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/840/UEB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ230300391

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

Review by: April Zou

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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/840/UEB**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
163.7	2352.7	14.37	0.9844

CCT (K)	CRI	Stabilization Time (Light & Power)
4055	82.2	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

TABLE OF CONTENT

SAMPLE PHOTO

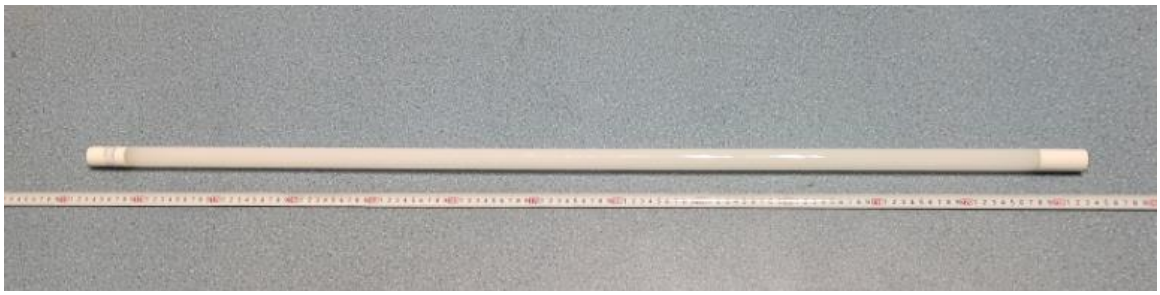


Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Tube
Model	: 14T8/4F/840/UEB
Electrical Ratings	: 120-277V, 50/60Hz, 14W
Product Description	: 4000K
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 ℃.

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	0.9844	0.9282
Test Power (W)	14.37	14.55
THD A%	15.43	15.26
Luminous Efficacy (lm/W)	163.7	163.6
Total Luminous Flux (lm)	2352.7	2380.4
Color Rendering Index (CRI)	82.2	
R9	4.7	
Correlated Color Temperature (CCT)(K)	4055	
Chromaticity Chroma x	0.3787	
Chromaticity Chroma y	0.3783	
Chromaticity Chroma u	0.2234	
Chromaticity Chroma v	0.3347	
Duv	0.0012	
Chromaticity Chroma u ’	0.2234	
Chromaticity Chroma v’	0.5020	

Special Color Rendering Indices	
R1	80.1
R2	88.4
R3	94.5
R4	80.9
R5	80.2
R6	83.8
R7	85.9
R8	63.5
R9	4.7
R10	72.6
R11	79.8
R12	58.9
R13	82.2
R14	97.2

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 ℃.

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	0.9845
Power (W)	14.38
Luminous Efficacy (lm/W)	164.3
Total Luminous Flux (lm)	2362.2
Beam Angle (°)	112.9 (0^o-180^o) / 219.2 (90^o-270^o)
Center Beam Candle Power (cd)	401
Maximum Beam Candle Power (cd)	402.0 (At: C=280.0, Gamma=5.5)
Spacing Criteria	1.25 (0^o-180^o) / 1.44 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	43.47%
Zonal Lumens in the 60 °-90 °Zone	26.85%
Zonal Lumens in the 90 °-120 °Zone	17.70%
Zonal Lumens in the 120 °-180 °Zone	11.98%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

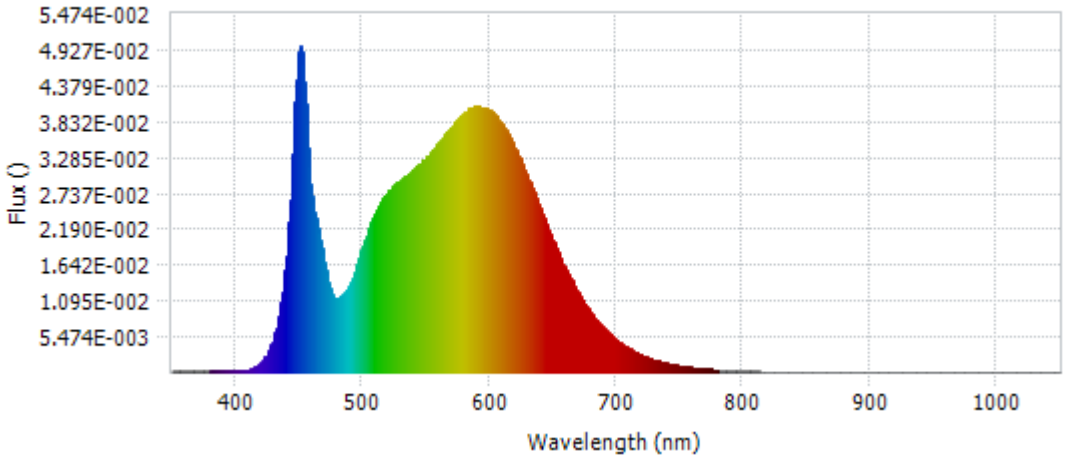
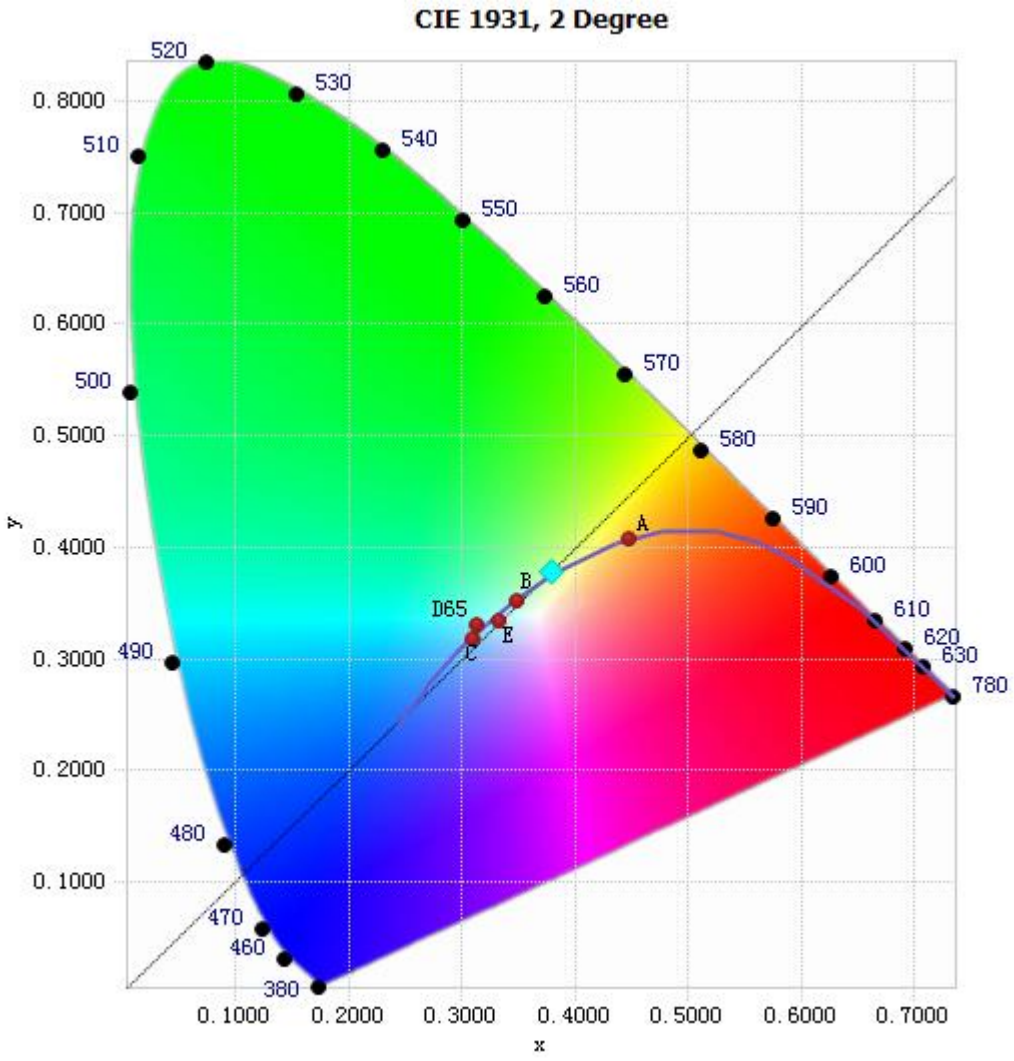


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.52E-04	485	1.19E-02	590	4.07E-02	695	5.83E-03
385	1.94E-04	490	1.34E-02	595	4.05E-02	700	4.99E-03
390	1.92E-04	495	1.61E-02	600	4.01E-02	705	4.26E-03
395	1.83E-04	500	1.92E-02	605	3.92E-02	710	3.65E-03
400	1.87E-04	505	2.20E-02	610	3.79E-02	715	3.10E-03
405	2.21E-04	510	2.43E-02	615	3.64E-02	720	2.64E-03
410	3.75E-04	515	2.63E-02	620	3.43E-02	725	2.27E-03
415	7.78E-04	520	2.74E-02	625	3.23E-02	730	1.93E-03
420	1.54E-03	525	2.85E-02	630	2.99E-02	735	1.64E-03
425	2.88E-03	530	2.94E-02	635	2.75E-02	740	1.40E-03
430	5.29E-03	535	3.00E-02	640	2.51E-02	745	1.20E-03
435	9.72E-03	540	3.09E-02	645	2.26E-02	750	1.03E-03
440	1.78E-02	545	3.18E-02	650	2.02E-02	755	8.72E-04
445	3.33E-02	550	3.27E-02	655	1.80E-02	760	7.50E-04
450	4.91E-02	555	3.39E-02	660	1.59E-02	765	6.34E-04
455	4.08E-02	560	3.50E-02	665	1.40E-02	770	5.53E-04
460	2.70E-02	565	3.63E-02	670	1.21E-02	775	4.73E-04
465	2.20E-02	570	3.74E-02	675	1.06E-02	780	3.98E-04
470	1.67E-02	575	3.86E-02	680	9.15E-03		
475	1.22E-02	580	3.95E-02	685	7.90E-03		
480	1.13E-02	585	4.04E-02	690	6.86E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3787, 0.3783)

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

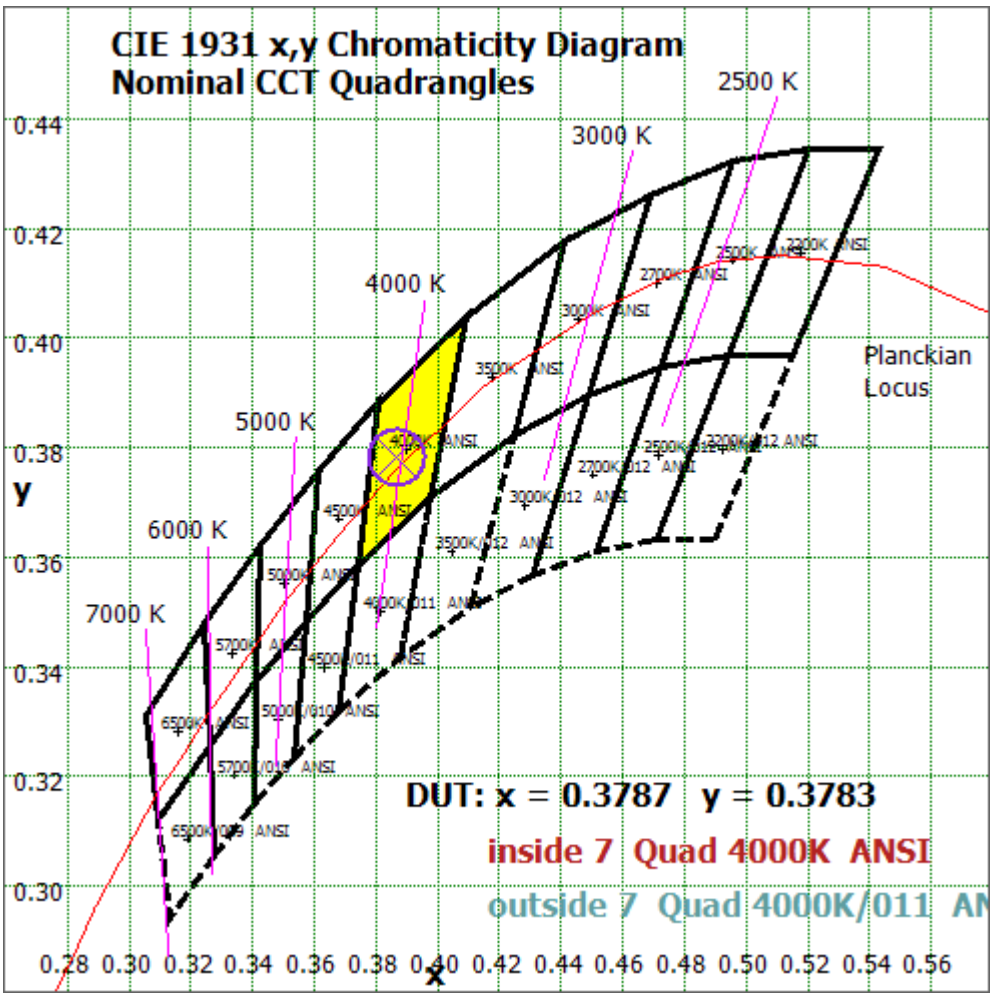


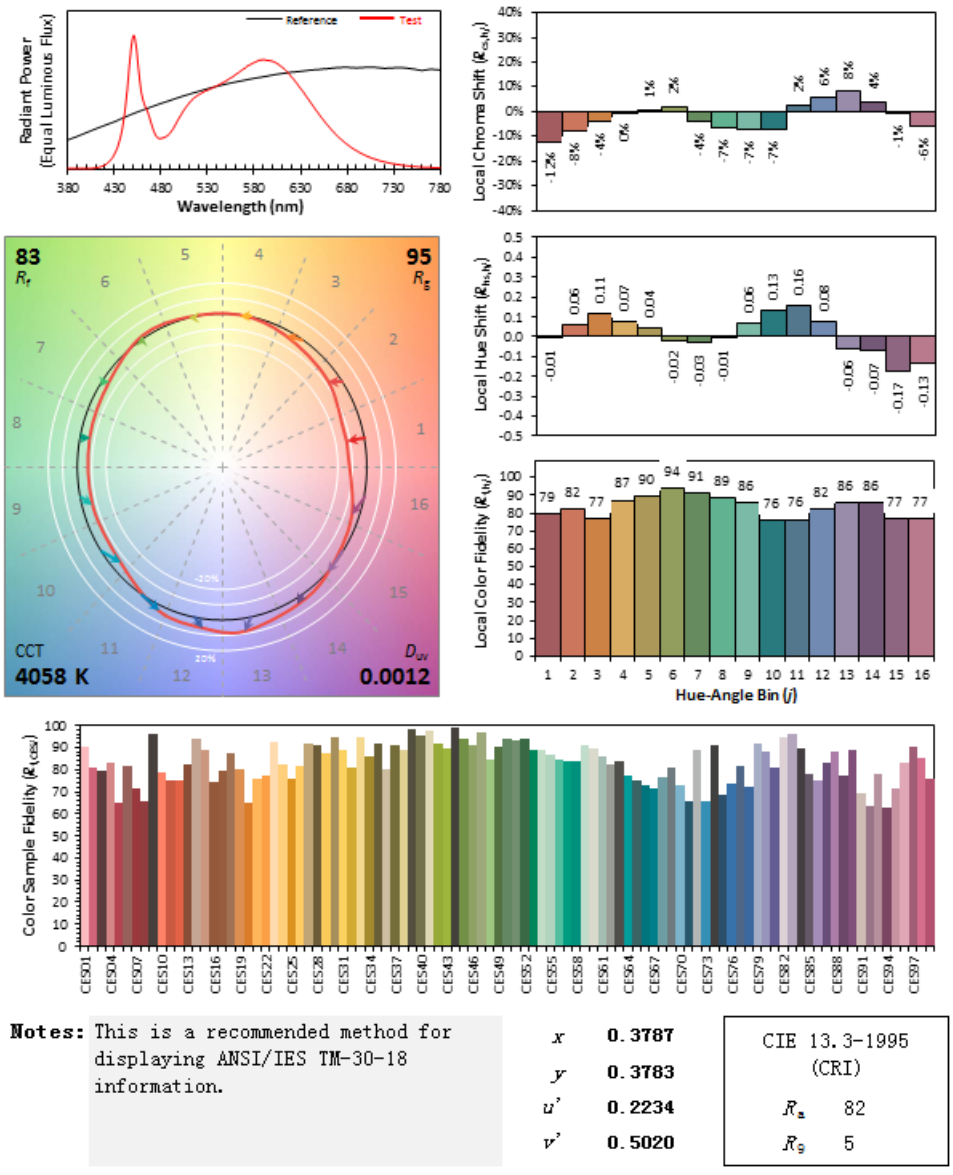
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

Source: LED **Manufacturer:** GREEN CREATIVE LTD

Date: 2023/03/30 **Model:** 14T8/4F/840/UEB



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

x	0.3787
y	0.3783
u'	0.2234
v'	0.5020

CIE 13.3-1995 (CRI)

R_a	82
R_9	5

olors 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

γ(°)	Lumens	% Total
0- 10	38.082	1.61%
10- 20	110.421	4.67%
20- 30	171.735	7.27%
30- 40	216.651	9.17%
40- 50	242.145	10.25%
50- 60	247.904	10.49%
60- 70	236.47	10.01%
70- 80	212.859	9.01%
80- 90	184.849	7.83%
90-100	160.123	6.78%
100-110	138.845	5.88%
110-120	119.027	5.04%
120-130	99.012	4.19%
130-140	77.55	3.28%
140-150	56.601	2.40%
150-160	34.478	1.46%
160-170	13.381	0.57%
170-180	2.065	0.09%
Total	2362.2	100%

γ(°)	Lumens	% Total
0- 60	1026.94	43.47%
60- 90	634.178	26.85%
0-90	1661.12	70.32%
90- 180	701.082	29.68%
0- 180	2362.2	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

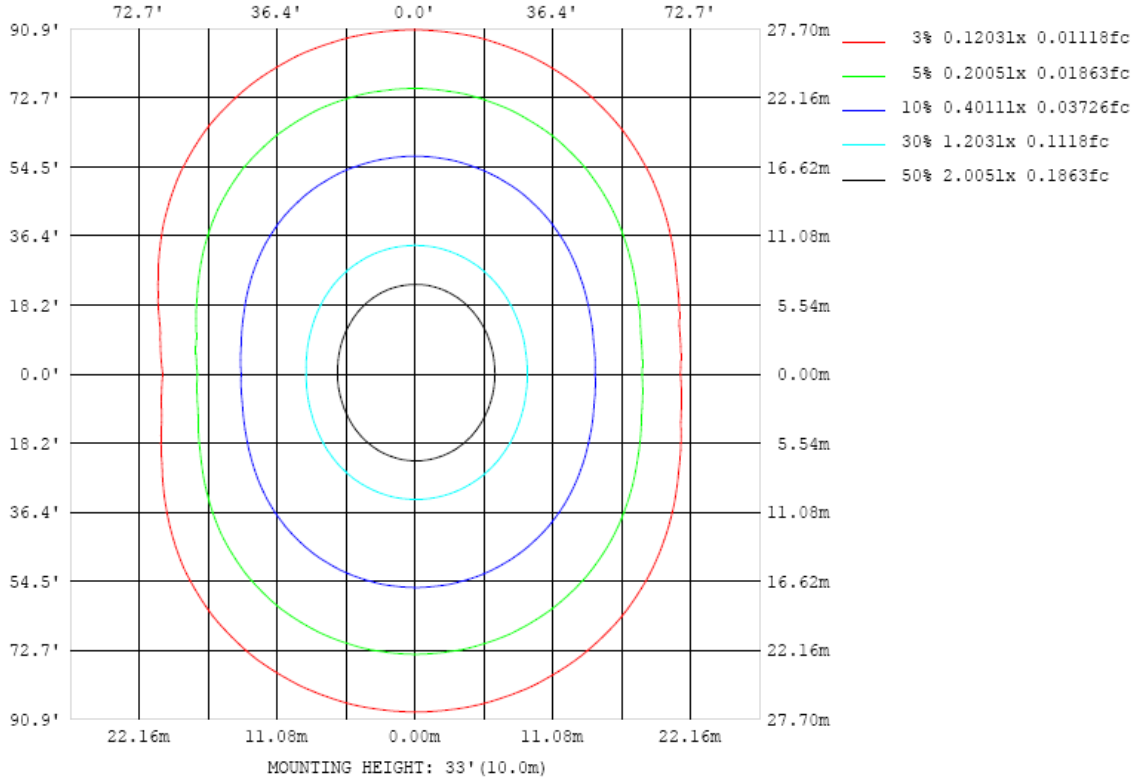


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

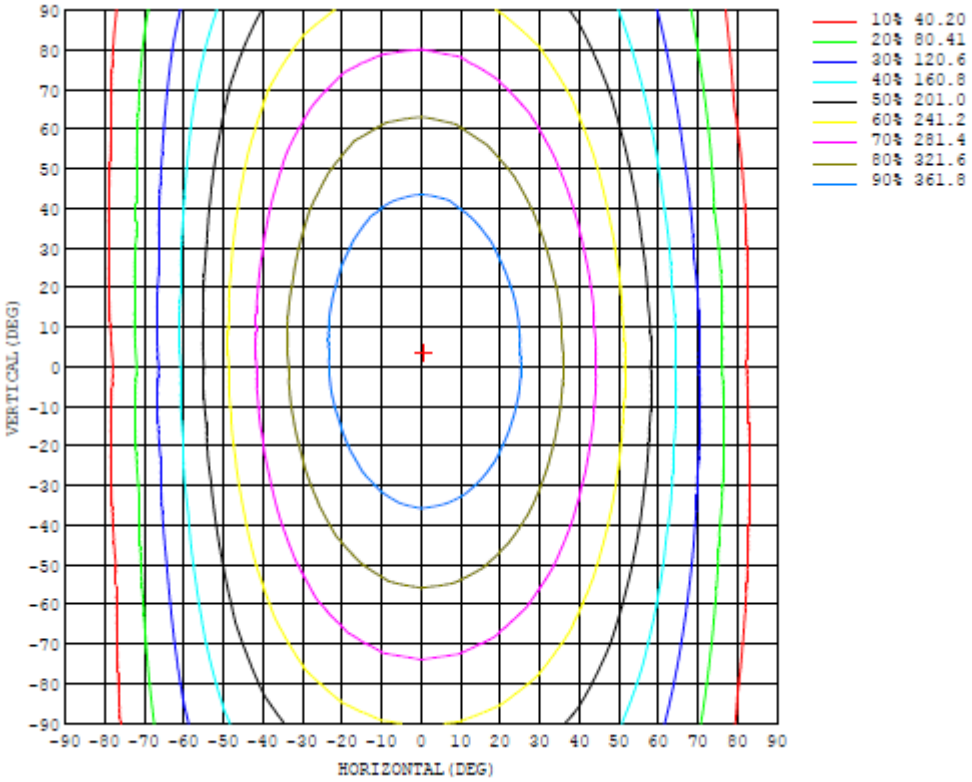


Chart 6: Isocandela Plot

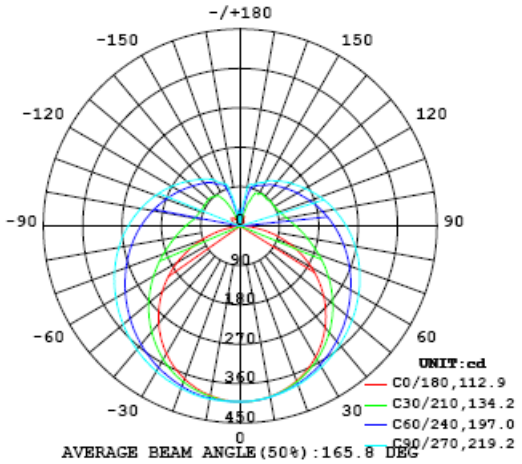


Chart 7: Polar Candela Distribution

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	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401
5	400	400	400	400	400	400	400	400	400	400	400	400	399	399	399	399	399	399	399
10	395	396	396	396	396	396	397	396	396	396	396	396	395	395	394	394	394	393	393
15	387	388	388	389	389	390	391	391	392	391	391	390	389	387	386	385	385	384	384
20	376	377	377	378	380	382	384	385	386	387	385	384	381	379	376	374	373	372	372
25	362	363	364	366	369	373	375	378	379	379	378	376	373	368	364	360	358	357	356
30	345	346	348	352	357	362	366	369	371	372	370	367	363	357	350	344	340	338	337
35	325	326	330	335	342	349	355	360	362	363	361	357	351	343	335	326	320	316	315
40	302	304	309	317	326	336	343	350	353	354	352	347	339	329	318	306	297	292	290
45	277	279	287	298	310	321	331	338	343	345	342	336	327	314	300	285	273	265	263
50	249	253	263	277	292	306	318	327	333	334	331	324	314	299	282	263	247	236	233
55	220	225	238	255	274	291	305	316	322	324	321	313	300	283	263	240	220	205	200
60	188	195	212	234	256	276	292	304	311	313	310	301	288	268	245	218	192	173	166
65	156	164	186	212	238	261	279	292	299	302	299	290	275	253	227	196	164	141	130
70	122	134	160	191	221	246	266	280	288	291	287	278	262	239	210	175	139	107	94.2
75	87.4	104	137	172	205	232	253	268	276	279	276	266	249	225	194	156	114	75.5	59.3
80	54.1	76.2	116	155	190	219	240	255	264	267	264	254	237	212	180	141	94.0	48.5	27.5
85	24.6	53.0	97.5	140	176	206	227	243	252	256	252	242	225	200	167	127	78.7	29.9	5.56
90	4.72	37.3	83.7	127	163	193	215	231	240	243	239	229	213	188	156	116	68.6	22.0	0.29
95	1.44	29.9	74.0	117	153	181	203	219	228	231	228	218	201	177	146	107	63.0	21.7	0.59
100	4.11	28.5	68.0	108	143	170	192	207	216	219	215	206	190	166	137	101	60.6	25.6	1.21
105	7.42	30.8	64.7	101	134	160	181	195	204	207	204	194	179	157	130	96.0	60.7	30.3	1.93
110	9.19	35.6	63.8	96.0	126	152	170	184	192	195	192	183	169	149	123	93.1	62.9	32.8	4.62
115	7.52	42.0	64.6	92.5	120	143	160	173	181	183	181	172	159	141	118	91.5	65.5	44.0	11.3
120	8.27	49.0	66.7	90.4	114	135	151	162	170	172	169	162	151	134	114	91.1	68.4	50.5	18.2
125	9.41	55.2	68.0	89.5	110	128	143	153	159	161	159	153	143	128	110	91.2	69.6	53.2	23.6
130	10.5	59.5	71.5	89.3	106	122	135	145	150	152	151	145	135	123	108	90.3	69.6	44.2	27.1
135	10.8	54.1	74.7	86.5	104	117	128	136	141	143	142	137	129	118	104	88.2	78.1	31.1	25.2
140	14.5	49.0	77.4	87.9	99.1	113	122	129	133	135	133	129	123	113	99.4	84.1	81.9	28.8	23.0
145	11.5	31.4	82.4	88.6	97.0	106	116	122	126	127	126	122	115	105	96.9	87.8	80.5	20.4	18.3
150	12.4	24.5	78.1	82.9	96.3	102	107	112	115	117	115	112	108	102	92.4	91.0	64.5	25.3	22.6
155	22.6	24.4	56.7	83.2	91.1	98.6	103	107	109	109	109	107	103	96.0	93.8	91.5	52.0	21.3	24.1
160	20.6	7.19	24.6	57.4	80.9	92.2	97.3	99.5	101	102	101	98.8	97.7	96.6	95.5	73.6	35.9	16.5	20.9
165	11.3	16.1	13.1	26.6	50.3	70.5	84.7	96.1	98.1	98.7	98.7	98.6	97.8	95.6	76.1	45.9	19.3	7.18	16.7
170	24.6	11.7	21.4	12.3	17.0	27.9	37.0	46.1	62.1	73.6	72.8	66.2	59.7	52.6	37.7	22.1	8.34	22.0	11.4
175	9.85	10.7	15.6	21.5	20.5	11.3	5.63	1.63	1.63	7.47	14.3	14.0	8.45	5.72	12.4	21.8	22.5	14.6	9.07
180	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18

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	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401
5	399	400	400	400	401	401	401	401	402	402	402	401	401	401	401	400	400
10	394	394	395	397	398	399	400	401	401	401	401	400	399	398	396	396	396
15	386	386	388	391	394	396	398	399	399	399	398	397	395	393	391	389	388
20	373	376	379	384	387	389	392	394	395	395	393	391	389	385	382	379	377
25	358	362	367	372	377	382	386	388	390	389	387	384	379	375	370	366	363
30	339	345	352	359	367	373	379	382	383	383	379	375	368	362	356	350	346
35	319	326	334	345	355	364	371	374	376	375	371	364	356	347	339	332	327
40	294	304	315	329	342	353	361	366	368	366	361	353	343	331	320	312	304
45	268	280	295	311	328	341	351	357	359	357	350	341	328	314	300	289	279
50	239	254	273	294	313	329	341	347	349	347	339	328	313	296	278	263	252
55	209	227	251	276	298	316	330	337	339	336	327	314	297	277	255	237	223
60	177	200	229	258	283	303	318	326	328	325	315	301	281	258	232	209	193
65	144	173	207	240	269	291	306	315	317	314	303	287	265	239	210	182	162
70	111	147	187	223	255	278	294	303	306	301	290	273	250	220	187	155	130
75	80.3	123	168	208	241	265	282	291	294	290	278	260	235	203	167	129	97.3
80	55.2	104	152	194	227	252	270	279	282	277	265	247	221	188	148	106	67.2
85	37.5	88.5	138	180	215	240	257	267	269	265	252	234	207	173	132	86.4	42.7
90	25.2	75.5	125	168	202	227	245	254	256	252	240	221	194	160	119	72.2	26.3
95	20.2	66.2	114	156	190	215	232	241	243	239	227	208	182	149	108	63.6	19.0
100	22.5	62.1	105	146	179	203	220	228	231	226	215	197	171	139	99.5	56.7	15.6
105	26.3	61.8	100	137	168	191	207	216	218	214	202	185	160	129	92.5	52.9	17.7
110	29.8	63.1	97.2	131	159	180	195	203	206	201	191	174	150	122	87.5	52.6	21.6
115	34.7	65.5	95.3	125	150	170	184	191	193	189	179	163	142	115	84.7	54.5	26.2
120	40.2	68.5	94.4	120	143	160	172	179	181	177	168	154	134	110	83.7	57.5	30.2
125	33.3	69.0	94.5	116	136	151	162	168	170	166	158	145	127	107	83.5	58.6	27.3
130	2.77	66.0	95.2	113	130	143	152	158	159	156	148	137	122	104	83.8	55.3	14.5
135	1.01	64.4	93.3	110	124	135	143	148	149	146	139	130	117	102	83.7	55.9	2.19
140	15.5	60.4	88.7	106	119	128	135	139	140	137	132	123	113	98.2	81.6	57.1	0.89
145	15.7	38.6	83.4	101	112	122	127	130	131	129	124	117	107	92.3	77.8	45.7	16.0
150	12.0	5.52	62.1	97.1	104	111	118	122	122	121	116	107	98.0	91.7	61.6	9.85	15.0
155	16.0	10.9	27.2	72.3	100	105	107	108	109	107	105	101	92.9	75.5	34.8	3.26	15.1
160	29.2	27.3	12.4	20.9	60.0	92.8	101	102	102	101	99.2	87.8	64.0	30.8	15.1	12.2	19.4
165	21.3	9.11	13.0	20.6	12.7	17.4	40.6	58.2	65.6	63.1	43.0	21.0	5.84	16.9	11.0	22.3	32.9
170	23.4	14.4	25.8	19.5	8.06	21.2	29.7	26.9	22.4	18.1	17.1	22.6	16.5	8.05	21.3	28.5	36.0
175	10.2	26.2	34.9	22.8	14.6	19.2	27.3	29.1	22.4	19.1	36.1	37.5	31.6	18.1	23.9	44.6	33.7
180	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18	7.18

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.

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The uncertainty of integrating sphere system reported in this document is expended 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 expended 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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