

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/835/DEB/R

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.: HZ20070023i

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

Review by:



Engineer: April Zou

Aug. 03, 2020

Approved by:



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/835/DEB/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
156.7	2270.7	14.49	0.9792
CCT (K)	CRI	Stabilization Time (Light & Power)	
3482	83.3	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

TABLE OF CONTENT

LM-79-08 TEST REPORT	1
TEST SUMMARY	2
SAMPLE PHOTO	4
TEST RESULTS	5
Sphere-Spectroradiometer Method.....	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Color Rendition Report – Sphere Spectroradiometer Method	10
Zonal Lumen Tabulation- Goniophotometer Method	11
Illuminance Plots- Goniophotometer Method	12
Luminous Intensity Distribution Plots- Goniophotometer Method.....	13
Luminous Intensity Data- Goniophotometer Method	14
EQUIPMENT LIST	16
TEST METHODS	16
Seasoning of SSL Product.....	16
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	16
Goniophotometer Method	17
Photometric and Electrical Measurements	17
Color Characteristics Measurements.....	17
Color Spatial Uniformity	17

SAMPLE PHOTO



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 14T8/4F/835/DEB/R
Electrical Ratings	: 120-277V, 50/60Hz, 14W
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 24.8 °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)	0.123	0.057
Power Factor	0.9792	0.9140
Test Power (W)	14.49	14.49
THD A%	19.00	21.51
Luminous Efficacy (lm/W)	156.7	155.7
Total Luminous Flux (lm)	2270.7	2256.0
Color Rendering Index (CRI)	83.3	
R9	8.2	
Correlated Color Temperature (CCT)(K)	3482	
Chromaticity Chroma x	0.4061	
Chromaticity Chroma y	0.3910	
Chromaticity Chroma u	0.2361	
Chromaticity Chroma v	0.3410	
Duv	0.0002	
Chromaticity Chroma u'	0.2361	
Chromaticity Chroma v'	0.5115	

Special Color Rendering Indices	
R1	81.7
R2	90.9
R3	96.4
R4	81.6
R5	82
R6	88
R7	84.2
R8	61.7
R9	8.2
R10	78.9
R11	81
R12	67.5
R13	84.1
R14	98.5

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 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)	0.123
Power Factor	0.9792
Power (W)	14.49
Luminous Efficacy (lm/W)	154.5
Total Luminous Flux (lm)	2238.5
Beam Angle (°)	110.3 (0°-180°) / 198.2 (90°-270°)
Center Beam Candle Power (cd)	402
Maximum Beam Candle Power (cd)	401.8 (At: C=270.0, Gamma=3.5)
Spacing Criteria	1.24 (0°-180°) / 1.42 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	45.02%
Zonal Lumens in the 60 °-90 °Zone	26.41%
Zonal Lumens in the 90 °-120 °Zone	16.45%
Zonal Lumens in the 120 °-180 °Zone	12.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

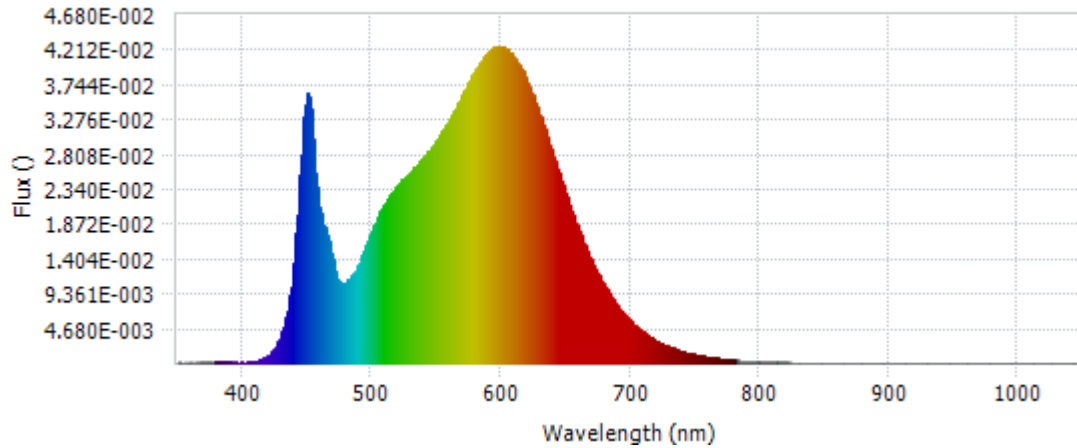
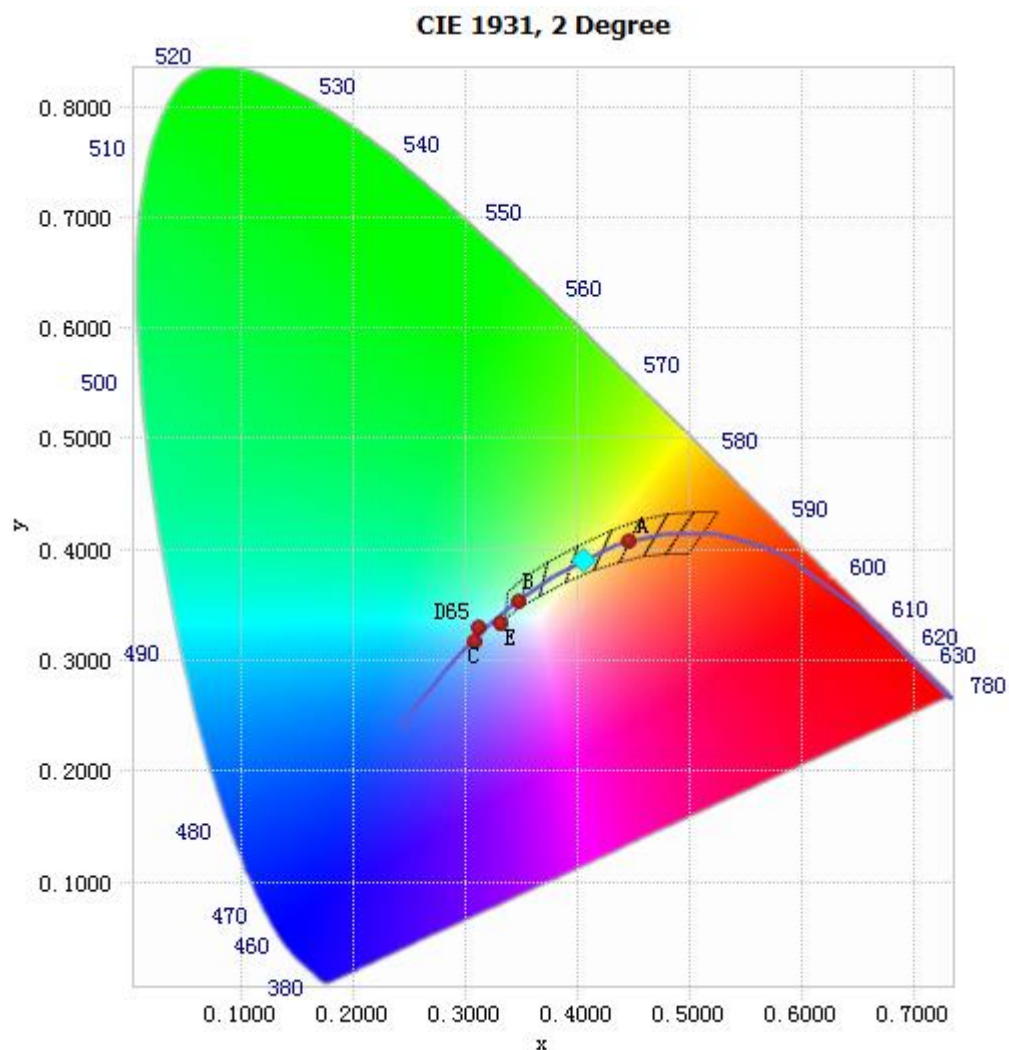


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.52E-04	485	1.18E-02	590	4.18E-02	695	6.72E-03
385	1.49E-04	490	1.33E-02	595	4.24E-02	700	5.75E-03
390	1.54E-04	495	1.54E-02	600	4.25E-02	705	4.92E-03
395	1.41E-04	500	1.77E-02	605	4.22E-02	710	4.20E-03
400	1.41E-04	505	1.97E-02	610	4.13E-02	715	3.60E-03
405	1.54E-04	510	2.13E-02	615	3.99E-02	720	3.09E-03
410	2.60E-04	515	2.28E-02	620	3.80E-02	725	2.63E-03
415	5.11E-04	520	2.39E-02	625	3.60E-02	730	2.25E-03
420	9.83E-04	525	2.48E-02	630	3.35E-02	735	1.91E-03
425	1.92E-03	530	2.56E-02	635	3.09E-02	740	1.63E-03
430	3.75E-03	535	2.65E-02	640	2.83E-02	745	1.39E-03
435	7.11E-03	540	2.75E-02	645	2.56E-02	750	1.19E-03
440	1.34E-02	545	2.86E-02	650	2.29E-02	755	1.02E-03
445	2.52E-02	550	2.98E-02	655	2.04E-02	760	8.72E-04
450	3.59E-02	555	3.12E-02	660	1.81E-02	765	7.47E-04
455	3.00E-02	560	3.26E-02	665	1.59E-02	770	6.37E-04
460	2.09E-02	565	3.41E-02	670	1.39E-02	775	5.44E-04
465	1.77E-02	570	3.59E-02	675	1.21E-02	780	4.69E-04
470	1.39E-02	575	3.76E-02	680	1.05E-02		
475	1.10E-02	580	3.92E-02	685	9.06E-03		
480	1.09E-02	585	4.07E-02	690	7.80E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4061, 0.3910)

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

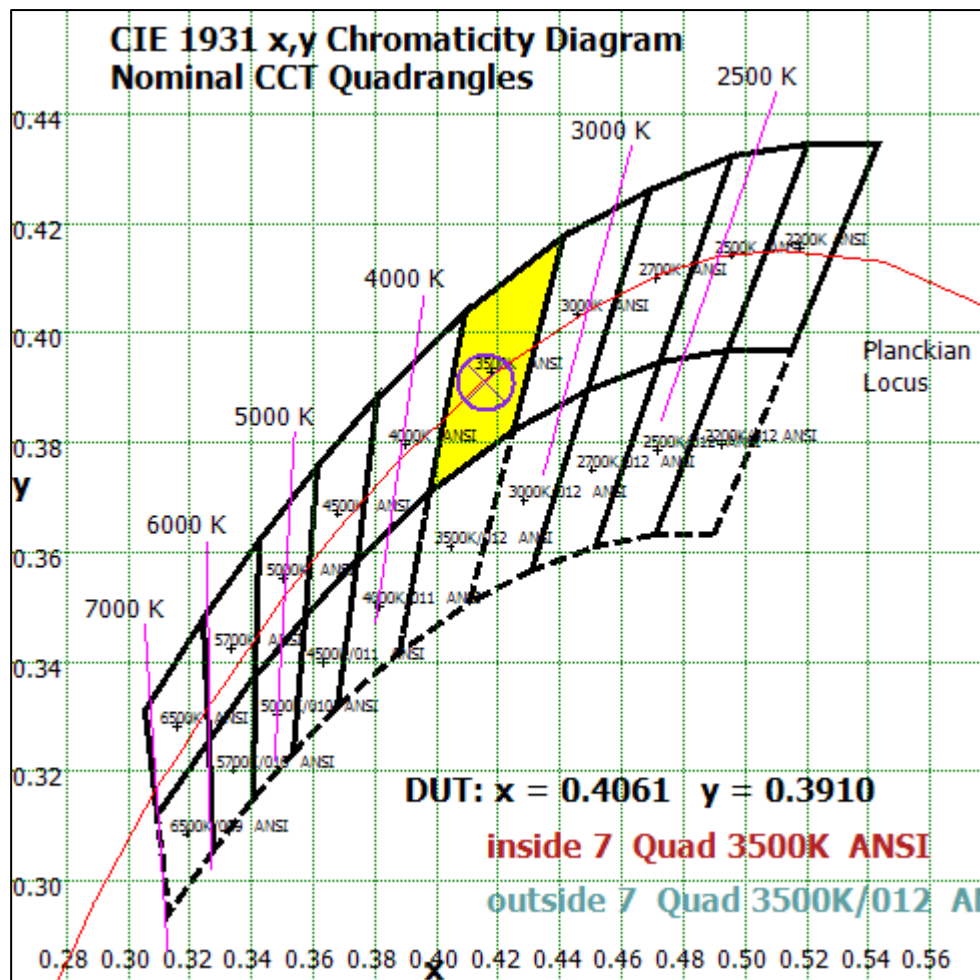
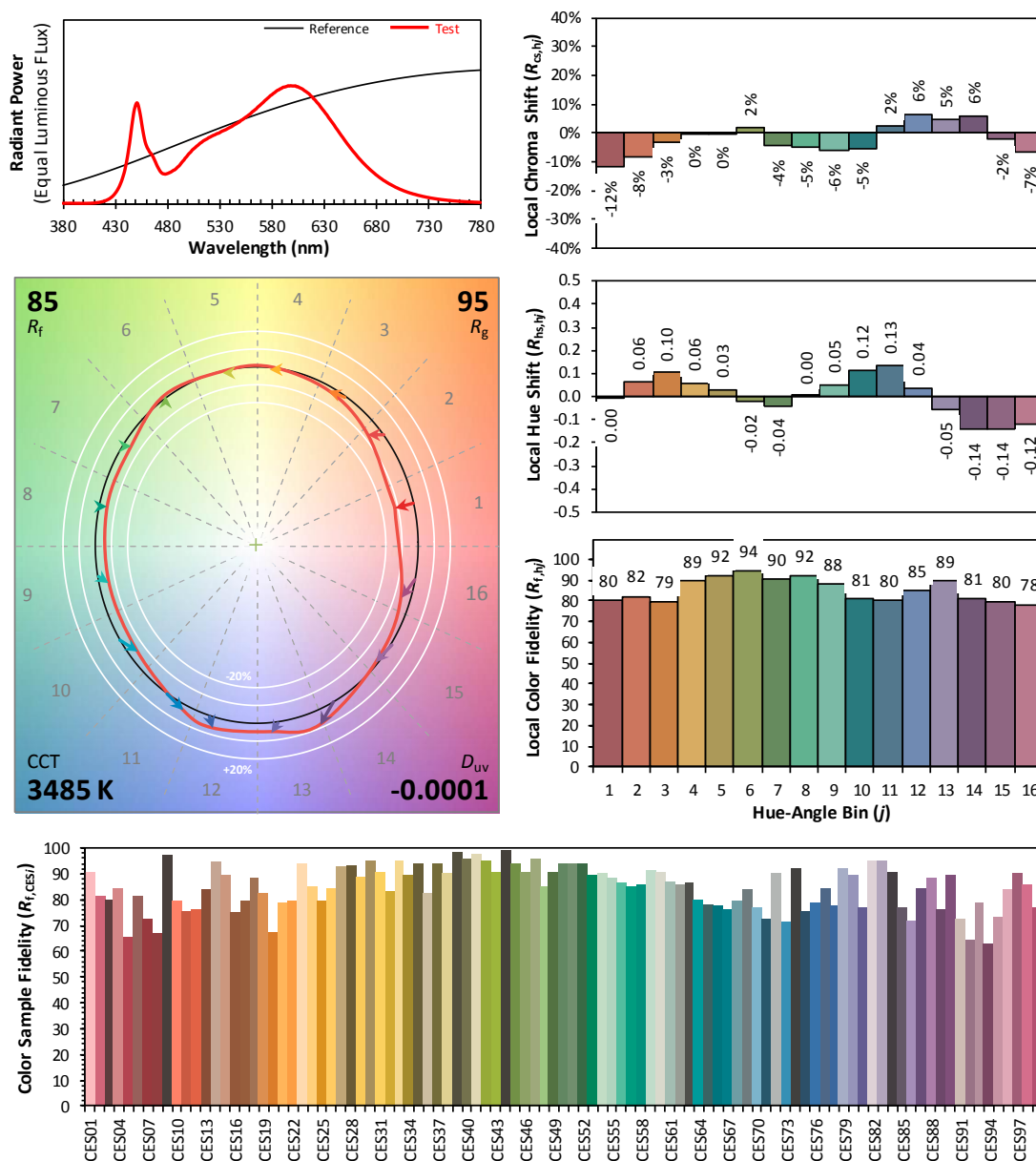


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

 x 0.4061

y 0.3910

$$U' \quad 0.2361$$

V' 0.5115

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	38.057	1.70%
10- 20	110.115	4.92%
20- 30	170.559	7.62%
30- 40	213.659	9.54%
40- 50	236.409	10.56%
50- 60	238.889	10.67%
60- 70	224.243	10.02%
70- 80	198.124	8.85%
80- 90	168.783	7.54%
90-100	143.588	6.41%
100-110	121.969	5.45%
110-120	102.657	4.59%
120-130	85.312	3.81%
130-140	69.127	3.09%
140-150	53.341	2.38%
150-160	37.057	1.66%
160-170	20.162	0.90%
170-180	6.452	0.29%
Total	2238.5	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1007.688	45.02%
60- 90	591.15	26.41%
0-90	1598.838	71.42%
90- 180	639.665	28.58%
0- 180	2238.5	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

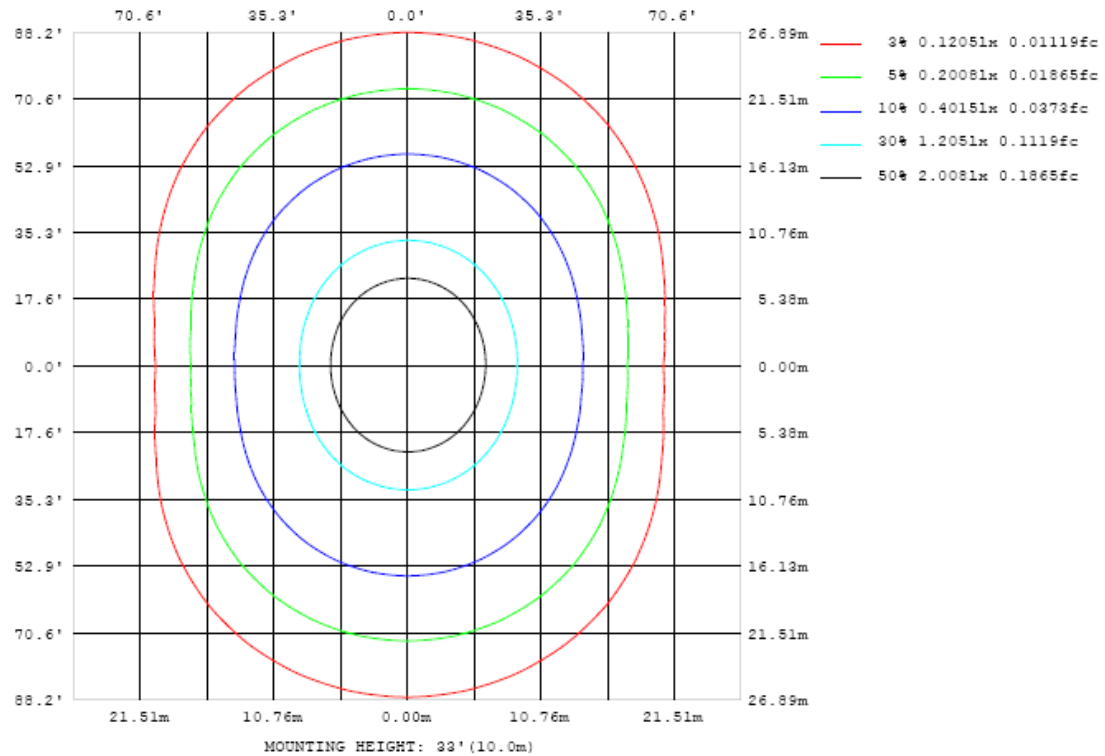


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

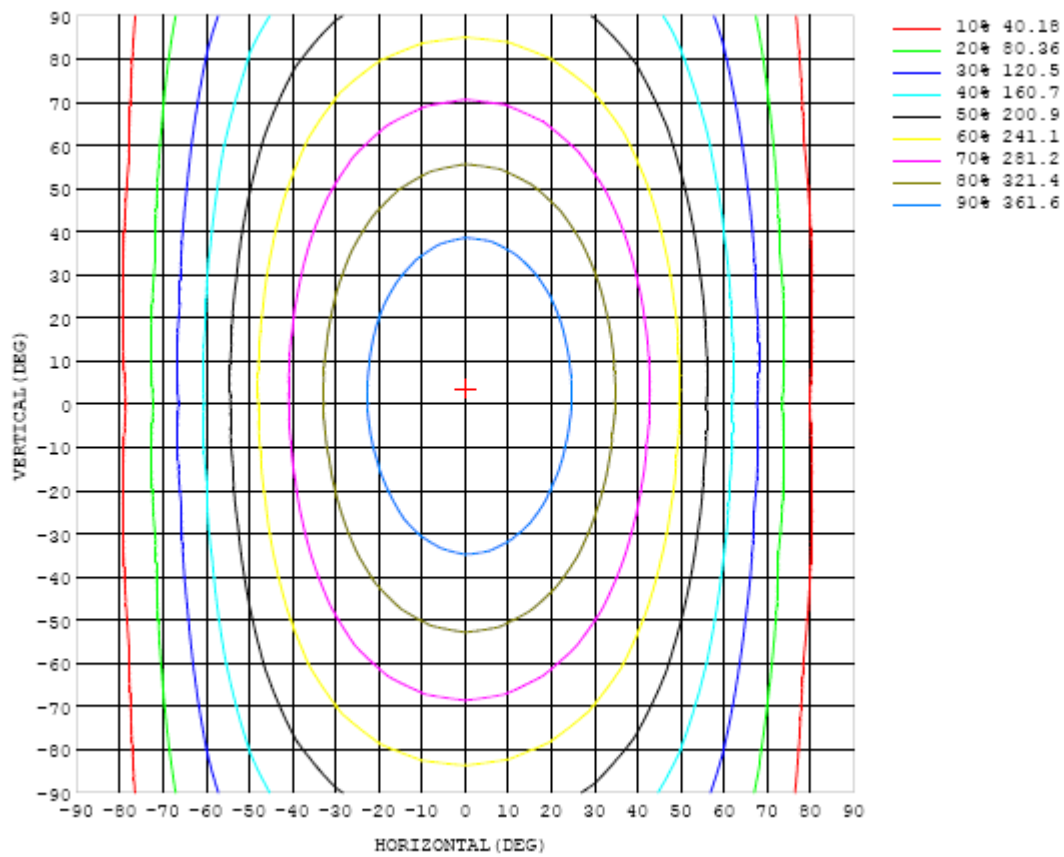


Chart 6: Isocandela Plot

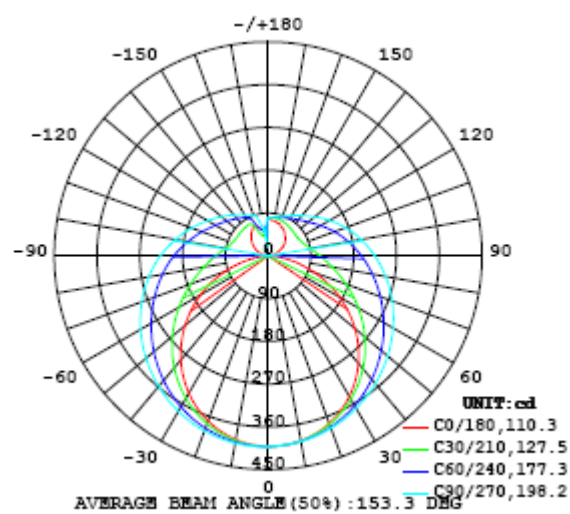


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402
5	400	400	400	400	400	400	400	400	399	400	399	399	399	399	399	399	399	399	399
10	395	395	395	396	396	396	396	396	397	397	396	395	395	394	394	393	393	392	393
15	387	387	387	388	389	390	391	392	392	392	391	390	389	387	386	384	384	383	383
20	375	375	376	378	379	381	384	385	386	386	385	383	381	378	376	373	371	370	370
25	360	360	361	364	367	371	375	377	379	379	377	375	372	367	363	358	355	354	353
30	342	341	344	348	353	359	364	368	370	371	369	366	361	355	348	342	337	334	334
35	320	320	324	330	337	345	352	357	360	361	359	355	349	341	332	324	316	312	311
40	295	296	302	310	320	330	339	346	350	351	349	344	336	326	314	303	293	287	286
45	268	269	277	288	302	314	325	333	338	340	337	332	323	310	296	282	269	261	258
50	238	241	251	266	282	298	311	320	327	328	326	319	309	294	277	259	243	232	228
55	207	211	224	242	262	281	296	307	314	316	313	306	295	278	258	236	216	201	197
60	173	179	196	219	243	264	281	293	301	304	301	293	280	262	239	214	189	170	164
65	139	147	169	196	223	247	266	279	288	291	288	280	266	246	221	192	162	139	131
70	104	115	142	175	205	231	251	266	275	278	275	266	252	231	204	171	137	107	96.3
75	70.1	84.3	118	155	188	216	237	252	261	264	261	253	238	216	187	152	114	78.0	62.8
80	39.2	57.9	96.4	137	172	201	223	238	248	251	248	240	224	202	173	136	94.0	53.2	32.5
85	14.3	36.9	79.5	122	158	187	209	225	234	238	235	226	211	189	159	122	78.8	34.7	9.46
90	1.88	24.8	67.9	109	145	174	196	211	221	224	222	213	198	176	147	110	68.2	25.5	0.74
95	2.95	20.3	59.6	98.8	134	162	183	199	208	211	209	201	186	165	136	101	61.8	22.7	2.83
100	7.35	20.7	53.9	90.4	124	151	172	186	195	199	196	188	174	154	126	93.5	57.2	24.0	7.51
105	13.1	24.0	51.0	83.4	114	140	160	174	183	186	184	176	163	143	117	87.0	54.9	27.7	13.4
110	20.0	29.2	50.7	78.3	106	130	148	162	170	173	171	164	151	133	109	82.0	55.1	32.9	20.1
115	27.3	34.9	52.0	75.1	98.7	120	138	150	158	161	159	152	140	123	102	78.9	56.6	38.3	26.4
120	34.5	40.9	54.3	73.2	93.2	112	128	139	146	149	147	141	130	115	96.8	77.2	59.0	44.3	32.9
125	41.3	47.0	57.5	72.6	89.2	105	119	129	135	138	136	130	121	108	92.8	76.5	61.7	50.5	38.8
130	46.8	52.7	60.8	72.7	86.4	99.5	111	119	125	127	126	121	113	102	89.7	76.5	64.4	56.0	44.6
135	51.7	57.8	64.4	73.4	84.3	95.2	104	112	116	118	117	113	107	97.8	87.4	76.8	67.0	60.7	50.3
140	55.6	62.8	68.0	74.5	83.0	91.6	99.1	105	109	110	109	106	101	94.0	85.7	77.4	69.9	64.6	55.0
145	60.2	67.6	71.1	75.8	82.2	88.7	94.6	99.3	102	104	103	100	96.2	90.7	84.4	77.9	72.1	68.5	61.1
150	64.0	71.7	73.8	77.1	81.7	86.5	90.9	94.4	96.8	97.8	97.2	95.3	92.1	88.1	83.3	78.4	74.3	72.1	65.5
155	66.8	74.5	76.3	78.3	81.5	84.7	87.8	90.4	92.1	92.8	92.4	91.0	88.8	85.9	82.6	79.0	76.2	74.4	69.3
160	71.2	77.0	78.2	79.4	81.4	83.4	85.4	87.1	88.2	88.7	88.4	87.5	86.1	84.2	81.9	79.6	77.7	72.9	63.8
165	71.7	78.4	79.5	80.4	81.3	82.5	83.6	84.5	85.2	85.5	85.3	84.7	83.8	82.7	81.8	79.3	72.3	65.6	59.2
170	74.9	78.7	80.3	81.0	81.3	81.8	82.3	82.7	83.0	83.1	82.9	82.7	82.3	82.3	81.1	74.7	66.8	59.2	55.3
175	75.3	77.9	79.5	80.5	81.1	81.3	81.4	81.5	81.6	81.6	81.6	81.5	81.7	81.2	78.5	71.9	64.4	57.4	52.4
180	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0

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	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402		
5	399	399	400	400	400	401	401	401	402	402	401	401	401	401	401	401	400		
10	393	394	395	396	397	398	399	400	400	400	400	399	398	398	397	396	396		
15	384	385	387	389	391	393	395	396	397	397	396	395	394	392	391	389	388		
20	371	373	376	380	383	386	389	391	392	392	391	389	387	384	381	378	376		
25	355	358	362	368	373	378	381	384	386	385	384	381	377	373	368	364	362		
30	336	340	346	354	361	367	372	376	378	377	375	371	365	359	353	347	344		
35	314	319	328	338	347	355	362	367	369	368	365	359	352	344	335	328	322		
40	289	297	307	320	332	342	351	356	359	358	353	346	337	326	315	306	299		
45	262	272	286	301	316	328	338	345	347	346	341	333	321	308	294	281	272		
50	234	246	263	282	299	314	325	333	336	334	328	318	305	288	271	255	244		
55	203	219	240	262	282	299	312	320	323	321	314	303	287	268	247	228	214		
60	172	191	217	242	265	284	298	307	310	308	300	288	270	248	224	200	182		
65	141	165	194	223	249	269	284	293	297	294	286	272	253	228	200	172	150		
70	109	139	173	205	233	255	270	279	283	280	272	257	236	210	178	146	118		
75	79.6	116	154	189	218	240	256	265	269	266	257	242	221	192	159	121	86.7		
80	53.8	95.6	137	173	203	226	242	252	255	252	243	228	205	176	141	99.0	59.1		
85	35.0	79.7	123	160	189	212	228	238	241	238	229	214	191	161	125	81.6	38.0		
90	25.0	68.1	111	147	176	198	214	223	227	224	215	200	178	149	112	68.9	26.0		
95	21.3	59.7	99.8	135	163	185	200	209	212	210	201	186	164	136	100	59.7	21.1		
100	22.4	54.7	91.0	124	152	172	186	195	198	195	187	173	153	125	91.1	54.1	21.5		
105	26.0	53.2	84.4	115	140	160	173	181	184	182	173	160	141	115	84.1	51.7	24.6		
110	31.1	53.9	80.5	107	130	148	161	168	171	169	161	149	130	106	79.2	51.9	29.4		
115	36.2	55.8	78.0	101	121	138	150	157	159	157	149	137	121	99.8	76.1	53.5	34.8		
120	41.0	58.4	76.8	96.3	114	129	139	145	148	145	139	128	113	94.9	74.7	56.3	40.0		
125	44.9	61.5	76.4	92.7	108	121	130	135	137	135	129	120	107	91.1	74.3	59.6	44.5		
130	47.4	64.8	76.5	90.1	103	114	122	127	128	126	121	113	102	88.4	74.8	62.9	48.5		
135	47.9	67.0	76.5	88.0	98.6	108	114	118	120	118	114	107	97.4	86.5	75.7	65.9	51.7		
140	47.0	68.7	76.8	85.6	94.9	102	108	111	113	111	107	102	93.9	85.3	76.7	67.5	53.5		
145	45.8	68.1	77.5	82.3	91.8	97.5	102	105	106	105	102	97.2	91.1	84.4	77.6	68.2	53.9		
150	48.0	62.7	77.5	79.8	85.4	93.6	96.8	98.9	99.9	99.1	96.9	93.5	89.0	84.1	77.9	65.8	55.6		
155	52.6	54.5	67.9	73.7	76.0	86.2	91.8	93.9	94.7	94.3	93.0	90.6	87.4	84.3	70.9	56.4	53.9		
160	55.9	44.9	50.8	59.0	62.6	66.2	73.3	86.0	90.2	90.0	89.3	88.0	85.9	81.5	57.7	49.5	52.4		
165	53.6	46.9	43.0	44.2	50.4	58.0	57.8	57.8	77.6	86.3	86.3	81.4	76.0	53.6	46.6	47.4	55.1		
170	54.5	51.5	49.9	49.6	51.8	56.7	58.7	51.5	57.1	83.3	74.8	48.6	46.7	49.9	45.5	45.3	61.6		
175	51.2	53.0	54.4	54.9	56.5	57.9	58.2	44.3	40.9	58.8	61.9	59.1	54.8	54.4	58.7	65.3	71.7		
180	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0		

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.

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 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 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 ***

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.