

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube System

Model: 10.5T8/3F/835/EXT/A2

(LED tube model: 10.5T8/3F/835/EXT 2pcs and LED driver model: 15T8T5HEDRIVER/2CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18080024ag

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: 10.5T8/3F/835/EXT/A2

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/2	Power Factor
134.7	1651.0	12.26	0.9948
CCT (K)	CRI	Stabilization Time (Light & Power)	
3510	83.2	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

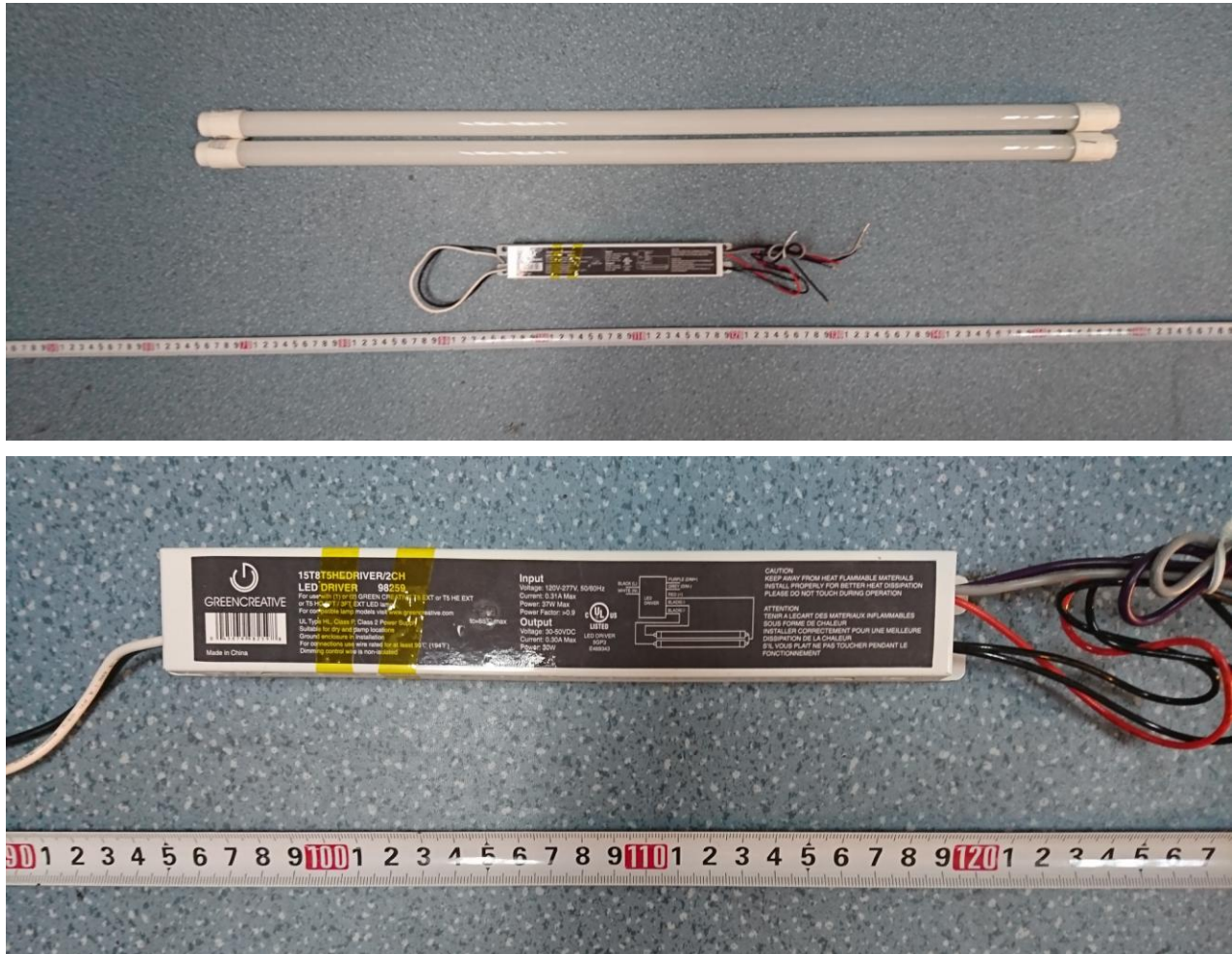


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 10.5T8/3F/835/EXT/A2
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 3500K LED tube model: 10.5T8/3F/835/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 25.5°C.

Base orientation was horizontal. 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)	0.205	0.097
Power Factor	0.9948	0.9398
Test Power (W)/2	12.26	12.65
THD A%	4.33	10.28
Luminous Efficacy (lm/W)	134.7	130.6
Luminous Flux per lamp (lm)	1651.0	1652.0
Color Rendering Index (CRI)	83.2	
R9	6.2	
Correlated Color Temperature (CCT)(K)	3510	
Chromaticity Chroma x	0.4069	
Chromaticity Chroma y	0.3952	
Chromaticity Chroma u	0.2349	
Chromaticity Chroma v	0.3422	
Duv	0.0016	
Chromaticity Chroma u'	0.2349	
Chromaticity Chroma v'	0.5133	

Special Color Rendering Indices	
R1	80.9
R2	90.4
R3	96.9
R4	81.9
R5	82.7
R6	89.8
R7	83.1
R8	60.2
R9	6.2
R10	78.2
R11	78
R12	62
R13	82.9
R14	98.8
Rf	83
Rg	93

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 24.7°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)	0.207
Power Factor	0.9948
Test Power (W)/2	12.33
Luminous Efficacy (lm/W)	131.8
Luminous Flux per lamp (lm)	1625.4
Beam Angle (°)	168.8
Center Beam Candle Power (cd)	266
Spacing Criteria	1.26 (0 °-180 °)/ 1.44 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	42.35%
Zonal Lumens in the 60 °-90 °Zone	26.81%
Zonal Lumens in the 90 °-120 °Zone	17.79%
Zonal Lumens in the 120 °-180 °Zone	13.05%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

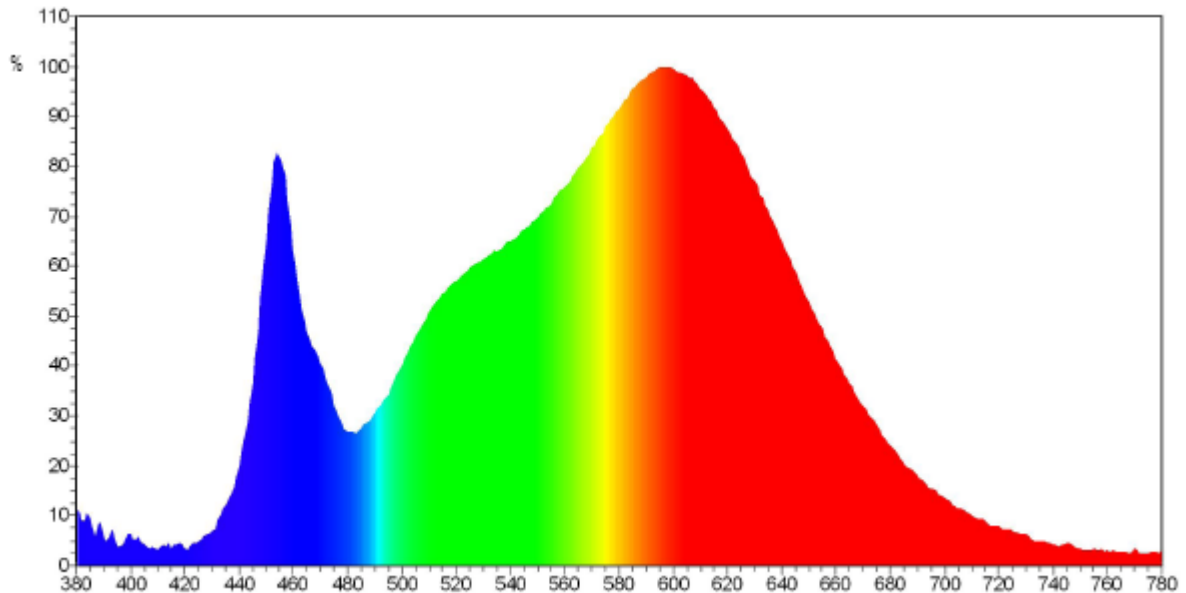
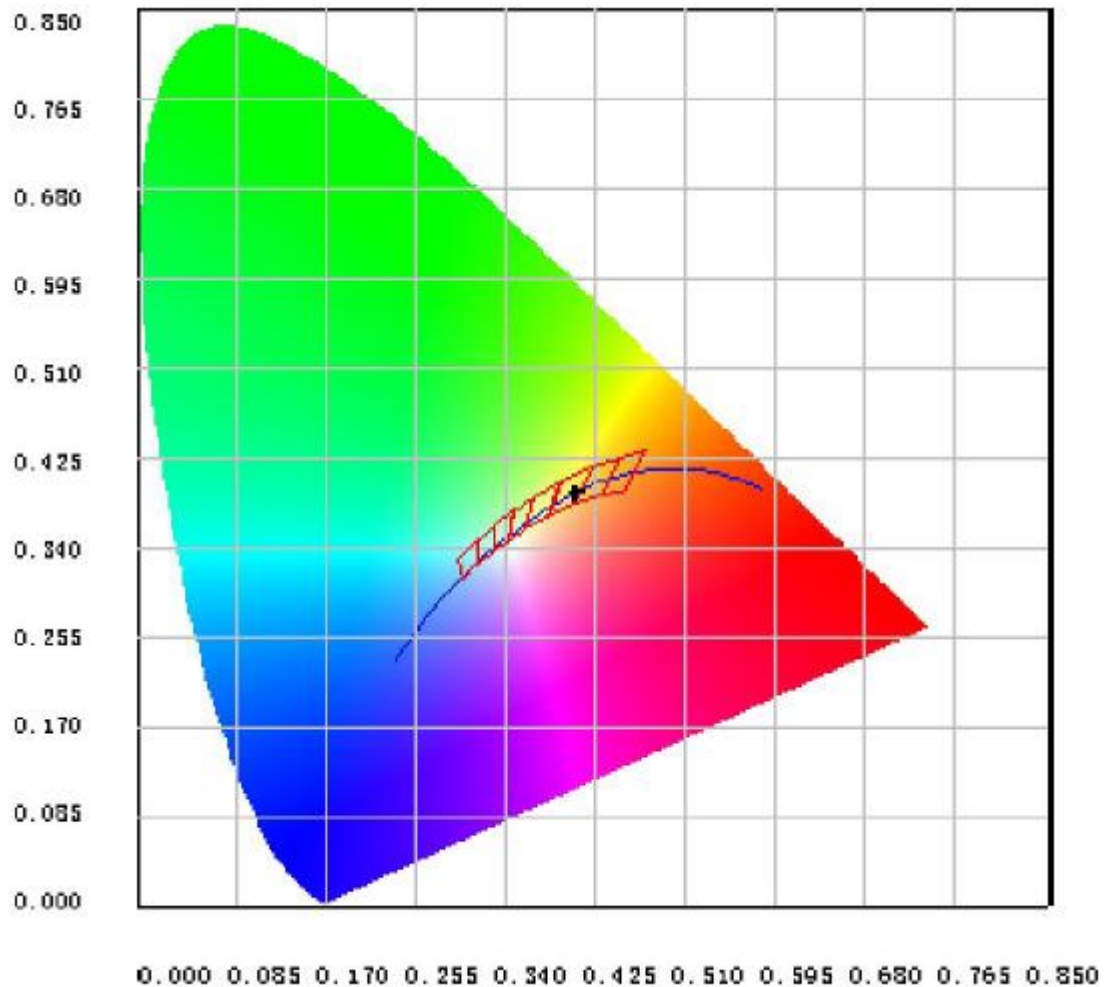


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	6.34E-03	485	1.51E-02	590	5.38E-02	695	8.50E-03
385	5.45E-03	490	1.68E-02	595	5.48E-02	700	7.50E-03
390	3.21E-03	495	1.88E-02	600	5.47E-02	705	6.34E-03
395	2.18E-03	500	2.20E-02	605	5.40E-02	710	5.51E-03
400	3.43E-03	505	2.51E-02	610	5.26E-02	715	4.95E-03
405	2.53E-03	510	2.78E-02	615	5.05E-02	720	4.44E-03
410	1.79E-03	515	2.99E-02	620	4.81E-02	725	3.88E-03
415	1.95E-03	520	3.12E-02	625	4.54E-02	730	3.37E-03
420	2.01E-03	525	3.28E-02	630	4.25E-02	735	2.71E-03
425	2.59E-03	530	3.37E-02	635	3.91E-02	740	2.35E-03
430	3.83E-03	535	3.46E-02	640	3.57E-02	745	2.43E-03
435	6.69E-03	540	3.57E-02	645	3.24E-02	750	1.91E-03
440	1.09E-02	545	3.69E-02	650	2.89E-02	755	1.93E-03
445	2.01E-02	550	3.83E-02	655	2.60E-02	760	1.65E-03
450	3.60E-02	555	4.00E-02	660	2.29E-02	765	1.62E-03
455	4.46E-02	560	4.17E-02	665	2.01E-02	770	1.94E-03
460	3.50E-02	565	4.38E-02	670	1.77E-02	775	1.35E-03
465	2.60E-02	570	4.60E-02	675	1.54E-02	780	1.64E-03
470	2.23E-02	575	4.83E-02	680	1.31E-02		
475	1.77E-02	580	5.03E-02	685	1.14E-02		
480	1.47E-02	585	5.25E-02	690	1.00E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4069, 0.3952)

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

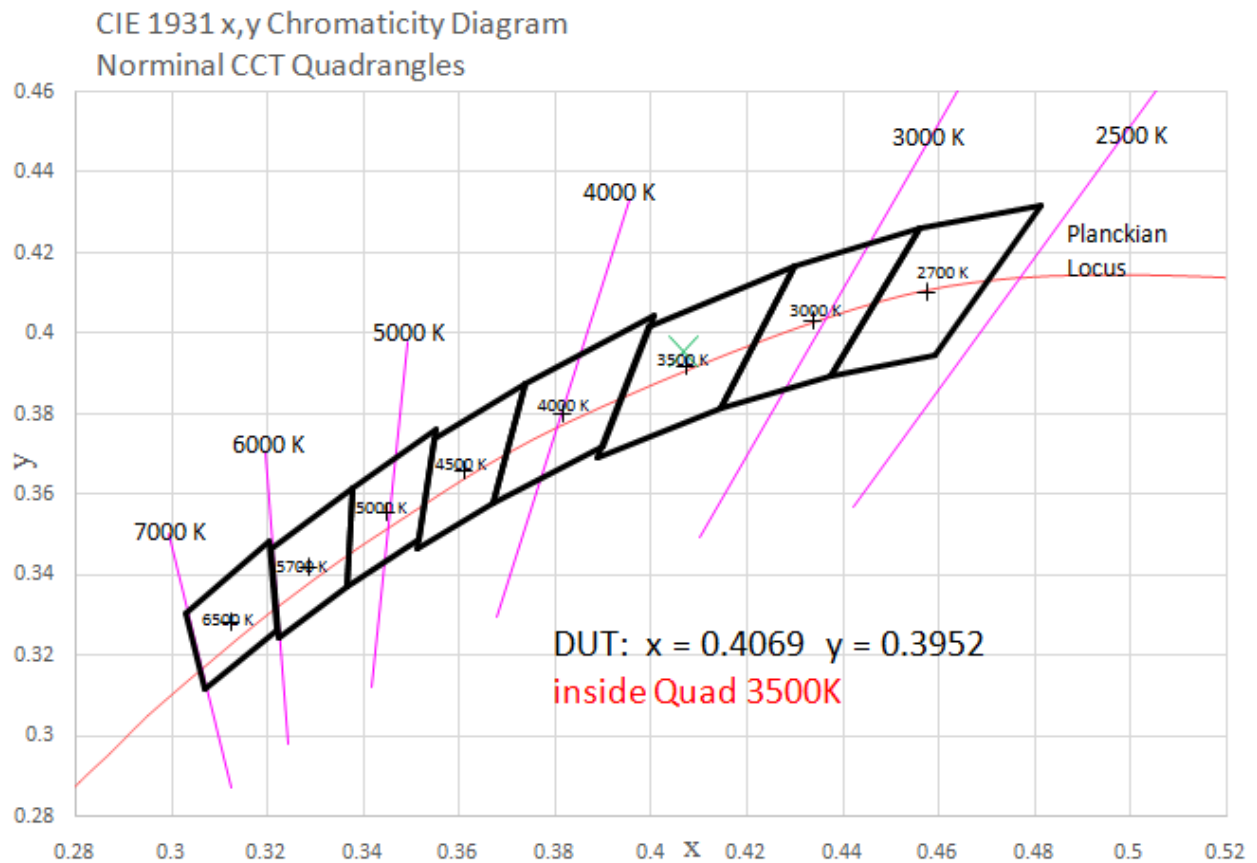


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	25.232	1.55%
10- 20	73.251	4.51%
20- 30	114.306	7.03%
30- 40	144.863	8.91%
40- 50	162.82	10.02%
50- 60	167.838	10.33%
60- 70	161.225	9.92%
70- 80	146.315	9.00%
80- 90	128.216	7.89%
90-100	111.812	6.88%
100-110	96.17	5.92%
110-120	81.145	4.99%
120-130	67.25	4.14%
130-140	54.388	3.35%
140-150	41.519	2.55%
150-160	28.768	1.77%
160-170	15.703	0.97%
170-180	4.552	0.28%
Total	1625.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	688.31	42.35%
60- 90	435.756	26.81%
0-90	1124.066	69.16%
90- 180	501.307	30.84%
0- 180	1625.4	100%

Table 5: Zonal Lumen Data

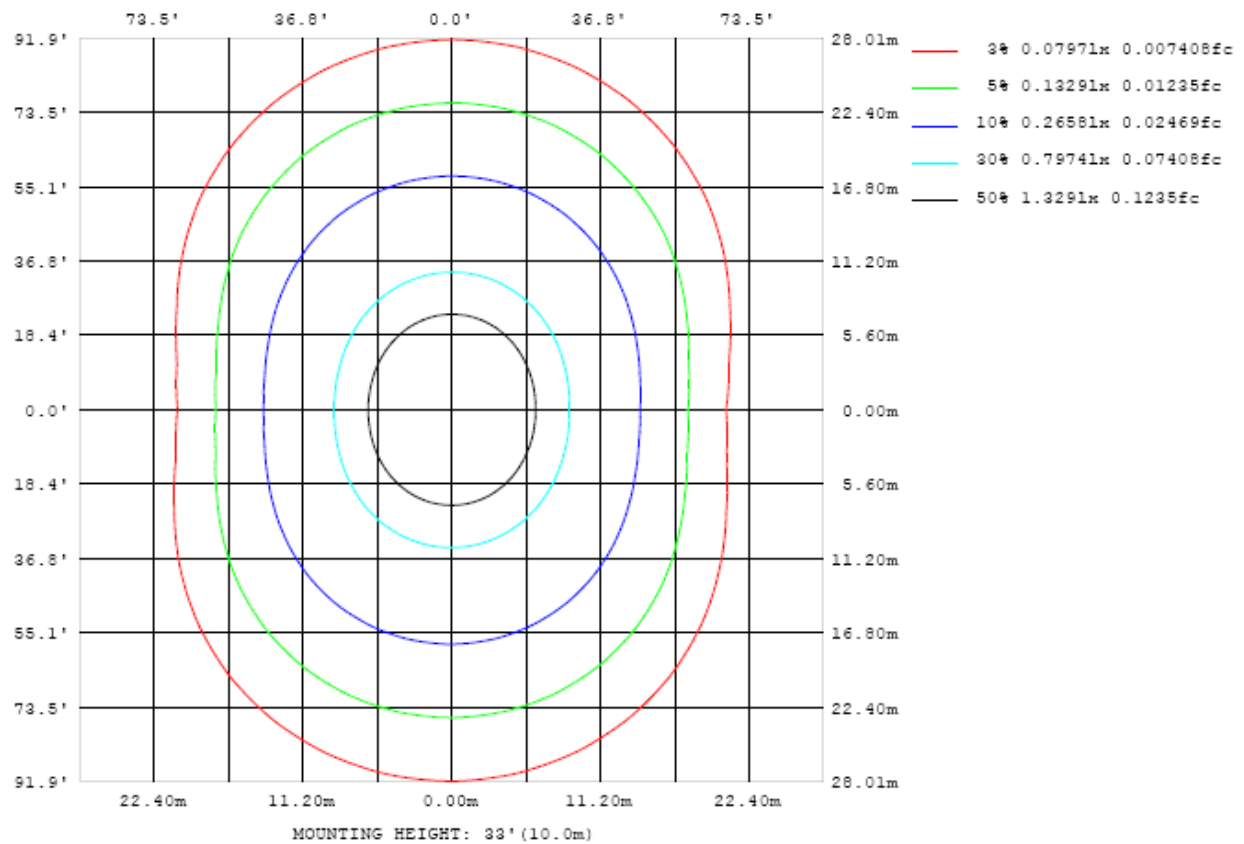


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

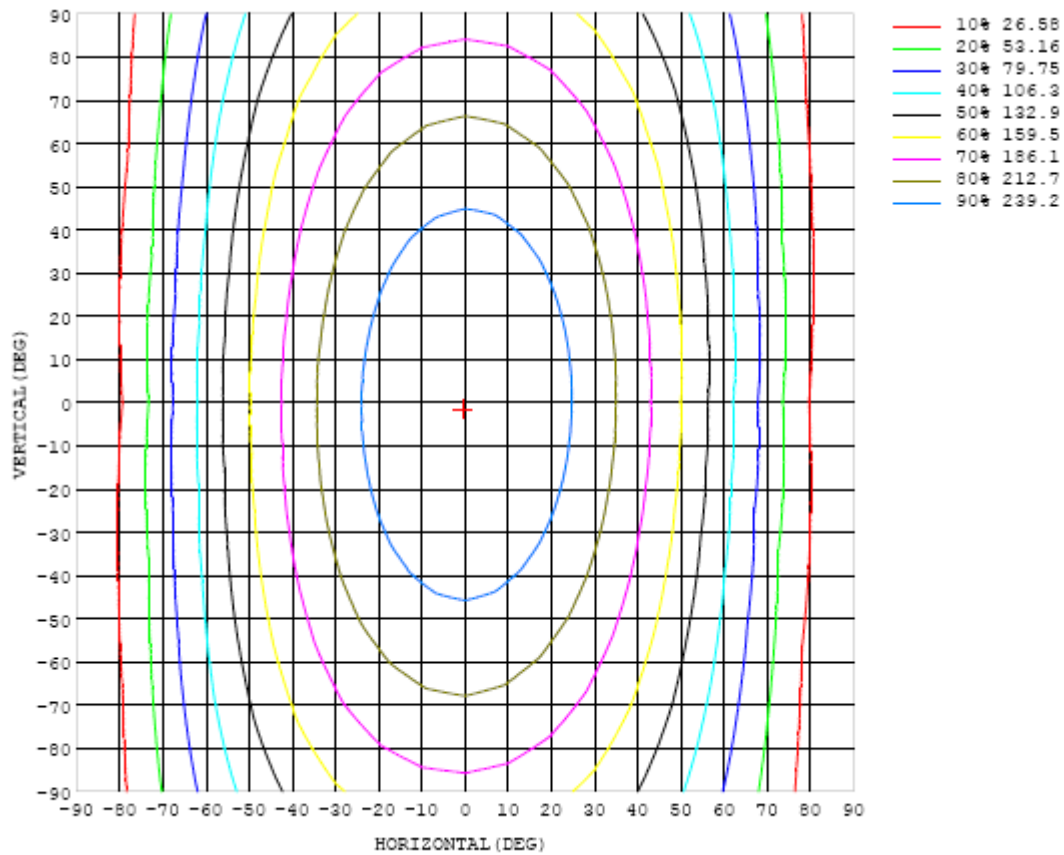


Chart 5: Isocandela Plot

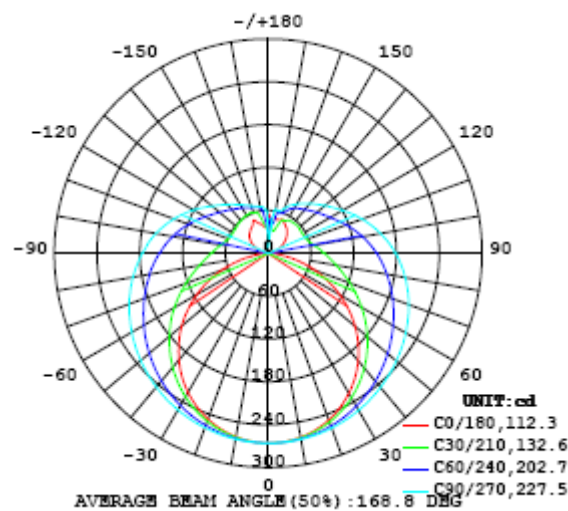


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	266	266	266	266	266	266	266	266	266	266	266	266	266	266	266	266	266	266	266
5	265	265	265	265	265	265	265	265	266	266	266	265	265	265	265	265	265	264	264
10	262	262	262	262	263	263	264	264	264	264	264	264	264	263	262	262	261	261	261
15	256	256	257	258	259	260	261	262	263	263	262	262	261	260	258	257	256	255	255
20	248	249	250	251	253	256	257	259	260	260	260	259	257	255	253	251	249	248	247
25	238	239	241	243	247	250	253	255	257	257	257	255	253	249	246	243	240	238	237
30	226	227	230	233	238	243	247	251	253	254	253	251	247	243	238	233	229	226	225
35	212	213	217	222	229	235	241	246	249	250	249	246	241	235	229	222	216	212	211
40	196	198	203	210	218	227	234	240	244	245	244	240	235	227	219	210	202	197	195
45	179	181	187	196	207	217	227	234	238	240	239	234	228	219	208	197	187	180	177
50	159	162	170	182	195	208	219	227	233	235	233	228	220	209	197	183	171	161	158
55	138	141	152	167	183	198	211	220	227	229	227	222	213	200	185	169	153	142	138
60	116	120	133	151	170	188	202	213	220	223	221	215	205	191	174	155	136	121	116
65	92.8	98.4	115	136	158	178	194	206	214	216	215	208	197	182	162	141	118	99.9	92.5
70	69.6	76.5	96.9	122	147	168	186	199	207	210	208	201	189	173	151	127	101	80.0	69.0
75	46.6	55.8	80.2	109	136	159	177	191	199	203	201	194	181	164	141	115	85.8	59.3	45.8
80	25.2	37.0	66.1	97.0	126	150	169	183	192	195	193	186	173	155	132	104	72.8	41.8	24.7
85	8.39	22.8	54.7	87.0	116	141	161	175	184	187	185	178	165	147	123	94.3	62.1	28.8	7.73
90	0.77	15.3	46.6	78.7	108	133	152	166	175	179	177	170	157	138	115	86.2	54.3	21.5	0.40
95	2.01	12.2	40.6	71.8	100	124	143	157	166	170	168	161	148	130	107	78.9	48.3	18.2	2.06
100	4.89	13.5	36.7	65.5	92.2	116	134	148	157	160	158	151	139	121	99.1	73.1	44.2	18.7	5.28
105	8.88	16.7	35.6	60.5	85.2	107	125	138	147	150	148	142	130	113	91.9	68.0	42.8	21.1	9.84
110	13.5	20.7	36.4	57.4	79.2	99.6	116	129	137	140	138	132	121	105	85.6	64.6	43.1	24.6	15.0
115	18.5	24.2	37.9	55.8	75.5	92.6	108	120	127	130	128	122	112	97.9	81.0	62.8	44.3	28.3	20.2
120	23.4	27.0	40.0	55.5	72.0	87.3	100	111	117	120	119	113	104	92.3	77.5	61.8	45.8	31.6	25.4
125	28.2	30.8	42.3	55.4	69.7	82.8	94.3	103	109	111	110	106	98.0	87.5	75.0	61.4	47.3	34.4	30.1
130	32.8	33.2	44.2	56.2	67.9	79.1	89.0	96.7	102	104	103	99.0	92.3	83.5	73.0	60.9	48.9	37.6	34.0
135	37.1	36.0	45.0	56.1	66.5	75.8	84.2	90.7	95.1	97.0	96.2	92.9	87.2	79.7	70.8	60.6	50.0	39.6	37.3
140	41.4	36.1	42.8	55.4	65.6	73.5	79.9	85.3	89.1	90.7	90.0	87.2	82.3	76.2	68.9	59.6	49.3	39.7	39.6
145	44.3	35.9	42.8	55.1	63.1	70.7	76.3	80.4	83.3	84.5	84.0	81.8	78.2	73.3	66.6	57.8	46.4	38.9	42.3
150	47.1	37.4	42.4	53.0	59.6	67.4	72.5	75.9	78.5	79.1	78.6	76.9	74.1	69.9	61.9	55.6	45.3	38.6	44.3
155	50.1	38.0	42.7	51.0	57.0	61.3	67.3	71.2	73.2	74.0	73.6	72.2	69.5	64.0	57.8	53.6	45.6	39.3	49.8
160	50.1	37.2	37.5	45.6	54.5	57.5	59.9	62.5	65.4	66.7	66.6	65.3	61.1	56.9	52.3	46.1	41.1	38.8	46.4
165	49.1	37.1	34.1	33.5	46.7	56.3	58.4	59.2	60.3	61.4	62.2	58.5	50.2	42.7	39.0	35.9	36.3	38.7	43.1
170	47.5	37.1	33.4	32.5	32.2	37.9	43.8	52.4	61.3	62.5	50.7	36.2	36.3	35.6	35.3	35.4	36.4	37.2	39.1
175	45.7	42.0	40.9	40.0	43.5	47.8	49.3	49.1	44.6	19.3	42.2	46.2	46.8	46.9	44.8	43.0	40.6	38.5	38.5
180	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	266	266	266	266	266	266	266	266	266	266	266	266	266	266	266	266	266		
5	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265		
10	261	261	262	262	263	263	264	264	264	264	264	264	263	263	262	262	262		
15	255	256	257	258	259	260	261	262	262	262	262	261	260	259	258	257	256		
20	248	249	250	252	254	256	258	259	260	260	259	257	255	254	252	250	249		
25	238	239	242	245	249	252	254	256	257	257	255	253	250	247	244	241	239		
30	226	228	232	237	242	246	250	252	253	253	251	248	243	239	234	230	227		
35	212	215	221	227	234	240	245	248	249	248	246	241	236	230	223	218	214		
40	196	201	208	217	225	233	239	243	244	243	240	235	227	219	211	204	199		
45	179	186	195	206	216	226	233	237	239	238	234	227	219	208	198	188	181		
50	161	169	181	194	207	218	226	231	233	232	227	220	209	197	184	172	164		
55	141	152	167	182	197	210	219	225	227	226	220	212	200	185	170	155	144		
60	120	134	152	170	187	201	212	219	221	219	213	203	190	173	156	137	123		
65	98.5	115	137	159	177	193	205	212	214	212	206	195	180	162	141	119	102		
70	76.7	97.5	123	147	168	185	197	205	208	205	198	187	170	151	127	102	80.5		
75	55.8	80.9	110	136	159	177	190	198	200	198	191	178	162	140	114	85.8	60.2		
80	37.3	66.5	98.0	127	150	169	182	190	193	190	183	170	153	130	102	71.6	42.2		
85	23.3	55.2	88.1	117	142	161	174	182	185	182	175	162	144	121	92.4	60.3	28.3		
90	16.0	47.4	80.0	109	133	153	166	174	176	174	167	154	136	112	83.9	52.1	20.3		
95	13.5	42.4	73.4	102	126	144	158	166	169	166	159	146	128	104	77.0	46.4	16.8		
100	14.7	38.9	67.7	94.7	118	136	149	157	160	158	150	137	119	97.0	70.8	42.1	16.6		
105	17.8	37.7	63.1	88.2	110	128	140	148	151	148	141	128	111	90.1	65.5	39.7	18.7		
110	22.4	38.3	59.6	82.3	102	119	131	138	141	138	131	120	104	83.7	61.3	39.3	22.5		
115	27.2	40.2	58.0	77.1	95.4	111	122	129	131	129	122	111	96.2	78.1	58.7	39.9	26.9		
120	32.0	42.7	57.4	73.6	88.9	103	113	119	121	119	113	103	89.5	73.7	57.3	41.6	31.4		
125	36.8	45.4	57.4	71.0	84.0	95.2	104	110	112	110	104	95.4	83.9	70.7	56.7	44.2	35.9		
130	41.4	48.2	58.0	69.1	80.0	89.4	96.8	101	103	101	96.7	89.2	79.6	68.5	56.9	47.1	40.3		
135	45.6	51.0	58.9	67.7	76.6	84.4	90.5	94.3	95.5	94.2	90.3	84.1	76.1	66.9	57.7	50.1	44.6		
140	48.1	53.8	59.8	66.8	73.8	80.1	85.0	88.0	89.1	87.9	84.7	79.7	73.2	66.0	58.8	52.9	48.5		
145	51.1	56.3	60.7	66.1	71.5	76.4	80.2	82.6	83.4	82.5	80.0	76.0	70.9	65.4	60.0	55.5	51.4		
150	53.3	57.9	61.5	65.6	69.6	73.2	76.1	77.9	78.5	77.8	75.9	72.9	69.1	65.1	61.2	57.9	54.4		
155	57.2	59.2	62.0	65.2	68.0	70.6	72.6	73.9	74.3	73.8	72.5	70.4	67.8	65.1	62.5	60.1	57.3		
160	57.0	60.8	59.8	63.9	66.8	68.4	69.7	70.6	70.9	70.6	69.8	68.5	66.8	65.2	63.6	61.8	58.6		
165	50.1	54.3	59.2	60.6	65.1	66.8	67.5	68.0	68.2	68.1	67.7	67.1	66.2	65.2	64.3	63.4	60.8		
170	41.6	44.0	46.7	51.7	58.5	64.6	66.2	66.1	66.3	66.3	66.1	65.9	65.5	65.1	64.3	62.6	59.6		
175	37.4	37.6	37.2	37.9	39.8	47.1	58.2	62.8	63.3	63.4	63.1	62.5	61.6	61.0	60.3	56.9	51.5		
180	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1		

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

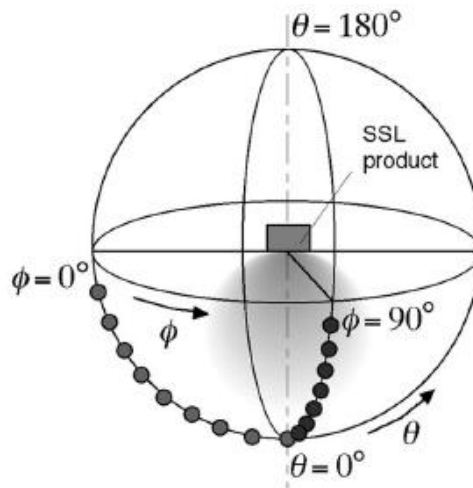
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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