

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

T5HO

Model: 10.5T5HO/2F/840/DIR

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, Yuhang Dist,
Hangzhou, Zhejiang Province, China 311100


Tel: +86 571 86376106

www.ledtestlab.com

Report No.: HZ18030001d

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

Review by:



Engineer: April Zou
Mar. 02, 2018

Approved by:



Manager: Jim Zhang
Mar. 02, 2018

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: 10.5T5HO/2F/840/DIR

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
114.1	1602.0	14.04	0.9826
CCT (K)	CRI	Stabilization Time (Light & Power)	
3996	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 : Mar. 01, 2018

Date of Test : Mar. 02, 2018

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

TABLE OF CONTENT

LM-79-08 Test Report.....	1
Test Summary.....	2
Sample Photos.....	4
TEST RESULTS	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Zonal Lumen Tabulation- Goniophotometer Method	10
Luminous Intensity Distribution Plots- Goniophotometer Method.....	12
Luminous Intensity Data- Goniophotometer Method.....	13
EQUIPMENT LIST	15
TEST METHODS	15
Seasoning of SSL Product.....	15
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	15
Goniophotometer Method	16
Photometric and Electrical Measurements.....	16
Color Characteristics Measurements.....	16
Color Spatial Uniformity	16

Sample Photos

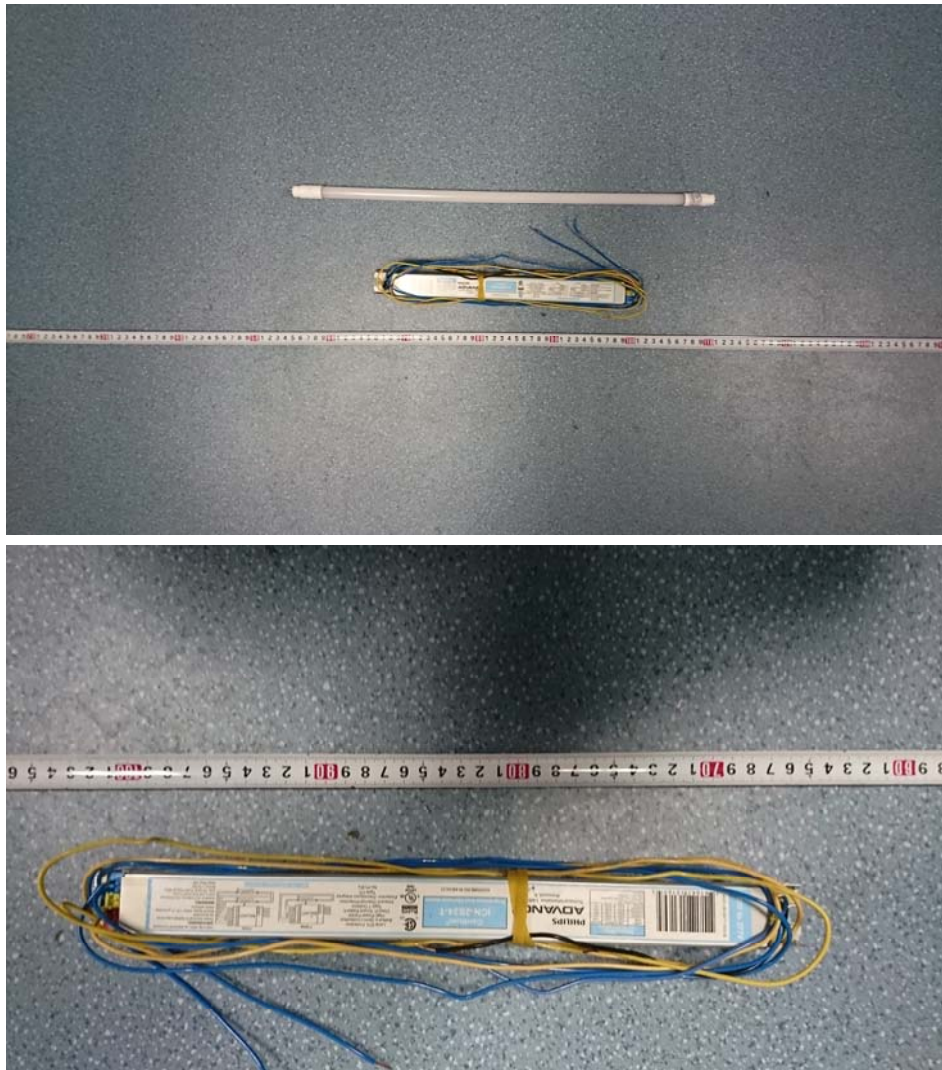


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: T5HO
Model	: 10.5T5HO/2F/840/DIR
Electrical Ratings	: 120-277V, 60Hz, 10.5W
Product Description	: 4000K LED Tubes supplied by a high frequency fluorescent lamp ballast: ICN-2S24-T
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 24.9°C.

Base orientation was light down. 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 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.119	0.062
Power Factor	0.9826	0.8567
Test Power (W)	14.04	14.65
THD A%	15.87	24.14
Luminous Efficacy (lm/W)	114.1	110.0
Total Luminous Flux (lm)	1602.0	1611.0
Color Rendering Index (CRI)	81.3	
R9	0.4	
Correlated Color Temperature (CCT)(K)	3996	
Chromaticity Chroma x	0.3818	
Chromaticity Chroma y	0.3817	
Chromaticity Chroma u	0.2241	
Chromaticity Chroma v	0.3360	
Duv	0.0019	
Chromaticity Chroma u'	0.2241	
Chromaticity Chroma v'	0.5039	

Special Color Rendering Indices	
R1	79
R2	87
R3	93.8
R4	80.9
R5	79.4
R6	82.5
R7	85.5
R8	62.2
R9	0.4
R10	69.7
R11	79.8
R12	61.5
R13	80.7
R14	96.6
Rf	81
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 25.1°C.

The photometric distance is 2.47m.

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)	0.120
Power Factor	0.9829
Test Power (W)	14.14
Luminous Efficacy (lm/W)	114.9
Total Luminous Flux (lm)	1624.3
Beam Angle (°)	124.0
Center Beam Candle Power (cd)	423
Spacing Criteria	1.22 (0°-180°)/ 1.33 (90°-270°)
Zonal Lumens in the 0°-60°Zone	60.89%
Zonal Lumens in the 60°-90°Zone	27.25%
Zonal Lumens in the 90°-120°Zone	9.28%
Zonal Lumens in the 120°-180°Zone	2.58%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

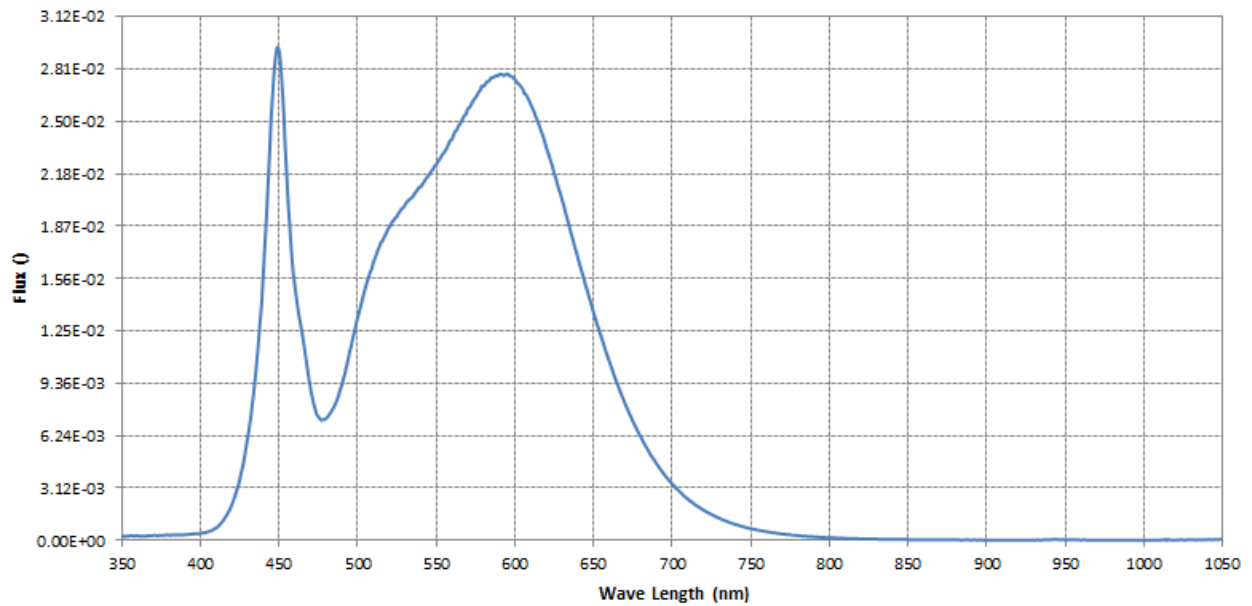
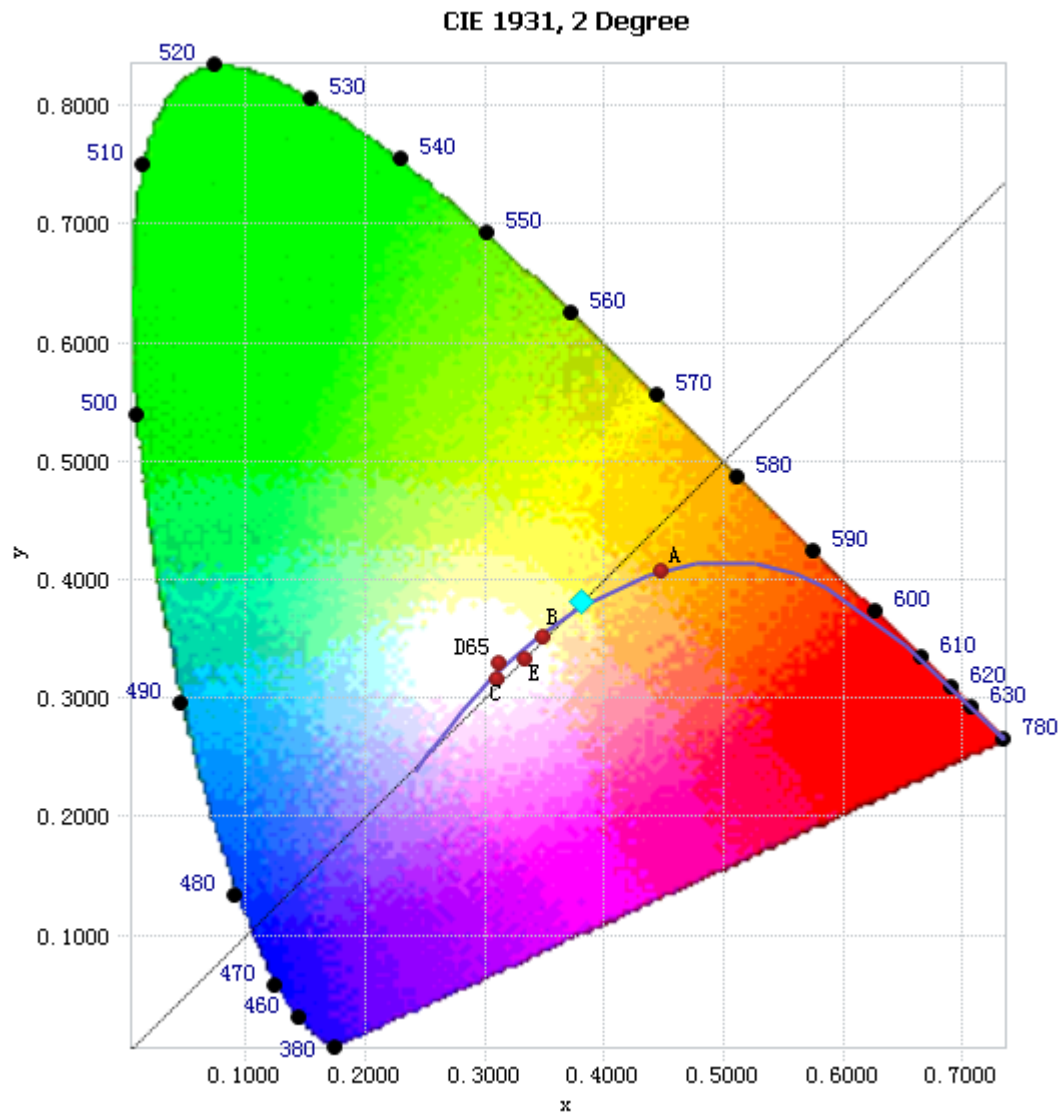


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.16E-04	485	7.95E-03	590	2.77E-02	695	3.95E-03
385	3.16E-04	490	9.25E-03	595	2.78E-02	700	3.38E-03
390	3.42E-04	495	1.12E-02	600	2.75E-02	705	2.90E-03
395	3.69E-04	500	1.32E-02	605	2.69E-02	710	2.47E-03
400	4.27E-04	505	1.50E-02	610	2.60E-02	715	2.11E-03
405	5.15E-04	510	1.66E-02	615	2.49E-02	720	1.80E-03
410	7.46E-04	515	1.78E-02	620	2.34E-02	725	1.55E-03
415	1.24E-03	520	1.86E-02	625	2.19E-02	730	1.32E-03
420	2.10E-03	525	1.93E-02	630	2.03E-02	735	1.12E-03
425	3.55E-03	530	1.99E-02	635	1.86E-02	740	9.63E-04
430	6.02E-03	535	2.05E-02	640	1.69E-02	745	8.24E-04
435	9.71E-03	540	2.10E-02	645	1.52E-02	750	7.07E-04
440	1.57E-02	545	2.17E-02	650	1.36E-02	755	6.09E-04
445	2.49E-02	550	2.24E-02	655	1.21E-02	760	5.23E-04
450	2.92E-02	555	2.31E-02	660	1.07E-02	765	4.48E-04
455	2.18E-02	560	2.39E-02	665	9.38E-03	770	3.85E-04
460	1.53E-02	565	2.48E-02	670	8.18E-03	775	3.34E-04
465	1.22E-02	570	2.57E-02	675	7.12E-03	780	2.90E-04
470	9.12E-03	575	2.64E-02	680	6.19E-03		
475	7.38E-03	580	2.70E-02	685	5.33E-03		
480	7.26E-03	585	2.76E-02	690	4.59E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3818, 0.3817)

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

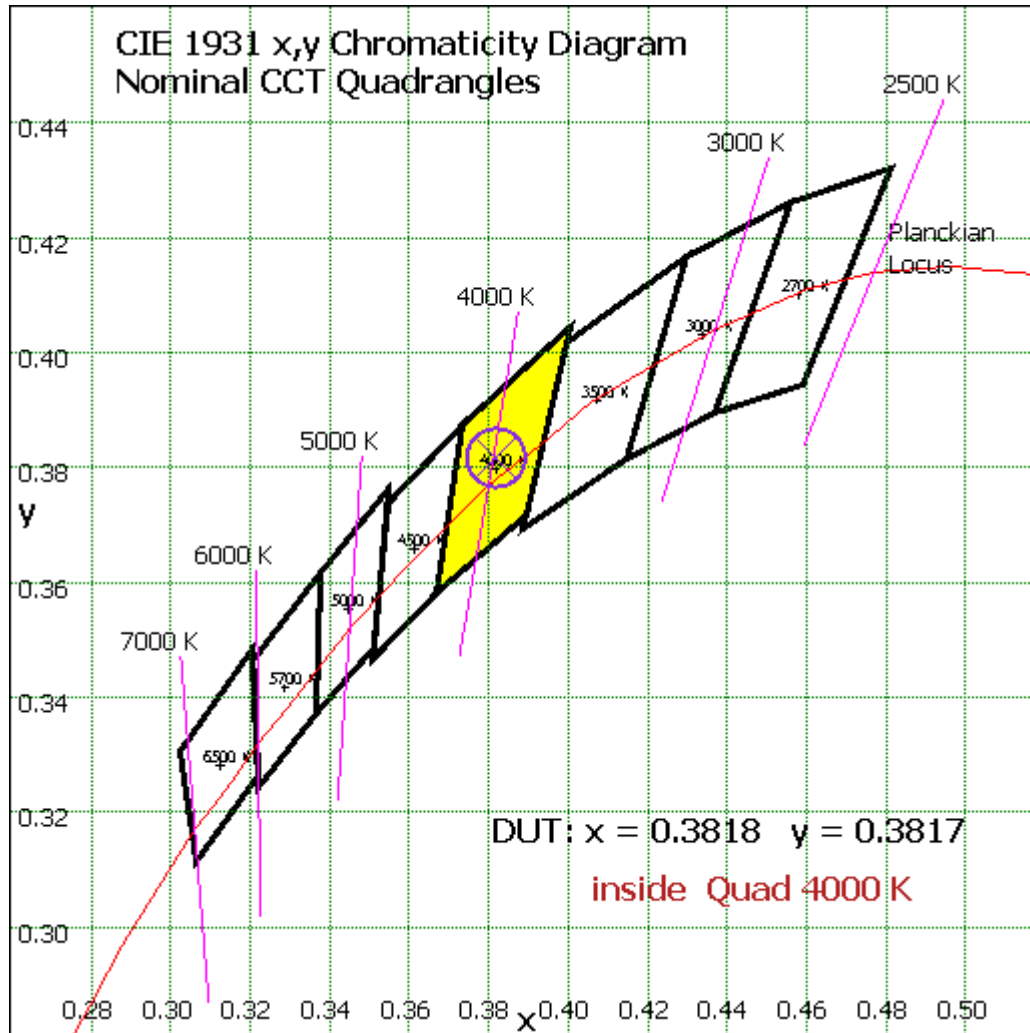


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	39.982	2.46%
10- 20	114.768	7.07%
20- 30	174.94	10.77%
30- 40	213.659	13.15%
40- 50	227.746	14.02%
50- 60	217.946	13.42%
60- 70	188.771	11.62%
70- 80	147.892	9.11%
80- 90	105.962	6.52%
90-100	73.078	4.50%
100-110	48.115	2.96%
110-120	29.554	1.82%
120-130	18.436	1.14%
130-140	11.2	0.69%
140-150	6.496	0.40%
150-160	3.609	0.22%
160-170	1.702	0.10%
170-180	0.4	0.02%
Total	1624.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	989.041	60.89%
60- 90	442.625	27.25%
0-90	1431.666	88.14%
90- 180	192.59	11.86%
0- 180	1624.3	100%

Table 5: Zonal Lumen Data

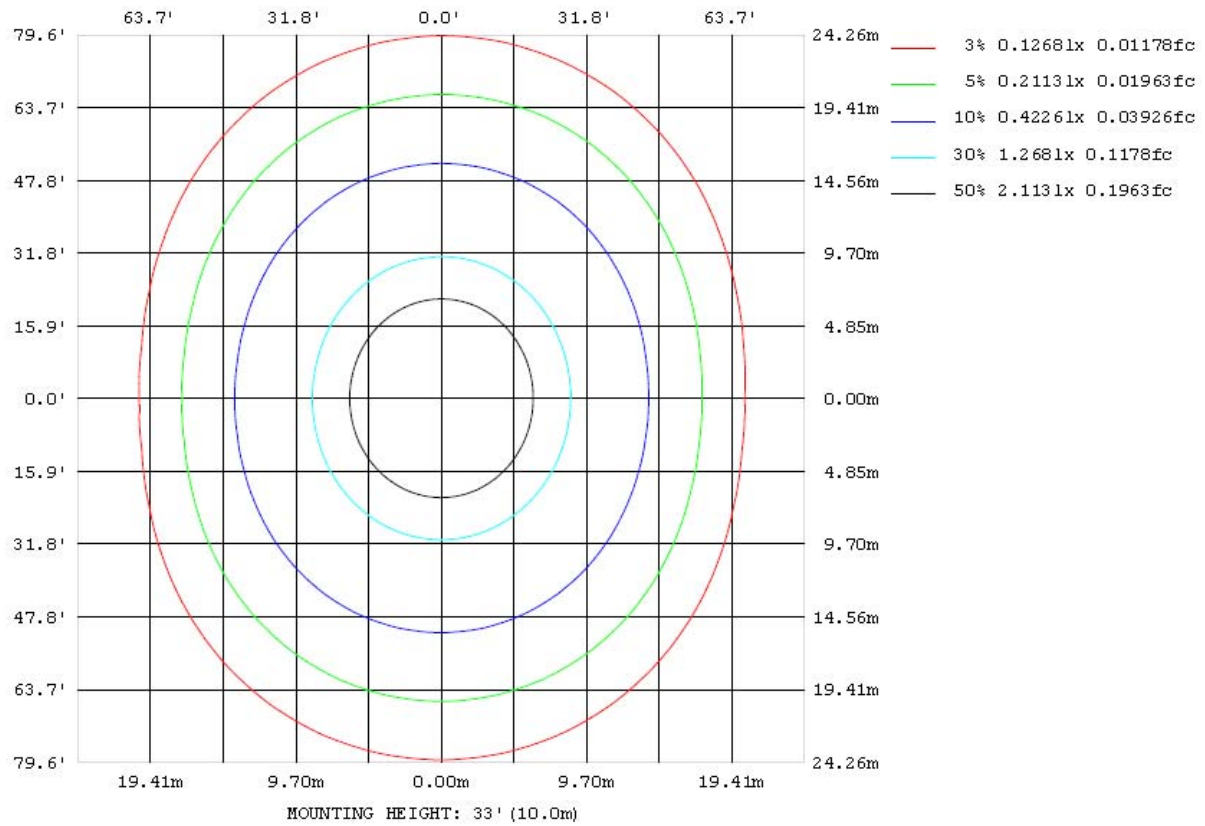


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

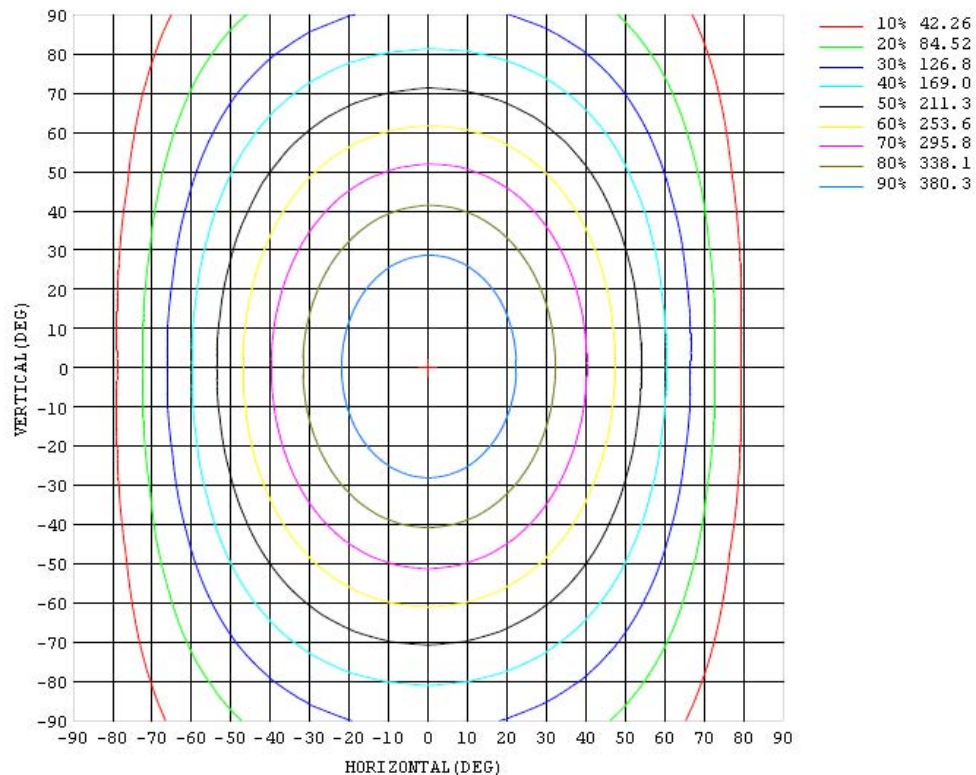


Chart 5: Isocandela Plot

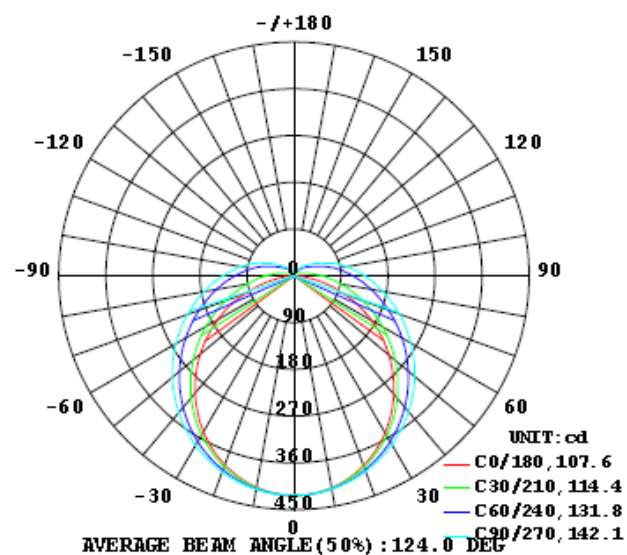


Chart 6: Polar Candela Distribution

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	423	423	423	423	423	423	423	423	423	423	423	423	423	423	423	423	423	423	423
5	420	421	421	420	421	421	421	421	421	421	421	421	421	421	420	420	420	420	420
10	414	414	414	415	415	416	416	416	417	417	417	416	416	415	414	414	414	413	413
15	403	404	404	405	406	407	408	409	410	410	410	409	408	407	405	404	403	402	402
20	389	389	390	392	394	396	398	399	400	401	400	399	397	395	393	390	389	387	387
25	370	371	372	375	378	381	384	387	388	389	388	386	384	380	377	373	371	369	368
30	349	349	351	355	359	364	368	372	374	375	374	371	368	363	358	353	350	347	346
35	324	325	328	332	338	344	350	355	358	359	358	354	349	343	337	331	326	323	322
40	297	298	302	307	315	323	330	336	340	341	340	336	330	322	314	306	300	296	294
45	268	269	274	281	290	299	308	316	320	322	320	316	308	299	289	280	272	267	265
50	237	239	244	253	264	275	286	294	299	301	300	294	286	275	263	252	242	236	234
55	205	207	214	224	237	250	262	272	278	280	278	272	263	251	237	224	212	204	202
60	172	174	183	196	211	225	239	249	256	258	256	250	239	226	211	195	181	172	168
65	137	141	152	167	184	201	215	227	234	236	234	227	216	202	185	167	151	138	135
70	103	107	121	140	159	177	193	205	212	215	212	205	194	178	160	141	121	106	99.8
75	69.3	74.9	92.9	114	135	155	171	183	191	193	191	184	172	156	137	116	93.8	75.3	66.4
80	38.4	46.8	68.0	90.9	113	133	150	162	170	173	171	163	151	135	115	92.8	69.8	47.4	35.2
85	13.3	24.1	47.1	71.2	93.8	114	131	143	151	154	152	144	132	116	95.9	73.2	49.5	26.0	11.0
90	0.99	10.4	31.4	54.9	76.9	96.5	113	125	133	136	133	126	115	98.7	79.3	57.7	34.3	12.7	0.40
95	0.44	3.94	20.3	41.5	62.8	81.3	96.8	109	116	119	117	110	98.6	83.3	65.4	44.4	23.2	5.96	0.45
100	0.54	2.67	12.5	30.0	49.7	67.8	81.9	93.3	100	103	101	94.5	83.9	69.7	52.1	32.8	15.6	4.02	0.53
105	0.65	1.97	9.51	21.5	37.2	53.4	68.0	78.3	85.0	87.5	85.5	79.4	69.4	55.6	40.0	24.9	11.7	3.29	0.87
110	0.93	2.18	7.55	17.4	29.2	41.8	53.5	62.8	69.0	71.2	69.6	64.0	55.4	44.6	32.2	19.8	9.68	3.36	1.23
115	1.25	2.57	6.43	14.3	24.2	34.4	43.8	51.5	56.4	58.3	57.2	52.8	45.7	36.6	26.4	16.5	8.52	3.57	1.59
120	1.58	2.95	5.52	11.9	20.0	28.5	36.3	42.6	46.7	48.3	47.3	43.8	37.9	30.3	22.0	14.1	7.76	3.78	2.01
125	1.96	3.29	5.24	9.90	16.7	23.8	30.2	35.4	38.8	40.1	39.2	36.2	31.5	25.4	18.7	12.1	6.87	4.04	2.45
130	2.36	3.60	5.26	8.69	13.8	19.8	25.1	29.4	32.1	33.2	32.5	30.1	26.2	21.2	15.5	10.3	6.73	4.08	2.69
135	2.79	3.65	5.50	8.24	11.2	16.2	20.1	24.2	26.5	27.5	26.9	24.9	21.7	17.4	12.8	9.08	6.29	4.10	2.95
140	3.23	3.62	5.48	7.40	9.90	12.6	16.6	19.7	21.4	22.3	22.1	20.6	17.8	14.1	11.2	8.77	6.08	4.03	3.33
145	3.60	3.53	5.30	6.97	9.24	11.0	12.7	14.9	16.4	17.4	16.9	15.7	14.4	12.3	10.1	8.01	5.71	3.90	3.75
150	3.97	3.44	4.64	6.61	8.02	9.85	11.4	12.4	13.1	13.5	13.4	12.9	12.1	10.6	9.17	7.41	5.39	3.86	3.99
155	4.07	3.29	4.19	6.02	7.69	8.68	9.83	10.9	11.5	11.5	11.6	11.1	10.4	9.39	8.16	6.36	4.59	3.71	3.92
160	4.50	3.24	3.76	4.82	6.00	7.88	8.65	9.24	9.77	10.0	9.98	9.67	9.13	8.37	6.73	5.33	4.12	3.54	3.77
165	4.42	3.39	3.43	4.13	5.46	5.45	6.91	7.89	8.26	8.47	8.41	8.22	7.51	6.60	5.64	4.43	3.57	3.65	3.81
170	3.72	3.43	3.43	3.48	3.51	4.12	5.60	6.26	5.97	5.85	6.03	5.19	4.49	3.87	3.70	3.60	3.46	3.39	3.35
175	3.28	3.30	3.33	3.35	3.39	3.43	3.40	3.65	3.12	1.80	2.81	3.05	3.18	3.06	2.95	2.89	2.86	2.82	2.99
180	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11

Table 6: Luminous Intensity Data

Table --2

UNIT: cd

C (DEG) γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	423	423	423	423	423	423	423	423	423	423	423	423	423	423	423	423	423		
5	420	420	420	420	421	421	421	421	421	421	421	421	421	421	421	421	420		
10	413	414	414	415	416	416	417	417	417	417	417	417	416	415	415	414	414		
15	402	403	404	406	407	408	410	410	411	410	410	409	408	407	406	404	404		
20	388	389	391	393	395	398	400	401	402	401	400	399	397	395	392	390	389		
25	369	371	374	377	381	384	387	389	390	390	388	386	383	379	376	373	371		
30	347	350	354	358	363	368	373	375	377	376	374	370	366	361	356	352	350		
35	323	326	331	337	344	350	356	359	361	360	357	353	346	340	334	329	326		
40	296	300	306	314	322	330	337	341	343	342	339	333	325	317	310	303	299		
45	267	272	280	289	299	309	317	322	324	323	319	312	303	293	283	276	270		
50	236	242	252	263	275	286	295	301	304	303	297	289	279	267	256	247	240		
55	204	212	223	237	251	263	273	280	283	280	275	266	254	241	228	217	208		
60	172	181	195	210	225	239	251	258	261	259	253	242	229	215	199	186	176		
65	139	150	166	183	201	216	228	235	239	237	230	219	205	189	171	156	143		
70	105	120	139	159	177	193	206	213	216	215	208	196	181	164	144	125	111		
75	73.5	91.5	114	135	155	171	184	192	195	193	186	175	159	140	119	97.4	79.0		
80	45.2	66.8	90.7	113	134	151	163	171	174	172	165	154	138	118	95.9	72.2	50.3		
85	23.2	46.2	70.6	93.8	114	131	144	152	155	153	146	134	118	98.2	75.6	51.5	27.9		
90	10.0	30.8	54.3	76.5	96.6	113	126	133	136	134	127	116	100	80.7	58.4	35.2	13.6		
95	4.21	20.2	41.2	62.1	80.8	96.7	109	116	119	117	110	99.2	84.1	65.7	45.0	23.7	5.91		
100	2.57	12.9	30.0	49.6	67.2	81.9	93.3	100	103	101	94.7	84.3	70.1	52.9	33.5	15.1	3.43		
105	2.38	9.32	21.8	37.1	53.8	68.1	78.7	85.4	88.0	86.2	80.4	70.3	56.6	40.1	23.9	10.4	2.66		
110	2.47	7.43	17.1	29.1	41.6	52.9	63.2	69.9	72.3	70.6	64.7	54.8	43.1	30.5	18.2	7.88	2.64		
115	2.56	6.45	13.7	23.4	33.5	42.8	50.2	54.9	56.7	55.4	50.9	43.7	34.6	24.4	14.4	6.56	2.71		
120	2.78	5.91	11.5	19.1	27.3	34.9	41.0	44.9	46.3	45.2	41.5	35.6	28.1	19.8	11.6	5.91	2.93		
125	3.18	5.56	9.84	15.8	22.4	28.6	33.5	36.7	37.9	37.0	33.9	29.1	22.9	16.2	9.85	5.63	3.23		
130	3.27	5.36	8.65	13.1	18.3	23.2	27.3	29.9	30.9	30.1	27.6	23.7	18.8	13.3	8.68	5.44	3.56		
135	3.35	5.14	7.70	11.1	15.0	19.0	22.2	24.2	25.1	24.4	22.4	19.3	15.4	11.3	7.92	5.39	3.91		
140	3.76	5.00	7.15	9.67	12.6	15.5	18.0	19.6	20.2	19.7	18.1	15.8	12.8	9.89	7.32	5.41	4.29		
145	4.41	5.21	6.70	8.56	10.6	12.7	14.5	15.7	16.2	15.8	14.6	12.8	10.8	8.71	6.86	5.49	4.64		
150	4.55	5.03	6.25	7.70	9.13	10.6	11.8	12.6	12.9	12.6	11.9	10.7	9.27	7.82	6.54	5.57	4.92		
155	4.54	5.03	5.91	6.98	7.95	8.90	9.70	10.2	10.5	10.3	9.80	9.03	8.12	7.17	6.33	5.72	5.09		
160	4.99	5.03	5.34	6.12	6.97	7.63	8.11	8.44	8.61	8.53	8.24	7.80	7.27	6.71	6.17	5.64	5.07		
165	4.81	5.32	5.12	5.33	6.07	6.59	6.80	7.13	7.27	7.26	7.10	6.85	6.60	6.31	5.99	5.79	5.32		
170	3.66	4.41	4.98	5.22	5.21	5.15	5.73	6.20	6.26	6.29	6.25	6.14	5.97	5.86	5.83	5.46	4.55		
175	3.12	3.14	3.28	3.67	4.13	4.49	4.50	4.82	5.43	5.69	5.76	5.66	5.58	5.52	5.17	4.28	3.54		
180	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	PF2010A	HZTE028-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	DPS1060	HZTE001-06	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	WY12010	HZTE004-03	Aug. 10, 2017	Aug. 09, 2018
Temperature recorder	JM624U	HZTE018-08	Aug. 17, 2017	Aug. 16, 2018
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 16, 2017	Aug. 15, 2018
Standard source	D908	HZTE012-01	Aug. 20, 2017	Aug. 19, 2018
Integrate Sphere system	2M	HZTE015-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	WT210	HZTE008-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	PCR 500L	HZTE001-07	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	IT6154	HZTE004-04	Aug. 10, 2017	Aug. 09, 2018
Standard source	SCL-1400	HZTE012-02	Aug. 20, 2017	Aug. 19, 2018
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 16, 2017	Aug. 15, 2018
Temperature Meter	TES1310	HZTE017-01	Aug. 17, 2017	Aug. 16, 2018

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 FA19 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 FA19 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

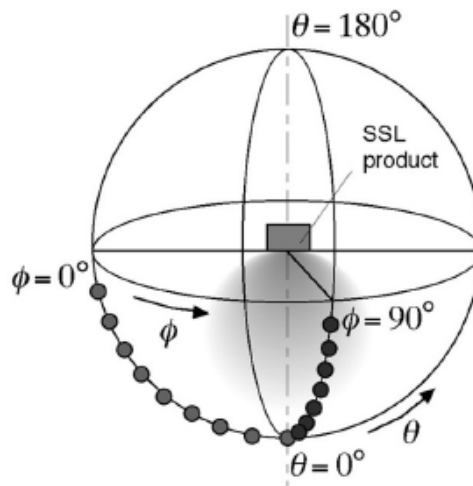
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.