

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 10.5T8/4F/840/IS/DIR

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19040014e

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

Review by:



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Apr. 18, 2019

Approved by:



Manager: Jim Zhang
Apr. 18, 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/840/IS/DIR**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
132.8	1850.0	13.93	0.9923
CCT (K)	CRI	Stabilization Time (Light & Power)	
4019	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	: Apr. 09, 2019
Date of Test	: Apr. 10, 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

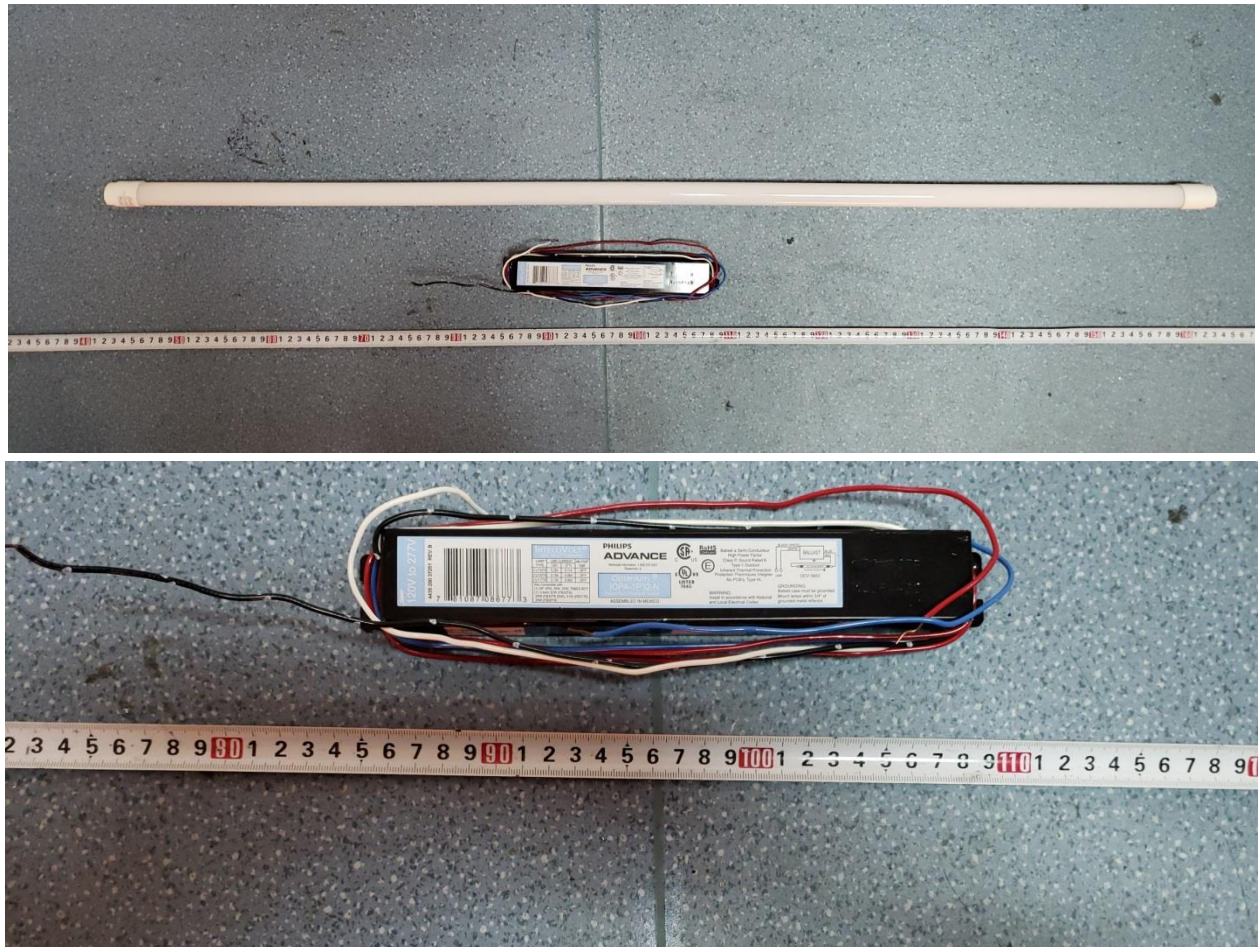


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 10.5T8/4F/840/IS/DIR
Electrical Ratings	: 120-277V, 60Hz
Product Description	: 4000K LED Tubes 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°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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.117	0.054
Power Factor	0.9923	0.9316
Test Power (W)	13.93	14.10
THD A%	8.73	14.91
Luminous Efficacy (lm/W)	132.8	131.2
Total Luminous Flux (lm)	1850.0	1850.0
Color Rendering Index (CRI)	81.3	
R9	1.2	
Correlated Color Temperature (CCT)(K)	4019	
Chromaticity Chroma x	0.3808	
Chromaticity Chroma y	0.3812	
Chromaticity Chroma u	0.2236	
Chromaticity Chroma v	0.3357	
Duv	0.0012	
Chromaticity Chroma u'	0.2236	
Chromaticity Chroma v'	0.5036	

Special Color Rendering Indices	
R1	79.1
R2	86.7
R3	93.3
R4	81.1
R5	79.4
R6	82.1
R7	85.7
R8	62.7
R9	1.2
R10	69.1
R11	80.1
R12	60.6
R13	80.7
R14	96.3
Rf	83
Rg	96

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°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)	0.118
Power Factor	0.9929
Power (W)	14.05
Luminous Efficacy (lm/W)	129.7
Total Luminous Flux (lm)	1822.0
Beam Angle (°)	116.6 (0°-180°) / 237.5 (90°-270°)
Center Beam Candle Power (cd)	282
Maximum Beam Candle Power (cd)	281.8 (At: C=90.0, Gamma=0.5)
Spacing Criteria	1.30 (0°-180°) / 1.46 (90°-270°)
Zonal Lumens in the 0°-60° Zone	41.13%
Zonal Lumens in the 60°-90° Zone	27.01%
Zonal Lumens in the 90°-120° Zone	18.30%
Zonal Lumens in the 120°-180° Zone	13.56%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

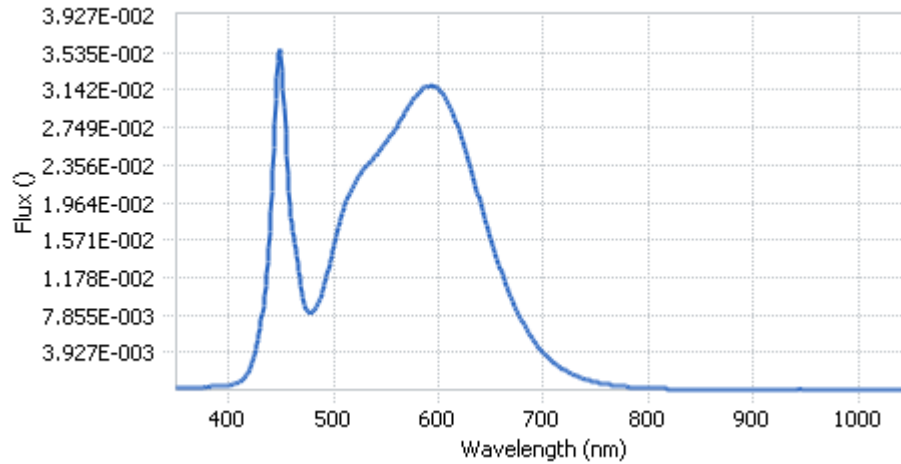
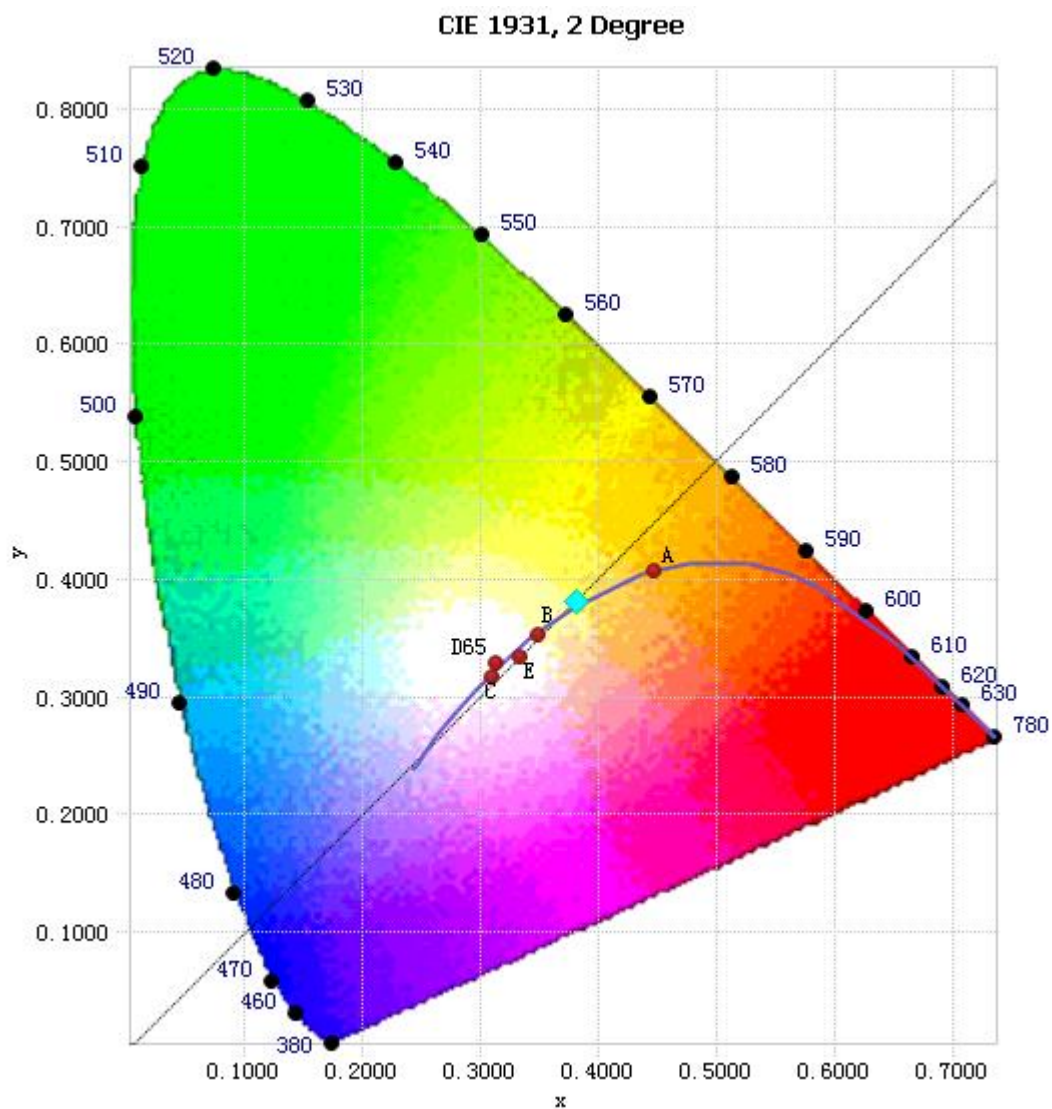


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.29E-04	485	8.97E-03	590	3.19E-02	695	4.53E-03
385	3.35E-04	490	1.05E-02	595	3.18E-02	700	3.89E-03
390	3.83E-04	495	1.27E-02	600	3.15E-02	705	3.33E-03
395	4.15E-04	500	1.51E-02	605	3.09E-02	710	2.85E-03
400	4.65E-04	505	1.73E-02	610	2.98E-02	715	2.44E-03
405	5.89E-04	510	1.92E-02	615	2.85E-02	720	2.08E-03
410	8.41E-04	515	2.06E-02	620	2.70E-02	725	1.78E-03
415	1.33E-03	520	2.17E-02	625	2.52E-02	730	1.53E-03
420	2.21E-03	525	2.26E-02	630	2.35E-02	735	1.31E-03
425	3.83E-03	530	2.34E-02	635	2.15E-02	740	1.11E-03
430	6.59E-03	535	2.39E-02	640	1.95E-02	745	9.57E-04
435	1.10E-02	540	2.46E-02	645	1.75E-02	750	8.17E-04
440	1.86E-02	545	2.53E-02	650	1.57E-02	755	7.06E-04
445	3.05E-02	550	2.60E-02	655	1.40E-02	760	6.11E-04
450	3.51E-02	555	2.68E-02	660	1.23E-02	765	5.24E-04
455	2.46E-02	560	2.76E-02	665	1.08E-02	770	4.49E-04
460	1.74E-02	565	2.85E-02	670	9.42E-03	775	3.91E-04
465	1.40E-02	570	2.95E-02	675	8.19E-03	780	3.36E-04
470	1.02E-02	575	3.02E-02	680	7.10E-03		
475	8.21E-03	580	3.10E-02	685	6.15E-03		
480	8.22E-03	585	3.16E-02	690	5.29E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3808, 0.3812)

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

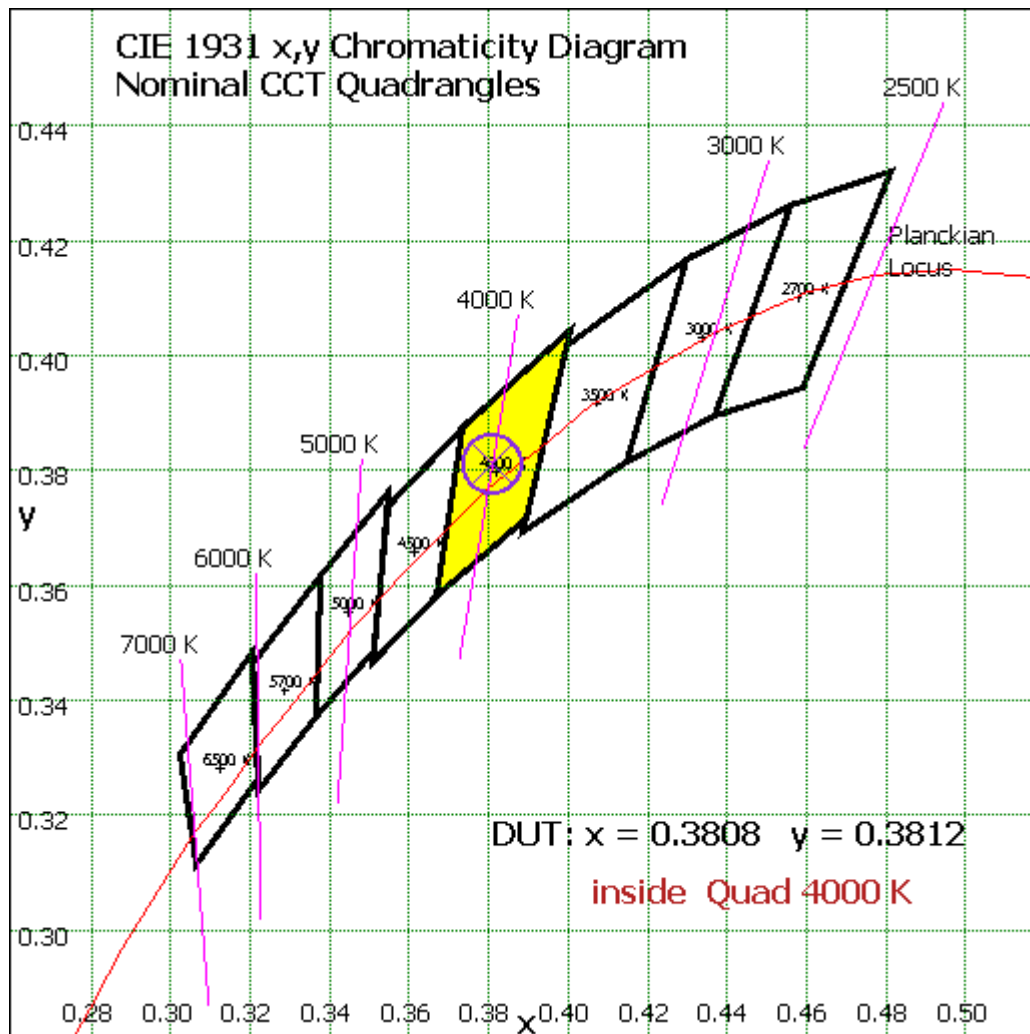
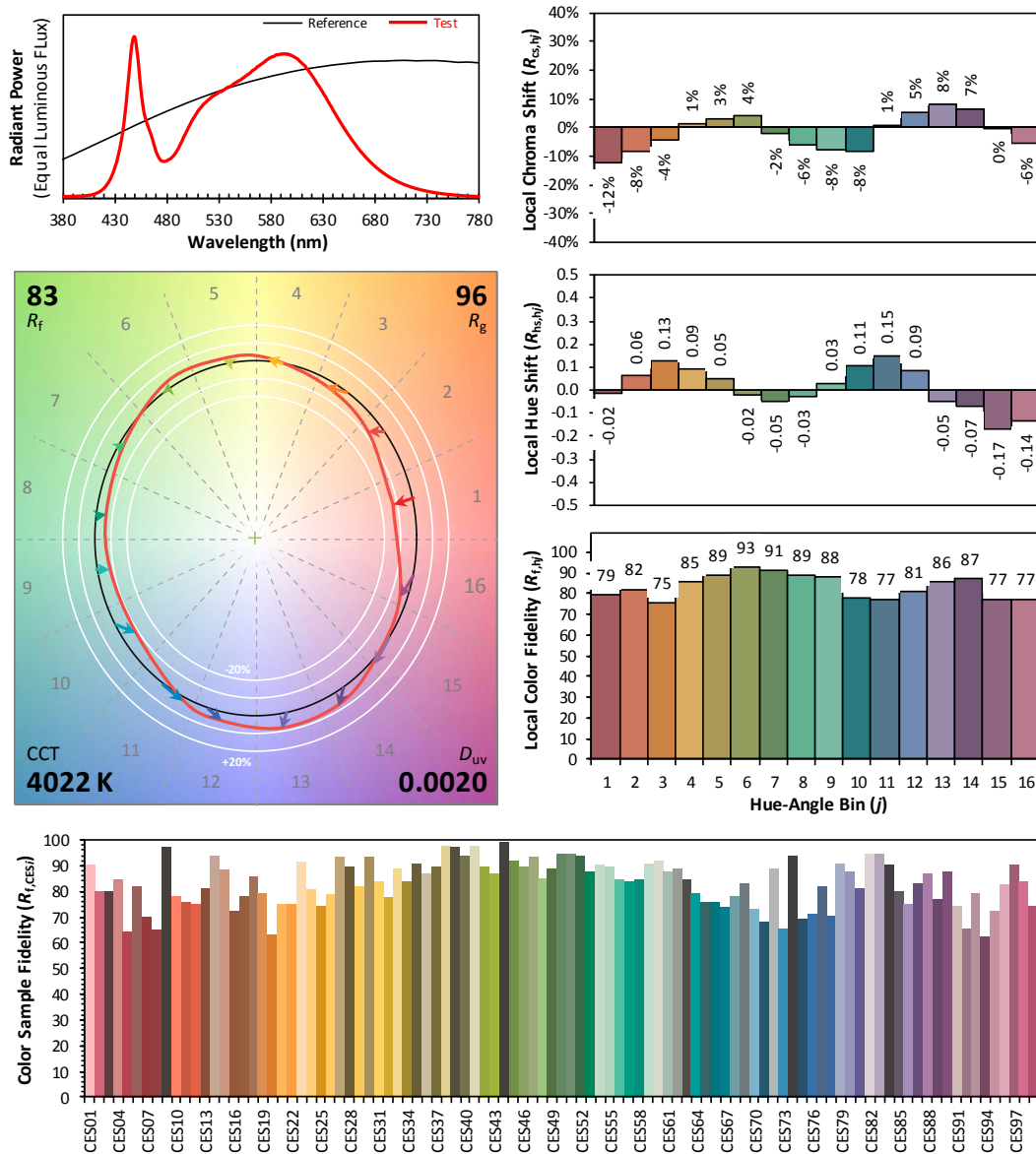


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3808
 y 0.3812
 u' 0.2236
 v' 0.5036

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	26.771	1.47%
10- 20	78.039	4.28%
20- 30	122.69	6.73%
30- 40	157.062	8.62%
40- 50	178.611	9.80%
50- 60	186.31	10.23%
60- 70	180.919	9.93%
70- 80	165.472	9.08%
80- 90	145.687	8.00%
90-100	127.696	7.01%
100-110	111.094	6.10%
110-120	94.599	5.19%
120-130	78.663	4.32%
130-140	63.209	3.47%
140-150	48.248	2.65%
150-160	33.193	1.82%
160-170	18.057	0.99%
170-180	5.702	0.31%
Total	1822.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	749.483	41.13%
60- 90	492.078	27.01%
0-90	1241.561	68.14%
90- 180	580.461	31.86%
0- 180	1822.0	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

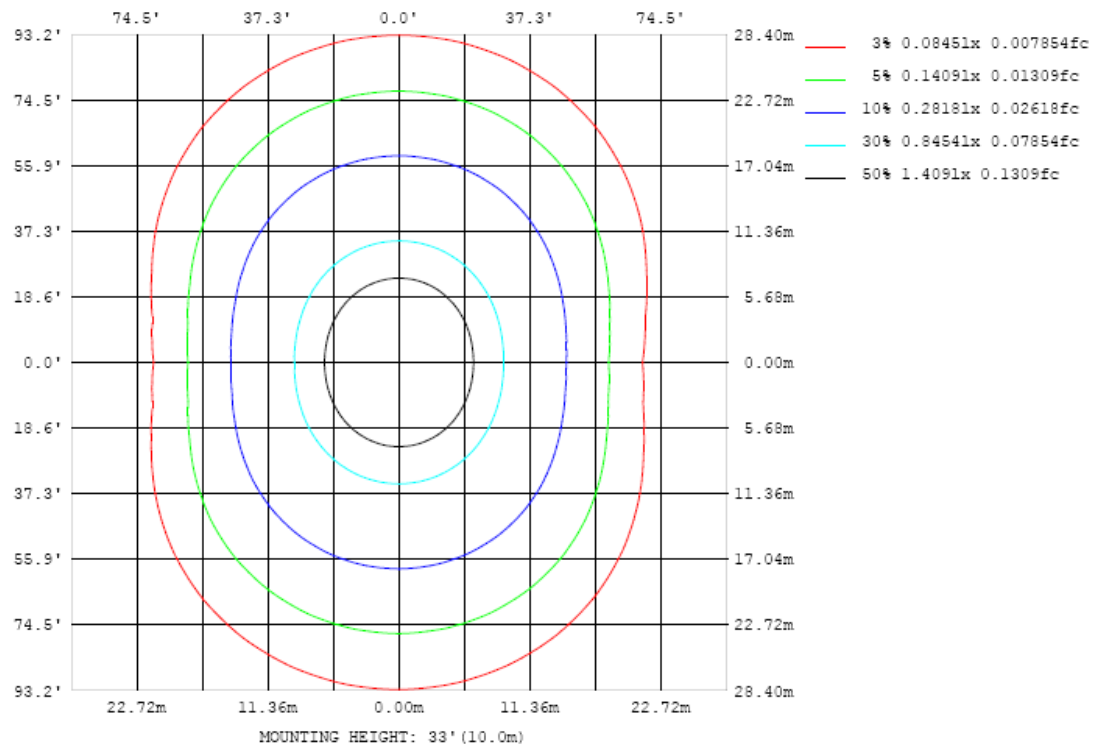


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

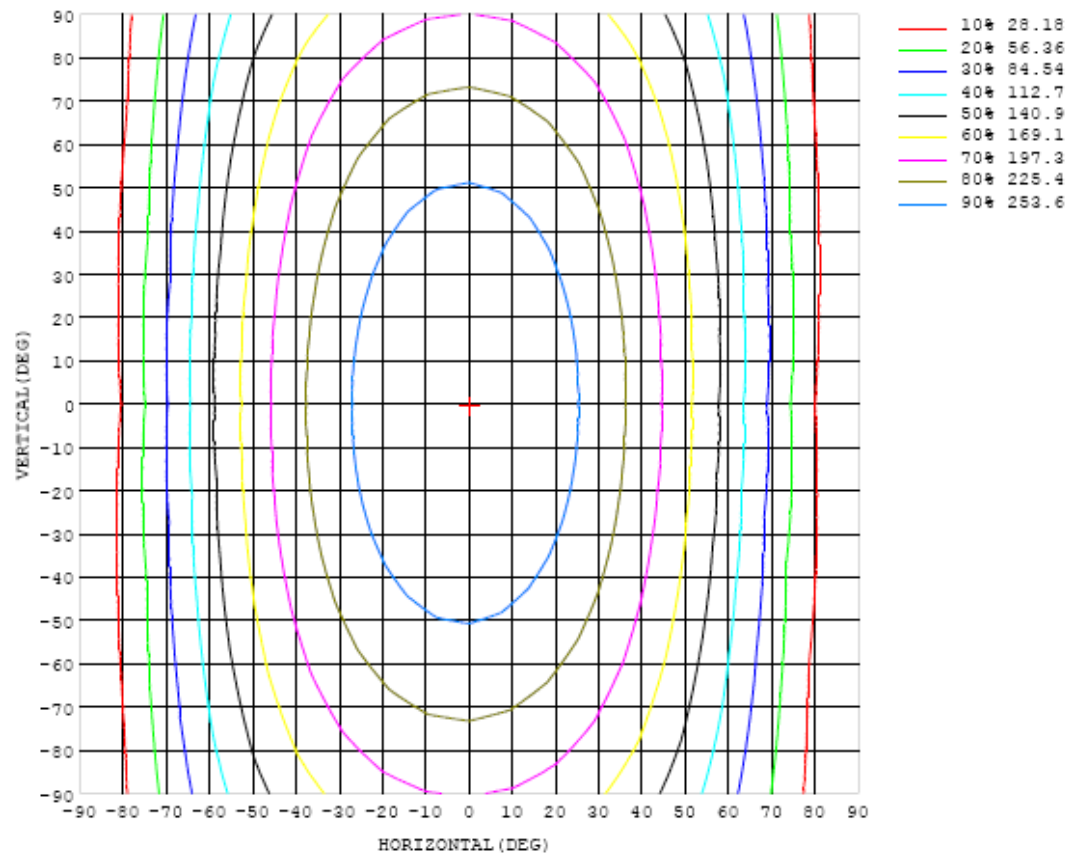


Chart 6: Isocandela Plot

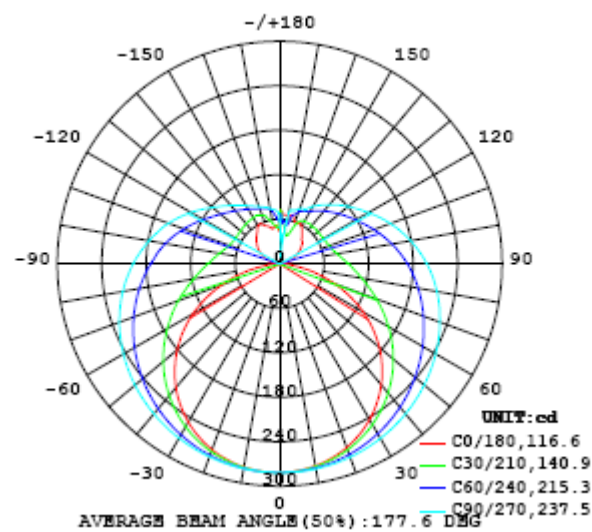


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DBG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
y (DBG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282
5	280	280	280	281	281	281	281	281	281	282	282	282	282	282	281	281	281	281	281
10	277	277	277	278	278	279	280	280	281	281	281	281	280	280	280	279	279	279	279
15	271	272	272	273	275	276	277	278	279	280	279	279	278	277	276	275	275	274	274
20	264	264	265	267	269	272	274	276	277	278	277	277	275	274	272	270	268	267	267
25	254	255	257	259	263	266	270	272	274	275	275	274	272	269	266	263	260	259	258
30	243	244	246	250	255	260	265	268	271	272	272	270	267	263	259	254	250	248	247
35	229	230	234	240	246	253	259	264	267	268	268	265	262	256	250	244	239	235	233
40	213	215	220	227	236	245	252	258	262	264	263	261	255	249	241	232	225	220	218
45	195	198	204	214	225	236	246	253	257	260	259	255	249	240	230	220	210	203	200
50	175	178	187	200	214	227	238	247	252	254	253	249	242	231	219	206	193	184	180
55	154	158	169	185	202	218	231	240	246	249	248	243	234	222	208	191	175	163	159
60	130	135	150	170	190	208	223	233	240	243	242	236	226	213	196	176	156	141	135
65	105	111	130	154	178	198	215	226	234	237	235	229	218	203	184	161	137	117	110
70	78.6	87.3	111	139	166	188	206	219	227	230	228	222	210	194	172	146	118	93.2	83.1
75	53.0	64.1	92.6	125	155	179	198	211	220	223	221	214	202	184	161	132	100	70.4	56.2
80	28.3	42.8	77.2	112	144	170	190	204	212	215	213	206	193	175	150	120	84.3	49.6	31.5
85	8.75	26.7	64.6	102	134	161	181	195	204	207	205	198	185	166	141	109	72.2	33.6	10.3
90	0.52	18.5	55.7	92.6	125	152	172	186	195	199	197	189	176	157	131	99.6	62.9	24.6	0.27
95	2.27	16.2	49.6	84.9	117	143	163	177	186	189	187	180	167	148	123	91.6	56.4	21.1	1.97
100	6.04	18.0	46.4	78.7	109	134	154	168	176	179	177	170	157	139	114	84.9	52.4	22.0	6.04
105	11.0	21.6	45.7	73.9	102	126	144	158	166	169	167	160	148	130	107	79.6	50.7	24.3	11.6
110	16.6	26.0	46.3	71.2	95.7	118	135	148	156	159	157	150	138	122	100	75.9	50.8	27.5	18.0
115	22.6	30.8	48.0	69.3	90.8	110	126	138	145	149	147	140	129	114	95.0	73.7	50.8	30.8	24.3
120	28.6	35.3	50.1	68.2	86.8	104	118	129	135	138	137	131	121	107	90.7	71.7	52.6	35.3	30.6
125	34.0	38.4	52.0	67.6	83.6	98.6	111	121	126	129	127	122	114	102	87.2	70.7	54.0	40.3	35.7
130	38.8	40.5	53.0	66.8	80.8	93.7	105	113	118	120	119	114	107	96.3	83.6	67.6	54.0	42.3	40.1
135	42.9	42.5	55.5	67.6	78.3	89.2	98.7	106	110	112	111	107	100	90.9	80.0	65.8	53.1	43.6	44.4
140	46.3	43.6	56.9	66.8	75.5	84.9	93.0	98.9	103	104	103	99.8	94.0	86.4	73.2	66.7	57.3	44.5	48.7
145	51.9	43.1	58.3	67.0	74.5	80.3	87.5	92.4	95.5	96.8	96.0	92.9	88.1	80.2	71.1	65.8	61.0	45.2	53.0
150	58.6	42.6	57.2	66.4	73.1	77.7	81.2	85.7	88.4	89.4	88.6	86.3	82.2	76.2	69.7	64.1	61.3	44.4	58.8
155	60.1	45.7	47.2	63.1	70.9	75.6	78.2	80.7	80.4	80.6	80.6	80.7	77.4	70.9	63.7	57.4	52.2	46.5	58.9
160	60.6	47.7	38.8	50.7	66.4	71.9	74.9	77.4	78.5	78.7	78.5	74.6	64.2	56.9	53.6	49.9	44.7	46.1	54.1
165	67.4	49.3	38.7	40.1	43.6	60.6	68.2	68.8	73.0	74.4	68.2	53.4	51.3	52.1	45.4	41.8	42.8	45.3	51.2
170	65.8	58.2	44.7	42.7	47.6	49.5	52.8	57.6	58.9	68.1	43.1	54.2	54.3	52.3	48.6	46.6	45.1	45.9	49.8
175	66.7	64.3	58.6	54.3	55.4	57.1	57.4	58.1	56.7	35.7	58.4	59.1	57.4	55.4	54.0	52.7	51.4	51.3	52.2
180	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (D ₅₀) γ (D ₅₀)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282		
5	281	281	281	281	281	281	281	281	281	281	281	281	281	281	280	280	280		
10	279	279	279	279	280	280	280	281	280	280	280	279	279	278	278	277	277		
15	274	274	275	276	277	278	279	279	279	279	278	277	276	274	273	272	272		
20	267	268	270	272	273	275	276	277	277	276	275	274	271	269	267	265	264		
25	259	260	263	265	268	271	273	274	275	274	272	269	266	263	260	257	255		
30	248	250	254	258	263	266	269	271	272	271	268	265	260	255	251	247	244		
35	235	238	244	250	256	261	265	268	268	267	264	259	253	247	240	234	230		
40	220	225	232	240	248	255	260	263	264	263	259	253	246	237	228	221	215		
45	203	210	219	230	240	249	255	259	260	258	254	247	237	227	216	206	198		
50	184	193	205	219	231	242	249	254	255	253	248	239	229	216	202	189	180		
55	164	175	190	207	222	234	243	248	249	247	241	232	219	204	188	172	160		
60	141	156	175	195	212	226	236	242	244	241	235	224	210	193	173	154	138		
65	117	137	160	183	203	218	229	235	237	234	228	216	201	181	159	135	115		
70	92.9	117	145	171	193	210	221	228	230	228	220	208	191	169	144	116	91.3		
75	69.2	98.3	131	160	183	201	213	221	223	220	212	200	182	159	130	98.4	68.6		
80	47.2	81.9	118	149	173	192	205	213	215	212	204	191	172	148	118	82.7	48.2		
85	30.3	68.6	107	139	165	183	197	204	207	204	196	182	164	138	107	70.1	32.3		
90	20.9	59.1	96.9	130	156	174	188	195	198	195	187	173	155	129	97.5	60.8	23.2		
95	17.6	52.9	89.2	121	146	166	178	186	189	186	178	165	146	121	89.8	54.6	19.7		
100	18.6	48.7	82.5	113	138	157	169	177	179	176	169	156	137	113	83.2	50.1	19.9		
105	22.1	46.8	76.8	105	129	147	160	167	169	167	160	147	128	105	77.4	47.8	23.0		
110	27.4	47.2	72.6	98.3	120	138	150	157	160	157	150	137	120	98.2	72.9	47.5	27.9		
115	33.0	49.0	70.2	92.2	112	128	140	147	149	147	140	128	112	91.9	70.0	48.6	33.2		
120	38.5	51.7	69.1	87.6	105	119	130	136	138	136	130	119	104	87.0	68.4	50.9	38.1		
125	43.8	54.6	68.8	84.3	98.8	111	120	126	128	126	120	111	98.1	83.5	67.8	53.9	43.1		
130	48.4	57.7	69.1	81.8	93.9	104	112	117	118	117	112	104	93.2	80.9	68.0	57.1	47.8		
135	52.9	60.7	69.7	79.9	89.8	98.3	105	109	110	109	104	97.8	89.1	78.9	68.7	60.0	51.9		
140	56.6	63.2	70.5	78.5	86.3	93.2	98.5	102	103	102	98.2	92.8	85.7	77.6	69.8	62.8	55.1		
145	60.2	64.8	71.2	77.4	83.4	88.8	93.0	95.7	96.5	95.5	92.7	88.4	82.9	76.7	70.7	64.8	59.0		
150	62.5	65.9	71.6	76.7	81.0	85.0	88.2	90.3	90.9	90.1	88.0	84.8	80.7	76.2	71.4	66.4	61.9		
155	63.0	66.6	71.9	76.0	79.0	81.9	84.2	85.6	86.1	85.5	84.0	81.8	79.0	75.6	71.6	68.0	63.2		
160	60.1	64.3	69.5	75.4	77.5	79.3	80.8	81.8	82.1	81.8	80.9	79.5	77.3	74.5	72.0	69.5	66.9		
165	54.2	59.2	63.7	71.3	76.2	77.3	78.2	78.8	79.1	78.9	78.3	77.1	75.4	73.8	72.3	70.2	67.8		
170	51.6	52.5	55.8	60.2	69.3	75.2	75.9	75.9	75.9	75.6	75.1	74.5	73.8	73.1	71.9	68.9	67.2		
175	52.2	51.5	50.5	52.8	58.5	65.0	70.4	72.5	72.9	72.9	72.4	71.6	70.5	70.0	69.7	67.5	66.4		
180	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6	57.6		

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

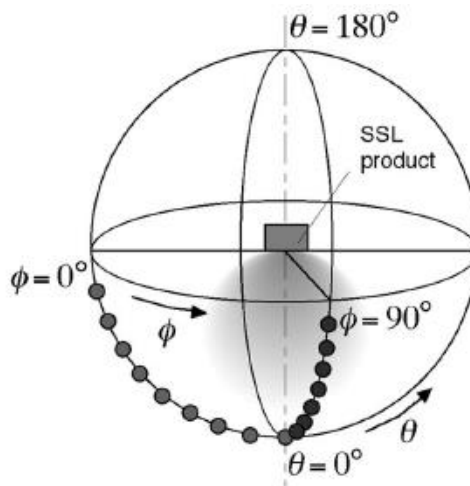
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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