

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.: HZ18080024z

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

Review by:



Engineer: April Zou
Aug. 28, 2018

Approved by:



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Aug. 28, 2018

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

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Sample Photos

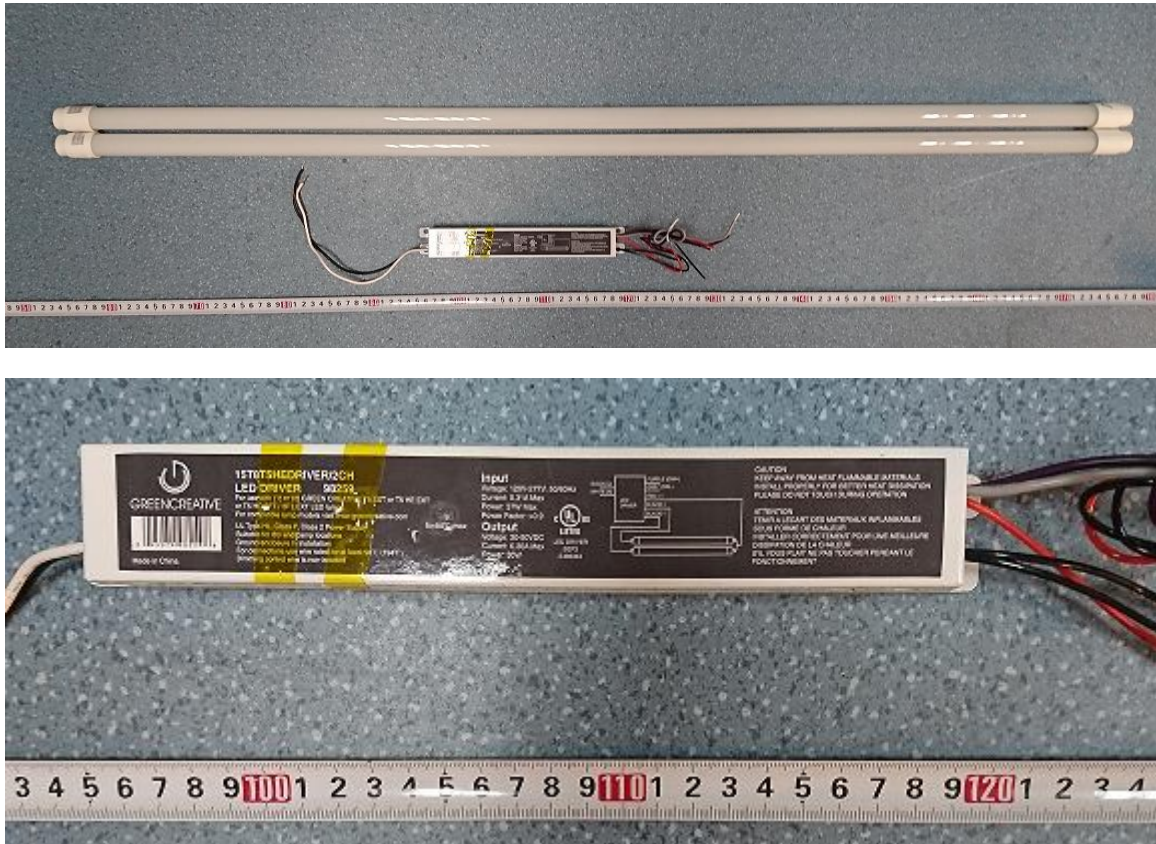


Figure 1- Overview of the sample

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 specifications:

Date of Receipt	: Jul. 30, 2018
Date of Test	: Aug. 09, 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

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.

The LED driver has 2 channels, the tests were conducted at each channel with the same lamps.

Sphere-Spectroradiometer Method

Parameter	Result	
	CH1	CH2
Test Voltage (V)	120.0	120.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.222	0.223
Power Factor	0.9935	0.9932
Test Power (W)/2	13.25	13.26
THD A%	4.40	4.26
Luminous Efficacy (lm/W)	134.2	133.7
Luminous Flux per lamp (lm)	1778	1773
Color Rendering Index (CRI)	82.0	82.0
R9	3.3	3.4
Correlated Color Temperature (CCT)(K)	4072	4072
Chromaticity Chroma x	0.3792	0.3792
Chromaticity Chroma y	0.3813	0.3813
Chromaticity Chroma u	0.2225	0.2225
Chromaticity Chroma v	0.3356	0.3356
Duv	0.0025	0.0025
Chromaticity Chroma u'	0.2225	0.2225
Chromaticity Chroma v'	0.5034	0.5034

Special Color Rendering Indices of CH1	
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 1: 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.

The LED driver has 2 channels, the tests were conducted at each channel with the same lamps.

Parameter	Result	
	CH1	CH2
Test Voltage (V)	120.0	120.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.223	0.223
Power Factor	0.9932	0.9930
Test Power (W)/2	13.27	13.29
Luminous Efficacy (lm/W)	131.9	131.3
Luminous Flux per lamp (lm)	1750.1	1744.9
Beam Angle (°)	174.2	173.3
Center Beam Candle Power (cd)	278	278
Spacing Criteria	1.29 (0°-180°)/ 1.45 (90°-270°)	1.29 (0°-180°)/ 1.45 (90°-270°)
Zonal Lumens in the 0°-60° Zone	41.90%	41.90%
Zonal Lumens in the 60°-90° Zone	27.01%	27.01%
Zonal Lumens in the 90°-120° Zone	18.06%	18.06%
Zonal Lumens in the 120°-180° Zone	13.03%	13.03%

Table 2: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method of CH1

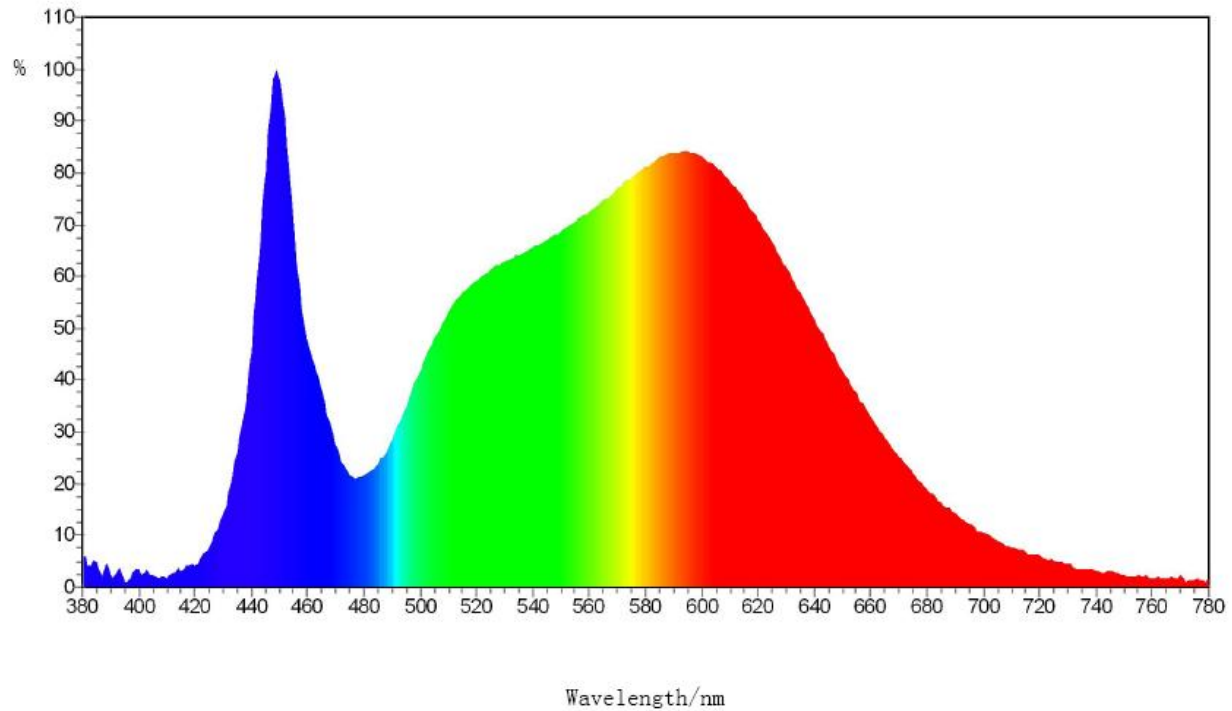
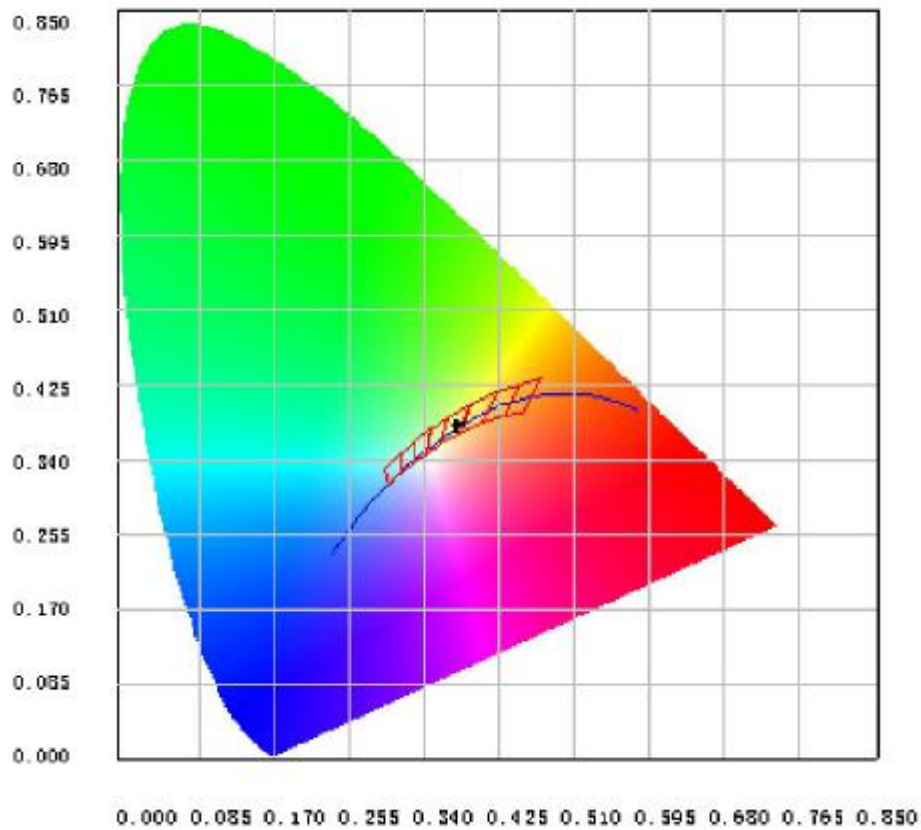


Chart 1: Spectral Power Distribution

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 3: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method of CH1



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 of CH1

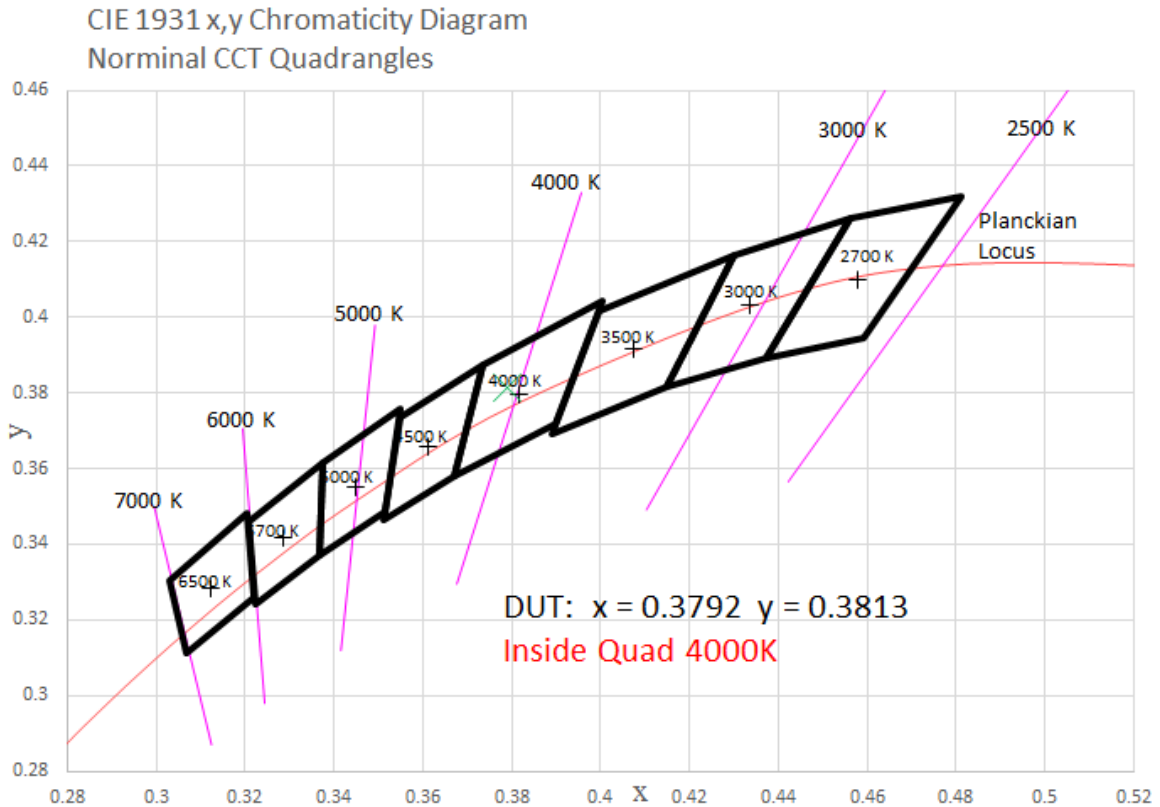


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method of CH1

$\gamma(^{\circ})$	Lumens	% Total
0- 10	26.449	1.51%
10- 20	76.985	4.40%
20- 30	120.724	6.90%
30- 40	153.966	8.80%
40- 50	174.279	9.96%
50- 60	180.829	10.33%
60- 70	174.581	9.98%
70- 80	158.82	9.07%
80- 90	139.302	7.96%
90-100	121.804	6.96%
100-110	105.254	6.01%
110-120	88.973	5.08%
120-130	73.507	4.20%
130-140	58.924	3.37%
140-150	44.647	2.55%
150-160	30.61	1.75%
160-170	16.094	0.92%
170-180	4.34	0.25%
Total	1750.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	733.232	41.90%
60- 90	472.703	27.01%
0-90	1205.935	68.91%
90- 180	544.153	31.09%
0- 180	1750.1	100%

Table 4: Zonal Lumen Data

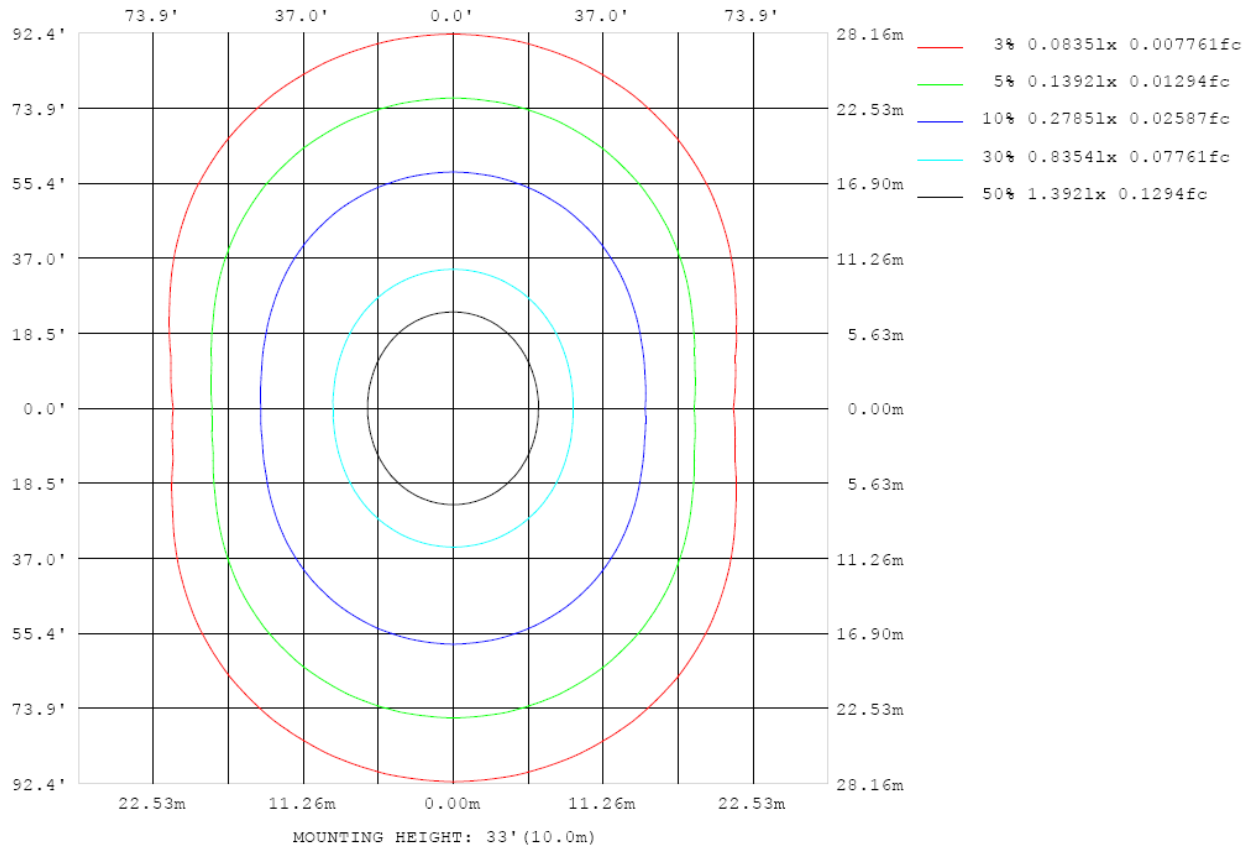


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method of CH1

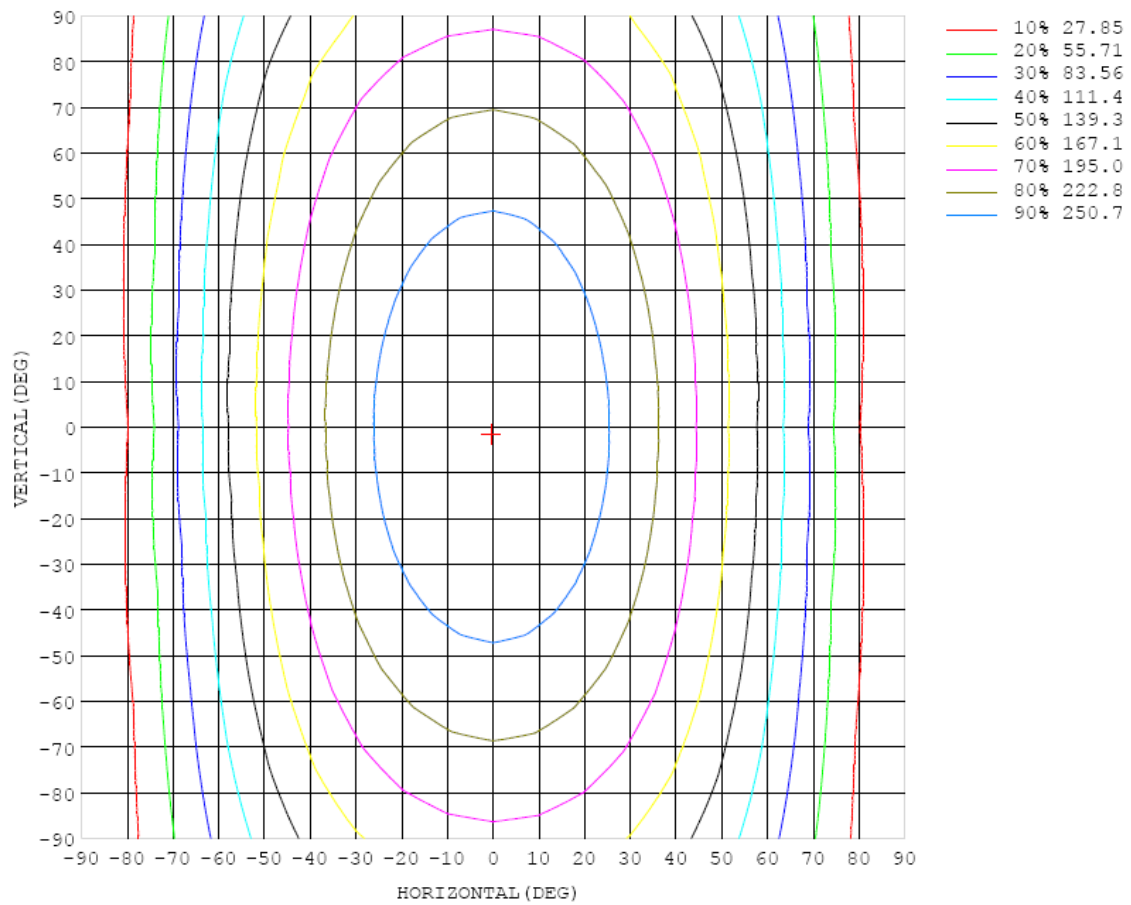


Chart 5: Isocandela Plot

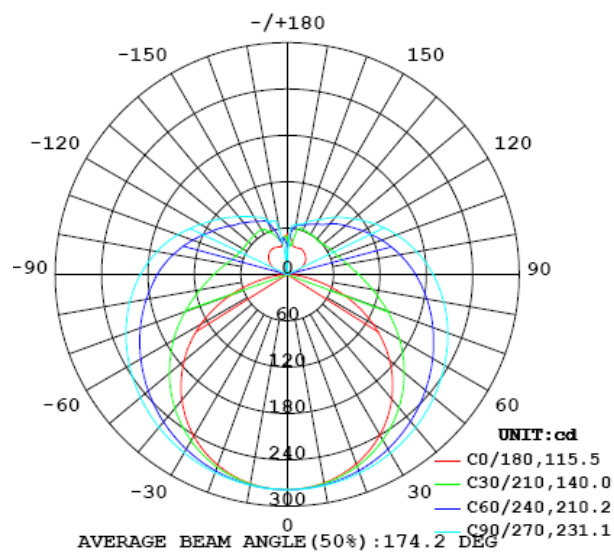


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method of CH1

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	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	278	278	278	278	278	278	278
10	274	274	274	275	275	276	276	277	277	277	277	277	277	276	276	275	275	275	275
15	268	269	269	270	271	273	274	275	275	276	276	275	274	273	272	271	270	270	270
20	261	261	263	264	266	268	270	272	273	273	273	272	271	269	267	265	264	263	263
25	251	252	254	257	260	263	266	268	270	271	270	269	267	264	261	258	255	254	253
30	240	241	243	247	252	257	261	264	266	267	266	265	262	258	253	249	245	242	242
35	226	228	231	237	243	249	255	259	262	263	262	260	255	250	244	238	232	229	228
40	210	212	217	225	233	241	248	254	257	258	257	254	249	242	234	225	218	213	212
45	193	195	202	212	222	232	241	247	252	253	252	248	241	233	223	212	202	196	194
50	173	176	185	198	211	223	233	241	246	247	246	241	234	223	211	197	185	176	174
55	151	156	168	183	199	214	225	234	240	241	239	234	225	213	198	182	167	155	153
60	128	134	149	168	187	204	217	227	233	235	233	227	217	203	186	166	147	133	129
65	103	111	130	153	175	194	209	220	226	228	226	219	208	193	173	151	128	109	103
70	77.9	87.8	111	138	163	184	201	212	219	221	218	211	200	183	161	136	108	85.3	77.2
75	52.8	65.7	93.6	124	152	175	192	204	211	213	211	203	191	173	150	121	90.4	62.7	51.1
80	28.9	45.4	78.5	112	141	165	183	196	203	206	203	195	182	164	139	109	74.8	42.2	27.1
85	10.1	29.8	66.3	101	132	156	175	188	195	197	195	187	173	154	129	98.5	63.0	26.9	8.44
90	1.78	21.3	57.4	92.4	123	147	166	179	186	189	186	178	165	146	121	89.7	54.6	19.1	0.99
95	2.77	18.3	51.3	84.9	115	139	157	170	178	180	177	169	156	137	112	82.5	49.0	17.1	2.54
100	6.16	19.1	47.4	78.9	107	130	148	161	168	170	167	160	147	128	105	76.5	45.8	18.4	6.12
105	10.5	20.3	45.5	73.8	99.7	122	139	151	158	161	158	150	138	120	98.0	72.3	44.5	20.7	11.1
110	15.4	23.3	45.5	69.7	93.2	114	130	142	149	151	148	141	129	113	91.5	68.8	44.9	24.0	15.8
115	20.4	28.1	45.3	67.0	87.5	106	121	132	139	141	138	132	120	104	86.4	66.5	45.7	27.4	20.2
120	24.8	31.8	45.2	65.4	82.8	99.4	113	123	129	131	129	122	112	98.2	82.1	65.1	46.3	30.9	24.2
125	28.6	36.5	46.2	63.0	79.3	93.3	105	114	120	121	119	114	104	92.8	78.6	63.7	48.0	34.1	27.8
130	31.4	39.7	48.3	60.8	76.0	88.3	98.5	106	111	112	110	106	97.4	87.3	76.0	63.5	49.1	36.8	31.3
135	33.5	41.5	51.2	59.3	71.6	83.1	92.4	98.9	103	104	103	98.7	92.1	83.1	73.9	63.5	49.7	39.6	34.1
140	35.2	43.5	52.2	59.4	68.9	77.5	85.5	91.9	95.7	96.9	95.4	89.9	85.7	79.4	72.8	62.8	50.2	41.3	36.2
145	36.7	44.5	54.2	60.8	65.9	73.7	78.9	84.4	87.7	89.0	88.0	84.6	81.8	77.0	70.8	61.0	52.8	43.1	37.8
150	37.9	46.2	54.8	59.7	65.0	70.6	75.3	78.3	80.7	82.1	81.6	79.2	76.4	73.3	67.5	58.5	52.5	45.1	38.6
155	37.6	44.8	56.5	61.1	65.0	68.3	71.7	74.1	75.8	76.8	76.7	74.4	72.4	69.5	63.4	55.9	50.4	43.8	38.4
160	37.0	41.9	57.4	60.9	63.7	66.3	69.1	70.6	71.9	71.9	71.5	69.7	68.0	64.9	54.7	48.7	45.3	41.2	37.8
165	37.1	38.3	47.8	61.2	62.1	65.5	66.1	67.0	67.0	67.0	64.4	64.9	62.5	51.6	45.3	41.5	39.1	37.7	37.1
170	40.2	37.9	36.2	44.8	59.4	62.4	62.9	64.9	65.1	64.9	61.1	56.0	45.5	40.6	38.2	39.5	39.4	38.9	39.9
175	48.6	47.1	44.2	40.0	38.7	42.6	52.2	55.1	62.2	62.0	42.4	32.9	33.9	39.9	43.1	44.8	46.1	46.5	49.3
180	4.98	4.94	4.83	4.65	4.41	4.12	3.80	3.46	3.09	2.77	2.90	3.02	3.14	3.26	3.36	3.45	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	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278		
5	278	278	278	278	278	278	278	278	278	278	278	278	278	277	277	277	277		
10	275	275	275	276	276	276	277	277	277	277	276	276	275	275	275	274	274		
15	270	270	271	272	273	274	275	275	275	275	274	273	272	271	270	269	269		
20	263	264	265	267	269	271	272	273	273	272	271	270	268	266	264	262	261		
25	254	255	258	261	263	266	268	270	270	269	268	265	262	259	256	254	252		
30	242	245	249	253	257	261	264	266	266	266	264	260	256	251	247	243	241		
35	229	233	238	244	250	255	259	262	262	261	259	254	249	242	236	231	228		
40	214	219	226	234	242	249	254	257	258	257	253	248	241	232	224	217	212		
45	197	203	213	223	234	242	248	252	253	252	248	241	232	222	211	202	195		
50	178	187	199	212	224	235	242	246	248	246	241	234	223	211	197	185	177		
55	158	169	184	200	215	227	235	240	242	240	235	226	214	199	183	168	157		
60	135	151	170	188	205	219	228	234	236	234	228	218	204	187	168	149	135		
65	112	132	155	176	196	211	221	227	229	227	220	209	194	175	153	130	112		
70	88.6	113	141	166	186	202	213	220	222	220	213	201	184	164	139	111	88.2		
75	66.0	95.5	127	155	176	194	206	212	215	212	205	193	175	153	125	93.4	65.3		
80	46.0	80.3	115	144	168	185	197	205	207	204	197	184	166	142	112	77.5	44.9		
85	31.0	68.2	104	134	159	176	189	196	198	196	188	175	157	132	101	64.8	28.9		
90	22.8	59.4	94.9	125	150	168	180	187	190	187	179	167	148	123	91.8	55.6	20.1		
95	19.5	52.9	87.0	117	141	159	171	178	181	178	170	158	139	114	83.8	49.1	16.6		
100	20.3	48.5	80.0	108	132	150	162	169	171	169	161	148	130	106	76.8	44.8	17.4		
105	23.6	46.9	74.2	100	123	140	152	159	161	159	151	139	121	98.0	71.1	43.3	20.8		
110	28.1	47.2	70.7	93.5	114	130	142	148	151	148	141	129	112	91.1	67.4	43.6	25.6		
115	32.9	48.4	68.0	87.9	106	121	132	138	140	138	131	120	104	85.9	65.2	45.3	30.7		
120	37.6	50.1	66.4	83.5	99.0	112	122	128	130	127	121	111	98.1	81.9	64.2	48.1	35.7		
125	42.2	52.4	65.9	80.0	93.0	105	114	119	120	119	113	105	92.9	78.9	64.2	51.2	40.6		
130	46.5	54.9	65.7	77.5	88.9	98.0	106	111	112	111	106	98.4	88.5	76.7	64.8	54.3	45.1		
135	49.9	57.3	66.1	75.4	84.6	92.0	98.3	104	105	103	99.2	92.6	84.6	75.2	65.7	57.2	49.3		
140	53.5	59.7	66.5	74.0	81.4	87.6	91.6	96.2	97.7	96.4	93.0	87.6	81.1	73.9	66.7	60.0	52.6		
145	56.3	57.7	67.0	72.8	78.3	83.4	86.2	88.1	91.5	90.4	87.7	83.4	78.2	72.7	67.4	62.3	55.6		
150	59.1	62.5	67.2	71.6	75.9	79.5	82.5	83.0	86.1	85.3	83.2	79.9	75.7	71.9	68.0	64.0	57.9		
155	54.8	60.3	62.8	70.1	73.7	76.4	78.1	78.9	81.3	80.9	79.4	77.1	74.0	71.1	67.2	64.9	52.7		
160	46.7	53.9	56.8	59.4	65.7	71.2	74.8	75.1	73.7	77.3	76.3	74.8	72.5	69.0	68.5	61.3	46.9		
165	39.5	45.6	49.1	50.0	52.2	56.9	62.1	70.4	71.6	74.1	73.7	72.5	67.3	59.7	56.0	54.2	42.6		
170	39.7	40.2	45.9	47.5	46.5	42.4	43.6	47.3	57.0	66.2	69.5	52.3	47.8	51.6	54.0	47.8	40.8		
175	49.4	48.9	48.2	49.7	47.8	47.0	38.9	24.7	14.8	6.60	22.3	42.9	48.9	48.8	49.7	47.6	48.3		
180	3.55	3.51	3.43	3.34	3.23	3.12	2.99	2.87	2.80	3.17	3.53	3.87	4.18	4.46	4.69	4.85	4.95		

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

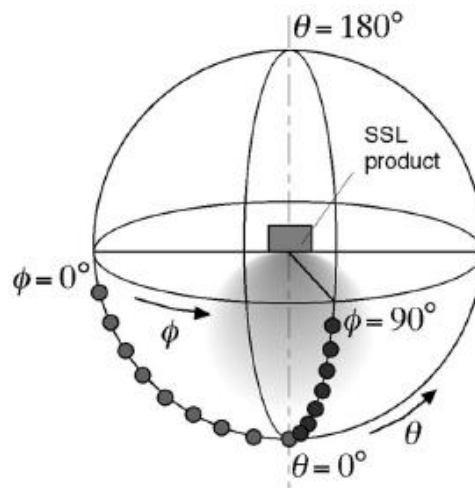
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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