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: 14BR40DIM/830

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ16110006a

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. 04, 2016

Approved by:

Manager: Jim Zhang

Nov. 04, 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: **14BR40DIM/830**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
96.7	1272.0	13.15	0.9186

CCT (K)	CRI	Stabilization Time (Light & Power)
3047	81.8	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	: Nov. 03, 2016
Date of Test	: Nov. 03, 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	: 14BR40DIM/830
Electrical Ratings	: 120Vac, 60Hz, 14W
Product Description	: E26 base, 3000K
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)	0.119
Power Factor	0.9186
Test Power (W)	13.15
THD A%	33.79
Luminous Efficacy (lm/W)	96.7
Total Luminous Flux (lm)	1272.0
Color Rendering Index (CRI)	81.8
R9	3.9
Correlated Color Temperature (CCT)(K)	3047
Chromaticity Chroma x	0.4355
Chromaticity Chroma y	0.4072
Chromaticity Chroma u	0.2483
Chromaticity Chroma v	0.3483
Duv	0.0014
Chromaticity Chroma u ’	0.2483
Chromaticity Chroma v’	0.5224

Special Color Rendering Indices	
R1	79.8
R2	90.7
R3	96.1
R4	78.9
R5	79.9
R6	88.6
R7	82.5
R8	57.8
R9	3.9
R10	78.7
R11	77.6
R12	69.6
R13	82.4
R14	98.5
Rf	83
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 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)	0.120
Power Factor	0.9178
Test Power (W)	13.19
Luminous Efficacy (lm/W)	100.0
Total Luminous Flux (lm)	1318.6
Beam Angle (°)	116.6
Center Beam Candle Power (cd)	407
Spacing Criteria	1.31 (0°-180°)/ 1.27 (90°-270°)
Zonal Lumens in the 0°-60°Zone	71.31%
Zonal Lumens in the 60°-90°Zone	24.82%
Zonal Lumens in the 90°-120°Zone	3.43%
Zonal Lumens in the 120°-180°Zone	0.45%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

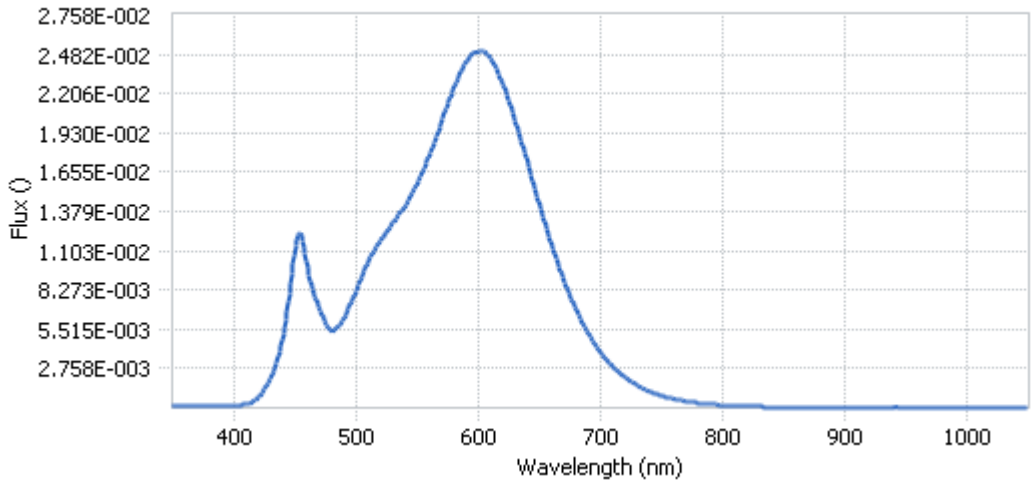
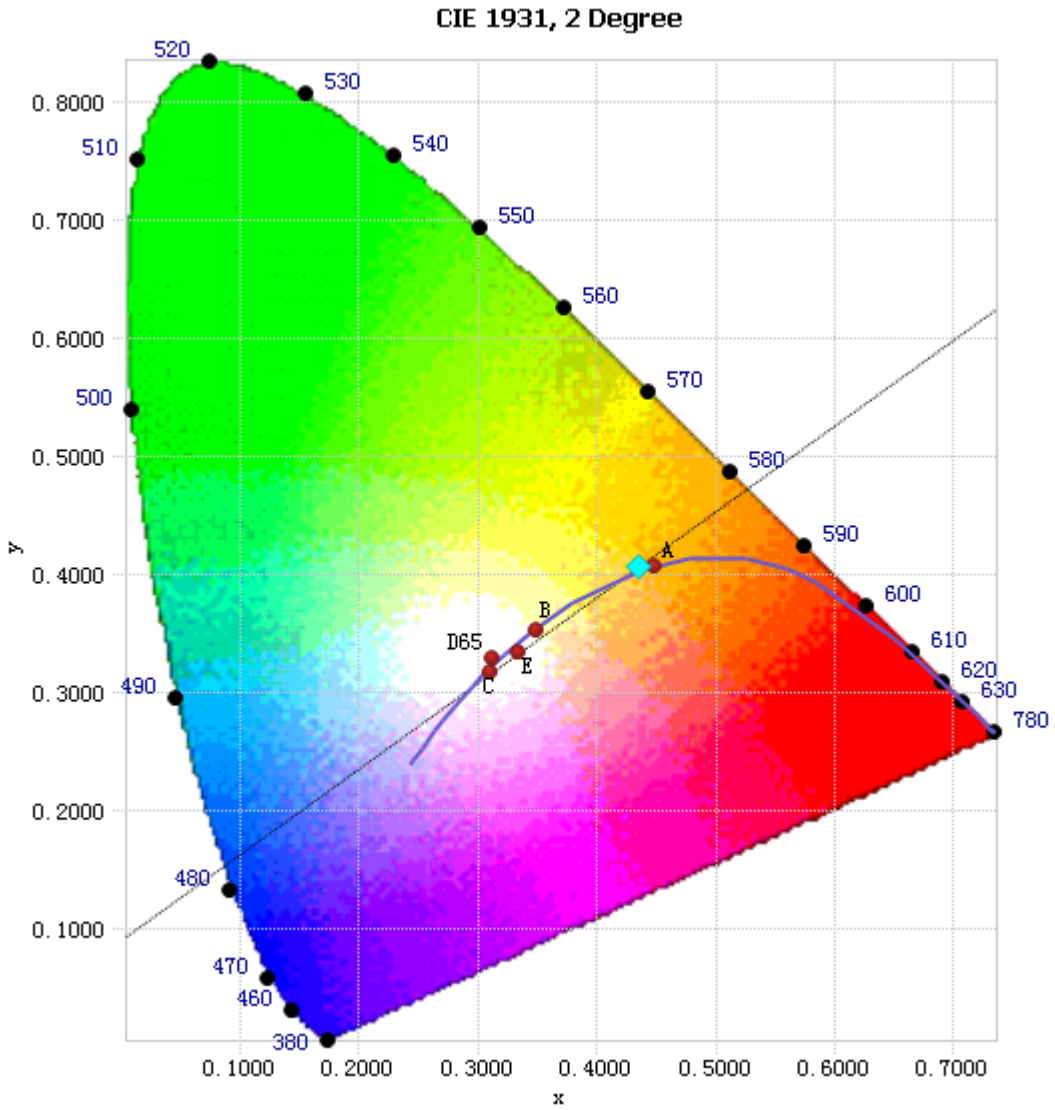


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.76E-04	485	5.66E-03	590	2.42E-02	695	4.62E-03
385	1.66E-04	490	6.23E-03	595	2.48E-02	700	3.99E-03
390	1.70E-04	495	7.15E-03	600	2.51E-02	705	3.45E-03
395	1.76E-04	500	8.15E-03	605	2.50E-02	710	2.96E-03
400	1.83E-04	505	9.16E-03	610	2.46E-02	715	2.56E-03
405	2.09E-04	510	1.01E-02	615	2.40E-02	720	2.22E-03
410	2.56E-04	515	1.10E-02	620	2.30E-02	725	1.90E-03
415	3.91E-04	520	1.17E-02	625	2.17E-02	730	1.63E-03
420	7.18E-04	525	1.23E-02	630	2.04E-02	735	1.40E-03
425	1.25E-03	530	1.29E-02	635	1.90E-02	740	1.19E-03
430	1.98E-03	535	1.35E-02	640	1.75E-02	745	1.03E-03
435	3.09E-03	540	1.41E-02	645	1.60E-02	750	8.83E-04
440	4.76E-03	545	1.49E-02	650	1.45E-02	755	7.60E-04
445	7.41E-03	550	1.56E-02	655	1.31E-02	760	6.53E-04
450	1.08E-02	555	1.66E-02	660	1.17E-02	765	5.69E-04
455	1.23E-02	560	1.76E-02	665	1.04E-02	770	4.87E-04
460	1.03E-02	565	1.88E-02	670	9.15E-03	775	4.18E-04
465	8.25E-03	570	2.00E-02	675	8.07E-03	780	3.61E-04
470	7.09E-03	575	2.12E-02	680	7.07E-03		
475	6.03E-03	580	2.23E-02	685	6.16E-03		
480	5.50E-03	585	2.34E-02	690	5.34E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4355, 0.4072)

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

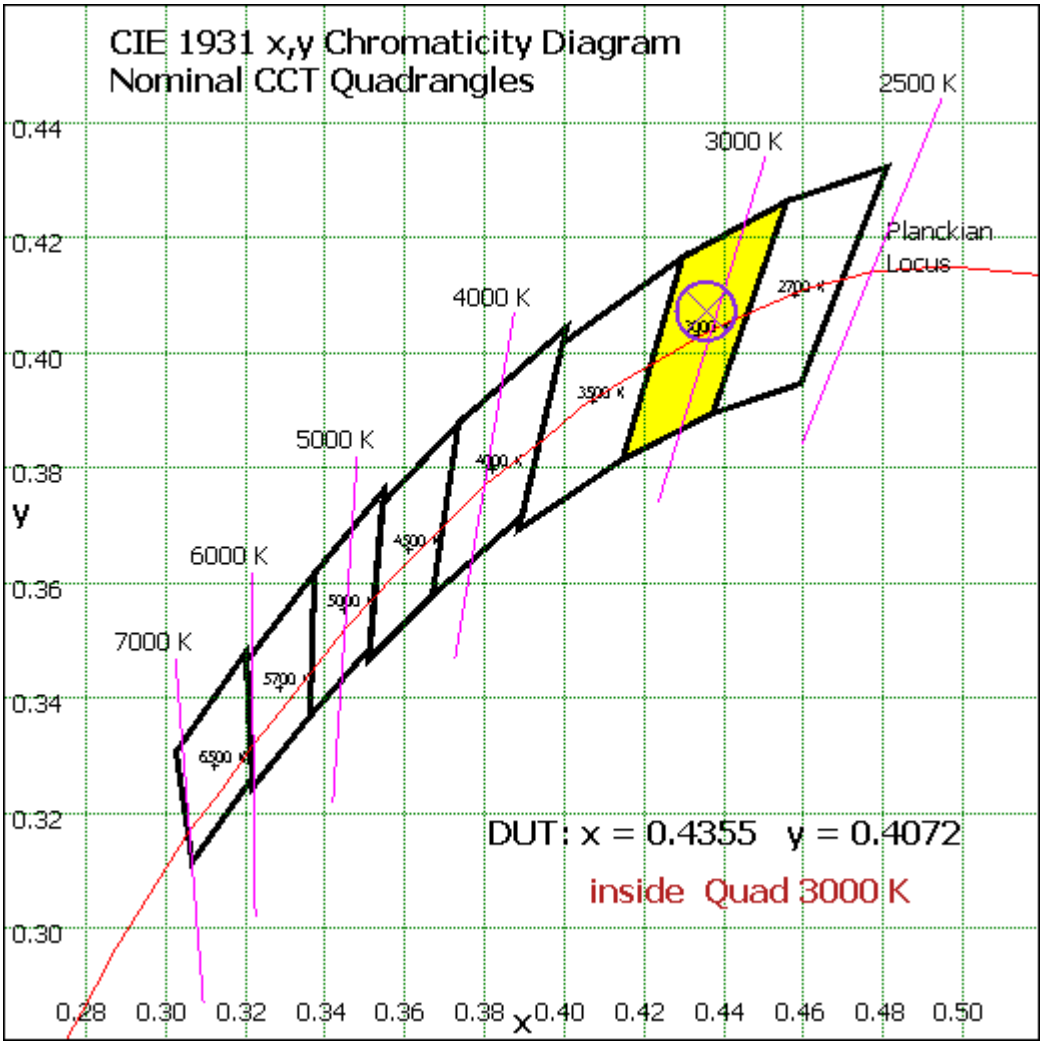


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	38.514	2.92%
10- 20	110.64	8.39%
20- 30	168.771	12.80%
30- 40	205.633	15.60%
40- 50	216.554	16.42%
50- 60	200.153	15.18%
60- 70	160.139	12.14%
70- 80	107.683	8.17%
80- 90	59.394	4.50%
90-100	27.178	2.06%
100-110	11.897	0.90%
110-120	6.128	0.46%
120-130	3.247	0.25%
130-140	1.519	0.12%
140-150	0.641	0.05%
150-160	0.287	0.02%
160-170	0.147	0.01%
170-180	0.045	0.00%
Total	1318.6	100%

γ(°)	Lumens	% Total
0- 60	940.265	71.31%
60- 90	327.216	24.82%
0-90	1267.481	96.13%
90- 180	51.089	3.87%
0- 180	1318.6	100%

Table 5: Zonal Lumen Data

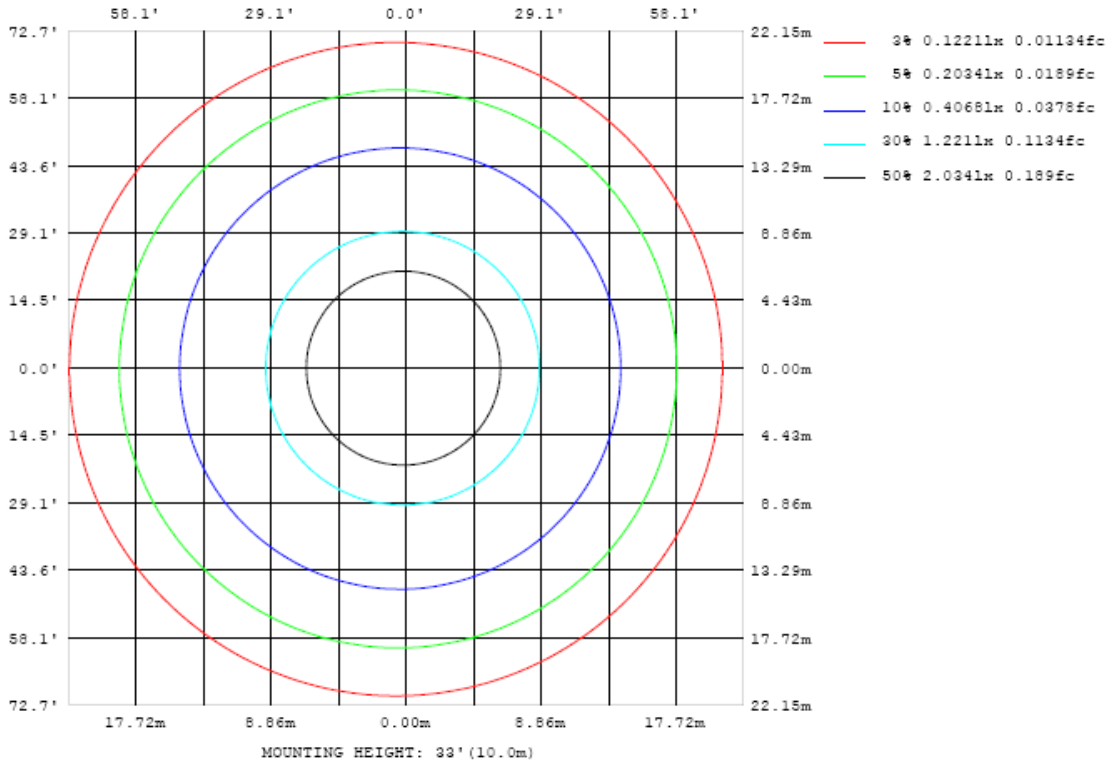


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

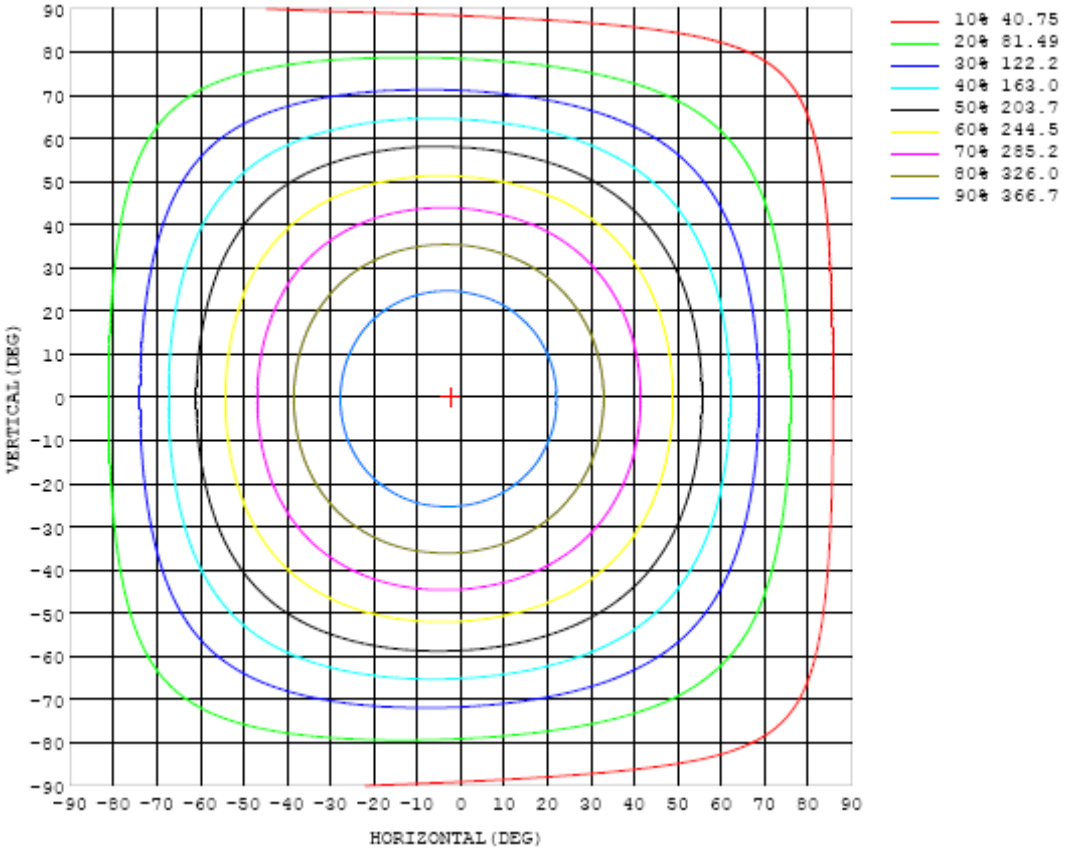


Chart 5: Isocandela Plot

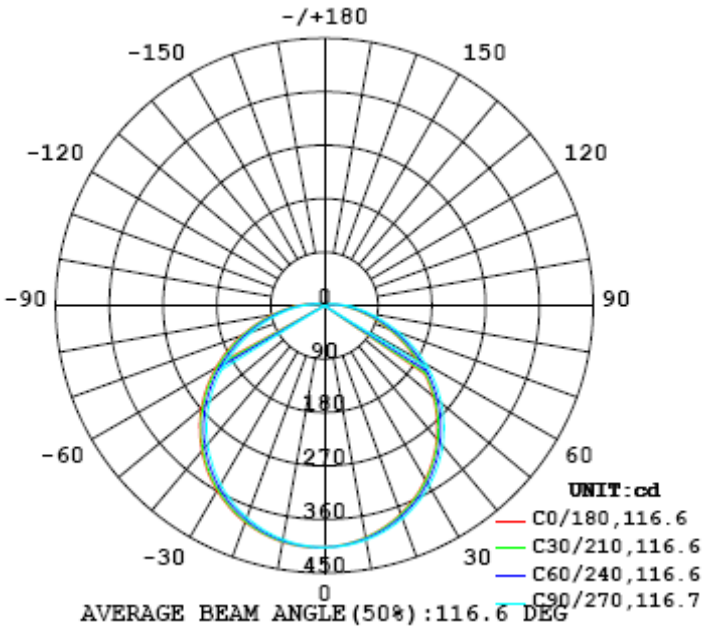


Chart 6: Polar Candela Distribution

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	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407
5	403	403	403	404	404	404	404	405	405	405	406	406	406	406	407	407	407	407	407
10	396	396	397	397	398	398	398	399	400	401	401	402	403	403	403	404	404	404	404
15	386	386	387	387	388	389	390	391	392	393	393	395	395	396	397	397	398	397	398
20	373	373	374	375	375	376	377	379	380	381	383	384	385	386	387	387	388	388	388
25	357	357	358	359	360	361	362	364	366	367	369	370	372	373	374	374	375	375	375
30	338	338	339	340	342	343	345	346	348	350	352	354	355	356	358	359	359	359	359
35	317	317	318	319	320	322	324	326	328	330	332	334	336	337	339	340	341	341	341
40	292	293	294	295	297	299	301	303	305	308	310	312	314	316	317	318	319	319	320
45	266	267	268	269	271	273	275	278	280	283	285	288	290	292	293	294	295	295	295
50	238	238	239	241	243	245	247	250	253	255	258	261	263	265	267	268	269	269	269
55	207	208	209	211	213	215	218	220	223	226	229	232	234	236	238	239	240	240	241
60	176	177	178	179	182	184	187	189	192	195	198	201	204	206	208	209	210	210	210
65	145	145	146	148	150	152	155	158	161	164	167	170	172	174	176	177	178	178	178
70	114	115	116	117	119	122	124	127	130	133	136	138	141	143	144	146	146	147	147
75	86.4	86.9	88.1	89.4	91.2	93.2	95.5	98.2	101	103	106	109	111	112	114	115	116	116	116
80	62.7	63.2	64.1	65.0	67.1	68.4	70.4	72.5	74.8	77.3	79.5	81.6	83.4	84.8	86.2	87.1	87.6	87.7	87.9
85	43.4	43.6	44.4	45.3	46.6	48.1	49.7	51.6	53.5	55.5	57.3	59.0	60.4	61.6	62.6	63.3	63.7	63.7	63.6
90	28.8	28.9	29.5	30.2	31.1	32.2	33.6	34.9	36.5	37.9	39.3	40.5	41.6	42.5	43.2	43.7	44.0	44.0	43.9
95	18.8	18.8	19.2	19.6	20.3	21.1	22.0	22.9	24.0	25.0	25.9	26.8	27.6	28.2	28.7	29.0	29.3	29.3	29.2
100	12.5	12.5	12.7	13.0	13.3	13.9	14.4	15.0	15.7	16.4	17.0	17.6	18.0	18.4	18.7	19.0	19.1	19.1	19.1
105	8.82	8.80	8.89	9.04	9.28	9.59	9.92	10.3	10.7	11.1	11.5	11.8	12.1	12.3	12.5	12.6	12.7	12.7	12.6
110	6.59	6.58	6.62	6.72	6.90	7.11	7.34	7.61	7.86	8.11	8.32	8.53	8.69	8.81	8.89	8.93	8.93	8.90	8.83
115	5.13	5.09	5.13	5.21	5.32	5.48	5.66	5.85	6.03	6.21	6.34	6.48	6.58	6.64	6.67	6.67	6.66	6.63	6.63
120	3.90	3.88	3.90	3.96	4.06	4.18	4.35	4.51	4.66	4.80	4.93	5.03	5.11	5.16	5.19	5.18	5.16	5.13	5.15
125	2.90	2.86	2.89	2.93	3.01	3.11	3.24	3.38	3.51	3.62	3.73	3.82	3.89	3.93	3.96	3.95	3.93	3.91	3.94
130	2.09	2.06	2.07	2.11	2.16	2.25	2.35	2.46	2.56	2.66	2.74	2.82	2.88	2.92	2.94	2.93	2.92	2.90	2.94
135	1.47	1.44	1.45	1.47	1.51	1.57	1.66	1.74	1.82	1.90	1.97	2.03	2.08	2.11	2.12	2.12	2.11	2.10	2.15
140	1.02	1.00	1.00	1.01	1.04	1.09	1.15	1.21	1.26	1.32	1.38	1.43	1.46	1.49	1.50	1.50	1.49	1.48	1.55
145	0.72	0.70	0.69	0.70	0.72	0.75	0.79	0.83	0.87	0.92	0.96	0.99	1.02	1.03	1.04	1.04	1.04	1.03	1.10
150	0.53	0.52	0.51	0.51	0.52	0.54	0.57	0.59	0.62	0.65	0.67	0.70	0.72	0.72	0.73	0.73	0.72	0.72	0.81
155	0.45	0.44	0.43	0.42	0.42	0.44	0.46	0.47	0.49	0.51	0.52	0.53	0.54	0.54	0.55	0.55	0.54	0.54	0.62
160	0.43	0.42	0.41	0.40	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.48	0.48	0.48	0.48	0.47	0.54
165	0.42	0.41	0.40	0.39	0.39	0.40	0.40	0.40	0.42	0.43	0.44	0.45	0.46	0.46	0.46	0.46	0.46	0.46	0.51
170	0.42	0.41	0.40	0.39	0.39	0.39	0.39	0.40	0.42	0.42	0.43	0.44	0.45	0.45	0.45	0.45	0.45	0.45	0.50
175	0.43	0.42	0.43	0.43	0.42	0.41	0.41	0.42	0.44	0.44	0.44	0.45	0.46	0.47	0.47	0.48	0.46	0.44	0.51
180	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30

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	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407	407		
5	407	407	407	406	406	406	406	405	405	405	404	404	404	404	403	403	403		
10	404	404	403	403	402	402	401	400	400	399	398	398	397	397	397	396	396		
15	397	397	396	396	395	394	393	392	391	390	389	389	388	387	387	386	386		
20	388	387	387	385	385	383	382	381	380	378	377	376	375	374	374	373	373		
25	375	374	373	372	371	370	368	367	365	363	362	361	359	359	358	357	357		
30	359	358	357	356	354	353	351	349	348	346	344	343	341	340	339	338	338		
35	340	339	338	337	335	333	331	329	327	325	323	321	320	319	317	317	316		
40	319	318	317	315	313	311	309	307	304	302	300	298	296	295	294	293	292		
45	295	294	292	291	289	287	284	281	279	276	274	272	270	268	267	266	266		
50	269	267	265	264	262	259	257	254	251	248	246	244	242	240	239	238	237		
55	240	239	237	235	233	230	228	225	222	219	216	214	212	210	209	208	207		
60	209	208	207	205	202	200	197	194	191	188	185	183	181	179	177	177	176		
65	178	176	174	173	171	168	166	162	160	157	154	152	150	148	146	146	145		
70	146	146	144	142	140	137	134	132	129	126	123	121	119	118	116	115	115		
75	116	115	113	111	109	107	105	103	99.8	97.3	95.0	92.9	91.0	89.7	88.0	87.2	87.0		
80	87.5	86.3	84.9	83.4	81.8	80.2	78.0	76.0	74.1	71.8	70.1	68.3	66.5	65.2	64.0	63.2	63.1		
85	63.0	62.3	61.3	60.2	58.7	57.4	55.7	54.2	52.6	51.0	49.4	48.0	46.7	45.5	44.4	43.9	43.4		
90	43.4	43.0	42.2	41.3	40.3	39.3	38.1	37.1	36.0	34.6	33.6	32.5	31.4	30.6	29.8	29.2	28.9		
95	28.9	28.6	28.0	27.4	26.8	26.1	25.4	24.6	23.8	23.0	22.3	21.5	20.8	20.2	19.5	19.1	18.9		
100	18.9	18.7	18.4	18.0	17.7	17.3	16.8	16.4	15.9	15.4	14.9	14.3	13.9	13.4	13.0	12.7	12.5		
105	12.5	12.3	12.2	12.0	11.8	11.6	11.4	11.2	10.9	10.6	10.3	10.0	9.75	9.48	9.21	9.01	8.85		
110	8.77	8.72	8.66	8.61	8.53	8.47	8.36	8.24	8.11	7.93	7.76	7.57	7.37	7.17	6.98	6.82	6.71		
115	6.59	6.58	6.57	6.56	6.55	6.52	6.49	6.43	6.33	6.21	6.08	5.93	5.77	5.61	5.45	5.31	5.21		
120	5.13	5.12	5.12	5.12	5.12	5.11	5.08	5.03	4.95	4.84	4.73	4.61	4.47	4.34	4.20	4.08	3.99		
125	3.92	3.92	3.92	3.92	3.92	3.93	3.91	3.86	3.78	3.70	3.60	3.50	3.39	3.27	3.15	3.05	2.97		
130	2.94	2.94	2.94	2.95	2.96	2.96	2.95	2.91	2.85	2.77	2.70	2.61	2.53	2.43	2.33	2.24	2.17		
135	2.15	2.16	2.17	2.18	2.19	2.19	2.19	2.16	2.12	2.06	2.00	1.93	1.86	1.78	1.70	1.62	1.56		
140	1.55	1.57	1.57	1.59	1.61	1.61	1.61	1.60	1.57	1.53	1.48	1.42	1.37	1.31	1.24	1.17	1.12		
145	1.12	1.13	1.15	1.16	1.18	1.20	1.20	1.19	1.18	1.15	1.12	1.08	1.03	0.98	0.93	0.87	0.82		
150	0.82	0.85	0.86	0.88	0.90	0.91	0.93	0.93	0.93	0.92	0.90	0.86	0.83	0.79	0.74	0.70	0.65		
155	0.65	0.68	0.69	0.71	0.73	0.74	0.77	0.78	0.79	0.79	0.78	0.76	0.72	0.69	0.65	0.61	0.57		
160	0.54	0.60	0.62	0.63	0.64	0.66	0.69	0.71	0.72	0.73	0.72	0.70	0.68	0.65	0.62	0.58	0.55		
165	0.53	0.55	0.55	0.56	0.58	0.60	0.64	0.66	0.66	0.67	0.67	0.66	0.63	0.61	0.58	0.56	0.53		
170	0.50	0.54	0.54	0.55	0.55	0.57	0.59	0.60	0.61	0.60	0.61	0.60	0.60	0.58	0.55	0.53	0.51		
175	0.51	0.52	0.52	0.53	0.54	0.54	0.54	0.54	0.54	0.55	0.56	0.56	0.55	0.55	0.53	0.51	0.50		
180	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30		

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

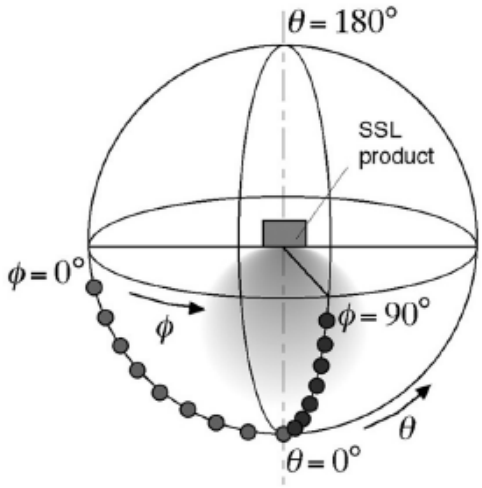
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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