LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 12T8/4F/830/HYB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19090007a

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

Review by: April Zou

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Sep. 10, 2019

Approved by: Jim Zhang

Manager: Jim Zhang
Sep. 10, 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: **12T8/4F/830/HYB**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)/2	Power Factor
124.8	1800.6	14.43	0.9974

CCT (K)	CRI	Stabilization Time (Light & Power)
3077	82.7	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	: Sep. 05, 2019
Date of Test	: Sep. 09, 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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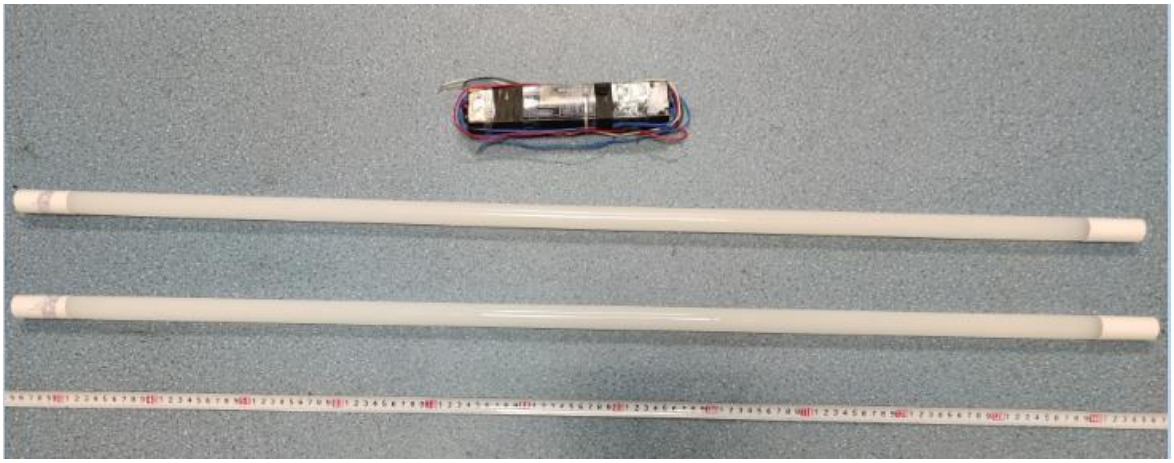
SAMPLE PHOTO



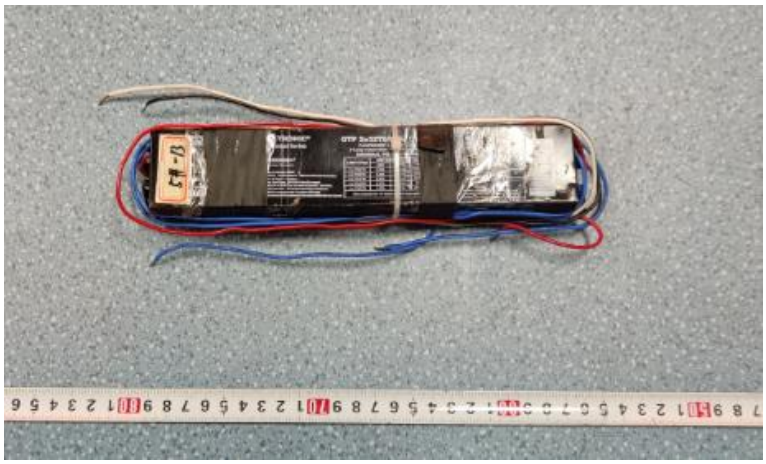


Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Tube
Model	: 12T8/4F/830/HYB
Electrical Ratings	: 120-277V, 60Hz, 12W
Product Description	: 3000K LED tubes supplied by a high frequency fluorescent lamp ballast: QTP 2x32T8/UNV ISN-SC
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)	0.241	0.110
Power Factor	0.9974	0.9574
Test Power (W)/2	14.43	14.58
THD A%	4.43	13.90
Luminous Efficacy (lm/W)	124.8	123.8
Total Luminous Flux (lm)	1800.6	1803.9
Color Rendering Index (CRI)	82.7	
R9	6.7	
Correlated Color Temperature (CCT)(K)	3077	
Chromaticity Chroma x	0.4301	
Chromaticity Chroma y	0.3994	
Chromaticity Chroma u	0.2482	
Chromaticity Chroma v	0.3457	
Duv	-0.0009	
Chromaticity Chroma u ’	0.2482	
Chromaticity Chroma v’	0.5185	

Special Color Rendering Indices	
R1	81.5
R2	91.9
R3	95.4
R4	80.3
R5	81.7
R6	90
R7	82
R8	58.6
R9	6.7
R10	81.4
R11	79.8
R12	70.5
R13	84.1
R14	98.3

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 25.1 ℃.

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)	0.243
Power Factor	0.9550
Power (W)/2	14.53
Luminous Efficacy (lm/W)	121.6
Total Luminous Flux (lm)	1766.6
Beam Angle (°)	111.0 (0^o-180^o) / 202.9 (90^o-270^o)
Center Beam Candle Power (cd)	314
Maximum Beam Candle Power (cd)	314.3 (At: C=310.0, Gamma=0.5)
Spacing Criteria	1.25 (0^o-180^o) / 1.41 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	44.89%
Zonal Lumens in the 60 °-90 °Zone	26.64%
Zonal Lumens in the 90 °-120 °Zone	16.68%
Zonal Lumens in the 120 °-180 °Zone	11.79%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

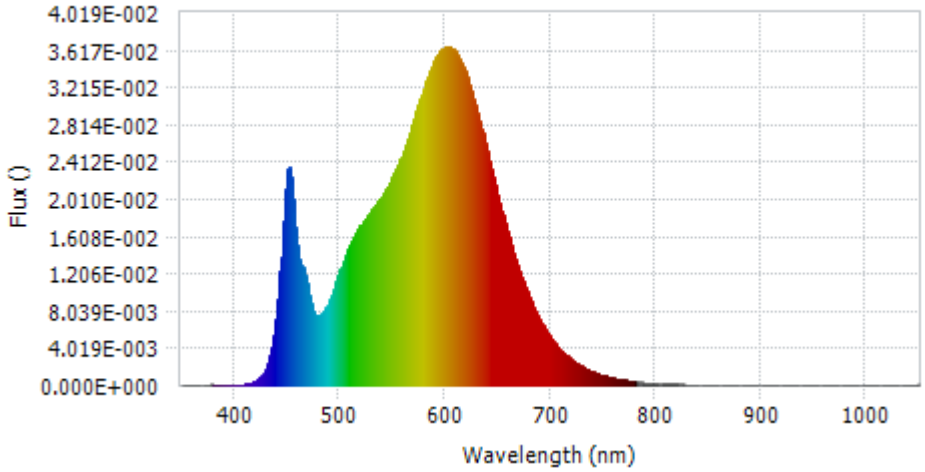
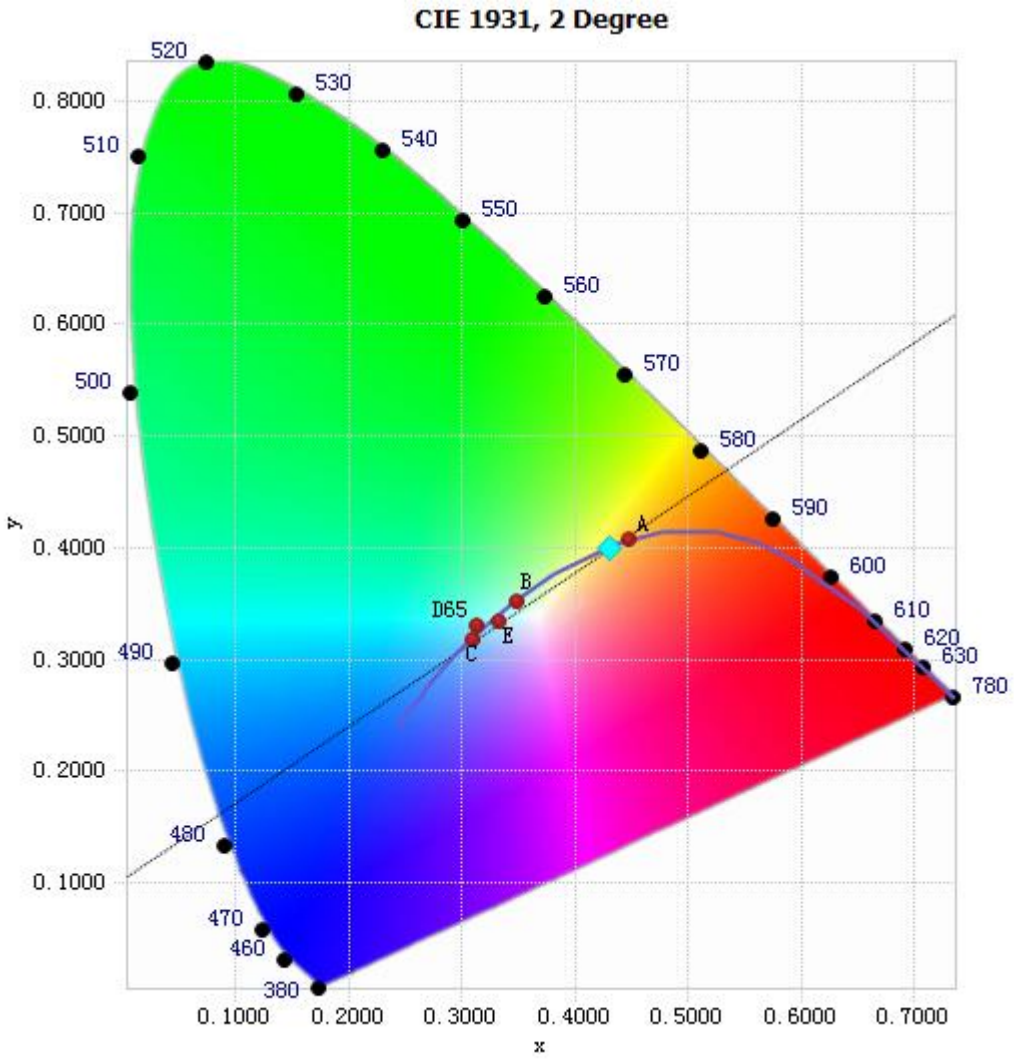


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	9.30E-05	485	8.01E-03	590	3.49E-02	695	6.06E-03
385	8.75E-05	490	8.94E-03	595	3.59E-02	700	5.19E-03
390	9.07E-05	495	1.04E-02	600	3.65E-02	705	4.44E-03
395	8.45E-05	500	1.21E-02	605	3.64E-02	710	3.78E-03
400	6.96E-05	505	1.38E-02	610	3.60E-02	715	3.24E-03
405	7.57E-05	510	1.51E-02	615	3.49E-02	720	2.77E-03
410	1.22E-04	515	1.63E-02	620	3.35E-02	725	2.35E-03
415	2.29E-04	520	1.72E-02	625	3.17E-02	730	2.02E-03
420	4.52E-04	525	1.80E-02	630	2.98E-02	735	1.72E-03
425	9.18E-04	530	1.87E-02	635	2.76E-02	740	1.46E-03
430	1.83E-03	535	1.95E-02	640	2.53E-02	745	1.25E-03
435	3.63E-03	540	2.03E-02	645	2.29E-02	750	1.06E-03
440	7.09E-03	545	2.13E-02	650	2.06E-02	755	9.05E-04
445	1.39E-02	550	2.24E-02	655	1.84E-02	760	7.64E-04
450	2.24E-02	555	2.36E-02	660	1.63E-02	765	6.57E-04
455	2.15E-02	560	2.50E-02	665	1.43E-02	770	5.62E-04
460	1.51E-02	565	2.67E-02	670	1.26E-02	775	4.88E-04
465	1.26E-02	570	2.84E-02	675	1.10E-02	780	4.12E-04
470	1.04E-02	575	3.02E-02	680	9.50E-03		
475	7.97E-03	580	3.20E-02	685	8.22E-03		
480	7.46E-03	585	3.37E-02	690	7.07E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4301, 0.3994)

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

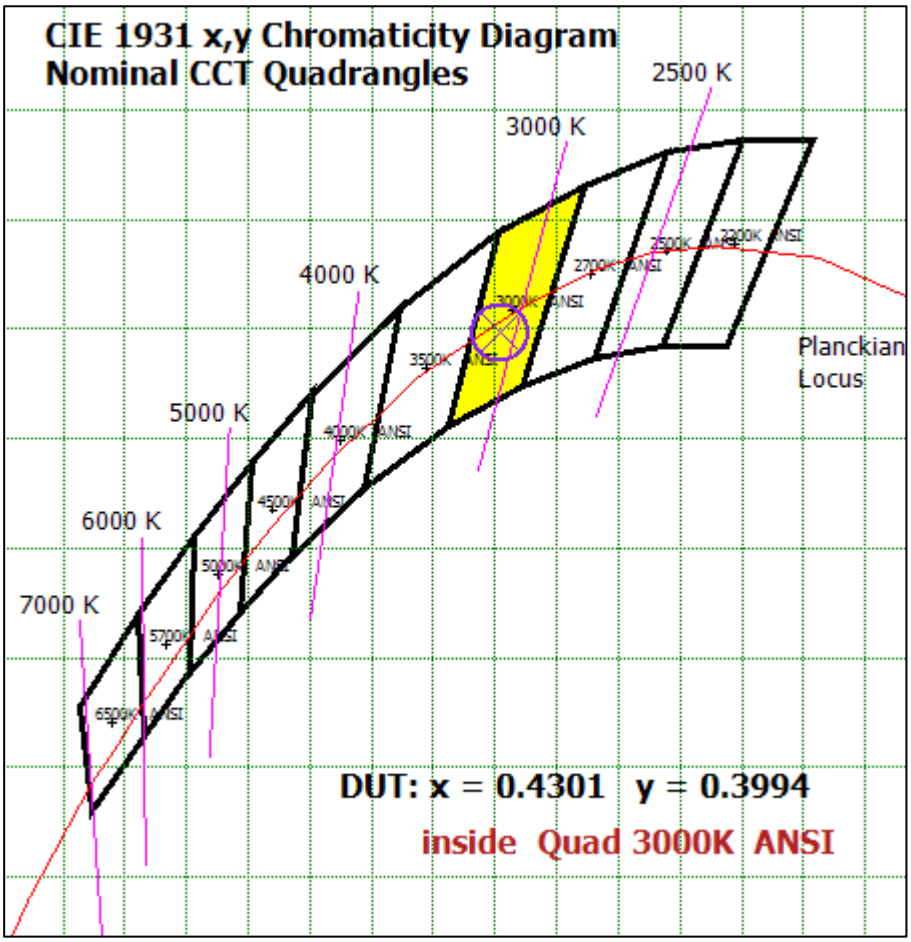
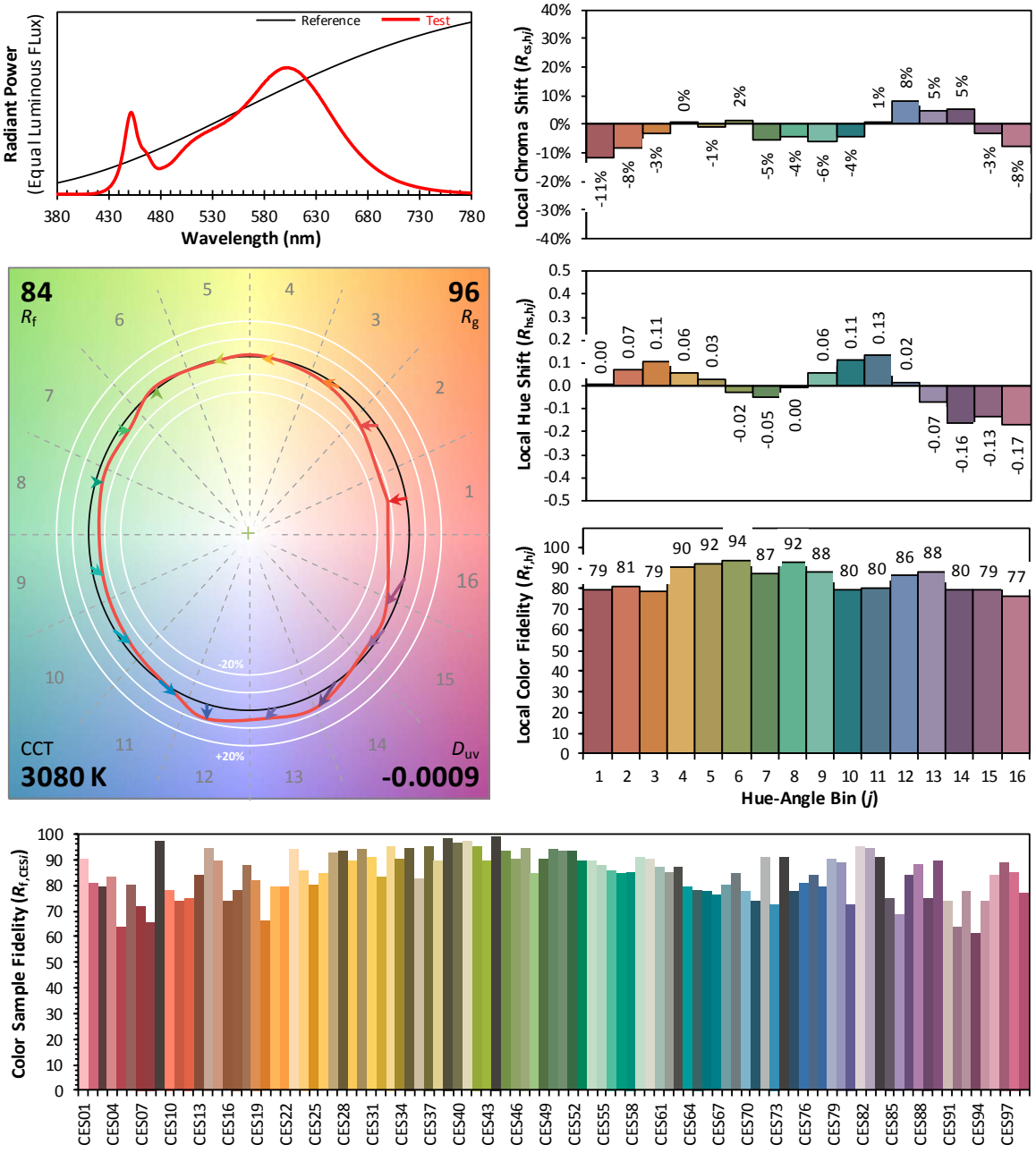


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.4301
y	0.3994
u'	0.2482
v'	0.5185

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	29.807	1.69%
10- 20	86.294	4.88%
20- 30	133.832	7.58%
30- 40	167.947	9.51%
40- 50	186.262	10.54%
50- 60	188.839	10.69%
60- 70	177.917	10.07%
70- 80	157.815	8.93%
80- 90	134.914	7.64%
90-100	115.351	6.53%
100-110	97.747	5.53%
110-120	81.573	4.62%
120-130	66.895	3.79%
130-140	53.587	3.03%
140-150	40.798	2.31%
150-160	28.14	1.59%
160-170	14.834	0.84%
170-180	4.087	0.23%
Total	1766.6	100%

γ(°)	Lumens	% Total
0- 60	792.981	44.89%
60- 90	470.646	26.64%
0-90	1263.627	71.53%
90- 180	503.012	28.47%
0- 180	1766.6	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

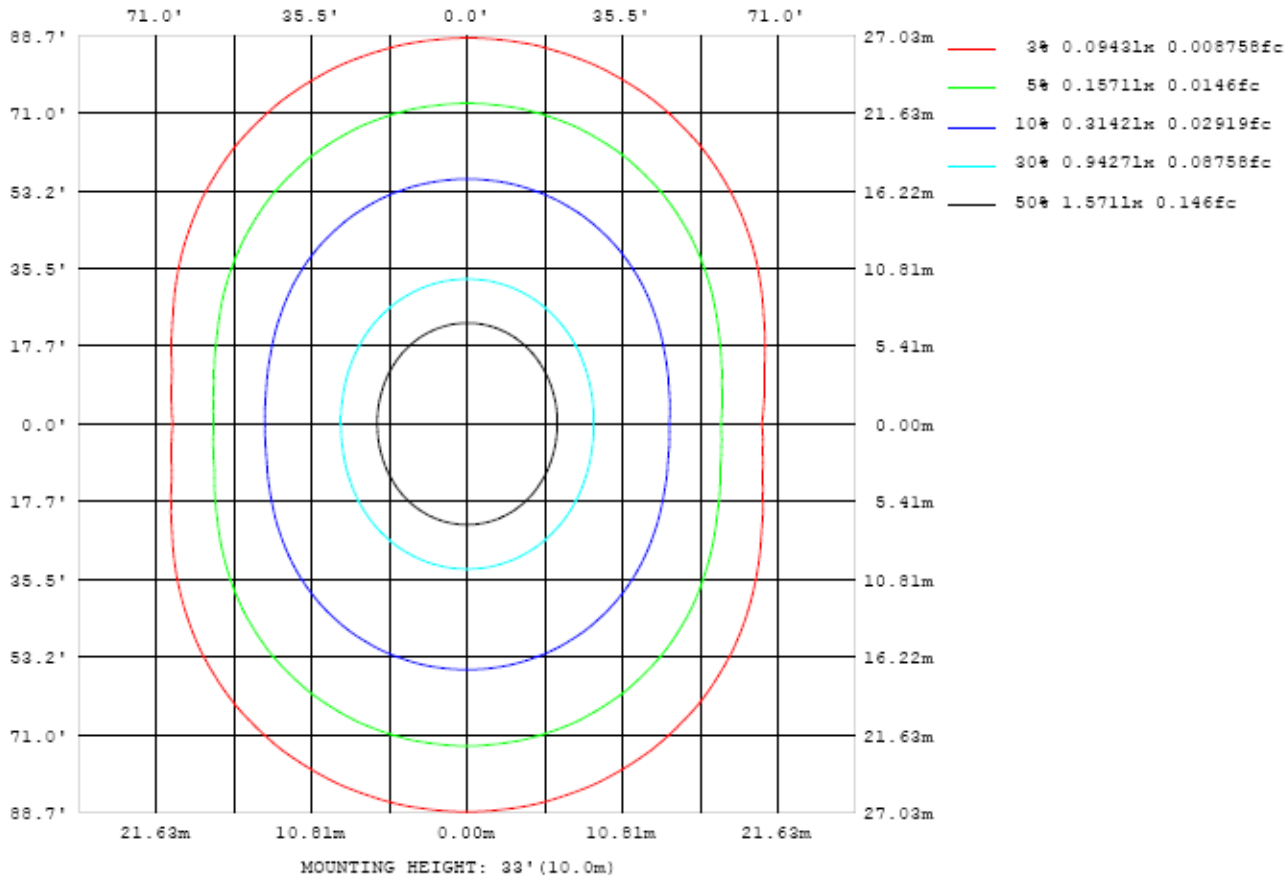


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

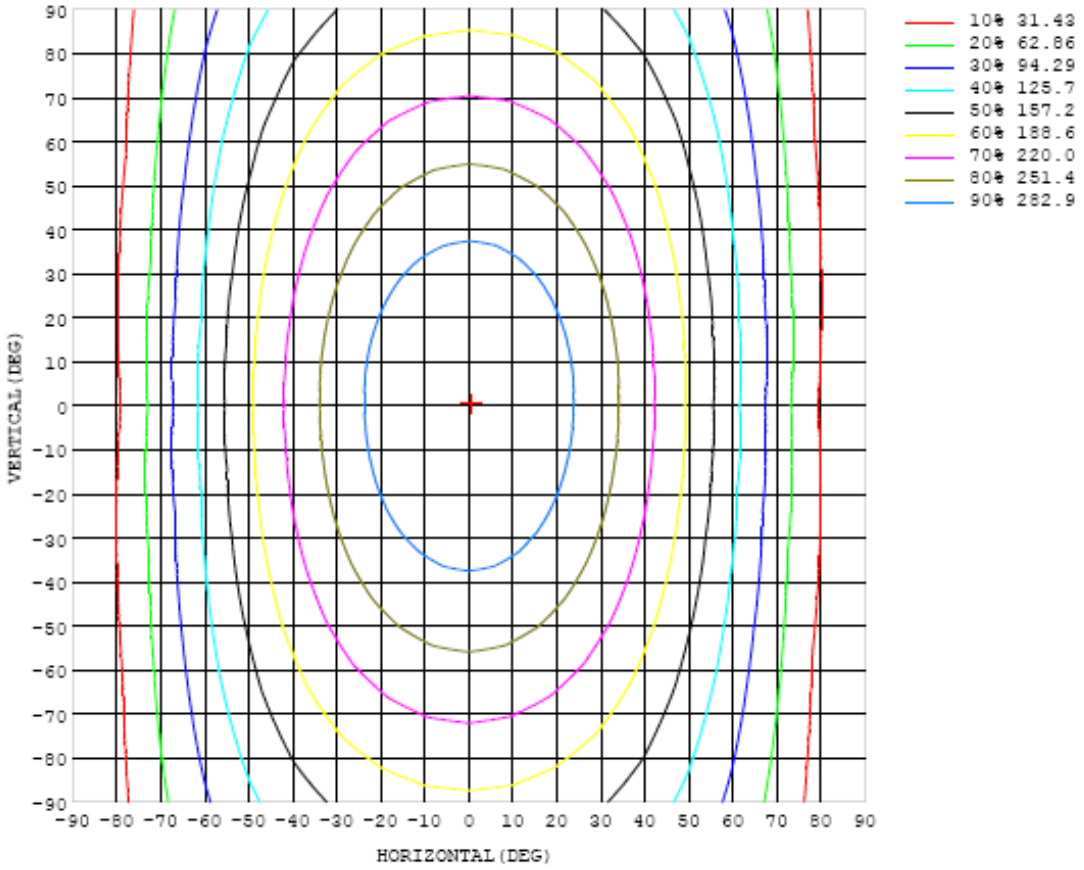


Chart 6: Isocandela Plot

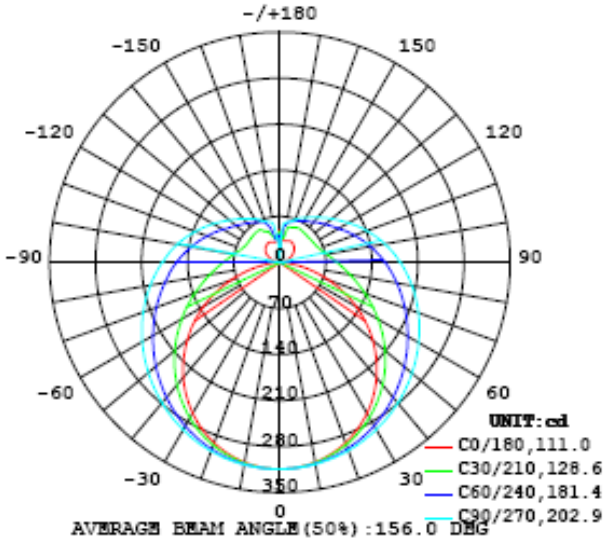


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314
5	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313	313
10	309	309	309	309	310	310	311	311	311	312	311	311	311	310	310	309	309	309	309
15	301	302	302	303	304	306	307	308	308	308	308	308	307	306	304	303	302	302	302
20	292	292	293	295	297	299	301	303	304	304	304	303	301	299	297	295	293	292	292
25	280	280	282	285	288	291	295	297	299	299	299	297	295	292	288	285	282	280	280
30	265	266	268	272	277	282	287	290	293	293	293	290	287	282	277	272	268	266	265
35	248	249	253	258	265	272	278	283	285	287	286	283	278	272	265	258	253	249	248
40	229	230	235	243	252	260	268	274	278	279	278	274	268	261	252	243	235	230	228
45	207	210	216	226	237	248	258	265	269	271	269	265	258	249	238	227	216	209	207
50	184	187	196	209	223	236	247	255	260	262	261	256	247	236	223	209	196	187	184
55	160	164	175	191	207	223	236	245	251	253	251	246	236	224	208	191	175	163	160
60	134	139	153	173	192	210	224	235	241	244	242	235	225	211	193	174	154	139	134
65	107	114	132	155	177	197	213	225	232	234	232	225	214	199	179	156	133	114	107
70	79.4	88.3	111	138	163	185	202	214	222	224	222	215	203	187	165	140	113	89.2	79.2
75	53.1	64.6	91.6	122	150	173	191	204	212	214	212	205	192	175	152	125	94.5	66.5	52.4
80	28.3	43.2	75.2	108	138	162	181	194	201	204	202	194	182	164	140	112	78.5	46.0	27.8
85	8.86	26.9	62.2	96.8	127	152	170	183	191	194	191	184	172	153	130	100	66.4	30.7	8.48
90	0.53	18.2	52.9	87.1	117	141	160	173	181	183	181	174	161	143	120	90.7	57.3	22.3	0.44
95	1.95	15.2	46.5	79.0	108	132	150	163	170	173	171	164	151	134	111	82.6	50.7	18.8	1.86
100	5.13	16.1	42.4	72.7	99.6	122	140	152	160	162	160	153	141	124	102	75.9	46.2	19.2	5.10
105	8.79	18.8	40.7	67.2	92.1	113	130	142	149	151	149	143	131	115	94.7	70.4	44.1	21.2	9.32
110	13.2	22.6	40.7	63.2	85.4	105	121	132	139	141	139	133	122	107	87.7	66.1	44.0	24.3	13.7
115	17.4	27.0	41.7	60.8	79.8	97.3	112	122	128	131	129	123	113	99.1	81.8	63.7	44.6	28.3	18.0
120	21.3	31.0	43.3	59.5	76.1	90.7	103	113	118	121	119	113	104	92.2	77.8	62.1	45.1	32.0	22.3
125	24.9	33.5	45.4	58.7	72.9	85.5	96.3	104	109	111	110	105	97.3	86.9	74.9	60.9	46.9	35.2	25.8
130	28.4	34.8	47.4	58.0	70.4	81.0	90.3	97.2	102	103	102	97.8	91.2	82.4	72.0	59.6	48.6	37.4	28.9
135	31.1	36.0	49.4	58.2	68.1	78.2	85.0	90.9	94.7	96.0	94.8	91.5	85.9	78.3	69.4	59.5	50.2	38.3	31.1
140	33.1	37.8	51.1	58.3	65.1	74.0	80.2	85.2	88.5	89.6	88.6	85.7	80.9	75.0	66.8	59.0	50.8	38.2	32.7
145	34.8	40.6	51.8	58.9	64.5	70.8	76.0	79.8	82.7	83.7	82.9	80.5	76.8	71.0	64.9	58.5	51.8	38.3	33.8
150	36.2	44.1	51.6	59.5	64.6	68.7	72.7	76.0	77.6	78.3	77.9	76.3	72.3	67.7	63.2	56.9	51.6	40.2	34.5
155	35.7	43.1	50.6	58.4	63.0	66.7	69.4	71.3	73.8	74.3	73.7	71.6	67.9	65.0	59.9	56.1	48.4	41.2	34.4
160	34.8	38.6	51.6	56.7	61.4	64.5	66.8	68.1	69.0	69.1	68.6	66.0	64.5	60.6	55.4	49.1	40.7	37.0	33.4
165	34.1	34.9	43.9	55.9	59.6	62.5	64.4	64.9	65.2	64.3	63.4	62.4	59.9	51.7	46.8	38.0	34.6	33.4	32.0
170	34.4	34.0	34.9	41.4	53.4	56.7	59.8	62.4	61.6	62.1	62.4	54.8	45.4	37.9	36.9	36.4	36.2	33.0	31.6
175	44.1	43.8	42.9	41.6	40.4	39.2	45.2	49.1	56.6	59.0	39.8	30.0	32.9	38.5	41.9	44.2	43.6	44.7	41.4
180	17.2	17.2	17.2	17.2	17.2	17.1	17.1	17.1	17.1	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0

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	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314	314		
5	313	313	313	313	313	314	314	314	314	314	314	314	314	313	313	313	313		
10	309	309	310	310	311	312	312	312	312	312	312	311	311	310	310	309	309		
15	302	303	304	305	307	308	309	309	310	309	309	308	306	305	304	303	302		
20	293	294	296	298	300	302	304	305	306	305	304	302	300	298	296	294	293		
25	281	283	286	289	292	296	298	300	300	300	298	296	292	289	286	283	281		
30	266	269	273	278	283	287	291	293	294	293	291	288	283	278	273	269	266		
35	249	253	259	266	272	278	283	286	287	286	283	279	273	266	260	254	250		
40	230	236	243	252	261	268	274	277	279	278	274	269	261	253	244	237	231		
45	209	216	226	237	248	257	264	269	270	269	265	258	249	239	228	218	211		
50	187	196	208	222	235	246	254	259	261	259	255	247	236	224	210	198	189		
55	164	175	190	207	222	234	244	249	251	250	244	235	223	208	192	177	166		
60	139	154	172	191	209	223	233	239	242	240	234	224	210	193	174	156	141		
65	114	132	155	176	196	211	222	229	231	229	223	212	197	179	157	135	116		
70	88.3	111	138	163	183	200	212	219	221	219	212	201	185	165	140	114	90.9		
75	64.3	91.7	122	149	171	188	201	208	210	208	202	190	173	152	125	94.9	67.1		
80	43.1	75.0	108	137	160	177	190	197	200	198	191	179	162	139	111	78.4	46.0		
85	27.2	61.9	96.1	126	149	167	179	187	189	187	180	169	151	128	99.0	65.1	30.0		
90	18.5	52.4	86.2	115	139	157	169	176	179	177	170	158	141	118	88.9	55.3	20.9		
95	15.3	46.0	78.0	106	129	147	159	167	169	167	160	148	131	108	80.5	48.4	17.0		
100	15.9	41.7	71.1	97.7	120	137	149	156	159	156	150	138	121	99.7	73.2	43.6	17.0		
105	18.6	39.8	65.5	90.0	111	127	139	145	148	146	139	128	112	91.7	67.2	41.1	19.4		
110	22.7	39.8	61.4	83.3	102	118	128	135	137	135	129	119	104	84.7	62.7	40.6	23.4		
115	27.2	41.0	58.9	77.3	94.8	109	119	125	127	125	119	110	95.9	78.8	59.9	41.3	27.9		
120	30.8	42.8	57.6	73.3	87.8	100	110	115	117	115	110	101	89.0	74.4	58.4	43.0	32.4		
125	34.0	45.1	57.2	70.3	82.6	93.0	101	106	108	106	102	94.0	83.6	71.1	57.6	45.4	36.4		
130	37.6	47.5	57.3	68.0	78.3	87.0	93.9	98.5	100.0	98.6	94.6	88.0	79.2	68.7	57.6	48.1	40.4		
135	40.6	49.5	57.7	66.4	74.8	82.0	87.7	91.7	93.0	91.9	88.5	82.9	75.5	66.9	58.2	50.6	44.3		
140	42.9	48.9	58.3	65.2	71.9	77.7	82.1	85.4	86.8	85.9	83.0	78.4	72.5	65.7	59.0	52.7	47.6		
145	45.9	50.2	58.6	64.1	69.4	74.0	77.5	78.2	81.3	80.6	78.3	74.7	70.0	64.8	59.6	53.9	49.9		
150	47.8	51.6	56.6	63.2	67.2	70.7	73.6	74.8	76.4	76.0	74.3	71.5	68.1	64.2	59.9	55.3	51.1		
155	46.5	51.9	52.0	61.4	65.1	67.9	69.9	71.1	71.7	72.0	70.9	69.0	66.4	63.2	59.7	57.5	50.9		
160	37.4	46.3	49.1	50.1	59.0	64.3	66.4	67.3	66.8	68.6	67.9	66.4	64.4	62.1	59.2	56.5	45.0		
165	32.1	38.4	41.7	42.9	43.1	53.0	57.6	63.3	63.4	63.0	64.1	63.6	62.6	56.3	56.1	54.1	38.7		
170	31.5	32.4	37.5	39.4	38.1	35.7	40.8	48.9	59.7	60.9	61.9	54.1	51.8	52.1	52.2	45.2	36.0		
175	41.3	41.2	41.3	44.0	42.2	43.0	36.9	29.0	29.0	11.6	38.6	48.0	48.8	46.8	46.9	44.0	43.7		
180	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.1	17.1	17.1	17.1	17.2	17.2	17.2	17.2		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	PF2010A	HZTE028-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	DPS1060	HZTE001-06	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	WY12010	HZTE004-03	Aug. 02, 2019	Aug. 01, 2020
Temperature recorder	JM624U	HZTE018-08	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 02, 2019	Aug. 01, 2020
Standard source	D908	HZTE012-01	Aug. 02, 2019	Aug. 01, 2020
Integrate Sphere system	3M	HZTE015-04	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	PCR 500L	HZTE001-07	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	IT6154	HZTE004-04	Aug. 02, 2019	Aug. 01, 2020
Standard source	SCL-1400	HZTE012-02	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 02, 2019	Aug. 01, 2020
Temperature Meter	TES1310	HZTE017-01	Aug. 02, 2019	Aug. 01, 2020

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

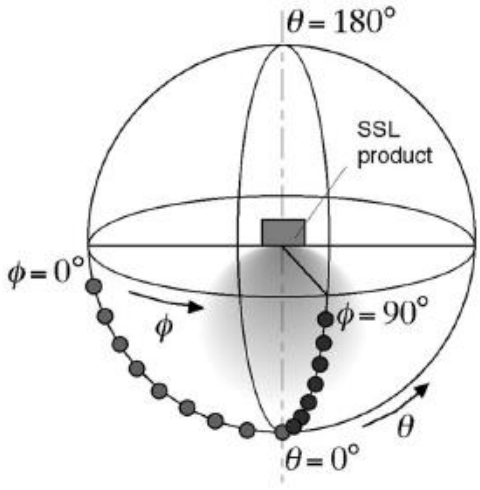
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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