	24.32%
0-90	1031.516	92.32%
90- 180	85.856	7.68%
0- 180	1117.4	100%

Table 5: Zonal Lumen Data

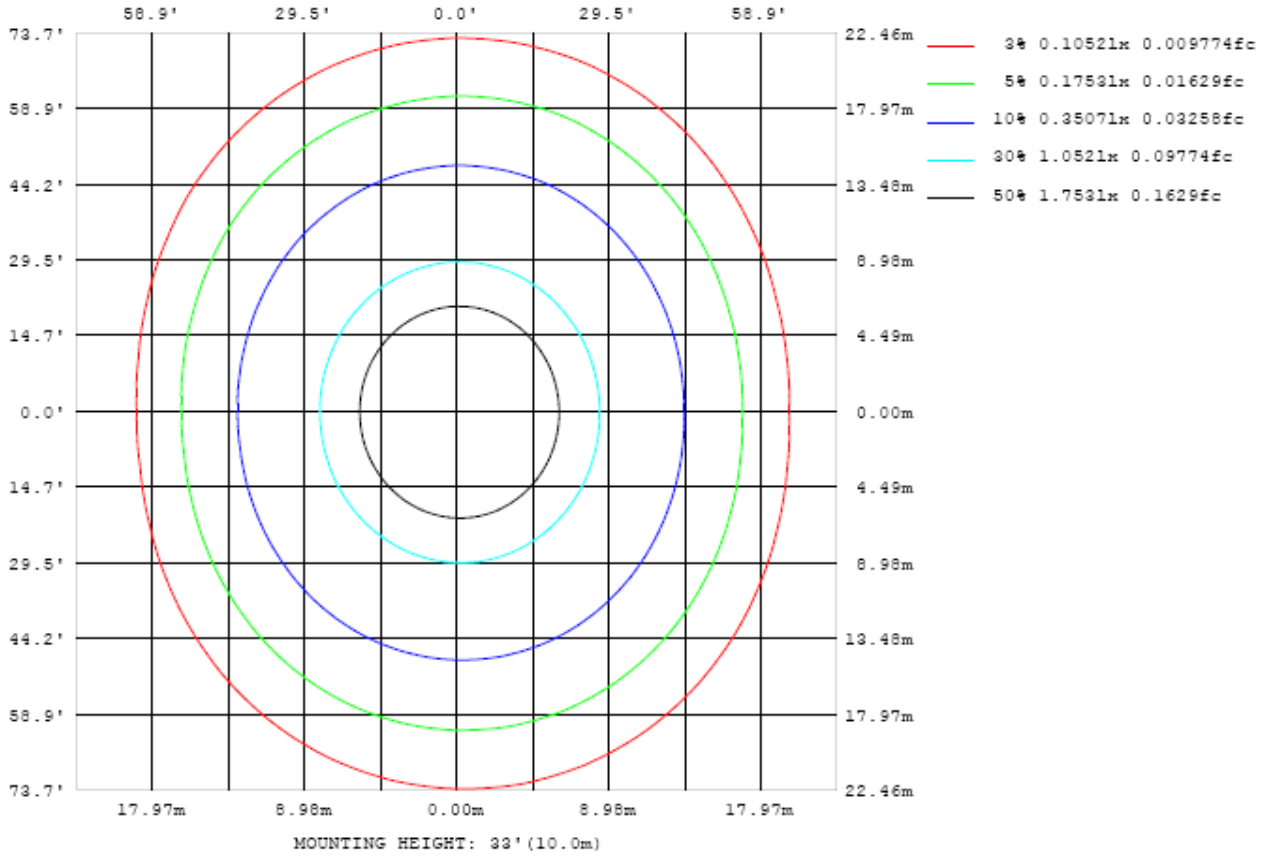


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

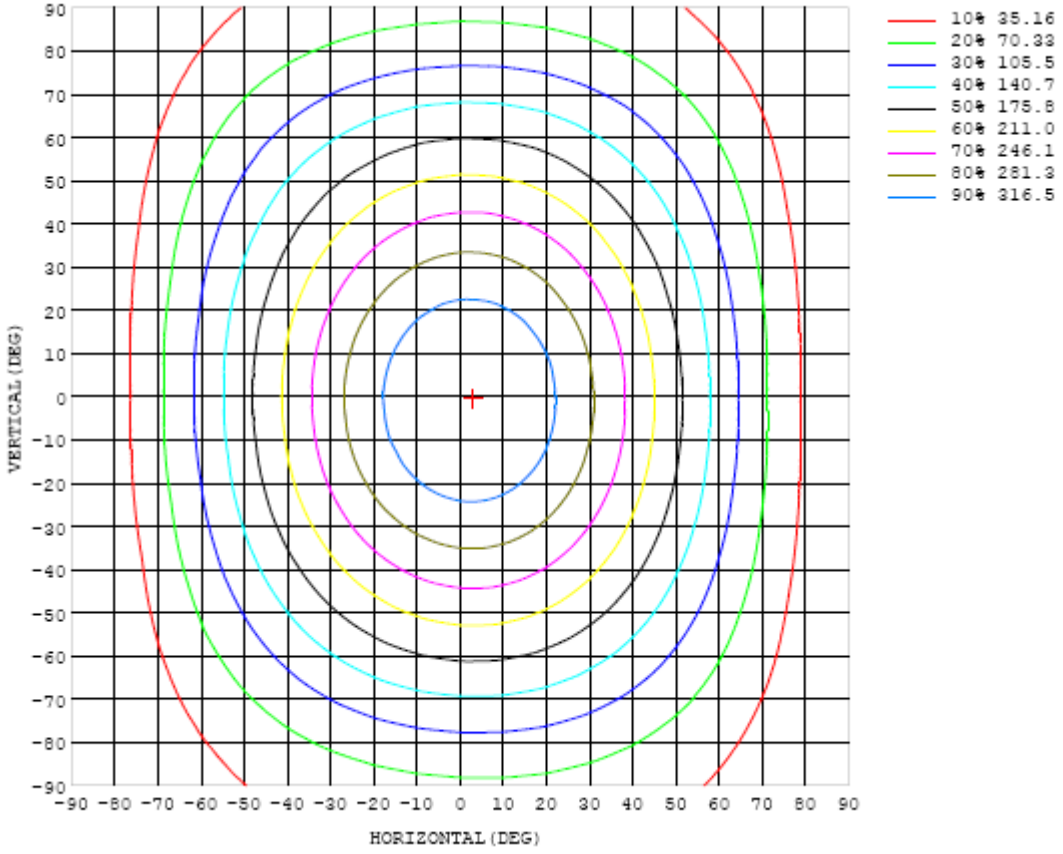


Chart 5: Isocandela Plot

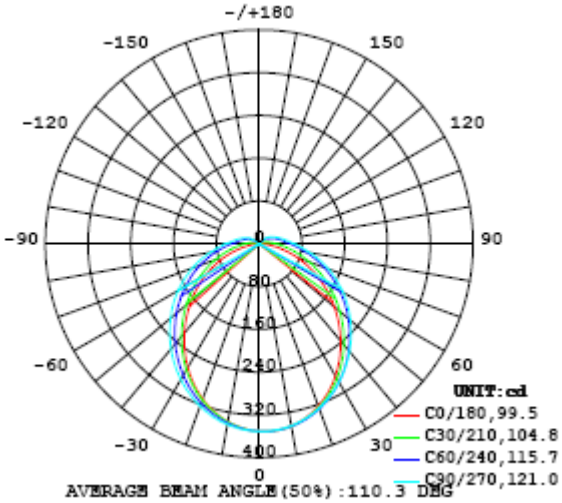


Chart 6: Polar Candela Distribution

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	351	351	351	351	351	351	351	351	351	351	351	351	351	351	351	351	351	351	351
5	351	351	350	351	351	350	350	350	350	350	349	349	348	348	347	347	347	346	346
10	346	346	346	346	346	347	347	347	346	345	344	343	342	341	340	340	339	338	338
15	337	337	337	338	339	339	339	339	339	338	336	335	333	331	329	328	327	325	325
20	323	324	324	326	327	328	329	329	328	327	325	323	321	318	315	313	311	309	309
25	306	307	308	310	312	314	315	316	315	314	311	309	305	302	298	295	292	290	289
30	285	287	288	291	294	296	299	300	300	299	296	292	288	283	278	274	271	268	267
35	262	264	266	269	274	277	281	282	283	281	278	274	268	263	256	251	247	244	243
40	237	239	242	246	251	256	260	263	264	263	259	254	248	241	234	228	222	219	218
45	211	213	217	222	228	234	239	243	244	243	239	234	227	219	210	203	197	193	192
50	183	186	191	197	204	212	218	222	224	223	219	213	205	196	187	178	172	167	166
55	156	159	164	172	180	189	196	201	203	202	198	192	183	173	163	154	146	141	140
60	129	132	139	147	157	166	174	179	182	181	177	170	161	151	140	130	121	115	114
65	102	106	113	123	133	143	151	157	160	159	155	149	140	129	118	107	97.4	90.4	88.7
70	76.3	80.7	89.3	99.9	111	121	130	135	138	138	134	128	119	108	96.5	85.1	74.6	66.3	64.4
75	52.2	57.4	66.8	78.2	89.5	99.9	108	114	117	116	113	107	98.8	88.5	76.8	65.2	54.1	44.0	40.8
80	30.1	36.5	47.1	59.1	70.2	80.5	88.7	94.4	97.0	96.4	93.7	88.2	80.3	70.5	59.6	47.8	35.9	25.5	21.0
85	13.0	19.8	30.8	42.8	54.4	64.0	71.8	77.1	79.7	79.4	76.9	72.0	64.3	55.9	45.2	34.0	22.1	11.3	6.68
90	1.81	9.25	20.0	31.3	42.2	51.5	58.8	63.3	65.7	65.7	63.5	59.5	53.0	44.6	34.8	24.3	13.4	3.24	0.50
95	0.53	4.80	13.8	24.1	33.9	42.3	49.0	53.4	55.7	55.7	53.8	50.0	44.1	36.6	27.8	18.3	8.02	2.09	0.31
100	0.54	3.20	10.1	18.9	27.7	35.4	41.5	45.7	47.8	47.9	46.2	42.7	37.5	30.6	22.7	14.2	5.94	1.31	0.34
105	0.48	2.51	7.57	15.0	22.8	29.7	35.3	39.2	41.2	41.3	39.8	36.7	31.9	25.8	18.6	11.0	4.45	1.10	0.30
110	0.37	1.65	5.28	11.6	18.4	25.0	30.0	33.6	35.4	35.7	34.3	31.5	27.2	21.7	15.4	8.39	2.77	0.72	0.30
115	0.27	1.04	3.44	8.95	15.0	20.4	25.5	28.7	30.4	30.6	29.4	26.9	23.1	18.2	12.5	5.77	2.31	0.70	0.38
120	0.33	0.82	2.33	5.89	11.9	17.0	20.8	24.3	25.9	26.2	25.1	22.8	19.4	15.0	9.43	3.50	1.90	0.72	0.51
125	0.40	0.72	1.81	3.88	7.61	13.5	17.2	20.2	21.8	22.0	21.1	19.0	15.8	11.3	5.62	3.13	1.69	0.77	0.64
130	0.45	0.66	1.47	3.14	5.52	8.75	12.7	15.6	17.5	17.8	16.9	14.8	11.3	6.96	4.24	2.77	1.57	0.83	0.65
135	0.50	0.64	1.23	2.59	4.30	6.19	8.35	10.3	11.7	11.9	10.9	9.03	7.17	5.28	3.71	2.45	1.42	0.87	0.84
140	0.54	0.64	1.04	2.08	3.41	4.72	6.01	7.24	7.97	8.32	7.91	7.11	5.93	4.35	2.93	2.08	1.25	0.86	0.91
145	0.59	0.65	0.93	1.61	2.70	3.60	4.57	5.30	5.79	5.90	5.87	5.38	4.33	3.37	2.35	1.74	1.11	0.75	0.75
150	0.65	0.69	0.91	1.37	2.08	2.73	3.41	3.88	4.20	4.30	4.16	3.69	3.15	2.58	1.88	1.40	0.98	0.78	0.66
155	0.71	0.75	0.94	1.21	1.62	2.05	2.52	2.82	3.02	3.04	2.80	2.59	2.30	1.88	1.49	1.13	0.86	0.64	0.61
160	0.76	0.80	0.91	1.05	1.27	1.52	1.81	1.97	2.03	2.02	1.96	1.77	1.62	1.34	1.12	0.84	0.71	0.53	0.58
165	0.69	0.70	0.80	0.88	0.97	1.11	1.22	1.31	1.37	1.37	1.29	1.26	1.16	0.97	0.87	0.77	0.70	0.50	0.62
170	0.63	0.65	0.69	0.76	0.82	0.87	0.92	0.95	0.94	0.91	0.91	0.86	0.82	0.79	0.75	0.71	0.63	0.51	0.48
175	0.58	0.58	0.59	0.60	0.61	0.66	0.71	0.72	0.76	0.76	0.71	0.68	0.63	0.54	0.46	0.41	0.38	0.37	0.46
180	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28

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	351	351	351	351	351	351	351	351	351	351	351	351	351	351	351	351	351		
5	346	347	347	346	347	347	348	348	349	349	349	350	350	350	350	350	350		
10	338	338	339	339	339	341	341	343	343	344	344	345	345	345	346	346	345		
15	325	326	326	328	329	330	332	333	335	335	336	336	337	336	336	336	336		
20	309	310	311	313	315	317	319	321	323	324	325	325	325	324	324	323	323		
25	290	291	293	296	299	302	305	307	309	310	310	310	309	308	307	306	306		
30	268	269	273	276	280	284	288	291	293	294	294	293	292	289	288	287	285		
35	244	246	250	254	260	265	269	273	276	277	276	274	272	268	266	264	262		
40	219	222	226	232	238	244	249	254	257	257	257	254	250	246	243	239	237		
45	193	197	202	209	216	223	229	234	237	238	236	233	228	223	218	214	211		
50	168	171	178	186	194	202	208	214	217	217	215	210	205	199	193	188	184		
55	142	147	154	163	172	180	188	193	196	196	194	189	182	175	168	161	157		
60	117	123	132	141	150	158	167	172	175	175	172	167	159	151	143	136	131		
65	91.9	99.4	109	119	129	138	146	151	154	153	151	145	138	129	119	111	105		
70	68.4	77.3	87.4	98.4	109	118	125	130	133	133	129	124	116	106	96.1	86.3	79.2		
75	46.7	56.9	67.7	79.1	89.2	98.1	105	110	112	112	109	103	94.9	84.9	74.1	63.6	55.4		
80	28.4	39.0	50.2	61.4	71.2	79.6	86.4	90.6	92.9	92.1	89.3	83.5	75.4	65.5	54.6	43.5	34.0		
85	14.6	25.1	36.1	46.6	56.3	64.3	70.1	74.2	75.6	75.2	72.4	66.9	59.0	49.3	38.5	27.3	17.3		
90	6.62	16.1	26.4	35.9	44.7	51.9	57.3	61.0	62.4	61.5	58.9	53.8	46.5	37.4	27.0	16.2	6.51		
95	3.36	10.7	19.7	28.5	36.5	43.0	47.8	50.7	51.9	51.5	48.9	44.2	37.5	29.2	19.9	10.4	2.99		
100	2.52	7.29	15.1	22.9	30.2	36.1	40.5	43.2	44.4	43.8	41.3	36.9	30.8	23.3	15.0	7.28	2.16		
105	1.63	4.75	11.2	18.5	25.0	30.4	34.5	37.0	37.9	37.4	35.1	31.1	25.5	18.6	11.4	5.56	1.46		
110	1.04	3.14	6.61	14.3	20.5	25.6	29.2	31.6	32.4	31.8	29.7	26.0	20.8	14.2	8.01	3.47	1.04		
115	0.81	2.08	4.40	9.04	16.1	21.0	24.5	26.6	27.4	26.8	24.7	21.3	15.9	9.08	5.15	2.17	0.62		
120	0.85	1.68	3.55	6.55	10.1	15.3	19.3	21.5	22.3	21.6	19.4	15.0	9.58	5.86	3.50	1.63	0.56		
125	0.75	1.63	3.01	5.06	7.46	9.89	12.2	14.4	15.2	14.3	11.9	9.33	6.76	4.33	2.68	1.32	0.55		
130	0.91	1.52	2.58	3.99	5.68	7.34	8.79	9.75	9.91	9.50	8.40	6.86	5.14	3.33	2.13	1.13	0.57		
135	0.92	1.47	2.24	3.28	4.50	5.62	6.61	7.16	7.25	6.98	6.29	5.27	4.04	2.62	1.75	1.00	0.61		
140	1.04	1.40	1.96	2.76	3.64	4.40	4.97	5.36	5.50	5.34	4.86	4.15	3.26	2.15	1.48	0.91	0.65		
145	0.89	1.15	1.60	2.16	2.74	3.30	3.81	4.13	4.27	4.17	3.85	3.35	2.65	1.89	1.32	0.87	0.71		
150	0.67	0.86	1.20	1.65	2.14	2.56	2.94	3.17	3.30	3.24	2.97	2.59	2.17	1.68	1.22	0.87	0.77		
155	0.64	0.77	1.03	1.33	1.67	1.96	2.23	2.40	2.47	2.43	2.28	2.02	1.71	1.39	1.09	0.88	0.85		
160	0.64	0.71	0.87	1.05	1.26	1.46	1.64	1.76	1.81	1.80	1.71	1.56	1.37	1.17	0.98	0.82	0.84		
165	0.64	0.64	0.76	0.85	0.96	1.07	1.18	1.26	1.29	1.29	1.24	1.16	1.05	0.94	0.87	0.77	0.76		
170	0.50	0.55	0.58	0.66	0.74	0.79	0.84	0.90	0.92	0.93	0.92	0.89	0.85	0.80	0.76	0.71	0.65		
175	0.46	0.47	0.45	0.43	0.41	0.44	0.48	0.56	0.59	0.54	0.62	0.59	0.58	0.55	0.57	0.58	0.60		
180	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 27, 2016	Jul. 26, 2017
Digital Power Meter	PF2010A	HZTE028-01	Jul. 27, 2016	Jul. 26, 2017
AC Power Supply	PCR 500L	HZTE001-08	Jul. 27, 2016	Jul. 26, 2017
DC Power Supply	WY12010	HZTE004-03	Jul. 27, 2016	Jul. 26, 2017
Temperature Meter	TES1310	HZTE017-01	Jul. 27, 2016	Jul. 26, 2017
Standard source	D908	HZTE012-01	Jul. 27, 2016	Jul. 26, 2017
Integrate Sphere system	2M	HZTE015-01	Jul. 27, 2016	Jul. 26, 2017
Digital Power Meter	WT210	HZTE008-01	Jul. 27, 2016	Jul. 26, 2017
AC Power Supply	PCR 500L	HZTE001-07	Jul. 27, 2016	Jul. 26, 2017
DC Power Supply	6154	HZTE004-04	Jul. 27, 2016	Jul. 26, 2017
Temperature and humidity recorder	JR900	HZTE018-01	Jul. 27, 2016	Jul. 26, 2017
Standard source	SCL-1400	HZTE012-02	Jul. 27, 2016	Jul. 26, 2017

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 FA19 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 1.06% 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 FA19 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 1.94% with a coverage factor k=2.

Color Characteristics Measurements

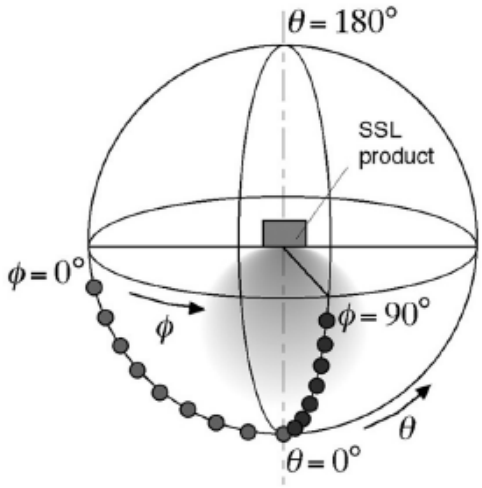
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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