

LM-79-19 TEST REPORT

for

GREEN CREATIVE LTD

Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL,
Hong Kong

LED Tube

Model: 24T5HO/4F/830/UEB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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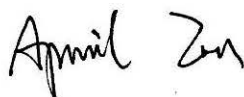
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Report No.: HZ22060037c

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

Review by:



Engineer: April Zou

Jun. 30, 2022

Approved by:



Manager: Jim Zhang

Jun. 30, 2022

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: **24T5HO/4F/830/UEB**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
129.3	3272.1	25.31	0.9813
CCT (K)	CRI	Stabilization Time (Light & Power)	
2960	82.0	50	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

Test specifications:

Date of Receipt	: Jun. 15, 2022
Date of Test	: Jun. 17, 2022
Test item	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
Reference Standard	: IESNA LM-79-2019 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

TABLE OF CONTENT

LM-79-19 TEST REPORT	1
TEST SUMMARY	2
SAMPLE PHOTO	4
TEST RESULTS	5
Sphere-Spectroradiometer Method.....	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Color Rendition Report – Sphere Spectroradiometer Method	10
Zonal Lumen Tabulation- Goniophotometer Method	11
Illuminance Plots- Goniophotometer Method	12
Luminous Intensity Distribution Plots- Goniophotometer Method.....	13
Luminous Intensity Data- Goniophotometer Method	14
EQUIPMENT LIST	16
TEST METHODS	16
Seasoning of SSL Product.....	16
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	16
Goniophotometer Method	17
Photometric and Electrical Measurements	17
Color Characteristics Measurements.....	17

SAMPLE PHOTO



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 24T5HO/4F/830/UEB
Electrical Ratings	: 120-277V, 60Hz, 24W
Product Description	: 3000K

TEST RESULTS

Test ambient temperature was 26.0°C.

Base orientation was base up. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 50 minutes, and the total operating time including stabilization was 55 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.215	0.098
Power Factor	0.9813	0.9132
Test Power (W)	25.31	24.91
THD A%	18.26	24.79
Luminous Efficacy (lm/W)	129.3	132.1
Total Luminous Flux (lm)	3272.1	3290.6
Color Rendering Index (CRI)	82.0	
R9	4.7	
Correlated Color Temperature (CCT)(K)	2960	
Chromaticity Chroma x	0.4388	
Chromaticity Chroma y	0.4032	
Chromaticity Chroma u	0.2521	
Chromaticity Chroma v	0.3475	
Duv	-0.0006	
Chromaticity Chroma u'	0.2521	
Chromaticity Chroma v'	0.5213	

Special Color Rendering Indices	
R1	80.2
R2	90.4
R3	96.2
R4	80.2
R5	80.7
R6	88.6
R7	82.1
R8	57.7
R9	4.7
R10	78.7
R11	79.8
R12	72.9
R13	82.6
R14	98.5

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 24.8°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)	0.218
Power Factor	0.9815
Power (W)	25.61
Luminous Efficacy (lm/W)	127.2
Total Luminous Flux (lm)	3257.0
Beam Angle (°)	109.1 (0°-180°) / 154.0 (90°-270°)
Center Beam Candle Power (cd)	712
Maximum Beam Candle Power (cd)	717.4 (At: C=240.0, Gamma=7.5)
Spacing Criteria	1.29 (0°-180°) / 1.38 (90°-270°)
Zonal Lumens in the 0°-60°Zone	52.77%
Zonal Lumens in the 60°-90°Zone	26.41%
Zonal Lumens in the 90°-120°Zone	13.05%
Zonal Lumens in the 120°-180°Zone	7.77%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

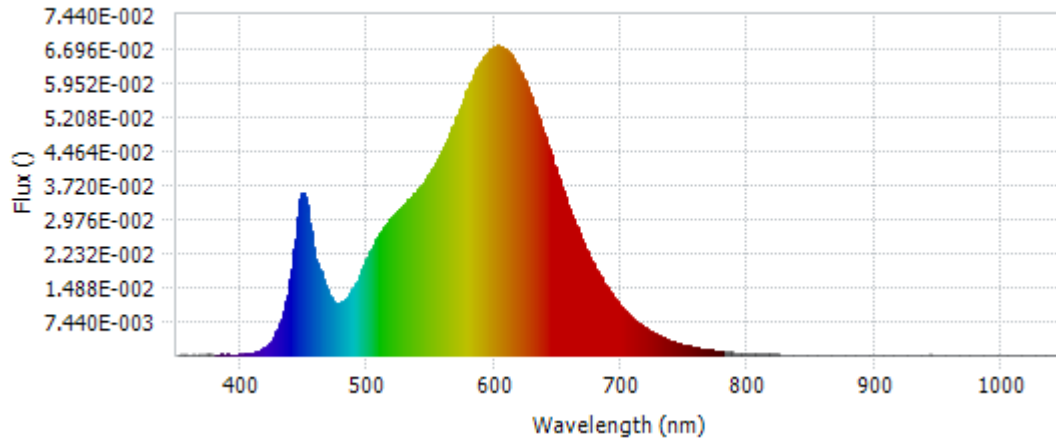
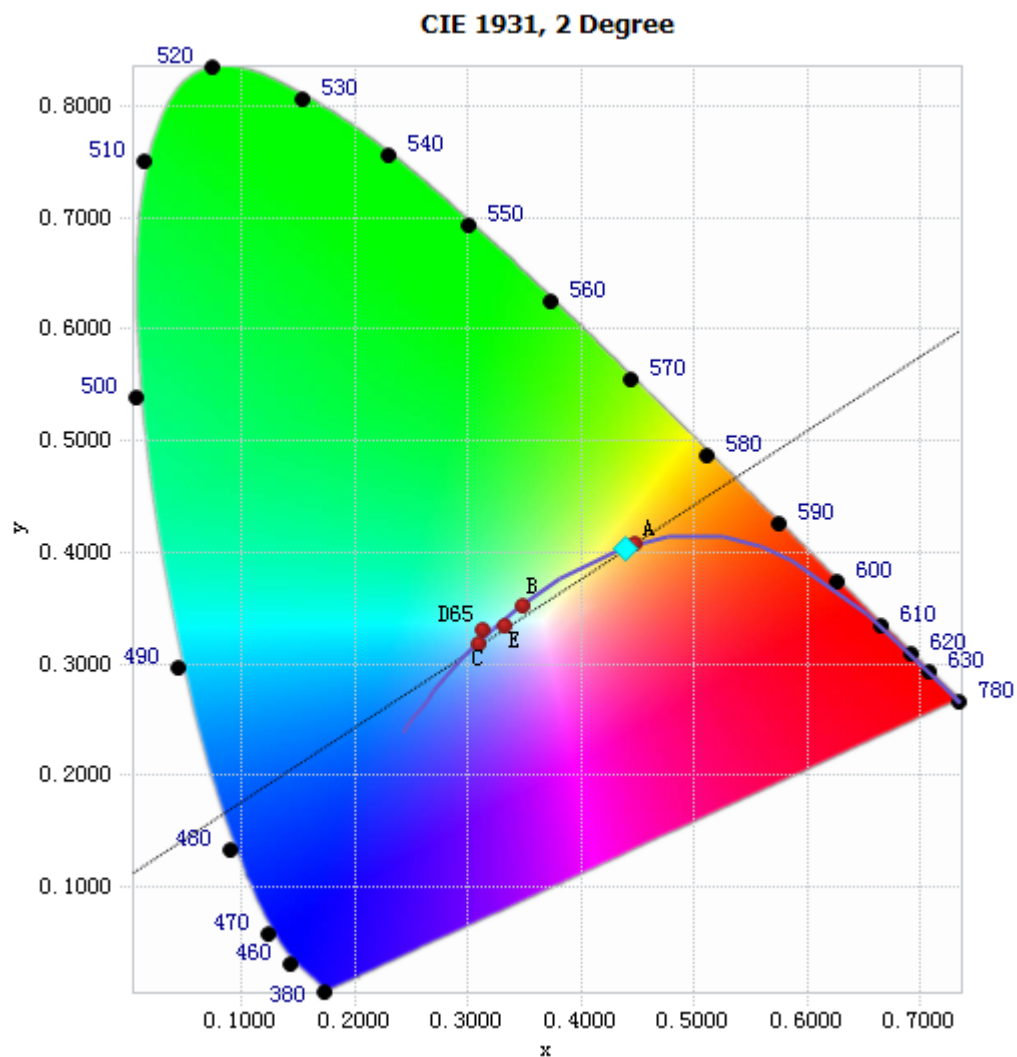


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.30E-04	485	1.31E-02	590	6.44E-02	695	1.24E-02
385	2.47E-04	490	1.53E-02	595	6.62E-02	700	1.06E-02
390	1.84E-04	495	1.83E-02	600	6.74E-02	705	9.15E-03
395	2.23E-04	500	2.14E-02	605	6.75E-02	710	7.87E-03
400	2.27E-04	505	2.43E-02	610	6.65E-02	715	6.72E-03
405	2.88E-04	510	2.67E-02	615	6.49E-02	720	5.81E-03
410	5.85E-04	515	2.88E-02	620	6.24E-02	725	4.98E-03
415	1.08E-03	520	3.04E-02	625	5.93E-02	730	4.23E-03
420	1.97E-03	525	3.19E-02	630	5.56E-02	735	3.62E-03
425	3.58E-03	530	3.31E-02	635	5.17E-02	740	3.07E-03
430	6.36E-03	535	3.47E-02	640	4.77E-02	745	2.63E-03
435	1.09E-02	540	3.62E-02	645	4.36E-02	750	2.23E-03
440	1.86E-02	545	3.81E-02	650	3.92E-02	755	1.91E-03
445	3.02E-02	550	4.01E-02	655	3.54E-02	760	1.64E-03
450	3.53E-02	555	4.26E-02	660	3.15E-02	765	1.40E-03
455	2.71E-02	560	4.53E-02	665	2.79E-02	770	1.20E-03
460	2.02E-02	565	4.86E-02	670	2.46E-02	775	1.03E-03
465	1.68E-02	570	5.20E-02	675	2.16E-02	780	8.70E-04
470	1.32E-02	575	5.53E-02	680	1.90E-02		
475	1.13E-02	580	5.90E-02	685	1.65E-02		
480	1.17E-02	585	6.20E-02	690	1.43E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4388, 0.4032)

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

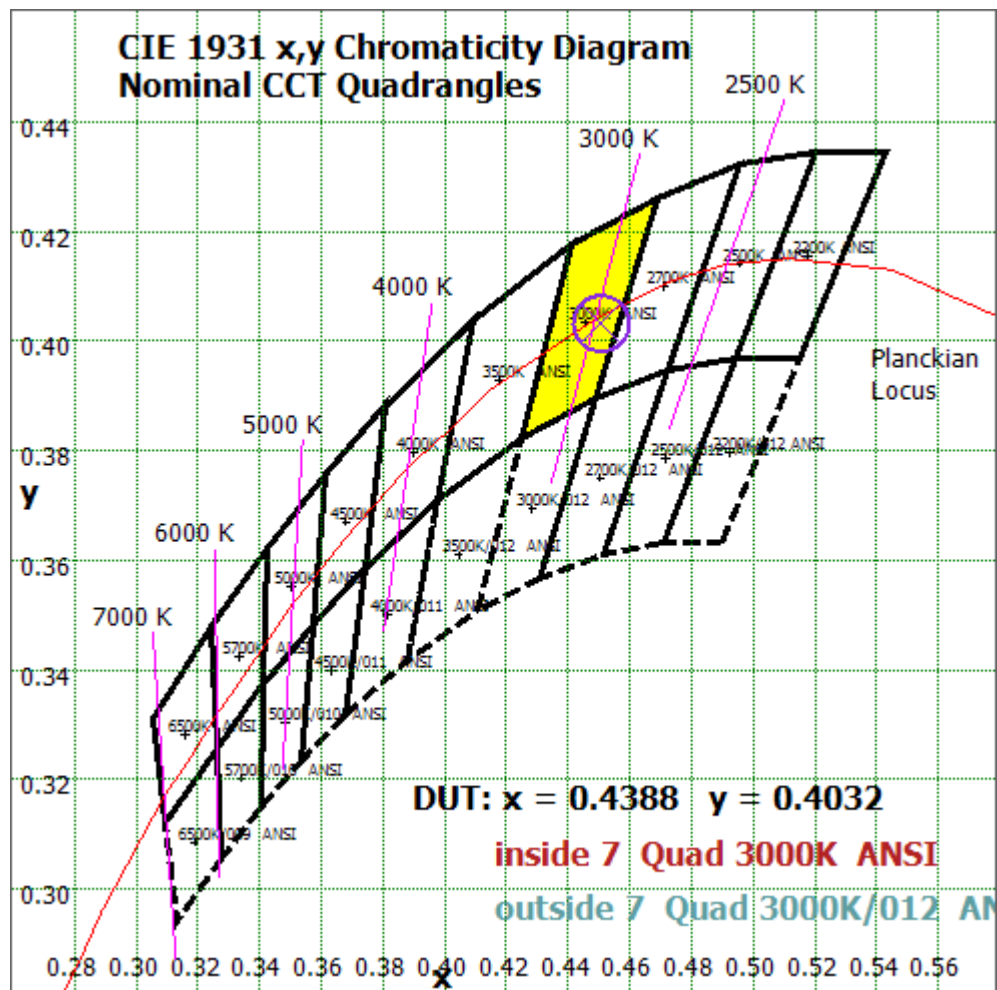


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

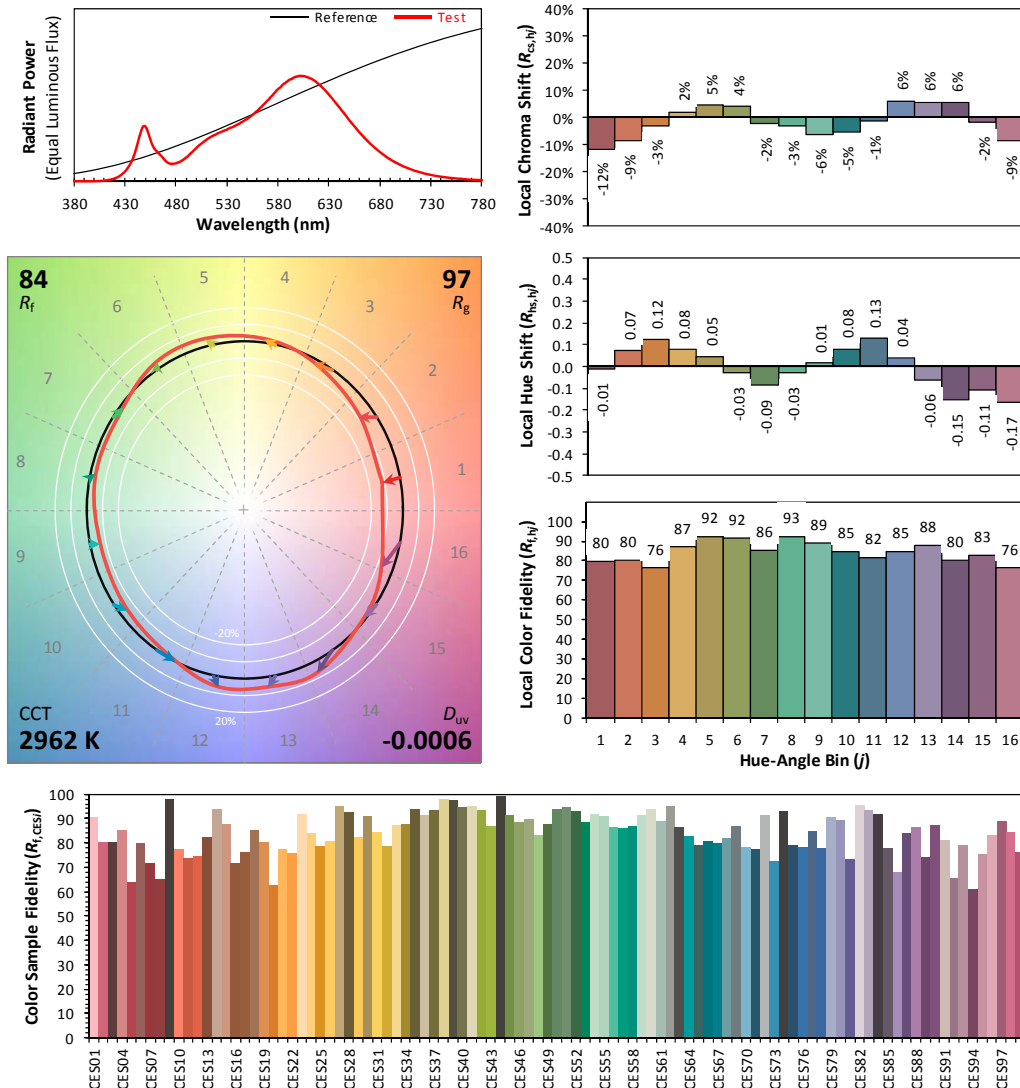
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2022/06/17

Model: 24T5HO/4F/830/UEB



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

x 0.4388
 y 0.4032
 u' 0.2521
 v' 0.5213

CIE 13.3-1995
(CRI)
 R_a 82
 R_9 5

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

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	67.455	2.07%
10- 20	194.544	5.97%
20- 30	299.106	9.18%
30- 40	369.229	11.34%
40- 50	399.058	12.25%
50- 60	389.391	11.96%
60- 70	347.722	10.68%
70- 80	287.522	8.83%
80- 90	224.839	6.90%
90-100	174.679	5.36%
100-110	139.426	4.28%
110-120	111.084	3.41%
120-130	86.674	2.66%
130-140	65.158	2.00%
140-150	46.75	1.44%
150-160	29.895	0.92%
160-170	18.065	0.55%
170-180	6.385	0.20%
Total	3257.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1718.78	52.77%
60- 90	860.083	26.41%
0-90	2578.87	79.18%
90- 180	678.116	20.82%
0- 180	3257.0	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

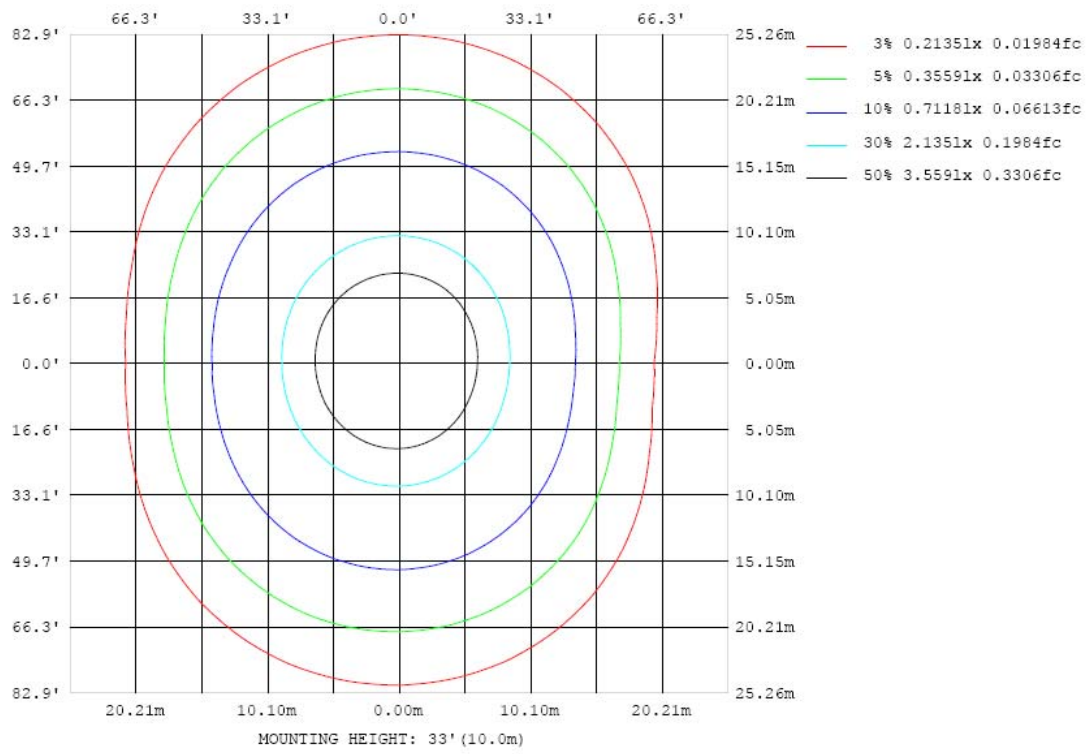


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

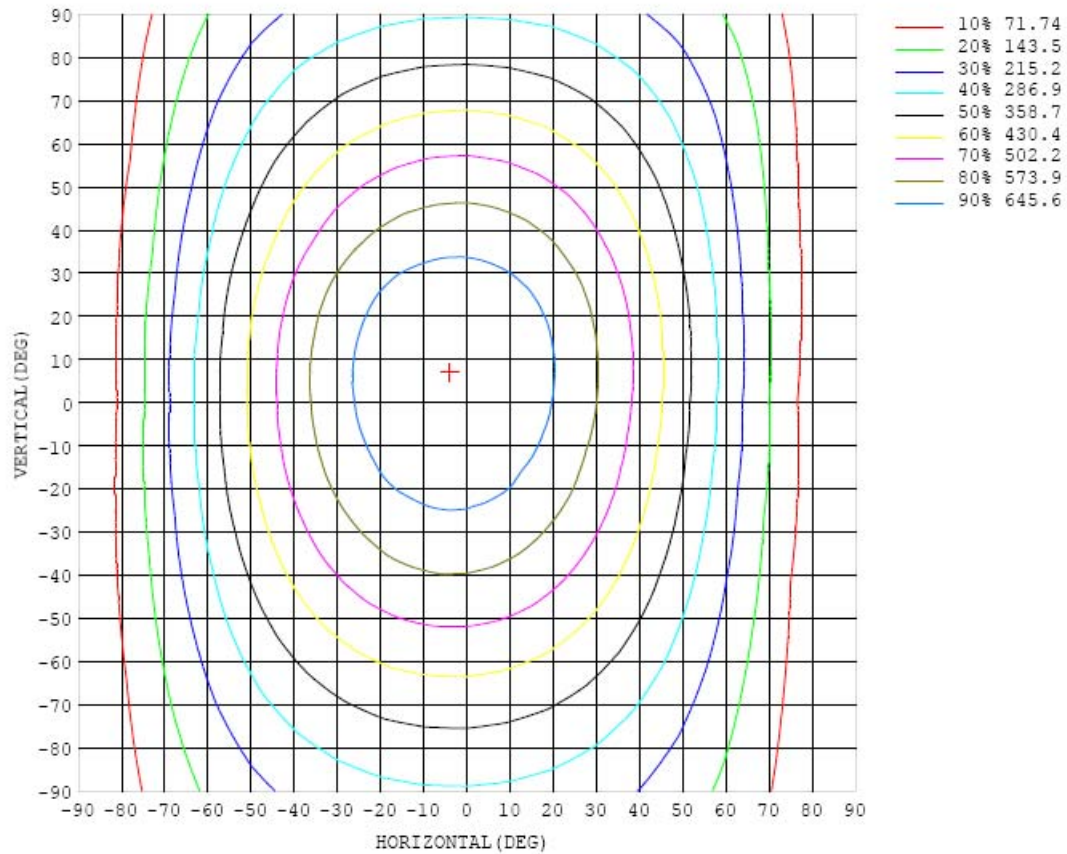


Chart 6: Isocandela Plot

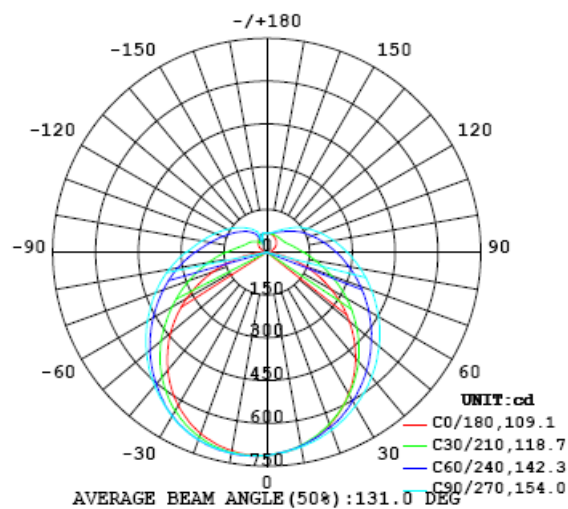


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712
5	704	704	702	702	702	702	702	703	704	704	705	706	706	707	709	710	711	712	713
10	691	689	687	688	688	689	689	691	693	694	695	696	698	700	701	703	704	705	706
15	671	667	667	667	668	670	672	675	678	680	681	684	685	687	687	689	691	691	695
20	643	641	640	641	644	646	652	656	661	663	667	669	669	668	669	670	672	674	677
25	612	608	608	611	615	624	630	635	639	644	647	648	648	649	649	647	647	648	652
30	574	571	571	576	585	594	602	610	618	622	625	624	625	622	622	619	617	616	620
35	531	528	531	539	551	562	574	584	591	598	600	601	599	595	589	586	582	580	583
40	484	481	487	499	514	529	544	556	565	571	575	573	571	563	555	547	541	539	540
45	433	431	440	456	475	494	512	527	536	543	546	544	538	530	518	507	498	492	492
50	378	378	391	412	435	459	479	496	507	513	515	513	506	494	480	463	450	442	440
55	320	323	341	367	396	423	445	464	476	483	484	481	472	458	439	419	401	388	384
60	261	266	290	323	357	388	413	432	445	452	453	448	437	421	399	374	349	331	324
65	201	209	240	280	319	353	380	401	414	421	422	416	404	385	359	329	298	272	263
70	143	155	194	241	284	321	349	371	384	391	391	384	370	349	321	286	248	215	200
75	87.6	105	153	205	252	290	320	342	355	362	361	354	339	316	285	246	202	161	140
80	39.9	62.8	119	175	223	262	292	314	328	334	333	324	309	285	252	210	161	113	82.7
85	9.13	34.8	92.3	149	197	237	267	288	301	307	305	297	281	256	223	179	128	72.6	34.8
90	1.79	22.5	74.6	129	176	214	244	264	277	282	280	272	255	230	197	153	101	45.1	5.32
95	4.27	18.9	63.4	113	157	193	222	242	254	259	257	248	232	207	174	133	82.7	31.1	2.07
100	8.32	19.9	56.5	101	142	175	203	221	233	238	235	227	210	187	155	116	70.2	25.7	4.48
105	13.7	22.8	51.7	91.1	129	159	185	202	213	218	215	207	191	168	139	103	61.9	24.7	8.47
110	19.9	27.3	49.8	83.0	117	146	168	185	195	199	197	189	174	153	126	92.2	55.8	26.2	13.6
115	26.5	32.1	50.0	76.5	107	134	155	169	179	182	180	172	158	139	114	83.3	52.3	29.2	19.9
120	32.9	36.8	51.2	72.5	97.0	121	141	154	163	166	164	157	144	126	102	75.8	51.0	32.5	26.3
125	38.5	41.7	52.9	69.9	89.6	110	127	140	148	151	149	142	130	113	92.7	70.9	51.3	36.7	32.5
130	43.8	46.2	54.8	68.5	84.1	99.9	114	126	133	136	134	128	117	102	85.0	67.8	52.1	41.0	38.0
135	48.4	50.2	57.0	67.5	79.9	92.5	104	113	119	121	119	114	105	92.9	79.6	65.9	53.6	45.2	42.9
140	51.8	53.9	59.0	67.0	76.6	86.6	95.3	102	107	108	107	102	95.2	86.0	75.3	64.8	55.4	49.2	47.2
145	56.1	57.4	60.8	66.7	73.9	81.4	88.2	93.5	96.9	98.0	96.7	93.3	87.7	80.5	72.3	64.3	57.3	52.9	51.4
150	57.5	60.1	62.5	66.7	71.8	77.2	82.1	86.1	88.6	89.4	88.3	85.6	81.3	76.0	70.0	64.1	59.3	56.3	55.5
155	61.2	62.6	63.9	66.7	70.2	73.9	77.2	79.9	81.6	82.2	81.3	79.3	76.3	72.6	68.3	64.3	61.2	59.2	58.6
160	63.2	64.3	65.1	66.8	68.9	71.3	73.3	75.0	76.1	76.4	75.8	74.4	72.5	69.9	67.3	64.8	62.7	61.6	61.5
165	66.0	65.8	66.1	66.9	67.9	69.2	70.4	71.2	71.7	71.8	71.4	70.7	69.6	68.2	66.7	65.3	64.3	63.8	63.7
170	66.5	66.5	66.6	66.9	67.4	67.8	68.3	68.7	68.8	68.9	68.7	68.2	67.8	67.1	66.5	65.9	65.6	65.3	65.4
175	67.0	67.0	67.0	67.1	67.1	67.1	67.2	67.2	67.2	67.2	67.2	67.1	66.9	66.7	66.5	66.4	66.5	66.4	66.5
180	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9

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	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712	712		
5	715	714	715	716	717	717	717	717	716	715	714	712	710	708	709	707	706		
10	709	710	713	715	716	716	716	715	715	713	711	707	705	702	699	696	694		
15	699	700	704	707	710	711	711	711	710	707	703	698	695	689	685	679	674		
20	680	685	689	694	697	701	702	701	699	696	691	686	679	671	663	654	649		
25	657	662	669	675	680	684	686	686	684	680	675	667	658	647	635	626	618		
30	626	634	641	649	657	662	665	666	665	659	653	644	633	619	605	592	581		
35	590	598	609	620	630	634	638	639	638	634	627	617	603	586	569	553	540		
40	547	559	572	585	594	603	609	612	611	606	598	585	569	551	530	511	494		
45	500	513	530	544	558	570	579	582	583	576	568	553	533	510	487	464	444		
50	449	465	484	500	519	534	545	550	550	544	534	519	496	470	442	415	391		
55	393	412	433	457	480	497	510	517	517	511	500	483	459	429	397	365	336		
60	334	358	384	413	439	460	474	482	484	478	466	447	421	389	352	313	280		
65	275	300	336	370	400	422	438	447	449	444	432	412	384	350	309	263	224		
70	214	247	289	328	360	386	403	413	415	411	399	378	349	313	268	218	169		
75	154	197	246	289	324	351	369	379	382	377	366	345	316	278	231	177	120		
80	101	154	207	253	290	317	334	345	347	344	332	312	284	246	199	142	80.3		
85	59.1	117	173	220	256	283	301	312	315	311	300	281	253	216	169	113	52.3		
90	32.8	87.9	142	189	225	251	270	279	283	279	267	249	221	185	140	87.8	35.0		
95	20.1	67.3	118	163	197	223	241	251	254	251	241	223	198	165	123	75.6	30.0		
100	17.7	56.7	101	142	175	200	217	227	231	228	219	203	179	148	110	68.6	28.7		
105	18.1	51.1	88.3	126	157	181	197	207	211	209	201	185	164	135	101	64.8	29.6		
110	18.7	48.9	79.8	113	141	164	180	189	193	191	183	169	150	124	93.3	62.4	30.8		
115	19.4	46.1	74.4	102	128	149	164	173	176	175	168	155	137	114	87.5	59.7	31.9		
120	23.0	42.7	70.0	94.7	117	135	149	158	161	160	154	142	126	106	82.8	56.7	35.0		
125	30.1	38.8	64.1	88.7	107	124	136	144	147	147	141	131	116	98.7	78.0	52.5	38.5		
130	37.4	33.6	58.0	81.0	99.4	113	124	131	135	134	129	120	108	90.5	71.6	47.8	43.5		
135	43.9	34.3	53.5	73.4	90.6	104	113	119	122	122	118	111	98.6	83.7	65.4	46.1	49.7		
140	49.6	45.9	47.2	69.2	79.4	93.2	103	109	112	111	108	99.0	87.2	80.0	56.6	50.3	53.9		
145	52.9	53.8	38.9	65.7	71.1	82.5	92.9	98.2	101	101	94.1	83.3	75.9	71.9	49.0	58.7	56.7		
150	56.4	59.1	55.8	39.9	56.8	69.9	79.7	87.1	89.9	77.1	66.1	66.6	68.6	50.1	58.0	62.7	59.6		
155	59.1	61.3	61.5	49.5	38.2	43.8	48.3	63.8	80.7	57.2	59.3	52.8	46.4	47.9	58.5	63.3	61.6		
160	61.7	63.1	65.1	66.0	58.0	40.0	44.8	58.9	51.2	60.8	54.4	45.7	46.7	54.1	59.0	64.5	59.4		
165	63.6	64.3	65.6	66.9	67.0	65.8	62.9	63.7	45.0	49.1	51.9	50.5	50.9	55.7	61.5	59.8	65.4		
170	65.3	65.7	66.2	66.7	67.5	68.3	68.9	69.2	69.7	62.9	55.3	55.0	56.4	56.4	66.8	67.0	67.0		
175	66.6	66.6	66.7	66.8	67.0	67.2	67.3	67.4	67.5	67.5	67.5	67.4	67.3	67.2	67.2	67.0	66.9		
180	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 05, 2021	Aug. 04, 2022
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2021	Aug. 04, 2022
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2021	Aug. 04, 2022
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2021	Aug. 04, 2022
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2021	Aug. 04, 2022
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2021	Aug. 04, 2022
Standard source	D908	HZTE012-01	Aug. 05, 2021	Aug. 04, 2022
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2021	Aug. 04, 2022
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2021	Aug. 04, 2022
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2021	Aug. 04, 2022
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2021	Aug. 04, 2022
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2021	Aug. 04, 2022
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2021	Aug. 04, 2022
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2021	Aug. 04, 2022

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 3 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 20 min, taken 10 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 20 min, taken 10 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.

*** End of Report ***

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