

## LM-79-08 TEST REPORT

for

### GREEN CREATIVE LTD

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

### LED Tube

**Model: 10PLL/835/GL/BYP**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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

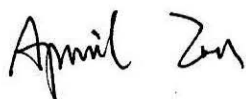
Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ19050037c

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

Review by:



Engineer: April Zou  
May 31, 2019

Approved by:



Manager: Jim Zhang  
May 31, 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: 10PLL/835/GL/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
140.1	1363.0	9.73	0.9979
CCT (K)	CRI	Stabilization Time (Light & Power)	
3485	82.1	60	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

### Test specifications:

<b>Date of Receipt</b>	: May 23, 2019
<b>Date of Test</b>	: May 29, 2019
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

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## SAMPLE PHOTO



Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Tube
<b>Model</b>	: 10PLL/835/GL/BYP
<b>Electrical Ratings</b>	: 120-277V, 60Hz, 10W
<b>Product Description</b>	: 3500K
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

## TEST RESULTS

Test ambient temperature was 24.8 °C.

Base orientation was base up. 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 65 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.083	0.040
Power Factor	0.9979	0.9036
Test Power (W)	9.73	9.92
THD A%	17.25	23.31
Luminous Efficacy (lm/W)	140.1	137.2
Total Luminous Flux (lm)	1363.0	1361.0
Color Rendering Index (CRI)	82.1	
R9	2.3	
Correlated Color Temperature (CCT)(K)	3485	
Chromaticity Chroma x	0.4067	
Chromaticity Chroma y	0.3929	
Chromaticity Chroma u	0.2357	
Chromaticity Chroma v	0.3416	
Duv	0.0004	
Chromaticity Chroma u'	0.2357	
Chromaticity Chroma v'	0.5124	

Special Color Rendering Indices	
R1	80.1
R2	90
R3	96.2
R4	80
R5	80.3
R6	86.8
R7	83.6
R8	59.5
R9	2.3
R10	76.7
R11	78.9
R12	65.6
R13	82.5
R14	98.4

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 2.47 m.

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)	0.083
Power Factor	0.9800
Power (W)	9.72
Luminous Efficacy (lm/W)	137.9
Total Luminous Flux (lm)	1339.9
Beam Angle ( ° )	99.6 (0°-180°) / 113.5 (90°-270°)
Center Beam Candle Power (cd)	405
Maximum Beam Candle Power (cd)	405.2 (At: C=240.0, Gamma=0.5)
Spacing Criteria	1.20 (0°-180°) / 1.33 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	66.45%
Zonal Lumens in the 60 °-90 °Zone	21.37%
Zonal Lumens in the 90 °-120 °Zone	7.09%
Zonal Lumens in the 120 °-180 °Zone	5.09%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

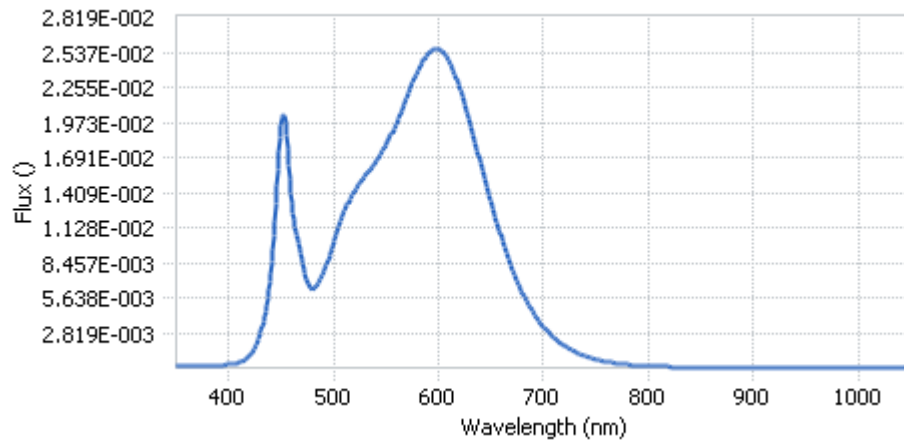


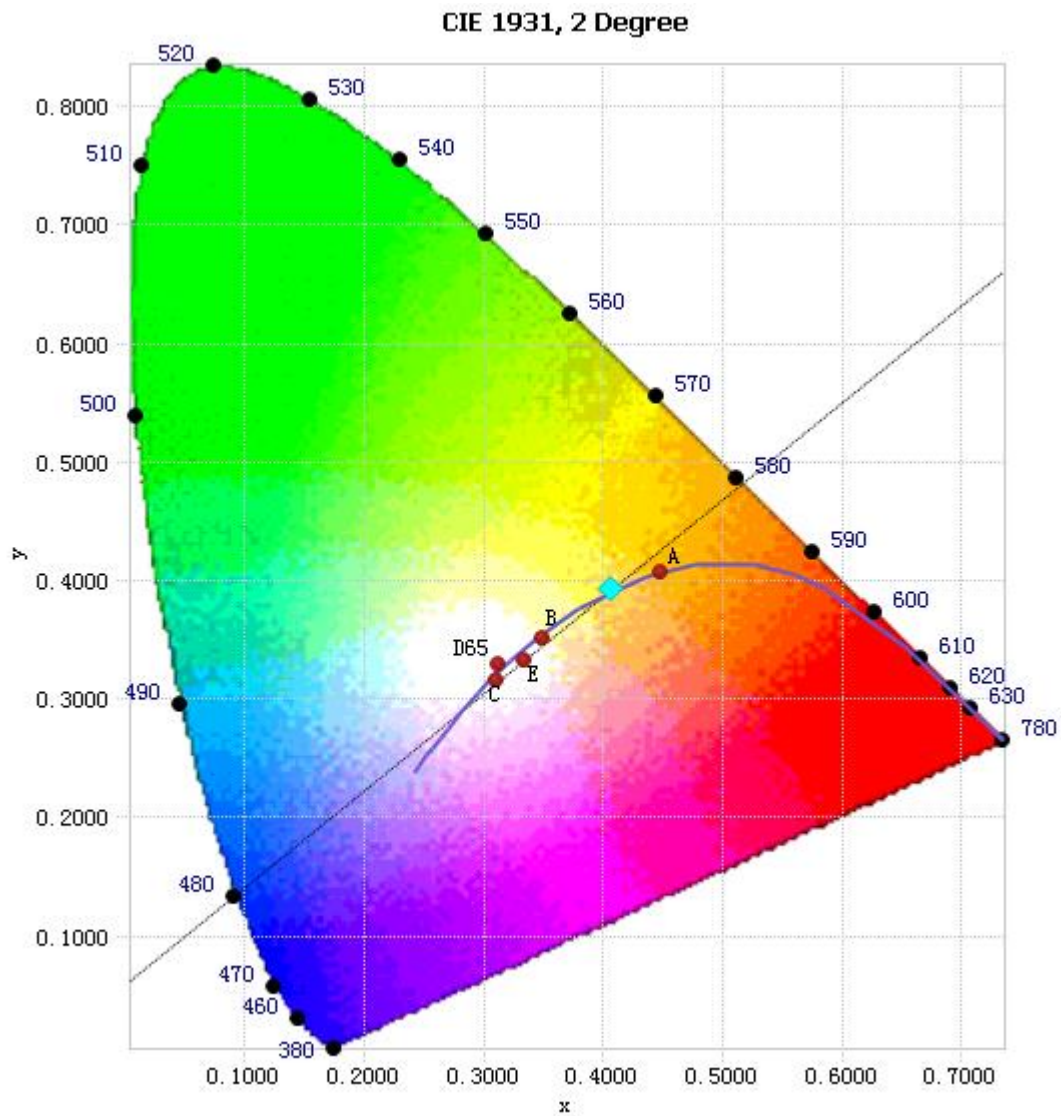
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.10E-04	485	6.79E-03	590	2.53E-02	695	3.85E-03
385	1.93E-04	490	7.59E-03	595	2.56E-02	700	3.31E-03
390	2.17E-04	495	8.75E-03	600	2.56E-02	705	2.83E-03
395	2.30E-04	500	1.02E-02	605	2.53E-02	710	2.42E-03
400	2.60E-04	505	1.15E-02	610	2.47E-02	715	2.07E-03
405	3.22E-04	510	1.25E-02	615	2.38E-02	720	1.76E-03
410	4.39E-04	515	1.36E-02	620	2.25E-02	725	1.51E-03
415	6.53E-04	520	1.42E-02	625	2.11E-02	730	1.30E-03
420	1.01E-03	525	1.49E-02	630	1.97E-02	735	1.10E-03
425	1.64E-03	530	1.55E-02	635	1.80E-02	740	9.41E-04
430	2.73E-03	535	1.60E-02	640	1.64E-02	745	8.06E-04
435	4.57E-03	540	1.66E-02	645	1.48E-02	750	6.89E-04
440	7.59E-03	545	1.72E-02	650	1.33E-02	755	5.89E-04
445	1.32E-02	550	1.79E-02	655	1.18E-02	760	5.09E-04
450	1.95E-02	555	1.88E-02	660	1.05E-02	765	4.35E-04
455	1.87E-02	560	1.97E-02	665	9.16E-03	770	3.78E-04
460	1.32E-02	565	2.07E-02	670	7.99E-03	775	3.24E-04
465	1.07E-02	570	2.18E-02	675	6.96E-03	780	2.80E-04
470	8.78E-03	575	2.29E-02	680	6.03E-03		
475	6.86E-03	580	2.39E-02	685	5.22E-03		
480	6.36E-03	585	2.47E-02	690	4.50E-03		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4067, 0.3929)

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

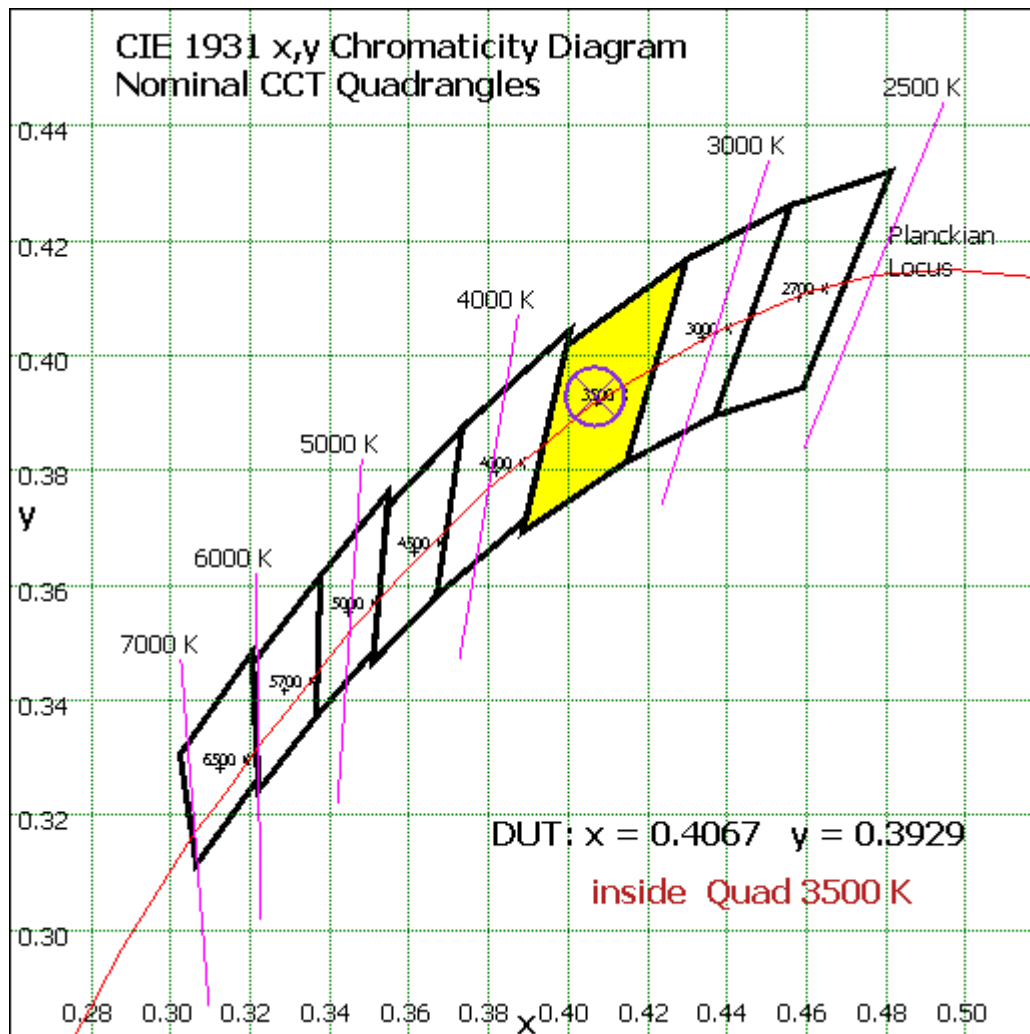
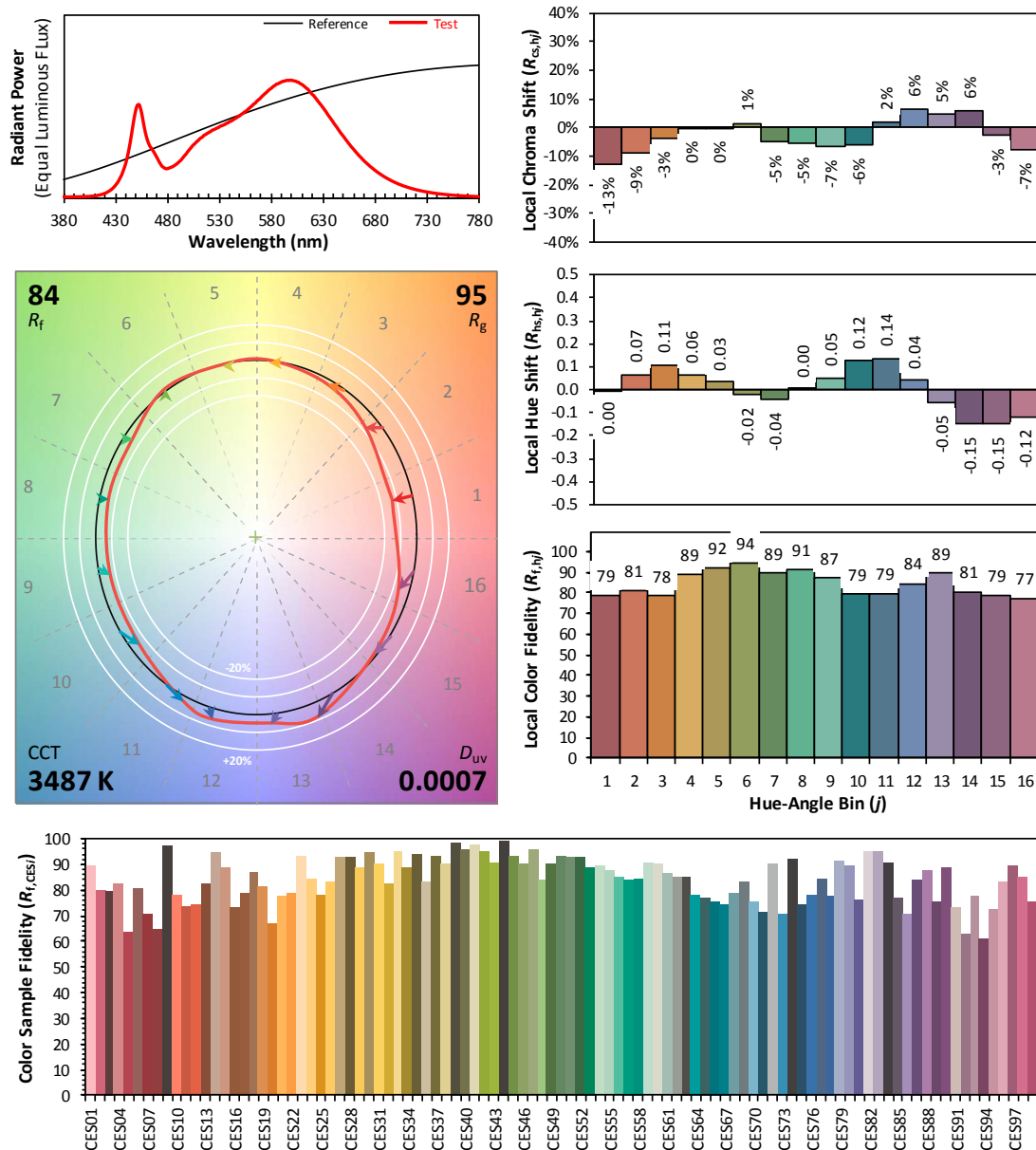


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Rendition Report – Sphere Spectroradiometer Method



**Notes:** This is a recommended method for displaying ANSI/IES TM-30-18 information.

$x$  0.4067  
 $y$  0.3929  
 $u'$  0.2357  
 $v'$  0.5124

Chart 4: Full Report Created with the IES TM-30 Calculator

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	38.203	2.85%
10- 20	108.651	8.11%
20- 30	163.818	12.23%
30- 40	197.284	14.72%
40- 50	203.383	15.18%
50- 60	179.053	13.36%
60- 70	135.78	10.13%
70- 80	92.902	6.93%
80- 90	57.618	4.30%
90-100	39.046	2.91%
100-110	30.6	2.28%
110-120	25.363	1.89%
120-130	21.969	1.64%
130-140	18.178	1.36%
140-150	13.471	1.01%
150-160	8.797	0.66%
160-170	4.706	0.35%
170-180	1.073	0.08%
Total	1339.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	890.392	66.45%
60- 90	286.3	21.37%
0-90	1176.692	87.82%
90- 180	163.203	12.18%
0- 180	1339.9	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

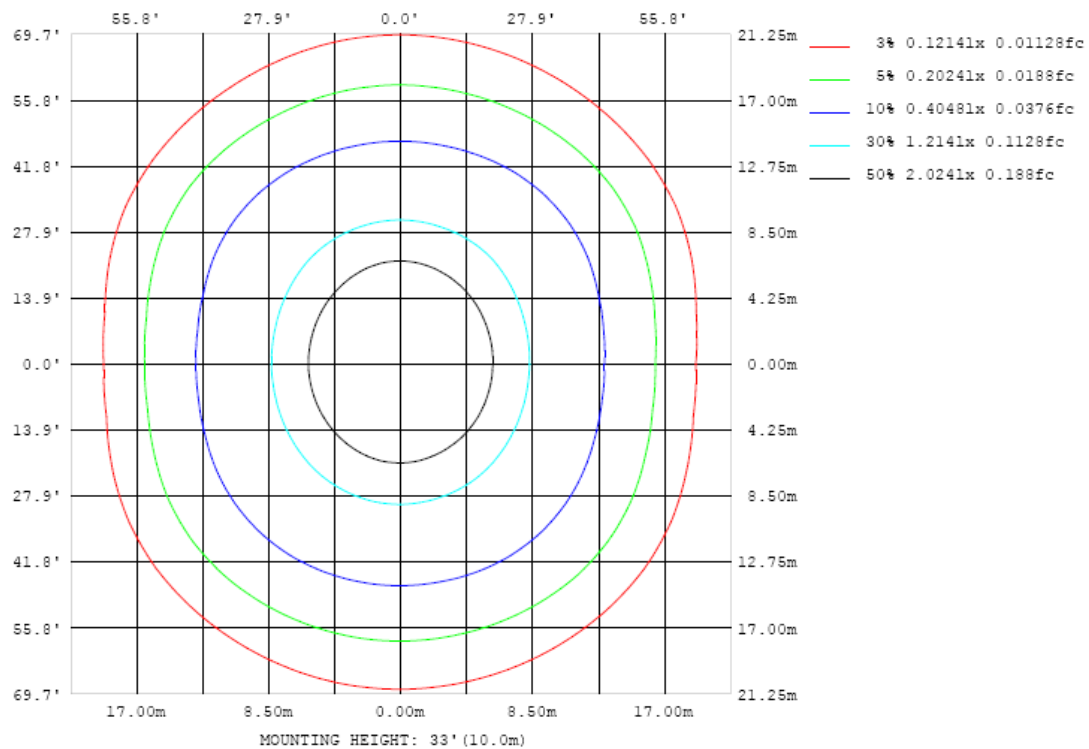


Chart 5: Illuminance Plot (Footcandles)

# Luminous Intensity Distribution Plots- Goniophotometer Method

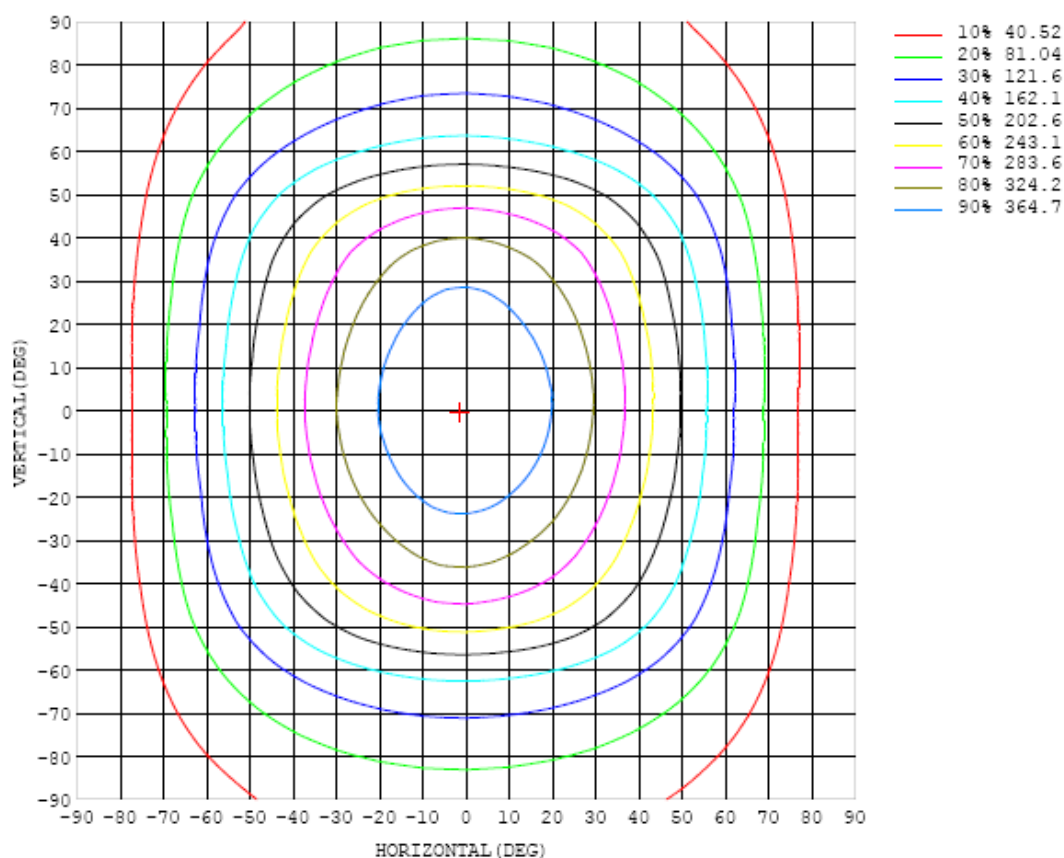


Chart 6: Isocandela Plot

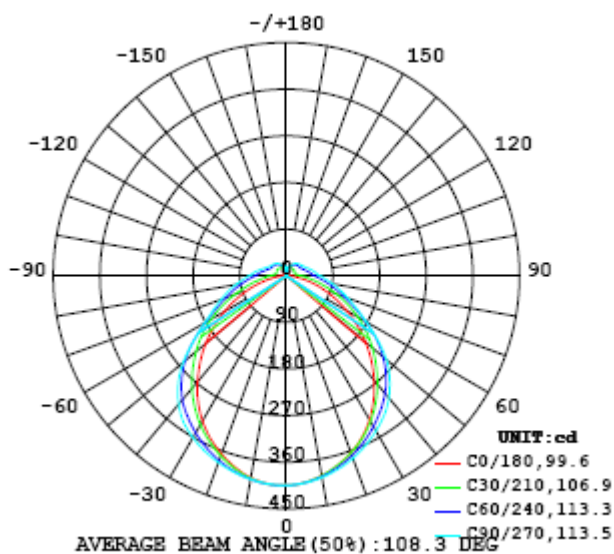


Chart 7: Polar Candela Distribution

## 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	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405
5	401	401	401	401	401	401	401	402	402	402	402	402	403	403	403	403	403	403	403
10	392	392	392	392	393	393	394	395	395	395	396	396	396	396	396	395	395	396	396
15	380	379	379	380	381	382	383	385	386	386	387	387	386	385	384	383	383	383	383
20	364	364	364	364	366	368	370	372	374	375	376	375	373	371	369	367	366	366	366
25	345	344	345	346	349	351	354	357	360	361	362	360	357	354	351	348	347	346	347
30	321	321	322	325	329	332	336	340	344	346	346	344	339	335	330	327	324	323	324
35	293	293	296	300	306	312	317	322	326	329	329	325	320	314	308	303	299	297	297
40	263	264	267	273	281	289	297	301	305	308	308	304	298	292	284	277	271	267	267
45	232	233	237	245	255	265	272	276	280	283	282	278	274	267	259	249	241	236	236
50	199	201	207	217	228	237	244	248	250	252	252	249	245	239	231	220	210	204	203
55	166	169	176	188	199	207	212	213	213	214	214	214	213	209	202	192	180	172	170
60	134	137	147	159	169	175	176	177	177	178	178	177	177	176	171	162	150	140	138
65	103	107	119	130	138	142	145	147	148	149	149	148	145	143	139	133	122	110	107
70	74.4	79.4	91.9	101	108	114	119	123	125	126	126	124	120	116	110	104	94.9	82.6	77.5
75	48.9	55.2	66.7	75.8	84.3	91.9	98.1	103	106	107	107	104	99.4	93.5	86.1	78.0	69.6	58.6	51.1
80	26.6	33.9	44.5	55.1	65.0	73.4	80.5	85.7	88.9	90.2	89.6	86.7	81.7	75.0	66.6	57.4	47.0	36.8	28.6
85	9.61	15.9	26.9	38.3	49.1	58.5	66.0	71.2	74.5	75.8	75.1	72.1	67.2	60.1	51.0	40.6	29.4	18.4	11.4
90	0.18	5.88	15.9	26.8	37.2	46.5	54.0	59.5	62.8	64.0	63.3	60.5	55.4	48.2	39.2	29.0	18.0	7.63	0.32
95	0.55	3.27	11.9	22.1	32.2	41.1	48.3	53.8	56.9	58.2	57.5	54.7	49.8	43.0	34.3	24.3	14.1	4.78	1.22
100	1.71	4.18	9.74	19.0	28.2	36.6	43.4	48.6	51.8	53.0	52.4	49.7	45.0	38.6	30.5	21.5	12.4	5.59	2.22
105	2.44	5.52	9.86	17.0	25.3	32.9	39.3	44.0	47.0	48.2	47.7	45.2	41.0	35.0	27.7	19.9	12.8	6.95	3.60
110	3.08	6.38	10.7	16.7	23.5	30.0	35.7	40.0	42.7	43.8	43.3	41.2	37.4	32.2	25.9	19.7	14.2	8.67	4.88
115	4.15	7.63	12.4	17.0	22.8	28.3	32.9	36.5	38.8	39.9	39.6	37.7	34.6	30.2	25.4	20.6	15.7	9.95	6.12
120	5.06	8.88	13.5	17.6	22.6	27.5	31.3	34.2	36.2	37.1	36.7	35.3	32.8	29.5	25.7	21.3	16.3	10.9	7.33
125	6.19	9.98	13.8	18.5	22.6	27.1	30.6	33.0	34.6	35.3	35.1	34.0	32.0	29.2	25.7	21.8	16.5	11.5	8.39
130	6.72	10.7	14.3	18.7	22.8	26.6	29.8	32.0	33.4	34.1	33.9	32.9	31.2	28.7	25.5	21.1	16.6	12.2	9.15
135	6.87	9.88	14.8	18.4	22.5	26.1	28.9	30.9	32.2	32.7	32.6	31.7	30.1	27.9	24.6	20.3	16.5	12.8	9.94
140	7.61	10.1	15.1	18.0	21.4	24.9	27.7	29.5	30.6	31.1	30.9	30.1	28.7	26.2	22.9	19.6	16.5	13.6	10.7
145	8.24	10.2	15.0	17.9	20.3	23.1	25.4	27.4	28.8	29.3	29.0	28.0	26.3	24.0	21.5	19.0	16.6	14.3	11.3
150	9.06	11.9	15.3	17.8	19.6	21.5	23.2	24.7	25.7	26.1	25.9	25.1	23.9	22.2	20.4	18.5	16.8	14.9	11.7
155	9.63	12.6	16.4	17.8	19.0	20.3	21.5	22.5	23.1	23.4	23.3	22.8	21.9	20.8	19.5	18.2	16.9	15.2	12.3
160	9.98	13.2	16.9	17.8	18.6	19.4	20.1	20.8	21.2	21.4	21.3	21.0	20.4	19.6	18.6	17.6	15.9	14.1	12.2
165	10.1	12.8	16.9	17.8	18.2	18.3	18.4	18.9	19.5	19.6	19.6	19.3	18.7	17.5	16.4	15.3	14.5	13.1	12.3
170	8.60	10.2	13.4	16.7	17.3	17.0	16.9	16.8	16.4	16.3	16.2	15.9	15.4	14.9	13.9	13.6	13.1	11.8	12.0
175	6.48	6.54	6.37	6.47	7.06	7.34	7.80	10.5	14.1	15.0	14.1	12.0	11.1	11.0	10.7	10.6	10.6	10.5	10.5
180	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47

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	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405		
5	403	403	404	404	404	404	404	404	403	403	403	403	403	402	402	402	401		
10	396	396	397	398	399	399	399	399	399	399	398	397	396	395	394	393	393		
15	383	384	386	387	389	391	392	393	392	392	390	388	386	384	382	381	381		
20	367	368	370	373	376	380	383	384	384	383	380	377	373	371	368	366	365		
25	348	349	352	357	361	366	371	373	373	372	368	363	359	355	351	348	346		
30	325	327	332	337	344	350	356	360	361	359	354	348	343	336	331	326	323		
35	299	303	309	317	325	332	340	345	346	343	338	331	324	316	308	301	296		
40	269	275	283	294	304	313	318	323	324	321	317	312	303	293	282	272	267		
45	238	245	256	269	279	286	291	295	296	293	290	286	279	267	254	243	236		
50	206	215	228	241	250	255	258	260	260	258	257	255	249	240	226	213	204		
55	174	184	199	210	216	219	219	218	218	217	217	218	215	209	198	183	172		
60	143	155	168	176	180	180	181	182	182	181	180	180	179	175	167	154	141		
65	112	126	137	143	146	149	153	155	156	154	152	149	146	142	136	125	111		
70	84.0	97.4	106	113	119	125	130	133	134	133	129	125	119	112	106	96.7	83.2		
75	59.1	70.5	79.6	88.6	97.3	105	111	115	116	114	111	105	97.1	88.4	79.2	70.0	58.5		
80	37.1	47.4	58.3	69.1	79.1	87.6	94.0	98.0	99.2	97.6	93.7	87.4	79.0	69.1	58.2	47.0	36.4		
85	18.6	29.7	41.6	53.2	63.8	72.5	79.1	82.9	84.2	82.7	78.9	72.5	63.9	53.4	41.7	29.6	18.1		
90	7.27	18.5	30.5	41.9	52.2	60.6	66.8	70.4	71.5	70.2	66.5	60.4	52.1	41.9	30.5	18.6	7.31		
95	4.87	14.1	25.3	36.3	46.1	54.0	59.9	63.2	64.2	63.0	59.6	53.9	46.1	36.4	25.4	14.1	4.30		
100	5.41	11.8	21.6	31.4	40.2	47.4	52.7	55.7	56.7	55.6	52.4	47.2	40.0	31.1	21.1	11.1	4.54		
105	6.58	12.0	19.7	27.9	35.6	41.9	46.6	49.2	50.0	49.1	46.3	41.6	35.2	27.2	18.5	10.8	5.95		
110	8.20	14.1	20.0	26.0	32.1	37.5	41.5	43.8	44.5	43.6	41.1	37.0	31.4	24.7	17.6	12.0	6.82		
115	9.56	15.8	20.8	25.8	30.5	34.3	37.4	39.3	39.9	39.2	37.0	33.6	29.3	23.7	18.1	13.6	7.68		
120	10.3	16.2	21.5	25.9	29.8	33.1	35.3	36.6	36.9	36.4	34.8	32.2	28.4	23.6	19.4	14.0	7.75		
125	11.2	16.4	21.9	25.9	29.4	32.1	34.1	35.2	35.5	34.9	33.5	31.3	27.9	24.1	20.0	14.4	8.74		
130	12.0	16.5	21.2	25.7	28.8	31.2	32.9	33.9	34.1	33.6	32.4	30.4	27.7	24.3	19.5	14.9	9.20		
135	12.8	16.3	20.3	24.4	27.8	30.1	31.6	32.5	32.7	32.3	31.1	29.4	27.1	23.3	19.1	15.2	10.5		
140	13.1	15.7	19.5	22.8	26.1	28.7	30.1	31.0	31.2	30.8	29.8	28.2	25.5	22.0	18.7	13.7	11.7		
145	13.3	15.4	18.1	21.5	24.0	26.2	27.9	29.0	29.3	28.9	27.7	25.8	23.6	21.1	18.5	14.8	10.9		
150	13.1	15.4	17.2	19.2	22.3	23.9	25.1	25.9	26.1	25.8	25.0	23.7	22.0	20.0	16.0	14.8	11.6		
155	12.6	15.4	17.0	17.7	20.0	21.9	22.8	23.4	23.5	23.4	22.8	21.9	20.7	17.9	14.9	15.1	12.6		
160	13.1	14.9	16.8	16.5	18.3	19.8	21.0	21.4	21.5	21.4	21.0	20.1	18.3	16.3	14.9	14.5	13.3		
165	12.4	14.3	15.8	15.5	15.8	17.2	19.3	19.8	19.9	19.8	19.1	18.3	17.0	15.6	13.9	12.9	12.6		
170	12.1	12.9	13.0	14.1	15.1	16.0	16.7	16.1	15.4	17.0	17.5	16.9	15.7	14.6	13.1	9.82	8.42		
175	10.5	10.5	10.5	10.5	10.5	10.5	10.7	11.5	12.1	10.2	10.9	6.03	4.93	5.33	6.18	6.09	6.08		
180	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47		

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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