

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 12T8/4F/850/HYB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19090007d

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

Review by:



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Sep. 10, 2019

Approved by:



Manager: Jim Zhang
Sep. 10, 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: 12T8/4F/850/HYB

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)/2	Power Factor
129.2	1863.8	14.43	0.9974
CCT (K)	CRI	Stabilization Time (Light & Power)	
5133	83.2	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	: Sep. 05, 2019
Date of Test	: Sep. 09, 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

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SAMPLE PHOTO

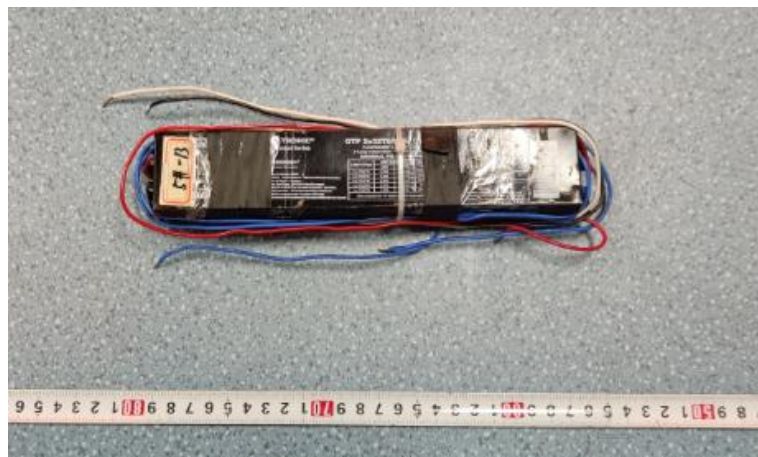


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 12T8/4F/850/HYB
Electrical Ratings	: 120-277V, 60Hz, 12W
Product Description	: 5000K LED tubes supplied by a high frequency fluorescent lamp ballast: QTP 2x32T8/UNV ISN-SC
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)	0.241	0.110
Power Factor	0.9974	0.9573
Test Power (W)/2	14.43	14.57
THD A%	4.40	14.04
Luminous Efficacy (lm/W)	129.2	127.8
Total Luminous Flux (lm)	1863.8	1861.9
Color Rendering Index (CRI)	83.2	
R9	6.8	
Correlated Color Temperature (CCT)(K)	5133	
Chromaticity Chroma x	0.3417	
Chromaticity Chroma y	0.3529	
Chromaticity Chroma u	0.2086	
Chromaticity Chroma v	0.3232	
Duv	0.0020	
Chromaticity Chroma u'	0.2086	
Chromaticity Chroma v'	0.4848	

Special Color Rendering Indices	
R1	81.6
R2	89
R3	93.2
R4	82.5
R5	82.1
R6	83.8
R7	86.6
R8	66.8
R9	6.8
R10	73.3
R11	81.9
R12	60
R13	83.7
R14	96.6

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)	0.243
Power Factor	0.9949
Power (W)/2	14.49
Luminous Efficacy (lm/W)	126.8
Total Luminous Flux (lm)	1836.2
Beam Angle (°)	111.3 (0°-180°) / 205.7 (90°-270°)
Center Beam Candle Power (cd)	324
Maximum Beam Candle Power (cd)	324.3 (At: C=330.0, Gamma=0.5)
Spacing Criteria	1.25 (0°-180°) / 1.41 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	44.59%
Zonal Lumens in the 60 °-90 °Zone	26.68%
Zonal Lumens in the 90 °-120 °Zone	16.85%
Zonal Lumens in the 120 °-180 °Zone	11.88%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

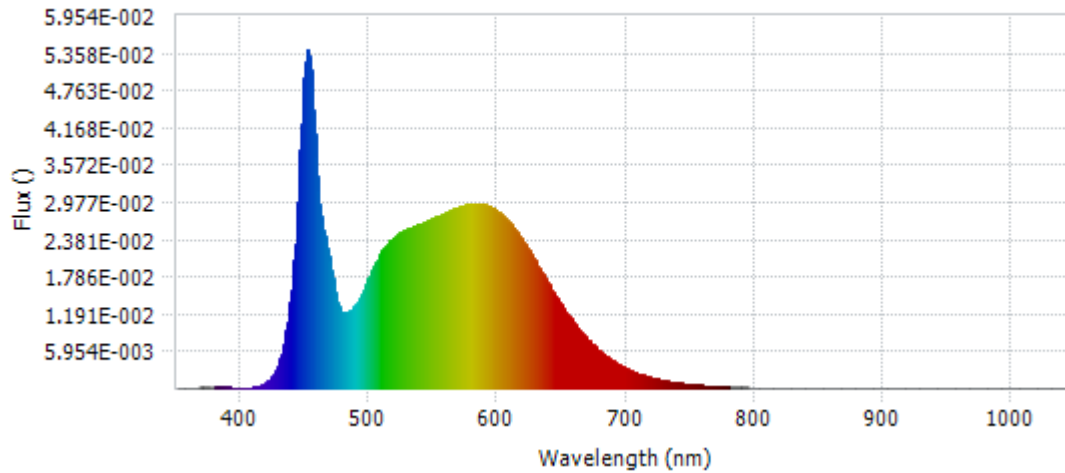
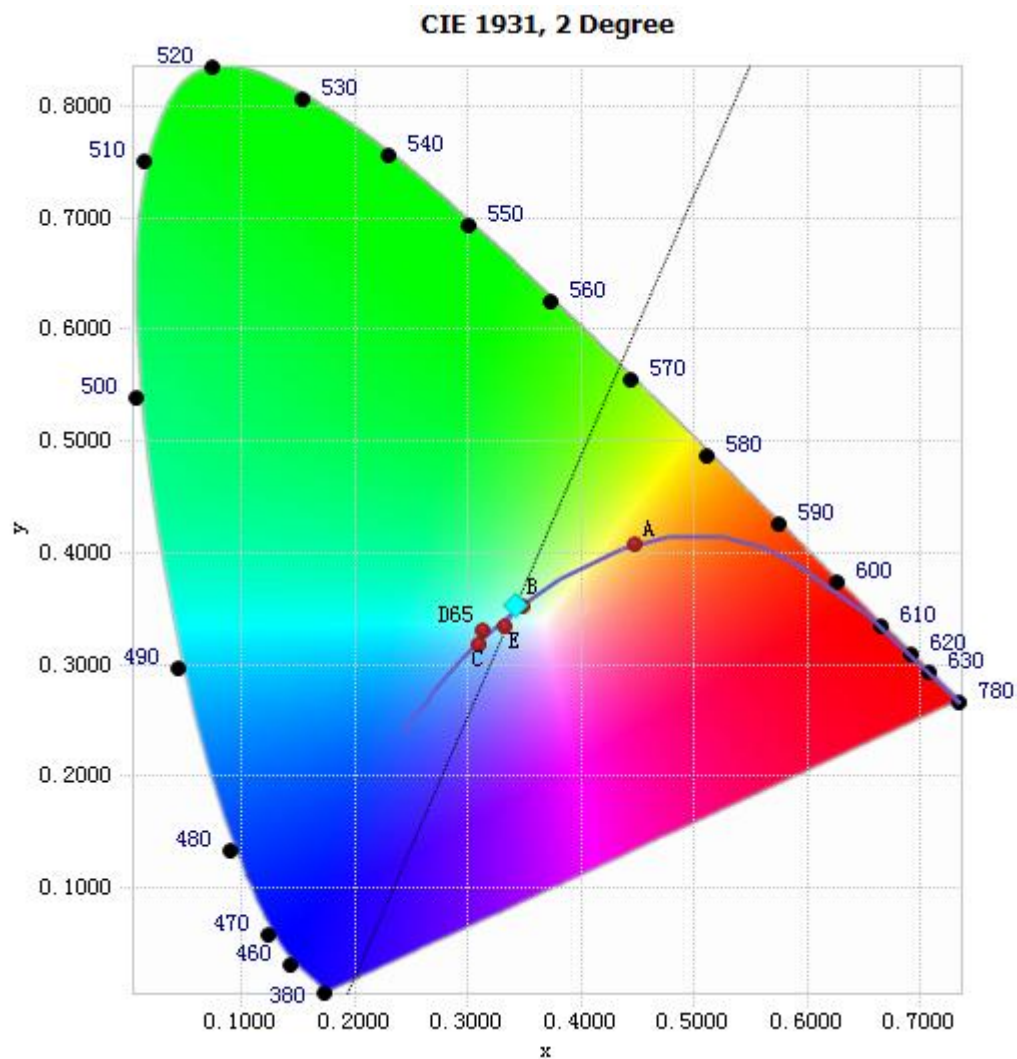


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.91E-04	485	1.24E-02	590	2.93E-02	695	3.73E-03
385	1.76E-04	490	1.35E-02	595	2.89E-02	700	3.21E-03
390	1.71E-04	495	1.56E-02	600	2.83E-02	705	2.72E-03
395	1.45E-04	500	1.80E-02	605	2.73E-02	710	2.33E-03
400	1.05E-04	505	2.02E-02	610	2.62E-02	715	1.98E-03
405	9.62E-05	510	2.20E-02	615	2.49E-02	720	1.70E-03
410	1.90E-04	515	2.34E-02	620	2.33E-02	725	1.46E-03
415	4.60E-04	520	2.43E-02	625	2.17E-02	730	1.24E-03
420	1.02E-03	525	2.49E-02	630	2.00E-02	735	1.06E-03
425	2.25E-03	530	2.55E-02	635	1.83E-02	740	8.96E-04
430	4.71E-03	535	2.58E-02	640	1.66E-02	745	7.66E-04
435	9.39E-03	540	2.63E-02	645	1.48E-02	750	6.52E-04
440	1.79E-02	545	2.68E-02	650	1.32E-02	755	5.60E-04
445	3.38E-02	550	2.72E-02	655	1.17E-02	760	4.79E-04
450	5.22E-02	555	2.77E-02	660	1.03E-02	765	4.15E-04
455	4.79E-02	560	2.81E-02	665	9.01E-03	770	3.48E-04
460	3.15E-02	565	2.86E-02	670	7.83E-03	775	3.07E-04
465	2.43E-02	570	2.91E-02	675	6.79E-03	780	2.60E-04
470	1.89E-02	575	2.93E-02	680	5.88E-03		
475	1.37E-02	580	2.95E-02	685	5.08E-03		
480	1.20E-02	585	2.96E-02	690	4.36E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3417, 0.3529)

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

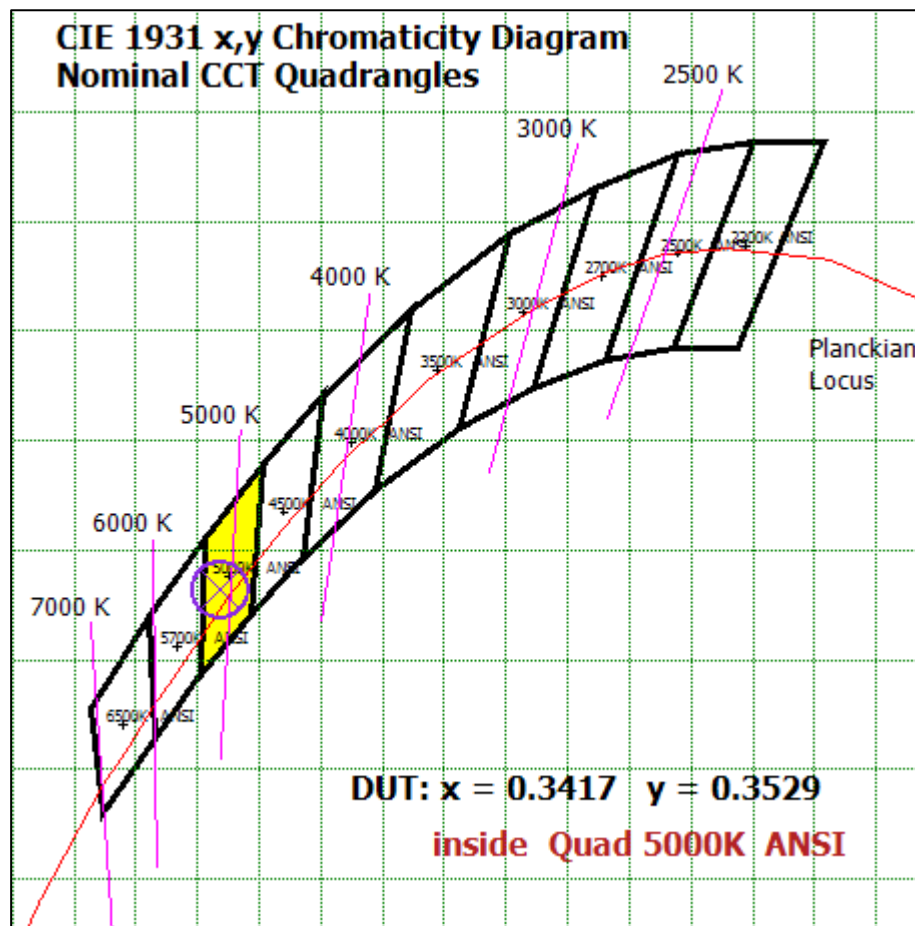
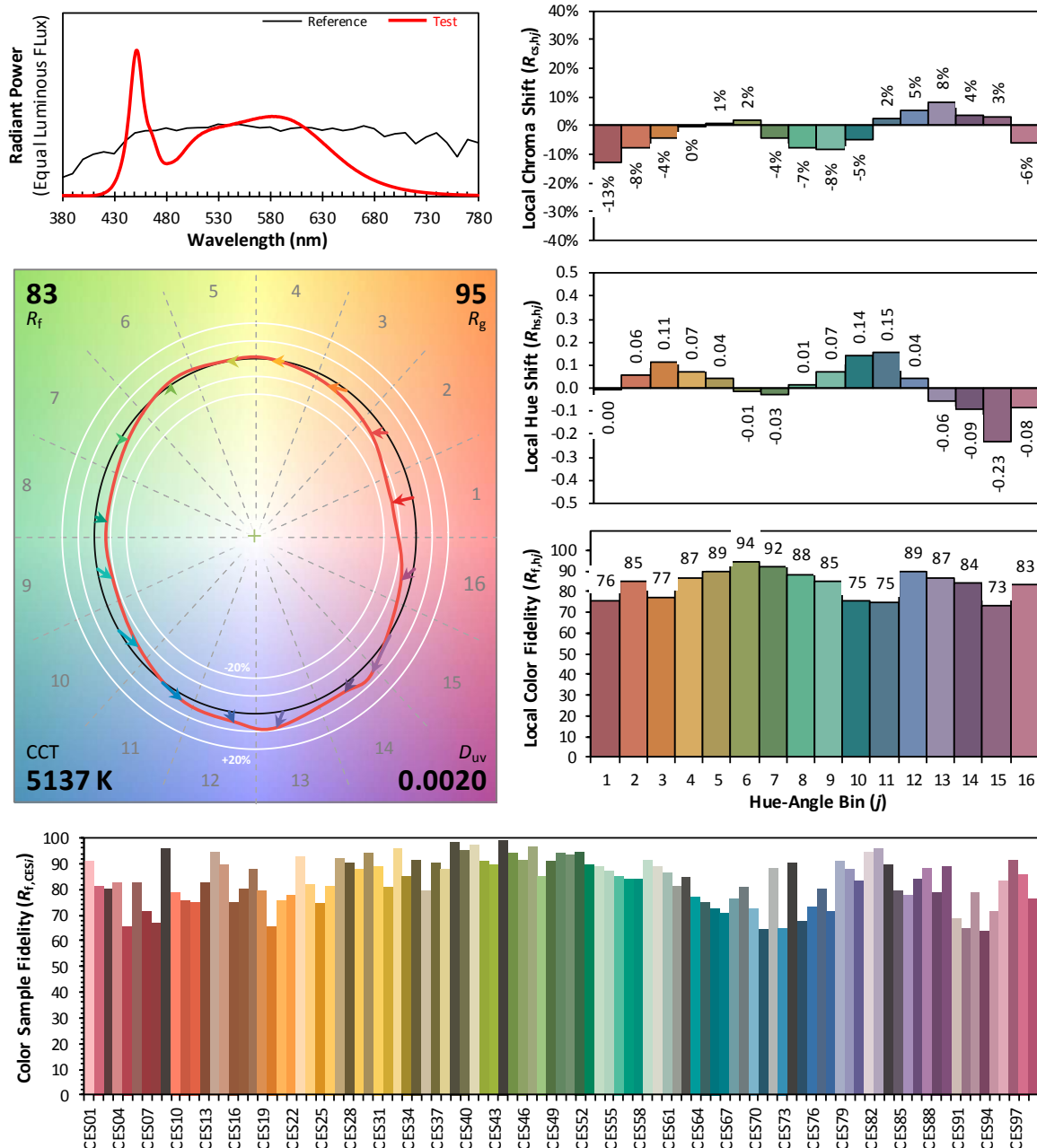


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3417
 y 0.3529
 u' 0.2086
 v' 0.4848

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	30.752	1.67%
10- 20	89.013	4.85%
20- 30	138.022	7.52%
30- 40	173.253	9.44%
40- 50	192.361	10.48%
50- 60	195.404	10.64%
60- 70	184.621	10.05%
70- 80	164.318	8.95%
80- 90	141.004	7.68%
90-100	120.922	6.59%
100-110	102.712	5.59%
110-120	85.683	4.67%
120-130	70.219	3.82%
130-140	56.075	3.05%
140-150	42.651	2.32%
150-160	29.384	1.60%
160-170	15.537	0.85%
170-180	4.294	0.23%
Total	1836.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	818.805	44.59%
60- 90	489.943	26.68%
0-90	1308.748	71.27%
90- 180	527.477	28.73%
0- 180	1836.2	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

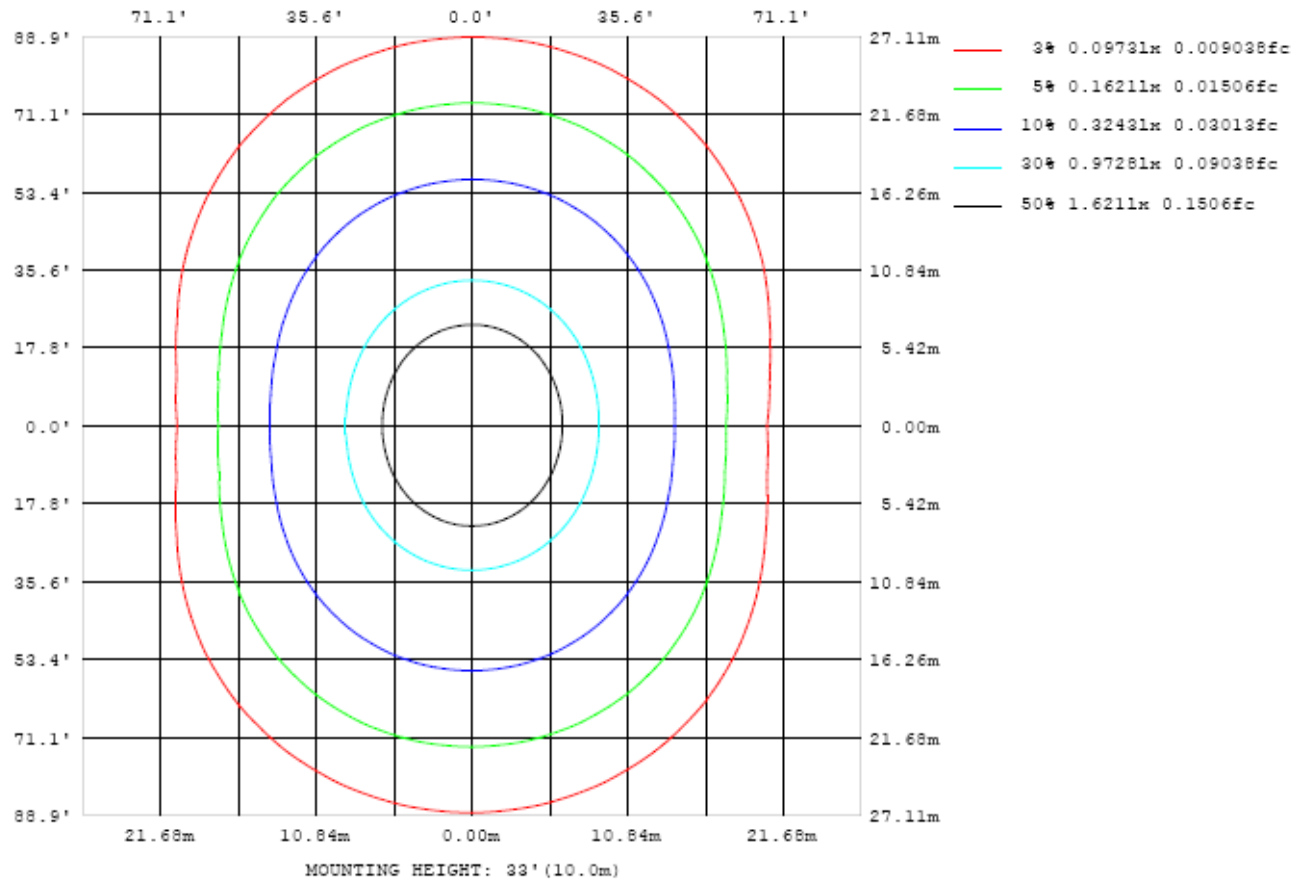


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

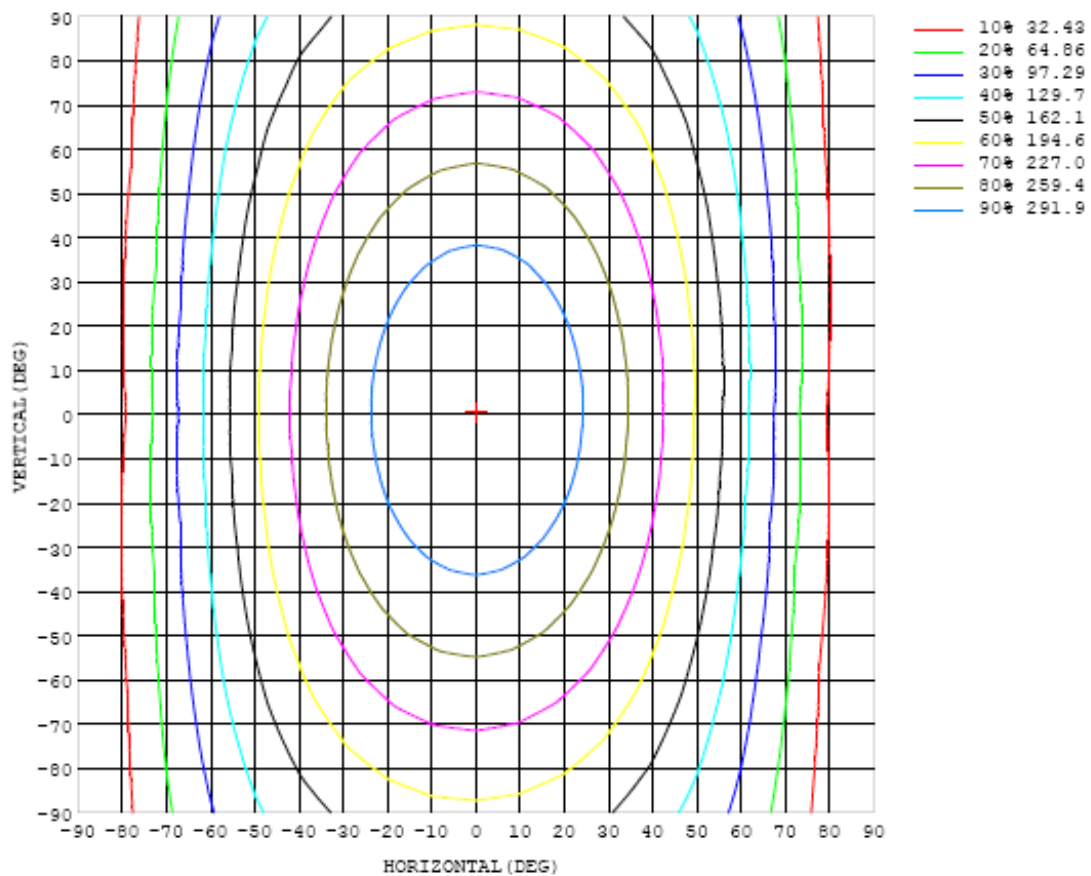


Chart 6: Isocandela Plot

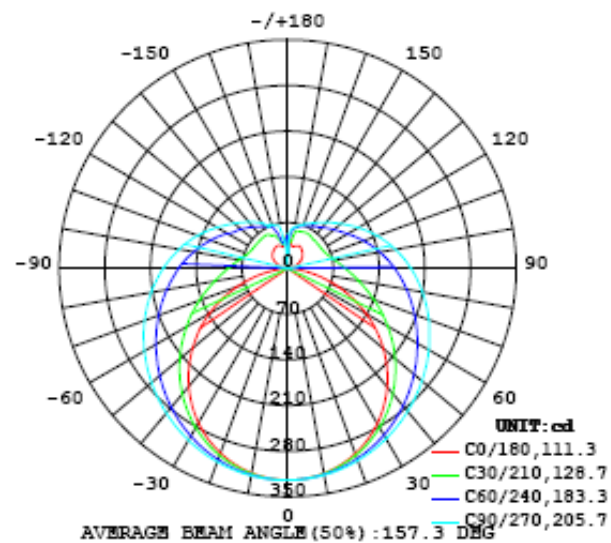


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324
5	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323	323
10	319	319	319	319	320	320	321	321	321	321	321	321	320	320	319	319	318	318	318
15	312	312	312	313	314	315	316	317	318	318	318	317	316	315	314	312	312	311	311
20	302	302	303	305	307	309	310	312	313	313	313	312	310	308	306	304	302	301	301
25	290	290	291	294	297	300	303	306	307	308	307	306	303	300	297	293	290	289	288
30	274	275	277	281	286	290	295	298	300	301	300	298	295	290	285	281	277	274	273
35	257	258	261	267	273	279	285	290	293	294	293	290	285	280	273	266	260	256	256
40	237	238	243	250	259	267	275	281	284	286	285	281	275	268	259	250	243	237	236
45	215	217	223	233	244	255	264	271	276	277	276	272	265	256	245	233	223	216	214
50	191	194	202	215	228	241	253	261	266	268	267	262	254	243	230	216	203	193	190
55	166	169	180	196	213	228	241	251	257	259	257	252	243	230	215	198	181	169	165
60	139	143	158	177	197	215	229	240	247	250	248	242	232	217	200	180	160	144	139
65	111	117	135	158	181	202	218	230	237	240	238	232	220	205	185	162	138	118	111
70	82.1	90.4	113	141	167	189	207	219	227	230	228	221	210	193	171	145	117	92.9	82.4
75	54.6	65.7	93.1	125	153	177	196	209	217	220	218	211	199	181	158	130	98.5	69.3	54.6
80	29.0	43.3	76.7	110	141	166	185	198	207	210	208	201	188	170	146	116	82.3	48.3	29.0
85	8.96	26.5	62.7	98.3	129	155	174	188	196	199	197	190	178	159	135	105	69.8	32.6	8.85
90	0.58	17.6	53.1	88.3	119	144	164	177	186	189	187	180	167	149	125	95.1	60.3	23.8	0.43
95	1.98	14.6	46.6	80.1	110	135	154	167	175	178	176	170	157	139	116	86.7	53.6	20.2	2.05
100	4.83	15.7	42.3	73.5	101	125	144	157	165	167	166	159	147	130	107	79.5	49.0	20.5	5.59
105	8.96	18.6	40.7	67.9	93.6	116	133	146	154	157	155	148	137	120	99.1	74.0	46.5	22.6	10.3
110	13.5	22.8	40.8	63.8	86.7	107	124	136	143	146	144	138	127	112	91.9	69.4	46.2	25.4	15.2
115	18.5	27.4	41.9	61.5	81.0	99.3	114	126	132	135	134	128	118	103	85.6	66.6	46.7	29.7	19.8
120	22.8	31.4	43.7	60.2	77.3	92.6	106	116	122	125	123	118	109	96.1	81.2	64.7	47.3	33.8	24.3
125	26.4	34.3	46.2	59.5	74.2	87.2	98.6	107	113	115	114	109	101	90.4	77.7	63.4	48.6	37.3	28.0
130	29.6	36.0	48.3	59.3	71.6	82.6	92.4	99.9	105	106	105	101	94.6	85.4	74.7	62.0	50.7	40.3	30.8
135	32.0	36.6	50.8	59.6	69.4	78.7	86.9	93.3	97.3	98.8	97.9	94.6	88.8	81.0	71.6	61.3	52.5	42.0	32.8
140	34.4	40.0	52.6	59.2	67.7	75.6	82.1	87.4	90.8	92.0	91.2	88.4	83.5	77.0	69.0	61.5	54.1	42.1	34.4
145	36.6	43.5	54.5	61.1	67.4	72.8	78.7	82.1	84.8	85.8	85.1	82.8	78.9	73.3	67.4	61.5	54.4	43.2	35.9
150	38.7	46.2	54.3	61.2	65.5	71.0	74.8	77.5	79.6	80.4	79.8	77.9	74.6	70.2	65.9	61.2	54.9	45.6	37.3
155	38.1	45.7	54.1	61.1	64.6	68.6	72.0	74.3	75.7	76.2	75.8	74.1	70.2	67.7	64.7	58.3	51.8	45.2	38.1
160	36.2	43.7	55.1	59.8	63.9	66.4	69.4	70.9	71.9	71.8	71.2	69.8	67.4	65.7	59.0	53.6	46.2	40.0	37.3
165	34.7	39.2	50.7	59.6	62.1	64.3	66.1	67.8	68.1	67.8	67.2	64.9	65.1	57.9	51.5	43.7	38.9	35.2	35.0
170	35.5	35.6	40.3	50.6	57.6	59.8	62.3	63.6	64.6	64.9	64.3	62.3	53.1	44.9	40.9	39.3	37.5	34.5	33.7
175	45.7	44.6	43.4	41.9	41.1	47.9	53.4	56.2	59.4	59.2	53.7	40.0	32.5	34.3	38.5	42.0	44.5	43.5	44.5
180	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0

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	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324	324		
5	323	323	323	323	323	324	324	324	324	324	324	324	323	323	323	323	323		
10	318	319	319	320	321	321	322	322	322	322	322	321	321	320	320	319	319		
15	311	312	313	315	316	317	318	319	319	319	319	318	316	315	314	313	312		
20	302	303	305	307	310	312	313	315	315	315	314	312	310	308	306	304	303		
25	289	291	294	298	301	305	307	309	310	310	308	305	302	299	295	293	291		
30	274	277	282	287	292	297	300	303	304	303	301	297	293	288	283	279	276		
35	257	261	267	274	281	288	292	295	297	296	293	288	282	276	269	263	259		
40	238	243	251	260	269	277	284	288	289	288	285	279	271	262	253	245	240		
45	216	224	234	246	257	267	274	279	281	280	275	268	259	248	236	226	219		
50	193	203	216	230	244	256	265	270	272	271	266	257	246	233	218	205	196		
55	170	181	197	215	231	244	254	261	263	261	256	246	233	217	200	184	172		
60	144	159	179	199	218	233	244	251	253	251	245	234	220	202	182	163	147		
65	118	137	161	184	205	222	234	241	243	241	235	223	207	187	165	141	121		
70	91.7	116	144	170	193	210	223	230	233	231	224	212	195	173	147	119	94.8		
75	66.7	95.6	128	157	181	199	212	220	223	220	213	200	183	160	132	99.7	70.1		
80	44.6	78.5	114	145	170	188	201	209	212	210	202	189	171	148	117	82.7	48.4		
85	27.9	64.9	102	133	159	177	191	199	202	199	191	178	161	136	105	69.1	31.9		
90	19.0	55.2	91.3	123	148	167	180	188	191	188	181	168	150	125	94.7	59.1	22.6		
95	15.8	48.5	82.8	113	138	157	170	177	180	177	170	158	140	116	85.9	52.0	18.7		
100	16.7	44.0	75.5	104	128	146	159	167	169	167	160	147	130	106	78.2	46.9	18.6		
105	19.5	42.3	69.7	96.1	119	136	148	156	158	156	149	137	120	98.0	72.0	44.3	20.9		
110	23.5	42.3	65.2	88.2	110	126	137	144	147	145	138	127	111	90.6	67.2	43.7	25.0		
115	27.9	43.5	63.0	82.6	99.9	116	127	134	136	134	128	117	102	84.4	64.2	44.3	29.6		
120	32.1	45.2	61.6	78.7	93.8	106	117	123	125	123	118	108	95.3	79.7	62.4	45.9	34.0		
125	36.2	47.1	60.9	75.3	88.8	98.5	108	114	116	114	109	101	89.5	76.1	61.4	48.3	38.3		
130	40.0	49.3	60.6	72.6	84.0	93.5	98.3	105	107	106	101	94.1	84.6	73.2	61.2	51.0	42.1		
135	43.0	51.6	60.5	70.5	80.0	87.9	92.9	98.1	99.5	98.3	94.5	88.4	80.5	71.1	61.6	53.2	45.4		
140	45.0	51.4	60.5	68.6	76.4	82.9	87.8	91.2	92.7	91.6	88.5	83.4	77.0	69.6	62.2	54.9	47.9		
145	46.9	53.8	60.8	67.1	73.0	78.4	82.5	82.6	86.5	85.6	83.1	79.1	74.1	68.5	62.7	57.2	49.7		
150	47.7	55.2	59.8	65.7	70.4	74.3	77.3	79.4	80.5	80.3	78.5	75.5	71.8	67.4	61.6	58.5	50.8		
155	45.9	55.0	55.6	63.8	68.3	70.9	72.8	74.5	71.6	75.8	74.6	72.6	69.8	66.6	63.3	58.9	49.1		
160	39.2	46.6	52.1	50.4	59.5	66.9	69.8	70.2	71.0	69.8	70.9	69.9	68.0	64.6	62.3	55.3	42.8		
165	35.3	39.0	43.2	45.2	45.9	50.6	58.4	66.6	67.3	64.7	67.1	66.4	62.3	58.1	57.9	49.9	36.7		
170	35.7	35.5	37.8	40.4	41.1	38.8	39.2	46.1	56.7	66.3	61.0	49.0	53.8	55.0	49.0	40.0	35.7		
175	46.1	46.6	46.6	45.3	46.2	44.0	41.6	31.0	19.1	10.6	43.0	46.0	47.6	49.2	45.8	45.9	46.3		
180	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0		

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 ***

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