NVLAP LAB CODE 200960-0

LM-79-08 Test and ISTMT Report

for

A.L.P. Lighting Components, Inc.

6333 Gross Point Road, Niles, IL 60714

2x4 LED Recessed Interior Luminaires

Model: ELL24-4850LCO-1

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

No.1805, DongLiu road, BinJiang District, Hangzhou, China

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www.ledtestlab.com

Report No.: HZ15070025x

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

Review by: April Zou

Engineer: April Zou

Sep. 01, 2015

Approved by: Jim Zhang

Manager: Jim Zhang

Sep. 01, 2015

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: **ELL24-4850LCO-1**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
97.7	4675.6	47.88	0.9956

CCT (K)	CRI	Stabilization Time (Light & Power)
5211	84.4	60

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Jul. 15, 2015
Date of Test	: Jul. 24, 2015 to Aug. 31, 2015
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/UL 8750-2011 Light Emitting Diode (LED) Equipment for Use in Lighting Products ANSI/UL 1598-2010 Standard for Safety of Luminaire

TABLE OF CONTENT

Sample Photo

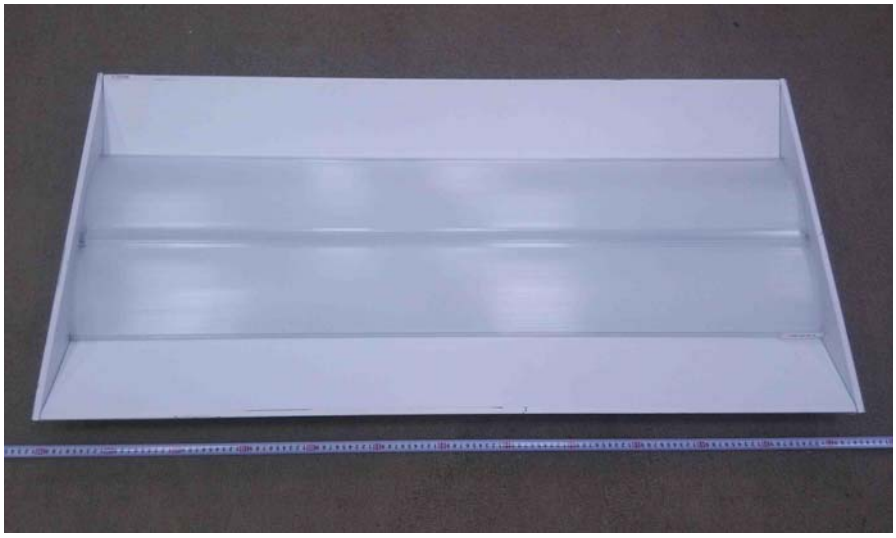


Figure 1- Overview of the sample

Equipment Under Test (EUT)	
Name	: 2x4 LED Recessed Interior Luminaires
Model	: ELL24-4850LCO-1
Brand Name	: A.L.P Lighting
Electrical Ratings	: AC120~277V, 50/60 Hz, 48W
Product Description	: 5000K, Dimmable Driver: PIFN-X048A Manufacturer of light source: LG Model of light source: LGITLED1-28-50K Quantity of light source: 112pcs
Manufacturer	: A.L.P. Lighting Components, Inc.
Address	: 6333 Gross Point Road, Niles, IL 60714

TEST RESULTS

Test ambient temperature was 25.3℃.

Sample orientation was light down. 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 95 minutes.

The photometric distance of Goniophotometer is 30m.

Luminous data was taken at 0.5°vertical intervals and 10°horizontal intervals.

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.401	0.179
Power Factor	0.9956	0.9476
Test Power (W)	47.88	46.89
Off-State Power (W)	0	0
THD A%	6.89	12.05
Luminous Efficacy (lm/W)	97.7	99.7
Total Luminous Flux (lm)	4675.6	4673.4
Color Rendering Index (CRI)	84.4	
R9	12	
Correlated Color Temperature (CCT) (K)	5211	
Chromaticity (Chroma x, Chroma y)	(0.3396, 0.3493)	
Chromaticity (Chroma u, Chroma v)	(0.2086, 0.3218)	
Chromaticity (Chroma u', Chroma v')	(0.2086, 0.4827)	
Duv	0.0011	
Average Beam Angle (°)	109.0	
Center Beam Candle Power (cd)	1715	
Spacing Criteria	1.26 (0°-180°)/ 1.23(90°-270°)	
Zonal Lumens in the 0°-60°Zone	80.66%	
Zonal Lumens in the 60°-90°Zone	19.25%	
Zonal Lumens in the 90°-120°Zone	0.03%	
Zonal Lumens in the 120°-180°Zone	0.06%	

Special Color Rendering Indices	
R1	83
R2	89
R3	93
R4	85
R5	84
R6	85
R7	87
R8	69
R9	12
R10	74
R11	84
R12	68
R13	84
R14	96

Table 2 Test data per Goniophotometer Method

Note: According to CIE 1976 (u', v') diagram, u' = u = 4x/(-2x+12y+3), v' = 3v/2 = 9y/(-2x+12y+3).

Spectral Power Distribution

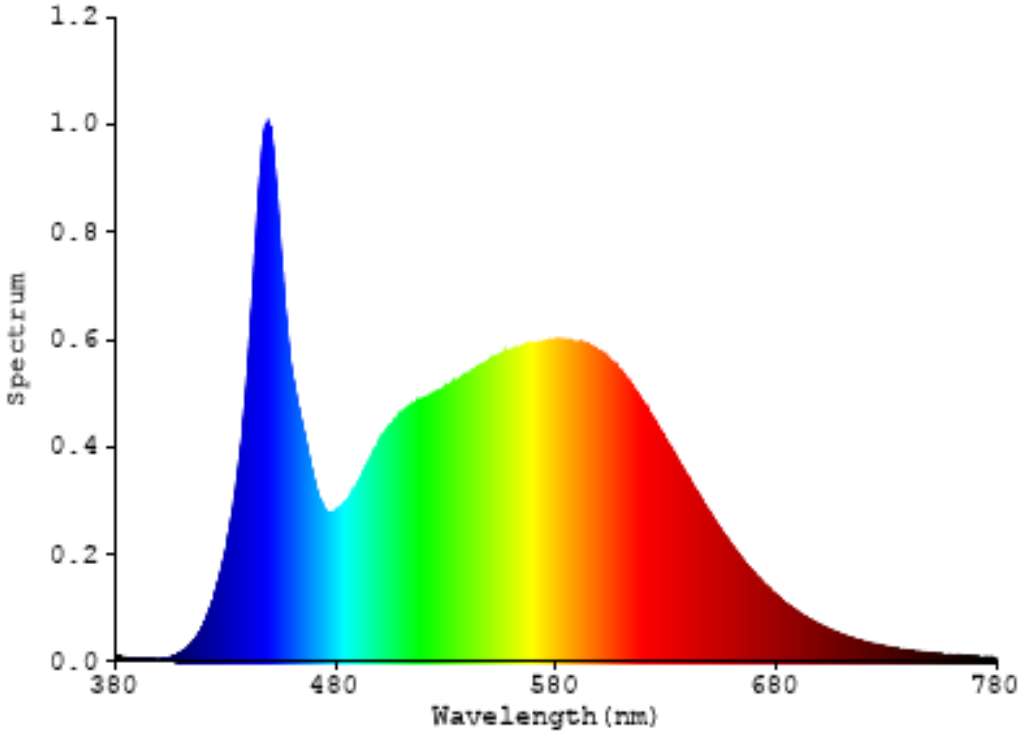


Chart 1: Spectral Power Distribution

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	162.211	3.47%
10- 20	463.861	9.92%
20- 30	700.071	14.97%
30- 40	836.897	17.90%
40- 50	854.968	18.29%
50- 60	753.097	16.11%
60- 70	551.411	11.79%
70- 80	295.638	6.32%
80- 90	53.002	1.13%
90-100	0.535	0.01%
100-110	0.594	0.01%
110-120	0.62	0.01%
120-130	0.628	0.01%
130-140	0.653	0.01%
140-150	0.574	0.01%
150-160	0.451	0.01%
160-170	0.268	0.01%
170-180	0.103	0.00%
Total	4675.6	100%

γ(°)	Lumens	% Total
0- 60	3771.105	80.66%
60- 90	900.051	19.25%
0-90	4671.156	99.91%
90- 180	4.426	0.09%
0- 180	4675.6	100%

Table 3: Zonal Lumen Data

Illuminance Plots

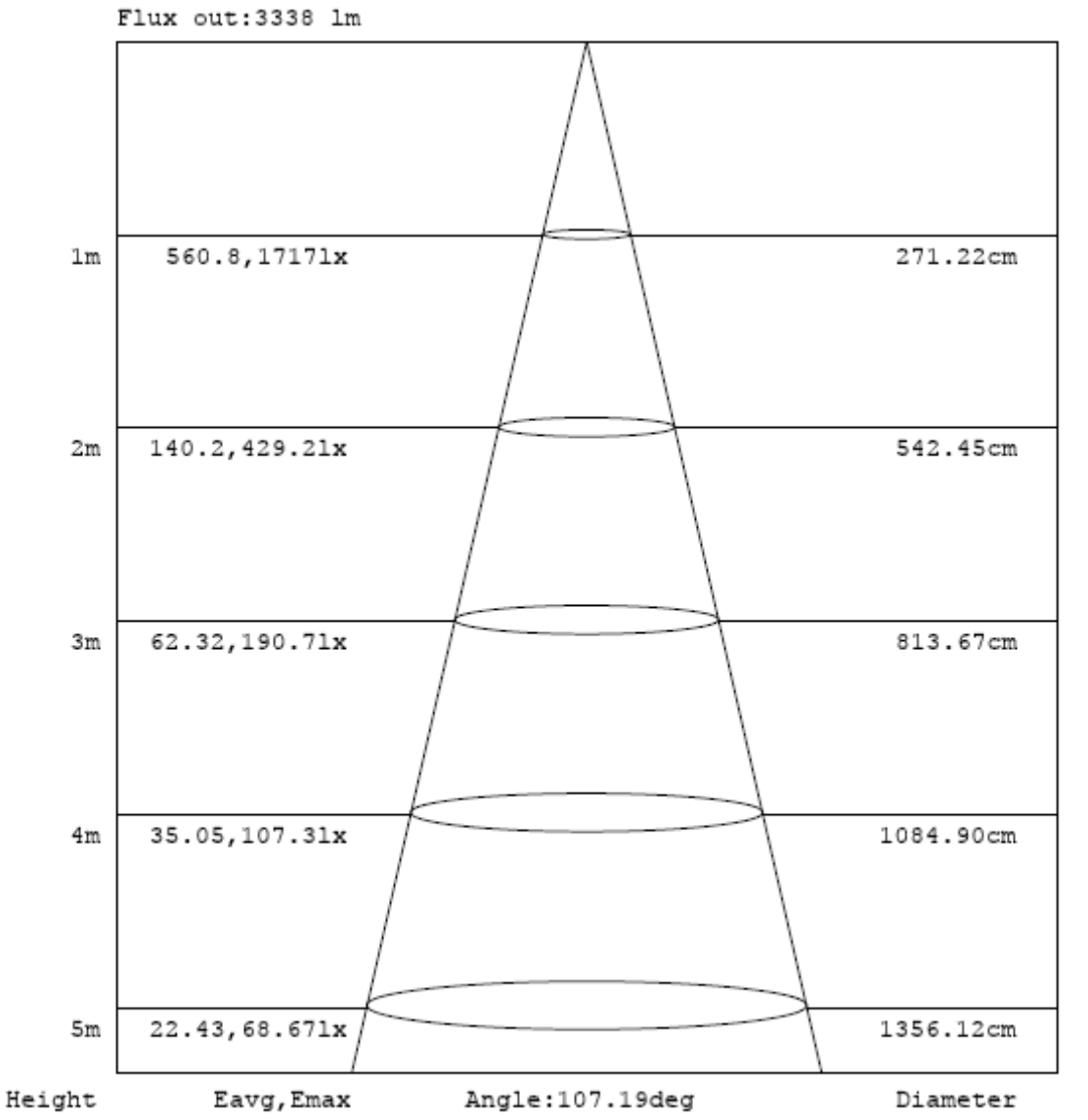


Chart 2: Beam angle

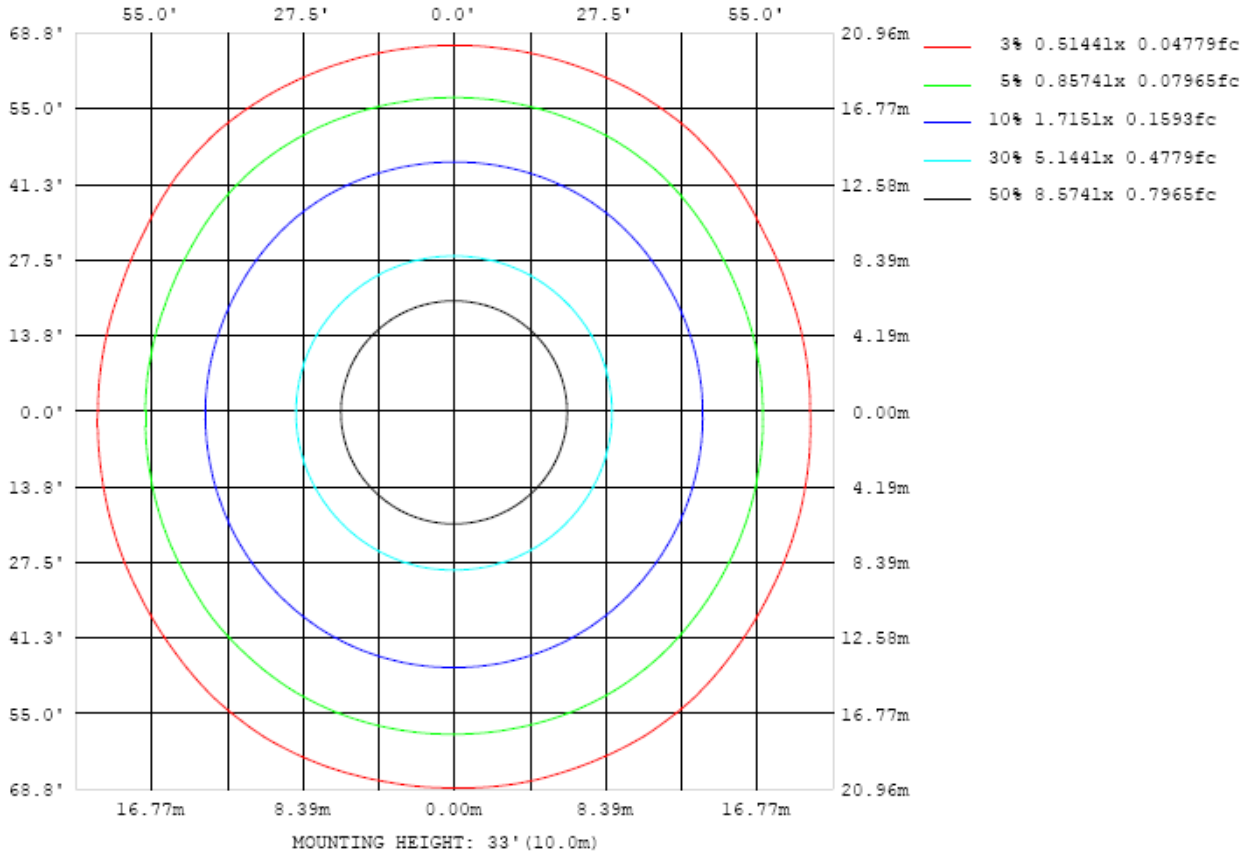


Chart 3: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots

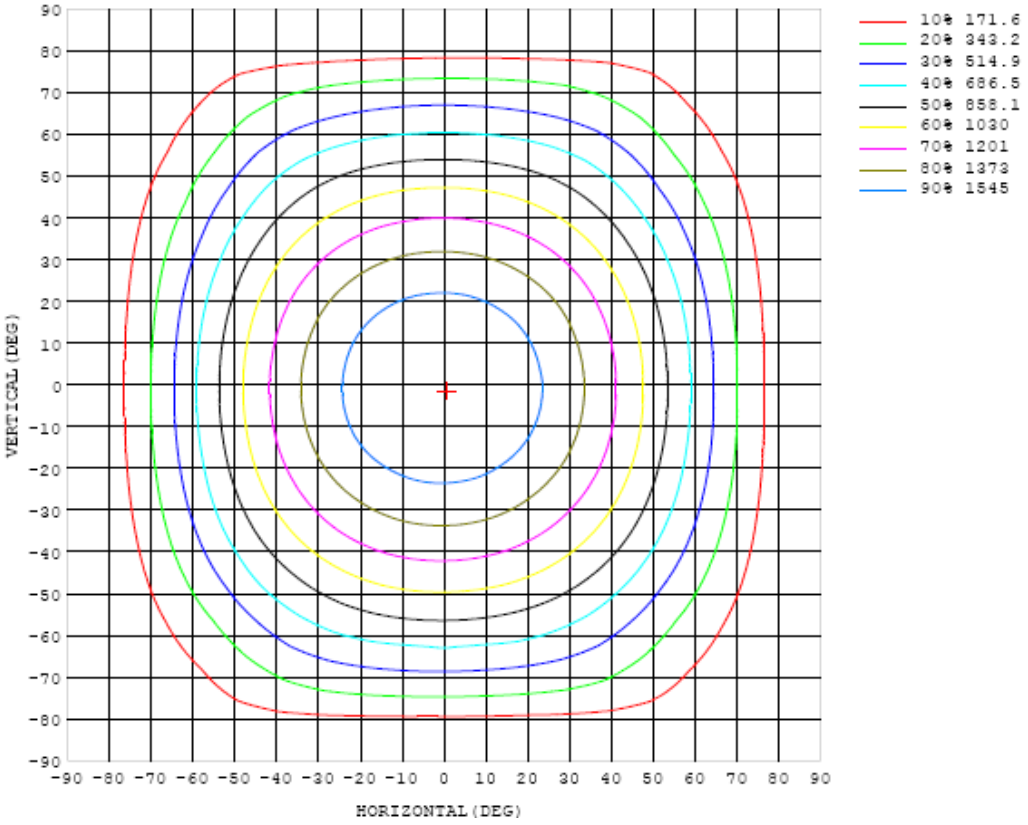


Chart 4: Isocandla Plot

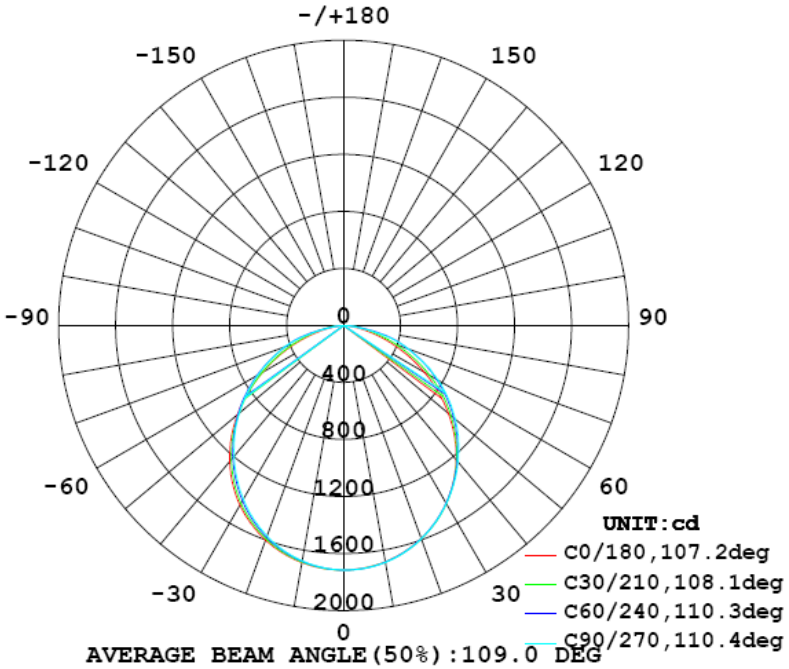


Chart 5: Polar Candela Distribution

Luminous Intensity Data

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	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715
5	1706	1707	1707	1708	1708	1708	1709	1709	1710	1710	1710	1710	1711	1710	1711	1711	1710	1710	1709
10	1682	1684	1684	1685	1685	1685	1685	1685	1686	1687	1688	1688	1689	1690	1690	1691	1690	1690	1688
15	1644	1645	1646	1646	1646	1646	1646	1646	1646	1648	1649	1650	1652	1654	1655	1655	1655	1655	1652
20	1591	1592	1593	1593	1592	1592	1591	1591	1592	1593	1594	1596	1598	1601	1603	1604	1604	1605	1602
25	1523	1524	1525	1525	1523	1522	1522	1522	1522	1524	1525	1528	1530	1533	1536	1538	1538	1539	1536
30	1440	1442	1442	1441	1440	1440	1438	1439	1440	1442	1443	1445	1448	1451	1454	1457	1457	1458	1456
35	1342	1345	1345	1344	1344	1344	1345	1346	1349	1351	1352	1353	1355	1356	1358	1360	1361	1360	1358
40	1229	1233	1235	1234	1235	1239	1241	1244	1247	1249	1251	1251	1252	1251	1249	1249	1249	1248	1245
45	1101	1106	1110	1113	1118	1123	1129	1133	1137	1140	1141	1140	1139	1135	1132	1127	1124	1120	1116
50	960	968	975	983	991	1001	1010	1016	1020	1022	1023	1023	1018	1011	1003	994	986	979	973
55	808	819	831	843	856	871	883	890	895	897	898	897	892	879	865	853	839	827	820
60	652	664	678	692	713	737	752	759	762	763	765	766	760	743	720	701	686	669	660
65	495	510	526	543	571	604	620	621	625	620	623	628	627	608	575	546	528	511	500
70	344	360	374	393	434	470	481	481	482	483	483	484	486	473	432	391	373	358	345
75	207	223	236	260	309	345	351	342	335	335	339	348	355	342	304	253	231	218	206
80	97.6	111	125	153	194	200	183	165	155	154	158	171	190	205	191	144	118	105	95.0
85	29.7	36.5	48.9	56.1	56.7	53.0	44.7	38.3	34.2	33.8	36.9	39.1	46.1	55.6	58.9	53.7	43.0	33.3	26.6
90	2.77	2.14	1.79	1.96	2.01	0.34	0.32	0.32	0.35	0.35	0.35	0.31	0.40	0.35	1.96	0.30	2.21	0.60	0.61
95	1.06	0.54	0.41	0.26	0.27	0.21	0.20	0.18	0.19	0.19	0.19	0.17	0.18	0.19	0.29	0.28	0.49	0.55	0.90
100	0.78	0.63	0.43	0.25	0.27	0.22	0.21	0.19	0.20	0.20	0.20	0.19	0.20	0.21	0.29	0.27	0.50	0.71	1.82
105	0.75	0.68	0.46	0.28	0.30	0.26	0.25	0.23	0.23	0.23	0.24	0.24	0.25	0.26	0.43	0.32	0.59	0.78	1.16
110	0.74	0.71	0.57	0.36	0.35	0.32	0.32	0.29	0.28	0.28	0.30	0.31	0.33	0.32	0.38	0.39	0.68	0.81	1.10
115	0.80	0.74	0.62	0.50	0.44	0.39	0.37	0.36	0.35	0.35	0.37	0.40	0.40	0.41	0.48	0.55	0.74	1.03	1.00
120	0.82	1.03	0.84	0.63	0.54	0.46	0.44	0.42	0.43	0.43	0.43	0.47	0.49	0.48	0.63	0.68	0.87	1.13	1.01
125	0.94	0.78	0.70	0.72	0.68	0.59	0.53	0.50	0.56	0.53	0.52	0.56	0.55	0.63	0.76	0.74	0.84	0.91	0.99
130	0.96	0.85	0.79	0.75	0.77	0.72	0.67	0.60	0.56	0.56	0.58	0.62	0.69	0.76	0.82	0.84	0.94	0.93	1.03
135	0.93	0.84	0.87	0.83	0.75	0.80	0.80	0.74	0.69	0.70	0.72	0.75	0.78	0.82	0.77	0.92	0.86	0.93	1.05
140	1.22	0.89	0.80	1.05	0.86	0.78	0.79	0.81	0.78	0.79	0.80	0.80	0.74	0.77	0.93	0.93	1.11	0.99	1.04
145	1.06	0.93	0.76	1.02	0.97	0.94	0.86	0.78	0.77	0.76	0.76	0.77	0.85	0.94	0.99	1.01	0.75	0.93	0.91
150	1.07	1.06	0.89	0.90	1.14	1.02	0.95	0.92	0.88	0.89	0.89	0.91	0.93	1.00	1.21	0.89	0.84	1.04	1.03
155	1.03	1.10	0.96	0.83	0.91	1.03	1.04	0.92	0.90	0.91	0.94	0.93	1.02	1.02	0.89	0.81	0.93	1.05	0.99
160	1.04	1.12	1.05	0.92	0.80	0.83	0.80	0.90	0.94	0.95	0.94	0.93	0.86	0.89	0.81	0.93	1.08	1.08	1.01
165	1.02	1.06	1.05	1.02	0.91	0.83	0.72	0.70	0.75	0.77	0.78	0.77	0.82	0.94	0.98	1.09	1.09	1.12	1.00
170	1.09	1.11	1.10	1.07	1.03	0.97	0.90	0.84	0.85	0.83	0.84	0.91	0.99	1.08	1.14	1.14	1.13	1.15	1.09
175	1.17	1.20	1.20	1.21	1.20	1.15	1.07	1.06	1.05	0.97	1.02	1.00	1.10	1.11	1.10	1.09	1.10	1.12	1.12
180	1.16	1.16	1.17	1.17	1.16	1.16	1.15	1.06	1.03	1.10	0.99	1.05	1.04	1.04	1.04	1.03	1.07	1.16	1.12

Table 4: Luminous Intensity Data

Table--2 UNIT: cd

γ (DEG) \ C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
0	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715
5	1709	1708	1707	1707	1706	1705	1704	1704	1704	1703	1703	1704	1704	1704	1704	1705	1705
10	1687	1686	1684	1683	1681	1679	1678	1677	1676	1676	1676	1676	1677	1677	1678	1679	1681
15	1651	1648	1646	1644	1640	1637	1635	1634	1633	1632	1632	1633	1634	1636	1637	1639	1641
20	1599	1596	1592	1588	1585	1580	1577	1574	1572	1572	1572	1574	1576	1579	1582	1584	1587
25	1532	1528	1523	1519	1513	1507	1501	1498	1497	1497	1497	1500	1504	1508	1511	1515	1518
30	1452	1447	1442	1434	1427	1420	1414	1411	1409	1408	1409	1413	1417	1423	1428	1433	1437
35	1353	1348	1342	1334	1326	1320	1314	1309	1307	1307	1309	1312	1317	1322	1329	1333	1338
40	1240	1234	1227	1221	1215	1209	1203	1199	1197	1197	1198	1201	1205	1209	1214	1220	1225
45	1110	1106	1100	1097	1094	1090	1086	1083	1081	1081	1082	1083	1084	1085	1088	1093	1097
50	968	965	961	964	967	968	964	960	958	958	961	962	959	954	951	954	957
55	815	812	815	827	837	839	833	829	827	828	831	835	830	817	806	804	807
60	656	653	664	687	703	703	698	696	695	695	697	702	698	678	656	650	651
65	497	496	513	548	565	565	563	563	563	563	564	568	564	540	506	495	496
70	345	344	371	412	431	434	438	441	442	441	437	437	431	406	363	347	347
75	209	211	244	287	310	301	290	283	282	288	299	313	312	283	239	215	213
80	99.7	109	140	165	153	132	119	113	113	117	128	147	171	173	137	112	105
85	29.9	37.1	38.5	34.1	28.0	22.5	20.0	19.1	19.2	20.3	23.1	27.1	34.1	44.5	48.5	41.8	33.1
90	0.80	0.57	0.45	0.51	0.45	0.49	0.55	0.61	0.63	0.60	0.54	0.63	0.43	0.44	0.40	0.61	0.74
95	0.78	0.66	0.57	0.59	0.53	0.55	0.55	0.57	0.58	0.57	0.54	0.54	0.55	0.57	0.53	0.68	0.76
100	0.98	0.74	0.61	0.65	0.60	0.62	0.63	0.63	0.63	0.63	0.61	0.60	0.61	0.60	0.58	0.74	0.93
105	1.08	0.81	0.67	0.67	0.64	0.66	0.67	0.66	0.65	0.66	0.65	0.67	0.64	0.67	0.64	0.86	1.01
110	1.06	0.84	0.67	0.66	0.66	0.68	0.66	0.65	0.66	0.65	0.65	0.66	0.74	0.68	0.68	0.86	0.96
115	1.04	0.78	0.70	0.61	0.59	0.61	0.61	0.61	0.61	0.61	0.62	0.62	0.61	0.64	0.69	0.80	1.09
120	1.07	0.75	0.74	0.65	0.56	0.59	0.55	0.54	0.55	0.56	0.57	0.61	0.57	0.69	0.71	0.77	0.97
125	0.91	0.78	0.81	0.73	0.67	0.58	0.58	0.56	0.56	0.58	0.57	0.61	0.65	0.75	0.69	0.84	1.19
130	0.97	1.25	0.86	0.81	0.80	0.73	0.68	0.67	0.66	0.66	0.69	0.73	0.75	0.75	0.76	0.86	0.85
135	0.93	0.91	0.97	0.79	0.88	0.87	0.84	0.83	0.82	0.82	0.83	0.86	0.76	0.82	0.83	0.82	0.87
140	0.90	1.08	1.01	0.95	0.83	0.83	0.90	0.92	0.91	0.90	0.87	0.83	0.86	0.89	0.93	0.84	0.92
145	0.88	0.83	1.03	1.05	0.98	0.94	0.86	0.89	0.89	0.87	0.86	0.95	1.00	1.06	0.81	0.73	0.96
150	1.02	0.84	0.92	1.06	1.06	1.00	0.96	0.99	0.98	0.94	0.97	0.98	1.12	0.96	0.85	0.85	0.95
155	1.00	0.90	0.89	0.94	1.09	1.07	1.08	1.01	1.07	1.02	1.08	1.02	0.94	0.91	0.86	1.00	1.02
160	1.04	1.04	0.88	0.90	0.93	0.91	0.95	1.02	0.99	1.04	0.92	0.91	0.89	0.89	0.97	1.07	1.07
165	1.02	1.03	1.03	0.98	0.94	0.90	0.91	0.93	0.88	0.87	0.88	0.85	0.88	0.93	1.01	0.98	0.96
170	1.10	1.13	1.14	1.18	1.14	1.14	1.01	0.95	0.95	0.97	0.95	0.98	0.99	1.03	1.05	1.04	1.04
175	1.12	1.14	1.15	1.16	1.16	1.17	1.11	1.06	1.05	1.02	1.10	1.04	1.07	1.11	1.15	1.12	1.12
180	1.12	1.15	1.17	1.16	1.16	1.15	1.13	1.06	0.99	1.03	0.96	1.04	1.06	1.08	1.06	1.06	1.08

Table 5: Luminous Intensity Data

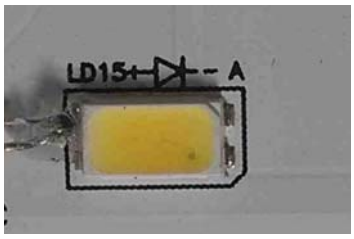
ISTMT TEST DATA:

Sample Tested**: ELL24-4850LCO-1**

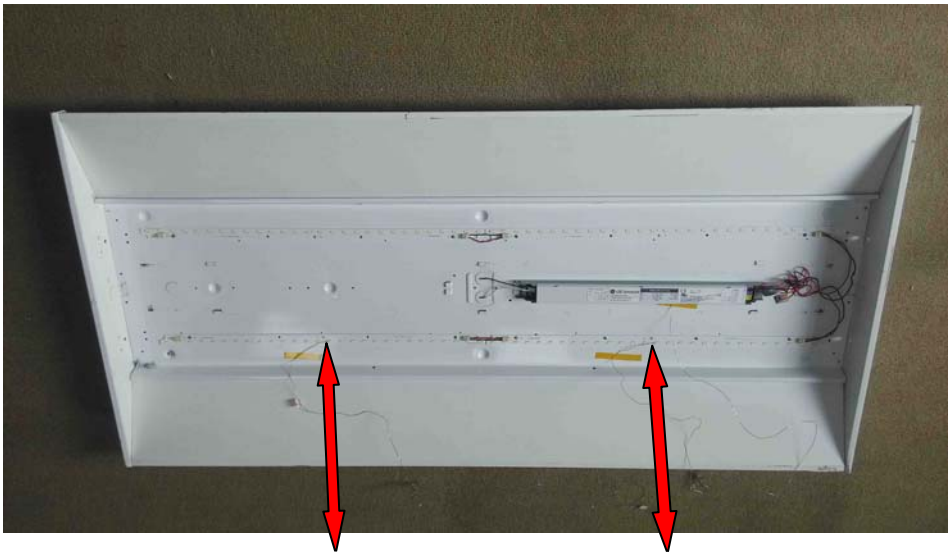
Test ambient temperature was 29.1℃.

Test orientation was Light Down.

The stabilization time of the sample was 7.5 hours.



View of In-Situ Point- Ts



Point B Location Point A Location

Location of In-Situ Point from overall view

Input Voltage (V)	Input Power (W)	Tested LED source current (mA)	Measured Driver Temp Maximum Temperature (Corrected to Ta=25℃)	Measured In-Situ Maximum Temperature (Corrected to Ta=25℃)	
				Point A	Point B
120.0	47.88	109.2	57.2	45.0	42.9
277.0	46.89	107.9	57.4	45.2	43.1

Table 6: ISTMT test data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	PF2010A	HZTE028-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-08	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	WY12010	HZTE004-03	Sep. 18, 2014	Sep. 17, 2015
Temperature Meter	TES1310	HZTE017-01	Sep. 18, 2014	Sep. 17, 2015
Standard source	D908	HZTE012-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	WT210	HZTE008-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-07	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	6154	HZTE004-04	Sep. 18, 2014	Sep. 17, 2015
Temperature and humidity recorder	JR900	HZTE018-01	Sep. 18, 2014	Sep. 17, 2015
Multi-Meter	FLUKE 289	HZTE020-03	Nov. 09, 2014	Nov. 08, 2015

Table 7: 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.

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.

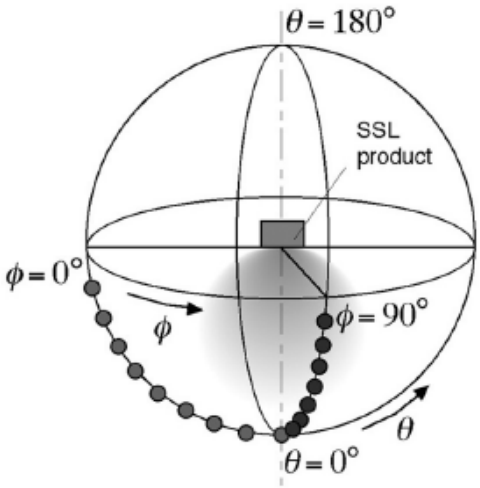
The uncertainty of goniophotometer system reported in this document is expended uncertainty is 1.94% with a coverage factor k=2.

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°/180° and C=90°/270°) 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, Δu'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.



ISTMT

The luminaire was installed to simulate intended usage, in accordance with the manufacturer's instructions.

Temperatures were measured after they stabilized, when the test was run for a minimum of 7.5 h.

The tests were conducted in an ambient temperature of 25 ± 5 °C. Ambient temperature variations above or below 25°C were respectively subtracted from or added to temperatures recorded at points on the luminaire. Temperatures recorded at points on a luminaire were measured by means of thermocouples.

The thermocouples had conductors no larger than No. 24 AWG (0.21mm^2) and no smaller than No. 30 AWG (0.05mm^2). Thermocouples complied with the requirements specified in ASTM MNL 12 and thermocouples as listed in the table of the limits of error specified in NIST ITS 90, or ISA MC96.1.

The luminaire was installed in the test box in the configuration that resulted in the highest operating temperatures, considering different trim and maximum lamp wattage combinations, lampholder adjustment heights, and the like.

The test box was constructed of 12mm thick plywood as described below:
The test box was rectangular and had four sides and a bottom.
The four sides of the test box for a ceiling-mounted luminaire were a minimum distance of 8.5 in (215mm) from the nearest part of the lamp housing or heat-producing parts. The top edge of the sides of the test box were a minimum of 8.5 in (215mm) above the highest point of any permanently attached part of the lamp housing.
Thermal insulation of the loose-fill type was poured into the test box through the open top, until level with the top, without applying any compacting procedure.
The thermal insulation was conditioned to the density specified by the insulation manufacturer to obtain a required rated thermal resistance of Rsi 0.56 to 0.678 (R3.2 to R3.85).
All spaces around the luminaire and between it and the sides of the box were filled with the thermal insulation.

*** End of Report ***