

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 13T8/4F/DIM/830/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19050008b

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

Review by:



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May 17, 2019

Approved by:



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May 17, 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: 13T8/4F/DIM/830/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
144.6	1825.0	12.62	0.9845
CCT (K)	CRI	Stabilization Time (Light & Power)	
2950	82.0	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 08, 2019

Date of Test : May 14, 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

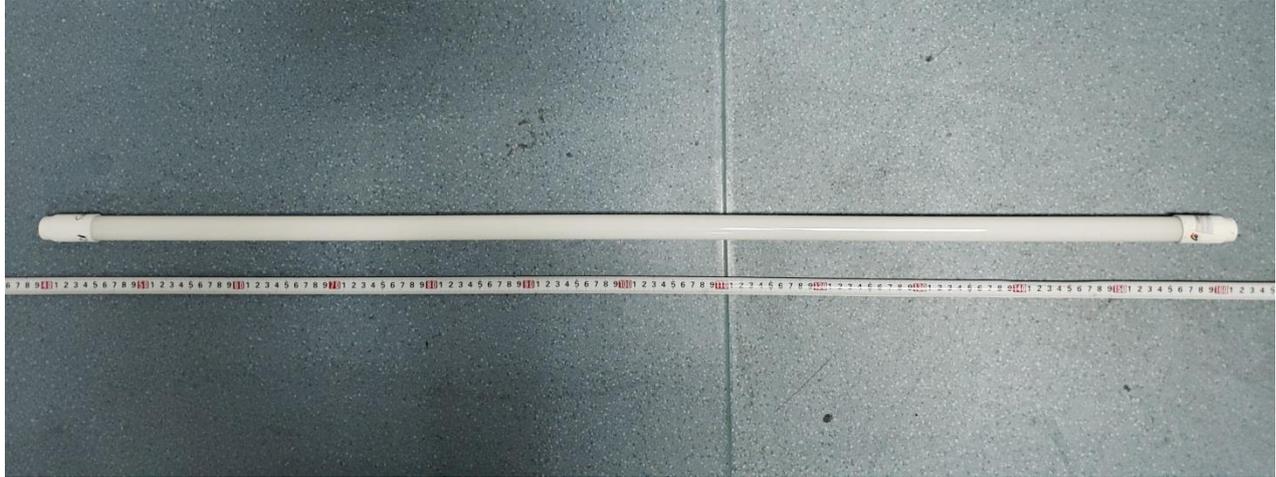


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 13T8/4F/DIM/830/BYP
Electrical Ratings	: 120V, 50/60Hz, 13W
Product Description	: 3000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

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
Voltage frequency (Hz)	60
Test Current (A)	0.107
Power Factor	0.9845
Test Power (W)	12.62
THD A%	12.51
Luminous Efficacy (lm/W)	144.6
Total Luminous Flux (lm)	1825.0
Color Rendering Index (CRI)	82.0
R9	2.3
Correlated Color Temperature (CCT)(K)	2950
Chromaticity Chroma x	0.4392
Chromaticity Chroma y	0.4029
Chromaticity Chroma u	0.2526
Chromaticity Chroma v	0.3475
Duv	0.0010
Chromaticity Chroma u'	0.2526
Chromaticity Chroma v'	0.5212

Special Color Rendering Indices	
R1	80.5
R2	91.3
R3	95.3
R4	80.3
R5	81.3
R6	90.1
R7	81.2
R8	56.3
R9	2.3
R10	80.8
R11	80.4
R12	75.1
R13	83.1
R14	98

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u',v') diagram, $u' = u / (-2x + 12y + 3)$, $v' = 3v / 2 = 9y / (-2x + 12y + 3)$.

Goniophotometer Method

Test ambient temperature was 24.7°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)	0.107
Power Factor	0.9844
Power (W)/2	12.65
Luminous Efficacy (lm/W)	142.1
Total Luminous Flux (lm)	1797.4
Beam Angle (°)	116.7 (0°-180°) / 250.5 (90°-270°)
Center Beam Candle Power (cd)	265
Maximum Beam Candle Power (cd)	265.6 (At: C=70.0, Gamma=2.0)
Spacing Criteria	1.28 (0°-180°) /1.47 (90°-270°)
Zonal Lumens in the 0°-60° Zone	39.55%
Zonal Lumens in the 60°-90° Zone	26.52%
Zonal Lumens in the 90°-120° Zone	18.79%
Zonal Lumens in the 120°-180° Zone	15.14%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

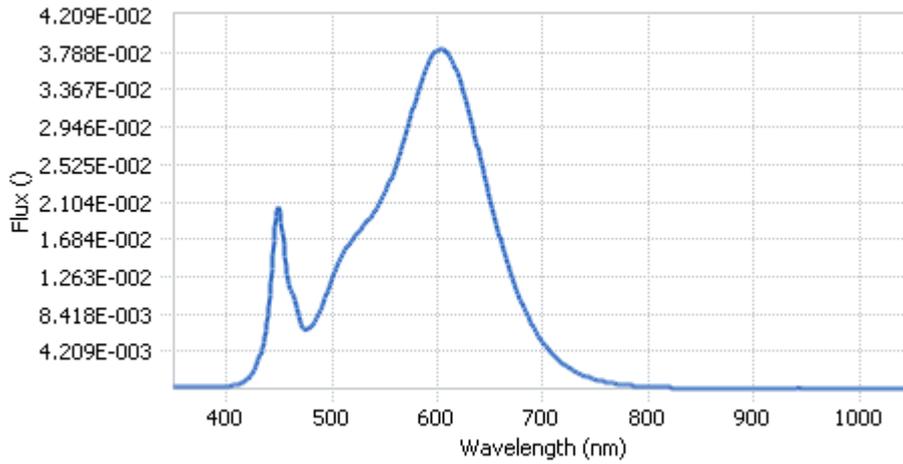
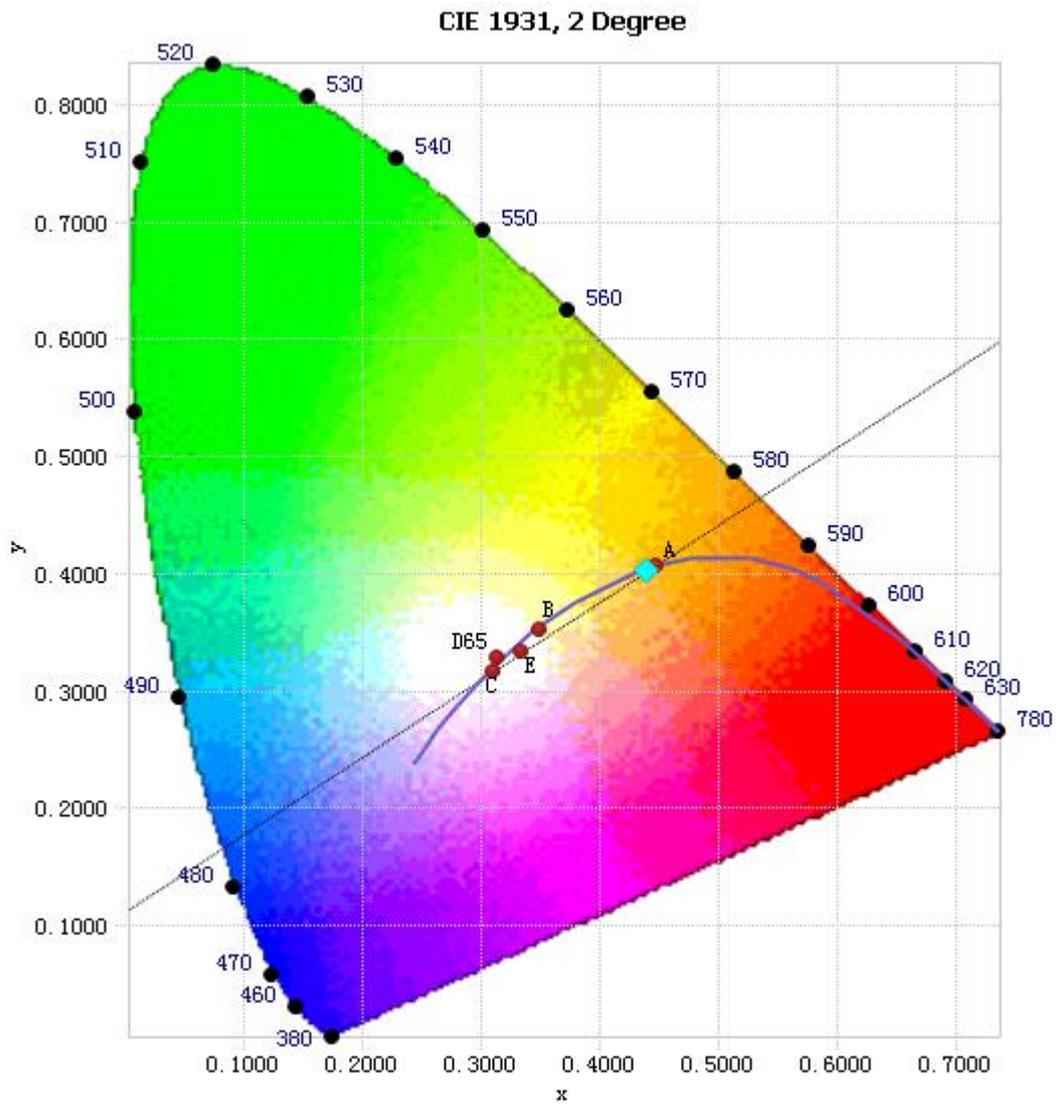


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.41E-04	485	7.81E-03	590	3.63E-02	695	6.07E-03
385	2.45E-04	490	9.08E-03	595	3.75E-02	700	5.21E-03
390	2.51E-04	495	1.08E-02	600	3.81E-02	705	4.45E-03
395	2.76E-04	500	1.24E-02	605	3.82E-02	710	3.77E-03
400	3.00E-04	505	1.39E-02	610	3.77E-02	715	3.21E-03
405	3.60E-04	510	1.51E-02	615	3.67E-02	720	2.73E-03
410	4.92E-04	515	1.62E-02	620	3.52E-02	725	2.33E-03
415	7.23E-04	520	1.69E-02	625	3.32E-02	730	1.98E-03
420	1.14E-03	525	1.77E-02	630	3.11E-02	735	1.70E-03
425	1.90E-03	530	1.84E-02	635	2.86E-02	740	1.43E-03
430	3.18E-03	535	1.91E-02	640	2.62E-02	745	1.22E-03
435	5.30E-03	540	2.00E-02	645	2.37E-02	750	1.03E-03
440	9.34E-03	545	2.09E-02	650	2.12E-02	755	8.92E-04
445	1.67E-02	550	2.20E-02	655	1.89E-02	760	7.66E-04
450	2.05E-02	555	2.34E-02	660	1.67E-02	765	6.56E-04
455	1.49E-02	560	2.49E-02	665	1.46E-02	770	5.54E-04
460	1.13E-02	565	2.67E-02	670	1.28E-02	775	4.81E-04
465	9.92E-03	570	2.87E-02	675	1.11E-02	780	4.08E-04
470	7.66E-03	575	3.08E-02	680	9.61E-03		
475	6.60E-03	580	3.28E-02	685	8.27E-03		
480	7.07E-03	585	3.48E-02	690	7.11E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4392, 0.4029)

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

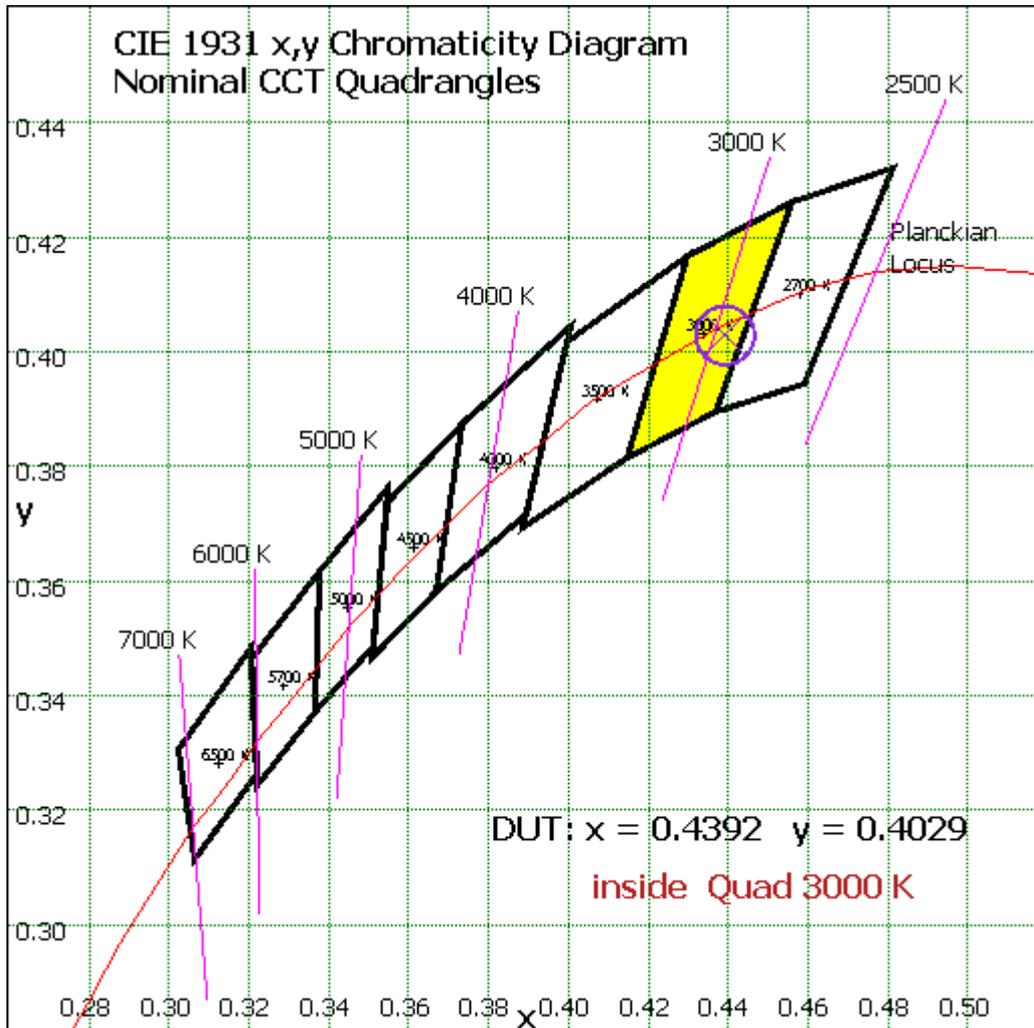
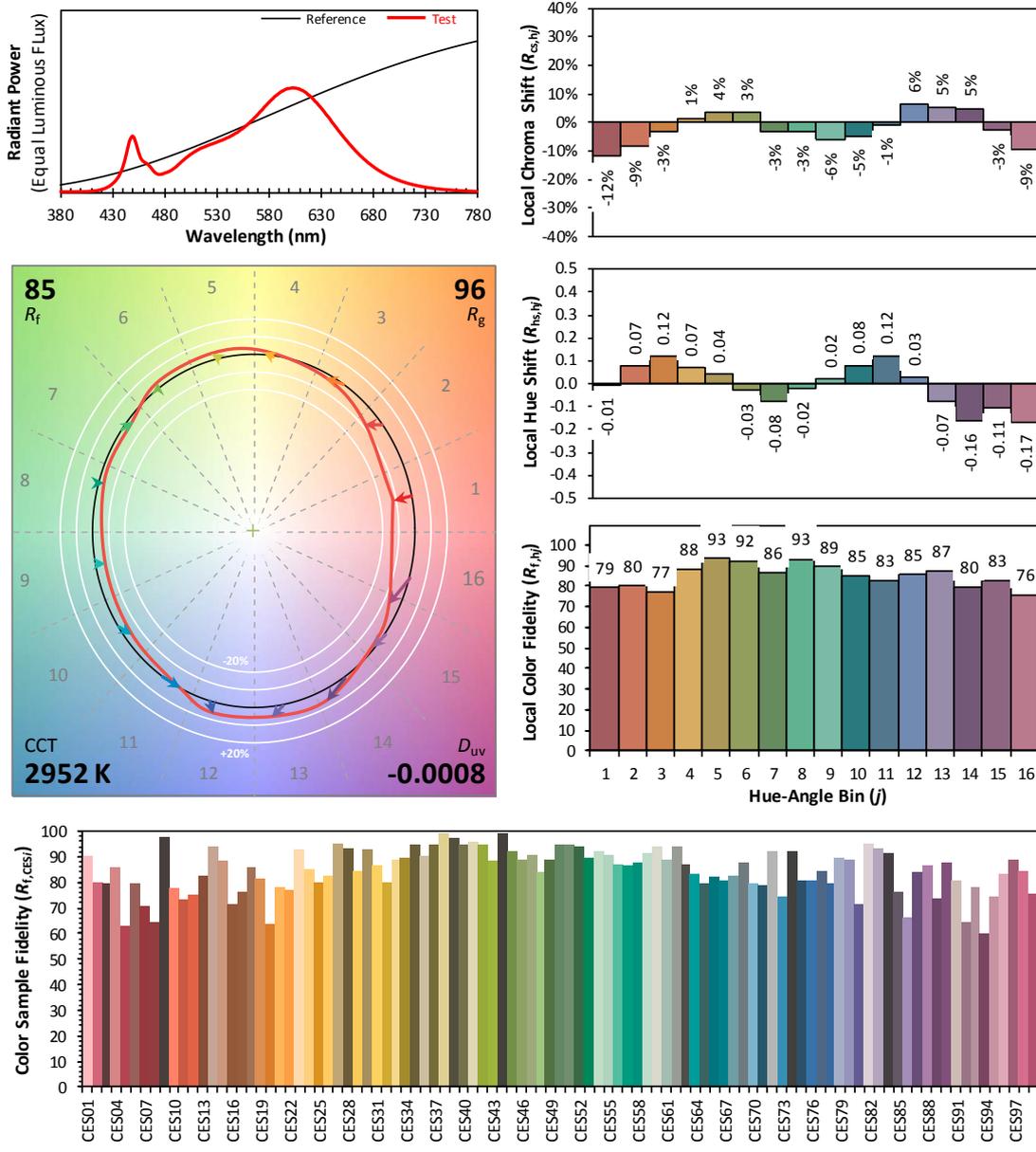


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4392
y	0.4029
u'	0.2526
v'	0.5212

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	25.229	1.40%
10- 20	73.605	4.10%
20- 30	115.904	6.45%
30- 40	148.723	8.27%
40- 50	169.668	9.44%
50- 60	177.763	9.89%
60- 70	173.607	9.66%
70- 80	160.171	8.91%
80- 90	142.896	7.95%
90-100	127.268	7.08%
100-110	112.485	6.26%
110-120	97.914	5.45%
120-130	83.37	4.64%
130-140	69.005	3.84%
140-150	54.182	3.01%
150-160	38.351	2.13%
160-170	21.073	1.17%
170-180	6.169	0.34%
Total	1797.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	710.892	39.55%
60- 90	476.674	26.52%
0-90	1187.566	66.07%
90- 180	609.817	33.93%
0- 180	1797.4	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

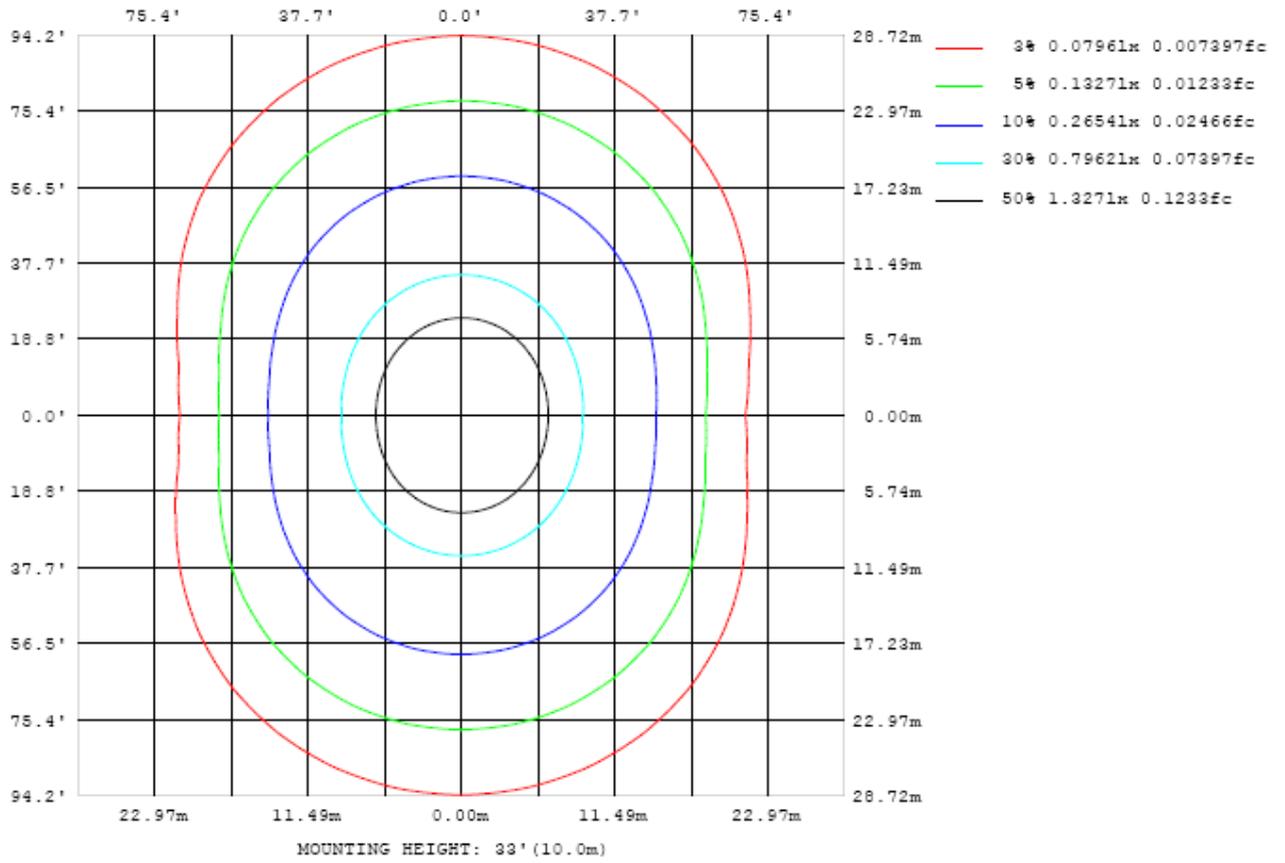


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

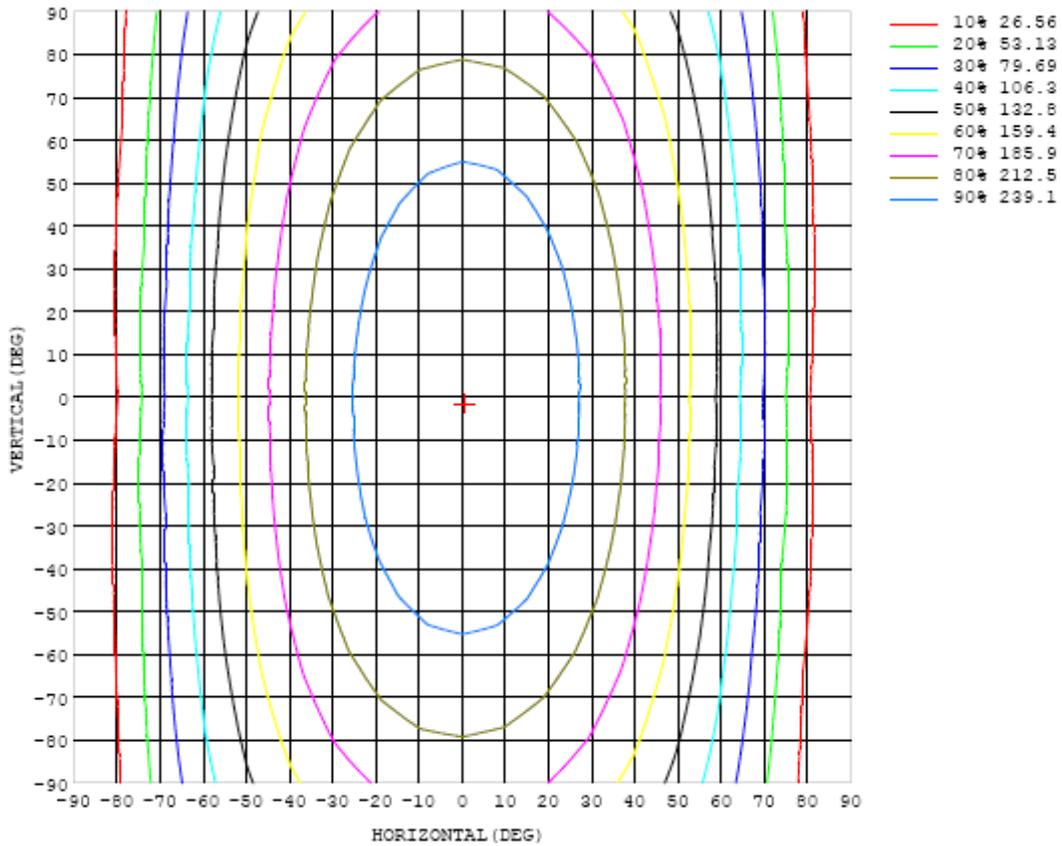


Chart 6: Isocandela Plot

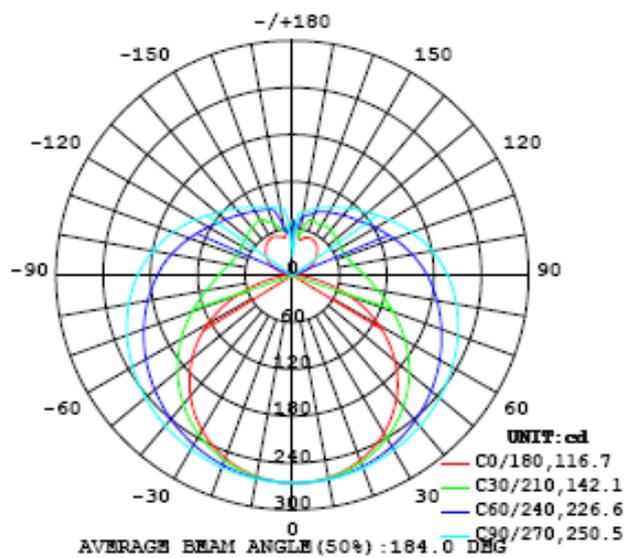


Chart 7: Polar Candela Distribution

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	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265
5	265	265	265	265	265	265	266	266	265	265	265	265	265	265	265	264	264	264	264
10	262	263	263	263	264	264	265	265	265	265	265	264	264	263	262	262	261	261	261
15	258	258	259	260	261	262	263	264	264	264	264	263	262	261	259	258	257	256	256
20	252	252	253	255	257	259	260	262	262	262	262	261	259	257	254	252	250	249	249
25	243	244	246	248	251	254	257	259	260	260	260	258	255	252	249	245	242	240	240
30	233	234	236	240	244	249	253	256	258	258	257	255	251	247	242	237	233	230	229
35	220	221	225	230	236	243	248	252	254	255	254	251	246	241	234	227	221	217	216
40	205	207	212	219	227	235	242	248	251	252	250	247	241	234	225	216	209	203	201
45	189	191	198	207	218	228	236	243	247	248	247	242	235	226	215	204	194	187	185
50	170	173	182	194	207	220	230	238	243	244	242	237	229	218	205	192	179	169	167
55	149	153	164	180	196	211	223	232	238	239	238	232	223	210	195	178	162	150	146
60	127	132	146	165	185	202	216	226	233	234	233	226	216	202	184	164	145	129	124
65	103	109	127	150	173	193	209	220	227	229	227	220	209	194	174	151	127	107	99.5
70	77.7	86.2	109	136	162	184	202	214	221	224	222	214	202	185	163	137	110	84.9	74.4
75	52.9	64.0	91.2	123	152	175	194	207	215	218	216	208	195	177	154	125	93.4	64.0	49.3
80	29.0	43.2	76.0	111	142	167	187	201	209	211	209	202	188	170	145	114	79.3	45.1	25.9
85	9.65	27.1	63.9	101	133	159	179	193	202	205	203	195	181	162	137	105	68.9	31.1	7.74
90	0.66	18.4	55.4	92.2	125	151	171	186	194	197	195	188	174	155	129	97.5	61.4	23.8	0.43
95	2.18	15.9	49.7	85.1	117	143	163	178	186	189	187	180	166	147	122	91.0	56.3	21.6	2.76
100	6.39	17.8	46.6	79.2	110	135	155	169	177	180	178	171	158	139	115	85.5	53.4	23.7	7.78
105	11.8	22.3	46.2	75.2	103	127	146	160	168	171	169	162	149	131	108	81.3	53.1	28.0	14.2
110	18.0	27.9	47.4	72.9	97.4	120	138	150	158	161	160	153	141	124	103	78.7	54.6	33.7	21.2
115	24.0	33.4	50.1	71.3	93.1	113	129	141	149	152	150	144	133	117	98.4	77.6	57.2	39.8	28.1
120	30.0	37.4	53.4	71.3	89.5	107	122	133	140	142	141	135	125	112	95.2	77.3	60.3	45.6	34.7
125	35.6	39.7	57.0	72.0	87.3	102	115	125	131	133	132	127	119	107	92.9	77.7	63.5	49.8	40.1
130	40.4	45.0	60.6	73.1	86.0	98.6	109	118	123	125	124	120	113	103	91.0	78.4	66.4	52.9	44.5
135	44.6	49.6	63.1	74.6	84.8	95.6	105	112	116	118	117	114	108	99.4	89.5	79.1	69.3	58.1	48.0
140	48.7	53.2	63.5	75.8	84.2	92.8	100	106	110	112	111	108	103	96.1	88.3	79.5	71.1	62.4	51.0
145	51.0	57.3	63.8	76.5	83.8	90.6	96.5	101	104	106	105	103	98.9	93.5	87.1	79.7	70.9	66.4	53.2
150	52.6	59.4	66.6	74.9	82.9	88.5	93.2	97.0	99.3	100	100	98.4	95.3	91.1	85.7	79.0	71.6	70.2	54.7
155	52.9	59.2	70.0	73.5	79.7	86.0	90.0	92.9	94.7	95.6	95.5	94.2	91.9	88.7	83.5	75.8	74.1	68.7	54.8
160	51.6	52.3	67.6	74.8	76.7	81.2	85.3	88.5	90.3	91.3	91.2	90.1	88.6	85.8	77.5	70.9	69.5	62.1	53.1
165	48.3	47.0	50.3	70.0	76.3	78.2	79.8	81.8	84.1	85.8	86.3	86.1	82.5	71.9	63.6	62.7	60.1	54.3	51.1
170	48.0	47.3	47.3	50.9	63.3	73.3	75.6	79.2	80.9	81.9	82.4	73.6	62.5	58.9	60.8	59.0	55.6	51.2	50.6
175	60.5	61.5	61.4	60.2	60.0	63.5	63.2	63.3	65.3	70.5	45.2	50.2	59.6	61.4	64.5	63.0	63.7	62.4	61.8
180	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4

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	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265		
5	264	264	264	264	265	265	265	265	265	265	265	265	265	265	265	265	265		
10	261	261	261	262	263	263	264	264	264	264	264	264	264	263	263	263	263		
15	256	256	257	259	260	261	262	263	263	263	263	262	261	260	259	259	258		
20	249	250	252	254	256	258	260	261	262	262	261	260	258	256	254	253	252		
25	240	242	245	248	251	254	257	259	260	259	258	256	254	251	248	246	244		
30	230	232	236	241	246	250	254	256	257	257	255	252	249	244	240	236	234		
35	217	221	226	233	239	245	250	253	254	254	251	247	242	236	230	225	222		
40	203	208	215	224	232	240	246	250	251	250	247	242	236	228	220	213	208		
45	187	194	203	214	225	234	241	246	247	247	243	236	228	218	208	199	192		
50	169	178	190	204	217	228	236	241	244	242	238	230	220	208	195	183	174		
55	150	162	177	193	209	221	231	237	239	238	232	224	212	197	182	167	156		
60	129	144	163	182	200	215	225	232	234	233	227	217	204	186	168	149	135		
65	106	125	149	172	192	208	219	226	229	227	221	210	195	176	154	131	112		
70	83.5	107	135	162	183	201	213	221	223	221	214	203	186	166	140	113	89.8		
75	61.2	90.2	122	152	175	194	207	215	218	215	208	195	178	155	127	96.3	67.6		
80	41.4	75.4	111	142	168	186	200	208	211	209	201	188	170	146	116	81.2	47.7		
85	26.6	63.9	101	134	160	179	193	201	204	201	193	180	162	137	105	69.1	32.0		
90	19.1	56.1	93.3	126	152	171	185	193	196	194	186	172	154	128	96.8	60.3	23.1		
95	17.3	51.1	86.9	119	144	164	177	185	188	186	178	165	146	121	89.7	54.4	19.8		
100	19.8	48.5	81.4	112	137	156	169	177	179	177	169	156	138	113	83.4	50.6	20.5		
105	24.7	48.5	77.4	105	129	147	161	168	170	168	161	148	130	106	78.6	49.1	24.3		
110	31.3	50.4	75.0	99.9	122	139	151	159	161	159	151	139	122	100	75.1	49.8	29.9		
115	38.1	53.7	74.2	95.5	115	131	142	150	152	149	142	131	115	95.1	73.3	51.9	36.3		
120	44.5	57.5	74.4	92.5	109	123	134	140	142	140	133	123	108	91.3	72.7	54.9	42.8		
125	50.5	61.5	75.3	90.5	105	117	126	131	133	131	125	116	104	88.9	73.1	58.8	48.7		
130	55.2	65.4	76.6	89.1	101	111	119	123	125	123	118	110	99.6	87.1	74.1	63.0	52.0		
135	59.8	69.3	78.1	88.1	97.8	106	113	117	118	116	112	105	96.3	86.1	75.6	67.0	55.7		
140	65.3	71.5	79.6	87.5	95.1	102	107	110	111	110	106	101	93.7	85.5	77.4	70.6	62.9		
145	69.4	72.9	81.0	87.0	92.9	98.2	102	105	106	104	102	97.1	91.6	85.3	79.1	73.1	67.7		
150	72.6	73.6	82.3	86.7	91.1	95.0	98.2	100	101	99.7	97.5	94.1	90.0	85.3	81.0	73.4	72.9		
155	72.0	73.7	75.4	86.5	89.5	92.2	94.5	95.9	96.3	95.6	94.0	91.7	88.9	85.6	81.9	75.1	72.6		
160	63.0	69.1	71.5	78.3	87.0	89.9	91.4	92.3	92.7	92.3	91.3	89.9	88.2	85.9	81.3	80.0	69.0		
165	55.4	61.0	63.2	65.4	71.7	84.0	88.9	89.6	89.9	89.7	89.2	88.5	86.8	84.3	81.2	81.7	63.8		
170	51.0	54.0	58.8	60.3	58.2	60.8	73.6	85.7	87.6	87.5	87.2	86.8	83.4	80.2	79.7	72.1	57.0		
175	61.3	59.5	61.5	60.2	59.7	57.2	51.6	54.0	73.1	84.1	85.4	79.0	73.0	68.7	64.2	62.9	60.5		
180	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4		

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

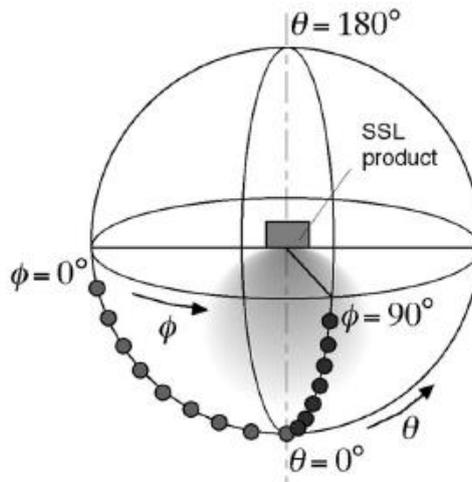
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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