NVLAP LAB CODE 200960-0

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED BR40

Model: 10.5BR40DIM/8CCTD

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.: HZ16100031f

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

Review by: April Zou

Engineer: April Zou

Nov. 01, 2016

Approved by:

Manager: Jim Zhang

Nov. 01, 2016

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: **10.5BR40DIM/8CCTD**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
79.1	830.2	10.50	0.9513

CCT (K)	CRI	Stabilization Time (Light & Power)
2790	83.9	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	: Oct. 26, 2016
Date of Test	: Oct. 31, 2016
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	: LED BR40
Model	: 10.5BR40DIM/8CCTD
Electrical Ratings	: 120Vac, 60Hz, 10.5W
Product Description	: E26 base, 2200-2700K
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
Voltage frequency (Hz)	60
Test Current (A)	0.092
Power Factor	0.9513
Test Power (W)	10.50
THD A%	17.07
Luminous Efficacy (lm/W)	79.1
Total Luminous Flux (lm)	830.2
Color Rendering Index (CRI)	83.9
R9	15.9
Correlated Color Temperature (CCT)(K)	2790
Chromaticity Chroma x	0.4503
Chromaticity Chroma y	0.4047
Chromaticity Chroma u	0.2590
Chromaticity Chroma v	0.3491
Duv	0.0014
Chromaticity Chroma u ’	0.2590
Chromaticity Chroma v’	0.5236

Special Color Rendering Indices	
R1	82.5
R2	91.3
R3	96.9
R4	82.4
R5	82.6
R6	89.9
R7	83.5
R8	61.8
R9	15.9
R10	80.4
R11	82.3
R12	77.2
R13	84.5
R14	98.8

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)	0.093
Power Factor	0.9504
Test Power (W)	10.58
Luminous Efficacy (lm/W)	80.8
Total Luminous Flux (lm)	854.6
Beam Angle (°)	116.4
Center Beam Candle Power (cd)	265
Spacing Criteria	1.31 (0°-180°)/ 1.27 (90°-270°)
Zonal Lumens in the 0°-60°Zone	71.58%
Zonal Lumens in the 60°-90°Zone	24.70%
Zonal Lumens in the 90°-120°Zone	3.32%
Zonal Lumens in the 120°-180°Zone	0.40%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

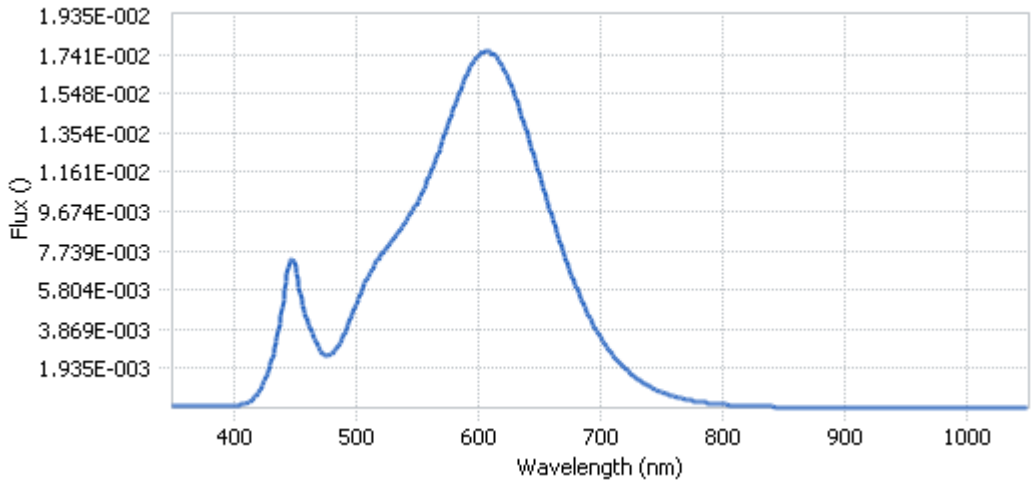
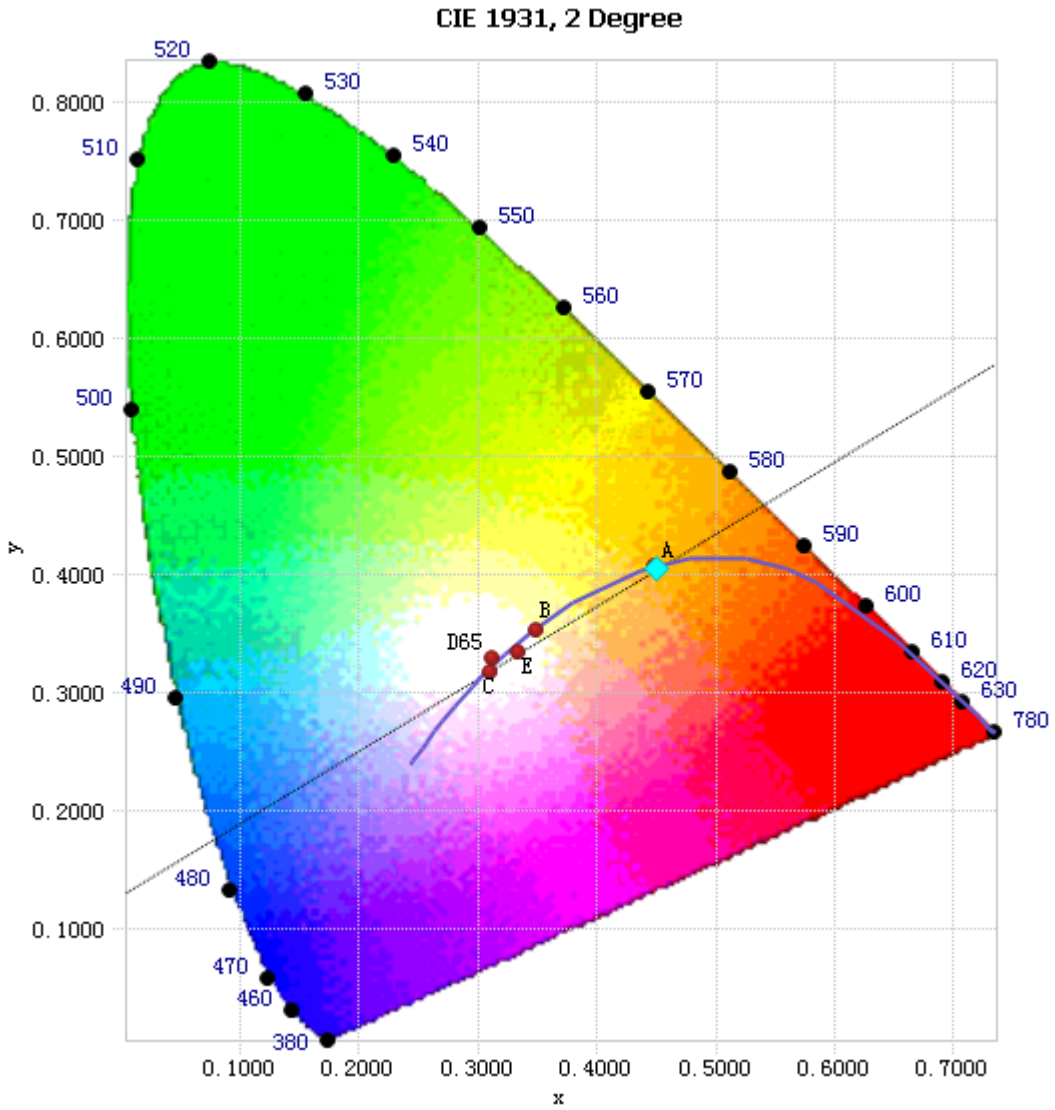


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.15E-04	485	2.98E-03	590	1.63E-02	695	4.08E-03
385	1.20E-04	490	3.52E-03	595	1.69E-02	700	3.55E-03
390	1.17E-04	495	4.25E-03	600	1.73E-02	705	3.09E-03
395	1.23E-04	500	5.04E-03	605	1.75E-02	710	2.67E-03
400	1.31E-04	505	5.75E-03	610	1.76E-02	715	2.32E-03
405	1.51E-04	510	6.42E-03	615	1.74E-02	720	2.01E-03
410	2.04E-04	515	6.99E-03	620	1.69E-02	725	1.73E-03
415	3.62E-04	520	7.43E-03	625	1.63E-02	730	1.49E-03
420	7.36E-04	525	7.83E-03	630	1.55E-02	735	1.26E-03
425	1.29E-03	530	8.24E-03	635	1.46E-02	740	1.09E-03
430	2.07E-03	535	8.62E-03	640	1.37E-02	745	9.33E-04
435	3.22E-03	540	9.07E-03	645	1.27E-02	750	8.03E-04
440	4.95E-03	545	9.54E-03	650	1.17E-02	755	6.89E-04
445	6.95E-03	550	1.00E-02	655	1.06E-02	760	5.94E-04
450	7.17E-03	555	1.07E-02	660	9.64E-03	765	5.10E-04
455	5.64E-03	560	1.13E-02	665	8.64E-03	770	4.36E-04
460	4.43E-03	565	1.21E-02	670	7.73E-03	775	3.75E-04
465	3.62E-03	570	1.29E-02	675	6.87E-03	780	3.23E-04
470	2.95E-03	575	1.38E-02	680	6.07E-03		
475	2.61E-03	580	1.47E-02	685	5.35E-03		
480	2.68E-03	585	1.55E-02	690	4.70E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4503, 0.4047)

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

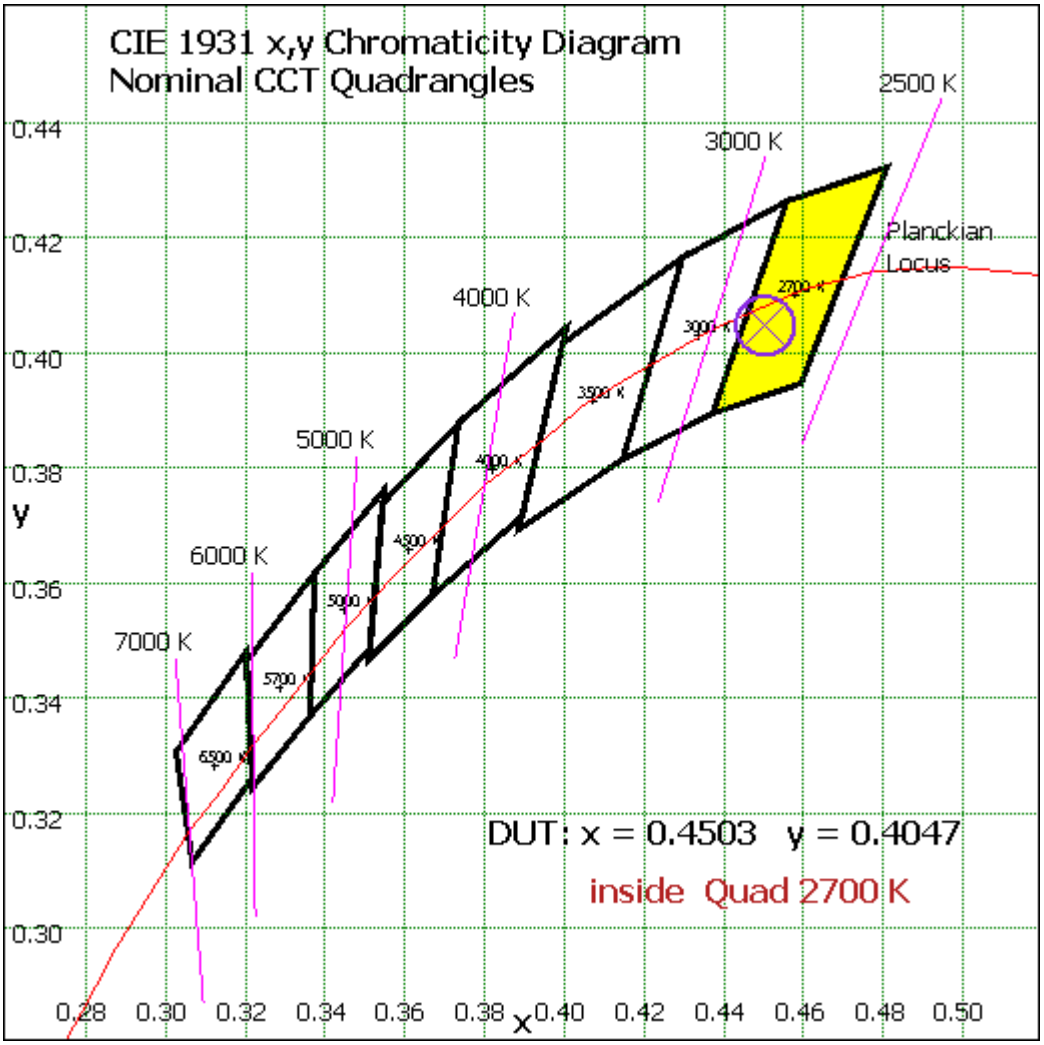


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	25.094	2.94%
10- 20	72.07	8.43%
20- 30	109.884	12.86%
30- 40	133.791	15.66%
40- 50	140.774	16.47%
50- 60	130.07	15.22%
60- 70	103.681	12.13%
70- 80	69.427	8.12%
80- 90	37.978	4.44%
90-100	17.173	2.01%
100-110	7.446	0.87%
110-120	3.791	0.44%
120-130	1.961	0.23%
130-140	0.871	0.10%
140-150	0.334	0.04%
150-160	0.136	0.02%
160-170	0.071	0.01%
170-180	0.023	0.00%
Total	854.6	100%

γ(°)	Lumens	% Total
0- 60	611.683	71.58%
60- 90	211.086	24.70%
0-90	822.769	96.28%
90- 180	31.806	3.72%
0- 180	854.6	100%

Table 5: Zonal Lumen Data

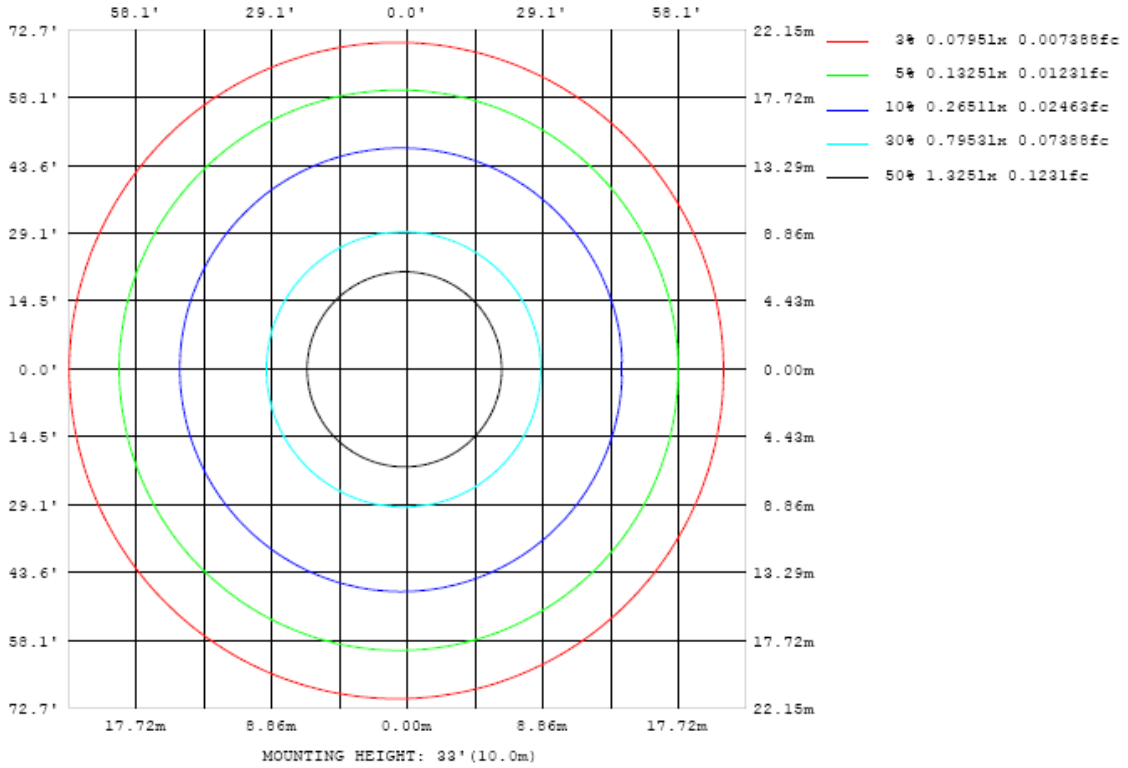


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

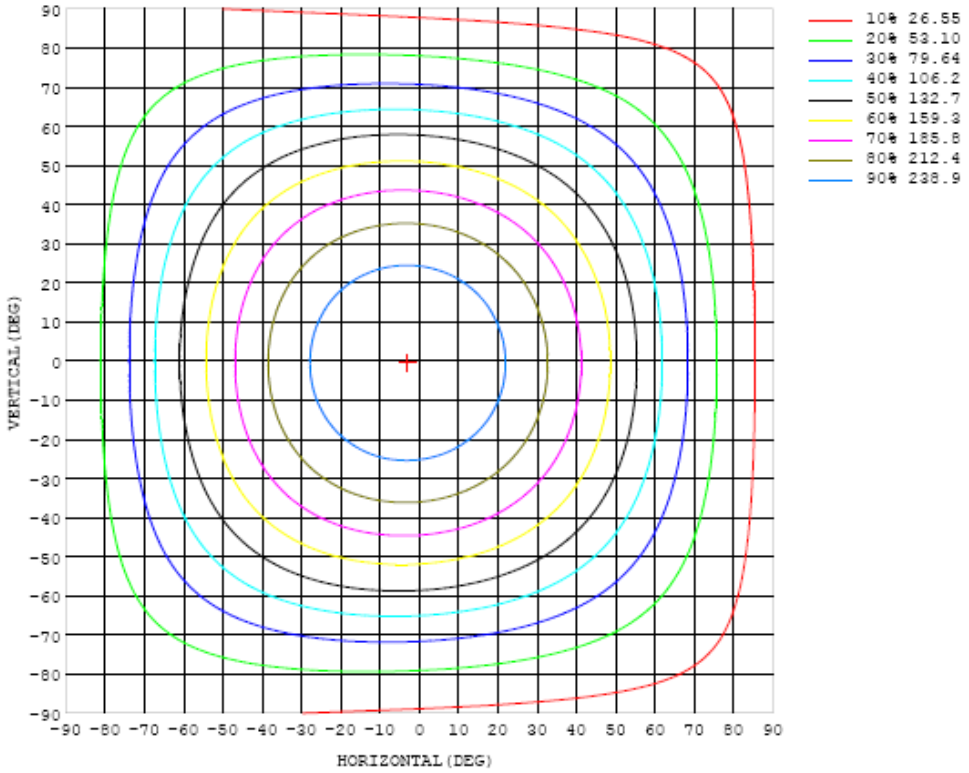


Chart 5: Isocandela Plot

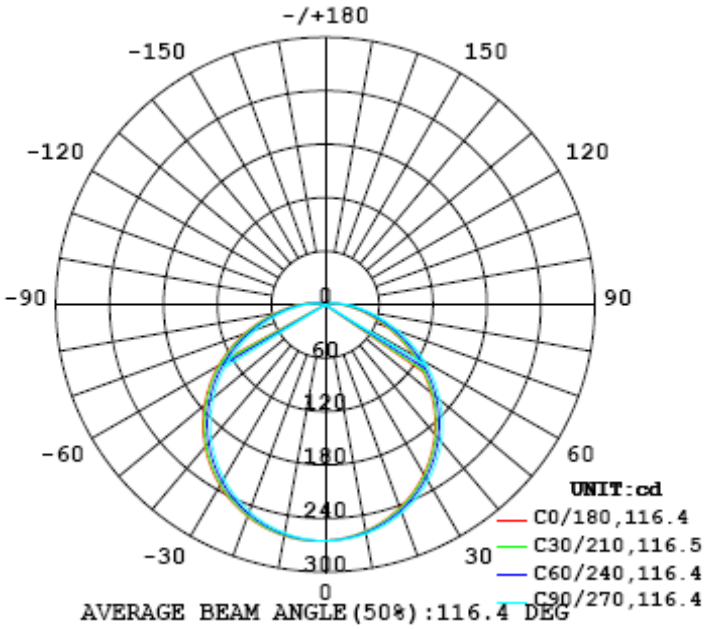


Chart 6: Polar Candela Distribution

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	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265
5	263	263	263	263	263	263	263	264	264	264	264	265	265	265	265	265	265	265	265
10	258	258	258	259	259	259	260	260	261	261	262	262	262	263	263	263	263	263	263
15	251	252	252	252	253	253	254	255	255	256	257	257	258	258	259	259	259	259	259
20	243	243	243	244	244	245	246	247	248	249	249	250	251	252	252	253	253	253	253
25	232	232	233	233	234	235	236	237	238	239	240	241	242	243	244	244	245	245	245
30	220	220	221	221	222	223	224	226	227	228	229	231	232	233	233	234	234	235	234
35	205	206	207	207	208	210	211	212	214	215	217	218	219	220	221	222	222	222	222
40	190	190	191	192	193	194	196	197	199	200	202	204	205	206	207	208	208	208	208
45	172	173	174	175	176	177	179	181	182	184	186	187	189	190	191	192	193	193	193
50	154	154	155	156	158	159	161	163	164	166	168	170	171	173	174	175	175	175	175
55	134	135	135	137	138	140	141	143	145	147	149	151	153	154	155	156	157	157	157
60	113	114	115	116	118	119	121	123	125	127	129	131	133	134	135	136	137	137	137
65	92.9	93.5	94.5	95.7	97.1	98.8	101	103	105	106	108	110	112	113	115	115	116	116	117
70	73.2	73.8	74.7	75.9	77.2	78.8	80.6	82.4	84.3	86.2	88.0	89.8	91.3	92.7	93.8	94.6	95.2	95.4	95.8
75	55.5	56.1	56.9	58.0	59.3	60.7	62.3	64.0	65.8	67.3	68.8	70.3	71.6	72.9	73.9	74.7	75.2	75.4	75.6
80	40.0	40.5	41.2	42.1	43.2	44.5	45.9	47.3	48.7	50.1	51.5	52.9	54.1	55.2	56.1	56.7	57.2	57.3	57.1
85	27.5	27.9	28.4	29.2	30.1	31.1	32.2	33.4	34.5	35.6	36.8	37.9	38.8	39.7	40.4	40.9	41.2	41.3	41.1
90	18.2	18.5	18.9	19.5	20.1	20.9	21.7	22.6	23.4	24.2	25.0	25.8	26.6	27.2	27.7	28.1	28.4	28.4	28.4
95	11.8	12.0	12.3	12.7	13.2	13.7	14.3	14.8	15.4	16.0	16.5	17.1	17.5	18.0	18.3	18.6	18.8	18.8	18.8
100	7.85	8.00	8.20	8.45	8.74	9.06	9.40	9.76	10.1	10.5	10.8	11.2	11.5	11.7	11.9	12.1	12.2	12.3	12.2
105	5.49	5.59	5.72	5.88	6.05	6.25	6.45	6.66	6.91	7.14	7.35	7.55	7.70	7.84	7.95	8.05	8.11	8.14	8.10
110	4.14	4.21	4.30	4.41	4.52	4.64	4.76	4.89	5.02	5.13	5.24	5.34	5.43	5.50	5.57	5.62	5.65	5.68	5.70
115	3.20	3.26	3.34	3.42	3.51	3.60	3.68	3.77	3.86	3.93	4.00	4.06	4.11	4.15	4.18	4.21	4.23	4.25	4.28
120	2.43	2.48	2.54	2.61	2.68	2.75	2.83	2.90	2.96	3.02	3.08	3.12	3.16	3.19	3.22	3.23	3.25	3.26	3.29
125	1.79	1.83	1.88	1.94	1.99	2.05	2.11	2.16	2.22	2.27	2.31	2.34	2.37	2.40	2.42	2.43	2.44	2.45	2.48
130	1.28	1.31	1.35	1.40	1.44	1.48	1.52	1.57	1.61	1.65	1.68	1.71	1.73	1.74	1.76	1.76	1.77	1.78	1.82
135	0.89	0.91	0.94	0.97	1.00	1.03	1.07	1.10	1.13	1.16	1.18	1.20	1.21	1.22	1.23	1.24	1.24	1.25	1.28
140	0.61	0.62	0.64	0.67	0.69	0.71	0.73	0.75	0.77	0.79	0.80	0.82	0.82	0.83	0.83	0.84	0.84	0.84	0.88
145	0.42	0.43	0.44	0.46	0.47	0.48	0.50	0.51	0.52	0.53	0.54	0.54	0.54	0.54	0.54	0.55	0.55	0.55	0.59
150	0.30	0.31	0.32	0.33	0.34	0.34	0.35	0.36	0.36	0.36	0.36	0.36	0.36	0.35	0.35	0.35	0.35	0.35	0.40
155	0.25	0.26	0.27	0.27	0.27	0.28	0.28	0.28	0.27	0.27	0.26	0.26	0.25	0.25	0.25	0.25	0.25	0.24	0.30
160	0.24	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.24	0.24	0.23	0.22	0.22	0.21	0.21	0.21	0.21	0.26
165	0.24	0.24	0.25	0.25	0.25	0.26	0.25	0.25	0.24	0.23	0.23	0.22	0.22	0.21	0.21	0.21	0.21	0.20	0.24
170	0.24	0.24	0.25	0.25	0.25	0.26	0.25	0.25	0.24	0.23	0.23	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.23
175	0.25	0.25	0.26	0.26	0.26	0.26	0.25	0.25	0.24	0.23	0.23	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
180	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19

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	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265		
5	265	265	265	265	265	264	264	264	264	264	263	263	263	263	263	263	263		
10	263	263	263	262	262	262	261	261	260	260	259	259	259	258	258	258	258		
15	259	259	258	258	257	257	256	255	255	254	253	253	252	252	252	251	251		
20	253	252	252	251	251	250	249	248	247	246	245	245	244	243	243	243	243		
25	244	244	243	242	242	241	240	238	237	236	235	234	234	233	232	232	232		
30	234	234	233	232	231	230	228	227	226	225	223	222	221	221	220	220	220		
35	222	221	220	219	218	217	216	214	213	211	210	208	207	207	206	206	205		
40	208	207	206	205	204	202	201	199	197	196	194	193	192	191	190	190	190		
45	192	191	191	189	188	186	184	183	181	179	178	176	175	174	173	172	172		
50	175	174	173	172	170	168	166	165	163	161	160	158	157	156	155	154	154		
55	157	156	155	153	152	150	148	146	144	142	140	139	137	136	135	135	135		
60	137	136	135	133	132	129	128	126	124	122	120	118	116	115	114	114	114		
65	116	115	114	112	111	109	107	105	103	101	99.0	97.2	95.7	94.8	93.6	93.3	93.1		
70	95.2	94.3	93.0	91.7	90.1	88.4	86.4	84.3	82.4	80.6	78.8	77.2	75.7	74.7	73.8	73.4	73.4		
75	75.1	74.3	73.3	71.9	70.5	68.8	67.2	65.1	63.6	61.7	60.2	58.6	57.3	56.4	55.7	55.3	55.4		
80	56.8	56.0	55.2	54.0	52.7	51.3	49.9	48.2	46.8	45.3	43.9	42.8	41.6	40.6	40.1	39.9	39.8		
85	41.0	40.4	39.8	38.7	37.8	36.6	35.5	34.0	32.9	31.8	30.6	29.6	28.7	28.0	27.6	27.3	27.3		
90	28.2	27.8	27.2	26.6	25.9	25.0	24.1	23.2	22.2	21.3	20.4	19.7	19.1	18.6	18.2	18.0	18.0		
95	18.7	18.4	18.0	17.6	17.0	16.5	15.9	15.3	14.6	13.8	13.2	12.7	12.3	11.9	11.7	11.6	11.6		
100	12.1	11.9	11.7	11.4	11.1	10.7	10.3	9.87	9.45	9.06	8.68	8.36	8.09	7.90	7.77	7.71	7.73		
105	8.05	7.96	7.83	7.66	7.47	7.23	6.98	6.72	6.47	6.22	5.99	5.79	5.64	5.52	5.45	5.42	5.44		
110	5.68	5.64	5.57	5.47	5.35	5.21	5.06	4.89	4.73	4.57	4.42	4.30	4.20	4.13	4.09	4.08	4.11		
115	4.27	4.25	4.21	4.15	4.07	3.97	3.86	3.75	3.64	3.52	3.41	3.31	3.24	3.19	3.15	3.15	3.18		
120	3.29	3.28	3.25	3.20	3.13	3.05	2.96	2.87	2.78	2.68	2.59	2.51	2.45	2.41	2.38	2.38	2.41		
125	2.48	2.47	2.44	2.41	2.35	2.29	2.21	2.14	2.07	1.99	1.92	1.86	1.81	1.77	1.75	1.76	1.78		
130	1.82	1.81	1.79	1.76	1.71	1.66	1.61	1.55	1.50	1.44	1.38	1.33	1.29	1.27	1.25	1.26	1.28		
135	1.29	1.28	1.27	1.24	1.21	1.17	1.13	1.09	1.05	1.01	0.97	0.93	0.90	0.89	0.88	0.89	0.90		
140	0.89	0.88	0.87	0.85	0.83	0.80	0.78	0.75	0.72	0.70	0.67	0.64	0.62	0.61	0.61	0.62	0.63		
145	0.60	0.59	0.59	0.58	0.56	0.54	0.53	0.51	0.50	0.48	0.46	0.45	0.44	0.44	0.44	0.45	0.45		
150	0.41	0.41	0.40	0.40	0.39	0.38	0.38	0.37	0.36	0.35	0.34	0.34	0.34	0.34	0.34	0.35	0.35		
155	0.31	0.31	0.30	0.30	0.29	0.29	0.30	0.29	0.29	0.29	0.29	0.29	0.30	0.30	0.30	0.31	0.31		
160	0.28	0.27	0.27	0.27	0.26	0.26	0.27	0.27	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.30	0.29		
165	0.26	0.26	0.26	0.25	0.26	0.25	0.26	0.26	0.26	0.27	0.27	0.27	0.28	0.28	0.28	0.29	0.28		
170	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.27	0.27	0.27	0.28	0.26		
175	0.24	0.25	0.24	0.24	0.24	0.24	0.24	0.25	0.24	0.23	0.23	0.23	0.24	0.26	0.26	0.27	0.25		
180	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19		

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

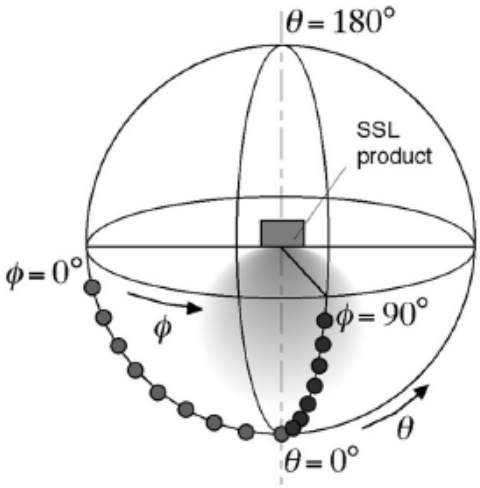
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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