

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: 14T8/4F/850/UEB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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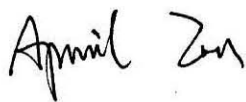
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Report No.: HZ23030039m

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

Review by:



Engineer: April Zou
Apr. 04, 2023

Approved by:



Manager: Jim Zhang
Apr. 04, 2023

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: **14T8/4F/850/UEB**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
156.7	2251.5	14.37	0.9850
CCT (K)	CRI	Stabilization Time (Light & Power)	
5130	84.0	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	: Mar. 28, 2023
Date of Test	: Mar. 30, 2023
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	: 14T8/4F/850/UEB
Electrical Ratings	: 120-277V, 50/60Hz, 14W
Product Description	: 5000K
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)	0.121	0.056
Power Factor	0.9850	0.9276
Test Power (W)	14.37	14.45
THD A%	15.16	15.57
Luminous Efficacy (lm/W)	156.7	157.2
Total Luminous Flux (lm)	2251.5	2271.3
Color Rendering Index (CRI)	84.0	
R9	12	
Correlated Color Temperature (CCT)(K)	5130	
Chromaticity Chroma x	0.3417	
Chromaticity Chroma y	0.3523	
Chromaticity Chroma u	0.2089	
Chromaticity Chroma v	0.323	
Duv	0.0017	
Chromaticity Chroma u'	0.2089	
Chromaticity Chroma v'	0.4845	

Special Color Rendering Indices	
R1	82.5
R2	89.3
R3	93.2
R4	83.6
R5	83.1
R6	84.3
R7	87.3
R8	68.7
R9	12
R10	74
R11	83
R12	61.9
R13	84.4
R14	96.5

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)	0.122
Power Factor	0.9848
Power (W)	14.40
Luminous Efficacy (lm/W)	157.2
Total Luminous Flux (lm)	2263.5
Beam Angle (°)	112.4 (0°-180°) / 218.0 (90°-270°)
Center Beam Candle Power (cd)	388
Maximum Beam Candle Power (cd)	388.1 (At: C=220.0, Gamma=3.0)
Spacing Criteria	1.28 (0°-180°) / 1.44 (90°-270°)
Zonal Lumens in the 0°-60° Zone	43.60%
Zonal Lumens in the 60°-90° Zone	26.82%
Zonal Lumens in the 90°-120° Zone	17.67%
Zonal Lumens in the 120°-180° Zone	11.91%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

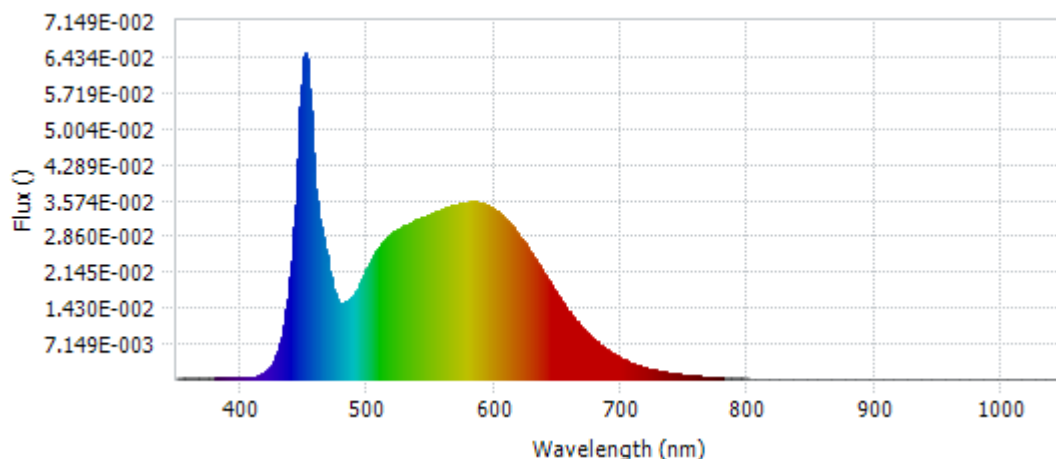
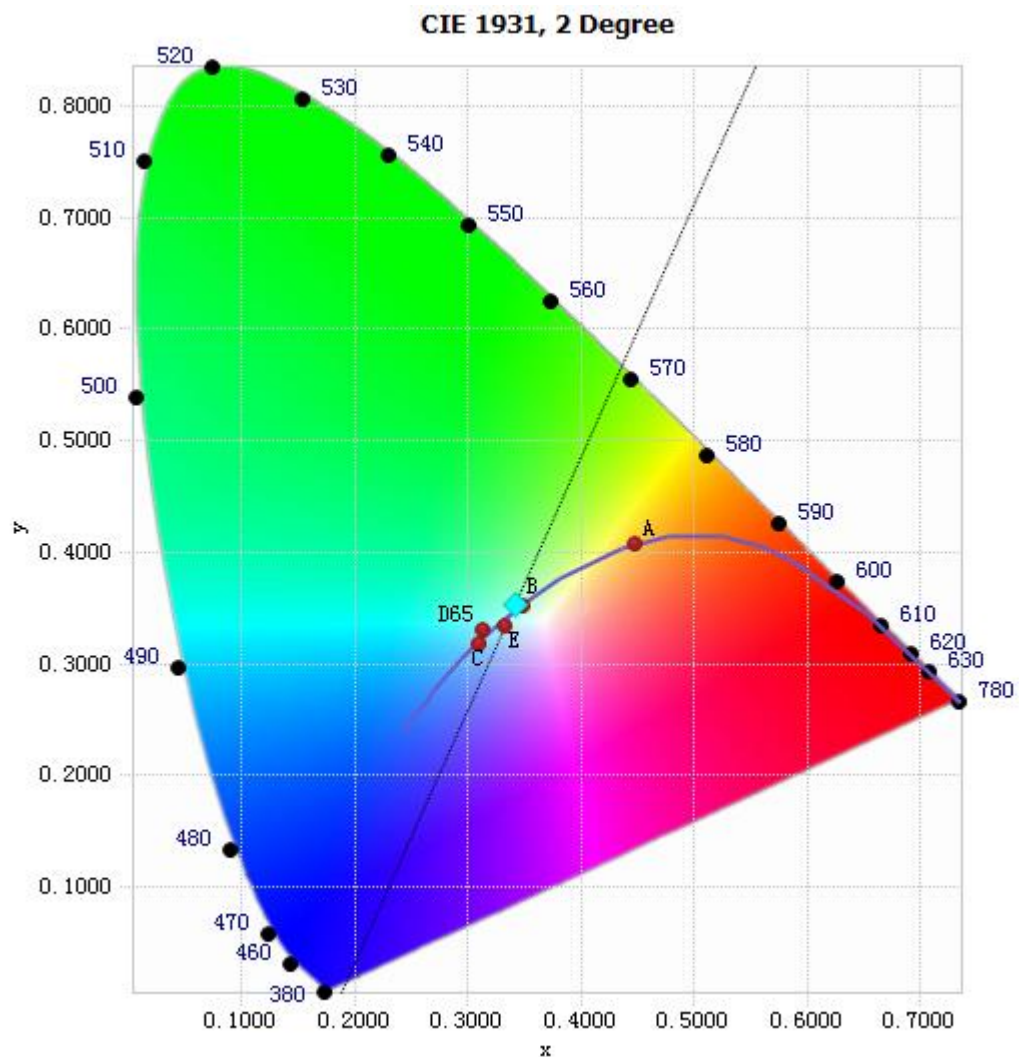


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.03E-04	485	1.58E-02	590	3.52E-02	695	4.90E-03
385	2.68E-04	490	1.72E-02	595	3.46E-02	700	4.19E-03
390	2.45E-04	495	1.96E-02	600	3.39E-02	705	3.62E-03
395	2.46E-04	500	2.24E-02	605	3.29E-02	710	3.07E-03
400	2.13E-04	505	2.47E-02	610	3.16E-02	715	2.64E-03
405	2.61E-04	510	2.65E-02	615	3.02E-02	720	2.25E-03
410	4.17E-04	515	2.82E-02	620	2.84E-02	725	1.94E-03
415	8.47E-04	520	2.91E-02	625	2.66E-02	730	1.66E-03
420	1.58E-03	525	3.00E-02	630	2.46E-02	735	1.43E-03
425	3.20E-03	530	3.08E-02	635	2.27E-02	740	1.21E-03
430	6.36E-03	535	3.13E-02	640	2.07E-02	745	1.05E-03
435	1.24E-02	540	3.18E-02	645	1.86E-02	750	8.90E-04
440	2.35E-02	545	3.25E-02	650	1.66E-02	755	7.70E-04
445	4.41E-02	550	3.29E-02	655	1.49E-02	760	6.65E-04
450	6.42E-02	555	3.35E-02	660	1.31E-02	765	5.72E-04
455	5.36E-02	560	3.40E-02	665	1.15E-02	770	4.89E-04
460	3.56E-02	565	3.45E-02	670	1.00E-02	775	4.26E-04
465	2.85E-02	570	3.48E-02	675	8.74E-03	780	3.60E-04
470	2.17E-02	575	3.51E-02	680	7.60E-03		
475	1.63E-02	580	3.53E-02	685	6.59E-03		
480	1.52E-02	585	3.55E-02	690	5.69E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method

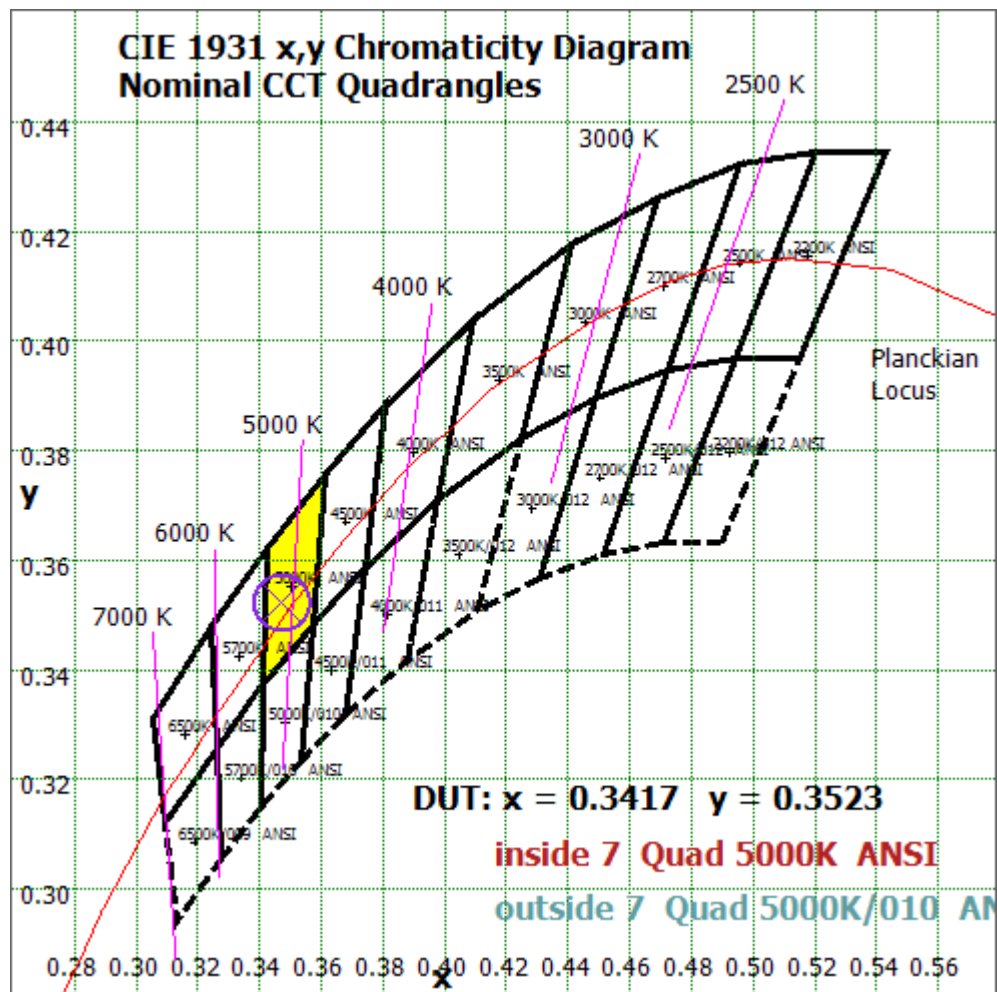


Tristimulus values(x, y): (0.3417, 0.3523)

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



Color Rendition Report – Sphere Spectroradiometer Method

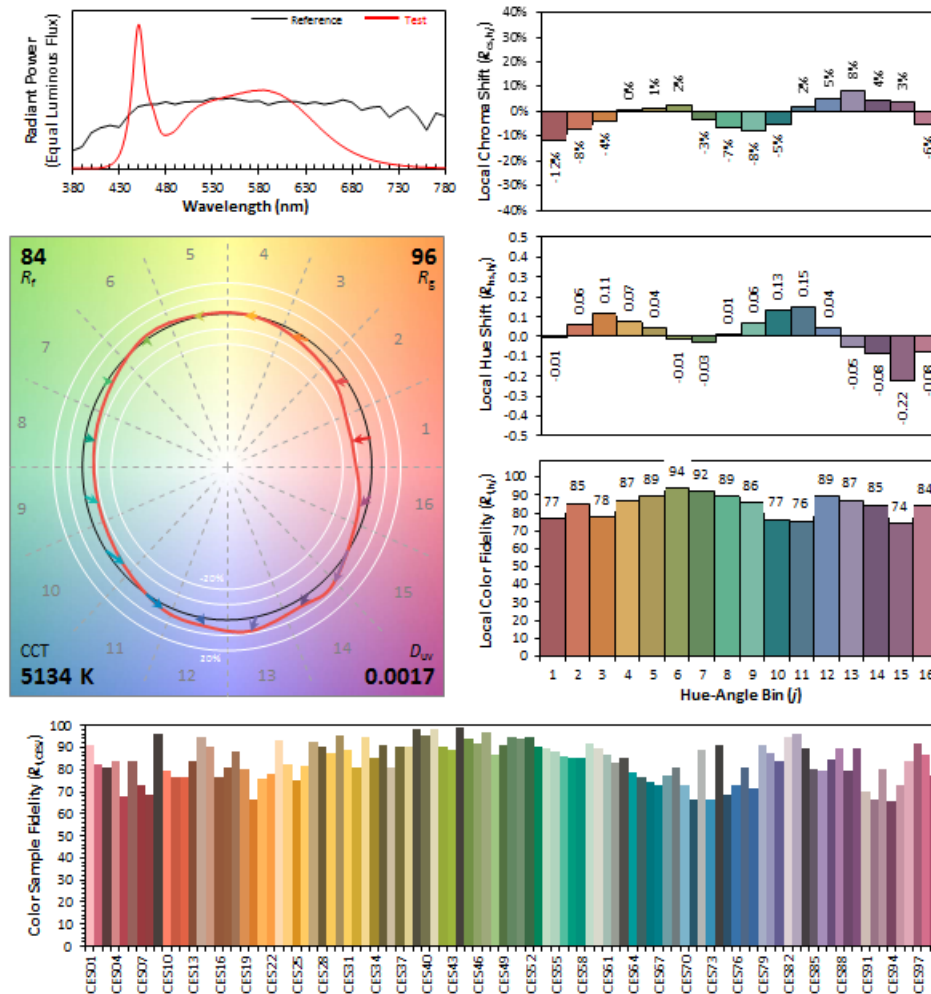
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2023/03/30

Model: 14T8/4F/850/UEB



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

x 0.3417
 y 0.3523
 u' 0.2089
 v' 0.4845

CIE 13.3-1995
(CRI)
 R_a 84
 R_g 12

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.0C

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	36.721	1.62%
10- 20	106.337	4.70%
20- 30	165.255	7.30%
30- 40	208.302	9.20%
40- 50	232.553	10.27%
50- 60	237.814	10.51%
60- 70	226.544	10.01%
70- 80	203.716	9.00%
80- 90	176.721	7.81%
90-100	153.023	6.76%
100-110	132.954	5.87%
110-120	113.946	5.03%
120-130	94.317	4.17%
130-140	72.823	3.22%
140-150	51.996	2.30%
150-160	29.076	1.28%
160-170	15.946	0.70%
170-180	5.497	0.24%
Total	2263.5	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	986.982	43.60%
60- 90	606.981	26.82%
0-90	1593.96	70.42%
90- 180	669.578	29.58%
0- 180	2263.5	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

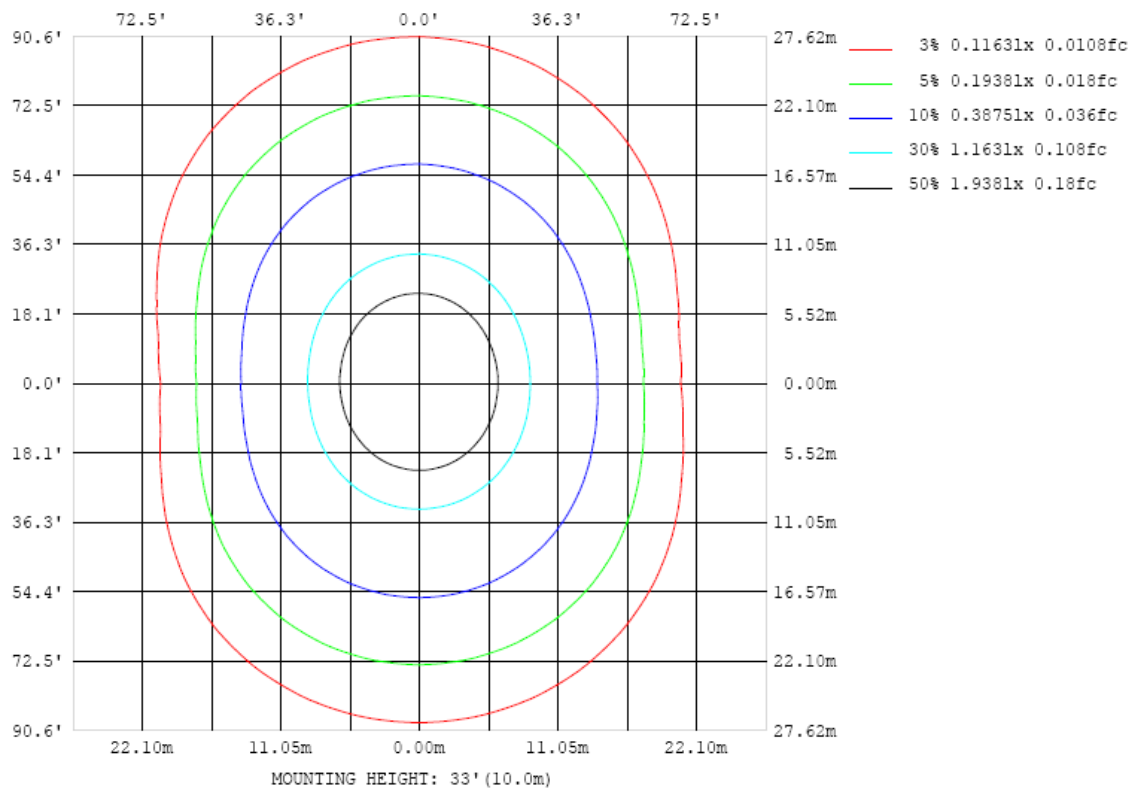


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

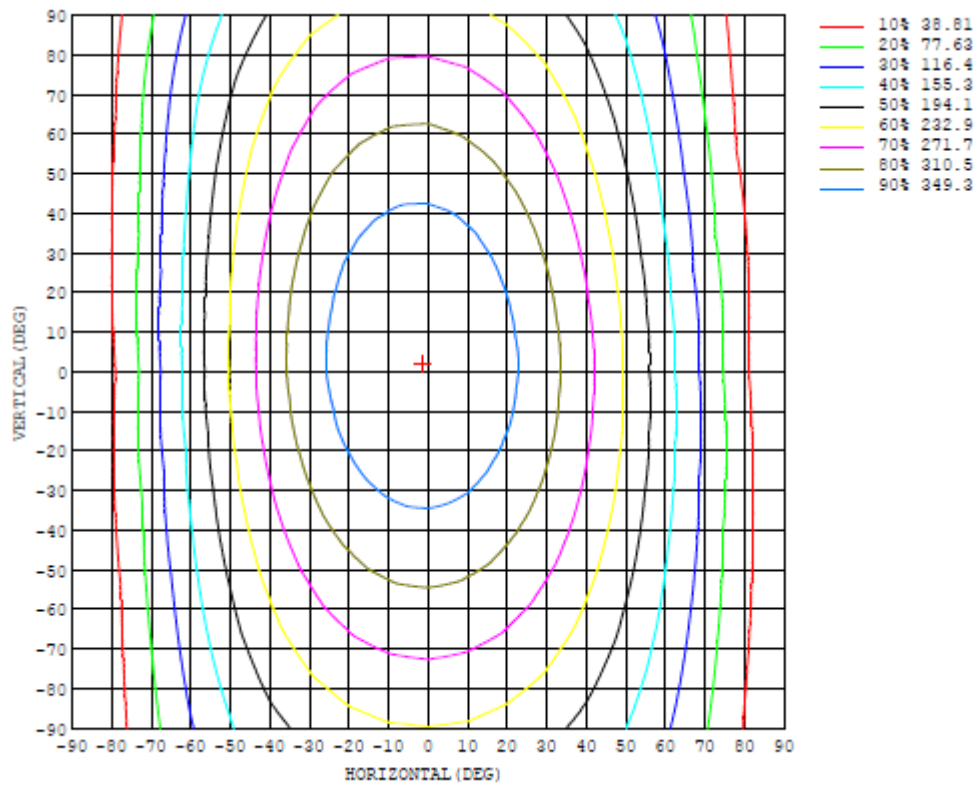


Chart 6: Isocandela Plot

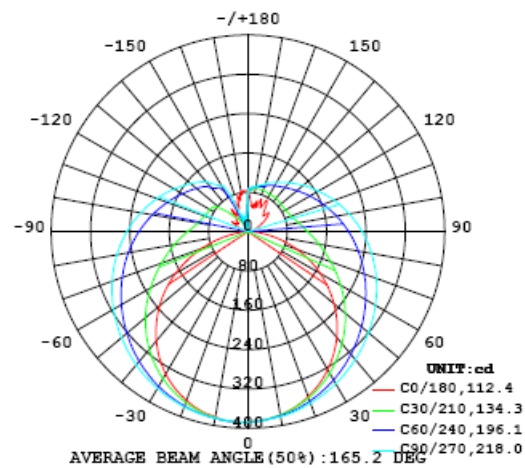


Chart 7: Polar Candela Distribution

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	388	388	388	388	388	388	388	388	388	388	388	388	388	388	388	388	388	388	388
5	385	384	384	384	384	384	385	385	385	385	385	385	385	385	386	386	387	386	387
10	379	378	378	379	379	379	380	381	381	382	382	382	382	382	382	382	382	382	383
15	370	369	369	370	372	373	375	376	377	378	378	378	377	377	376	375	375	376	376
20	357	357	357	360	363	365	367	369	371	371	372	372	370	369	367	365	365	365	366
25	342	342	344	347	350	354	358	361	364	365	365	364	362	359	357	354	351	351	352
30	324	325	328	332	337	343	348	353	355	357	357	355	352	348	343	339	335	333	334
35	304	305	309	315	323	330	337	343	346	348	348	346	341	335	329	322	317	313	314
40	281	283	289	297	307	317	326	333	337	339	339	335	330	322	312	303	296	290	290
45	256	259	267	278	291	303	314	322	327	330	329	325	317	307	295	283	272	265	264
50	228	233	244	258	274	289	301	311	318	320	319	314	304	292	277	261	246	237	235
55	199	206	220	238	257	274	289	300	307	310	308	302	292	277	259	239	220	207	204
60	170	178	195	218	240	260	276	289	296	299	297	291	279	262	241	216	193	175	170
65	138	150	171	198	223	246	264	277	285	289	287	279	266	247	223	194	165	143	135
70	107	122	149	179	208	232	252	266	274	278	275	268	253	233	206	173	140	110	99.5
75	74.6	94.0	127	162	193	219	240	254	263	266	264	256	241	219	190	155	115	79.1	64.9
80	44.7	69.1	108	147	179	207	228	243	252	255	252	244	229	206	176	139	94.0	51.6	33.1
85	19.6	49.3	92.3	133	167	194	216	231	240	244	241	233	217	194	163	125	77.8	31.2	8.51
90	4.02	36.8	80.5	122	156	183	205	220	229	232	230	221	205	183	153	114	67.2	21.2	0.39
95	3.39	31.3	72.4	112	146	172	194	208	217	220	218	209	194	172	143	105	61.1	19.9	0.74
100	7.11	30.4	67.2	104	137	162	183	197	206	209	207	198	183	161	134	98.0	58.3	23.6	2.86
105	11.5	32.8	64.4	98.1	129	154	172	186	195	198	195	187	173	153	126	93.2	58.2	29.7	7.76
110	15.9	37.6	63.6	93.6	122	145	162	175	184	187	184	176	163	144	119	90.1	60.0	36.9	15.2
115	22.7	43.4	64.6	90.4	115	137	154	165	173	176	173	166	154	137	114	88.4	63.3	43.5	23.0
120	31.9	49.5	66.5	88.4	110	130	145	156	163	165	163	157	146	130	110	87.8	67.2	49.3	35.0
125	43.3	54.9	69.4	87.5	106	123	137	147	154	155	154	148	138	124	106	88.2	71.3	57.3	25.8
130	54.4	58.9	72.5	87.6	103	118	130	139	145	147	145	139	130	118	104	89.0	75.5	63.6	27.0
135	45.9	64.4	75.5	87.9	101	113	123	131	136	138	136	132	124	114	102	90.2	79.0	68.0	34.5
140	50.5	70.9	76.8	89.0	98.8	109	117	124	128	129	128	124	118	110	101	90.8	80.3	71.1	38.6
145	63.9	75.9	80.0	88.3	97.6	105	112	117	121	122	121	118	113	107	99.9	89.6	82.3	76.9	49.9
150	71.4	75.7	83.0	87.8	96.5	103	108	112	115	116	115	113	109	104	96.6	89.9	85.2	78.0	43.3
155	61.7	79.8	85.4	89.0	92.9	99.2	104	107	109	110	110	108	105	99.4	94.5	91.0	86.1	81.5	64.6
160	55.3	76.7	86.0	89.5	92.6	95.2	97.6	101	103	104	103	101	98.5	96.3	93.8	90.6	86.8	79.7	51.8
165	55.7	76.6	86.9	89.8	91.3	93.5	95.3	96.7	97.7	98.1	97.6	96.8	95.9	94.4	92.2	90.3	87.7	85.0	68.9
170	49.8	73.4	84.5	89.2	90.7	91.4	92.2	92.9	93.5	93.7	93.5	93.0	92.4	91.9	91.5	90.1	86.5	85.9	76.7
175	62.2	76.4	82.3	85.4	87.6	89.1	89.9	90.5	90.8	90.9	90.8	90.4	89.8	89.0	87.8	85.9	85.2	86.5	84.3
180	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6

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	388	388	388	388	388	388	388	388	388	388	388	388	388	388	388	388	388		
5	387	387	387	387	388	388	388	387	387	387	387	387	386	386	386	385	385		
10	384	384	384	385	385	386	386	386	386	385	384	383	382	381	380	379	379		
15	376	377	378	380	381	382	383	383	383	382	380	378	376	374	372	371	370		
20	366	367	370	373	375	378	379	380	379	378	376	372	369	365	362	359	358		
25	352	355	359	364	368	371	374	375	375	372	369	365	359	354	349	345	343		
30	336	340	346	352	358	364	367	369	368	365	361	355	348	341	334	329	325		
35	316	322	330	339	348	354	359	362	361	358	353	345	336	326	317	309	305		
40	293	301	312	324	335	344	351	354	354	350	343	334	322	310	298	289	283		
45	268	279	293	307	322	333	341	345	345	341	333	322	308	293	278	266	258		
50	240	254	272	291	308	321	331	336	336	331	322	309	292	275	257	241	231		
55	211	228	251	273	293	309	320	326	326	321	310	296	277	256	235	216	203		
60	180	202	229	255	279	297	309	315	316	310	299	283	262	238	212	189	173		
65	147	175	207	238	265	285	298	304	305	299	287	270	247	220	190	162	143		
70	115	149	187	222	250	272	286	293	294	288	275	257	232	202	169	136	112		
75	84.5	126	169	207	237	260	274	282	282	276	263	244	218	186	150	112	81.3		
80	58.9	106	152	192	223	247	262	270	271	264	251	232	205	172	133	90.4	54.0		
85	40.2	89.3	137	178	210	235	249	258	259	252	239	219	192	158	118	73.2	31.8		
90	26.3	74.7	123	165	197	222	237	245	246	240	227	207	180	146	106	61.7	19.0		
95	20.8	64.3	111	152	185	210	225	233	234	228	215	196	169	135	95.7	52.1	12.2		
100	21.2	60.6	103	142	173	197	212	220	222	216	203	185	158	126	87.6	46.0	11.6		
105	21.7	59.8	97.6	134	163	186	200	208	209	204	192	174	149	118	82.4	44.4	13.3		
110	21.2	59.5	93.9	126	154	175	189	196	197	192	181	163	140	112	79.2	45.1	13.9		
115	18.8	58.9	91.3	120	145	164	177	184	185	180	170	154	132	107	77.6	46.5	11.7		
120	15.7	60.4	89.6	115	137	154	166	172	174	169	160	145	126	103	76.2	46.7	8.60		
125	10.7	53.6	87.3	111	130	145	156	161	162	159	150	137	120	99.6	69.5	37.5	3.34		
130	7.62	18.5	73.8	106	124	137	146	151	152	149	141	129	115	94.5	61.7	2.39	12.9		
135	5.95	0.00	53.6	100	116	129	137	142	142	139	133	123	106	88.5	45.8	5.76	18.7		
140	1.01	2.96	35.6	88.5	107	117	127	132	133	130	122	109	96.4	79.5	31.0	18.9	18.1		
145	16.7	8.42	29.4	24.4	97.3	109	113	116	117	114	108	98.6	82.6	26.5	25.2	32.4	16.1		
150	17.5	10.5	10.2	1.82	35.0	90.3	103	108	108	106	91.1	70.0	36.2	2.09	27.1	26.8	14.2		
155	23.8	14.0	12.0	2.44	35.4	9.26	17.6	50.9	65.2	49.7	17.8	3.73	25.9	8.36	31.7	10.8	21.3		
160	23.4	6.57	10.9	11.5	24.8	4.28	17.9	34.5	37.6	15.1	25.0	7.17	13.8	30.5	9.89	7.10	20.5		
165	33.1	27.9	14.7	15.2	10.2	26.5	14.3	15.0	8.32	36.6	33.0	32.2	32.6	10.6	9.90	8.46	23.7		
170	43.4	35.2	24.3	8.03	12.2	19.6	15.4	13.2	5.62	13.2	15.7	17.3	17.2	10.4	11.2	19.5	28.6		
175	62.9	44.0	39.5	36.9	31.4	27.9	28.5	27.0	20.8	14.4	11.5	13.3	16.7	20.7	25.4	28.7	36.3		
180	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6		

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 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 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 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 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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