LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube System

Model: 10.5T8/3F/835/EXT/A4

(LED tube model: 10.5T8/3F/835/EXT 4pcs and LED driver model: 15T8T5HEDRIVER/4CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18080024m

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

Review by: April Zou

Engineer: April Zou
Aug. 28, 2018

Approved by: Jim Zhang

Manager: Jim Zhang
Aug. 28, 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: **10.5T8/3F/835/EXT/A4**

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/4	Power Factor
132.0	1579.0	11.96	0.9962

CCT (K)	CRI	Stabilization Time (Light & Power)
3330	82.5	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	: Jul. 30, 2018
Date of Test	: Aug. 02, 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 System
Model	: 10.5T8/3F/835/EXT/A4
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 3500K LED tube model: 10.5T8/3F/835/EXT 4 LED tubes supplied by a LED driver: 15T8T5HEDRIVER/4CH
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 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)	0.400	0.180
Power Factor	0.9962	0.9528
Test Power (W)/4	11.96	11.89
THD A%	3.82	6.88
Luminous Efficacy (lm/W)	132.0	132.8
Luminous Flux per lamp (lm)	1579.0	1579.0
Color Rendering Index (CRI)	82.5	
R9	1.9	
Correlated Color Temperature (CCT)(K)	3330	
Chromaticity Chroma x	0.4153	
Chromaticity Chroma y	0.3960	
Chromaticity Chroma u	0.2400	
Chromaticity Chroma v	0.3433	
Duv	0.0002	
Chromaticity Chroma u ’	0.2400	
Chromaticity Chroma v’	0.5149	

Special Color Rendering Indices	
R1	81.3
R2	92
R3	95.4
R4	79.9
R5	81.5
R6	89.8
R7	82
R8	57.9
R9	1.9
R10	81.1
R11	79.4
R12	68.2
R13	84.2
R14	98.2
Rf	82
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 24.8℃.

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)	0.401
Power Factor	0.9963
Test Power (W)/4	11.97
Luminous Efficacy (lm/W)	130.2
Luminous Flux per lamp (lm)	1558.2
Beam Angle (°)	169.6
Center Beam Candle Power (cd)	255
Spacing Criteria	1.26 (0°-180°)/ 1.44 (90°-270°)
Zonal Lumens in the 0°-60°Zone	42.35%
Zonal Lumens in the 60°-90°Zone	26.81%
Zonal Lumens in the 90°-120°Zone	17.79%
Zonal Lumens in the 120°-180°Zone	13.05%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

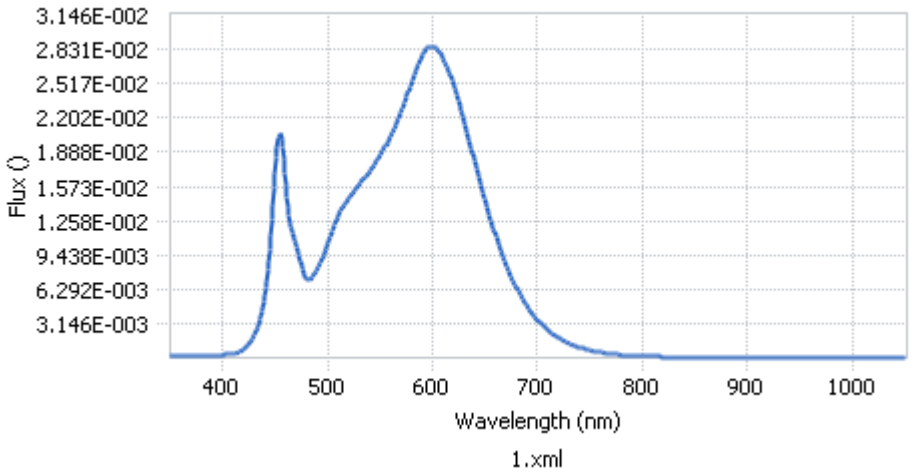
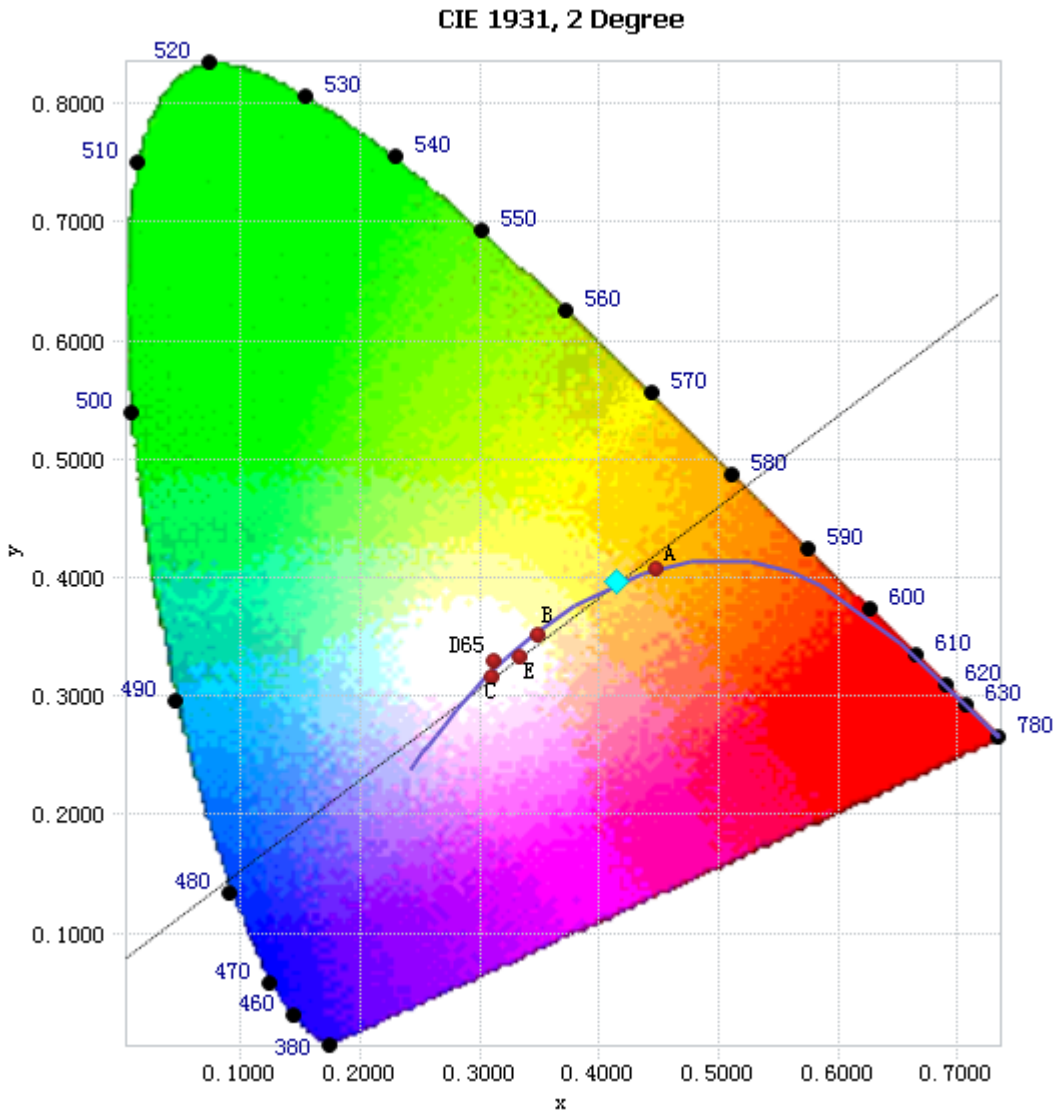


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.48E-04	485	7.38E-03	590	2.77E-02	695	4.03E-03
385	2.21E-04	490	8.12E-03	595	2.84E-02	700	3.46E-03
390	2.47E-04	495	9.17E-03	600	2.86E-02	705	2.95E-03
395	2.54E-04	500	1.05E-02	605	2.82E-02	710	2.52E-03
400	2.59E-04	505	1.19E-02	610	2.75E-02	715	2.13E-03
405	3.06E-04	510	1.29E-02	615	2.65E-02	720	1.83E-03
410	3.61E-04	515	1.39E-02	620	2.51E-02	725	1.55E-03
415	5.00E-04	520	1.46E-02	625	2.35E-02	730	1.33E-03
420	7.72E-04	525	1.53E-02	630	2.17E-02	735	1.12E-03
425	1.25E-03	530	1.59E-02	635	1.98E-02	740	9.52E-04
430	2.06E-03	535	1.65E-02	640	1.81E-02	745	8.11E-04
435	3.43E-03	540	1.71E-02	645	1.62E-02	750	6.90E-04
440	5.74E-03	545	1.78E-02	650	1.45E-02	755	5.90E-04
445	9.98E-03	550	1.86E-02	655	1.28E-02	760	5.04E-04
450	1.69E-02	555	1.95E-02	660	1.13E-02	765	4.31E-04
455	2.06E-02	560	2.03E-02	665	9.85E-03	770	3.69E-04
460	1.58E-02	565	2.14E-02	670	8.53E-03	775	3.15E-04
465	1.20E-02	570	2.26E-02	675	7.41E-03	780	2.71E-04
470	1.04E-02	575	2.39E-02	680	6.42E-03		
475	8.39E-03	580	2.53E-02	685	5.53E-03		
480	7.19E-03	585	2.66E-02	690	4.73E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4153, 0.3960)

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

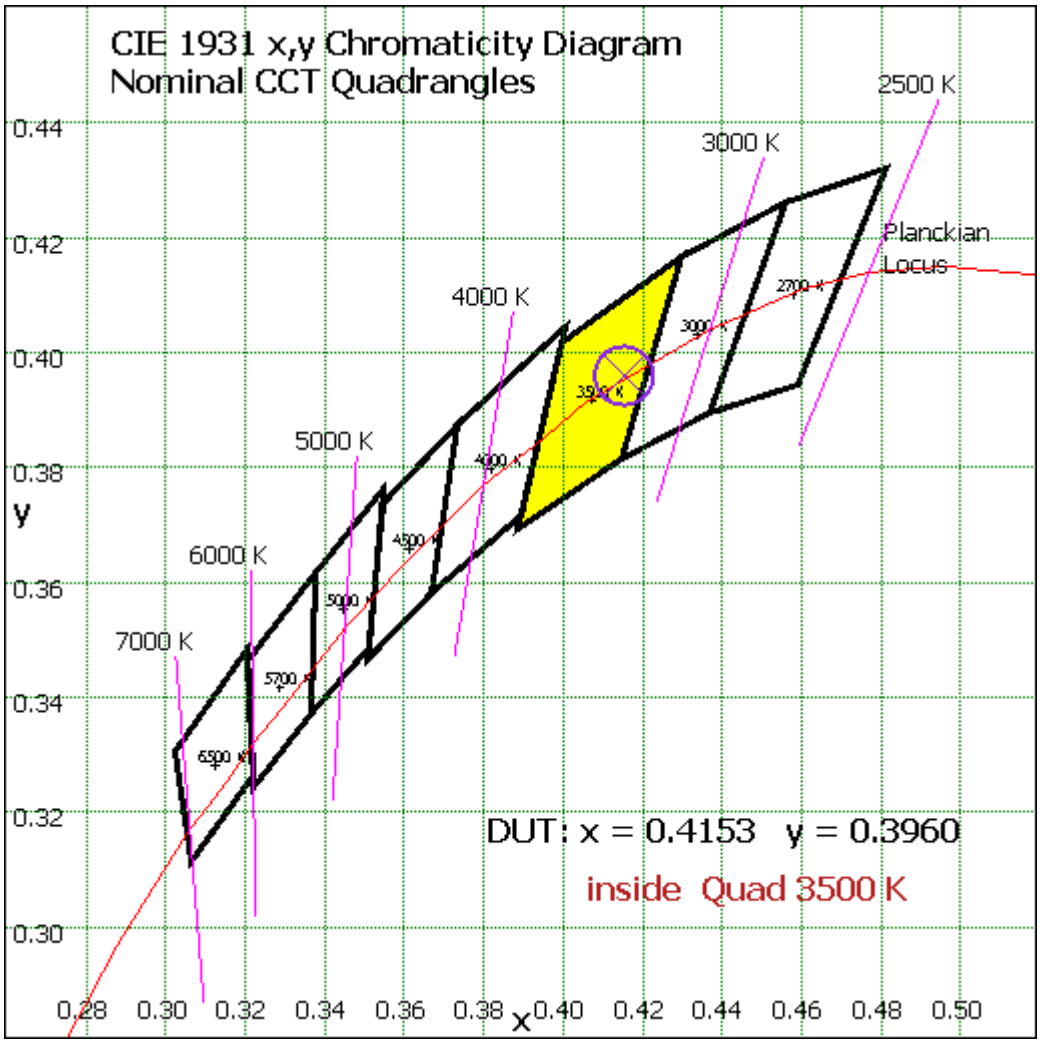


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	24.189	1.55%
10- 20	70.222	4.51%
20- 30	109.58	7.03%
30- 40	138.874	8.91%
40- 50	156.089	10.02%
50- 60	160.902	10.33%
60- 70	154.565	9.92%
70- 80	140.277	9.00%
80- 90	122.938	7.89%
90-100	107.203	6.88%
100-110	92.203	5.92%
110-120	77.799	4.99%
120-130	64.474	4.14%
130-140	52.14	3.35%
140-150	39.796	2.55%
150-160	27.571	1.77%
160-170	15.052	0.97%
170-180	4.364	0.28%
Total	1558.2	100%

γ(°)	Lumens	% Total
0- 60	659.856	42.35%
60- 90	417.78	26.81%
0-90	1077.636	69.16%
90- 180	480.602	30.84%
0- 180	1558.2	100%

Table 5: Zonal Lumen Data

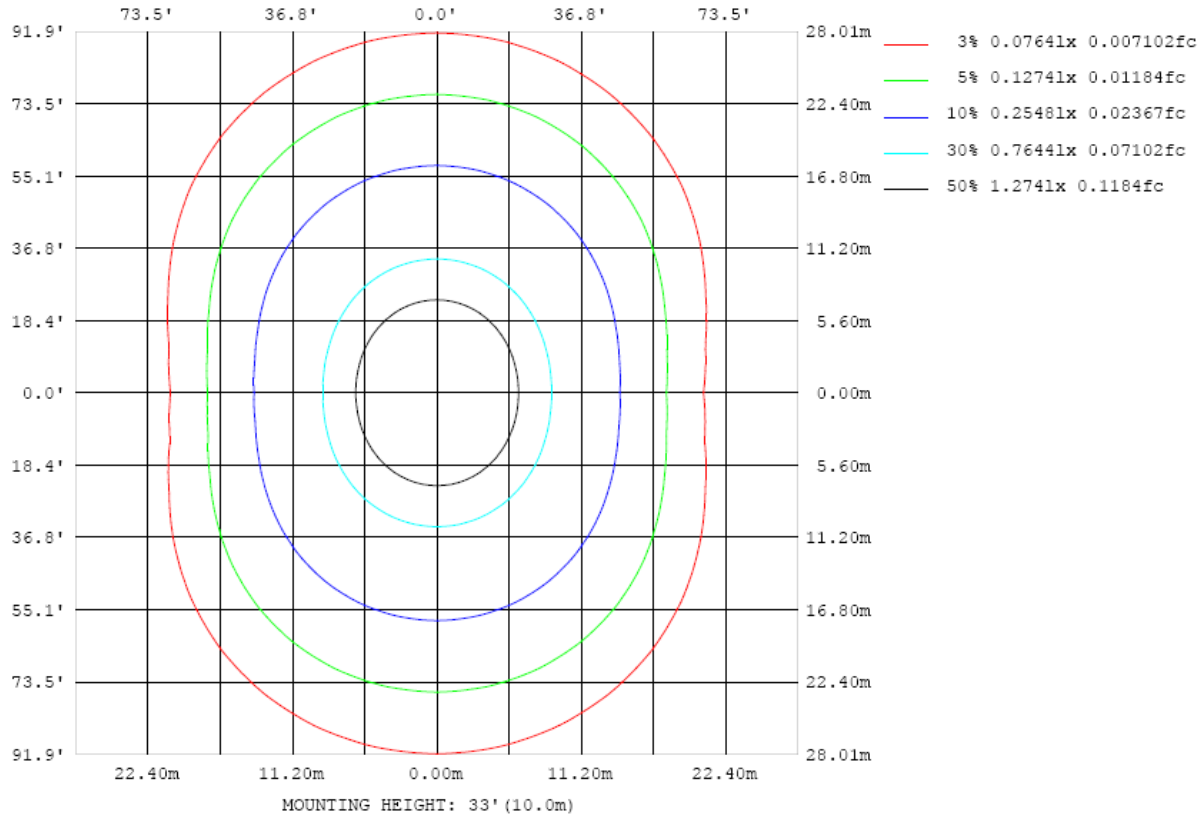


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

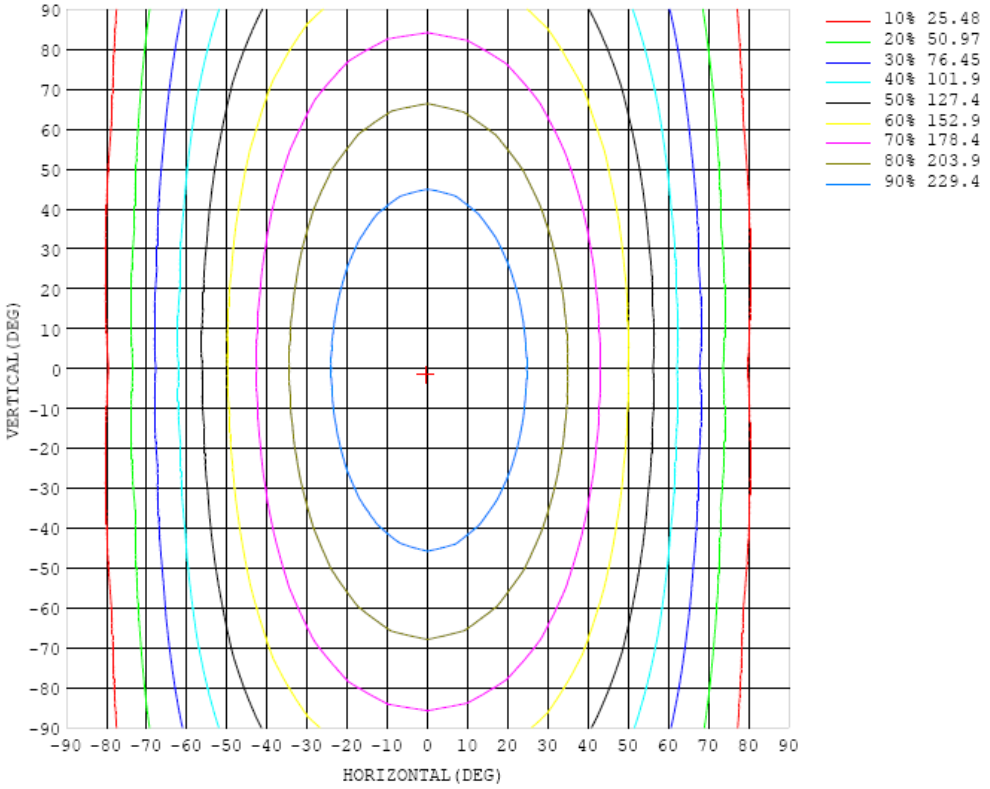


Chart 5: Isocandela Plot

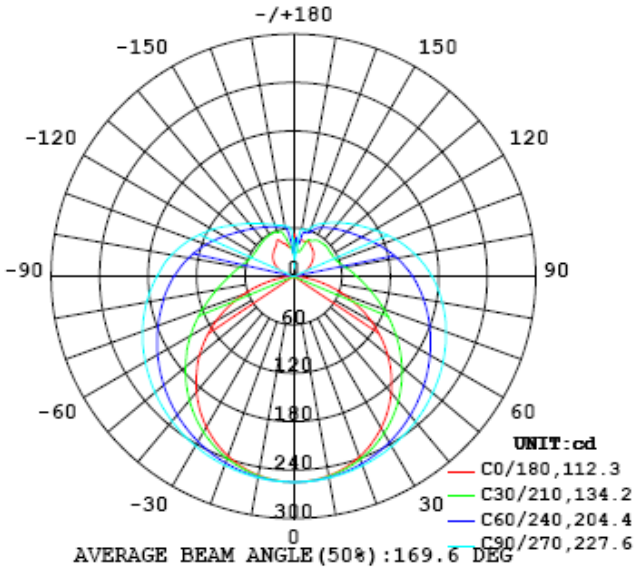


Chart 6: Polar Candela Distribution

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	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255
5	254	254	254	254	254	254	254	254	255	255	255	254	254	254	254	254	254	254	254
10	251	251	251	252	252	253	253	253	254	254	253	253	253	252	251	251	251	250	250
15	246	246	246	247	248	250	250	251	252	252	252	251	250	249	248	246	245	245	245
20	238	239	240	241	243	245	247	248	249	250	249	248	246	244	242	240	239	237	237
25	229	229	231	234	237	240	243	245	246	247	246	244	242	239	235	232	230	228	227
30	217	218	221	224	229	233	237	241	243	243	242	240	237	232	228	223	219	216	216
35	204	205	208	214	220	226	231	236	238	239	238	235	231	225	219	212	207	203	202
40	188	190	195	202	210	218	225	230	234	235	234	230	224	217	209	201	193	188	187
45	171	173	180	189	199	209	218	225	229	230	229	224	217	209	198	188	178	172	170
50	153	156	164	175	188	200	211	218	223	225	223	218	210	200	187	174	162	154	152
55	132	136	147	161	177	191	203	212	218	219	217	212	203	191	176	160	146	135	132
60	111	116	129	147	165	182	195	205	212	214	211	205	195	181	165	146	129	115	111
65	89.0	95.6	112	133	154	172	187	198	205	207	205	199	188	172	154	133	111	94.5	88.7
70	66.8	74.8	95.2	119	143	163	179	191	199	201	199	192	180	164	143	119	94.8	75.0	66.2
75	44.9	55.4	79.5	107	132	154	172	184	192	194	192	185	172	155	133	107	79.4	54.8	44.0
80	24.5	37.7	66.3	95.8	123	146	164	176	184	187	185	177	165	147	124	96.6	66.6	37.6	23.8
85	8.66	24.4	55.6	86.4	114	137	156	169	177	180	177	170	157	139	115	87.4	56.2	24.7	7.65
90	1.41	17.2	47.8	78.4	106	129	148	161	169	172	169	162	149	131	107	79.7	48.8	17.7	0.62
95	2.12	13.9	41.9	71.7	98.4	121	139	152	160	163	160	153	140	123	99.8	72.8	43.2	15.1	2.04
100	4.89	14.7	37.8	65.4	90.8	113	130	143	151	154	151	144	132	114	92.6	67.4	39.7	16.0	5.10
105	8.78	17.4	36.4	60.4	84.0	105	122	134	141	144	142	135	123	107	85.9	62.7	38.7	18.5	9.48
110	13.2	21.1	36.8	57.1	77.9	97.3	113	125	132	134	132	126	115	99.1	80.1	59.9	39.3	22.2	14.4
115	17.9	24.2	37.9	55.4	74.1	90.4	105	115	122	125	123	117	106	92.3	75.9	58.4	40.8	25.9	19.5
120	22.4	26.8	39.8	54.8	70.5	85.0	97.4	107	113	115	113	108	99.1	87.1	72.8	57.7	42.3	29.3	24.6
125	26.9	30.4	41.7	54.5	68.1	80.5	91.4	99.7	105	107	105	101	93.0	82.8	70.7	57.5	43.9	32.2	29.2
130	31.0	32.6	43.5	55.0	66.2	76.8	86.1	93.3	97.9	99.6	98.4	94.3	87.8	79.1	68.8	57.2	45.7	35.3	33.1
135	35.0	35.1	44.2	54.8	64.7	73.6	81.4	87.5	91.5	93.0	92.0	88.6	83.0	75.6	66.9	57.1	46.8	37.4	36.3
140	38.6	34.9	42.2	54.2	63.7	71.1	77.2	82.2	85.6	87.0	86.1	83.2	78.4	72.4	65.2	56.1	46.1	37.6	38.6
145	41.0	34.6	42.1	53.7	61.3	68.4	73.6	77.4	80.0	81.0	80.4	78.1	74.5	69.7	63.1	54.4	43.5	37.2	41.3
150	43.6	35.8	41.5	51.6	57.9	65.2	69.9	73.0	75.4	75.8	75.2	73.5	70.7	66.3	58.8	52.4	42.5	37.2	43.3
155	46.1	36.3	41.7	49.6	55.1	59.4	65.0	68.5	70.3	70.9	70.5	69.0	66.2	60.7	55.0	50.7	42.8	38.2	48.6
160	46.2	35.2	36.5	44.6	52.7	55.4	57.7	60.2	62.9	64.0	63.8	62.3	58.2	54.2	49.6	43.7	39.0	37.6	45.6
165	45.5	35.0	32.4	33.1	45.9	54.4	56.1	56.9	57.9	59.0	59.5	55.4	47.4	40.5	37.1	34.3	35.0	37.4	42.0
170	44.3	35.0	31.8	31.0	31.3	36.9	42.7	51.2	59.3	59.2	47.1	34.3	34.7	34.0	33.8	34.0	34.9	35.8	37.7
175	43.3	40.1	39.0	38.6	42.1	46.1	47.4	47.1	40.2	19.7	41.4	44.5	44.9	44.8	42.7	41.0	38.7	36.9	36.8
180	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

C(DEG) / γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255	255		
5	254	254	254	254	254	254	254	254	254	254	254	254	254	254	254	254	254		
10	250	251	251	251	252	252	253	253	253	253	253	253	252	252	252	251	251		
15	245	245	246	247	249	250	251	251	252	251	251	250	249	248	247	246	246		
20	237	238	240	242	244	246	248	249	249	249	248	247	245	243	241	240	238		
25	228	230	232	235	239	242	244	246	246	246	244	242	239	236	233	231	229		
30	217	219	223	227	232	236	240	242	243	242	240	237	233	228	224	220	218		
35	204	207	212	219	225	231	235	238	239	238	235	231	225	219	213	208	205		
40	189	193	201	209	217	224	230	233	234	233	230	224	217	209	202	195	190		
45	172	179	188	198	208	217	224	228	229	228	224	217	209	199	189	180	174		
50	155	163	175	187	200	210	217	222	224	222	217	210	199	188	175	164	156		
55	136	147	161	176	190	202	211	216	218	216	211	202	190	176	161	148	137		
60	116	130	147	165	181	194	204	210	212	210	204	194	180	164	147	130	117		
65	95.6	113	134	154	172	186	197	204	206	203	197	186	171	154	133	113	96.4		
70	75.1	95.8	120	143	163	179	190	197	199	196	189	178	162	142	119	95.5	75.7		
75	55.4	80.3	108	133	155	171	183	190	192	189	182	170	153	132	107	79.6	55.9		
80	38.0	66.7	96.8	124	146	163	175	182	185	182	174	162	145	122	95.3	65.6	38.3		
85	24.9	56.1	87.4	115	138	156	168	175	177	174	166	154	136	113	85.6	54.6	24.7		
90	17.9	48.6	79.6	107	130	148	160	167	169	166	159	146	128	105	77.5	46.7	17.1		
95	15.2	43.6	73.3	100	122	140	152	160	162	159	151	138	120	97.7	70.9	41.4	14.1		
100	15.9	40.0	67.6	93.2	115	132	144	151	153	151	143	130	113	90.7	65.1	37.6	14.2		
105	18.5	38.4	63.0	86.8	107	124	135	142	144	142	134	122	105	84.1	60.2	35.7	16.5		
110	22.7	38.6	59.3	80.9	100	115	126	133	135	132	125	113	97.6	78.2	56.6	35.8	20.4		
115	27.1	40.1	57.4	75.8	93.1	107	118	124	125	123	116	105	90.6	73.1	54.3	36.8	24.8		
120	31.5	42.2	56.5	72.0	86.7	99.4	109	114	116	114	108	97.5	84.3	69.1	53.3	38.7	29.2		
125	36.0	44.6	56.3	69.3	81.7	92.3	100	106	107	105	99.3	90.4	79.3	66.4	53.1	41.5	33.6		
130	40.3	47.1	56.6	67.3	77.7	86.5	93.3	97.4	98.6	96.8	92.1	84.7	75.3	64.5	53.5	44.4	38.0		
135	44.3	49.6	57.2	65.8	74.3	81.6	87.2	90.6	91.5	90.0	86.0	79.9	72.1	63.3	54.5	47.4	42.1		
140	46.7	52.1	57.9	64.7	71.4	77.3	81.8	84.6	85.4	84.1	80.8	75.8	69.5	62.5	55.8	50.3	45.9		
145	49.6	54.4	58.7	63.9	69.0	73.6	77.2	79.3	79.9	78.9	76.3	72.4	67.5	62.2	57.1	52.9	48.7		
150	51.7	55.9	59.3	63.3	67.0	70.5	73.2	74.8	75.2	74.4	72.5	69.5	65.9	62.0	58.4	55.3	51.6		
155	55.2	57.0	59.8	62.8	65.4	67.9	69.8	70.9	71.2	70.7	69.3	67.2	64.7	62.2	59.7	57.4	54.4		
160	55.3	58.3	57.6	61.6	64.2	65.7	67.0	67.7	67.9	67.6	66.8	65.5	63.9	62.3	60.9	59.1	55.6		
165	48.5	52.5	56.9	58.5	62.6	64.1	64.7	65.2	65.4	65.3	64.9	64.2	63.4	62.4	61.6	60.7	57.5		
170	40.1	42.4	45.2	50.1	56.7	62.2	63.5	63.4	63.5	63.5	63.4	63.1	62.8	62.3	61.5	59.9	56.4		
175	35.8	36.0	35.7	36.3	38.6	46.2	56.4	60.4	60.7	60.8	60.4	59.8	59.0	58.5	57.6	54.1	48.8		
180	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8		

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

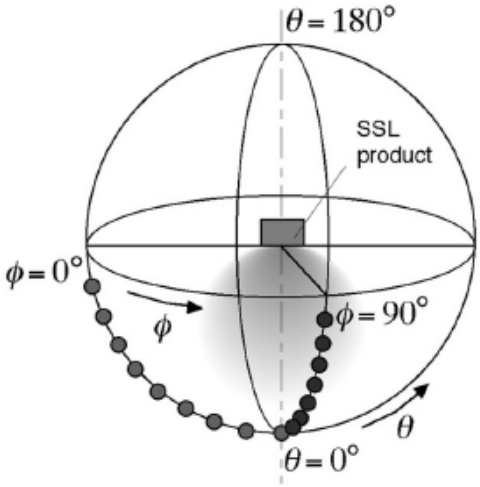
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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