LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

PLS LAMP

Model: 6PLS/830/HYB/GX23/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ17030069b

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:

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: **6PLS/830/HYB/GX23/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
118.0	698.7	5.92	0.9756

CCT (K)	CRI	Stabilization Time (Light & Power)
2959	82.5	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	: Mar. 21, 2017
Date of Test	: Mar. 22, 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	: PLS LAMP
Model	: 6PLS/830/HYB/GX23/R
Electrical Ratings	: 120-277Vac, 60Hz, 6W
Product Description	: GX23 base, 3000K, 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)	0.051	0.024
Power Factor	0.9756	0.8904
Test Power (W)	5.92	5.96
THD A%	20.1	25.95
Luminous Efficacy (lm/W)	118.0	117.2
Total Luminous Flux (lm)	698.7	698.8
Color Rendering Index (CRI)	82.5	
R9	7.8	
Correlated Color Temperature (CCT)(K)	2959	
Chromaticity Chroma x	0.4345	
Chromaticity Chroma y	0.3945	
Chromaticity Chroma u	0.2532	
Chromaticity Chroma v	0.3448	
Duv	0.0037	
Chromaticity Chroma u ’	0.2532	
Chromaticity Chroma v’	0.5172	

Special Color Rendering Indices	
R1	82
R2	93.6
R3	92.9
R4	79.3
R5	82.7
R6	92.1
R7	80
R8	57.3
R9	7.8
R10	85.4
R11	78.8
R12	76.2
R13	85.2
R14	96.9
Rf	83
Rg	96

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)	0.051
Power Factor	0.9751
Test Power (W)	5.92
Luminous Efficacy (lm/W)	120.9
Total Luminous Flux (lm)	715.5
Beam Angle (°)	112.6
Center Beam Candle Power (cd)	216
Spacing Criteria	1.15 (0°-180°)/ 1.25 (90°-270°)
Zonal Lumens in the 0°-60°Zone	66.70%
Zonal Lumens in the 60°-90°Zone	25.06%
Zonal Lumens in the 90°-120°Zone	7.06%
Zonal Lumens in the 120°-180°Zone	1.19%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

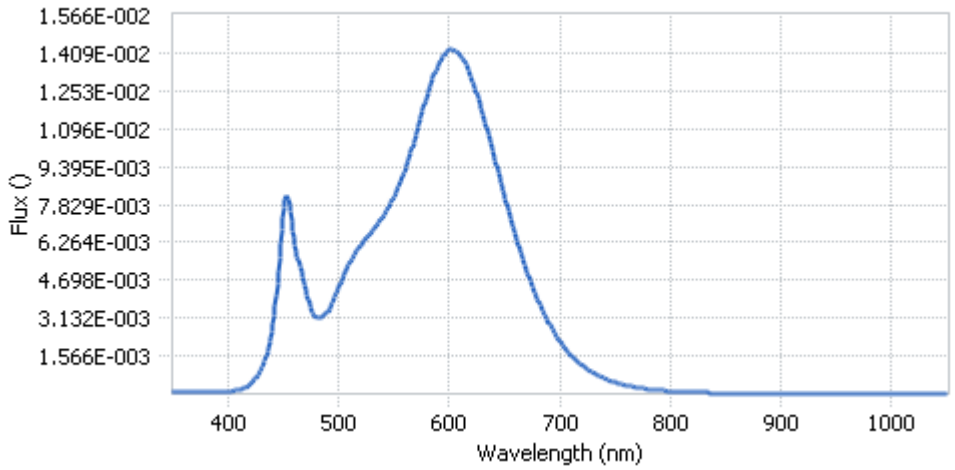
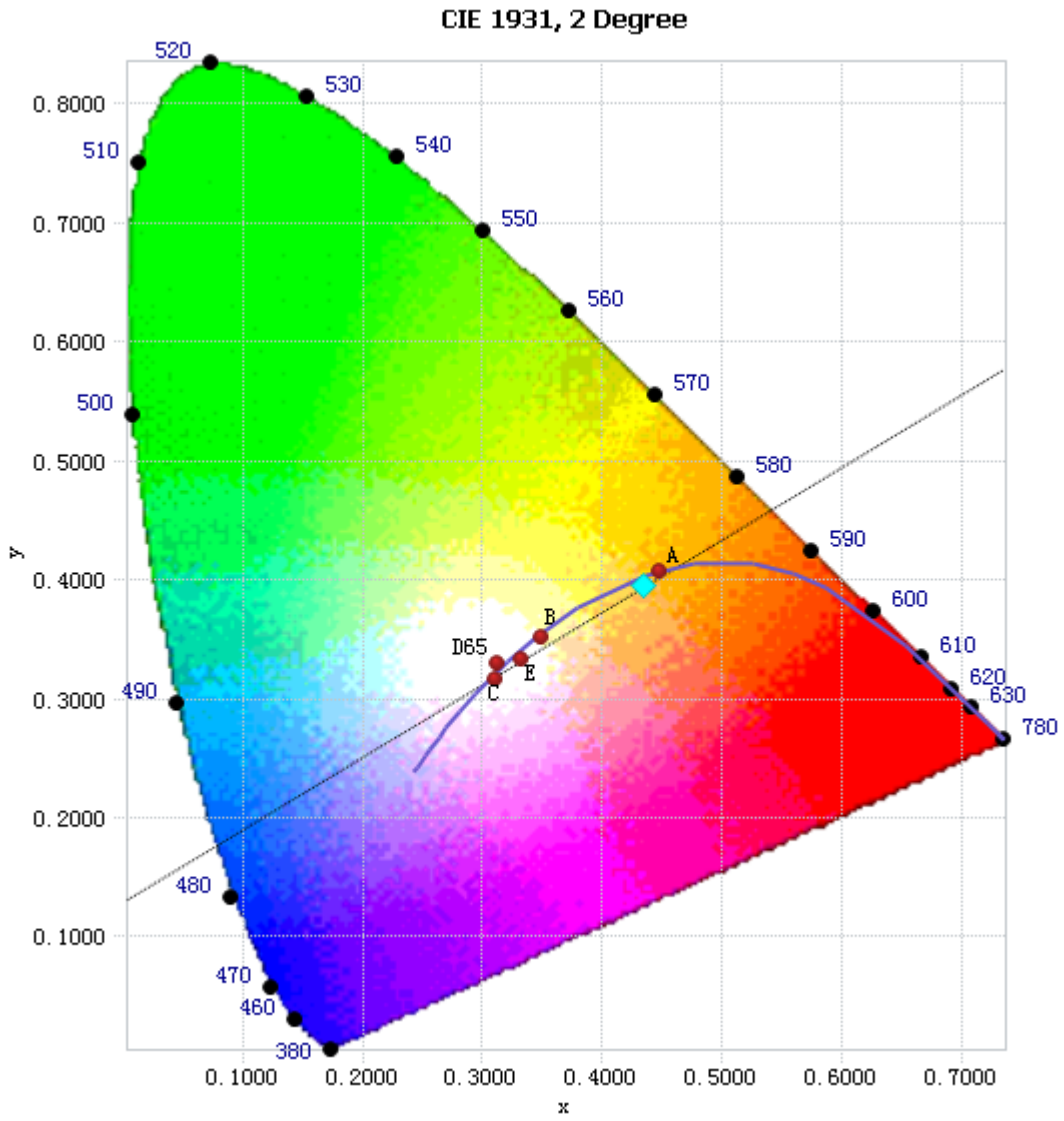


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	8.54E-05	485	3.17E-03	590	1.35E-02	695	2.54E-03
385	9.47E-05	490	3.40E-03	595	1.40E-02	700	2.19E-03
390	9.19E-05	495	3.83E-03	600	1.42E-02	705	1.89E-03
395	9.80E-05	500	4.35E-03	605	1.42E-02	710	1.62E-03
400	1.06E-04	505	4.91E-03	610	1.40E-02	715	1.40E-03
405	1.23E-04	510	5.38E-03	615	1.37E-02	720	1.20E-03
410	1.70E-04	515	5.79E-03	620	1.31E-02	725	1.03E-03
415	2.52E-04	520	6.14E-03	625	1.25E-02	730	8.84E-04
420	3.89E-04	525	6.44E-03	630	1.17E-02	735	7.53E-04
425	6.29E-04	530	6.70E-03	635	1.08E-02	740	6.43E-04
430	9.98E-04	535	6.98E-03	640	1.00E-02	745	5.55E-04
435	1.59E-03	540	7.31E-03	645	9.11E-03	750	4.79E-04
440	2.61E-03	545	7.70E-03	650	8.26E-03	755	4.12E-04
445	4.53E-03	550	8.13E-03	655	7.42E-03	760	3.58E-04
450	7.28E-03	555	8.63E-03	660	6.60E-03	765	3.03E-04
455	8.08E-03	560	9.22E-03	665	5.84E-03	770	2.64E-04
460	6.43E-03	565	9.91E-03	670	5.15E-03	775	2.26E-04
465	5.28E-03	570	1.07E-02	675	4.50E-03	780	1.93E-04
470	4.47E-03	575	1.15E-02	680	3.93E-03		
475	3.57E-03	580	1.23E-02	685	3.42E-03		
480	3.16E-03	585	1.30E-02	690	2.94E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4345, 0.3945)

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

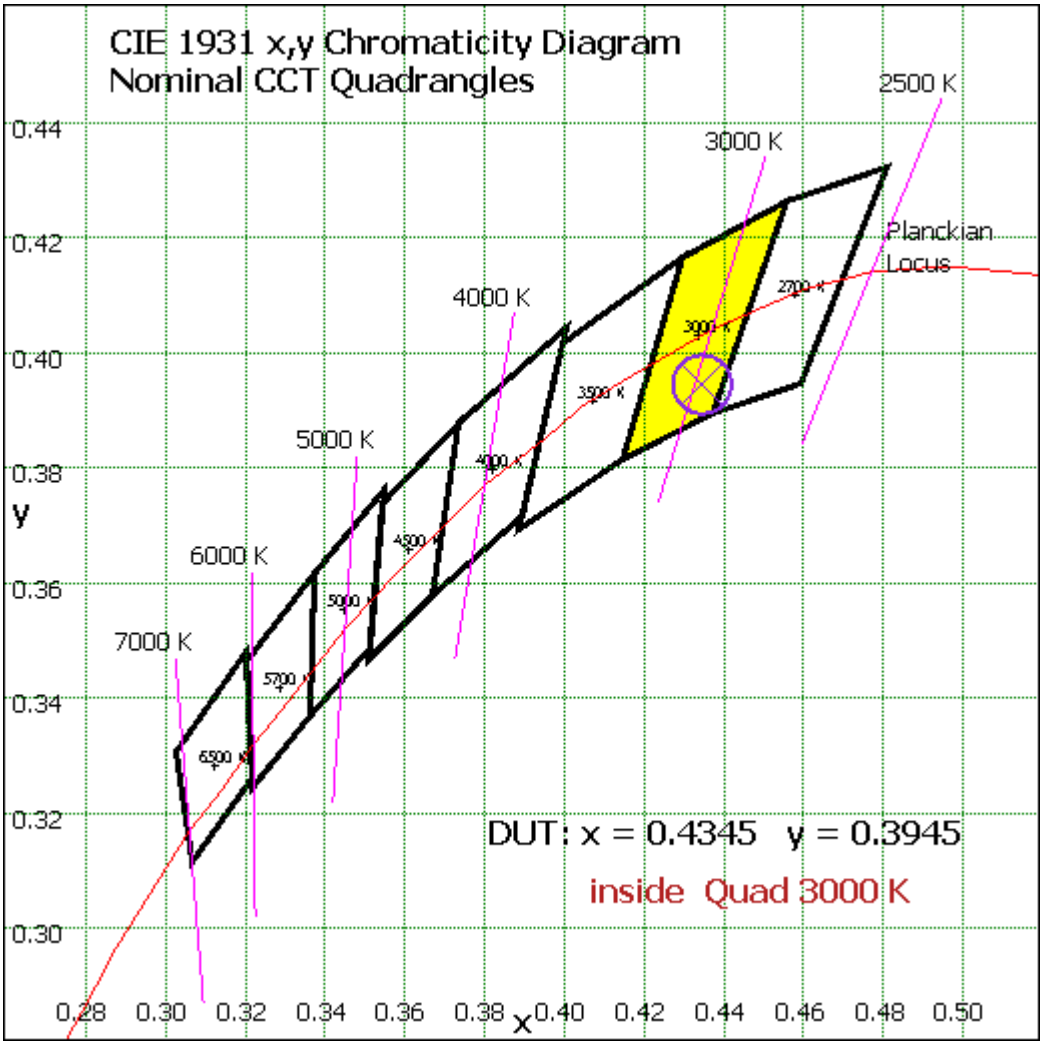


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	20.413	2.85%
10- 20	58.079	8.12%
20- 30	87.042	12.17%
30- 40	103.895	14.52%
40- 50	107.874	15.08%
50- 60	99.877	13.96%
60- 70	82.409	11.52%
70- 80	59.412	8.30%
80- 90	37.484	5.24%
90-100	23.966	3.35%
100-110	16.312	2.28%
110-120	10.209	1.43%
120-130	5.064	0.71%
130-140	2.128	0.30%
140-150	0.833	0.12%
150-160	0.323	0.05%
160-170	0.115	0.02%
170-180	0.025	0.00%
Total	715.5	100%

γ(°)	Lumens	% Total
0- 60	477.18	66.70%
60- 90	179.305	25.06%
0-90	656.485	91.76%
90- 180	58.975	8.24%
0- 180	715.5	100%

Table 5: Zonal Lumen Data

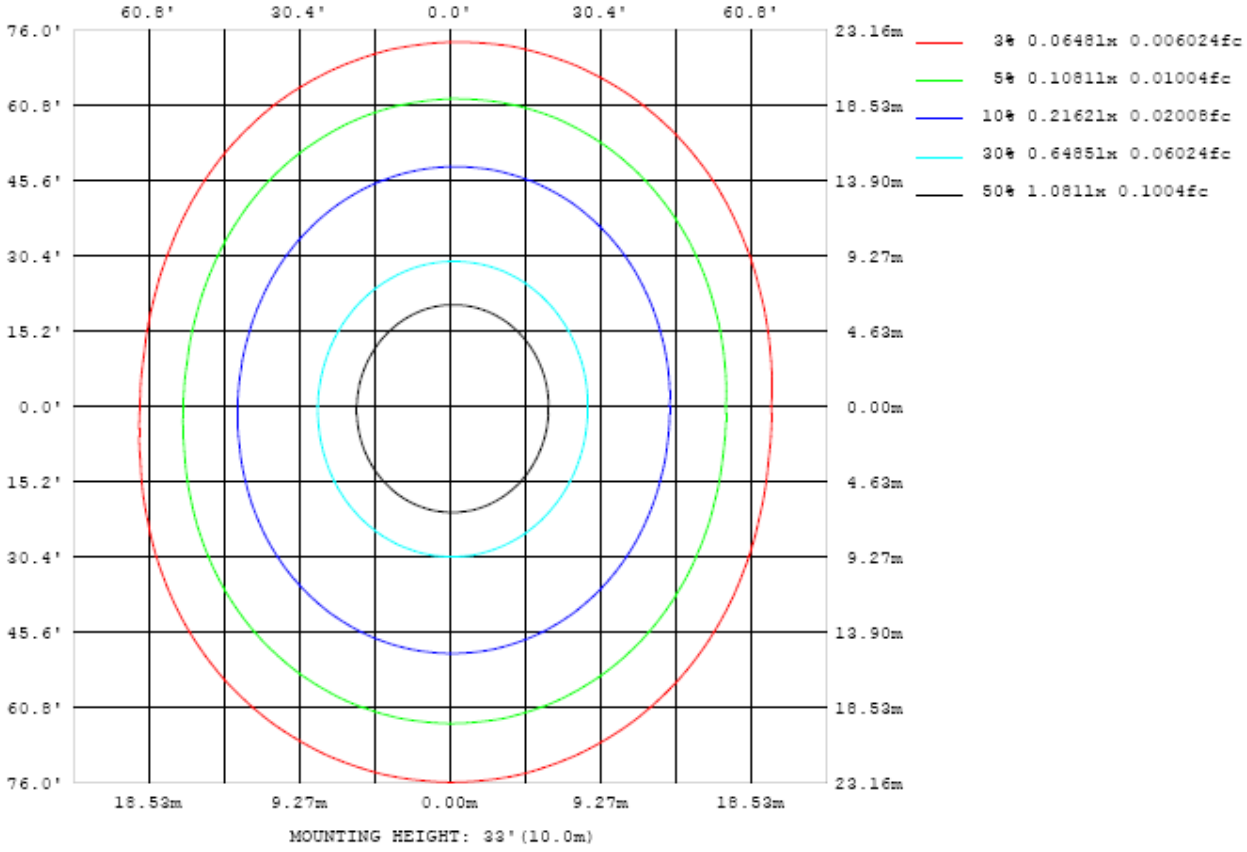


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

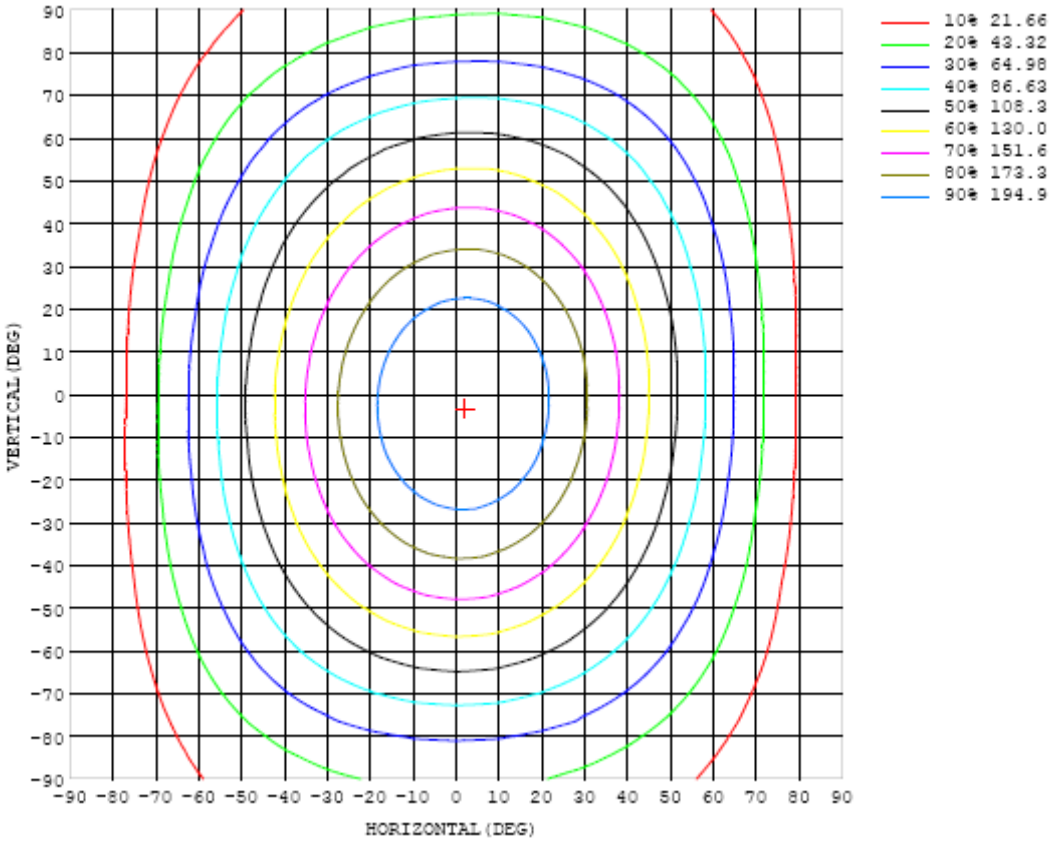


Chart 5: Isocandela Plot

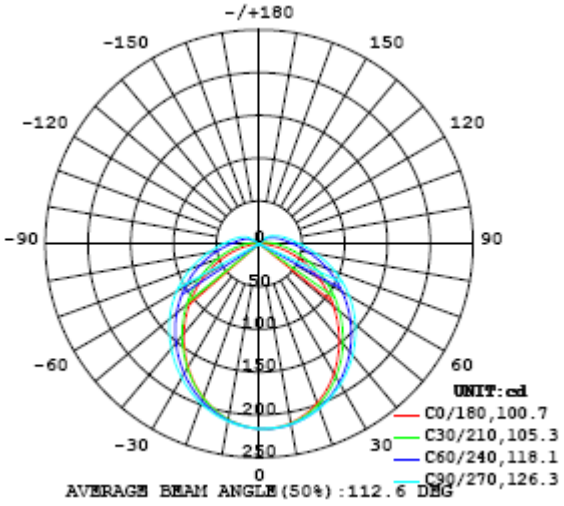


Chart 6: Polar Candela Distribution

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	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216
5	216	216	216	216	216	216	216	216	216	216	216	216	215	215	215	215	214	214	214
10	213	213	213	214	214	214	214	214	215	214	214	213	213	212	211	210	210	209	209
15	207	207	208	208	209	210	210	210	211	210	210	209	208	206	205	204	203	202	201
20	198	199	200	201	202	203	205	205	205	205	204	203	201	199	197	195	194	192	191
25	187	188	189	191	193	195	197	198	198	198	197	195	193	191	188	185	182	181	179
30	175	176	177	180	182	185	187	189	190	190	189	186	184	180	177	173	170	168	166
35	161	162	164	167	170	173	176	179	180	180	179	176	173	169	164	160	156	154	152
40	145	147	149	152	157	161	165	168	170	170	168	166	161	157	151	146	142	139	137
45	130	131	133	138	142	148	152	156	158	159	157	154	149	144	138	132	127	123	121
50	113	114	118	122	128	134	139	144	146	147	145	142	137	131	124	117	112	107	105
55	96.8	98.0	102	107	113	120	126	131	134	134	133	129	124	117	110	103	96.2	91.3	89.0
60	80.4	81.7	85.7	91.6	98.4	105	112	117	121	121	120	116	111	104	96.1	88.3	81.2	75.6	72.8
65	64.1	65.5	70.1	76.6	84.0	91.6	98.3	104	107	108	107	103	97.3	90.3	82.4	74.1	66.4	60.3	56.9
70	48.6	50.0	55.4	62.0	69.9	77.6	84.7	89.9	93.4	94.1	93.0	89.5	84.0	77.1	69.1	60.9	52.7	45.7	41.3
75	33.4	35.0	41.0	48.9	56.9	64.4	71.2	76.6	79.8	80.8	79.5	76.3	71.1	64.5	57.0	48.3	39.7	31.8	26.7
80	19.7	21.5	28.2	36.3	44.7	52.3	59.0	63.4	66.9	67.7	66.6	63.4	59.4	52.9	45.4	37.0	28.2	19.7	13.8
85	8.91	10.6	17.7	26.0	34.3	41.7	48.2	52.9	55.8	56.5	55.6	53.2	48.9	42.9	35.7	27.6	19.0	10.5	4.04
90	2.16	3.94	10.7	18.6	26.4	33.6	39.4	43.9	46.5	47.3	46.6	44.2	40.3	34.9	28.4	20.9	13.1	5.78	0.25
95	0.69	1.54	6.78	13.7	21.1	27.5	32.9	36.9	39.3	40.0	39.5	37.4	33.9	29.0	23.1	16.4	9.54	3.38	0.19
100	0.55	1.15	4.71	10.7	17.1	23.0	27.9	31.6	33.8	34.5	34.0	32.2	29.0	24.5	19.1	13.2	7.15	2.11	0.27
105	0.41	0.89	3.51	8.34	13.9	19.3	23.8	27.1	29.2	29.9	29.5	27.7	24.8	20.8	15.9	10.6	5.35	1.61	0.22
110	0.24	0.52	2.52	6.42	11.3	16.1	20.1	23.2	25.2	25.9	25.4	23.9	21.2	17.6	13.2	8.51	3.72	1.21	0.19
115	0.11	0.28	1.65	4.57	9.05	13.3	17.0	19.7	21.5	22.2	21.8	20.4	18.0	14.7	10.8	6.44	2.39	0.84	0.22
120	0.12	0.23	1.03	2.92	6.48	10.8	14.1	16.6	18.2	18.8	18.5	17.2	15.1	12.1	8.53	3.84	1.87	0.71	0.26
125	0.14	0.23	0.79	1.94	3.80	7.80	11.3	13.7	15.2	15.7	15.4	14.3	12.3	9.50	5.40	3.00	1.38	0.64	0.33
130	0.16	0.24	0.64	1.43	2.56	4.52	7.76	10.5	12.1	12.6	12.3	11.2	9.11	5.95	3.74	2.23	1.09	0.60	0.43
135	0.19	0.25	0.53	1.08	1.87	2.98	4.70	6.42	7.99	8.69	8.40	7.18	5.44	4.15	2.84	1.54	0.90	0.55	0.46
140	0.21	0.27	0.46	0.83	1.40	2.23	3.10	4.18	4.90	5.22	5.09	4.65	3.97	3.06	2.13	1.39	0.81	0.50	0.35
145	0.23	0.28	0.40	0.65	1.03	1.73	2.21	2.64	3.33	3.54	3.50	3.25	2.79	2.23	1.62	1.12	0.74	0.43	0.25
150	0.25	0.28	0.36	0.50	0.68	1.15	1.66	2.01	2.00	2.37	2.33	2.14	1.88	1.55	1.14	0.79	0.50	0.30	0.24
155	0.25	0.27	0.32	0.40	0.57	0.82	1.17	1.39	1.54	1.60	1.56	1.45	1.27	0.99	0.78	0.56	0.40	0.29	0.26
160	0.29	0.31	0.34	0.40	0.45	0.60	0.81	0.93	1.02	1.05	1.03	0.91	0.86	0.70	0.58	0.45	0.35	0.28	0.27
165	0.33	0.36	0.37	0.37	0.40	0.45	0.54	0.62	0.65	0.66	0.65	0.62	0.57	0.49	0.42	0.36	0.30	0.26	0.26
170	0.26	0.27	0.28	0.30	0.33	0.35	0.37	0.40	0.42	0.42	0.41	0.40	0.38	0.36	0.32	0.30	0.28	0.23	0.21
175	0.24	0.24	0.24	0.24	0.25	0.29	0.28	0.30	0.30	0.30	0.29	0.28	0.27	0.27	0.24	0.23	0.22	0.21	0.20
180	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17

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	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216	216		
5	214	214	214	214	214	214	214	214	214	215	215	215	215	215	215	215	216		
10	208	208	209	209	209	210	210	210	211	211	212	212	212	212	212	212	213		
15	201	201	201	202	203	203	204	205	205	206	206	206	206	206	206	206	207		
20	191	191	192	193	194	195	197	198	199	199	200	199	199	199	198	198	198		
25	179	179	180	182	184	186	188	189	190	191	191	191	191	190	189	188	187		
30	166	167	168	170	172	175	178	180	181	182	182	181	180	179	177	176	175		
35	152	152	154	157	160	164	167	169	171	172	172	170	168	166	164	162	161		
40	137	138	141	144	148	151	155	158	160	161	160	159	156	153	150	148	147		
45	121	123	125	130	134	139	143	147	148	149	149	147	144	140	136	133	131		
50	105	107	110	115	121	126	131	135	137	138	137	134	130	126	122	118	115		
55	88.8	91.1	95.6	101	107	113	118	122	124	125	124	121	117	112	107	102	99.2		
60	72.9	75.9	80.7	86.7	93.3	99.5	105	109	112	112	111	108	103	97.5	91.6	86.6	82.7		
65	56.8	60.7	66.2	73.4	79.7	86.6	92.0	96.0	98.2	99.0	97.4	94.2	89.2	83.6	77.1	71.3	67.0		
70	41.6	46.1	52.6	59.8	67.0	73.6	78.8	82.8	85.4	85.5	84.3	80.7	75.8	69.8	63.3	56.9	51.7		
75	27.7	32.9	40.2	47.7	54.9	61.2	66.4	70.2	72.2	72.6	71.3	67.8	63.1	56.9	50.1	43.2	37.3		
80	15.2	21.4	29.0	36.7	43.8	50.0	55.0	58.7	60.4	60.7	59.3	56.2	51.2	45.3	38.2	31.1	24.3		
85	6.07	12.6	20.1	27.9	34.7	40.5	45.2	48.5	50.2	50.2	49.0	45.9	41.3	35.4	28.4	21.1	14.0		
90	1.84	7.51	14.5	21.4	27.8	33.2	37.4	40.4	41.7	42.0	40.7	38.0	33.5	28.0	21.3	14.2	7.38		
95	0.77	4.68	10.7	17.0	22.8	27.8	31.7	34.4	35.7	35.9	34.6	32.1	27.9	22.8	16.5	10.0	4.10		
100	0.71	2.35	8.02	13.6	19.0	23.6	27.3	29.8	30.9	31.0	29.9	27.4	23.6	18.8	13.1	7.44	2.81		
105	0.46	2.43	5.60	10.7	15.7	20.0	23.4	25.7	26.8	26.8	25.8	23.4	19.8	15.4	10.3	5.55	2.11		
110	0.29	1.29	3.69	7.47	12.5	16.7	19.8	22.0	23.0	23.0	22.0	19.7	16.4	12.1	7.50	3.68	1.16		
115	0.28	0.96	2.57	3.93	8.09	12.9	16.3	18.4	19.4	19.4	18.3	16.0	12.3	7.96	4.55	2.10	0.59		
120	0.31	0.78	1.72	3.09	4.06	7.13	11.3	13.8	15.0	14.9	13.5	10.5	6.76	4.48	2.79	1.36	0.44		
125	0.37	0.67	1.23	2.09	3.04	4.41	5.70	7.31	8.33	8.16	6.89	5.29	4.02	2.99	1.92	0.98	0.37		
130	0.49	0.61	0.91	1.49	2.09	3.07	3.93	4.58	4.88	4.79	4.28	3.36	2.74	2.09	1.37	0.75	0.33		
135	0.52	0.55	0.53	1.12	1.51	2.16	2.63	2.96	3.17	3.12	2.80	2.24	1.93	1.50	1.02	0.60	0.32		
140	0.36	0.43	0.59	0.68	1.04	1.42	1.74	2.00	2.15	2.12	1.90	1.59	1.40	1.10	0.78	0.50	0.32		
145	0.22	0.25	0.33	0.49	0.51	0.97	1.22	1.40	1.51	1.50	1.37	1.20	1.02	0.82	0.61	0.43	0.32		
150	0.23	0.25	0.31	0.41	0.57	0.74	0.70	0.98	1.06	1.08	0.96	0.90	0.80	0.65	0.51	0.39	0.32		
155	0.24	0.24	0.29	0.37	0.46	0.56	0.64	0.65	0.73	0.73	0.68	0.61	0.57	0.50	0.43	0.36	0.32		
160	0.24	0.26	0.28	0.33	0.37	0.43	0.47	0.42	0.43	0.53	0.50	0.45	0.43	0.39	0.36	0.34	0.34		
165	0.26	0.23	0.27	0.29	0.31	0.33	0.36	0.37	0.34	0.35	0.38	0.35	0.34	0.33	0.31	0.30	0.32		
170	0.21	0.23	0.26	0.27	0.28	0.29	0.29	0.30	0.30	0.29	0.30	0.30	0.29	0.29	0.29	0.27	0.27		
175	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.24	0.24	0.22	0.23	0.24	0.23	0.24	0.25	0.25	0.25		
180	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17		

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

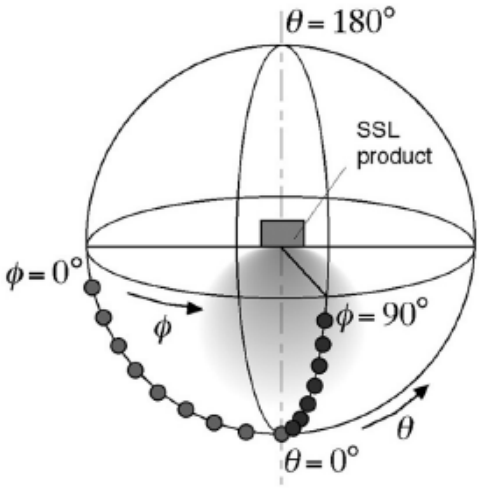
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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