LM-79-19 TEST REPORT

for

LED One Corporation

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LED Tube

Model: LOC-4FTT8B-9.5W50K

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ23050016b

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

Review by: Wei Fei

Engineer: Wei Fei
May 25, 2023

Approve by: April Zou

Manager: April Zou
May 25, 2023

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: **LOC-4FTT8B-9.5W50K**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
164.4	1600.9	9.74	0.9839

CCT (K)	CRI	Stabilization Time (Light & Power)
5043	83.5	50

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

Test specifications:

Date of Receipt : May 17, 2023

Date of Test : May 22, 2023

Test item : Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters

Reference Standard : IESNA LM-79-2019 Approved Method: 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	: LOC-4FTT8B-9.5W50K
Electrical Ratings	: 120-277V, 50/60Hz, 9.5W
Product Description	: 5000K
Manufacturer	: LED One Corporation
Address	: 12437 Bellegrave Ave Eastvale,CA 91752

TEST RESULTS

Test ambient temperature was 26.0 ℃.

Base orientation was base up. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 50 minutes, and the total operating time including stabilization was 55 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.783	0.040
Power Factor	0.9839	0.9180
Test Power (W)	9.74	10.05
THD A%	17.16	20.36
Luminous Efficacy (lm/W)	164.4	162.4
Total Luminous Flux (lm)	1600.9	1632.6
Color Rendering Index (CRI)	83.5	
R9	9.5	
Correlated Color Temperature (CCT)(K)	5043	
Chromaticity Chroma x	0.3442	
Chromaticity Chroma y	0.3553	
Chromaticity Chroma u	0.2094	
Chromaticity Chroma v	0.3242	
Duv	0.0022	
Chromaticity Chroma u ’	0.2094	
Chromaticity Chroma v’	0.4863	

Special Color Rendering Indices	
R1	81.8
R2	89.3
R3	93.6
R4	82.5
R5	82.2
R6	84.3
R7	86.9
R8	67.4
R9	9.5
R10	74.1
R11	81.8
R12	60.1
R13	84
R14	96.8

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 24.8 ℃.

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)	0.083
Power Factor	0.9841
Power (W)	9.77
Luminous Efficacy (lm/W)	164.9
Total Luminous Flux (lm)	1611.2
Beam Angle (°)	111.6 (0^o-180^o) / 210.6 (90^o-270^o)
Center Beam Candle Power (cd)	283
Maximum Beam Candle Power (cd)	283.7 (At: C=140.0, Gamma=3.5)
Spacing Criteria	1.29 (0^o-180^o) / 1.39 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	44.26%
Zonal Lumens in the 60 °-90 °Zone	26.63%
Zonal Lumens in the 90 °-120 °Zone	17.40%
Zonal Lumens in the 120 °-180 °Zone	11.71%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

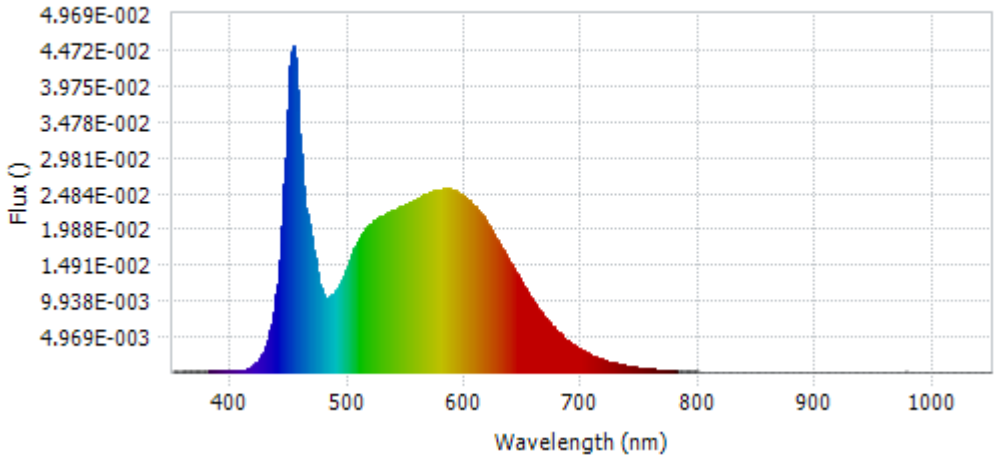
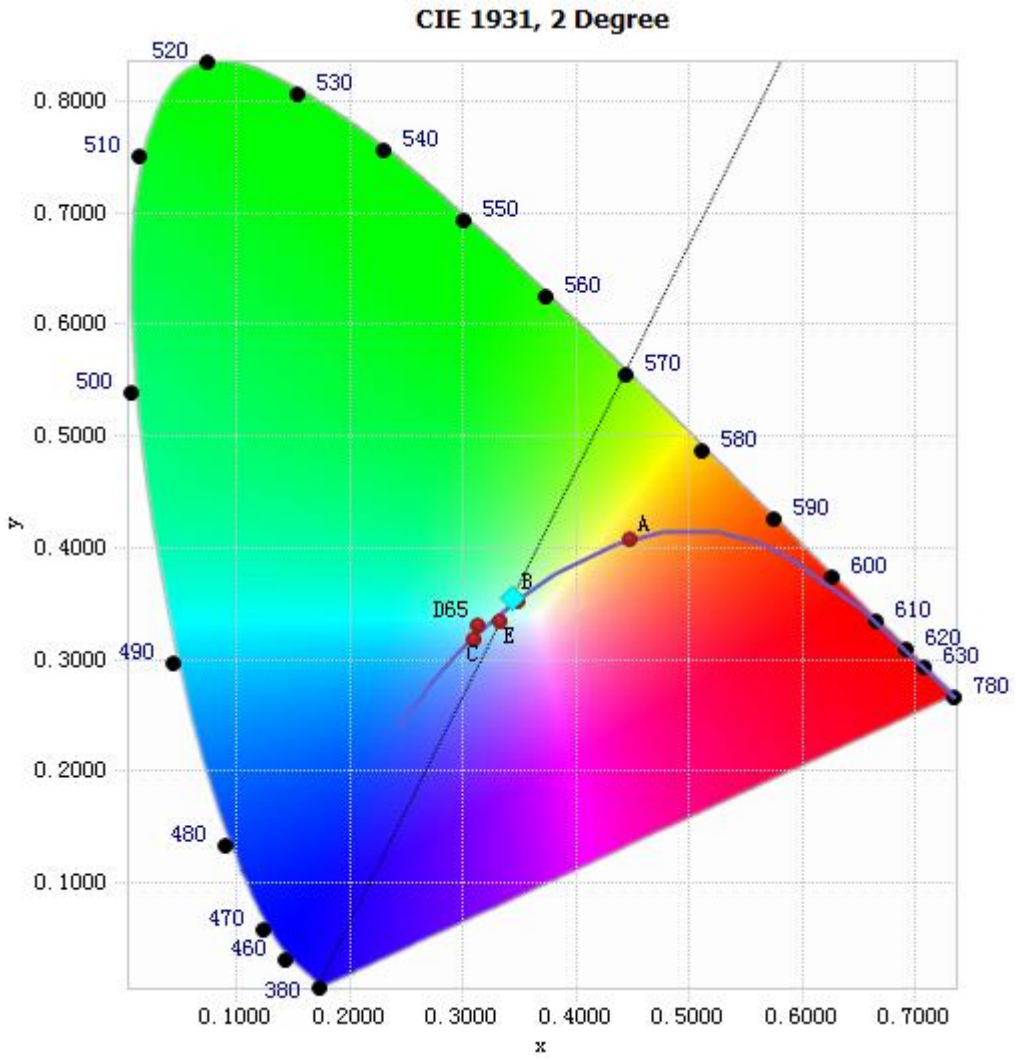


Chart 1: Spectral Power Distribution

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	1.06E-02	590	2.52E-02	695	3.51E-03
385	1.76E-04	490	1.14E-02	595	2.48E-02	700	3.02E-03
390	1.77E-04	495	1.31E-02	600	2.43E-02	705	2.58E-03
395	1.81E-04	500	1.52E-02	605	2.34E-02	710	2.21E-03
400	1.56E-04	505	1.72E-02	610	2.25E-02	715	1.87E-03
405	2.00E-04	510	1.87E-02	615	2.15E-02	720	1.62E-03
410	3.15E-04	515	2.00E-02	620	2.02E-02	725	1.39E-03
415	5.78E-04	520	2.07E-02	625	1.89E-02	730	1.18E-03
420	1.09E-03	525	2.13E-02	630	1.76E-02	735	1.01E-03
425	2.15E-03	530	2.18E-02	635	1.62E-02	740	8.64E-04
430	4.04E-03	535	2.21E-02	640	1.48E-02	745	7.33E-04
435	7.38E-03	540	2.25E-02	645	1.33E-02	750	6.28E-04
440	1.37E-02	545	2.29E-02	650	1.19E-02	755	5.40E-04
445	2.61E-02	550	2.33E-02	655	1.06E-02	760	4.71E-04
450	4.24E-02	555	2.37E-02	660	9.38E-03	765	3.98E-04
455	4.17E-02	560	2.42E-02	665	8.27E-03	770	3.38E-04
460	2.78E-02	565	2.46E-02	670	7.17E-03	775	2.89E-04
465	2.11E-02	570	2.48E-02	675	6.26E-03	780	2.53E-04
470	1.69E-02	575	2.52E-02	680	5.46E-03		
475	1.22E-02	580	2.54E-02	685	4.73E-03		
480	1.04E-02	585	2.55E-02	690	4.11E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3442, 0.3553)

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

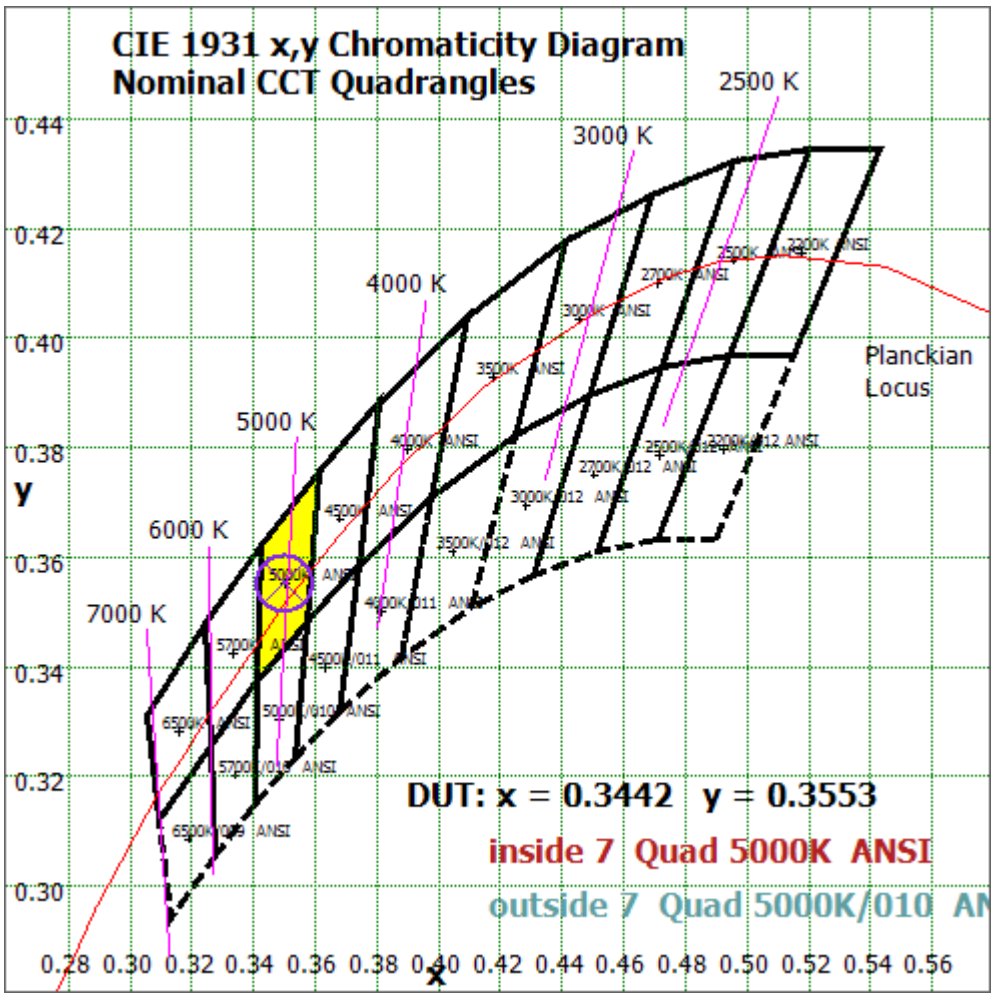


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: LED One Corporation

Date: 2023/05/22

Model: LOC-4FTT8B-9.5W50K

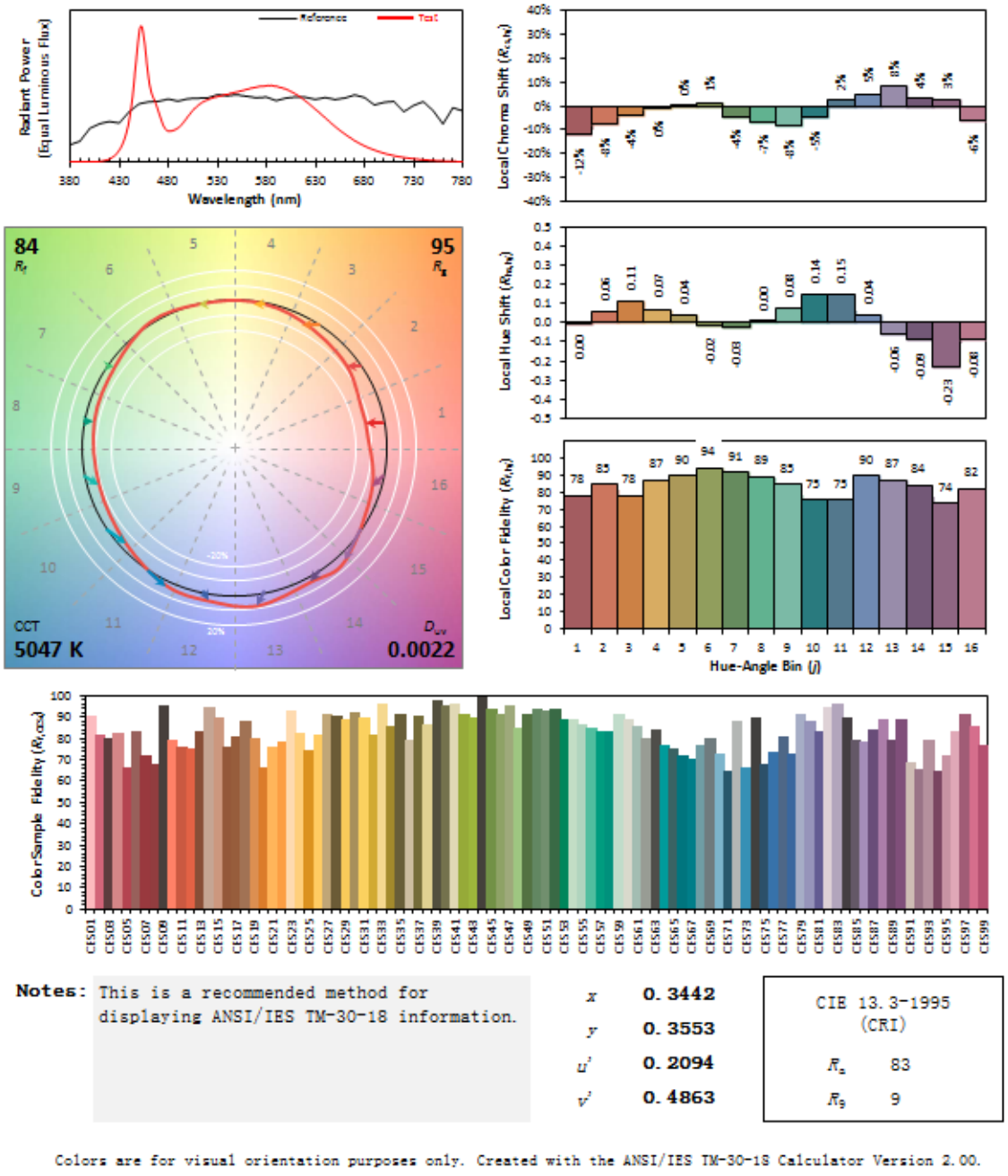


Chart 4: Full Report Created with the IES TM-30 Calculator

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	26.841	1.67%
10- 20	77.66	4.82%
20- 30	120.283	7.47%
30- 40	150.835	9.36%
40- 50	167.388	10.39%
50- 60	170.11	10.56%
60- 70	160.999	9.99%
70- 80	143.831	8.93%
80- 90	124.28	7.71%
90-100	107.768	6.69%
100-110	93.153	5.78%
110-120	79.466	4.93%
120-130	66.083	4.10%
130-140	51.769	3.21%
140-150	37.7	2.34%
150-160	23.112	1.43%
160-170	8.837	0.55%
170-180	1.115	0.07%
Total	1611.2	100%

γ(°)	Lumens	% Total
0- 60	713.117	44.26%
60- 90	429.11	26.63%
0-90	1142.227	70.89%
90- 180	469.003	29.11%
0- 180	1611.2	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

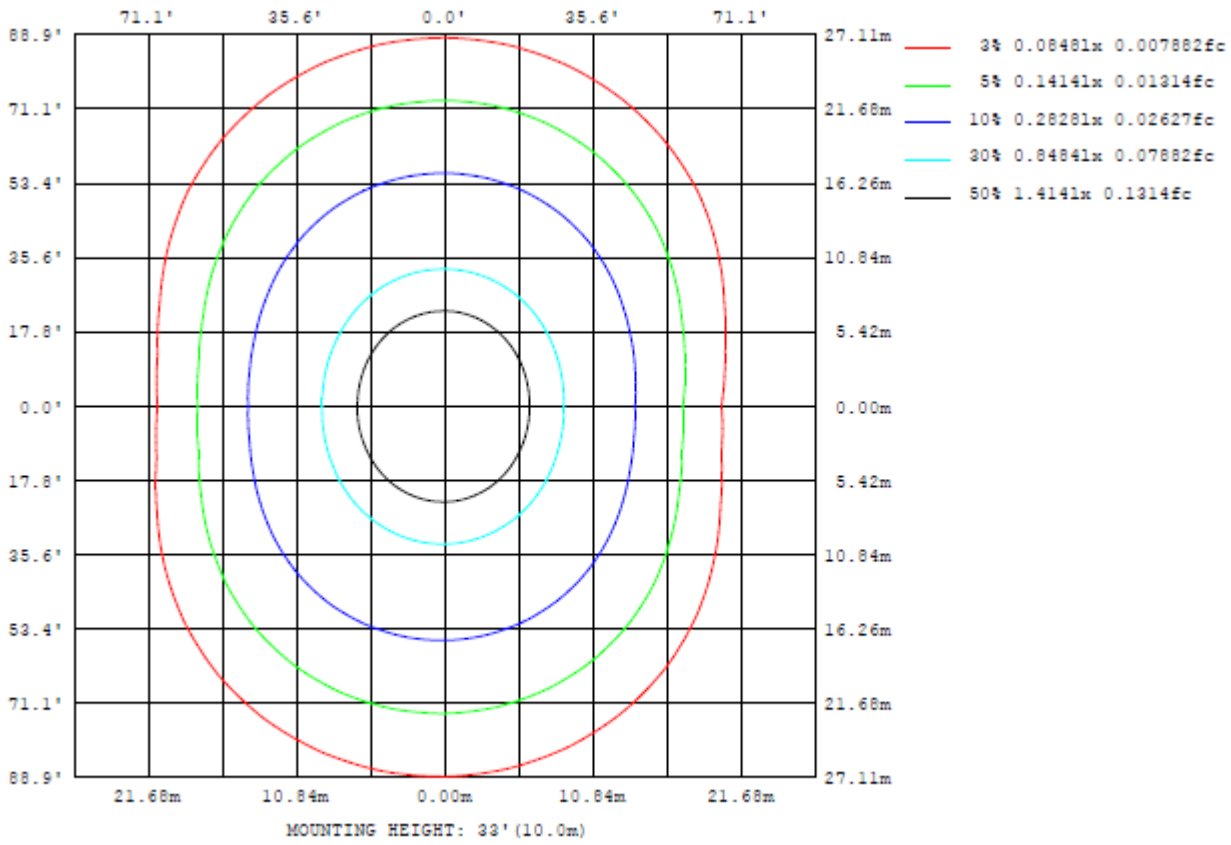


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

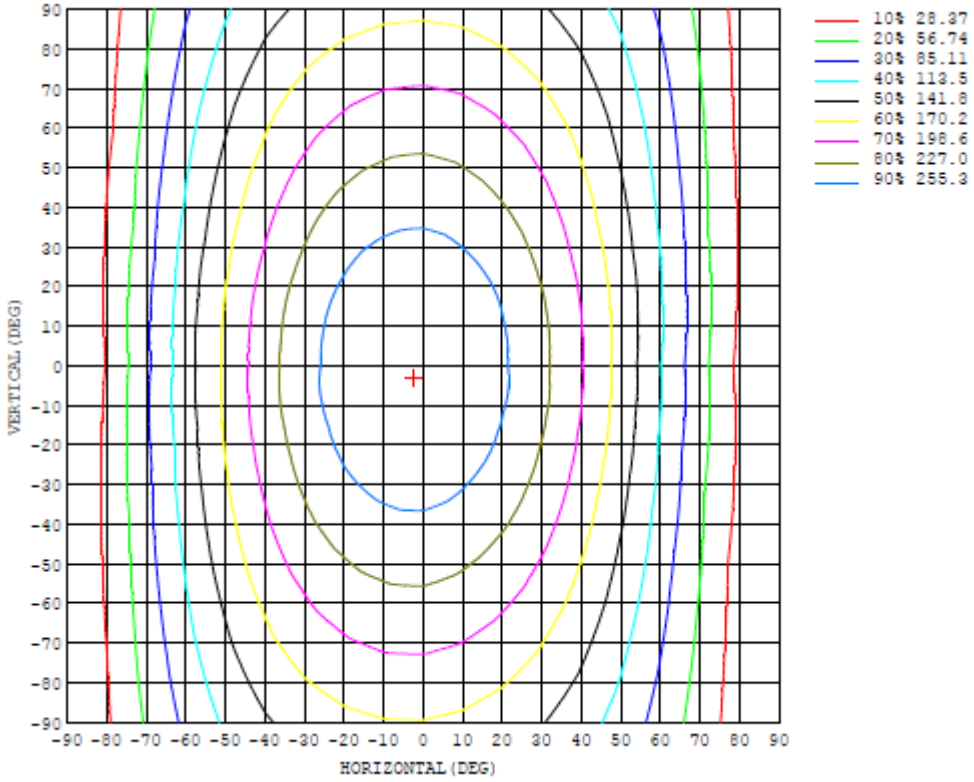


Chart 6: Isocandela Plot

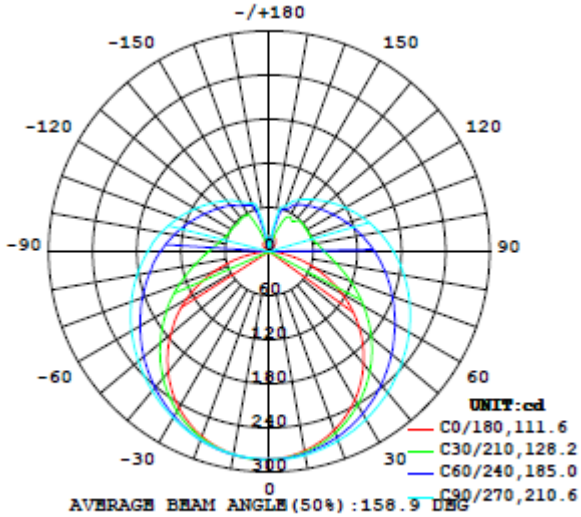


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283
5	280	281	281	281	282	282	282	283	283	283	283	283	283	283	283	283	283	283	283
10	275	276	276	278	278	279	279	280	281	281	281	282	282	282	282	281	281	281	280
15	268	269	270	271	272	274	275	276	277	278	278	279	278	278	278	277	276	276	275
20	259	259	261	263	265	267	269	272	273	274	274	274	274	273	272	271	269	268	268
25	247	248	250	252	255	259	262	265	268	269	269	269	268	266	264	262	260	259	258
30	233	234	237	241	245	250	254	259	262	263	264	263	261	259	255	251	249	247	246
35	217	219	222	227	234	240	246	251	255	257	257	256	254	250	245	240	235	233	231
40	200	202	206	213	221	229	237	244	248	250	250	249	245	240	234	226	220	217	214
45	180	183	188	197	208	218	227	235	240	243	243	241	236	230	221	212	204	198	196
50	159	162	170	181	194	206	217	226	233	236	236	233	227	219	209	197	186	178	175
55	137	141	150	165	180	195	207	217	224	228	228	224	218	208	195	181	167	157	154
60	114	118	131	148	167	183	198	209	216	220	220	216	208	197	182	165	148	135	130
65	90.3	95.5	111	133	154	172	188	200	208	212	211	207	199	186	170	150	129	112	105
70	66.4	72.9	92.9	118	141	162	178	191	199	203	203	199	189	176	158	135	111	89.1	79.5
75	43.4	52.3	75.9	104	130	152	169	182	191	195	195	190	180	166	146	122	93.8	67.8	54.1
80	22.3	33.6	62.3	92.3	120	142	160	174	182	186	186	181	171	156	136	110	79.0	48.7	30.2
85	6.23	20.1	51.3	82.6	111	134	152	165	174	178	177	172	162	147	126	99.3	67.8	33.7	10.6
90	0.43	13.6	44.1	74.9	103	125	143	157	165	169	169	164	154	139	118	90.8	59.3	24.9	0.68
95	0.29	12.9	40.0	69.8	95.7	118	135	148	157	160	160	155	145	131	110	83.6	53.6	21.9	0.33
100	0.22	14.9	38.3	65.4	89.8	111	128	140	148	152	152	147	137	123	103	78.2	50.4	22.4	0.33
105	0.22	17.9	38.2	62.4	84.6	105	120	132	140	144	143	138	129	115	96.9	73.9	48.9	24.8	0.49
110	0.68	17.6	39.3	60.3	80.2	98.6	113	125	132	135	135	130	122	109	91.5	71.1	48.7	28.3	0.33
115	0.96	23.7	40.8	59.2	76.7	93.2	107	117	124	127	127	122	114	102	86.9	69.1	49.6	29.1	0.75
120	1.49	29.4	43.2	58.9	74.0	88.6	101	110	117	119	119	115	108	96.8	83.1	67.6	51.2	34.8	2.97
125	3.17	30.3	43.6	58.6	71.7	84.5	95.2	104	109	112	111	108	101	91.7	79.5	66.8	52.4	39.5	6.26
130	5.83	24.4	39.6	59.2	70.5	80.9	90.2	97.6	103	105	105	101	95.6	87.2	77.0	66.4	50.9	41.6	9.20
135	9.00	15.5	44.8	58.9	69.2	77.6	85.7	92.2	96.4	98.5	98.0	95.3	90.5	83.4	74.9	65.4	53.9	33.1	11.7
140	12.2	7.95	47.1	53.8	67.3	74.8	81.4	87.0	90.7	92.5	92.1	89.9	85.7	80.0	72.1	62.0	54.9	26.3	13.1
145	15.2	2.92	43.2	52.6	64.1	71.7	77.7	82.2	85.2	86.6	86.4	84.7	81.4	75.8	69.5	61.0	53.5	8.60	14.0
150	17.8	8.23	31.2	54.5	57.0	67.5	73.8	77.4	80.1	81.3	80.9	79.2	76.7	71.0	64.7	58.5	42.2	6.02	14.3
155	19.5	12.8	16.0	47.7	59.0	60.2	65.6	70.4	73.8	75.0	74.5	72.3	69.6	65.4	61.7	52.0	28.5	5.78	14.2
160	20.4	8.60	7.32	31.0	50.3	59.5	62.5	63.4	64.6	65.7	65.8	65.2	64.4	61.6	49.0	30.5	8.62	13.3	13.7
165	20.8	6.33	9.63	10.9	26.9	38.0	52.1	58.7	61.1	61.8	61.8	60.8	53.4	35.0	26.6	8.38	3.34	7.71	13.1
170	21.4	5.55	9.73	12.6	7.43	12.2	16.7	25.9	32.5	34.2	34.0	25.5	12.3	8.53	6.87	5.88	12.8	6.41	13.9
175	22.1	15.4	7.15	6.58	10.2	11.7	15.0	13.9	12.1	12.6	9.48	10.2	12.0	13.4	12.0	10.2	6.48	5.16	17.8
180	21.5	22.4	21.5	20.7	6.96	8.31	18.4	15.7	10.2	2.43	6.42	5.32	5.15	7.08	10.2	14.7	16.4	15.6	21.5

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	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283	283		
5	282	283	283	283	283	282	282	282	282	282	281	281	281	281	281	280	281		
10	280	280	280	280	281	281	281	281	280	280	279	278	278	277	276	276	276		
15	275	275	276	277	277	277	278	278	277	276	276	274	273	272	270	269	269		
20	268	268	270	271	272	273	273	273	273	272	271	269	267	264	262	260	259		
25	258	259	261	263	265	266	268	268	267	266	264	261	259	256	252	249	248		
30	246	248	251	253	256	259	261	262	261	259	257	253	250	245	241	237	234		
35	232	235	239	242	247	251	254	255	255	253	249	245	239	234	228	222	219		
40	215	219	225	230	237	242	246	248	248	245	242	236	229	221	213	207	202		
45	197	202	209	218	226	232	237	240	240	238	233	226	218	208	198	190	183		
50	177	184	194	204	215	223	229	232	232	230	225	217	207	195	183	172	164		
55	157	165	177	191	203	213	220	224	225	222	216	207	196	182	167	154	144		
60	134	146	161	177	191	203	211	216	216	213	207	197	185	169	152	135	122		
65	111	125	145	164	180	193	202	207	208	205	198	188	174	158	137	116	100		
70	86.3	106	130	152	170	183	193	199	200	197	190	179	164	146	123	98.7	77.9		
75	63.0	87.4	115	140	160	174	184	190	191	188	181	170	155	135	110	82.4	57.1		
80	42.2	71.4	102	129	150	165	176	181	182	180	172	161	146	125	98.5	68.8	39.4		
85	25.9	58.8	91.4	119	141	157	167	172	174	171	164	153	137	115	88.8	58.2	26.6		
90	16.8	49.9	82.5	110	132	148	159	164	165	162	156	145	128	107	80.6	50.3	19.3		
95	13.6	44.1	75.4	102	124	140	150	156	158	155	148	136	120	99.2	73.2	43.8	14.3		
100	13.2	40.5	69.6	95.1	116	131	142	148	149	146	139	128	112	92.0	67.2	39.2	14.0		
105	15.5	38.9	65.3	89.0	108	123	133	139	141	138	131	120	105	85.8	62.3	37.5	16.1		
110	18.8	39.0	62.2	83.7	102	116	126	131	132	130	123	113	98.7	80.5	59.4	37.9	18.9		
115	22.5	40.2	60.4	79.5	95.8	109	118	123	124	122	116	106	92.9	76.5	57.9	39.1	22.1		
120	26.7	42.3	59.6	76.1	90.6	102	111	115	117	114	109	99.9	88.0	73.5	57.2	40.5	25.9		
125	23.7	44.7	58.9	73.5	86.0	96.3	104	108	109	107	102	94.4	83.9	71.1	56.9	41.8	21.8		
130	12.9	46.1	57.7	71.5	82.3	91.0	97.6	101	102	101	96.4	89.4	80.4	69.4	55.0	43.4	5.94		
135	6.94	48.4	58.5	68.3	79.0	86.3	91.9	95.1	96.1	94.6	90.9	85.0	77.2	66.9	55.6	45.7	5.85		
140	3.60	50.4	58.7	65.5	74.5	82.0	86.7	89.5	90.2	89.1	85.9	80.9	73.4	64.0	56.1	46.5	5.84		
145	12.4	37.3	58.7	65.2	70.3	75.5	80.9	83.8	84.7	83.6	80.7	74.6	69.3	63.7	57.2	33.0	12.1		
150	9.05	16.2	58.5	64.8	68.5	72.3	75.0	76.6	77.2	76.5	74.6	71.9	67.7	63.5	57.3	9.89	7.31		
155	4.95	5.74	35.6	58.3	67.2	69.2	71.1	72.5	73.2	72.8	71.6	69.4	66.6	63.8	38.3	6.55	3.72		
160	15.2	14.2	9.81	33.5	53.5	67.2	68.4	69.2	69.6	69.2	68.7	67.2	63.8	43.4	12.4	14.2	8.42		
165	8.21	5.71	14.0	8.85	13.5	30.5	45.7	55.1	58.4	57.9	53.5	45.0	29.8	12.5	7.50	13.7	17.5		
170	11.8	16.5	7.54	10.3	13.7	7.03	8.41	9.36	11.6	11.5	10.4	7.61	8.75	14.5	11.7	8.31	15.3		
175	17.7	12.4	14.9	17.3	12.2	9.09	7.42	6.41	6.22	6.98	5.89	7.13	12.2	18.3	18.4	12.0	14.1		
180	21.5	21.4	21.2	20.7	19.7	21.0	16.1	14.8	11.8	3.49	12.7	10.1	11.2	12.6	13.9	15.0	15.6		

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, 2022	Aug. 04, 2023
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2022	Aug. 04, 2023
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2022	Aug. 04, 2023
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2022	Aug. 04, 2023
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2022	Aug. 04, 2023
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2022	Aug. 04, 2023
Standard source	D908	HZTE012-01	Aug. 05, 2022	Aug. 04, 2023
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2022	Aug. 04, 2023
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2022	Aug. 04, 2023
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2022	Aug. 04, 2023
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2022	Aug. 04, 2023
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2022	Aug. 04, 2023
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2022	Aug. 04, 2023
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2022	Aug. 04, 2023

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 3 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 20 min, taken 10 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 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 20 min, taken 10 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.

*** End of Report ***

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