LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube

Model: 8.5T8/2F/830/DEB/RC

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18120037a

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

Review by:

Engineer: April Zou
Jan. 09, 2019

Approved by:

Manager: Jim Zhang
Jan. 09, 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/830/DEB/RC**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
132.2	1093.0	8.27	0.9897

CCT (K)	CRI	Stabilization Time (Light & Power)
3069	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	: Dec. 26, 2018
Date of Test	: Dec. 27, 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/830/DEB/RC
Electrical Ratings	: 120-277V, 50/60Hz, 8.5W
Product Description	: G13 base, 3000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.2℃.

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	0.9897	0.9224
Test Power (W)	8.27	8.47
THD A%	12.55	18.39
Luminous Efficacy (lm/W)	132.2	129.8
Total Luminous Flux (lm)	1093.0	1099.0
Color Rendering Index (CRI)	81.8	
R9	3.6	
Correlated Color Temperature (CCT)(K)	3069	
Chromaticity Chroma x	0.4314	
Chromaticity Chroma y	0.4013	
Chromaticity Chroma u	0.2482	
Chromaticity Chroma v	0.3463	
Duv	0.0004	
Chromaticity Chroma u ’	0.2482	
Chromaticity Chroma v’	0.5195	

Special Color Rendering Indices	
R1	80.3
R2	91.7
R3	94.8
R4	78.7
R5	80.7
R6	89.9
R7	81.4
R8	57.1
R9	3.6
R10	81.1
R11	77.6
R12	72.2
R13	83.1
R14	97.8
Rf	83
Rg	94

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	0.9899
Test Power (W)	8.32
Luminous Efficacy (lm/W)	129.3
Total Luminous Flux (lm)	1076.0
Beam Angle (°)	150.7
Center Beam Candle Power (cd)	200
Spacing Criteria	1.23 (0°-180°)/ 1.41 (90°-270°)
Zonal Lumens in the 0°-60° Zone	45.85%
Zonal Lumens in the 60°-90° Zone	26.73%
Zonal Lumens in the 90°-120° Zone	16.28%
Zonal Lumens in the 120°-180° Zone	11.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

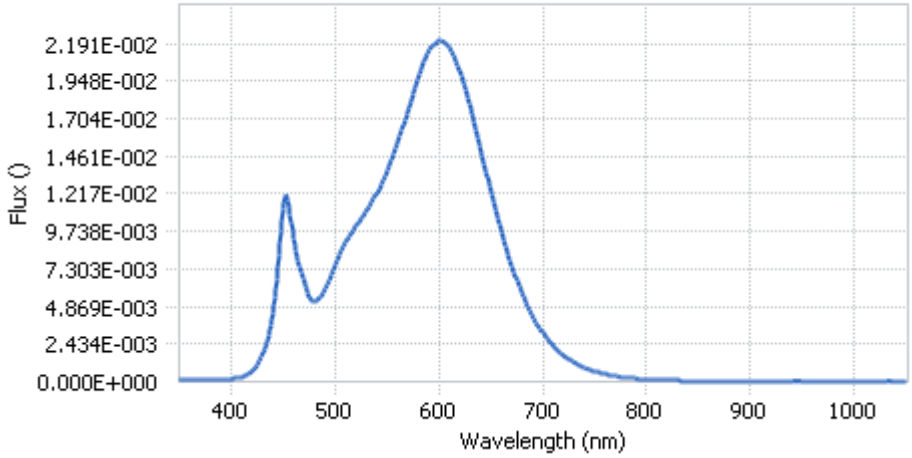
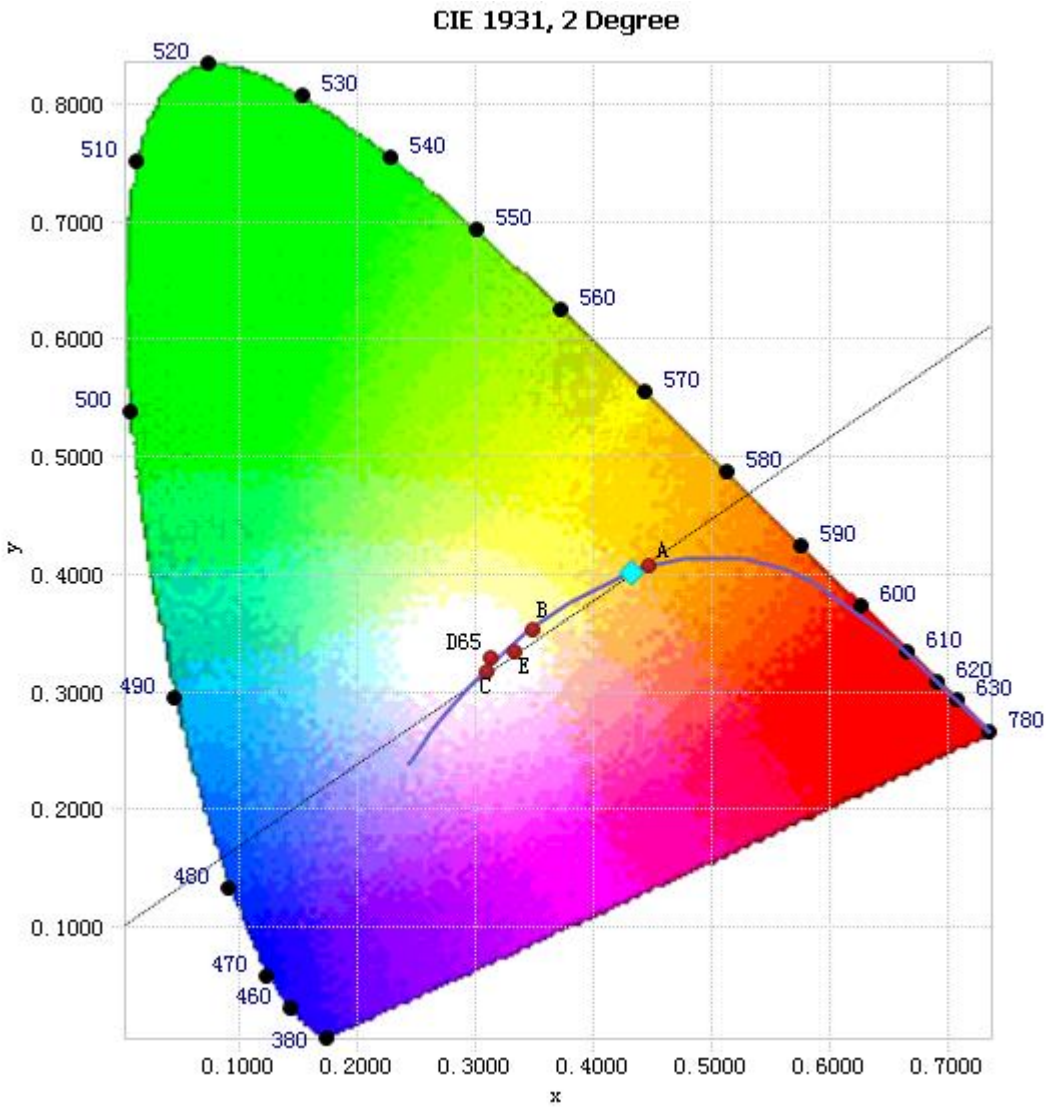


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.41E-04	485	5.43E-03	590	2.13E-02	695	3.71E-03
385	1.38E-04	490	5.96E-03	595	2.19E-02	700	3.19E-03
390	1.41E-04	495	6.67E-03	600	2.21E-02	705	2.73E-03
395	1.58E-04	500	7.51E-03	605	2.20E-02	710	2.33E-03
400	1.83E-04	505	8.30E-03	610	2.17E-02	715	1.99E-03
405	2.07E-04	510	8.97E-03	615	2.11E-02	720	1.72E-03
410	2.88E-04	515	9.57E-03	620	2.02E-02	725	1.47E-03
415	4.22E-04	520	1.01E-02	625	1.91E-02	730	1.25E-03
420	6.59E-04	525	1.05E-02	630	1.79E-02	735	1.07E-03
425	1.06E-03	530	1.11E-02	635	1.66E-02	740	9.11E-04
430	1.74E-03	535	1.16E-02	640	1.52E-02	745	7.74E-04
435	2.78E-03	540	1.22E-02	645	1.38E-02	750	6.61E-04
440	4.45E-03	545	1.29E-02	650	1.24E-02	755	5.65E-04
445	7.45E-03	550	1.36E-02	655	1.11E-02	760	4.87E-04
450	1.12E-02	555	1.45E-02	660	9.83E-03	765	4.21E-04
455	1.18E-02	560	1.54E-02	665	8.66E-03	770	3.58E-04
460	9.23E-03	565	1.64E-02	670	7.58E-03	775	3.05E-04
465	7.59E-03	570	1.75E-02	675	6.63E-03	780	2.64E-04
470	6.60E-03	575	1.86E-02	680	5.76E-03		
475	5.53E-03	580	1.97E-02	685	4.99E-03		
480	5.16E-03	585	2.07E-02	690	4.30E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y) : (0.4314,0.4013)

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

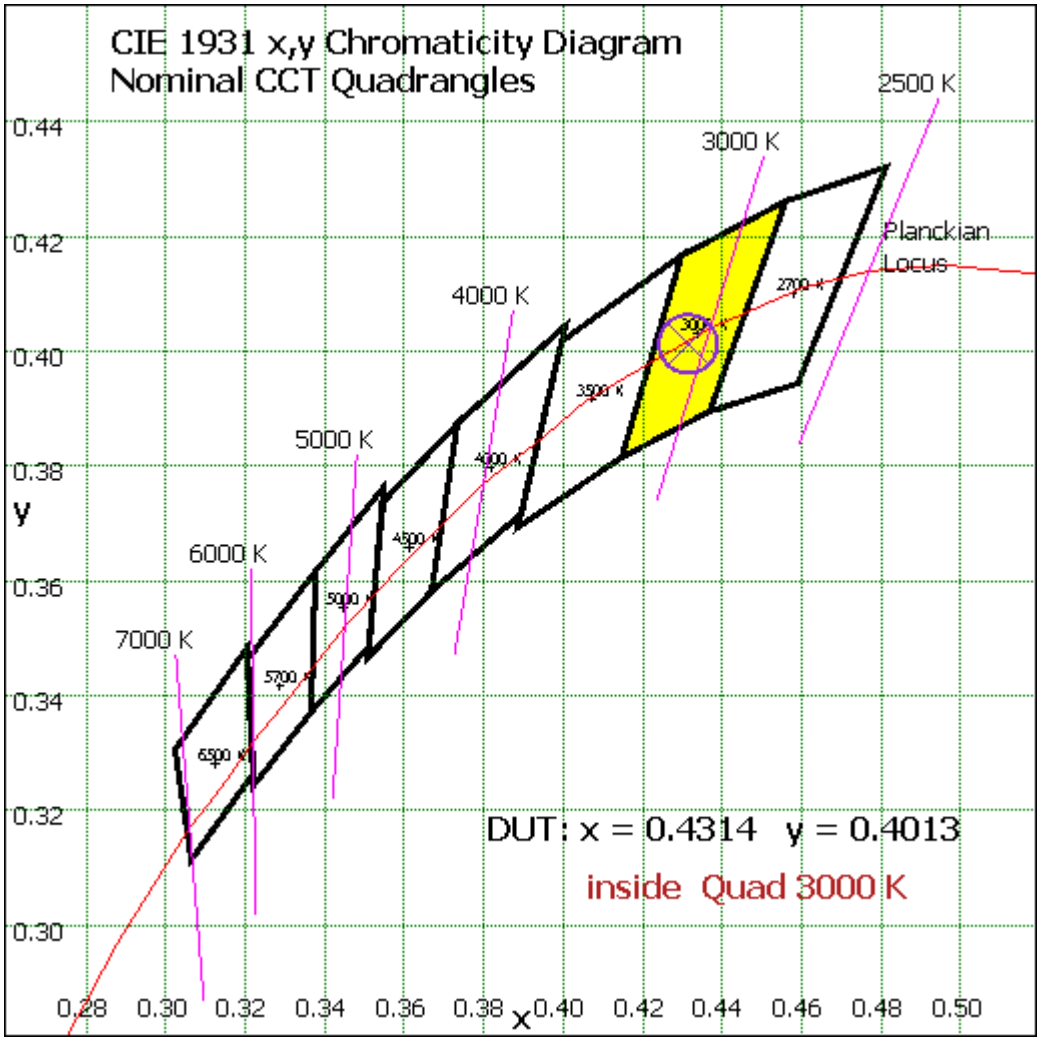


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	18.922	1.76%
10- 20	54.576	5.07%
20- 30	84.068	7.81%
30- 40	104.695	9.73%
40- 50	115.196	10.71%
50- 60	115.955	10.78%
60- 70	108.752	10.11%
70- 80	96.391	8.96%
80- 90	82.528	7.67%
90-100	70.052	6.51%
100-110	57.995	5.39%
110-120	47.1	4.38%
120-130	38.027	3.53%
130-140	30.52	2.84%
140-150	23.498	2.18%
150-160	16.46	1.53%
160-170	9.121	0.85%
170-180	2.191	0.20%
Total	1076.0	100%

γ(°)	Lumens	% Total
0- 60	493.412	45.85%
60- 90	287.671	26.73%
0-90	781.083	72.59%
90- 180	294.964	27.41%
0- 180	1076.0	100%

Table 5: Zonal Lumen Data

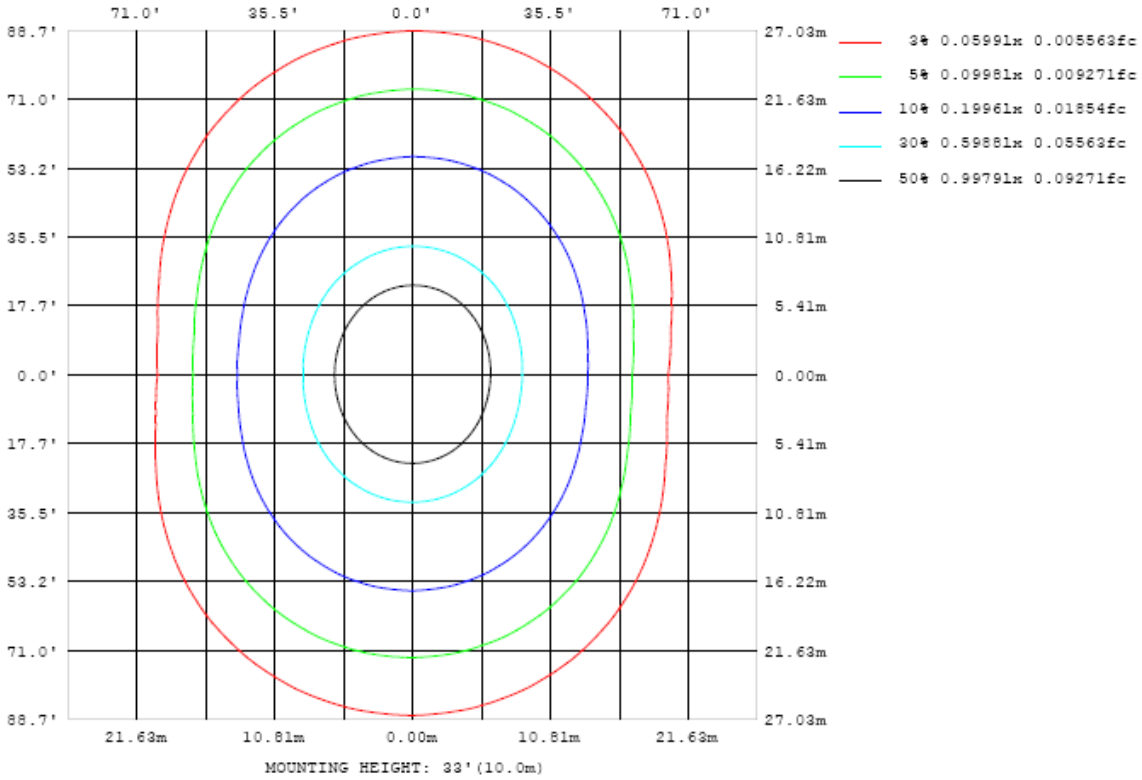


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

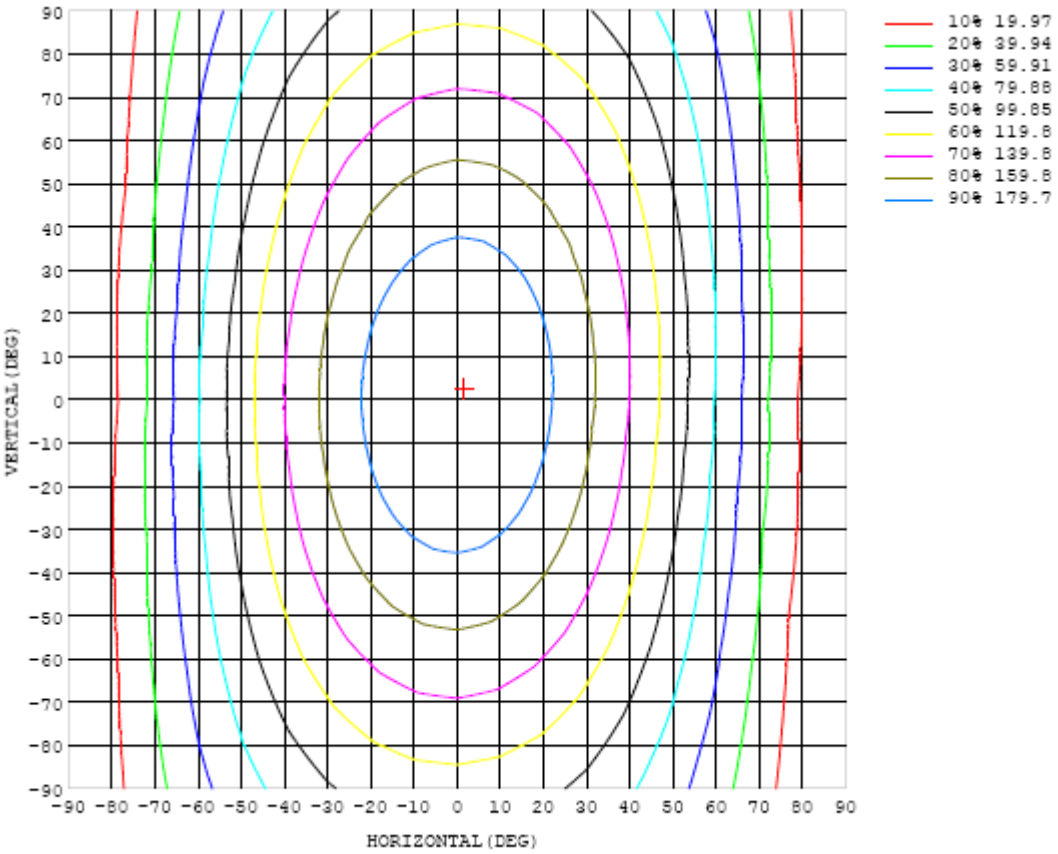


Chart 5: Isocandela Plot

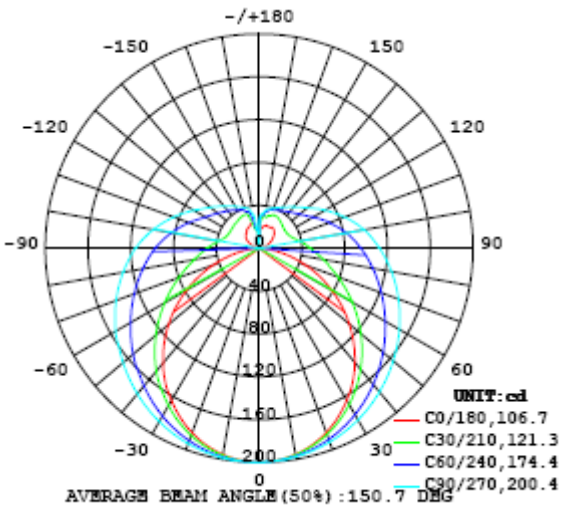


Chart 6: Polar Candela Distribution

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	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
5	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199	199
10	195	195	196	196	196	197	197	197	198	198	198	197	197	197	196	196	196	196	196
15	190	190	190	191	192	193	194	195	195	195	195	195	194	193	192	192	191	190	190
20	183	183	184	185	187	188	190	191	192	193	192	192	190	189	187	186	184	184	183
25	174	174	175	177	180	182	185	187	188	189	189	188	186	183	181	178	176	175	174
30	164	164	166	168	172	176	179	182	184	185	184	183	180	177	173	170	167	165	164
35	152	152	154	158	163	168	173	177	179	180	180	178	174	170	165	160	156	154	153
40	139	139	142	147	154	160	166	171	174	175	174	172	168	162	156	150	144	141	140
45	125	125	130	136	144	152	159	164	168	169	169	166	161	154	146	139	132	127	126
50	110	111	116	124	134	143	151	158	162	164	163	159	153	146	137	127	119	113	111
55	94.4	95.7	102	112	123	134	144	151	156	158	156	153	146	137	127	116	105	97.6	94.8
60	78.4	80.3	88.6	100	113	126	136	144	149	151	150	146	139	129	117	104	92.1	82.4	78.6
65	62.7	65.3	75.1	89.2	104	117	129	137	143	145	144	139	131	121	108	93.7	79.2	67.5	62.1
70	46.5	50.2	62.8	78.6	94.8	109	122	131	136	139	137	133	124	113	99.4	83.6	67.4	53.2	45.7
75	31.0	35.8	51.0	68.5	86.5	102	115	124	130	132	131	126	118	106	91.5	74.5	56.7	39.7	30.2
80	17.0	23.1	40.8	60.9	79.0	95.0	108	117	123	126	124	119	111	99.2	84.2	67.0	47.3	28.1	16.3
85	6.29	13.6	32.9	53.8	72.2	88.4	101	111	117	119	118	113	104	92.7	77.7	60.2	39.9	19.4	5.48
90	1.01	8.30	27.4	48.0	66.8	82.3	95.1	105	110	113	111	107	98.3	86.5	71.6	54.4	34.5	14.4	0.79
95	1.28	6.15	23.5	43.2	61.4	76.5	89.1	98.3	104	106	105	100	92.1	80.7	66.8	49.5	30.4	11.5	1.22
100	2.96	6.30	20.2	38.5	56.0	70.7	82.8	91.8	97.4	99.7	98.3	93.8	85.9	74.8	61.3	44.7	26.8	10.7	2.56
105	5.20	7.88	18.9	34.6	50.8	65.1	76.2	84.9	90.2	92.4	91.3	86.8	79.3	69.2	55.9	40.4	24.2	11.4	4.41
110	7.62	10.3	18.7	31.7	46.0	59.3	69.9	77.9	83.0	85.1	84.1	79.9	72.7	63.3	50.9	36.8	23.7	13.2	6.36
115	10.2	12.9	19.2	30.2	42.1	53.9	63.9	70.7	75.9	77.9	76.9	73.0	66.8	57.6	46.5	34.8	24.0	15.6	8.65
120	12.8	15.5	20.7	29.4	39.5	49.3	58.1	65.0	69.4	70.8	71.2	66.9	60.8	52.5	43.4	33.7	24.8	18.0	11.6
125	15.3	18.3	22.7	29.3	37.8	46.0	53.1	58.9	62.9	64.6	63.8	60.6	55.3	48.9	41.3	33.3	26.0	20.4	14.4
130	17.7	20.8	24.7	29.7	36.6	43.5	49.6	54.3	57.4	58.6	58.1	55.6	51.5	46.0	39.8	33.2	27.1	22.5	16.3
135	20.0	23.2	26.8	30.6	35.9	41.6	46.6	50.5	53.0	54.2	53.7	51.6	48.2	43.8	38.6	33.3	28.5	23.7	18.0
140	21.6	24.8	28.7	31.7	35.7	40.2	44.2	47.3	49.4	50.3	49.9	48.2	45.5	41.9	37.8	33.5	30.0	23.7	18.4
145	22.8	25.9	29.9	32.8	35.7	39.1	42.2	44.6	46.3	47.0	46.7	45.3	43.2	40.4	37.2	33.9	31.3	26.0	20.6
150	22.4	25.6	30.8	33.8	35.8	38.2	40.5	42.4	43.6	44.2	43.9	42.9	41.3	39.1	36.7	34.4	31.7	26.8	21.5
155	21.8	26.4	30.7	33.9	36.1	37.6	39.2	40.5	41.4	41.8	41.6	40.9	39.7	38.2	36.5	34.8	31.9	27.1	22.3
160	22.0	26.7	28.9	32.2	35.6	37.3	38.2	39.0	39.6	39.8	39.7	39.2	38.4	37.4	36.5	34.7	30.4	28.3	23.6
165	21.9	26.5	29.1	30.8	33.2	35.6	37.4	37.9	38.2	38.3	38.2	37.9	37.5	37.0	35.8	32.6	30.7	28.7	24.7
170	20.6	22.9	28.5	30.5	30.5	33.1	34.8	35.2	35.5	35.8	36.0	35.9	35.3	34.3	32.6	30.6	27.2	23.1	20.2
175	17.9	18.7	22.9	27.7	30.1	31.1	31.6	32.1	32.3	32.4	32.6	32.8	32.7	30.9	25.9	21.0	17.7	15.3	13.8
180	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4

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	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
5	199	199	199	199	199	199	199	199	200	200	200	199	199	199	199	199	199
10	196	196	196	197	197	198	198	198	199	198	198	198	197	197	196	196	196
15	191	191	192	193	194	195	196	196	197	197	196	195	194	193	192	191	191
20	184	185	186	188	189	191	193	194	194	194	193	192	190	188	187	185	184
25	175	176	178	181	184	186	189	190	191	191	189	187	185	182	179	177	175
30	165	167	170	173	177	181	184	186	187	186	185	182	179	175	171	167	165
35	154	157	160	165	170	175	178	181	182	182	180	176	172	167	162	157	154
40	141	144	150	156	162	168	173	176	177	177	174	170	164	158	152	146	142
45	127	131	138	146	154	161	166	170	172	171	168	163	157	149	141	134	128
50	112	118	126	136	146	154	160	164	166	165	162	157	149	140	130	121	114
55	96.9	104	114	125	137	146	154	159	160	159	156	150	141	130	118	107	98.9
60	81.2	89.9	102	115	128	139	147	153	155	154	150	143	132	120	107	94.0	83.8
65	65.5	76.2	90.7	106	120	132	141	146	149	148	143	136	125	111	96.2	81.1	68.7
70	50.0	63.2	79.9	96.7	112	124	134	140	142	141	137	128	117	103	86.1	69.0	54.1
75	35.6	51.5	70.3	88.4	104	117	127	133	136	135	130	121	110	94.5	76.9	57.9	40.4
80	23.0	41.4	61.8	80.8	97.3	111	120	127	129	128	123	115	103	87.1	68.7	48.4	28.6
85	13.5	33.6	54.7	74.0	90.6	104	114	120	122	121	117	108	95.7	80.2	61.6	40.7	19.6
90	8.58	28.1	48.9	68.0	84.3	97.4	107	113	116	115	110	101	89.3	73.9	55.4	34.9	14.2
95	6.22	23.7	43.4	61.8	77.7	90.4	99.9	106	108	107	103	94.2	82.5	67.5	49.6	29.8	10.8
100	6.62	20.7	38.7	56.0	71.2	83.4	92.5	98.2	101	99.4	95.0	87.0	75.6	61.2	44.1	25.8	9.84
105	8.33	19.9	34.8	50.7	65.0	76.5	85.1	90.6	92.8	91.7	87.4	79.8	69.0	55.3	39.6	23.5	10.5
110	10.3	20.2	32.7	46.1	59.1	69.9	78.0	83.1	85.2	84.1	80.1	72.8	62.7	50.1	36.2	22.7	12.4
115	12.9	21.5	31.8	43.0	53.9	63.6	71.0	75.8	77.8	76.7	72.9	66.2	56.9	45.9	34.0	22.8	14.9
120	15.3	22.9	31.4	41.0	50.3	58.2	64.6	68.9	70.6	69.7	66.2	60.2	52.4	43.1	32.9	23.6	17.3
125	17.6	24.1	31.4	39.5	47.4	54.2	59.6	63.0	64.4	63.6	60.8	55.8	49.2	41.1	32.5	25.1	18.9
130	19.5	25.4	31.7	38.5	45.0	50.9	55.4	58.4	59.5	58.8	56.3	52.2	46.5	39.6	32.7	26.9	21.3
135	21.2	27.2	32.1	37.7	43.2	48.0	51.8	54.2	55.2	54.6	52.5	49.0	44.3	38.7	33.2	28.5	23.3
140	22.8	28.7	32.3	37.0	41.6	45.5	48.6	50.6	51.4	50.9	49.2	46.3	42.5	38.2	33.6	29.5	24.9
145	23.4	29.9	33.1	36.3	40.0	43.4	45.8	47.4	48.1	47.7	46.4	44.1	41.1	37.7	34.2	30.8	26.0
150	23.0	30.8	33.7	36.1	38.6	41.1	43.3	44.6	45.2	44.9	43.9	42.1	39.9	37.1	34.6	31.9	26.6
155	21.8	30.2	34.1	35.6	37.6	39.5	40.9	41.9	42.4	42.3	41.7	40.5	38.7	36.8	35.2	32.5	26.5
160	20.3	24.1	33.9	34.6	35.3	36.3	38.6	39.8	40.2	40.2	39.8	39.0	38.0	36.8	35.5	30.3	24.5
165	20.1	19.7	23.9	29.3	32.0	34.5	34.4	34.3	38.3	38.3	38.2	37.8	37.2	36.4	33.3	26.5	21.0
170	16.8	17.6	18.0	18.0	18.7	20.5	21.8	24.5	32.4	32.0	34.5	32.1	25.7	22.2	19.1	19.1	18.9
175	13.7	14.4	15.0	15.8	17.1	18.3	19.2	16.6	4.87	10.8	15.5	16.3	17.0	16.8	17.0	17.7	18.0
180	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 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

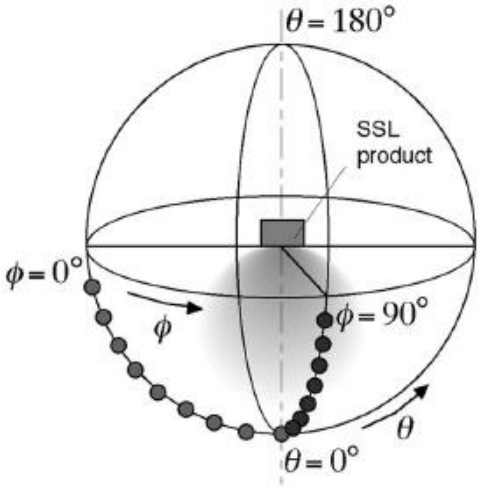
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

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