

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube System

Model: 22T5HO/4F/840/EXT/A2

(LED tube model: 22T5HO/4F/840/EXT 2pcs and LED driver model: 24T5HODRIVER/2CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18080024ac

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

Review by:



Engineer: April Zou

Aug. 29, 2018

Approved by:



Manager: Jim Zhang

Aug. 29, 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: 22T5HO/4F/840/EXT/A2

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/2	Power Factor
138.6	3549.0	25.60	0.9956
CCT (K)	CRI	Stabilization Time (Light & Power)	
4048	81.5	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 : Jul. 30, 2018

Date of Test : Aug. 03, 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

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Sample Photos

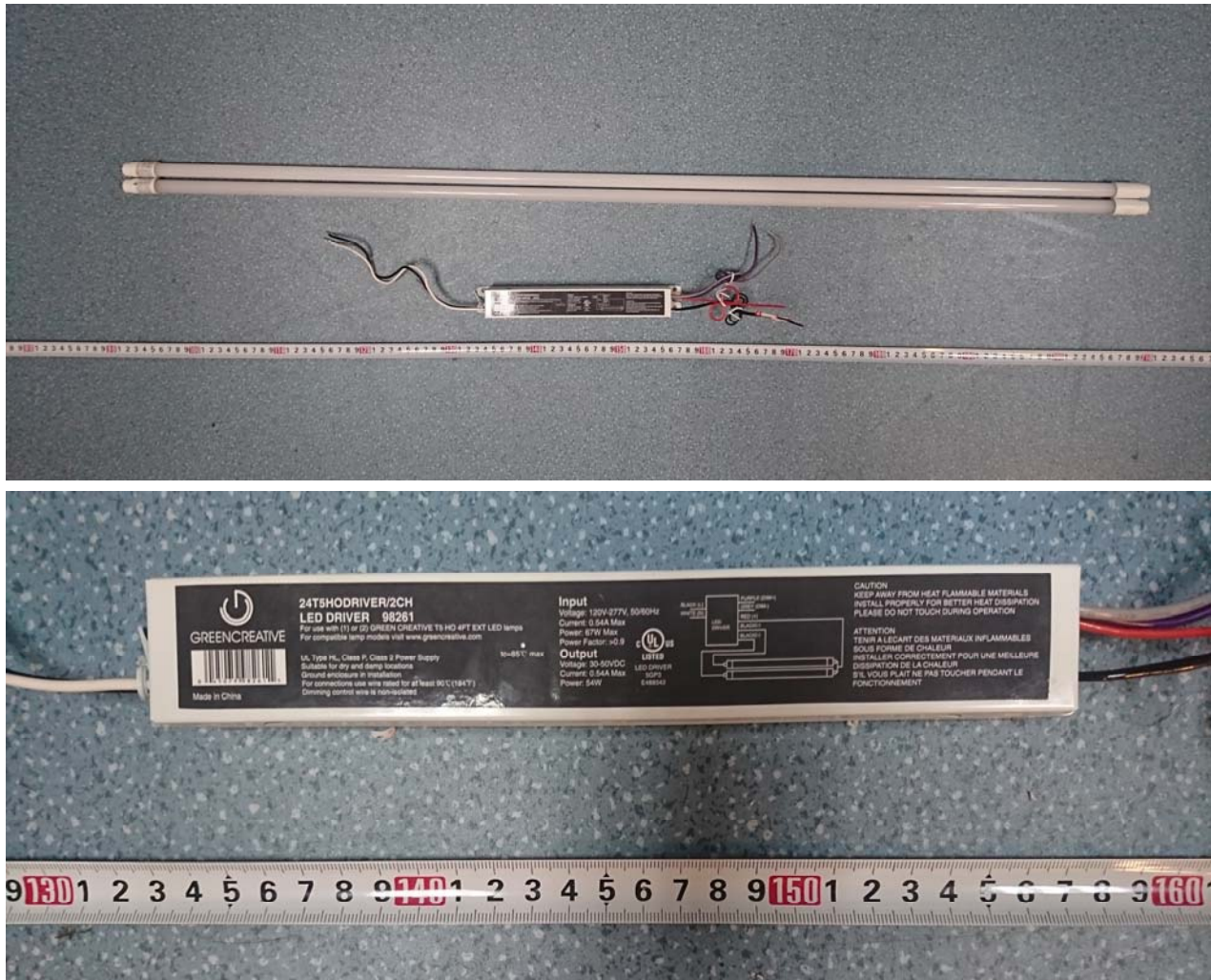


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 22T5HO/4F/840/EXT/A2
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 4000K LED tube model: 22T5HO/4F/840/EXT 2 LED tubes supplied by a LED driver: 24T5HODRIVER/2CH
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 25.0°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)	0.429	0.194
Power Factor	0.9956	0.9562
Test Power (W)/2	25.60	25.64
THD A%	4.99	6.29
Luminous Efficacy (lm/W)	138.6	138.4
Luminous Flux per lamp (lm)	3549.0	3549.0
Color Rendering Index (CRI)	81.5	
R9	1.2	
Correlated Color Temperature (CCT)(K)	4048	
Chromaticity Chroma x	0.3795	
Chromaticity Chroma y	0.3801	
Chromaticity Chroma u	0.2231	
Chromaticity Chroma v	0.3353	
Duv	0.0012	
Chromaticity Chroma u'	0.2231	
Chromaticity Chroma v'	0.5029	

Special Color Rendering Indices	
R1	79.2
R2	87.2
R3	93.9
R4	81.1
R5	79.6
R6	82.8
R7	85.7
R8	62.6
R9	1.2
R10	70.2
R11	80.1
R12	61.4
R13	81
R14	96.7
Rf	82
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 30m.

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)	0.429
Power Factor	0.9964
Test Power (W)/2	25.67
Luminous Efficacy (lm/W)	136.2
Luminous Flux per lamp (lm)	3495.8
Beam Angle (°)	119.5
Center Beam Candle Power (cd)	954
Spacing Criteria	1.23 (0°-180°)/ 1.31 (90°-270°)
Zonal Lumens in the 0°-60°Zone	63.36%
Zonal Lumens in the 60°-90°Zone	25.89%
Zonal Lumens in the 90°-120°Zone	7.93%
Zonal Lumens in the 120°-180°Zone	2.82%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

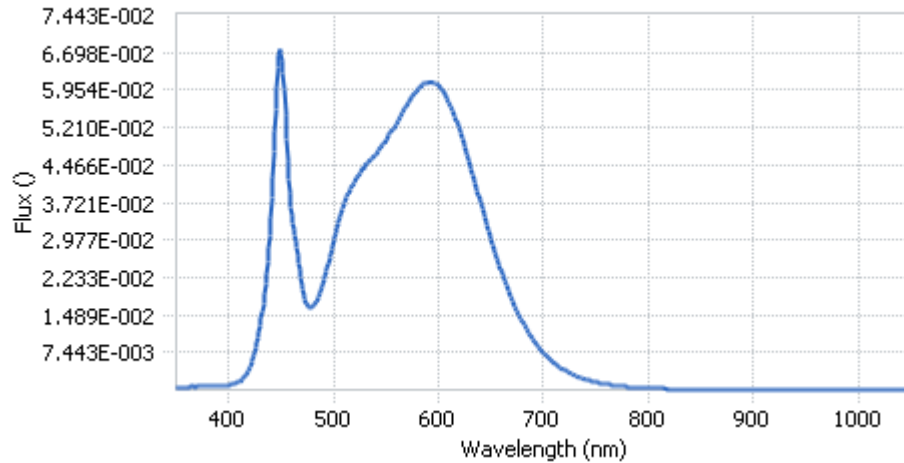
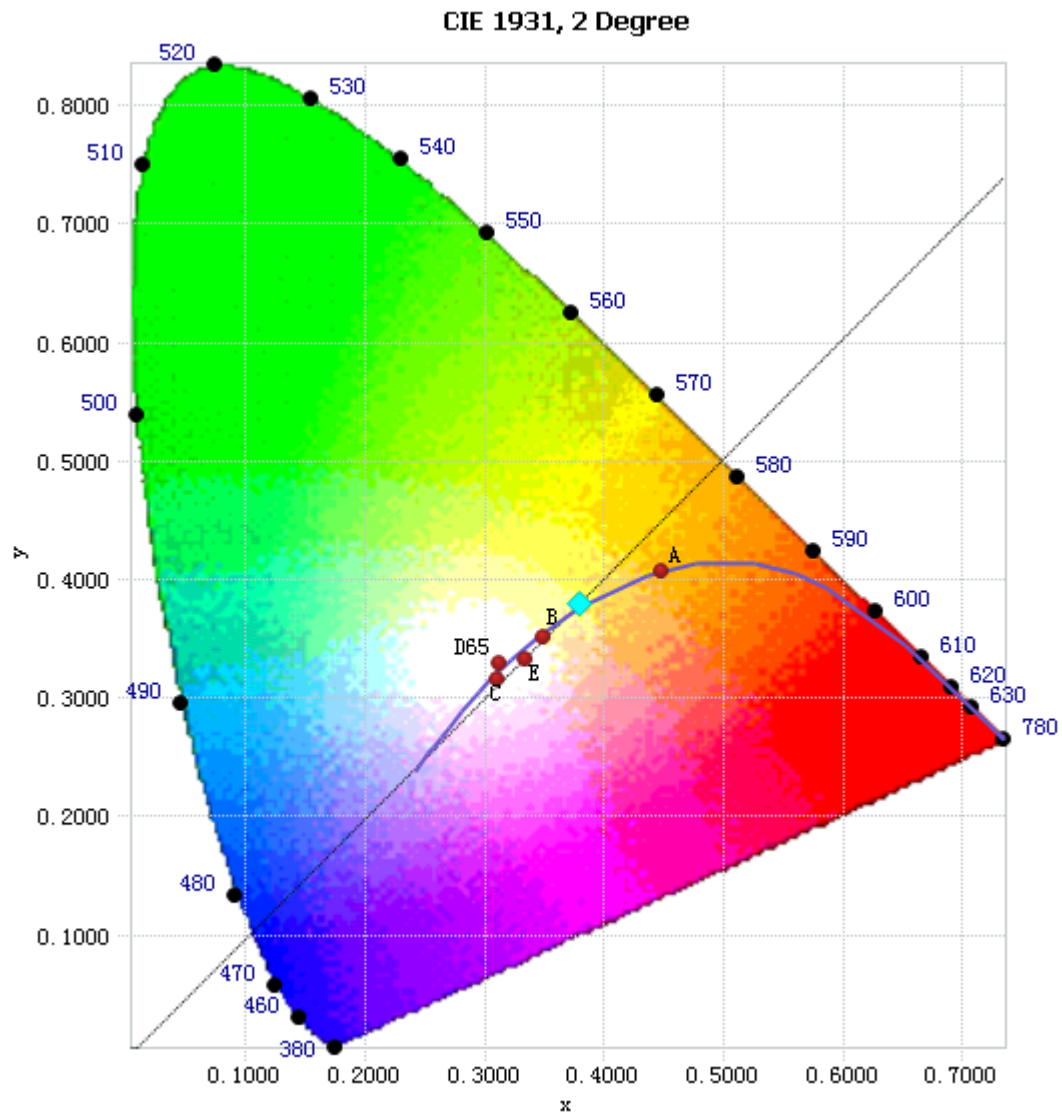


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	7.69E-04	485	1.82E-02	590	6.11E-02	695	8.59E-03
385	7.17E-04	490	2.10E-02	595	6.10E-02	700	7.38E-03
390	8.00E-04	495	2.52E-02	600	6.04E-02	705	6.28E-03
395	8.85E-04	500	2.97E-02	605	5.92E-02	710	5.36E-03
400	1.00E-03	505	3.38E-02	610	5.70E-02	715	4.59E-03
405	1.21E-03	510	3.69E-02	615	5.46E-02	720	3.94E-03
410	1.74E-03	515	3.96E-02	620	5.16E-02	725	3.37E-03
415	2.67E-03	520	4.16E-02	625	4.82E-02	730	2.87E-03
420	4.46E-03	525	4.32E-02	630	4.47E-02	735	2.45E-03
425	7.59E-03	530	4.46E-02	635	4.09E-02	740	2.09E-03
430	1.29E-02	535	4.56E-02	640	3.72E-02	745	1.79E-03
435	2.10E-02	540	4.68E-02	645	3.35E-02	750	1.53E-03
440	3.43E-02	545	4.82E-02	650	2.99E-02	755	1.31E-03
445	5.58E-02	550	4.96E-02	655	2.66E-02	760	1.14E-03
450	6.69E-02	555	5.13E-02	660	2.35E-02	765	9.69E-04
455	4.98E-02	560	5.28E-02	665	2.05E-02	770	8.29E-04
460	3.47E-02	565	5.48E-02	670	1.79E-02	775	7.17E-04
465	2.81E-02	570	5.67E-02	675	1.55E-02	780	6.19E-04
470	2.09E-02	575	5.82E-02	680	1.34E-02		
475	1.67E-02	580	5.97E-02	685	1.16E-02		
480	1.66E-02	585	6.07E-02	690	9.99E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3795, 0.3801)

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

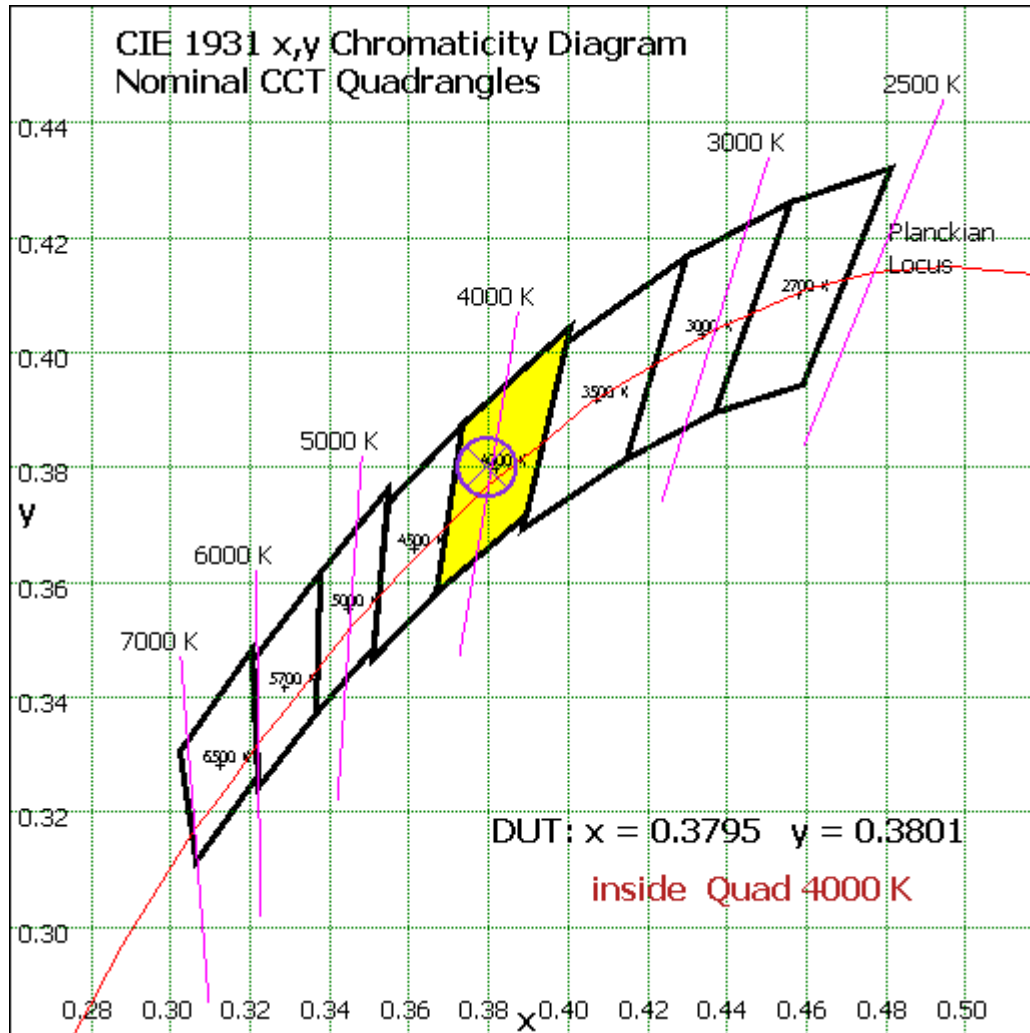


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	90.315	2.58%
10- 20	259.371	7.42%
20- 30	395.346	11.31%
30- 40	481.649	13.78%
40- 50	509.215	14.57%
50- 60	478.925	13.70%
60- 70	402.396	11.51%
70- 80	300.59	8.60%
80- 90	202.049	5.78%
90-100	132.465	3.79%
100-110	87.385	2.50%
110-120	57.512	1.65%
120-130	38.826	1.11%
130-140	26.093	0.75%
140-150	17.039	0.49%
150-160	10.281	0.29%
160-170	4.993	0.14%
170-180	1.363	0.04%
Total	3495.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	2214.821	63.36%
60- 90	905.035	25.89%
0-90	3119.856	89.25%
90- 180	375.957	10.75%
0- 180	3495.8	100%

Table 5: Zonal Lumen Data

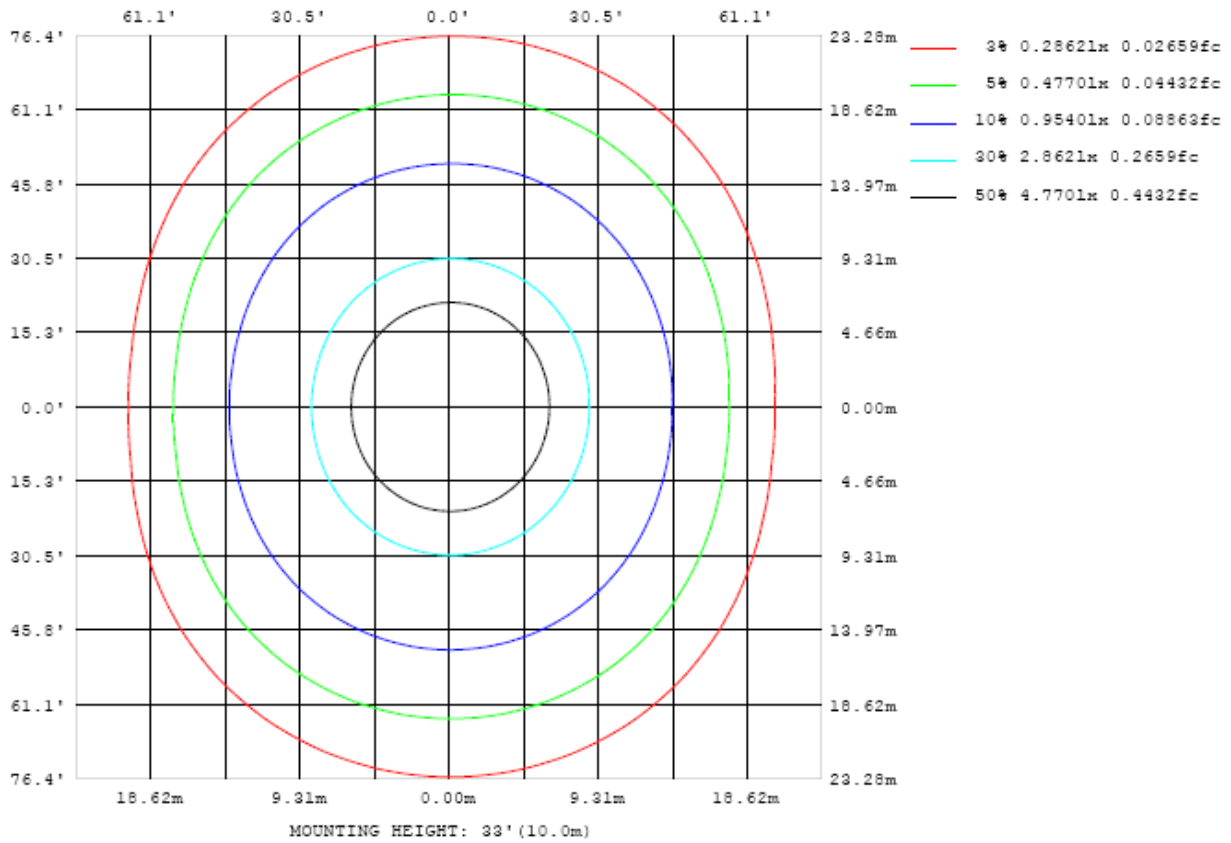


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

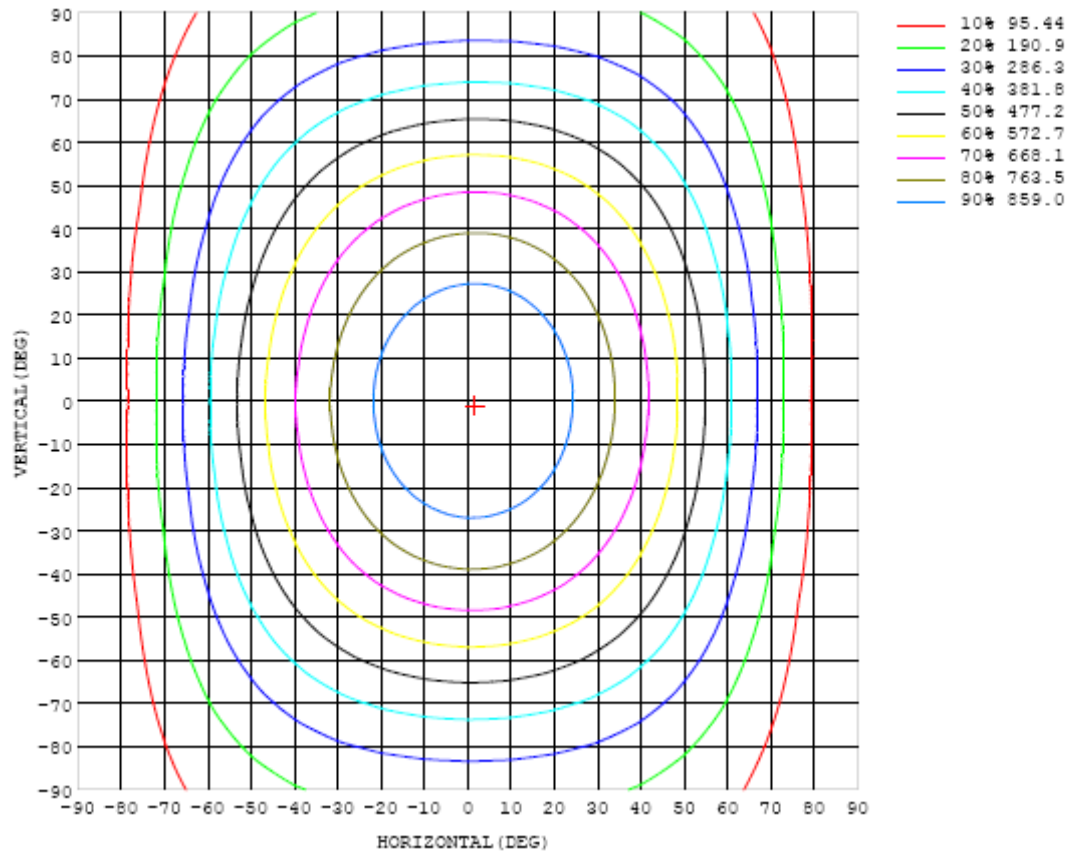


Chart 5: Isocandela Plot

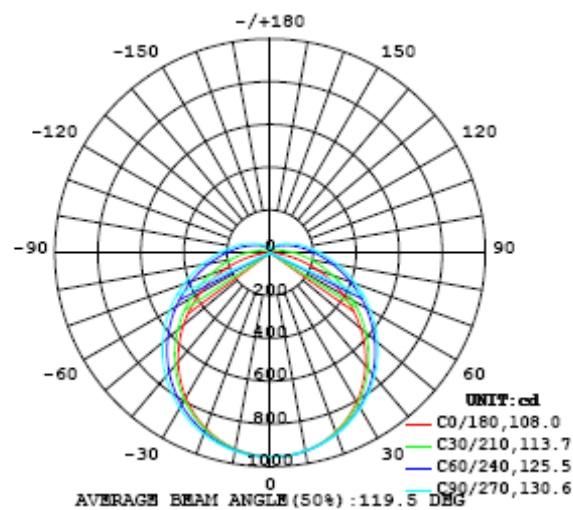


Chart 6: Polar Candela Distribution

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	954	954	954	954	954	954	954	954	954	954	954	954	954	954	954	954	954		
5	947	947	948	948	949	949	949	950	951	951	951	952	952	952	952	952	952		
10	931	932	933	934	936	937	938	940	941	942	942	942	942	942	942	941	941		
15	907	908	910	912	915	918	920	923	925	925	926	926	925	924	923	921	921		
20	874	876	879	883	887	893	896	900	902	903	903	902	900	898	895	893	892		
25	833	836	841	847	853	860	866	870	874	875	874	872	868	864	860	857	854		
30	784	788	795	804	813	822	829	835	839	840	839	836	830	824	817	812	808		
35	728	734	744	755	767	778	787	794	799	800	798	793	786	777	768	760	755		
40	666	674	686	701	715	730	741	749	754	755	753	746	737	725	713	702	694		
45	599	609	625	642	660	676	690	699	705	705	702	694	682	668	652	638	628		
50	529	541	559	581	602	621	636	646	652	653	648	639	625	607	587	569	556		
55	455	470	492	518	542	563	579	591	597	597	592	581	565	544	520	498	482		
60	380	398	425	454	482	505	522	533	539	540	534	522	504	480	452	425	405		
65	303	327	359	392	422	446	464	476	482	482	476	463	443	416	385	353	328		
70	229	258	296	332	364	389	407	419	425	425	418	405	384	355	320	283	251		
75	158	195	237	277	310	335	353	365	371	370	364	350	328	298	260	218	179		
80	95.2	140	186	227	260	286	303	315	320	319	313	299	277	246	206	161	114		
85	46.8	94.7	143	183	216	241	259	269	274	274	267	253	231	200	160	113	62.5		
90	19.7	62.4	108	148	179	203	219	230	234	233	226	213	191	162	123	77.0	30.3		
95	9.34	41.3	81.2	118	148	170	186	195	199	198	192	178	158	130	93.7	52.5	15.0		
100	6.81	29.0	60.7	94.0	122	143	158	167	170	169	163	150	131	104	71.0	36.3	9.99		
105	6.81	22.7	47.5	74.1	98.8	119	133	142	145	144	137	125	106	81.9	54.3	27.4	8.54		
110	7.66	19.5	38.8	60.7	81.1	97.6	110	118	121	120	113	102	86.2	66.1	43.6	22.5	8.76		
115	8.53	18.0	33.0	50.8	67.9	82.1	92.7	99.2	102	100	94.9	85.3	71.6	54.8	36.4	19.8	9.62		
120	9.57	17.2	29.1	43.4	57.5	69.6	78.7	84.3	86.5	85.3	80.4	72.0	60.3	46.2	31.2	18.5	10.5		
125	10.7	16.9	26.3	37.8	49.4	59.4	67.2	72.0	73.9	72.8	68.5	61.3	51.4	39.8	27.7	17.6	11.4		
130	11.7	16.9	24.3	33.4	42.4	51.0	57.5	61.7	63.2	62.2	58.6	52.4	44.2	34.8	25.4	17.8	12.5		
135	12.5	16.8	22.8	30.0	37.4	44.0	49.5	52.9	54.1	53.3	50.2	45.2	38.6	31.1	23.6	17.9	13.6		
140	13.4	16.6	21.9	27.5	33.1	38.2	42.7	45.4	46.4	45.7	43.2	39.1	33.9	28.2	22.6	18.0	14.5		
145	14.0	17.4	20.9	25.5	29.7	33.5	36.7	39.1	39.8	39.3	37.3	34.1	30.1	25.9	21.7	18.2	15.4		
150	14.8	17.9	20.3	23.6	26.9	29.7	31.9	33.7	34.2	33.8	32.3	30.0	27.2	24.1	21.0	18.5	16.0		
155	14.2	17.0	18.0	21.5	24.3	26.4	28.0	28.9	29.6	29.4	28.4	26.9	24.9	22.6	20.5	18.4	15.4		
160	12.4	14.6	16.2	16.8	19.7	22.6	24.6	25.4	25.9	25.8	25.3	24.3	23.0	21.3	19.1	17.1	14.1		
165	11.3	12.4	13.5	14.4	14.7	16.6	19.0	22.2	22.5	23.1	22.8	22.2	21.0	19.0	18.1	15.6	12.3		
170	11.6	11.7	12.4	13.5	13.7	13.8	13.2	14.5	17.7	19.1	20.3	17.6	16.7	17.2	15.0	12.7	11.9		
175	14.5	14.5	14.6	14.6	15.1	14.6	13.9	10.9	5.29	9.60	13.4	14.5	15.1	15.1	14.5	14.8	14.8		
180	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20	6.20		

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 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

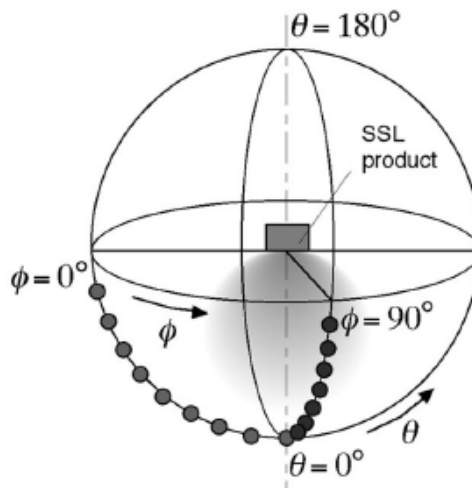
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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