LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED tube

Model: 12T8/3F/840/BYP/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18040014d

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

Review by: April Zou

Engineer: April Zou

Apr. 27, 2018

Approved by: Jim Zhang

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: **12T8/3F/840/BYP/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
135.5	1665.0	12.29	0.9883

CCT (K)	CRI	Stabilization Time (Light & Power)
4016	81.1	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	: 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

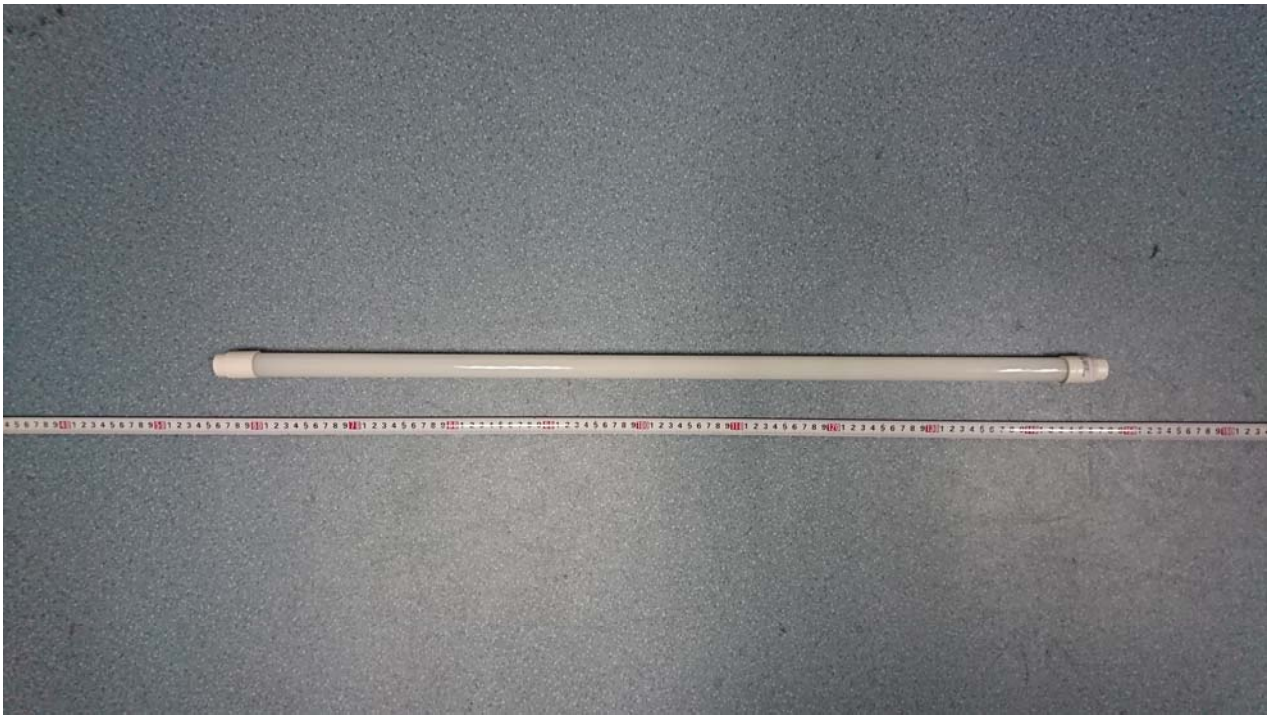


Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: LED tube
Model	: 12T8/3F/840/BYP/R
Electrical Ratings	: 120-277V, 50/60Hz, 12W
Product Description	: 4000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 24.9℃.

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)	0.104	0.048
Power Factor	0.9883	0.9183
Test Power (W)	12.29	12.32
THD A%	13.64	18.36
Luminous Efficacy (lm/W)	135.5	136.0
Total Luminous Flux (lm)	1665.0	1675.0
Color Rendering Index (CRI)	81.1	
R9	0.7	
Correlated Color Temperature (CCT)(K)	4016	
Chromaticity Chroma x	0.3826	
Chromaticity Chroma y	0.3874	
Chromaticity Chroma u	0.2223	
Chromaticity Chroma v	0.3377	
Duv	0.0036	
Chromaticity Chroma u ’	0.2223	
Chromaticity Chroma v’	0.5065	

Special Color Rendering Indices	
R1	78.4
R2	86.3
R3	93.7
R4	80.7
R5	78.7
R6	81.8
R7	86.4
R8	62.8
R9	0.7
R10	68.5
R11	79.4
R12	60.2
R13	80
R14	96.5
Rf	82
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 24.9℃.

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)	0.104
Power Factor	0.9851
Test Power (W)	12.32
Luminous Efficacy (lm/W)	132.9
Total Luminous Flux (lm)	1637.5
Beam Angle (°)	172.2
Center Beam Candle Power (cd)	260
Spacing Criteria	1.26 (0°-180°)/ 1.45 (90°-270°)
Zonal Lumens in the 0°-60°Zone	41.51%
Zonal Lumens in the 60°-90°Zone	26.67%
Zonal Lumens in the 90°-120°Zone	18.02%
Zonal Lumens in the 120°-180°Zone	13.80%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

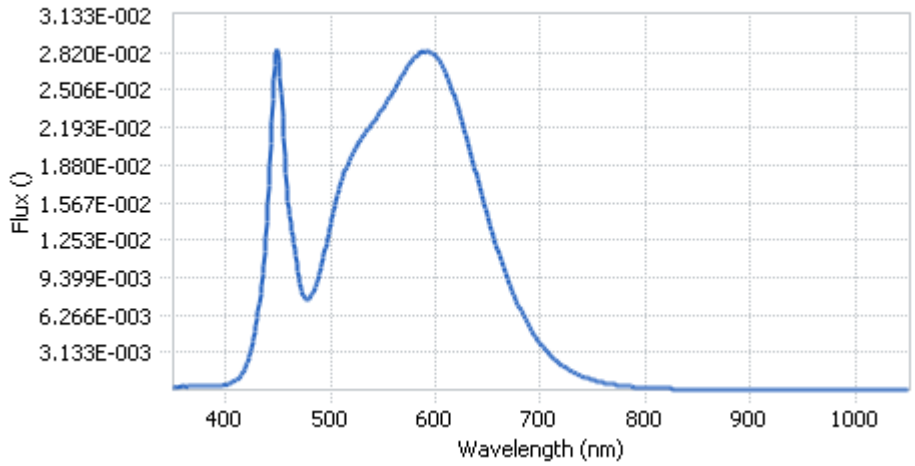
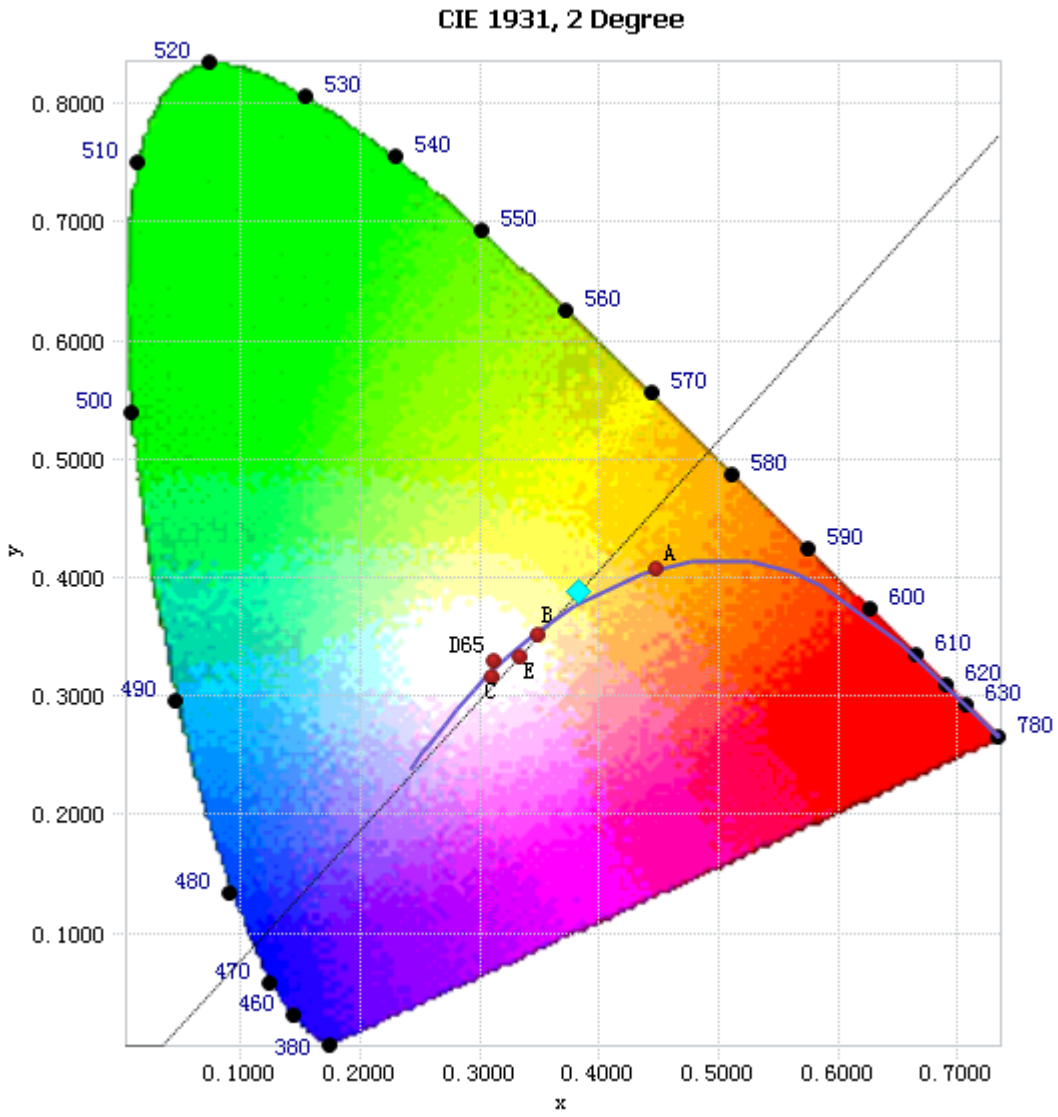


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.25E-04	485	8.53E-03	590	2.83E-02	695	4.47E-03
385	3.27E-04	490	9.88E-03	595	2.82E-02	700	3.87E-03
390	3.58E-04	495	1.19E-02	600	2.79E-02	705	3.33E-03
395	3.93E-04	500	1.40E-02	605	2.73E-02	710	2.85E-03
400	4.30E-04	505	1.58E-02	610	2.64E-02	715	2.45E-03
405	5.72E-04	510	1.74E-02	615	2.53E-02	720	2.11E-03
410	8.35E-04	515	1.86E-02	620	2.39E-02	725	1.81E-03
415	1.31E-03	520	1.97E-02	625	2.24E-02	730	1.55E-03
420	2.15E-03	525	2.04E-02	630	2.10E-02	735	1.32E-03
425	3.61E-03	530	2.11E-02	635	1.93E-02	740	1.13E-03
430	6.07E-03	535	2.17E-02	640	1.76E-02	745	9.71E-04
435	9.69E-03	540	2.23E-02	645	1.60E-02	750	8.33E-04
440	1.56E-02	545	2.29E-02	650	1.44E-02	755	7.13E-04
445	2.43E-02	550	2.35E-02	655	1.29E-02	760	6.21E-04
450	2.83E-02	555	2.43E-02	660	1.15E-02	765	5.28E-04
455	2.11E-02	560	2.50E-02	665	1.02E-02	770	4.55E-04
460	1.51E-02	565	2.58E-02	670	8.97E-03	775	3.88E-04
465	1.23E-02	570	2.65E-02	675	7.86E-03	780	3.34E-04
470	9.41E-03	575	2.72E-02	680	6.89E-03		
475	7.73E-03	580	2.78E-02	685	5.99E-03		
480	7.77E-03	585	2.83E-02	690	5.18E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3826, 0.3874)

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

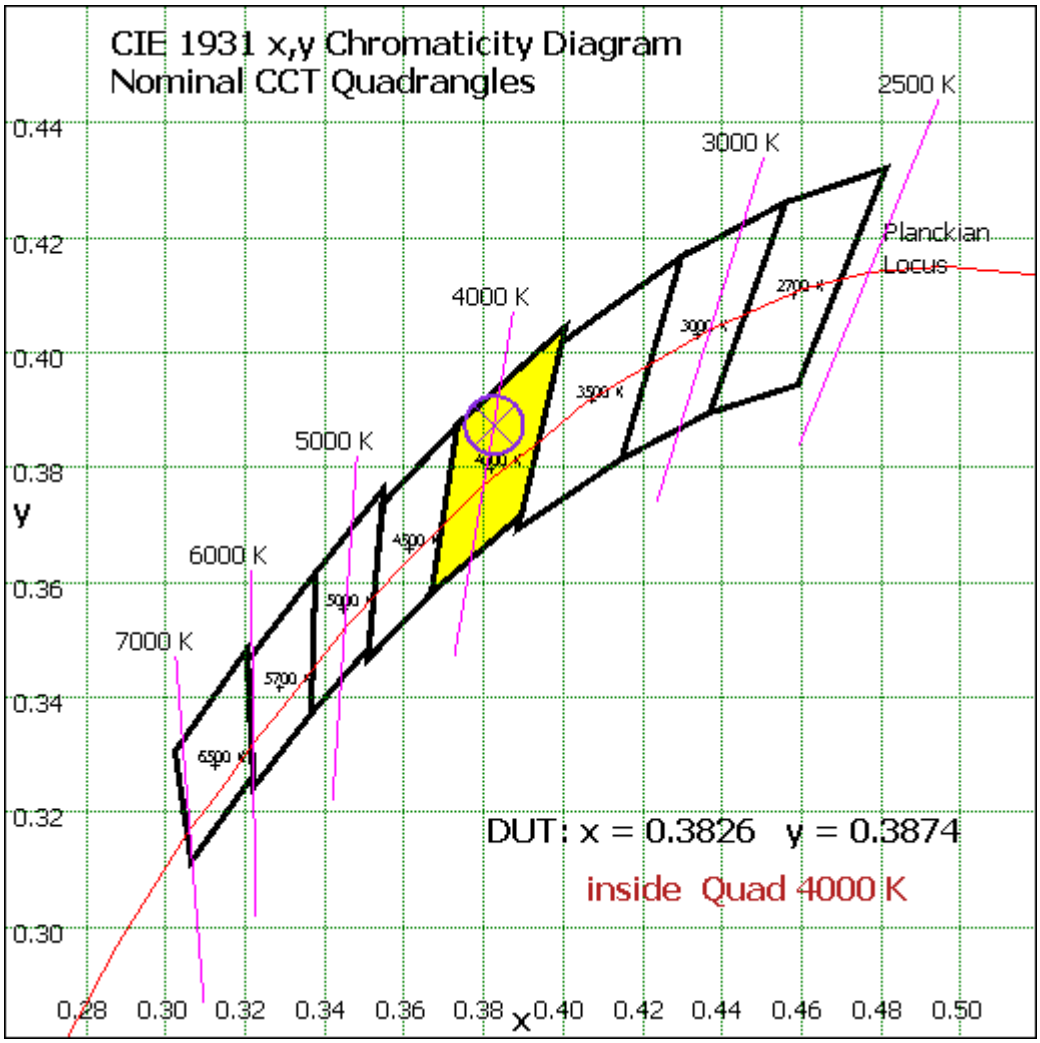


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	24.724	1.51%
10- 20	71.869	4.39%
20- 30	112.397	6.86%
30- 40	142.864	8.72%
40- 50	161.144	9.84%
50- 60	166.755	10.18%
60- 70	160.872	9.82%
70- 80	146.661	8.96%
80- 90	129.206	7.89%
90-100	113.313	6.92%
100-110	98.148	5.99%
110-120	83.61	5.11%
120-130	70.051	4.28%
130-140	57.453	3.51%
140-150	44.691	2.73%
150-160	31.613	1.93%
160-170	17.406	1.06%
170-180	4.719	0.29%
Total	1637.5	100%

γ(°)	Lumens	% Total
0- 60	679.753	41.51%
60- 90	436.739	26.67%
0-90	1116.492	68.18%
90- 180	521.004	31.82%
0- 180	1637.5	100%

Table 5: Zonal Lumen Data

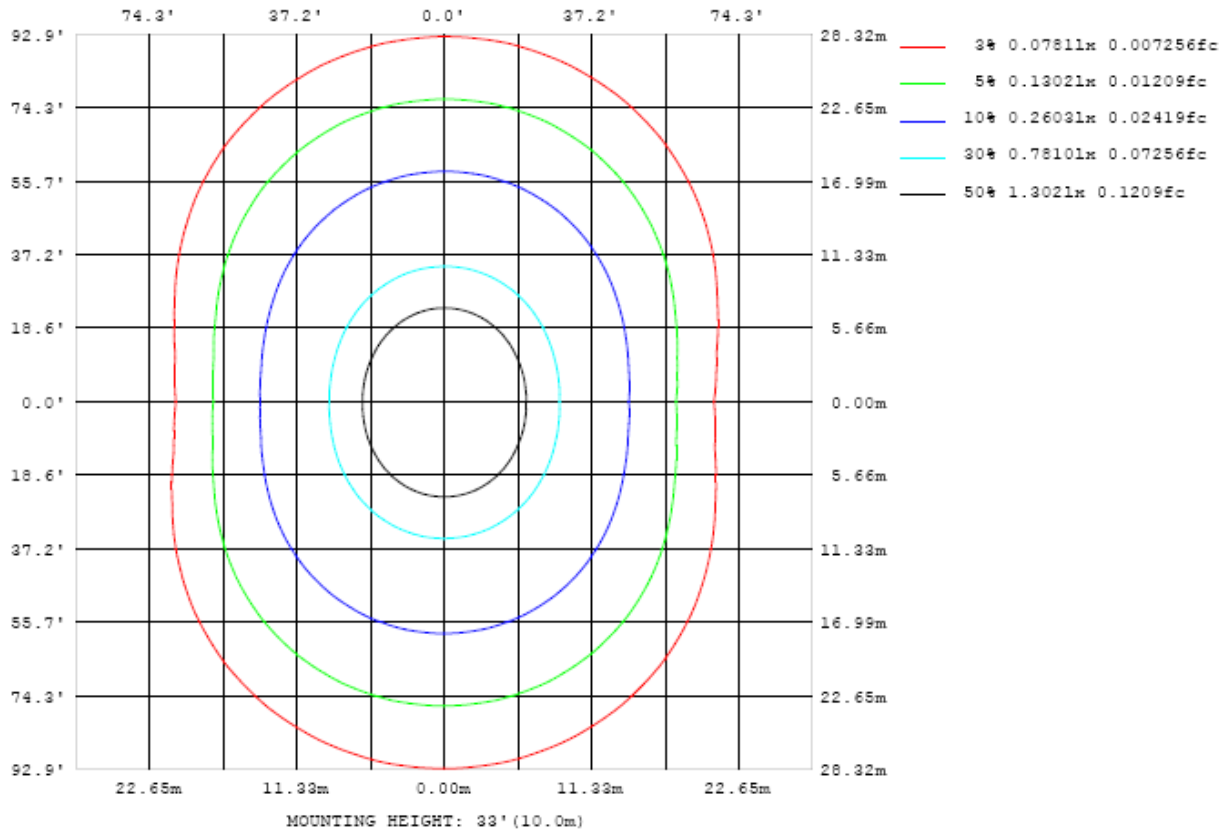


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

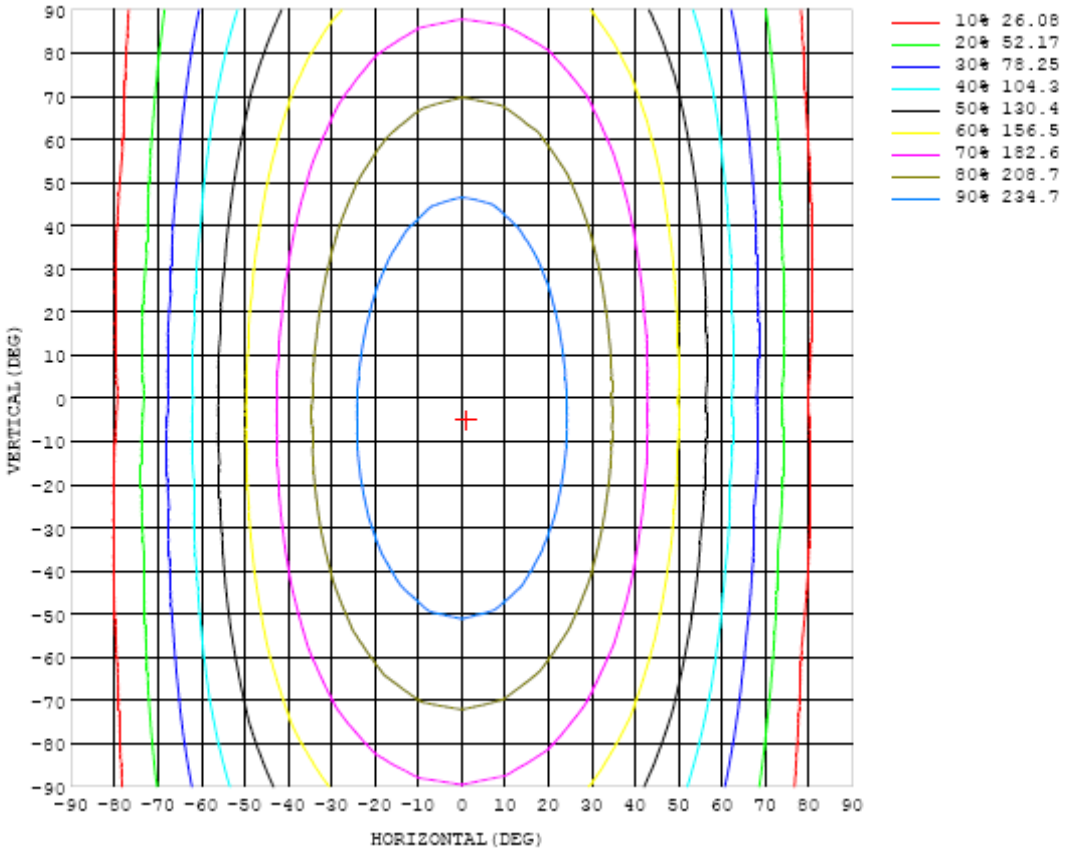


Chart 5: Isocandela Plot

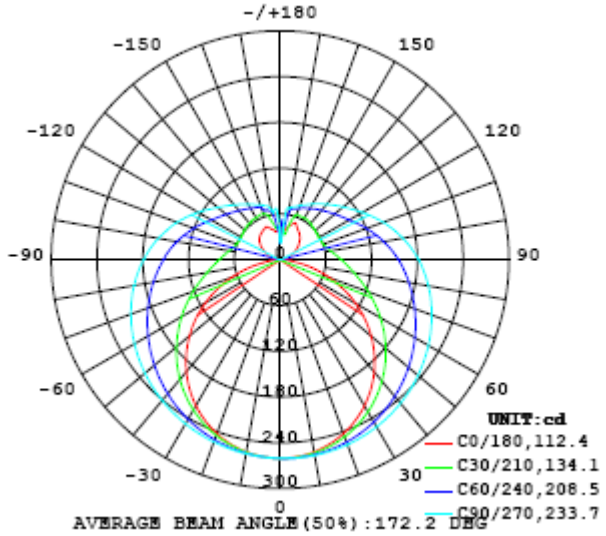


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260
5	259	259	260	260	260	260	261	261	261	261	261	261	260	260	260	260	260	259	259
10	256	256	257	257	258	259	259	260	260	260	260	260	259	259	258	257	257	256	256
15	250	251	252	253	255	256	257	259	259	259	259	259	258	256	255	253	252	251	250
20	242	243	245	247	249	252	254	256	258	258	258	256	255	252	250	247	245	243	243
25	233	234	236	239	243	247	251	253	255	256	255	253	251	247	243	240	236	234	233
30	221	222	226	230	235	241	246	250	252	253	252	250	246	241	236	230	226	222	221
35	207	209	213	219	227	234	240	245	248	249	249	245	240	234	227	220	213	209	207
40	192	194	200	208	217	226	234	240	244	245	244	241	234	226	217	208	200	194	191
45	175	178	185	195	206	217	227	235	239	241	240	235	228	218	207	195	185	177	174
50	156	159	168	181	195	208	220	229	234	236	234	229	221	209	196	182	168	159	155
55	136	140	151	166	183	199	212	222	228	230	229	223	213	200	184	167	152	139	135
60	114	119	133	152	171	189	204	215	222	224	223	216	205	191	173	153	134	119	113
65	91.9	98.1	115	137	159	179	196	208	216	218	216	209	197	181	162	139	117	98.0	90.5
70	68.9	76.7	97.5	123	148	170	188	201	209	211	209	202	189	172	151	126	99.8	77.2	67.3
75	46.6	56.3	81.2	110	137	161	180	193	202	205	202	195	181	163	140	114	84.3	57.8	44.6
80	25.5	37.7	66.7	98.4	127	152	171	186	194	197	195	187	174	155	131	103	70.9	40.5	23.6
85	8.65	23.3	55.5	88.5	118	143	163	178	187	190	187	179	166	147	122	93.2	60.7	27.6	7.33
90	0.86	15.5	47.5	80.4	110	136	155	170	178	182	179	171	158	139	114	85.4	53.2	20.6	0.50
95	1.82	12.6	41.7	73.2	102	127	147	161	170	173	171	163	149	130	107	78.6	47.6	17.6	2.08
100	5.01	14.0	38.2	67.3	94.9	119	138	152	160	163	161	154	141	122	99.7	72.7	44.0	18.5	5.47
105	9.06	17.2	37.4	63.0	88.2	111	129	142	151	154	152	144	132	115	92.9	68.0	42.8	21.4	10.2
110	13.6	21.5	38.3	60.1	82.5	103	120	133	141	144	142	135	123	107	87.0	64.8	43.6	25.6	15.5
115	18.4	26.8	40.4	58.9	78.2	96.5	112	124	131	134	132	126	115	99.9	82.3	63.9	45.5	30.4	20.9
120	23.1	31.7	43.0	58.6	75.2	91.0	105	115	122	124	123	117	107	94.2	79.3	63.3	47.8	34.9	25.8
125	27.7	35.5	45.6	59.0	73.0	86.8	98.5	108	113	115	114	109	101	89.8	76.9	63.4	50.4	38.8	30.5
130	32.2	37.9	48.9	59.9	71.5	83.2	93.3	101	106	108	107	102	95.4	86.0	75.1	63.9	52.8	41.7	34.9
135	36.3	41.3	52.0	60.7	70.5	80.3	88.8	95.4	99.6	101	100	96.5	90.6	82.7	73.8	64.6	55.2	44.4	38.6
140	40.4	43.1	53.9	62.2	69.6	77.8	84.8	90.2	93.7	95.0	94.3	91.3	86.3	79.9	72.6	65.1	57.2	46.7	41.1
145	43.4	47.4	55.6	63.1	69.1	75.3	81.2	85.7	88.4	89.5	88.9	86.5	82.6	77.4	71.6	65.3	57.4	47.3	42.9
150	46.2	46.5	56.4	63.5	68.9	73.4	77.5	81.2	83.5	84.5	84.1	82.2	79.0	75.0	70.7	65.1	58.5	48.2	45.0
155	50.6	47.4	57.1	62.9	67.7	71.7	74.9	77.4	78.9	79.6	79.3	78.1	75.9	73.5	67.8	61.9	60.5	47.7	46.8
160	50.7	39.8	50.6	63.1	66.7	69.2	71.7	73.9	75.1	75.6	75.9	74.9	73.7	70.3	65.6	60.7	56.2	44.3	44.6
165	46.0	36.1	38.3	49.3	66.5	67.8	69.3	70.3	70.8	71.7	72.6	72.1	67.0	57.9	51.4	49.6	46.6	39.8	41.4
170	41.1	35.6	34.6	33.8	36.0	52.2	61.0	67.5	67.1	67.9	66.7	52.8	44.3	43.2	41.5	40.9	38.7	37.3	38.1
175	42.3	40.1	41.8	45.0	45.5	44.4	44.7	47.8	41.3	33.7	31.2	45.2	48.4	48.0	46.7	46.0	44.8	43.3	41.3
180	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4

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	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260
5	259	259	259	259	259	259	260	260	259	259	260	259	259	259	259	259	259
10	256	256	256	257	257	258	258	258	258	258	258	258	257	256	256	256	256
15	250	251	252	253	254	255	256	256	256	256	256	255	254	253	252	251	250
20	243	244	245	247	249	251	253	254	254	254	253	251	249	247	245	244	243
25	233	235	237	240	244	247	249	251	251	251	249	247	244	241	237	235	233
30	221	224	228	232	237	241	245	248	248	248	246	242	238	233	228	224	222
35	208	211	217	223	230	236	241	244	245	244	241	237	231	224	218	212	209
40	193	197	205	213	222	229	235	239	241	240	236	230	223	214	206	199	194
45	176	182	191	202	213	222	230	235	236	235	231	224	215	204	193	184	178
50	157	166	178	191	204	215	224	230	231	230	225	217	206	194	180	168	160
55	139	149	163	179	195	208	218	224	226	225	219	210	197	183	167	152	141
60	118	131	149	168	186	200	211	218	220	219	212	202	188	171	153	135	121
65	96.4	113	135	156	176	192	204	212	215	213	206	195	179	160	139	118	100
70	75.0	95.9	121	146	167	184	197	205	208	206	199	187	170	150	126	101	79.6
75	54.6	79.8	109	136	158	176	190	199	202	199	192	180	162	140	114	85.3	59.8
80	36.6	66.0	97.4	126	150	169	183	192	194	192	185	172	154	131	103	71.5	42.0
85	23.1	55.0	87.9	117	142	161	175	184	187	185	177	164	146	122	93.0	60.5	28.2
90	16.0	47.5	80.1	109	134	153	167	176	179	177	169	156	138	114	85.0	52.6	20.1
95	13.5	42.5	73.7	102	127	146	159	168	171	169	161	149	130	106	78.2	47.0	16.8
100	14.8	39.1	68.1	95.4	119	138	151	159	162	160	152	140	122	99.4	72.3	42.8	16.7
105	18.3	38.2	63.6	88.9	111	129	142	150	153	151	144	132	114	92.5	67.1	40.7	19.3
110	23.3	39.3	60.6	83.3	104	120	133	141	144	142	135	123	107	86.3	63.3	40.9	23.9
115	28.5	41.7	59.5	78.5	97.0	112	124	131	134	132	125	115	99.4	81.0	61.2	42.1	28.9
120	33.6	44.6	59.3	75.6	91.0	105	115	122	124	123	116	106	92.9	77.1	60.4	44.5	34.2
125	38.2	47.8	59.9	73.6	86.8	98.0	107	113	115	113	108	99.3	88.0	74.6	60.3	47.7	39.1
130	42.2	51.0	60.9	72.1	83.2	92.7	100	105	107	106	101	93.7	84.2	72.9	61.1	51.2	43.6
135	47.4	53.5	62.2	71.3	80.3	88.2	94.6	98.6	100	98.9	95.0	88.9	80.9	71.7	62.3	54.5	47.8
140	50.6	55.8	62.4	70.8	77.9	84.3	89.4	92.8	94.0	93.0	89.8	84.8	78.4	70.9	63.7	57.2	52.0
145	52.6	57.1	63.8	70.4	75.9	80.9	85.0	87.6	88.6	87.8	85.2	81.3	76.3	70.6	65.4	57.5	53.3
150	55.6	58.8	63.0	65.5	74.6	78.1	81.1	83.1	83.9	83.3	81.4	78.4	74.6	70.5	66.3	60.3	56.3
155	58.9	61.7	64.7	67.3	71.2	75.7	77.8	79.3	79.8	79.4	78.0	75.9	73.4	70.3	65.2	61.8	59.6
160	55.7	61.5	64.3	66.8	68.6	72.0	75.1	76.0	76.5	76.3	75.5	74.2	72.3	69.1	65.6	63.7	60.9
165	48.6	53.1	58.6	63.6	66.4	68.4	70.1	73.4	73.4	73.4	73.0	72.0	69.9	68.3	66.2	64.8	59.9
170	39.5	43.2	46.7	51.0	57.7	64.7	65.9	62.9	66.4	68.5	68.8	68.2	67.6	67.3	67.1	65.0	52.9
175	40.8	41.7	42.5	42.2	41.0	43.2	51.0	60.6	67.5	67.3	65.9	65.4	66.2	64.5	58.7	50.4	44.8
180	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4

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 expended 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

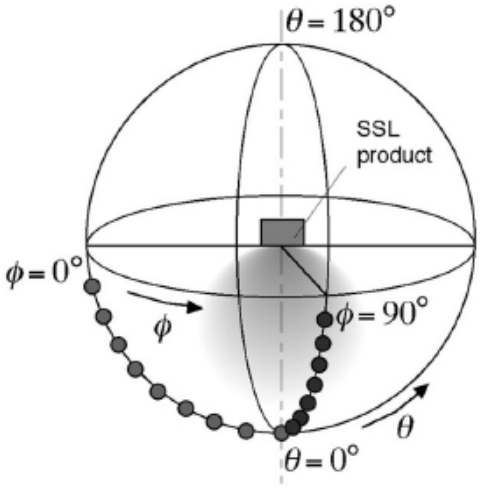
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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°/180° and C=90°/270°) 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, Δu'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 ***