

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 13T8/4F/DIM/835/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19050008c

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/835/BYP**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
148.3	1871.0	12.62	0.9828
CCT (K)	CRI	Stabilization Time (Light & Power)	
3391	81.3	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	: 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

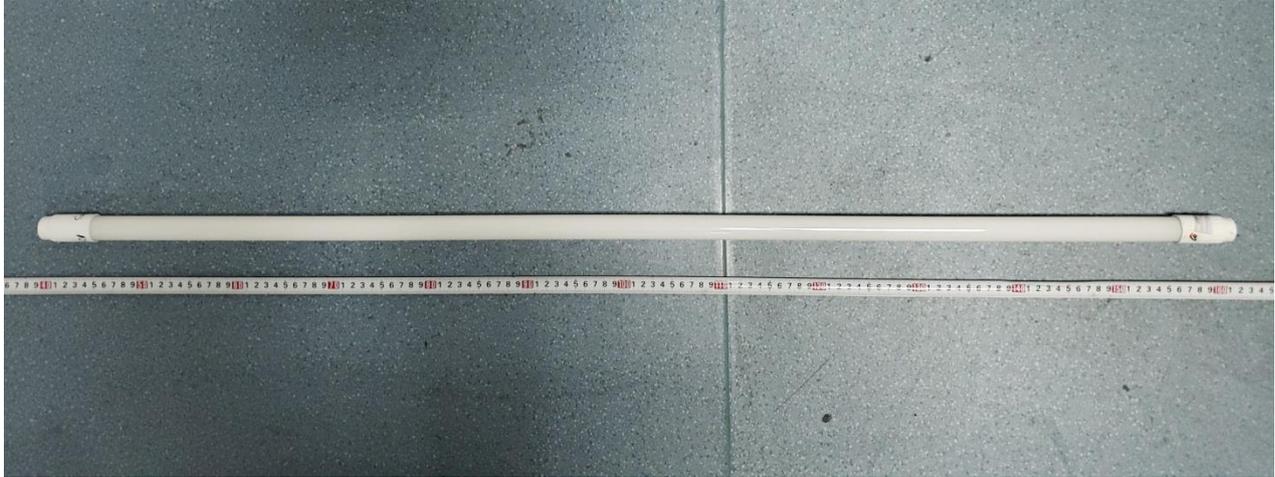


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 13T8/4F/DIM/835/BYP
Electrical Ratings	: 120V, 60Hz, 13W
Product Description	: 3500K
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	0.9828
Test Power (W)	12.62
THD A%	13.81
Luminous Efficacy (lm/W)	148.3
Total Luminous Flux (lm)	1871.0
Color Rendering Index (CRI)	81.3
R9	0.1
Correlated Color Temperature (CCT)(K)	3391
Chromaticity Chroma x	0.4127
Chromaticity Chroma y	0.3969
Chromaticity Chroma u	0.2380
Chromaticity Chroma v	0.3433
Duv	0.0007
Chromaticity Chroma u'	0.2380
Chromaticity Chroma v'	0.5149

Special Color Rendering Indices	
R1	79.1
R2	88.1
R3	95.7
R4	80.3
R5	79.3
R6	84.6
R7	83.9
R8	59.1
R9	0.1
R10	72.7
R11	79.3
R12	64.4
R13	81.1
R14	97.7

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	0.9826
Power (W)/2	12.66
Luminous Efficacy (lm/W)	145.7
Total Luminous Flux (lm)	1844.8
Beam Angle (°)	116.8 (0°-180°) / 251.3 (90°-270°)
Center Beam Candle Power (cd)	272
Maximum Beam Candle Power (cd)	272.1 (At: C=70.0, Gamma=2.5)
Spacing Criteria	1.28 (0°-180°) /1.47 (90°-270°)
Zonal Lumens in the 0°-60° Zone	39.48%
Zonal Lumens in the 60°-90° Zone	26.50%
Zonal Lumens in the 90°-120° Zone	18.80%
Zonal Lumens in the 120°-180° Zone	15.22%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

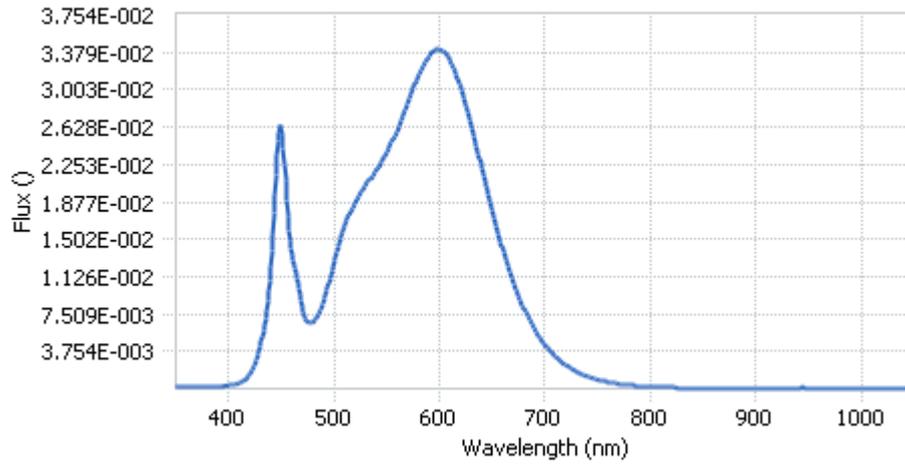
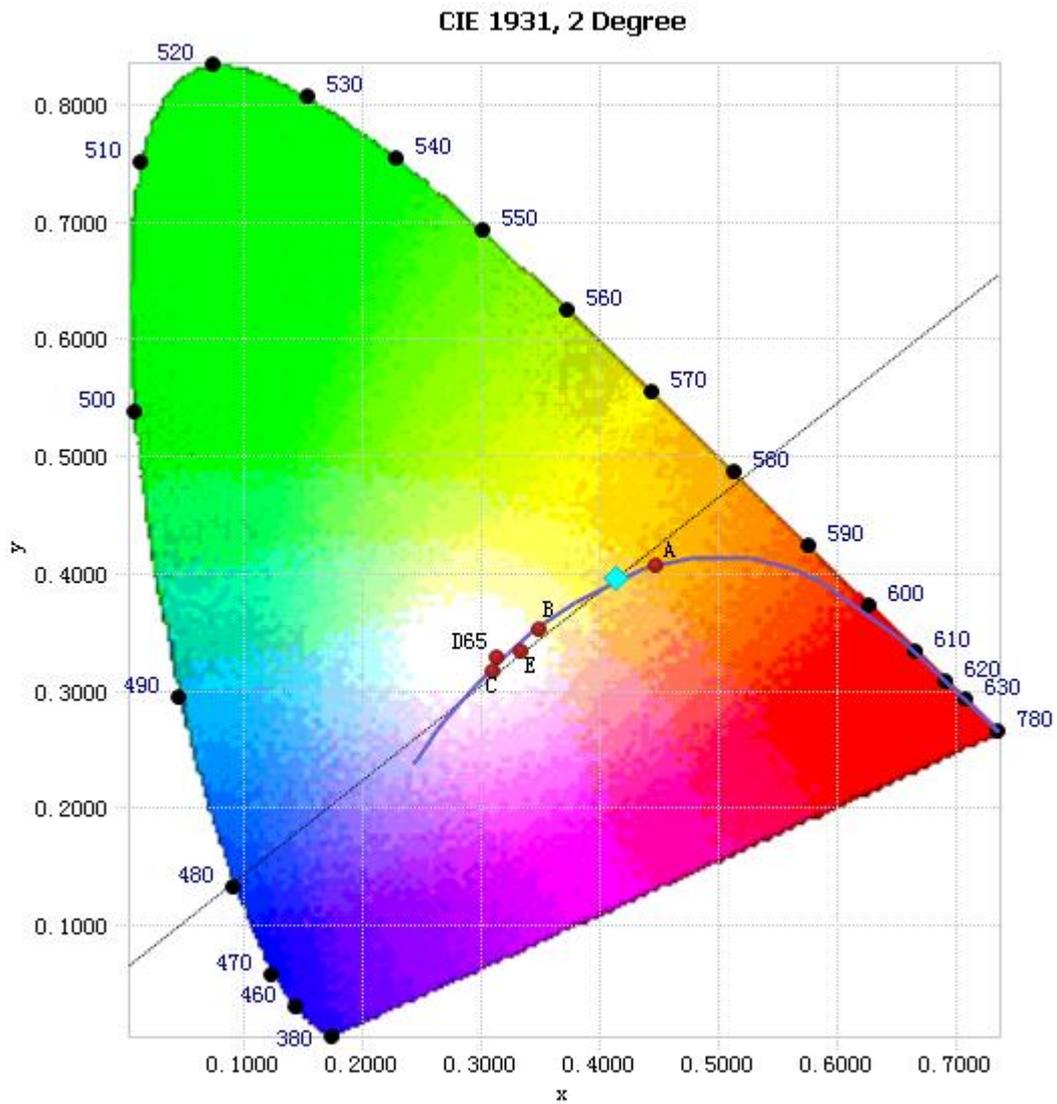


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.68E-04	485	7.41E-03	590	3.34E-02	695	5.15E-03
385	2.61E-04	490	8.69E-03	595	3.40E-02	700	4.41E-03
390	2.97E-04	495	1.06E-02	600	3.41E-02	705	3.78E-03
395	3.16E-04	500	1.28E-02	605	3.37E-02	710	3.22E-03
400	3.50E-04	505	1.48E-02	610	3.30E-02	715	2.75E-03
405	4.27E-04	510	1.63E-02	615	3.19E-02	720	2.35E-03
410	5.91E-04	515	1.78E-02	620	3.03E-02	725	2.02E-03
415	9.03E-04	520	1.87E-02	625	2.83E-02	730	1.72E-03
420	1.49E-03	525	1.97E-02	630	2.65E-02	735	1.47E-03
425	2.53E-03	530	2.05E-02	635	2.43E-02	740	1.25E-03
430	4.27E-03	535	2.12E-02	640	2.21E-02	745	1.07E-03
435	7.13E-03	540	2.20E-02	645	2.00E-02	750	9.16E-04
440	1.23E-02	545	2.28E-02	650	1.78E-02	755	7.83E-04
445	2.15E-02	550	2.37E-02	655	1.59E-02	760	6.79E-04
450	2.63E-02	555	2.49E-02	660	1.40E-02	765	5.74E-04
455	1.89E-02	560	2.60E-02	665	1.23E-02	770	5.02E-04
460	1.34E-02	565	2.74E-02	670	1.07E-02	775	4.31E-04
465	1.12E-02	570	2.87E-02	675	9.31E-03	780	3.71E-04
470	8.26E-03	575	3.02E-02	680	8.07E-03		
475	6.65E-03	580	3.15E-02	685	6.96E-03		
480	6.74E-03	585	3.26E-02	690	6.00E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4127, 0.3969)

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

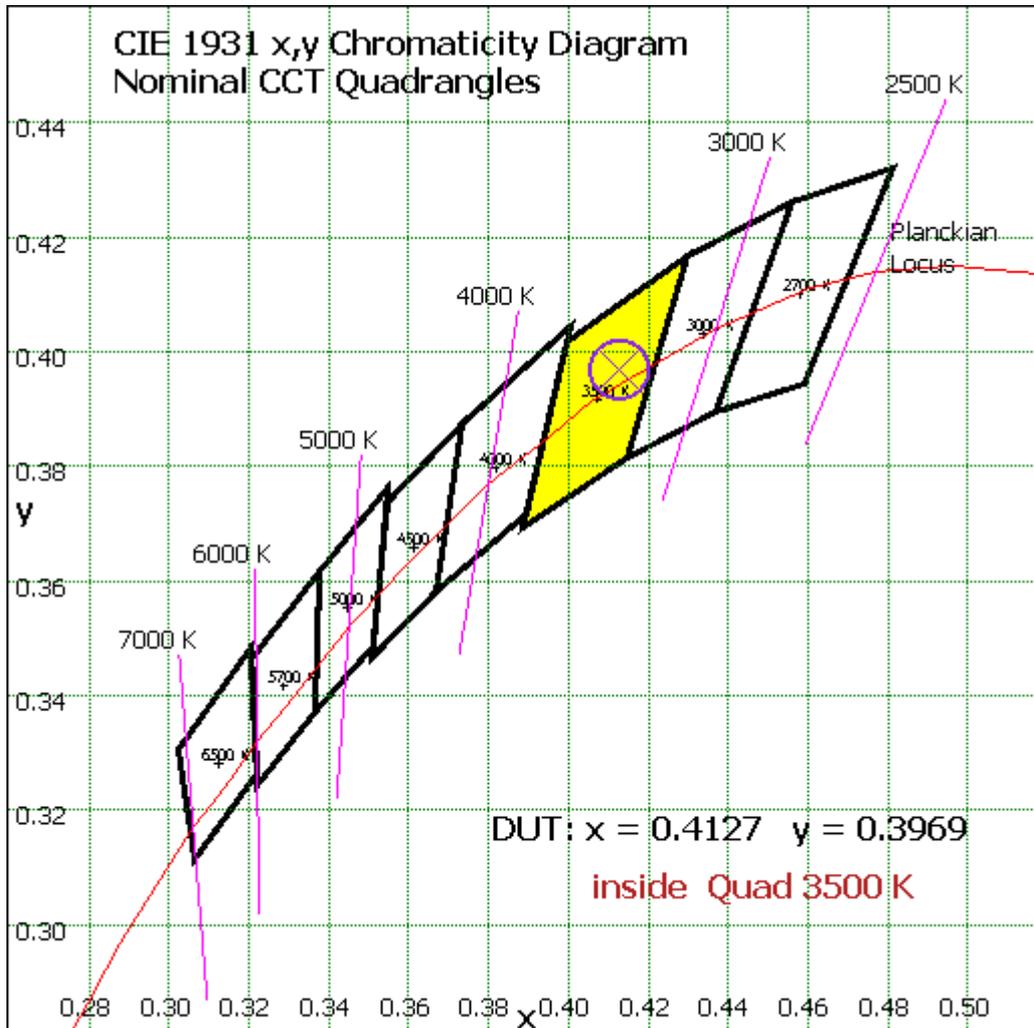
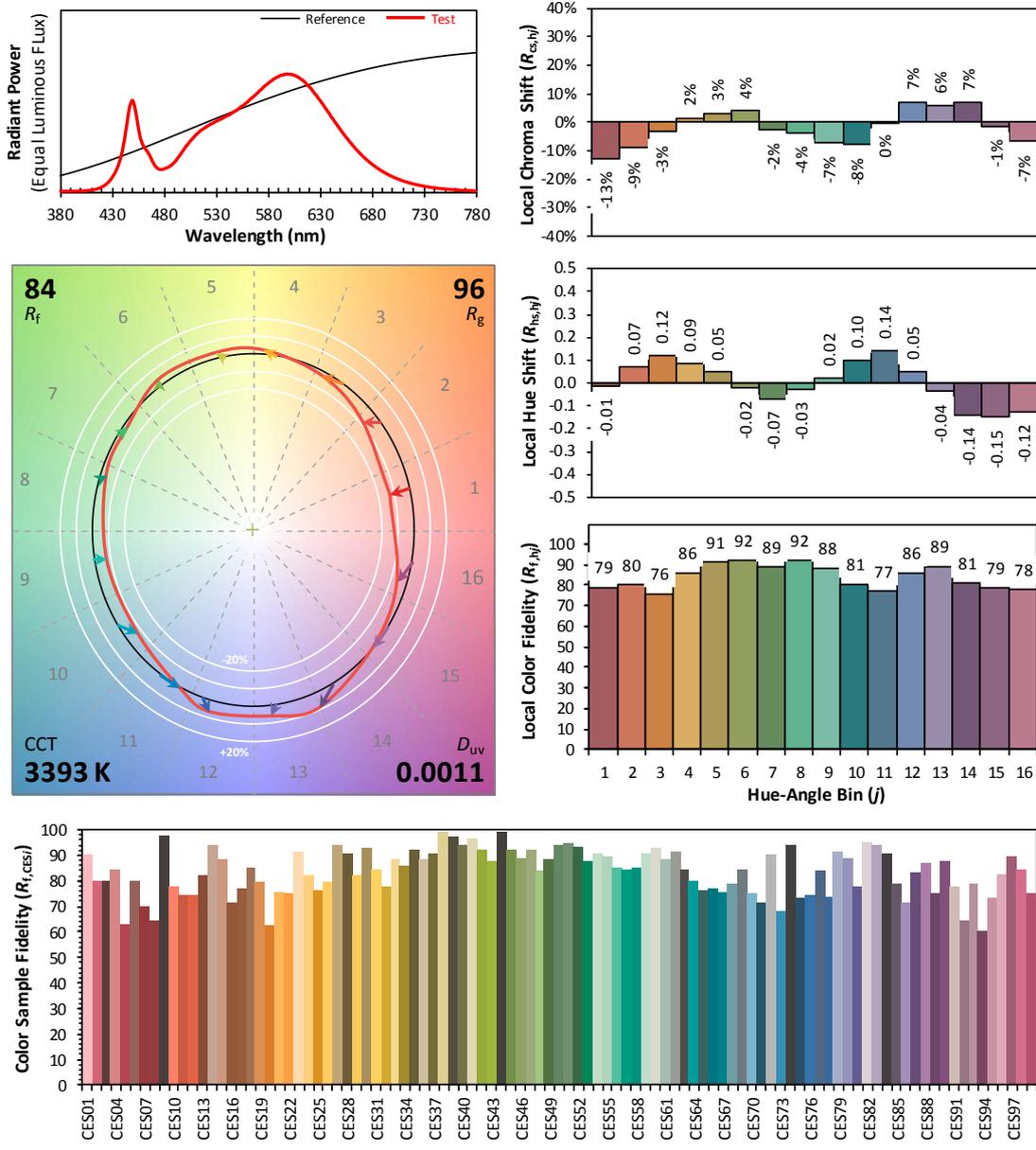


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4127
y	0.3969
u'	0.2380
v'	0.5149

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	25.837	1.40%
10- 20	75.373	4.09%
20- 30	118.702	6.43%
30- 40	152.344	8.26%
40- 50	173.842	9.42%
50- 60	182.18	9.88%
60- 70	178.005	9.65%
70- 80	164.292	8.91%
80- 90	146.593	7.95%
90-100	130.608	7.08%
100-110	115.549	6.26%
110-120	100.705	5.46%
120-130	85.835	4.65%
130-140	71.077	3.85%
140-150	55.864	3.03%
150-160	39.575	2.15%
160-170	21.857	1.18%
170-180	6.541	0.35%
Total	1844.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	728.278	39.48%
60- 90	488.89	26.50%
0-90	1217.168	65.98%
90- 180	627.611	34.02%
0- 180	1844.8	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

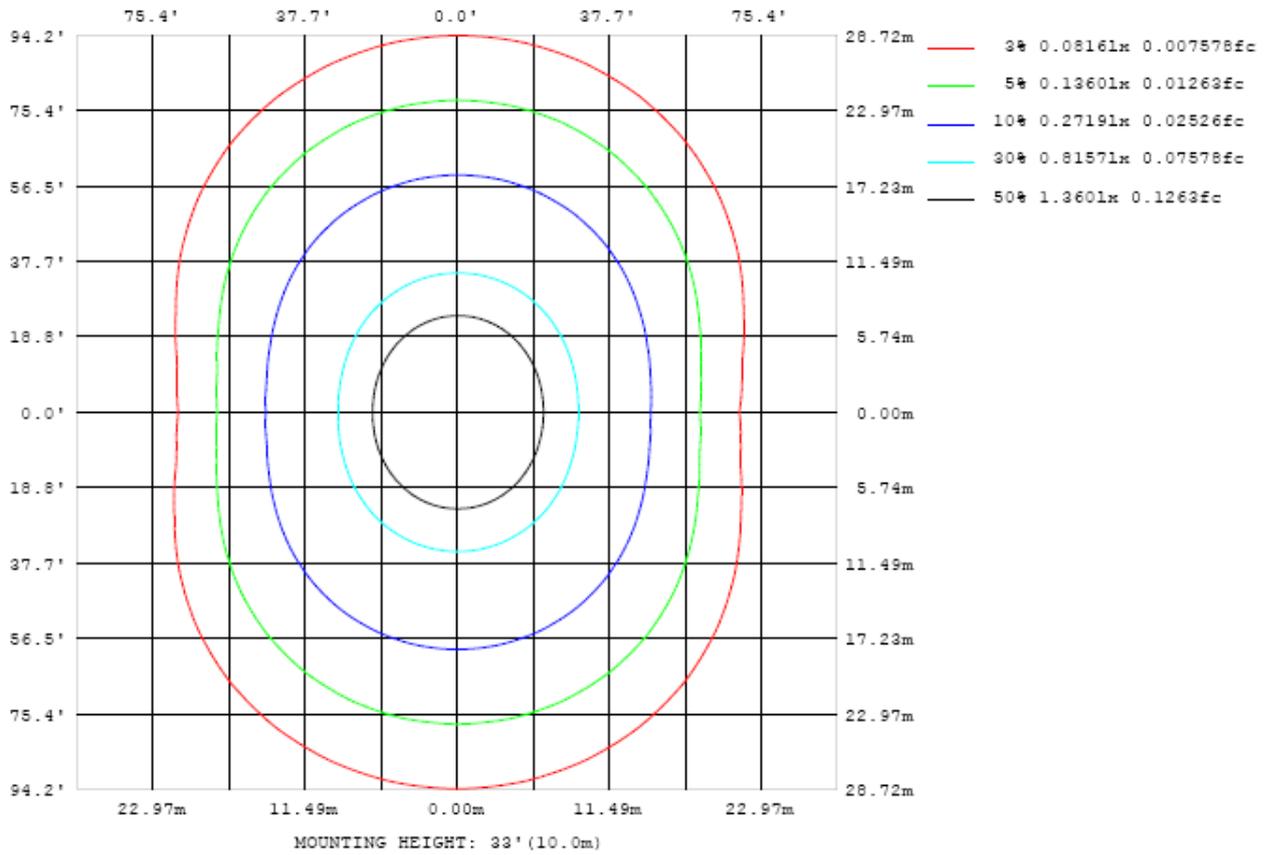


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

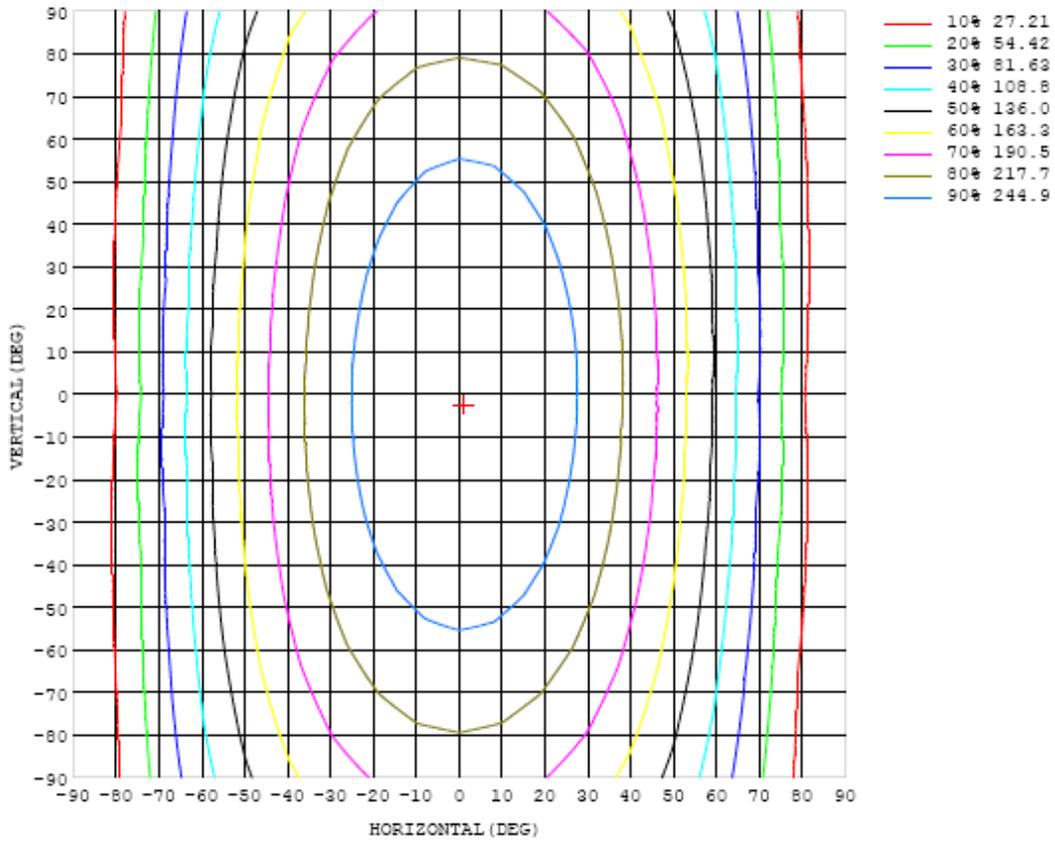


Chart 6: Isocandela Plot

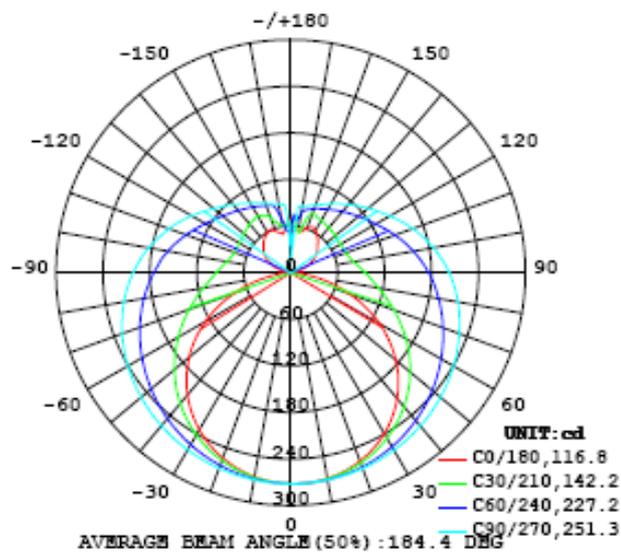


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C (DEG) \ γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
5	271	272	271	272	272	272	272	272	272	272	272	271	271	271	271	271	270	270	270
10	269	269	269	270	270	271	271	271	271	271	271	270	270	269	268	268	267	267	267
15	265	265	265	266	267	268	269	270	270	270	269	269	268	266	265	264	262	262	261
20	258	259	260	261	263	265	266	268	269	268	268	266	265	262	260	258	256	255	254
25	250	250	252	254	257	261	263	265	266	266	266	264	261	258	254	251	248	246	245
30	239	240	242	246	251	255	259	262	264	264	263	260	257	252	247	242	238	235	234
35	226	228	231	236	243	249	254	258	261	261	260	256	252	246	239	232	226	222	221
40	212	213	218	225	234	242	248	254	257	258	256	252	246	239	230	221	213	208	205
45	194	197	203	213	223	234	243	249	253	254	252	248	240	231	220	209	199	191	188
50	175	178	187	199	213	226	236	244	249	250	248	242	234	223	210	196	183	173	170
55	154	158	169	185	202	217	229	238	244	245	243	237	228	215	199	182	166	153	149
60	131	136	151	170	190	208	222	232	239	240	238	231	221	206	188	168	148	132	126
65	106	113	131	155	178	199	215	226	233	235	233	225	214	198	177	154	130	110	102
70	80.2	88.9	112	140	167	190	207	220	227	229	227	219	207	189	167	140	112	86.9	76.1
75	54.6	66.0	94.2	127	156	181	200	213	221	223	221	213	200	181	157	128	95.4	65.7	50.7
80	29.8	44.7	78.1	114	146	172	192	206	214	217	214	206	193	173	148	116	81.0	46.3	26.8
85	9.86	28.1	66.2	104	137	164	184	199	207	210	208	199	186	166	139	107	70.2	31.8	8.01
90	0.51	19.3	57.5	95.3	129	156	177	191	200	203	200	192	178	158	132	99.5	62.5	24.2	0.36
95	2.31	16.6	51.5	87.9	120	147	168	182	191	194	192	184	170	150	124	92.8	57.2	21.8	2.76
100	6.85	18.5	48.3	81.9	113	139	159	173	182	185	183	175	162	142	117	87.3	54.3	23.9	7.84
105	12.9	22.2	47.9	77.6	106	131	151	164	173	176	174	166	153	135	111	83.1	54.0	28.2	14.5
110	19.7	27.4	49.0	74.7	101	124	142	155	163	166	164	157	145	127	105	80.4	55.6	33.9	21.7
115	26.5	33.6	51.0	73.9	96.0	117	133	146	153	156	154	148	136	120	101	79.4	58.4	40.1	28.9
120	33.2	40.1	53.9	73.3	92.7	111	126	137	144	146	145	138	128	114	97.6	79.1	61.5	46.2	35.7
125	39.3	43.6	57.0	73.3	90.0	106	119	129	135	137	136	131	122	110	95.0	79.4	64.7	50.8	41.3
130	44.0	50.0	60.5	74.1	88.0	102	113	122	127	129	128	123	116	105	93.1	80.0	67.6	53.8	45.8
135	48.5	55.3	64.6	75.1	86.3	98.0	108	115	120	122	121	117	110	102	91.4	80.8	71.1	58.4	49.5
140	54.0	60.1	67.8	75.9	85.4	94.7	103	109	113	115	114	111	106	98.4	90.0	81.4	73.6	61.9	53.7
145	58.4	63.7	69.3	76.7	84.3	91.9	98.4	103	107	108	108	105	101	95.3	89.0	81.6	74.5	64.9	57.1
150	62.9	67.1	74.0	78.1	83.6	89.3	94.4	98.4	101	103	102	100	97.0	92.6	87.8	81.8	77.1	66.7	60.0
155	64.6	62.7	74.4	79.0	82.7	87.4	90.9	93.8	96.0	97.2	97.0	95.7	93.3	90.7	85.0	77.5	76.4	63.3	60.9
160	61.3	54.3	68.0	81.2	82.2	84.5	88.2	90.4	91.9	92.5	92.5	92.1	91.5	85.8	77.0	72.6	68.9	57.8	57.2
165	55.6	50.3	54.0	64.9	82.8	82.7	84.1	86.1	87.7	89.1	89.9	88.5	79.1	68.5	64.4	62.3	58.2	52.7	53.1
170	54.9	50.9	52.4	53.0	60.6	72.1	79.0	82.3	86.2	87.2	83.4	62.9	60.5	64.3	61.1	60.2	54.1	53.0	52.3
175	63.7	62.5	64.7	67.4	67.9	67.0	68.6	70.9	64.5	57.9	48.7	66.3	69.2	69.7	68.1	67.9	66.7	65.2	63.2
180	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8

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	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272		
5	270	270	271	271	271	271	271	271	272	272	272	272	272	272	271	271	271		
10	267	267	268	268	269	270	270	271	271	271	271	271	270	270	270	269	269		
15	262	262	263	265	266	267	268	269	270	270	269	269	268	267	266	265	265		
20	255	256	257	260	262	264	266	267	268	268	267	266	265	263	261	260	259		
25	246	247	250	253	257	260	263	265	266	266	265	263	260	257	255	252	250		
30	235	237	241	246	251	256	260	262	263	263	262	259	255	251	247	243	240		
35	222	226	231	238	245	251	256	259	261	260	258	254	249	243	237	232	228		
40	207	212	220	229	238	245	251	256	257	257	254	249	242	234	226	219	214		
45	191	197	207	219	230	239	247	252	254	253	249	243	235	224	214	204	197		
50	172	181	194	208	222	233	242	247	250	249	244	237	226	214	201	188	179		
55	153	165	180	197	213	226	236	243	245	244	239	230	218	203	187	171	160		
60	131	146	166	186	205	219	231	238	240	239	233	223	209	192	173	154	138		
65	109	128	152	175	196	212	225	232	235	233	227	216	200	181	159	135	115		
70	85.3	109	138	165	187	205	218	226	229	228	220	209	192	170	144	116	92.0		
75	62.7	92.0	125	155	179	198	212	220	223	221	214	201	183	160	131	98.8	69.2		
80	42.5	77.1	113	145	171	191	205	214	216	214	206	193	174	150	119	83.3	48.6		
85	27.5	65.4	103	137	163	183	197	206	209	207	199	186	167	141	108	70.9	32.6		
90	19.7	57.3	95.3	128	155	175	190	199	201	199	191	177	159	132	99.7	62.0	23.5		
95	17.7	52.3	88.7	121	148	168	182	190	193	191	183	169	150	124	92.5	56.1	20.3		
100	20.2	49.5	83.1	114	140	160	173	181	184	182	174	161	142	117	86.2	52.3	21.3		
105	25.1	49.3	79.0	108	132	151	165	172	175	173	166	153	134	110	81.3	50.9	25.3		
110	31.9	51.3	76.4	102	124	142	156	163	166	164	156	144	126	104	77.7	51.7	31.4		
115	38.9	54.7	75.6	97.5	118	134	146	154	156	154	147	135	119	98.3	75.9	54.0	38.1		
120	45.6	58.7	75.9	94.5	112	126	137	144	146	144	138	127	112	94.5	75.5	57.2	44.8		
125	52.0	62.8	76.9	92.4	107	119	129	135	137	135	129	120	107	92.0	75.9	61.3	50.8		
130	56.7	66.9	78.3	91.0	103	114	122	127	128	127	122	114	103	90.3	77.0	65.8	54.3		
135	60.9	70.9	80.0	90.2	100	109	116	120	121	120	115	108	99.6	89.2	78.6	69.9	58.8		
140	67.3	73.4	81.5	89.6	97.5	105	110	113	114	113	110	104	96.9	88.6	80.4	73.3	66.0		
145	71.5	75.2	83.0	89.2	95.4	101	105	108	109	108	105	100	94.8	88.2	81.9	76.0	70.7		
150	74.5	76.3	84.4	88.7	93.5	97.7	101	103	104	103	101	97.2	92.8	87.6	83.4	76.5	74.8		
155	74.9	74.6	79.6	88.6	91.6	94.6	97.1	98.7	99.1	98.4	96.7	94.2	91.1	87.7	84.6	78.6	75.5		
160	67.5	72.0	76.1	84.2	90.2	92.1	93.7	94.8	95.0	94.6	93.6	92.1	90.2	88.2	84.5	82.1	76.3		
165	60.2	64.3	66.2	70.7	81.3	89.8	91.1	91.8	92.0	91.8	91.2	90.6	89.4	87.2	84.4	83.5	78.2		
170	53.6	59.4	62.7	60.5	62.6	72.1	83.4	89.8	89.8	89.7	89.5	89.4	88.1	84.7	82.4	81.5	70.7		
175	62.1	62.9	62.5	62.0	58.2	53.1	59.0	72.5	85.8	88.4	88.1	86.6	83.0	80.1	76.4	70.3	65.8		
180	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8	36.8		

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

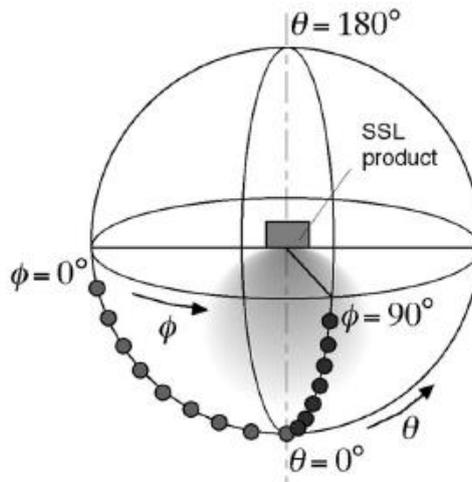
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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