



LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED tube

Model: 13T8/4F/850/BYP/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18040014f

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/850/BYP/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
138.9	1858.0	13.38	0.9796
CCT (K)	CRI	Stabilization Time (Light & Power)	
4999	82.1	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. 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

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Sample Photos



Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED tube
Model	: 13T8/4F/850/BYP/R
Electrical Ratings	: 120-277V, 50/60Hz, 13W
Product Description	: 5000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.0°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	0.9796	0.9248
Test Power (W)	13.38	13.45
THD A%	19.28	16.50
Luminous Efficacy (lm/W)	138.9	139.3
Total Luminous Flux (lm)	1858.0	1873.0
Color Rendering Index (CRI)	82.1	
R9	5	
Correlated Color Temperature (CCT)(K)	4999	
Chromaticity Chroma x	0.3455	
Chromaticity Chroma y	0.3569	
Chromaticity Chroma u	0.2097	
Chromaticity Chroma v	0.3249	
Duv	0.0025	
Chromaticity Chroma u'	0.2097	
Chromaticity Chroma v'	0.4873	

Special Color Rendering Indices	
R1	80
R2	86.4
R3	91.4
R4	82.4
R5	80.6
R6	81.3
R7	87.4
R8	67.2
R9	5
R10	67.9
R11	81.4
R12	58.8
R13	81.5
R14	95.4
Rf	81
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)	0.115
Power Factor	0.9762
Test Power (W)	13.44
Luminous Efficacy (lm/W)	136.9
Total Luminous Flux (lm)	1839.6
Beam Angle (°)	182.2
Center Beam Candle Power (cd)	274
Spacing Criteria	1.28 (0°-180°)/ 1.48 (90°-270°)
Zonal Lumens in the 0°-60°Zone	39.86%
Zonal Lumens in the 60°-90°Zone	26.62%
Zonal Lumens in the 90°-120°Zone	18.67%
Zonal Lumens in the 120°-180°Zone	14.85%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

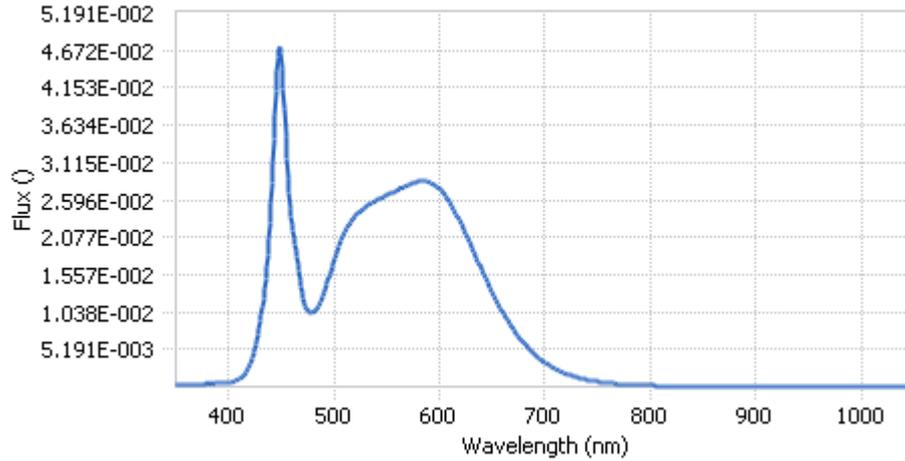
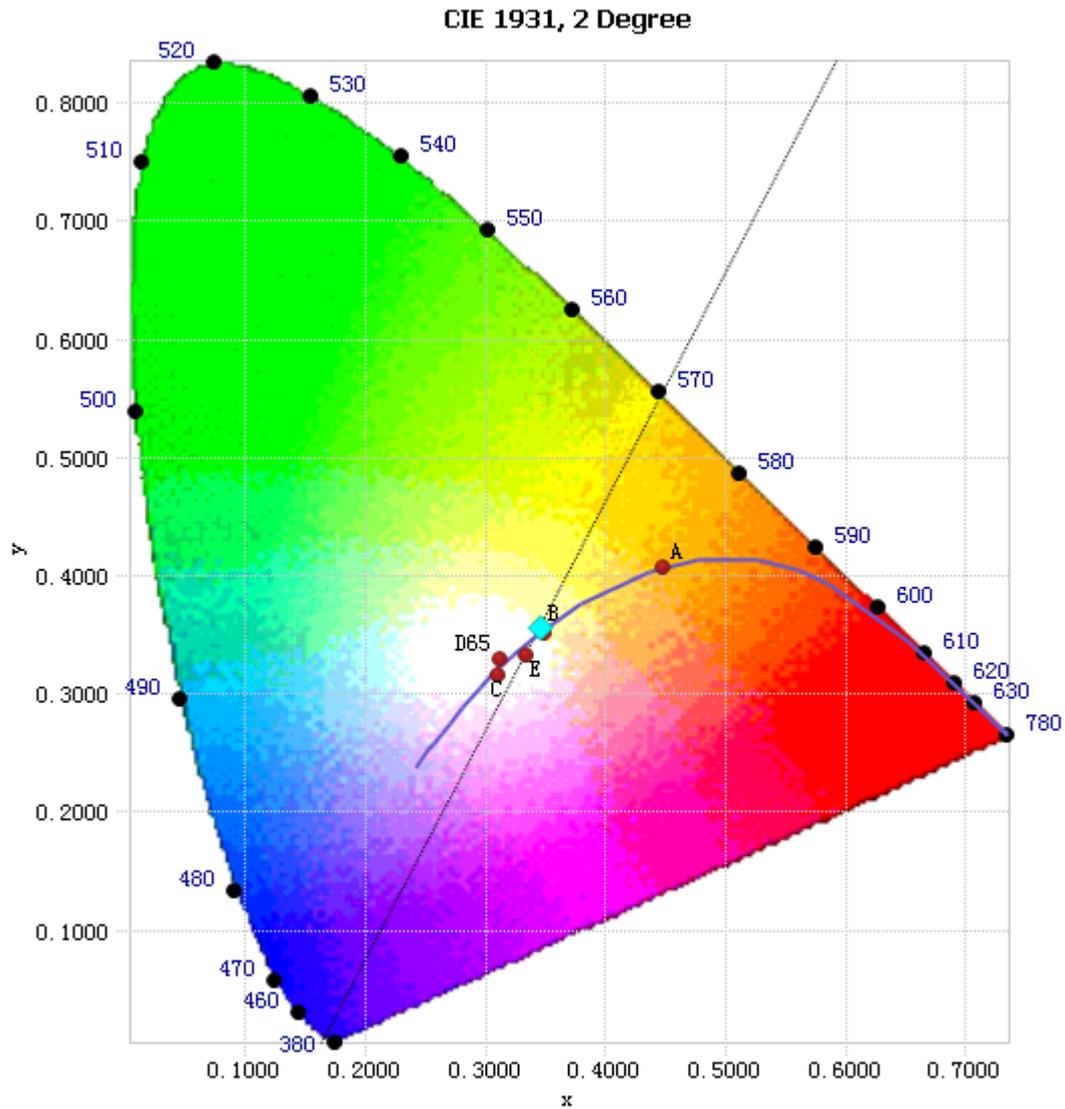


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.31E-04	485	1.12E-02	590	2.85E-02	695	3.91E-03
385	4.28E-04	490	1.28E-02	595	2.80E-02	700	3.37E-03
390	4.79E-04	495	1.52E-02	600	2.75E-02	705	2.89E-03
395	5.28E-04	500	1.77E-02	605	2.66E-02	710	2.46E-03
400	6.03E-04	505	1.97E-02	610	2.55E-02	715	2.11E-03
405	7.76E-04	510	2.15E-02	615	2.42E-02	720	1.81E-03
410	1.11E-03	515	2.28E-02	620	2.27E-02	725	1.56E-03
415	1.75E-03	520	2.38E-02	625	2.11E-02	730	1.33E-03
420	2.99E-03	525	2.44E-02	630	1.96E-02	735	1.14E-03
425	5.20E-03	530	2.50E-02	635	1.79E-02	740	9.73E-04
430	9.14E-03	535	2.54E-02	640	1.62E-02	745	8.36E-04
435	1.51E-02	540	2.59E-02	645	1.46E-02	750	7.18E-04
440	2.54E-02	545	2.62E-02	650	1.31E-02	755	6.13E-04
445	4.12E-02	550	2.66E-02	655	1.17E-02	760	5.28E-04
450	4.63E-02	555	2.70E-02	660	1.04E-02	765	4.63E-04
455	3.17E-02	560	2.72E-02	665	9.12E-03	770	3.93E-04
460	2.24E-02	565	2.77E-02	670	7.98E-03	775	3.39E-04
465	1.79E-02	570	2.79E-02	675	6.96E-03	780	2.88E-04
470	1.30E-02	575	2.83E-02	680	6.07E-03		
475	1.05E-02	580	2.85E-02	685	5.26E-03		
480	1.04E-02	585	2.87E-02	690	4.56E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3455, 0.3569)

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

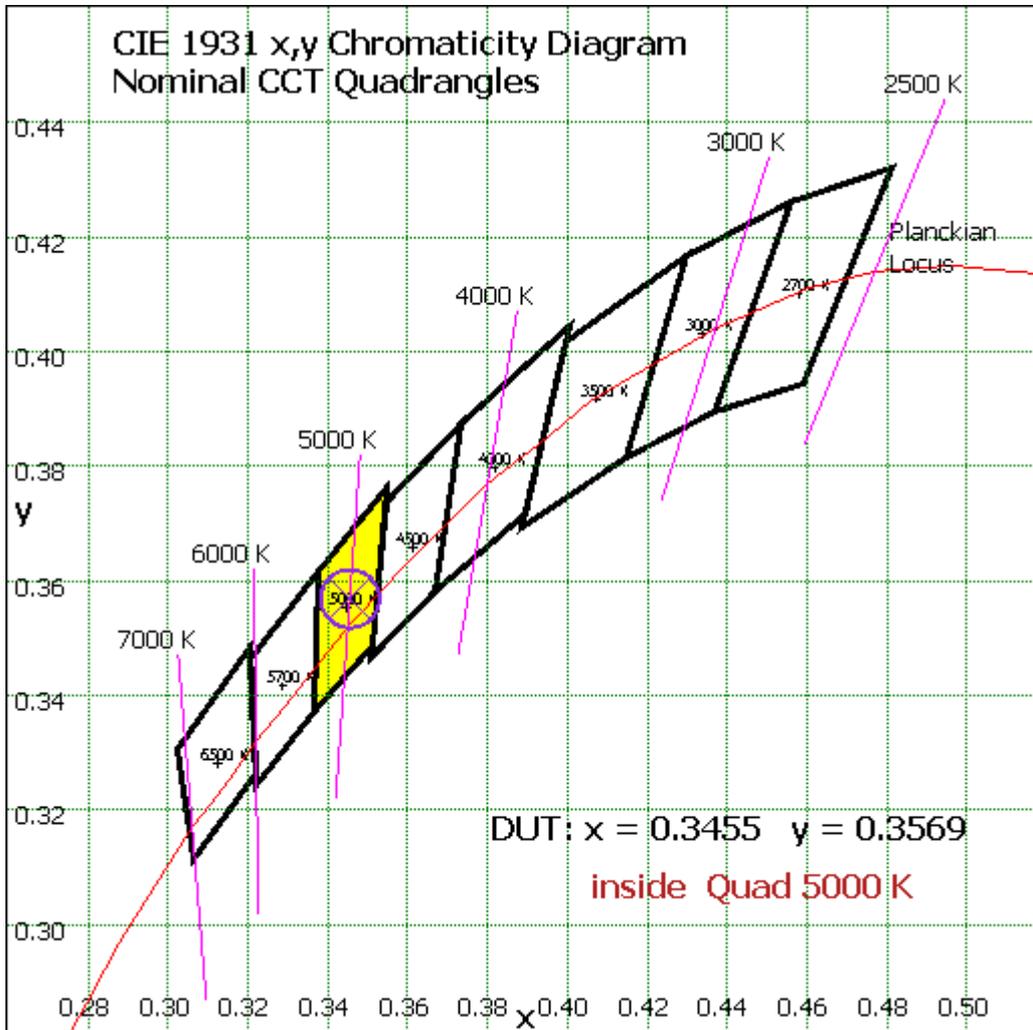


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	26.059	1.42%
10- 20	76.018	4.13%
20- 30	119.67	6.51%
30- 40	153.492	8.34%
40- 50	174.989	9.51%
50- 60	183.129	9.95%
60- 70	178.671	9.71%
70- 80	164.578	8.95%
80- 90	146.466	7.96%
90-100	130.011	7.07%
100-110	114.379	6.22%
110-120	99.004	5.38%
120-130	84.046	4.57%
130-140	69.324	3.77%
140-150	54.279	2.95%
150-160	38.133	2.07%
160-170	20.964	1.14%
170-180	6.411	0.35%
Total	1839.6	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	733.357	39.86%
60- 90	489.715	26.62%
0-90	1223.072	66.48%
90- 180	616.551	33.52%
0- 180	1839.6	100%

Table 5: Zonal Lumen Data

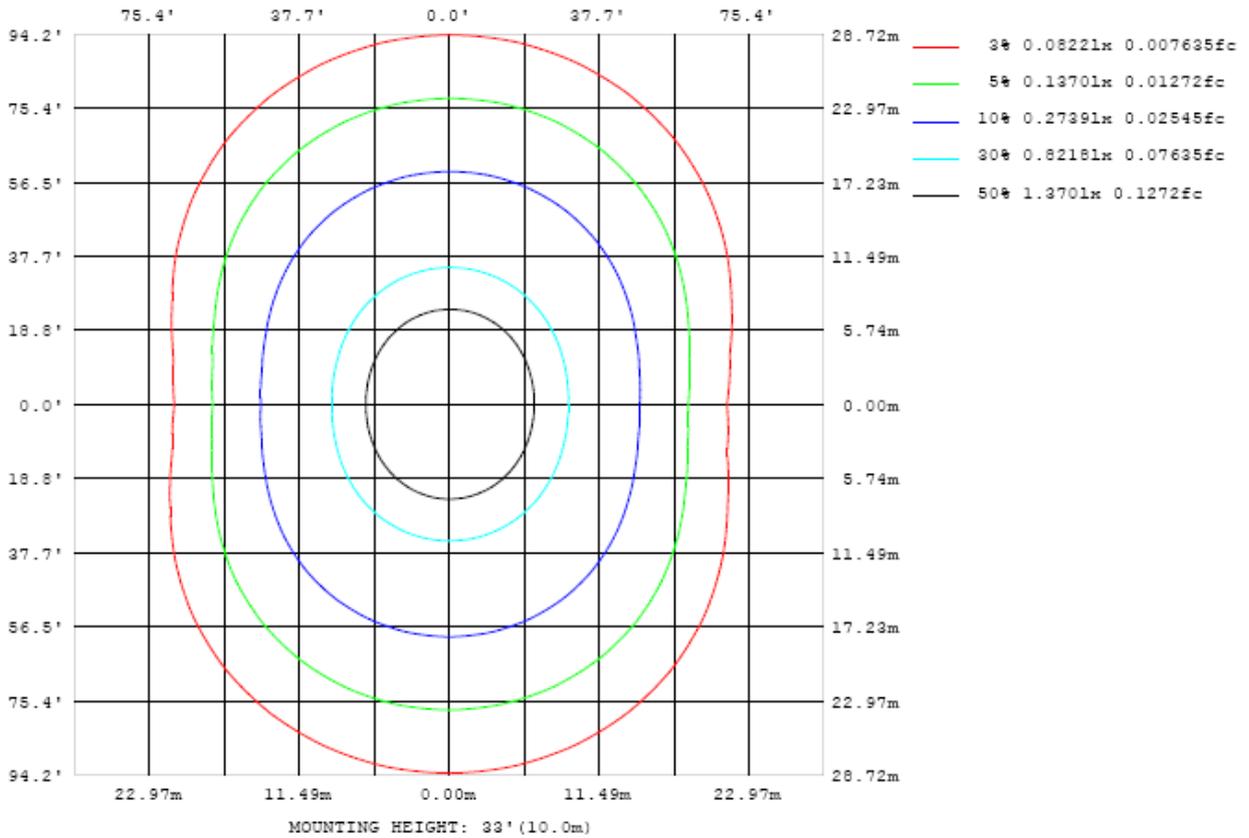


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

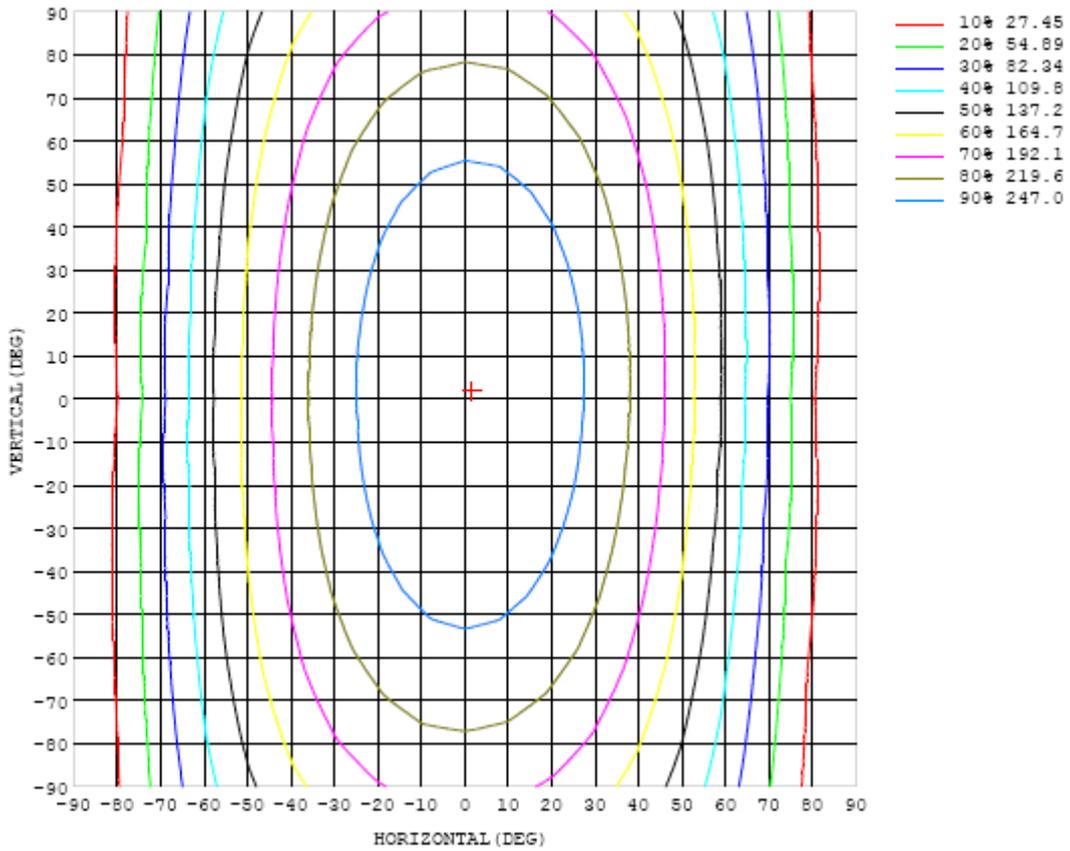


Chart 5: Isocandela Plot

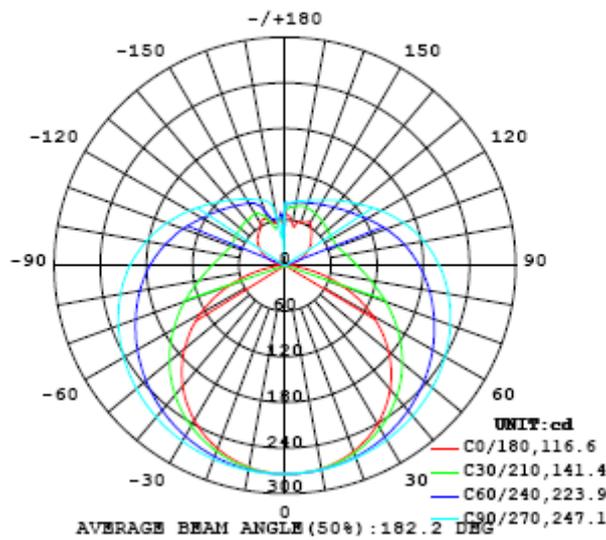


Chart 6: Polar Candela Distribution

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	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274
5	274	274	274	274	274	274	274	274	274	273	274	273	273	273	273	273	273	273	273
10	271	271	271	272	272	272	273	273	273	273	273	272	272	271	270	270	269	269	269
15	267	267	267	268	269	270	271	271	271	271	271	270	269	268	267	265	264	264	264
20	260	260	261	263	265	266	268	269	270	269	269	268	266	264	262	259	258	256	256
25	252	252	253	256	259	262	264	266	267	267	267	265	262	259	255	252	249	247	247
30	241	241	244	247	252	256	260	263	264	265	264	261	258	253	248	243	239	236	235
35	228	229	232	237	243	249	255	259	261	262	261	257	253	247	240	233	227	223	222
40	213	214	219	226	234	242	249	254	257	258	257	253	247	240	231	222	214	209	207
45	195	197	204	213	224	234	243	249	253	254	253	248	241	232	221	210	200	192	189
50	176	179	187	199	213	225	236	244	249	250	248	243	235	224	211	197	184	174	170
55	155	158	169	185	201	216	229	238	244	245	244	238	228	216	200	183	167	154	150
60	131	136	150	169	189	207	222	232	238	240	238	232	222	207	189	169	149	133	127
65	106	112	131	154	178	198	214	226	232	235	233	226	215	199	178	155	131	111	102
70	80.3	88.2	111	139	166	189	206	219	226	229	227	219	207	190	168	142	113	88.3	76.6
75	54.5	64.7	93.0	125	155	180	199	212	220	222	221	213	200	182	158	129	96.8	66.7	51.2
80	29.8	43.7	76.9	113	145	171	191	205	213	216	214	206	193	174	149	118	82.6	47.8	27.2
85	9.94	27.1	64.3	102	135	162	183	197	205	208	206	198	185	166	140	108	71.4	33.3	8.57
90	0.85	18.1	55.9	93.9	127	154	175	189	198	201	199	191	177	158	132	100	64.1	25.6	0.67
95	2.53	15.6	50.5	87.0	119	146	166	181	189	192	190	182	169	150	125	93.9	58.5	22.8	2.64
100	6.96	17.6	47.0	80.9	112	138	158	172	181	184	182	174	161	142	118	88.0	54.9	24.0	7.50
105	12.0	22.2	46.3	76.1	105	130	149	163	171	174	172	165	152	134	111	83.0	53.4	27.7	13.8
110	18.3	28.2	47.5	72.9	98.9	122	140	153	161	164	162	155	143	126	105	79.2	54.2	33.0	20.8
115	25.0	34.6	50.0	71.5	93.7	114	131	144	151	154	152	146	134	119	99.1	77.5	56.4	39.2	27.9
120	31.7	41.2	53.5	71.1	90.1	108	123	134	141	144	143	136	126	112	95.2	76.8	59.2	45.4	34.9
125	38.2	47.6	57.5	71.4	87.6	103	116	125	132	134	133	127	118	107	92.4	76.9	62.3	51.4	40.9
130	44.1	53.2	61.5	72.4	85.8	98.7	110	118	123	125	124	120	112	102	90.2	77.3	65.6	57.2	46.1
135	48.0	57.2	65.5	74.0	84.6	95.3	104	111	116	118	117	113	107	98.5	88.5	78.0	68.7	62.1	50.3
140	53.8	62.7	69.2	75.6	83.8	92.4	99.8	106	109	111	110	107	102	95.1	87.2	78.9	71.9	65.7	53.9
145	59.4	68.0	72.4	77.3	83.5	90.1	95.8	100	104	105	104	102	97.7	92.3	86.2	79.8	74.8	69.2	57.0
150	64.7	70.3	74.5	79.0	83.4	88.2	92.5	96.0	98.4	99.5	99.1	97.1	94.1	90.0	85.4	80.8	77.2	73.4	63.0
155	62.8	71.2	77.1	80.3	83.4	86.8	89.8	92.3	94.0	94.7	94.5	93.2	91.0	88.1	84.9	81.5	76.8	72.6	67.1
160	60.4	76.4	77.6	81.3	83.6	85.7	87.6	89.2	90.3	90.8	90.8	89.9	88.4	86.6	84.5	81.0	75.5	66.9	63.0
165	56.9	72.8	78.6	81.1	83.6	84.9	85.9	86.8	87.5	87.7	87.7	87.3	86.4	85.7	83.8	75.9	67.5	61.7	58.4
170	55.6	70.6	76.5	78.4	81.1	83.3	84.5	85.1	85.4	85.5	85.6	85.5	84.8	81.6	73.8	65.6	59.8	61.3	58.6
175	65.1	69.4	74.4	76.9	77.8	79.3	81.1	82.3	82.7	82.8	83.3	82.4	77.9	70.2	60.9	55.5	56.1	59.1	60.2
180	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6

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	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274		
5	273	273	273	273	274	274	274	274	274	274	274	274	274	274	274	274	274		
10	270	270	270	271	272	272	273	273	274	274	274	273	273	273	272	272	271		
15	264	265	266	267	269	270	272	272	273	273	273	272	271	270	269	268	267		
20	257	258	260	263	265	267	269	271	271	271	271	270	268	266	264	262	261		
25	248	250	253	256	260	263	266	268	269	269	268	266	264	260	257	255	252		
30	237	240	244	249	254	259	263	266	267	267	265	262	258	254	249	245	242		
35	224	228	234	241	248	254	259	262	264	264	261	257	252	246	239	234	230		
40	209	214	222	231	240	248	255	259	260	260	257	252	245	237	228	221	215		
45	192	199	210	221	232	242	250	255	257	256	252	246	237	227	216	206	199		
50	174	183	196	210	224	236	244	250	252	251	247	239	229	216	203	190	180		
55	154	165	182	199	215	229	239	245	247	246	241	232	220	205	189	172	160		
60	132	148	167	188	206	222	233	240	242	241	235	225	211	194	174	154	139		
65	109	129	153	176	197	214	226	234	237	235	229	218	202	182	159	136	116		
70	85.6	110	139	165	188	207	220	228	230	229	222	210	193	171	146	117	92.3		
75	62.5	92.1	125	155	180	199	213	221	224	222	215	202	184	160	132	99.7	69.5		
80	42.0	76.7	113	146	171	191	206	214	217	215	207	194	175	151	120	84.2	48.9		
85	26.5	64.6	103	137	163	184	198	207	210	208	200	186	167	141	109	71.8	33.2		
90	18.6	56.6	95.0	129	155	176	190	199	201	199	191	178	158	133	100	62.8	24.3		
95	16.6	51.0	87.9	121	147	167	181	190	192	190	182	169	150	124	92.6	56.2	20.9		
100	19.0	48.3	82.2	113	139	158	172	180	183	181	173	160	141	116	86.0	52.3	21.7		
105	23.5	48.2	77.8	106	131	149	163	171	173	171	163	151	133	109	80.7	50.7	25.1		
110	29.6	50.1	75.3	101	123	141	153	161	163	161	154	142	125	102	77.0	51.4	30.2		
115	35.9	53.2	74.4	96.2	116	132	144	151	153	151	145	133	117	97.0	74.9	53.4	36.0		
120	41.9	56.8	74.4	93.1	110	124	135	142	144	142	135	125	111	93.2	74.1	56.3	41.7		
125	47.1	60.7	75.0	90.7	105	118	127	133	135	133	127	118	105	90.3	74.2	60.1	47.0		
130	51.0	63.8	75.5	89.0	101	112	120	125	126	125	120	112	101	88.2	74.9	63.9	51.7		
135	54.1	67.6	76.8	87.7	97.8	107	114	118	119	117	113	106	97.3	86.8	76.2	67.7	55.5		
140	55.9	71.1	77.3	85.9	95.0	102	108	111	112	111	107	102	94.3	85.9	77.6	71.2	58.1		
145	56.3	74.3	77.8	84.4	92.4	97.9	102	105	106	105	102	97.6	91.8	85.3	79.1	74.5	58.5		
150	55.0	76.3	78.7	81.2	87.1	94.5	97.6	99.8	100	99.8	97.7	94.4	89.9	85.2	80.7	75.0	55.9		
155	52.1	67.7	74.3	77.7	81.6	89.0	93.7	95.1	95.6	95.3	93.9	91.6	88.5	85.2	82.3	67.5	48.5		
160	53.2	53.5	64.0	67.6	71.0	75.1	85.3	91.5	91.6	91.6	90.8	89.4	87.5	85.7	80.0	57.5	47.1		
165	52.8	49.2	51.9	56.7	63.1	62.8	64.9	76.0	87.1	87.7	88.2	85.3	83.6	80.9	61.2	44.1	46.6		
170	53.5	51.6	53.8	55.1	57.9	60.5	61.2	53.8	66.8	83.8	77.3	73.1	65.2	56.3	49.2	48.5	48.1		
175	59.6	61.7	62.9	64.5	67.9	68.4	68.3	68.2	43.8	67.5	69.7	65.2	62.9	63.0	60.8	59.2	61.8		
180	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6	77.6		

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

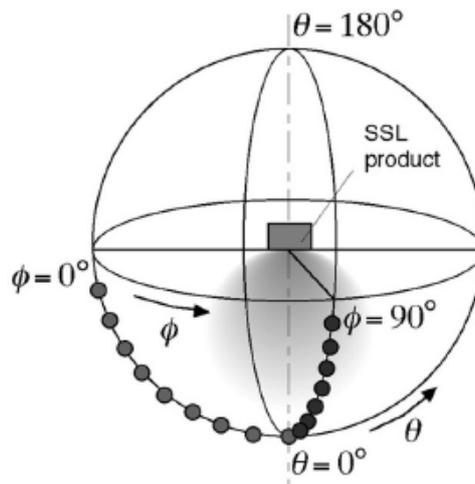
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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