

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: 14.5T5HO/3F/835/BYP/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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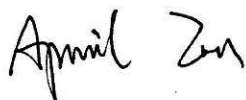
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www.ledtestlab.com

Report No.: HZ22070025q

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

Review by:



Engineer: April Zou
Aug. 16, 2022

Approved by:



Manager: Jim Zhang
Aug. 16, 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: 14.5T5HO/3F/835/BYP/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
132.6	1995.6	15.05	0.9681
CCT (K)	CRI	Stabilization Time (Light & Power)	
3499	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	: Jul. 20, 2022
Date of Test	: Aug. 15, 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

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SAMPLE PHOTO



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 14.5T5HO/3F/835/BYP/R
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 3500K
Manufacturer	: GREEN CREATIVE LTD
Address	: Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong

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)	0.130	0.060
Power Factor	0.9681	0.9332
Test Power (W)	15.05	15.38
THD A%	22.58	17.56
Luminous Efficacy (lm/W)	132.6	132.2
Total Luminous Flux (lm)	1995.6	2032.8
Color Rendering Index (CRI)	82.0	
R9	1.6	
Correlated Color Temperature (CCT)(K)	3499	
Chromaticity Chroma x	0.4061	
Chromaticity Chroma y	0.3931	
Chromaticity Chroma u	0.2353	
Chromaticity Chroma v	0.3416	
Duv	0.0009	
Chromaticity Chroma u'	0.2353	
Chromaticity Chroma v'	0.5124	

Special Color Rendering Indices	
R1	79.9
R2	89.4
R3	96.3
R4	80.5
R5	80.3
R6	86.3
R7	83.9
R8	59.6
R9	1.6
R10	75.8
R11	79.7
R12	66.9
R13	82.1
R14	98.3

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)	0.130
Power Factor	0.9683
Power (W)	15.12
Luminous Efficacy (lm/W)	132.5
Total Luminous Flux (lm)	2003.3
Beam Angle (°)	112.2 (0°-180°) / 232.9 (90°-270°)
Center Beam Candle Power (cd)	318
Maximum Beam Candle Power (cd)	318.7 (At: C=290.0, Gamma=6.0)
Spacing Criteria	1.22 (0°-180°) / 1.47 (90°-270°)
Zonal Lumens in the 0°-60°Zone	41.62%
Zonal Lumens in the 60°-90°Zone	26.97%
Zonal Lumens in the 90°-120°Zone	17.98%
Zonal Lumens in the 120°-180°Zone	13.43%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

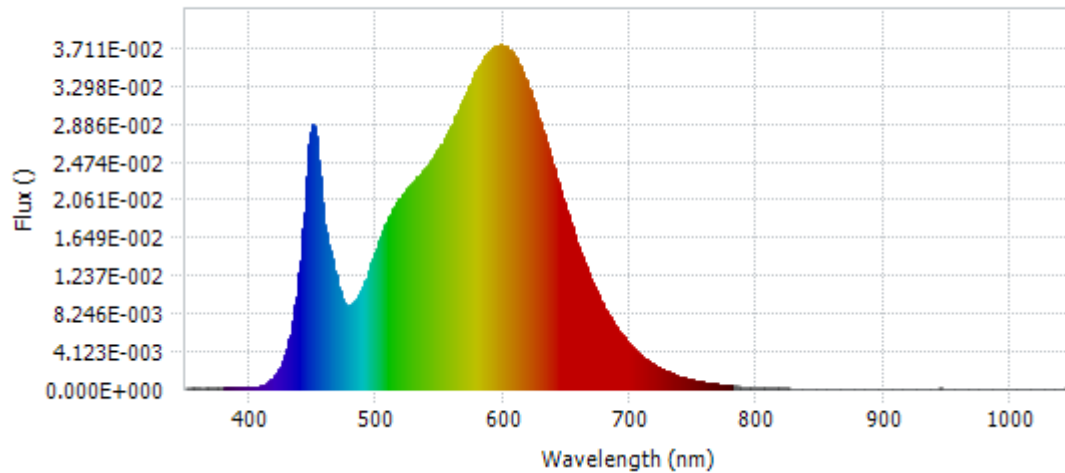
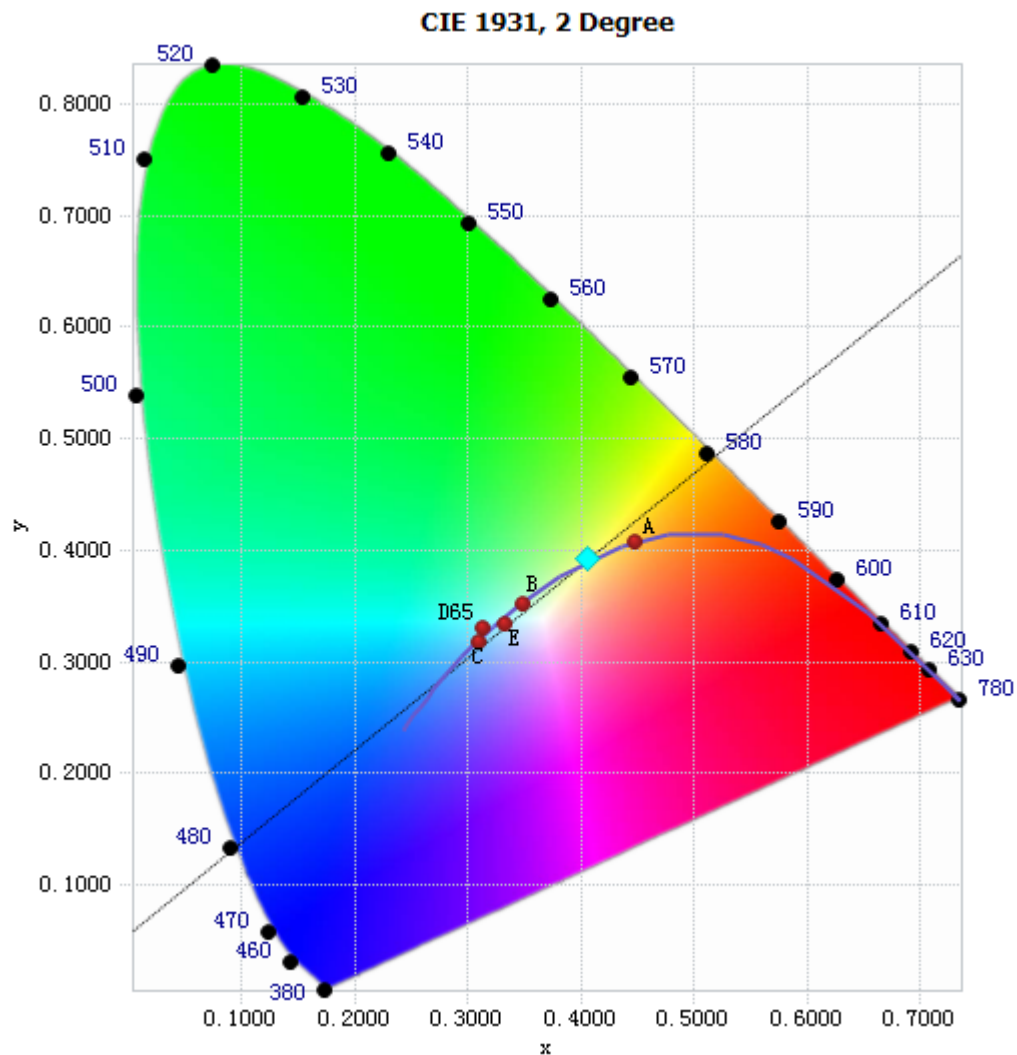


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.73E-04	485	1.00E-02	590	3.68E-02	695	5.62E-03
385	1.32E-04	490	1.13E-02	595	3.73E-02	700	4.80E-03
390	1.52E-04	495	1.34E-02	600	3.73E-02	705	4.11E-03
395	1.32E-04	500	1.53E-02	605	3.68E-02	710	3.49E-03
400	1.42E-04	505	1.72E-02	610	3.59E-02	715	2.99E-03
405	2.13E-04	510	1.87E-02	615	3.45E-02	720	2.56E-03
410	4.21E-04	515	2.02E-02	620	3.27E-02	725	2.18E-03
415	7.89E-04	520	2.11E-02	625	3.08E-02	730	1.86E-03
420	1.45E-03	525	2.19E-02	630	2.85E-02	735	1.57E-03
425	2.67E-03	530	2.26E-02	635	2.63E-02	740	1.33E-03
430	4.79E-03	535	2.34E-02	640	2.39E-02	745	1.13E-03
435	8.25E-03	540	2.43E-02	645	2.15E-02	750	9.62E-04
440	1.39E-02	545	2.53E-02	650	1.94E-02	755	8.22E-04
445	2.31E-02	550	2.64E-02	655	1.72E-02	760	7.13E-04
450	2.88E-02	555	2.75E-02	660	1.51E-02	765	5.93E-04
455	2.31E-02	560	2.88E-02	665	1.33E-02	770	5.18E-04
460	1.70E-02	565	3.03E-02	670	1.16E-02	775	4.44E-04
465	1.41E-02	570	3.19E-02	675	1.02E-02	780	3.78E-04
470	1.11E-02	575	3.34E-02	680	8.78E-03		
475	9.19E-03	580	3.49E-02	685	7.60E-03		
480	9.15E-03	585	3.62E-02	690	6.54E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4061, 0.3931)

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

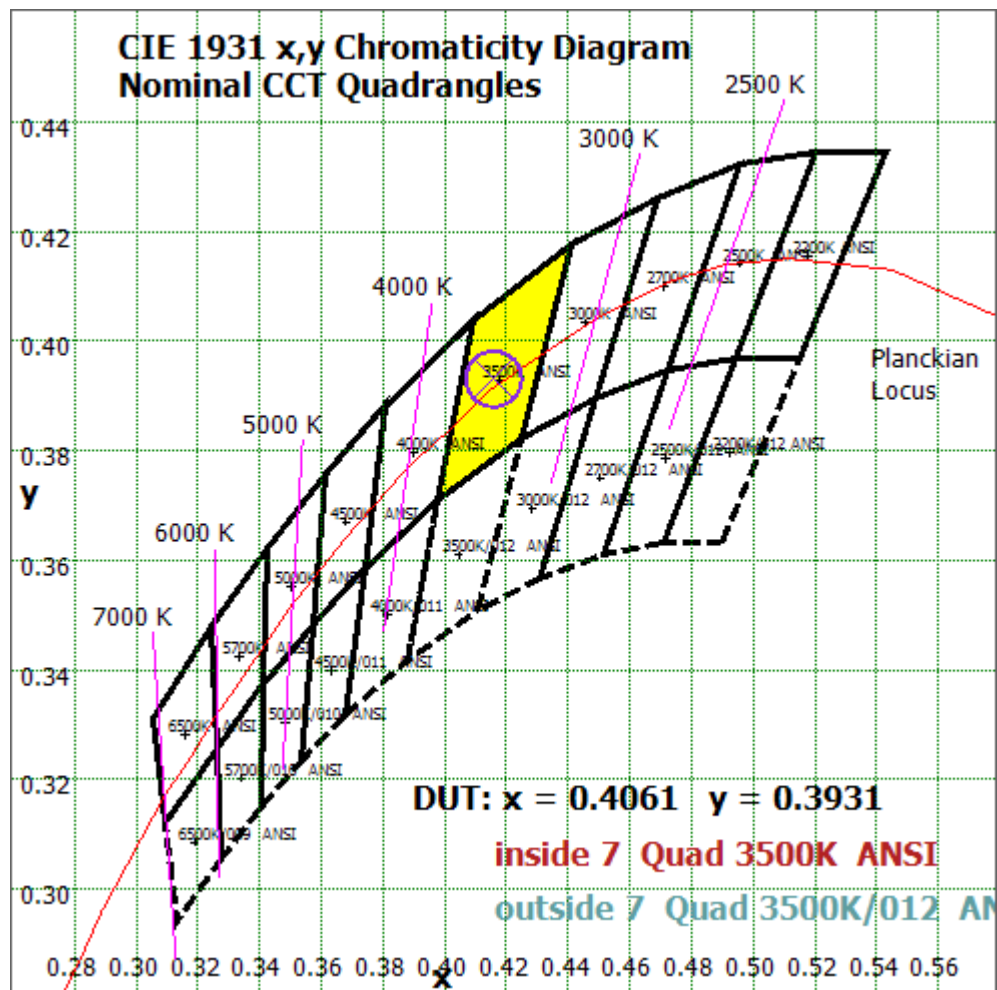


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

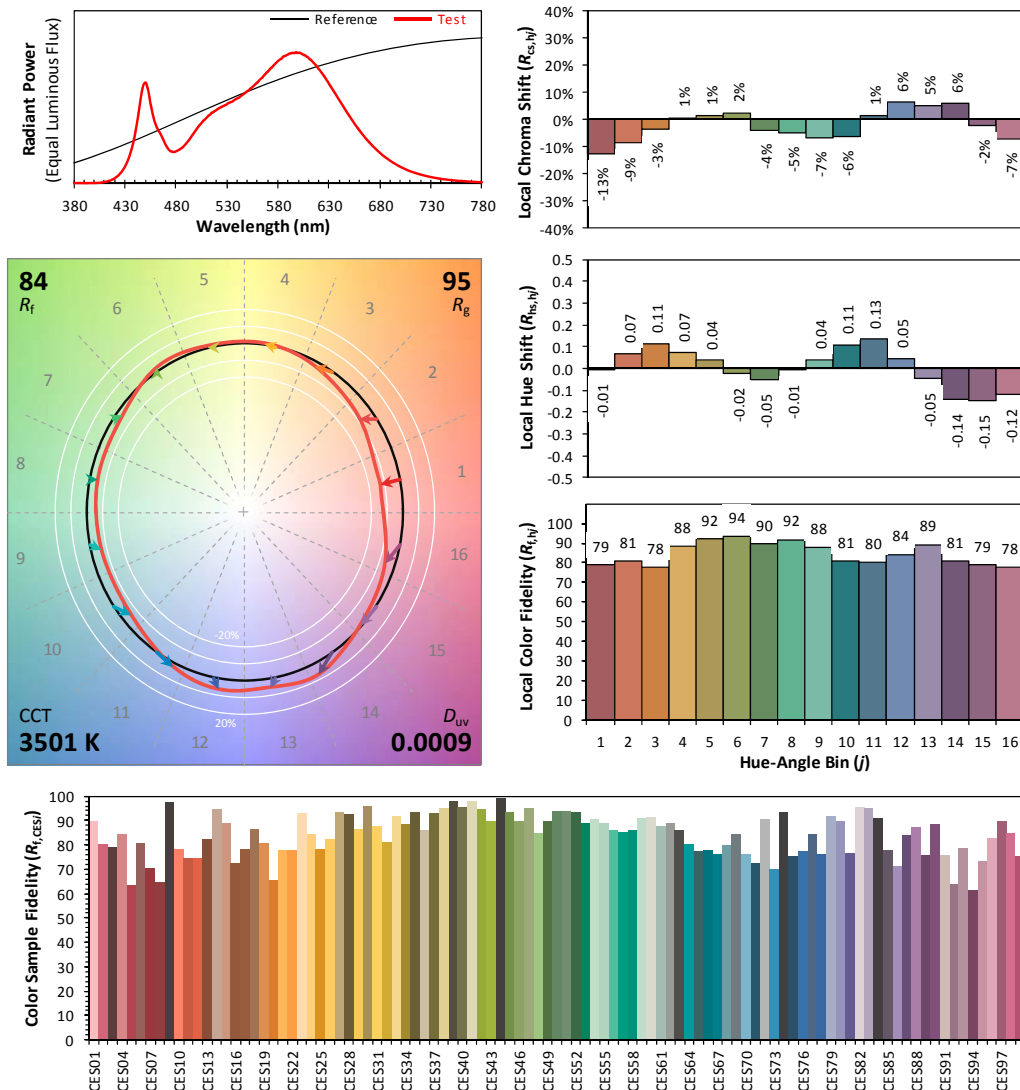
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2022/08/15

Model: 14.5T5HO/3F/835/BYP/R



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

x 0.4061
 y 0.3931
 u' 0.2353
 v' 0.5124

CIE 13.3-1995
(CRI)
 R_a 82
 R_9 2

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	30.169	1.51%
10- 20	87.784	4.38%
20- 30	137.536	6.87%
30- 40	175.212	8.75%
40- 50	197.983	9.88%
50- 60	205.136	10.24%
60- 70	198.447	9.91%
70- 80	181.512	9.06%
80- 90	160.269	8.00%
90-100	139.773	6.98%
100-110	119.642	5.97%
110-120	100.795	5.03%
120-130	84.095	4.20%
130-140	68.494	3.42%
140-150	52.955	2.64%
150-160	37.419	1.87%
160-170	20.784	1.04%
170-180	5.34	0.27%
Total	2003.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	833.82	41.62%
60- 90	540.228	26.97%
0-90	1374.05	68.59%
90- 180	629.297	31.41%
0- 180	2003.3	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

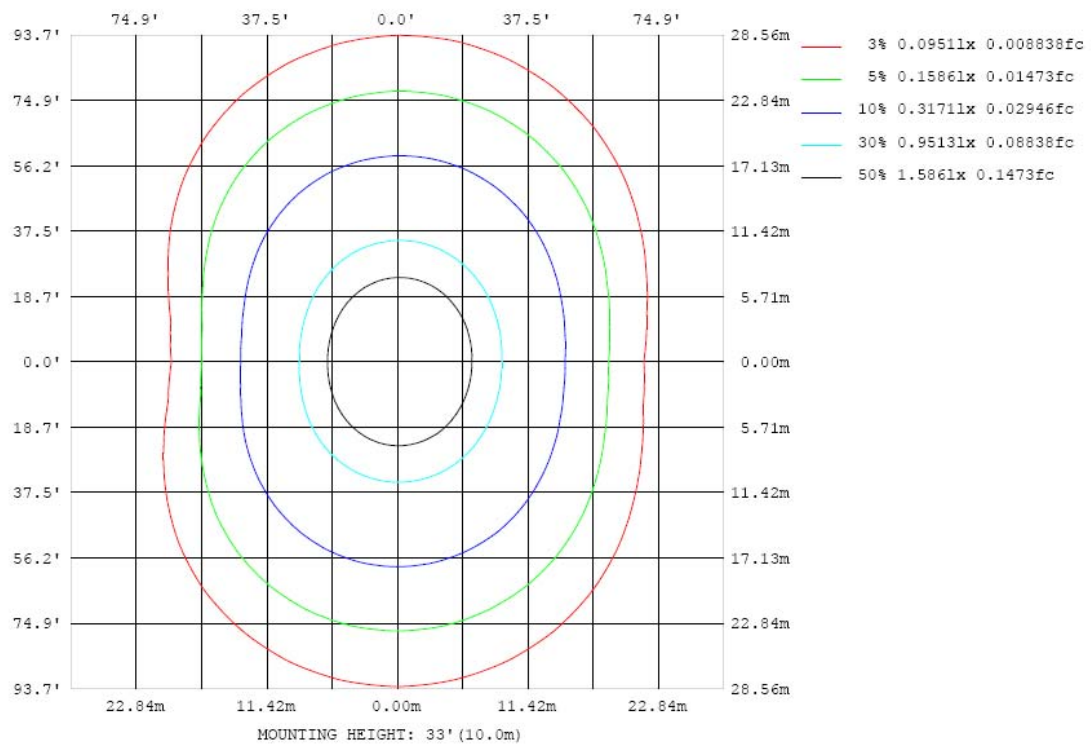


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

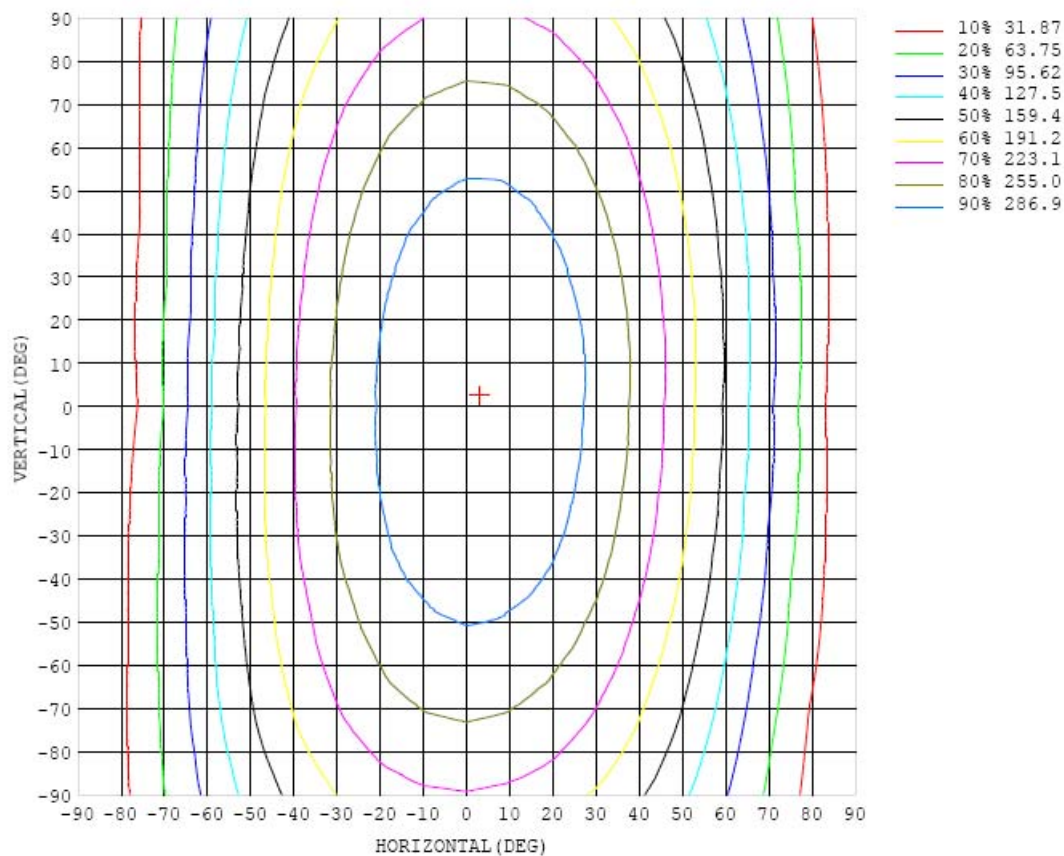


Chart 6: Isocandela Plot

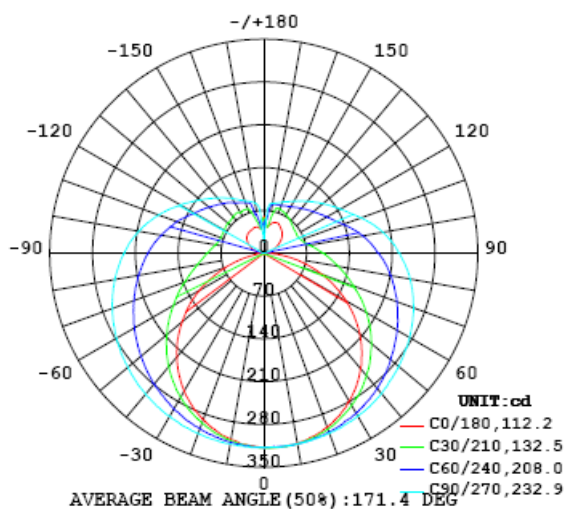


Chart 7: Polar Candela Distribution

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	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318
5	318	317	318	318	317	318	317	318	318	318	317	317	316	315	315	315	315	314	315
10	315	315	315	317	316	316	317	317	318	317	315	315	314	313	312	311	310	309	309
15	310	310	311	313	313	313	314	315	316	315	314	313	311	309	306	304	302	301	301
20	303	303	304	306	307	309	311	313	313	313	312	310	306	303	299	296	293	290	289
25	293	293	294	297	301	304	308	309	312	311	309	306	302	296	290	285	280	277	276
30	279	280	282	287	292	297	302	305	308	308	305	301	296	289	281	273	267	261	260
35	264	265	269	275	282	289	296	300	304	304	302	297	289	280	269	260	250	245	242
40	246	248	252	261	271	280	289	295	298	299	296	291	282	270	258	245	233	225	221
45	227	228	235	246	258	270	280	288	293	293	290	284	273	261	245	229	215	203	199
50	205	207	216	230	245	259	271	281	287	288	284	277	265	249	232	213	194	180	174
55	181	183	195	212	230	246	261	272	280	282	278	270	256	238	217	196	174	155	149
60	155	159	174	194	214	234	252	264	272	275	272	263	247	228	204	178	153	130	121
65	129	134	151	175	200	222	242	256	265	268	264	255	239	218	191	161	132	105	93.1
70	101	107	129	156	185	211	232	247	257	261	257	247	230	208	179	146	112	81.0	64.8
75	73.3	81.7	106	139	171	199	221	238	248	252	249	239	222	198	168	133	94.7	59.9	37.9
80	47.3	58.0	87.1	124	158	187	211	228	239	243	239	229	212	188	157	121	81.0	42.0	15.8
85	23.4	36.9	70.6	110	145	175	200	218	229	233	229	220	202	178	147	111	70.2	30.8	2.78
90	6.82	21.5	58.7	97.6	133	163	187	205	217	221	219	209	192	168	137	102	62.9	24.4	2.31
95	2.05	14.2	48.6	86.2	122	152	177	194	206	210	208	198	181	157	127	92.8	56.2	23.6	5.25
100	4.65	12.0	40.7	76.3	111	140	164	182	194	198	195	185	169	146	117	85.0	53.8	25.5	9.67
105	9.41	15.7	38.4	68.2	100.0	128	152	169	179	184	182	172	157	135	108	80.7	53.7	30.2	14.1
110	15.2	21.1	38.2	65.1	91.6	117	138	155	165	170	167	158	144	125	103	78.4	55.4	33.3	19.4
115	21.0	26.1	41.0	62.5	86.3	109	128	142	152	155	154	147	135	118	98.4	77.4	57.1	39.7	23.9
120	26.7	31.3	43.2	61.9	82.3	102	119	132	141	145	143	138	127	112	95.2	76.9	56.6	45.2	28.2
125	32.6	35.5	47.6	63.0	79.4	96.7	112	124	131	135	134	129	120	107	92.4	76.4	59.4	49.9	32.7
130	38.2	41.2	52.4	63.3	77.9	92.8	106	116	123	126	126	121	113	103	89.8	73.3	63.4	54.0	36.3
135	42.7	46.3	56.7	66.0	76.5	89.5	100	109	115	118	118	114	108	98.2	85.9	73.5	67.9	58.1	39.0
140	46.2	51.5	60.7	68.5	75.3	85.7	96.0	103	108	111	110	107	102	92.9	82.1	75.3	70.3	61.9	41.0
145	49.1	54.5	63.8	70.9	75.8	82.6	91.6	97.8	102	104	104	101	95.4	88.3	82.4	78.4	72.7	65.3	42.3
150	52.1	56.2	67.5	73.1	77.1	81.7	88.1	92.6	96.3	98.3	98.0	96.0	92.5	87.9	83.7	78.8	72.8	66.5	43.0
155	54.9	56.7	70.1	75.1	77.9	81.6	85.4	89.0	91.5	93.1	93.2	91.8	89.5	86.6	82.9	77.1	74.5	65.9	43.8
160	53.3	54.3	67.2	76.8	78.7	81.0	83.3	85.8	87.7	88.8	89.0	88.3	86.5	84.6	76.2	77.1	74.3	59.3	44.8
165	50.9	46.9	55.8	75.2	79.4	80.7	82.3	83.3	84.6	85.4	85.2	85.1	83.6	74.9	72.3	65.7	57.0	47.5	44.3
170	45.8	42.5	43.6	48.5	69.5	79.5	81.2	81.9	82.6	82.7	82.4	80.9	66.0	59.7	54.2	46.9	44.4	41.8	42.3
175	48.9	49.0	48.1	46.5	52.5	51.6	55.7	64.4	71.1	73.3	55.9	38.7	39.9	46.4	44.4	48.2	44.8	46.4	45.2
180	58.6	58.2	56.8	55.7	51.0	41.0	36.0	41.2	23.0	20.7	19.3	35.4	27.4	48.4	45.8	55.4	58.2	60.4	58.8

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	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318		
5	315	315	315	315	316	316	317	318	318	317	319	318	318	318	318	318	318		
10	309	310	312	312	313	314	315	316	317	317	318	317	318	317	317	317	316		
15	301	302	305	306	308	311	312	314	315	316	317	316	315	314	313	312	311		
20	291	292	296	299	301	305	308	312	314	314	315	313	311	309	307	305	304		
25	277	280	285	289	295	301	305	309	312	312	312	310	306	303	299	296	293		
30	261	265	272	279	287	294	300	305	308	308	308	304	300	294	290	285	282		
35	244	249	258	267	277	286	295	301	305	304	304	299	293	285	278	272	267		
40	224	230	242	254	267	279	289	297	301	301	298	293	284	274	265	256	250		
45	202	211	225	241	256	271	283	291	296	295	293	285	275	263	251	239	231		
50	177	189	207	226	245	262	276	286	290	290	286	278	264	250	235	221	210		
55	153	167	189	212	234	253	268	279	285	284	279	268	254	236	218	201	188		
60	126	146	170	198	222	244	261	272	278	277	271	259	243	222	201	180	164		
65	99.9	123	154	184	211	235	253	265	271	270	263	250	232	209	184	159	140		
70	73.6	102	138	171	201	226	245	258	264	262	254	240	220	195	167	139	114		
75	49.7	83.7	123	159	190	217	237	250	256	254	246	230	209	181	152	118	89.3		
80	30.5	68.9	111	149	181	208	228	242	248	245	237	220	197	169	136	99.9	66.0		
85	19.2	58.3	101	139	172	199	219	233	238	236	227	210	187	157	123	84.1	46.1		
90	15.2	51.8	92.8	131	163	190	210	223	228	226	217	200	176	147	111	71.6	32.0		
95	16.3	47.3	86.0	123	155	180	200	214	219	216	207	190	166	137	102	62.9	24.8		
100	19.6	45.8	80.4	115	146	170	190	202	208	205	196	179	156	128	93.6	56.3	21.4		
105	24.4	47.1	76.4	108	137	160	178	191	196	193	184	168	147	118	86.0	51.6	22.3		
110	30.8	49.9	75.0	102	129	151	167	179	183	181	172	157	136	110	79.6	49.8	25.4		
115	37.0	53.5	74.7	97.9	120	141	156	166	170	168	160	146	126	102	75.6	50.1	30.3		
120	43.2	56.0	75.0	94.9	114	131	145	155	158	156	149	135	117	95.8	73.5	51.7	36.0		
125	47.9	59.3	76.0	92.7	109	124	135	143	146	144	137	125	110	91.8	72.3	54.1	41.9		
130	51.9	63.3	76.5	90.9	105	117	127	134	136	134	128	118	104	88.5	72.2	57.2	47.7		
135	56.3	67.1	76.6	89.6	101	111	119	125	127	124	119	111	99.5	86.2	72.7	61.0	52.6		
140	59.1	70.3	78.1	87.1	97.6	106	112	117	118	116	112	105	95.2	84.5	73.4	64.6	56.3		
145	59.6	71.0	79.6	85.6	93.4	101	106	110	110	109	105	99.4	91.9	83.0	75.0	68.1	60.9		
150	61.3	72.1	76.5	85.3	90.1	95.2	99.8	103	104	102	99.3	94.5	88.5	82.5	76.4	71.0	63.2		
155	64.1	73.2	78.0	83.0	88.1	91.3	94.0	95.7	96.3	95.5	93.9	90.6	86.7	82.1	77.9	72.3	66.6		
160	58.3	69.2	77.4	79.1	85.9	88.3	89.9	91.3	91.7	91.0	90.0	87.8	85.2	82.2	78.6	75.0	66.8		
165	48.3	56.8	62.9	69.1	75.6	84.1	86.2	87.3	87.5	87.0	86.6	85.3	83.7	81.4	78.9	75.4	60.2		
170	43.0	44.7	47.4	51.0	55.4	60.2	67.3	81.3	83.4	83.3	83.0	82.3	81.3	79.9	77.1	58.8	46.8		
175	44.8	43.9	42.3	45.8	41.3	43.6	39.9	42.1	62.8	77.2	78.6	74.7	60.9	52.1	49.3	46.7	45.4		
180	58.7	58.5	57.4	54.9	50.7	47.0	39.6	33.5	23.1	10.7	23.2	35.7	42.4	44.2	49.9	54.1	57.0		

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, 2022	Aug. 04, 2023
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2022	Aug. 04, 2023
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2022	Aug. 04, 2023
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2022	Aug. 04, 2023
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2022	Aug. 04, 2023
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2022	Aug. 04, 2023
Standard source	D908	HZTE012-01	Aug. 05, 2022	Aug. 04, 2023
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2022	Aug. 04, 2023
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2022	Aug. 04, 2023
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2022	Aug. 04, 2023
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2022	Aug. 04, 2023
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2022	Aug. 04, 2023
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2022	Aug. 04, 2023
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2022	Aug. 04, 2023

Table 7: 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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