

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: 17T8/4F/835/DEB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,
Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ20100014e

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

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: 17T8/4F/835/DEB

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
138.2	2395.1	17.33	0.9770
CCT (K)	CRI	Stabilization Time (Light & Power)	
3497	83.4	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

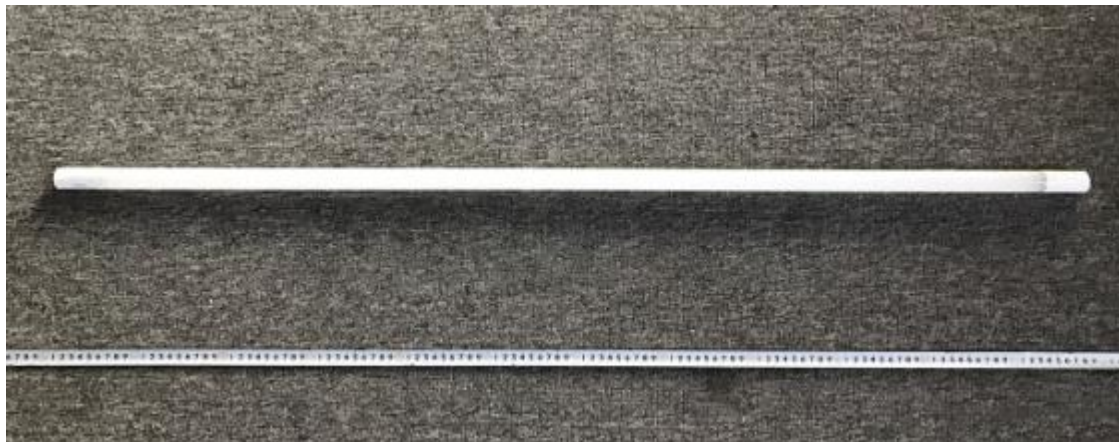


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 17T8/4F/835/DEB
Electrical Ratings	: 120-277V, 50/60Hz, 17W
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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.148	0.067
Power Factor	0.9770	0.9295
Test Power (W)	17.33	17.18
THD A%	20.63	19.37
Luminous Efficacy (lm/W)	138.2	137.6
Total Luminous Flux (lm)	2395.1	2363.5
Color Rendering Index (CRI)	83.4	
R9	9.1	
Correlated Color Temperature (CCT)(K)	3497	
Chromaticity Chroma x	0.4048	
Chromaticity Chroma y	0.3894	
Chromaticity Chroma u	0.2359	
Chromaticity Chroma v	0.3404	
Duv	-0.0005	
Chromaticity Chroma u'	0.2359	
Chromaticity Chroma v'	0.5106	

Special Color Rendering Indices	
R1	81.7
R2	89.7
R3	96
R4	82.8
R5	82.2
R6	86.8
R7	84.9
R8	62.8
R9	9.1
R10	76.4
R11	82.7
R12	70.1
R13	83.5
R14	98

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 25.1 °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)	0.148
Power Factor	0.9766
Power (W)	17.36
Luminous Efficacy (lm/W)	136.1
Total Luminous Flux (lm)	2362.6
Beam Angle (°)	109.8 (0°-180°) / 193.2 (90°-270°)
Center Beam Candle Power (cd)	435
Maximum Beam Candle Power (cd)	435.4 (At: C=270.0, Gamma=0.5)
Spacing Criteria	1.25 (0°-180°) / 1.38 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	45.63%
Zonal Lumens in the 60 °-90 °Zone	26.32%
Zonal Lumens in the 90 °-120 °Zone	16.32%
Zonal Lumens in the 120 °-180 °Zone	11.73%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

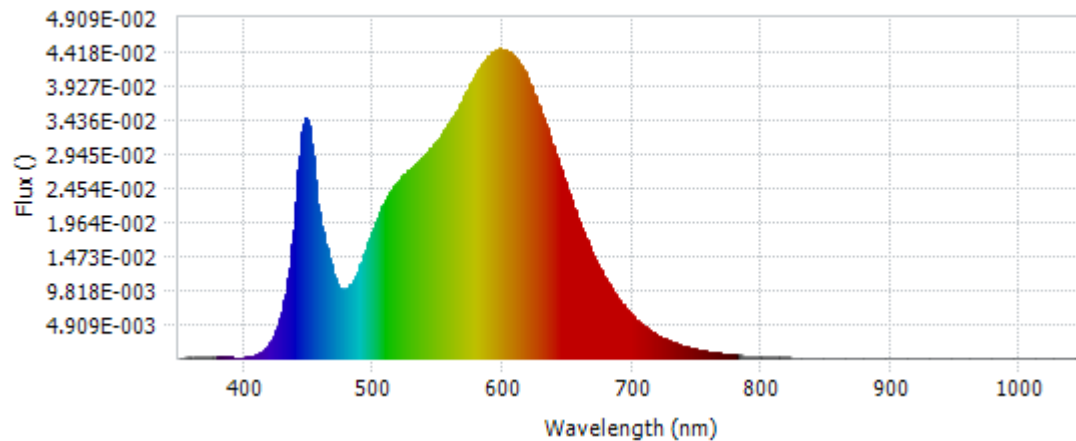
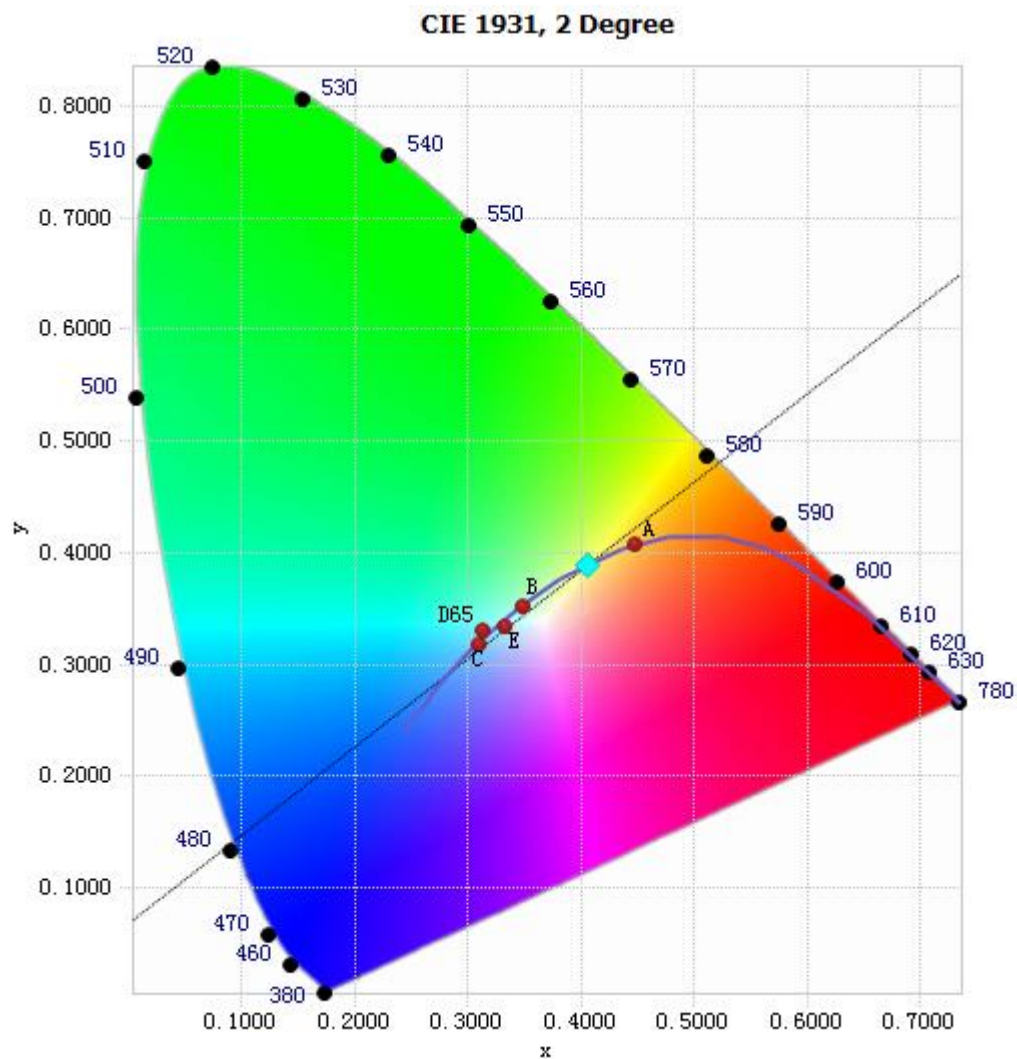


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.86E-04	485	1.14E-02	590	4.37E-02	695	7.22E-03
385	1.61E-04	490	1.35E-02	595	4.44E-02	700	6.20E-03
390	1.67E-04	495	1.61E-02	600	4.45E-02	705	5.32E-03
395	1.43E-04	500	1.88E-02	605	4.42E-02	710	4.53E-03
400	1.51E-04	505	2.11E-02	610	4.33E-02	715	3.87E-03
405	2.52E-04	510	2.30E-02	615	4.19E-02	720	3.32E-03
410	5.62E-04	515	2.46E-02	620	4.00E-02	725	2.83E-03
415	1.16E-03	520	2.57E-02	625	3.78E-02	730	2.43E-03
420	2.21E-03	525	2.66E-02	630	3.53E-02	735	2.06E-03
425	4.18E-03	530	2.75E-02	635	3.26E-02	740	1.76E-03
430	7.43E-03	535	2.84E-02	640	3.00E-02	745	1.51E-03
435	1.31E-02	540	2.94E-02	645	2.71E-02	750	1.29E-03
440	2.26E-02	545	3.04E-02	650	2.44E-02	755	1.10E-03
445	3.25E-02	550	3.16E-02	655	2.17E-02	760	9.44E-04
450	3.34E-02	555	3.29E-02	660	1.93E-02	765	8.07E-04
455	2.56E-02	560	3.43E-02	665	1.70E-02	770	6.93E-04
460	1.91E-02	565	3.59E-02	670	1.48E-02	775	5.95E-04
465	1.52E-02	570	3.77E-02	675	1.30E-02	780	5.11E-04
470	1.16E-02	575	3.95E-02	680	1.13E-02		
475	1.00E-02	580	4.11E-02	685	9.74E-03		
480	1.01E-02	585	4.27E-02	690	8.40E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4048, 0.3894)

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

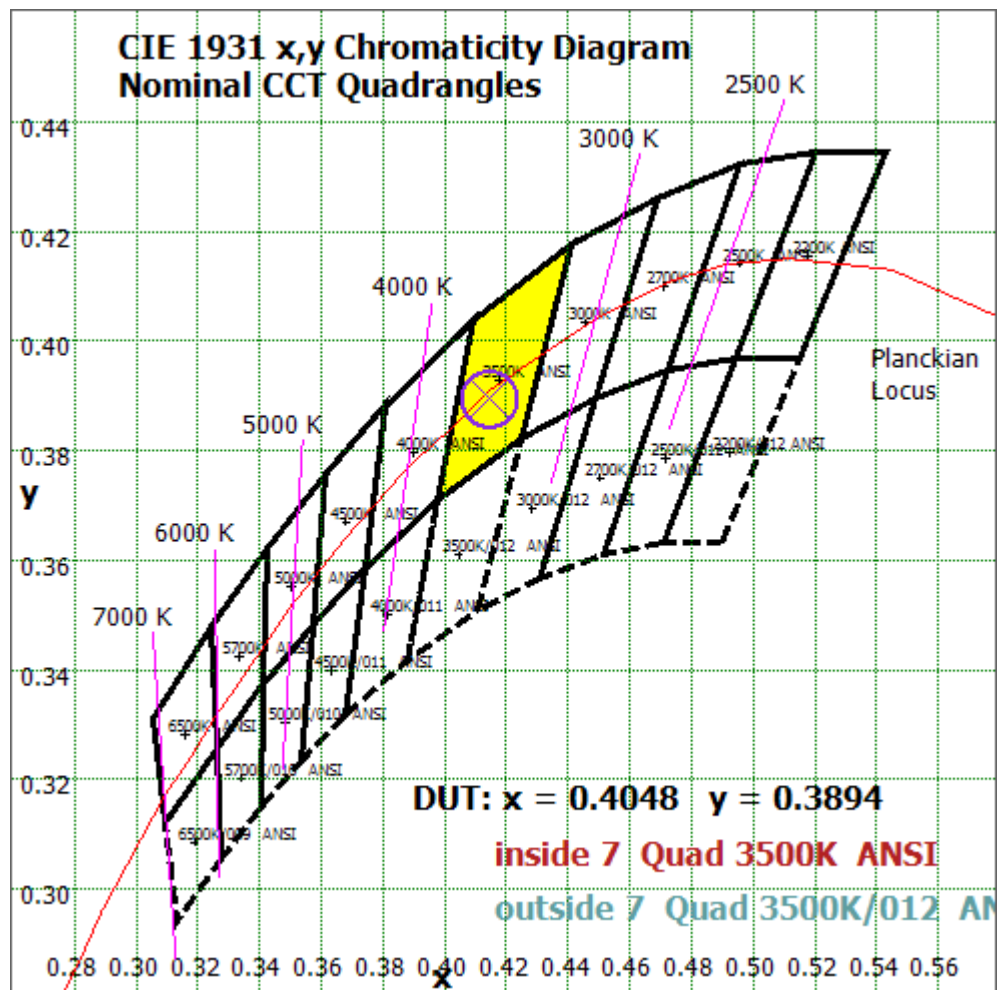


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

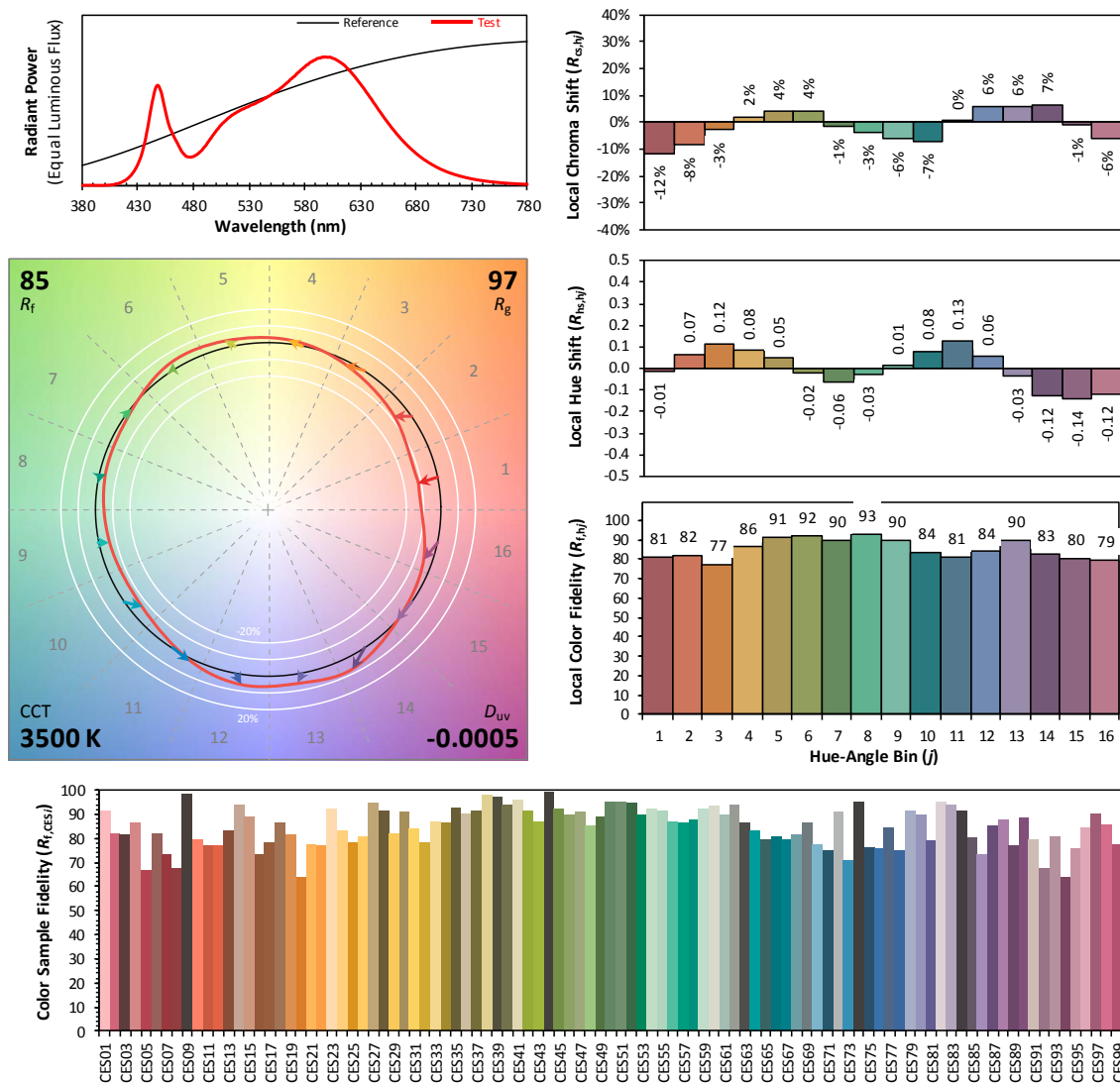
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2020/10/22

Model: 17T8/4F/835/DEB



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

x 0.4048
 y 0.3894
 u' 0.2359
 v' 0.5106

CIE 13.3-1995
(CRI)
 R_a 83
 R_g 9

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	41.259	1.75%
10- 20	119.133	5.04%
20- 30	183.807	7.78%
30- 40	229.028	9.69%
40- 50	251.89	10.66%
50- 60	253.046	10.71%
60- 70	236.391	10.01%
70- 80	208.221	8.81%
80- 90	177.156	7.50%
90-100	150.984	6.39%
100-110	127.743	5.41%
110-120	106.793	4.52%
120-130	87.899	3.72%
130-140	70.788	3.00%
140-150	54.339	2.30%
150-160	37.773	1.60%
160-170	20.566	0.87%
170-180	5.812	0.25%
Total	2362.6	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1078.163	45.63%
60- 90	621.768	26.32%
0-90	1699.931	71.95%
90- 180	662.697	28.05%
0- 180	2362.6	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

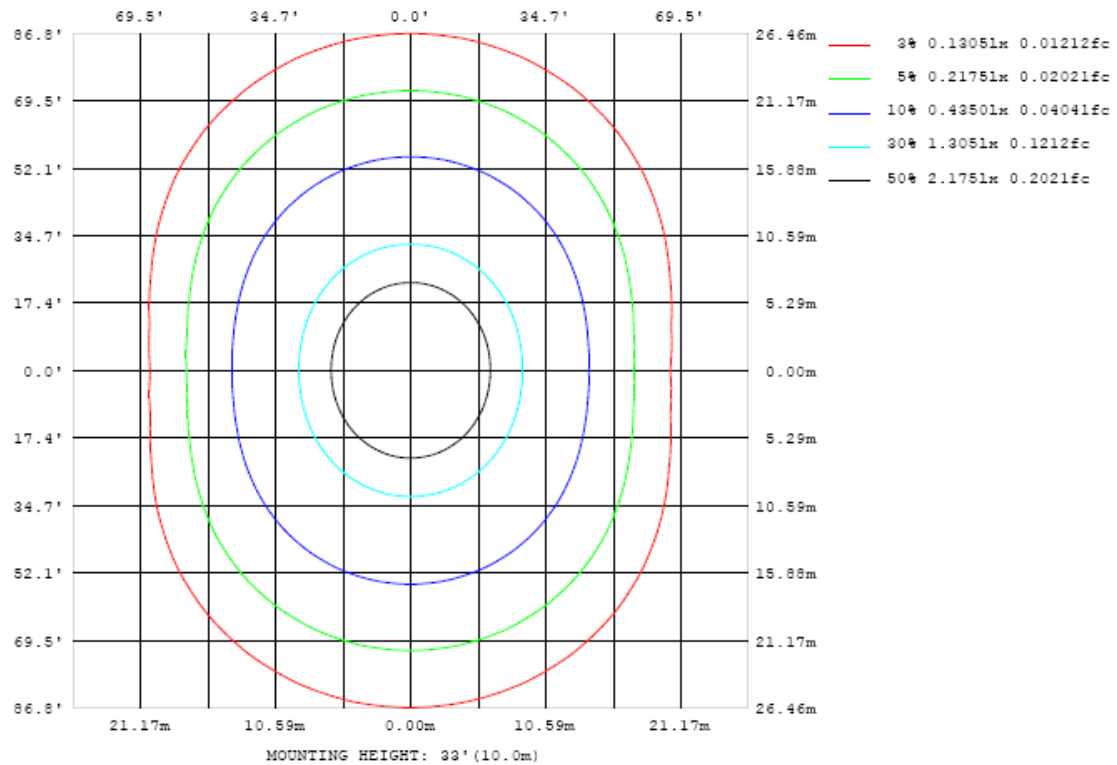


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

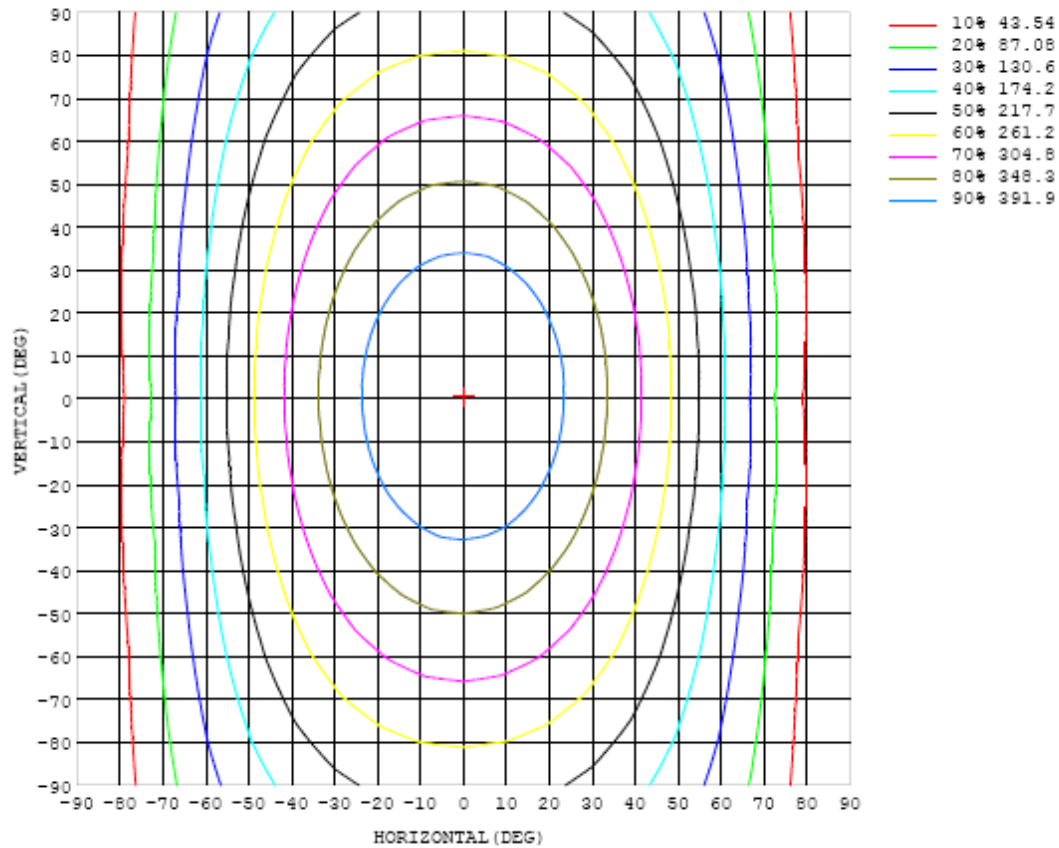


Chart 6: Isocandela Plot

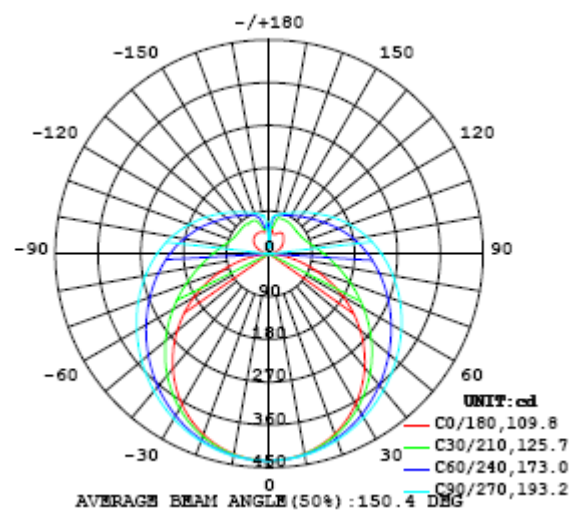


Chart 7: Polar Candela Distribution

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	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435
5	433	433	433	433	433	433	434	434	434	434	434	434	434	434	433	433	433	433	433
10	427	427	427	428	428	429	429	430	430	430	430	430	430	429	429	428	428	428	428
15	417	417	418	419	420	421	423	424	424	425	425	424	423	422	421	419	418	418	418
20	403	403	405	407	409	411	414	416	417	417	417	416	414	412	410	407	406	404	405
25	386	386	388	391	395	399	403	406	408	408	408	406	403	400	396	392	389	387	387
30	364	365	368	373	379	385	390	394	397	398	398	395	391	386	380	375	370	367	366
35	340	341	346	353	360	369	376	382	385	387	386	383	377	370	362	354	348	343	342
40	313	315	321	330	340	351	361	368	373	374	374	369	362	353	342	332	323	317	315
45	282	285	294	306	319	333	345	354	359	362	361	355	346	335	322	308	296	287	285
50	250	254	265	281	298	315	329	339	346	348	347	341	330	317	300	283	267	256	253
55	215	221	235	255	276	296	312	325	332	335	333	326	314	298	279	258	238	223	218
60	180	187	205	230	255	278	296	310	318	321	319	311	298	280	258	232	208	189	182
65	143	152	176	206	235	260	281	295	304	307	305	296	282	263	237	208	178	154	146
70	106	118	148	183	215	243	265	281	290	293	291	282	267	246	218	185	150	119	108
75	70.0	85.8	122	162	198	227	250	266	275	279	276	267	252	230	200	164	124	87.0	71.0
80	37.8	58.2	100	144	181	212	235	252	261	265	262	253	237	214	184	146	102	59.4	37.5
85	12.5	37.0	83.2	128	167	198	221	237	247	250	248	239	223	200	169	130	84.9	38.4	11.8
90	1.76	25.6	71.4	115	154	184	208	224	233	236	234	225	209	186	156	118	72.7	27.1	0.66
95	2.91	21.1	62.6	104	141	171	194	210	219	222	220	211	196	173	144	107	64.7	23.0	2.49
100	6.65	21.8	56.6	95.1	130	159	181	196	205	208	206	197	182	161	132	97.6	59.2	23.9	7.21
105	11.9	25.1	53.8	87.5	120	147	168	182	191	194	192	183	169	149	122	90.3	56.4	27.2	13.2
110	18.4	30.4	53.1	81.8	111	136	155	169	177	180	178	170	157	138	113	84.8	56.6	32.3	19.9
115	24.6	36.2	54.0	78.3	103	125	143	156	164	167	165	158	145	128	106	81.7	58.0	38.3	27.1
120	30.0	42.3	56.1	76.1	97.2	116	132	144	151	154	152	145	134	119	100	79.8	60.3	44.1	33.7
125	34.7	47.3	59.1	75.0	92.8	109	123	133	140	142	140	134	125	112	96.0	78.8	63.0	49.6	38.8
130	38.9	52.3	62.5	74.6	89.4	103	115	124	130	132	130	125	117	106	92.6	78.6	65.8	54.2	42.8
135	43.1	56.8	65.9	75.2	86.9	98.5	108	116	121	122	121	117	110	101	90.1	78.6	68.7	57.6	45.7
140	47.1	60.8	68.9	76.1	85.1	94.5	102	109	113	114	113	110	104	96.6	87.9	79.0	71.3	61.3	47.8
145	50.3	63.9	71.0	77.3	84.0	91.2	97.4	102	105	107	106	103	98.8	93.0	86.2	79.5	73.1	63.8	49.1
150	50.8	65.4	73.0	78.1	83.2	88.4	93.1	96.9	99.3	100	99.9	97.7	94.3	90.0	85.0	80.1	73.7	63.6	49.8
155	48.8	62.4	74.5	78.2	82.6	86.3	89.7	92.3	94.1	94.8	94.6	93.0	90.6	87.6	84.0	78.6	72.3	61.2	49.8
160	44.6	54.7	74.4	78.5	81.6	84.7	86.8	88.6	89.7	90.3	90.1	89.1	87.6	85.4	79.1	72.6	65.2	59.0	49.1
165	42.4	47.0	63.0	78.9	81.4	83.4	84.6	85.6	86.1	86.2	86.2	85.5	83.7	74.7	68.1	60.7	53.4	51.3	47.7
170	44.2	44.0	47.9	64.2	75.4	79.1	81.4	83.0	82.9	82.3	81.7	78.1	66.0	56.7	53.6	50.8	51.3	45.0	46.6
175	56.4	56.4	54.0	55.2	58.7	61.7	65.8	69.7	76.7	76.7	76.7	76.7	62.8	43.1	45.1	53.7	55.1	56.3	58.7
180	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8

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	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435		
5	433	434	434	434	434	435	435	435	435	435	434	434	434	434	433	433	433		
10	428	428	429	430	430	431	432	432	432	432	431	431	430	429	428	428	427		
15	418	419	421	422	424	425	426	427	427	427	426	425	423	421	420	419	418		
20	405	407	409	412	414	417	419	420	420	419	418	416	414	411	408	406	404		
25	388	391	394	398	402	406	409	411	411	410	408	405	402	397	393	390	387		
30	368	371	376	382	388	394	398	400	401	400	397	393	387	381	375	370	366		
35	344	349	356	364	372	380	385	389	390	388	384	379	371	363	355	348	342		
40	318	324	334	344	355	364	372	376	377	376	371	363	354	343	332	323	316		
45	289	297	310	324	337	348	357	362	364	362	356	347	336	322	308	296	286		
50	257	269	285	302	318	332	343	349	350	348	341	331	317	300	283	267	255		
55	224	239	259	280	300	316	328	334	336	334	326	314	298	278	257	237	222		
60	190	209	234	259	281	299	312	320	322	319	311	298	279	256	231	207	188		
65	156	179	209	238	263	283	297	305	308	305	296	281	261	235	206	177	154		
70	121	152	186	219	246	267	282	291	293	290	281	265	244	216	183	149	120		
75	88.7	126	166	201	230	252	267	276	279	276	266	250	227	198	162	123	87.2		
80	60.2	104	147	184	214	237	253	262	264	261	251	235	212	181	144	101	59.0		
85	39.0	86.2	132	169	200	223	238	247	250	247	237	221	197	166	129	83.2	37.6		
90	27.5	73.7	119	157	186	209	224	233	236	233	223	207	184	154	115	70.6	25.9		
95	23.0	65.0	108	145	173	195	211	220	222	219	209	194	171	142	104	61.9	21.3		
100	23.7	59.2	98.3	133	162	182	197	205	208	205	195	180	159	130	94.9	56.0	21.4		
105	27.2	56.5	90.7	123	150	169	183	191	194	191	182	167	147	120	87.3	53.0	24.5		
110	32.6	56.3	85.3	114	138	157	170	178	180	177	168	156	136	111	81.7	52.6	29.7		
115	38.5	57.7	81.9	106	128	146	158	164	167	164	157	144	125	103	78.0	53.5	35.5		
120	44.4	60.0	80.0	101	119	135	146	153	155	152	144	133	117	97.2	75.8	55.8	41.3		
125	50.0	62.7	79.1	96.4	112	125	135	141	142	140	134	123	109	92.8	74.9	59.1	46.8		
130	55.2	65.6	78.8	93.1	106	118	126	131	132	130	124	115	104	89.5	74.9	62.6	52.0		
135	59.4	67.5	79.0	90.5	101	111	118	122	123	121	116	109	98.8	87.1	75.6	66.0	56.7		
140	63.5	70.5	79.4	88.5	97.2	105	110	114	115	113	109	103	94.8	85.5	76.6	69.0	60.1		
145	65.3	72.7	75.8	86.8	93.5	99.4	104	107	107	106	103	97.9	91.5	84.5	77.7	71.7	62.2		
150	66.6	74.9	77.9	84.5	90.4	94.8	98.3	100	101	100	97.5	93.7	89.0	83.8	79.0	73.6	60.5		
155	61.9	74.6	77.4	81.2	87.7	91.0	93.6	95.2	95.5	94.9	93.1	90.5	87.1	83.4	80.3	75.6	60.5		
160	54.3	65.3	71.3	75.2	82.1	86.0	89.5	90.6	90.9	90.6	89.5	87.9	85.8	83.5	81.1	73.1	54.8		
165	50.2	52.4	59.2	63.6	69.4	76.6	80.1	84.9	87.0	86.8	86.4	85.6	84.3	82.8	79.2	68.5	48.6		
170	48.0	47.6	52.0	56.1	57.8	57.0	66.0	78.3	80.7	80.6	83.1	82.7	79.7	76.2	68.0	54.8	46.3		
175	58.5	57.3	56.6	59.1	57.5	57.5	51.6	42.4	51.6	77.4	71.5	62.7	60.3	59.8	58.0	55.9	55.7		
180	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8		

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

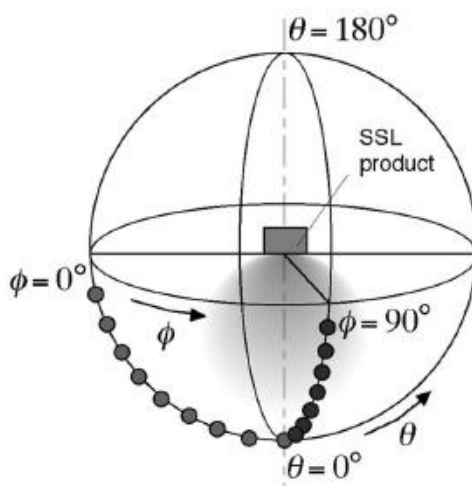
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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