

LM-79-19 TEST REPORT

for

ESPEN TECHNOLOGY INC.

12257 FLORENCE AVE SANTA FE SPRINGS LOS ANGELES CA 90670, USA

LED Tube

Model: L48T8/940/10G-ID DE

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ26060029a

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

Review by:

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Jun. 18, 2026

Approved by:



April Zou

Manager: April Zou
Jun. 18, 2026

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the US Government.

TEST SUMMARY

Sample Tested: **L48T8/940/10G-ID DE**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
176.8	1674.0	9.47	0.9828
CCT (K)	CRI	Stabilization Time (Light & Power)	
3988	92.4	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	: Jun. 15, 2026
Date of Test	: Jun. 17, 2026
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)		Customer provided information
Name	:	LED Tube
Model	:	L48T8/940/10G-ID DE
Electrical Ratings	:	120-277V, 50/60Hz, 9.5W
Product Description	:	4000K
Manufacturer	:	ESPER TECHNOLOGY INC.
Address	:	12257 FLORENCE AVE SANTA FE SPRINGS LOS ANGELES CA 90670, USA

TEST RESULTS

Test ambient temperature was 26.0 °C.

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)	0.080	0.039
Power Factor	0.9828	0.9107
Test Power (W)	9.47	9.75
THD A%	15.49	19.04
Luminous Efficacy (lm/W)	176.8	174.5
Total Luminous Flux (lm)	1674.0	1701.8
Color Rendering Index (CRI)	92.4	
R9	62.1	
Correlated Color Temperature (CCT)(K)	3988	
Chromaticity Chroma x	0.3825	
Chromaticity Chroma y	0.3832	
Chromaticity Chroma u	0.2239	
Chromaticity Chroma v	0.3365	
Duv	0.0024	
Chromaticity Chroma u'	0.2239	
Chromaticity Chroma v'	0.5047	

Special Color Rendering Indices	
R1	92.9
R2	95.1
R3	95.6
R4	92.3
R5	91.3
R6	92.8
R7	94
R8	85.5
R9	62.1
R10	86.5
R11	92.4
R12	67.9
R13	93.3
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 °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)	0.080
Power Factor	0.9848
Power (W)	9.51
Luminous Efficacy (lm/W)	177.1
Total Luminous Flux (lm)	1683.8
Beam Angle (°)	110.8 (0°-180°) / 200.6 (90°-270°)
Center Beam Candle Power (cd)	301
Maximum Beam Candle Power (cd)	302.1 (At: C=30.0, Gamma=0.5)
Spacing Criteria	1.25 (0°-180°) / 1.40 (90°-270°)
Zonal Lumens in the 0°-60° Zone	44.69%
Zonal Lumens in the 60°-90° Zone	26.33%
Zonal Lumens in the 90°-120° Zone	16.68%
Zonal Lumens in the 120°-180° Zone	12.31%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

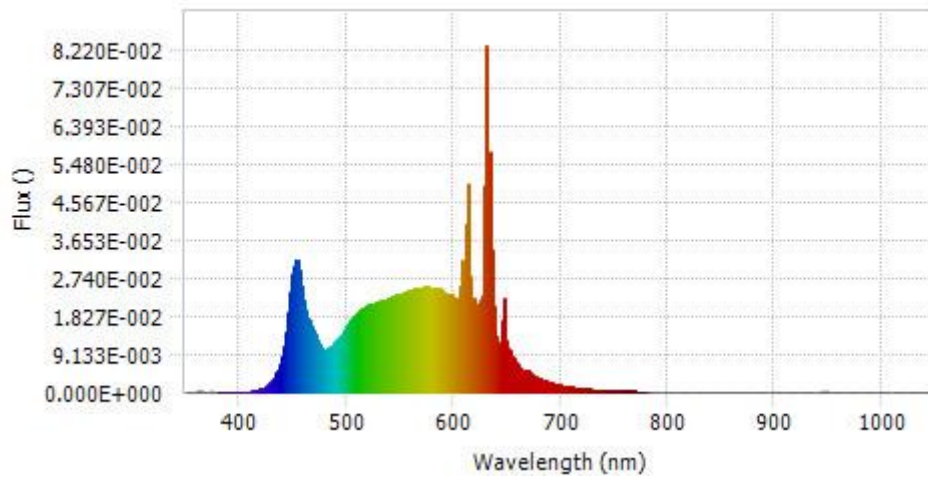
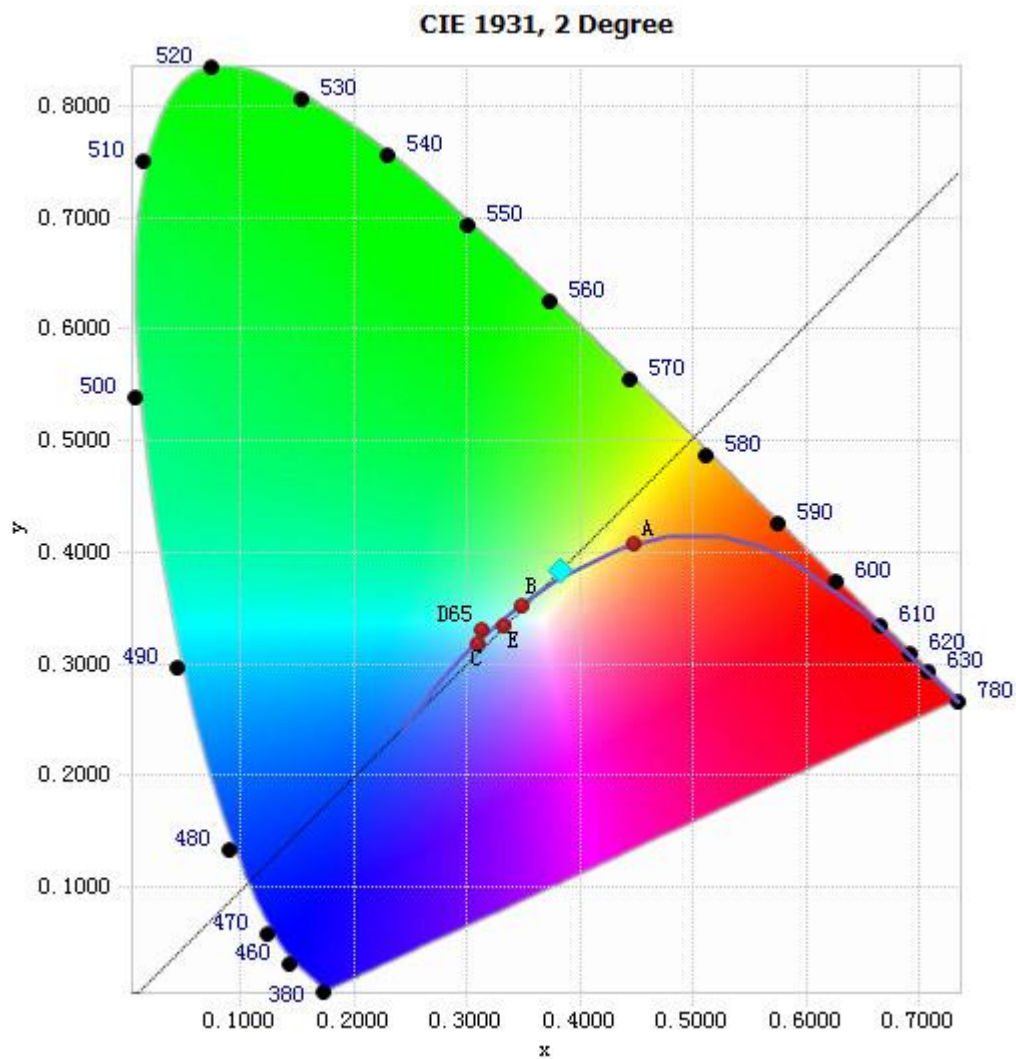


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.34E-04	485	1.09E-02	590	2.42E-02	695	1.96E-03
385	1.61E-04	490	1.19E-02	595	2.32E-02	700	1.65E-03
390	1.38E-04	495	1.36E-02	600	2.27E-02	705	1.40E-03
395	1.61E-04	500	1.57E-02	605	2.20E-02	710	1.21E-03
400	9.91E-05	505	1.75E-02	610	2.46E-02	715	1.01E-03
405	1.48E-04	510	1.89E-02	615	2.79E-02	720	8.68E-04
410	1.74E-04	515	2.00E-02	620	2.15E-02	725	7.67E-04
415	3.78E-04	520	2.06E-02	625	2.20E-02	730	6.53E-04
420	6.99E-04	525	2.13E-02	630	8.30E-02	735	5.63E-04
425	1.31E-03	530	2.17E-02	635	5.75E-02	740	4.74E-04
430	2.43E-03	535	2.21E-02	640	1.25E-02	745	4.19E-04
435	4.64E-03	540	2.26E-02	645	1.19E-02	750	3.54E-04
440	8.74E-03	545	2.31E-02	650	1.06E-02	755	3.04E-04
445	1.67E-02	550	2.35E-02	655	8.22E-03	760	2.47E-04
450	2.84E-02	555	2.40E-02	660	6.70E-03	765	2.33E-04
455	3.05E-02	560	2.45E-02	665	5.32E-03	770	2.02E-04
460	2.21E-02	565	2.49E-02	670	5.08E-03	775	1.79E-04
465	1.72E-02	570	2.52E-02	675	3.87E-03	780	1.55E-04
470	1.45E-02	575	2.52E-02	680	3.23E-03		
475	1.15E-02	580	2.51E-02	685	2.73E-03		
480	1.01E-02	585	2.50E-02	690	2.32E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3825, 0.3832)

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

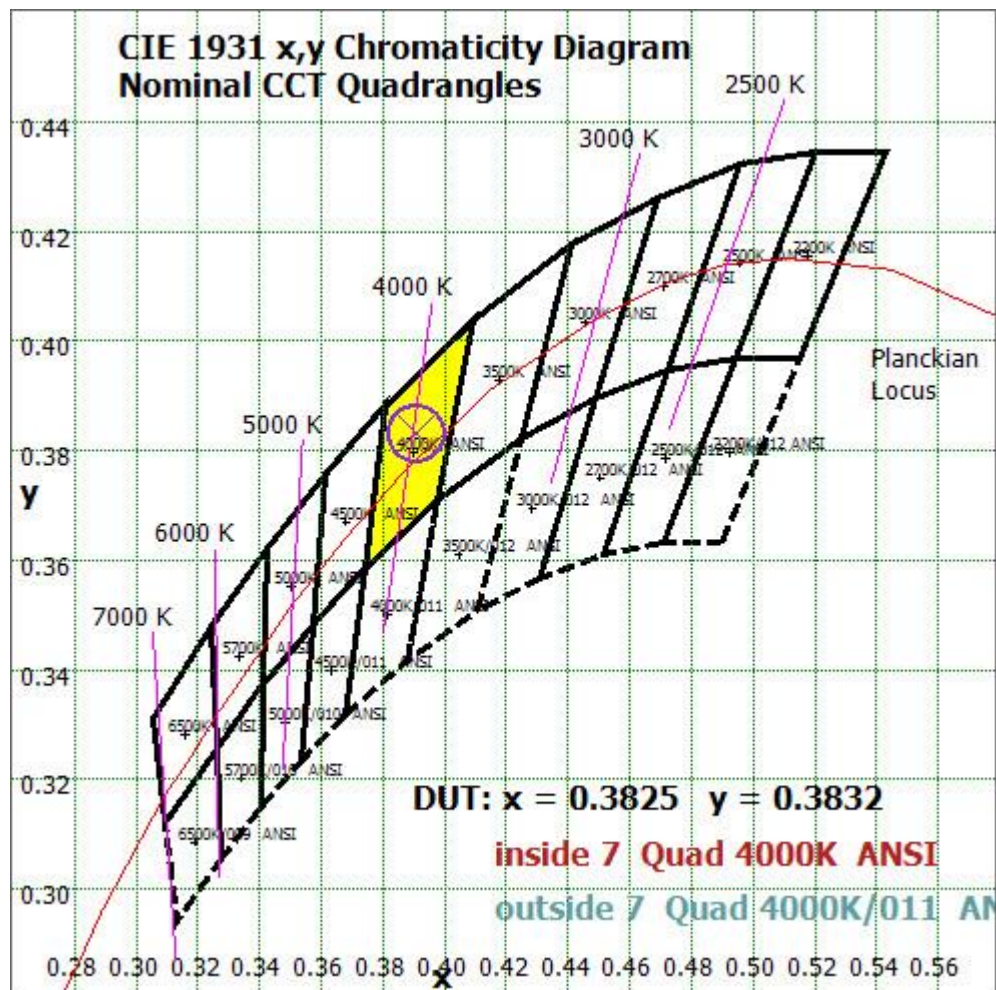


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

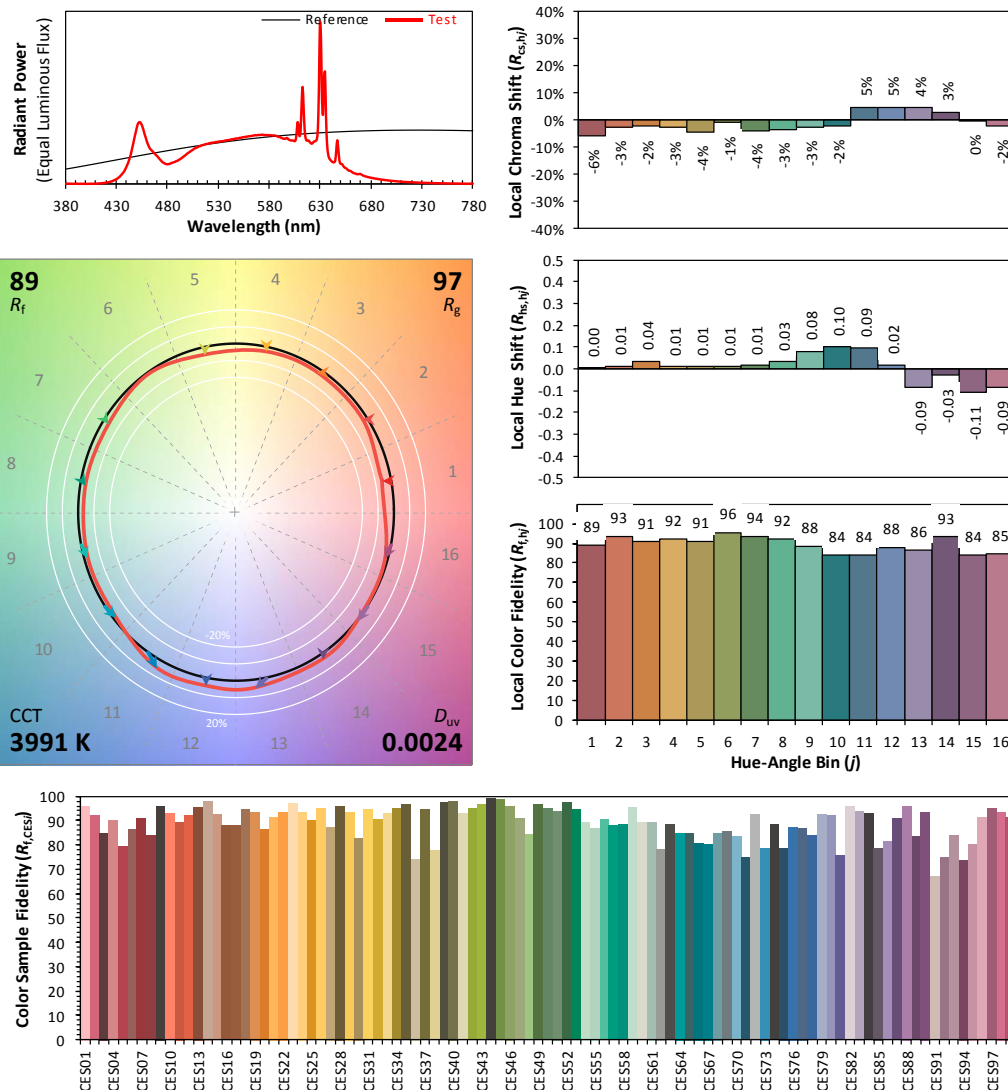
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: ESPEN TECHNOLOGY INC.

Date: 2026/06/15

Model: L48T8/940/10G-ID DE



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

x 0.3825
 y 0.3831
 u' 0.2239
 v' 0.5047

CIE 13.3-1995
(CRI)
 R_a 92
 R_g 62

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

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	28.576	1.70%
10- 20	82.605	4.91%
20- 30	127.686	7.58%
30- 40	159.523	9.47%
40- 50	176.116	10.46%
50- 60	177.91	10.57%
60- 70	167.347	9.94%
70- 80	148.579	8.82%
80- 90	127.433	7.57%
90-100	109.256	6.49%
100-110	93.107	5.53%
110-120	78.433	4.66%
120-130	65.251	3.88%
130-140	52.86	3.14%
140-150	40.838	2.43%
150-160	28.568	1.70%
160-170	15.425	0.92%
170-180	4.299	0.26%
Total	1683.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	752.416	44.69%
60- 90	443.359	26.33%
0-90	1195.775	71.02%
90- 180	488.037	28.98%
0- 180	1683.8	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

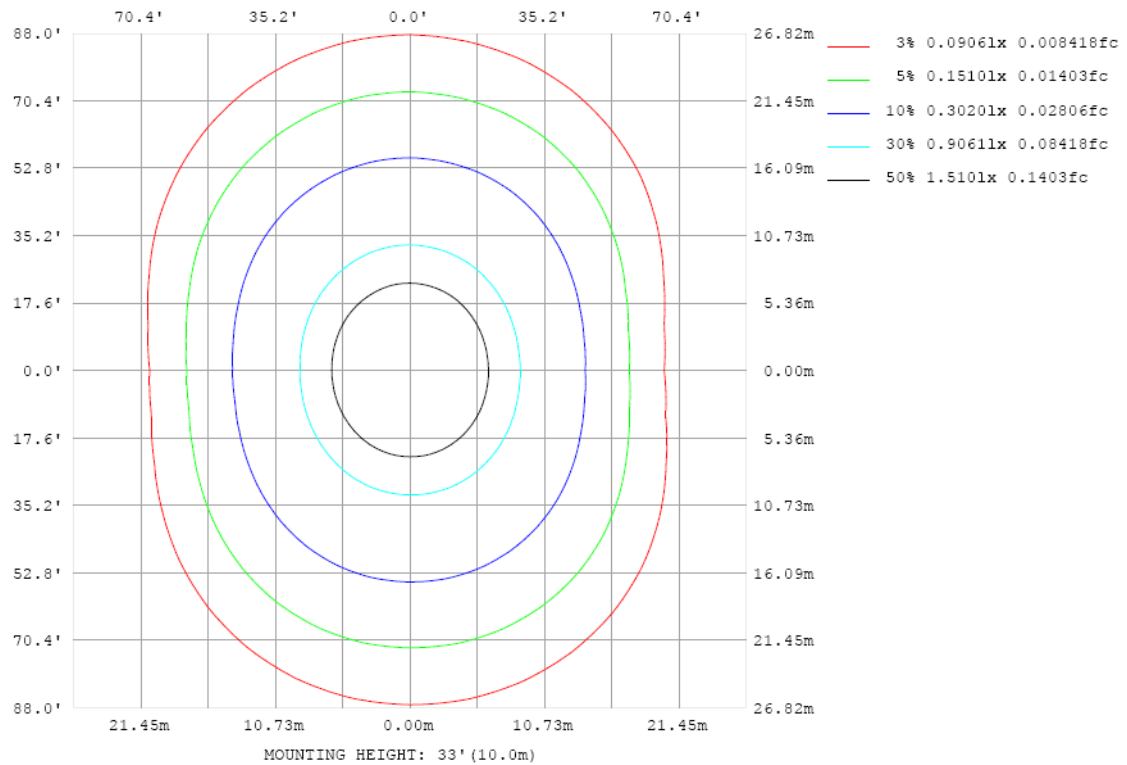


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

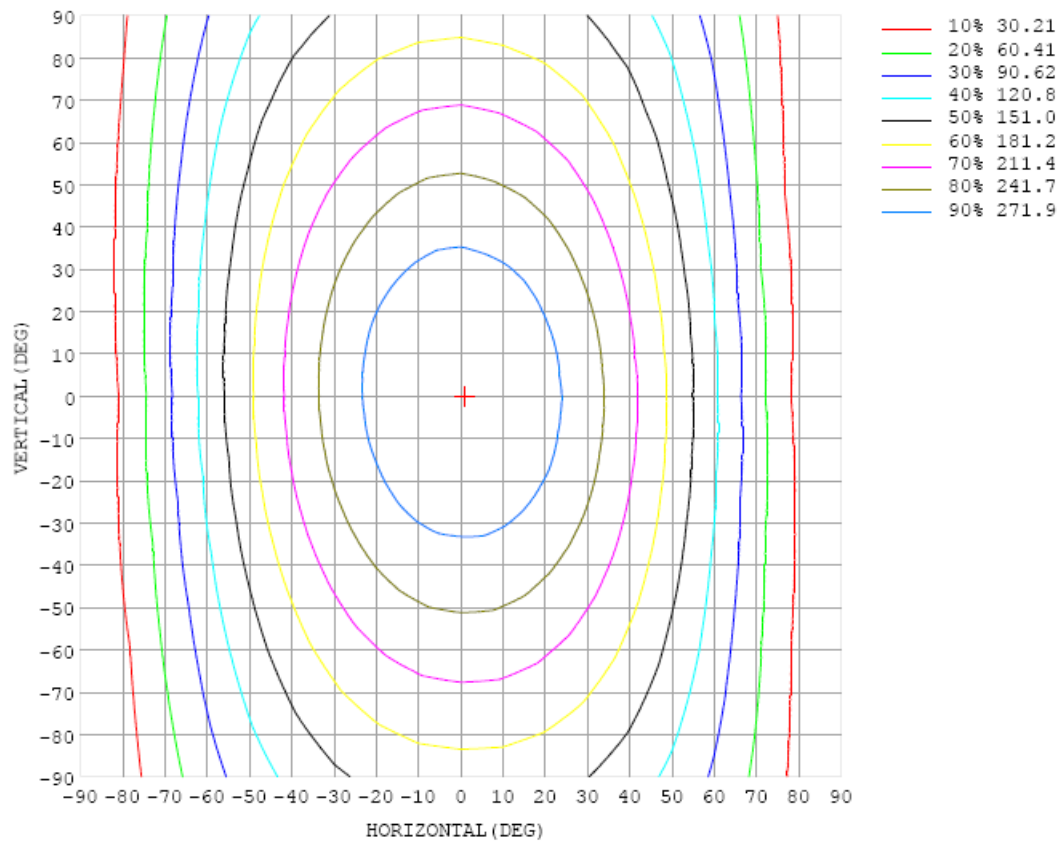


Chart 6: Isocandela Plot

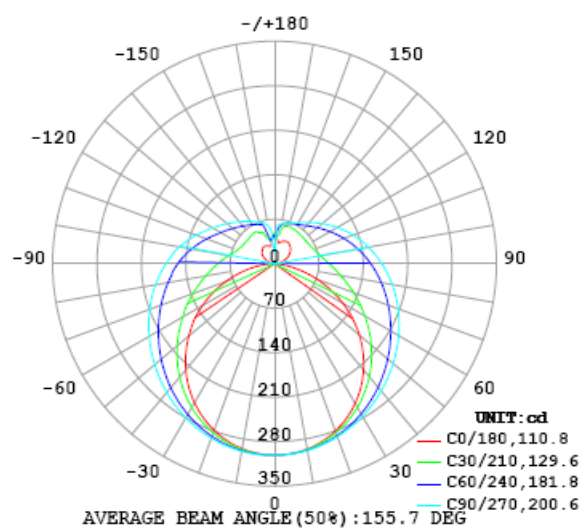


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	301	301	301	301	301	301	301	301	301	301	301	301	301	301	301	301	301	301	301
5	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
10	296	296	297	297	297	297	298	298	298	298	298	298	297	297	296	296	296	295	295
15	290	290	290	291	292	293	294	294	295	295	294	294	293	292	291	290	289	289	288
20	280	281	282	283	285	286	288	289	290	290	290	289	287	285	283	282	280	279	279
25	268	269	271	273	276	278	281	283	284	284	284	282	280	277	274	271	269	267	267
30	254	255	258	261	265	269	273	276	277	277	277	274	271	267	263	259	255	253	253
35	237	239	242	247	253	259	264	267	269	270	269	266	261	256	250	245	240	237	236
40	218	220	225	232	240	247	254	258	261	261	260	257	251	244	237	229	223	219	218
45	197	200	207	216	226	236	244	249	252	253	252	247	240	232	222	213	205	200	198
50	175	178	187	199	212	223	233	240	243	244	243	237	229	219	207	196	185	179	177
55	150	155	166	182	197	211	222	230	234	235	233	227	218	206	192	178	165	157	155
60	124	131	146	165	183	199	212	220	225	226	224	217	207	194	178	161	145	134	131
65	97.5	106	125	148	169	187	201	211	216	217	215	207	196	182	163	144	124	110	107
70	71.7	82.0	106	132	156	176	191	201	206	207	205	198	186	170	150	127	105	87.0	82.1
75	45.0	60.2	88.2	118	144	165	181	191	197	198	196	188	176	159	137	113	86.2	65.0	57.5
80	22.1	41.1	73.4	106	133	155	171	181	187	188	186	178	165	148	126	99.3	70.3	44.4	34.5
85	5.17	27.5	62.8	95.2	123	145	161	172	178	179	176	169	156	138	115	88.0	57.5	27.3	15.2
90	0.62	20.8	54.6	86.5	114	136	152	162	168	169	167	159	146	129	106	78.5	47.7	16.6	3.14
95	2.81	18.8	49.2	79.3	106	127	143	153	159	160	158	150	137	120	97.9	71.2	41.5	12.6	1.48
100	6.80	19.9	45.9	73.4	98.3	118	134	144	149	150	148	141	129	112	90.7	65.9	37.7	12.6	3.84
105	11.8	22.8	44.6	69.5	91.6	111	125	135	140	141	139	132	120	104	84.2	61.2	35.9	15.0	6.96
110	16.9	26.7	44.5	66.0	85.7	103	117	126	131	132	130	123	112	97.3	78.5	57.8	35.9	18.6	10.8
115	21.7	31.5	45.6	63.6	80.7	96.2	109	117	122	123	121	115	104	90.6	73.7	55.6	37.0	23.3	15.2
120	25.8	36.2	47.3	62.1	76.5	90.2	101	109	113	114	113	107	97.3	84.9	70.7	54.4	38.9	28.1	19.5
125	29.6	40.6	49.4	61.4	73.1	84.8	94.5	101	105	106	105	99.2	90.8	79.9	67.7	54.1	41.4	33.0	23.2
130	33.1	44.7	51.7	61.1	71.3	80.1	88.3	94.3	97.6	98.3	97.1	92.4	85.0	75.5	65.5	54.3	44.3	37.5	26.0
135	35.8	48.0	53.8	61.1	69.2	76.2	82.9	87.8	90.6	91.2	90.1	86.1	79.9	72.1	64.0	55.0	47.1	41.6	27.9
140	37.5	50.7	55.9	61.4	67.6	73.0	78.3	82.2	84.4	84.9	84.0	80.7	75.6	70.1	63.0	56.0	49.9	45.4	29.6
145	39.3	52.7	57.7	61.9	66.5	71.1	74.4	77.5	79.2	79.5	78.7	76.1	72.1	67.9	62.4	57.1	52.5	47.5	31.7
150	40.0	54.9	59.1	62.3	65.5	69.0	71.3	73.4	74.6	74.9	74.4	72.3	70.0	66.3	62.2	58.3	54.9	50.2	31.6
155	39.2	54.1	59.9	62.7	64.9	67.2	69.3	70.8	71.2	71.3	71.1	69.9	67.6	65.0	62.1	58.2	53.9	48.4	31.0
160	37.6	48.3	59.8	62.6	64.4	65.8	67.0	68.0	68.5	68.5	68.3	67.3	65.8	64.0	57.9	53.9	48.8	44.4	29.7
165	35.5	42.4	52.8	61.3	63.3	64.5	65.3	65.8	66.0	66.0	65.9	65.3	62.8	54.0	50.1	45.1	42.8	37.9	28.3
170	33.4	35.8	41.0	50.2	57.9	59.7	62.4	63.5	63.7	63.7	63.8	58.1	47.5	43.5	43.7	43.5	40.7	32.8	31.1
175	41.9	41.2	41.4	42.9	46.6	47.3	49.9	52.8	60.2	60.8	44.3	33.3	38.3	42.7	42.1	42.7	40.5	38.3	41.3
180	48.3	48.3	47.7	46.1	44.0	40.8	39.3	36.8	30.0	18.9	26.6	36.5	38.4	44.0	44.9	46.2	47.0	47.3	48.1

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	301	301	301	301	301	301	301	301	301	301	301	301	301	301	301	301	301		
5	300	300	300	300	300	301	301	301	301	301	301	301	301	301	301	300	300		
10	296	296	297	297	298	299	299	299	300	299	299	299	298	298	297	297	296		
15	289	290	291	292	293	295	296	296	297	296	295	295	294	292	291	291	290		
20	280	281	283	285	287	289	291	292	292	291	290	289	287	285	283	282	281		
25	268	270	273	276	279	282	284	286	287	285	284	282	279	276	273	270	269		
30	254	257	261	266	270	274	277	279	280	279	277	273	270	265	261	257	255		
35	238	243	248	254	259	265	269	272	273	271	268	264	259	253	247	242	238		
40	221	226	233	241	248	255	260	263	264	262	259	254	247	239	231	224	220		
45	202	208	217	227	236	244	251	254	256	253	250	243	235	224	214	205	199		
50	181	190	200	213	224	233	241	245	247	244	240	232	222	209	196	185	177		
55	160	170	184	198	212	222	231	236	238	235	230	221	209	194	178	164	154		
60	138	152	167	184	199	212	221	226	228	225	220	210	196	179	161	143	129		
65	116	132	152	171	187	201	211	217	219	216	210	199	184	165	144	121	104		
70	93.1	114	137	159	176	191	201	207	210	206	200	189	173	153	128	101	78.2		
75	71.7	96.5	123	147	165	180	191	198	200	197	190	179	162	140	113	81.9	54.4		
80	52.5	81.3	110	136	156	171	182	188	191	187	180	169	153	129	99.9	66.3	34.0		
85	37.0	68.7	99.2	125	146	162	172	179	181	178	171	160	143	119	89.3	54.6	19.9		
90	26.8	59.1	89.7	116	137	153	163	169	172	168	162	151	133	110	80.5	46.7	13.6		
95	21.2	51.8	81.4	107	128	143	154	161	162	159	153	141	124	101	72.8	41.0	12.9		
100	19.3	46.0	73.9	98.2	118	133	144	150	152	149	142	131	115	92.8	66.5	38.4	15.2		
105	20.5	42.7	67.4	90.2	109	124	134	140	142	139	132	122	106	85.6	62.2	38.5	19.0		
110	23.0	41.7	62.8	83.1	101	114	124	130	132	129	123	112	98.0	80.0	59.8	39.6	23.8		
115	26.8	41.9	60.0	77.6	93.1	106	115	120	122	119	113	104	91.6	76.0	58.6	41.4	28.3		
120	30.9	42.8	58.3	73.6	87.2	98.2	106	111	113	110	105	97.3	86.4	72.8	58.0	43.8	32.4		
125	34.9	44.6	57.2	70.4	82.3	92.0	99.1	104	105	103	98.6	91.5	82.0	70.4	57.9	46.5	35.7		
130	38.5	46.8	56.8	67.9	78.1	86.6	92.9	96.8	98.2	96.2	92.5	86.4	78.2	68.5	58.2	48.8	38.8		
135	41.5	49.2	57.1	65.9	74.6	81.8	87.3	90.7	91.9	90.2	87.0	81.9	75.0	67.0	58.8	51.2	41.6		
140	44.5	51.4	57.7	64.6	71.6	77.7	82.3	85.2	86.3	84.8	82.2	77.9	72.3	65.9	59.6	53.3	43.8		
145	47.0	52.1	58.5	63.8	69.2	74.1	77.8	80.2	81.1	80.0	77.9	74.5	70.2	65.3	59.8	54.3	45.9		
150	48.7	53.9	58.5	63.2	67.3	71.0	73.9	75.9	76.6	75.7	74.1	71.6	68.4	64.0	60.7	54.9	46.7		
155	45.4	51.8	54.1	62.2	65.6	68.4	70.6	72.0	72.7	72.0	71.0	69.3	66.2	64.0	60.5	55.5	44.2		
160	38.1	45.5	51.1	51.8	63.3	65.5	66.8	68.2	68.9	68.0	67.4	66.6	65.3	63.2	59.6	54.7	40.7		
165	31.6	37.1	41.0	43.1	47.2	53.8	64.5	65.4	65.9	65.6	65.2	64.4	62.9	60.7	58.7	48.8	38.0		
170	30.4	32.4	37.4	40.8	39.6	38.7	42.8	52.8	60.5	61.0	60.8	60.3	58.1	54.8	48.3	37.4	37.0		
175	41.3	41.3	41.4	42.9	41.4	41.3	35.8	28.7	38.7	51.9	46.4	42.0	42.2	44.7	45.7	44.4	42.7		
180	48.1	48.0	47.4	46.3	44.1	41.8	39.8	37.7	27.9	18.5	27.4	35.8	39.1	43.1	44.5	46.0	47.0		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Oct. 09, 2025	-
Digital Power Meter	PF2010A	HZTE028-01	Aug. 07, 2025	Aug. 06, 2026
AC Power Supply	DPS1060	HZTE001-06	Aug. 07, 2025	Aug. 06, 2026
DC Power Supply	WY12010	HZTE004-03	Aug. 07, 2025	Aug. 06, 2026
Temperature recorder	JM624U	HZTE018-08	Aug. 07, 2025	Aug. 06, 2026
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 07, 2025	Aug. 06, 2026
Standard source	D908	HZTE012-01	Aug. 14, 2018	-
Integrate Sphere system	3M	HZTE015-04	Aug. 07, 2025	-
Digital Power Meter	WT210	HZTE008-01	Aug. 07, 2025	Aug. 06, 2026
AC Power Supply	PCR 500L	HZTE001-07	Aug. 07, 2025	Aug. 06, 2026
DC Power Supply	IT6154	HZTE004-04	Aug. 07, 2025	Aug. 06, 2026
Standard source	SCL-1400	HZTE012-06	Nov. 04, 2021	-
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 07, 2025	Aug. 06, 2026
Temperature Meter	TES1310	HZTE017-01	Aug. 07, 2025	Aug. 06, 2026

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.

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 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.

*** End of Report ***

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