



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/A2

(LED tube model: 11.5T8/4F/850/EXT 2pcs and LED driver model: 15T8T5HEDRIVER/2CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18070047n

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/A2

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/2	Power Factor
133.4	1765.0	13.23	0.9970
CCT (K)	CRI	Stabilization Time (Light & Power)	
4961	81.7	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

TABLE OF CONTENT

LM-79-08 Test Report.....	1
Test Summary.....	2
Sample Photos.....	4
TEST RESULTS	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Zonal Lumen Tabulation- Goniophotometer Method	10
Luminous Intensity Distribution Plots- Goniophotometer Method.....	12
Luminous Intensity Data- Goniophotometer Method.....	13
EQUIPMENT LIST	15
TEST METHODS	15
Seasoning of SSL Product.....	15
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	15
Goniophotometer Method	16
Photometric and Electrical Measurements.....	16
Color Characteristics Measurements.....	16
Color Spatial Uniformity	16

Sample Photos

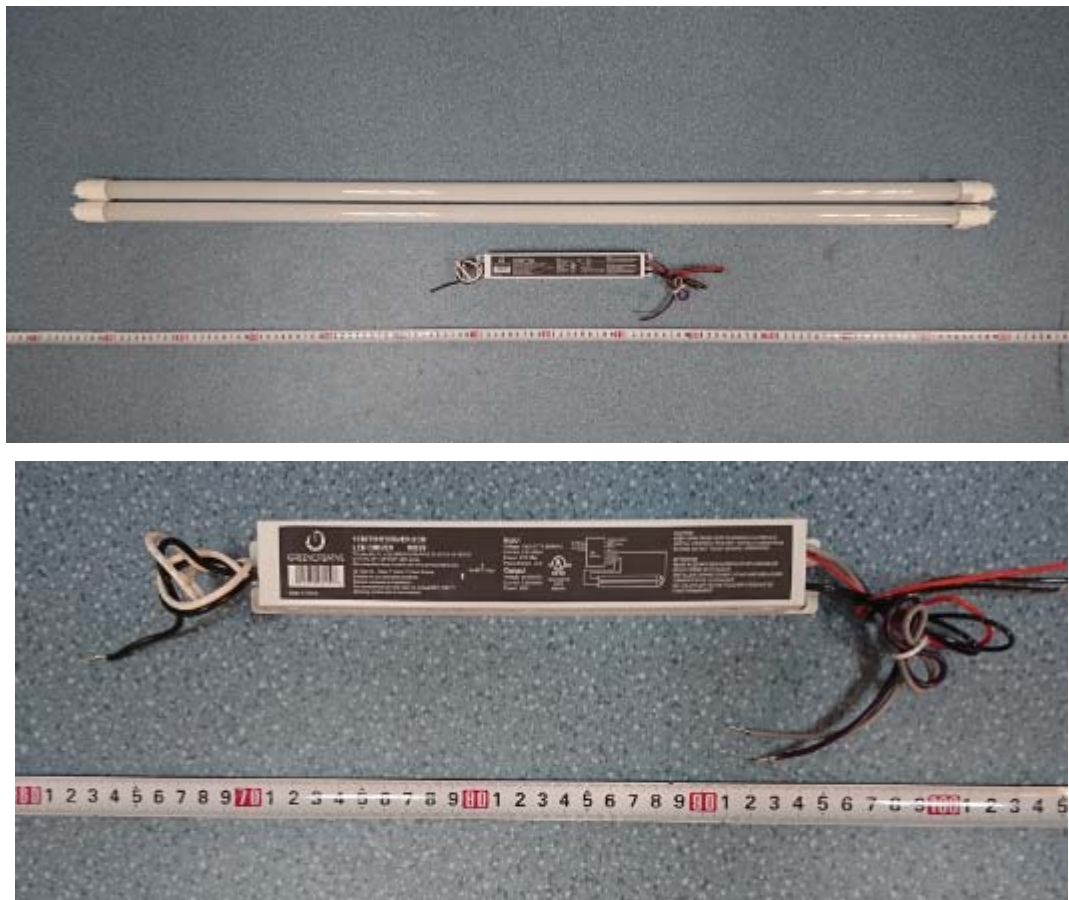


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 11.5T8/4F/850/EXT/A2
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 5000K LED tube model: 11.5T8/4F/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 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)	0.221	0.103
Power Factor	0.9970	0.9425
Test Power (W)/2	13.23	13.50
THD A%	1.92	6.74
Luminous Efficacy (lm/W)	133.4	130.8
Luminous Flux per lamp (lm)	1765.0	1765.0
Color Rendering Index (CRI)	81.7	
R9	1.3	
Correlated Color Temperature (CCT)(K)	4961	
Chromaticity Chroma x	0.3467	
Chromaticity Chroma y	0.3579	
Chromaticity Chroma u	0.2101	
Chromaticity Chroma v	0.3253	
Duv	0.0025	
Chromaticity Chroma u'	0.2101	
Chromaticity Chroma v'	0.4880	

Special Color Rendering Indices	
R1	78.8
R2	86.2
R3	92
R4	82.1
R5	81.1
R6	83.3
R7	85.8
R8	64.5
R9	1.3
R10	68
R11	83.2
R12	53.1
R13	80.1
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 24.8°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)	0.221
Power Factor	0.9961
Test Power (W)/2	13.21
Luminous Efficacy (lm/W)	131.5
Luminous Flux per lamp (lm)	1736.0
Beam Angle (°)	170.3
Center Beam Candle Power (cd)	281
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	17.80%
Zonal Lumens in the 120°-180°Zone	12.97%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

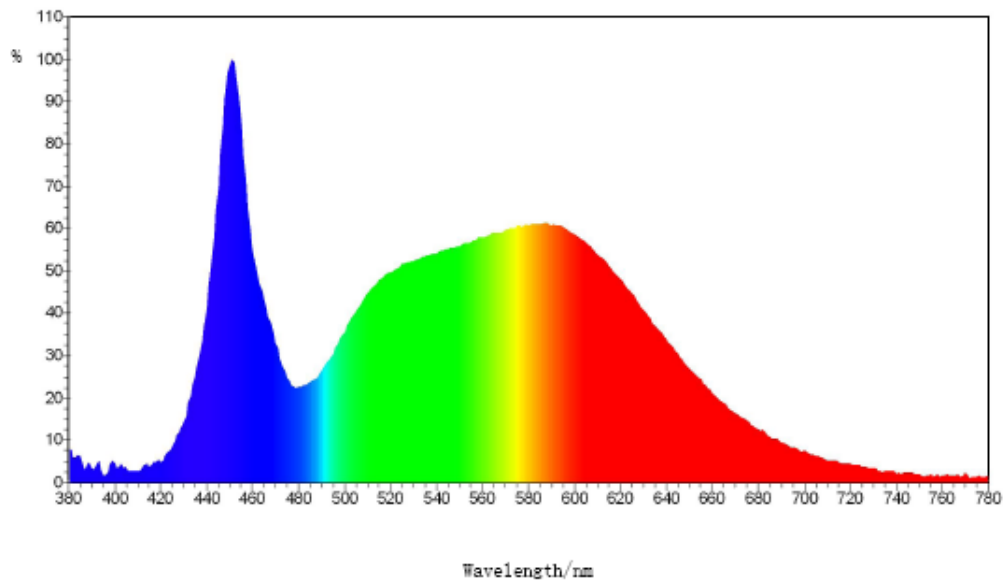
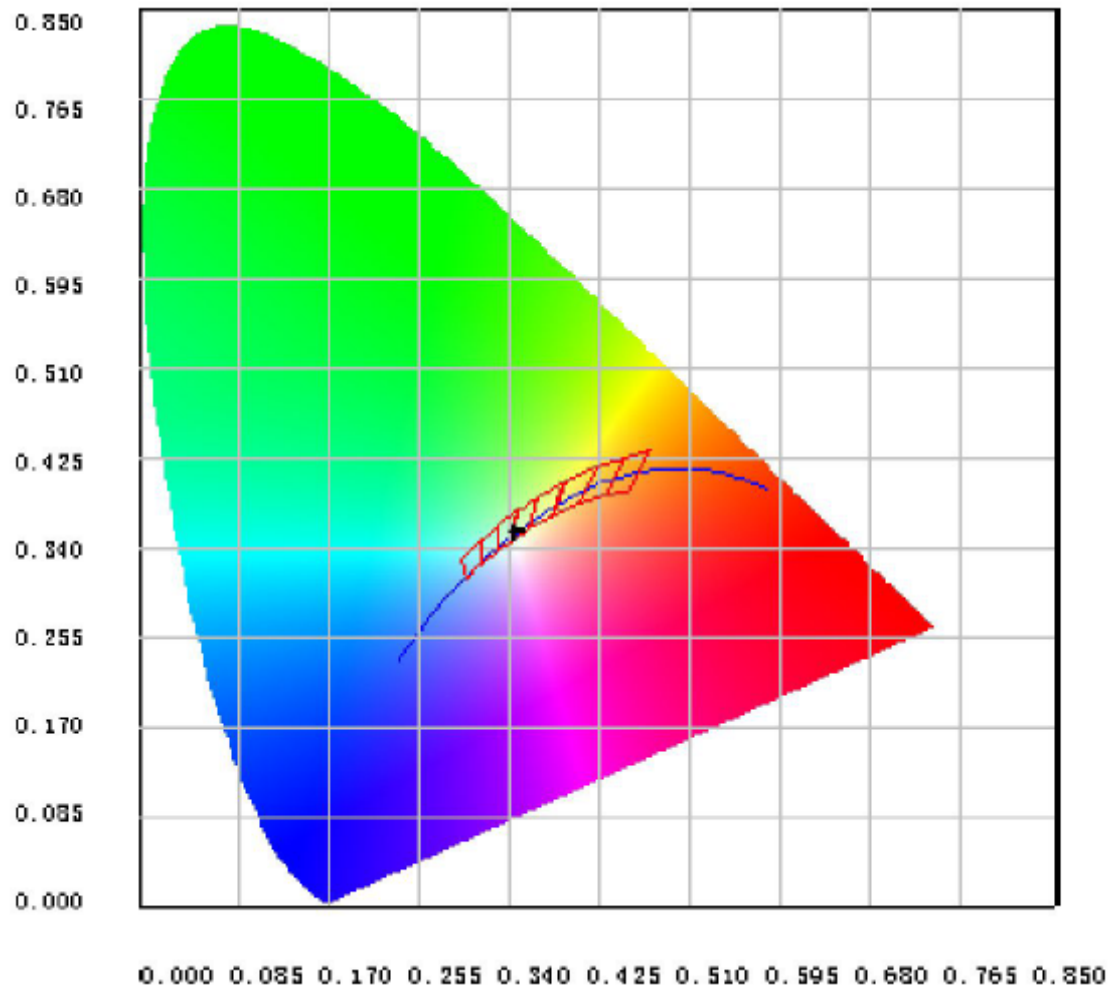


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.77E-03	485	1.09E-02	590	2.81E-02	695	3.85E-03
385	2.97E-03	490	1.23E-02	595	2.78E-02	700	3.47E-03
390	1.54E-03	495	1.41E-02	600	2.70E-02	705	2.91E-03
395	7.91E-04	500	1.65E-02	605	2.62E-02	710	2.48E-03
400	2.09E-03	505	1.86E-02	610	2.50E-02	715	2.34E-03
405	1.70E-03	510	2.06E-02	615	2.36E-02	720	2.06E-03
410	1.23E-03	515	2.20E-02	620	2.22E-02	725	1.81E-03
415	1.71E-03	520	2.29E-02	625	2.06E-02	730	1.60E-03
420	2.31E-03	525	2.38E-02	630	1.89E-02	735	1.27E-03
425	3.83E-03	530	2.42E-02	635	1.71E-02	740	1.03E-03
430	6.63E-03	535	2.46E-02	640	1.56E-02	745	1.19E-03
435	1.16E-02	540	2.50E-02	645	1.40E-02	750	9.60E-04
440	1.90E-02	545	2.55E-02	650	1.24E-02	755	9.27E-04
445	3.23E-02	550	2.58E-02	655	1.12E-02	760	7.28E-04
450	4.55E-02	555	2.63E-02	660	9.79E-03	765	8.39E-04
455	3.87E-02	560	2.67E-02	665	8.64E-03	770	1.09E-03
460	2.57E-02	565	2.72E-02	670	7.63E-03	775	6.14E-04
465	2.02E-02	570	2.75E-02	675	6.76E-03	780	8.05E-04
470	1.54E-02	575	2.80E-02	680	5.80E-03		
475	1.15E-02	580	2.81E-02	685	5.01E-03		
480	1.04E-02	585	2.83E-02	690	4.40E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3467, 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

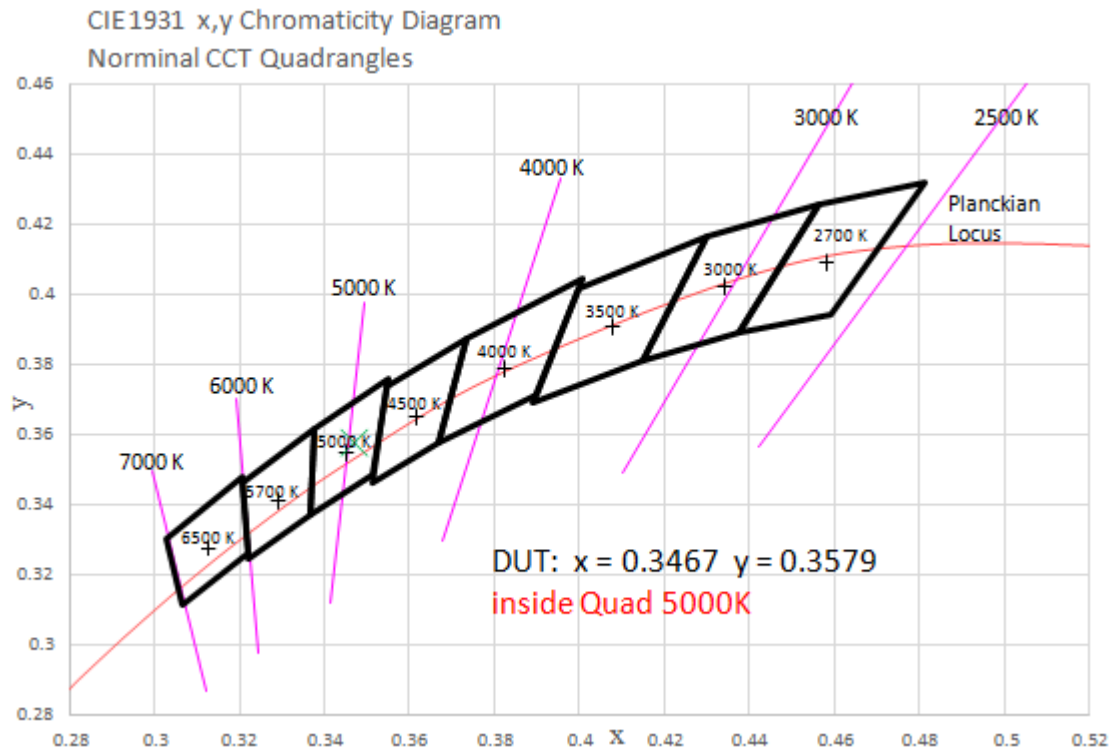


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	26.657	1.54%
10- 20	77.539	4.47%
20- 30	121.396	6.99%
30- 40	154.467	8.90%
40- 50	174.341	10.04%
50- 60	180.269	10.38%
60- 70	173.365	9.99%
70- 80	157.001	9.04%
80- 90	136.975	7.89%
90-100	119.259	6.87%
100-110	102.825	5.92%
110-120	86.859	5.00%
120-130	71.889	4.14%
130-140	57.877	3.33%
140-150	44.039	2.54%
150-160	30.323	1.75%
160-170	16.301	0.94%
170-180	4.653	0.27%
Total	1736.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	734.669	42.32%
60- 90	467.341	26.92%
0-90	1202.01	69.24%
90- 180	534.025	30.76%
0- 180	1736.0	100%

Table 5: Zonal Lumen Data

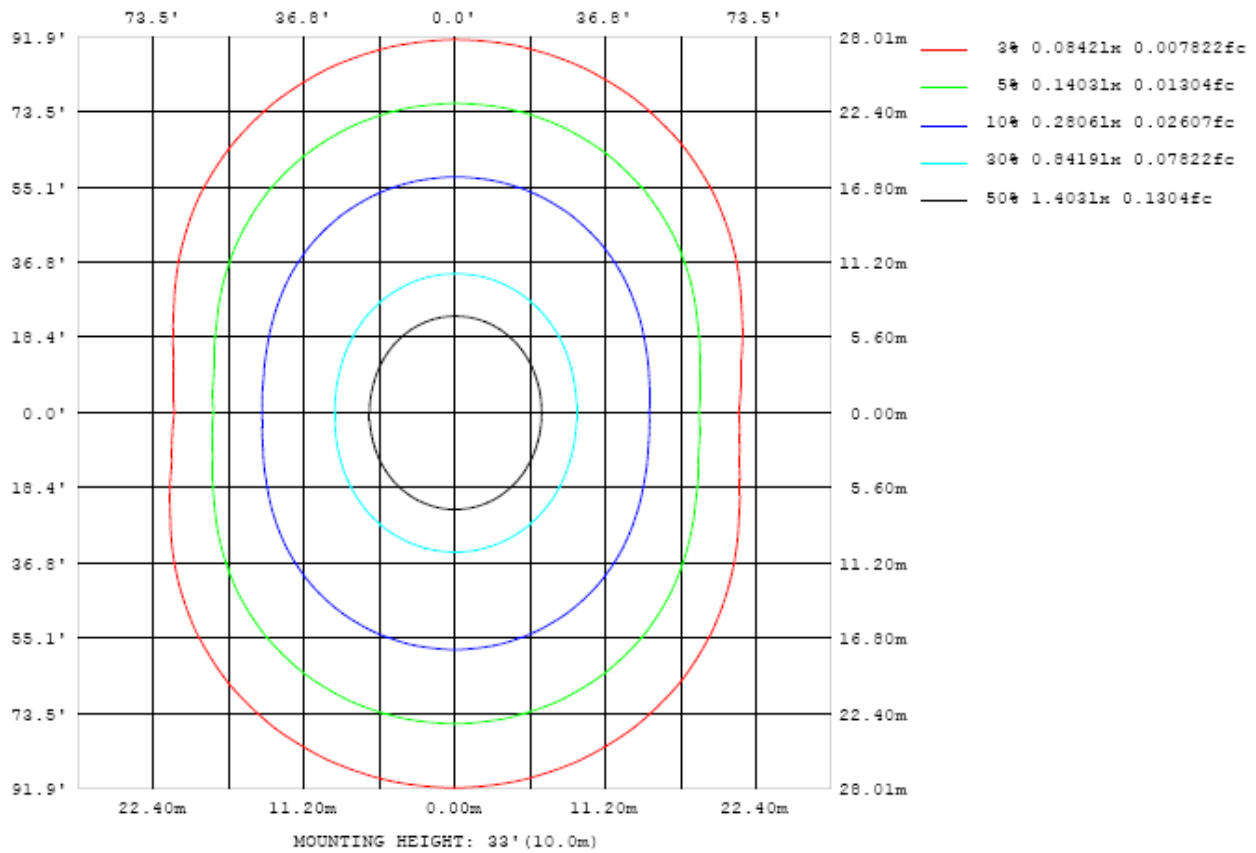


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

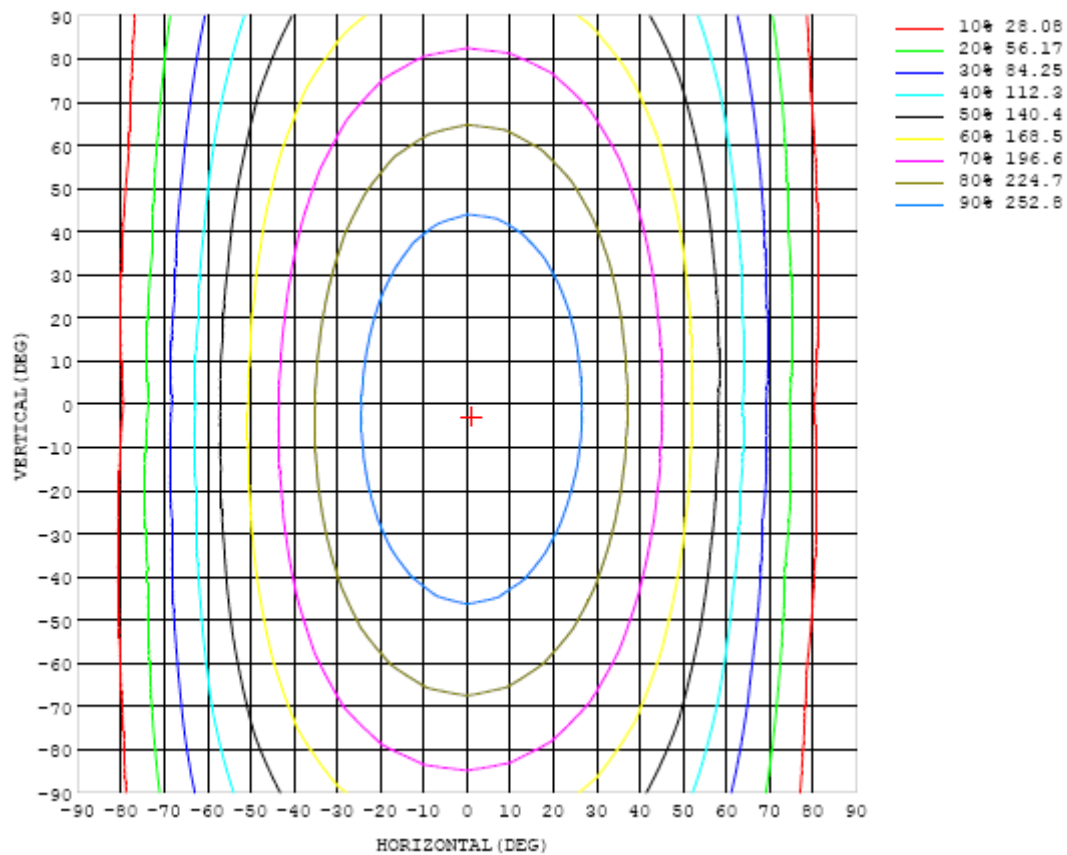


Chart 5: Isocandela Plot

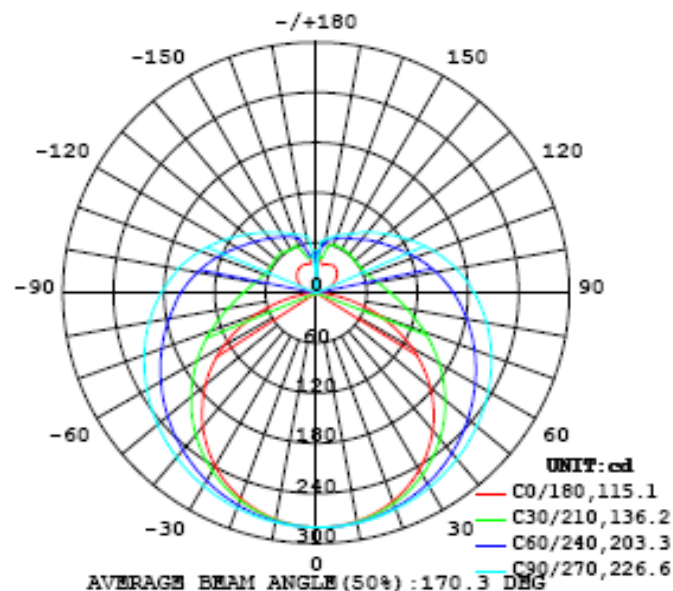


Chart 6: Polar Candela Distribution

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	281	281	281	281	281	281	281	281	281	281	281	281	281	281	281	281	281	281	281
5	280	280	280	281	280	281	281	281	281	280	280	280	280	280	280	280	279	279	279
10	277	278	278	278	279	279	279	280	280	280	279	279	278	278	277	277	276	275	275
15	273	273	273	274	275	276	277	278	278	278	277	276	276	275	273	272	271	270	269
20	265	266	267	268	270	272	273	275	275	275	274	272	270	267	265	263	262	261	
25	256	257	258	261	264	266	269	271	272	272	272	270	267	264	261	257	254	252	251
30	245	246	248	251	255	260	264	267	268	269	268	265	262	258	253	248	244	241	239
35	231	232	235	241	246	252	257	261	264	264	263	260	256	250	243	237	231	227	225
40	215	217	221	228	236	244	250	256	259	259	258	254	249	242	233	225	217	211	209
45	197	199	205	215	225	235	243	249	253	254	253	248	242	233	222	212	201	194	191
50	177	180	188	200	212	225	235	242	247	248	247	242	234	224	211	198	185	175	171
55	155	158	169	184	200	215	226	235	240	242	240	235	226	214	199	183	167	154	150
60	131	136	150	168	187	204	217	227	233	235	233	227	218	205	187	168	148	133	126
65	106	112	130	152	174	194	209	220	226	228	226	220	210	195	176	154	130	110	101
70	79.6	87.9	110	137	162	183	200	211	218	221	219	212	201	185	164	139	112	87.1	75.3
75	54.1	64.8	91.6	122	150	173	191	203	211	213	211	204	192	176	153	126	95.0	65.9	49.8
80	29.5	43.3	75.3	109	139	163	181	194	202	205	203	196	184	166	143	114	80.2	46.6	26.1
85	9.93	26.6	62.5	97.7	128	153	172	185	193	196	194	187	175	157	133	103	69.0	32.1	7.68
90	0.86	17.5	53.0	88.1	119	144	163	176	184	187	185	178	166	148	124	94.6	60.3	24.2	0.50
95	2.09	14.2	46.5	80.2	110	135	154	167	175	178	176	169	157	139	116	86.9	54.0	20.8	2.16
100	5.73	15.2	42.3	73.9	102	126	144	157	165	168	166	159	148	130	108	80.2	49.7	21.3	5.71
105	10.5	18.2	40.8	68.3	94.4	117	135	147	155	158	156	150	138	122	100	74.9	47.7	23.6	10.2
110	15.6	22.5	40.9	64.6	87.7	109	125	137	145	148	146	140	129	113	93.3	71.0	47.7	27.3	14.8
115	19.9	27.0	41.9	62.3	82.4	101	116	128	135	138	136	130	120	105	87.7	68.6	48.6	31.7	19.3
120	24.4	31.3	43.8	61.0	78.3	94.6	108	118	125	127	126	120	111	98.8	83.5	67.1	49.2	35.8	23.6
125	28.7	35.3	46.5	60.0	75.6	89.2	101	110	116	118	117	112	104	93.2	80.0	65.7	51.3	39.8	27.3
130	31.9	39.5	49.1	59.7	72.8	84.6	94.8	102	108	110	108	104	97.7	88.4	77.2	64.2	53.5	43.2	30.1
135	35.0	42.8	51.4	60.5	70.2	80.3	89.1	95.8	100	102	101	97.6	91.9	83.9	74.0	64.4	55.2	46.3	32.3
140	36.9	43.7	53.4	61.1	68.9	76.4	83.7	89.7	93.5	95.0	94.2	91.3	86.0	78.8	71.8	64.5	55.6	48.3	34.2
145	38.3	44.0	55.1	61.4	68.0	74.1	78.7	83.4	86.6	87.9	87.1	84.5	80.4	76.1	70.6	64.4	56.7	49.3	35.7
150	38.7	43.1	56.2	61.5	66.8	71.8	76.0	78.5	80.7	81.7	81.0	79.4	76.8	73.7	69.1	63.2	57.8	50.4	36.7
155	37.4	38.1	56.6	61.6	65.5	69.4	72.7	75.3	76.4	77.2	76.8	75.9	73.9	71.0	67.4	59.4	56.0	46.2	36.9
160	36.6	34.9	54.4	60.9	64.2	66.9	69.3	71.3	72.7	73.3	73.0	72.0	70.5	68.2	58.3	55.7	48.1	41.0	36.5
165	35.2	34.5	39.7	57.6	61.5	64.7	66.2	67.5	68.4	68.8	68.6	67.9	65.4	54.2	50.7	45.1	40.5	34.6	35.9
170	36.0	36.7	35.3	43.1	55.0	58.0	60.2	64.0	64.7	65.3	65.4	60.2	48.3	42.9	44.0	42.0	39.4	34.6	37.3
175	44.4	45.1	45.4	44.0	46.8	46.8	48.9	52.0	57.4	60.5	62.1	61.4	58.4	43.3	42.1	43.9	41.4	42.5	45.5
180	2.09	2.06	1.96	1.81	1.61	1.37	1.10	0.81	0.51	0.21	0.41	0.61	0.81	1.00	1.17	1.31	1.42	1.48	1.50

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	281	281	281	281	281	281	281	281	281	281	281	281	281	281	281	281	281		
5	279	279	279	279	279	280	280	280	280	280	280	280	280	280	280	280	280		
10	275	275	276	276	277	278	278	279	279	279	279	279	278	278	278	277	277		
15	270	270	271	272	273	275	276	276	277	277	277	276	275	275	274	273	273		
20	262	263	264	266	268	270	272	274	274	274	274	273	271	270	268	266	266		
25	252	253	256	259	262	265	268	270	271	271	270	268	266	263	260	258	257		
30	240	242	246	250	255	260	263	266	267	267	265	263	259	255	251	247	245		
35	226	229	235	241	247	253	258	261	262	262	260	257	252	246	241	235	232		
40	210	215	222	230	238	246	252	256	257	257	254	250	243	236	228	221	217		
45	193	199	208	219	229	238	245	250	251	251	248	242	234	225	215	206	199		
50	173	181	194	207	219	230	238	243	245	245	241	234	224	213	201	189	180		
55	153	164	178	194	209	221	231	236	239	238	233	225	214	201	186	171	160		
60	131	145	164	182	198	212	223	229	232	230	225	217	204	188	170	153	138		
65	107	125	148	169	188	204	215	222	224	223	217	208	194	176	156	133	115		
70	83.5	106	133	158	178	195	207	214	217	215	209	199	183	164	140	114	91.3		
75	60.6	88.0	119	146	168	186	199	206	209	207	201	190	173	153	126	96.5	68.5		
80	40.3	72.3	106	136	160	177	190	198	201	199	192	181	164	142	113	80.6	48.1		
85	25.1	60.1	95.3	126	150	168	182	189	192	191	184	172	155	132	102	67.9	32.3		
90	17.3	51.6	86.5	117	142	161	173	181	184	182	175	164	146	122	92.9	58.5	23.1		
95	15.0	46.2	79.4	109	133	152	165	172	175	173	166	154	137	114	85.0	51.9	19.3		
100	16.7	42.9	73.4	101	125	143	156	163	166	164	157	145	128	106	78.2	47.5	19.2		
105	20.2	41.9	68.7	94.6	117	134	146	154	156	154	148	136	120	98.2	72.6	45.1	21.7		
110	24.9	42.7	65.3	88.5	109	125	137	144	146	144	138	127	111	91.4	68.3	44.7	25.8		
115	29.0	44.6	63.6	83.3	101	116	127	134	136	134	128	118	104	85.6	65.5	45.5	30.2		
120	32.4	47.1	62.8	79.7	95.1	108	118	124	127	125	119	110	96.7	81.1	63.9	47.2	33.7		
125	39.4	49.7	62.7	76.8	90.0	101	110	115	117	115	110	102	91.1	77.7	63.2	49.7	38.9		
130	44.0	51.7	62.9	74.6	85.7	95.3	103	107	109	107	103	95.9	86.4	75.0	63.0	52.2	44.2		
135	47.4	52.7	63.5	72.9	82.0	90.0	96.2	100	101	100	96.5	90.4	82.4	73.1	63.4	54.3	48.1		
140	49.5	53.2	63.6	71.6	78.8	85.3	90.4	93.6	94.6	93.6	90.5	85.5	79.0	71.6	64.0	55.9	50.7		
145	51.0	58.2	60.7	70.4	76.1	81.2	85.2	87.8	88.6	87.7	85.3	81.3	76.2	70.5	64.4	59.2	52.7		
150	53.0	60.5	60.0	68.3	73.7	77.6	80.7	82.8	83.3	82.6	80.9	77.8	74.0	69.6	64.6	61.4	53.5		
155	49.3	57.7	61.4	62.4	70.7	74.1	76.8	78.4	78.7	78.4	77.1	75.0	72.2	68.5	65.9	62.9	51.4		
160	41.0	49.8	56.1	59.6	64.3	70.0	72.9	74.4	74.9	74.7	74.1	72.7	71.0	68.9	66.7	63.7	48.5		
165	36.8	41.3	45.9	49.3	54.4	59.1	70.3	71.4	71.7	71.7	71.6	70.8	69.8	68.3	65.3	61.8	42.3		
170	37.6	38.1	43.4	46.0	46.8	45.0	49.1	61.8	68.9	69.0	69.0	68.6	65.5	63.9	61.1	49.6	40.6		
175	45.4	46.4	47.3	49.7	47.6	48.7	43.6	34.2	40.2	63.5	63.8	57.8	54.0	51.0	50.5	46.4	44.5		
180	1.48	1.42	1.31	1.17	1.00	0.81	0.61	0.41	0.21	0.51	0.81	1.10	1.37	1.61	1.81	1.96	2.06		

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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