LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 10.5T8/4F/830/DIR/RD

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19050049b

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

Review by: April Zou

Engineer: April Zou
Jun. 04, 2019

Approved by:

Manager: Jim Zhang
Jun. 04, 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/830/DIR/RD**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
128.7	1785.0	13.87	0.9922

CCT (K)	CRI	Stabilization Time (Light & Power)
2946	81.5	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 30, 2019

Date of Test : Jun. 04, 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

TABLE OF CONTENT

SAMPLE PHOTO

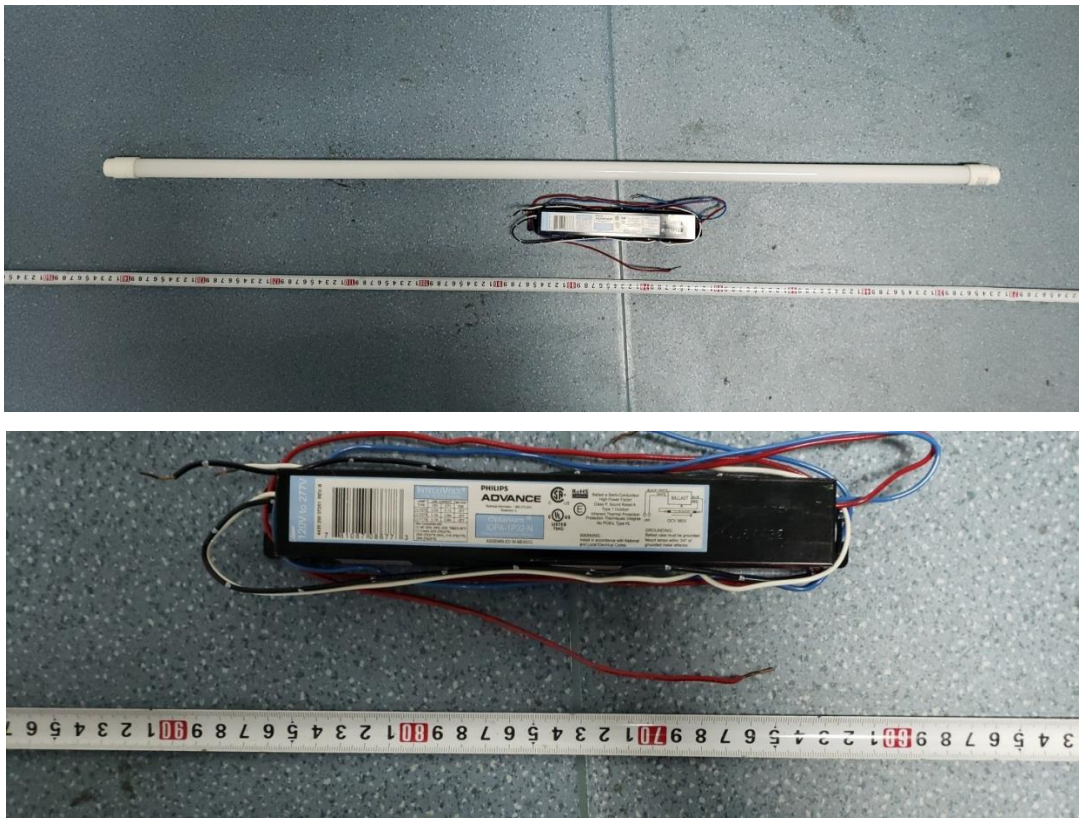


Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Tube
Model	: 10.5T8/4F/830/DIR/RD
Electrical Ratings	: 120-277V, 60Hz, 10.5W
Product Description	: 3000K 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)	0.117	0.054
Power Factor	0.9922	0.9308
Test Power (W)	13.87	13.94
THD A%	8.60	14.92
Luminous Efficacy (lm/W)	128.7	128.0
Total Luminous Flux (lm)	1785.0	1784.0
Color Rendering Index (CRI)	81.5	
R9	1	
Correlated Color Temperature (CCT)(K)	2946	
Chromaticity Chroma x	0.4397	
Chromaticity Chroma y	0.4033	
Chromaticity Chroma u	0.2527	
Chromaticity Chroma v	0.3477	
Duv	0.0009	
Chromaticity Chroma u ’	0.2527	
Chromaticity Chroma v’	0.5215	

Special Color Rendering Indices	
R1	80
R2	91.2
R3	95
R4	79.2
R5	80.5
R6	89.8
R7	80.8
R8	55.6
R9	1
R10	80.4
R11	78.8
R12	72.8
R13	82.8
R14	97.9

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 24.7 ℃.

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)	0.117
Power Factor	0.9930
Power (W)	13.94
Luminous Efficacy (lm/W)	126.1
Total Luminous Flux (lm)	1757.2
Beam Angle (°)	117.1 (0^o-180^o) / 238.5 (90^o-270^o)
Center Beam Candle Power (cd)	270
Maximum Beam Candle Power (cd)	269.7 (At: C=210.0, Gamma=1.5)
Spacing Criteria	1.30 (0^o-180^o) / 1.47 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	40.99%
Zonal Lumens in the 60 °-90 °Zone	26.97%
Zonal Lumens in the 90 °-120 °Zone	18.29%
Zonal Lumens in the 120 °-180 °Zone	13.75%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

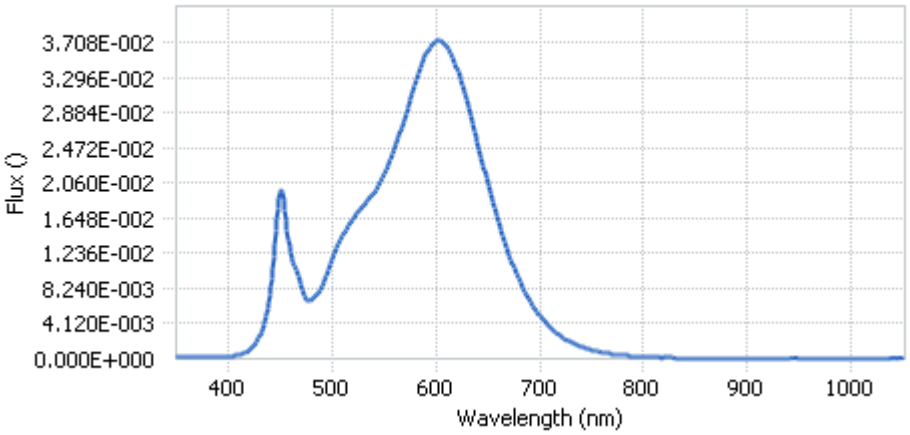
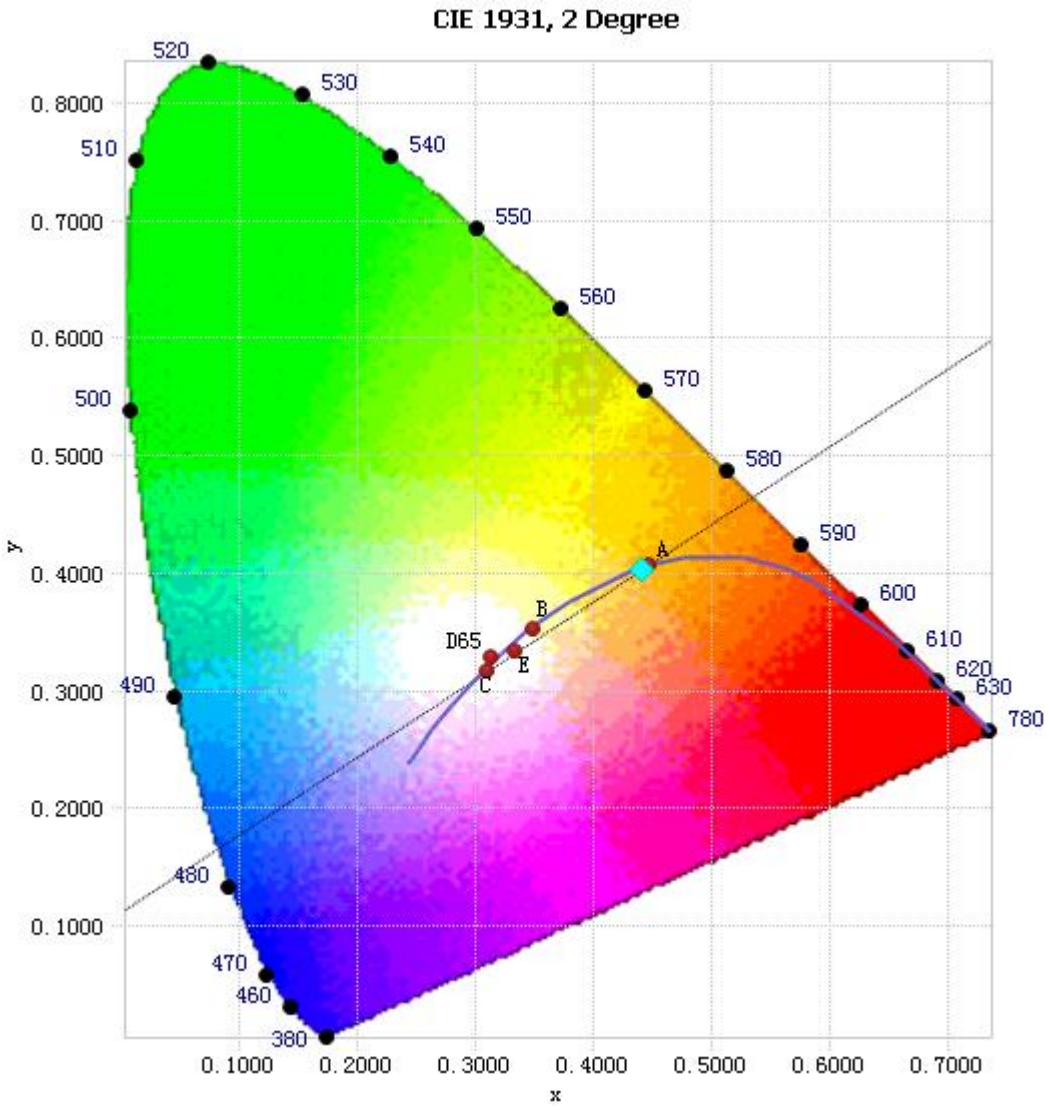


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.45E-04	485	7.50E-03	590	3.57E-02	695	5.95E-03
385	2.34E-04	490	8.51E-03	595	3.67E-02	700	5.09E-03
390	2.62E-04	495	9.95E-03	600	3.72E-02	705	4.36E-03
395	2.56E-04	500	1.16E-02	605	3.74E-02	710	3.72E-03
400	2.95E-04	505	1.32E-02	610	3.68E-02	715	3.16E-03
405	3.38E-04	510	1.44E-02	615	3.57E-02	720	2.70E-03
410	4.31E-04	515	1.55E-02	620	3.42E-02	725	2.29E-03
415	6.32E-04	520	1.64E-02	625	3.23E-02	730	1.97E-03
420	9.64E-04	525	1.72E-02	630	3.03E-02	735	1.66E-03
425	1.55E-03	530	1.79E-02	635	2.79E-02	740	1.42E-03
430	2.62E-03	535	1.86E-02	640	2.55E-02	745	1.21E-03
435	4.37E-03	540	1.95E-02	645	2.30E-02	750	1.03E-03
440	7.47E-03	545	2.05E-02	650	2.07E-02	755	8.83E-04
445	1.34E-02	550	2.16E-02	655	1.84E-02	760	7.57E-04
450	1.95E-02	555	2.30E-02	660	1.62E-02	765	6.44E-04
455	1.74E-02	560	2.45E-02	665	1.43E-02	770	5.52E-04
460	1.24E-02	565	2.63E-02	670	1.24E-02	775	4.79E-04
465	1.06E-02	570	2.82E-02	675	1.08E-02	780	4.09E-04
470	8.67E-03	575	3.03E-02	680	9.36E-03		
475	6.99E-03	580	3.23E-02	685	8.08E-03		
480	6.84E-03	585	3.42E-02	690	6.94E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4397, 0.4033)

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

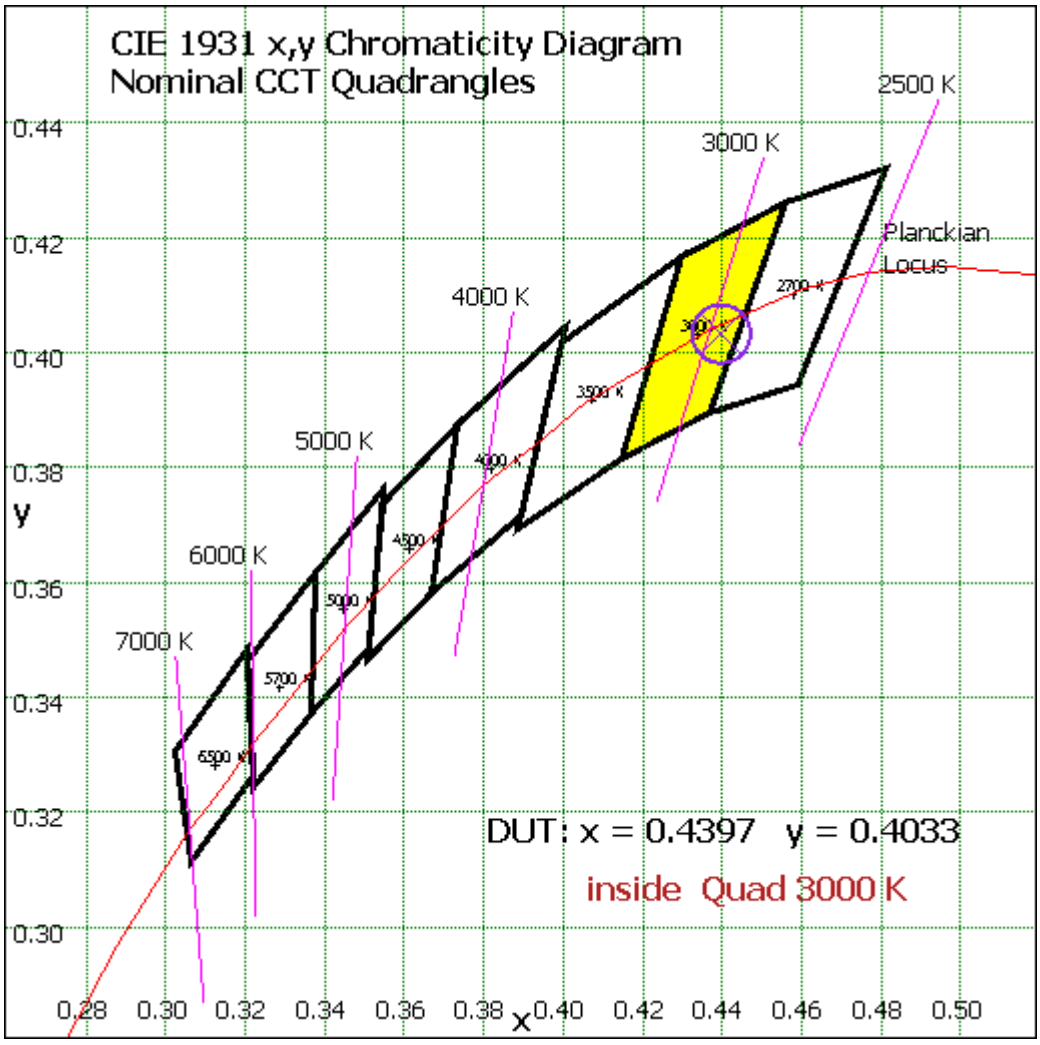
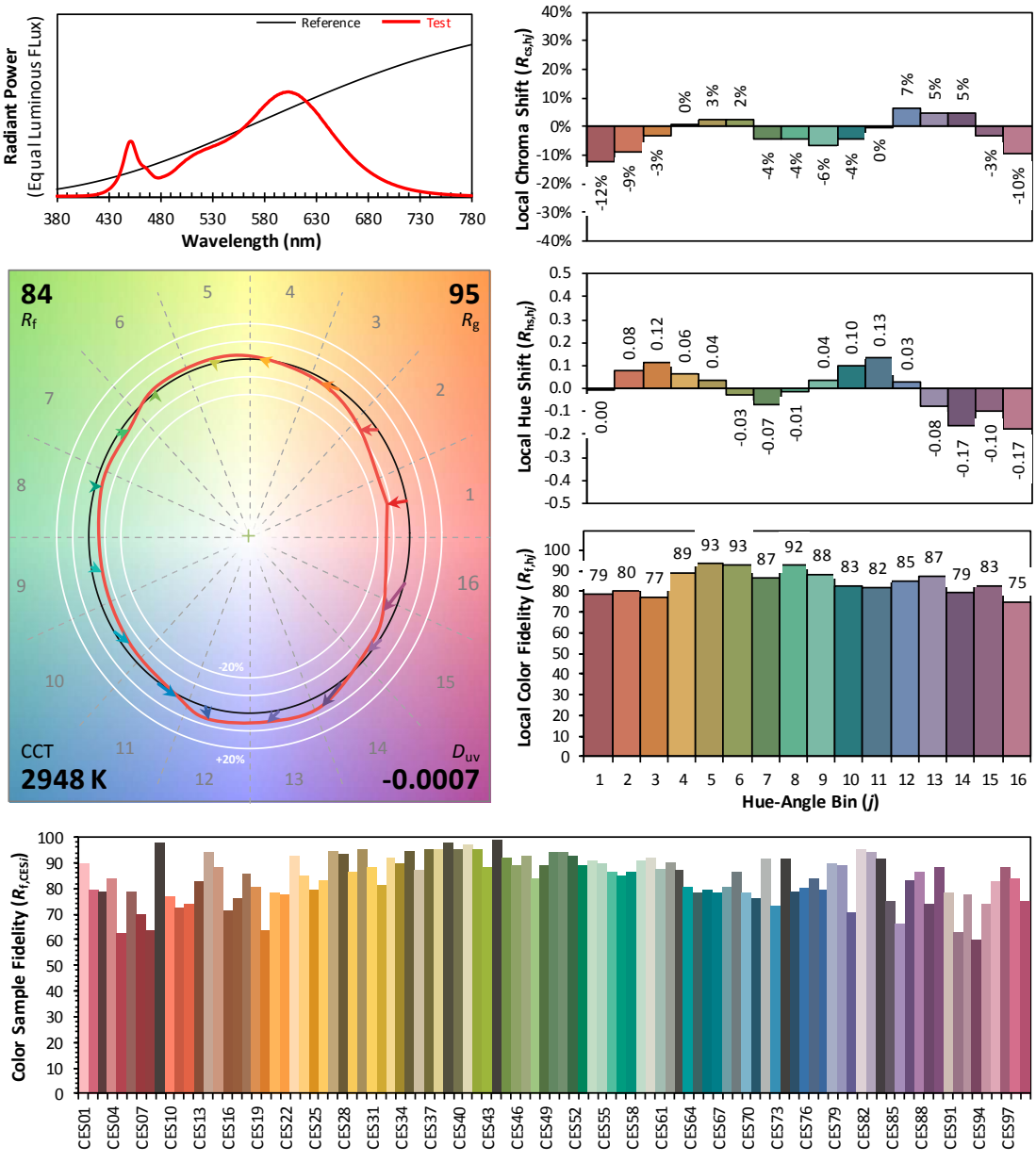


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4397
y	0.4033
u'	0.2527
v'	0.5215

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	25.627	1.46%
10- 20	74.753	4.25%
20- 30	117.666	6.70%
30- 40	150.874	8.59%
40- 50	171.868	9.78%
50- 60	179.494	10.21%
60- 70	174.303	9.92%
70- 80	159.358	9.07%
80- 90	140.289	7.98%
90-100	123.098	7.01%
100-110	106.956	6.09%
110-120	91.289	5.20%
120-130	76.478	4.35%
130-140	61.971	3.53%
140-150	47.462	2.70%
150-160	32.719	1.86%
160-170	17.667	1.01%
170-180	5.301	0.30%
Total	1757.2	100%

γ(°)	Lumens	% Total
0- 60	720.282	40.99%
60- 90	473.95	26.97%
0-90	1194.232	67.96%
90- 180	562.941	32.04%
0- 180	1757.2	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

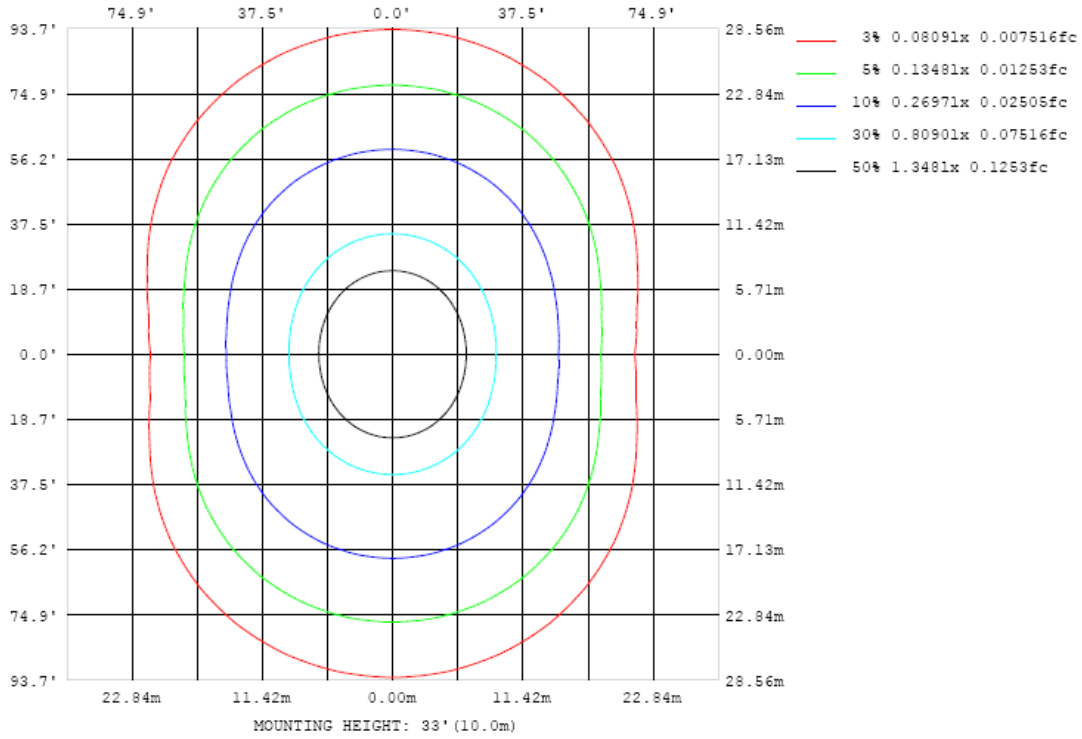


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

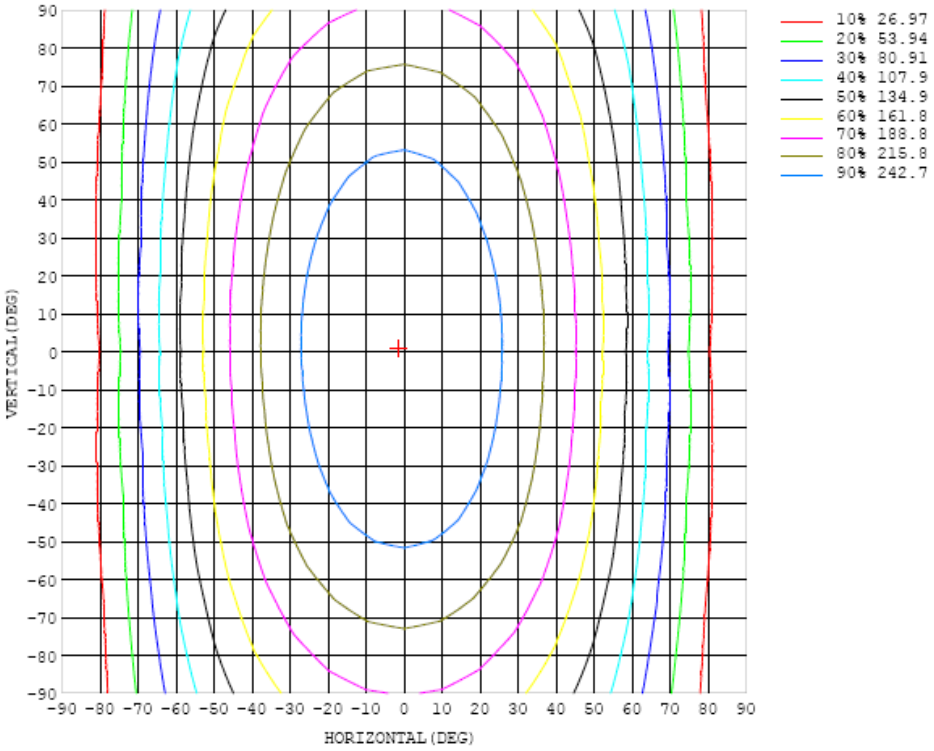


Chart 6: Isocandela Plot

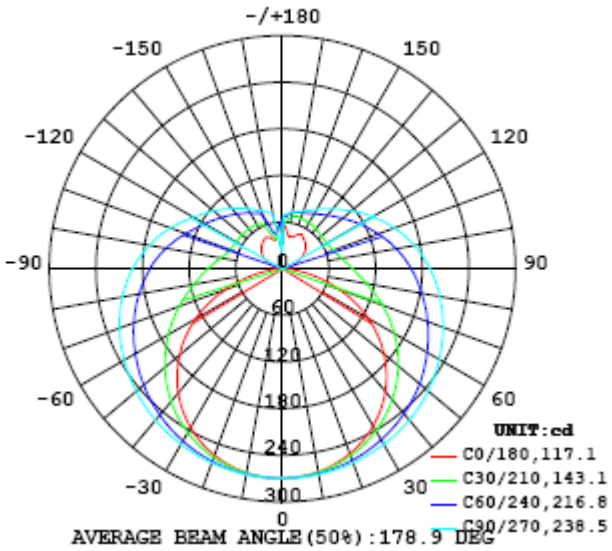


Chart 7: Polar Candela Distribution

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	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270
5	268	268	268	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269
10	265	265	266	266	266	267	268	268	268	269	269	268	268	268	267	267	267	267	267
15	260	260	261	262	263	264	265	266	267	267	267	267	266	265	264	263	263	262	262
20	253	253	255	256	258	260	262	264	265	266	265	265	263	262	260	258	257	256	256
25	244	245	246	249	252	256	259	261	263	263	263	262	260	257	254	251	249	247	247
30	233	234	237	241	245	250	254	258	260	261	260	258	255	251	247	243	239	237	236
35	221	222	225	231	237	243	249	254	256	258	257	254	250	245	239	233	228	224	224
40	206	207	212	220	228	236	243	249	253	254	253	250	245	238	230	222	214	210	209
45	189	191	198	208	218	228	237	244	248	250	248	245	238	230	220	209	200	193	192
50	170	173	182	194	208	220	231	238	243	245	243	239	231	221	209	196	183	175	173
55	150	154	165	180	197	211	223	232	237	239	237	232	224	212	197	181	166	155	152
60	127	132	147	166	185	202	215	225	231	233	231	226	216	202	186	166	147	133	129
65	103	110	129	152	173	192	207	218	224	226	224	218	208	193	174	151	128	110	104
70	77.9	87.4	110	137	161	182	199	211	218	220	218	211	199	183	162	137	110	86.4	78.3
75	53.1	65.6	92.8	123	150	173	190	203	210	213	211	204	191	174	150	123	92.0	64.1	52.2
80	29.0	45.3	76.6	110	139	163	182	195	203	206	203	196	183	164	140	110	76.2	43.8	27.9
85	9.60	29.2	64.0	98.9	130	155	174	187	195	198	195	188	175	156	131	99.6	64.1	28.3	8.63
90	0.49	19.5	55.3	90.4	121	146	166	179	187	190	187	180	166	147	122	91.3	55.9	19.8	0.68
95	2.33	16.8	49.5	83.3	114	138	157	171	179	182	179	171	158	139	114	84.4	50.6	17.7	2.27
100	6.31	17.9	46.1	77.5	106	130	149	162	170	172	170	162	149	131	107	79.9	47.6	19.3	5.98
105	11.5	21.1	44.9	73.1	99.2	122	140	153	160	163	161	153	141	123	101	74.7	46.4	22.8	10.9
110	17.3	26.1	45.1	69.8	93.4	114	131	143	151	153	151	144	132	116	94.9	71.4	47.1	27.8	16.5
115	22.9	31.2	46.4	67.5	88.4	108	123	134	141	144	142	135	124	109	89.9	69.2	48.9	33.0	22.0
120	28.6	36.5	48.6	66.1	84.1	101	115	126	132	134	132	126	116	102	85.6	68.3	51.4	37.8	27.2
125	33.9	41.8	51.4	65.6	80.7	95.3	108	117	123	125	123	118	109	96.5	82.5	67.9	54.1	42.3	31.5
130	38.7	47.0	53.8	65.7	78.6	90.5	101	109	114	116	114	110	102	91.9	80.0	68.0	56.3	47.1	35.5
135	42.0	50.4	56.9	66.4	76.5	86.3	95.2	102	106	108	106	103	96.2	87.7	78.4	68.5	58.7	50.4	38.4
140	45.2	53.9	59.3	67.0	74.9	82.7	90.1	95.7	99.3	101	99.5	96.3	91.1	84.2	76.8	69.0	60.1	53.0	41.2
145	47.5	56.4	61.9	67.6	74.0	79.7	85.5	90.0	92.8	93.9	93.2	90.6	86.5	81.1	75.4	69.3	61.9	56.0	43.3
150	50.3	59.8	64.2	68.0	73.4	78.0	81.7	85.0	87.2	88.1	87.5	85.6	82.6	78.6	74.2	69.2	64.1	58.2	45.4
155	48.8	60.2	65.9	68.7	72.5	76.1	78.8	81.1	82.6	83.2	82.8	81.5	79.3	76.6	73.6	67.8	62.8	57.5	44.9
160	44.8	60.3	67.6	69.5	71.8	74.9	77.2	78.2	79.0	79.1	78.7	77.6	76.5	74.9	71.7	65.8	58.7	51.9	41.9
165	43.1	58.1	67.9	70.1	71.9	73.4	75.1	76.2	76.6	76.6	76.1	75.3	74.5	72.9	66.3	56.0	50.9	44.5	38.0
170	44.0	52.5	63.2	67.1	69.4	71.8	73.3	73.9	74.1	74.1	74.0	74.2	71.8	63.9	52.5	47.7	46.4	44.5	41.7
175	52.2	52.9	56.6	62.4	65.2	66.2	67.7	70.0	71.1	71.2	72.0	67.5	56.5	46.4	42.5	45.7	48.9	49.9	51.3
180	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0

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	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270		
5	269	269	269	269	269	269	269	270	269	269	269	269	269	269	269	268	268		
10	267	267	267	268	268	268	269	269	269	269	268	268	267	267	266	266	265		
15	262	263	264	265	266	267	267	268	268	267	267	265	264	263	262	261	260		
20	256	257	259	260	262	264	265	266	266	265	264	262	260	258	256	255	254		
25	248	249	252	255	258	260	262	263	264	263	261	259	256	252	249	247	245		
30	237	240	244	248	252	256	259	261	261	260	258	254	250	245	241	237	235		
35	225	229	234	240	246	251	255	257	258	257	254	249	243	237	231	226	222		
40	211	216	223	231	239	246	251	254	254	253	249	243	236	228	220	213	208		
45	194	201	211	221	231	240	246	249	250	249	244	237	229	218	208	198	192		
50	176	185	198	211	223	233	240	245	246	244	239	231	220	208	195	183	174		
55	157	169	184	200	214	226	235	239	241	239	233	224	212	197	181	166	155		
60	135	151	170	188	205	219	228	234	235	233	227	217	203	186	167	149	134		
65	113	132	156	177	196	211	222	228	230	227	220	209	194	174	153	130	112		
70	89.3	114	141	167	187	204	215	222	223	221	214	201	185	164	139	112	88.6		
75	66.6	96.2	128	156	178	196	208	215	217	214	206	194	176	153	125	94.2	66.0		
80	46.3	81.0	116	146	170	187	200	207	209	207	199	185	168	143	113	78.8	45.5		
85	31.0	68.8	105	136	161	179	192	199	201	199	191	177	159	134	103	66.3	29.6		
90	22.6	59.8	96.2	127	152	171	183	191	193	190	182	169	150	125	93.5	57.2	20.6		
95	19.1	53.1	87.9	118	143	162	174	181	184	181	173	160	141	116	85.2	50.3	17.0		
100	19.9	48.7	80.8	110	134	152	165	172	174	171	164	151	132	107	78.0	45.9	18.0		
105	23.0	47.4	75.2	102	125	142	155	162	164	162	154	141	123	99.6	72.4	44.5	21.7		
110	27.3	47.8	71.9	95.3	116	133	144	151	154	151	143	131	114	93.0	69.0	45.0	26.6		
115	30.9	49.3	70.0	90.4	109	123	134	141	143	140	133	122	107	88.0	67.0	46.9	31.5		
120	36.0	51.4	68.8	86.5	103	116	125	131	133	131	124	114	101	84.2	66.2	49.8	36.5		
125	40.3	53.7	68.2	83.4	97.3	109	117	122	124	122	116	108	95.7	81.4	66.3	53.0	41.2		
130	43.5	55.1	67.7	80.8	92.7	103	110	114	116	114	109	102	91.4	79.3	66.9	55.6	44.8		
135	45.4	56.4	67.5	78.6	88.6	97.1	103	107	108	107	103	96.2	87.7	77.7	67.8	58.5	48.1		
140	47.3	59.7	67.3	76.4	85.0	92.0	97.2	100	102	100	96.9	91.4	84.4	76.4	68.3	60.7	50.0		
145	46.9	61.1	67.0	73.7	81.6	87.4	91.6	94.3	95.2	94.3	91.5	87.2	81.5	75.2	69.5	61.7	49.9		
150	45.1	60.4	66.2	71.6	77.9	82.7	86.5	88.7	89.4	88.8	86.7	83.2	78.8	74.7	69.9	61.3	49.0		
155	41.5	53.6	63.7	66.3	73.1	79.1	80.8	82.6	83.4	83.1	81.7	79.9	77.5	74.2	70.7	58.2	45.6		
160	39.1	45.5	51.2	57.7	60.2	70.2	78.4	79.3	79.9	79.9	79.2	77.9	75.9	72.7	69.3	51.7	42.3		
165	37.8	39.4	41.5	44.7	49.4	50.4	58.2	72.5	75.8	75.9	75.1	72.8	71.5	69.1	60.1	44.4	40.8		
170	39.6	41.2	42.1	45.1	46.0	46.6	41.2	38.9	66.0	70.1	66.3	64.1	59.9	54.0	46.5	44.3	43.8		
175	51.5	52.3	54.5	55.8	56.7	56.5	56.1	52.7	26.6	47.0	57.8	55.8	55.5	55.9	55.1	53.0	51.4		
180	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0		

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

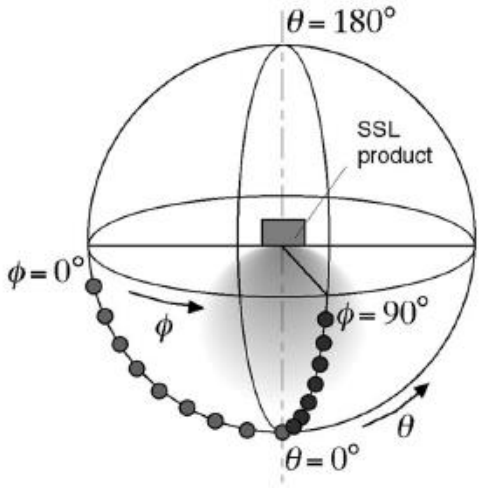
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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