

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/850/EXT/A4

(LED tube model: 11.5T8/4F/850/EXT 4pcs and LED driver model: 15T8T5HEDRIVER/4CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18070047p

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: **11.5T8/4F/850/EXT/A4**

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/4	Power Factor
135.4	1756.0	12.97	0.9976
CCT (K)	CRI	Stabilization Time (Light & Power)	
4961	81.6	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

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Sample Photos

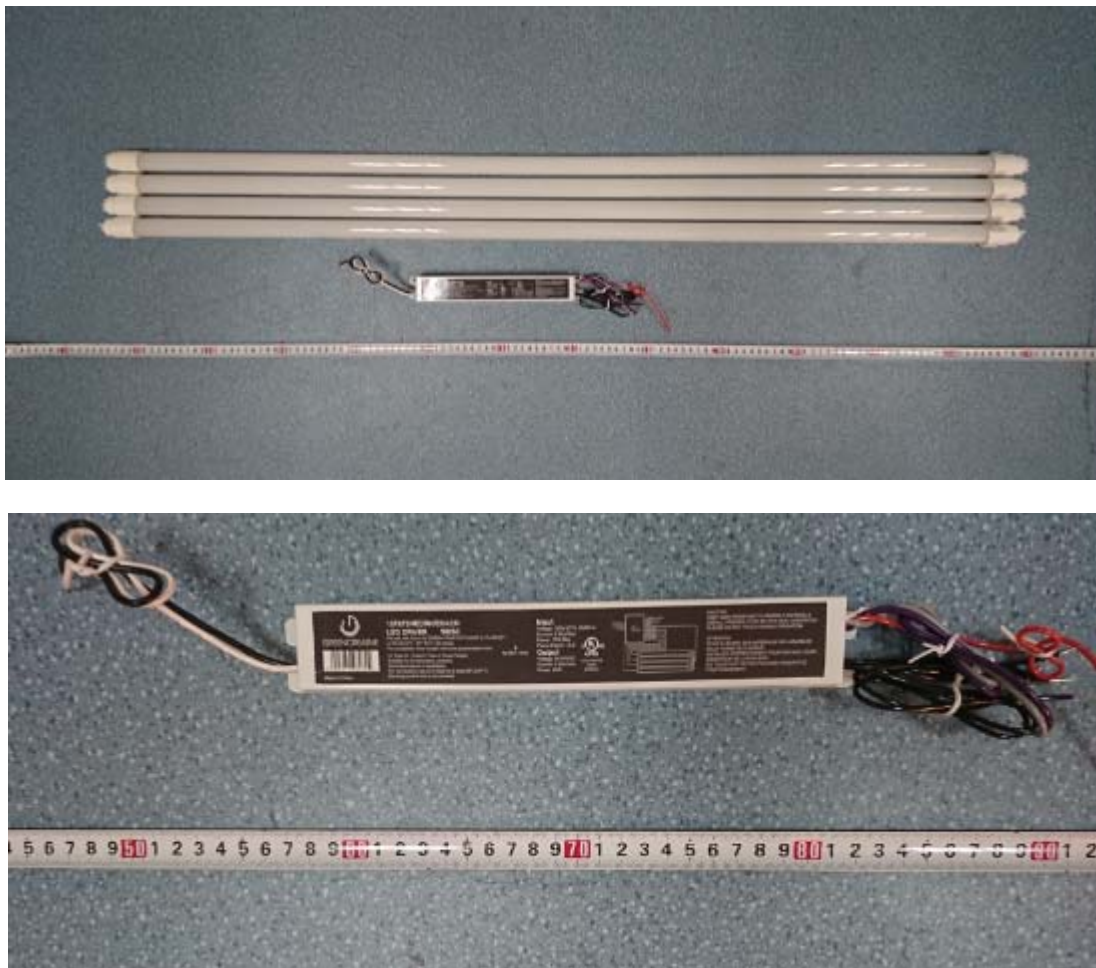


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 11.5T8/4F/850/EXT/A4
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 5000K LED tube model: 11.5T8/4F/850/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°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)	0.433	0.193
Power Factor	0.9976	0.9616
Test Power (W)/4	12.97	12.86
THD A%	2.39	4.61
Luminous Efficacy (lm/W)	135.4	136.6
Luminous Flux per lamp (lm)	1756.0	1756.0
Color Rendering Index (CRI)	81.6	
R9	0.9	
Correlated Color Temperature (CCT)(K)	4961	
Chromaticity Chroma x	0.3468	
Chromaticity Chroma y	0.3579	
Chromaticity Chroma u	0.2101	
Chromaticity Chroma v	0.3253	
Duv	0.0024	
Chromaticity Chroma u'	0.2101	
Chromaticity Chroma v'	0.4880	

Special Color Rendering Indices	
R1	78.6
R2	86.1
R3	92
R4	82.1
R5	81.2
R6	83.2
R7	85.6
R8	64.3
R9	0.9
R10	67.8
R11	83.2
R12	53.1
R13	79.9
R14	95.6
Rf	81
Rg	95

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)	0.433
Power Factor	0.9967
Test Power (W)/4	12.96
Luminous Efficacy (lm/W)	133.3
Luminous Flux per lamp (lm)	1727.1
Beam Angle (°)	169.6
Center Beam Candle Power (cd)	279
Spacing Criteria	1.27 (0°-180°)/ 1.44(90°-270°)
Zonal Lumens in the 0°-60°Zone	42.32%
Zonal Lumens in the 60°-90°Zone	26.92%
Zonal Lumens in the 90°-120°Zone	17.79%
Zonal Lumens in the 120°-180°Zone	12.97%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

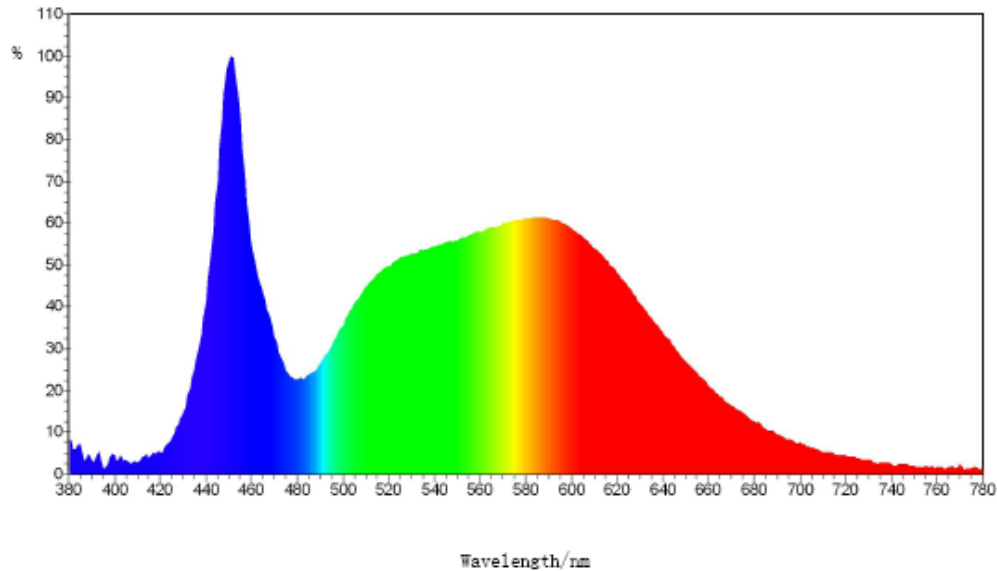
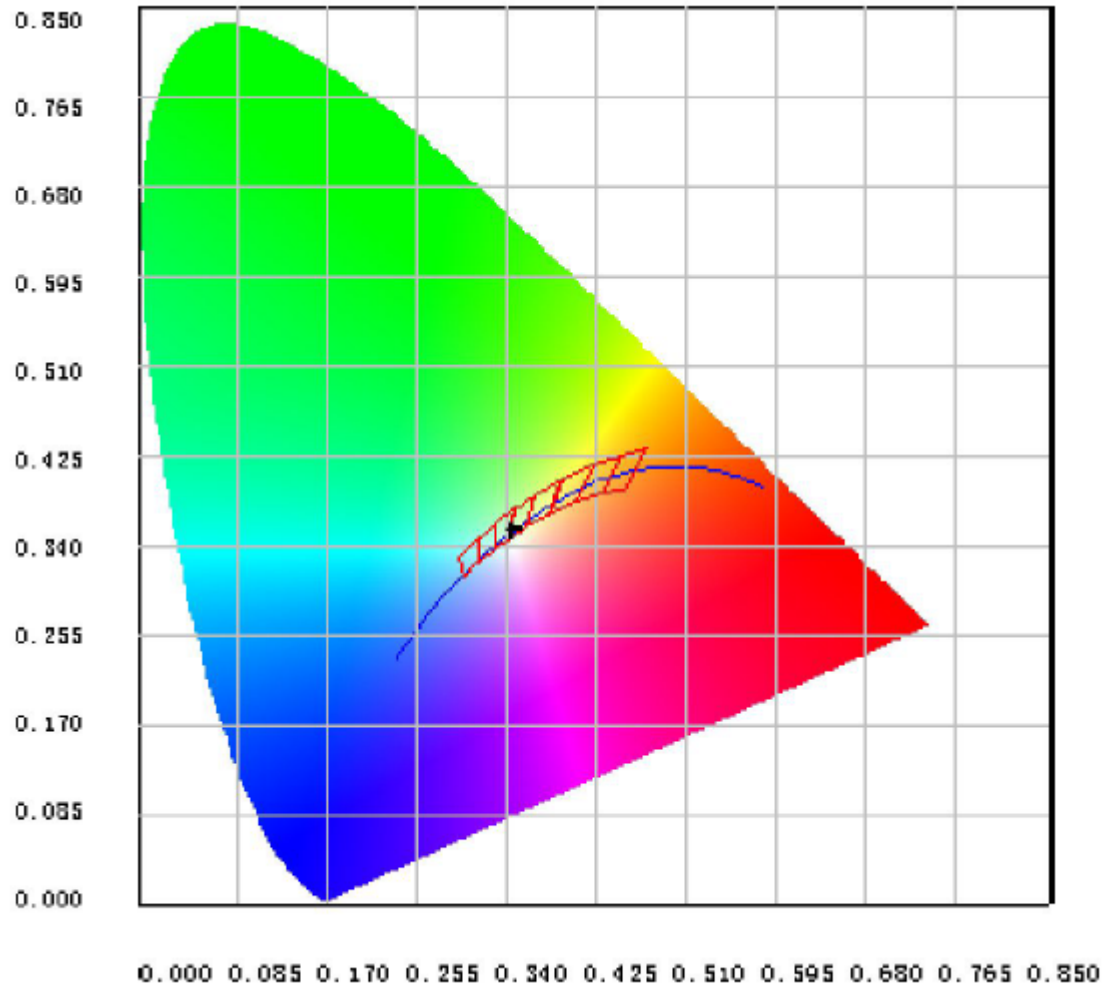


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.85E-03	485	1.09E-02	590	2.80E-02	695	3.81E-03
385	3.31E-03	490	1.21E-02	595	2.77E-02	700	3.44E-03
390	1.61E-03	495	1.40E-02	600	2.69E-02	705	2.87E-03
395	6.07E-04	500	1.63E-02	605	2.60E-02	710	2.45E-03
400	2.01E-03	505	1.86E-02	610	2.48E-02	715	2.31E-03
405	1.65E-03	510	2.04E-02	615	2.35E-02	720	2.11E-03
410	1.34E-03	515	2.19E-02	620	2.20E-02	725	1.77E-03
415	1.75E-03	520	2.27E-02	625	2.04E-02	730	1.61E-03
420	2.35E-03	525	2.37E-02	630	1.88E-02	735	1.23E-03
425	3.81E-03	530	2.41E-02	635	1.70E-02	740	1.05E-03
430	6.64E-03	535	2.45E-02	640	1.55E-02	745	1.16E-03
435	1.16E-02	540	2.50E-02	645	1.39E-02	750	9.25E-04
440	1.89E-02	545	2.54E-02	650	1.23E-02	755	9.43E-04
445	3.21E-02	550	2.57E-02	655	1.11E-02	760	7.36E-04
450	4.53E-02	555	2.62E-02	660	9.75E-03	765	7.93E-04
455	3.85E-02	560	2.65E-02	665	8.55E-03	770	1.11E-03
460	2.56E-02	565	2.71E-02	670	7.56E-03	775	5.84E-04
465	2.00E-02	570	2.75E-02	675	6.73E-03	780	7.84E-04
470	1.53E-02	575	2.78E-02	680	5.76E-03		
475	1.14E-02	580	2.80E-02	685	5.01E-03		
480	1.05E-02	585	2.82E-02	690	4.35E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3468, 0.3579)

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

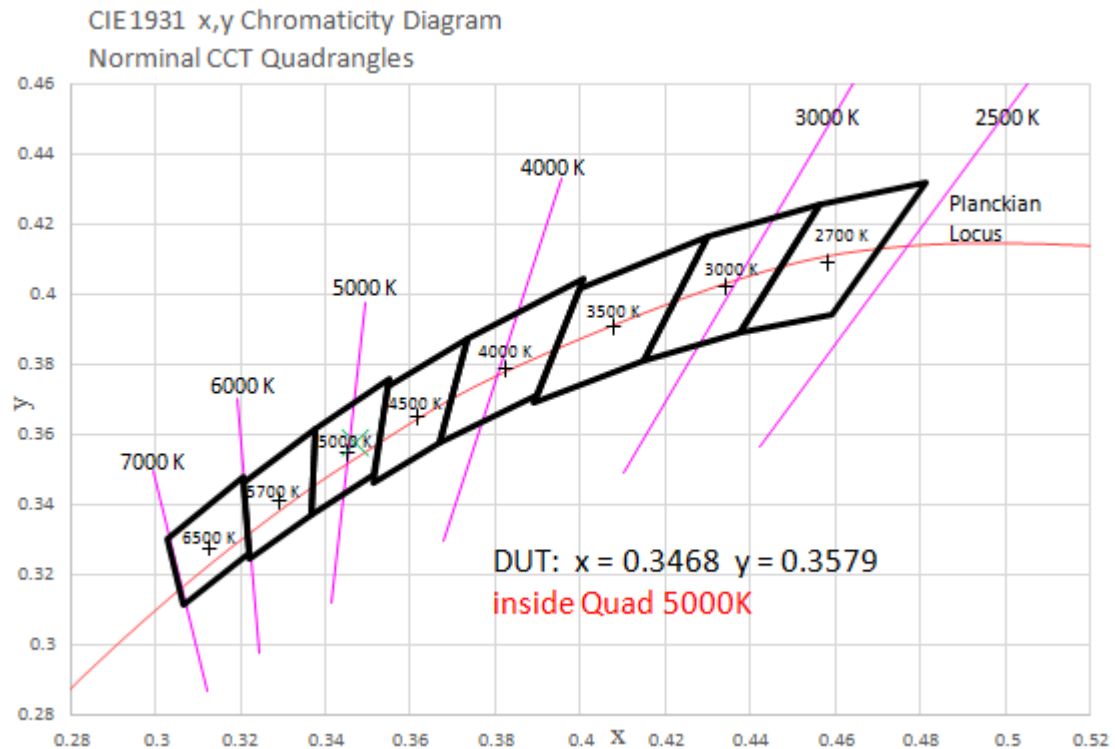


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	26.521	1.54%
10- 20	77.141	4.47%
20- 30	120.774	6.99%
30- 40	153.677	8.90%
40- 50	173.449	10.04%
50- 60	179.347	10.38%
60- 70	172.477	9.99%
70- 80	156.194	9.04%
80- 90	136.266	7.89%
90-100	118.635	6.87%
100-110	102.289	5.92%
110-120	86.409	5.00%
120-130	71.52	4.14%
130-140	57.581	3.33%
140-150	43.815	2.54%
150-160	30.172	1.75%
160-170	16.219	0.94%
170-180	4.639	0.27%
Total	1727.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	730.909	42.32%
60- 90	464.937	26.92%
0-90	1195.846	69.24%
90- 180	531.279	30.76%
0- 180	1727.1	100%

Table 5: Zonal Lumen Data

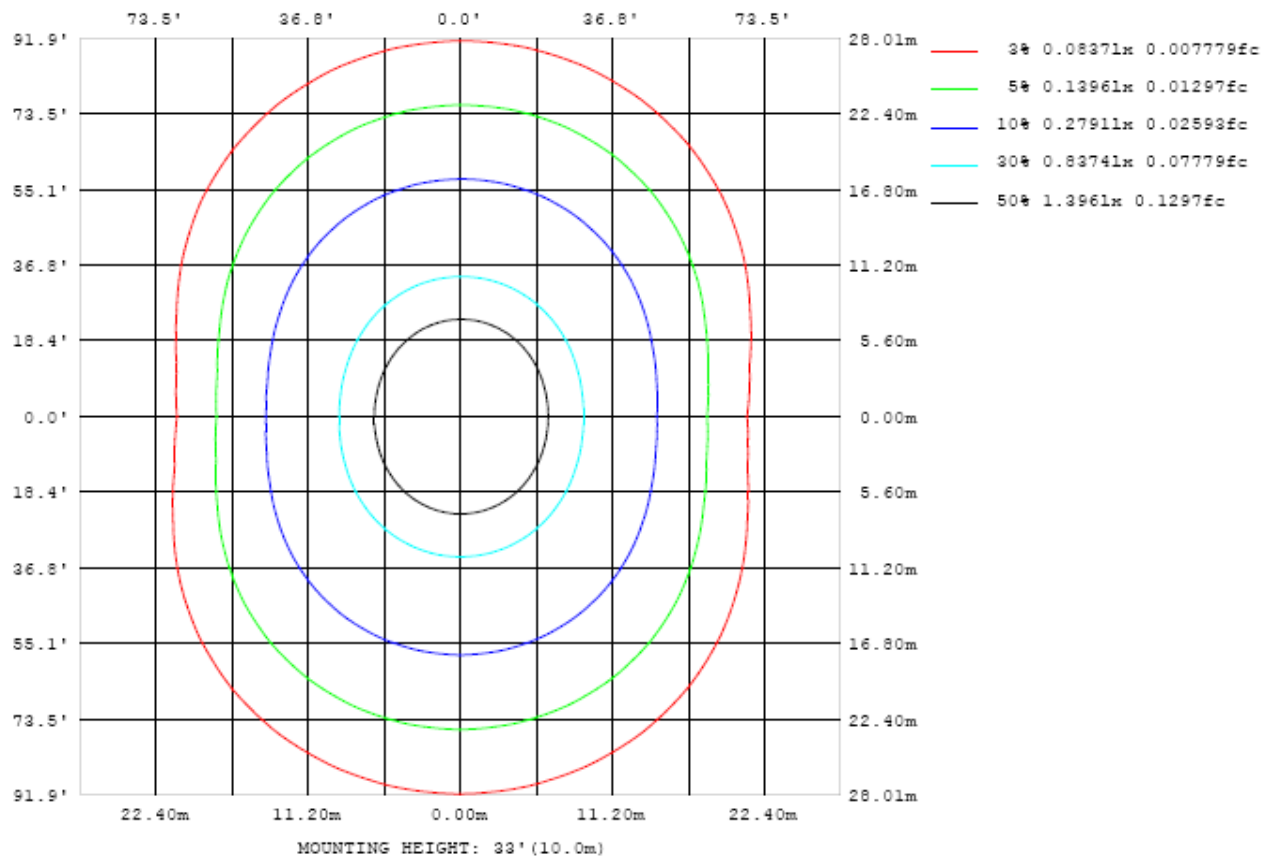


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

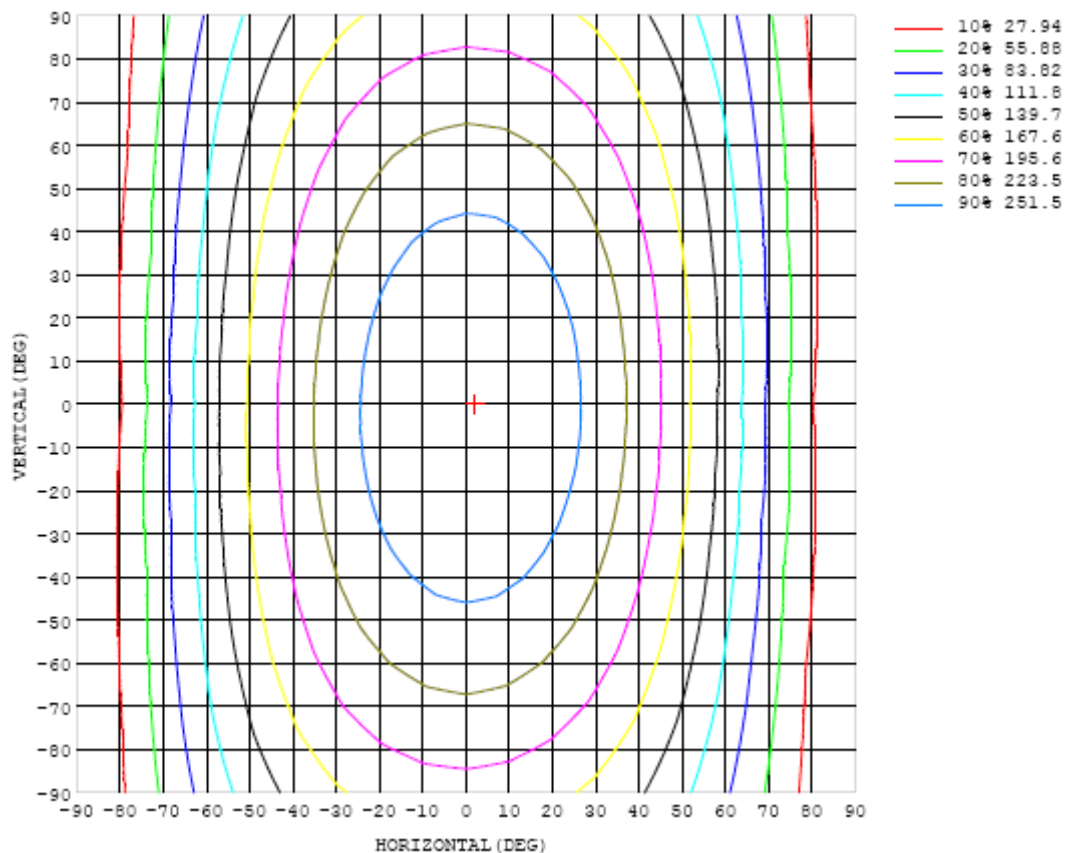


Chart 5: Isocandela Plot

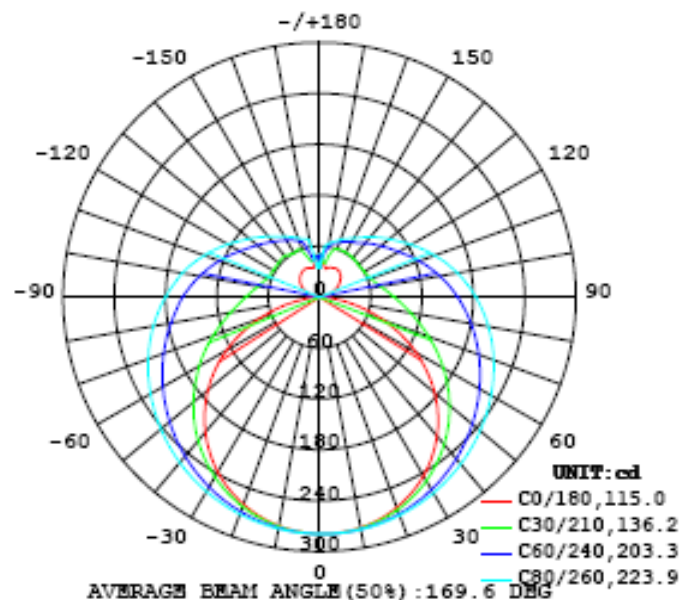


Chart 6: Polar Candela Distribution

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	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279
5	279	279	279	279	279	279	279	279	279	279	279	279	279	279	278	278	278	278	278
10	276	276	276	277	277	278	278	278	278	278	278	277	277	276	276	275	275	274	274
15	271	271	272	273	274	275	275	276	276	276	276	275	274	273	272	270	269	268	268
20	264	264	265	267	269	271	272	273	274	274	273	272	270	268	266	264	262	261	260
25	255	255	257	259	262	265	267	269	271	271	270	268	266	263	259	256	253	251	250
30	243	244	246	250	254	258	262	265	267	267	266	264	260	256	251	247	242	239	238
35	229	231	234	239	245	251	256	260	262	263	261	258	254	249	242	236	230	226	224
40	214	215	220	227	235	242	249	254	257	258	256	253	248	240	232	224	216	210	208
45	196	198	204	213	223	233	241	247	251	252	251	247	240	232	221	210	200	193	190
50	176	179	187	199	211	223	233	241	245	247	245	240	233	222	210	197	184	174	170
55	154	158	168	183	199	213	225	233	239	240	239	233	225	213	198	182	166	154	149
60	130	135	149	167	186	203	216	226	232	234	232	226	217	203	186	167	148	132	125
65	105	111	129	151	173	192	207	218	224	227	225	218	208	193	175	153	129	109	101
70	79.2	87.3	109	136	161	182	198	210	217	219	217	211	200	184	163	138	111	86.6	75.0
75	53.8	64.4	91.0	121	149	172	189	201	209	212	209	203	191	174	152	125	94.4	65.5	49.6
80	29.4	43.0	74.8	108	138	162	180	193	201	203	201	194	182	165	142	113	79.7	46.3	26.0
85	9.87	26.4	62.0	97.0	127	152	171	184	192	195	193	186	174	156	132	103	68.5	32.0	7.67
90	0.86	17.4	52.6	87.4	118	143	162	175	183	186	184	177	165	147	123	93.9	59.8	24.0	0.50
95	2.09	14.1	46.1	79.5	109	134	152	166	174	177	175	168	156	138	115	86.1	53.5	20.6	2.15
100	5.72	15.1	41.9	73.1	101	125	143	156	164	167	165	158	146	129	107	79.4	49.2	21.1	5.68
105	10.4	18.0	40.4	67.7	93.5	116	133	146	154	157	155	148	137	121	99.2	74.3	47.3	23.3	10.2
110	15.5	22.3	40.5	64.0	86.9	108	124	136	144	146	145	138	128	112	92.4	70.4	47.2	27.0	14.8
115	19.9	26.7	41.5	61.7	81.6	100.0	115	126	133	136	134	129	119	104	86.9	67.9	48.1	31.4	19.3
120	24.4	31.1	43.4	60.4	77.5	93.7	107	117	124	126	125	119	110	97.8	82.7	66.4	48.7	35.4	23.5
125	28.7	35.0	46.1	59.4	74.9	88.3	100.0	109	114	117	115	111	103	92.4	79.3	65.0	50.9	39.3	27.3
130	31.9	39.2	48.6	59.2	72.1	83.8	93.9	102	107	109	107	103	96.7	87.5	76.4	63.6	53.0	42.7	30.2
135	35.1	42.3	50.9	60.0	69.5	79.5	88.3	94.9	99.3	101	100	96.6	91.0	83.0	73.3	63.8	54.7	45.6	32.5
140	37.1	43.1	52.9	60.5	68.3	75.7	82.9	88.8	92.7	94.1	93.4	90.5	85.2	78.1	71.2	63.9	55.0	47.5	34.4
145	38.5	43.4	54.4	60.9	67.4	73.5	78.0	82.6	85.7	87.0	86.2	83.6	79.7	75.4	70.0	63.8	56.1	48.4	36.0
150	39.1	42.5	55.4	61.0	66.2	71.2	75.3	77.9	80.0	80.9	80.3	78.7	76.2	73.0	68.4	62.5	57.2	49.4	37.1
155	37.9	37.2	55.3	61.1	64.9	68.8	72.0	74.7	75.8	76.5	76.4	75.3	73.3	70.4	66.6	58.8	55.2	45.1	37.3
160	37.2	33.9	52.7	60.3	63.7	66.4	68.7	70.7	72.1	72.7	72.3	71.3	69.9	67.3	57.3	54.8	47.1	40.2	36.4
165	35.3	34.2	38.0	55.7	60.9	63.9	65.7	66.9	67.8	68.2	68.0	67.3	64.0	53.0	49.5	44.2	39.5	34.2	35.7
170	36.2	36.6	35.1	41.1	52.8	57.5	59.0	63.1	64.1	64.8	64.8	58.3	46.7	42.5	43.6	41.3	38.4	34.6	37.2
175	44.0	44.8	45.4	44.3	46.1	46.6	47.6	50.1	54.9	58.7	36.6	31.4	39.9	43.3	42.5	43.3	41.3	43.4	45.3
180	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4

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	279	279	279	279	279	279	279	279	279	279	279		
10	274	274	275	275	276	276	277	277	278	278	278	277	277	277	277	276	276		
15	268	269	270	271	272	273	274	275	276	276	275	275	274	273	272	272	271		
20	260	261	263	265	267	269	271	272	273	273	273	272	270	268	267	265	264		
25	251	252	255	258	261	264	267	269	270	270	269	267	265	262	259	257	255		
30	239	241	245	249	254	258	262	265	266	266	264	262	258	254	250	246	244		
35	225	228	234	240	246	252	257	260	261	261	259	255	251	245	239	234	231		
40	209	214	221	229	237	245	251	255	256	256	253	249	242	235	227	220	216		
45	192	198	207	218	228	237	244	249	250	250	247	241	233	224	214	205	198		
50	172	181	193	206	218	229	237	242	244	244	240	233	224	212	200	188	179		
55	152	163	177	194	208	220	230	236	238	237	232	225	214	200	185	170	160		
60	130	144	163	181	198	212	222	228	231	230	225	216	203	188	170	152	137		
65	107	125	147	169	187	203	214	221	224	222	217	207	193	175	155	133	114		
70	83.1	106	132	157	177	194	206	213	216	215	209	198	183	164	140	114	90.8		
75	60.3	87.7	118	146	168	185	198	206	208	207	200	189	173	152	126	96.1	68.2		
80	40.2	72.1	106	135	159	176	190	198	200	198	192	180	164	141	113	80.3	47.9		
85	25.0	59.9	95.0	125	150	168	181	189	192	190	183	171	155	131	102	67.7	32.2		
90	17.3	51.5	86.3	117	141	160	172	180	183	181	174	163	145	122	92.7	58.3	23.0		
95	15.0	46.1	79.2	109	133	151	165	171	174	172	166	154	137	113	84.9	51.9	19.3		
100	16.7	42.9	73.3	101	124	143	155	163	166	164	157	145	128	105	78.1	47.5	19.3		
105	20.2	41.9	68.6	94.5	116	134	146	153	156	154	147	136	119	98.1	72.6	45.1	21.7		
110	24.9	42.7	65.3	88.4	109	125	137	144	146	144	138	127	111	91.4	68.3	44.7	25.8		
115	29.0	44.6	63.6	83.2	101	116	127	134	136	134	128	118	104	85.5	65.5	45.5	30.2		
120	32.4	47.0	62.8	79.6	95.0	108	118	124	126	125	119	110	96.6	81.1	63.9	47.2	33.7		
125	39.3	49.6	62.6	76.7	90.0	101	110	115	117	115	110	102	91.0	77.6	63.1	49.6	38.8		
130	44.0	51.6	62.8	74.5	85.6	95.2	103	107	109	107	103	95.8	86.3	75.0	62.9	52.1	44.1		
135	47.4	52.6	63.4	72.8	81.9	89.9	96.1	99.9	101	100	96.3	90.3	82.3	73.0	63.3	54.2	48.0		
140	49.5	53.1	63.6	71.5	78.7	85.2	90.3	93.5	94.5	93.5	90.4	85.4	78.9	71.5	63.9	55.8	50.7		
145	51.3	58.0	60.6	70.3	75.9	81.0	85.1	87.7	88.4	87.6	85.2	81.2	76.1	70.4	64.3	59.1	52.8		
150	53.4	60.2	59.9	68.3	73.6	77.5	80.6	82.6	83.1	82.5	80.7	77.7	73.8	69.4	64.4	61.2	53.8		
155	49.9	57.9	61.2	62.3	70.6	73.9	76.7	78.3	78.6	78.2	76.9	74.8	72.0	68.3	65.7	62.9	52.0		
160	41.5	50.3	56.5	60.1	64.8	70.1	72.8	74.2	74.8	74.5	73.9	72.5	70.8	68.6	66.5	63.9	49.6		
165	37.0	41.8	46.2	49.9	54.7	60.4	70.4	71.1	71.4	71.5	71.4	70.6	69.6	68.2	65.4	62.5	44.1		
170	37.2	38.4	43.7	46.3	46.4	45.3	50.1	63.8	68.7	68.9	68.8	68.5	65.9	63.9	61.8	51.6	41.7		
175	45.3	46.2	47.5	48.8	47.2	47.4	41.4	34.2	44.8	62.9	65.2	59.8	55.5	51.7	50.3	47.5	44.6		
180	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4		

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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