

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

LED Tube

Model: 20.5T8/4F/840/BYP

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.: HZ19070027a

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

Review by:



Engineer: April Zou

Jul. 19, 2019

Approved by:



Manager: Jim Zhang

Jul. 19, 2019

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: 20.5T8/4F/840/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
154.4	3067.5	19.87	0.9740
CCT (K)	CRI	Stabilization Time (Light & Power)	
4088	82.1	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. 17, 2019
Date of Test	: Jul. 18, 2019
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	: 20.5T8/4F/840/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 20.5W
Product Description	: 4000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

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)	0.170	0.079
Power Factor	0.9740	0.9135
Test Power (W)	19.87	20.03
THD A%	20.76	21.40
Luminous Efficacy (lm/W)	154.4	153.8
Total Luminous Flux (lm)	3067.5	3080.6
Color Rendering Index (CRI)	82.1	
R9	4.2	
Correlated Color Temperature (CCT)(K)	4088	
Chromaticity Chroma x	0.3774	
Chromaticity Chroma y	0.3775	
Chromaticity Chroma u	0.2228	
Chromaticity Chroma v	0.3343	
Duv	0.0013	
Chromaticity Chroma u'	0.2228	
Chromaticity Chroma v'	0.5015	

Special Color Rendering Indices	
R1	80.2
R2	88.7
R3	94.7
R4	80.4
R5	80
R6	84
R7	85.7
R8	63.2
R9	4.2
R10	73
R11	79
R12	58
R13	82.4
R14	97.3

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 25.0 °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)	0.170
Power Factor	0.9736
Power (W)	19.90
Luminous Efficacy (lm/W)	152.0
Total Luminous Flux (lm)	3024.2
Beam Angle (°)	114.7 (0°-180°) / 233.9 (90°-270°)
Center Beam Candle Power (cd)	475
Maximum Beam Candle Power (cd)	475.4 (At: C=40.0, Gamma=1.5)
Spacing Criteria	1.26 (0°-180°) / 1.44 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	41.16%
Zonal Lumens in the 60 °-90 °Zone	26.46%
Zonal Lumens in the 90 °-120 °Zone	18.07%
Zonal Lumens in the 120 °-180 °Zone	14.31%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

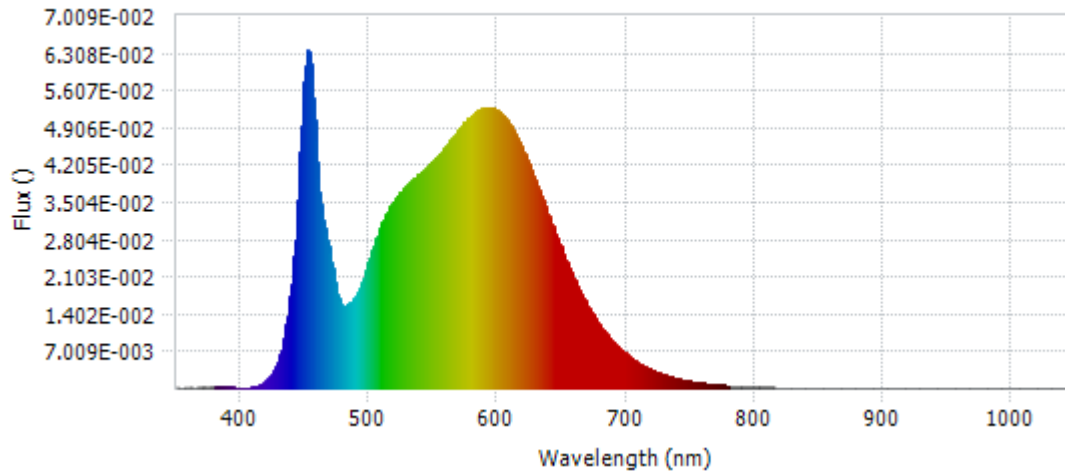
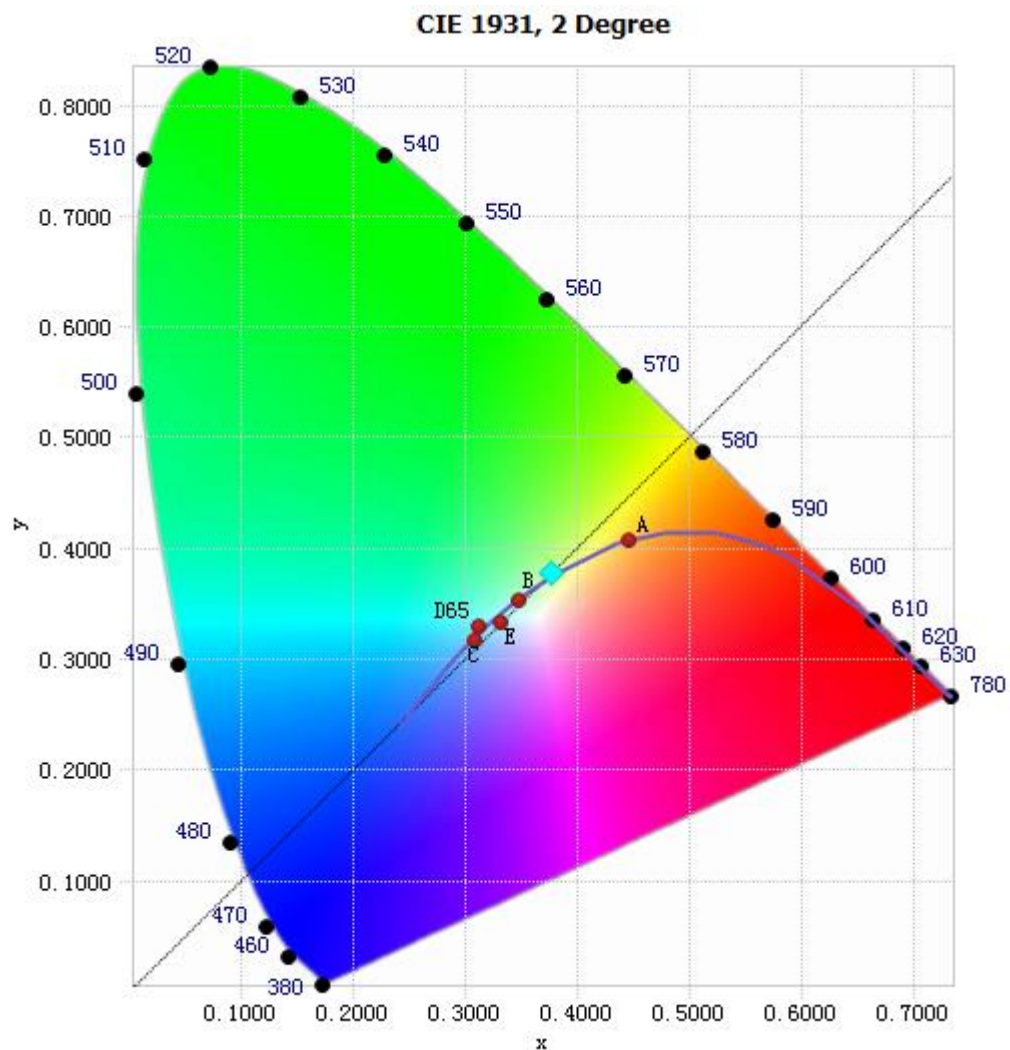


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.01E-04	485	1.62E-02	590	5.28E-02	695	7.55E-03
385	2.40E-04	490	1.78E-02	595	5.27E-02	700	6.47E-03
390	2.26E-04	495	2.08E-02	600	5.22E-02	705	5.55E-03
395	1.67E-04	500	2.45E-02	605	5.11E-02	710	4.72E-03
400	1.49E-04	505	2.81E-02	610	4.93E-02	715	4.05E-03
405	1.44E-04	510	3.11E-02	615	4.72E-02	720	3.47E-03
410	3.35E-04	515	3.38E-02	620	4.46E-02	725	2.97E-03
415	7.49E-04	520	3.57E-02	625	4.18E-02	730	2.51E-03
420	1.56E-03	525	3.71E-02	630	3.87E-02	735	2.15E-03
425	3.22E-03	530	3.85E-02	635	3.55E-02	740	1.84E-03
430	6.39E-03	535	3.95E-02	640	3.23E-02	745	1.59E-03
435	1.21E-02	540	4.06E-02	645	2.90E-02	750	1.35E-03
440	2.20E-02	545	4.18E-02	650	2.60E-02	755	1.16E-03
445	3.97E-02	550	4.29E-02	655	2.31E-02	760	9.88E-04
450	6.06E-02	555	4.42E-02	660	2.04E-02	765	8.44E-04
455	5.83E-02	560	4.57E-02	665	1.78E-02	770	7.27E-04
460	3.94E-02	565	4.73E-02	670	1.56E-02	775	6.19E-04
465	3.02E-02	570	4.88E-02	675	1.36E-02	780	5.35E-04
470	2.39E-02	575	5.02E-02	680	1.18E-02		
475	1.77E-02	580	5.14E-02	685	1.02E-02		
480	1.56E-02	585	5.24E-02	690	8.78E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3774, 0.3775)

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

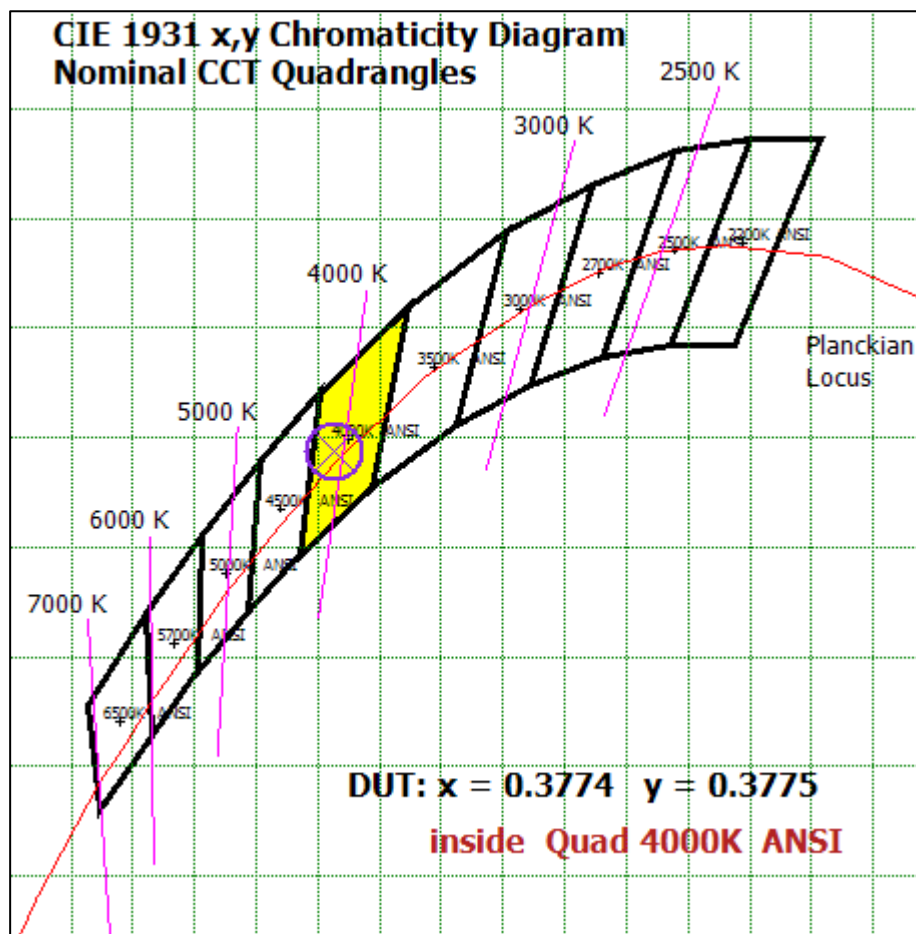
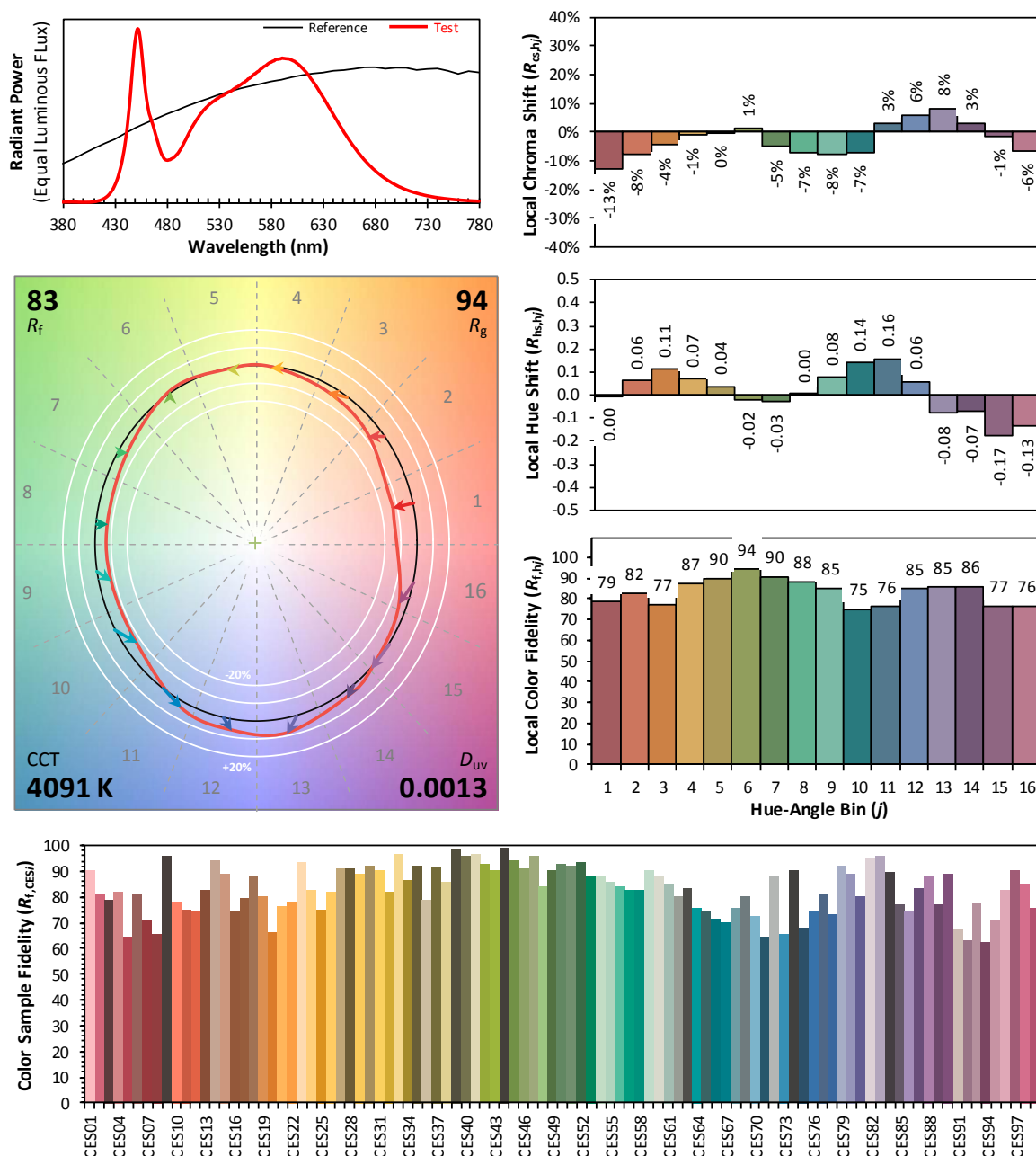


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

 $x = 0.3774$ $y = 0.3775$
$$U' \quad 0.2228$$

V' 0.5015

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	45.111	1.49%
10- 20	131.198	4.34%
20- 30	205.432	6.79%
30- 40	261.522	8.65%
40- 50	295.456	9.77%
50- 60	305.979	10.12%
60- 70	295.141	9.76%
70- 80	268.682	8.88%
80- 90	236.273	7.81%
90-100	207.683	6.87%
100-110	181.816	6.01%
110-120	157.101	5.19%
120-130	133.135	4.40%
130-140	109.753	3.63%
140-150	85.861	2.84%
150-160	60.398	2.00%
160-170	33.131	1.10%
170-180	10.576	0.35%
Total	3024.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1244.698	41.16%
60- 90	800.096	26.46%
0-90	2044.794	67.61%
90- 180	979.454	32.39%
0- 180	3024.2	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

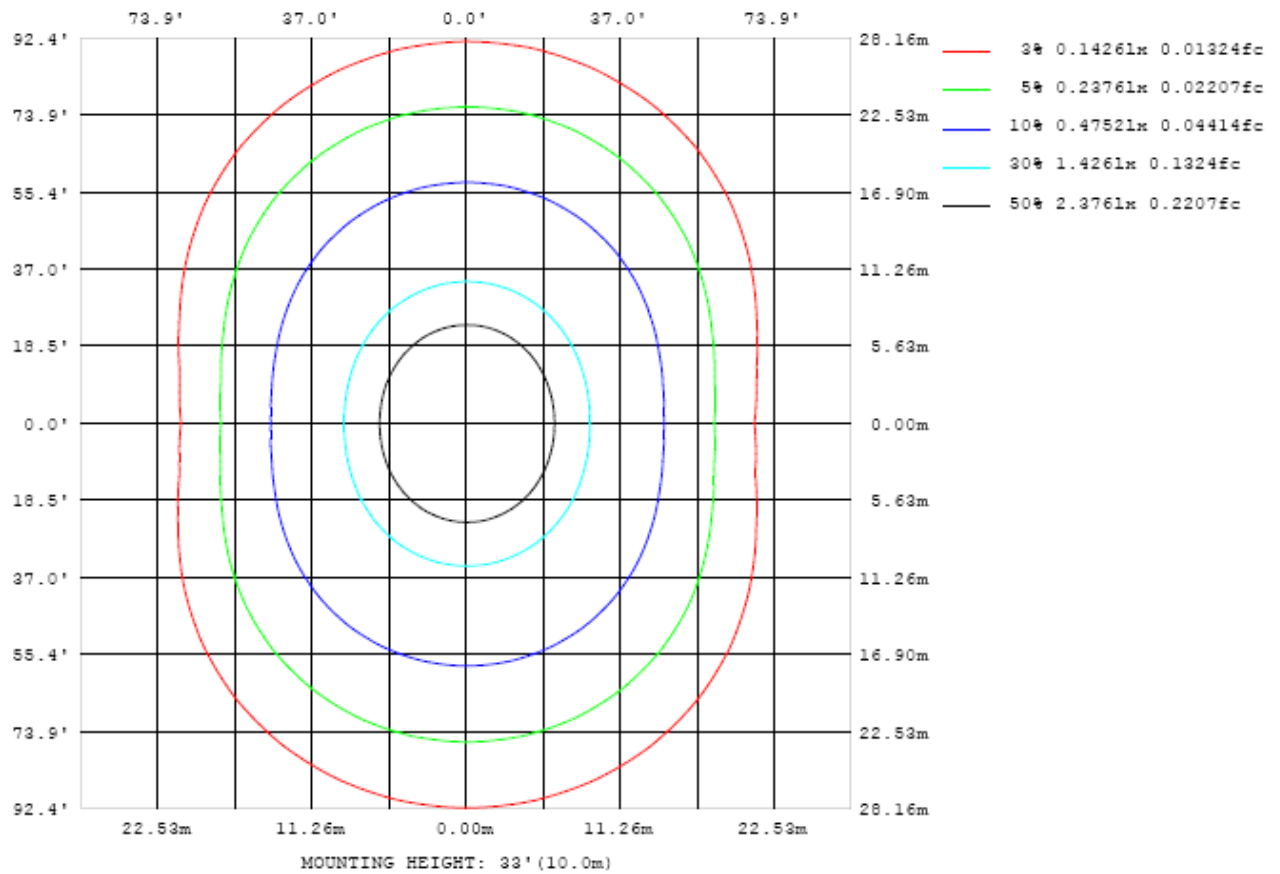


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

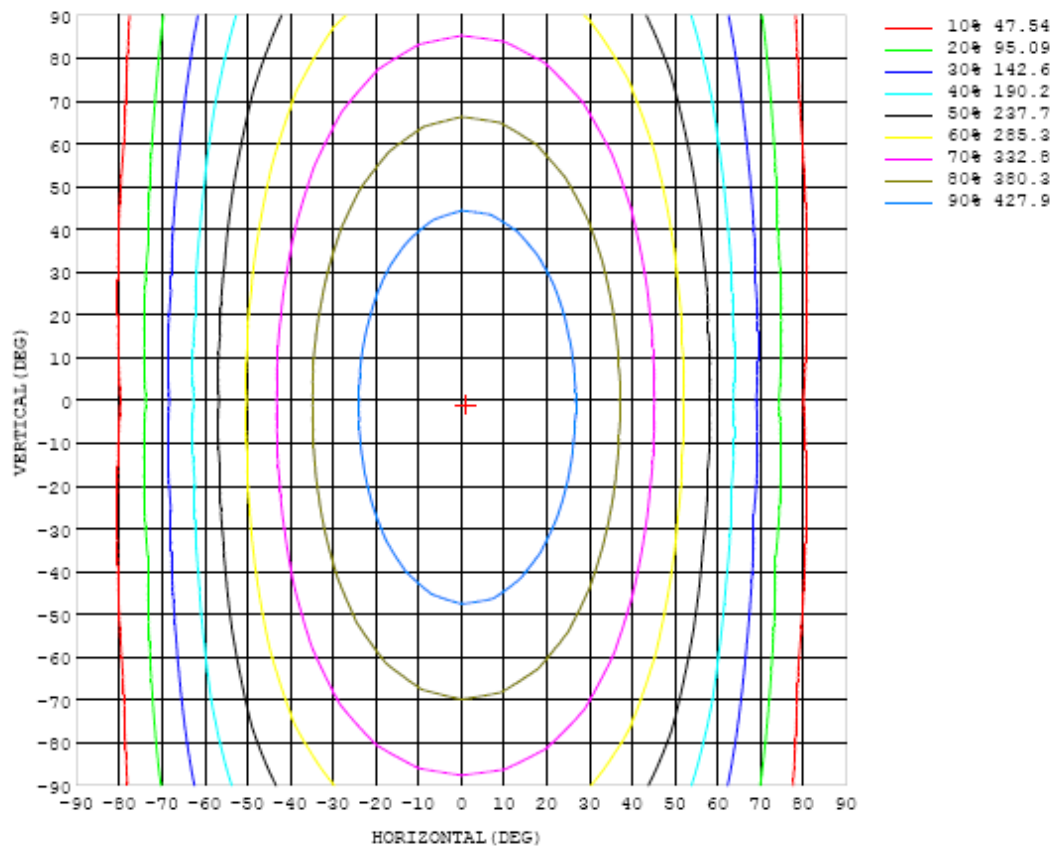


Chart 6: Isocandela Plot

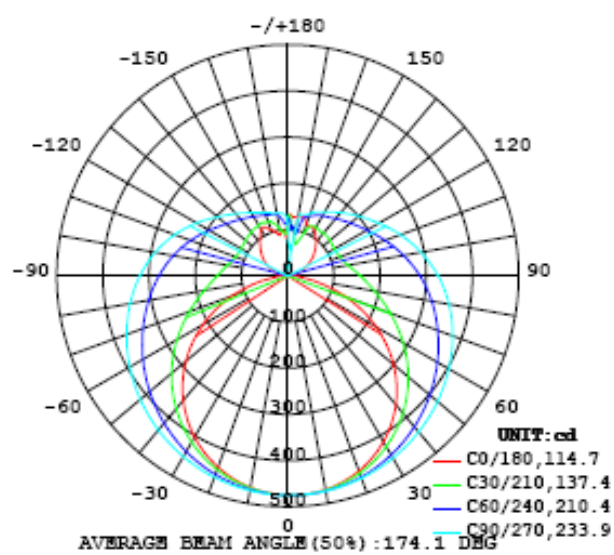


Chart 7: Polar Candela Distribution

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	475	475	475	475	475	475	475	475	475	475	475	475	475	475	475	475	475	475	475
5	475	475	475	475	475	475	475	475	475	475	474	474	474	473	473	473	473	472	472
10	470	470	471	471	472	472	473	473	474	473	472	472	471	470	468	467	466	466	465
15	462	462	463	464	466	468	469	470	471	470	469	468	466	464	461	459	457	456	455
20	450	450	452	455	458	461	463	466	467	466	465	463	460	456	452	448	445	442	441
25	434	435	438	442	447	452	456	460	462	461	460	456	452	446	440	434	429	425	424
30	415	416	420	427	434	442	448	453	456	456	453	449	442	434	426	417	410	405	403
35	391	393	399	409	419	429	438	444	448	449	446	440	432	422	410	399	389	382	379
40	364	367	376	388	402	415	427	435	440	441	438	431	421	408	393	378	365	356	352
45	333	337	349	365	383	400	415	425	431	432	429	421	409	393	374	355	338	326	321
50	299	304	320	341	363	384	402	414	422	423	420	410	396	377	355	331	310	294	288
55	261	269	288	315	343	368	388	403	411	413	409	399	383	361	335	307	279	259	251
60	221	230	255	288	322	351	374	391	400	403	398	387	369	345	315	282	248	222	212
65	178	190	222	262	301	334	360	378	389	392	387	375	355	329	295	256	216	183	171
70	133	149	189	236	280	317	346	365	377	380	375	362	342	313	276	232	185	145	128
75	89.0	109	158	212	261	301	331	352	364	368	363	350	328	297	258	210	157	107	85.6
80	47.9	73.8	131	191	243	285	317	338	351	354	350	336	314	282	241	190	132	74.2	45.7
85	14.9	46.9	110	172	226	269	302	324	337	341	336	322	299	267	225	172	112	50.0	14.4
90	0.47	32.6	94.5	157	211	254	286	309	322	326	321	307	285	252	210	158	97.2	36.4	0.37
95	3.84	28.4	84.1	143	196	238	271	293	306	310	305	292	269	237	196	145	87.1	31.8	3.83
100	11.0	31.6	78.6	133	182	223	255	276	289	293	289	276	253	223	183	135	81.6	34.5	11.4
105	20.5	38.0	77.6	125	171	209	239	260	273	276	272	259	238	209	171	127	80.7	40.7	21.4
110	30.4	46.8	79.7	120	161	196	224	244	256	260	256	244	224	196	162	122	83.1	49.2	32.6
115	41.4	56.3	83.7	118	153	185	210	229	240	244	240	228	210	185	155	121	87.3	58.2	44.1
120	53.2	64.8	88.8	117	147	175	198	214	224	228	224	214	198	176	149	120	92.5	66.6	55.3
125	64.0	68.9	93.0	118	143	167	187	202	211	213	211	202	187	168	145	121	97.0	72.3	65.2
130	74.8	74.3	99.2	119	140	160	178	190	198	201	198	191	178	162	142	122	99.5	74.3	74.3
135	85.0	77.3	105	121	138	155	169	180	187	189	187	180	170	156	140	124	106	78.6	83.8
140	95.2	77.4	109	121	137	150	162	171	176	178	177	171	162	151	138	123	109	80.0	93.5
145	105	74.3	112	120	136	146	155	162	167	168	167	163	156	147	137	119	112	79.2	104
150	115	76.8	112	122	131	143	150	155	158	159	159	155	150	144	130	116	113	81.5	114
155	117	86.7	91.3	118	131	137	144	149	151	152	152	149	144	131	116	110	97.0	87.0	116
160	120	89.2	71.8	94.1	124	135	138	143	143	144	143	136	115	105	99.5	97.6	80.4	85.9	105
165	132	102	74.0	73.1	78.6	107	128	131	138	138	126	97.3	95.5	96.6	87.3	78.6	74.6	84.5	97.9
170	129	117	92.0	82.2	84.2	89.8	91.6	102	101	111	86.3	97.9	98.7	93.7	86.2	81.5	78.4	84.2	92.3
175	128	125	118	108	104	106	109	109	91.9	61.7	99.9	103	102	100	97.5	94.3	93.8	95.8	96.2
180	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115

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	475	475	475	475	475	475	475	475	475	475	475	475	475	475	475	475	475		
5	472	472	472	473	473	473	474	474	474	474	474	474	474	474	474	475	474		
10	465	466	467	468	469	470	471	471	472	472	472	472	471	471	471	470	470		
15	455	456	458	460	462	464	466	468	469	469	468	468	466	465	464	463	462		
20	442	444	447	450	454	458	461	463	464	464	463	462	459	456	454	452	450		
25	425	428	433	438	444	449	454	457	459	459	457	454	450	445	441	437	435		
30	405	410	416	424	432	440	445	450	452	452	449	445	439	432	425	420	416		
35	382	388	397	408	418	428	436	442	444	444	440	434	426	417	407	399	393		
40	355	364	376	390	404	416	426	433	436	435	431	423	412	399	386	375	367		
45	326	337	353	371	388	404	415	423	427	426	420	410	397	381	364	348	337		
50	293	308	328	351	372	390	404	413	417	415	409	397	380	361	339	319	305		
55	258	277	303	330	355	376	392	402	406	404	396	383	364	340	314	288	269		
60	221	245	277	309	338	362	379	390	395	393	384	368	346	319	287	256	232		
65	183	213	251	289	321	348	367	379	383	381	371	354	329	298	261	223	192		
70	145	182	226	269	305	333	354	367	371	369	358	339	312	277	235	191	152		
75	107	153	204	250	289	319	341	354	359	356	345	325	296	258	212	160	114		
80	72.7	128	183	233	274	306	328	342	347	343	331	310	280	240	191	133	78.5		
85	47.1	107	166	218	260	292	315	328	334	330	318	296	265	224	172	112	51.3		
90	33.6	93.7	153	204	246	279	301	315	320	316	304	282	251	210	158	97.3	36.2		
95	29.8	85.4	142	192	234	265	288	301	306	303	290	268	237	197	146	87.9	31.2		
100	32.6	80.3	133	181	221	252	273	287	292	288	276	254	224	184	136	81.7	32.8		
105	39.4	78.6	126	170	208	238	259	271	276	273	260	240	211	173	128	79.1	39.2		
110	49.1	80.5	120	161	196	224	244	256	260	257	245	225	198	163	121	79.9	48.6		
115	59.4	84.7	118	152	184	210	229	240	244	241	230	211	186	154	118	83.0	58.6		
120	69.8	90.0	117	146	174	197	214	225	228	225	215	198	175	147	117	87.9	68.9		
125	79.8	95.6	118	142	165	185	200	209	213	210	201	185	166	142	117	93.7	78.7		
130	88.9	101	119	139	159	175	187	195	198	196	188	175	158	139	118	99.9	88.3		
135	95.8	106	121	137	153	167	177	184	186	184	177	167	153	137	120	106	97.2		
140	104	112	123	136	149	159	168	173	175	174	168	159	148	135	122	112	105		
145	111	115	125	135	145	153	160	164	166	164	160	153	144	135	125	117	112		
150	116	116	126	135	142	148	153	157	158	157	154	148	141	134	127	122	117		
155	120	120	127	134	139	144	147	150	151	151	148	144	139	134	130	126	123		
160	114	118	125	134	137	140	142	144	146	145	144	141	137	135	132	129	129		
165	103	108	119	129	136	137	139	140	141	141	140	139	137	135	133	132	131		
170	95.0	97.0	104	115	127	135	136	137	138	138	138	137	136	135	134	133	131		
175	92.8	89.5	92.8	101	109	121	130	134	136	136	136	136	136	135	135	133	130		
180	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

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.