

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube System

Model: 22T5HO/4F/835/EXT/A2

(LED tube model: 22T5HO/4F/835/EXT 2pcs and LED driver model: 24T5HODRIVER/2CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18080024ab

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/835/EXT/A2

Luminous Efficacy (Lumens /Watt)	Luminous Flux per lamp (Lumens)	Power (Watts)/2	Power Factor
133.5	3412.0	25.56	0.9956
CCT (K)	CRI	Stabilization Time (Light & Power)	
3394	82.1	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

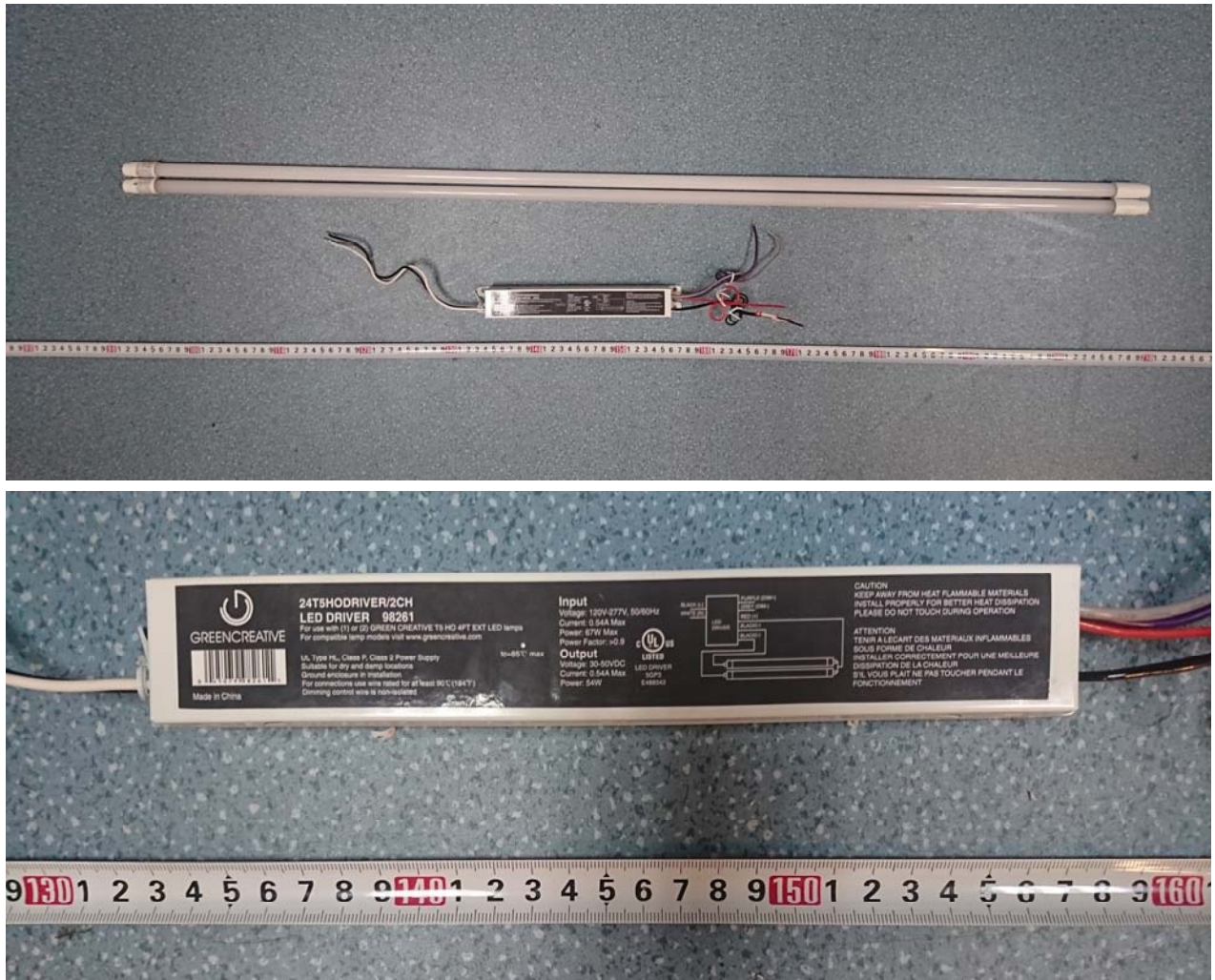


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 22T5HO/4F/835/EXT/A2
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 3500K LED tube model: 22T5HO/4F/835/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	0.193
Power Factor	0.9956	0.9559
Test Power (W)/2	25.56	25.57
THD A%	4.92	6.93
Luminous Efficacy (lm/W)	133.5	133.5
Luminous Flux per lamp (lm)	3412.0	3412.0
Color Rendering Index (CRI)	82.1	
R9	1.9	
Correlated Color Temperature (CCT)(K)	3394	
Chromaticity Chroma x	0.4122	
Chromaticity Chroma y	0.3959	
Chromaticity Chroma u	0.2380	
Chromaticity Chroma v	0.3430	
Duv	0.0004	
Chromaticity Chroma u'	0.2380	
Chromaticity Chroma v'	0.5144	

Special Color Rendering Indices	
R1	80.5
R2	91.3
R3	95.6
R4	79.1
R5	80.6
R6	88.7
R7	82.5
R8	58.3
R9	1.9
R10	79.5
R11	78.1
R12	66.5
R13	83.3
R14	98.2
Rf	82
Rg	94

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	25.64
Luminous Efficacy (lm/W)	131.1
Luminous Flux per lamp (lm)	3360.8
Beam Angle (°)	119.3
Center Beam Candle Power (cd)	918
Spacing Criteria	1.23 (0°-180°)/ 1.31 (90°-270°)
Zonal Lumens in the 0°-60°Zone	63.22%
Zonal Lumens in the 60°-90°Zone	25.92%
Zonal Lumens in the 90°-120°Zone	8.01%
Zonal Lumens in the 120°-180°Zone	2.85%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

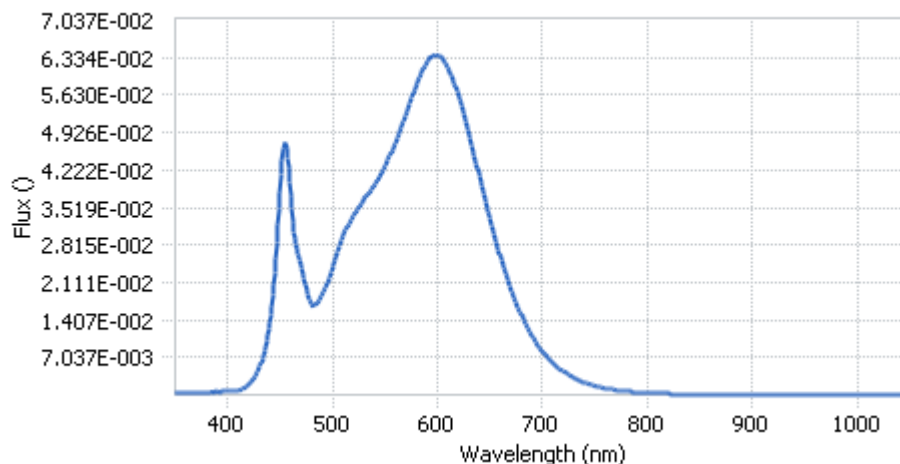


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	5.89E-04	485	1.73E-02	590	6.26E-02	695	9.53E-03
385	5.19E-04	490	1.88E-02	595	6.35E-02	700	8.18E-03
390	6.41E-04	495	2.10E-02	600	6.37E-02	705	6.99E-03
395	6.25E-04	500	2.41E-02	605	6.32E-02	710	5.96E-03
400	6.87E-04	505	2.72E-02	610	6.12E-02	715	5.10E-03
405	7.56E-04	510	2.97E-02	615	5.90E-02	720	4.37E-03
410	9.54E-04	515	3.20E-02	620	5.60E-02	725	3.74E-03
415	1.29E-03	520	3.38E-02	625	5.25E-02	730	3.18E-03
420	1.96E-03	525	3.54E-02	630	4.89E-02	735	2.70E-03
425	3.14E-03	530	3.68E-02	635	4.49E-02	740	2.31E-03
430	5.19E-03	535	3.80E-02	640	4.09E-02	745	1.97E-03
435	8.40E-03	540	3.95E-02	645	3.68E-02	750	1.70E-03
440	1.37E-02	545	4.11E-02	650	3.30E-02	755	1.45E-03
445	2.30E-02	550	4.29E-02	655	2.93E-02	760	1.25E-03
450	3.82E-02	555	4.51E-02	660	2.59E-02	765	1.07E-03
455	4.71E-02	560	4.75E-02	665	2.27E-02	770	9.15E-04
460	3.75E-02	565	5.01E-02	670	1.97E-02	775	7.84E-04
465	2.82E-02	570	5.28E-02	675	1.72E-02	780	6.76E-04
470	2.45E-02	575	5.56E-02	680	1.49E-02		
475	1.98E-02	580	5.84E-02	685	1.29E-02		
480	1.69E-02	585	6.09E-02	690	1.11E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method

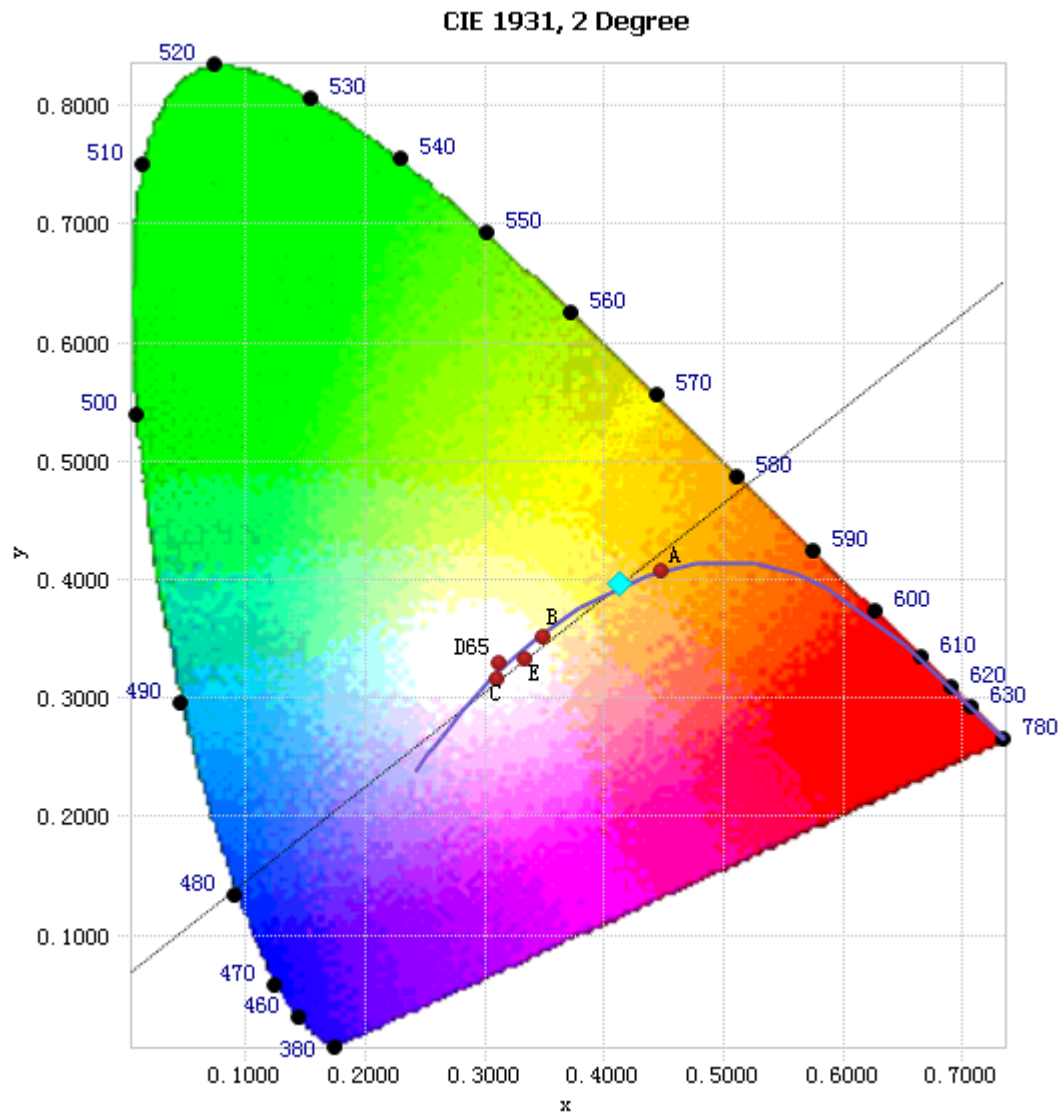


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

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

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

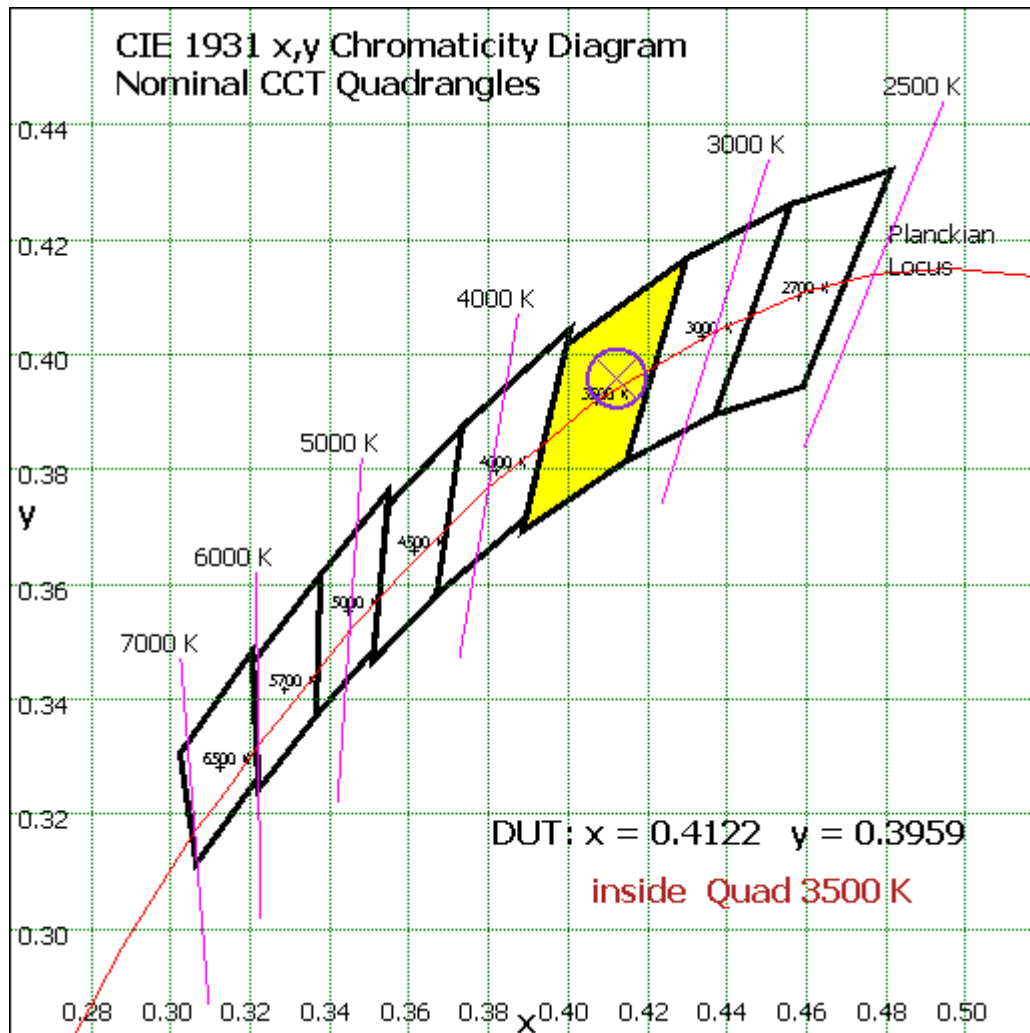


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	86.887	2.59%
10- 20	249.397	7.42%
20- 30	379.745	11.30%
30- 40	461.965	13.75%
40- 50	487.853	14.52%
50- 60	458.782	13.65%
60- 70	386.008	11.49%
70- 80	289.466	8.61%
80- 90	195.756	5.82%
90-100	128.926	3.84%
100-110	84.886	2.53%
110-120	55.447	1.65%
120-130	37.16	1.11%
130-140	25.21	0.75%
140-150	16.608	0.49%
150-160	10.165	0.30%
160-170	5.062	0.15%
170-180	1.452	0.04%
Total	3360.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	2124.629	63.22%
60- 90	871.23	25.92%
0-90	2995.859	89.14%
90- 180	364.916	10.86%
0- 180	3360.8	100%

Table 5: Zonal Lumen Data

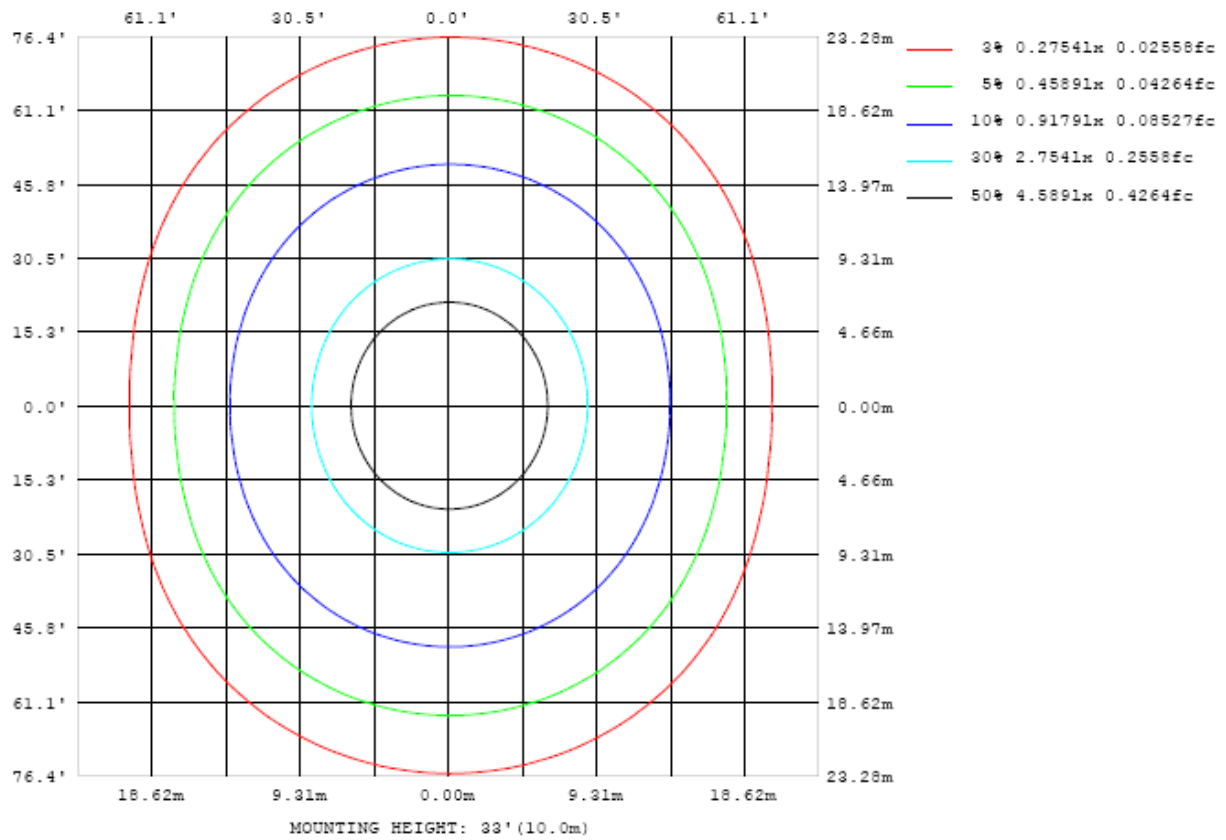


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

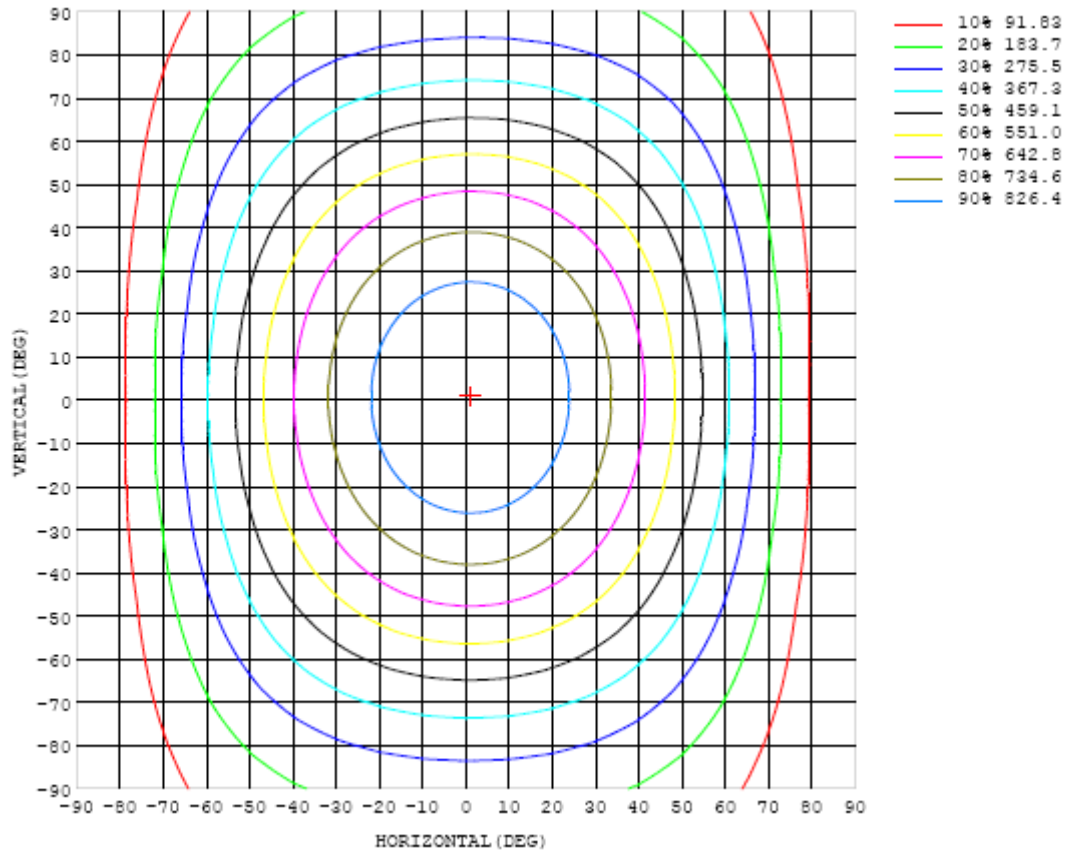


Chart 5: Isocandela Plot

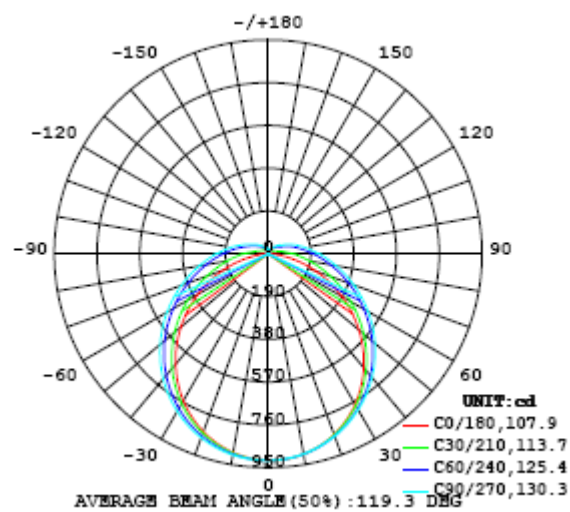


Chart 6: Polar Candela Distribution

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	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918
5	915	915	915	915	915	915	914	914	914	914	913	913	912	912	912	912	911	911	912
10	904	904	903	903	904	904	904	904	903	903	902	901	900	899	898	897	897	896	896
15	884	883	884	884	885	886	886	887	886	886	885	883	881	879	877	875	873	873	873
20	855	855	855	857	859	860	862	863	863	862	861	858	855	851	848	845	842	841	841
25	817	817	819	821	825	828	831	834	834	834	832	828	823	818	813	808	804	801	801
30	772	772	775	779	785	790	795	799	800	800	797	792	786	779	771	764	758	754	754
35	719	720	724	730	738	746	753	758	761	761	758	752	744	734	724	714	706	701	700
40	660	661	667	676	687	697	707	714	717	717	714	707	697	685	672	659	648	641	640
45	595	597	604	616	631	645	657	665	670	670	666	659	647	632	616	600	586	577	575
50	526	528	538	554	572	589	603	613	619	619	615	607	594	577	558	538	521	509	506
55	453	456	469	489	511	531	548	559	566	567	562	554	539	520	498	475	453	438	435
60	378	383	400	423	450	473	491	504	511	512	508	499	483	463	438	411	385	367	361
65	302	308	330	359	389	415	435	449	456	458	454	444	428	406	379	348	318	294	286
70	225	234	262	297	331	359	381	395	403	405	401	391	375	352	323	289	253	224	212
75	151	164	199	239	276	306	329	344	352	354	350	340	324	301	270	234	193	157	141
80	81.9	101	143	188	227	258	281	296	304	306	303	294	277	254	223	185	141	97.2	74.5
85	27.0	51.5	97.7	144	184	215	238	253	261	264	260	251	235	213	182	143	98.0	52.2	23.1
90	0.84	22.0	65.2	109	148	178	201	215	223	226	223	214	199	177	147	110	67.5	24.9	0.29
95	0.71	9.91	43.2	82.2	118	147	169	183	191	193	190	182	168	147	119	84.1	46.3	11.7	0.84
100	1.34	6.71	29.1	62.6	94.3	121	141	155	162	165	162	154	141	121	95.5	64.8	30.7	8.30	1.62
105	2.29	6.23	21.6	46.7	74.9	99.4	118	131	138	141	138	131	118	100.0	76.1	47.2	23.7	7.56	2.61
110	3.46	6.71	18.1	36.7	58.1	79.9	97.6	110	117	119	117	110	97.8	80.1	57.6	37.6	19.6	7.81	3.72
115	4.64	7.68	16.2	30.5	47.6	63.1	78.4	89.8	96.6	98.9	96.6	89.7	77.9	61.8	47.8	32.5	18.0	8.72	4.89
120	5.77	8.83	15.2	26.8	40.3	53.9	63.4	71.9	77.4	79.3	76.9	71.4	62.2	54.3	41.9	27.7	17.0	9.85	6.01
125	6.85	10.0	15.0	23.9	34.9	45.6	55.8	62.3	65.6	66.4	65.3	62.3	56.5	47.0	35.7	25.6	16.5	10.9	7.09
130	7.94	11.1	15.0	21.8	30.6	39.5	47.1	53.4	57.4	58.9	57.7	53.9	47.9	40.0	31.9	23.6	16.2	11.6	7.99
135	8.77	11.6	15.2	20.5	27.3	34.4	40.7	45.5	48.5	49.7	48.8	45.8	40.9	35.2	28.6	21.9	16.3	12.6	9.01
140	9.48	12.1	15.3	19.6	24.8	30.2	35.2	39.2	41.7	42.5	41.8	39.5	35.9	31.1	25.7	20.6	16.4	13.1	9.77
145	10.0	12.8	16.0	18.8	22.7	26.9	30.6	33.7	35.7	36.4	35.9	34.2	31.3	27.6	23.7	19.9	16.5	13.7	10.4
150	10.7	13.6	16.4	18.2	21.2	24.1	27.0	29.2	30.7	31.2	30.9	29.7	27.6	25.0	22.1	19.2	16.5	14.5	11.2
155	11.0	13.7	16.5	18.2	20.1	22.1	23.9	25.5	26.6	27.1	26.9	26.0	24.6	22.8	20.7	18.3	16.6	14.4	11.4
160	10.5	13.5	16.8	18.2	19.2	20.2	21.4	22.6	23.3	23.6	23.4	22.9	22.1	21.3	19.5	17.0	14.6	13.0	11.5
165	10.8	12.6	16.0	18.0	19.0	19.6	19.8	20.3	20.7	20.9	21.0	21.0	20.8	19.4	17.1	14.6	12.7	11.8	11.1
170	11.4	11.4	14.2	16.9	17.9	18.8	19.4	19.5	19.7	19.9	20.0	20.0	18.0	15.3	13.6	13.1	13.2	12.4	11.1
175	14.1	14.0	14.0	14.5	15.8	16.8	17.2	18.0	18.6	18.6	18.4	15.7	12.6	11.9	12.9	13.8	14.0	14.3	14.1
180	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36

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	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918	918		
5	912	912	913	913	914	915	915	915	916	916	916	916	916	916	916	916	915		
10	897	898	899	900	902	904	905	906	907	907	908	907	907	906	906	905	904		
15	874	876	878	880	883	886	888	890	892	892	892	892	890	889	887	886	885		
20	842	845	849	853	857	862	865	868	870	870	870	868	866	863	861	858	856		
25	803	807	812	818	825	831	835	839	842	842	841	839	835	831	826	822	819		
30	756	762	769	777	786	794	800	805	808	809	807	803	798	792	785	779	775		
35	703	710	719	730	741	752	760	766	769	770	767	762	755	746	737	729	723		
40	643	652	664	678	692	704	714	721	725	726	722	716	707	695	683	672	664		
45	579	590	605	622	639	654	665	673	678	678	673	666	654	639	624	610	600		
50	511	524	542	563	583	600	613	622	627	627	622	612	598	581	562	544	532		
55	440	456	478	502	525	544	559	568	573	573	567	556	540	520	497	476	461		
60	368	387	413	441	467	488	503	514	519	518	512	500	482	458	432	406	387		
65	296	319	350	381	409	432	448	459	464	463	457	443	424	398	367	337	313		
70	224	254	289	324	354	378	395	405	411	410	403	389	368	340	306	270	240		
75	157	193	233	271	302	327	344	354	359	358	351	337	315	285	248	207	170		
80	96.2	140	184	223	255	280	296	307	311	310	303	289	266	236	197	152	107		
85	49.5	96.8	143	182	214	237	254	264	268	267	259	245	223	193	154	107	57.9		
90	22.5	65.2	109	148	177	200	216	225	230	228	221	207	186	156	118	72.9	27.5		
95	11.2	43.2	82.8	119	148	169	184	193	196	195	188	174	155	126	89.8	49.1	13.3		
100	7.98	30.8	62.2	93.7	121	142	156	165	168	166	160	147	127	99.8	67.2	34.1	9.14		
105	7.87	24.3	49.0	75.0	97.9	116	130	138	142	140	133	120	102	78.9	52.2	26.1	8.36		
110	8.41	20.8	40.3	61.7	81.4	97.3	109	115	118	116	110	99.7	84.3	64.5	42.4	21.8	8.81		
115	8.77	19.1	34.4	51.9	68.5	82.3	92.3	98.2	101	99.0	93.5	84.1	70.6	53.8	35.5	19.7	9.28		
120	9.73	18.2	30.4	44.5	58.3	70.1	78.7	84.0	86.1	84.7	79.7	71.4	59.8	45.6	30.9	18.7	9.87		
125	10.7	17.8	27.4	38.8	50.1	60.0	67.5	72.1	73.9	72.6	68.3	61.1	51.2	39.5	27.9	18.3	10.8		
130	11.9	17.7	25.4	34.4	43.6	51.8	58.1	62.0	63.5	62.4	58.7	52.5	44.4	35.0	25.8	18.0	12.1		
135	12.9	17.8	23.9	31.1	38.4	45.0	50.2	53.4	54.6	53.7	50.5	45.5	38.9	31.5	24.2	17.4	13.2		
140	13.8	18.0	22.8	28.4	34.1	39.4	43.5	46.0	47.1	46.2	43.6	39.6	34.4	28.7	22.8	17.9	14.0		
145	14.5	18.0	21.9	26.3	30.6	34.6	37.7	39.7	40.5	39.9	37.9	34.8	30.8	26.2	21.4	18.3	14.6		
150	14.8	18.6	21.2	24.4	27.6	30.5	32.9	34.4	35.0	34.6	33.1	30.7	27.6	24.0	21.1	18.7	15.1		
155	13.6	17.3	18.3	21.9	24.9	26.9	28.7	29.8	30.3	30.0	29.0	27.2	24.8	22.8	20.8	18.5	14.2		
160	11.5	14.2	16.6	17.7	20.8	23.9	25.1	25.7	26.0	25.9	25.3	24.4	23.3	21.9	20.6	17.4	12.6		
165	11.1	12.1	13.5	14.5	14.9	16.8	20.8	22.9	23.2	23.1	22.9	22.5	21.7	20.8	19.4	15.0	11.1		
170	11.7	11.9	12.2	13.8	14.0	14.3	13.2	15.9	21.2	21.1	20.8	19.9	19.3	17.6	14.4	12.3	11.3		
175	14.5	14.9	15.1	15.3	15.4	15.6	15.1	14.0	9.45	13.6	15.4	16.1	15.9	14.9	14.6	14.6	14.4		
180	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36		

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

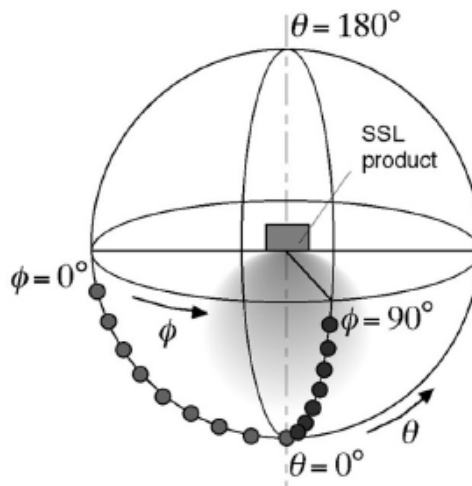
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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