

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 12T8/4F/840/HYB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19090007c

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

Review by:



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Sep. 10, 2019

Approved by:



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/840/HYB

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)/2	Power Factor
132.7	1917.7	14.46	0.9974
CCT (K)	CRI	Stabilization Time (Light & Power)	
4102	82.5	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

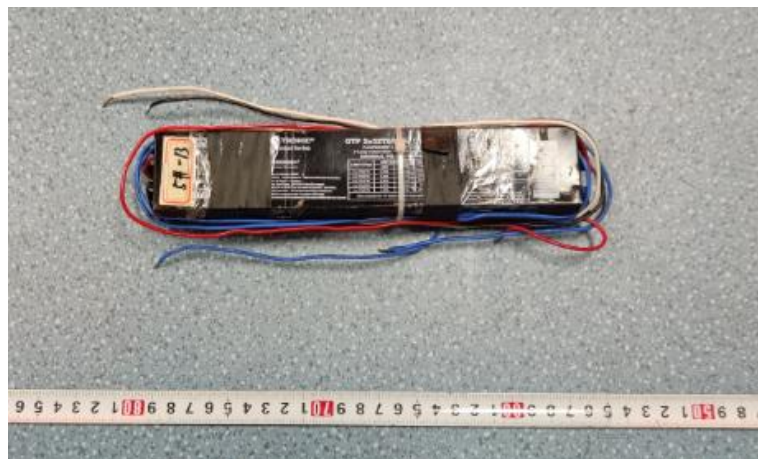


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 12T8/4F/840/HYB
Electrical Ratings	: 120-277V, 60Hz, 12W
Product Description	: 4000K 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 °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)	0.242	0.110
Power Factor	0.9974	0.9575
Test Power (W)/2	14.46	14.60
THD A%	4.41	13.93
Luminous Efficacy (lm/W)	132.7	131.6
Total Luminous Flux (lm)	1917.7	1920.8
Color Rendering Index (CRI)	82.5	
R9	4.5	
Correlated Color Temperature (CCT)(K)	4102	
Chromaticity Chroma x	0.3771	
Chromaticity Chroma y	0.3787	
Chromaticity Chroma u	0.2222	
Chromaticity Chroma v	0.3346	
Duv	0.0019	
Chromaticity Chroma u'	0.2222	
Chromaticity Chroma v'	0.5019	

Special Color Rendering Indices	
R1	80.4
R2	89
R3	95.1
R4	80.9
R5	80.4
R6	84.5
R7	85.9
R8	63.4
R9	4.5
R10	73.9
R11	79.9
R12	58.8
R13	82.6
R14	97.6

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 °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)	0.243
Power Factor	0.9949
Power (W)/2	14.51
Luminous Efficacy (lm/W)	129.9
Total Luminous Flux (lm)	1884.9
Beam Angle (°)	111.1 (0°-180°) / 205.0 (90°-270°)
Center Beam Candle Power (cd)	333
Maximum Beam Candle Power (cd)	333.2 (At: C=260.0, Gamma=3.0)
Spacing Criteria	1.26 (0°-180°) / 1.42 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	44.63%
Zonal Lumens in the 60 °-90 °Zone	26.68%
Zonal Lumens in the 90 °-120 °Zone	16.81%
Zonal Lumens in the 120 °-180 °Zone	11.88%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

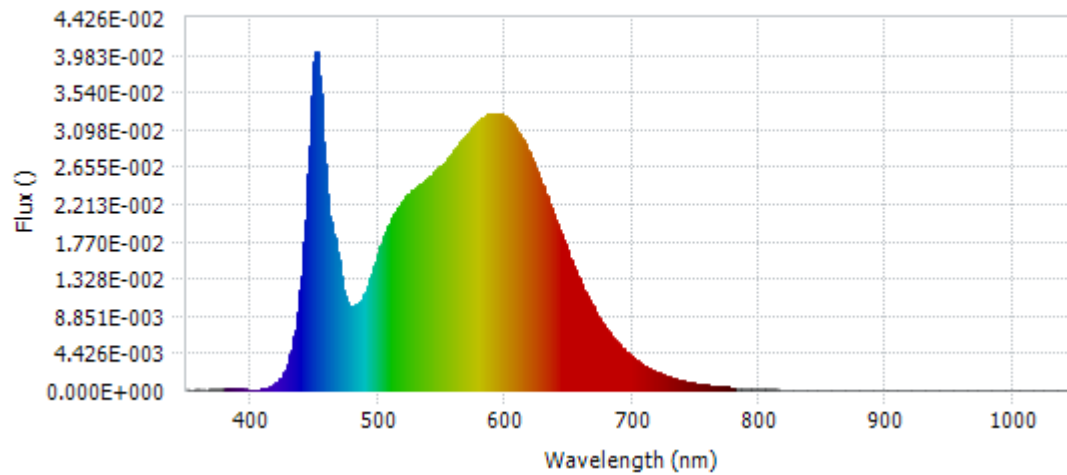
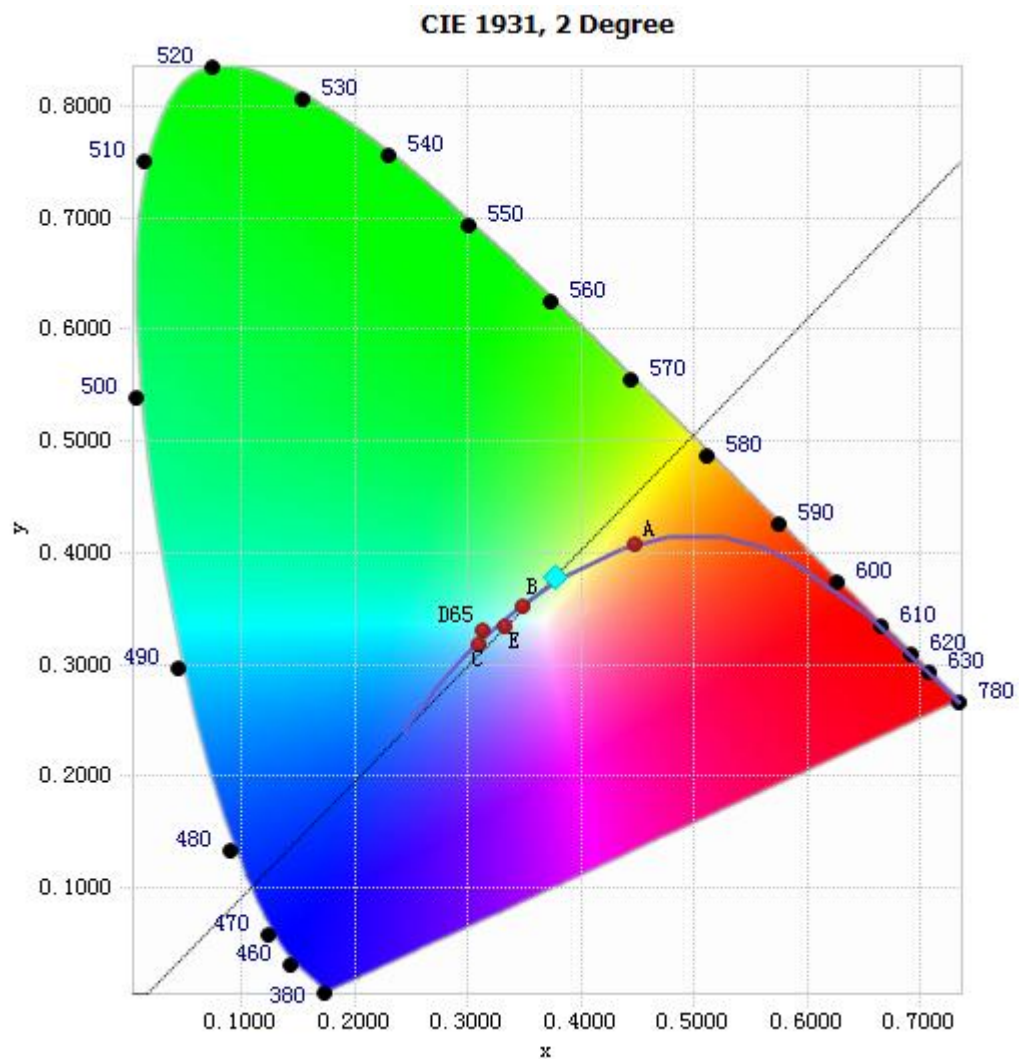


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.66E-04	485	1.04E-02	590	3.28E-02	695	4.60E-03
385	1.55E-04	490	1.17E-02	595	3.29E-02	700	3.94E-03
390	1.34E-04	495	1.37E-02	600	3.26E-02	705	3.36E-03
395	1.19E-04	500	1.61E-02	605	3.19E-02	710	2.86E-03
400	8.48E-05	505	1.83E-02	610	3.08E-02	715	2.44E-03
405	1.02E-04	510	2.01E-02	615	2.95E-02	720	2.08E-03
410	1.68E-04	515	2.15E-02	620	2.78E-02	725	1.79E-03
415	3.88E-04	520	2.26E-02	625	2.60E-02	730	1.51E-03
420	8.58E-04	525	2.33E-02	630	2.42E-02	735	1.29E-03
425	1.80E-03	530	2.40E-02	635	2.21E-02	740	1.11E-03
430	3.66E-03	535	2.46E-02	640	2.01E-02	745	9.41E-04
435	7.18E-03	540	2.52E-02	645	1.81E-02	750	8.03E-04
440	1.36E-02	545	2.60E-02	650	1.61E-02	755	6.82E-04
445	2.57E-02	550	2.67E-02	655	1.43E-02	760	5.88E-04
450	3.91E-02	555	2.75E-02	660	1.26E-02	765	5.01E-04
455	3.52E-02	560	2.85E-02	665	1.11E-02	770	4.27E-04
460	2.34E-02	565	2.95E-02	670	9.66E-03	775	3.66E-04
465	1.86E-02	570	3.05E-02	675	8.38E-03	780	3.13E-04
470	1.46E-02	575	3.13E-02	680	7.26E-03		
475	1.07E-02	580	3.20E-02	685	6.24E-03		
480	9.84E-03	585	3.27E-02	690	5.37E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3771, 0.3787)

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

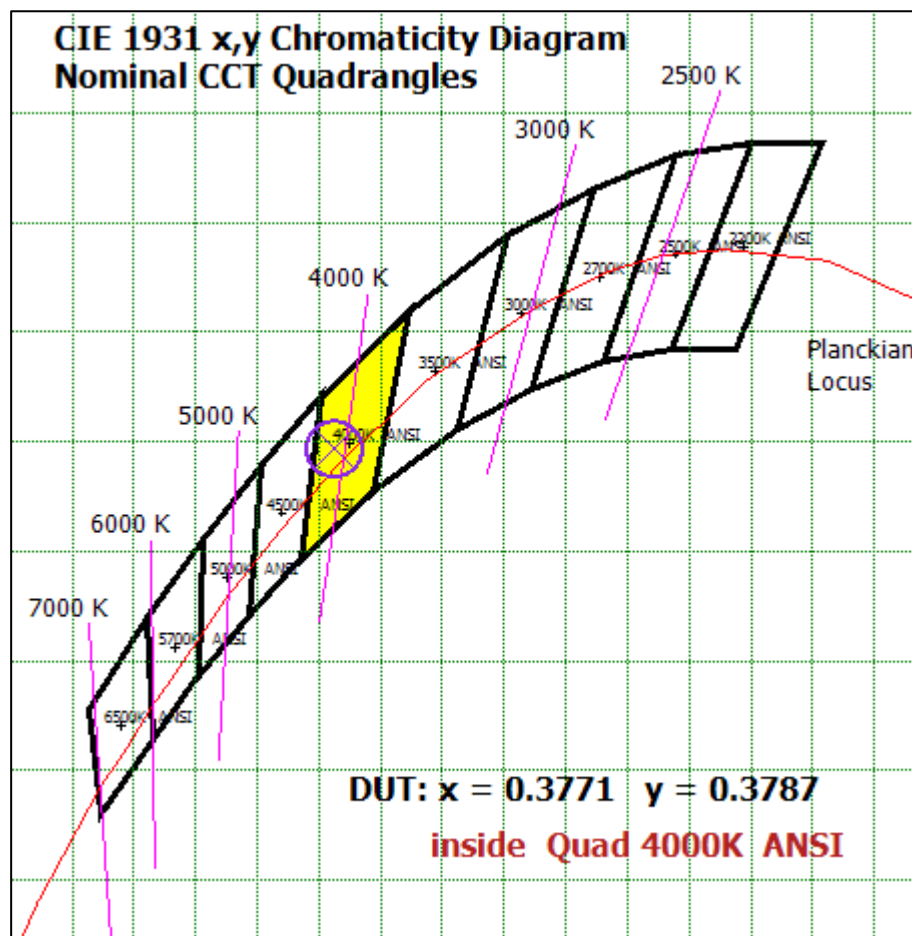
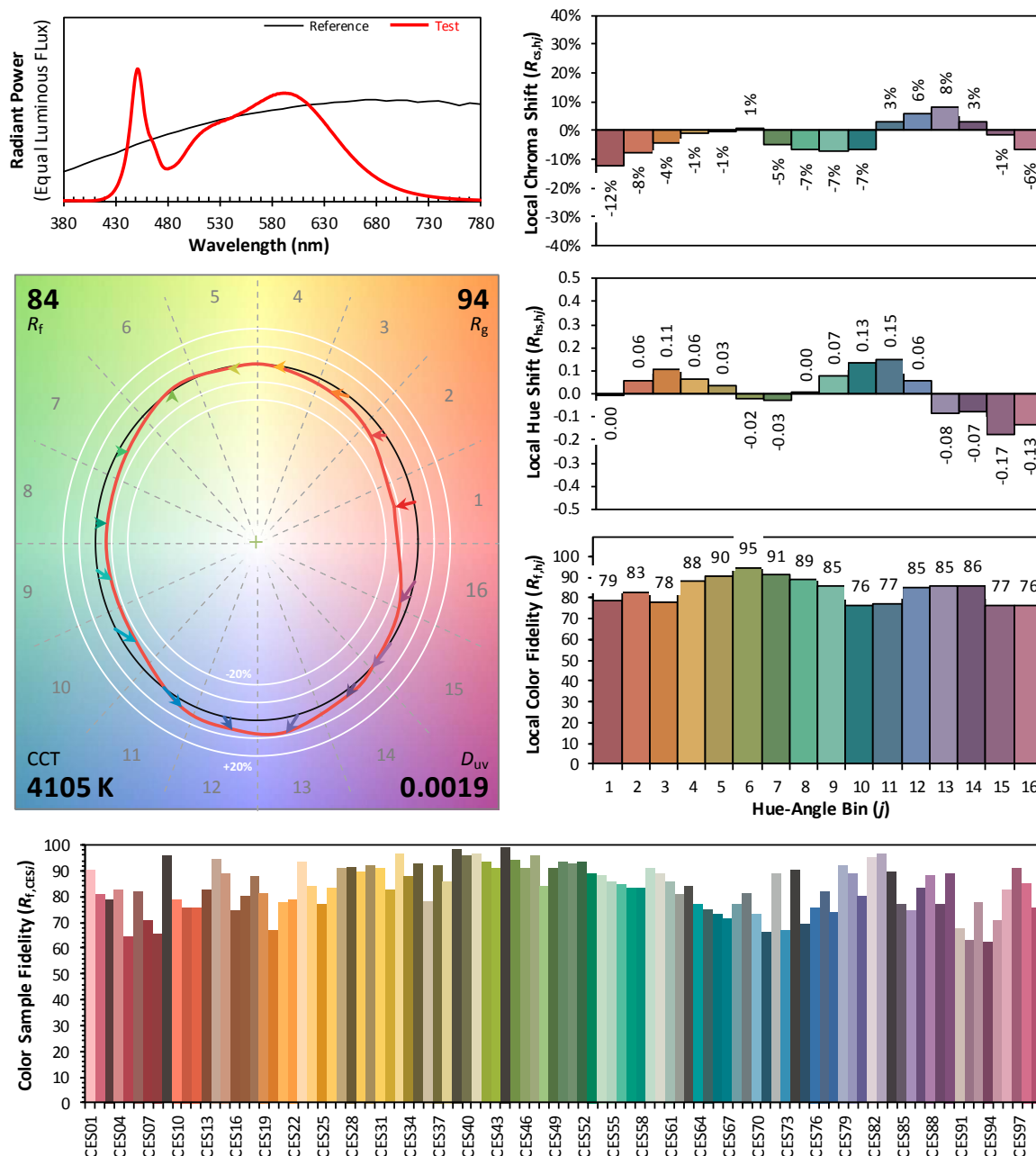


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3771

y 0.3787

u' 0.2222

v' 0.5019

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	31.577	1.68%
10- 20	91.39	4.85%
20- 30	141.737	7.52%
30- 40	177.971	9.44%
40- 50	197.665	10.49%
50- 60	200.809	10.65%
60- 70	189.69	10.06%
70- 80	168.713	8.95%
80- 90	144.557	7.67%
90-100	123.641	6.56%
100-110	105.256	5.58%
110-120	88.028	4.67%
120-130	72.152	3.83%
130-140	57.531	3.05%
140-150	43.656	2.32%
150-160	29.875	1.58%
160-170	15.858	0.84%
170-180	4.774	0.25%
Total	1884.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	841.149	44.63%
60- 90	502.96	26.68%
0-90	1344.109	71.31%
90- 180	540.771	28.69%
0- 180	1884.9	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

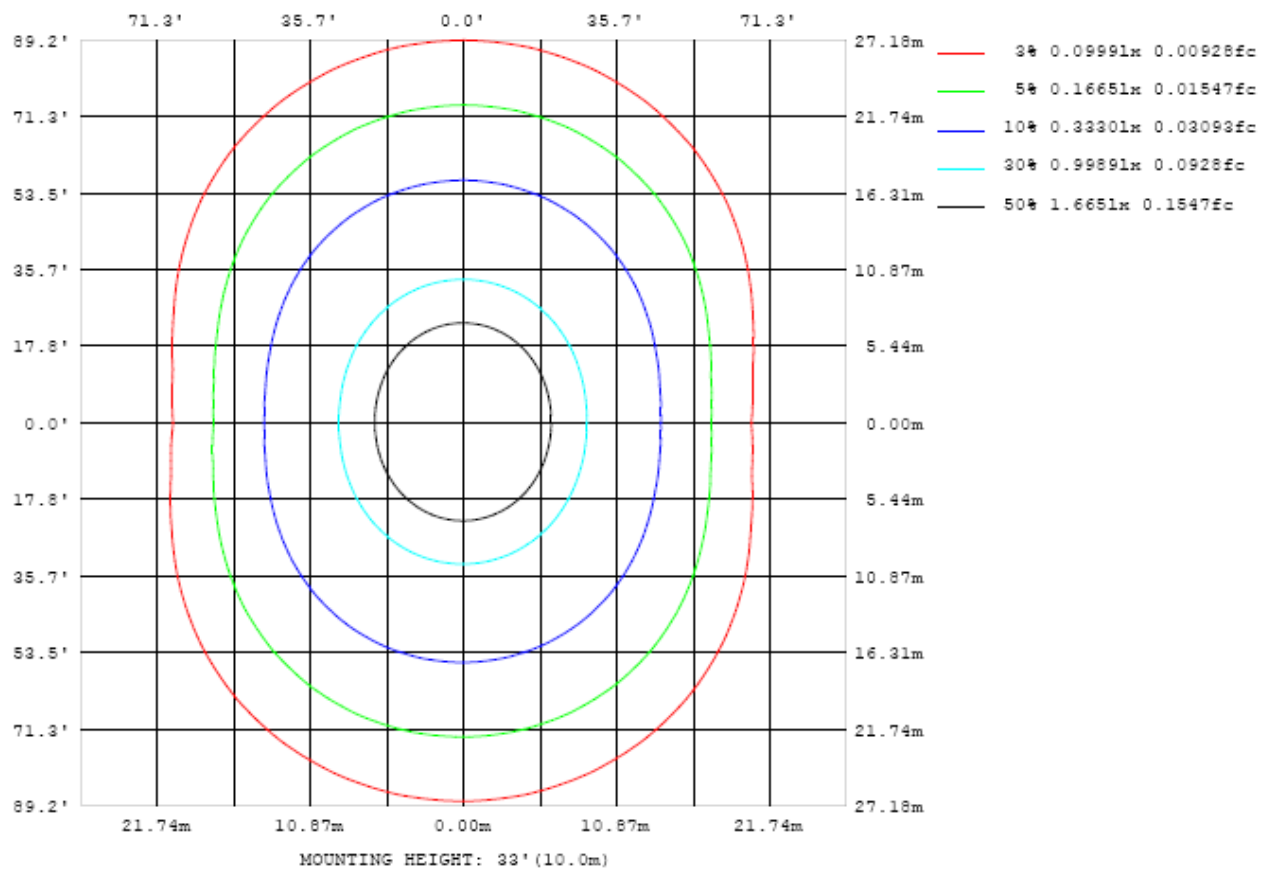


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

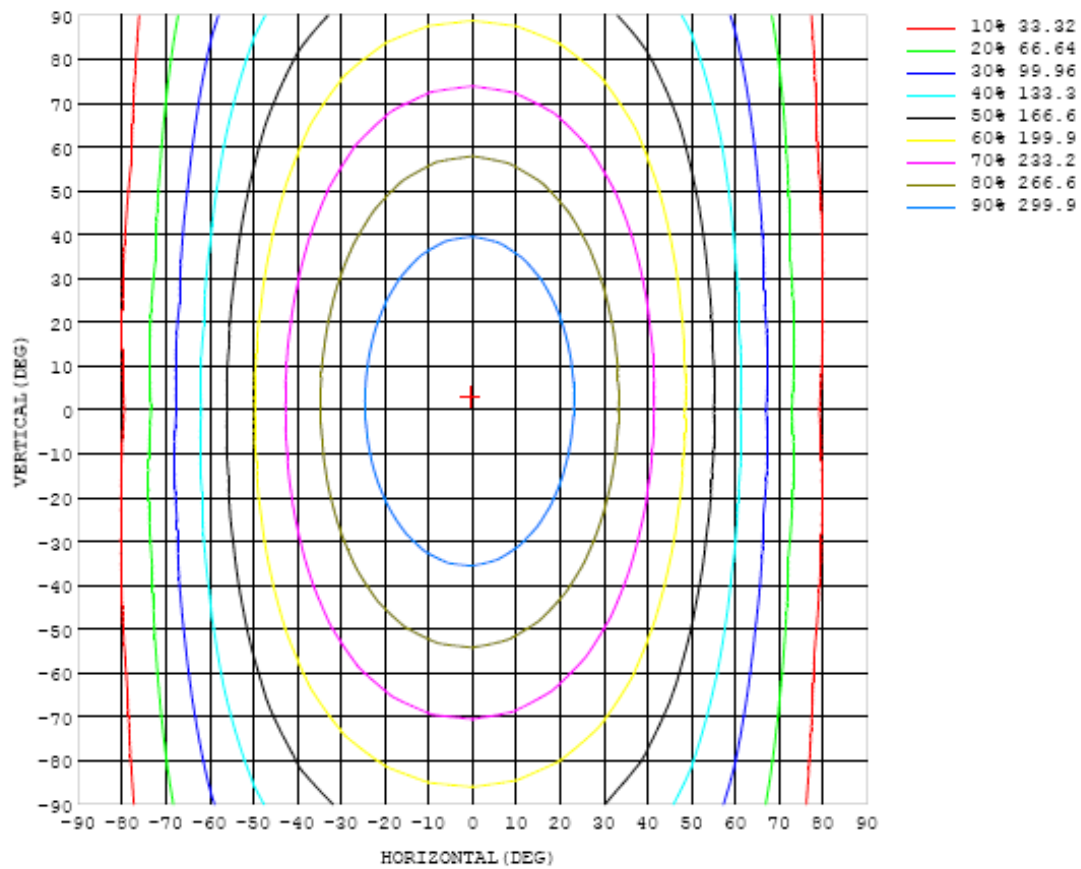


Chart 6: Isocandela Plot

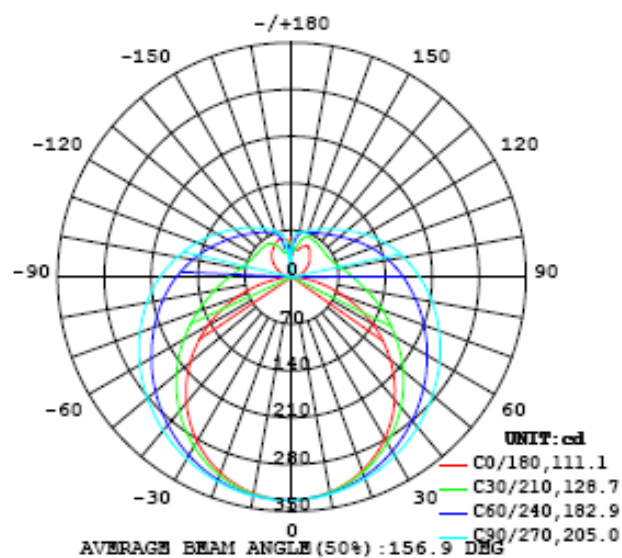


Chart 7: Polar Candela Distribution

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	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333
5	331	331	331	331	331	331	331	331	332	332	332	332	332	332	332	332	332	332	332
10	326	326	326	326	327	327	328	328	329	329	329	329	329	329	328	328	328	328	328
15	318	318	319	320	321	322	323	324	325	325	325	325	325	324	323	322	321	321	321
20	308	308	309	310	312	315	317	319	320	321	321	320	319	317	315	313	312	311	311
25	294	294	296	299	302	306	309	312	314	315	315	314	311	309	306	303	300	299	299
30	278	279	281	285	290	296	300	304	307	308	308	306	303	299	294	290	286	284	283
35	260	261	265	270	277	284	290	296	299	301	300	298	294	288	282	275	270	266	265
40	239	241	246	254	263	272	280	286	291	293	292	289	283	276	268	259	252	247	245
45	217	219	226	236	247	259	269	277	282	284	283	279	273	264	253	242	232	225	223
50	192	195	204	217	232	246	257	266	272	275	274	269	261	251	238	224	211	202	198
55	167	171	182	198	216	232	246	256	262	265	264	259	250	237	222	205	189	177	172
60	139	145	160	179	200	219	234	245	252	255	254	248	238	224	206	187	167	152	144
65	111	119	138	161	185	205	222	234	242	245	243	237	226	211	191	168	145	125	116
70	82.8	92.1	116	144	170	193	210	223	231	234	233	226	215	198	176	151	123	98.6	86.2
75	54.9	67.0	95.7	128	157	180	199	212	221	224	222	215	203	186	163	135	103	73.3	57.8
80	29.2	44.9	78.5	114	144	169	188	202	210	213	211	204	192	174	150	120	85.2	50.8	31.0
85	8.85	28.4	65.1	101	133	159	177	191	199	202	200	193	181	163	138	107	71.0	33.5	9.86
90	0.36	19.5	55.5	91.4	123	148	167	180	188	191	189	182	170	152	127	96.7	60.7	23.4	0.63
95	1.96	16.4	49.3	83.3	113	138	157	170	178	181	179	172	160	142	118	88.0	53.7	19.3	2.22
100	5.39	17.1	44.9	76.4	105	129	147	160	168	170	169	162	150	132	109	80.6	48.5	18.9	5.95
105	10.1	20.2	42.8	70.6	97.1	120	137	150	157	160	158	151	140	123	101	74.0	45.4	21.4	10.6
110	15.3	24.7	42.7	66.1	90.0	111	127	139	146	149	147	141	129	114	92.9	68.8	44.6	25.8	15.9
115	20.1	29.6	44.0	63.5	83.7	103	118	129	136	138	136	130	120	105	86.2	65.5	45.1	30.5	21.4
120	24.6	34.3	45.9	61.9	78.9	95.1	109	119	125	127	126	120	110	97.1	81.0	63.6	47.0	35.4	26.8
125	29.3	38.9	48.4	61.4	75.5	89.0	101	110	115	117	116	111	102	90.8	77.3	62.6	49.4	40.2	32.3
130	33.9	43.4	51.0	61.5	73.1	84.1	93.8	102	106	108	107	102	95.3	85.9	74.5	62.5	52.2	45.0	37.5
135	38.0	47.2	53.7	61.9	71.3	80.3	88.3	94.8	98.9	100	99.2	95.5	89.6	81.7	72.4	63.0	55.0	49.3	42.4
140	41.5	49.3	55.9	62.5	69.9	77.1	83.3	88.4	92.3	93.5	92.6	89.6	84.7	78.4	71.0	63.7	57.5	52.7	46.6
145	47.2	52.5	58.1	63.4	68.9	74.5	79.3	83.4	86.6	87.5	86.8	84.4	80.5	75.6	70.0	64.5	59.9	55.2	49.6
150	50.3	55.6	60.2	64.0	68.2	72.3	76.1	78.3	79.8	82.3	81.8	79.9	77.0	73.4	69.3	65.3	61.8	57.8	53.7
155	52.2	55.7	58.4	64.7	67.5	70.5	73.2	75.1	76.4	77.9	77.5	76.2	74.2	71.6	68.8	66.2	63.2	61.0	56.2
160	48.7	54.0	59.1	65.0	66.9	68.8	70.7	72.1	72.9	73.1	73.8	73.3	71.9	70.3	68.6	66.8	64.3	62.7	59.2
165	44.2	48.1	50.2	58.6	64.7	67.7	68.6	69.5	69.7	69.3	70.6	71.0	70.3	69.4	68.6	67.0	64.7	61.3	58.2
170	40.9	42.5	44.2	48.0	56.7	61.5	64.9	67.3	68.0	67.9	67.5	66.8	68.0	68.5	67.6	66.4	62.4	58.0	57.0
175	40.5	37.7	37.6	39.7	43.3	48.8	53.9	58.3	62.6	65.6	65.6	64.8	64.9	65.6	65.7	63.0	57.0	51.8	51.1
180	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3

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	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333		
5	332	332	332	332	333	333	333	333	333	333	333	332	332	332	332	331	331		
10	328	329	329	330	330	331	331	332	332	331	331	330	329	328	328	327	326		
15	321	322	324	325	326	327	328	329	329	328	327	326	325	323	321	320	319		
20	312	313	315	318	320	322	324	325	325	324	323	321	318	315	313	310	309		
25	300	302	305	309	312	316	318	320	320	319	317	314	310	306	302	298	295		
30	285	288	292	298	303	307	311	313	314	313	310	305	300	294	288	283	280		
35	267	272	278	285	292	298	303	306	307	305	302	296	289	281	274	267	262		
40	247	253	261	271	280	288	294	298	299	297	293	286	277	267	257	248	242		
45	226	233	244	256	268	277	285	289	291	289	283	275	265	252	240	228	220		
50	202	212	225	240	254	266	275	280	282	279	274	264	252	237	221	207	196		
55	177	189	206	224	241	254	264	270	272	270	263	253	238	221	203	185	172		
60	150	166	186	208	227	242	254	260	262	260	253	241	225	206	184	163	146		
65	123	142	167	192	214	230	243	250	252	249	242	229	212	190	166	140	120		
70	95.2	120	149	177	200	219	232	239	242	239	231	218	199	176	149	119	93.6		
75	69.2	98.7	132	163	188	207	221	228	231	228	220	206	187	162	133	99.8	69.5		
80	45.8	80.8	117	149	176	195	209	217	220	217	209	195	175	150	119	83.2	48.1		
85	28.3	66.9	104	137	164	184	198	206	209	206	198	184	164	138	107	70.4	32.3		
90	18.9	56.5	93.7	126	153	173	186	194	197	194	186	172	153	127	96.2	60.5	23.4		
95	15.9	49.4	84.6	116	142	161	175	183	185	183	175	161	142	117	87.3	53.3	19.8		
100	17.1	45.3	77.3	107	131	150	163	171	174	171	163	150	132	108	80.0	48.9	20.2		
105	19.7	43.6	72.9	98.8	122	140	152	160	162	160	152	140	122	100	74.2	46.7	22.0		
110	23.5	43.6	68.2	91.9	113	130	141	148	151	149	142	130	114	93.3	70.4	46.4	24.9		
115	27.9	44.7	65.5	86.2	105	120	131	138	140	138	131	120	106	87.6	67.6	47.0	28.1		
120	31.5	46.2	63.9	81.8	98.1	111	121	127	129	128	122	112	98.8	83.1	65.4	47.8	30.8		
125	33.9	47.5	62.8	78.1	92.4	104	113	118	120	118	113	105	93.0	79.2	64.1	49.2	32.6		
130	34.5	47.8	62.5	75.0	87.2	97.6	105	110	111	110	105	97.8	87.7	75.8	63.3	50.2	33.8		
135	34.4	47.4	61.7	72.0	82.4	91.4	97.9	102	104	102	98.0	91.7	83.0	73.0	63.0	49.8	33.9		
140	34.9	47.2	62.0	70.6	78.7	85.8	91.3	94.9	96.1	95.0	91.8	86.1	78.9	70.8	61.6	47.3	33.5		
145	36.0	46.8	61.2	69.3	76.1	81.8	85.9	88.5	89.7	89.0	85.8	80.4	75.1	68.3	59.2	43.4	33.5		
150	40.2	46.6	57.4	67.2	73.1	77.1	81.2	83.5	84.1	83.0	79.6	76.0	71.0	62.3	55.6	42.7	36.4		
155	43.7	41.1	51.6	62.8	69.6	73.8	76.1	78.6	78.5	76.9	74.5	70.0	61.1	55.4	45.9	37.4	38.6		
160	44.0	36.8	42.8	55.6	64.5	69.4	71.8	72.3	72.9	71.9	64.7	54.1	46.9	40.4	36.0	34.0	37.5		
165	49.3	38.1	37.1	38.8	45.0	57.4	63.6	67.1	65.9	55.1	41.9	41.0	39.2	31.5	32.4	33.9	37.0		
170	54.3	44.3	39.4	40.7	43.3	44.9	44.7	41.9	44.6	36.0	45.3	42.4	40.1	39.6	36.4	34.6	37.7		
175	51.5	52.7	51.9	49.2	47.0	45.1	41.0	19.6	7.96	39.0	45.1	46.6	47.2	46.0	44.4	43.9	43.0		
180	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3	40.3		

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.

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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