

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED tube

Model: 13T8/4F/830/BYP/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, Yuhang Dist,
Hangzhou, Zhejiang Province, China 311100


Tel: +86 571 86376106

www.ledtestlab.com

Report No.: HZ18040014e

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

Review by:



Engineer: April Zou
Apr. 27, 2018

Approved by:



Manager: Jim Zhang
Apr. 27, 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: 13T8/4F/830/BYP/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
132.4	1768.0	13.35	0.9797
CCT (K)	CRI	Stabilization Time (Light & Power)	
3134	81.8	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 : Apr. 09, 2018

Date of Test : Apr. 12, 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

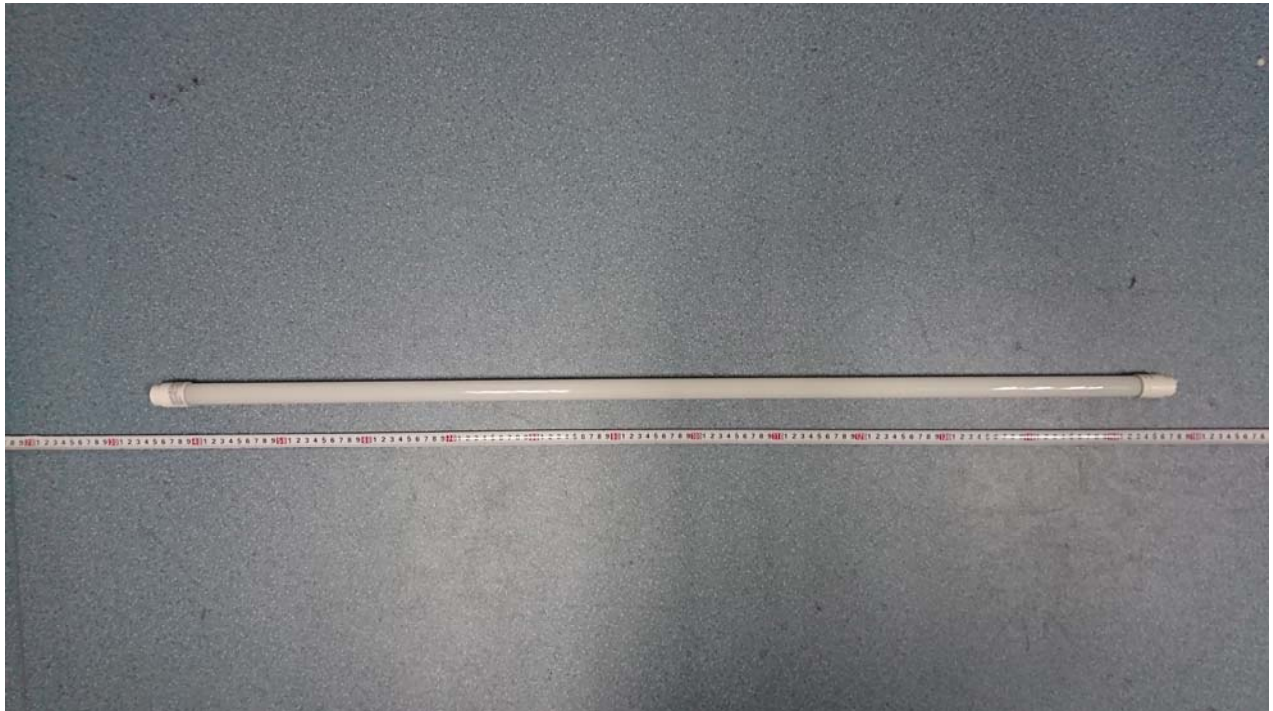


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED tube
Model	: 13T8/4F/830/BYP/R
Electrical Ratings	: 120-277V, 50/60Hz, 13W
Product Description	: 3000K
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 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)	0.114	0.053
Power Factor	0.9797	0.9212
Test Power (W)	13.35	13.40
THD A%	18.73	15.17
Luminous Efficacy (lm/W)	132.4	132.9
Total Luminous Flux (lm)	1768.0	1781.0
Color Rendering Index (CRI)	81.8	
R9	4.7	
Correlated Color Temperature (CCT)(K)	3134	
Chromaticity Chroma x	0.4306	
Chromaticity Chroma y	0.4073	
Chromaticity Chroma u	0.2451	
Chromaticity Chroma v	0.3478	
Duv	0.0018	
Chromaticity Chroma u'	0.2451	
Chromaticity Chroma v'	0.5217	

Special Color Rendering Indices	
R1	79.4
R2	88.6
R3	96.8
R4	80.4
R5	79.4
R6	85.7
R7	84.3
R8	59.7
R9	4.7
R10	74.2
R11	79.4
R12	66.8
R13	81.3
R14	98.3
Rf	83
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)	0.114
Power Factor	0.9764
Test Power (W)	13.40
Luminous Efficacy (lm/W)	130.1
Total Luminous Flux (lm)	1743.5
Beam Angle (°)	178.1
Center Beam Candle Power (cd)	268
Spacing Criteria	1.28 (0°-180°)/ 1.46 (90°-270°)
Zonal Lumens in the 0°-60°Zone	40.74%
Zonal Lumens in the 60°-90°Zone	26.68%
Zonal Lumens in the 90°-120°Zone	18.34%
Zonal Lumens in the 120°-180°Zone	14.25%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

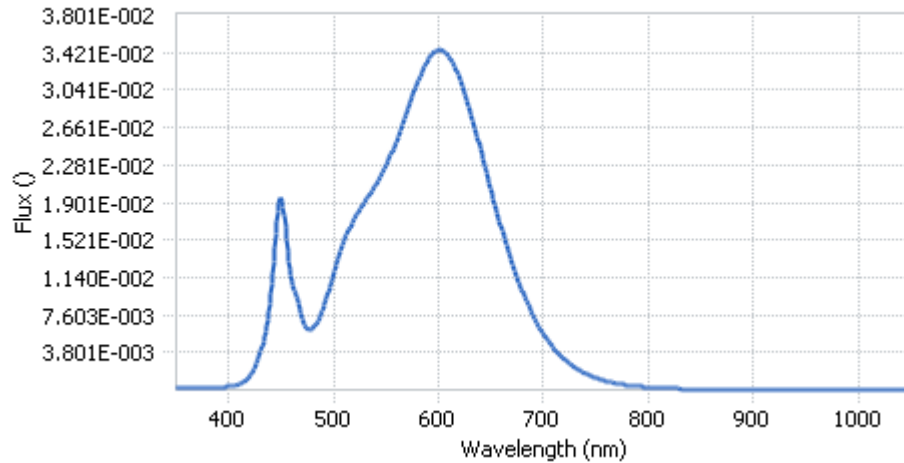


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.77E-04	485	7.02E-03	590	3.35E-02	695	6.55E-03
385	2.69E-04	490	8.22E-03	595	3.41E-02	700	5.67E-03
390	2.95E-04	495	1.00E-02	600	3.45E-02	705	4.88E-03
395	3.10E-04	500	1.19E-02	605	3.43E-02	710	4.18E-03
400	3.28E-04	505	1.36E-02	610	3.38E-02	715	3.59E-03
405	4.28E-04	510	1.51E-02	615	3.29E-02	720	3.09E-03
410	5.85E-04	515	1.64E-02	620	3.16E-02	725	2.65E-03
415	8.76E-04	520	1.75E-02	625	3.00E-02	730	2.27E-03
420	1.42E-03	525	1.83E-02	630	2.83E-02	735	1.95E-03
425	2.31E-03	530	1.91E-02	635	2.63E-02	740	1.66E-03
430	3.81E-03	535	1.99E-02	640	2.43E-02	745	1.42E-03
435	5.98E-03	540	2.08E-02	645	2.23E-02	750	1.22E-03
440	9.69E-03	545	2.18E-02	650	2.02E-02	755	1.04E-03
445	1.58E-02	550	2.27E-02	655	1.83E-02	760	8.90E-04
450	1.96E-02	555	2.40E-02	660	1.64E-02	765	7.66E-04
455	1.53E-02	560	2.52E-02	665	1.46E-02	770	6.54E-04
460	1.11E-02	565	2.68E-02	670	1.29E-02	775	5.62E-04
465	9.36E-03	570	2.82E-02	675	1.13E-02	780	4.88E-04
470	7.43E-03	575	2.98E-02	680	9.97E-03		
475	6.14E-03	580	3.12E-02	685	8.71E-03		
480	6.26E-03	585	3.26E-02	690	7.58E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method

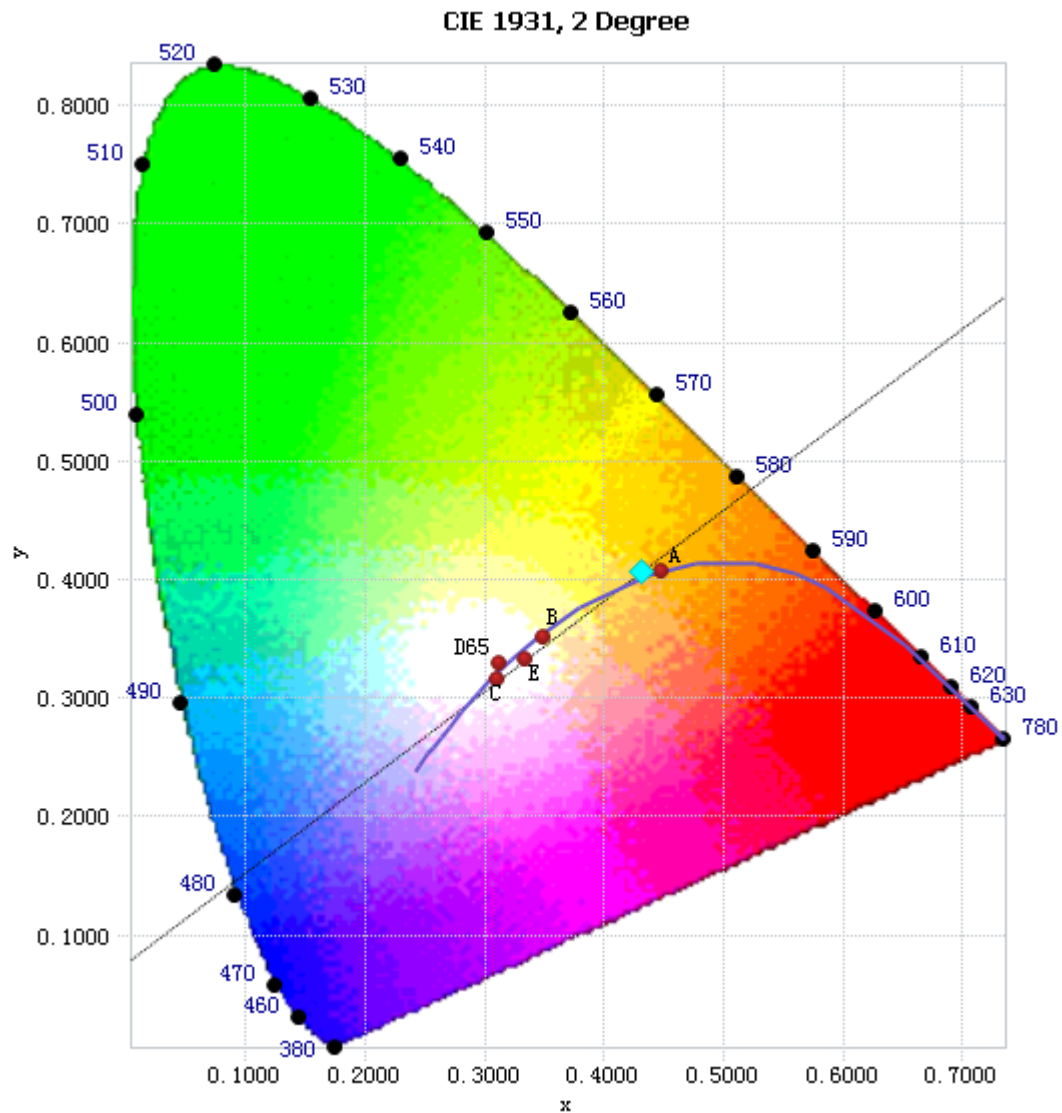


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

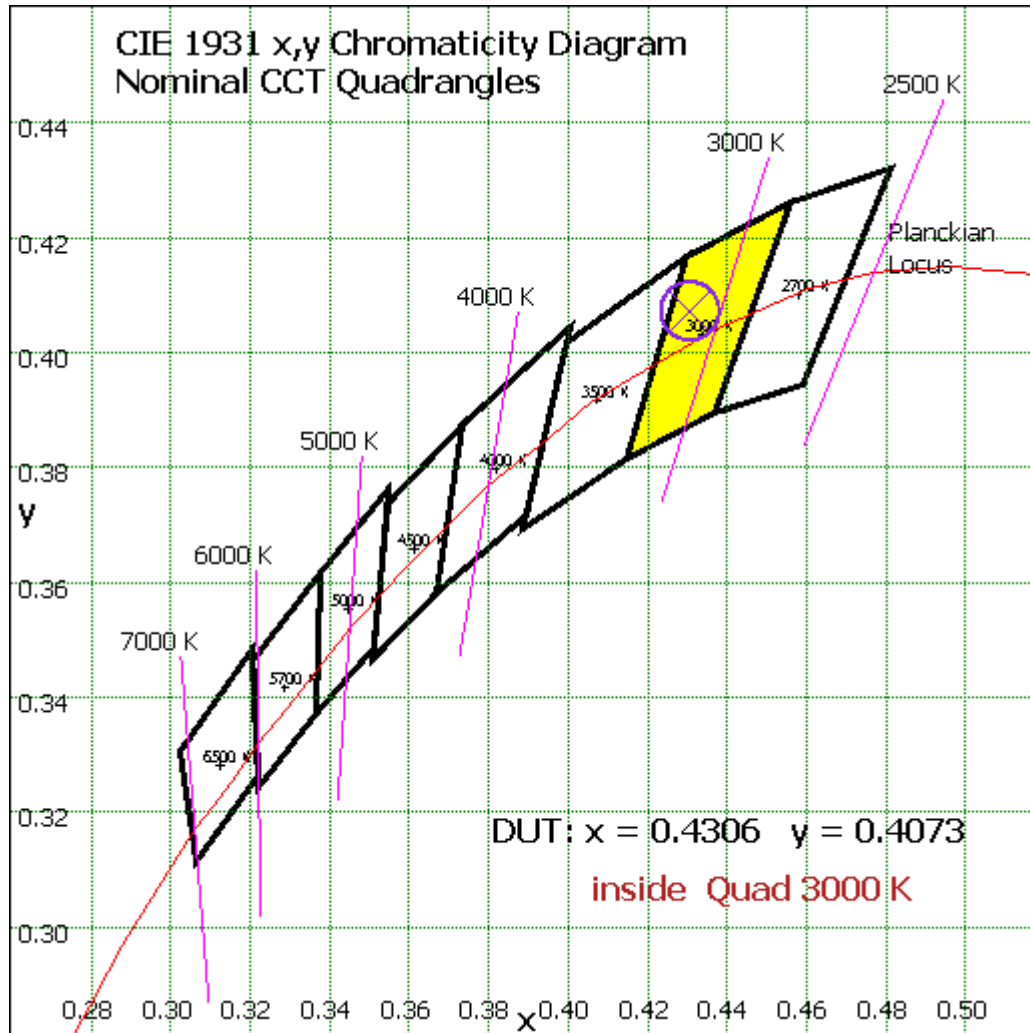


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	25.451	1.46%
10- 20	74.159	4.25%
20- 30	116.487	6.68%
30- 40	148.939	8.54%
40- 50	169.118	9.70%
50- 60	176.117	10.10%
60- 70	170.827	9.80%
70- 80	156.279	8.96%
80- 90	138.005	7.92%
90-100	121.728	6.98%
100-110	106.432	6.10%
110-120	91.619	5.25%
120-130	77.219	4.43%
130-140	63.336	3.63%
140-150	49.124	2.82%
150-160	34.489	1.98%
160-170	18.767	1.08%
170-180	5.447	0.31%
Total	1743.5	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	710.271	40.74%
60- 90	465.111	26.68%
0-90	1175.382	67.41%
90- 180	568.161	32.59%
0- 180	1743.5	100%

Table 5: Zonal Lumen Data

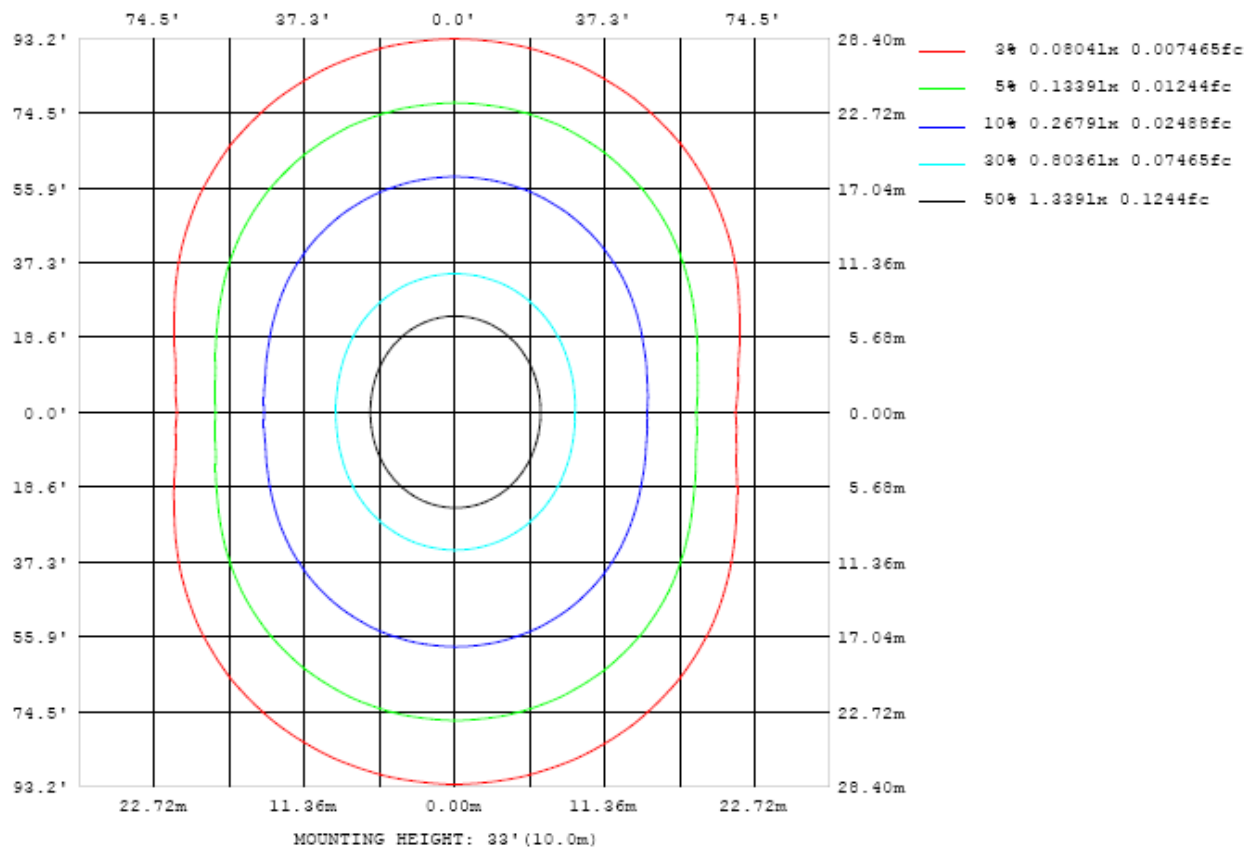


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

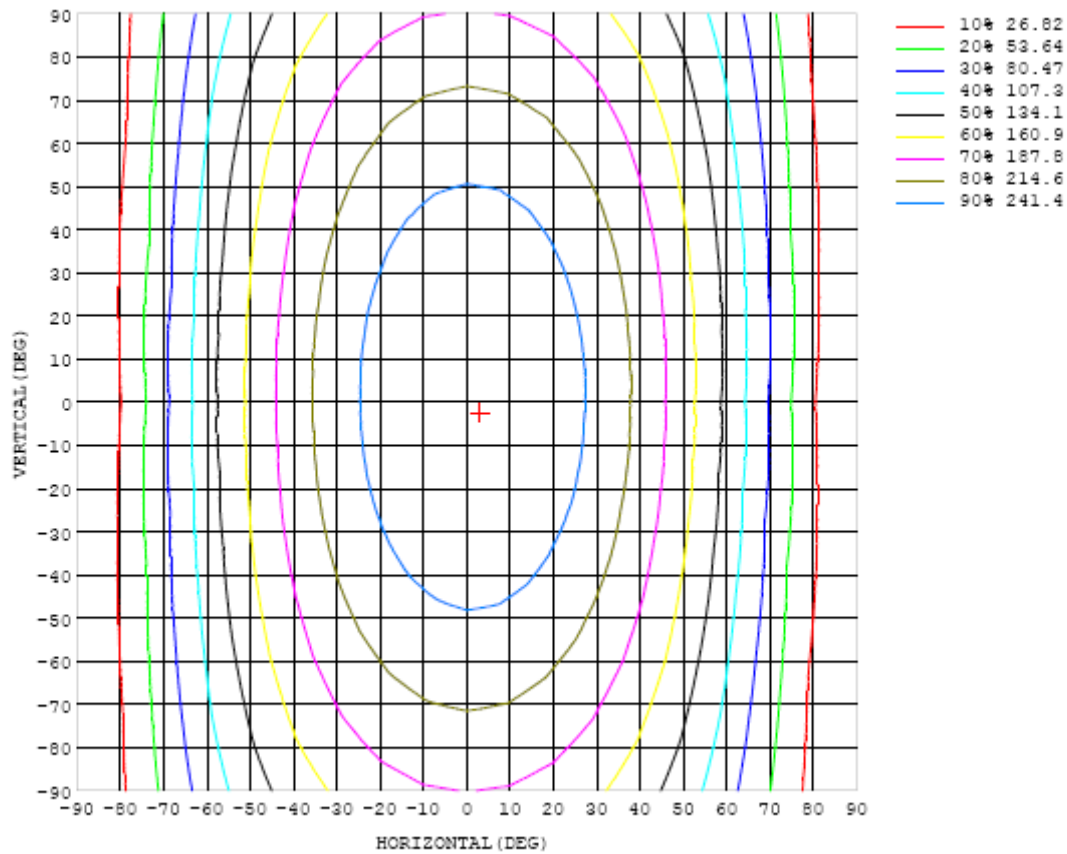


Chart 5: Isocandela Plot

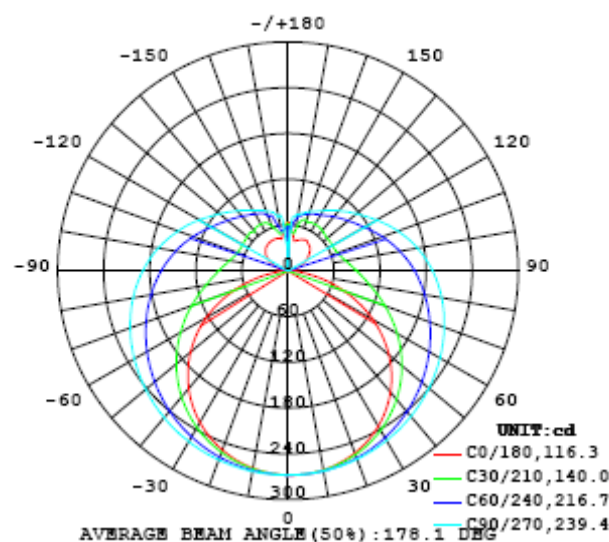


Chart 6: Polar Candela Distribution

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	268	268	268	268	268	268	268	268	268	268	268	268	268	268	268	268	268	268	268
5	268	267	268	267	268	268	268	268	268	268	267	267	267	267	267	267	266	266	266
10	265	265	265	265	266	266	266	267	267	266	266	266	265	265	264	264	263	263	263
15	261	261	261	262	263	264	264	265	265	265	264	264	262	261	260	259	258	257	257
20	254	254	255	257	258	260	261	262	263	263	262	261	259	257	255	253	251	250	250
25	246	246	248	250	253	255	257	259	260	260	259	257	255	252	249	246	243	241	241
30	235	236	238	241	246	249	252	255	257	257	256	253	250	246	241	237	233	230	230
35	222	223	227	231	237	242	247	251	253	253	252	249	244	239	232	226	221	217	216
40	208	209	214	220	228	235	241	246	249	249	247	244	238	231	223	215	208	203	201
45	191	192	199	207	218	226	234	240	244	245	243	238	231	223	213	203	193	186	184
50	172	174	182	194	207	218	227	234	239	240	237	233	225	214	202	189	177	168	166
55	150	154	165	179	195	208	220	228	233	234	232	226	217	205	191	175	160	149	146
60	128	132	146	164	183	199	212	222	227	229	226	220	210	197	180	161	143	128	123
65	103	110	127	149	171	190	204	215	221	223	220	214	203	188	169	147	125	106	99.1
70	78.0	86.2	108	134	160	180	197	208	215	217	214	207	195	179	158	134	107	84.0	74.1
75	52.9	63.4	90.4	121	149	171	189	201	208	210	207	200	188	170	148	121	90.9	63.1	49.2
80	28.8	42.8	74.6	108	138	163	181	194	201	203	201	193	180	162	139	110	76.7	44.3	26.2
85	9.49	26.6	62.5	98.0	129	154	173	186	194	196	193	186	172	154	130	100	65.6	30.2	7.72
90	0.78	17.9	53.9	89.5	121	146	165	178	186	188	186	178	165	146	122	92.3	58.1	22.7	0.54
95	2.02	15.2	48.2	82.4	113	138	157	170	178	180	178	170	157	139	115	85.6	52.7	20.1	2.32
100	5.83	17.1	44.8	76.4	106	130	148	161	169	171	169	161	148	131	108	79.8	49.4	21.4	6.66
105	10.7	20.9	44.1	71.8	99.0	122	139	152	160	162	160	152	140	123	101	75.3	48.3	24.9	12.3
110	16.2	26.1	45.2	68.8	93.0	114	131	143	150	153	150	143	132	116	95.3	72.1	49.3	29.8	18.3
115	21.6	32.1	47.3	67.3	88.2	107	122	134	141	143	141	134	123	109	90.4	70.6	51.2	35.4	24.2
120	27.0	36.5	49.3	66.8	84.8	101	115	125	131	133	131	125	116	103	87.1	70.0	53.8	40.7	30.0
125	32.0	40.9	52.8	66.9	82.2	96.3	108	117	122	124	123	117	109	97.8	84.4	70.0	56.5	44.8	34.9
130	36.5	44.5	56.7	66.6	80.4	92.1	102	110	115	116	115	111	103	93.7	82.5	70.3	59.5	49.0	38.5
135	40.6	49.2	59.8	67.7	78.4	88.8	97.2	104	108	109	108	104	98.1	90.2	80.8	70.8	62.2	51.9	41.2
140	43.3	51.1	61.6	69.4	76.8	85.4	92.8	98.2	102	103	102	98.6	93.7	87.0	79.2	71.6	64.3	55.1	42.9
145	45.0	53.4	63.5	70.5	76.7	82.3	88.2	92.9	95.9	97.0	96.1	93.6	89.3	84.0	78.3	72.3	62.7	58.6	44.1
150	46.5	56.1	63.8	70.5	76.3	80.7	84.5	87.8	90.1	91.0	90.4	88.6	85.5	81.8	77.6	72.7	65.7	61.8	44.7
155	45.2	53.2	66.7	70.1	75.1	79.1	82.1	84.4	85.9	86.5	86.1	84.9	82.8	80.2	77.1	68.6	65.4	60.4	45.1
160	43.2	47.4	64.1	70.5	74.1	76.7	79.4	81.1	82.3	82.7	82.5	81.9	80.4	78.4	69.9	62.4	58.8	55.9	44.9
165	41.0	41.5	50.5	67.9	72.8	73.0	76.4	77.5	78.2	78.4	78.4	78.6	76.2	64.5	57.4	54.1	52.3	49.1	44.0
170	43.1	42.9	42.7	52.4	65.8	68.3	70.9	74.8	75.1	75.1	75.4	70.0	58.3	51.6	54.2	53.2	51.8	46.1	44.7
175	55.0	54.6	53.1	51.8	55.5	54.8	57.7	60.0	67.3	71.3	49.1	40.2	48.3	54.0	53.5	55.5	53.6	55.0	55.1
180	4.98	4.95	4.84	4.67	4.44	4.17	3.86	3.53	3.18	2.84	3.05	3.27	3.49	3.69	3.87	4.03	4.14	4.22	4.24

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	268	268	268	268	268	268	268	268	268	268	268	268	268	268	268	268	268		
5	266	267	266	267	267	267	268	268	268	268	268	268	268	268	268	268	268		
10	263	263	264	265	265	266	266	267	267	267	267	267	267	266	266	265	265		
15	258	258	259	261	262	263	264	265	266	266	266	265	264	263	262	262	261		
20	250	252	253	256	258	260	262	263	264	264	263	262	261	259	257	256	255		
25	241	243	246	250	253	256	259	260	261	261	260	258	256	253	251	248	247		
30	231	233	237	242	247	251	255	257	258	258	257	254	251	247	242	239	236		
35	218	222	227	234	240	246	251	254	255	255	253	249	244	238	233	228	224		
40	203	209	216	225	233	240	246	250	251	251	248	243	237	229	222	215	210		
45	187	194	203	214	225	234	240	245	247	246	243	237	229	219	209	200	194		
50	169	178	190	204	216	227	235	240	242	241	237	230	220	209	196	184	176		
55	149	161	176	192	207	219	229	235	237	235	231	223	211	198	182	167	156		
60	128	143	161	181	198	212	223	229	231	230	224	215	202	186	168	150	135		
65	106	125	148	170	189	205	216	223	225	223	218	207	193	175	153	131	113		
70	83.3	106	134	159	180	197	209	216	219	217	211	199	184	163	140	113	89.9		
75	61.0	89.2	120	149	171	189	202	210	212	210	203	191	175	153	126	95.6	67.5		
80	41.2	74.1	109	139	163	181	195	202	205	203	196	183	166	143	114	80.3	47.4		
85	26.1	62.4	98.5	130	154	173	187	195	197	195	188	175	157	133	103	67.8	31.6		
90	18.3	54.2	90.2	122	147	165	179	186	189	187	180	167	149	125	94.2	58.7	22.4		
95	16.0	48.8	83.2	114	139	157	170	178	181	178	171	158	141	116	86.6	52.4	18.8		
100	18.0	45.7	77.5	107	131	149	161	169	172	169	162	150	132	109	80.0	48.1	19.2		
105	22.2	45.1	72.9	99.8	122	140	152	160	162	160	153	141	124	101	74.6	46.3	22.5		
110	27.8	46.4	70.0	93.9	115	131	144	150	152	150	144	132	116	94.8	70.9	46.7	27.6		
115	33.6	49.0	68.7	89.2	108	123	134	141	143	141	134	123	108	89.5	68.7	48.3	33.3		
120	38.3	52.1	68.4	85.9	102	115	125	131	133	131	125	115	102	85.5	67.9	51.0	38.7		
125	43.5	55.4	68.8	83.5	97.2	109	117	122	124	122	117	108	96.7	82.8	67.8	54.3	43.4		
130	46.1	58.0	69.6	81.7	93.1	103	110	115	116	115	110	102	92.6	80.8	68.5	57.8	48.0		
135	52.4	60.9	70.6	80.3	89.7	97.8	104	108	109	108	104	97.4	89.1	79.4	69.6	60.9	52.5		
140	56.3	62.9	67.5	79.4	86.8	93.3	98.6	102	103	101	98.2	92.9	86.2	78.5	70.9	62.8	55.2		
145	58.6	65.1	70.6	78.4	84.3	89.4	93.6	96.1	96.9	95.9	93.3	89.2	83.9	77.9	71.8	65.1	57.5		
150	62.4	65.8	70.9	73.6	82.2	86.1	89.3	91.2	91.8	91.1	89.2	86.0	82.0	77.4	72.1	66.3	61.5		
155	60.7	65.7	69.9	75.2	77.1	83.2	85.5	86.9	87.4	86.9	85.6	83.4	80.4	76.9	73.0	68.7	60.1		
160	52.4	59.0	62.9	68.6	76.1	76.7	82.3	83.1	83.4	83.2	82.5	81.0	78.6	76.0	72.7	69.7	55.3		
165	46.2	51.3	53.9	57.4	62.8	69.9	73.9	77.1	79.8	79.6	79.2	78.3	77.2	74.5	71.5	68.2	48.6		
170	44.9	45.1	49.9	54.0	54.5	53.7	59.8	70.6	71.5	74.4	75.2	75.4	71.8	69.8	67.0	56.0	46.0		
175	54.9	54.8	53.8	56.2	53.5	54.8	49.0	41.1	51.3	72.4	70.1	62.0	59.1	56.5	56.9	53.6	53.5		
180	4.22	4.14	4.03	3.87	3.69	3.49	3.27	3.05	2.84	3.18	3.53	3.86	4.17	4.44	4.67	4.84	4.95		

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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