

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube System

Model: 22T5HO/4F/850/EXT/A2

(LED tube model: 22T5HO/4F/850/EXT 2pcs and LED driver model: 24T5HODRIVER/2CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18080024ad

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/850/EXT/A2

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/2	Power Factor
134.6	3443.0	25.59	0.9956
CCT (K)	CRI	Stabilization Time (Light & Power)	
4899	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 : 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

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

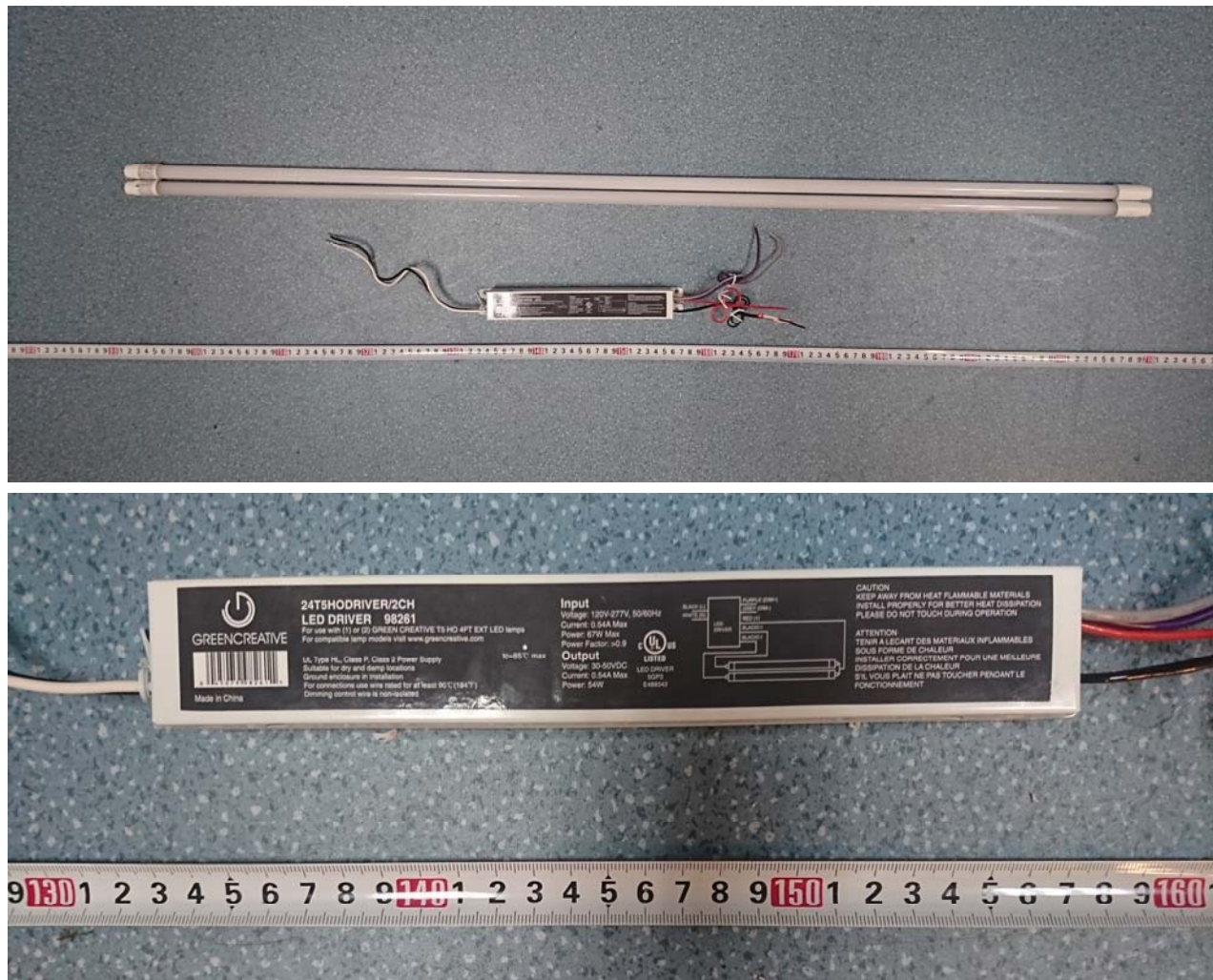


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 22T5HO/4F/850/EXT/A2
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 5000K LED tube model: 22T5HO/4F/850/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)	0.428	0.194
Power Factor	0.9956	0.9560
Test Power (W)/2	25.59	25.62
THD A%	5.07	6.53
Luminous Efficacy (lm/W)	134.6	134.4
Luminous Flux per lamp (lm)	3443.0	3443.0
Color Rendering Index (CRI)	82.5	
R9	3.8	
Correlated Color Temperature (CCT)(K)	4899	
Chromaticity Chroma x	0.3486	
Chromaticity Chroma y	0.3605	
Chromaticity Chroma u	0.2104	
Chromaticity Chroma v	0.3263	
Duv	0.0030	
Chromaticity Chroma u'	0.2104	
Chromaticity Chroma v'	0.4895	

Special Color Rendering Indices	
R1	80.2
R2	88.1
R3	93.7
R4	81.3
R5	80.5
R6	83.1
R7	87.3
R8	65.8
R9	3.8
R10	71.7
R11	80.1
R12	57.5
R13	82.4
R14	96.7
Rf	82
Rg	95

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	25.66
Luminous Efficacy (lm/W)	132.3
Luminous Flux per lamp (lm)	3393.7
Beam Angle (°)	129.8
Center Beam Candle Power (cd)	837
Spacing Criteria	1.28 (0°-180°)/ 1.33 (90°-270°)
Zonal Lumens in the 0°-60°Zone	59.46%
Zonal Lumens in the 60°-90°Zone	27.80%
Zonal Lumens in the 90°-120°Zone	9.87%
Zonal Lumens in the 120°-180°Zone	2.88%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

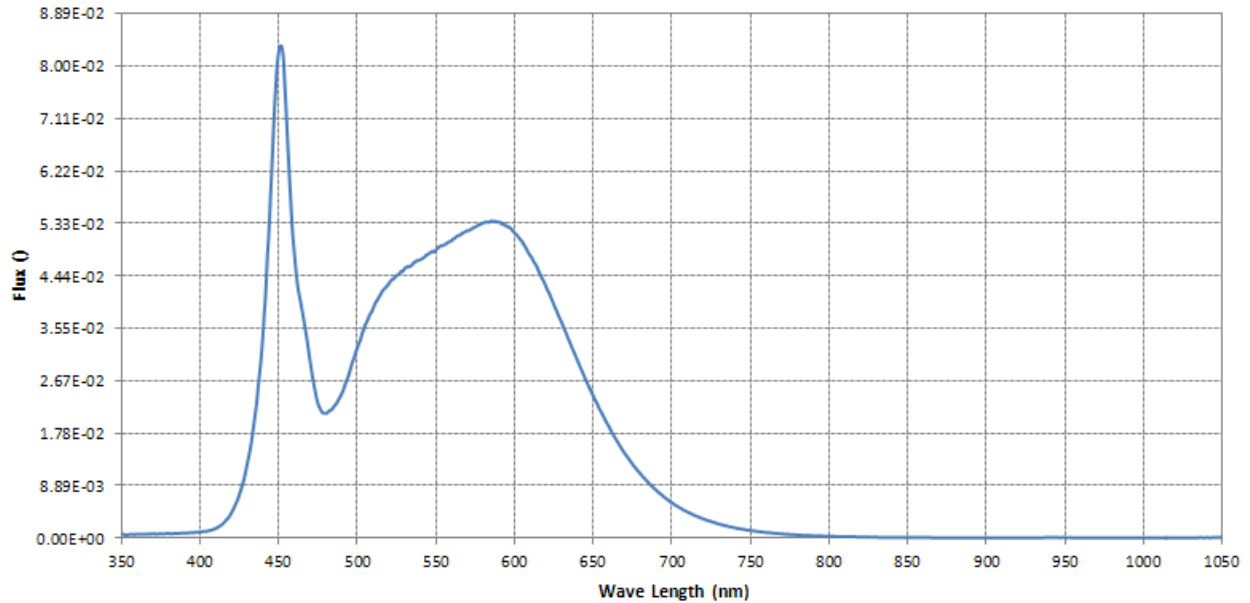


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	8.40E-04	485	2.22E-02	590	5.35E-02	695	7.00E-03
385	7.85E-04	490	2.43E-02	595	5.29E-02	700	6.04E-03
390	8.58E-04	495	2.79E-02	600	5.18E-02	705	5.17E-03
395	9.16E-04	500	3.21E-02	605	5.02E-02	710	4.43E-03
400	1.01E-03	505	3.60E-02	610	4.79E-02	715	3.81E-03
405	1.21E-03	510	3.88E-02	615	4.55E-02	720	3.28E-03
410	1.66E-03	515	4.13E-02	620	4.27E-02	725	2.81E-03
415	2.51E-03	520	4.30E-02	625	3.96E-02	730	2.40E-03
420	4.25E-03	525	4.45E-02	630	3.66E-02	735	2.06E-03
425	7.28E-03	530	4.56E-02	635	3.33E-02	740	1.77E-03
430	1.24E-02	535	4.63E-02	640	3.02E-02	745	1.51E-03
435	2.06E-02	540	4.72E-02	645	2.70E-02	750	1.29E-03
440	3.41E-02	545	4.80E-02	650	2.42E-02	755	1.12E-03
445	5.80E-02	550	4.88E-02	655	2.14E-02	760	9.65E-04
450	8.20E-02	555	4.96E-02	660	1.90E-02	765	8.38E-04
455	7.19E-02	560	5.03E-02	665	1.66E-02	770	7.22E-04
460	4.85E-02	565	5.13E-02	670	1.44E-02	775	6.24E-04
465	3.86E-02	570	5.21E-02	675	1.26E-02	780	5.38E-04
470	3.02E-02	575	5.27E-02	680	1.09E-02		
475	2.29E-02	580	5.33E-02	685	9.48E-03		
480	2.11E-02	585	5.37E-02	690	8.16E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method

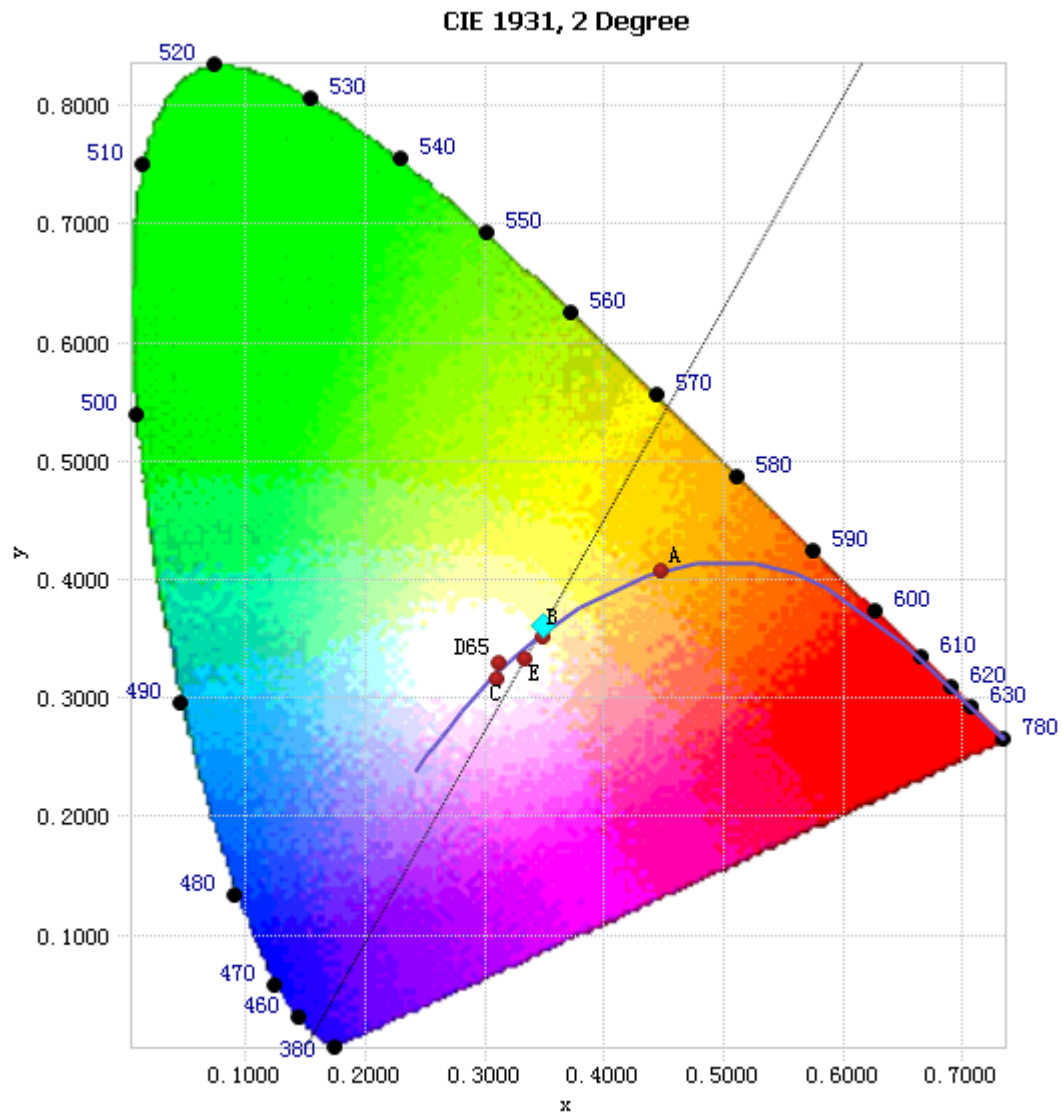


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

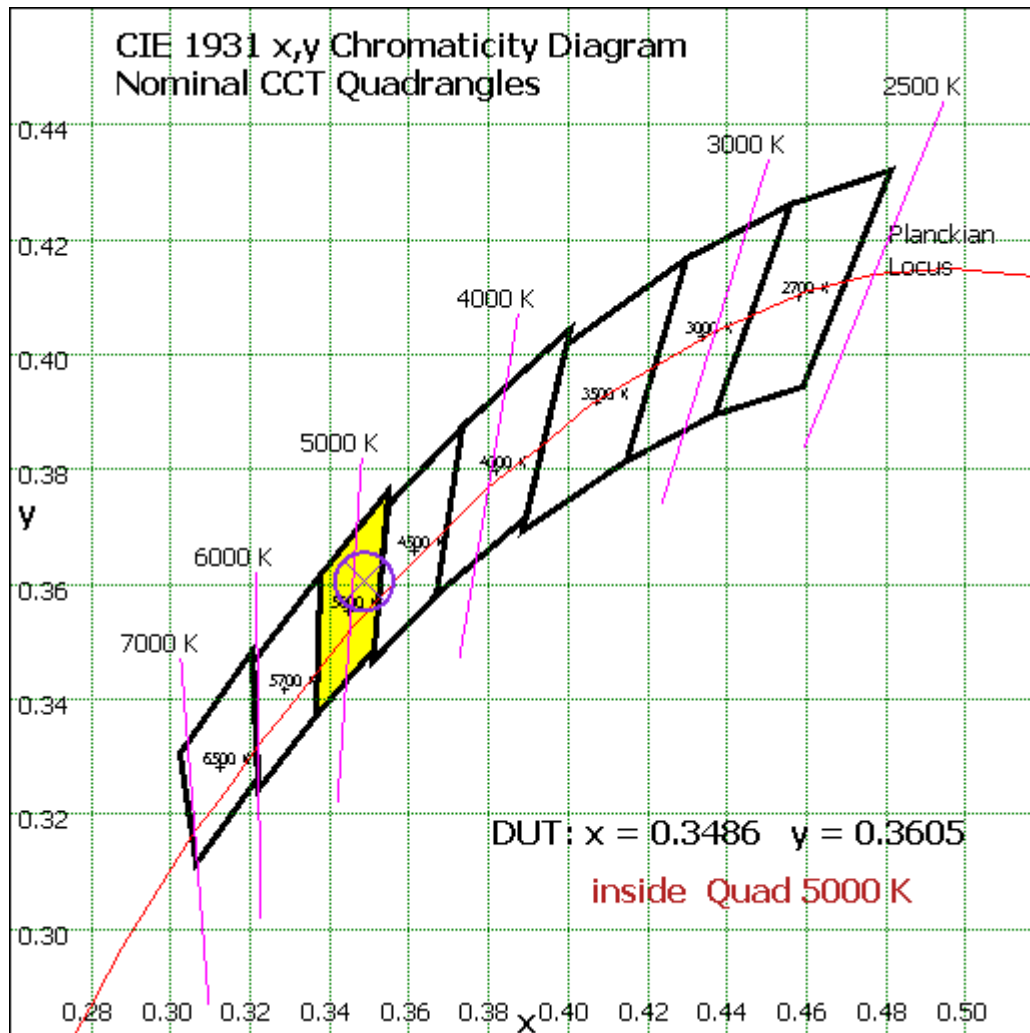


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	79.292	2.34%
10- 20	228.579	6.74%
20- 30	351.348	10.35%
30- 40	434.095	12.79%
40- 50	469.061	13.82%
50- 60	455.385	13.42%
60- 70	399.633	11.78%
70- 80	316.154	9.32%
80- 90	227.738	6.71%
90-100	158.381	4.67%
100-110	107.367	3.16%
110-120	69.14	2.04%
120-130	43.437	1.28%
130-140	26.028	0.77%
140-150	15.091	0.44%
150-160	8.324	0.25%
160-170	3.729	0.11%
170-180	0.966	0.03%
Total	3393.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	2017.76	59.46%
60- 90	943.525	27.80%
0-90	2961.285	87.26%
90- 180	432.463	12.74%
0- 180	3393.7	100%

Table 5: Zonal Lumen Data

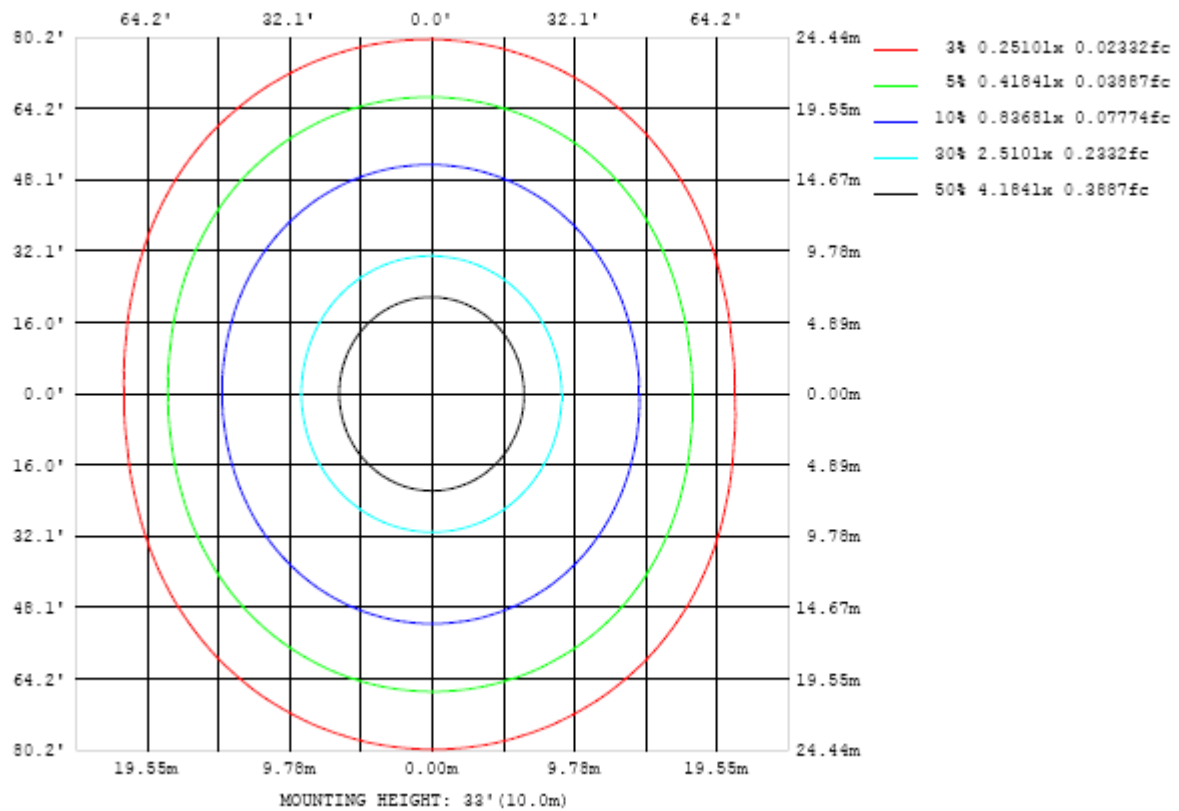


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

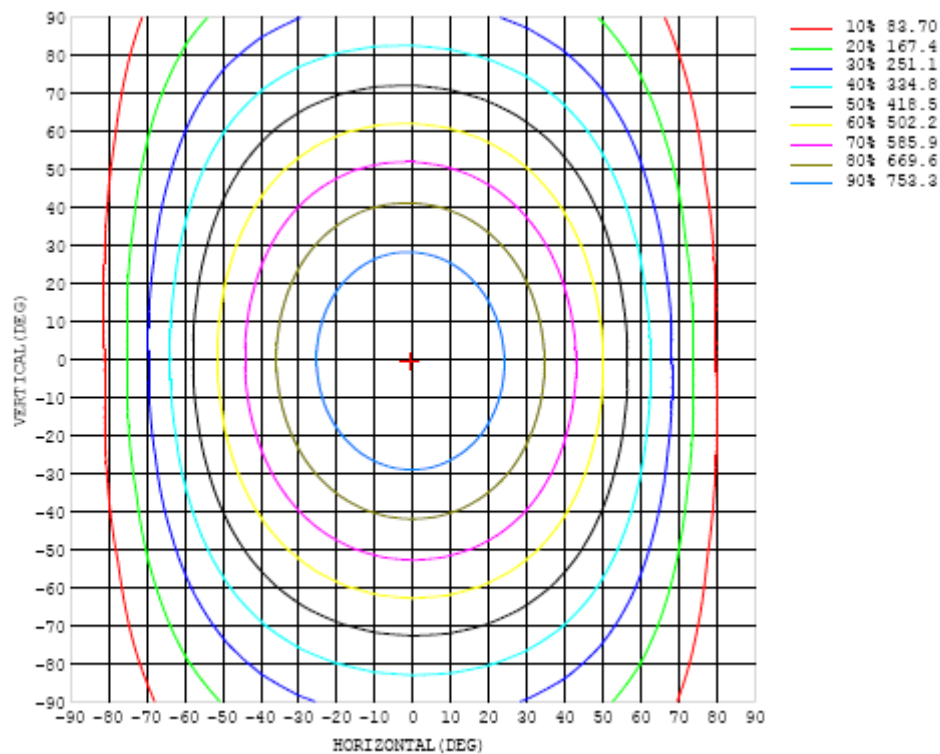


Chart 5: Isocandela Plot

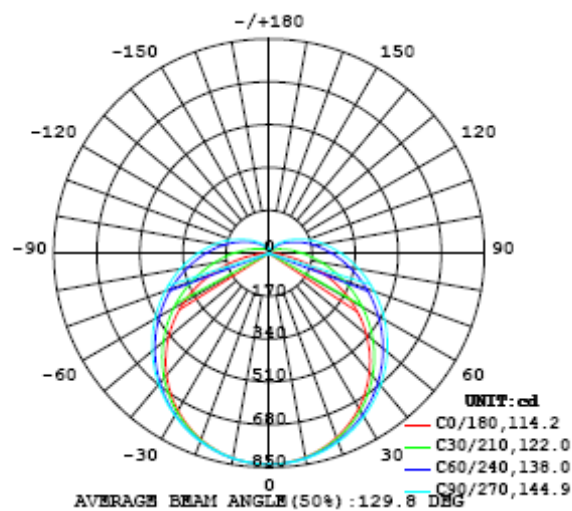


Chart 6: Polar Candela Distribution

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	837	837	837	837	837	837	837	837	837	837	837	837	837	837	837	837	837		
5	834	834	834	834	834	834	834	834	834	834	833	833	833	832	833	832	832		
10	825	825	825	825	826	826	826	826	825	825	824	823	823	822	822	821	821		
15	809	809	810	811	812	812	813	812	812	811	810	808	807	805	804	803	803		
20	786	786	788	790	792	793	794	794	794	792	790	788	785	783	780	778	778		
25	756	758	761	763	766	769	771	771	771	769	766	762	758	754	750	748	746		
30	721	723	727	732	736	740	743	744	743	741	737	732	726	720	715	711	709		
35	679	683	689	695	701	707	711	713	713	709	704	697	689	681	674	668	665		
40	632	637	645	654	663	670	676	679	678	675	668	659	648	638	628	620	616		
45	580	587	597	609	621	631	639	642	641	637	629	618	604	591	578	567	562		
50	522	532	546	561	576	589	598	603	602	597	588	574	558	541	524	511	503		
55	461	473	492	511	530	545	556	562	562	556	545	529	510	489	468	450	439		
60	395	412	435	460	482	501	514	520	520	514	502	484	461	436	410	386	372		
65	327	350	379	409	435	456	470	478	478	472	458	438	413	383	351	322	301		
70	257	287	324	358	388	411	427	436	436	429	415	394	365	332	294	257	229		
75	189	228	270	310	342	368	385	394	395	388	373	350	320	283	241	196	160		
80	126	173	221	264	299	326	345	354	355	348	333	309	277	238	192	142	96.3		
85	73.3	127	178	222	259	287	306	316	317	310	294	270	238	197	150	96.9	47.4		
90	38.4	89.9	141	185	222	250	269	280	281	274	258	234	202	162	115	64.2	19.7		
95	20.1	63.0	110	154	189	216	235	246	247	240	225	202	171	132	87.8	42.4	8.48		
100	12.6	44.1	85.1	126	160	186	204	214	216	209	195	172	143	106	65.8	29.0	5.62		
105	10.1	32.9	65.5	99.9	132	157	174	184	186	180	166	145	116	83.9	50.5	22.0	5.27		
110	9.30	26.4	52.3	80.9	108	129	145	155	156	151	138	119	95.0	67.7	40.4	18.0	5.70		
115	9.13	22.4	42.8	66.3	88.9	108	121	129	131	126	115	98.9	78.4	55.5	33.2	15.9	6.20		
120	9.32	19.8	35.9	54.9	73.7	89.8	102	108	110	105	96.2	82.4	65.0	46.1	28.1	14.8	6.78		
125	9.66	18.0	30.7	45.9	61.2	74.5	84.5	90.3	91.4	88.0	80.2	68.5	54.1	38.7	24.6	14.1	7.34		
130	10.00	16.7	26.6	38.6	50.9	61.8	70.1	74.9	75.9	73.0	66.5	57.0	45.3	33.0	22.1	13.6	8.06		
135	10.4	15.7	23.6	32.9	42.5	51.2	57.9	61.8	62.6	60.3	55.1	47.4	38.2	28.7	20.1	13.4	8.85		
140	10.8	15.0	21.2	28.3	35.7	42.4	47.6	50.7	51.3	49.5	45.4	39.4	32.4	25.1	18.5	13.3	9.64		
145	11.3	14.4	18.8	24.6	30.1	35.1	39.0	41.4	41.8	40.5	37.4	32.9	27.7	22.2	17.2	13.1	10.4		
150	11.6	13.9	17.2	21.4	25.4	29.0	31.9	33.6	34.0	33.0	30.8	27.6	23.8	19.9	16.1	13.2	10.9		
155	11.2	13.1	15.4	18.0	21.5	24.0	26.0	27.3	27.6	27.0	25.5	23.3	20.7	17.9	15.3	13.2	10.7		
160	9.01	11.5	13.2	15.1	17.6	19.9	21.2	22.1	22.4	22.1	21.3	19.9	18.2	16.4	14.9	13.2	9.80		
165	7.61	9.51	10.6	11.7	13.4	15.2	17.6	18.1	18.3	18.2	17.8	17.1	16.2	15.3	14.4	12.7	8.58		
170	7.16	7.98	9.44	10.0	10.2	10.4	12.0	14.6	15.4	15.4	15.3	14.8	14.1	13.6	12.5	9.94	7.85		
175	9.07	9.22	9.37	9.78	9.68	9.83	8.75	8.04	10.2	13.6	12.9	11.3	10.7	10.3	10.1	9.54	9.36		
180	0.22	0.21	0.19	0.16	0.13	0.10	0.06	0.03	0.00	0.03	0.06	0.09	0.12	0.14	0.16	0.18	0.19		

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

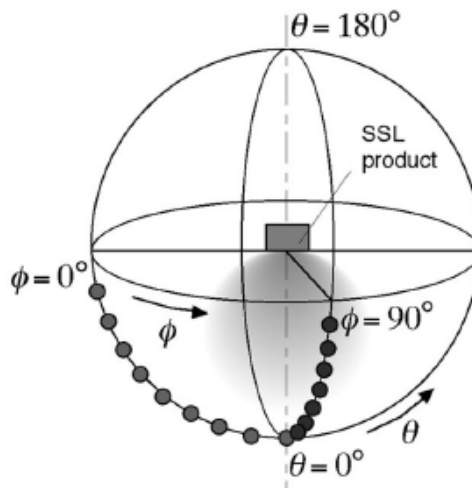
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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