



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/850/EXT/A2

(LED tube model: 10.5T8/3F/850/EXT 2pcs and LED driver model: 15T8T5HEDRIVER/2CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18070047x

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

Review by:

Engineer: April Zou
Aug. 09, 2018

Approved by:



Manager: Jim Zhang
Aug. 09, 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/850/EXT/A2

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/2	Power Factor
134.7	1643.0	12.20	0.9963
CCT (K)	CRI	Stabilization Time (Light & Power)	
4972	82.4	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

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Sample Photos

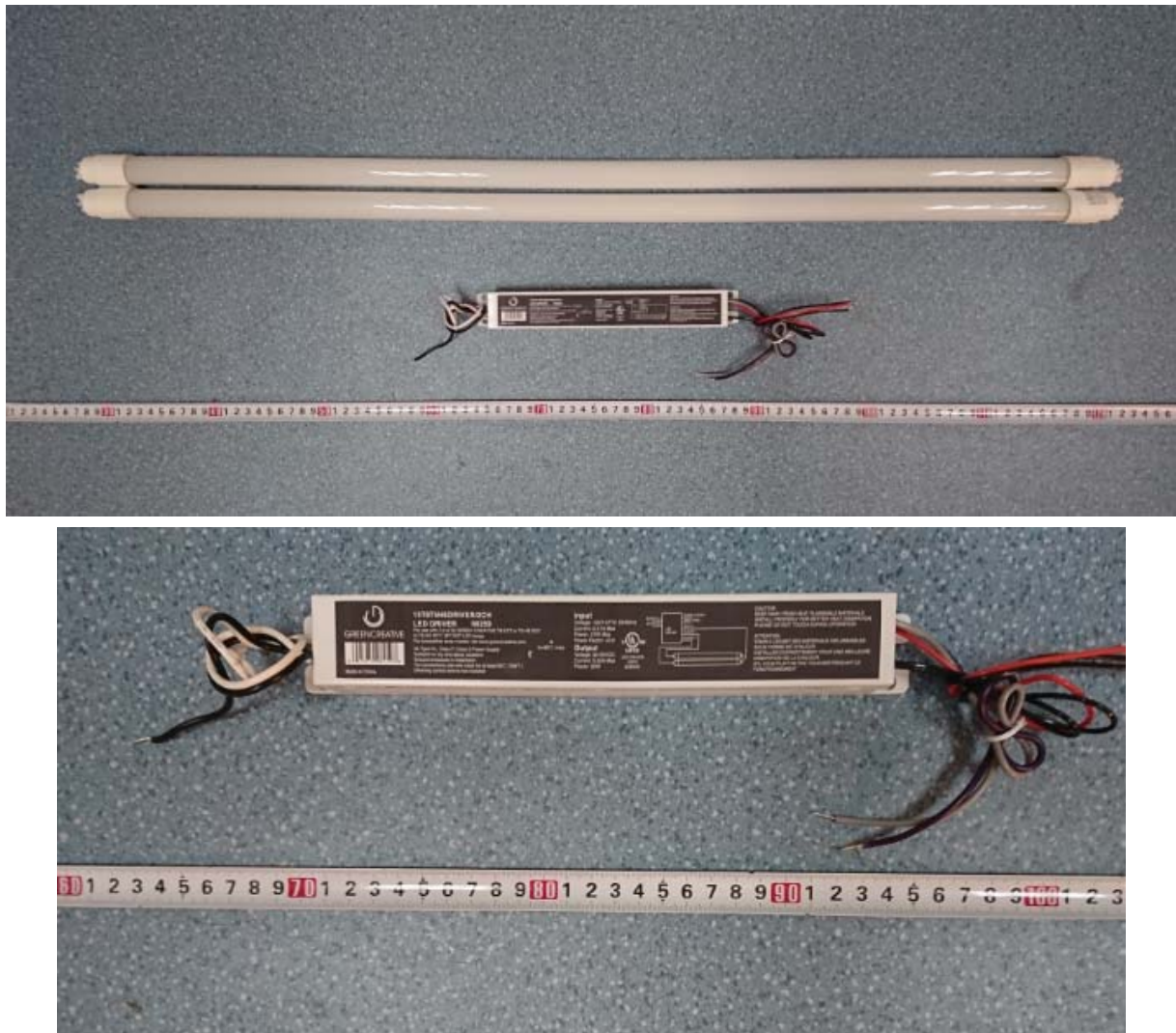


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 10.5T8/3F/850/EXT/A2
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 5000K LED tube model: 10.5T8/3F/850/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 24.9°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)	0.204	0.097
Power Factor	0.9963	0.9351
Test Power (W)/2	12.20	12.50
THD A%	2.38	7.53
Luminous Efficacy (lm/W)	134.7	131.6
Luminous Flux per lamp (lm)	1643.0	1644.0
Color Rendering Index (CRI)	82.4	
R9	5.4	
Correlated Color Temperature (CCT)(K)	4972	
Chromaticity Chroma x	0.3460	
Chromaticity Chroma y	0.3526	
Chromaticity Chroma u	0.2117	
Chromaticity Chroma v	0.3235	
Duv	0.0001	
Chromaticity Chroma u'	0.2117	
Chromaticity Chroma v'	0.4853	

Special Color Rendering Indices	
R1	80.2
R2	86.9
R3	91.5
R4	83.1
R5	82.3
R6	83.7
R7	85.8
R8	65.9
R9	5.4
R10	68.8
R11	83.1
R12	55.8
R13	81.4
R14	95.2
Rf	81
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 24.9°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)	0.205
Power Factor	0.9963
Test Power (W)/2	12.24
Luminous Efficacy (lm/W)	132.4
Luminous Flux per lamp (lm)	1619.4
Beam Angle (°)	172.1
Center Beam Candle Power (cd)	259
Spacing Criteria	1.27 (0°-180°)/ 1.46 (90°-270°)
Zonal Lumens in the 0°-60°Zone	41.91%
Zonal Lumens in the 60°-90°Zone	26.93%
Zonal Lumens in the 90°-120°Zone	18.00%
Zonal Lumens in the 120°-180°Zone	13.16%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

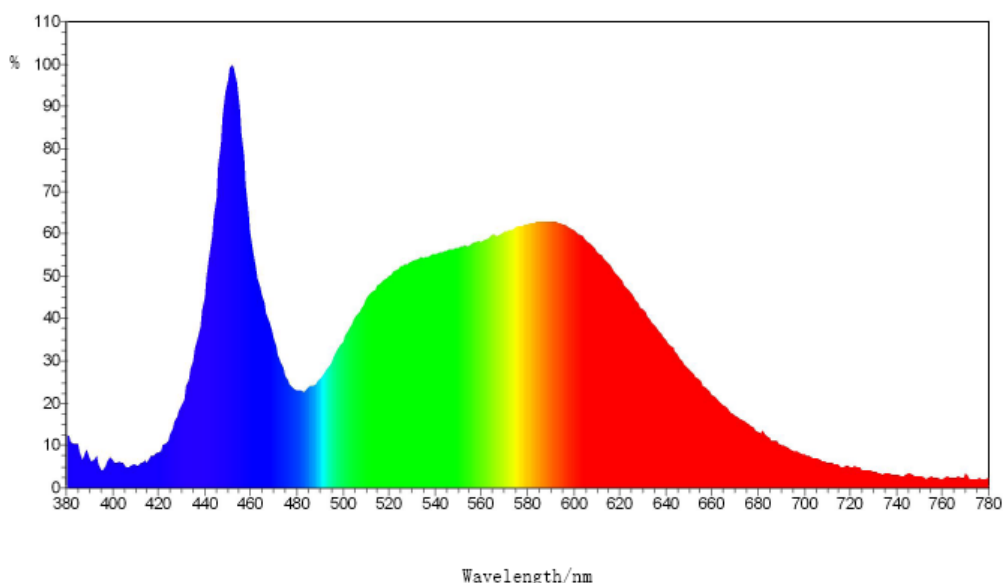
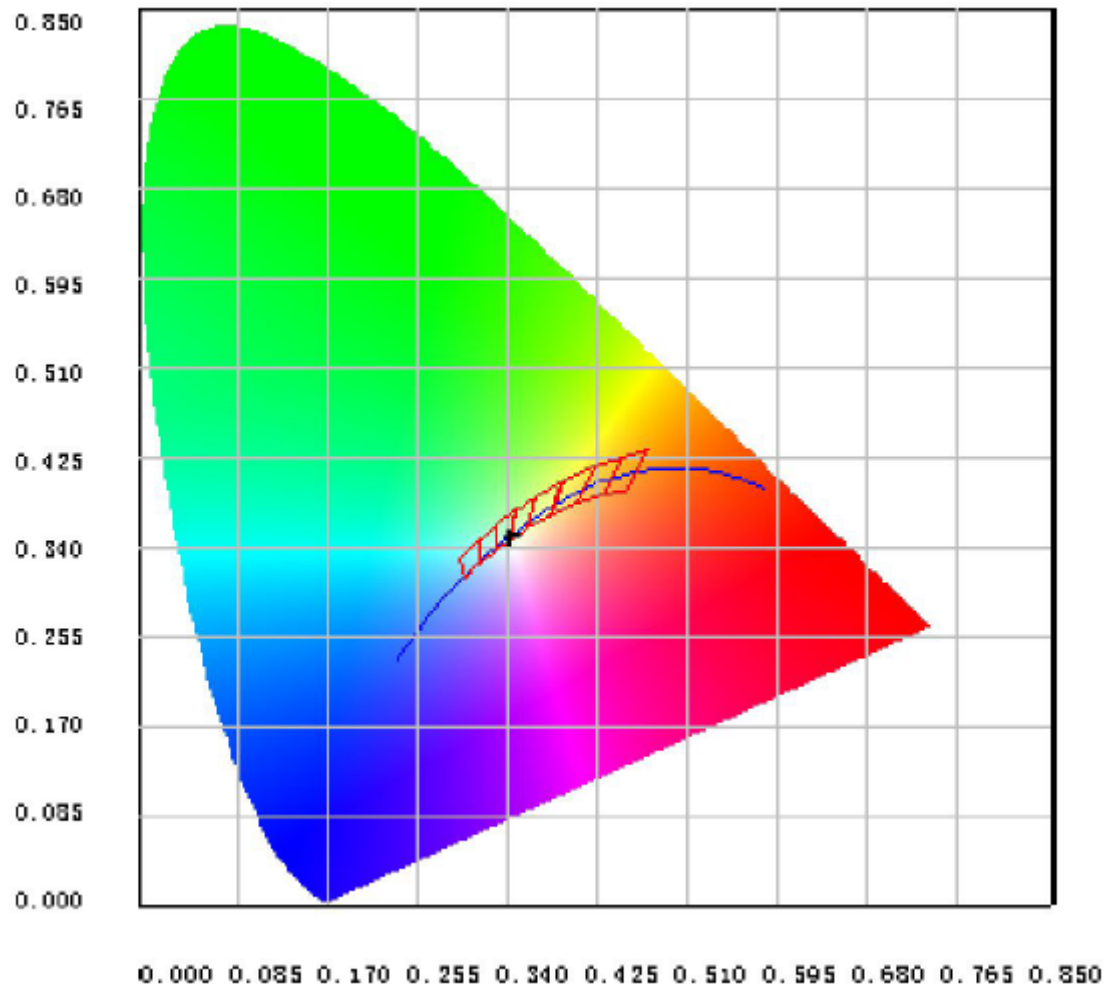


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	5.28E-03	485	9.97E-03	590	2.65E-02	695	3.76E-03
385	4.46E-03	490	1.10E-02	595	2.63E-02	700	3.40E-03
390	2.92E-03	495	1.25E-02	600	2.56E-02	705	2.95E-03
395	1.79E-03	500	1.46E-02	605	2.48E-02	710	2.55E-03
400	2.76E-03	505	1.68E-02	610	2.36E-02	715	2.33E-03
405	2.49E-03	510	1.86E-02	615	2.23E-02	720	2.10E-03
410	2.34E-03	515	2.01E-02	620	2.09E-02	725	1.84E-03
415	2.49E-03	520	2.10E-02	625	1.94E-02	730	1.64E-03
420	3.48E-03	525	2.20E-02	630	1.78E-02	735	1.47E-03
425	5.27E-03	530	2.25E-02	635	1.62E-02	740	1.27E-03
430	8.24E-03	535	2.29E-02	640	1.48E-02	745	1.45E-03
435	1.27E-02	540	2.32E-02	645	1.32E-02	750	1.24E-03
440	1.90E-02	545	2.36E-02	650	1.18E-02	755	1.14E-03
445	2.90E-02	550	2.39E-02	655	1.06E-02	760	9.52E-04
450	4.07E-02	555	2.42E-02	660	9.32E-03	765	1.07E-03
455	3.78E-02	560	2.45E-02	665	8.23E-03	770	1.47E-03
460	2.55E-02	565	2.52E-02	670	7.24E-03	775	8.46E-04
465	1.93E-02	570	2.54E-02	675	6.47E-03	780	1.02E-03
470	1.50E-02	575	2.60E-02	680	5.61E-03		
475	1.13E-02	580	2.63E-02	685	4.98E-03		
480	9.72E-03	585	2.66E-02	690	4.29E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3460, 0.3526)

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

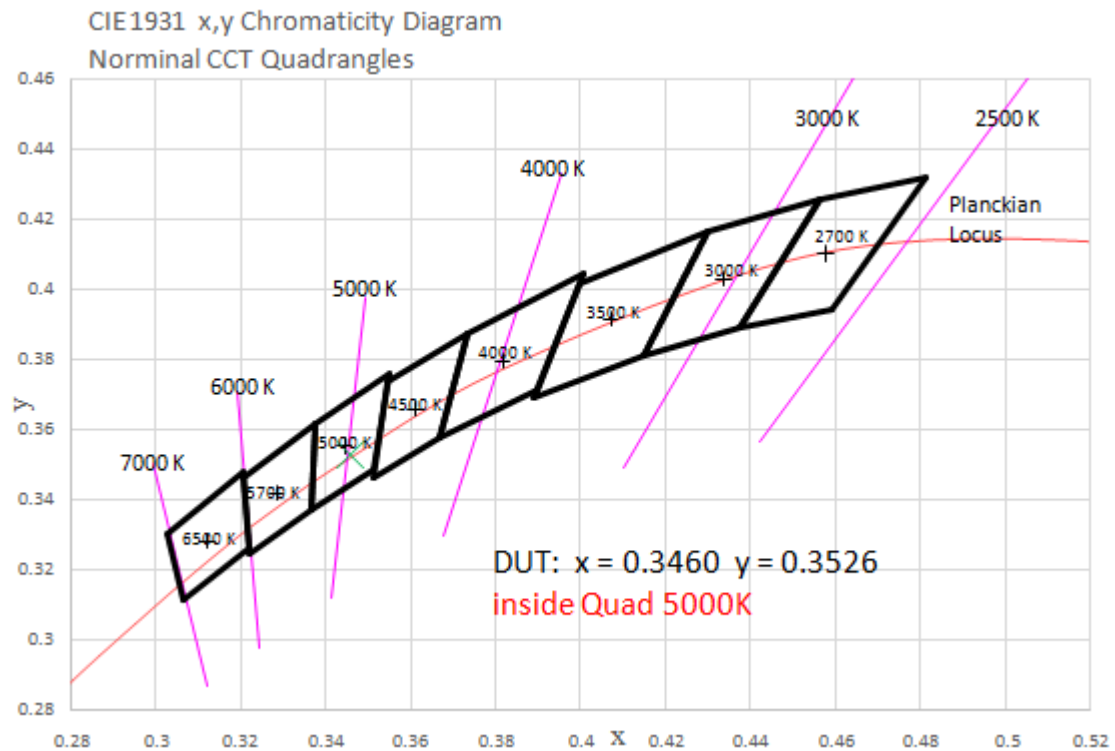


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	24.641	1.52%
10- 20	71.667	4.43%
20- 30	112.147	6.93%
30- 40	142.631	8.81%
40- 50	160.96	9.94%
50- 60	166.646	10.29%
60- 70	160.767	9.93%
70- 80	146.507	9.05%
80- 90	128.846	7.96%
90-100	112.758	6.96%
100-110	96.997	5.99%
110-120	81.665	5.04%
120-130	67.585	4.17%
130-140	54.661	3.38%
140-150	41.863	2.59%
150-160	29.094	1.80%
160-170	15.842	0.98%
170-180	4.088	0.25%
Total	1619.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	678.692	41.91%
60- 90	436.12	26.93%
0-90	1114.812	68.84%
90- 180	504.553	31.16%
0- 180	1619.4	100%

Table 5: Zonal Lumen Data

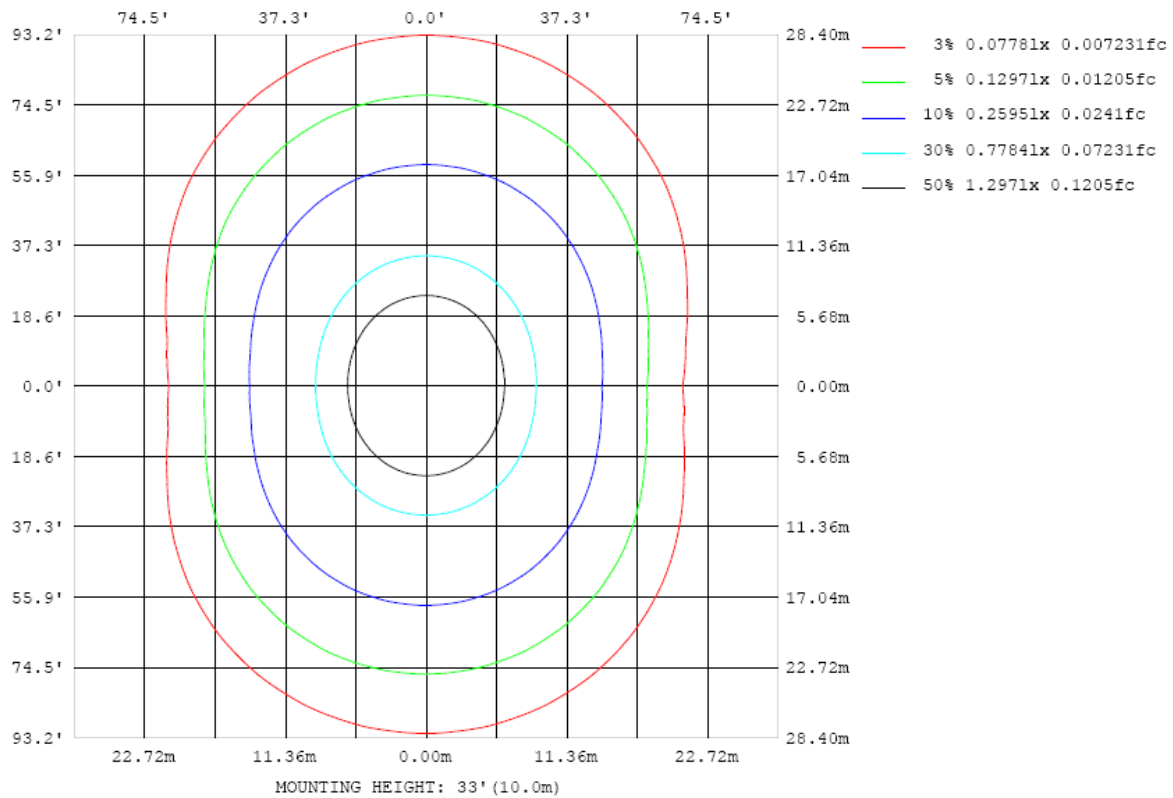


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

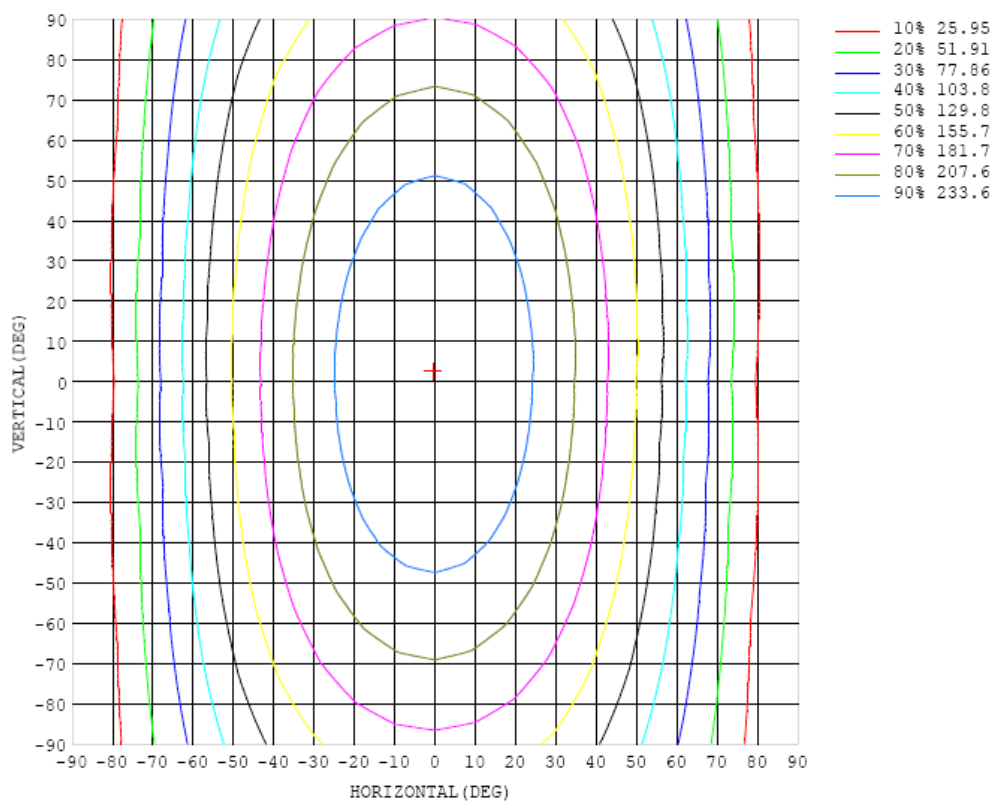


Chart 5: Isocandela Plot

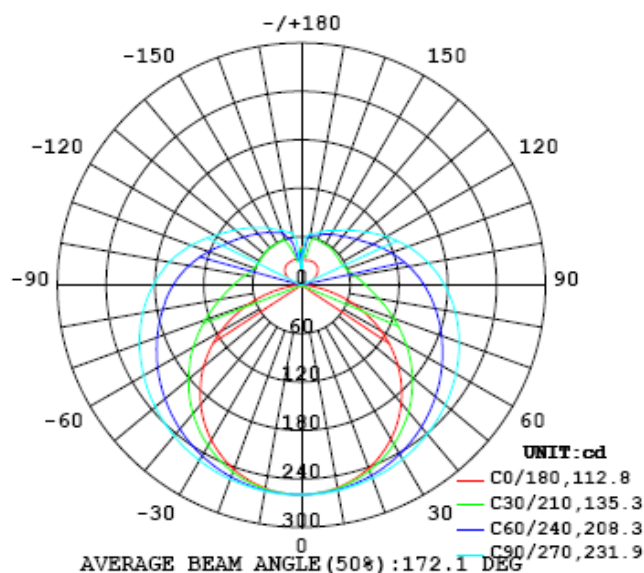


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259
5	258	258	258	258	258	259	259	259	259	259	259	259	259	259	259	259	259	259	258
10	255	255	255	255	256	256	257	258	258	258	258	258	258	257	257	256	256	256	255
15	249	249	250	251	252	253	255	256	256	257	257	256	255	254	253	252	251	250	250
20	241	242	243	245	247	249	251	253	254	255	254	254	252	250	248	246	244	243	243
25	232	232	234	237	240	244	247	249	251	252	252	250	248	245	241	238	236	234	233
30	220	221	223	227	232	237	242	245	248	249	248	246	243	239	234	229	225	222	222
35	206	207	211	217	223	230	236	241	244	245	244	242	237	231	225	218	213	209	208
40	191	192	197	205	213	222	230	235	239	241	240	237	231	224	215	207	199	194	193
45	174	176	182	192	203	213	222	230	234	236	235	231	224	215	205	194	184	177	175
50	155	158	166	178	191	204	215	224	229	231	229	225	217	206	194	180	168	159	157
55	135	138	149	164	180	195	207	217	223	225	224	218	209	197	182	166	151	140	137
60	113	118	131	149	168	185	200	210	217	219	217	212	201	187	170	152	133	119	115
65	90.5	96.6	113	135	156	176	192	203	210	213	211	205	193	178	159	137	116	98.1	92.0
70	68.0	75.5	96.1	121	145	166	183	196	204	206	204	197	185	169	148	124	98.7	76.5	68.6
75	45.2	55.5	79.9	108	135	157	175	188	197	199	197	190	177	160	137	111	82.8	57.4	45.7
80	24.1	37.3	66.3	96.6	125	148	167	181	189	192	190	182	169	151	128	99.9	69.5	39.6	24.3
85	7.63	23.4	55.1	86.9	116	140	159	173	181	184	182	174	161	142	119	90.2	58.5	26.2	7.67
90	0.37	16.1	47.2	78.9	108	132	151	165	173	176	174	166	153	134	111	82.2	50.7	18.9	0.29
95	1.92	13.4	41.8	72.6	100	124	143	156	165	168	165	158	145	126	103	75.8	45.3	16.2	1.67
100	4.73	14.4	38.4	66.9	93.0	116	134	148	156	158	156	149	136	118	95.9	70.2	41.8	16.8	4.57
105	8.34	17.1	36.8	62.2	86.6	108	126	139	146	149	147	140	127	111	89.4	65.6	40.0	19.4	8.47
110	11.9	20.8	37.3	58.8	80.7	101	117	130	137	140	138	131	119	103	83.6	61.9	40.3	23.2	12.1
115	15.6	25.1	38.8	56.8	76.2	94.0	109	121	127	130	128	122	111	96.1	78.4	59.7	41.6	26.9	16.0
120	19.4	28.9	40.9	56.1	72.5	87.7	101	112	118	121	119	113	103	89.6	74.9	58.7	43.6	30.2	19.9
125	23.0	33.3	43.4	56.1	69.9	82.6	94.2	103	109	111	110	104	95.6	84.4	72.1	58.4	45.9	33.4	23.6
130	26.3	37.0	45.9	56.5	68.0	78.7	88.5	96.0	101	103	101	96.9	89.7	80.3	69.9	58.7	47.9	37.3	26.6
135	28.7	40.6	48.1	57.3	66.7	75.9	83.5	89.8	93.9	95.3	94.2	90.6	84.7	77.0	68.3	59.2	49.3	40.6	28.7
140	30.2	43.9	49.7	57.9	65.7	73.1	79.2	84.3	87.6	88.9	87.9	85.0	80.1	74.3	67.1	59.5	50.4	43.5	30.4
145	31.1	45.8	51.7	58.2	64.7	70.9	76.0	79.5	82.1	83.1	82.4	80.2	76.7	71.7	66.1	59.1	50.7	45.7	31.5
150	31.9	45.6	53.2	58.0	63.8	68.6	72.9	76.0	77.1	78.1	77.7	76.5	73.6	69.6	64.7	57.1	53.8	47.3	31.9
155	32.3	43.7	55.6	58.4	62.4	66.4	69.9	72.3	73.8	74.4	74.1	73.0	70.5	67.0	62.0	57.3	56.0	47.9	32.4
160	32.2	36.6	56.7	59.5	61.5	64.0	66.5	68.4	69.5	70.0	69.9	68.9	67.2	64.4	58.6	59.2	54.2	43.2	32.8
165	31.6	31.9	43.8	60.1	61.7	62.8	64.0	65.0	65.8	66.5	66.8	66.3	65.0	58.0	55.7	49.4	43.7	35.5	32.9
170	30.8	31.0	31.9	42.4	56.4	61.2	62.8	63.6	64.0	64.3	64.4	63.5	52.4	44.7	39.8	37.7	34.3	31.6	32.4
175	38.8	38.8	37.6	37.4	41.5	41.0	43.2	51.3	57.1	58.8	48.0	32.0	31.1	36.7	35.8	38.2	36.1	37.7	36.6
180	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0

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	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259	259		
5	259	259	259	259	259	259	259	259	259	259	259	259	259	259	258	258	258		
10	256	256	256	257	258	258	259	259	259	259	258	258	257	257	256	255	255		
15	251	251	252	254	255	256	257	257	258	257	257	256	254	253	252	251	250		
20	243	245	246	249	251	253	255	256	256	255	254	253	250	248	246	244	242		
25	234	236	239	242	246	249	251	253	254	253	251	249	245	242	238	235	233		
30	223	226	230	235	240	244	248	250	251	250	248	244	239	234	229	225	222		
35	210	214	219	226	233	239	244	246	248	246	243	239	233	226	219	213	209		
40	195	200	208	216	225	233	239	242	244	242	239	233	225	216	207	199	194		
45	178	185	195	206	217	226	233	238	239	238	233	226	217	206	195	185	177		
50	161	169	181	195	208	219	228	233	235	233	228	219	209	195	181	169	161		
55	141	153	168	184	199	212	221	227	230	228	222	212	200	184	168	153	141		
60	121	135	154	172	190	204	215	222	224	222	216	205	191	173	154	136	121		
65	99.3	117	140	162	181	197	208	216	218	216	209	197	182	163	141	118	99.9		
70	78.0	99.9	126	151	172	189	202	209	212	210	202	190	173	152	127	101	78.8		
75	57.5	83.8	113	140	164	181	194	202	205	203	195	182	165	142	115	85.2	58.6		
80	39.5	69.9	102	131	155	173	187	195	198	195	187	174	156	132	103	71.4	40.7		
85	25.9	58.9	92.2	122	147	166	179	187	190	188	180	167	148	123	93.8	60.4	27.0		
90	18.4	51.0	84.1	114	138	158	171	179	182	180	172	159	140	115	85.6	52.4	19.4		
95	14.9	45.1	77.0	106	130	149	163	171	174	171	164	150	132	107	78.4	46.3	15.7		
100	15.7	40.8	70.4	98.1	122	140	154	162	165	163	155	141	123	99.4	71.7	41.8	16.1		
105	18.9	39.6	65.0	90.7	113	131	144	152	155	152	145	132	114	91.8	66.0	40.0	19.2		
110	23.2	40.2	61.9	84.1	105	122	134	141	144	142	135	122	106	84.9	62.3	39.9	22.9		
115	27.4	42.1	60.4	79.5	97.3	112	124	131	134	131	125	113	97.9	79.8	60.1	41.3	26.9		
120	31.3	44.3	59.7	76.1	91.7	105	114	121	123	121	115	105	92.0	76.2	59.1	43.9	31.2		
125	34.8	46.5	59.7	73.7	87.0	98.4	107	112	114	112	107	98.6	87.2	73.4	59.1	45.9	35.2		
130	39.1	49.0	60.0	71.8	83.0	92.8	100	105	106	105	100	92.8	83.1	71.5	59.8	48.4	39.5		
135	42.8	51.2	60.2	70.2	79.6	87.8	93.9	97.8	99.3	98.0	94.1	87.8	79.7	70.1	59.7	51.0	43.0		
140	44.8	52.0	60.7	68.8	76.6	83.3	88.4	91.6	92.9	91.8	88.5	83.3	76.7	68.6	60.2	53.3	45.0		
145	45.5	53.6	59.6	67.2	73.7	79.3	83.4	86.1	87.0	86.2	83.5	79.4	73.6	66.8	61.2	55.8	45.9		
150	45.9	55.8	59.9	65.4	70.8	75.0	78.6	80.9	81.7	81.1	78.8	74.9	70.7	66.4	62.2	57.9	46.2		
155	44.1	56.4	60.0	62.4	68.7	71.6	73.9	75.4	76.0	75.6	74.2	71.9	69.3	66.1	63.1	59.0	47.4		
160	36.4	50.3	58.1	60.1	62.6	68.6	70.4	71.6	72.1	72.1	71.2	69.8	68.0	65.9	63.7	58.5	43.5		
165	34.1	37.6	44.1	50.1	57.4	61.1	65.8	67.9	68.5	68.7	68.4	67.5	66.8	65.4	62.4	55.5	37.7		
170	32.3	31.2	31.2	34.0	38.0	43.2	51.5	61.8	65.7	65.8	65.8	64.7	63.0	60.8	53.1	39.9	33.1		
175	36.7	35.5	33.9	36.0	33.3	35.2	29.4	28.4	34.9	55.1	54.8	49.0	43.6	41.5	41.6	37.2	36.7		
180	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.1	21.1	21.1	21.1	21.1	21.1		

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

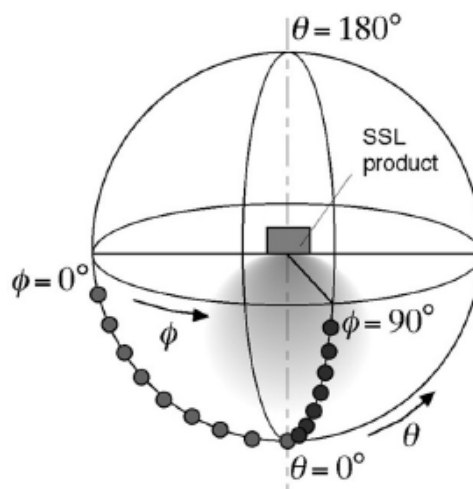
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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