



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: ELNV24-4850-1

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ15070025s

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

Review by:

Engineer: April Zou
Sep. 08, 2015

Approved



1 Manager: Jim Zhang
Sep. 08, 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: **ELNV24-4850-1**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
98.3	4713.9	47.96	0.9956
CCT (K)	CRI	Stabilization Time (Light & Power)	
5303	84.4	60	

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Jul. 15, 2015
Date of Test	: Jul. 29, 2015 to Sep. 08, 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

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Sample Photo



Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: 2x4 LED Recessed Interior Luminaires
Model	: ELNV24-4850-1
Brand Name	: A.L.P Lighting
Electrical Ratings	: AC120~277V, 50/60Hz, 48W
Product Description	: 2x4 Panel Light, 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 25.2°C.

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	0.9478
Test Power (W)	47.96	46.92
Off-State Power (W)	0	0
THD A%	6.77	11.87
Luminous Efficacy (lm/W)	98.3	100.5
Total Luminous Flux (lm)	4713.9	4714.9
Color Rendering Index (CRI)	84.4	
R9	12	
Correlated Color Temperature (CCT) (K)	5303	
Chromaticity (Chroma x, Chroma y)	(0.3372, 0.3470)	
Chromaticity (Chroma u, Chroma v)	(0.2078, 0.3208)	
Chromaticity (Chroma u', Chroma v')	(0.2078, 0.4812)	
Duv	0.0010	
Average Beam Angle (°)	111.2	
Center Beam Candle Power (cd)	1679	
Spacing Criteria	1.26 (0°-180°)/ 1.22 (90°-270°)	
Zonal Lumens in the 0°-60°Zone	79.09%	
Zonal Lumens in the 60°-90°Zone	20.79%	
Zonal Lumens in the 90°-120°Zone	0.07%	
Zonal Lumens in the 120°-180°Zone	0.05%	

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

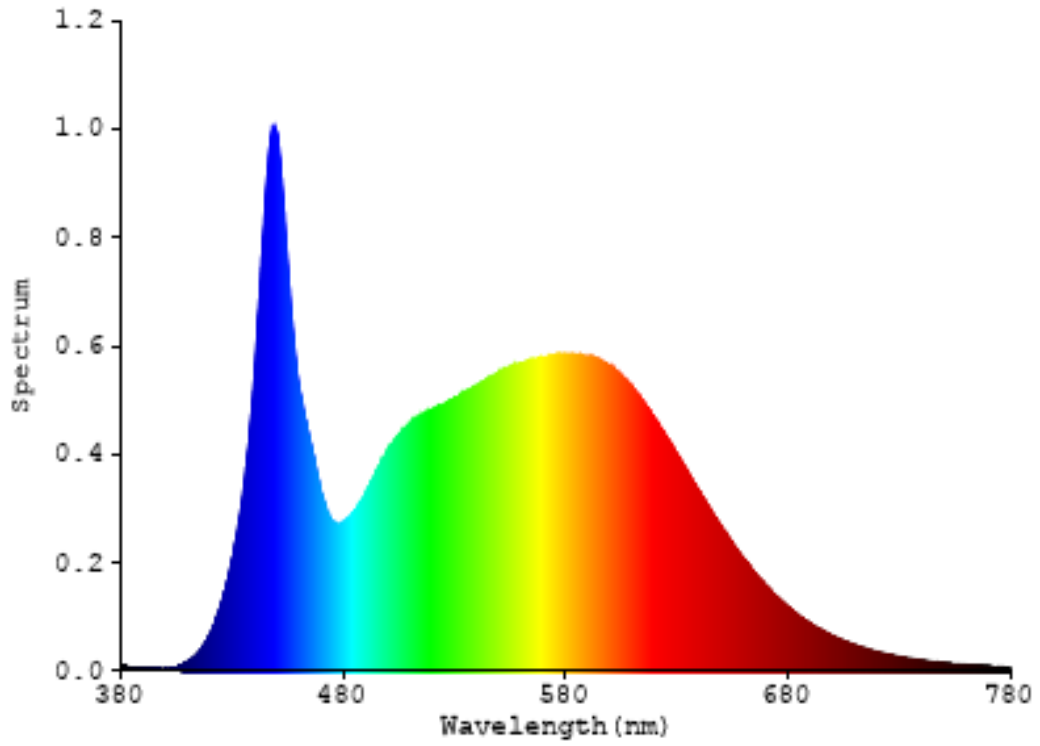


Chart 1: Spectral Power Distribution

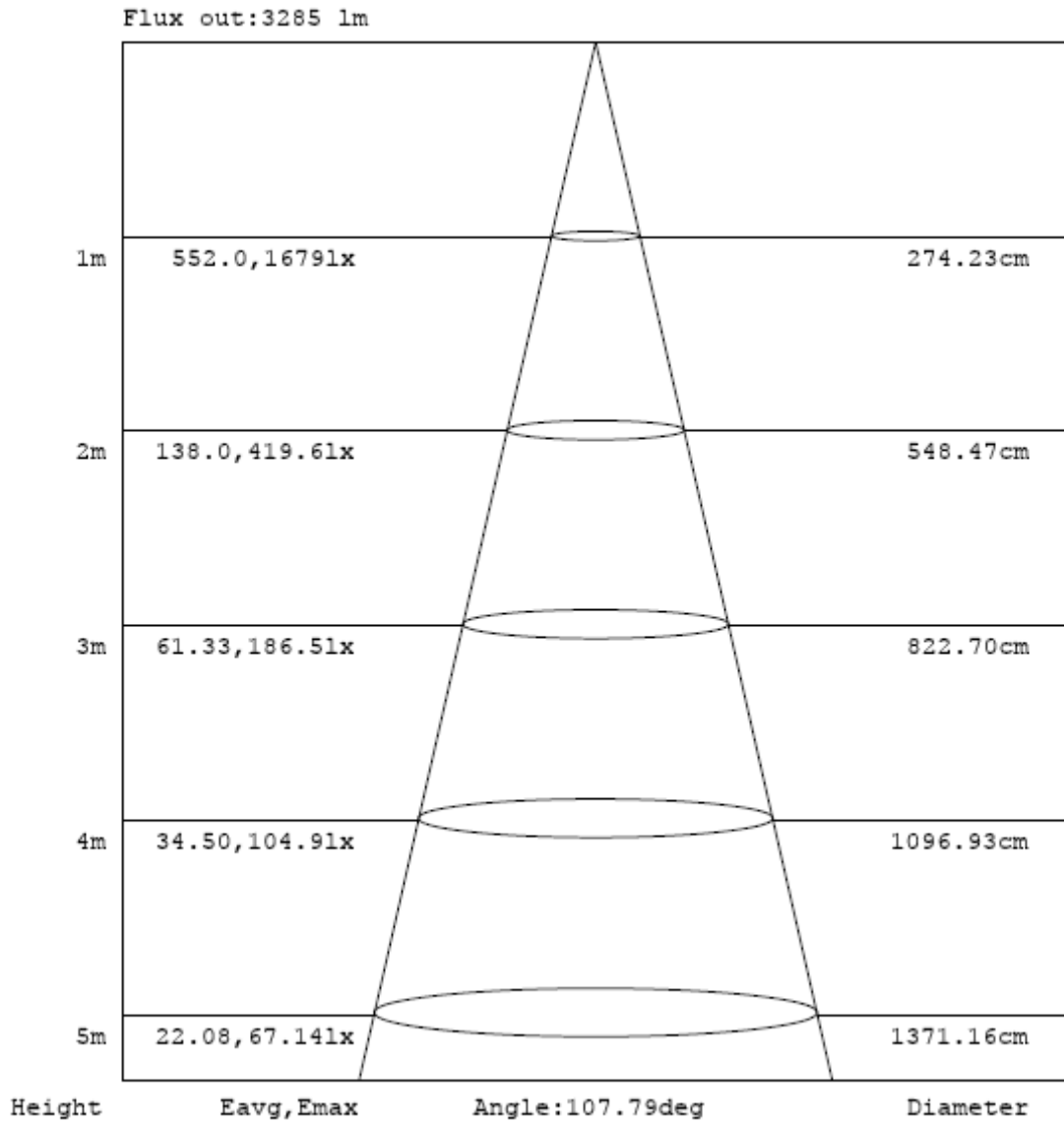
Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	158.67	3.37%
10- 20	453.175	9.61%
20- 30	683.763	14.51%
30- 40	820.307	17.40%
40- 50	847.569	17.98%
50- 60	764.647	16.22%
60- 70	582.406	12.35%
70- 80	327.82	6.95%
80- 90	69.942	1.48%
90-100	1.171	0.02%
100-110	1.138	0.02%
110-120	0.837	0.02%
120-130	0.697	0.01%
130-140	0.615	0.01%
140-150	0.49	0.01%
150-160	0.367	0.01%
160-170	0.24	0.01%
170-180	0.088	0.00%
Total	4713.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	3728.131	79.09%
60- 90	980.168	20.79%
0-90	4708.299	99.88%
90- 180	5.643	0.12%
0- 180	4713.9	100%

Table 3: Zonal Lumen Data

Illuminance Plots



Note: The Curves indicate the illuminated area and the average illumination when the luminaire is at different distance.

Chart 2: Beam angle

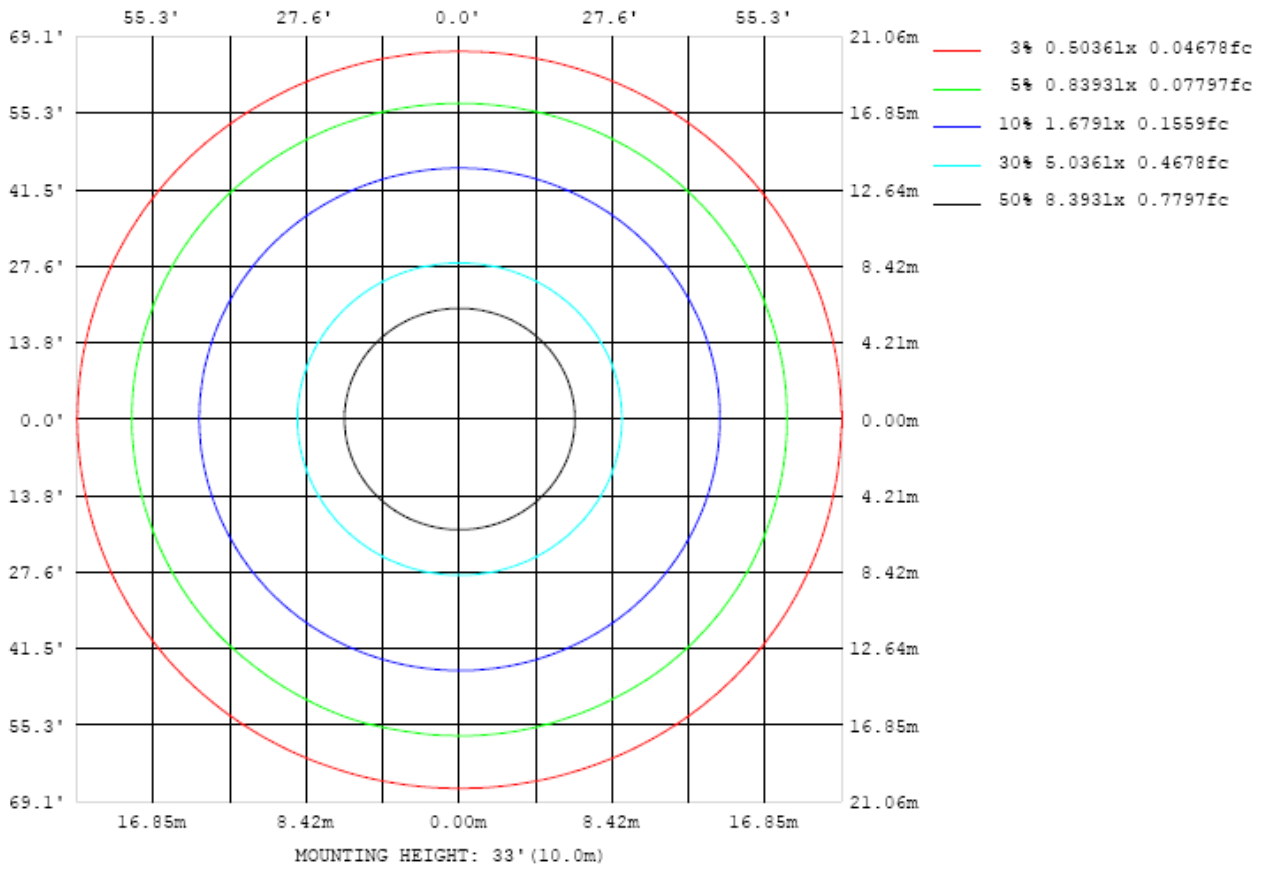


Chart 3: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots

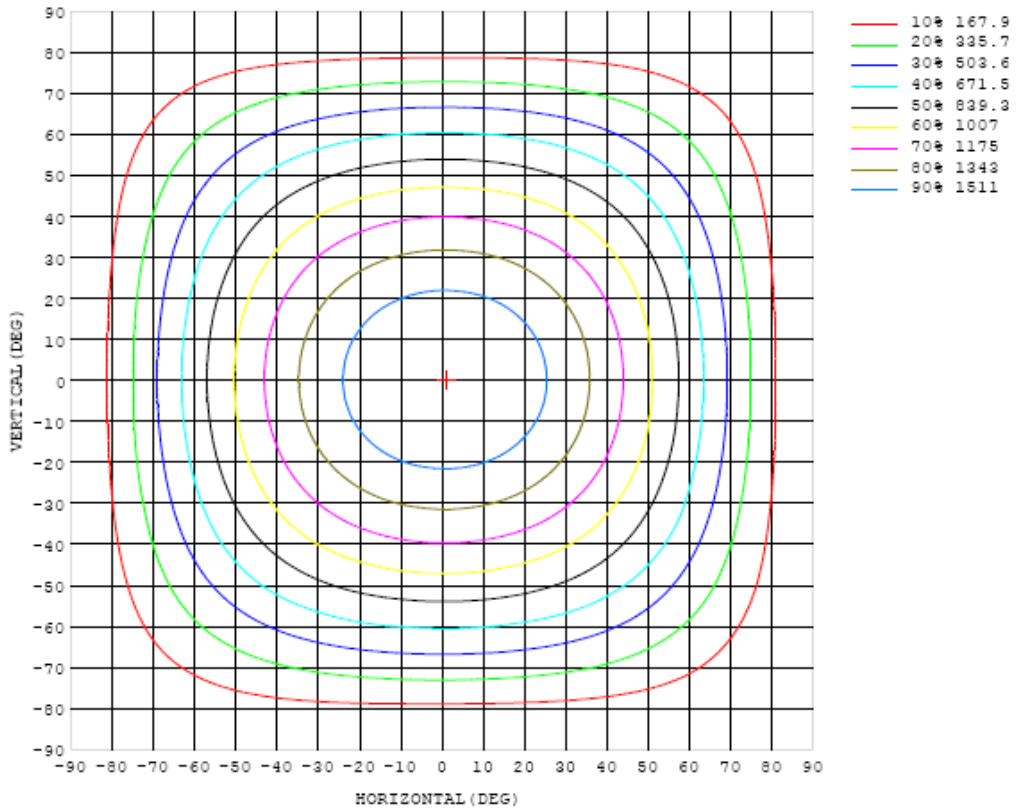


Chart 4: Isocandla Plot

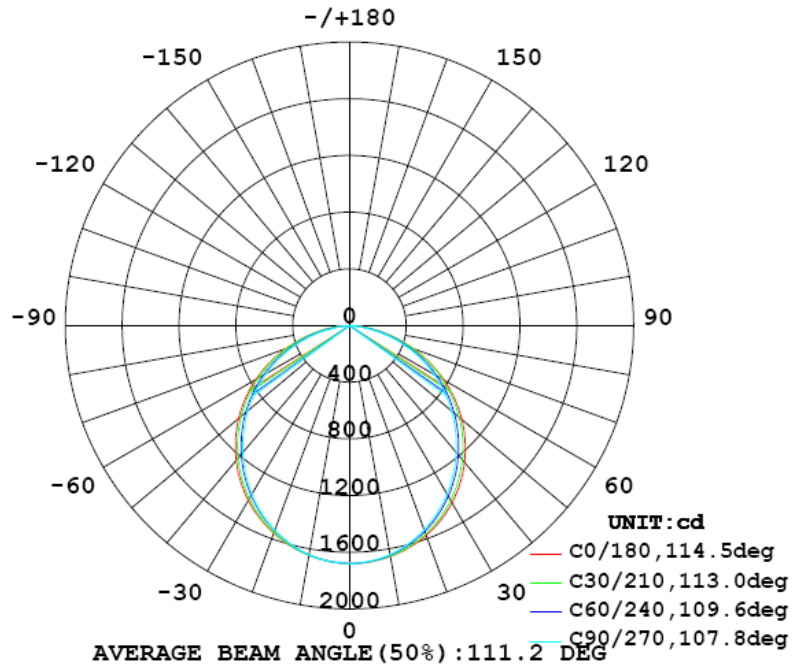


Chart 5: Polar Candela Distribution

Luminous Intensity Data

Table--1 UNIT: cd

C (DEG) \ y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679
5	1673	1673	1673	1673	1672	1671	1671	1669	1669	1669	1668	1668	1668	1668	1669	1669	1669	1669	1669
10	1655	1655	1654	1651	1649	1648	1645	1643	1642	1641	1640	1641	1641	1642	1644	1645	1646	1646	1646
15	1622	1622	1619	1616	1612	1607	1603	1599	1596	1595	1594	1596	1598	1600	1603	1606	1609	1610	1609
20	1576	1575	1571	1565	1559	1552	1545	1539	1535	1534	1534	1536	1539	1544	1549	1553	1558	1560	1560
25	1516	1515	1509	1501	1492	1483	1474	1466	1461	1458	1458	1462	1467	1473	1480	1487	1494	1497	1499
30	1443	1441	1435	1425	1413	1401	1390	1380	1374	1371	1371	1375	1382	1391	1400	1410	1418	1423	1426
35	1358	1355	1347	1335	1322	1308	1295	1284	1277	1273	1274	1279	1287	1297	1309	1320	1330	1336	1339
40	1260	1256	1248	1236	1221	1206	1192	1180	1172	1168	1169	1175	1184	1196	1208	1220	1231	1239	1242
45	1151	1148	1139	1126	1111	1096	1080	1067	1060	1056	1056	1063	1074	1086	1099	1112	1123	1131	1135
50	1032	1029	1021	1007	993	978	963	950	941	937	939	945	956	969	983	995	1007	1015	1019
55	904	901	893	882	869	854	838	825	817	813	815	822	834	846	860	872	882	890	894
60	767	765	759	750	738	724	704	693	689	684	686	700	705	717	732	743	751	757	761
65	625	624	620	613	602	589	576	564	556	553	555	562	573	586	599	609	616	619	622
70	478	478	476	471	461	451	439	428	421	418	421	428	438	449	460	469	475	476	480
75	331	332	333	328	321	312	302	292	285	283	286	294	304	313	322	330	335	334	337
80	192	194	194	191	184	173	159	146	139	137	141	151	165	180	190	196	199	200	201
85	70.2	74.1	71.3	65.1	54.7	44.8	38.7	36.6	33.2	32.9	33.9	38.0	43.2	50.3	59.1	71.7	78.2	79.8	80.9
90	3.24	5.21	3.63	2.62	3.01	1.60	1.48	1.37	1.35	2.04	1.50	1.64	1.69	2.51	2.78	2.83	3.37	4.34	2.14
95	1.34	1.97	1.65	1.57	1.14	0.76	0.43	0.27	0.21	0.21	0.21	0.25	0.35	0.67	1.00	1.33	1.68	2.17	1.86
100	2.01	2.04	1.72	1.46	1.12	0.76	0.44	0.29	0.24	0.23	0.23	0.27	0.35	0.64	0.93	1.21	2.47	2.16	2.04
105	1.59	2.64	1.50	1.30	1.05	0.81	0.47	0.33	0.26	0.26	0.26	0.32	0.34	0.69	0.90	1.33	1.22	1.12	1.60
110	1.37	1.79	1.39	1.83	0.95	0.61	0.44	0.35	0.30	0.29	0.29	0.34	0.42	0.58	1.12	0.98	1.26	1.06	1.34
115	1.25	1.44	1.45	1.07	0.85	0.73	0.50	0.38	0.34	0.33	0.35	0.40	0.46	0.57	0.72	0.93	1.18	1.00	1.15
120	1.15	1.30	1.16	1.31	0.81	0.65	0.58	0.46	0.41	0.40	0.43	0.47	0.53	0.62	0.77	0.87	0.98	1.12	1.03
125	1.10	1.27	1.09	0.99	0.81	0.73	0.60	0.52	0.49	0.48	0.50	0.54	0.56	0.70	0.79	0.86	1.14	0.94	0.93
130	1.03	1.14	1.03	0.93	0.88	0.74	0.63	0.59	0.55	0.56	0.56	0.59	0.59	0.72	0.83	0.86	0.87	0.88	0.87
135	0.96	0.99	1.03	0.97	0.87	0.71	0.66	0.63	0.59	0.62	0.63	0.63	0.66	0.70	0.82	0.95	0.94	1.15	0.88
140	1.00	0.95	1.03	0.94	0.80	0.72	0.71	0.66	0.62	0.67	0.65	0.64	0.68	0.66	0.75	0.87	0.89	1.11	0.93
145	0.96	0.92	0.95	0.82	0.78	0.76	0.74	0.67	0.65	0.71	0.66	0.64	0.71	0.75	0.72	0.78	0.86	0.85	0.85
150	0.79	0.79	0.86	0.85	0.79	0.81	0.75	0.69	0.68	0.73	0.69	0.67	0.73	0.80	0.80	0.77	0.77	0.72	0.71
155	0.81	0.81	0.89	0.91	0.85	0.79	0.72	0.73	0.72	0.75	0.74	0.71	0.73	0.79	0.83	0.88	0.83	0.77	0.74
160	0.93	0.90	0.90	0.91	0.83	0.76	0.74	0.74	0.73	0.72	0.75	0.72	0.74	0.80	0.85	0.86	0.84	0.92	0.88
165	0.93	0.89	0.88	0.90	0.86	0.78	0.76	0.75	0.76	0.76	0.76	0.75	0.80	0.85	0.86	0.86	0.87	0.92	0.87
170	0.97	0.97	0.94	0.92	0.89	0.83	0.79	0.84	0.85	0.82	0.81	0.81	0.95	0.92	0.91	0.92	0.93	0.94	0.92
175	1.01	1.00	1.00	0.99	0.96	0.89	0.86	0.88	0.87	0.83	0.85	0.84	0.87	0.92	0.94	0.93	0.93	0.94	0.97
180	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97

Table 4: 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	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679	1679		
5	1669	1669	1670	1669	1669	1669	1669	1669	1670	1670	1671	1671	1672	1672	1673	1673	1673		
10	1647	1646	1645	1644	1643	1642	1642	1642	1643	1643	1645	1647	1648	1650	1652	1654	1655		
15	1610	1608	1607	1604	1601	1599	1598	1597	1598	1598	1602	1605	1609	1613	1617	1619	1621		
20	1560	1558	1554	1550	1545	1541	1538	1537	1537	1538	1543	1548	1555	1561	1567	1571	1574		
25	1498	1494	1489	1483	1477	1470	1465	1464	1464	1463	1471	1479	1487	1495	1504	1510	1514		
30	1425	1420	1412	1404	1394	1385	1379	1376	1375	1378	1386	1395	1406	1418	1429	1437	1443		
35	1338	1332	1322	1312	1300	1290	1282	1278	1277	1281	1289	1300	1313	1326	1339	1350	1357		
40	1240	1233	1222	1210	1197	1185	1177	1171	1170	1174	1183	1195	1210	1225	1239	1251	1259		
45	1133	1125	1113	1100	1087	1073	1063	1057	1056	1060	1070	1083	1098	1114	1129	1142	1150		
50	1016	1008	996	983	968	954	943	937	935	939	949	963	979	996	1011	1023	1031		
55	891	884	873	860	844	830	819	812	810	814	824	837	853	870	885	895	903		
60	759	752	743	729	714	699	688	681	678	682	693	706	722	737	751	760	767		
65	620	616	607	594	580	566	554	547	545	549	558	571	585	599	612	621	625		
70	478	475	467	456	442	430	419	412	410	413	422	433	446	458	469	476	479		
75	336	334	327	317	306	294	283	275	273	277	286	297	307	318	326	332	334		
80	201	198	192	183	168	151	138	130	127	132	142	156	171	183	190	194	196		
85	83.2	76.5	65.0	49.4	39.1	33.2	29.8	28.0	27.6	28.5	30.8	34.6	40.8	50.6	64.8	73.9	74.9		
90	1.52	1.42	1.32	1.00	0.76	0.53	0.40	0.37	0.37	0.38	0.43	0.55	0.88	1.27	1.40	1.71	1.50		
95	1.97	1.74	1.66	1.24	0.92	0.65	0.52	0.49	0.49	0.50	0.57	0.70	1.06	1.42	1.77	2.17	1.96		
100	1.94	2.30	1.57	1.21	0.91	0.67	0.58	0.55	0.56	0.57	0.63	0.77	1.11	1.45	2.05	3.65	1.73		
105	1.75	1.47	2.05	1.16	0.82	0.68	0.62	0.59	0.60	0.61	0.67	0.87	1.28	1.37	2.47	1.85	1.68		
110	2.05	1.35	1.20	0.94	0.75	0.67	0.58	0.56	0.57	0.57	0.64	0.69	0.95	1.84	1.35	1.71	1.46		
115	1.28	1.61	0.99	0.80	0.66	0.62	0.53	0.51	0.51	0.53	0.56	0.66	0.83	1.05	1.16	1.36	1.25		
120	1.20	0.96	0.90	0.73	0.61	0.53	0.47	0.45	0.45	0.47	0.53	0.62	0.75	0.92	1.09	1.19	1.14		
125	1.12	1.03	0.86	0.74	0.63	0.51	0.48	0.47	0.46	0.47	0.56	0.59	0.75	0.91	0.99	1.26	1.19		
130	0.99	0.90	0.87	0.80	0.65	0.55	0.55	0.55	0.55	0.55	0.61	0.60	0.76	0.88	0.92	1.03	1.21		
135	0.92	0.95	0.96	0.82	0.68	0.65	0.62	0.65	0.65	0.63	0.67	0.71	0.72	0.90	0.96	1.04	1.27		
140	0.90	1.00	0.89	0.75	0.69	0.71	0.67	0.71	0.74	0.69	0.73	0.77	0.73	0.82	0.92	0.96	0.99		
145	0.85	0.87	0.77	0.73	0.78	0.74	0.70	0.76	0.79	0.72	0.75	0.79	0.80	0.74	0.78	0.86	0.88		
150	0.71	0.75	0.75	0.81	0.80	0.74	0.72	0.77	0.75	0.71	0.74	0.77	0.84	0.83	0.79	0.77	0.70		
155	0.71	0.80	0.84	0.83	0.80	0.73	0.75	0.75	0.76	0.76	0.78	0.80	0.83	0.87	0.92	0.81	0.76		
160	0.83	0.85	0.83	0.82	0.83	0.80	0.76	0.82	0.80	0.84	0.80	0.84	0.84	0.89	0.90	0.86	0.89		
165	0.82	0.82	0.84	0.85	0.86	0.86	0.83	0.83	0.86	0.87	0.82	0.86	0.88	0.88	0.86	0.84	0.87		
170	0.88	0.91	0.93	0.95	0.97	0.96	0.93	0.92	0.95	0.94	1.01	0.99	0.89	0.93	0.93	0.90	0.93		
175	0.95	0.95	0.97	0.99	1.00	1.01	0.99	0.92	0.91	0.96	0.95	0.93	0.95	0.95	0.92	0.92	0.99		
180	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97		

Table 5: Luminous Intensity Data

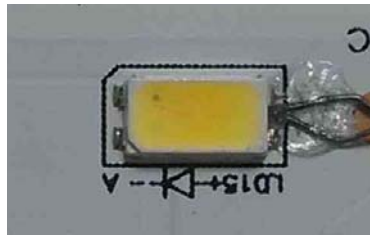
ISTMT TEST DATA:

Sample Tested: **ELNV24-4850-1**

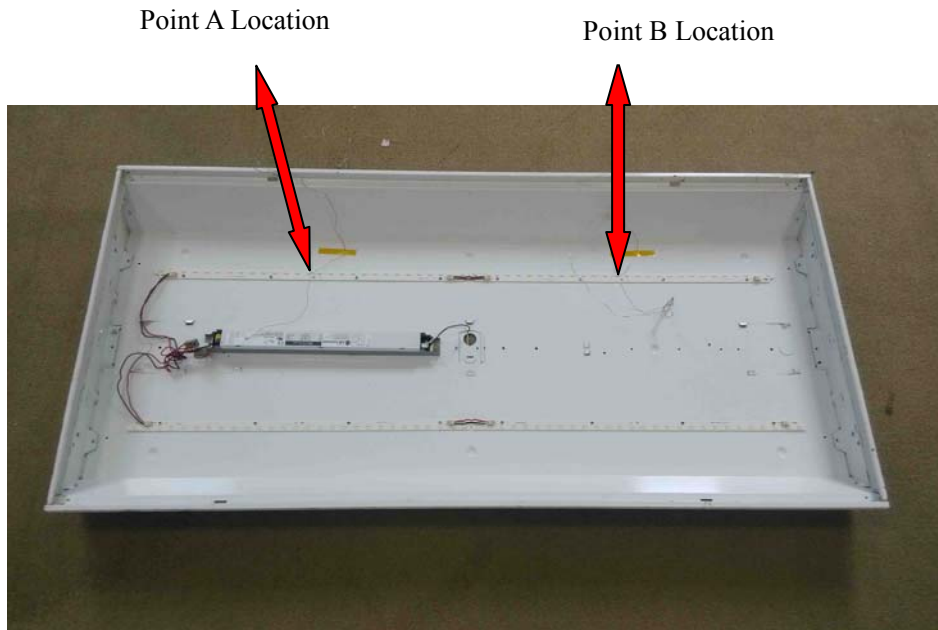
Test ambient temperature was 27.1°C.

Test orientation was Light Down.

The stabilization time of the sample was 7.5 hours.



View of In-Situ Point- Ts



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°C)	Measured In-Situ Maximum Temperature (Corrected to Ta=25°C)	
				Point A	Point B
120.0	47.96	106.7	55.8	44.0	40.5
277.0	46.92	106.7	55.5	44.1	40.5

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 expanded uncertainty is 1.94% with a coverage factor $k=2$.

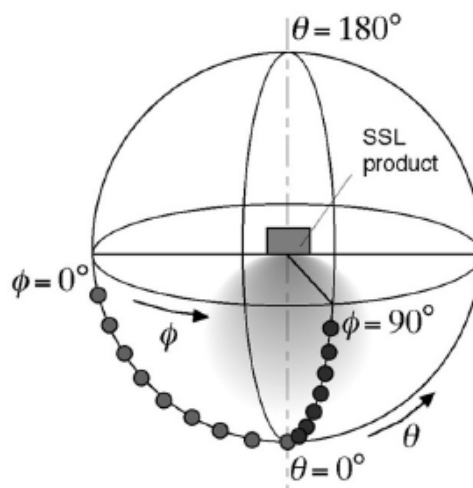
Color Characteristics Measurements

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 ($C=0^\circ/180^\circ$ 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.



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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 ***

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