LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube

Model: 8.5T8/2F/840/DEB/RC

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18120037h

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

Review by: April Zou

Engineer: April Zou
Jan. 18, 2019

Approved by: Jim Zhang

Manager: Jim Zhang
Jan. 18, 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: **8.5T8/2F/840/DEB/RC**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
133.0	1093.0	8.22	0.9769

CCT (K)	CRI	Stabilization Time (Light & Power)
4048	82.6	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	: Dec. 26, 2018
Date of Test	: Dec. 29, 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	: 8.5T8/2F/840/DEB/RC
Electrical Ratings	: 120-277V, 50/60Hz, 8.5W
Product Description	: G13 base, 4000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 26.0℃.

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 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.070	0.033
Power Factor	0.9769	0.9137
Test Power (W)	8.22	8.44
THD A%	17.49	17.25
Luminous Efficacy (lm/W)	133.0	130.0
Total Luminous Flux (lm)	1093.0	1097.0
Color Rendering Index (CRI)	82.6	
R9	7.4	
Correlated Color Temperature (CCT)(K)	4048	
Chromaticity Chroma x	0.3791	
Chromaticity Chroma y	0.3788	
Chromaticity Chroma u	0.2234	
Chromaticity Chroma v	0.3348	
Duv	0.0007	
Chromaticity Chroma u ’	0.2234	
Chromaticity Chroma v’	0.5023	

Special Color Rendering Indices	
R1	80.6
R2	88.7
R3	94.7
R4	81.1
R5	80.6
R6	84.2
R7	86.3
R8	64.4
R9	7.4
R10	73.2
R11	79.8
R12	60.3
R13	82.6
R14	97.2
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)	0.070
Power Factor	0.9775
Test Power (W)	8.21
Luminous Efficacy (lm/W)	130.6
Total Luminous Flux (lm)	1072.3
Beam Angle (°)	151.9
Center Beam Candle Power (cd)	197
Spacing Criteria	1.23 (0 °-180 °)/ 1.40 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	45.55%
Zonal Lumens in the 60 °-90 °Zone	26.73%
Zonal Lumens in the 90 °-120 °Zone	16.42%
Zonal Lumens in the 120 °-180 °Zone	11.29%

Table 3: Test data per Goniophotometer Method

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Spectral Power Distribution - Sphere Spectroradiometer Method

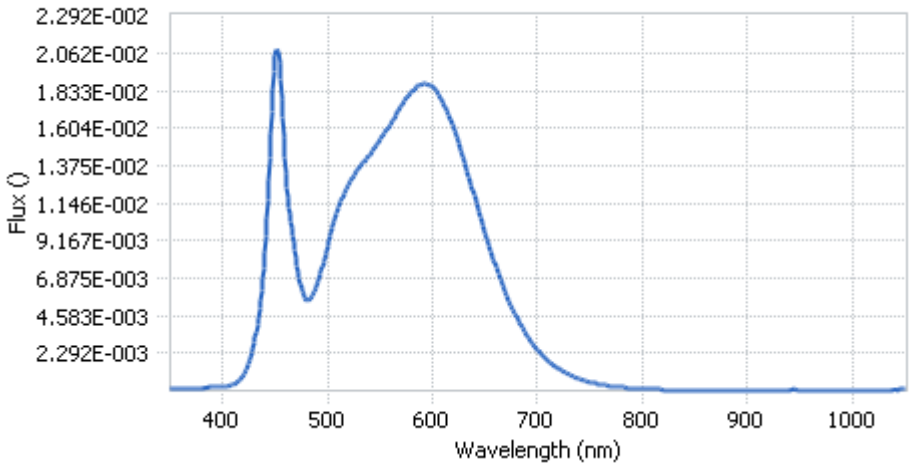
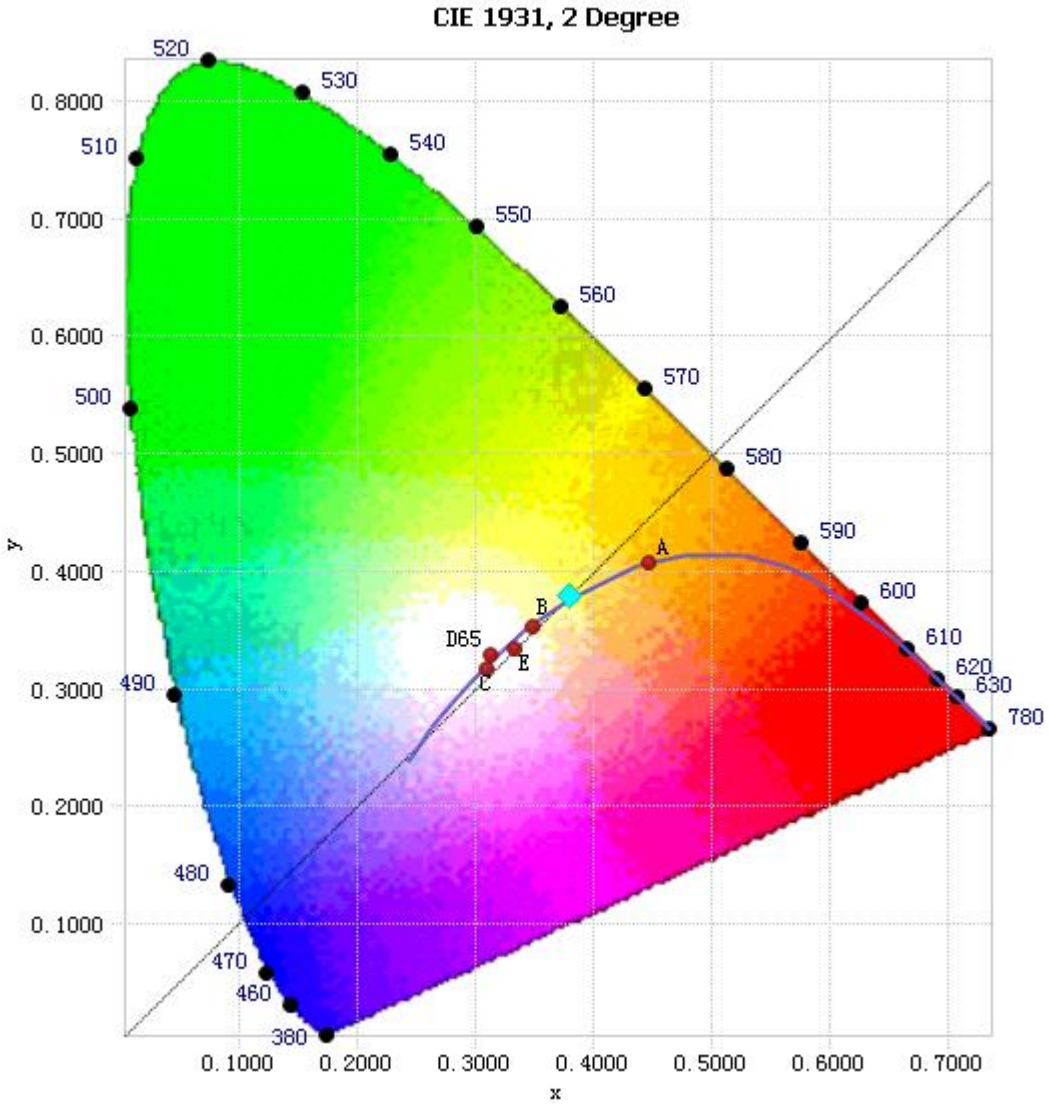


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.96E-04	485	5.79E-03	590	1.87E-02	695	2.90E-03
385	2.05E-04	490	6.48E-03	595	1.87E-02	700	2.51E-03
390	2.13E-04	495	7.58E-03	600	1.85E-02	705	2.15E-03
395	2.32E-04	500	8.87E-03	605	1.81E-02	710	1.84E-03
400	2.55E-04	505	1.01E-02	610	1.76E-02	715	1.57E-03
405	3.03E-04	510	1.11E-02	615	1.69E-02	720	1.36E-03
410	4.21E-04	515	1.20E-02	620	1.60E-02	725	1.17E-03
415	6.30E-04	520	1.27E-02	625	1.51E-02	730	1.00E-03
420	1.02E-03	525	1.32E-02	630	1.41E-02	735	8.53E-04
425	1.73E-03	530	1.36E-02	635	1.30E-02	740	7.28E-04
430	2.96E-03	535	1.40E-02	640	1.19E-02	745	6.26E-04
435	5.03E-03	540	1.44E-02	645	1.07E-02	750	5.34E-04
440	8.45E-03	545	1.49E-02	650	9.63E-03	755	4.60E-04
445	1.43E-02	550	1.53E-02	655	8.63E-03	760	3.99E-04
450	2.04E-02	555	1.58E-02	660	7.64E-03	765	3.42E-04
455	1.90E-02	560	1.63E-02	665	6.74E-03	770	2.97E-04
460	1.33E-02	565	1.68E-02	670	5.89E-03	775	2.54E-04
465	1.03E-02	570	1.74E-02	675	5.16E-03	780	2.19E-04
470	8.14E-03	575	1.79E-02	680	4.50E-03		
475	6.22E-03	580	1.83E-02	685	3.90E-03		
480	5.56E-03	585	1.86E-02	690	3.38E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y) : (0.3791,0.3788)

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

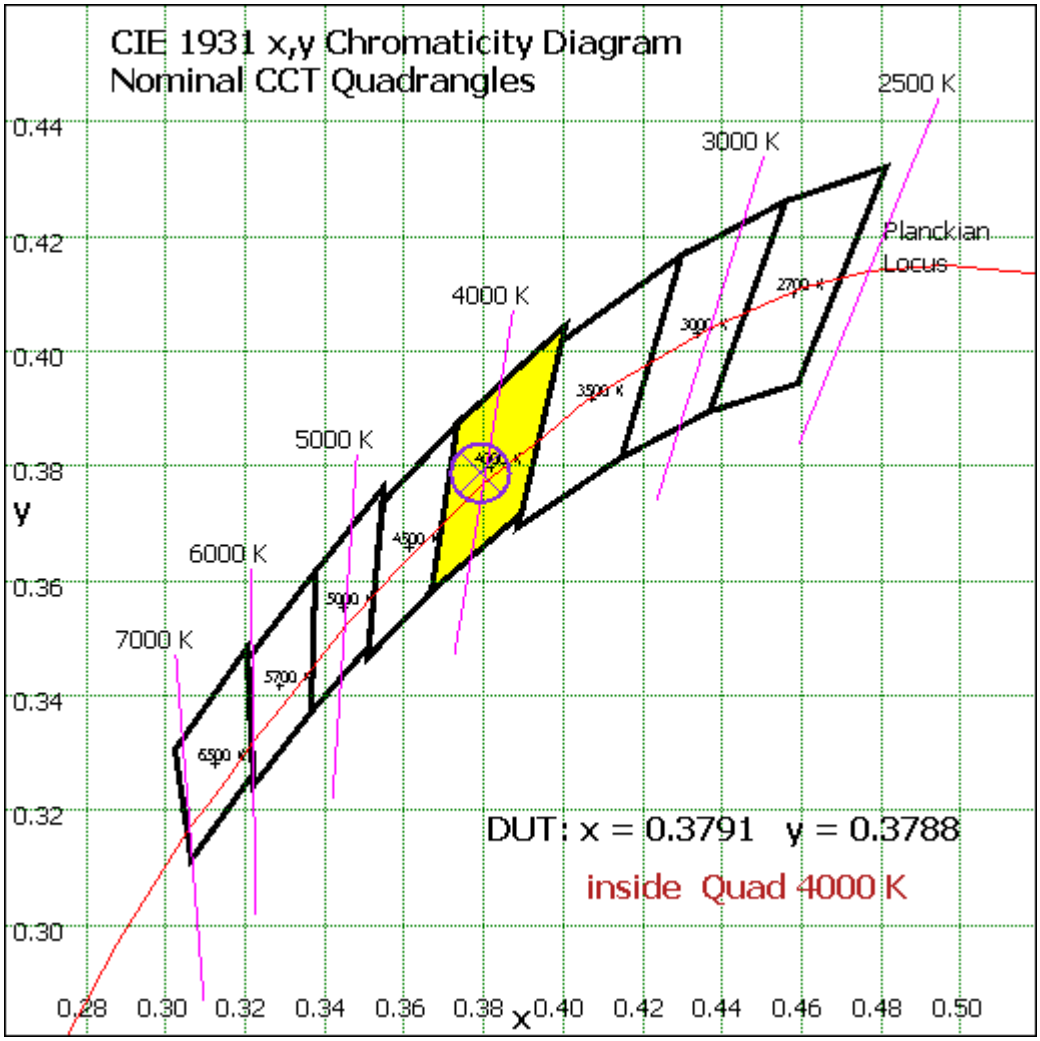


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	18.701	1.74%
10- 20	53.936	5.03%
20- 30	83.1	7.75%
30- 40	103.557	9.66%
40- 50	114.094	10.64%
50- 60	115.05	10.73%
60- 70	108.113	10.08%
70- 80	96.061	8.96%
80- 90	82.484	7.69%
90-100	70.222	6.55%
100-110	58.372	5.44%
110-120	47.526	4.43%
120-130	38.407	3.58%
130-140	30.833	2.88%
140-150	23.705	2.21%
150-160	16.534	1.54%
160-170	9.264	0.86%
170-180	2.339	0.22%
Total	1072.3	100%

γ(°)	Lumens	% Total
0- 60	488.438	45.55%
60- 90	286.658	26.73%
0-90	775.096	72.28%
90- 180	297.202	27.72%
0- 180	1072.3	100%

Table 5: Zonal Lumen Data

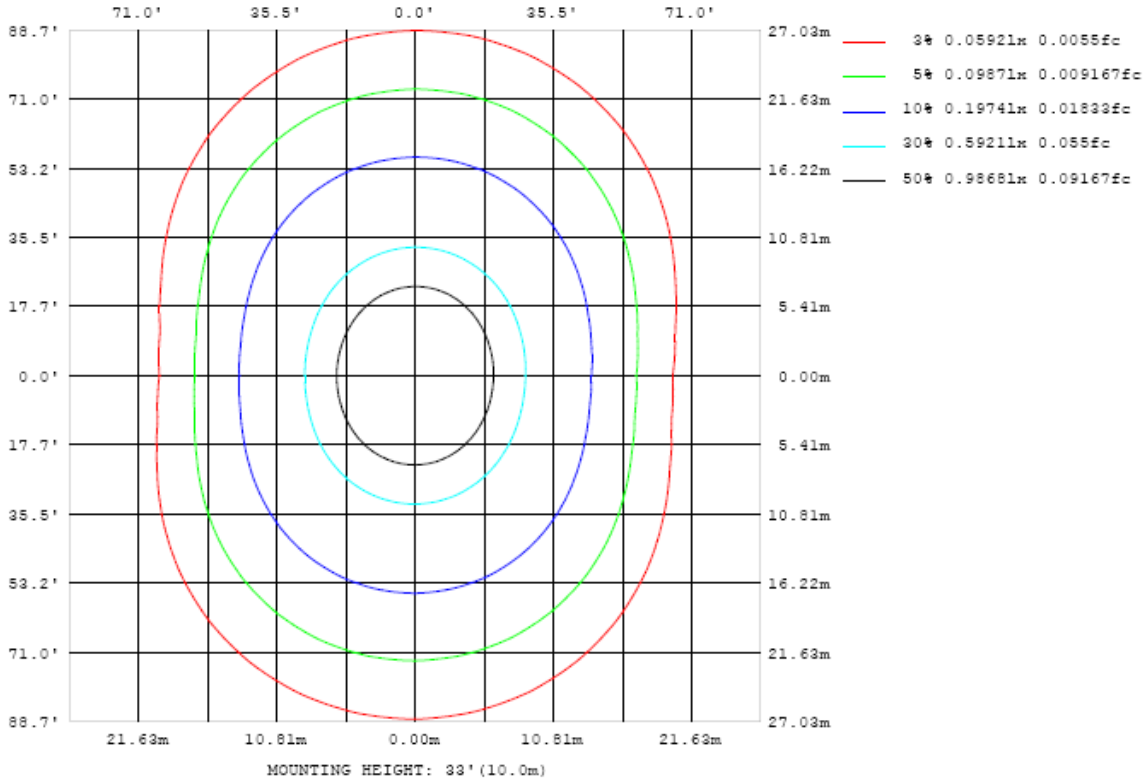


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

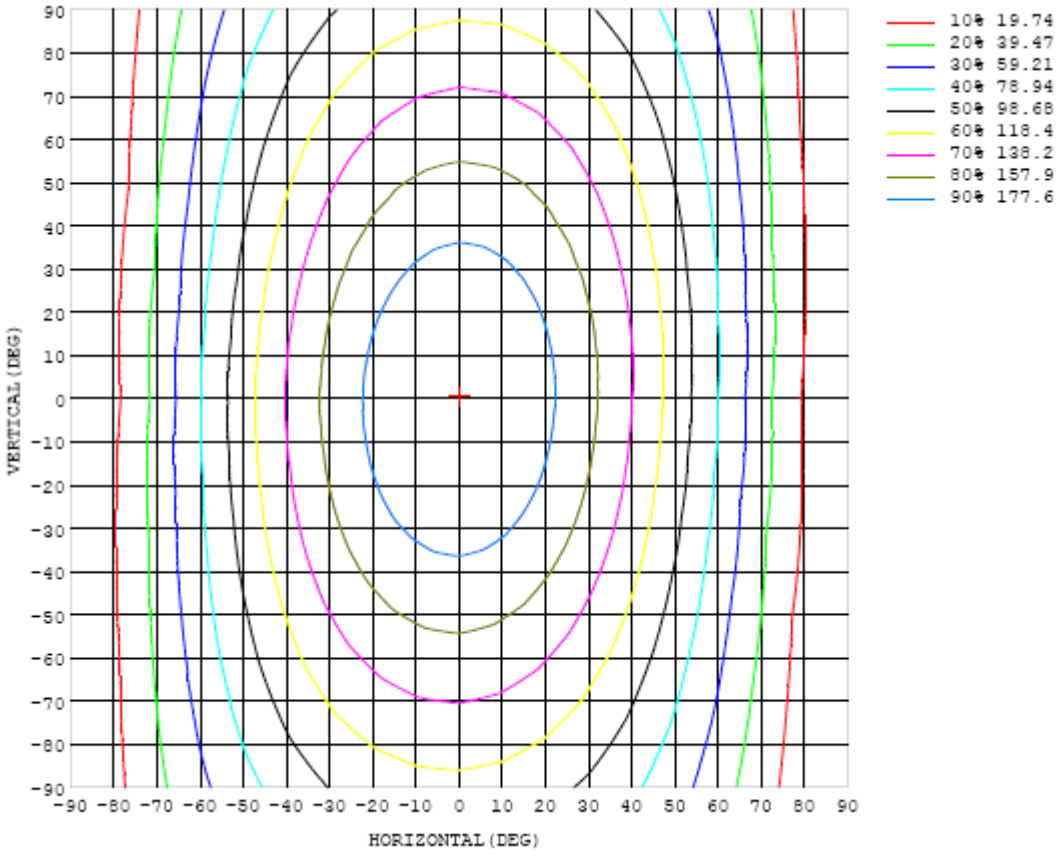


Chart 5: Isocandela Plot

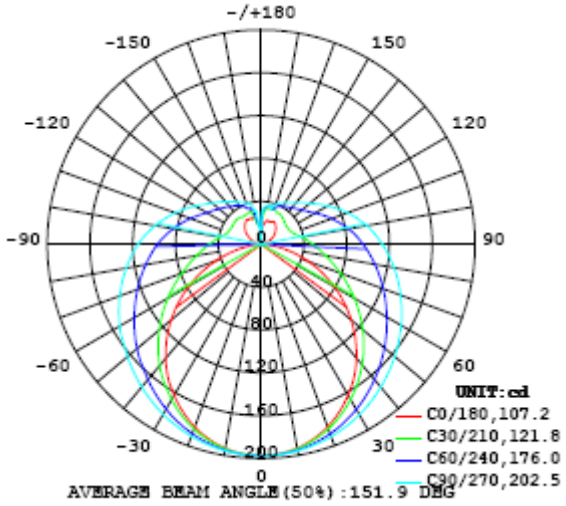


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C(DEG) / γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197
5	196	196	196	196	197	197	197	197	197	197	197	197	197	197	197	197	196	196	196
10	193	193	193	194	194	195	195	195	196	196	196	196	195	195	194	194	194	193	193
15	188	188	189	189	190	191	192	193	193	194	194	193	193	192	191	190	189	189	188
20	181	181	182	183	185	187	188	190	191	191	191	190	189	187	186	184	183	182	182
25	173	173	174	176	178	181	184	186	187	188	187	186	184	182	179	177	175	173	173
30	162	163	164	167	171	174	178	181	183	184	183	182	179	176	172	169	165	164	163
35	151	151	154	157	162	167	172	175	178	179	178	176	173	169	164	159	155	153	152
40	138	139	142	147	153	159	165	170	173	174	173	171	167	161	155	149	143	140	139
45	125	125	129	136	143	151	158	163	167	169	168	165	160	153	146	138	131	126	125
50	110	111	116	124	133	142	151	157	161	163	162	159	153	145	136	127	118	112	110
55	94.5	95.9	102	112	123	134	143	150	155	157	156	152	146	137	127	115	105	97.0	94.1
60	78.8	80.7	88.9	101	113	125	136	144	149	151	150	146	139	129	117	104	91.7	81.8	77.9
65	63.2	65.7	75.5	89.4	104	117	129	137	143	145	144	139	132	121	108	93.7	78.9	66.8	61.3
70	47.2	50.8	63.3	78.9	94.9	109	121	131	136	139	138	133	125	114	99.8	83.8	67.1	52.5	45.0
75	31.8	36.5	51.5	69.3	86.7	102	115	124	130	132	131	126	118	107	91.9	74.8	56.6	39.0	29.3
80	17.8	23.8	41.3	61.3	79.3	95.2	108	118	124	126	125	120	112	99.9	84.9	67.7	47.4	27.6	15.6
85	6.78	14.0	33.3	54.1	72.5	88.7	102	111	117	120	119	114	105	93.5	78.3	60.7	40.1	19.2	5.28
90	1.13	8.47	27.6	48.2	67.1	82.5	95.4	105	111	113	112	107	99.2	87.4	72.5	55.0	34.8	14.5	0.83
95	1.22	6.05	23.4	43.2	61.6	76.7	89.3	98.7	104	107	106	101	93.3	81.7	67.7	50.2	30.7	11.6	1.37
100	2.58	5.94	20.0	38.4	56.0	70.8	83.0	92.2	97.8	100	99.3	94.9	87.1	75.9	62.2	45.5	27.2	11.2	2.94
105	4.47	7.63	18.5	34.3	50.7	65.2	76.5	85.2	90.8	93.2	92.3	88.0	80.5	70.9	56.9	41.1	24.9	12.0	5.22
110	6.70	10.1	18.4	31.5	45.9	59.3	70.1	78.4	83.6	85.9	85.1	81.0	73.9	64.4	51.9	37.5	24.5	13.9	7.95
115	9.33	12.6	18.9	29.9	42.0	53.9	64.1	71.4	76.4	78.7	77.7	74.0	67.9	58.7	47.4	35.7	24.9	16.2	10.7
120	12.0	15.3	20.5	29.2	39.4	49.3	58.3	65.4	69.7	71.4	70.7	67.8	61.8	53.5	44.3	34.7	25.7	18.6	13.5
125	14.7	18.0	22.5	29.1	37.7	46.1	53.3	59.2	63.3	65.2	64.6	61.4	56.3	49.9	42.2	34.2	26.8	21.0	16.5
130	17.1	20.3	24.6	29.6	36.6	43.6	49.8	54.7	57.9	59.4	58.8	56.5	52.5	47.1	40.7	34.1	27.9	23.3	19.4
135	19.2	22.4	26.7	30.5	35.9	41.7	46.8	51.0	53.5	54.8	54.4	52.4	49.1	44.7	39.6	34.2	29.0	25.2	21.7
140	21.2	24.7	28.7	31.6	35.7	40.3	44.4	47.7	49.8	50.9	50.5	49.0	46.3	42.7	38.7	34.5	29.1	26.7	23.8
145	23.0	26.8	30.4	32.7	35.8	39.2	42.4	45.0	46.7	47.5	47.2	46.0	43.9	41.1	38.0	33.2	30.3	29.3	25.5
150	24.1	28.3	31.9	33.3	35.6	38.4	40.7	42.6	44.0	44.6	44.4	43.5	42.0	39.9	36.7	31.8	31.3	30.8	26.5
155	23.3	29.4	33.1	34.2	35.0	37.1	39.4	40.7	41.7	42.2	42.0	41.4	40.3	38.6	34.5	32.8	33.9	31.7	26.4
160	22.6	30.4	33.0	34.4	35.6	34.4	35.3	38.0	38.7	39.5	39.5	39.2	38.7	37.3	35.9	35.1	34.0	32.6	25.0
165	23.1	29.9	33.8	33.8	35.0	36.0	36.6	36.7	35.7	35.3	36.0	37.1	37.4	36.8	36.2	35.2	33.3	31.4	27.1
170	20.8	25.5	31.4	33.7	34.0	34.9	35.8	36.3	36.5	36.6	36.8	36.8	36.6	36.1	35.5	33.8	31.0	26.9	21.6
175	17.0	18.2	23.4	29.6	32.0	33.3	34.2	34.6	34.7	34.7	34.6	34.6	34.8	33.4	28.9	23.9	20.0	17.1	16.7
180	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7

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	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197		
5	196	196	196	197	197	197	197	197	197	197	197	197	197	196	197	196	196		
10	193	194	194	194	195	195	195	196	196	196	195	195	195	194	194	193	193		
15	188	189	190	190	191	192	193	193	194	193	193	192	191	191	190	189	188		
20	182	182	184	185	187	188	190	190	191	190	190	189	187	185	184	183	182		
25	173	174	176	178	181	183	185	187	187	187	186	184	182	179	177	175	173		
30	163	165	167	171	174	178	180	182	183	183	181	179	176	172	168	165	163		
35	153	155	158	162	167	171	175	178	179	178	176	173	169	164	159	156	153		
40	140	143	148	154	159	165	169	173	174	173	171	167	161	156	150	144	141		
45	126	130	136	144	152	158	163	167	169	168	165	160	154	147	139	132	127		
50	111	117	125	134	143	152	158	162	163	162	159	154	147	137	128	119	113		
55	95.9	103	113	124	135	144	152	156	158	157	154	147	139	128	117	107	98.8		
60	80.2	88.8	101	114	126	137	145	151	153	152	148	140	131	119	106	93.6	83.9		
65	64.4	75.2	89.6	105	118	130	139	144	147	146	141	133	123	110	95.4	80.8	69.0		
70	49.0	62.3	79.0	95.8	111	123	132	138	141	140	135	127	115	101	85.4	68.9	54.6		
75	34.6	50.6	69.5	87.7	103	116	126	132	135	133	128	120	108	93.5	76.3	57.8	41.1		
80	22.2	40.7	61.2	80.3	96.6	110	120	126	128	127	122	113	101	86.1	68.2	48.3	29.2		
85	12.9	33.1	54.3	73.7	90.1	103	113	119	122	121	116	107	94.9	79.5	61.2	40.6	20.0		
90	8.37	27.8	48.5	67.7	84.0	97.1	107	113	115	114	109	101	88.6	73.4	55.1	34.8	14.4		
95	6.30	23.6	43.4	61.8	77.7	90.4	99.8	106	108	107	102	93.7	82.1	67.2	49.5	29.9	11.0		
100	6.81	20.8	38.8	56.2	71.4	83.6	92.7	98.4	101	99.5	94.9	86.8	75.5	61.1	44.2	25.9	9.75		
105	8.42	20.1	35.2	51.2	65.4	76.9	85.6	91.1	93.2	92.0	87.6	79.8	69.1	55.4	39.6	23.5	10.3		
110	11.3	20.7	33.2	46.8	59.7	70.5	78.6	83.7	85.7	84.6	80.4	73.1	62.9	50.3	36.2	22.6	12.0		
115	13.7	21.9	32.3	43.7	54.6	64.3	71.8	76.5	78.4	77.3	73.4	66.6	57.2	46.0	34.0	22.5	13.9		
120	15.7	22.9	31.9	41.7	50.9	58.8	65.3	69.6	71.3	70.3	66.7	60.5	52.6	43.1	32.8	23.4	16.7		
125	17.8	24.3	32.1	40.2	48.0	54.9	60.3	63.7	65.0	64.1	61.1	56.0	49.3	41.0	32.3	25.0	19.2		
130	20.0	25.8	32.3	39.1	45.8	51.5	56.0	58.9	60.0	59.2	56.6	52.3	46.5	39.6	32.2	26.2	21.3		
135	22.0	26.9	32.6	38.5	43.8	48.6	52.4	54.8	55.7	55.0	52.8	49.1	44.3	38.6	33.0	28.0	22.8		
140	23.7	27.0	32.1	37.7	42.2	46.1	49.1	51.1	51.9	51.3	49.5	46.5	42.6	37.9	33.4	29.5	24.2		
145	24.8	28.3	31.0	36.2	40.8	43.8	46.3	47.9	48.5	48.0	46.6	44.2	41.0	37.1	33.3	29.8	25.2		
150	25.1	29.6	30.9	34.1	38.4	41.8	43.7	45.1	45.5	45.2	44.1	42.2	39.5	36.0	32.9	30.5	26.0		
155	24.1	29.9	31.3	32.4	34.7	38.9	41.4	42.4	42.9	42.6	41.6	39.7	37.2	35.1	33.4	31.4	26.5		
160	22.6	27.0	32.1	33.8	35.0	35.8	38.5	40.2	40.6	39.7	38.2	37.3	36.2	35.0	33.9	31.2	25.4		
165	22.0	22.3	26.6	30.4	32.6	34.8	33.3	33.5	38.5	37.4	36.7	36.3	35.7	34.6	31.4	27.0	22.1		
170	19.2	19.0	19.0	19.3	20.3	21.3	22.4	26.8	32.5	33.0	34.7	31.8	24.4	20.5	20.6	20.5	19.7		
175	16.6	17.2	17.8	17.9	18.1	19.2	19.9	17.3	6.04	12.9	17.5	18.2	18.4	18.0	17.9	17.8	17.5		
180	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7		

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 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

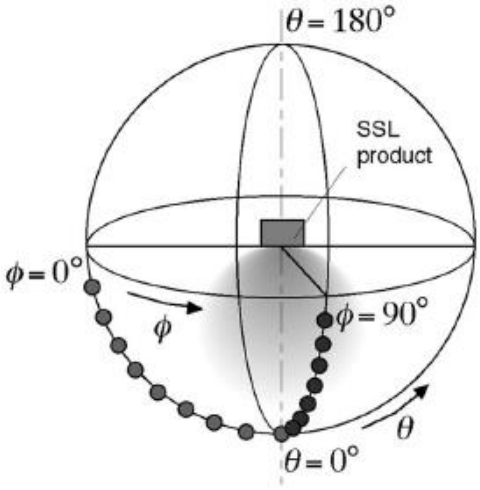
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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