

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/840/EXT/A2

(LED tube model: 11.5T8/4F/840/EXT 2pcs and LED driver model: 15T8T5HEDRIVER/2CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18080024an

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

Review by:



Engineer: April Zou

Aug. 29, 2018

Approved by:



Manager: Jim Zhang

Aug. 29, 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/840/EXT/A2

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/2	Power Factor
134.2	1778.0	13.25	0.9935
CCT (K)	CRI	Stabilization Time (Light & Power)	
4072	82.0	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. 03, 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

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Sample Photos

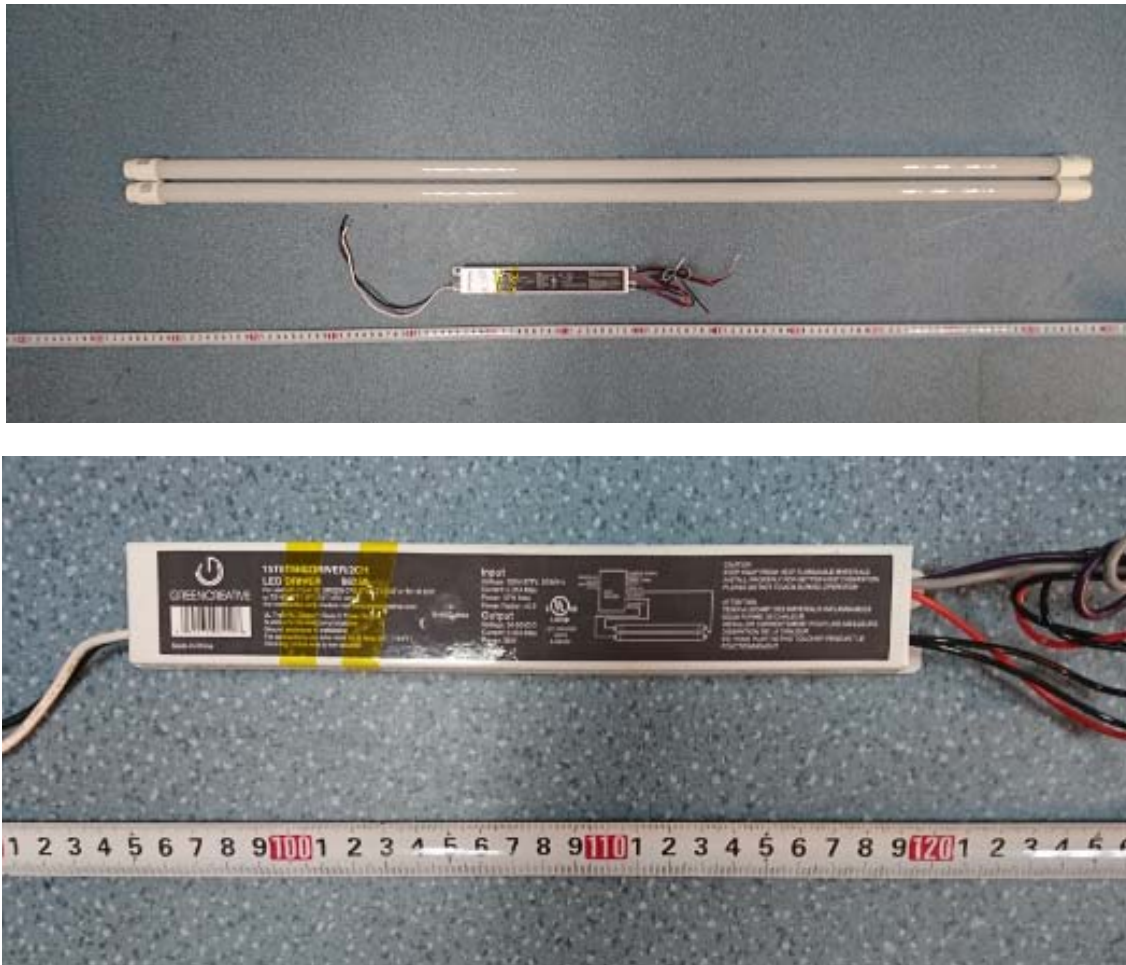


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 11.5T8/4F/840/EXT/A2
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 4000K LED tube model: 11.5T8/4F/840/EXT 2 LED tubes supplied by a LED driver: 15T8T5HEDRIVER/2CH
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.0°C.

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)	0.222	0.104
Power Factor	0.9935	0.9456
Test Power (W)/2	13.25	13.60
THD A%	4.40	9.72
Luminous Efficacy (lm/W)	134.2	130.8
Luminous Flux per lamp (lm)	1778.0	1778.0
Color Rendering Index (CRI)	82.0	
R9	3.3	
Correlated Color Temperature (CCT)(K)	4072	
Chromaticity Chroma x	0.3792	
Chromaticity Chroma y	0.3813	
Chromaticity Chroma u	0.2225	
Chromaticity Chroma v	0.3356	
Duv	0.0025	
Chromaticity Chroma u'	0.2225	
Chromaticity Chroma v'	0.5034	

Special Color Rendering Indices	
R1	79.1
R2	86.1
R3	92.9
R4	83.3
R5	81.6
R6	84.4
R7	85.2
R8	63.0
R9	3.3
R10	68.8
R11	82.8
R12	58.8
R13	80.1
R14	95.9
Rf	82
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 25.0°C.

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)	0.222
Power Factor	0.9927
Test Power (W)/2	13.23
Luminous Efficacy (lm/W)	132.5
Luminous Flux per lamp (lm)	1752.6
Beam Angle (°)	174.2
Center Beam Candle Power (cd)	279
Spacing Criteria	1.29 (0°-180°)/ 1.45 (90°-270°)
Zonal Lumens in the 0°-60°Zone	41.90%
Zonal Lumens in the 60°-90°Zone	27.01%
Zonal Lumens in the 90°-120°Zone	18.06%
Zonal Lumens in the 120°-180°Zone	13.03%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

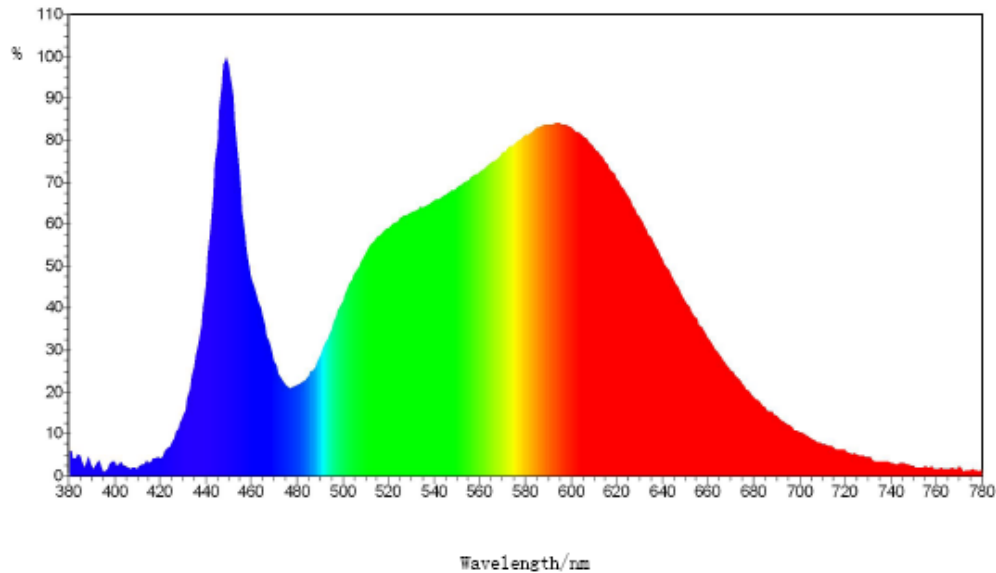
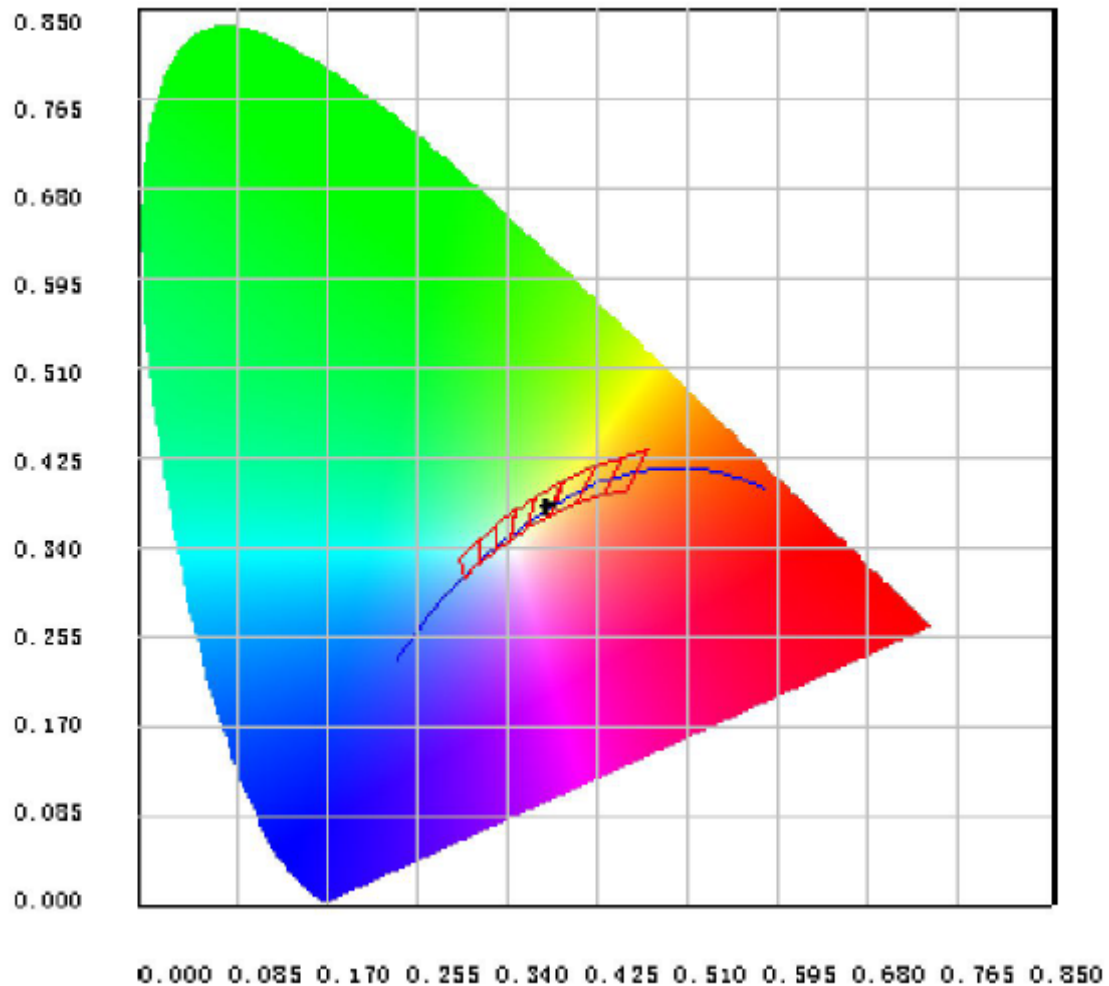


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.10E-03	485	8.66E-03	590	3.04E-02	695	4.42E-03
385	1.80E-03	490	1.04E-02	595	3.05E-02	700	3.86E-03
390	9.41E-04	495	1.26E-02	600	3.01E-02	705	3.25E-03
395	4.31E-04	500	1.52E-02	605	2.95E-02	710	2.81E-03
400	1.23E-03	505	1.74E-02	610	2.85E-02	715	2.48E-03
405	9.31E-04	510	1.92E-02	615	2.72E-02	720	2.26E-03
410	6.35E-04	515	2.06E-02	620	2.58E-02	725	1.89E-03
415	1.11E-03	520	2.14E-02	625	2.42E-02	730	1.65E-03
420	1.57E-03	525	2.23E-02	630	2.24E-02	735	1.32E-03
425	2.75E-03	530	2.28E-02	635	2.06E-02	740	1.11E-03
430	5.18E-03	535	2.32E-02	640	1.88E-02	745	1.09E-03
435	9.45E-03	540	2.38E-02	645	1.69E-02	750	8.76E-04
440	1.66E-02	545	2.43E-02	650	1.51E-02	755	8.31E-04
445	2.91E-02	550	2.49E-02	655	1.35E-02	760	6.64E-04
450	3.55E-02	555	2.56E-02	660	1.20E-02	765	6.80E-04
455	2.51E-02	560	2.62E-02	665	1.05E-02	770	8.63E-04
460	1.73E-02	565	2.71E-02	670	9.15E-03	775	4.98E-04
465	1.39E-02	570	2.79E-02	675	8.02E-03	780	5.70E-04
470	9.95E-03	575	2.87E-02	680	6.89E-03		
475	7.83E-03	580	2.95E-02	685	5.92E-03		
480	7.81E-03	585	3.01E-02	690	5.15E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3792, 0.3813)

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

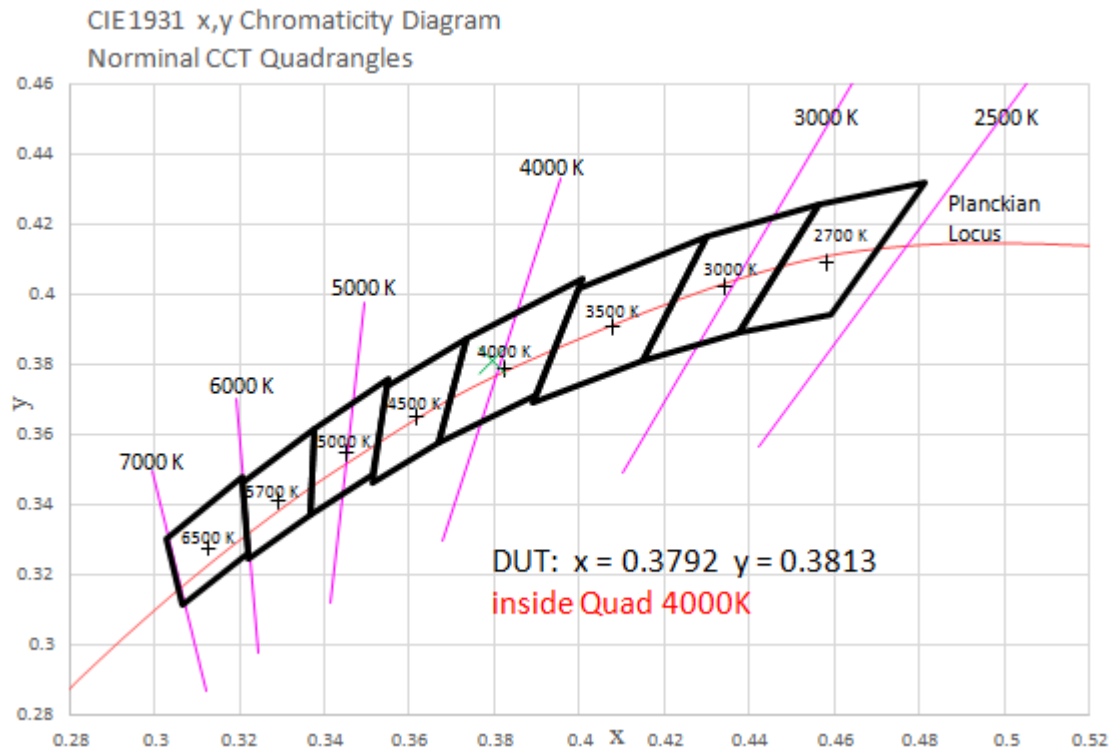


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	26.487	1.51%
10- 20	77.095	4.40%
20- 30	120.896	6.90%
30- 40	154.186	8.80%
40- 50	174.528	9.96%
50- 60	181.087	10.33%
60- 70	174.83	9.98%
70- 80	159.047	9.07%
80- 90	139.501	7.96%
90-100	121.978	6.96%
100-110	105.405	6.01%
110-120	89.1	5.08%
120-130	73.612	4.20%
130-140	59.008	3.37%
140-150	44.711	2.55%
150-160	30.653	1.75%
160-170	16.117	0.92%
170-180	4.346	0.25%
Total	1752.6	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	734.279	41.90%
60- 90	473.378	27.01%
0-90	1207.657	68.91%
90- 180	544.93	31.09%
0- 180	1752.6	100%

Table 5: Zonal Lumen Data

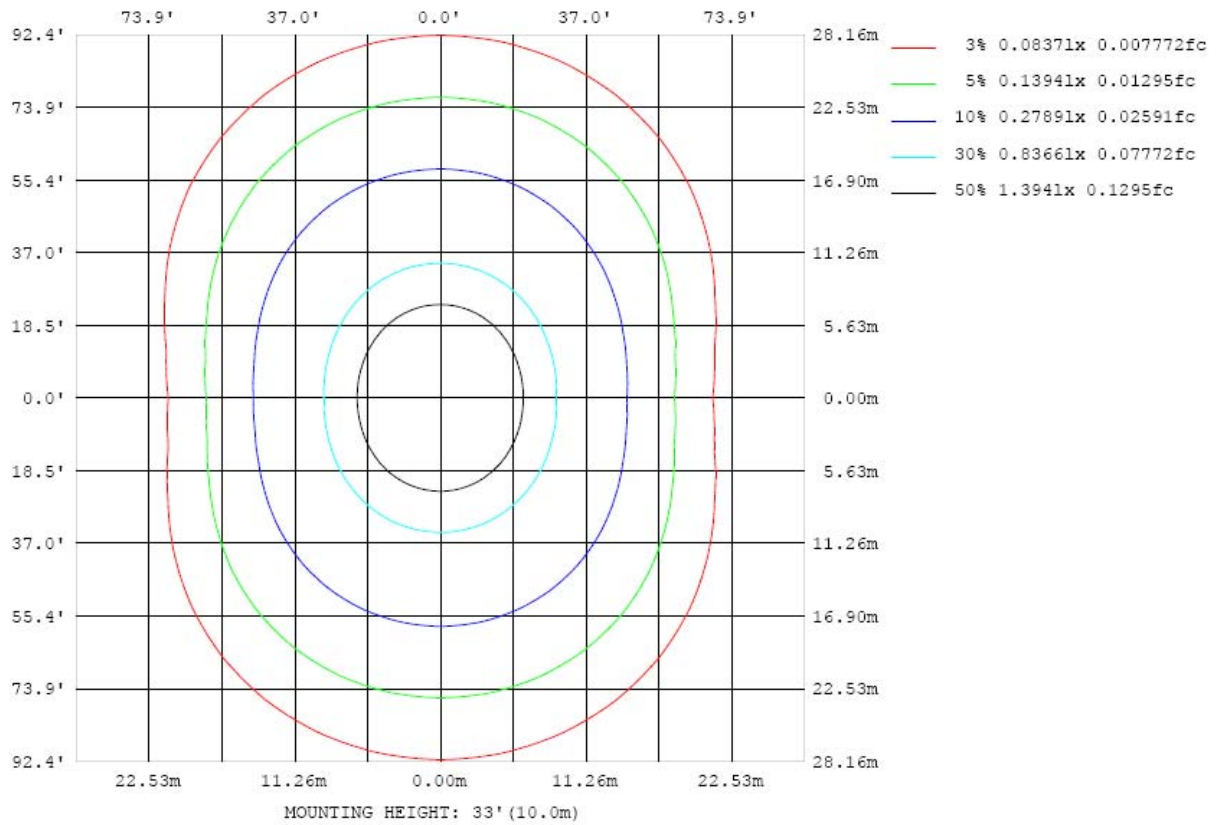


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

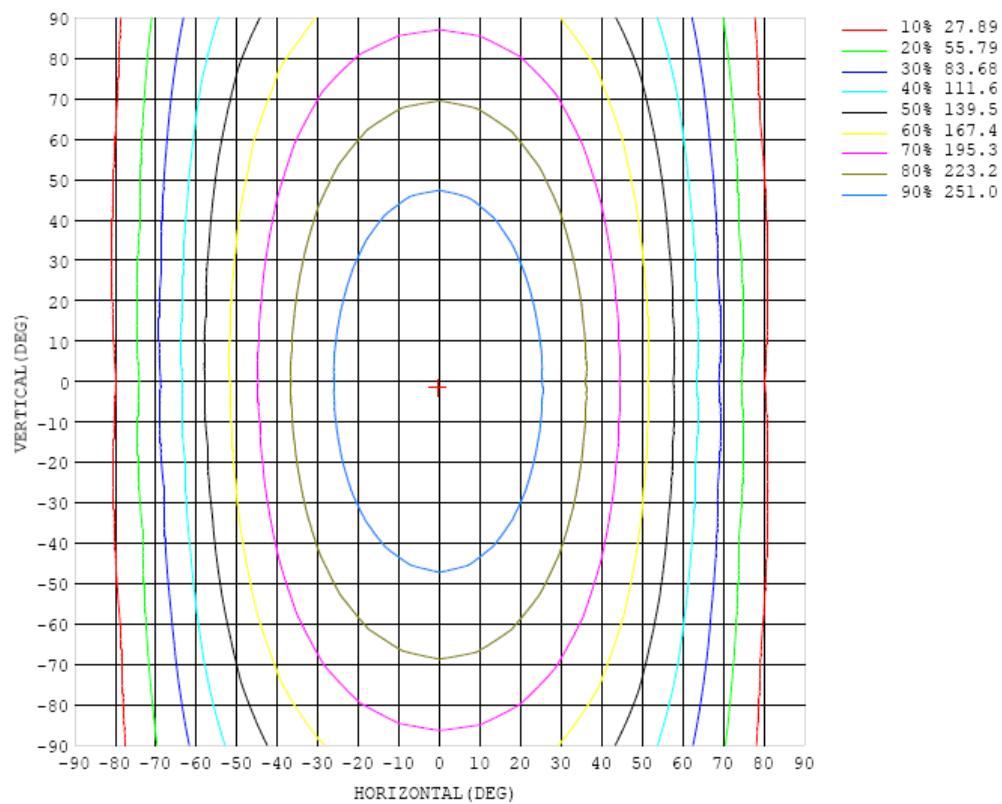


Chart 5: Isocandela Plot

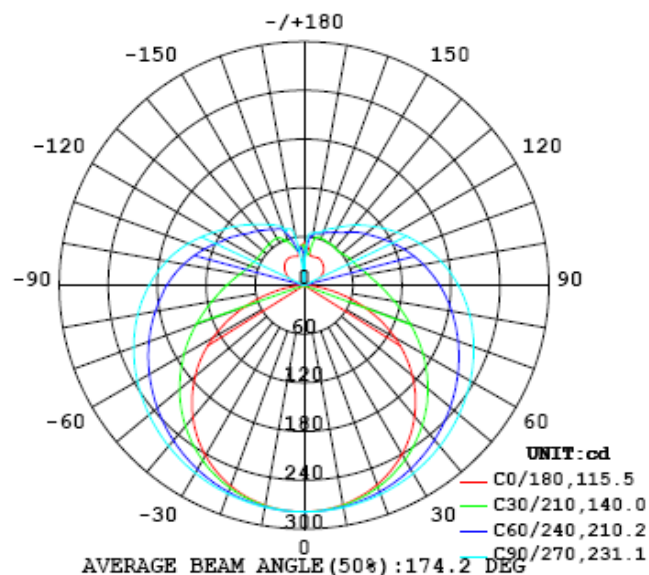


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279
5	278	278	278	278	278	278	278	278	279	279	279	279	279	279	278	278	278	278	278
10	274	274	275	275	276	276	277	277	278	278	278	278	277	277	276	276	275	275	275
15	269	269	270	271	272	273	274	275	276	276	276	276	275	274	273	272	271	270	270
20	261	262	263	265	267	269	271	272	273	274	274	273	271	270	268	266	264	263	263
25	252	253	254	257	260	263	266	269	270	271	271	269	267	264	261	258	256	254	253
30	240	241	244	248	252	257	261	264	267	267	267	265	262	258	253	249	245	243	242
35	226	228	232	237	243	250	255	259	262	263	262	260	256	251	244	238	233	229	228
40	211	213	218	225	233	241	249	254	257	259	258	254	249	242	234	226	218	214	212
45	193	196	202	212	223	233	241	248	252	253	252	248	242	233	223	212	203	196	194
50	173	177	186	198	211	223	234	241	246	248	246	242	234	224	211	198	185	177	174
55	152	156	168	183	199	214	226	234	240	242	240	234	226	213	199	182	167	156	153
60	128	134	149	168	187	204	218	227	233	235	233	227	217	203	186	167	147	133	129
65	104	111	130	153	175	194	209	220	226	228	226	219	209	193	173	151	128	109	104
70	78.0	87.9	111	138	163	184	201	212	219	221	219	212	200	183	161	136	109	85.4	77.3
75	52.9	65.8	93.7	124	152	175	192	204	212	214	211	204	191	173	150	122	90.5	62.8	51.2
80	28.9	45.4	78.6	112	142	166	184	196	204	206	203	196	182	164	139	109	74.9	42.3	27.2
85	10.1	29.9	66.3	102	132	157	175	188	195	198	195	187	174	155	129	98.6	63.1	26.9	8.45
90	1.78	21.3	57.4	92.5	123	148	166	179	187	189	186	178	165	146	121	89.8	54.6	19.1	0.99
95	2.77	18.3	51.4	85.0	115	139	157	170	178	180	177	169	156	137	113	82.6	49.1	17.1	2.54
100	6.17	19.1	47.5	79.0	107	130	148	161	168	170	168	160	147	129	105	76.6	45.9	18.4	6.13
105	10.6	20.3	45.6	73.9	99.8	122	139	151	159	161	158	151	138	120	98.2	72.4	44.5	20.7	11.1
110	15.4	23.4	45.6	69.8	93.3	114	130	142	149	151	148	141	129	113	91.6	68.9	45.0	24.1	15.8
115	20.5	28.1	45.4	67.1	87.6	107	122	132	139	141	138	132	121	104	86.5	66.5	45.7	27.4	20.2
120	24.9	31.9	45.2	65.5	82.9	99.5	113	123	129	131	129	123	112	98.3	82.2	65.2	46.4	30.9	24.2
125	28.6	36.5	46.3	63.1	79.4	93.5	105	114	120	122	119	114	104	92.9	78.7	63.8	48.1	34.2	27.9
130	31.5	39.8	48.4	60.9	76.1	88.5	98.6	106	111	112	111	106	97.6	87.5	76.1	63.5	49.2	36.9	31.3
135	33.5	41.5	51.3	59.4	71.7	83.2	92.5	99.1	103	104	103	98.8	92.2	83.3	74.0	63.6	49.8	39.6	34.2
140	35.3	43.5	52.3	59.4	69.0	77.6	85.6	92.0	95.8	97.0	95.6	90.0	85.9	79.5	72.9	62.9	50.3	41.3	36.3
145	36.8	44.6	54.3	60.8	66.0	73.8	79.1	84.5	87.8	89.1	88.1	84.7	81.9	77.1	70.9	61.1	52.9	43.2	37.8
150	37.9	46.3	54.9	59.8	65.1	70.7	75.4	78.5	80.9	82.2	81.7	79.3	76.5	73.4	67.6	58.6	52.6	45.2	38.6
155	37.6	44.8	56.6	61.2	65.1	68.4	71.8	74.2	76.0	76.9	76.8	74.5	72.5	69.6	63.5	56.0	50.5	43.9	38.5
160	37.1	41.9	57.5	61.0	63.8	66.4	69.2	70.7	72.0	72.0	71.6	69.8	68.1	65.0	54.7	48.7	45.3	41.2	37.9
165	37.1	38.3	47.9	61.3	62.2	65.6	66.1	67.1	67.1	67.1	64.5	65.0	62.6	51.7	45.3	41.5	39.1	37.8	37.1
170	40.2	38.0	36.3	44.9	59.5	62.5	63.0	65.0	65.2	65.0	61.2	56.1	45.6	40.7	38.2	39.5	39.4	38.9	39.9
175	48.6	47.1	44.2	40.1	38.7	42.7	52.3	55.1	62.3	62.1	42.4	32.9	33.9	39.9	43.2	44.9	46.2	46.5	49.4
180	4.99	4.95	4.83	4.65	4.42	4.13	3.81	3.46	3.09	2.78	2.90	3.02	3.14	3.26	3.37	3.46	3.52	3.56	3.57

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	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279		
5	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278		
10	275	275	276	276	276	277	277	277	277	277	277	276	276	275	275	275	274		
15	270	271	271	272	273	274	275	275	275	275	275	274	273	271	270	270	269		
20	263	264	266	267	269	271	272	273	273	273	272	270	268	266	264	263	262		
25	254	256	258	261	264	267	269	270	270	270	268	266	263	259	256	254	252		
30	243	245	249	253	258	262	265	266	267	266	264	261	256	252	247	243	241		
35	229	233	238	244	250	256	260	262	263	262	259	255	249	243	237	231	228		
40	214	219	226	234	242	249	254	258	258	257	254	248	241	233	225	218	213		
45	197	204	213	224	234	242	249	252	254	252	248	241	232	222	212	202	196		
50	178	187	199	212	225	235	242	247	248	246	242	234	223	211	198	185	177		
55	158	170	185	201	215	227	236	241	242	240	235	226	214	199	183	168	157		
60	135	151	170	189	206	219	229	234	236	234	228	218	204	187	168	150	135		
65	112	132	155	177	196	211	221	227	229	227	221	210	194	175	154	130	112		
70	88.7	113	141	166	186	202	214	220	222	220	213	201	185	164	139	111	88.3		
75	66.1	95.7	127	155	177	194	206	213	215	213	205	193	175	153	125	93.5	65.4		
80	46.1	80.4	115	144	168	185	198	205	207	205	197	184	167	142	112	77.6	44.9		
85	31.0	68.3	104	135	159	176	189	196	199	196	188	175	157	132	101	64.9	29.0		
90	22.9	59.5	95.0	125	150	168	180	188	190	187	180	167	148	123	91.9	55.7	20.1		
95	19.5	53.0	87.1	117	141	159	171	178	181	178	171	158	139	114	84.0	49.2	16.6		
100	20.3	48.6	80.1	108	132	150	162	169	171	169	162	149	130	106	76.9	44.8	17.4		
105	23.6	47.0	74.3	101	123	140	152	159	161	159	151	139	121	98.1	71.2	43.4	20.9		
110	28.1	47.3	70.8	93.6	114	130	142	149	151	148	141	129	112	91.3	67.5	43.7	25.7		
115	33.0	48.5	68.1	88.0	106	121	132	138	140	138	131	120	105	86.0	65.3	45.4	30.8		
120	37.7	50.2	66.5	83.6	99.1	112	122	128	130	128	121	112	98.3	82.0	64.3	48.2	35.8		
125	42.3	52.5	66.0	80.1	93.1	105	114	119	121	119	113	105	93.0	79.0	64.3	51.3	40.7		
130	46.6	55.0	65.8	77.6	89.0	98.2	106	111	113	111	106	98.5	88.6	76.8	64.9	54.4	45.2		
135	50.0	57.4	66.2	75.5	84.7	92.1	98.4	104	105	103	99.3	92.8	84.7	75.3	65.8	57.3	49.4		
140	53.6	59.7	66.6	74.1	81.5	87.7	91.8	96.3	97.8	96.6	93.1	87.8	81.2	74.1	66.7	60.0	52.7		
145	56.4	57.8	67.1	72.9	78.4	83.5	86.3	88.2	91.6	90.6	87.8	83.5	78.3	72.8	67.5	62.4	55.7		
150	59.1	62.6	67.3	71.7	76.0	79.6	82.6	83.2	86.2	85.4	83.3	80.0	75.8	72.0	68.1	64.1	57.9		
155	54.9	60.4	62.9	70.2	73.8	76.5	78.2	79.0	81.4	81.0	79.6	77.2	74.1	71.2	67.3	65.0	52.7		
160	46.8	53.9	56.9	59.5	65.8	71.3	74.9	75.2	73.9	77.4	76.5	74.9	72.6	69.1	68.6	61.4	47.0		
165	39.5	45.6	49.2	50.1	52.3	57.0	62.2	70.5	71.7	74.2	73.8	72.6	67.4	59.8	56.1	54.3	42.7		
170	39.8	40.2	45.9	47.6	46.6	42.5	43.6	47.3	57.0	66.3	69.6	52.3	47.9	51.6	54.0	47.8	40.9		
175	49.5	49.0	48.3	49.8	47.8	47.1	39.0	24.8	14.8	6.61	22.4	42.9	49.0	48.9	49.8	47.7	48.4		
180	3.56	3.51	3.44	3.35	3.24	3.12	3.00	2.87	2.80	3.17	3.53	3.87	4.19	4.47	4.69	4.86	4.96		

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

Color Characteristics Measurements

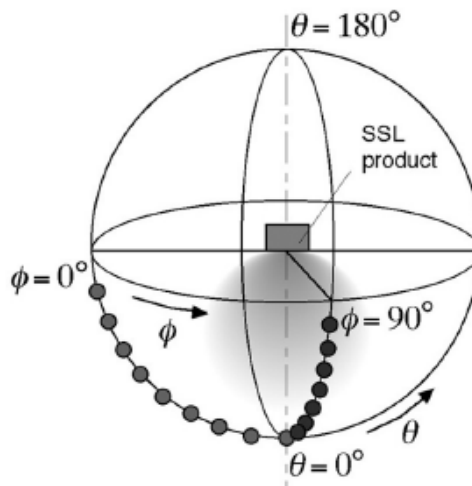
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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 ($C=0^\circ/180^\circ$ and $C=90^\circ/270^\circ$) 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, $\Delta u'v'$, 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 ***

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