LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED tube

Model: 8T8/2F/840/BYP/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18040014b

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: 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: **8T8/2F/840/BYP/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
130.7	1115.0	8.53	0.9886

CCT (K)	CRI	Stabilization Time (Light & Power)
3993	81.5	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. 26, 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

Sample Photos

Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: LED tube
Model	: 8T8/2F/840/BYP/R
Electrical Ratings	: 120-277V, 50/60Hz, 8W
Product Description	: 4000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.0℃.

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)	0.072	0.034
Power Factor	0.9886	0.9224
Test Power (W)	8.53	8.60
THD A%	13.60	17.67
Luminous Efficacy (lm/W)	130.7	130.1
Total Luminous Flux (lm)	1115.0	1119.0
Color Rendering Index (CRI)	81.5	
R9	1.2	
Correlated Color Temperature (CCT)(K)	3993	
Chromaticity Chroma x	0.3836	
Chromaticity Chroma y	0.3877	
Chromaticity Chroma u	0.2228	
Chromaticity Chroma v	0.3379	
Duv	0.0041	
Chromaticity Chroma u ’	0.2228	
Chromaticity Chroma v’	0.5068	

Special Color Rendering Indices	
R1	78.9
R2	86.7
R3	94
R4	81.2
R5	79.2
R6	82.5
R7	86.4
R8	62.8
R9	1.2
R10	69.4
R11	80
R12	61
R13	80.5
R14	96.7
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)	0.072
Power Factor	0.9855
Test Power (W)	8.56
Luminous Efficacy (lm/W)	127.3
Total Luminous Flux (lm)	1089.3
Beam Angle (°)	172.6
Center Beam Candle Power (cd)	174
Spacing Criteria	1.25 (0°-180°)/ 1.46 (90°-270°)
Zonal Lumens in the 0°-60°Zone	41.56%
Zonal Lumens in the 60°-90°Zone	26.89%
Zonal Lumens in the 90°-120°Zone	18.07%
Zonal Lumens in the 120°-180°Zone	13.48%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

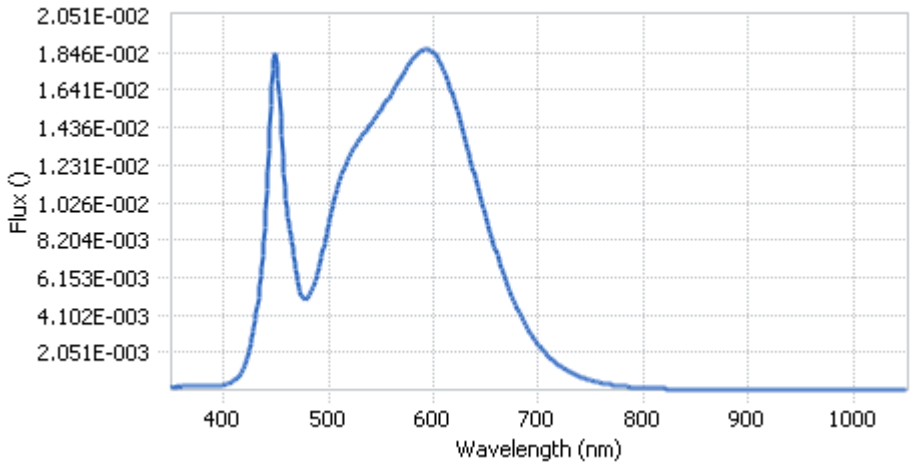
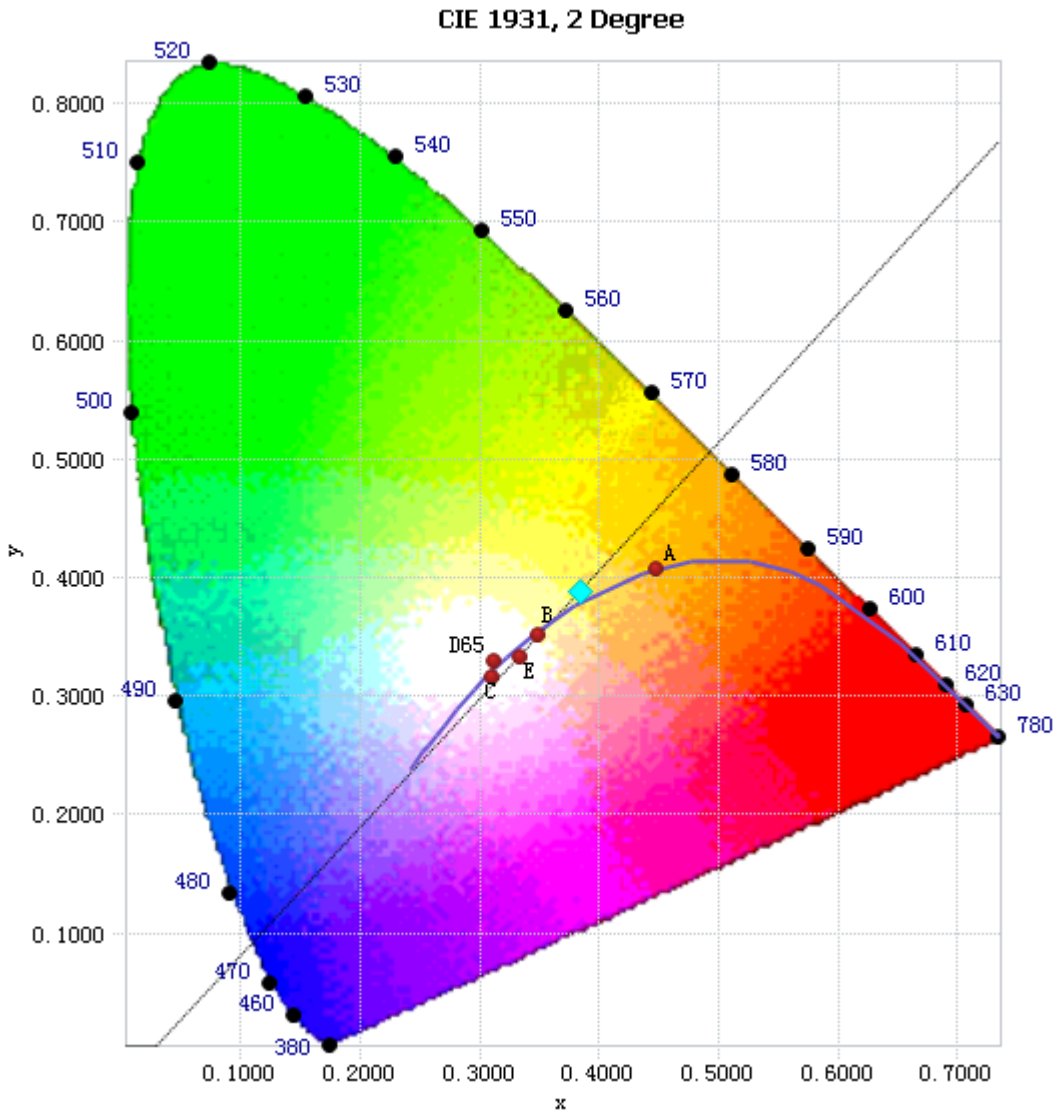


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.05E-04	485	5.60E-03	590	1.86E-02	695	2.87E-03
385	2.12E-04	490	6.50E-03	595	1.86E-02	700	2.47E-03
390	2.15E-04	495	7.79E-03	600	1.85E-02	705	2.12E-03
395	2.49E-04	500	9.16E-03	605	1.80E-02	710	1.81E-03
400	2.79E-04	505	1.03E-02	610	1.75E-02	715	1.55E-03
405	3.53E-04	510	1.14E-02	615	1.67E-02	720	1.33E-03
410	5.20E-04	515	1.22E-02	620	1.58E-02	725	1.14E-03
415	8.17E-04	520	1.28E-02	625	1.48E-02	730	9.76E-04
420	1.38E-03	525	1.33E-02	630	1.38E-02	735	8.35E-04
425	2.33E-03	530	1.38E-02	635	1.26E-02	740	7.11E-04
430	3.88E-03	535	1.41E-02	640	1.16E-02	745	6.08E-04
435	6.22E-03	540	1.46E-02	645	1.04E-02	750	5.21E-04
440	9.93E-03	545	1.49E-02	650	9.42E-03	755	4.44E-04
445	1.56E-02	550	1.53E-02	655	8.44E-03	760	3.84E-04
450	1.84E-02	555	1.58E-02	660	7.48E-03	765	3.25E-04
455	1.39E-02	560	1.62E-02	665	6.60E-03	770	2.80E-04
460	9.93E-03	565	1.67E-02	670	5.80E-03	775	2.36E-04
465	8.11E-03	570	1.72E-02	675	5.08E-03	780	2.05E-04
470	6.21E-03	575	1.76E-02	680	4.43E-03		
475	5.11E-03	580	1.81E-02	685	3.84E-03		
480	5.10E-03	585	1.84E-02	690	3.33E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3836, 0.3877)

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

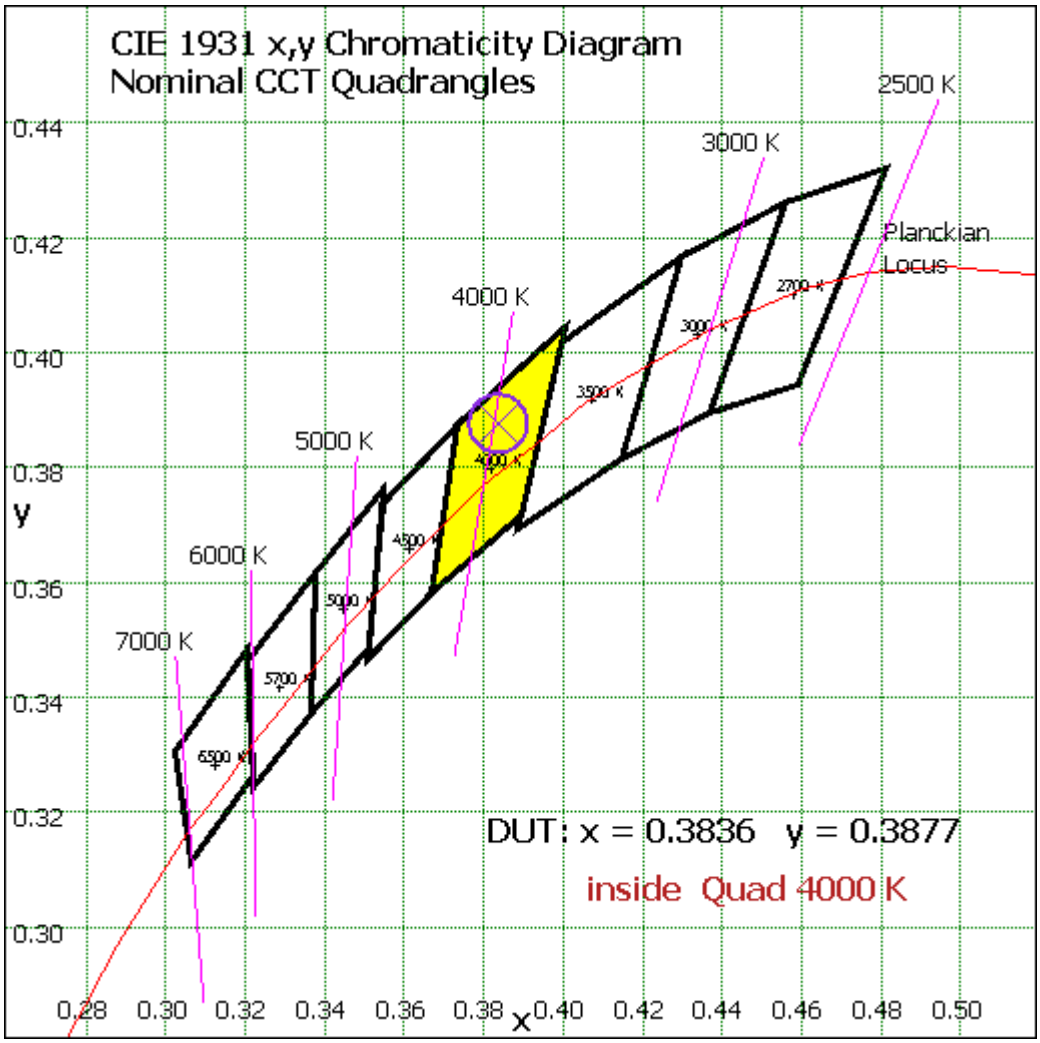


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	16.487	1.51%
10- 20	47.905	4.40%
20- 30	74.858	6.87%
30- 40	95.135	8.73%
40- 50	107.29	9.85%
50- 60	111.073	10.20%
60- 70	107.425	9.86%
70- 80	98.352	9.03%
80- 90	87.1	8.00%
90-100	76.392	7.01%
100-110	65.439	6.01%
110-120	54.958	5.05%
120-130	45.605	4.19%
130-140	37.338	3.43%
140-150	29.015	2.66%
150-160	20.459	1.88%
160-170	11.572	1.06%
170-180	2.883	0.26%
Total	1089.3	100%

γ(°)	Lumens	% Total
0- 60	452.748	41.56%
60- 90	292.877	26.89%
0-90	745.625	68.45%
90- 180	343.661	31.55%
0- 180	1089.3	100%

Table 5: Zonal Lumen Data

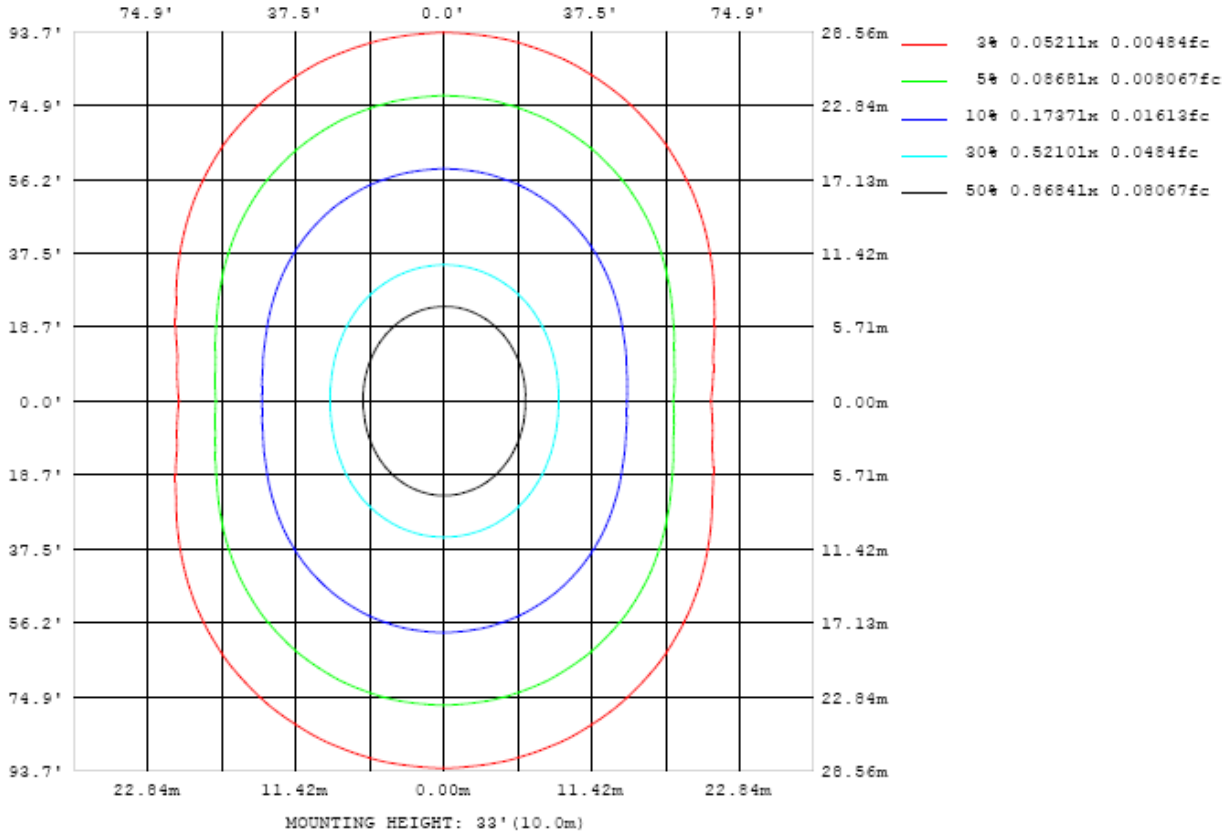


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

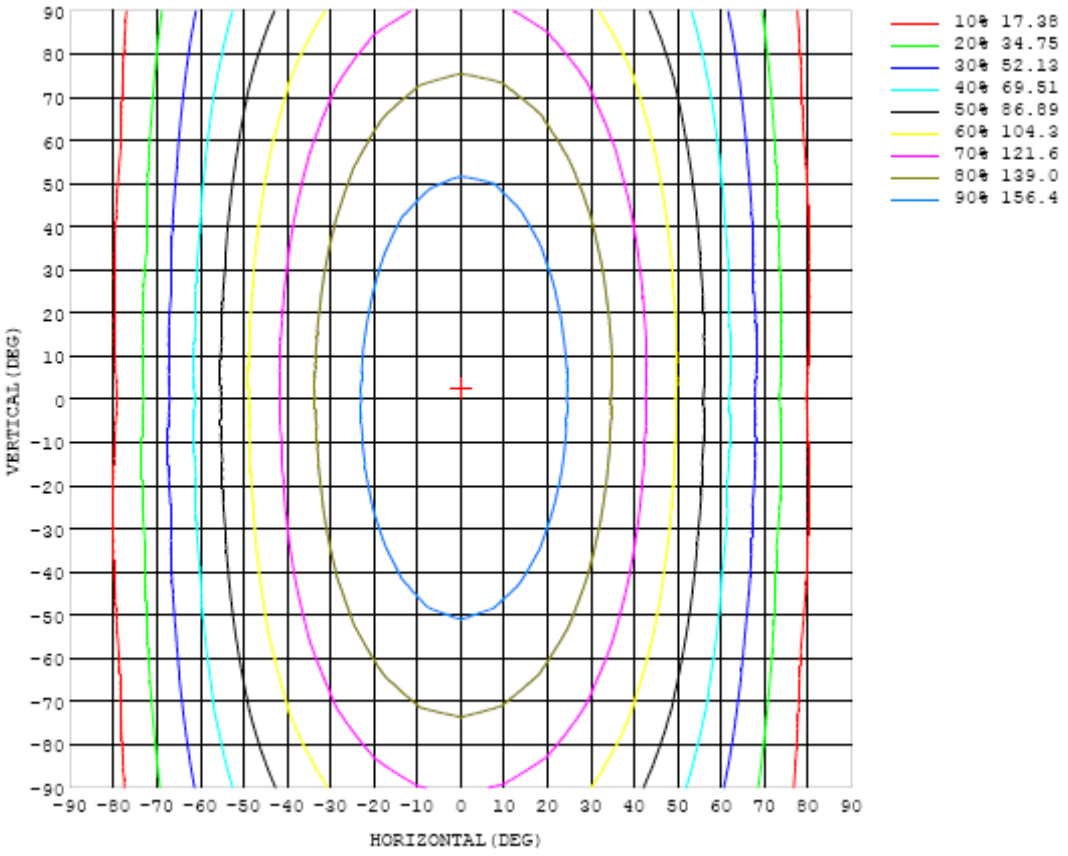


Chart 5: Isocandela Plot

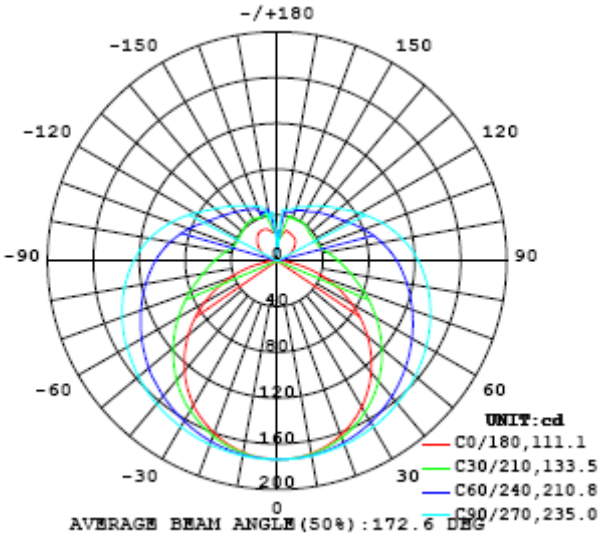


Chart 6: Polar Candela Distribution

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	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174
5	173	173	173	173	173	173	174	174	173	174	174	173	173	173	173	173	173	172	173
10	171	171	171	172	172	172	173	173	173	173	173	173	172	172	171	171	170	170	170
15	167	168	168	169	170	170	171	172	172	172	172	171	171	170	169	167	167	166	166
20	162	163	163	165	166	168	169	170	171	171	171	170	168	167	165	163	162	161	160
25	156	156	157	159	162	164	166	168	169	170	169	167	165	163	160	158	155	154	153
30	147	148	150	153	156	160	163	166	167	168	167	165	162	159	155	151	148	146	146
35	138	139	142	146	150	155	159	163	165	165	165	162	158	154	149	144	139	137	136
40	127	129	132	137	144	150	155	159	162	163	162	159	154	148	142	136	130	126	126
45	116	117	122	129	136	144	151	156	159	160	159	155	150	143	135	127	120	115	114
50	103	105	111	119	129	138	146	152	156	157	156	152	145	137	128	118	109	103	101
55	89.3	92.0	99.3	110	121	132	141	148	152	154	152	148	140	131	120	108	97.8	90.1	87.5
60	74.9	78.2	87.4	99.8	113	125	136	143	148	150	148	143	135	125	112	99.0	86.3	76.6	73.3
65	60.4	64.7	75.4	90.2	105	119	130	139	144	146	144	139	130	119	105	89.8	74.8	63.4	58.5
70	45.1	50.4	64.1	80.9	97.8	113	125	134	140	142	140	135	125	113	97.9	81.0	63.9	49.7	44.4
75	30.2	36.8	53.6	72.4	90.8	107	120	130	136	138	136	130	120	107	91.3	72.8	53.9	36.7	29.0
80	16.5	24.8	44.1	65.4	84.4	101	115	125	131	133	131	125	115	102	85.3	66.4	45.1	25.4	15.5
85	5.84	15.6	36.7	58.8	78.5	95.8	110	120	126	128	126	120	110	96.6	79.7	60.1	38.1	16.8	5.22
90	0.51	10.6	31.5	53.5	73.3	90.4	104	115	121	123	121	115	105	91.5	74.6	55.2	33.3	12.2	0.34
95	1.17	8.18	27.4	48.6	67.9	84.9	98.7	109	115	117	115	109	99.6	86.2	69.6	50.5	29.5	9.96	1.33
100	2.84	8.67	24.6	44.3	63.2	79.3	92.7	102	109	111	109	103	93.8	80.8	64.9	46.4	26.9	10.5	3.33
105	5.37	10.1	23.6	41.0	58.5	73.7	86.6	96.1	102	104	103	96.9	87.7	75.4	60.5	43.0	25.7	12.4	6.21
110	8.21	12.9	24.0	38.6	54.3	68.4	80.5	89.4	95.0	97.2	95.7	90.3	81.7	70.0	56.3	40.7	26.4	15.1	9.55
115	11.2	16.3	25.1	37.5	51.0	63.9	74.6	82.9	88.1	90.2	88.8	83.9	75.8	65.4	52.8	39.8	27.8	18.4	12.8
120	14.2	19.9	25.9	37.1	48.7	59.7	69.1	76.6	81.4	83.3	82.1	77.5	70.3	61.1	50.6	39.5	29.5	21.5	16.0
125	17.2	23.1	28.2	37.3	47.2	56.6	64.7	70.8	75.0	76.7	75.6	71.5	65.6	58.0	49.2	39.7	31.1	24.6	19.1
130	20.0	25.5	30.6	37.2	46.1	54.2	61.1	66.1	69.6	71.0	70.1	66.8	62.2	55.6	48.1	40.3	33.0	27.5	21.9
135	22.5	26.2	32.6	38.1	45.1	52.2	58.0	62.6	65.3	66.6	65.7	63.2	59.0	53.5	47.3	40.6	34.8	28.7	24.6
140	24.5	27.3	34.0	39.4	44.3	50.2	55.4	59.0	61.5	62.5	61.8	59.6	56.2	51.8	46.4	41.2	36.3	30.2	27.1
145	25.4	29.9	34.6	40.0	44.5	48.4	52.4	55.8	57.9	58.8	58.3	56.4	53.5	49.7	45.8	41.7	36.3	31.2	28.6
150	25.8	30.8	36.0	40.0	44.4	47.7	50.3	52.4	54.0	54.8	54.4	53.1	51.0	48.5	45.5	41.7	37.0	32.9	29.6
155	26.6	31.8	35.4	39.2	43.3	46.5	48.8	50.4	51.5	52.0	51.8	50.8	49.4	47.5	44.9	40.7	37.2	33.7	29.9
160	27.3	31.3	36.6	39.8	42.0	44.2	46.6	48.0	48.9	49.5	49.5	48.8	47.9	46.6	44.4	40.7	38.2	34.1	29.4
165	26.5	24.4	32.9	40.0	42.1	43.2	44.1	44.7	45.3	46.3	47.3	46.8	45.8	44.1	41.8	39.8	36.8	31.0	27.7
170	22.5	20.6	22.1	24.5	32.0	41.3	44.1	44.1	44.4	45.3	45.5	44.4	40.4	35.0	32.0	30.3	28.7	26.4	25.4
175	19.9	19.5	19.2	19.2	19.1	19.8	20.8	26.5	32.5	32.6	24.0	24.3	24.4	24.6	24.6	24.8	24.9	24.9	24.9
180	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79

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	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174		
5	173	173	173	173	173	173	173	173	174	174	173	174	173	173	173	173	173		
10	170	170	171	171	171	172	173	173	173	173	173	173	172	172	172	171	171		
15	166	167	167	168	169	170	171	172	172	172	172	171	170	170	169	168	168		
20	161	162	163	165	166	168	170	170	171	171	170	169	168	166	165	163	163		
25	154	155	157	160	163	165	168	169	169	169	168	166	164	162	159	158	156		
30	147	149	151	155	158	162	165	167	168	168	166	163	160	157	153	151	149		
35	137	140	144	149	154	158	162	165	166	165	163	160	156	151	147	143	140		
40	127	131	136	143	149	154	159	162	163	163	160	156	151	145	139	133	130		
45	116	120	127	136	144	150	155	159	161	160	157	152	146	138	130	123	118		
50	103	110	118	128	138	146	152	156	157	157	153	148	140	130	121	112	106		
55	90.4	98.1	109	120	132	141	149	152	154	153	150	143	134	123	111	101	92.9		
60	76.8	86.5	99.4	113	125	136	144	149	151	150	145	138	127	115	102	88.9	79.4		
65	63.0	74.9	90.0	105	119	131	140	146	148	146	141	133	121	107	92.2	77.3	65.4		
70	49.2	63.7	81.2	98.4	114	126	136	142	144	142	137	127	115	100	83.1	65.8	51.4		
75	36.1	53.3	72.9	91.6	108	121	131	137	139	138	132	122	109	93.2	74.8	55.3	38.2		
80	24.6	44.4	65.7	85.5	103	116	126	133	135	133	127	117	104	86.9	67.3	46.1	26.4		
85	15.9	37.4	59.6	79.9	97.2	111	121	128	130	128	122	112	98.2	81.0	60.9	38.8	17.4		
90	11.3	32.4	54.5	74.7	92.0	106	116	123	125	123	117	107	92.9	75.7	55.6	33.4	12.2		
95	8.81	28.6	50.0	69.8	86.8	101	111	117	119	117	111	101	87.6	70.6	50.8	29.4	9.41		
100	9.28	25.6	45.7	64.6	81.1	94.5	104	110	113	111	105	95.0	81.7	65.2	46.2	26.0	9.11		
105	11.5	24.7	41.9	59.6	75.3	88.2	97.7	104	106	104	98.0	88.6	75.8	60.0	42.1	24.4	11.3		
110	14.8	25.4	39.7	55.0	69.6	81.7	90.7	96.1	98.2	96.5	91.0	82.0	69.9	55.2	39.2	24.4	14.4		
115	18.1	27.0	38.8	51.7	64.3	75.3	83.7	88.8	90.7	89.1	83.9	75.5	64.3	51.2	37.8	25.3	17.7		
120	21.5	29.0	38.8	49.7	60.2	69.3	76.8	81.5	83.2	81.6	76.9	69.3	59.8	48.8	37.3	27.5	20.9		
125	24.7	30.9	39.2	48.3	57.3	65.1	71.1	74.8	76.2	74.9	70.9	64.8	56.8	47.4	37.6	30.0	24.1		
130	27.3	33.0	39.9	47.5	55.0	61.5	66.6	69.8	70.8	69.7	66.4	61.2	54.4	46.5	38.6	32.5	27.2		
135	30.1	35.1	40.7	46.9	53.1	58.5	62.8	65.3	66.3	65.3	62.5	58.1	52.5	46.0	39.9	34.8	29.7		
140	32.4	36.6	41.5	46.5	51.4	55.8	59.3	61.4	62.2	61.4	59.1	55.5	51.0	45.9	41.1	36.7	31.4		
145	34.5	36.6	42.5	46.2	50.1	53.6	56.3	58.0	58.6	58.0	56.2	53.3	49.8	45.9	42.2	37.7	33.3		
150	35.5	35.6	42.1	45.3	49.0	51.7	53.8	55.0	55.5	55.0	53.6	51.5	48.8	46.0	42.6	39.6	34.3		
155	36.4	38.2	41.4	44.4	46.5	50.0	51.5	52.5	52.8	52.5	51.5	50.1	48.2	45.6	41.6	39.4	35.8		
160	36.2	39.3	40.9	44.3	44.9	45.9	49.6	50.2	50.6	50.5	49.9	48.5	47.2	43.8	42.3	38.2	36.3		
165	33.4	38.8	41.8	44.0	45.2	43.7	39.3	46.5	48.1	48.0	46.9	45.6	44.2	43.4	41.6	38.9	35.1		
170	26.5	28.7	32.4	36.3	41.1	45.3	44.8	41.2	36.8	41.1	43.1	43.3	42.8	42.0	39.6	33.5	26.3		
175	24.9	24.9	24.8	25.0	25.7	26.9	29.6	35.2	42.3	41.7	41.3	39.7	36.1	30.5	23.7	20.6	20.2		
180	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79	9.79		

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

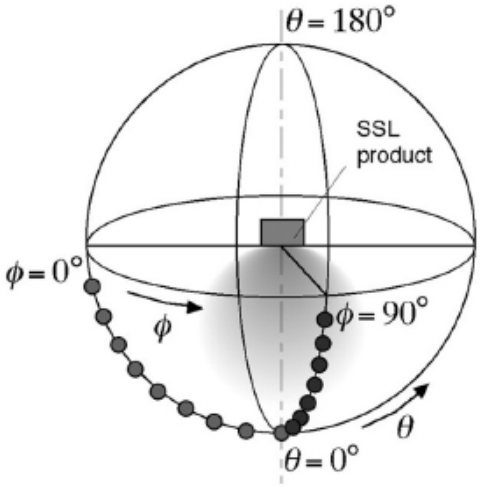
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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