LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube

Model: 11.5T8/4F/840/DEB/RC

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, Yuhang Dist, Hangzhou, Zhejiang Province, China 311100

Tel: +86 571 86376106

www.ledtestlab.com

Report No.: HZ18120037k/R1

This report is replaced the old report No. HZ18120037k dated Jan. 18, 2019.

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

Review by: April Zou

Engineer: April Zou

Feb. 20, 2019

Approved by: Zhang

Manager: Jim Zhang

Feb. 20, 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: **11.5T8/4F/840/DEB/RC**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
152.5	1839.0	12.06	0.9775

CCT (K)	CRI	Stabilization Time (Light & Power)
4066	83.1	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	: 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	: 11.5T8/4F/840/DEB/RC
Electrical Ratings	: 120-277V, 50/60Hz, 11.5W
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)	0.103	0.048
Power Factor	0.9775	0.9279
Test Power (W)	12.06	12.37
THD A%	19.46	19.07
Luminous Efficacy (lm/W)	152.5	149.6
Total Luminous Flux (lm)	1839.0	1851.0
Color Rendering Index (CRI)	83.1	
R9	9.5	
Correlated Color Temperature (CCT)(K)	4066	
Chromaticity Chroma x	0.3782	
Chromaticity Chroma y	0.3778	
Chromaticity Chroma u	0.2232	
Chromaticity Chroma v	0.3345	
Duv	0.0006	
Chromaticity Chroma u ’	0.2232	
Chromaticity Chroma v’	0.5017	

Special Color Rendering Indices	
R1	81.2
R2	89.2
R3	94.9
R4	81.6
R5	81.2
R6	84.8
R7	86.5
R8	65.1
R9	9.5
R10	74.2
R11	80.4
R12	60.7
R13	83.2
R14	97.3
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 25.1℃.

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)	0.103
Power Factor	0.9773
Test Power (W)	12.05
Luminous Efficacy (lm/W)	151.8
Total Luminous Flux (lm)	1829.0
Beam Angle (°)	153.6
Center Beam Candle Power (cd)	329
Spacing Criteria	1.25(0 °-180 °)/ 1.40 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	44.99%
Zonal Lumens in the 60 °-90 °Zone	26.45%
Zonal Lumens in the 90 °-120 °Zone	16.58%
Zonal Lumens in the 120 °-180 °Zone	11.98%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

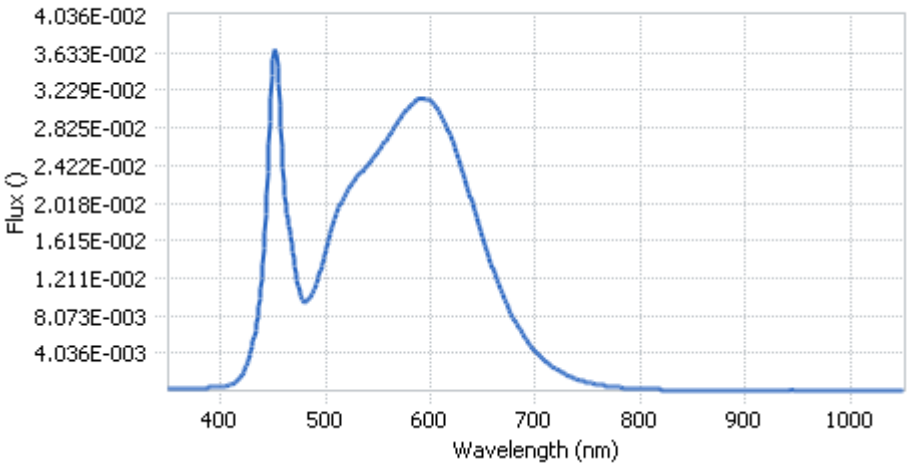
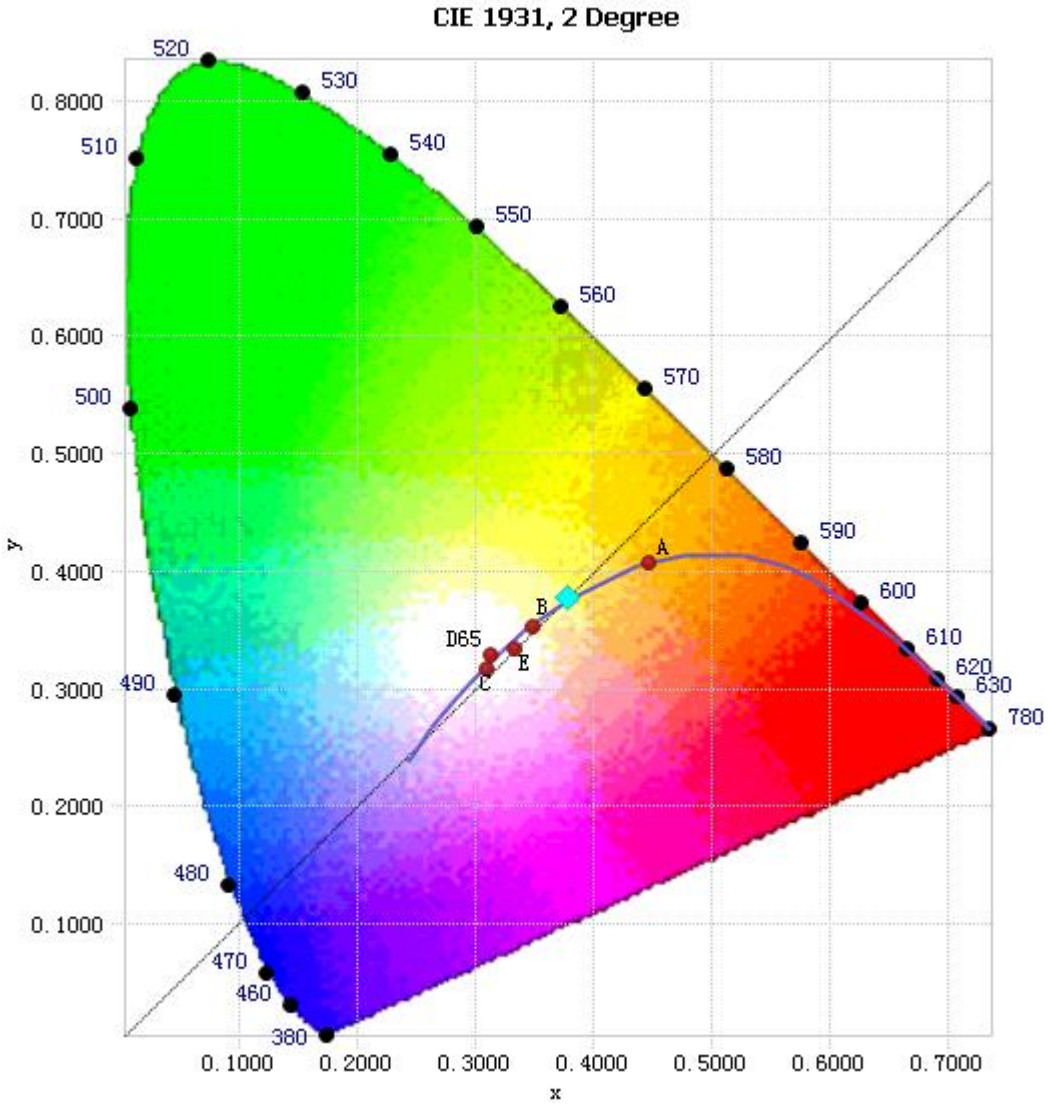


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.09E-04	485	1.00E-02	590	3.14E-02	695	4.92E-03
385	3.20E-04	490	1.11E-02	595	3.14E-02	700	4.24E-03
390	3.54E-04	495	1.30E-02	600	3.12E-02	705	3.65E-03
395	3.72E-04	500	1.52E-02	605	3.05E-02	710	3.12E-03
400	4.11E-04	505	1.73E-02	610	2.96E-02	715	2.67E-03
405	5.05E-04	510	1.89E-02	615	2.85E-02	720	2.31E-03
410	6.83E-04	515	2.04E-02	620	2.71E-02	725	1.96E-03
415	1.02E-03	520	2.14E-02	625	2.55E-02	730	1.69E-03
420	1.66E-03	525	2.22E-02	630	2.38E-02	735	1.43E-03
425	2.82E-03	530	2.30E-02	635	2.19E-02	740	1.23E-03
430	4.80E-03	535	2.36E-02	640	2.00E-02	745	1.05E-03
435	8.11E-03	540	2.42E-02	645	1.81E-02	750	9.02E-04
440	1.36E-02	545	2.50E-02	650	1.63E-02	755	7.78E-04
445	2.36E-02	550	2.57E-02	655	1.46E-02	760	6.68E-04
450	3.56E-02	555	2.65E-02	660	1.29E-02	765	5.79E-04
455	3.31E-02	560	2.73E-02	665	1.14E-02	770	4.94E-04
460	2.22E-02	565	2.82E-02	670	1.00E-02	775	4.23E-04
465	1.77E-02	570	2.91E-02	675	8.73E-03	780	3.75E-04
470	1.42E-02	575	2.99E-02	680	7.62E-03		
475	1.07E-02	580	3.06E-02	685	6.60E-03		
480	9.60E-03	585	3.12E-02	690	5.71E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y) : (0.3782,0.3778)

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

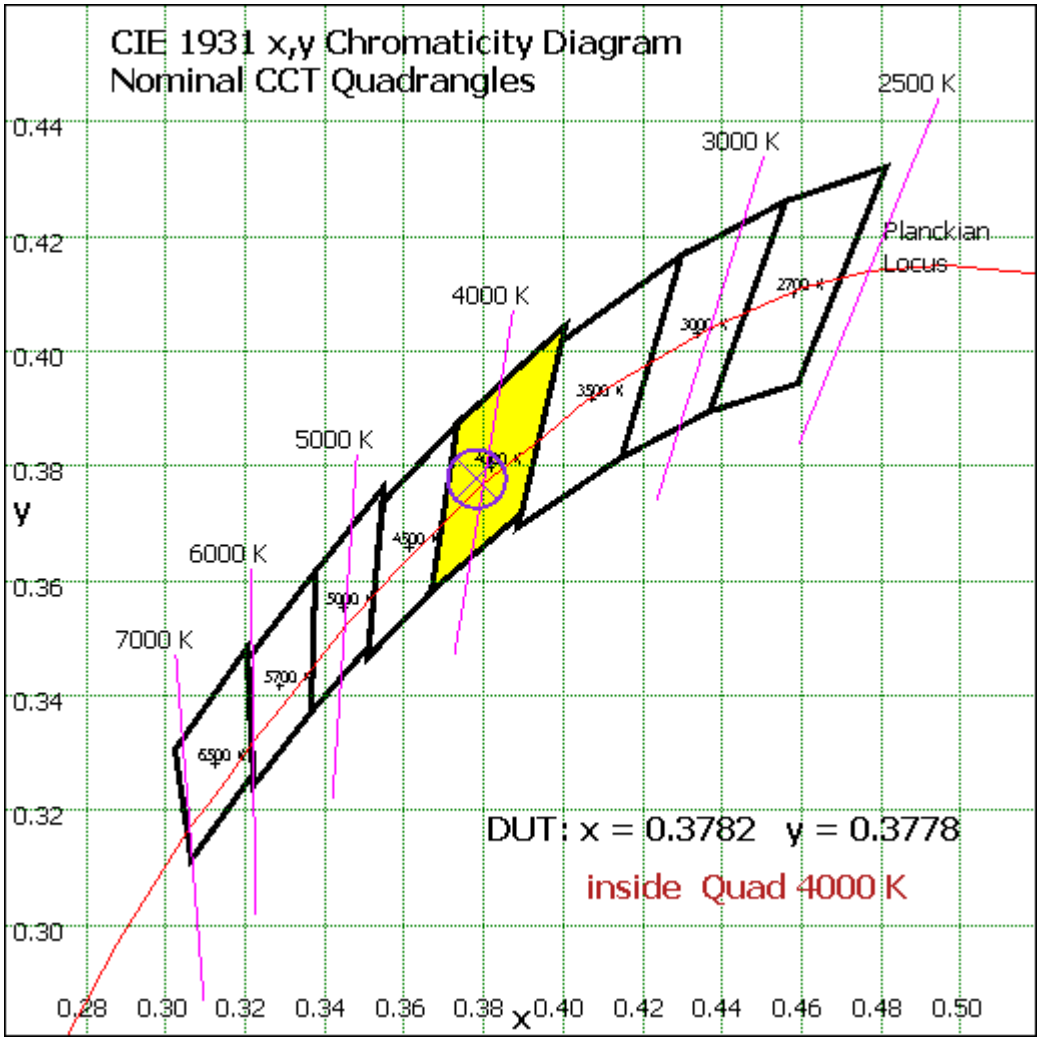


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	31.173	1.70%
10- 20	90.115	4.93%
20- 30	139.413	7.62%
30- 40	174.423	9.54%
40- 50	192.832	10.54%
50- 60	194.878	10.65%
60- 70	183.167	10.01%
70- 80	162.169	8.87%
80- 90	138.515	7.57%
90-100	118.355	6.47%
100-110	100.549	5.50%
110-120	84.257	4.61%
120-130	69.456	3.80%
130-140	56.095	3.07%
140-150	43.042	2.35%
150-160	29.874	1.63%
160-170	16.037	0.88%
170-180	4.647	0.25%
Total	1829.0	100%

γ(°)	Lumens	% Total
0- 60	822.834	44.99%
60- 90	483.851	26.45%
0-90	1306.685	71.44%
90- 180	522.312	28.56%
0- 180	1829.0	100%

Table 5: Zonal Lumen Data

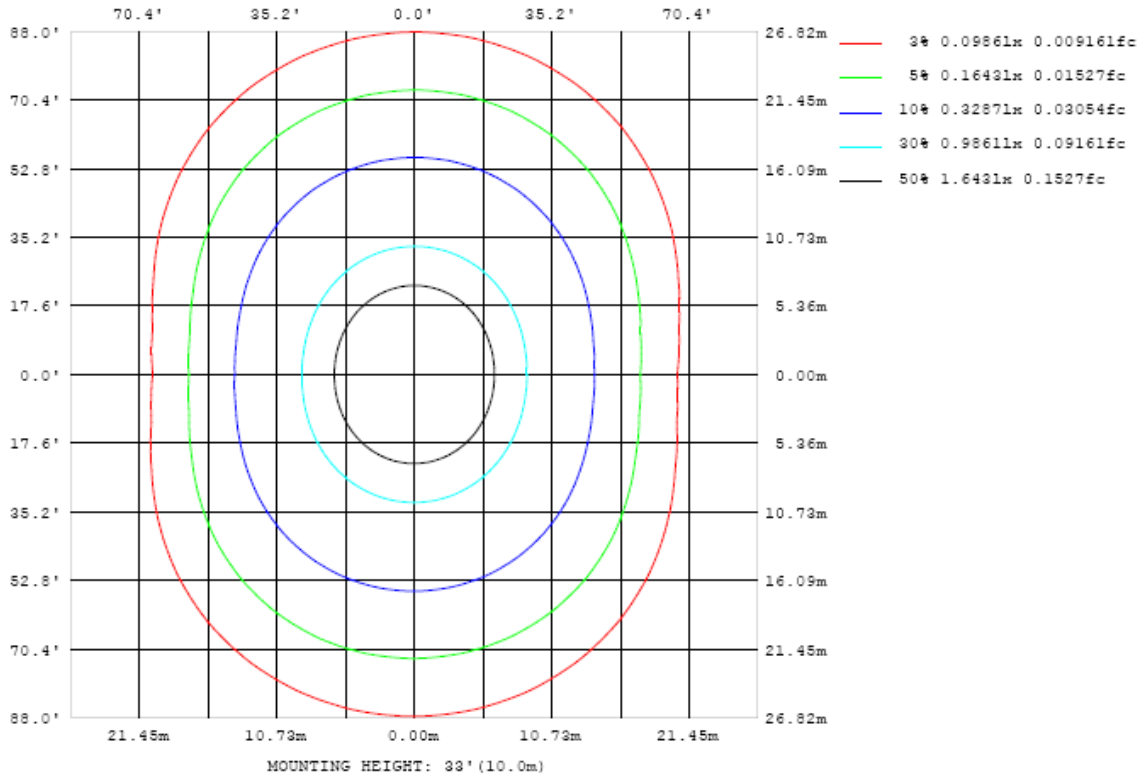


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

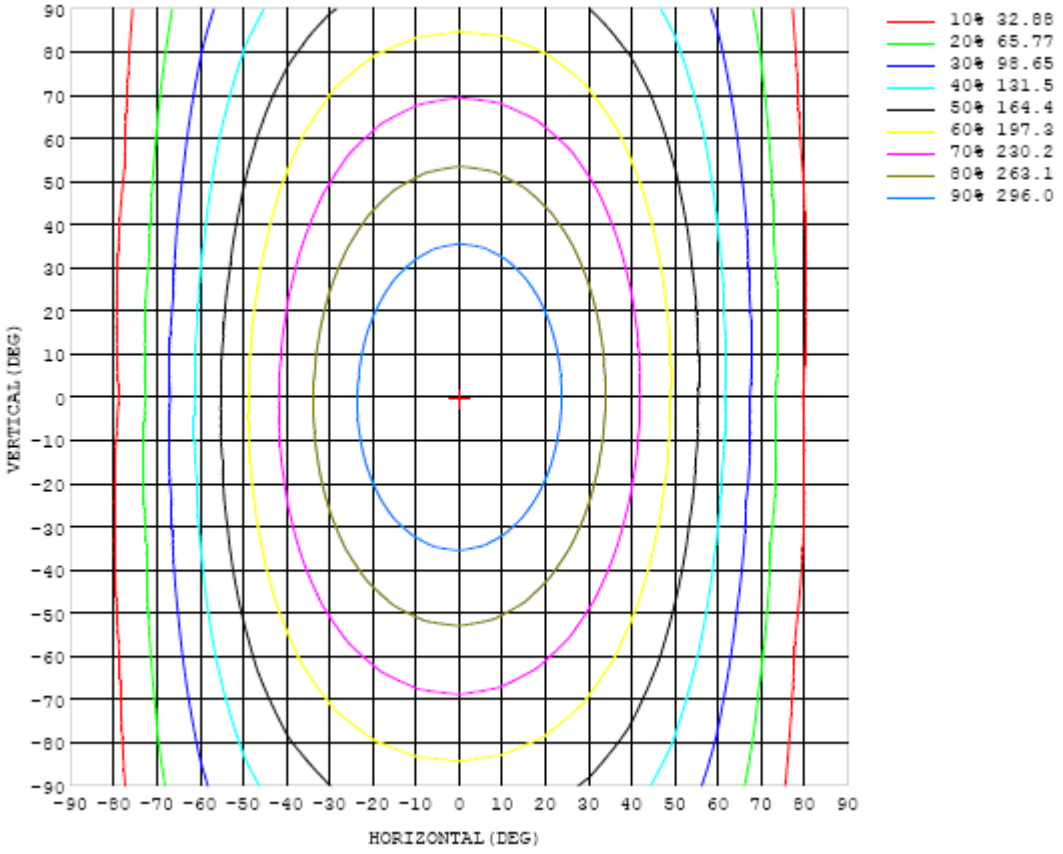


Chart 5: Isocandela Plot

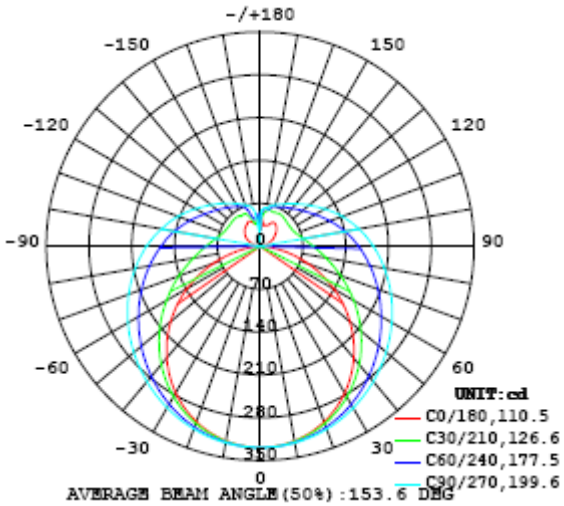


Chart 6: Polar Candela Distribution

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	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329
5	327	327	327	328	328	328	328	328	328	328	328	328	328	328	328	328	327	327	327
10	323	323	323	324	324	325	325	326	326	326	326	326	325	325	324	324	323	323	323
15	316	316	316	317	318	320	321	322	322	323	322	322	321	320	319	317	316	316	315
20	305	306	307	308	310	313	315	316	317	318	318	317	315	313	311	309	307	306	305
25	292	293	294	297	300	304	307	310	311	312	311	310	308	305	301	298	295	293	292
30	277	277	280	284	289	293	298	301	304	305	304	302	299	295	290	285	281	278	276
35	259	260	263	269	275	282	288	292	296	297	296	293	289	283	277	270	264	260	258
40	238	240	245	252	261	269	277	283	287	288	287	284	278	271	262	254	246	240	238
45	216	218	224	234	245	256	265	272	277	279	278	274	267	258	247	236	226	219	215
50	192	195	203	215	229	242	253	262	267	269	268	263	255	245	232	218	205	195	191
55	166	170	181	196	213	228	241	251	257	259	258	252	243	231	216	199	183	170	165
60	140	144	158	177	196	214	229	239	246	249	247	241	231	217	200	180	160	145	139
65	112	118	135	158	181	201	217	228	236	238	237	230	219	204	185	162	138	118	110
70	83.8	91.4	113	140	166	188	205	217	225	228	226	219	208	191	170	145	117	92.5	81.2
75	56.7	66.5	93.2	124	152	175	194	207	214	217	215	208	196	179	157	129	97.8	68.3	53.0
80	31.1	44.5	75.6	109	139	164	182	196	204	206	205	198	185	168	144	115	81.4	47.7	28.5
85	10.6	27.0	62.3	97.1	128	153	171	185	193	196	194	187	175	157	133	103	68.6	32.1	7.95
90	0.77	17.3	52.3	87.0	118	142	161	174	182	185	183	176	164	147	123	93.6	59.6	23.7	0.48
95	1.83	13.9	45.6	78.8	108	133	151	164	172	175	173	166	154	137	114	85.4	53.1	20.3	2.15
100	4.93	14.7	41.2	71.6	99.7	123	141	154	161	164	162	156	144	127	105	78.4	48.6	20.8	5.53
105	9.28	17.9	39.5	66.5	91.9	114	131	143	151	153	152	145	134	118	97.4	72.5	46.2	23.1	10.3
110	14.2	22.4	39.6	62.4	85.0	105	121	133	140	143	141	135	124	110	90.4	68.6	46.0	27.1	15.3
115	19.7	27.4	40.7	60.0	79.4	97.6	112	123	130	132	131	125	115	102	84.4	65.9	47.0	31.6	20.7
120	24.6	31.8	43.0	58.7	75.3	90.8	104	114	120	122	121	116	107	94.6	80.0	64.3	48.6	36.2	25.8
125	28.9	35.2	45.9	58.2	72.1	85.4	96.6	105	110	113	112	107	99.3	89.1	76.6	63.5	50.6	39.2	29.8
130	33.5	40.0	48.9	58.6	70.2	81.0	90.5	97.9	102	104	103	99.6	93.2	84.4	73.9	63.1	52.9	41.9	32.8
135	37.6	44.2	51.7	59.4	68.5	77.3	85.4	91.5	95.6	97.0	96.3	93.1	87.6	80.4	71.8	63.1	55.1	46.6	36.0
140	41.3	47.1	53.5	60.5	67.5	74.4	80.9	86.0	89.3	90.6	90.0	87.3	82.9	77.0	70.6	63.6	56.4	49.9	38.7
145	44.1	49.4	54.6	61.8	66.8	72.0	77.1	81.1	83.8	84.9	84.4	82.3	78.8	74.1	69.2	64.2	56.1	50.0	40.7
150	44.5	50.8	56.8	62.1	66.8	70.9	73.8	76.9	78.9	79.8	79.5	77.9	75.2	71.7	68.2	64.1	56.9	50.9	42.2
155	41.7	51.4	57.4	60.8	66.2	69.0	71.2	73.4	74.9	75.5	75.3	74.2	72.2	70.2	67.9	61.7	57.0	55.3	45.0
160	36.4	51.0	59.5	59.8	63.1	67.7	69.5	70.5	71.5	71.9	71.8	71.1	70.0	69.0	65.2	58.1	54.0	48.8	42.7
165	36.3	45.6	58.9	61.8	61.4	61.9	65.0	67.8	68.7	69.2	68.8	68.9	67.7	64.9	59.8	52.6	46.7	43.9	39.3
170	34.3	40.3	52.9	58.2	60.5	62.7	63.2	63.1	63.2	63.6	64.0	64.6	62.8	57.0	49.5	42.5	42.9	42.4	37.9
175	42.0	42.3	45.2	50.5	55.6	57.5	58.5	60.5	61.5	61.6	62.4	58.1	47.9	39.2	36.8	40.6	41.7	42.4	44.3
180	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1

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	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329	329		
5	327	327	327	328	328	328	328	328	328	328	328	328	328	328	328	327	327		
10	323	323	323	324	325	325	325	326	326	326	325	325	325	324	324	323	323		
15	315	316	317	318	319	321	321	322	322	322	322	321	320	318	317	316	316		
20	305	306	308	310	312	314	316	317	317	317	316	315	313	311	308	307	306		
25	292	294	297	300	303	307	309	311	312	311	310	307	304	301	298	295	293		
30	277	280	284	288	293	298	301	304	305	304	302	299	294	289	285	281	278		
35	259	263	269	275	282	288	293	296	297	296	293	289	283	276	270	264	260		
40	239	244	252	261	269	277	283	287	288	287	284	278	271	262	254	246	240		
45	217	224	234	245	256	266	273	278	279	278	274	267	258	247	236	226	219		
50	194	203	215	229	243	254	263	268	270	268	264	256	245	232	218	205	196		
55	169	180	196	213	229	242	252	258	260	258	253	244	231	216	199	184	171		
60	143	158	177	197	215	230	241	247	250	248	242	232	218	200	181	162	147		
65	116	135	159	182	202	218	230	237	240	238	231	220	205	185	163	140	121		
70	89.8	113	141	167	189	207	219	226	229	227	220	209	192	171	146	119	95.4		
75	64.4	93.2	125	154	177	195	208	216	218	216	209	197	180	158	131	99.6	70.9		
80	42.4	76.0	111	141	165	184	197	205	207	205	198	186	168	145	116	82.7	49.4		
85	26.1	62.6	98.9	130	155	173	186	194	197	195	188	175	158	134	104	69.0	32.7		
90	17.7	53.3	89.0	120	144	162	175	183	186	184	177	165	148	123	93.7	58.9	23.0		
95	15.0	46.7	80.5	110	134	153	165	172	175	173	166	155	137	114	84.8	51.5	18.8		
100	16.3	42.9	73.5	102	125	142	155	161	164	162	156	144	127	105	77.2	46.4	18.4		
105	19.3	41.6	68.1	93.7	115	132	144	151	154	152	145	134	118	96.3	71.0	43.8	20.6		
110	24.0	42.1	64.5	87.1	107	123	134	141	143	141	135	124	109	89.0	66.3	43.1	24.3		
115	28.6	43.6	62.5	81.8	99.1	114	124	130	132	131	125	115	101	83.0	63.3	43.8	28.5		
120	32.8	45.6	61.5	77.9	92.8	105	115	120	122	121	115	106	93.8	78.5	61.6	45.5	33.2		
125	35.7	48.0	61.0	74.9	87.7	98.6	106	111	113	112	107	99.0	88.2	75.0	60.8	47.6	37.4		
130	39.2	50.5	61.2	72.4	83.3	92.6	99.4	104	105	104	99.6	92.8	83.6	72.4	60.8	50.1	40.4		
135	42.1	52.0	61.4	70.7	79.4	87.3	93.1	96.7	98.0	96.8	93.2	87.4	79.7	70.4	60.9	52.6	43.7		
140	44.2	53.3	61.4	69.5	76.4	82.6	87.4	90.4	91.5	90.5	87.5	82.7	76.4	68.9	61.3	54.2	46.8		
145	45.3	55.2	60.6	67.7	73.8	78.7	82.5	84.8	85.8	84.9	82.5	78.6	73.5	67.9	61.6	56.0	49.1		
150	45.7	57.2	58.8	65.0	71.5	75.2	78.0	79.8	80.5	79.9	78.1	75.3	71.5	66.7	61.7	57.8	49.9		
155	43.3	54.5	58.5	59.8	65.9	72.3	74.1	75.5	76.1	75.7	74.5	72.5	69.2	65.4	62.7	56.9	47.1		
160	39.1	45.1	51.4	54.8	57.7	64.5	70.8	71.6	71.9	71.7	70.7	69.0	66.8	64.8	63.9	51.9	41.8		
165	37.0	37.9	41.8	44.4	47.3	49.7	56.6	65.5	67.5	67.5	67.1	66.4	64.7	63.6	60.0	42.2	37.7		
170	35.7	37.0	37.6	41.2	43.3	46.1	42.3	43.4	60.3	64.4	63.5	60.7	57.4	50.4	41.0	38.0	36.6		
175	44.4	46.1	47.9	48.9	49.9	50.0	50.6	47.2	26.1	40.1	50.2	50.1	48.2	48.5	47.9	45.7	43.3		
180	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1	38.1		

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

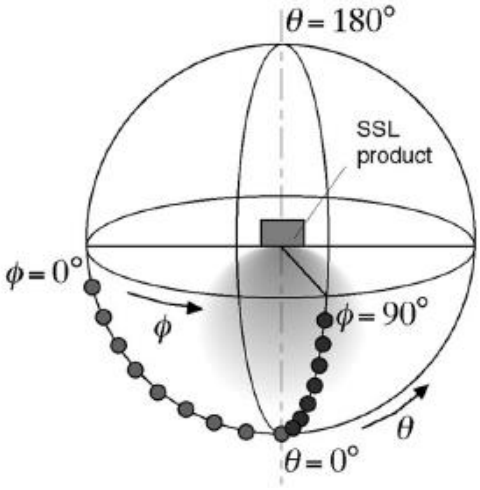
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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