



## LM-79-08 Test Report

for

### GREEN CREATIVE LTD

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

### LED Tube

**Model: 11.5T5HO/2F/840/BYP**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ19020002x

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. 22, 2019

Approved by:



*Jim Zhang*

Manager: Jim Zhang  
Feb. 22, 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: 11.5T5HO/2F/840/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
139.0	1500.0	10.79	0.9796
CCT (K)	CRI	Stabilization Time (Light & Power)	
4020	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** : Feb. 01, 2019

**Date of Test** : Feb. 12, 2019

**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 Photo



Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Tube
<b>Model</b>	: 11.5T5HO/2F/840/BYP
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 11.5W
<b>Product Description</b>	: 4000K
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: 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)	0.092	0.043
Power Factor	0.9796	0.9419
Test Power (W)	10.79	11.20
THD A%	18.78	18.83
Luminous Efficacy (lm/W)	139.0	133.9
Total Luminous Flux (lm)	1500.0	1500.0
Color Rendering Index (CRI)	82.1	
R9	3.1	
Correlated Color Temperature (CCT)(K)	4020	
Chromaticity Chroma x	0.3811	
Chromaticity Chroma y	0.3824	
Chromaticity Chroma u	0.2233	
Chromaticity Chroma v	0.3361	
Duv	0.0017	
Chromaticity Chroma u'	0.2233	
Chromaticity Chroma v'	0.5041	

Special Color Rendering Indices	
R1	79.8
R2	87.6
R3	94.4
R4	81.8
R5	80.3
R6	83.5
R7	86.1
R8	63.3
R9	3.1
R10	71.3
R11	81.1
R12	62.7
R13	81.5
R14	97
Rf	84
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 25.1 °C.

The photometric distance is 2.47m.

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)	0.092
Power Factor	0.9797
Test Power (W)	10.83
Luminous Efficacy (lm/W)	136.5
Total Luminous Flux (lm)	1478.2
Beam Angle ( °)	116.8
Center Beam Candle Power (cd)	412
Spacing Criteria	1.21 (0 °-180 °)/ 1.30 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	63.39%
Zonal Lumens in the 60 °-90 °Zone	25.92%
Zonal Lumens in the 90 °-120 °Zone	8.24%
Zonal Lumens in the 120 °-180 °Zone	2.45%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

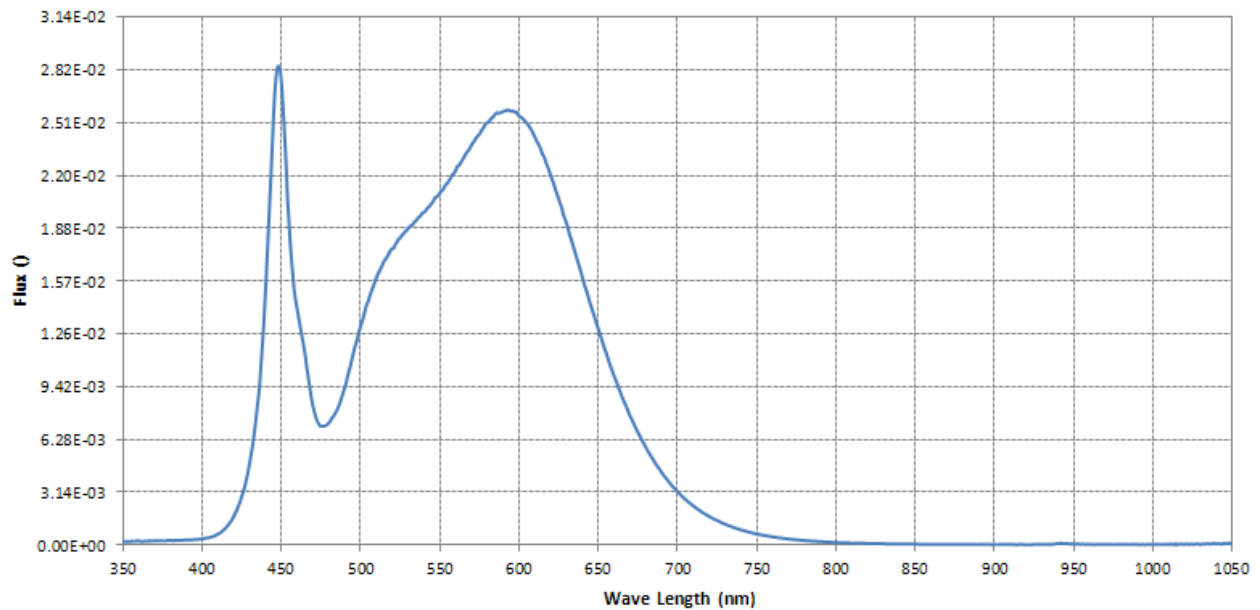
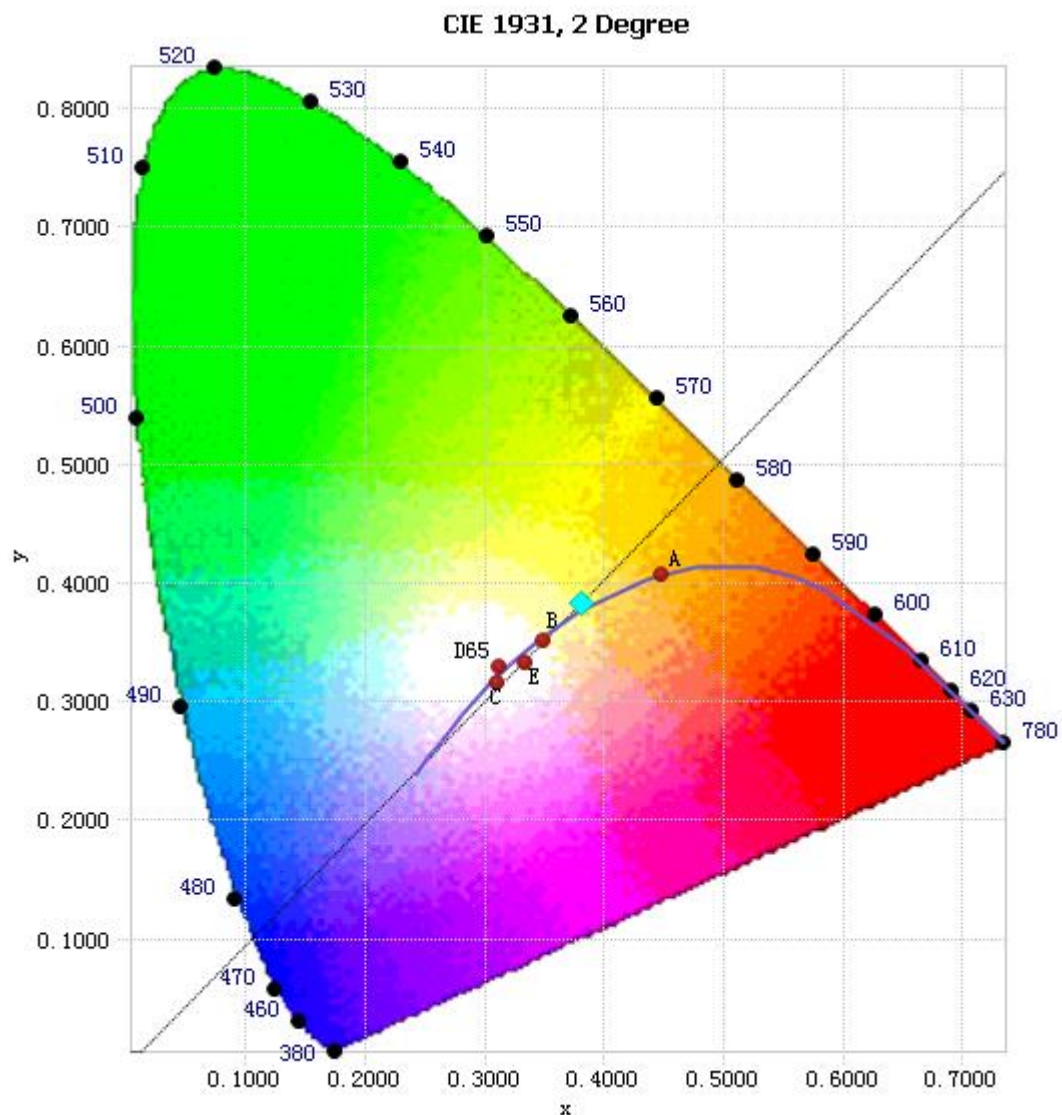


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.76E-04	485	7.97E-03	590	2.58E-02	695	3.72E-03
385	2.71E-04	490	9.33E-03	595	2.58E-02	700	3.20E-03
390	2.93E-04	495	1.12E-02	600	2.55E-02	705	2.72E-03
395	3.29E-04	500	1.30E-02	605	2.51E-02	710	2.33E-03
400	3.63E-04	505	1.45E-02	610	2.43E-02	715	1.99E-03
405	4.51E-04	510	1.59E-02	615	2.32E-02	720	1.71E-03
410	6.56E-04	515	1.69E-02	620	2.20E-02	725	1.47E-03
415	1.02E-03	520	1.76E-02	625	2.06E-02	730	1.25E-03
420	1.68E-03	525	1.82E-02	630	1.91E-02	735	1.07E-03
425	2.86E-03	530	1.88E-02	635	1.75E-02	740	9.09E-04
430	4.82E-03	535	1.93E-02	640	1.59E-02	745	7.73E-04
435	8.31E-03	540	1.98E-02	645	1.43E-02	750	6.62E-04
440	1.49E-02	545	2.03E-02	650	1.29E-02	755	5.73E-04
445	2.50E-02	550	2.09E-02	655	1.14E-02	760	4.94E-04
450	2.77E-02	555	2.15E-02	660	1.01E-02	765	4.27E-04
455	1.91E-02	560	2.22E-02	665	8.84E-03	770	3.62E-04
460	1.41E-02	565	2.30E-02	670	7.71E-03	775	3.16E-04
465	1.14E-02	570	2.38E-02	675	6.71E-03	780	2.78E-04
470	8.28E-03	575	2.44E-02	680	5.82E-03		
475	7.06E-03	580	2.51E-02	685	5.04E-03		
480	7.26E-03	585	2.56E-02	690	4.33E-03		

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

## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3811, 0.3824)

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

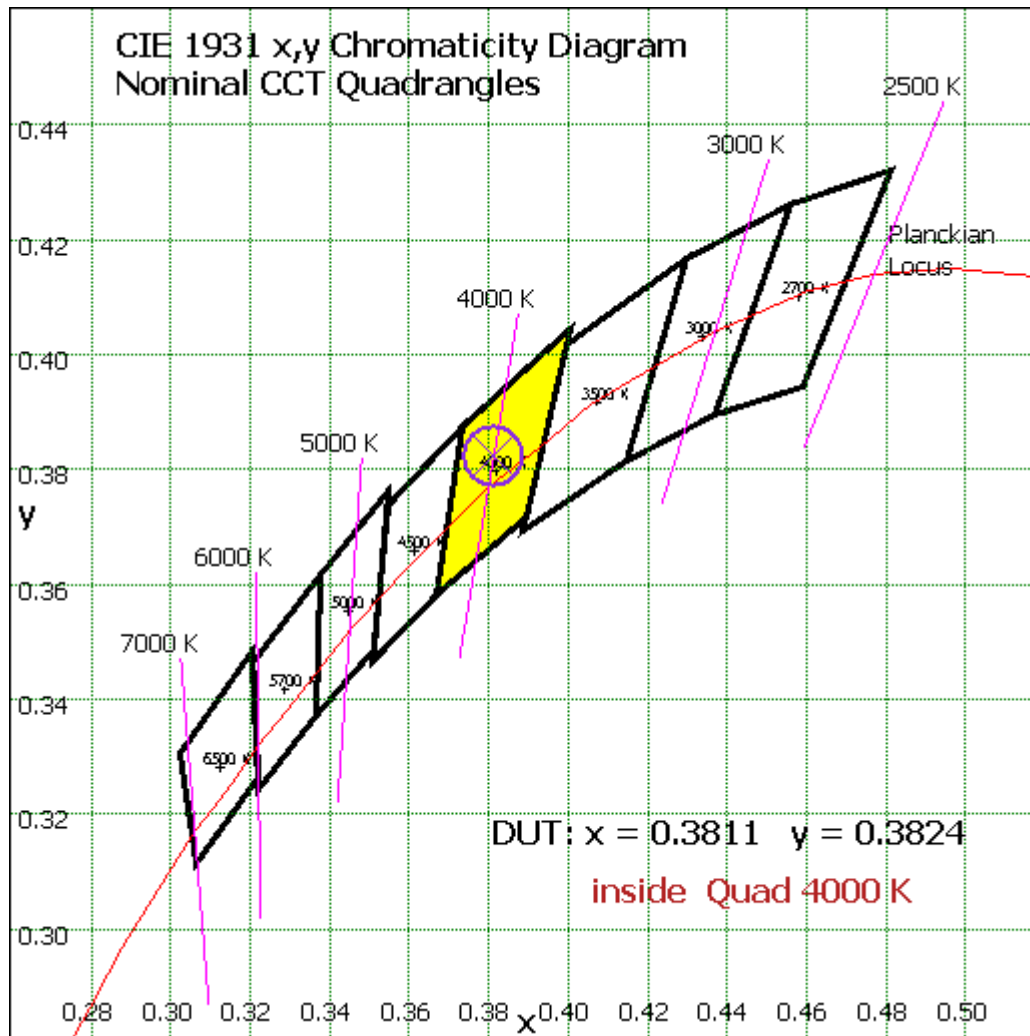


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Vector – Sphere Spectroradiometer Method

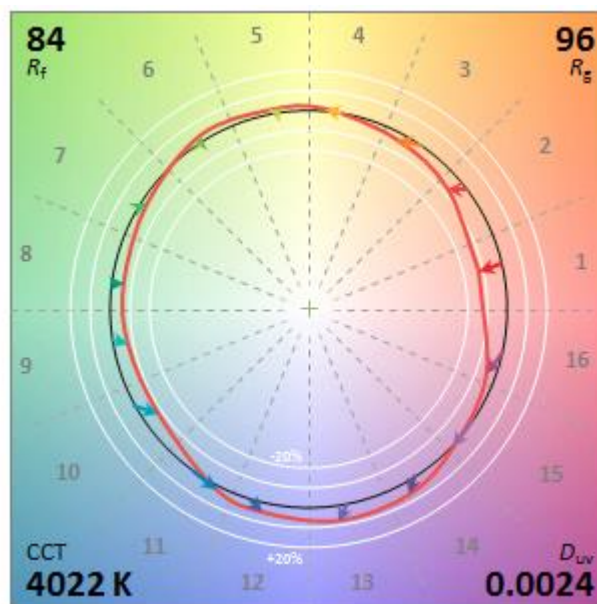


Chart 4: Color Vector Diagram of TM-30-18

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	39.082	2.64%
10- 20	111.769	7.56%
20- 30	169.074	11.44%
30- 40	203.979	13.80%
40- 50	213.567	14.45%
50- 60	199.582	13.50%
60- 70	167.978	11.36%
70- 80	127.256	8.61%
80- 90	87.872	5.94%
90-100	58.816	3.98%
100-110	38.77	2.62%
110-120	24.214	1.64%
120-130	15.168	1.03%
130-140	9.615	0.65%
140-150	5.942	0.40%
150-160	3.448	0.23%
160-170	1.702	0.12%
170-180	0.409	0.03%
Total	1478.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	937.053	63.39%
60- 90	383.106	25.92%
0-90	1320.159	89.31%
90- 180	158.084	10.69%
0- 180	1478.2	100%

Table 5: Zonal Lumen

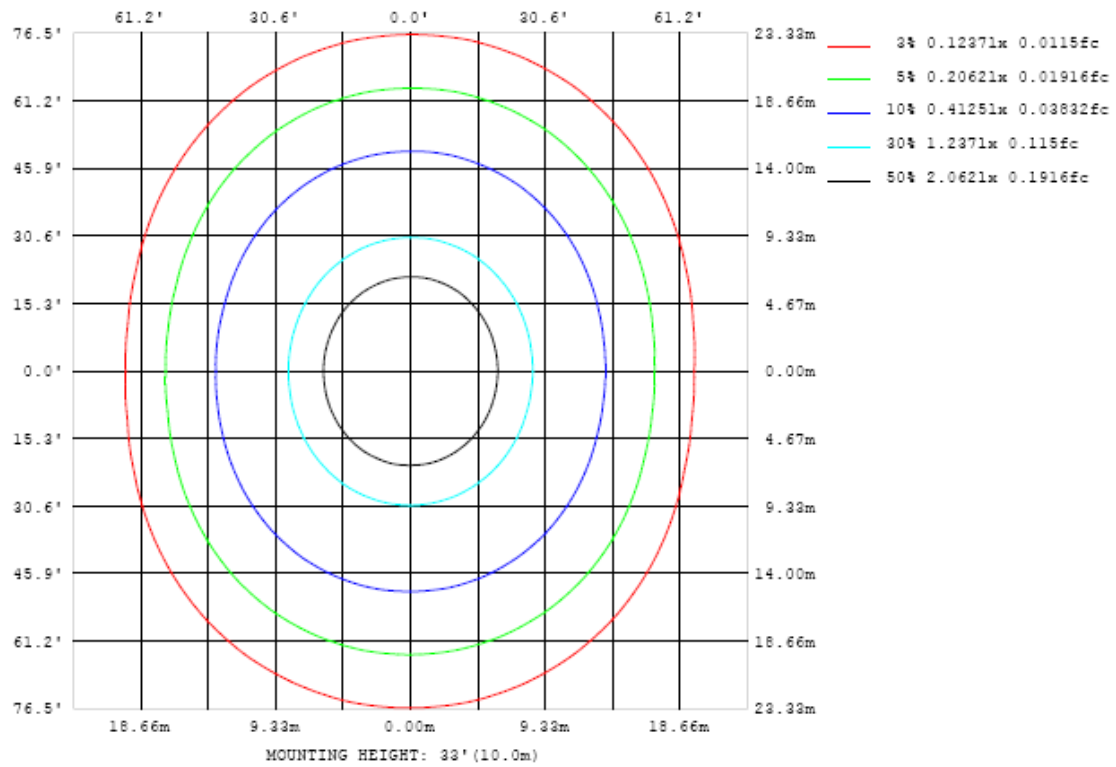


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

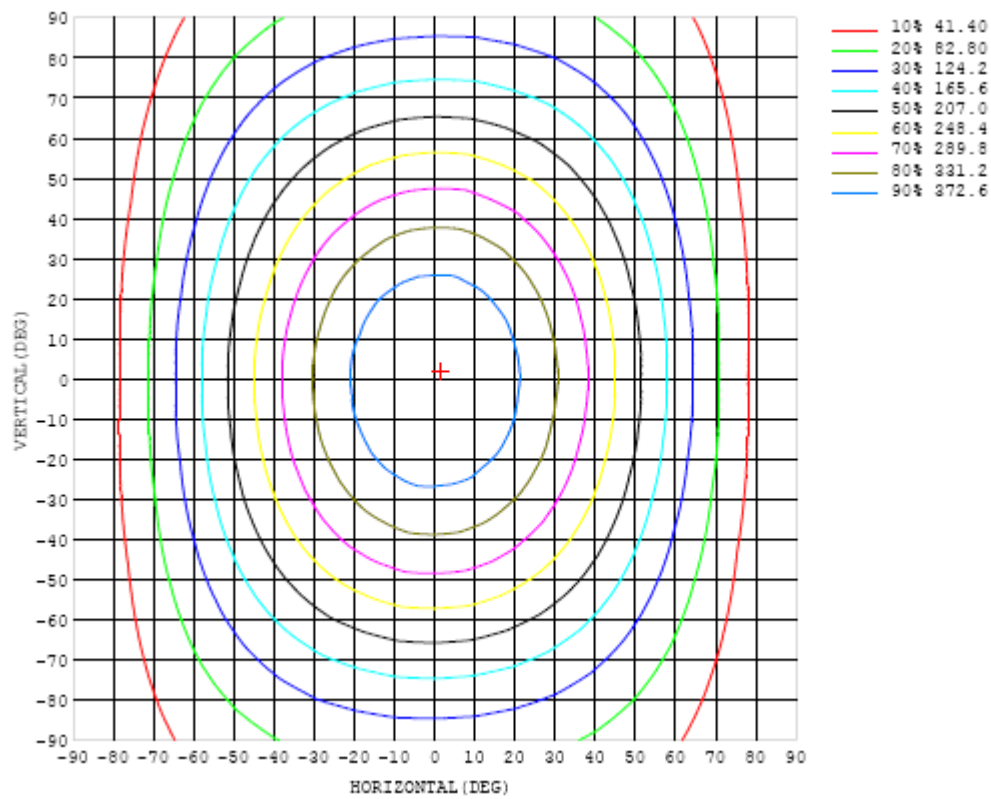


Chart 6: Isocandela Plot

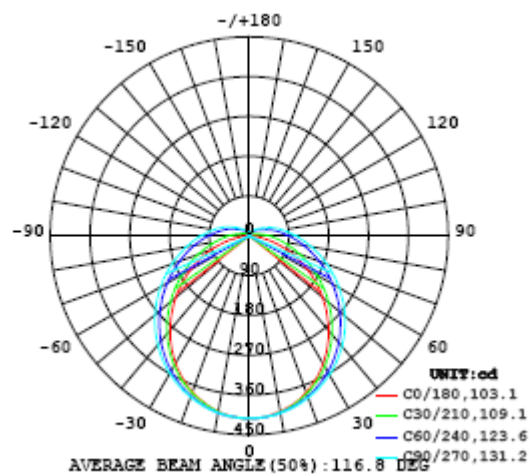


Chart 7: Polar Candela Distribution

## 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	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412
5	411	411	411	412	411	411	412	413	412	412	413	412	411	412	412	411	411	411	411
10	404	405	405	405	406	406	406	407	407	407	408	407	406	406	406	404	405	403	404
15	392	393	394	395	397	397	398	400	400	400	400	400	399	398	396	394	393	393	391
20	377	377	379	380	383	386	387	388	390	391	391	389	388	386	382	380	378	376	377
25	357	357	359	363	366	370	372	375	377	378	378	376	374	370	366	362	359	357	356
30	334	334	336	341	347	352	355	359	362	363	364	360	357	352	346	341	337	334	333
35	308	308	311	317	323	331	336	341	345	345	346	342	338	331	324	318	312	308	307
40	279	280	283	291	299	308	315	321	325	326	326	322	318	310	301	293	285	280	279
45	248	250	255	264	273	283	292	299	304	306	305	301	295	285	275	265	257	250	248
50	217	218	224	234	246	258	268	276	281	283	283	277	270	260	248	237	227	219	217
55	184	186	193	205	218	231	243	251	257	259	259	253	246	234	222	208	197	188	185
60	152	154	163	176	191	205	218	227	233	235	234	229	221	208	194	180	167	157	153
65	119	123	133	148	165	180	193	202	209	211	210	204	196	183	168	153	138	126	122
70	87.6	91.8	104	122	139	156	169	179	185	187	186	180	171	159	144	127	110	96.1	90.3
75	58.0	63.3	78.7	97.9	116	133	146	156	162	164	163	157	149	137	121	104	84.9	68.6	60.5
80	30.8	38.2	56.7	76.5	95.9	112	125	135	140	142	141	136	128	116	101	82.6	63.5	44.5	33.2
85	10.0	18.8	38.3	59.1	77.6	93.9	106	115	121	123	122	117	109	97.3	82.7	64.9	45.3	25.2	11.5
90	0.75	7.65	25.0	44.6	62.9	77.9	89.8	98.4	104	106	104	99.8	92.7	81.4	66.7	50.5	31.3	12.8	0.91
95	0.43	3.11	15.6	33.0	50.0	64.4	75.5	83.6	88.4	90.2	89.5	85.1	78.2	67.6	54.5	38.5	21.1	6.10	0.40
100	0.56	1.94	10.3	24.0	39.0	52.6	63.4	70.4	75.0	76.8	76.2	72.1	65.7	56.0	43.3	28.7	13.9	3.93	0.46
105	0.70	1.67	7.54	17.8	30.0	42.0	51.9	59.1	63.6	65.0	64.7	61.0	54.7	45.4	33.7	21.3	10.4	2.97	0.73
110	1.00	1.67	5.81	13.7	23.2	32.8	41.4	48.3	52.6	54.2	53.6	50.0	43.9	35.5	26.5	16.8	8.39	2.87	1.07
115	1.36	2.04	4.99	11.2	18.8	26.5	33.3	38.6	42.1	43.4	42.9	39.9	35.4	28.9	21.4	13.7	7.24	3.03	1.44
120	1.72	2.41	4.70	9.36	15.5	21.8	27.5	31.9	34.7	35.8	35.4	33.1	29.2	23.8	17.8	11.6	6.49	3.18	1.84
125	2.10	2.81	3.81	7.93	13.1	18.2	22.8	26.5	28.8	29.7	29.4	27.4	24.3	19.9	15.0	10.1	5.99	3.16	2.23
130	2.48	3.09	4.51	7.31	11.1	15.4	19.1	22.1	24.1	24.8	24.5	22.8	20.2	16.7	12.8	8.86	5.37	3.37	2.55
135	2.87	3.35	4.71	6.22	9.44	13.1	16.0	18.4	20.0	20.7	20.4	19.1	17.0	14.1	11.0	7.85	4.95	3.47	2.82
140	3.20	3.49	4.80	5.99	8.44	11.1	13.5	15.5	16.8	17.2	17.0	16.0	14.3	12.0	9.55	6.93	5.12	3.77	3.25
145	3.42	3.69	4.66	5.92	6.99	9.38	11.4	12.9	13.9	14.3	14.1	13.3	12.1	10.3	8.30	6.55	5.28	4.04	3.62
150	3.54	3.86	4.73	5.58	6.84	7.99	8.97	10.6	11.5	11.8	11.8	11.2	10.3	9.06	7.71	6.42	5.43	4.18	3.97
155	3.97	3.82	4.87	5.32	6.14	7.23	8.04	8.68	9.09	9.21	9.58	9.39	8.80	8.00	6.99	6.10	5.53	4.10	4.31
160	4.34	3.58	4.69	5.30	5.68	6.27	7.02	7.49	7.81	8.00	8.10	7.98	7.64	7.01	6.34	5.72	5.35	3.83	4.36
165	4.97	3.60	3.87	4.79	5.35	5.77	6.03	6.26	6.49	6.69	6.77	6.71	6.17	6.15	5.82	5.45	4.61	3.59	4.33
170	3.96	3.56	3.06	3.29	3.36	3.49	4.45	5.56	5.81	5.84	5.93	4.97	4.40	4.15	3.94	3.78	3.50	3.41	3.77
175	3.09	3.02	2.99	2.94	3.01	3.04	3.05	2.95	2.59	1.35	2.48	3.19	3.30	3.33	3.35	3.36	3.37	3.38	3.40
180	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58

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	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412		
5	410	410	411	411	411	411	412	412	411	412	411	411	410	411	412	411	410		
10	403	404	404	405	406	407	406	407	407	408	408	406	406	405	404	405	405		
15	392	393	393	395	397	397	398	399	399	400	399	398	396	395	394	393	393		
20	377	378	378	381	384	386	387	388	388	389	388	386	385	382	380	377	377		
25	357	358	360	364	367	370	373	375	375	376	374	372	368	365	362	359	358		
30	334	336	339	344	349	353	357	360	359	360	357	355	350	345	341	337	335		
35	309	310	315	322	327	332	338	340	342	342	339	335	329	323	317	312	309		
40	280	283	289	296	305	311	317	321	322	322	318	314	306	298	291	285	280		
45	250	253	261	270	279	288	295	299	301	301	296	291	282	273	263	255	250		
50	219	223	233	243	254	263	272	277	278	278	273	267	257	246	235	225	219		
55	187	193	203	216	228	239	248	253	255	255	249	242	231	219	206	195	187		
60	156	163	175	189	203	214	224	230	232	232	225	218	206	192	178	165	156		
65	125	134	149	163	178	190	200	207	208	208	202	194	181	167	151	137	125		
70	94.4	106	122	139	155	167	178	184	185	185	179	171	158	143	126	109	94.6		
75	65.8	80.2	98.8	117	133	146	156	162	164	163	157	150	137	121	103	83.4	66.7		
80	40.3	57.9	78.0	96.7	113	126	136	142	145	144	138	129	117	101	81.7	61.5	42.2		
85	20.8	39.9	60.1	79.0	95.4	108	118	124	126	125	120	111	98.8	82.9	64.1	43.7	23.5		
90	8.97	26.6	46.1	64.3	79.8	92.3	101	107	109	108	103	95.2	83.2	67.9	49.9	30.4	11.7		
95	3.94	17.9	35.2	52.1	66.6	78.3	87.1	92.4	94.0	93.3	88.4	81.0	69.6	55.3	38.9	21.2	5.83		
100	2.47	11.4	26.8	42.0	55.5	66.3	74.4	79.4	81.1	80.2	75.7	68.7	58.2	45.1	30.0	14.4	3.61		
105	2.17	8.44	19.6	33.2	45.7	55.8	63.2	67.8	69.6	68.6	64.7	58.0	48.3	36.0	22.3	10.3	2.92		
110	2.41	6.95	15.1	25.4	36.5	46.1	53.1	57.6	59.0	58.4	54.3	48.1	38.8	27.7	17.0	8.02	2.80		
115	2.66	6.22	12.5	20.6	28.8	36.2	42.9	47.2	48.7	47.8	44.1	37.8	30.3	21.9	13.7	6.69	2.96		
120	2.98	5.82	10.7	17.0	23.6	29.5	34.4	37.4	38.5	37.8	35.0	30.6	24.8	18.2	11.5	6.13	3.17		
125	3.29	5.60	9.49	14.4	19.8	24.5	28.4	30.9	31.8	31.2	29.0	25.4	20.6	15.2	9.88	5.87	3.46		
130	3.54	5.52	8.64	12.5	16.8	20.5	23.7	25.7	26.5	26.0	24.1	21.2	17.4	13.0	8.88	5.81	3.77		
135	3.69	5.45	7.89	10.9	14.2	17.3	19.8	21.5	22.1	21.7	20.2	17.9	14.8	11.3	8.21	5.78	4.08		
140	4.11	5.48	7.37	9.74	12.2	14.6	16.7	18.0	18.5	18.2	17.0	15.1	12.7	10.1	7.71	5.80	4.36		
145	4.40	5.48	7.01	8.78	10.7	12.5	14.0	15.0	15.4	15.2	14.2	12.8	11.0	9.08	7.26	5.84	4.50		
150	4.72	5.53	6.72	8.00	9.38	10.7	11.8	12.5	12.8	12.6	11.9	10.9	9.64	8.22	6.92	5.89	4.67		
155	4.63	5.31	6.44	7.33	8.28	9.21	9.99	10.5	10.7	10.6	10.1	9.42	8.52	7.56	6.67	5.83	4.91		
160	4.96	5.24	6.02	6.75	7.41	7.99	8.50	8.83	8.96	8.91	8.62	8.20	7.67	7.07	6.50	5.81	4.84		
165	5.08	5.12	5.50	5.97	6.58	7.08	7.36	7.56	7.66	7.66	7.52	7.30	7.01	6.67	6.32	5.92	5.31		
170	4.39	4.80	5.07	5.48	5.78	5.97	6.34	6.66	6.70	6.73	6.68	6.58	6.46	6.29	6.11	5.97	5.10		
175	3.46	3.65	3.77	3.86	4.24	4.66	4.71	4.97	5.48	5.77	5.93	5.95	5.96	5.95	5.77	5.04	3.82		
180	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58		

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  $4\pi$ . 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  $10^\circ$  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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