LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 10.5T8/4F/850/DIR/RD

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19060033a

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

Review by: April Zou

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Jun. 28, 2019

Approved by: Jim Zhang

Manager: Jim Zhang
Jun. 28, 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: **10.5T8/4F/850/DIR/RD**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
137.6	1897.5	13.79	0.9921

CCT (K)	CRI	Stabilization Time (Light & Power)
5026	82.3	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	: Jun. 26, 2019
Date of Test	: Jun. 27, 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	: 10.5T8/4F/850/DIR/RD
Electrical Ratings	: 120-277V, 50/60Hz, 10.5W
Product Description	: 5000K The LED Tube supplied by a high frequency fluorescent lamp ballast: IOPA -1P32-N
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 65 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.116	0.054
Power Factor	0.9921	0.9303
Test Power (W)	13.79	13.90
THD A%	9.09	15.16
Luminous Efficacy (lm/W)	137.6	136.4
Total Luminous Flux (lm)	1897.5	1896.6
Color Rendering Index (CRI)	82.3	
R9	2.0	
Correlated Color Temperature (CCT)(K)	5026	
Chromaticity Chroma x	0.3450	
Chromaticity Chroma y	0.3590	
Chromaticity Chroma u	0.2085	
Chromaticity Chroma v	0.3255	
Duv	0.0037	
Chromaticity Chroma u ’	0.2085	
Chromaticity Chroma v’	0.4882	

Special Color Rendering Indices	
R1	80.1
R2	87.8
R3	93
R4	81.8
R5	80.9
R6	82.9
R7	86.5
R8	65.3
R9	2.0
R10	71
R11	81
R12	59.5
R13	82.2
R14	96.4

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 24.9 ℃.

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)	0.116
Power Factor	0.9928
Power (W)	13.83
Luminous Efficacy (lm/W)	135.2
Total Luminous Flux (lm)	1869.3
Beam Angle (°)	116.0 (0^o-180^o) / 235.1 (90^o-270^o)
Center Beam Candle Power (cd)	292
Maximum Beam Candle Power (cd)	291.9 (At: C=80.0, Gamma=2.0)
Spacing Criteria	1.28 (0^o-180^o) / 1.46 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	41.42%
Zonal Lumens in the 60 °-90 °Zone	27.08%
Zonal Lumens in the 90 °-120 °Zone	18.23%
Zonal Lumens in the 120 °-180 °Zone	13.27%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

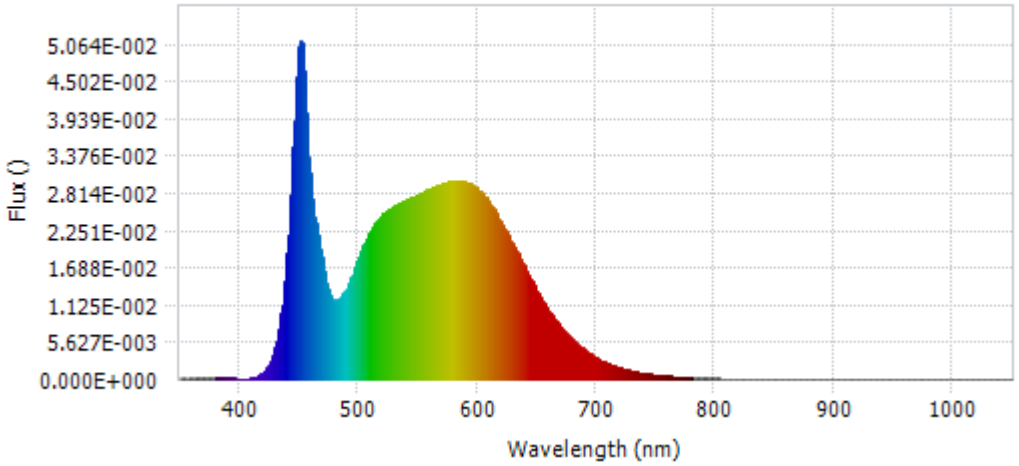
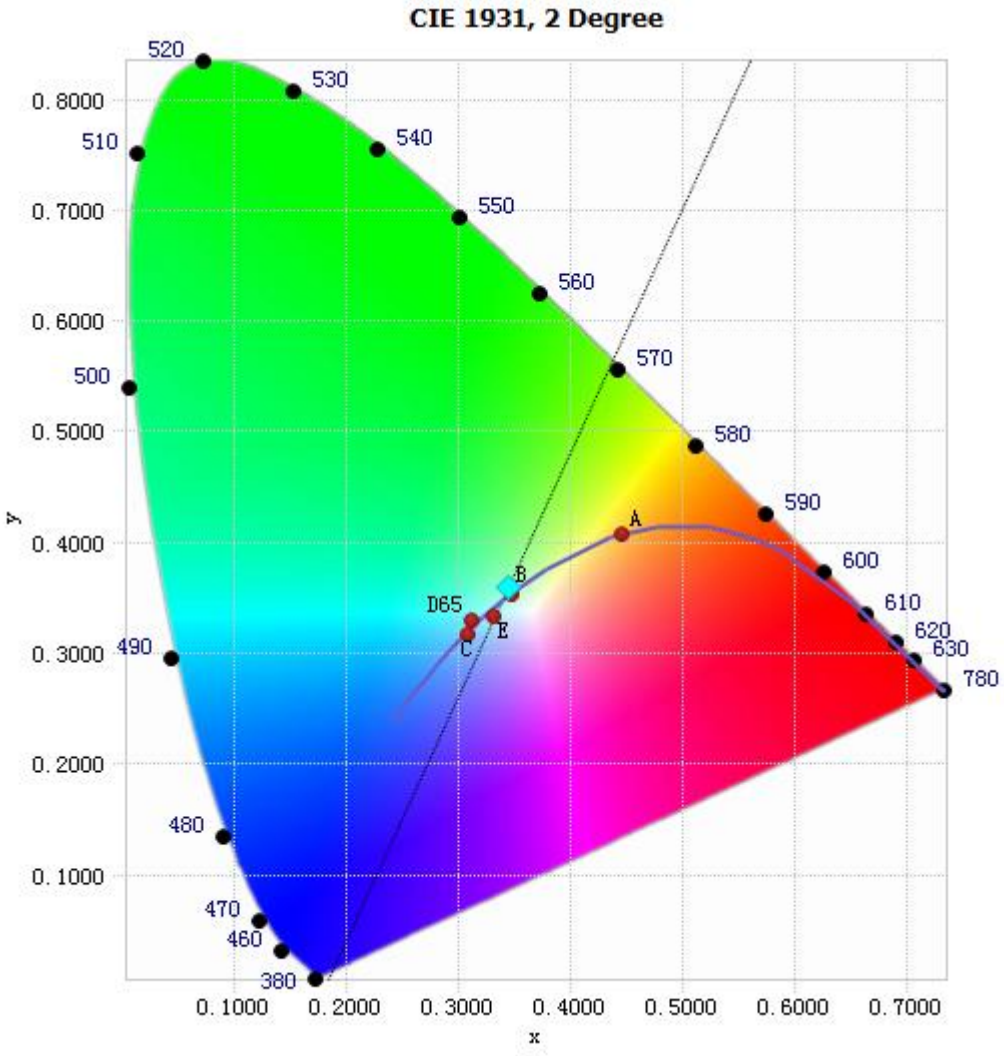


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.96E-04	485	1.24E-02	590	2.98E-02	695	3.78E-03
385	1.84E-04	490	1.37E-02	595	2.93E-02	700	3.23E-03
390	1.66E-04	495	1.58E-02	600	2.88E-02	705	2.77E-03
395	1.39E-04	500	1.84E-02	605	2.78E-02	710	2.35E-03
400	7.44E-05	505	2.06E-02	610	2.66E-02	715	2.02E-03
405	9.19E-05	510	2.23E-02	615	2.53E-02	720	1.73E-03
410	1.95E-04	515	2.38E-02	620	2.37E-02	725	1.48E-03
415	4.74E-04	520	2.48E-02	625	2.21E-02	730	1.26E-03
420	1.07E-03	525	2.55E-02	630	2.03E-02	735	1.07E-03
425	2.36E-03	530	2.61E-02	635	1.86E-02	740	9.09E-04
430	4.95E-03	535	2.65E-02	640	1.68E-02	745	7.76E-04
435	9.97E-03	540	2.70E-02	645	1.51E-02	750	6.67E-04
440	1.90E-02	545	2.74E-02	650	1.34E-02	755	5.71E-04
445	3.51E-02	550	2.79E-02	655	1.19E-02	760	4.83E-04
450	5.03E-02	555	2.83E-02	660	1.04E-02	765	4.15E-04
455	4.37E-02	560	2.87E-02	665	9.14E-03	770	3.56E-04
460	2.90E-02	565	2.92E-02	670	7.91E-03	775	3.07E-04
465	2.26E-02	570	2.96E-02	675	6.88E-03	780	2.65E-04
470	1.73E-02	575	2.98E-02	680	5.93E-03		
475	1.30E-02	580	3.00E-02	685	5.12E-03		
480	1.18E-02	585	3.01E-02	690	4.41E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3450, 0.3590)

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

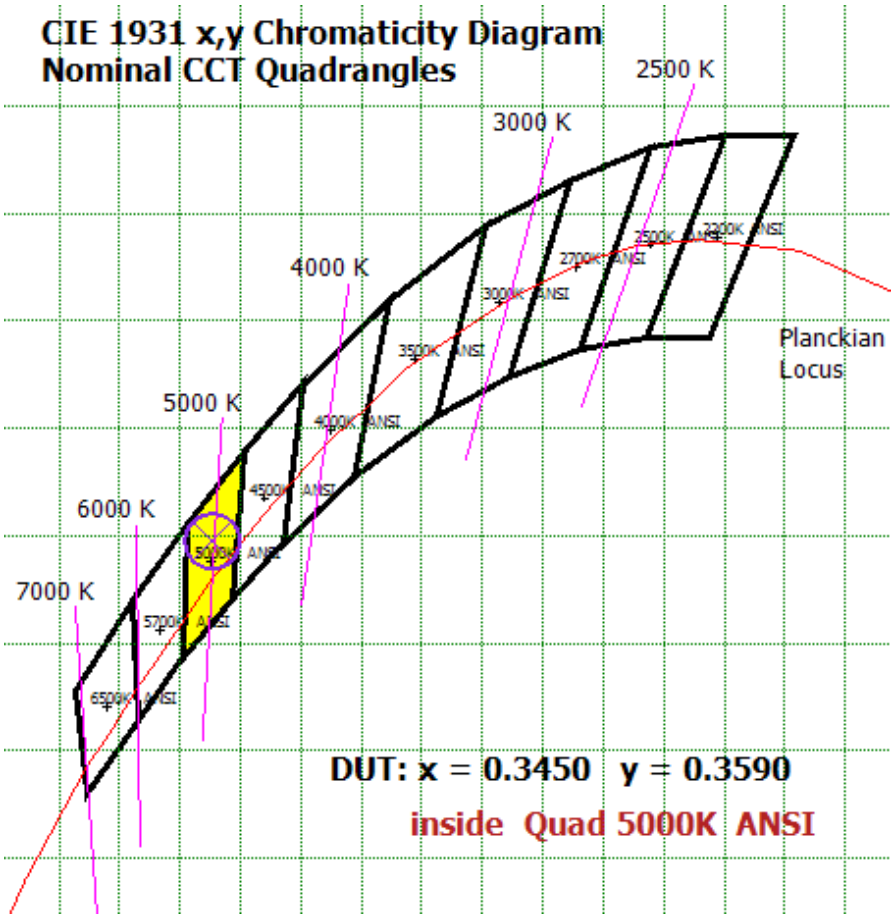
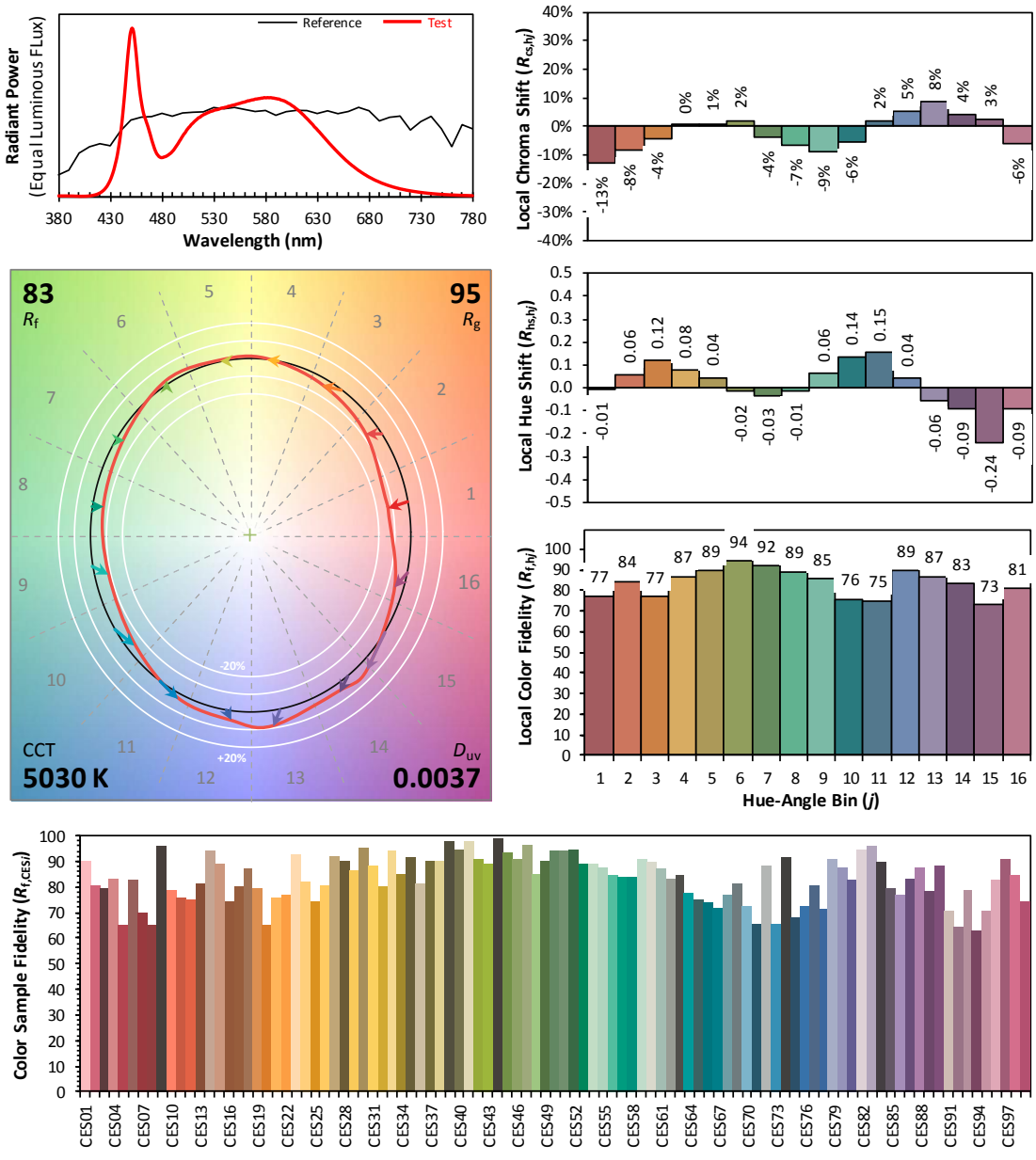


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.3450
y	0.3590
u'	0.2085
v'	0.4882

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

γ(°)	Lumens	% Total
0- 10	27.728	1.48%
10- 20	80.799	4.32%
20- 30	126.962	6.79%
30- 40	162.385	8.69%
40- 50	184.417	9.87%
50- 60	192.071	10.27%
60- 70	186.25	9.96%
70- 80	170.17	9.10%
80- 90	149.74	8.01%
90-100	131.16	7.02%
100-110	113.521	6.07%
110-120	96.111	5.14%
120-130	79.397	4.25%
130-140	63.818	3.41%
140-150	48.526	2.60%
150-160	33.21	1.78%
160-170	17.791	0.95%
170-180	5.255	0.28%
Total	1869.3	100%

γ(°)	Lumens	% Total
0- 60	774.362	41.42%
60- 90	506.16	27.08%
0-90	1280.522	68.50%
90- 180	588.789	31.50%
0- 180	1869.3	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

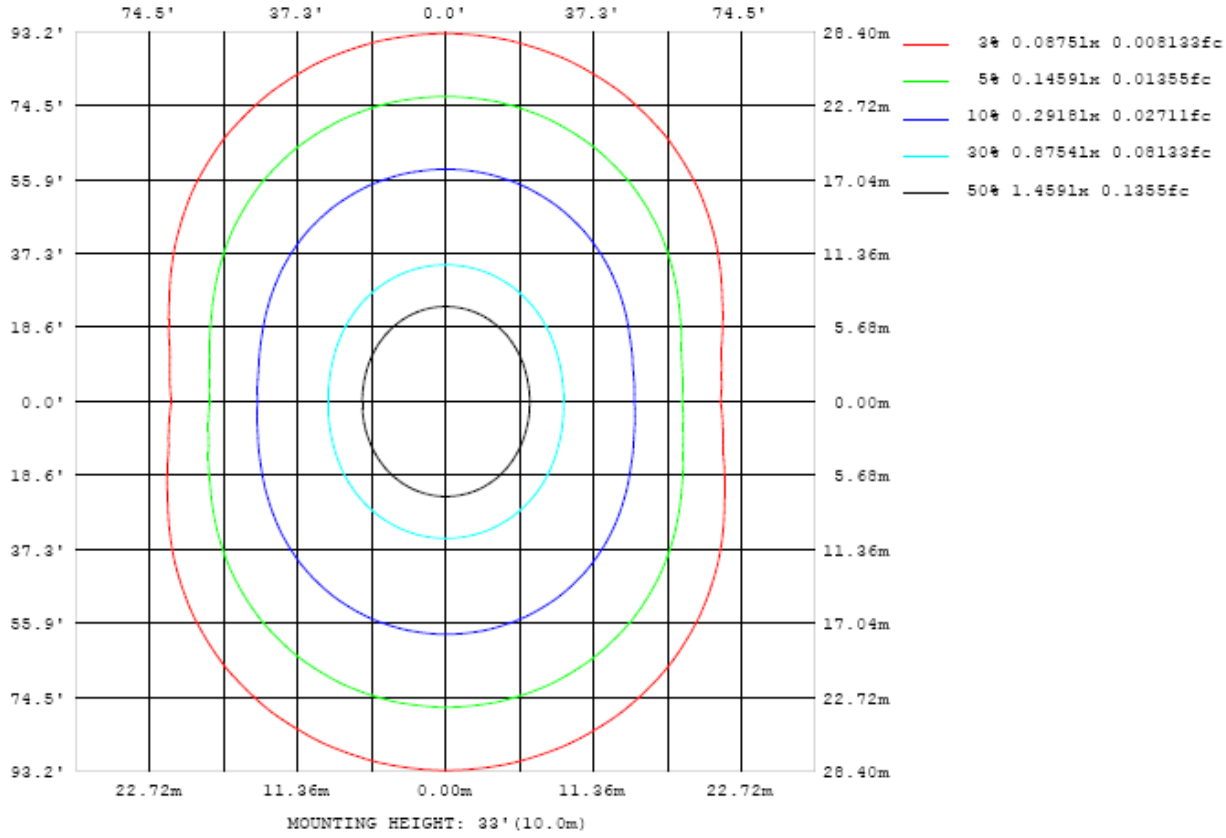


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

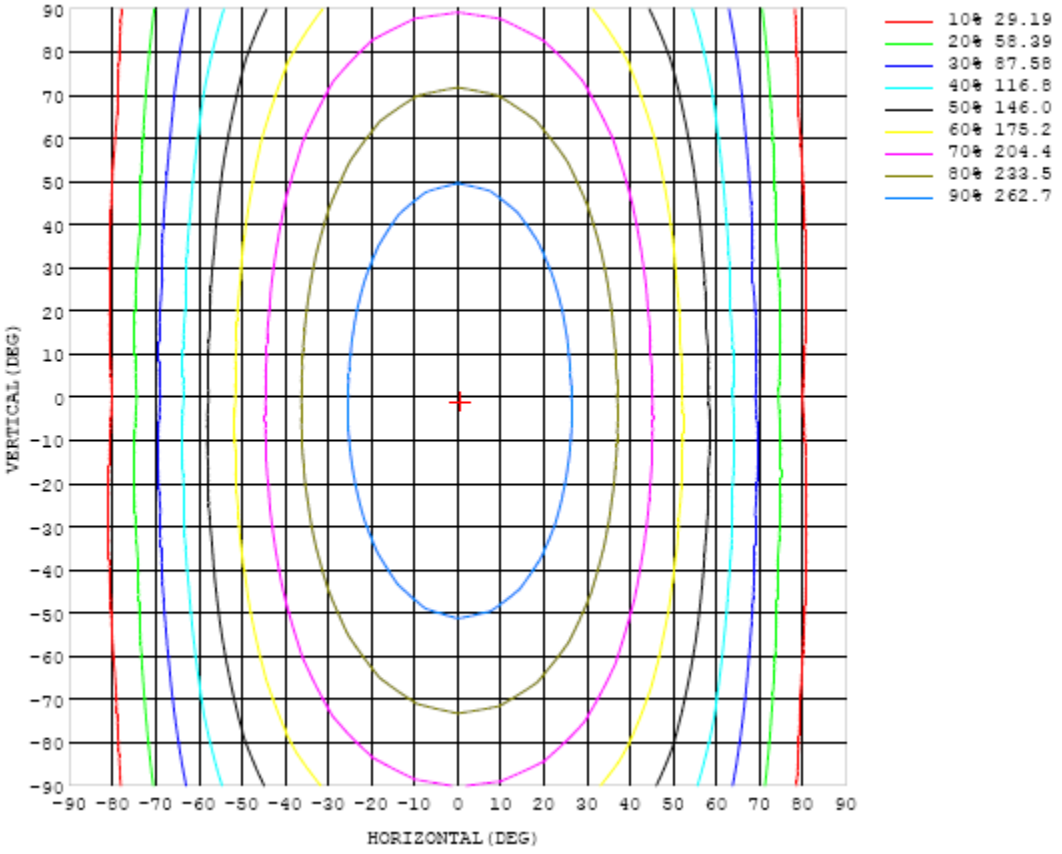


Chart 6: Isocandela Plot

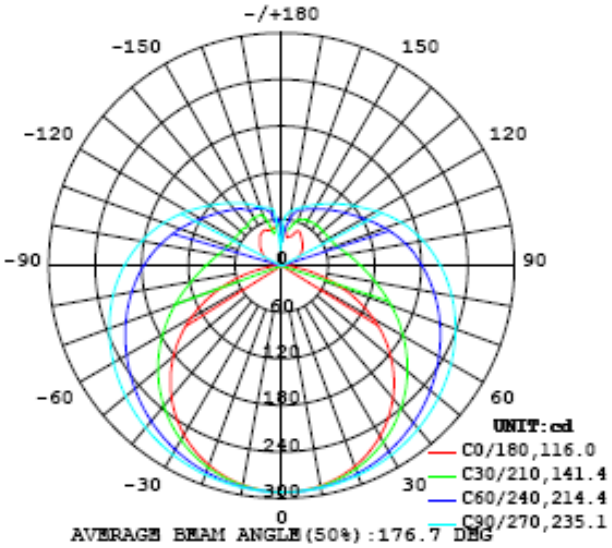


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292
5	291	291	291	291	291	292	292	292	292	292	292	292	291	291	291	291	291	291	290
10	288	288	289	289	289	290	290	291	291	291	291	290	290	289	289	288	288	287	287
15	283	283	284	285	286	287	288	289	289	290	289	288	287	286	285	284	283	282	281
20	275	276	277	279	281	283	285	287	287	288	287	286	284	282	280	277	276	274	274
25	266	267	269	272	275	278	281	283	285	285	284	282	280	277	273	270	267	265	264
30	254	255	258	262	267	272	276	280	281	282	281	279	275	270	265	260	256	253	252
35	240	242	246	252	258	265	271	275	278	278	277	274	269	263	256	249	243	239	237
40	223	226	231	240	248	257	264	270	273	274	273	269	263	255	246	237	229	223	221
45	205	208	216	226	238	249	258	264	268	269	268	263	256	246	235	223	213	206	202
50	184	188	198	212	226	239	250	258	263	264	262	257	248	237	223	209	196	186	182
55	162	167	180	196	214	230	242	251	257	258	256	250	240	227	211	194	178	166	159
60	137	144	161	181	201	220	234	244	250	252	250	243	232	217	199	178	159	143	135
65	110	119	140	166	189	210	226	237	244	246	243	235	224	207	186	163	139	119	109
70	82.3	94.3	121	150	177	200	217	229	236	238	236	228	215	197	174	148	119	94.2	82.1
75	54.7	70.1	102	136	166	190	208	221	229	231	228	220	206	187	163	133	100	70.2	55.6
80	28.9	48.6	85.6	123	155	180	200	213	220	223	219	211	197	177	152	120	83.8	48.5	30.4
85	8.57	32.4	72.7	112	145	171	190	204	212	214	211	202	188	169	142	109	70.5	31.7	9.68
90	0.53	23.6	63.2	102	135	162	181	195	202	205	202	193	179	159	132	99.2	60.9	22.1	0.35
95	2.19	20.0	56.7	93.9	126	153	172	185	193	195	192	184	170	150	124	91.1	54.2	18.3	2.16
100	5.99	20.6	51.9	86.5	118	143	163	175	183	185	182	174	160	141	115	83.7	49.3	18.8	5.92
105	11.1	23.4	49.7	80.2	109	134	152	165	173	175	172	164	150	131	107	77.4	47.0	22.3	11.1
110	16.7	27.8	49.4	75.6	101	124	142	154	162	164	161	153	140	122	98.9	72.8	46.9	27.2	16.9
115	22.3	32.7	50.5	72.7	95.0	115	131	143	150	152	150	142	130	113	92.5	70.1	48.1	31.7	22.1
120	27.5	37.5	52.4	70.9	90.0	107	122	132	139	141	138	131	120	105	87.8	68.5	50.7	36.5	26.8
125	31.8	42.1	54.4	70.0	86.1	101	113	123	128	130	128	122	112	99.3	84.2	67.8	53.7	41.0	31.1
130	35.5	46.1	56.7	69.5	83.0	95.7	106	114	119	120	119	113	105	94.2	81.4	68.1	56.1	45.9	35.5
135	38.6	49.3	57.4	69.3	80.4	91.0	99.9	107	111	112	110	106	99.0	89.9	79.3	68.8	58.7	50.3	39.7
140	41.5	53.2	60.5	69.2	78.2	86.8	94.2	99.8	103	104	103	99.3	93.5	86.1	77.7	69.0	60.7	54.1	43.9
145	44.5	56.2	61.6	68.4	76.4	83.2	89.1	93.6	96.4	97.4	96.3	93.3	88.7	82.9	76.4	69.6	62.4	57.2	48.2
150	48.3	58.9	61.9	67.7	75.0	79.9	84.5	88.0	90.3	91.1	90.3	88.0	84.5	80.1	74.8	69.7	64.4	59.1	49.9
155	49.4	58.4	61.5	65.7	72.4	77.1	80.3	83.1	84.8	85.5	85.0	83.4	80.5	77.3	73.9	69.6	65.6	61.2	50.6
160	41.8	52.3	58.9	62.9	68.0	73.7	77.1	78.7	79.8	80.3	80.0	79.1	77.6	75.3	72.3	69.2	67.1	64.0	48.5
165	38.9	45.7	49.9	54.9	59.7	66.8	72.3	74.9	75.8	76.2	76.1	75.5	74.2	72.3	70.4	69.0	67.7	65.7	49.4
170	38.1	42.2	46.8	47.6	48.8	54.6	59.0	66.5	71.5	71.4	71.4	71.1	70.6	69.8	68.2	66.6	65.8	61.7	49.3
175	48.0	47.4	48.0	47.3	44.7	42.0	44.2	51.3	59.2	65.9	67.5	67.5	67.7	66.7	64.5	63.5	61.7	57.0	53.1
180	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0

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	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292		
5	290	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291	291		
10	287	287	288	288	289	289	290	290	290	290	290	290	289	289	289	288	288		
15	282	282	283	284	286	287	288	289	289	289	288	287	286	285	284	283	283		
20	274	275	277	279	281	283	285	286	287	287	286	284	282	280	278	277	276		
25	264	266	269	272	276	279	282	283	284	284	282	280	277	274	271	268	266		
30	252	255	259	264	269	274	278	280	281	280	278	275	271	266	261	257	254		
35	239	243	248	255	262	268	273	276	277	276	273	269	263	257	250	244	241		
40	223	228	236	245	254	262	268	271	273	272	268	263	255	247	238	230	225		
45	205	212	222	234	245	254	262	266	268	266	262	255	246	235	224	214	207		
50	185	195	208	222	236	247	255	260	262	261	256	248	237	223	209	196	186		
55	164	176	193	210	226	239	249	254	256	255	249	240	227	211	194	177	164		
60	141	157	177	197	216	231	241	248	250	248	242	231	217	198	178	157	141		
65	117	137	161	185	206	222	234	241	243	241	234	223	206	186	162	137	117		
70	92.0	117	146	173	196	214	226	234	236	234	226	214	196	173	146	117	91.5		
75	68.6	98.2	131	161	186	205	218	226	229	226	218	205	186	162	132	98.5	67.9		
80	46.9	81.7	118	150	176	196	210	218	221	218	210	196	176	151	119	82.3	46.5		
85	30.4	69.4	107	140	167	187	201	209	212	209	201	187	167	140	108	69.9	30.5		
90	21.4	60.0	97.8	131	158	178	192	200	203	200	192	178	158	131	98.3	60.7	22.0		
95	18.3	53.5	89.6	122	148	168	182	190	193	190	182	168	148	122	90.3	54.3	19.3		
100	19.5	49.5	82.9	113	139	158	172	180	183	180	172	158	139	114	83.6	50.6	20.6		
105	22.8	47.8	77.4	106	130	149	162	170	172	170	162	149	130	106	78.4	49.1	23.9		
110	27.4	48.2	73.9	99.0	121	139	152	159	162	159	152	139	122	99.6	74.9	49.7	28.5		
115	32.5	49.8	71.5	93.2	113	130	142	149	151	149	141	130	114	93.9	72.8	51.4	33.3		
120	37.4	52.0	70.2	88.8	106	121	132	138	140	138	132	121	106	89.8	71.7	53.7	37.6		
125	41.9	53.1	69.1	85.5	100	113	122	128	130	128	122	113	101	86.5	70.8	54.7	41.5		
130	45.9	55.7	69.0	82.8	95.3	106	114	119	121	119	114	106	95.8	84.1	69.9	54.4	45.1		
135	48.1	59.4	68.2	79.9	91.2	100	107	111	113	111	107	100	91.8	81.2	69.8	59.4	46.9		
140	49.1	61.6	68.3	77.3	87.1	94.9	100	104	105	104	101	95.2	88.0	77.7	67.4	62.1	47.5		
145	48.2	61.9	70.6	74.9	81.9	89.5	94.7	97.6	98.5	97.7	94.9	90.2	82.3	74.6	70.4	62.9	46.9		
150	45.8	61.2	71.2	75.5	78.9	81.8	87.1	91.2	92.3	91.9	88.7	82.7	78.5	75.4	67.5	61.0	45.7		
155	42.0	55.4	71.1	74.8	78.3	81.2	83.8	85.7	86.3	84.2	81.7	80.7	78.9	73.0	65.6	55.0	41.8		
160	40.8	46.4	67.1	73.5	76.6	78.3	79.6	80.3	80.7	80.8	80.3	77.5	69.2	58.3	54.9	45.6	39.5		
165	40.2	41.5	45.9	64.9	72.0	74.4	76.5	77.5	78.0	78.0	71.6	60.6	51.6	49.9	42.3	39.3	38.1		
170	42.4	44.8	45.8	46.8	54.5	62.5	68.8	72.9	74.7	59.7	45.2	51.1	50.3	49.3	44.8	42.5	40.6		
175	52.5	51.3	52.6	56.4	59.3	60.1	59.3	59.2	27.4	54.7	60.6	60.0	58.3	56.2	54.3	51.2	48.6		
180	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0		

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.

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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

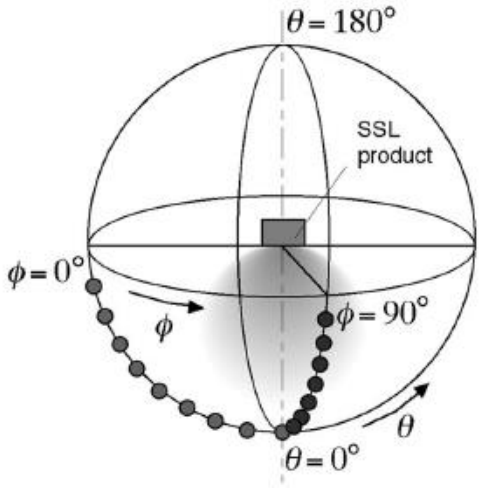
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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