

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 10.5T8/4F/835/IS/DIR

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19040014d

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/835/IS/DIR**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
133.1	1860.0	13.97	0.9923
CCT (K)	CRI	Stabilization Time (Light & Power)	
3304	81.6	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

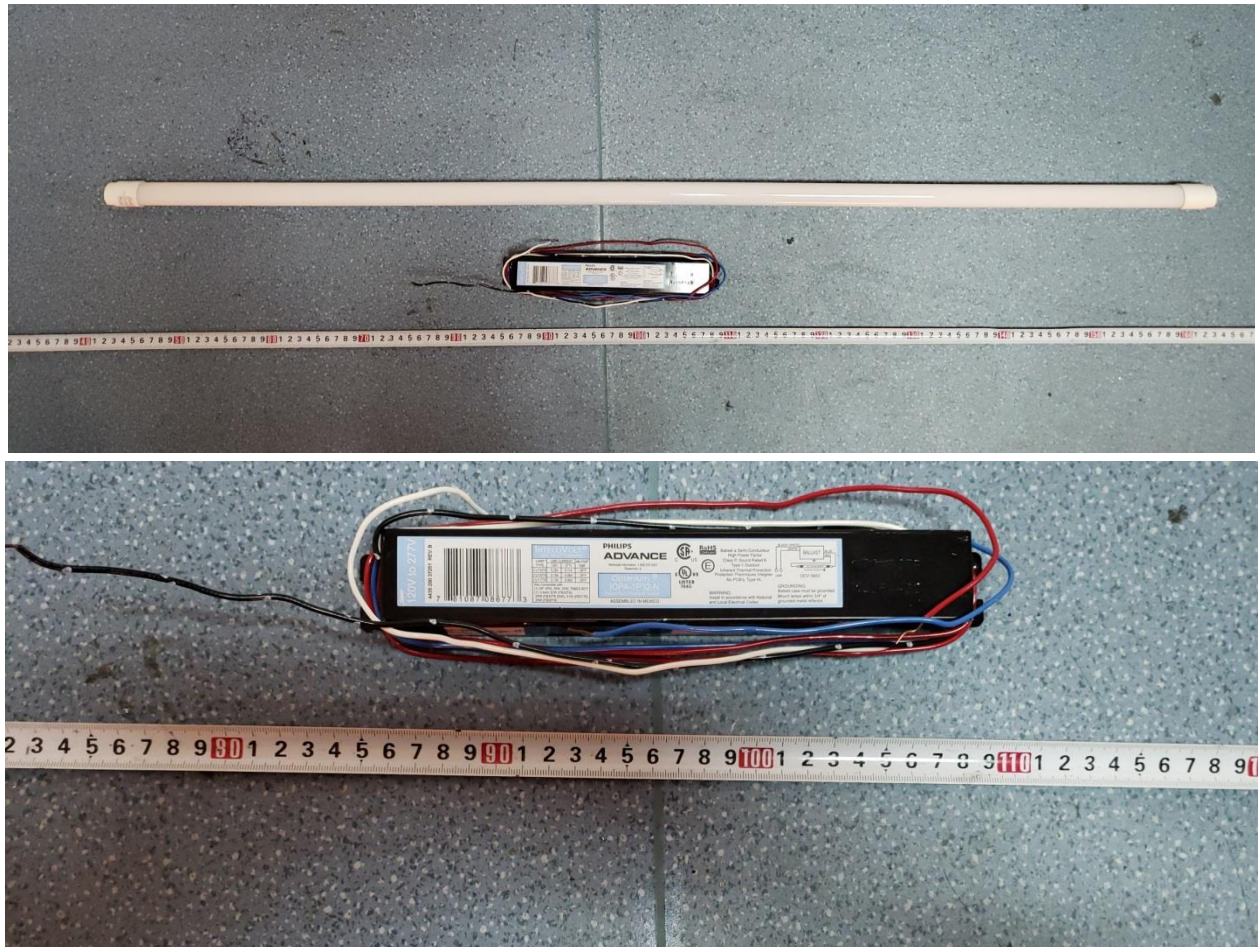


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 10.5T8/4F/835/IS/DIR
Electrical Ratings	: 120-277V, 60Hz
Product Description	: 3500K 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	0.055
Power Factor	0.9923	0.9319
Test Power (W)	13.97	14.11
THD A%	9.08	15.43
Luminous Efficacy (lm/W)	133.1	131.9
Total Luminous Flux (lm)	1860.0	1861.0
Color Rendering Index (CRI)	81.6	
R9	1.5	
Correlated Color Temperature (CCT)(K)	3304	
Chromaticity Chroma x	0.4172	
Chromaticity Chroma y	0.3974	
Chromaticity Chroma u	0.2407	
Chromaticity Chroma v	0.3439	
Duv	0.0004	
Chromaticity Chroma u'	0.2407	
Chromaticity Chroma v'	0.5158	

Special Color Rendering Indices	
R1	79.7
R2	88.4
R3	95.8
R4	80.9
R5	79.9
R6	85.2
R7	83.7
R8	59.2
R9	1.5
R10	73.4
R11	80.2
R12	66.6
R13	81.6
R14	97.7
Rf	84
Rg	97

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	0.9930
Power (W)	14.05
Luminous Efficacy (lm/W)	130.2
Total Luminous Flux (lm)	1829.6
Beam Angle (°)	116.9 (0°-180°) / 238.6 (90°-270°)
Center Beam Candle Power (cd)	282
Maximum Beam Candle Power (cd)	281.6 (At: C=70.0, Gamma=1.0)
Spacing Criteria	1.29 (0°-180°) / 1.46 (90°-270°)
Zonal Lumens in the 0°-60° Zone	40.98%
Zonal Lumens in the 60°-90° Zone	26.98%
Zonal Lumens in the 90°-120° Zone	18.35%
Zonal Lumens in the 120°-180° Zone	13.69%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

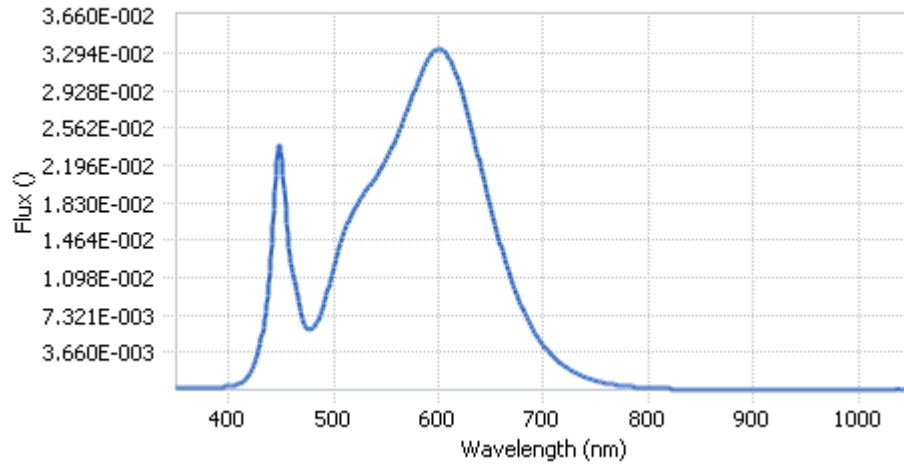
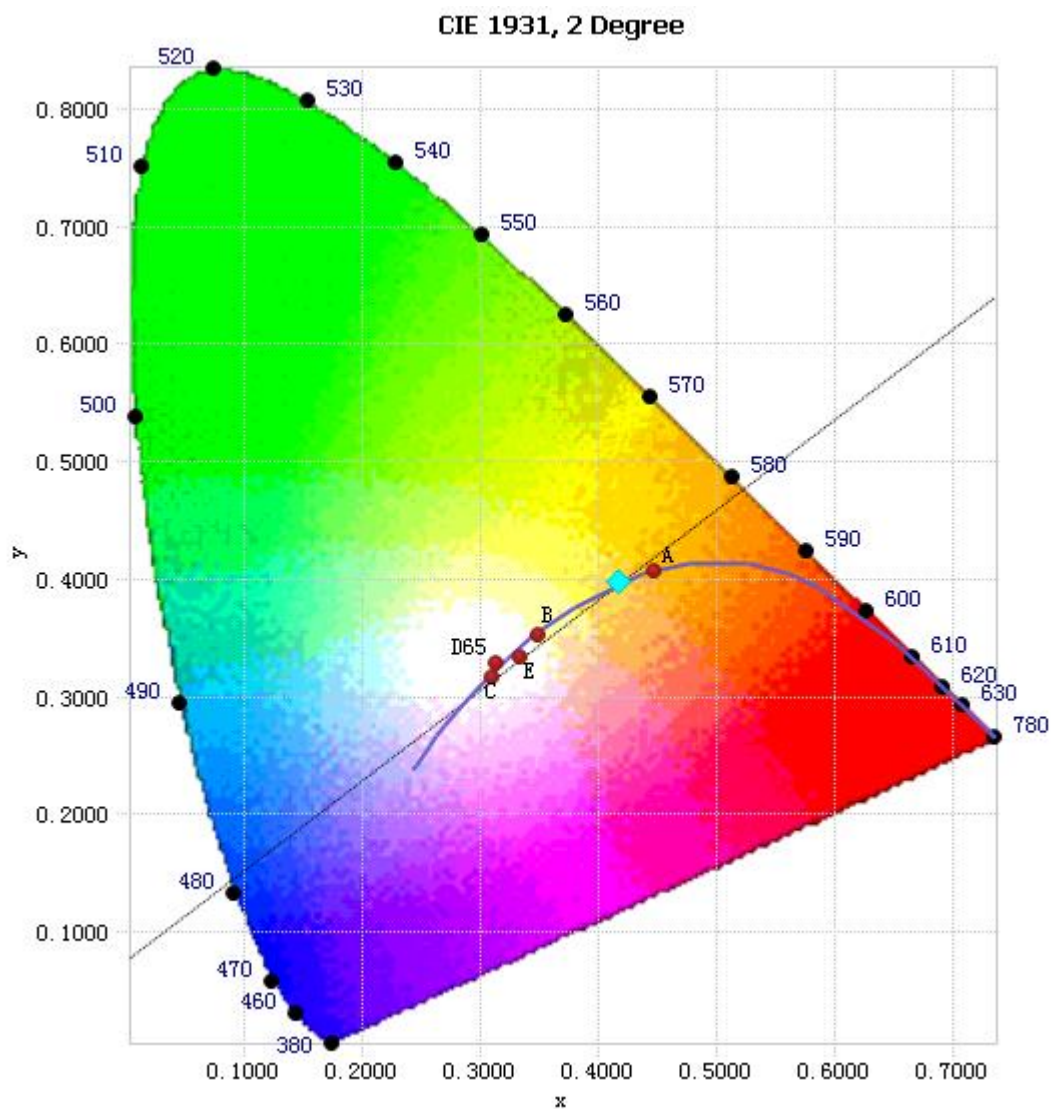


Chart 1: Spectral Power Distribution

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	6.77E-03	590	3.23E-02	695	5.06E-03
385	2.60E-04	490	8.09E-03	595	3.30E-02	700	4.36E-03
390	2.81E-04	495	9.99E-03	600	3.32E-02	705	3.73E-03
395	3.07E-04	500	1.20E-02	605	3.32E-02	710	3.17E-03
400	3.54E-04	505	1.39E-02	610	3.24E-02	715	2.72E-03
405	4.38E-04	510	1.55E-02	615	3.13E-02	720	2.30E-03
410	6.32E-04	515	1.67E-02	620	2.98E-02	725	2.00E-03
415	9.77E-04	520	1.77E-02	625	2.80E-02	730	1.70E-03
420	1.60E-03	525	1.86E-02	630	2.61E-02	735	1.45E-03
425	2.71E-03	530	1.94E-02	635	2.39E-02	740	1.24E-03
430	4.59E-03	535	2.00E-02	640	2.18E-02	745	1.06E-03
435	7.56E-03	540	2.08E-02	645	1.97E-02	750	8.99E-04
440	1.29E-02	545	2.16E-02	650	1.76E-02	755	7.73E-04
445	2.10E-02	550	2.25E-02	655	1.57E-02	760	6.65E-04
450	2.34E-02	555	2.36E-02	660	1.38E-02	765	5.71E-04
455	1.63E-02	560	2.47E-02	665	1.21E-02	770	4.93E-04
460	1.20E-02	565	2.60E-02	670	1.06E-02	775	4.25E-04
465	9.70E-03	570	2.73E-02	675	9.17E-03	780	3.74E-04
470	7.08E-03	575	2.87E-02	680	7.97E-03		
475	5.92E-03	580	3.00E-02	685	6.87E-03		
480	6.07E-03	585	3.13E-02	690	5.92E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4172, 0.3974)

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

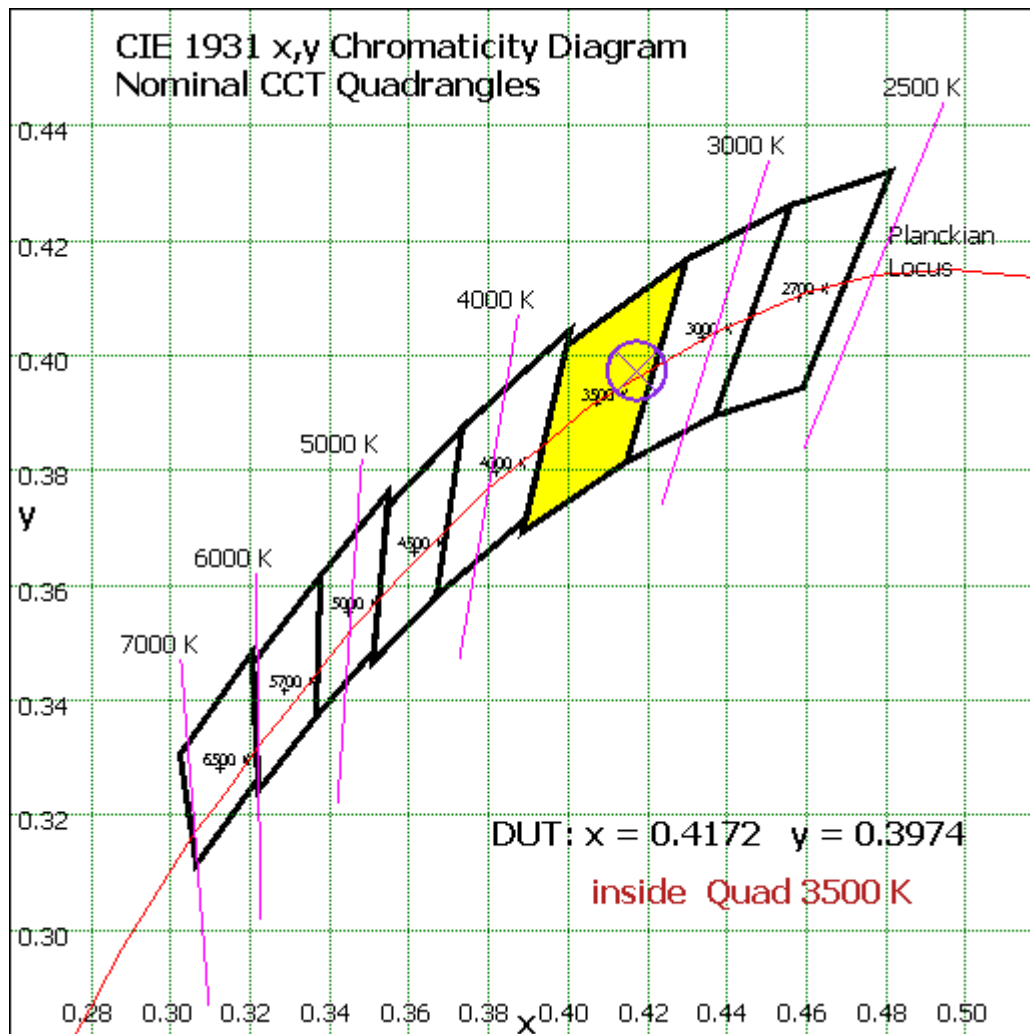
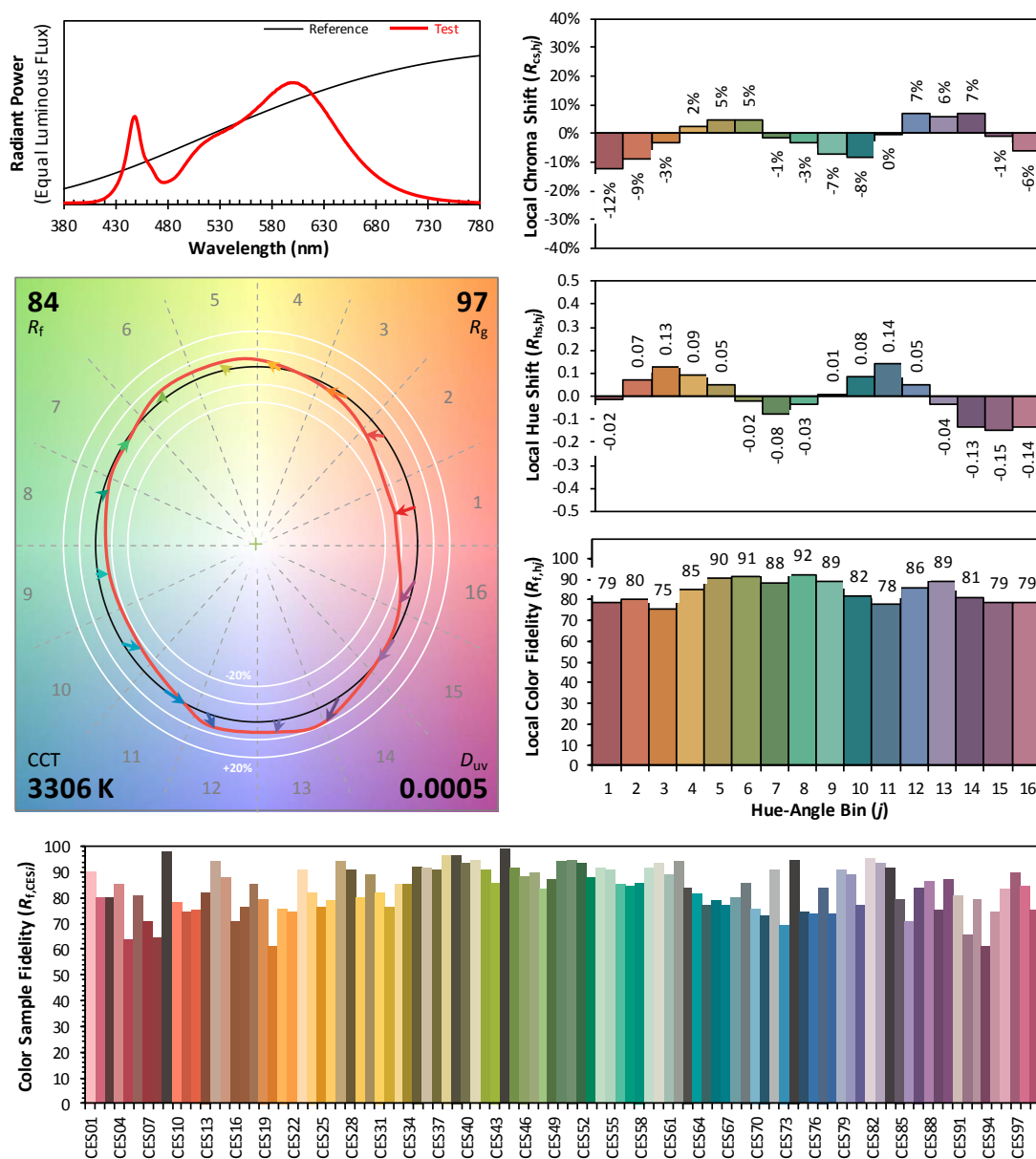


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4172

y 0.3974

u' 0.2407

v' 0.5158

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	26.758	1.46%
10- 20	78.012	4.26%
20- 30	122.681	6.71%
30- 40	157.098	8.59%
40- 50	178.713	9.77%
50- 60	186.514	10.19%
60- 70	181.252	9.91%
70- 80	165.973	9.07%
80- 90	146.39	8.00%
90-100	128.625	7.03%
100-110	111.846	6.11%
110-120	95.323	5.21%
120-130	79.42	4.34%
130-140	64.153	3.51%
140-150	49.213	2.69%
150-160	33.895	1.85%
160-170	18.267	1.00%
170-180	5.446	0.30%
Total	1829.6	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	749.776	40.98%
60- 90	493.615	26.98%
0-90	1243.391	67.96%
90- 180	586.188	32.04%
0- 180	1829.6	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

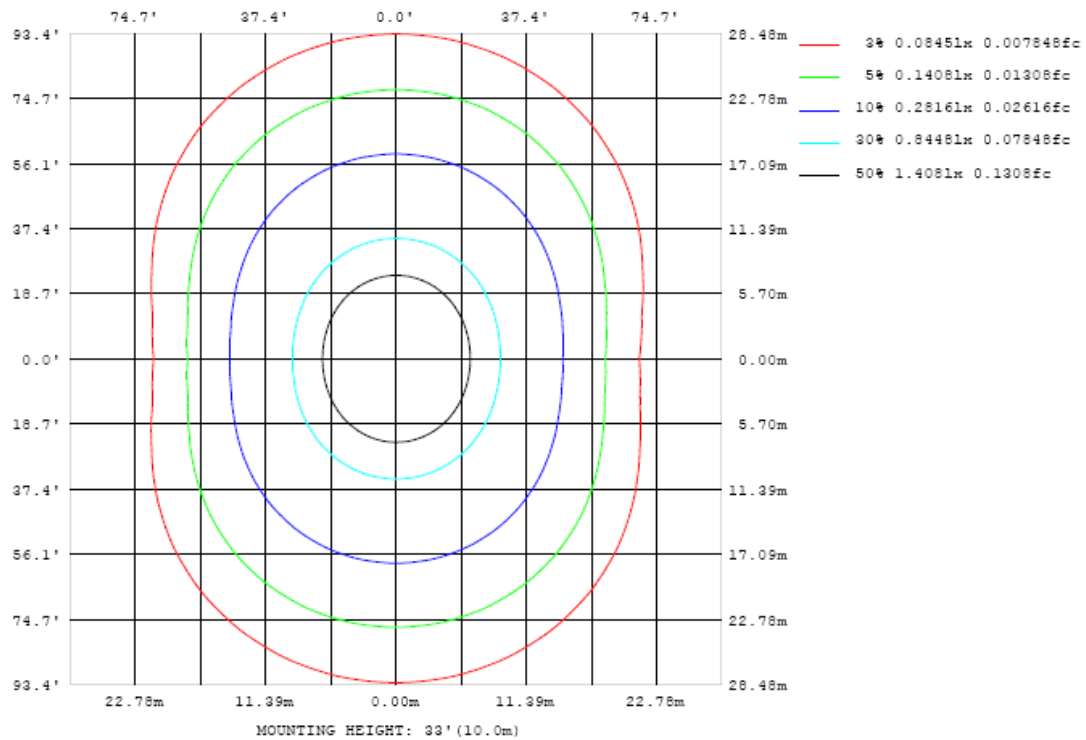


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

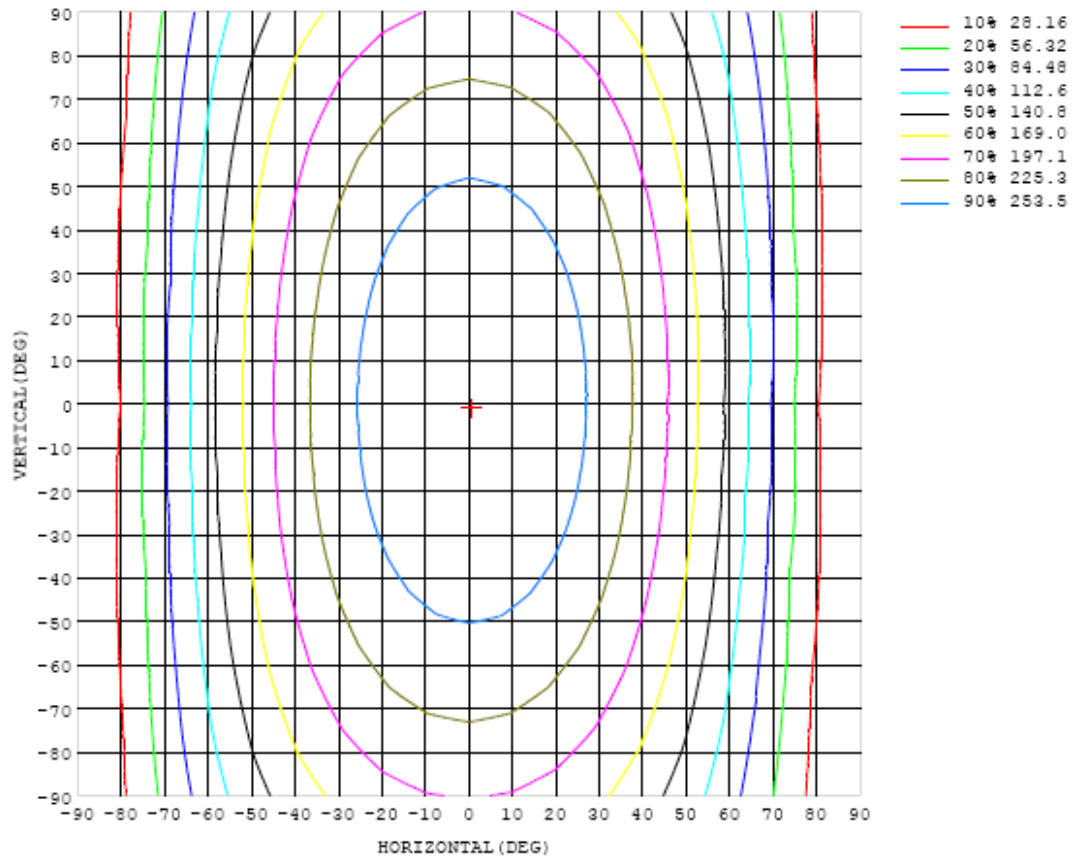


Chart 6: Isocandela Plot

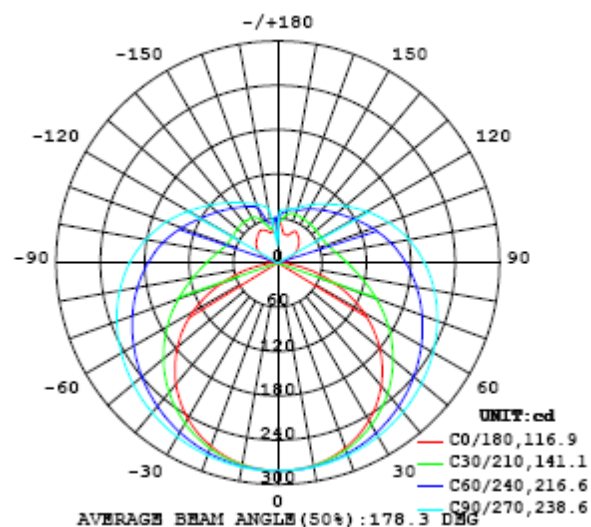


Chart 7: Polar Candela Distribution

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	282	282	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	281	281	280	280	280
10	278	278	278	279	279	280	280	280	280	280	280	280	279	279	278	278	277	277	277
15	274	274	274	275	276	277	278	279	279	279	279	278	277	276	274	273	272	272	272
20	267	267	268	269	271	273	275	276	277	277	276	275	274	272	269	267	266	265	264
25	258	258	260	262	265	268	271	273	274	274	274	272	270	266	263	260	257	255	255
30	246	247	250	253	258	262	266	269	271	271	270	268	265	260	255	251	247	244	243
35	233	234	238	243	249	255	260	264	267	268	266	264	259	253	247	240	235	231	230
40	218	219	224	231	239	247	254	259	263	264	262	259	253	246	237	229	221	216	214
45	200	202	208	218	228	239	247	254	258	259	257	253	246	237	227	216	206	199	197
50	180	183	191	204	217	229	240	248	252	254	252	247	239	229	216	202	189	180	177
55	158	162	173	189	205	220	232	241	247	248	246	241	232	219	204	188	172	160	156
60	134	139	154	173	193	210	224	234	241	242	240	234	224	210	193	173	153	138	133
65	109	115	134	157	180	200	216	227	234	236	234	228	216	201	181	158	134	114	107
70	82.0	90.4	114	142	168	190	208	220	227	230	227	220	208	191	169	143	115	90.9	80.7
75	55.7	66.9	95.1	127	157	181	199	212	220	223	220	213	200	182	159	130	98.0	68.6	54.6
80	30.3	45.0	78.6	114	146	171	191	204	212	215	213	205	192	173	148	118	82.7	48.2	29.4
85	9.85	28.0	66.0	103	136	162	182	196	204	207	205	197	183	164	139	107	71.0	32.7	9.11
90	0.63	18.9	56.7	94.0	127	153	173	187	196	199	196	188	175	155	130	98.5	62.1	24.3	0.26
95	2.25	16.0	50.6	86.5	119	145	164	179	187	190	187	180	166	147	122	91.1	56.2	21.1	2.08
100	6.12	17.6	46.8	80.0	111	136	155	169	177	180	178	170	157	138	114	84.6	52.0	21.9	6.27
105	11.2	21.2	45.5	75.3	103	127	146	159	167	170	168	161	148	130	107	79.2	50.2	24.8	11.9
110	16.7	26.3	46.1	71.5	96.6	119	137	149	157	160	158	151	139	121	100.0	75.6	50.4	28.3	18.1
115	22.1	31.6	47.7	69.4	90.9	111	128	139	147	149	147	141	129	114	94.1	73.3	51.9	32.3	24.1
120	27.9	36.9	50.0	68.2	86.7	104	119	130	136	139	137	131	121	106	89.6	71.7	53.3	36.9	30.0
125	32.6	40.9	52.9	67.8	83.4	98.3	111	120	127	129	127	122	113	101	86.1	71.1	54.9	42.7	34.7
130	36.6	44.3	55.3	67.8	80.7	93.5	104	112	118	120	118	114	106	95.4	83.4	70.4	55.7	45.8	38.3
135	40.9	48.9	58.0	68.1	78.7	89.4	98.5	105	110	111	110	106	99.8	91.2	80.8	70.0	55.4	48.1	41.2
140	44.0	52.4	60.2	68.3	77.5	85.7	93.3	99.0	103	104	103	99.9	94.5	87.1	78.4	68.7	60.1	53.0	43.6
145	46.5	55.5	62.6	68.5	75.8	82.3	88.4	93.2	96.2	97.4	96.6	94.0	89.2	83.1	76.5	65.3	59.7	57.6	46.9
150	48.9	57.9	64.1	68.9	73.7	79.2	84.0	87.7	89.9	90.8	90.2	88.1	84.5	79.5	73.0	67.3	62.9	60.4	49.2
155	45.0	56.6	66.3	69.8	73.0	75.8	79.3	82.6	84.3	84.9	84.5	82.7	79.7	76.5	71.7	65.9	62.3	58.8	49.0
160	39.4	55.7	67.8	69.7	72.3	74.6	75.4	76.6	78.1	78.4	78.2	77.4	76.9	74.1	69.0	63.2	58.8	53.9	46.4
165	39.9	49.4	64.7	69.8	71.4	73.3	75.1	76.1	76.1	76.4	76.3	75.9	73.2	68.6	62.3	56.0	51.8	47.5	42.6
170	41.6	44.9	57.9	66.1	67.0	69.5	72.0	72.8	73.2	73.1	73.2	71.7	66.8	59.0	52.1	50.7	50.7	47.9	43.9
175	51.9	52.7	54.3	57.9	62.4	65.1	67.0	70.2	72.3	72.3	70.5	62.3	50.8	46.4	48.1	51.1	52.1	53.2	53.8
180	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8

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	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282	282		
5	280	280	281	281	281	281	281	281	281	281	281	281	281	281	281	281	281		
10	277	277	278	278	279	279	280	280	281	281	280	280	280	279	279	279	278		
15	272	272	273	275	276	277	278	279	279	279	279	278	277	276	275	274	274		
20	265	266	267	270	272	274	275	277	277	277	276	275	273	272	270	268	267		
25	256	257	260	263	267	270	272	274	275	275	273	271	269	266	263	260	258		
30	244	247	251	256	261	265	269	271	272	271	270	267	263	258	254	250	248		
35	231	235	241	247	254	260	264	267	269	268	265	261	256	250	244	238	235		
40	216	221	229	238	246	254	259	263	265	264	261	255	249	241	232	225	220		
45	199	206	216	227	238	247	254	259	260	259	255	249	240	230	220	210	203		
50	180	189	202	216	229	240	248	253	255	254	250	242	232	219	206	193	184		
55	160	172	187	204	220	233	242	248	250	249	243	234	222	208	191	175	164		
60	138	153	173	193	211	225	236	242	245	243	237	227	213	196	176	157	142		
65	115	134	158	181	201	217	229	236	238	236	230	219	203	184	162	138	118		
70	90.4	115	143	170	192	209	222	229	232	230	223	211	194	172	147	119	94.4		
75	66.7	96.3	129	159	183	201	214	222	225	222	215	202	184	162	133	101	70.9		
80	45.4	80.4	117	148	173	193	206	214	217	215	207	194	175	151	120	84.7	49.7		
85	29.1	67.7	106	139	165	184	198	206	209	207	199	185	167	141	109	71.8	33.3		
90	20.3	58.6	96.7	130	156	176	190	198	201	198	190	176	158	132	99.7	62.2	23.9		
95	17.4	52.3	88.8	121	147	167	180	188	191	189	180	167	149	123	91.3	55.2	19.9		
100	18.9	48.5	82.2	113	138	158	170	178	181	179	171	158	139	114	84.0	50.5	20.3		
105	22.8	47.5	76.9	105	129	148	161	168	171	169	161	148	130	106	78.1	48.4	23.4		
110	28.1	48.4	73.6	98.7	121	139	151	159	161	159	151	139	121	99.1	73.9	48.4	28.3		
115	33.5	50.6	71.7	93.5	113	129	141	148	150	148	141	129	113	93.3	71.3	49.8	33.6		
120	38.9	53.3	70.9	89.5	107	121	131	137	140	137	131	120	106	88.9	69.9	52.3	38.6		
125	43.5	56.3	70.8	86.5	101	113	122	128	130	128	122	113	101	85.5	69.6	55.3	42.6		
130	46.9	59.1	71.2	84.1	96.5	107	115	120	121	119	114	106	95.8	83.0	70.1	58.2	45.7		
135	49.9	61.0	71.6	82.3	92.5	101	108	112	113	112	107	101	91.7	81.2	70.9	60.8	48.9		
140	52.2	63.5	72.2	80.8	89.0	96.1	101	105	106	105	101	95.5	88.3	80.0	71.7	62.2	50.2		
145	53.4	65.6	70.3	78.7	86.1	91.5	95.8	98.6	99.6	98.5	95.6	91.1	85.5	79.0	72.0	64.2	53.8		
150	54.4	67.1	70.8	77.1	83.2	87.6	90.8	92.9	93.7	92.9	90.8	87.4	83.2	77.9	71.7	66.6	57.2		
155	51.6	62.3	67.2	71.9	79.4	84.2	86.4	88.0	88.7	88.2	86.8	84.3	80.8	76.4	71.2	64.8	53.4		
160	46.9	54.0	59.1	62.8	67.8	77.8	82.9	83.8	84.4	84.1	82.8	80.7	78.3	74.8	71.7	60.7	46.2		
165	44.4	46.9	50.5	52.6	55.5	59.0	69.1	78.9	79.9	79.3	78.4	77.2	73.8	70.9	70.8	50.0	39.6		
170	44.9	46.8	47.7	51.8	51.7	55.0	51.9	56.2	73.5	73.9	71.8	70.5	69.6	62.0	48.4	41.5	42.0		
175	54.1	56.0	57.2	57.9	57.8	58.0	57.6	55.0	34.2	47.0	56.2	59.5	56.5	55.4	55.5	54.9	53.6		
180	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8		

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

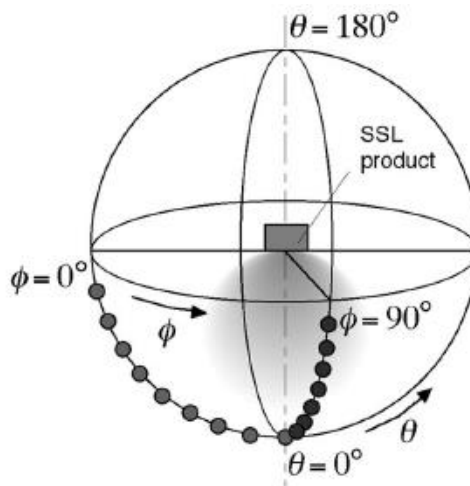
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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