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: 14T8/4F/850/DEB/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20070023k

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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Aug. 03, 2020

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Manager: Jim Zhang

Aug. 03, 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: **14T8/4F/850/DEB/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
171.9	2456.1	14.29	0.9800

CCT (K)	CRI	Stabilization Time (Light & Power)
5081	82.5	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	: Jul. 22, 2020
Date of Test	: Jul. 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	: 14T8/4F/850/DEB/R
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 24.8 ℃.

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)	0.122	0.056
Power Factor	0.9800	0.9120
Test Power (W)	14.29	14.26
THD A%	18.59	21.37
Luminous Efficacy (lm/W)	171.9	171.3
Total Luminous Flux (lm)	2456.1	2442.9
Color Rendering Index (CRI)	82.5	
R9	5	
Correlated Color Temperature (CCT)(K)	5081	
Chromaticity Chroma x	0.3430	
Chromaticity Chroma y	0.3535	
Chromaticity Chroma u	0.2093	
Chromaticity Chroma v	0.3235	
Duv	0.0018	
Chromaticity Chroma u ’	0.2093	
Chromaticity Chroma v’	0.4853	

Special Color Rendering Indices	
R1	80.8
R2	87.5
R3	91.9
R4	82.6
R5	81.6
R6	82.4
R7	86.4
R8	66.6
R9	5
R10	70.3
R11	82
R12	60.5
R13	82.5
R14	95.8

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 ℃.

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	0.9801
Power (W)	14.30
Luminous Efficacy (lm/W)	169.2
Total Luminous Flux (lm)	2419.8
Beam Angle (°)	110.2 (0^o-180^o) / 198.4 (90^o-270^o)
Center Beam Candle Power (cd)	434
Maximum Beam Candle Power (cd)	434.5 (At: C=280.0, Gamma=1.0)
Spacing Criteria	1.24 (0^o-180^o) / 1.41 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	44.95%
Zonal Lumens in the 60 °-90 °Zone	26.44%
Zonal Lumens in the 90 °-120 °Zone	16.52%
Zonal Lumens in the 120 °-180 °Zone	12.09%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

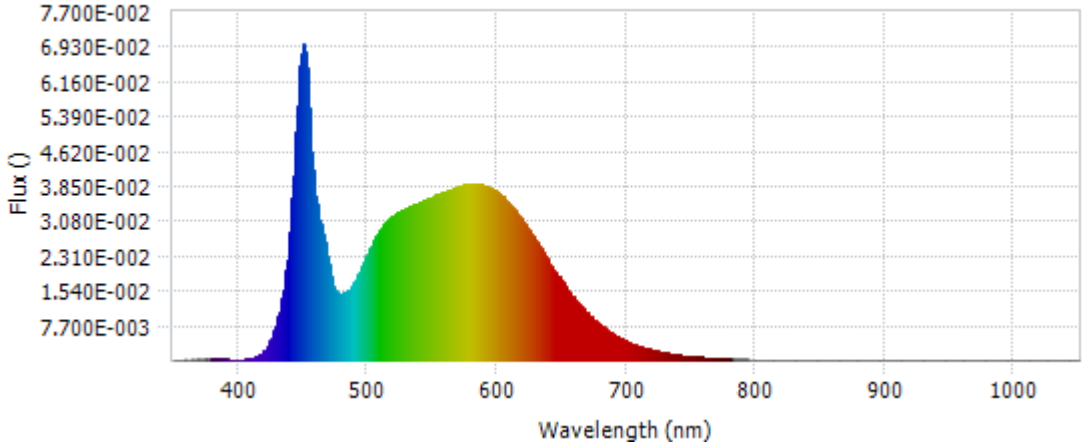
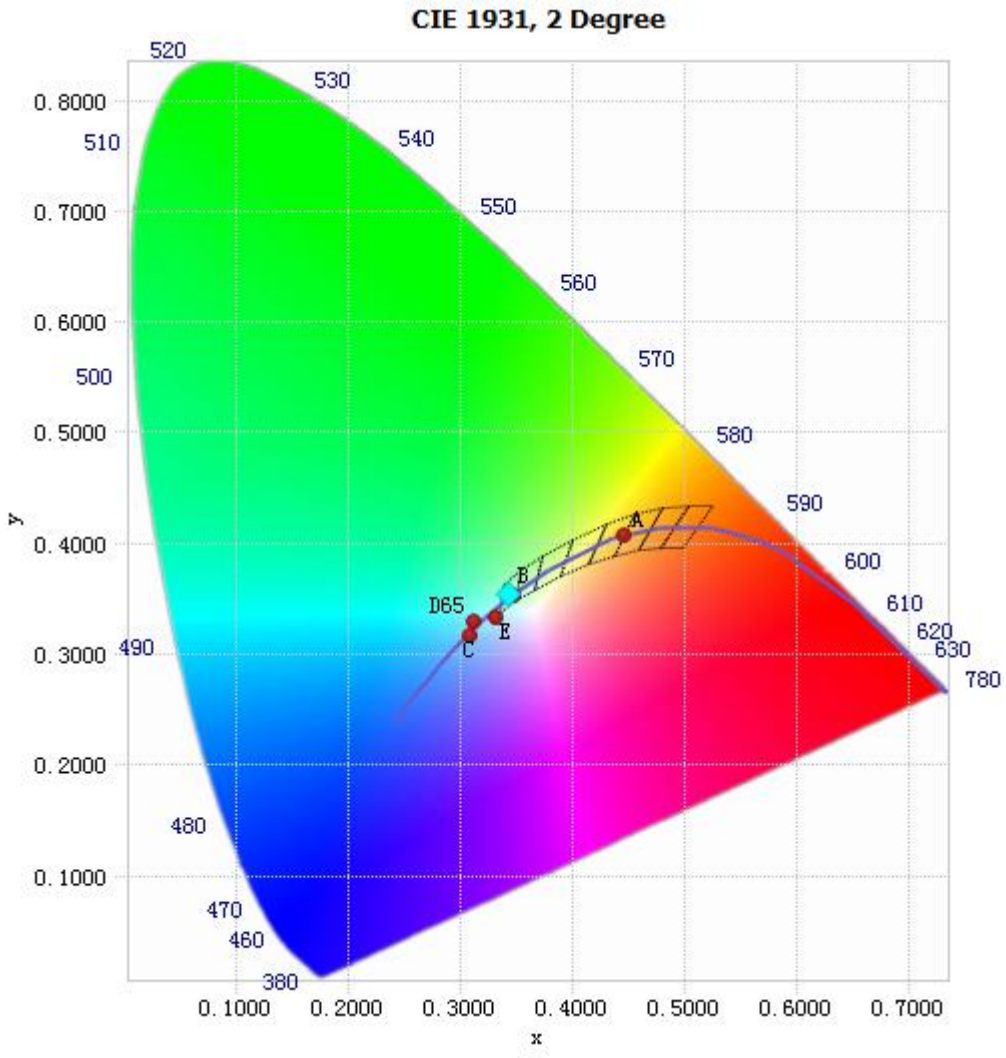


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.47E-04	485	1.54E-02	590	3.87E-02	695	4.99E-03
385	2.32E-04	490	1.71E-02	595	3.81E-02	700	4.27E-03
390	2.45E-04	495	2.02E-02	600	3.72E-02	705	3.65E-03
395	2.09E-04	500	2.35E-02	605	3.61E-02	710	3.12E-03
400	1.80E-04	505	2.65E-02	610	3.46E-02	715	2.66E-03
405	2.00E-04	510	2.88E-02	615	3.28E-02	720	2.29E-03
410	4.17E-04	515	3.07E-02	620	3.08E-02	725	1.95E-03
415	9.74E-04	520	3.20E-02	625	2.87E-02	730	1.67E-03
420	2.07E-03	525	3.29E-02	630	2.65E-02	735	1.42E-03
425	4.29E-03	530	3.35E-02	635	2.41E-02	740	1.21E-03
430	8.42E-03	535	3.42E-02	640	2.19E-02	745	1.03E-03
435	1.56E-02	540	3.48E-02	645	1.97E-02	750	8.87E-04
440	2.81E-02	545	3.55E-02	650	1.75E-02	755	7.56E-04
445	5.05E-02	550	3.61E-02	655	1.55E-02	760	6.50E-04
450	6.96E-02	555	3.67E-02	660	1.37E-02	765	5.60E-04
455	5.57E-02	560	3.73E-02	665	1.20E-02	770	4.80E-04
460	3.62E-02	565	3.78E-02	670	1.04E-02	775	4.10E-04
465	2.90E-02	570	3.84E-02	675	9.04E-03	780	3.55E-04
470	2.14E-02	575	3.87E-02	680	7.83E-03		
475	1.57E-02	580	3.90E-02	685	6.75E-03		
480	1.46E-02	585	3.90E-02	690	5.81E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3430, 0.3535)

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

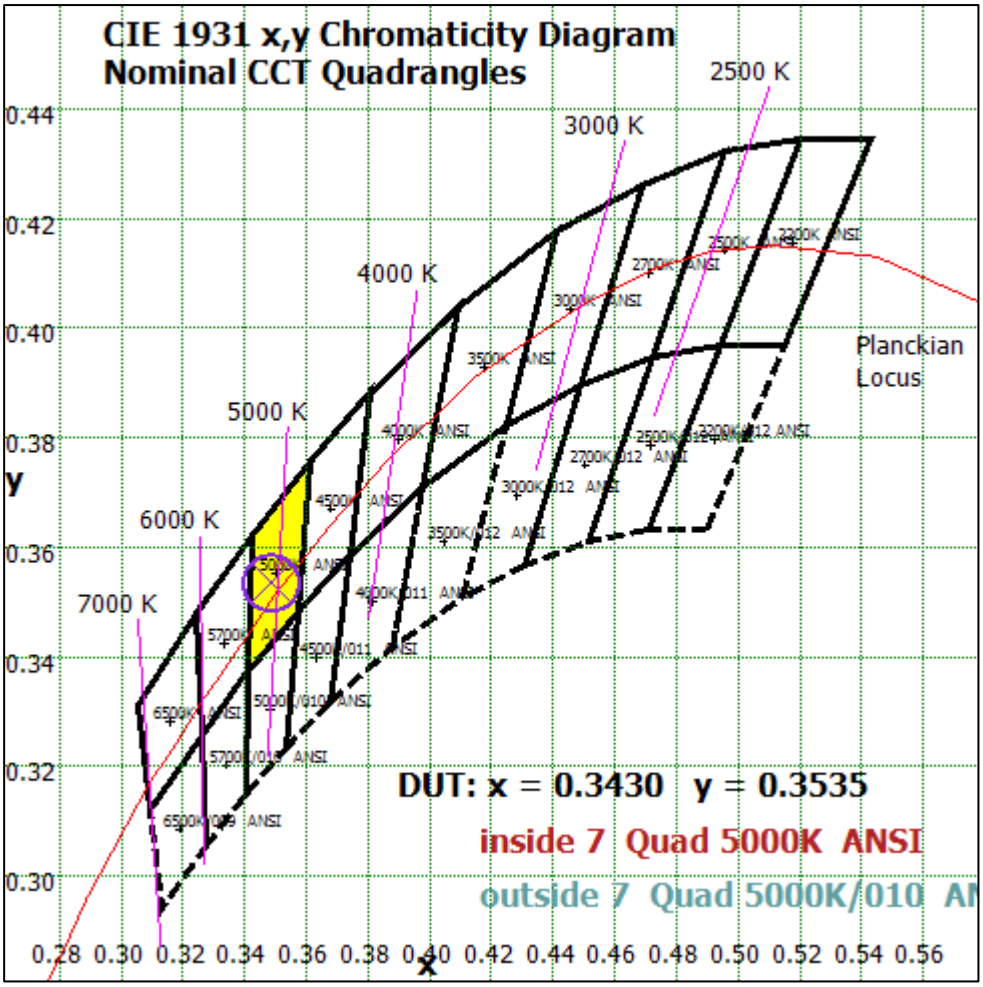
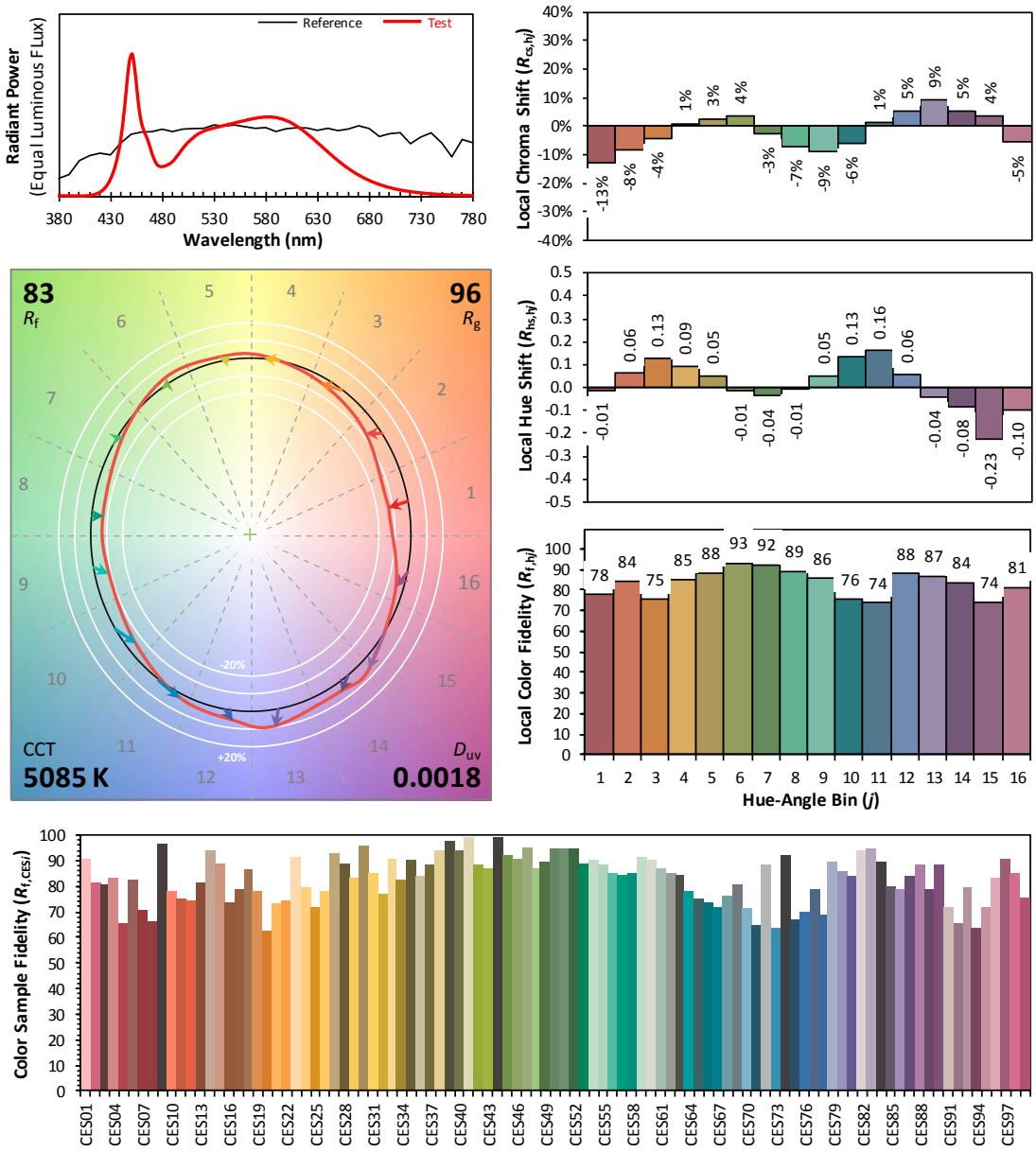


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x	0.3430
y	0.3535
u'	0.2093
v'	0.4853

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	41.177	1.70%
10- 20	119.047	4.92%
20- 30	184.248	7.61%
30- 40	230.608	9.53%
40- 50	254.999	10.54%
50- 60	257.714	10.65%
60- 70	242.212	10.01%
70- 80	214.486	8.86%
80- 90	183	7.56%
90-100	155.615	6.43%
100-110	132.447	5.47%
110-120	111.75	4.62%
120-130	92.75	3.83%
130-140	74.68	3.09%
140-150	57.168	2.36%
150-160	38.715	1.60%
160-170	21.413	0.88%
170-180	7.734	0.32%
Total	2419.8	100%

γ(°)	Lumens	% Total
0- 60	1087.793	44.95%
60- 90	639.698	26.44%
0-90	1727.491	71.39%
90- 180	692.272	28.61%
0- 180	2419.8	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

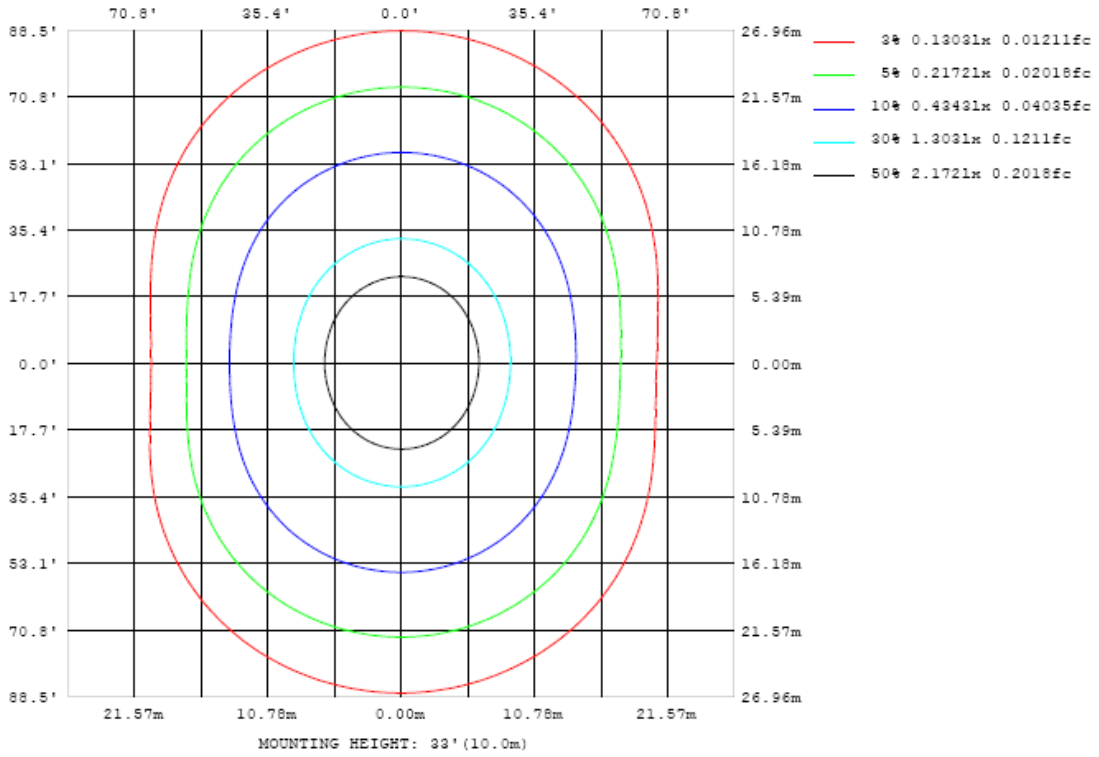


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

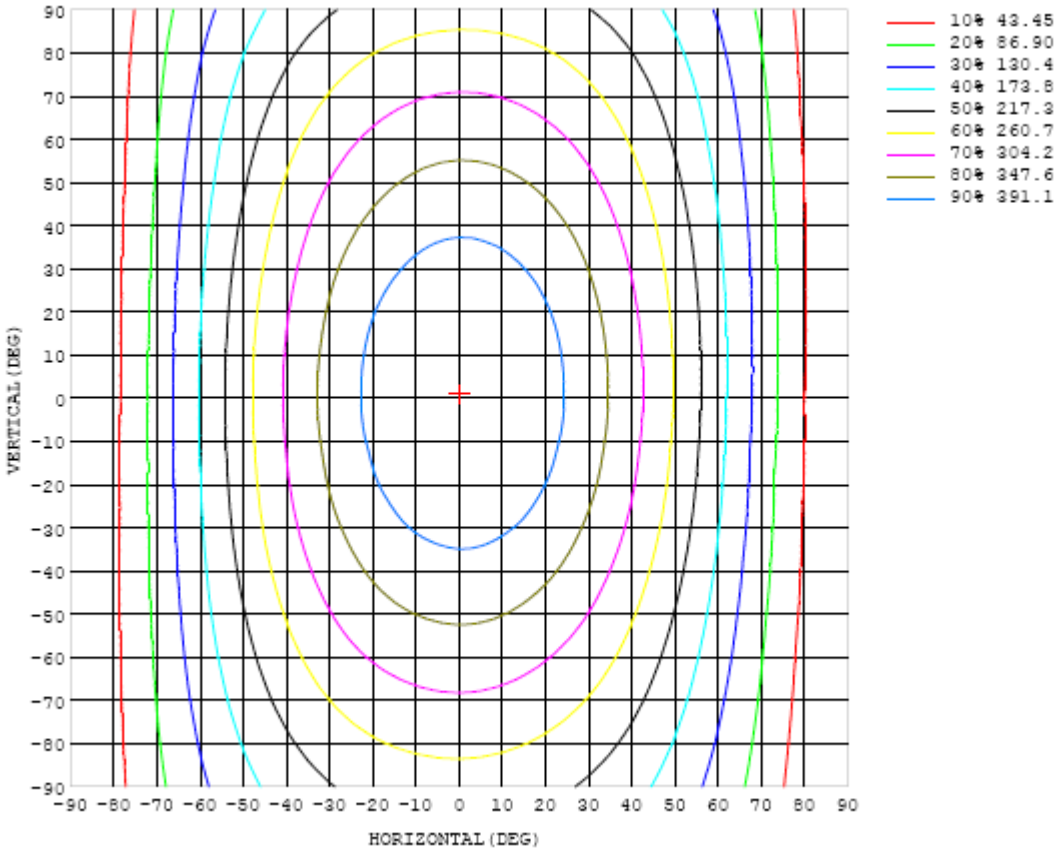


Chart 6: Isocandela Plot

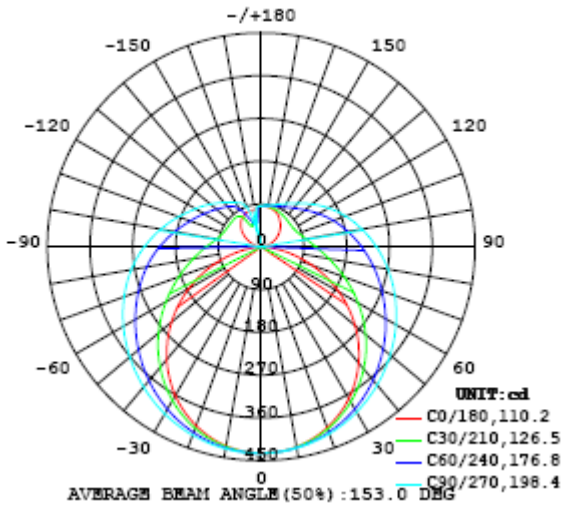


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434
5	433	433	433	433	433	433	433	433	433	433	433	433	432	432	432	432	432	431	432
10	428	427	428	428	428	429	429	429	430	430	429	429	428	428	427	426	426	425	425
15	418	418	419	420	421	422	423	425	425	425	424	423	422	420	419	417	416	415	415
20	405	406	407	408	410	413	415	417	418	419	418	416	413	411	407	404	402	401	400
25	389	389	391	394	398	402	406	408	410	411	409	407	403	399	394	389	385	383	383
30	369	369	372	377	383	388	394	398	401	402	400	397	392	385	379	371	365	362	361
35	345	346	350	357	365	373	381	386	390	391	389	385	378	370	361	351	343	338	337
40	319	320	326	336	346	357	366	373	378	379	377	372	364	354	342	330	318	311	309
45	290	291	300	312	325	339	351	359	365	367	365	359	349	336	322	306	292	282	279
50	258	260	271	287	304	321	335	345	352	354	351	345	334	319	301	282	264	251	246
55	224	227	242	261	282	302	319	331	338	341	338	331	318	301	280	257	235	218	212
60	188	193	211	235	261	284	302	316	324	327	324	316	303	284	260	233	206	184	176
65	152	158	181	210	240	266	286	301	310	313	310	302	287	266	240	209	177	151	140
70	114	123	151	186	220	248	270	286	296	299	296	287	272	250	221	187	150	117	103
75	77.2	89.7	124	164	201	232	255	271	281	285	282	273	257	234	204	167	126	86.2	66.5
80	43.4	60.2	101	145	184	216	240	257	267	271	268	259	243	219	188	150	105	59.9	34.0
85	16.1	37.0	82.0	128	169	201	225	242	253	257	254	245	229	205	174	135	88.9	41.0	9.63
90	1.28	23.4	68.8	115	155	187	211	228	239	243	240	231	215	192	161	123	77.6	31.3	0.69
95	3.23	19.2	61.0	104	143	174	198	215	225	229	226	217	202	179	149	112	70.4	28.0	3.46
100	7.92	20.1	56.0	96.0	132	162	185	202	212	215	213	204	190	168	139	104	65.6	28.4	8.52
105	14.3	24.0	53.2	89.1	123	151	173	189	198	202	200	192	178	157	130	97.5	62.5	31.9	14.5
110	21.8	29.8	53.0	83.8	115	141	162	176	186	189	187	179	166	146	121	92.0	61.6	37.0	21.7
115	29.5	36.2	54.8	80.4	107	131	150	164	173	176	174	167	154	136	114	87.7	62.4	42.9	29.4
120	37.0	42.6	57.5	78.3	101	122	140	152	160	164	162	155	144	127	107	85.0	64.4	48.9	37.5
125	44.2	49.1	60.9	77.5	96.2	114	130	141	149	151	150	144	133	119	102	83.6	66.9	54.6	45.6
130	50.7	55.6	64.5	77.6	92.7	108	121	131	137	140	138	133	124	112	97.7	83.0	69.7	59.9	53.7
135	57.3	61.5	68.0	78.3	90.4	102	113	121	127	129	128	123	116	106	94.8	83.0	72.5	64.9	60.7
140	63.3	66.9	71.6	79.3	88.8	98.2	107	113	118	120	119	115	109	101	92.5	83.4	75.2	69.5	67.1
145	68.0	71.8	75.0	80.5	87.7	94.9	102	107	110	112	111	108	104	97.7	90.9	83.9	77.7	73.2	71.7
150	73.9	75.7	78.0	81.9	87.0	92.3	97.2	101	104	105	104	102	99.0	94.6	89.5	84.4	80.0	76.7	74.8
155	78.2	79.0	80.5	83.2	86.7	90.3	93.8	96.6	98.6	99.4	99.0	97.5	95.2	92.1	88.5	85.0	81.9	79.7	78.4
160	80.9	81.6	82.7	84.5	86.5	88.8	91.0	92.9	94.2	94.7	94.5	93.5	92.0	90.1	87.8	85.5	83.7	81.8	79.2
165	83.2	83.6	84.5	85.4	86.5	87.8	89.1	90.1	90.8	91.1	91.0	90.4	89.6	88.5	87.3	86.1	85.0	82.8	76.9
170	84.8	85.2	85.6	86.1	86.6	87.2	87.7	88.2	88.5	88.6	88.5	88.3	87.9	87.5	87.0	86.5	86.0	84.6	78.8
175	85.7	85.9	86.2	86.4	86.6	86.8	86.9	87.0	87.1	87.1	87.1	87.0	86.9	86.8	86.6	86.4	86.3	86.0	85.5
180	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

γ (DEG) \ C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434	434		
5	432	432	432	433	433	433	433	434	434	434	434	434	433	433	433	433	433		
10	426	426	427	428	429	430	431	431	432	432	431	431	430	429	429	428	428		
15	416	417	418	420	422	424	426	427	427	427	427	426	424	423	421	420	419		
20	401	403	406	410	413	416	419	421	422	422	420	418	416	413	410	408	406		
25	384	387	391	397	402	406	410	413	414	414	412	409	405	401	397	392	390		
30	363	367	374	381	388	395	400	404	406	405	402	398	393	386	380	374	370		
35	339	345	353	363	373	382	389	394	396	395	391	386	378	370	361	353	348		
40	312	320	331	344	357	368	376	382	385	384	379	372	363	351	339	329	322		
45	283	292	307	323	339	353	363	370	373	372	366	358	346	332	317	303	294		
50	251	264	282	302	321	337	350	358	361	359	353	343	328	311	293	276	263		
55	218	234	257	281	303	322	335	344	348	346	339	327	311	290	268	247	231		
60	184	204	231	260	285	306	321	331	335	332	325	311	293	270	243	218	197		
65	149	175	207	239	268	290	307	317	321	319	310	296	275	249	219	189	163		
70	115	147	184	220	251	275	292	303	307	304	295	280	258	230	196	161	129		
75	82.2	121	164	202	235	260	277	288	292	290	281	265	242	212	175	135	96.6		
80	53.9	99.0	145	186	219	245	263	274	278	275	266	250	226	195	157	113	67.5		
85	33.7	82.0	130	170	204	229	247	258	262	259	250	234	211	179	141	94.3	45.5		
90	23.1	69.2	116	156	189	214	231	242	246	243	234	218	195	164	126	79.9	32.4		
95	20.3	60.5	104	143	175	199	216	226	230	228	219	203	180	151	113	69.0	26.2		
100	21.8	56.4	95.3	132	161	185	201	211	215	212	203	188	167	138	102	62.3	26.0		
105	25.5	55.7	89.3	122	150	171	186	196	199	197	189	174	154	127	94.1	59.4	29.0		
110	29.8	57.2	85.6	114	140	159	173	182	185	183	175	161	143	118	88.4	59.0	33.6		
115	33.3	59.5	83.3	108	131	149	161	169	172	169	162	151	133	110	84.9	60.5	38.3		
120	36.2	62.3	82.1	103	123	139	151	158	160	158	152	141	125	105	83.2	63.0	42.2		
125	39.1	65.2	81.7	99.7	117	131	141	147	150	148	142	132	118	101	82.5	65.6	44.9		
130	42.1	66.4	81.3	96.8	111	123	132	137	140	138	133	124	112	97.3	82.6	67.7	48.0		
135	47.0	63.7	81.9	94.2	106	116	124	129	130	129	124	117	107	94.9	83.1	68.8	53.9		
140	54.6	57.7	81.8	89.3	101	110	116	120	122	121	117	111	102	93.0	83.5	68.0	58.4		
145	65.8	50.2	79.0	89.3	93.7	103	110	113	114	113	111	106	99.0	91.7	82.6	62.6	61.8		
150	73.8	51.5	63.7	81.2	86.4	89.7	102	106	108	107	105	101	96.3	89.3	75.3	60.4	68.1		
155	76.1	62.7	47.8	62.8	70.1	72.5	77.9	91.2	102	101	100	97.9	95.2	73.7	58.0	59.4	73.6		
160	74.2	67.2	53.7	47.9	50.1	57.0	63.3	59.5	89.3	94.6	89.9	85.8	66.9	53.0	50.2	65.2	80.3		
165	71.1	64.5	57.1	50.4	47.9	53.9	60.3	66.3	4.81	73.9	52.1	55.8	50.9	46.5	55.0	77.5	83.7		
170	71.6	65.2	60.7	59.6	59.0	58.6	60.6	60.9	47.0	61.0	60.1	58.6	63.6	72.9	81.1	83.4	84.4		
175	84.0	82.0	79.9	78.3	78.0	77.7	82.4	86.0	84.9	85.2	85.0	84.9	85.0	84.8	85.0	85.3	85.5		
180	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0	86.0		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	PF2010A	HZTE028-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	DPS1060	HZTE001-06	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	WY12010	HZTE004-03	Aug. 02, 2019	Aug. 01, 2020
Temperature recorder	JM624U	HZTE018-08	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 02, 2019	Aug. 01, 2020
Standard source	D908	HZTE012-01	Aug. 02, 2019	Aug. 01, 2020
Integrate Sphere system	3M	HZTE015-04	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	PCR 500L	HZTE001-07	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	IT6154	HZTE004-04	Aug. 02, 2019	Aug. 01, 2020
Standard source	SCL-1400	HZTE012-02	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 02, 2019	Aug. 01, 2020
Temperature Meter	TES1310	HZTE017-01	Aug. 02, 2019	Aug. 01, 2020

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 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 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.

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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 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 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

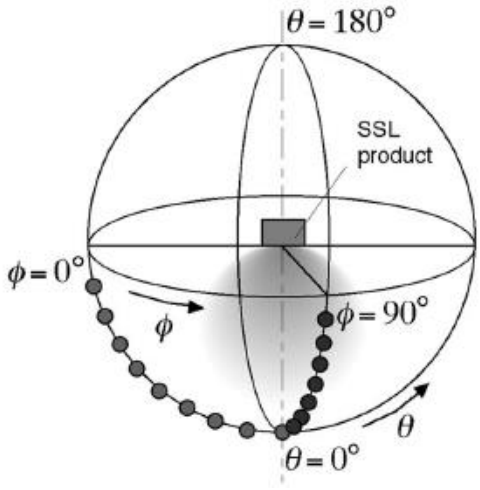
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

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 °/180 ° and C=90 °/270 °) 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, Δu'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 ***