

## LM-79-08 TEST REPORT

for

### GREEN CREATIVE LTD

Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL,  
Hong Kong

### LED Tube

**Model: 10T8/4F/830/DEB/C**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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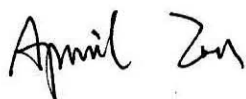
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Report No.: HZ20070023a

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

Review by:



Engineer: April Zou

Aug. 03, 2020

Approved by:



Manager: Jim Zhang

Aug. 03, 2020

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: 10T8/4F/830/DEB/C

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
168.0	1726.7	10.28	0.9789
CCT (K)	CRI	Stabilization Time (Light & Power)	
3044	82.8	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>	: Jul. 22, 2020
<b>Date of Test</b>	: Jul. 24, 2020
<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

## TABLE OF CONTENT

LM-79-08 TEST REPORT .....	1
TEST SUMMARY .....	2
SAMPLE PHOTO .....	4
TEST RESULTS .....	5
Sphere-Spectroradiometer Method.....	5
Goniophotometer Method .....	6
Spectral Power Distribution - Sphere Spectroradiometer Method .....	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method .....	9
Color Rendition Report – Sphere Spectroradiometer Method .....	10
Zonal Lumen Tabulation- Goniophotometer Method .....	11
Illuminance Plots- Goniophotometer Method .....	12
Luminous Intensity Distribution Plots- Goniophotometer Method.....	13
Luminous Intensity Data- Goniophotometer Method .....	14
EQUIPMENT LIST .....	16
TEST METHODS .....	16
Seasoning of SSL Product.....	16
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	16
Goniophotometer Method .....	17
Photometric and Electrical Measurements .....	17
Color Characteristics Measurements.....	17
Color Spatial Uniformity .....	17

## SAMPLE PHOTO



Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Tube
<b>Model</b>	: 10T8/4F/830/DEB/C
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 10W
<b>Product Description</b>	: 3000K
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong

## TEST RESULTS

Test ambient temperature was 26.0 °C.

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 65 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.088	0.042
Power Factor	0.9789	0.9032
Test Power (W)	10.28	10.41
THD A%	18.36	20.98
Luminous Efficacy (lm/W)	168.0	165.5
Total Luminous Flux (lm)	1726.7	1722.6
Color Rendering Index (CRI)	82.8	
R9	5.9	
Correlated Color Temperature (CCT)(K)	3044	
Chromaticity Chroma x	0.4334	
Chromaticity Chroma y	0.4022	
Chromaticity Chroma u	0.2491	
Chromaticity Chroma v	0.3468	
Duv	0.0003	
Chromaticity Chroma u'	0.2491	
Chromaticity Chroma v'	0.5201	

Special Color Rendering Indices	
R1	81.4
R2	91.7
R3	95.6
R4	80.8
R5	81.9
R6	90.2
R7	82.2
R8	58.4
R9	5.9
R10	81.3
R11	80.8
R12	72
R13	84
R14	98.3

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 25.0 °C.

The photometric distance is 30 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)	0.088
Power Factor	0.9792
Power (W)	10.31
Luminous Efficacy (lm/W)	166.7
Total Luminous Flux (lm)	1718.6
Beam Angle ( ° )	106.8 (0°-180°) / 171.9 (90°-270°)
Center Beam Candle Power (cd)	345
Maximum Beam Candle Power (cd)	345.5 (At: C=70.0, Gamma=1.0)
Spacing Criteria	1.23 (0°-180°) / 1.33 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	48.15%
Zonal Lumens in the 60 °-90 °Zone	25.99%
Zonal Lumens in the 90 °-120 °Zone	15.16%
Zonal Lumens in the 120 °-180 °Zone	10.69%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

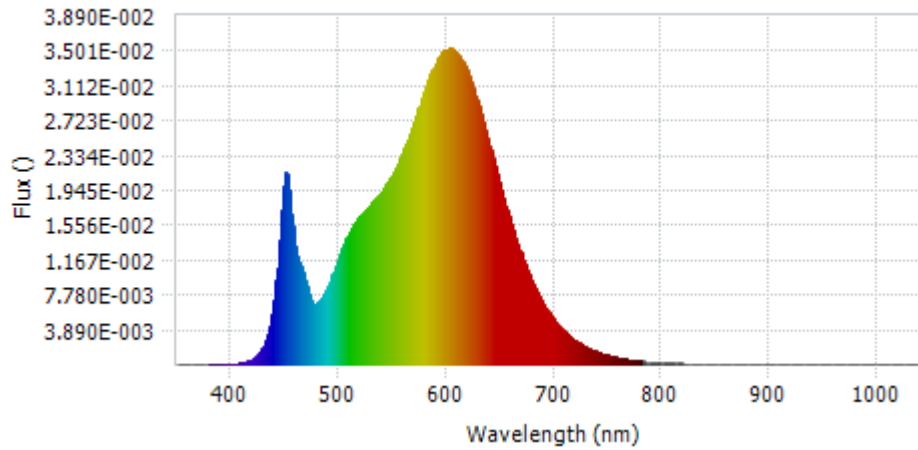
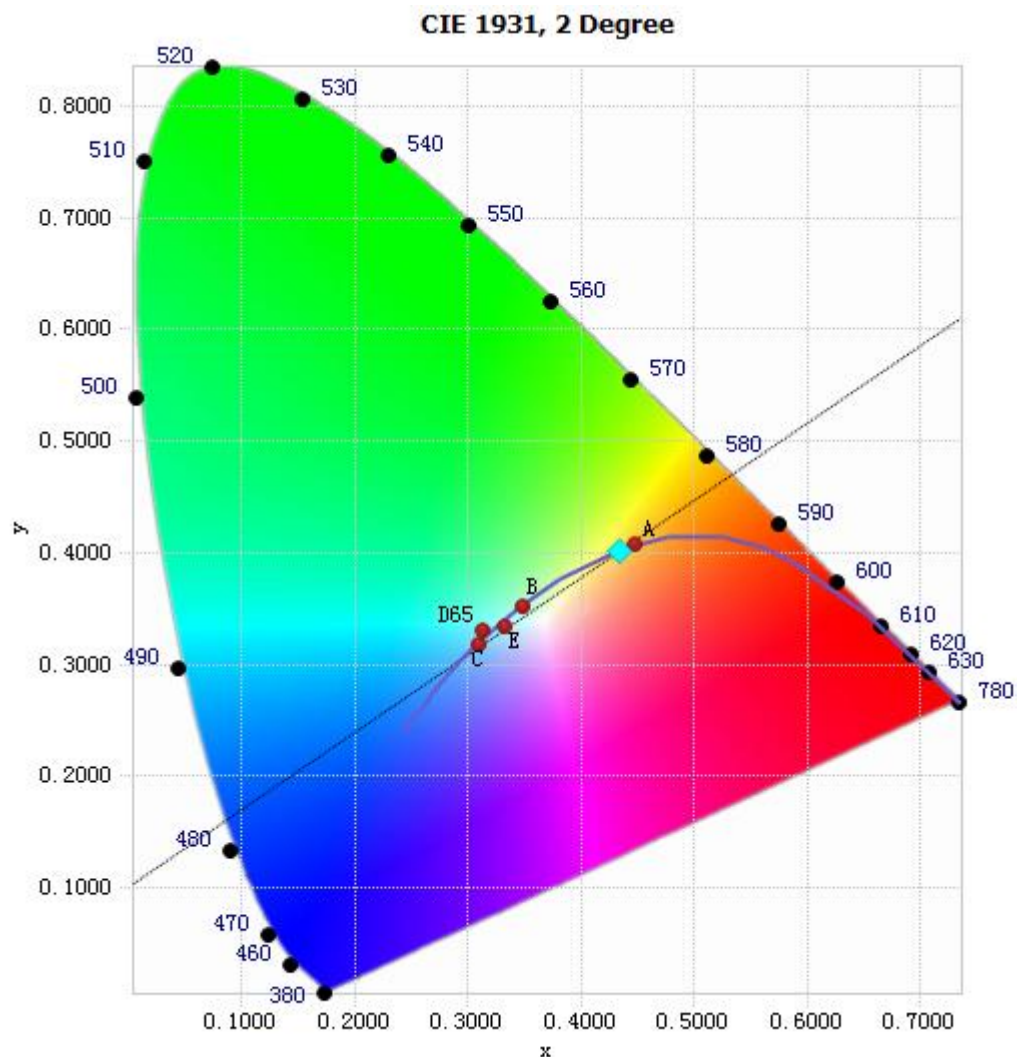


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.11E-04	485	7.65E-03	590	3.36E-02	695	5.80E-03
385	1.04E-04	490	8.71E-03	595	3.47E-02	700	4.96E-03
390	9.81E-05	495	1.03E-02	600	3.52E-02	705	4.24E-03
395	9.15E-05	500	1.20E-02	605	3.52E-02	710	3.60E-03
400	9.65E-05	505	1.35E-02	610	3.48E-02	715	3.07E-03
405	1.03E-04	510	1.47E-02	615	3.38E-02	720	2.61E-03
410	1.71E-04	515	1.58E-02	620	3.24E-02	725	2.23E-03
415	3.07E-04	520	1.66E-02	625	3.08E-02	730	1.89E-03
420	5.73E-04	525	1.72E-02	630	2.88E-02	735	1.61E-03
425	1.10E-03	530	1.79E-02	635	2.66E-02	740	1.37E-03
430	2.08E-03	535	1.86E-02	640	2.45E-02	745	1.17E-03
435	3.86E-03	540	1.93E-02	645	2.22E-02	750	9.91E-04
440	7.18E-03	545	2.03E-02	650	1.99E-02	755	8.44E-04
445	1.38E-02	550	2.12E-02	655	1.77E-02	760	7.20E-04
450	2.09E-02	555	2.25E-02	660	1.57E-02	765	6.15E-04
455	1.82E-02	560	2.38E-02	665	1.38E-02	770	5.27E-04
460	1.26E-02	565	2.54E-02	670	1.21E-02	775	4.43E-04
465	1.10E-02	570	2.71E-02	675	1.05E-02	780	3.82E-04
470	8.81E-03	575	2.89E-02	680	9.09E-03		
475	6.93E-03	580	3.07E-02	685	7.87E-03		
480	6.90E-03	585	3.24E-02	690	6.76E-03		

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

# Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4334, 0.4022)

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

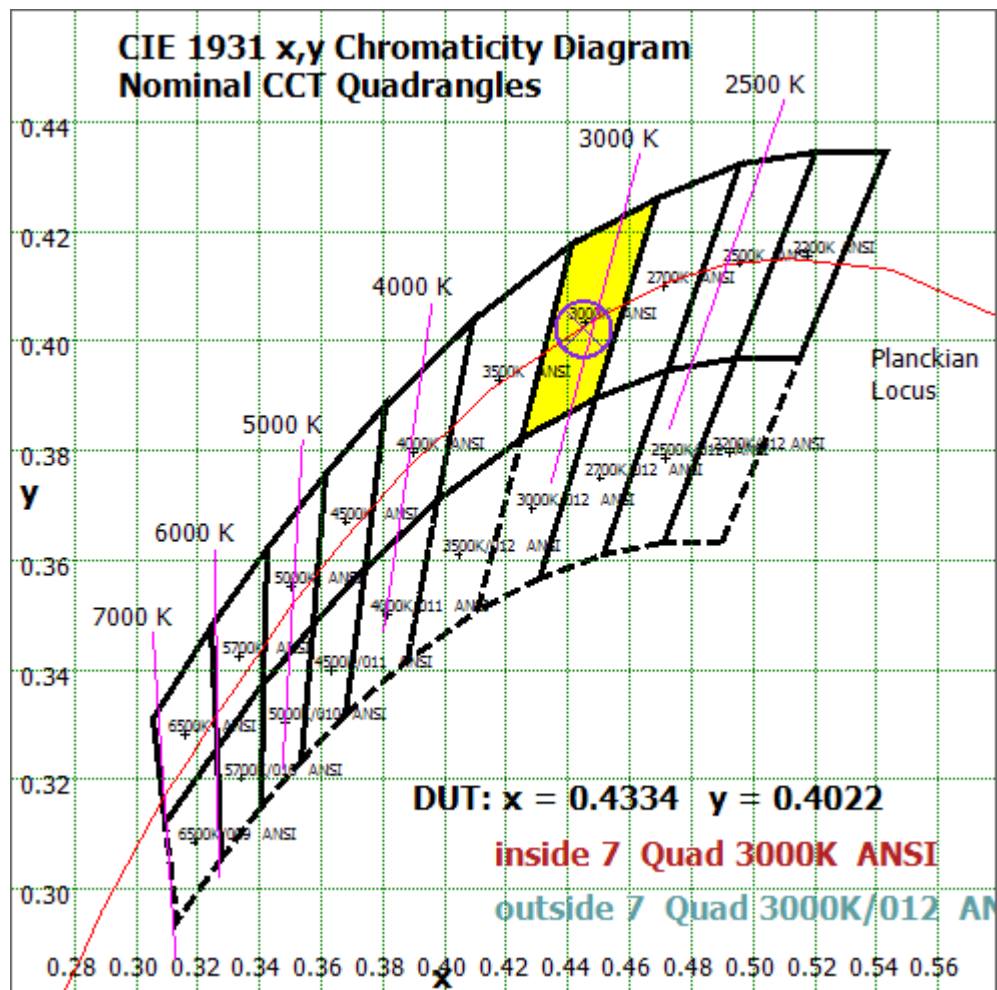
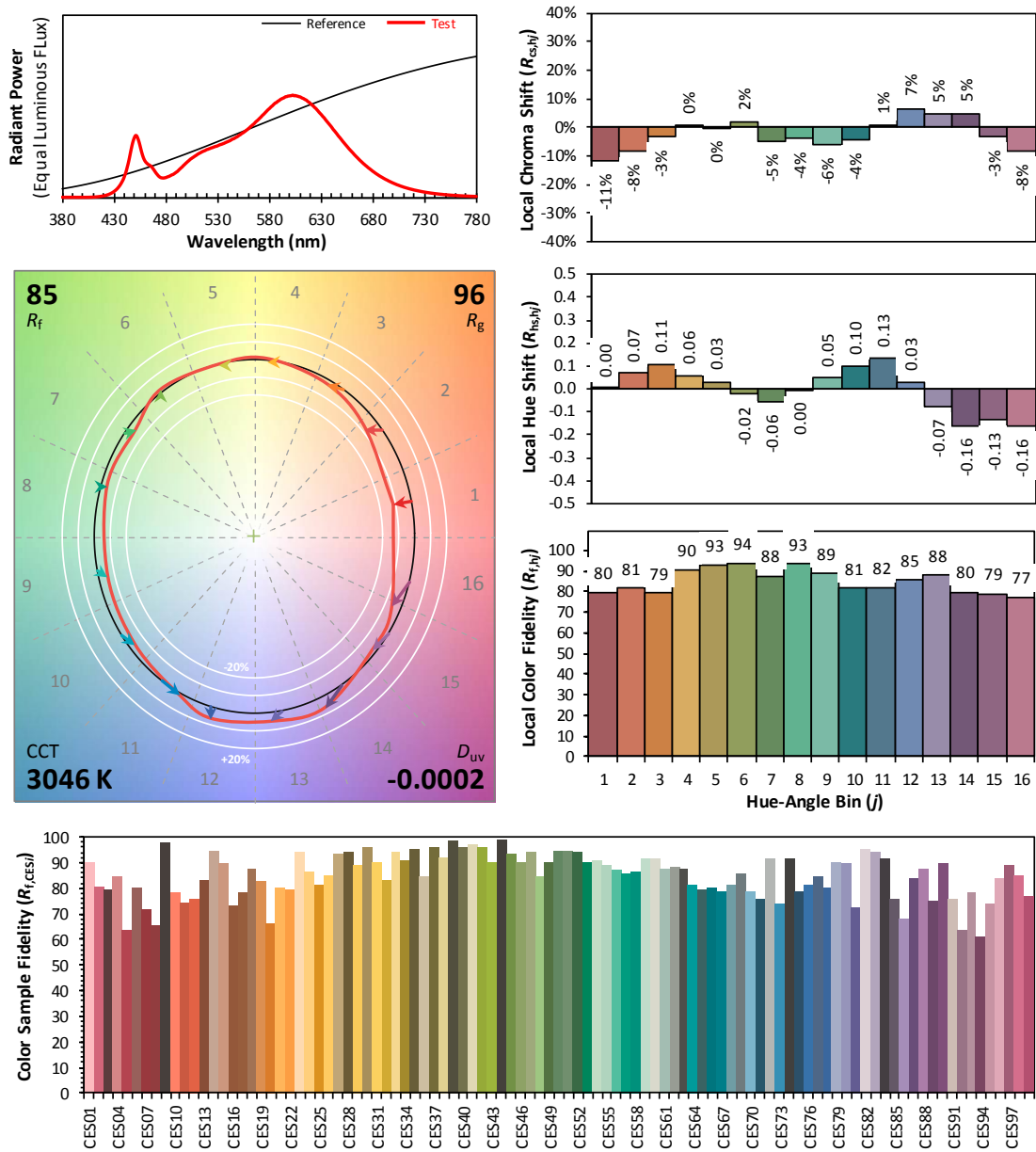


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Rendition Report – Sphere Spectroradiometer Method



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

$x$  0.4334  
 $y$  0.4022  
 $u'$  0.2491  
 $v'$  0.5201

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	32.694	1.90%
10- 20	93.974	5.47%
20- 30	143.74	8.36%
30- 40	176.858	10.29%
40- 50	191.412	11.14%
50- 60	188.823	10.99%
60- 70	173.055	10.07%
70- 80	149.417	8.69%
80- 90	124.26	7.23%
90-100	103.499	6.02%
100-110	86.076	5.01%
110-120	71.041	4.13%
120-130	58.153	3.38%
130-140	46.79	2.72%
140-150	36.031	2.10%
150-160	25.121	1.46%
160-170	13.663	0.79%
170-180	4.01	0.23%
Total	1718.6	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	827.501	48.15%
60- 90	446.732	25.99%
0-90	1274.233	74.14%
90- 180	444.384	25.86%
0- 180	1718.6	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

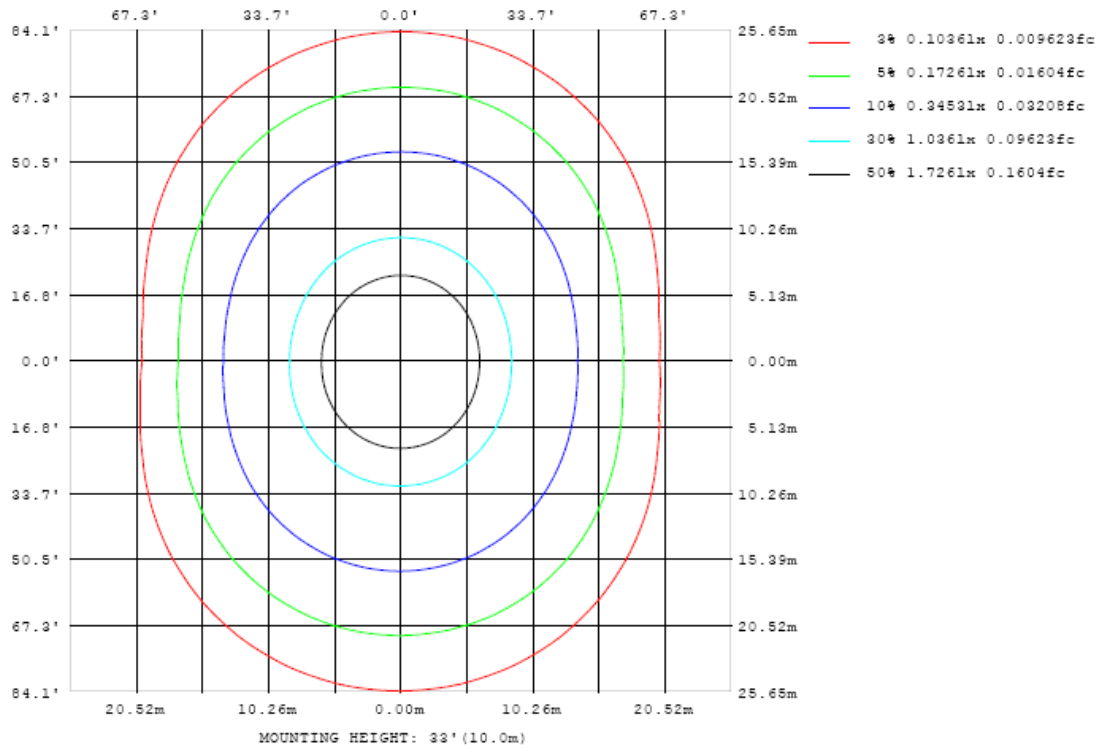


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

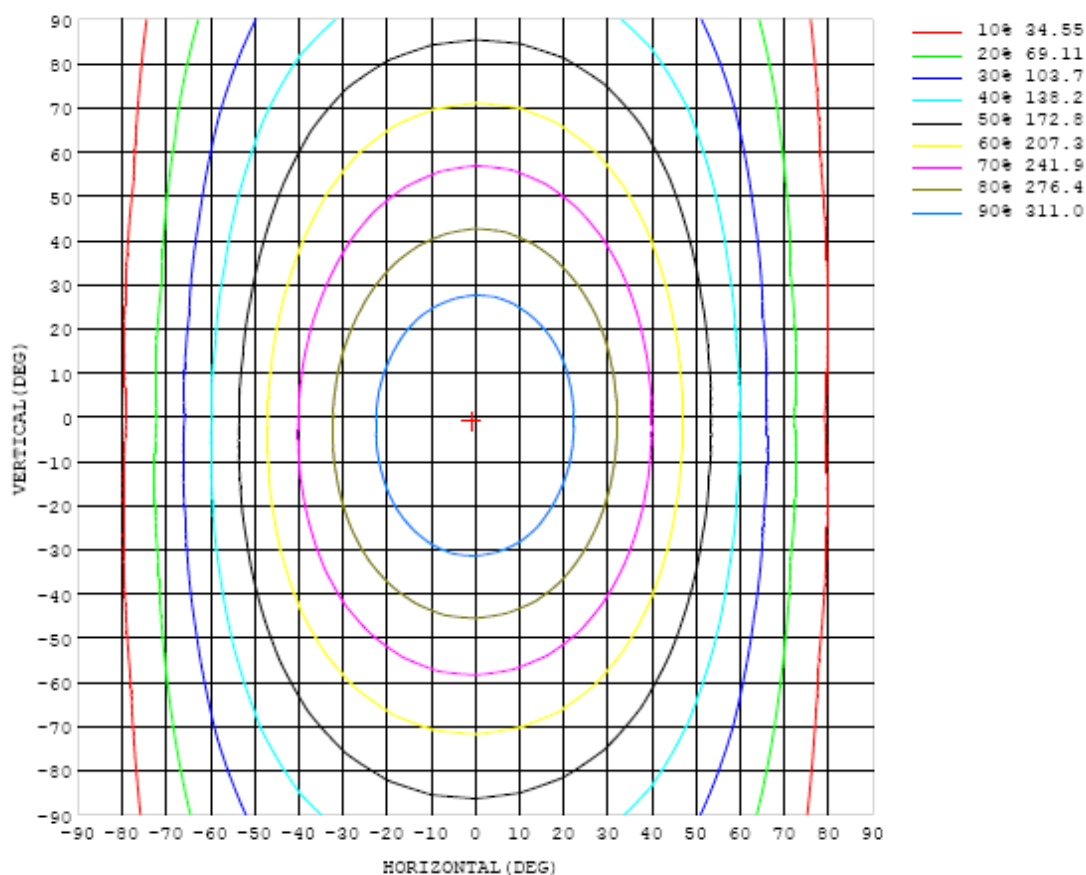


Chart 6: Isocandela Plot

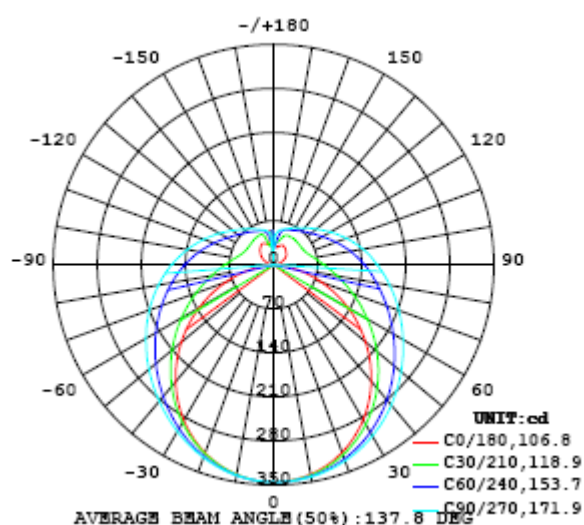


Chart 7: Polar Candela Distribution

## 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	345	345	345	345	345	345	345	345	345	345	345	345	345	345	345	345	345	345	345
5	343	343	344	344	344	344	344	345	345	345	345	345	345	344	344	344	344	344	344
10	338	338	339	340	340	341	341	342	342	342	342	342	342	341	340	340	339	339	339
15	329	330	331	332	333	334	336	337	337	338	338	337	336	335	334	333	332	330	330
20	317	318	320	322	324	326	328	330	331	332	332	331	329	327	325	323	321	319	318
25	302	303	306	308	312	315	319	321	323	324	323	322	320	317	314	310	307	305	303
30	284	286	289	293	297	302	307	311	313	314	314	312	309	305	300	295	291	287	285
35	264	266	270	275	282	288	294	299	302	303	303	300	296	291	284	278	272	268	265
40	241	243	249	256	264	273	280	286	289	291	290	287	282	275	267	259	251	245	242
45	217	219	226	236	246	256	265	272	276	278	277	273	267	259	249	239	229	222	218
50	191	194	203	214	227	239	250	258	262	264	263	259	252	242	230	218	206	197	192
55	164	168	179	193	208	223	235	243	249	251	250	245	237	225	212	196	182	170	164
60	137	142	155	172	190	206	220	229	235	238	236	231	222	209	193	175	158	145	136
65	109	115	132	153	172	190	205	216	222	225	223	217	207	193	176	156	135	118	109
70	81.1	89.5	110	134	157	176	191	202	209	212	210	204	193	178	160	137	113	92.2	81.0
75	54.7	65.6	90.0	117	142	162	178	190	197	199	198	191	180	165	145	120	93.3	68.3	55.0
80	30.5	44.7	73.1	103	129	150	166	178	185	188	186	179	168	153	132	106	76.2	47.4	30.6
85	10.2	28.7	59.8	90.2	117	138	155	166	173	176	174	168	157	141	120	93.2	62.7	31.4	10.2
90	0.24	19.7	50.3	80.1	106	128	144	156	162	165	163	157	146	130	109	82.9	52.9	21.9	0.37
95	2.19	16.0	43.8	72.1	97.1	118	134	146	152	155	153	147	136	120	99.7	74.6	46.1	17.7	2.10
100	5.55	16.1	39.3	65.3	88.8	109	124	135	142	144	142	136	126	111	91.3	67.5	41.2	17.2	5.50
105	9.36	18.4	37.2	59.8	81.4	100.0	115	125	131	134	132	126	116	102	83.5	61.7	38.6	19.2	8.89
110	13.3	22.0	37.0	55.9	75.0	92.0	106	115	121	123	122	116	107	93.6	76.8	57.4	37.8	22.6	12.5
115	17.4	25.9	37.9	53.6	69.8	84.9	97.2	106	111	113	112	107	98.2	86.2	71.2	54.6	38.1	26.3	16.8
120	21.1	29.7	39.4	52.4	66.1	78.8	89.6	97.6	102	104	103	98.3	90.4	79.8	67.0	52.9	39.4	30.0	20.6
125	24.3	33.3	41.2	51.9	63.3	74.1	83.3	90.0	94.2	95.8	94.6	90.6	83.8	74.8	63.9	52.0	41.3	33.7	24.0
130	26.5	36.3	43.2	51.8	61.2	70.3	78.0	83.8	87.3	88.6	87.6	84.2	78.4	70.7	61.6	51.9	43.3	37.3	27.2
135	28.2	38.7	45.2	52.0	59.7	67.1	73.5	78.3	81.3	82.4	81.6	78.6	73.8	67.4	59.8	52.1	45.4	40.5	30.4
140	30.3	41.4	46.5	52.4	58.4	64.4	69.6	73.6	76.0	77.0	76.2	73.8	69.8	64.6	58.6	52.6	47.2	43.4	33.3
145	32.1	43.8	48.1	52.5	57.4	62.1	66.3	69.5	71.4	72.2	71.6	69.6	66.4	62.3	57.7	53.1	49.1	45.4	35.7
150	33.2	44.8	48.5	51.8	56.8	60.2	63.4	65.8	67.3	67.9	67.5	65.9	63.5	60.4	57.0	53.6	50.7	47.0	37.6
155	34.2	44.8	48.8	51.6	55.6	58.6	60.9	62.6	63.7	64.2	63.9	62.8	61.1	58.9	56.5	54.2	52.2	47.7	37.6
160	33.1	41.2	45.7	48.5	53.3	56.8	58.7	59.9	60.7	61.0	60.9	60.3	59.1	57.7	56.2	54.6	53.2	48.6	35.5
165	30.4	35.5	39.8	42.1	45.8	52.1	56.5	57.7	58.2	58.4	58.4	58.1	57.6	56.9	55.8	54.6	53.4	51.8	33.5
170	27.9	31.7	35.5	37.9	37.1	40.3	46.8	52.1	55.1	56.3	56.4	56.1	55.9	56.0	55.5	54.5	53.6	54.5	41.5
175	33.0	35.8	36.5	35.9	34.8	32.7	32.4	38.0	44.7	49.9	51.3	52.2	53.7	54.5	54.9	54.8	54.2	53.6	53.6
180	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2

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	345	345	345	345	345	345	345	345	345	345	345	345	345	345	345	345	345		
5	343	343	344	344	344	344	343	343	344	344	344	344	343	343	343	343	343		
10	338	338	338	339	339	339	339	340	340	340	340	339	339	339	338	338	338		
15	330	330	330	331	332	333	333	333	334	334	333	333	332	331	331	330	329		
20	318	318	319	321	322	324	325	325	326	326	325	324	322	321	320	318	317		
25	303	304	306	308	310	313	314	316	316	316	315	313	311	309	306	304	303		
30	285	287	290	293	297	300	303	305	306	306	304	301	298	294	290	287	285		
35	265	268	272	276	282	287	291	293	295	294	292	288	283	278	273	268	265		
40	243	247	252	259	266	273	278	281	283	282	279	274	268	261	254	247	243		
45	219	224	232	241	250	259	265	269	271	270	266	260	252	243	233	225	219		
50	193	200	211	222	234	244	252	257	259	258	253	246	236	225	213	201	193		
55	167	176	190	204	218	230	239	244	247	245	240	232	221	207	192	178	167		
60	140	152	169	186	203	216	226	232	234	233	227	218	205	189	172	154	141		
65	114	129	149	170	188	203	213	220	222	221	215	204	190	173	152	131	115		
70	88.0	108	131	154	174	189	200	207	210	208	202	191	176	157	134	110	89.4		
75	64.3	88.0	115	139	160	177	188	195	198	196	190	178	163	143	118	91.2	66.3		
80	43.4	70.7	100	126	147	164	176	183	186	184	177	166	150	129	104	74.8	46.5		
85	27.4	58.2	87.6	114	135	152	164	171	174	172	165	154	138	117	91.5	62.3	31.2		
90	18.1	48.2	77.2	103	125	141	153	160	162	160	154	143	127	107	81.2	52.5	22.1		
95	14.4	41.2	68.5	93.5	114	130	141	148	151	149	143	132	117	97.0	72.6	45.4	18.0		
100	14.7	36.8	62.1	85.0	105	120	131	137	139	138	132	122	107	88.4	66.0	40.8	17.9		
105	16.9	34.8	56.8	77.5	95.7	110	120	126	128	127	121	112	98.2	80.7	60.4	38.4	19.6		
110	20.3	34.6	53.1	71.3	87.8	101	110	116	118	117	111	103	90.2	74.3	56.4	38.0	22.5		
115	24.1	35.4	50.7	66.8	81.0	92.9	101	107	109	107	102	94.4	83.1	69.1	54.0	38.6	25.8		
120	27.7	36.9	49.5	63.1	75.2	85.6	93.3	98.0	99.9	98.6	94.2	87.0	77.3	65.9	52.5	39.9	29.0		
125	31.0	39.1	49.0	60.4	70.6	79.5	86.1	90.3	91.9	90.7	87.0	80.9	72.6	62.8	51.7	41.5	32.1		
130	33.9	41.4	49.1	58.3	67.3	74.5	80.1	83.7	85.1	84.1	80.9	75.7	68.6	60.6	51.4	43.3	34.5		
135	36.2	43.5	49.6	56.9	64.3	70.1	74.8	77.9	79.1	78.3	75.6	71.3	65.8	58.8	51.5	45.2	36.3		
140	37.7	45.3	50.4	56.0	61.8	67.0	70.3	72.8	73.8	73.2	71.0	67.6	63.1	57.5	51.7	46.9	37.4		
145	38.1	46.6	51.2	55.4	59.8	63.8	66.9	68.5	69.3	68.9	67.4	64.6	60.8	56.4	52.1	48.6	37.8		
150	38.3	47.7	51.8	55.0	58.2	61.2	63.5	65.1	65.7	65.3	63.9	61.8	59.0	55.7	52.6	49.3	36.4		
155	34.2	45.3	52.6	54.7	57.0	59.1	60.7	61.8	62.2	62.0	61.0	59.5	57.3	54.8	50.8	47.0	34.0		
160	29.9	39.1	51.0	54.3	55.9	57.3	58.4	59.1	59.4	59.2	58.6	57.5	53.5	48.3	45.0	41.4	30.4		
165	28.6	30.5	36.2	51.4	53.7	55.1	56.5	56.9	57.1	57.1	55.0	48.4	42.0	39.8	36.8	34.2	27.5		
170	24.8	30.4	30.9	33.7	42.2	48.5	51.2	53.9	54.4	49.7	35.7	36.6	37.4	36.2	34.8	30.0	27.8		
175	54.6	29.8	26.7	38.2	39.3	39.3	40.3	37.6	28.0	34.0	39.0	42.8	42.0	40.2	37.3	36.1	34.2		
180	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2		

Table 7: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	PF2010A	HZTE028-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	DPS1060	HZTE001-06	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	WY12010	HZTE004-03	Aug. 02, 2019	Aug. 01, 2020
Temperature recorder	JM624U	HZTE018-08	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 02, 2019	Aug. 01, 2020
Standard source	D908	HZTE012-01	Aug. 02, 2019	Aug. 01, 2020
Integrate Sphere system	3M	HZTE015-04	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	PCR 500L	HZTE001-07	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	IT6154	HZTE004-04	Aug. 02, 2019	Aug. 01, 2020
Standard source	SCL-1400	HZTE012-02	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 02, 2019	Aug. 01, 2020
Temperature Meter	TES1310	HZTE017-01	Aug. 02, 2019	Aug. 01, 2020

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**

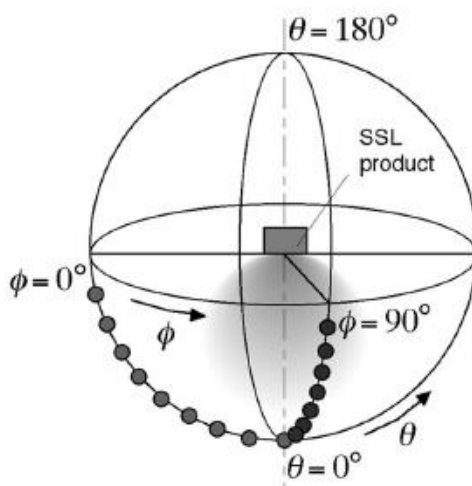
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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