

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 13T8/4F/850/GL/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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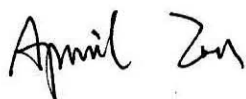
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Report No.: HZ19070032k

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

Review by:



Engineer: April Zou

Jul. 25, 2019

Approved by:



Manager: Jim Zhang

Jul. 25, 2019

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: 13T8/4F/850/GL/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
144.6	1856.5	12.84	0.9792
CCT (K)	CRI	Stabilization Time (Light & Power)	
5143	84.1	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. 22, 2019
Date of Test	: Jul. 23, 2019
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 ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

TABLE OF CONTENT

LM-79-08 TEST REPORT	1
TEST SUMMARY	2
SAMPLE PHOTO	4
TEST RESULTS	5
Sphere-Spectroradiometer Method.....	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Color Rendition Report – Sphere Spectroradiometer Method	10
Zonal Lumen Tabulation- Goniophotometer Method	11
Illuminance Plots- Goniophotometer Method	12
Luminous Intensity Distribution Plots- Goniophotometer Method.....	13
Luminous Intensity Data- Goniophotometer Method	14
EQUIPMENT LIST	16
TEST METHODS	16
Seasoning of SSL Product.....	16
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	16
Goniophotometer Method	17
Photometric and Electrical Measurements	17
Color Characteristics Measurements.....	17
Color Spatial Uniformity	17

SAMPLE PHOTO

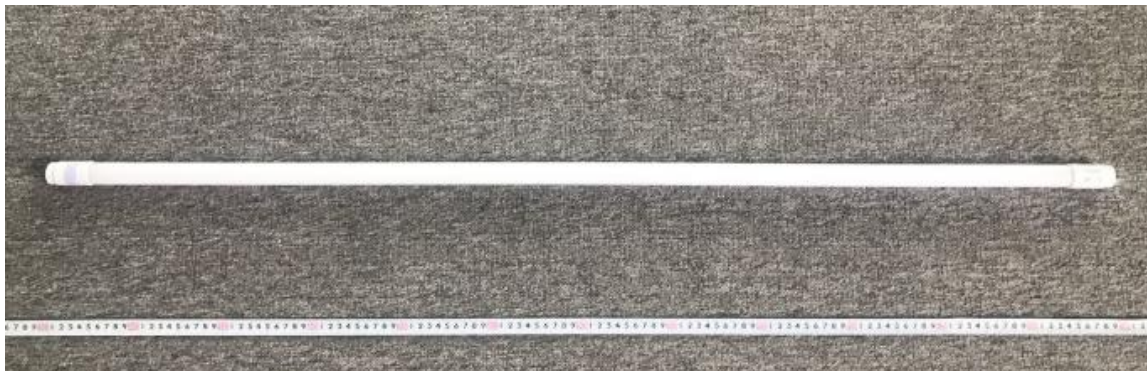


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 13T8/4F/850/GL/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 13W
Product Description	: 5000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 26.0 °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 65 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.109	0.052
Power Factor	0.9792	0.9038
Test Power (W)	12.84	12.99
THD A%	17.67	13.29
Luminous Efficacy (lm/W)	144.6	143.8
Total Luminous Flux (lm)	1856.5	1868.6
Color Rendering Index (CRI)	84.1	
R9	12.4	
Correlated Color Temperature (CCT)(K)	5143	
Chromaticity Chroma x	0.3414	
Chromaticity Chroma y	0.3533	
Chromaticity Chroma u	0.2083	
Chromaticity Chroma v	0.3233	
Duv	0.0023	
Chromaticity Chroma u'	0.2083	
Chromaticity Chroma v'	0.4849	

Special Color Rendering Indices	
R1	83.1
R2	92.4
R3	94.8
R4	80.3
R5	82.5
R6	87
R7	85.7
R8	67
R9	12.4
R10	80.1
R11	79.2
R12	60.1
R13	86.3
R14	97.8

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 30 m.

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)	0.110
Power Factor	0.9795
Power (W)	12.89
Luminous Efficacy (lm/W)	141.8
Total Luminous Flux (lm)	1827.7
Beam Angle (°)	116.1 (0°-180°) / 247.3 (90°-270°)
Center Beam Candle Power (cd)	273
Maximum Beam Candle Power (cd)	273.2 (At: C=90.0, Gamma=3.0)
Spacing Criteria	1.28 (0°-180°) / 1.46 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	39.77%
Zonal Lumens in the 60 °-90 °Zone	26.52%
Zonal Lumens in the 90 °-120 °Zone	18.72%
Zonal Lumens in the 120 °-180 °Zone	15.00%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

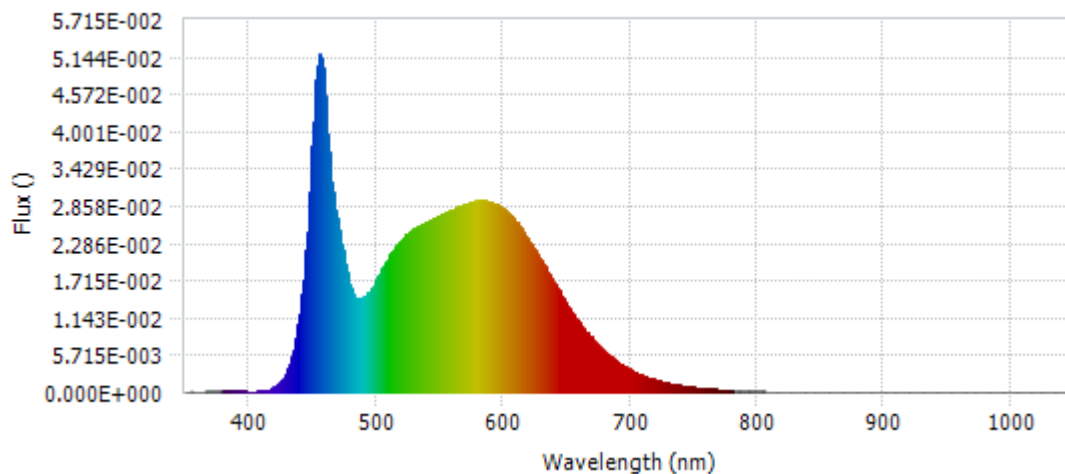
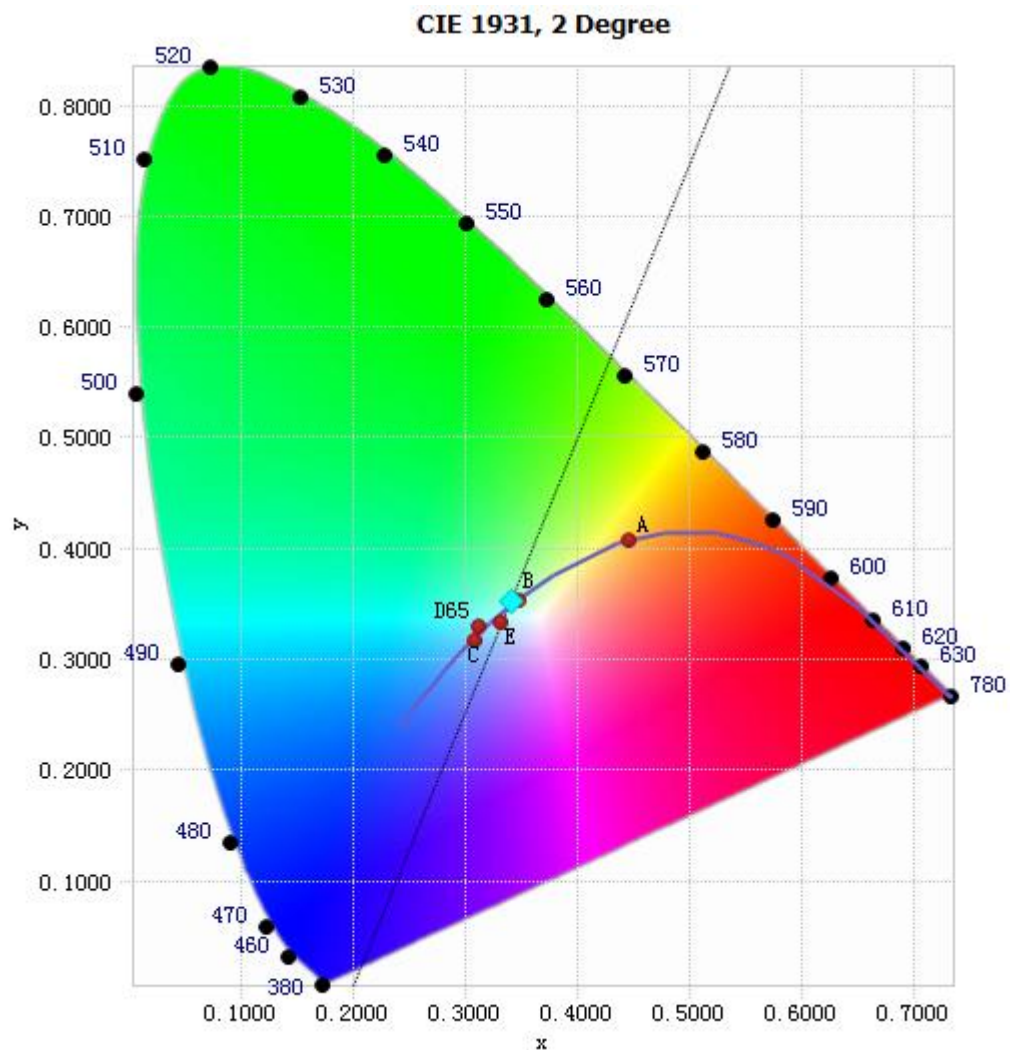


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.75E-04	485	1.44E-02	590	2.92E-02	695	4.06E-03
385	1.69E-04	490	1.46E-02	595	2.88E-02	700	3.49E-03
390	1.78E-04	495	1.55E-02	600	2.82E-02	705	3.01E-03
395	1.60E-04	500	1.71E-02	605	2.73E-02	710	2.57E-03
400	1.34E-04	505	1.90E-02	610	2.62E-02	715	2.22E-03
405	1.29E-04	510	2.08E-02	615	2.49E-02	720	1.92E-03
410	1.91E-04	515	2.23E-02	620	2.35E-02	725	1.65E-03
415	3.94E-04	520	2.35E-02	625	2.19E-02	730	1.42E-03
420	8.31E-04	525	2.43E-02	630	2.03E-02	735	1.22E-03
425	1.69E-03	530	2.51E-02	635	1.85E-02	740	1.04E-03
430	3.33E-03	535	2.56E-02	640	1.69E-02	745	8.97E-04
435	6.44E-03	540	2.61E-02	645	1.52E-02	750	7.76E-04
440	1.20E-02	545	2.67E-02	650	1.36E-02	755	6.65E-04
445	2.17E-02	550	2.70E-02	655	1.21E-02	760	5.76E-04
450	3.79E-02	555	2.75E-02	660	1.07E-02	765	4.96E-04
455	5.15E-02	560	2.80E-02	665	9.37E-03	770	4.26E-04
460	4.54E-02	565	2.84E-02	670	8.22E-03	775	3.69E-04
465	3.23E-02	570	2.89E-02	675	7.17E-03	780	3.18E-04
470	2.58E-02	575	2.91E-02	680	6.24E-03		
475	2.06E-02	580	2.93E-02	685	5.41E-03		
480	1.61E-02	585	2.94E-02	690	4.69E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3414, 0.3533)

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

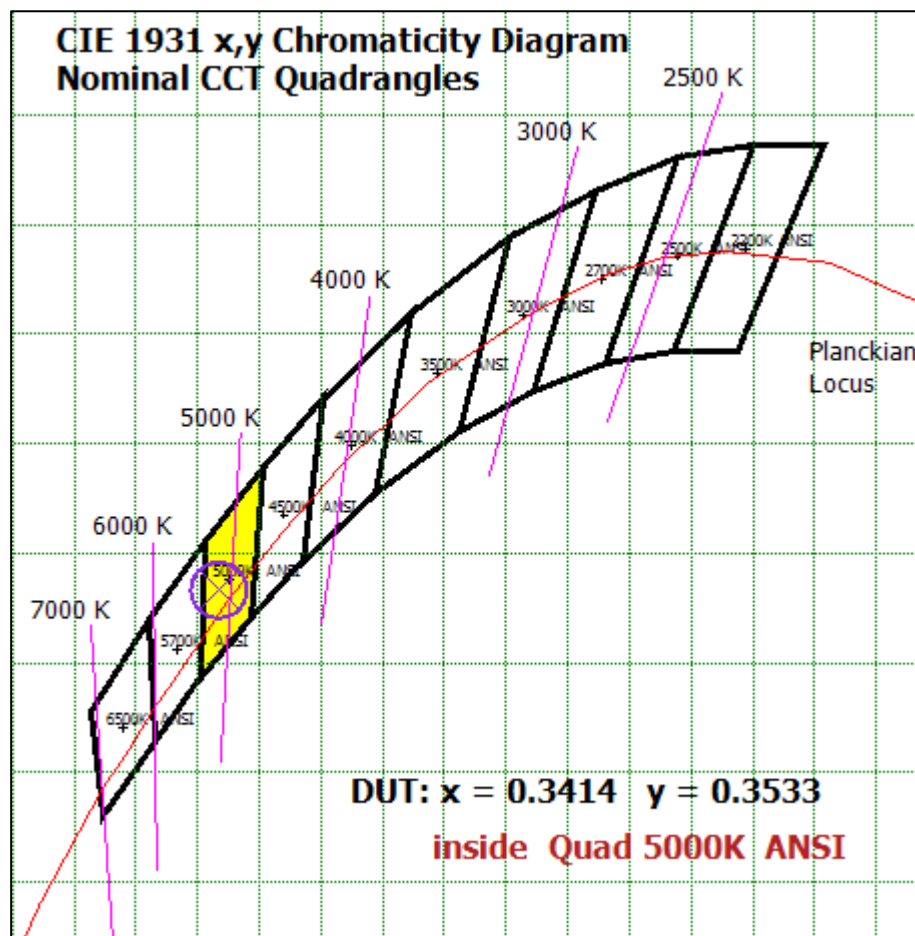
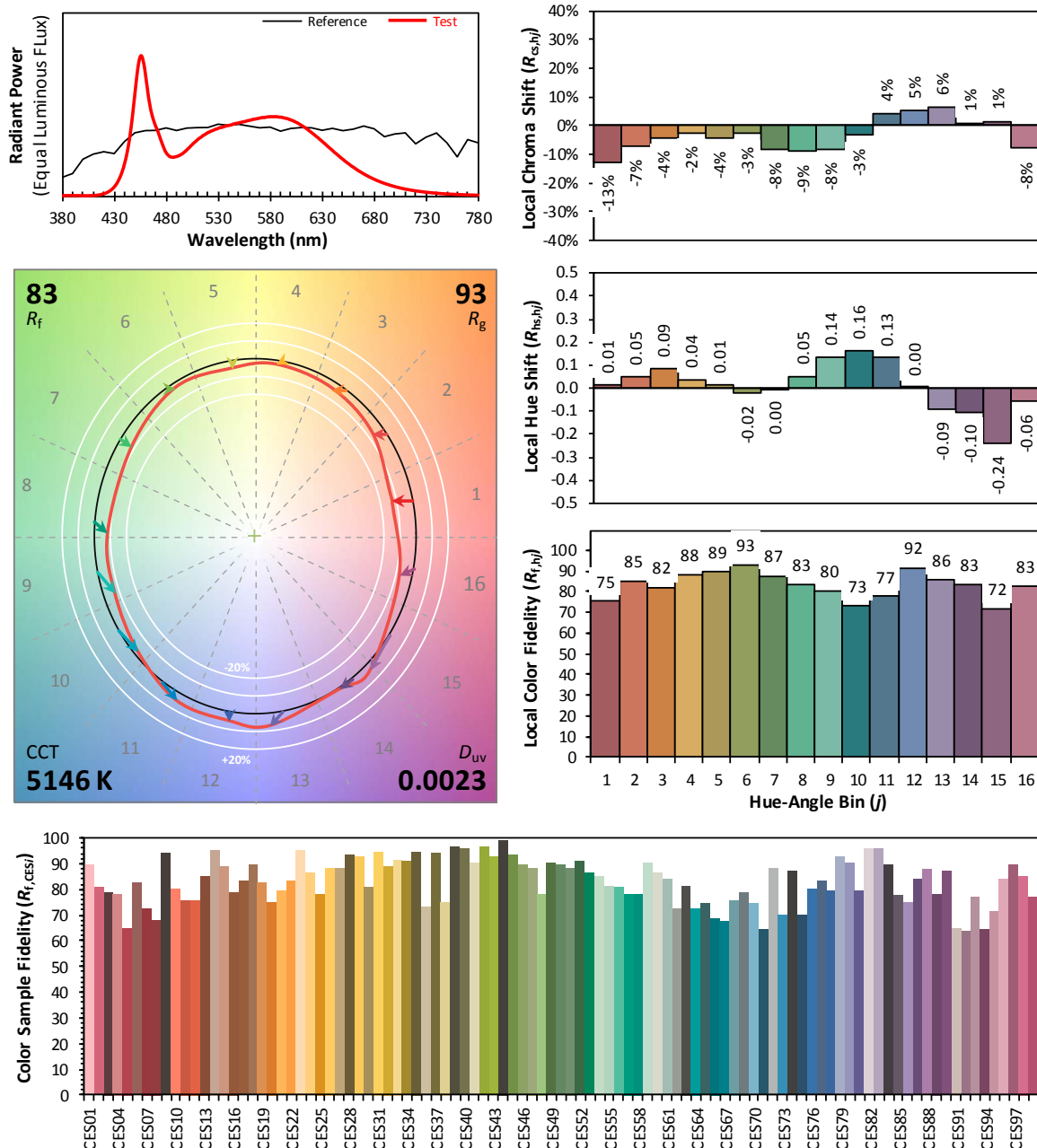


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x 0.3414
 y 0.3533
 u' 0.2083
 v' 0.4849

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	25.925	1.42%
10- 20	75.577	4.13%
20- 30	118.839	6.50%
30- 40	152.19	8.33%
40- 50	173.212	9.48%
50- 60	181.067	9.91%
60- 70	176.608	9.66%
70- 80	162.852	8.91%
80- 90	145.219	7.95%
90-100	129.238	7.07%
100-110	113.946	6.23%
110-120	98.907	5.41%
120-130	84.119	4.60%
130-140	69.531	3.80%
140-150	54.54	2.98%
150-160	38.492	2.11%
160-170	21.219	1.16%
170-180	6.262	0.34%
Total	1827.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	726.81	39.77%
60- 90	484.679	26.52%
0-90	1211.489	66.28%
90- 180	616.254	33.72%
0- 180	1827.7	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

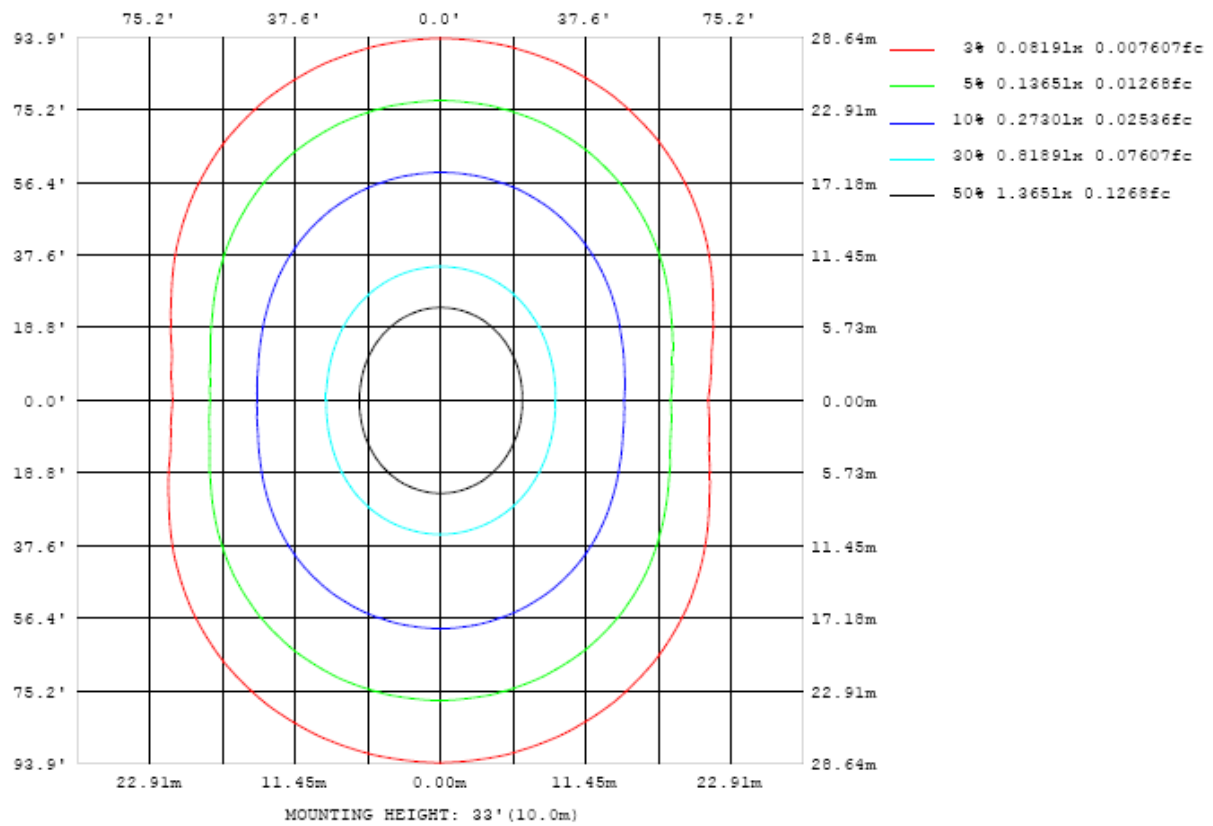


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

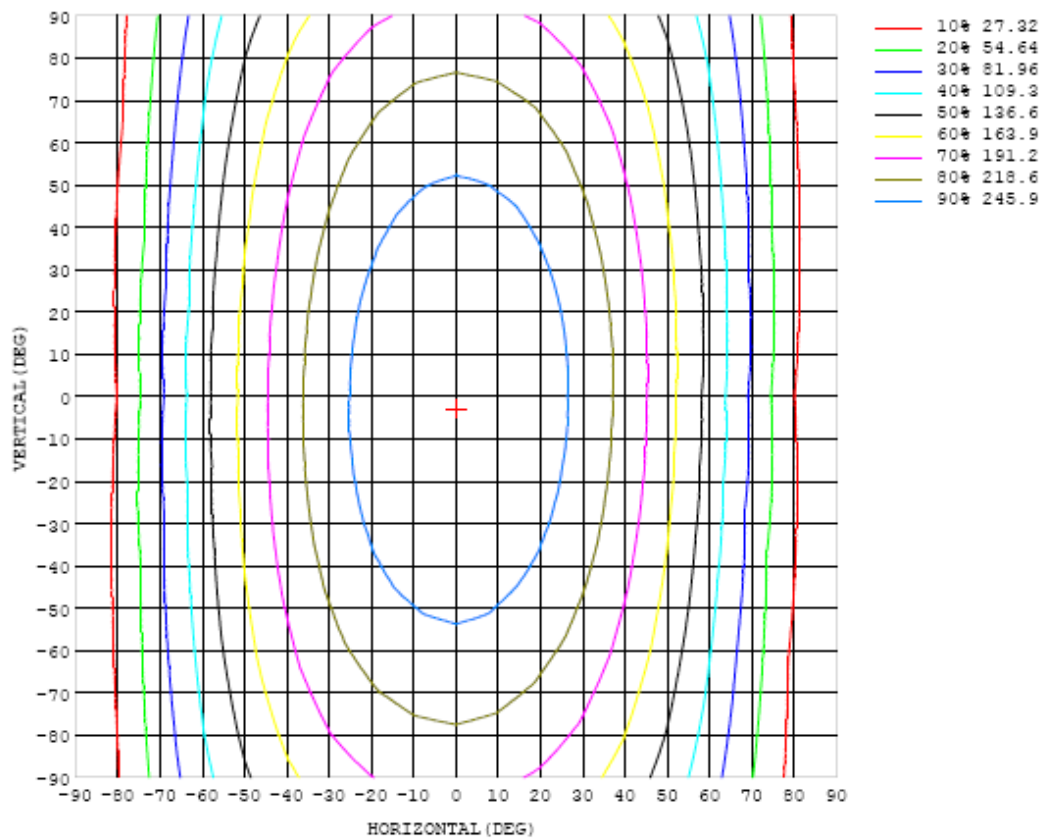


Chart 6: Isocandela Plot

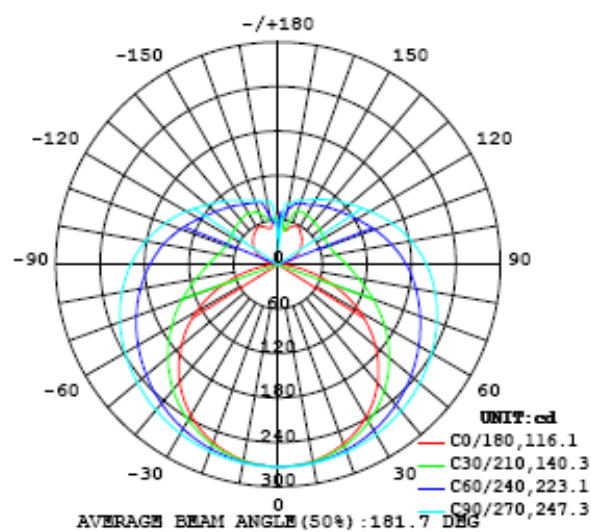


Chart 7: Polar Candela Distribution

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	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273
5	272	272	272	272	272	272	272	273	273	273	272	272	272	272	272	272	272	272	272
10	270	269	270	270	270	271	272	272	272	272	272	272	271	270	270	269	269	269	268
15	265	265	265	266	267	269	269	270	271	271	270	270	269	268	266	265	264	263	263
20	258	258	259	261	263	265	267	268	269	270	269	268	266	264	262	259	258	256	256
25	249	249	251	254	257	260	263	265	267	267	266	265	262	259	255	252	249	247	246
30	238	239	241	245	250	254	258	261	264	265	263	261	258	254	249	244	239	236	235
35	225	226	229	235	241	247	253	257	261	262	260	257	253	247	240	234	228	224	222
40	209	211	216	223	232	240	247	253	257	258	256	253	248	240	231	222	215	209	207
45	192	194	200	210	221	232	241	248	252	254	252	248	241	232	221	210	200	192	189
50	172	175	184	196	210	223	234	242	247	250	248	243	235	224	211	197	184	174	170
55	150	154	166	181	198	214	227	236	242	245	243	237	228	216	200	184	167	154	150
60	127	132	147	166	187	205	219	230	237	239	237	232	221	207	190	170	149	133	127
65	103	109	128	151	175	195	212	223	231	234	232	225	214	199	179	155	132	111	103
70	77.0	85.4	109	136	163	186	204	217	225	228	226	219	207	190	168	142	114	88.7	77.5
75	51.9	62.8	90.8	123	153	177	196	210	219	222	220	213	200	182	158	130	97.4	67.5	52.6
80	27.9	42.0	75.2	111	143	169	189	203	212	215	213	206	193	174	149	118	83.2	48.5	29.4
85	9.22	26.2	63.7	101	134	160	181	195	204	208	206	198	186	166	141	109	71.9	34.0	9.50
90	0.88	18.3	55.4	92.6	126	152	173	188	197	201	198	191	178	158	133	101	64.7	26.3	0.74
95	2.83	16.1	49.9	85.5	118	144	165	179	188	192	190	183	170	151	125	94.4	59.1	23.5	3.10
100	7.29	18.6	47.0	79.7	110	136	156	170	179	183	181	174	161	142	118	88.5	55.8	25.1	8.02
105	12.9	23.5	47.0	75.4	104	128	147	161	170	173	171	164	152	134	111	83.8	55.0	28.9	14.1
110	19.0	28.6	48.5	73.0	98.1	120	138	152	160	163	161	155	143	127	105	80.8	56.2	34.2	20.9
115	25.1	34.7	51.3	71.9	93.8	114	130	142	150	153	152	146	135	119	101	79.3	58.4	39.3	28.0
120	31.3	40.4	54.8	71.9	90.8	108	123	133	141	144	142	136	127	114	97.1	78.9	61.4	45.2	34.7
125	36.9	45.1	57.6	72.6	88.5	103	116	126	132	135	133	129	120	109	94.4	79.0	64.2	50.9	39.9
130	41.1	48.7	60.9	73.7	87.0	99.7	111	119	124	127	126	121	114	104	92.3	79.3	66.5	55.7	44.4
135	45.7	52.2	64.9	74.5	85.8	96.6	106	113	117	120	118	115	109	101	90.6	79.6	69.8	59.6	48.0
140	49.7	56.1	67.8	75.1	84.6	93.9	101	107	111	113	112	109	104	97.5	89.2	80.0	72.9	61.7	51.3
145	52.9	59.8	69.8	76.9	83.1	90.8	97.4	102	105	107	106	104	100	94.8	88.3	81.2	75.8	63.8	54.0
150	56.6	61.9	70.9	77.4	83.2	87.7	92.9	97.3	100	101	101	99.5	96.5	92.5	87.7	82.0	77.2	65.0	56.6
155	57.3	55.1	68.7	77.6	82.5	86.9	89.7	92.2	94.5	95.7	95.9	95.4	93.5	90.6	86.5	78.7	73.3	62.7	57.0
160	54.9	47.8	63.1	77.1	80.8	85.1	88.3	90.4	92.0	92.8	92.8	92.1	90.9	86.1	77.3	72.3	67.4	57.3	53.7
165	49.0	45.0	47.2	60.2	78.6	80.1	83.3	86.2	87.6	88.4	88.4	87.0	79.2	70.5	65.3	61.7	58.0	52.0	50.7
170	46.7	47.8	47.7	46.8	55.5	69.3	75.8	78.1	81.8	82.7	80.8	66.1	59.2	61.5	60.3	59.7	53.8	51.7	51.2
175	56.9	57.4	62.4	64.5	63.7	61.8	64.9	64.9	61.1	59.2	44.5	62.1	65.0	66.9	65.2	65.6	65.1	64.1	62.9
180	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2

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	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273	273		
5	272	272	272	272	272	272	272	272	272	272	273	272	272	272	272	272	272		
10	268	268	269	269	270	270	271	271	272	271	271	271	271	270	270	270	269		
15	263	264	265	266	267	268	269	270	270	270	270	269	268	267	266	265	265		
20	256	257	259	261	263	265	267	268	268	268	267	266	265	263	261	259	258		
25	247	248	251	254	258	261	263	265	266	266	265	262	260	257	254	251	250		
30	236	238	242	247	252	256	260	262	263	263	261	258	254	250	246	242	239		
35	223	227	232	238	245	251	256	259	260	259	257	253	248	242	236	230	226		
40	208	213	221	229	237	245	251	255	256	255	252	247	240	233	224	217	211		
45	191	198	208	219	229	239	246	250	252	251	248	241	233	222	212	202	195		
50	173	182	194	208	221	232	240	246	248	246	242	235	224	212	198	186	176		
55	154	165	180	197	212	225	235	241	243	241	237	228	216	201	184	169	157		
60	132	147	165	185	203	218	229	236	238	236	231	221	207	190	170	151	136		
65	109	128	152	174	194	211	223	230	233	231	225	214	198	178	157	133	113		
70	86.2	110	137	163	186	204	216	224	227	225	218	206	189	168	143	114	90.1		
75	63.6	92.1	124	154	177	196	209	218	221	218	211	199	181	158	130	97.6	67.9		
80	43.2	76.9	113	144	169	189	202	211	214	211	204	191	172	149	118	82.6	48.0		
85	27.8	65.1	103	135	161	181	195	203	206	204	196	183	164	139	108	70.8	32.9		
90	19.7	56.9	94.4	127	154	173	187	196	199	196	188	175	157	131	99.3	62.4	24.5		
95	17.4	51.7	87.7	120	146	165	179	187	191	188	180	167	148	123	92.1	56.6	21.3		
100	19.6	48.6	81.9	112	138	157	170	179	182	179	171	159	140	116	85.8	52.6	22.1		
105	24.2	48.1	77.5	106	130	148	161	169	172	169	162	150	132	108	80.8	51.0	25.7		
110	30.7	49.9	74.5	100	122	140	152	160	163	160	153	141	124	102	77.1	51.7	30.5		
115	37.5	53.0	73.7	95.1	115	131	143	150	153	151	144	133	117	96.8	75.1	53.6	37.0		
120	43.8	56.7	73.8	92.1	109	123	134	141	143	141	135	124	110	92.9	74.4	55.7	43.2		
125	50.0	60.6	74.7	89.9	104	116	126	132	134	132	126	117	105	90.2	74.6	58.9	49.1		
130	55.8	64.5	75.7	88.4	100	111	119	124	125	124	119	111	101	88.3	74.5	62.9	54.4		
135	61.2	68.2	77.1	87.3	97.2	106	112	117	118	116	112	106	97.2	86.6	75.3	66.9	59.6		
140	65.4	69.0	78.7	86.4	94.5	102	107	110	111	110	107	101	94.0	84.9	77.0	70.1	64.7		
145	70.1	73.4	80.0	85.7	91.8	97.6	102	105	106	104	102	97.0	90.9	84.5	78.8	73.4	69.1		
150	73.7	75.4	79.6	85.6	89.8	93.9	97.1	99.1	99.9	98.8	96.6	93.2	89.0	84.7	80.2	75.6	72.4		
155	72.5	75.5	78.4	85.2	88.4	91.1	93.3	94.7	95.2	94.4	93.0	90.8	88.0	84.8	81.7	79.1	73.3		
160	63.7	71.3	73.7	78.4	87.0	88.8	90.3	91.3	91.7	91.2	90.5	89.2	87.3	85.1	82.9	81.9	72.5		
165	57.6	62.7	66.1	68.4	75.2	86.4	88.0	88.5	88.9	88.7	88.3	87.6	86.6	85.4	84.1	83.2	72.1		
170	51.7	58.8	62.7	61.4	61.9	66.8	76.9	87.1	86.8	86.7	86.5	86.4	85.3	83.0	81.1	78.3	65.1		
175	61.1	62.3	62.0	62.2	60.7	55.8	55.3	63.3	77.3	82.0	84.3	84.0	79.5	76.6	71.4	64.6	60.0		
180	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

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

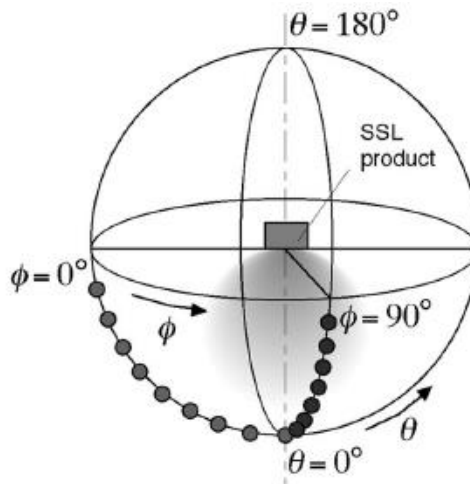
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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