

LM-79-08 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: 14.5T8/4F/835/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20100014k

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

Review by:



Engineer: April Zou

Oct. 23, 2020

Approved by:



Manager: Jim Zhang

Oct. 23, 2020

TEST SUMMARY

Sample Tested: 14.5T8/4F/835/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
161.2	2307.2	14.31	0.9786
CCT (K)	CRI	Stabilization Time (Light & Power)	
3483	83.2	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 : Oct. 20, 2020

Date of Test : Oct. 22, 2020

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
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	: 14.5T8/4F/835/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 14.5W
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 horizontal. 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 65 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
	Test Voltage (V)	120.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.122	0.057
Power Factor	0.9786	0.8927
Test Power (W)	14.31	14.05
THD A%	18.21	17.97
Luminous Efficacy (lm/W)	161.2	162.0
Total Luminous Flux (lm)	2307.2	2276.0
Color Rendering Index (CRI)	83.2	
R9	7.9	
Correlated Color Temperature (CCT)(K)	3483	
Chromaticity Chroma x	0.4066	
Chromaticity Chroma y	0.3923	
Chromaticity Chroma u	0.2359	
Chromaticity Chroma v	0.3414	
Duv	0.0004	
Chromaticity Chroma u'	0.2359	
Chromaticity Chroma v'	0.5121	

Special Color Rendering Indices	
R1	81.9
R2	91.9
R3	95.8
R4	80.4
R5	81.9
R6	89.2
R7	83.5
R8	61
R9	7.9
R10	80.9
R11	79.7
R12	65.5
R13	84.6
R14	98.4

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u',v') diagram, $u' = u / (-2x + 12y + 3)$, $v' = 3v / 2 = 9y / (-2x + 12y + 3)$.

Goniophotometer Method

Test ambient temperature was 25.0 °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)	0.122
Power Factor	0.9790
Power (W)	14.33
Luminous Efficacy (lm/W)	158.8
Total Luminous Flux (lm)	2275.4
Beam Angle (°)	110.6 (0°-180°) / 197.1 (90°-270°)
Center Beam Candle Power (cd)	412
Maximum Beam Candle Power (cd)	412.2 (At: C=100.0, Gamma=1.0)
Spacing Criteria	1.25 (0°-180°) / 1.38 (90°-270°)
Zonal Lumens in the 0°-60° Zone	45.25%
Zonal Lumens in the 60°-90° Zone	26.48%
Zonal Lumens in the 90°-120° Zone	16.46%
Zonal Lumens in the 120°-180° Zone	11.81%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

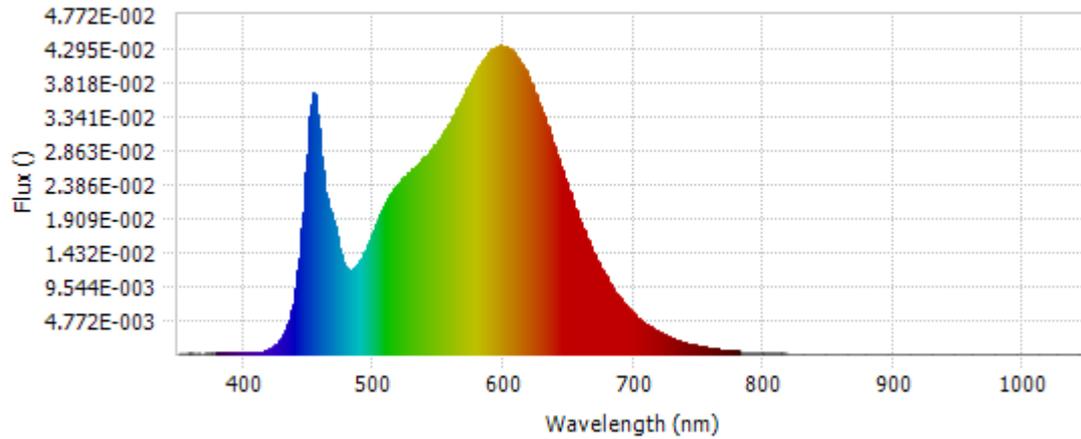
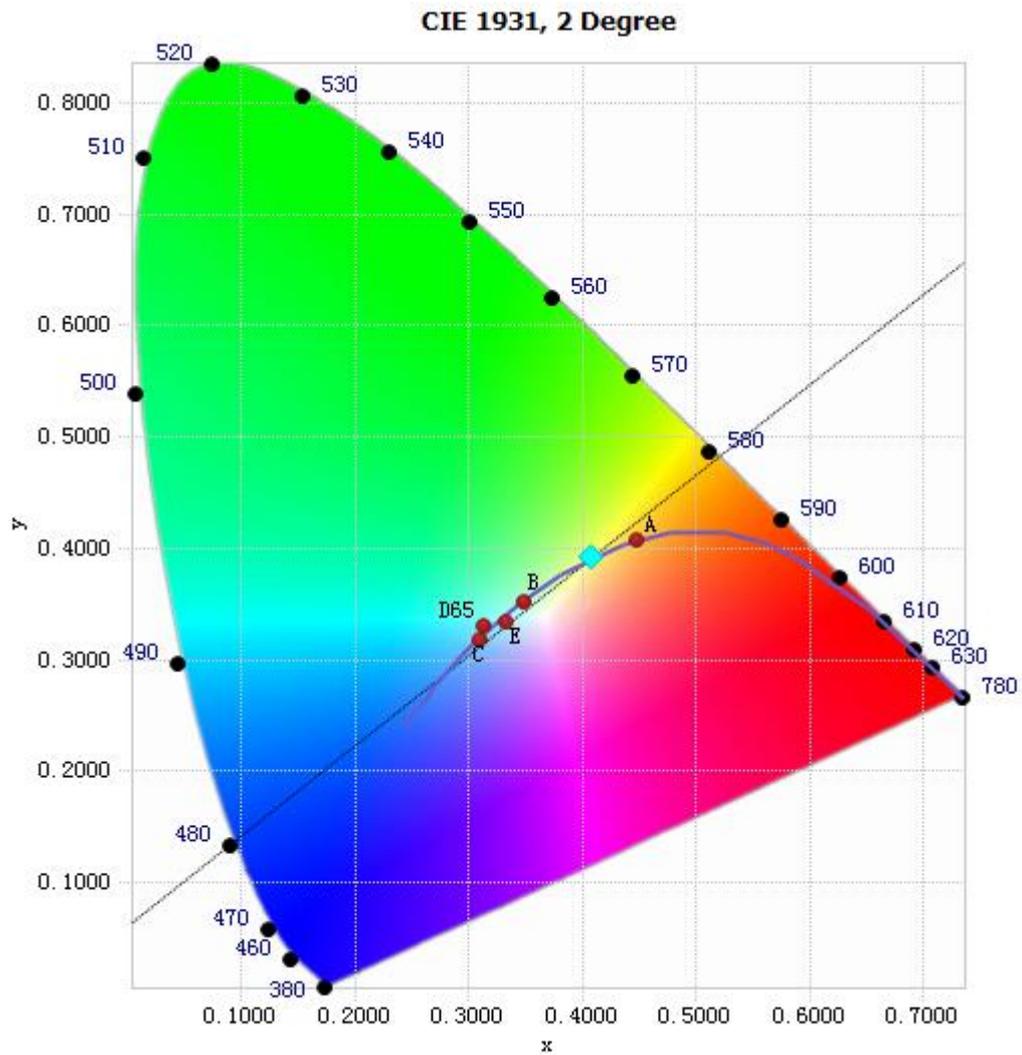


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.83E-04	485	1.22E-02	590	4.26E-02	695	6.71E-03
385	1.81E-04	490	1.33E-02	595	4.32E-02	700	5.74E-03
390	1.80E-04	495	1.50E-02	600	4.32E-02	705	4.91E-03
395	1.77E-04	500	1.73E-02	605	4.29E-02	710	4.17E-03
400	1.65E-04	505	1.96E-02	610	4.19E-02	715	3.56E-03
405	1.73E-04	510	2.14E-02	615	4.05E-02	720	3.05E-03
410	2.42E-04	515	2.30E-02	620	3.86E-02	725	2.61E-03
415	4.08E-04	520	2.42E-02	625	3.64E-02	730	2.22E-03
420	7.28E-04	525	2.51E-02	630	3.39E-02	735	1.89E-03
425	1.37E-03	530	2.60E-02	635	3.13E-02	740	1.60E-03
430	2.61E-03	535	2.68E-02	640	2.87E-02	745	1.37E-03
435	4.91E-03	540	2.78E-02	645	2.58E-02	750	1.17E-03
440	9.16E-03	545	2.88E-02	650	2.31E-02	755	9.99E-04
445	1.76E-02	550	3.01E-02	655	2.06E-02	760	8.58E-04
450	3.07E-02	555	3.15E-02	660	1.82E-02	765	7.29E-04
455	3.66E-02	560	3.30E-02	665	1.60E-02	770	6.26E-04
460	2.77E-02	565	3.47E-02	670	1.39E-02	775	5.39E-04
465	2.12E-02	570	3.65E-02	675	1.22E-02	780	4.56E-04
470	1.80E-02	575	3.83E-02	680	1.05E-02		
475	1.41E-02	580	4.00E-02	685	9.08E-03		
480	1.19E-02	585	4.16E-02	690	7.81E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4066, 0.3923)

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

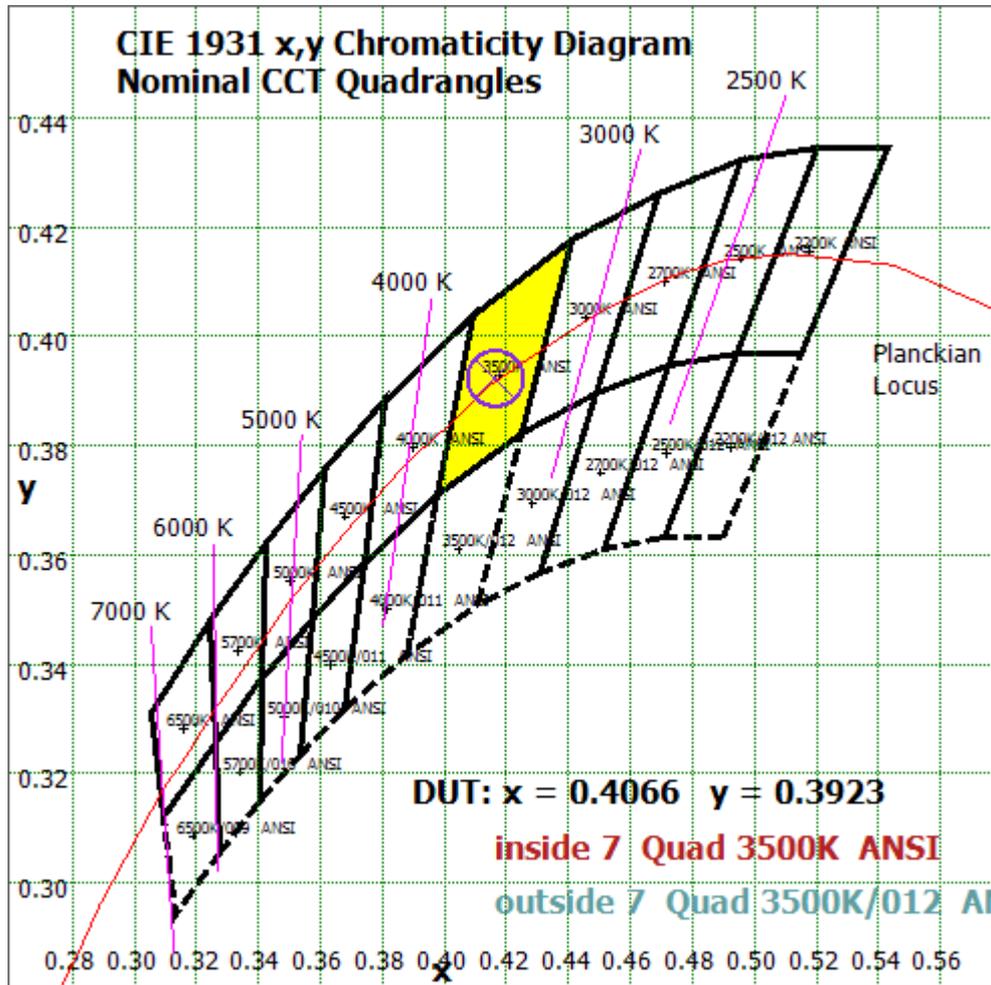


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

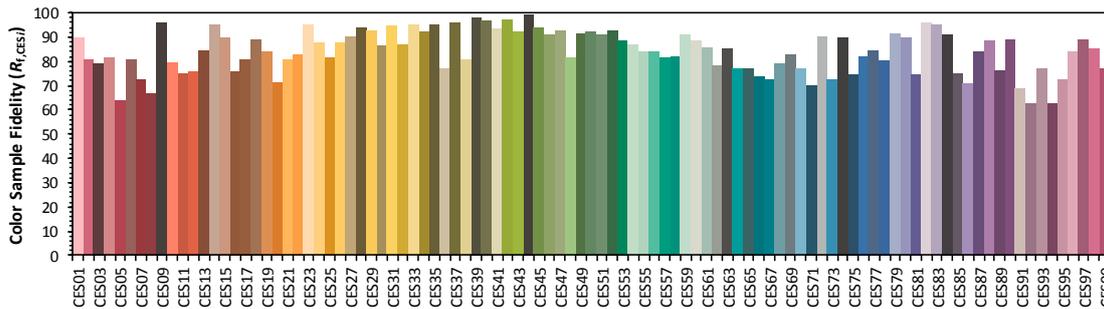
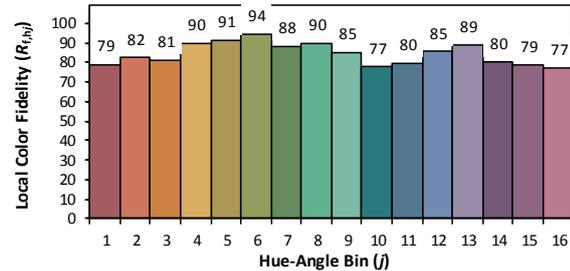
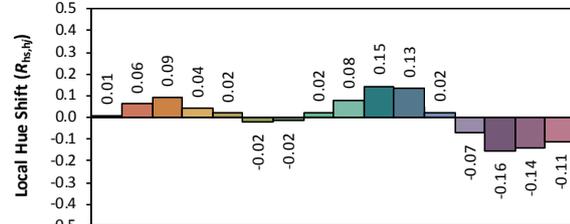
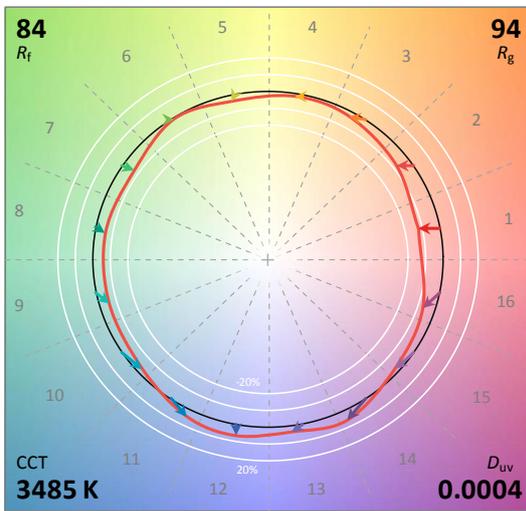
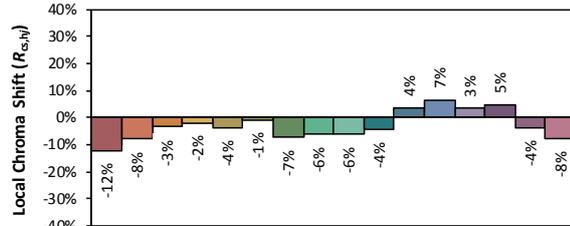
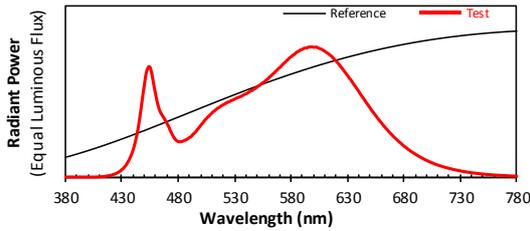
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2020/10/22

Model: 14.5T8/4F/835/BYP



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.	x	0.4066	CIE 13.3-1995 (CRI) R_a 83 R_g 8
	y	0.3923	
	u'	0.2359	
	v'	0.5121	

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	39.08	1.72%
10- 20	112.939	4.96%
20- 30	174.635	7.67%
30- 40	218.356	9.60%
40- 50	241.191	10.60%
50- 60	243.445	10.70%
60- 70	228.454	10.04%
70- 80	201.924	8.87%
80- 90	172.065	7.56%
90-100	146.568	6.44%
100-110	124.145	5.46%
110-120	103.805	4.56%
120-130	85.434	3.75%
130-140	68.658	3.02%
140-150	52.585	2.31%
150-160	36.476	1.60%
160-170	19.803	0.87%
170-180	5.88	0.26%
Total	2275.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1029.646	45.25%
60- 90	602.443	26.48%
0-90	1632.089	71.73%
90- 180	643.354	28.27%
0- 180	2275.4	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

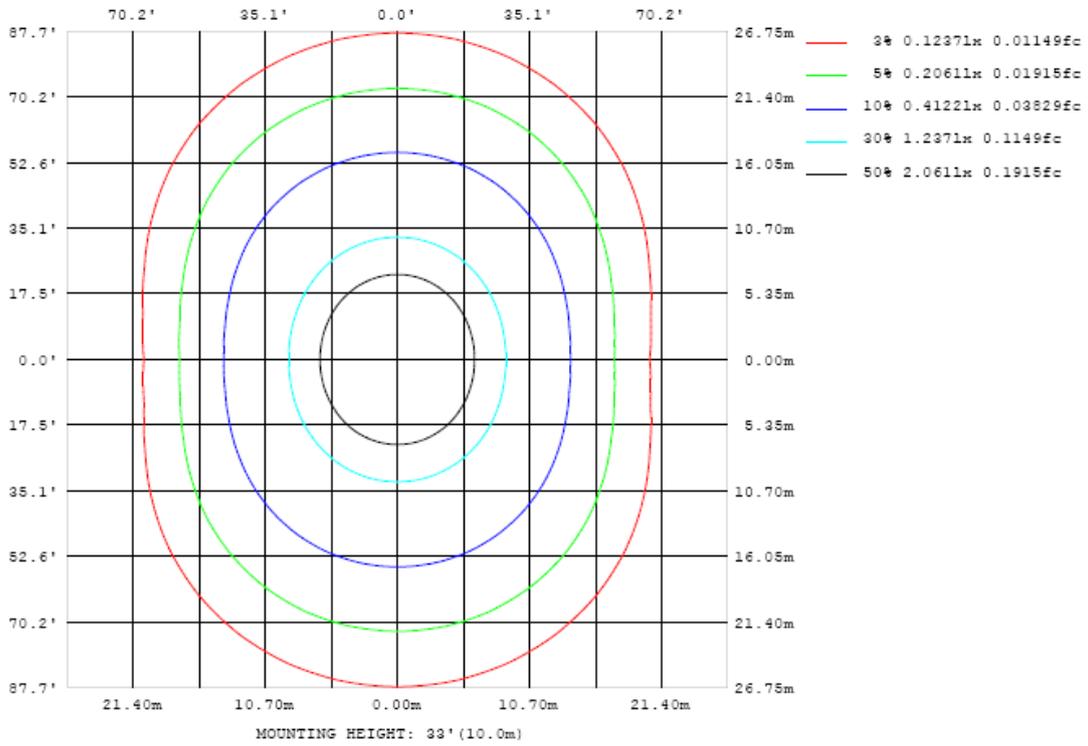


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

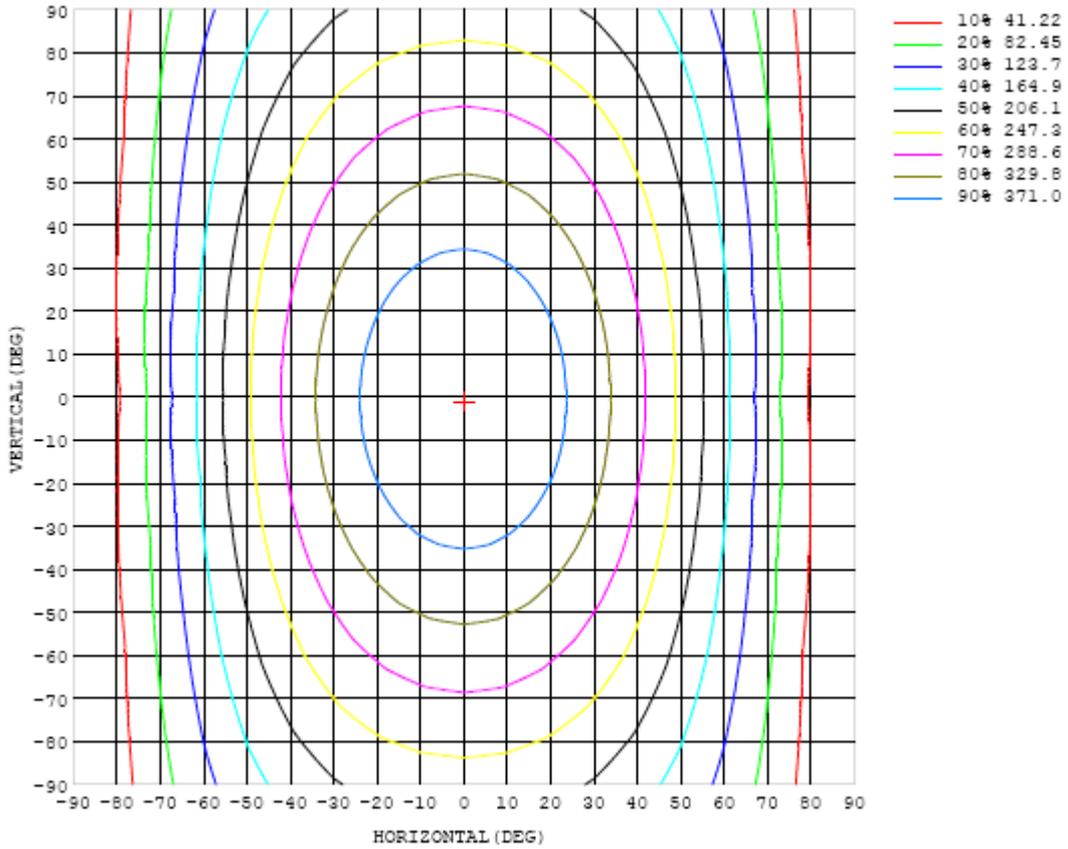


Chart 6: Isocandela Plot

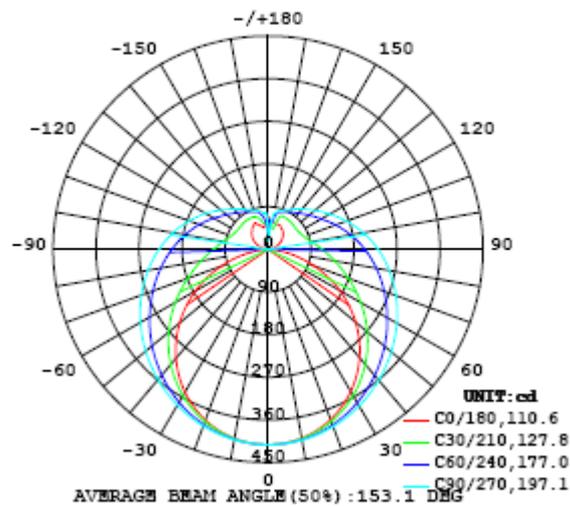


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	
0	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	
5	410	410	410	411	411	411	411	411	411	411	411	411	411	411	411	411	411	410	410	
10	404	405	405	406	406	407	408	408	409	409	409	409	408	407	407	406	406	405	405	
15	395	396	396	398	399	401	402	403	404	404	404	404	403	401	400	398	397	396	396	
20	382	383	384	387	389	392	394	396	398	398	398	397	395	393	390	387	386	384	383	
25	366	367	369	373	377	381	385	388	390	390	390	388	385	382	377	374	371	368	367	
30	346	348	351	356	362	368	374	378	381	382	381	378	374	369	363	357	353	349	348	
35	324	325	330	337	346	354	361	367	370	371	370	367	361	354	346	339	332	327	326	
40	298	300	307	317	328	338	347	355	359	360	359	355	348	339	328	318	309	302	300	
45	270	273	282	295	309	322	333	342	347	349	347	342	333	322	309	295	283	275	272	
50	239	244	255	271	289	305	318	329	335	337	334	329	318	305	289	272	256	245	242	
55	207	213	227	248	269	288	303	315	322	324	322	315	303	287	269	248	228	214	209	
60	173	180	199	224	249	271	288	301	309	311	309	301	288	270	249	224	200	182	175	
65	138	147	171	201	230	254	273	287	296	298	295	287	273	254	229	201	172	148	141	
70	102	115	145	179	211	238	259	274	282	285	282	273	259	238	211	179	145	115	105	
75	68.1	84.0	120	159	194	223	244	260	269	271	268	260	244	222	194	159	120	84.2	69.6	
80	37.0	57.2	99.1	142	179	208	230	246	255	258	255	246	230	208	178	141	98.4	57.3	37.5	
85	12.3	36.8	82.3	126	164	194	216	232	241	244	241	232	216	194	164	126	81.6	36.6	11.9	
90	1.71	25.5	70.4	114	151	180	203	218	228	230	227	219	203	180	151	113	69.4	25.3	0.57	
95	2.80	21.0	61.3	102	138	167	189	205	214	216	213	205	189	167	138	102	61.2	21.1	2.34	
100	6.90	21.6	55.4	92.8	127	155	176	191	199	202	199	191	176	155	127	93.2	55.8	22.0	6.82	
105	12.2	24.8	52.7	85.3	117	143	163	177	186	188	186	178	163	143	117	86.1	53.7	25.3	12.9	
110	18.5	29.7	52.1	80.0	108	132	151	164	172	175	172	165	151	132	108	81.3	53.8	30.1	19.7	
115	24.4	35.2	53.0	76.5	101	122	139	152	159	162	159	152	140	123	102	78.4	55.4	35.6	26.7	
120	30.1	40.7	55.2	74.3	95.1	114	129	140	147	149	147	140	129	115	96.6	76.6	57.6	40.9	33.5	
125	35.5	45.6	58.1	73.3	90.6	107	120	130	136	138	136	131	121	108	92.5	75.8	60.4	45.5	39.2	
130	40.3	49.6	61.2	73.1	87.3	101	112	121	126	128	126	122	113	102	89.3	75.5	63.3	49.0	44.0	
135	44.9	52.4	63.9	73.7	84.8	96.0	106	113	117	119	118	114	107	97.4	86.7	75.7	66.0	51.3	48.3	
140	48.2	54.5	66.4	74.6	83.1	91.9	99.7	106	110	111	110	107	101	93.2	84.6	76.2	67.6	51.8	52.5	
145	51.6	54.9	67.9	75.5	81.8	88.6	94.7	99.5	103	104	103	100	95.6	89.6	83.0	76.9	68.8	51.7	56.9	
150	53.7	52.5	67.7	75.9	81.0	85.9	90.4	94.0	96.5	97.3	96.7	94.7	91.2	86.8	81.4	76.9	69.2	51.5	59.2	
155	56.5	46.6	61.3	76.0	80.0	83.7	86.9	89.5	91.2	91.8	91.4	90.0	87.6	83.4	79.4	70.4	63.0	49.6	60.6	
160	56.2	43.4	51.0	73.2	79.0	82.0	84.0	85.7	86.8	87.2	87.0	86.4	81.6	74.4	66.7	60.4	55.7	47.4	54.3	
165	56.6	43.1	44.6	47.0	69.0	77.5	79.5	82.4	83.1	82.9	82.9	82.9	72.9	63.2	54.9	53.0	50.9	48.4	46.7	50.5
170	59.2	47.0	43.7	46.7	47.5	55.0	61.8	68.9	74.7	77.1	55.6	48.1	55.1	52.4	53.5	48.8	47.6	46.6	46.5	
175	59.8	57.1	56.2	56.2	59.2	59.8	59.6	60.6	59.0	31.3	60.5	65.2	65.4	60.5	58.6	58.0	56.1	54.6	54.8	
180	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	

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	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412		
5	411	411	411	411	411	411	411	411	411	411	411	411	411	411	410	410	410		
10	405	405	406	406	406	407	408	408	408	408	407	407	407	406	405	405	405		
15	396	397	398	399	400	401	402	403	403	403	402	401	400	398	397	396	395		
20	384	385	387	389	391	394	395	396	397	396	395	393	391	388	386	384	382		
25	368	370	373	377	381	384	387	388	389	388	386	383	380	376	372	369	366		
30	349	352	357	362	368	373	377	379	380	379	376	372	367	361	355	351	347		
35	327	332	338	346	353	360	365	369	370	368	365	359	352	344	336	330	325		
40	303	309	317	327	338	346	353	357	359	357	353	346	337	326	316	307	300		
45	275	284	295	308	321	332	340	345	347	345	340	331	320	307	293	282	273		
50	246	257	272	288	304	317	327	333	335	332	326	316	303	287	270	255	244		
55	215	229	248	268	287	302	313	319	322	320	313	301	286	267	246	227	213		
60	183	201	224	248	269	286	299	306	309	306	299	286	268	247	222	199	180		
65	151	173	201	229	252	271	285	293	296	293	285	271	252	227	199	171	148		
70	118	147	179	210	236	257	271	279	282	279	271	256	236	209	177	144	115		
75	86.7	122	160	193	221	242	257	266	269	266	257	242	220	192	157	119	84.3		
80	59.4	101	142	177	206	228	243	252	255	252	243	228	206	176	140	97.4	56.8		
85	38.7	83.8	127	163	192	215	230	239	242	239	230	214	192	162	125	80.3	35.8		
90	27.1	71.7	115	151	179	201	217	226	228	226	217	201	179	150	112	68.1	24.3		
95	22.7	63.5	104	140	167	189	204	212	215	213	204	188	167	138	102	60.0	20.2		
100	23.0	57.7	95.6	129	157	177	191	200	202	200	191	176	156	128	93.0	54.6	20.5		
105	26.0	54.7	88.2	119	145	164	178	186	189	186	178	164	144	118	85.7	51.6	23.6		
110	31.1	54.1	82.5	111	135	153	166	173	176	173	165	153	133	109	80.0	51.1	28.8		
115	36.8	55.2	78.9	103	125	142	154	161	163	161	154	141	123	101	76.3	52.0	34.5		
120	42.5	57.3	76.8	97.2	116	131	143	149	152	149	142	131	114	95.2	74.1	54.0	40.4		
125	48.2	59.9	75.8	92.8	109	122	132	138	140	138	131	121	107	90.7	73.0	57.0	46.2		
130	53.6	62.6	75.4	89.4	103	114	122	127	129	127	121	113	101	87.3	72.7	60.2	51.7		
135	57.9	65.1	75.6	86.8	97.6	107	114	118	119	118	113	106	96.1	84.8	73.2	63.5	56.9		
140	62.2	67.6	76.0	84.8	93.4	101	107	110	111	110	106	99.9	92.0	83.0	74.1	66.7	60.1		
145	66.2	69.7	76.0	83.2	89.9	95.7	100	103	104	103	99.7	94.8	88.6	81.8	75.0	69.6	63.9		
150	68.8	70.6	75.9	82.1	87.0	91.3	94.7	96.8	97.5	96.6	94.3	90.6	85.9	81.0	76.1	72.4	66.6		
155	70.5	71.7	74.8	80.4	84.5	87.6	90.0	91.5	92.0	91.4	89.7	87.1	83.9	80.5	77.1	74.7	70.1		
160	66.1	69.7	72.3	77.8	81.9	84.5	86.1	87.1	87.5	87.1	86.1	84.5	82.4	80.3	78.3	76.3	71.5		
165	57.4	62.2	66.2	71.8	77.9	81.5	83.1	83.6	83.9	83.8	83.3	82.4	81.3	80.2	79.1	77.3	73.9		
170	51.8	56.3	56.9	60.1	65.5	72.7	76.8	79.6	81.4	81.3	81.0	80.7	80.2	79.6	78.0	75.9	71.2		
175	54.9	56.3	55.1	53.0	52.8	58.7	67.8	74.2	77.2	76.2	75.6	76.9	77.0	76.0	73.6	70.1	65.9		
180	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0		

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, 2020	Aug. 04, 2021
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2020	Aug. 04, 2021
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2020	Aug. 04, 2021
Standard source	D908	HZTE012-01	Aug. 05, 2020	Aug. 04, 2021
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2020	Aug. 04, 2021
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2020	Aug. 04, 2021
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2020	Aug. 04, 2021
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2020	Aug. 04, 2021

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 Tubes) 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 Tubes) 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

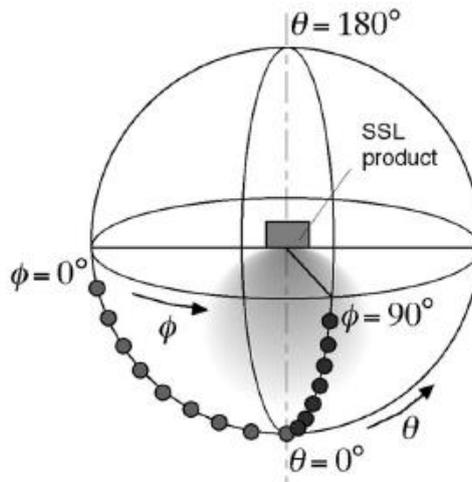
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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