

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 10PLL/840/GL/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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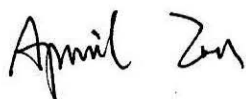
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Report No.: HZ19050037d

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/840/GL/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
144.4	1401.0	9.70	0.9791
CCT (K)	CRI	Stabilization Time (Light & Power)	
4055	81.8	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	: May 23, 2019
Date of Test	: May 29, 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 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)

Name	: LED Tube
Model	: 10PLL/840/GL/BYP
Electrical Ratings	: 120-277V, 60Hz, 10W
Product Description	: 4000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 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	0.9791	0.9025
Test Power (W)	9.70	9.88
THD A%	18.26	24.49
Luminous Efficacy (lm/W)	144.4	142.0
Total Luminous Flux (lm)	1401.0	1403.0
Color Rendering Index (CRI)	81.8	
R9	2.1	
Correlated Color Temperature (CCT)(K)	4055	
Chromaticity Chroma x	0.3792	
Chromaticity Chroma y	0.3801	
Chromaticity Chroma u	0.2230	
Chromaticity Chroma v	0.3352	
Duv	0.0013	
Chromaticity Chroma u'	0.2230	
Chromaticity Chroma v'	0.5029	

Special Color Rendering Indices	
R1	79.6
R2	88.1
R3	94.6
R4	80.5
R5	79.7
R6	83.6
R7	85.7
R8	62.6
R9	2.1
R10	72
R11	79.1
R12	59.8
R13	81.7
R14	97.2

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	0.9792
Power (W)	9.70
Luminous Efficacy (lm/W)	142.0
Total Luminous Flux (lm)	1377.8
Beam Angle (°)	99.8 (0°-180°) / 115.6 (90°-270°)
Center Beam Candle Power (cd)	414
Maximum Beam Candle Power (cd)	414.3 (At: C=110.0, Gamma=2.5)
Spacing Criteria	1.19 (0°-180°) / 1.27 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	65.94%
Zonal Lumens in the 60 °-90 °Zone	22.10%
Zonal Lumens in the 90 °-120 °Zone	7.19%
Zonal Lumens in the 120 °-180 °Zone	4.76%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

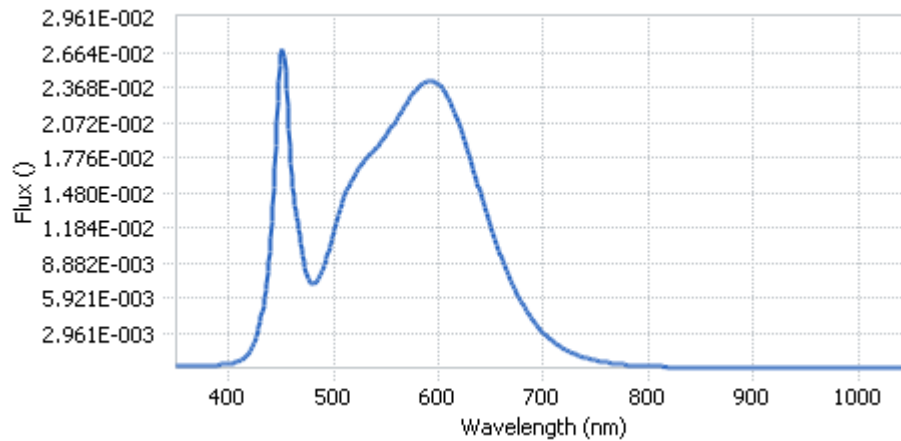
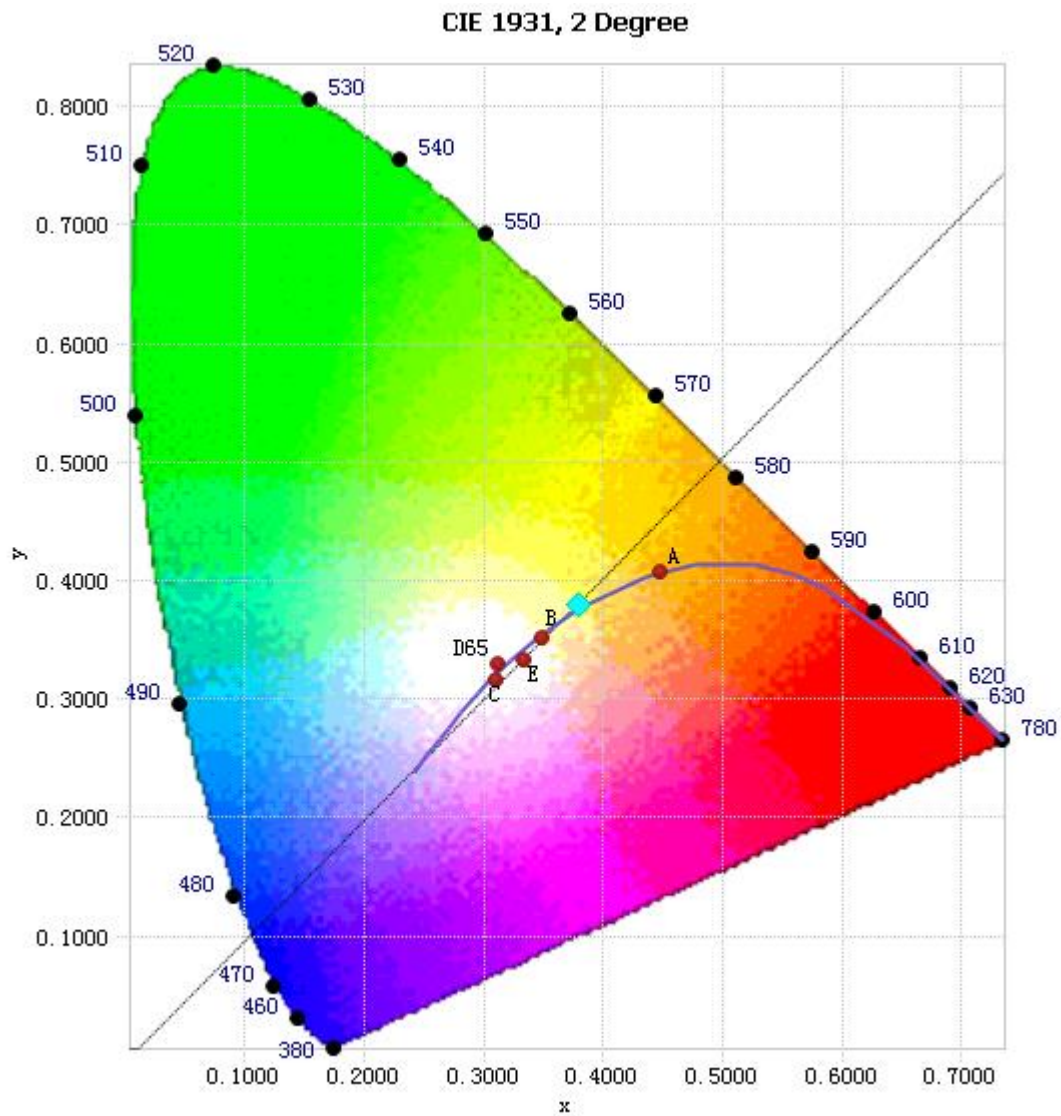


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.50E-04	485	7.48E-03	590	2.42E-02	695	3.44E-03
385	2.40E-04	490	8.36E-03	595	2.43E-02	700	2.96E-03
390	2.69E-04	495	9.77E-03	600	2.39E-02	705	2.55E-03
395	2.94E-04	500	1.15E-02	605	2.34E-02	710	2.17E-03
400	3.37E-04	505	1.31E-02	610	2.27E-02	715	1.87E-03
405	4.11E-04	510	1.43E-02	615	2.16E-02	720	1.59E-03
410	5.75E-04	515	1.55E-02	620	2.04E-02	725	1.37E-03
415	8.67E-04	520	1.63E-02	625	1.91E-02	730	1.17E-03
420	1.37E-03	525	1.70E-02	630	1.77E-02	735	1.00E-03
425	2.28E-03	530	1.75E-02	635	1.62E-02	740	8.54E-04
430	3.88E-03	535	1.81E-02	640	1.47E-02	745	7.33E-04
435	6.55E-03	540	1.86E-02	645	1.32E-02	750	6.33E-04
440	1.10E-02	545	1.91E-02	650	1.19E-02	755	5.44E-04
445	1.88E-02	550	1.97E-02	655	1.05E-02	760	4.70E-04
450	2.65E-02	555	2.03E-02	660	9.32E-03	765	4.01E-04
455	2.36E-02	560	2.10E-02	665	8.14E-03	770	3.44E-04
460	1.61E-02	565	2.16E-02	670	7.09E-03	775	3.00E-04
465	1.28E-02	570	2.24E-02	675	6.19E-03	780	2.59E-04
470	1.00E-02	575	2.31E-02	680	5.39E-03		
475	7.69E-03	580	2.36E-02	685	4.65E-03		
480	7.08E-03	585	2.41E-02	690	4.01E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3792, 0.3801)

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

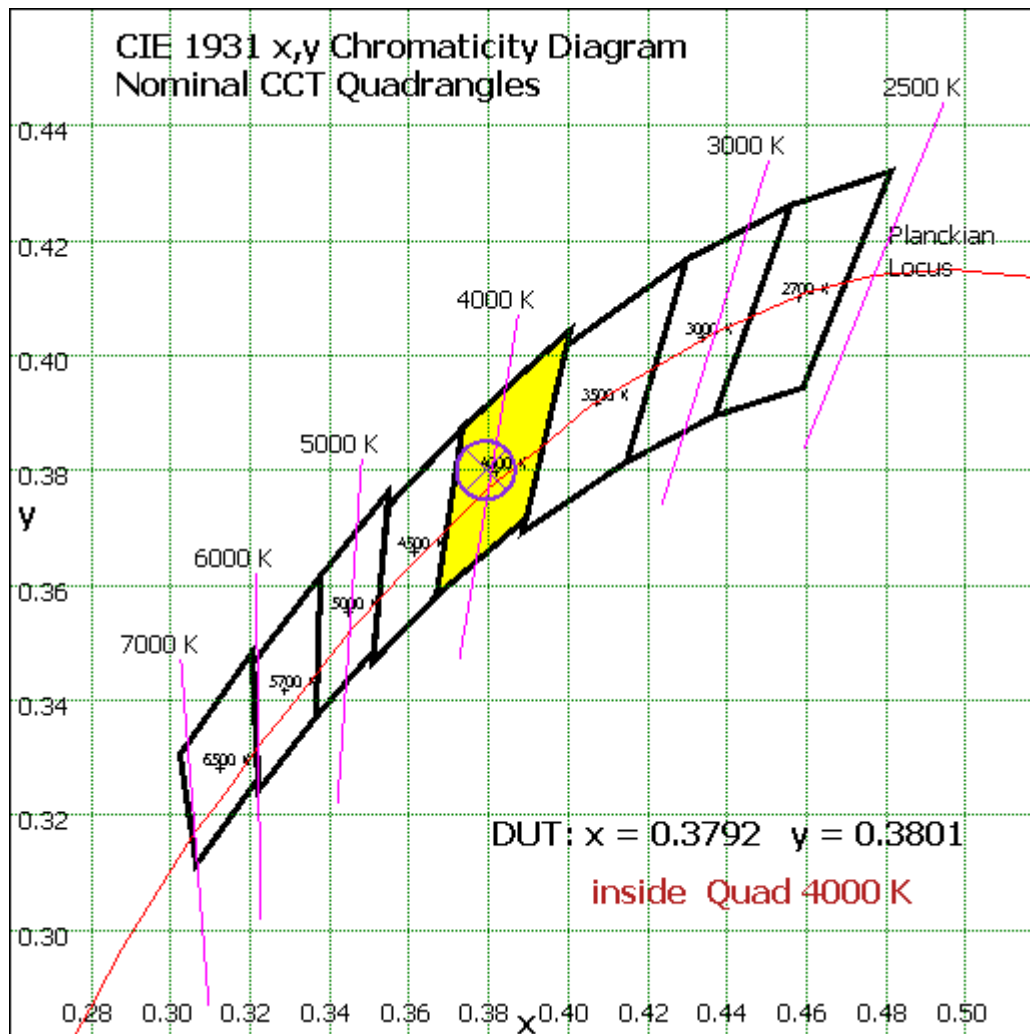
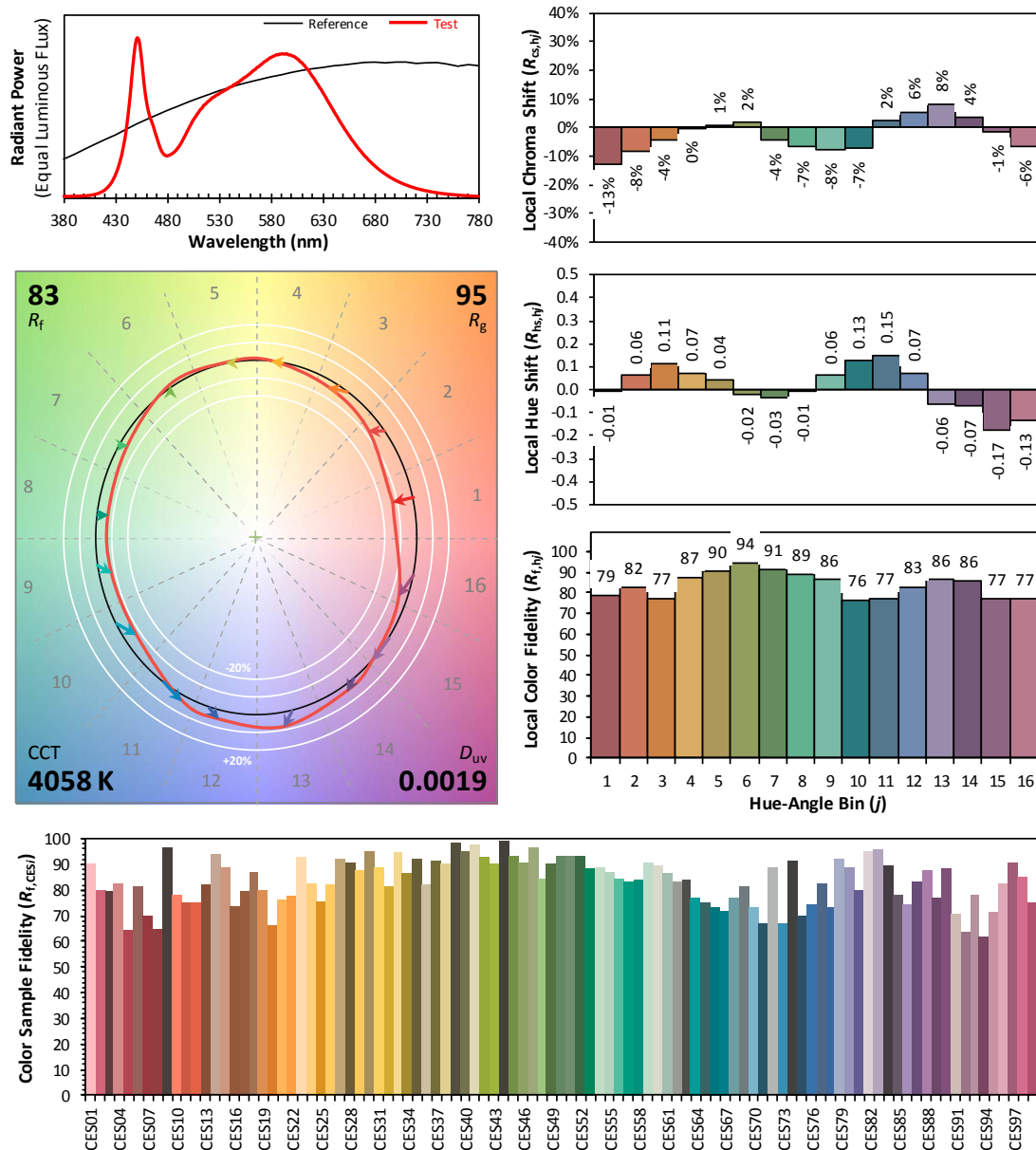


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3792
 y 0.3801
 u' 0.2230
 v' 0.5029

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	39.095	2.84%
10- 20	111.513	8.09%
20- 30	167.703	12.17%
30- 40	200.417	14.55%
40- 50	206.07	14.96%
50- 60	183.792	13.34%
60- 70	142.746	10.36%
70- 80	99.345	7.21%
80- 90	62.396	4.53%
90-100	41.825	3.04%
100-110	31.823	2.31%
110-120	25.476	1.85%
120-130	21.576	1.57%
130-140	17.576	1.28%
140-150	12.833	0.93%
150-160	8.258	0.60%
160-170	4.328	0.31%
170-180	1.035	0.08%
Total	1377.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	908.59	65.94%
60- 90	304.487	22.10%
0-90	1213.077	88.04%
90- 180	164.73	11.96%
0- 180	1377.8	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

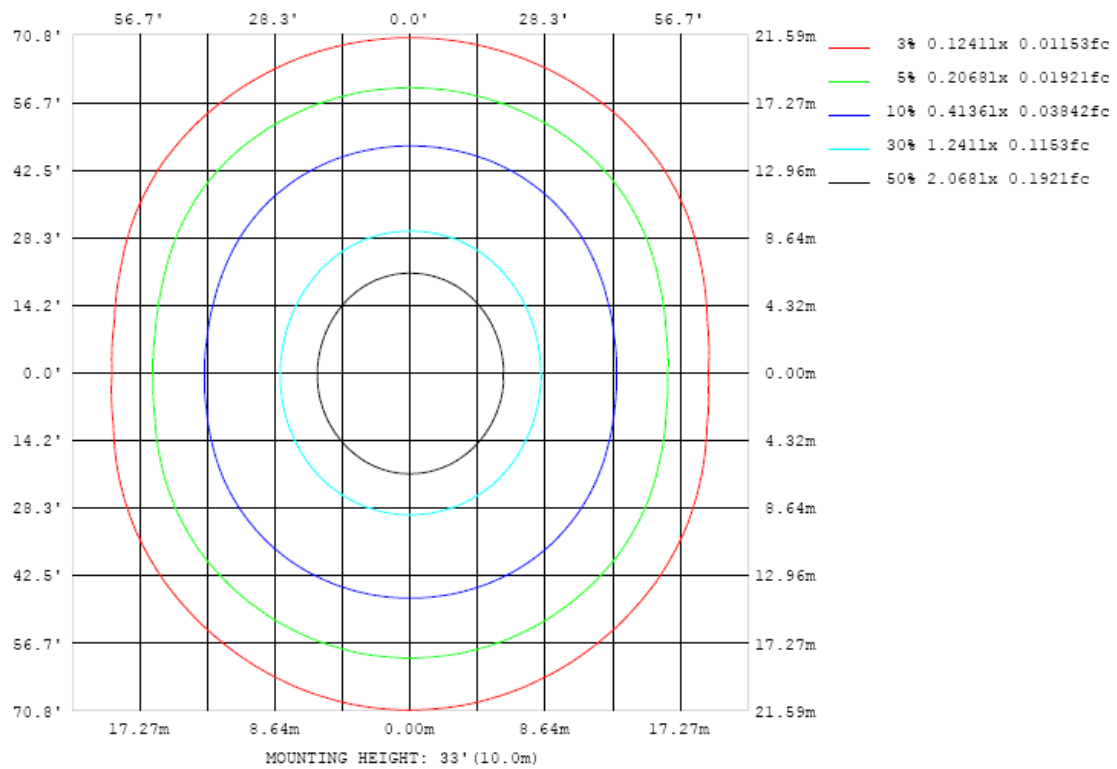


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

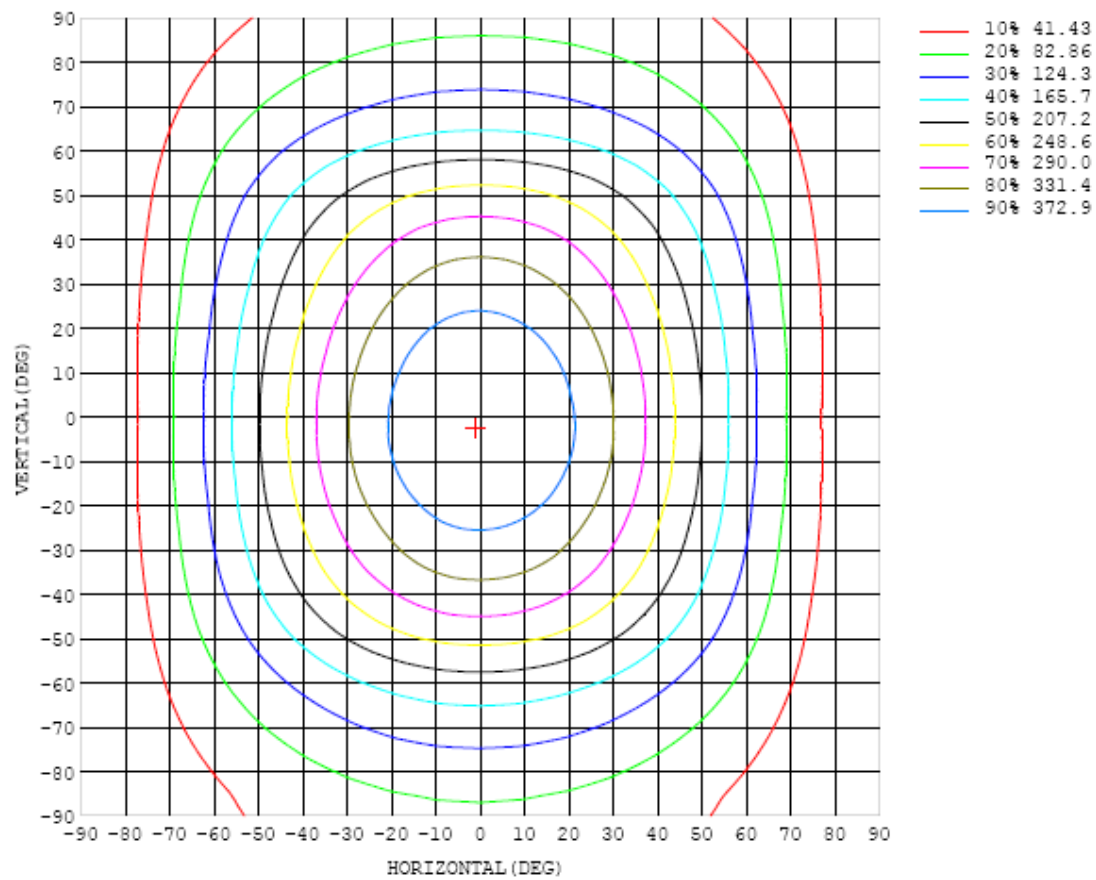


Chart 6: Isocandela Plot

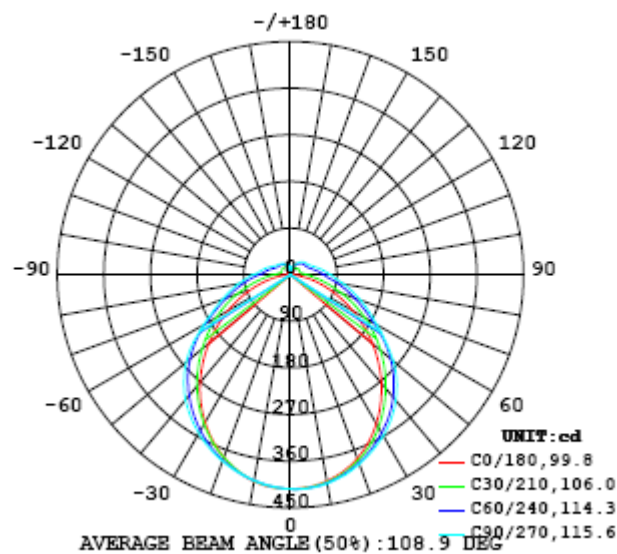


Chart 7: Polar Candela Distribution

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	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414
5	411	411	412	412	412	413	413	414	414	414	414	414	413	413	413	413	412	412	412
10	404	405	406	406	407	408	408	409	409	409	409	409	409	408	408	407	407	406	405
15	393	394	396	396	397	398	399	400	400	401	401	400	400	399	398	396	395	394	392
20	377	379	381	382	384	385	387	388	389	389	389	388	387	385	383	381	379	377	375
25	357	359	361	363	366	368	371	373	374	375	375	374	371	368	365	361	359	356	354
30	332	334	337	340	344	349	352	356	358	359	358	356	352	348	343	338	335	331	329
35	303	306	309	314	320	326	332	336	338	340	339	337	332	325	319	313	308	304	302
40	273	276	280	286	294	302	309	313	316	317	316	313	308	301	293	285	279	274	271
45	241	244	249	257	267	275	282	287	290	291	290	286	281	274	266	257	248	242	239
50	207	210	217	228	237	246	253	257	259	259	259	256	252	245	237	227	216	209	205
55	173	176	185	197	207	215	220	223	224	224	224	222	219	214	206	197	185	175	172
60	139	144	154	166	175	182	187	190	192	193	192	190	186	181	175	166	155	143	139
65	107	112	124	135	144	151	157	162	166	167	166	163	157	151	144	136	125	113	107
70	77.0	83.0	95.6	106	115	124	132	139	143	144	143	139	133	124	116	107	96.8	84.3	78.0
75	50.7	57.5	68.9	79.9	90.8	101	110	118	122	124	123	118	111	102	91.8	81.1	70.7	59.6	51.7
80	27.7	35.0	46.4	58.7	70.4	81.4	91.2	98.6	103	105	104	99.2	91.8	82.4	71.5	60.1	48.3	37.1	29.0
85	10.3	16.4	28.5	41.4	54.0	65.4	74.7	82.0	86.4	87.8	86.7	82.6	75.3	66.2	55.2	42.9	30.4	18.6	11.6
90	0.19	6.72	18.4	31.3	43.9	55.3	65.0	71.6	76.0	77.4	76.3	72.3	65.9	56.6	45.5	33.1	20.3	8.35	0.33
95	0.65	3.84	13.5	25.5	37.3	47.9	56.9	63.5	67.4	68.6	67.8	64.3	58.0	49.4	39.1	27.5	15.6	4.89	1.12
100	1.69	4.58	11.1	21.3	31.9	41.6	49.6	55.5	59.1	60.5	59.7	56.5	50.9	43.2	33.9	23.5	13.2	5.80	1.99
105	2.43	5.03	11.2	19.1	28.1	36.5	43.6	48.9	52.1	53.3	52.6	49.8	44.9	38.2	30.0	21.3	13.8	7.03	3.22
110	3.34	5.84	11.8	18.7	26.0	33.0	39.0	43.4	46.2	47.3	46.7	44.3	40.2	34.5	27.9	21.6	14.9	8.22	4.39
115	4.26	7.16	13.1	18.8	25.2	31.3	35.9	39.4	41.7	42.7	42.1	40.1	36.9	32.7	27.7	22.1	16.0	8.95	5.56
120	5.29	8.20	13.1	19.2	24.9	30.3	34.6	37.4	39.2	39.9	39.5	38.0	35.5	32.0	27.5	22.3	15.9	9.46	6.69
125	6.38	9.05	13.0	19.3	24.7	29.4	33.4	36.1	37.6	38.3	37.9	36.6	34.4	31.2	27.1	22.0	15.7	10.1	7.56
130	7.32	9.52	13.2	18.5	24.2	28.7	32.2	34.6	36.0	36.7	36.3	35.1	33.1	30.2	26.2	20.7	15.5	10.5	7.69
135	8.39	9.39	13.0	17.5	22.6	27.4	30.8	33.0	34.3	34.9	34.5	33.4	31.6	28.6	24.2	19.6	14.6	9.71	8.20
140	9.07	9.15	12.7	16.7	20.9	24.9	28.2	30.8	32.3	32.9	32.6	31.3	29.0	25.9	22.4	18.6	14.0	9.52	8.82
145	8.94	8.89	12.0	15.7	19.5	22.7	25.3	27.4	28.7	29.3	28.9	27.8	25.9	23.5	20.7	17.7	14.3	10.3	10.1
150	9.80	8.38	10.9	14.4	18.0	20.6	22.9	24.4	25.4	25.8	25.5	24.7	23.3	21.4	19.3	16.0	13.9	10.6	11.0
155	10.5	8.17	10.9	13.5	16.2	18.7	20.5	21.9	22.7	23.0	22.8	22.1	21.1	19.7	18.1	15.8	14.4	10.7	12.1
160	10.4	7.99	10.7	12.6	14.6	16.8	18.3	19.3	20.0	20.4	20.2	19.7	19.0	17.2	15.4	13.3	11.0	10.5	12.8
165	11.3	8.93	8.16	11.1	13.5	14.7	15.9	17.0	17.6	17.7	17.5	17.1	16.1	15.0	14.9	12.6	11.0	10.7	12.9
170	12.9	9.05	7.29	7.68	7.75	8.49	9.67	11.9	14.8	15.3	15.2	12.8	11.1	10.3	9.81	9.40	9.57	10.3	13.0
175	8.67	7.33	6.73	6.75	7.19	7.04	6.67	6.04	2.64	0.48	3.49	7.69	8.13	7.73	7.82	7.83	7.86	7.94	8.21
180	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52

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	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414		
5	411	411	411	410	411	410	410	410	410	410	410	410	410	410	410	410	411		
10	404	404	404	404	404	403	403	403	404	403	403	403	403	403	403	404	404		
15	392	392	392	393	393	394	394	394	394	394	393	393	393	392	392	392	393		
20	375	375	376	378	379	381	382	383	383	383	382	381	379	378	377	377	377		
25	354	354	356	359	362	366	368	369	370	369	368	366	363	361	358	357	357		
30	329	330	333	338	343	348	351	353	354	353	351	348	344	340	336	333	331		
35	302	304	308	314	321	327	332	335	335	335	332	328	323	317	311	306	304		
40	271	275	281	288	297	304	310	314	315	314	311	306	299	291	284	277	274		
45	239	244	252	262	272	280	286	290	291	290	287	282	274	264	255	247	242		
50	206	212	222	234	245	253	259	262	263	262	260	255	247	237	226	216	209		
55	173	181	193	206	216	223	227	229	229	229	228	224	218	209	197	184	176		
60	142	152	165	176	185	189	192	193	194	193	193	191	187	179	168	154	144		
65	111	123	137	147	154	158	161	163	164	163	162	159	156	150	140	126	113		
70	83.1	96.9	109	119	126	132	136	139	140	139	137	133	128	120	111	98.7	84.4		
75	58.5	72.1	83.7	93.6	102	110	115	119	120	119	116	111	104	95.2	85.2	73.5	59.6		
80	37.5	50.0	62.0	73.2	83.1	91.0	96.9	100	102	101	97.5	92.0	84.4	74.6	63.2	50.9	38.1		
85	19.5	32.0	44.6	56.3	66.6	74.7	80.9	84.5	85.7	84.8	81.5	75.8	67.7	57.5	45.6	32.7	19.7		
90	7.84	19.5	31.6	43.0	53.1	61.2	67.1	70.6	71.8	71.0	67.7	62.1	54.3	44.2	32.6	20.3	8.06		
95	4.57	14.3	25.4	35.7	44.7	52.0	57.2	60.3	61.3	60.5	57.5	52.6	45.5	36.4	26.1	14.9	4.81		
100	4.80	11.5	21.5	31.1	39.7	46.6	51.4	54.4	55.3	54.5	51.8	47.1	40.4	31.8	21.9	11.5	4.18		
105	5.83	10.9	18.6	27.1	34.8	41.1	45.7	48.5	49.5	48.7	46.0	41.5	35.3	27.5	18.6	10.4	5.52		
110	7.39	12.1	17.8	24.0	30.6	36.2	40.3	42.8	43.6	42.9	40.5	36.5	30.9	24.0	16.9	10.9	6.34		
115	8.93	13.8	18.2	22.9	27.6	32.2	35.6	37.6	38.4	37.7	35.7	32.3	27.6	22.2	16.6	12.4	7.30		
120	9.97	14.6	18.9	22.8	26.6	29.6	32.1	33.8	34.4	33.8	32.1	29.5	26.1	21.7	17.3	13.3	8.42		
125	10.5	15.0	19.5	22.8	26.0	28.7	30.6	31.7	32.1	31.7	30.4	28.4	25.5	21.7	18.3	13.8	9.62		
130	10.3	15.4	19.5	22.8	25.5	27.8	29.5	30.5	30.9	30.4	29.3	27.5	25.0	22.0	18.6	14.3	10.6		
135	11.2	15.4	19.1	22.6	24.9	26.9	28.3	29.2	29.6	29.2	28.1	26.6	24.5	22.1	18.3	14.6	11.5		
140	11.8	15.4	18.3	21.5	24.2	25.8	27.0	27.8	28.1	27.7	26.9	25.6	24.0	21.2	17.9	15.0	12.2		
145	12.9	15.6	17.9	20.2	22.7	24.8	25.8	26.4	26.7	26.4	25.7	24.6	22.6	20.1	17.6	15.1	11.9		
150	13.8	15.7	17.5	19.2	21.0	22.6	23.9	24.7	25.0	24.7	23.9	22.6	21.0	19.1	17.0	14.3	11.8		
155	14.4	15.9	17.1	18.4	19.6	20.7	21.6	22.2	22.5	22.3	21.7	20.8	19.6	18.3	16.2	13.9	12.4		
160	15.0	16.0	16.8	17.6	18.4	19.2	19.7	20.2	20.4	20.2	19.9	19.2	18.4	17.1	15.5	14.0	12.2		
165	15.2	16.2	16.6	17.1	17.5	18.0	18.2	18.4	18.5	18.4	18.1	17.5	16.8	15.8	14.9	14.1	13.0		
170	14.3	14.9	15.0	15.3	16.0	16.7	16.9	16.9	16.7	16.4	16.2	15.9	15.5	15.0	14.6	14.0	13.4		
175	8.98	10.6	12.7	14.1	14.3	14.0	13.8	13.8	14.1	14.6	15.0	15.1	15.0	14.8	14.5	13.4	10.8		
180	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52	6.52		

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 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° 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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