LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube System

Model: 11.5T8/4F/835/EXT/A4

(LED tube model: 11.5T8/4F/835/EXT 4pcs and LED driver model: 15T8T5HEDRIVER/4CH 1pcs)

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.: HZ18080024s

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

Review by: April Zou

Engineer: April Zou
Aug. 28, 2018

Approved by: Jim Zhang

Manager: Jim Zhang
Aug. 28, 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: **11.5T8/4F/835/EXT/A4**

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/4	Power Factor
133.4	1731.0	12.98	0.9969

CCT (K)	CRI	Stabilization Time (Light & Power)
3312	82.6	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	: Jul. 30, 2018
Date of Test	: Aug. 02, 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

Sample Photos

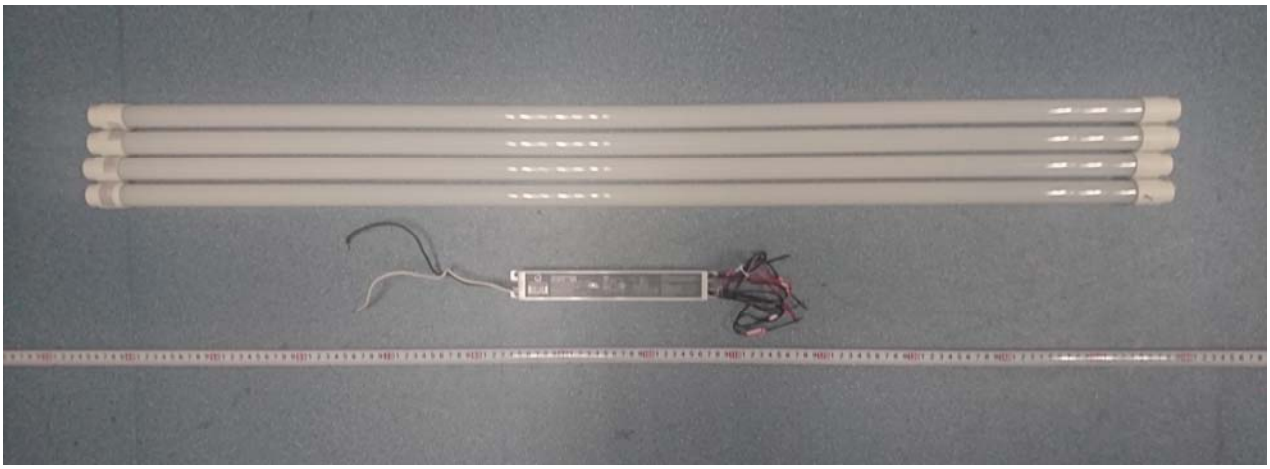


Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: LED Tube System
Model	: 11.5T8/4F/835/EXT/A4
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 3500K LED tube model: 11.5T8/4F/835/EXT 4 LED tubes supplied by a LED driver: 15T8T5HEDRIVER/4CH
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 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)	0.434	0.194
Power Factor	0.9969	0.9580
Test Power (W)/4	12.98	12.86
THD A%	3.40	7.16
Luminous Efficacy (lm/W)	133.4	134.6
Luminous Flux per lamp (lm)	1731.0	1731.0
Color Rendering Index (CRI)	82.6	
R9	1.8	
Correlated Color Temperature (CCT)(K)	3312	
Chromaticity Chroma x	0.4151	
Chromaticity Chroma y	0.3934	
Chromaticity Chroma u	0.2410	
Chromaticity Chroma v	0.3426	
Duv	0.0009	
Chromaticity Chroma u ’	0.2410	
Chromaticity Chroma v’	0.5138	

Special Color Rendering Indices	
R1	81.3
R2	91.1
R3	96.1
R4	81.1
R5	81.7
R6	88.8
R7	82.4
R8	58.3
R9	1.8
R10	79.3
R11	81
R12	69.3
R13	84
R14	98.5
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 24.8℃.

The photometric distance is 30m.

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)	0.435
Power Factor	0.9960
Test Power (W)/4	13.01
Luminous Efficacy (lm/W)	131.0
Luminous Flux per lamp (lm)	1703.3
Beam Angle (°)	170.7
Center Beam Candle Power (cd)	278
Spacing Criteria	1.27 (0°-180°)/ 1.44 (90°-270°)
Zonal Lumens in the 0°-60°Zone	42.59%
Zonal Lumens in the 60°-90°Zone	26.91%
Zonal Lumens in the 90°-120°Zone	17.68%
Zonal Lumens in the 120°-180°Zone	12.82%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

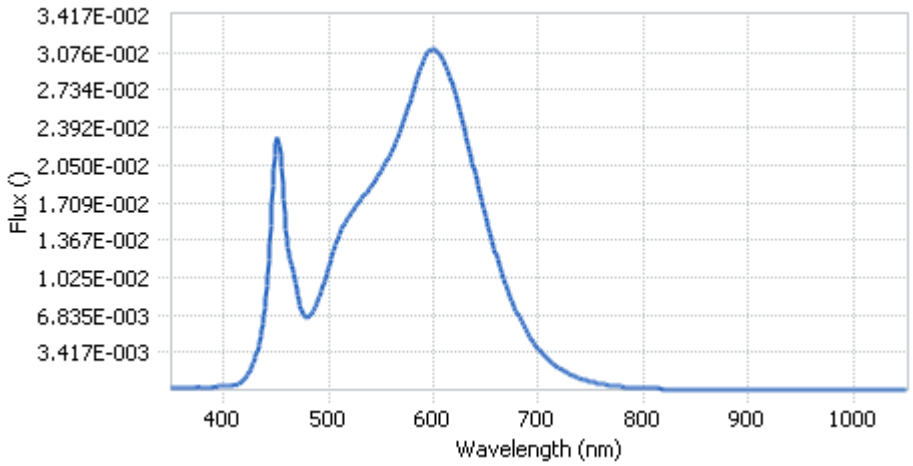
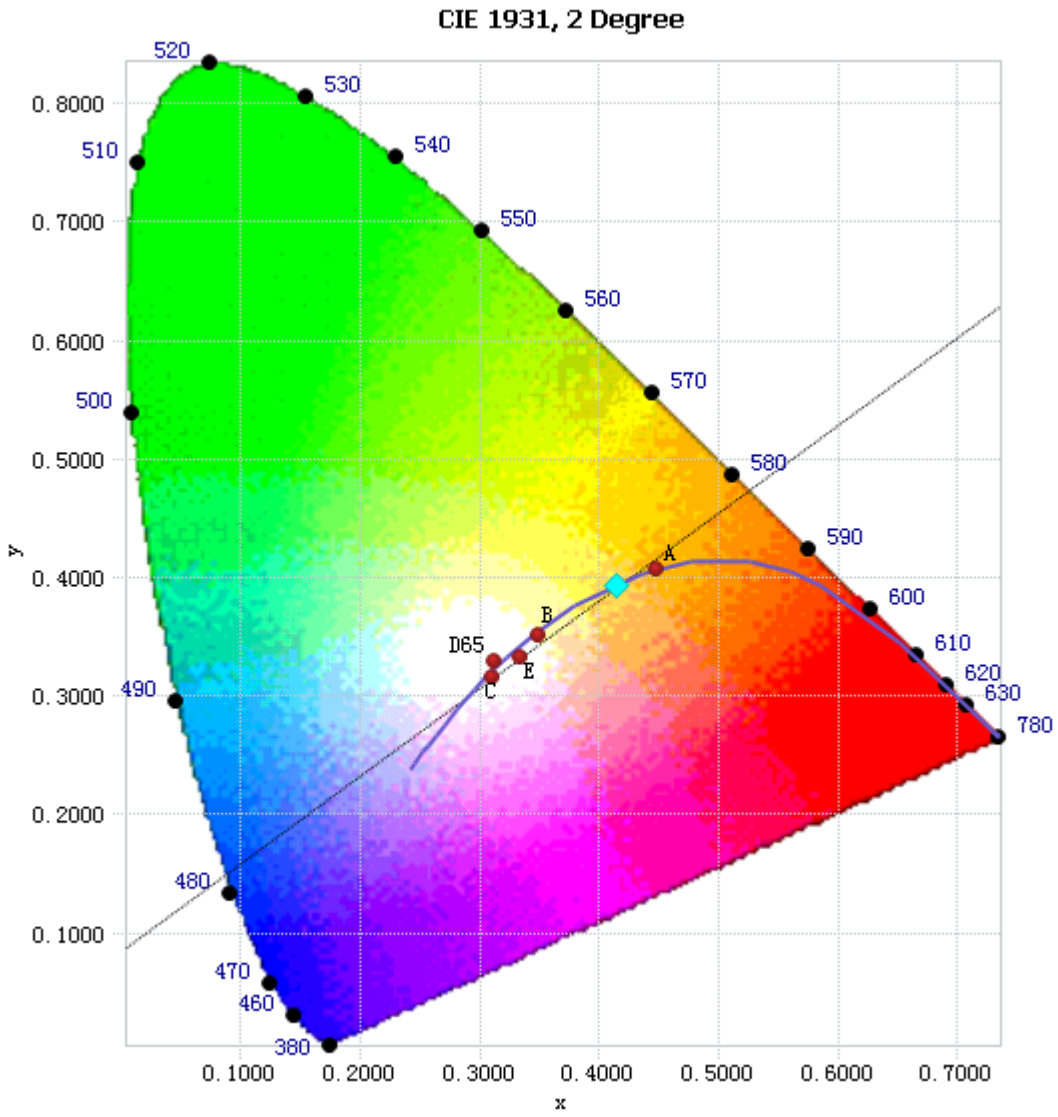


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.78E-04	485	7.20E-03	590	3.00E-02	695	4.37E-03
385	2.65E-04	490	8.16E-03	595	3.08E-02	700	3.74E-03
390	2.82E-04	495	9.62E-03	600	3.10E-02	705	3.19E-03
395	3.00E-04	500	1.12E-02	605	3.07E-02	710	2.71E-03
400	3.15E-04	505	1.28E-02	610	2.99E-02	715	2.31E-03
405	3.64E-04	510	1.41E-02	615	2.87E-02	720	1.97E-03
410	4.70E-04	515	1.52E-02	620	2.72E-02	725	1.68E-03
415	6.51E-04	520	1.60E-02	625	2.54E-02	730	1.42E-03
420	1.05E-03	525	1.66E-02	630	2.35E-02	735	1.21E-03
425	1.74E-03	530	1.72E-02	635	2.15E-02	740	1.03E-03
430	2.93E-03	535	1.79E-02	640	1.95E-02	745	8.74E-04
435	4.89E-03	540	1.85E-02	645	1.75E-02	750	7.43E-04
440	8.44E-03	545	1.93E-02	650	1.57E-02	755	6.36E-04
445	1.50E-02	550	2.00E-02	655	1.38E-02	760	5.44E-04
450	2.24E-02	555	2.09E-02	660	1.22E-02	765	4.63E-04
455	2.03E-02	560	2.18E-02	665	1.06E-02	770	3.97E-04
460	1.37E-02	565	2.28E-02	670	9.25E-03	775	3.39E-04
465	1.13E-02	570	2.41E-02	675	8.02E-03	780	2.88E-04
470	9.13E-03	575	2.55E-02	680	6.94E-03		
475	6.99E-03	580	2.71E-02	685	5.98E-03		
480	6.66E-03	585	2.87E-02	690	5.11E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4151, 0.3934)

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

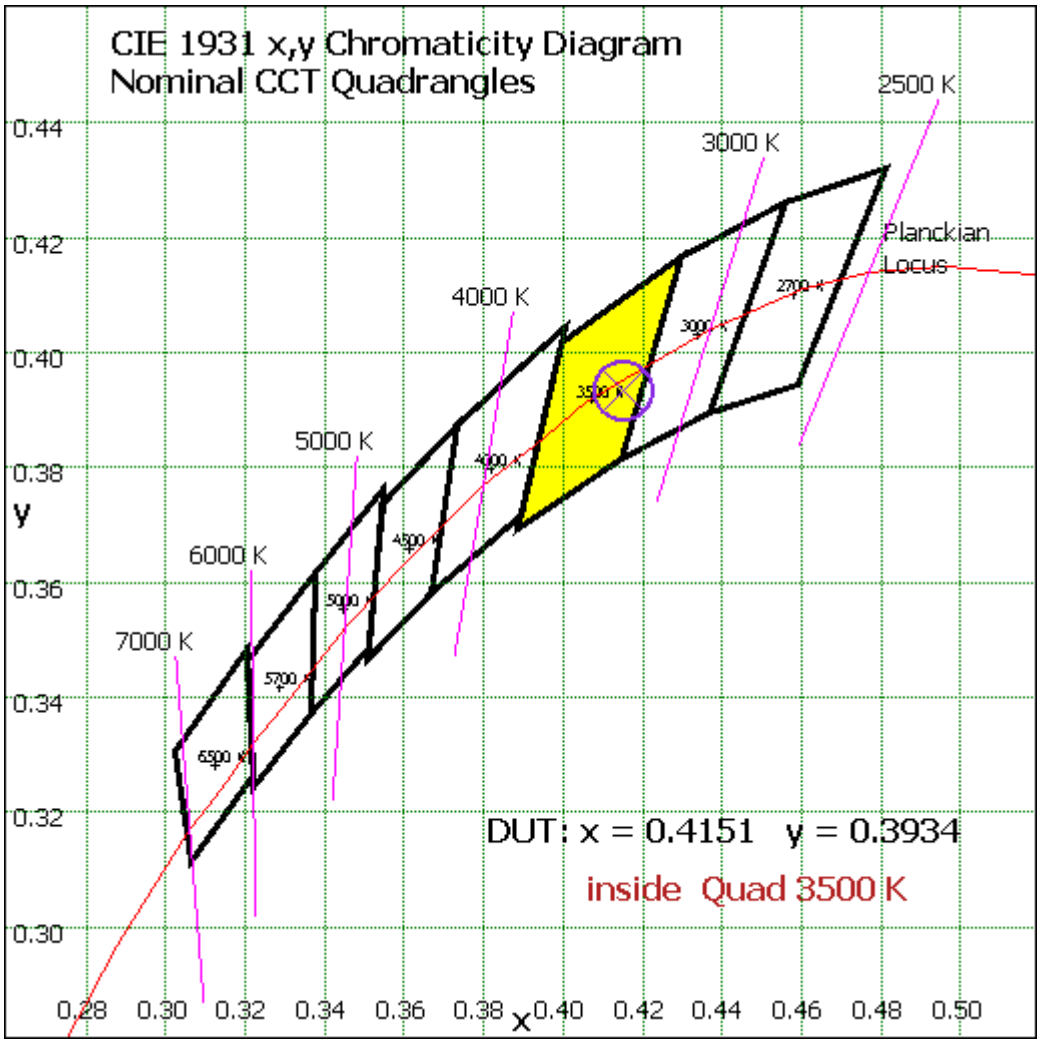


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	26.392	1.55%
10- 20	76.739	4.51%
20- 30	120.063	7.05%
30- 40	152.634	8.96%
40- 50	172.077	10.10%
50- 60	177.62	10.43%
60- 70	170.427	10.01%
70- 80	153.943	9.04%
80- 90	133.968	7.87%
90-100	116.387	6.83%
100-110	100.188	5.88%
110-120	84.559	4.96%
120-130	69.851	4.10%
130-140	56.02	3.29%
140-150	42.518	2.50%
150-160	29.412	1.73%
160-170	15.865	0.93%
170-180	4.665	0.27%
Total	1703.3	100%

γ(°)	Lumens	% Total
0- 60	725.525	42.59%
60- 90	458.338	26.91%
0-90	1183.863	69.50%
90- 180	519.465	30.50%
0- 180	1703.3	100%

Table 5: Zonal Lumen Data

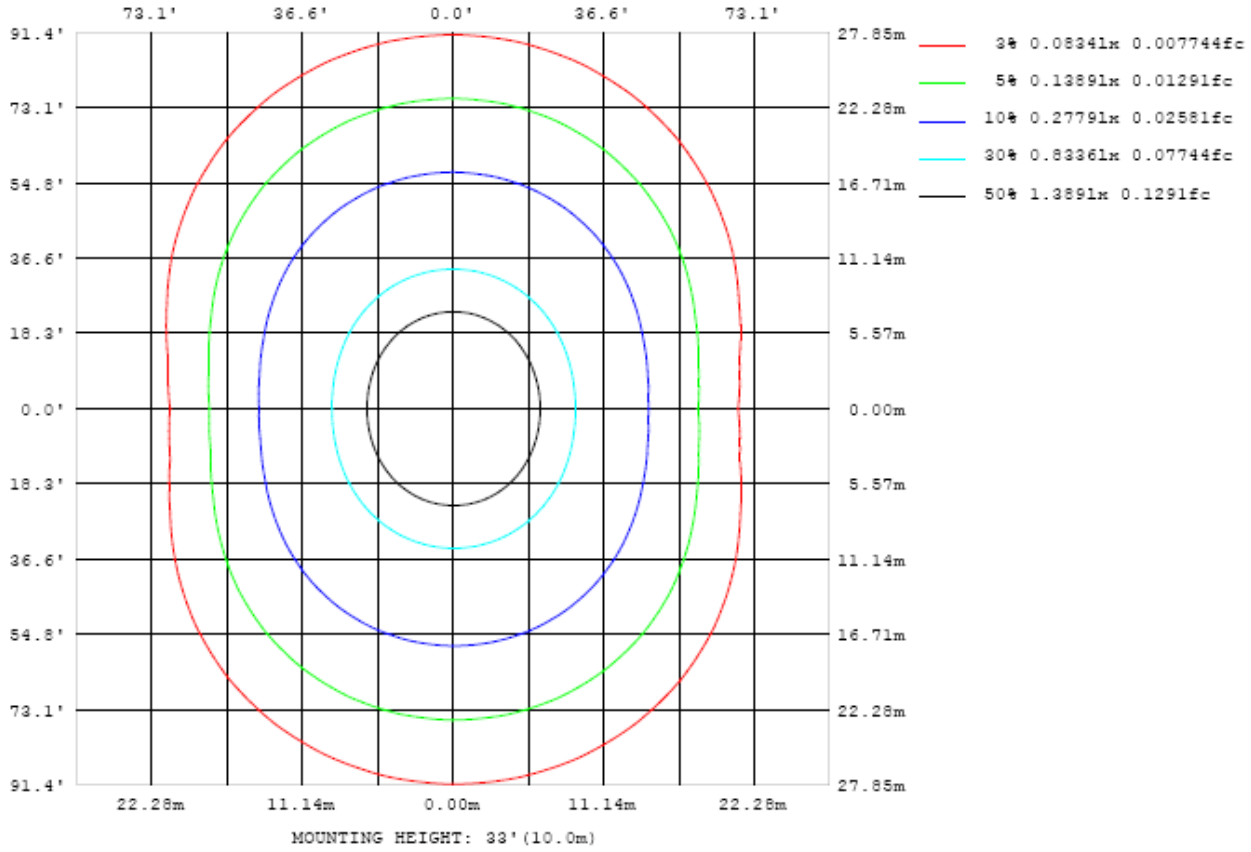


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

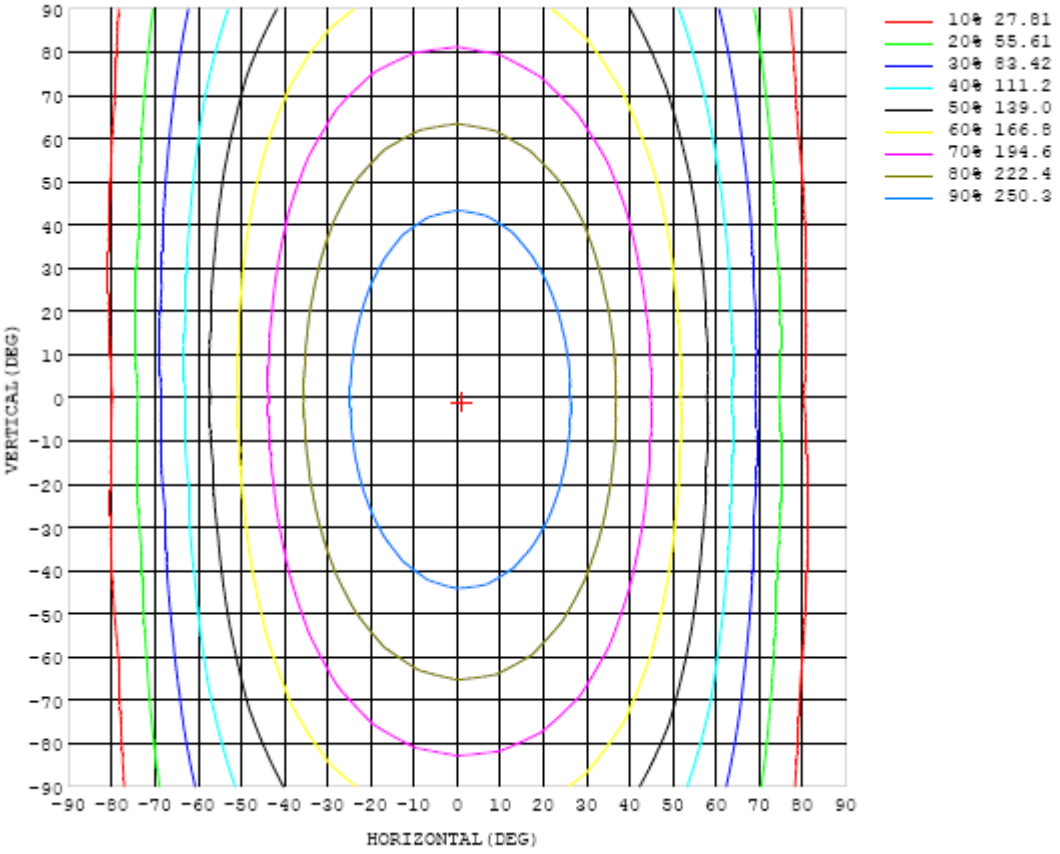


Chart 5: Isocandela Plot

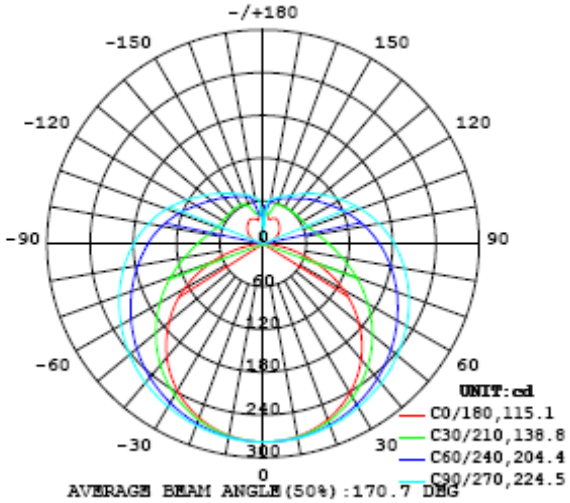


Chart 6: Polar Candela Distribution

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	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278
5	277	277	277	277	278	278	278	278	278	278	278	278	277	277	277	277	277	277	277
10	274	274	275	275	276	276	276	277	277	277	277	276	276	275	275	274	273	273	273
15	269	270	270	271	272	273	274	274	275	275	274	274	273	272	270	269	268	268	267
20	262	263	264	265	267	269	270	272	272	272	272	270	269	267	265	263	261	260	260
25	253	254	255	258	261	263	266	268	269	269	268	266	264	261	258	255	252	250	250
30	241	242	245	248	253	257	260	263	264	265	264	261	258	254	249	245	241	239	238
35	228	229	233	238	244	249	254	258	260	260	259	256	251	246	240	234	228	225	224
40	212	214	219	226	233	241	247	252	254	255	253	250	244	237	229	221	214	209	208
45	194	197	203	213	222	232	240	245	249	249	247	243	237	228	218	207	198	192	190
50	174	178	187	198	211	222	232	238	242	243	241	236	228	218	206	193	181	173	170
55	152	157	168	183	199	212	223	231	236	237	234	229	220	208	193	178	163	152	149
60	129	135	150	168	187	202	215	224	229	230	227	221	211	197	181	162	144	130	126
65	104	112	130	153	174	192	206	216	222	223	220	213	202	187	168	147	124	107	101
70	78.5	88.7	112	138	162	182	198	208	214	215	213	205	194	177	156	132	105	83.5	76.0
75	53.4	66.5	94.2	124	151	173	189	200	206	208	205	197	185	167	145	118	87.9	61.4	50.7
80	29.5	46.2	78.6	112	140	163	180	191	198	200	196	189	176	158	134	105	72.5	41.4	27.5
85	10.4	30.5	66.5	101	130	153	171	183	189	191	188	180	167	149	125	94.8	60.8	26.2	8.77
90	1.48	21.6	57.2	91.3	121	144	162	174	181	182	179	171	158	140	116	86.0	52.2	18.2	0.92
95	2.51	18.1	50.6	83.3	112	135	153	165	171	173	170	162	149	131	107	78.6	46.4	15.8	2.15
100	5.53	18.6	46.3	76.6	104	126	143	155	162	164	161	153	140	123	99.7	72.5	43.1	16.9	5.11
105	9.43	20.2	44.4	71.6	96.6	118	134	146	152	154	151	144	131	114	93.0	68.2	41.8	19.0	9.26
110	13.9	23.5	44.3	67.5	90.0	110	125	136	142	144	141	134	123	107	87.0	64.9	42.2	22.6	13.5
115	18.6	28.1	44.4	65.1	84.5	102	116	127	133	134	132	125	114	99.7	82.1	63.0	43.0	26.7	17.6
120	23.0	31.4	45.9	63.7	80.3	95.6	108	118	123	125	123	116	107	93.5	78.4	61.6	44.7	30.4	21.5
125	26.5	33.9	47.0	62.5	77.0	90.1	101	109	114	115	114	108	99.7	88.5	75.2	60.6	46.9	33.3	25.1
130	29.5	35.9	49.0	61.5	74.3	85.6	94.8	102	106	107	106	101	93.7	83.9	72.2	60.1	48.9	35.9	28.1
135	32.3	37.5	50.2	61.0	71.3	80.9	88.8	95.0	98.7	99.8	98.4	94.5	88.0	79.4	69.8	60.5	50.5	37.9	31.0
140	34.7	39.6	51.2	60.7	69.2	75.8	82.5	88.0	91.4	92.4	91.3	87.8	82.0	74.9	68.3	60.4	51.6	39.1	33.7
145	37.0	41.7	51.9	60.2	67.2	72.9	77.3	80.8	83.4	84.4	83.4	80.9	77.0	72.2	66.9	60.5	52.6	40.4	36.0
150	39.4	44.1	52.6	59.6	65.5	70.5	73.9	76.6	78.2	78.7	78.1	76.3	73.5	70.1	65.7	58.9	50.1	41.9	38.2
155	39.5	42.4	52.3	59.1	63.7	67.5	70.7	73.0	74.0	74.1	73.7	72.6	70.8	67.9	63.9	56.9	48.8	39.4	38.7
160	38.0	38.9	50.3	58.8	62.3	65.2	67.3	68.9	70.1	70.4	70.1	69.3	67.8	63.0	53.2	47.3	42.3	36.3	37.4
165	35.7	35.9	40.4	51.5	60.4	62.1	64.2	65.6	66.2	66.5	66.5	64.9	57.2	47.7	44.1	39.9	35.3	33.6	35.7
170	38.6	38.5	38.9	40.7	48.7	57.2	59.2	61.2	63.1	63.3	60.9	48.0	42.5	44.0	42.8	40.5	36.1	36.1	35.8
175	46.3	47.1	48.7	48.3	47.6	48.8	50.3	49.0	49.5	49.6	29.2	43.1	46.7	47.3	47.0	46.2	46.9	46.6	46.3
180	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5

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	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278		
5	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277	277		
10	273	273	274	274	275	275	276	276	276	276	276	276	275	275	275	275	274		
15	267	268	269	270	271	272	273	274	274	274	274	273	272	271	271	270	269		
20	260	261	263	264	266	268	270	271	271	271	270	269	268	266	265	263	262		
25	250	252	255	258	261	263	266	267	268	268	266	265	262	260	257	255	253		
30	239	241	245	249	254	258	261	263	264	263	262	259	255	251	248	244	242		
35	225	229	234	240	246	251	256	258	259	258	256	253	248	242	237	232	229		
40	210	215	222	230	238	244	250	253	254	253	250	245	239	232	224	218	214		
45	193	199	209	219	229	237	243	247	248	247	244	238	230	221	211	202	196		
50	174	183	195	207	219	229	236	240	242	241	236	229	220	209	196	185	177		
55	154	165	180	196	209	220	228	233	235	233	228	220	210	196	181	167	157		
60	132	147	165	183	199	212	221	226	228	226	220	211	199	183	166	149	135		
65	110	129	151	171	189	203	213	218	220	218	212	202	188	170	150	129	112		
70	87.0	110	136	160	179	194	205	211	212	210	203	192	177	157	135	110	88.1		
75	65.1	93.2	123	149	169	185	196	203	205	202	195	183	167	146	120	91.0	65.0		
80	45.6	78.1	110	138	160	177	188	195	197	194	186	174	157	134	106	74.3	44.2		
85	30.7	66.1	100.0	129	152	168	180	186	188	186	178	165	148	124	94.9	61.0	27.7		
90	22.5	57.4	91.2	120	143	160	171	178	180	177	169	157	139	115	85.6	51.7	18.3		
95	19.1	51.3	83.7	112	135	152	163	169	171	168	160	148	130	107	77.9	45.3	14.8		
100	19.8	47.1	77.1	104	126	143	154	160	162	159	152	139	122	98.7	71.2	41.1	15.4		
105	22.8	45.3	71.6	96.6	117	134	145	151	153	150	142	130	113	91.4	65.8	39.6	18.6		
110	26.5	45.4	67.9	90.0	109	124	135	141	143	140	133	121	105	84.9	62.2	39.7	22.6		
115	30.3	46.8	65.6	84.6	102	116	125	131	133	130	123	112	97.6	79.7	60.0	41.2	26.8		
120	34.2	48.1	64.4	80.6	95.4	107	116	121	123	120	114	104	91.4	75.8	58.9	43.2	31.0		
125	38.5	50.0	63.8	77.5	90.1	101	108	112	114	112	106	97.6	86.4	72.9	58.8	45.8	35.6		
130	41.5	51.5	63.3	75.0	85.6	94.6	101	105	106	104	99.2	91.8	82.1	70.9	58.9	48.6	40.1		
135	44.6	53.3	63.1	73.0	81.7	89.1	94.6	97.8	98.7	97.1	93.0	86.7	78.7	69.5	59.7	51.1	43.8		
140	48.0	55.2	62.9	70.8	78.5	84.5	88.9	91.6	92.3	90.9	87.5	82.4	75.9	68.1	60.5	53.5	46.8		
145	49.8	54.0	63.1	69.3	75.2	80.4	83.9	86.0	86.6	85.5	82.7	78.4	73.0	67.3	61.1	55.6	49.2		
150	53.3	57.3	63.2	68.2	72.8	76.7	79.5	81.1	81.5	80.3	78.0	74.9	71.0	66.5	61.7	57.2	51.9		
155	51.3	55.6	60.9	67.0	70.6	73.5	75.6	76.8	77.2	76.3	74.4	72.1	69.2	65.8	62.5	58.9	51.5		
160	45.2	50.4	56.6	63.4	68.8	70.8	72.2	73.1	73.4	73.0	71.4	69.5	67.5	65.2	62.8	60.2	49.8		
165	39.7	43.0	46.0	51.1	59.3	66.7	69.1	69.5	69.9	69.7	69.0	67.7	65.9	63.9	62.6	60.4	48.7		
170	36.5	40.6	43.6	44.1	44.3	49.1	57.6	64.9	65.4	65.5	65.3	64.7	63.4	61.4	59.6	55.3	45.1		
175	45.4	45.7	45.8	44.5	43.8	39.9	37.4	43.3	57.1	62.4	63.1	60.3	56.4	54.8	51.5	48.9	47.5		
180	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5		

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 expended 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

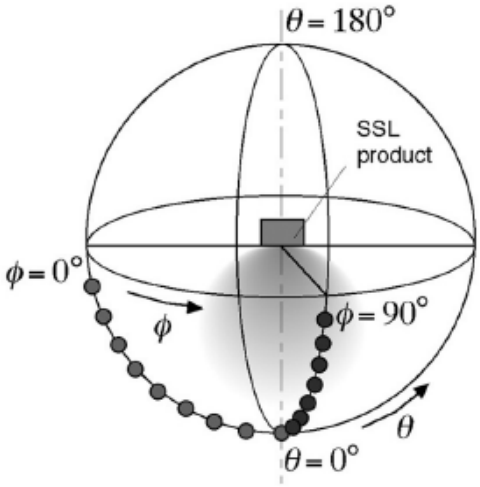
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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