



LM-79-08 Test and ISTMT Report

for

A.L.P. Lighting Components, Inc.

6333 Gross Point Road, Niles, IL 60714

2x2 LED Recessed Interior Luminaires

Model: ELNV22-3735-1

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ15070025a/R1

This report is replaced the old report No. HZ15070025a dated Sep. 08, 2015

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

Review by:

Engineer: April Zou
Nov. 12, 2015

Approved by:



Manager: Jim Zhang
Nov. 12, 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: **ELNV22-3735-1**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
86.2	2472.4	28.69	0.9943
CCT (K)	CRI	Stabilization Time (Light & Power)	
3622	85.6	60	

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Jul. 15, 2015
Date of Test	: Jul. 29, 2015 to Sep. 07, 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	: 2x2 LED Recessed Interior Luminaires
Model	: ELNV22-3735-1
Brand Name	: A.L.P Lighting
Electrical Ratings	: AC120~277V, 50/60Hz, 37W
Product Description	: 2x2 Panel Light, 3500K, Dimmable Driver: PIFC-C201R (Consist of PIFC-C201B with Resistor 511 Ohm) Manufacturer of light source: LG Model of light source: LGITLED1-28-35K Quantity of light source: 56pcs
Manufacturer	: A.L.P. Lighting Components, Inc.
Address	: 6333 Gross Point Road, Niles, IL 60714

TEST RESULTS

Test ambient temperature was 25.1°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)	0.240	0.114
Power Factor	0.9943	0.9261
Test Power (W)	28.69	29.10
Off-State Power (W)	0	0
THD A%	6.21	18.15
Luminous Efficacy (lm/W)	86.2	85.0
Total Luminous Flux (lm)	2472.4	2472.6
Color Rendering Index (CRI)	85.6	
R9	10	
Correlated Color Temperature (CCT) (K)	3622	
Chromaticity (Chroma x, Chroma y)	(0.3971, 0.3829)	
Chromaticity (Chroma u, Chroma v)	(0.2336, 0.3378)	
Chromaticity (Chroma u', Chroma v')	(0.2336, 0.5067)	
Duv	0.0016	
Average Beam Angle (°)	106.4	
Center Beam Candle Power (cd)	930	
Spacing Criteria	1.22 (0°-180°)/ 1.21 (90°-270°)	
Zonal Lumens in the 0°-60°Zone	80.17%	
Zonal Lumens in the 60°-90°Zone	19.59%	
Zonal Lumens in the 90°-120°Zone	0.14%	
Zonal Lumens in the 120°-180°Zone	0.10%	

Special Rendering Indices	Color
R1	82
R2	92
R3	96
R4	81
R5	83
R6	89
R7	84
R8	62
R9	10
R10	81
R11	80
R12	70
R13	85
R14	98

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

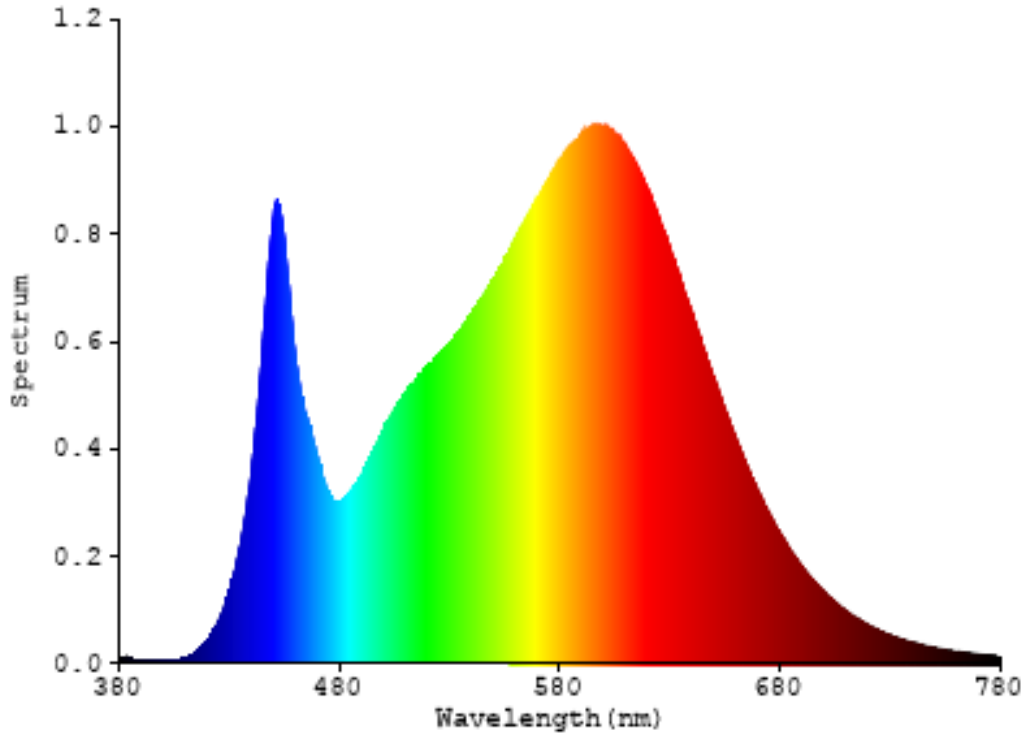


Chart 1: Spectral Power Distribution

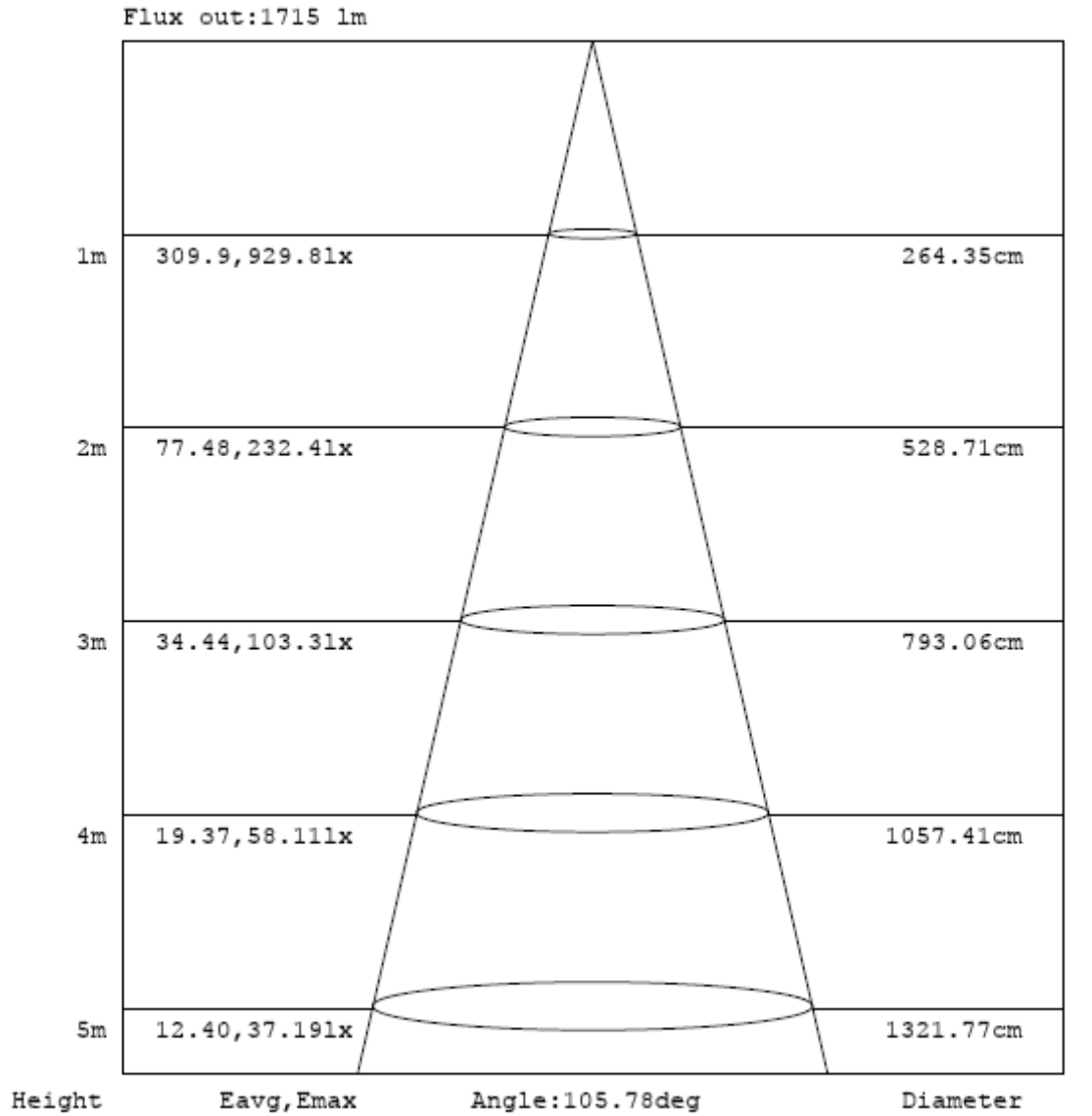
Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	87.741	3.55%
10- 20	248.881	10.07%
20- 30	370.663	14.99%
30- 40	437.528	17.70%
40- 50	444.169	17.97%
50- 60	393.056	15.90%
60- 70	293.54	11.87%
70- 80	159.675	6.46%
80- 90	31.09	1.26%
90-100	1.16	0.05%
100-110	1.287	0.05%
110-120	0.998	0.04%
120-130	0.765	0.03%
130-140	0.634	0.03%
140-150	0.511	0.02%
150-160	0.361	0.01%
160-170	0.233	0.01%
170-180	0.078	0.00%
Total	2472.4	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1982.038	80.17%
60- 90	484.305	19.59%
0-90	2466.343	99.76%
90- 180	6.027	0.24%
0- 180	2472.4	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

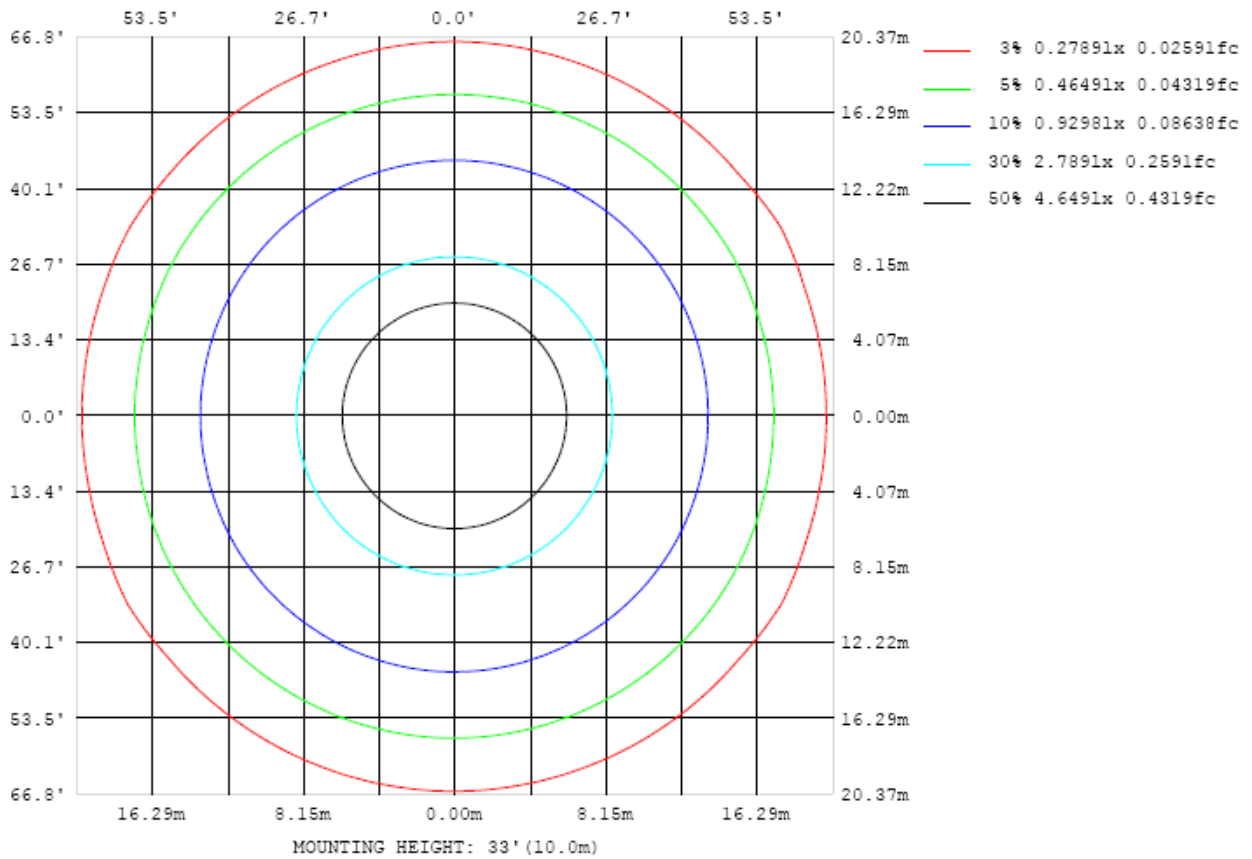


Chart 3: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots

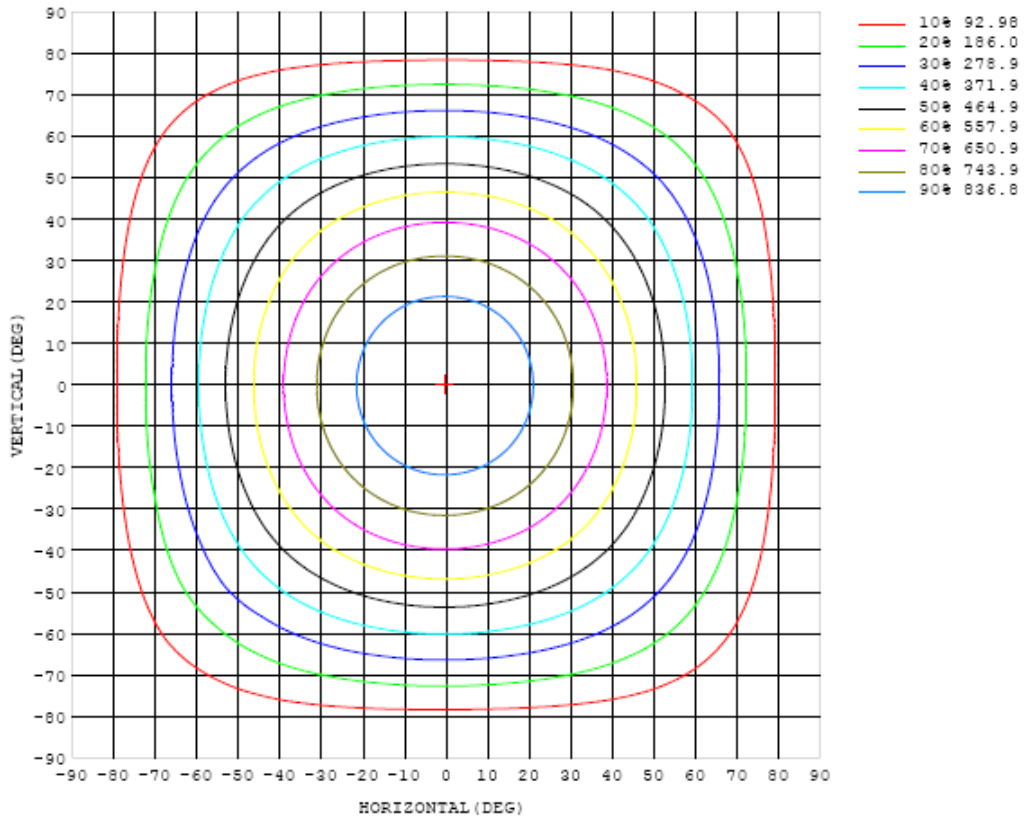


Chart 4: Isocandla Plot

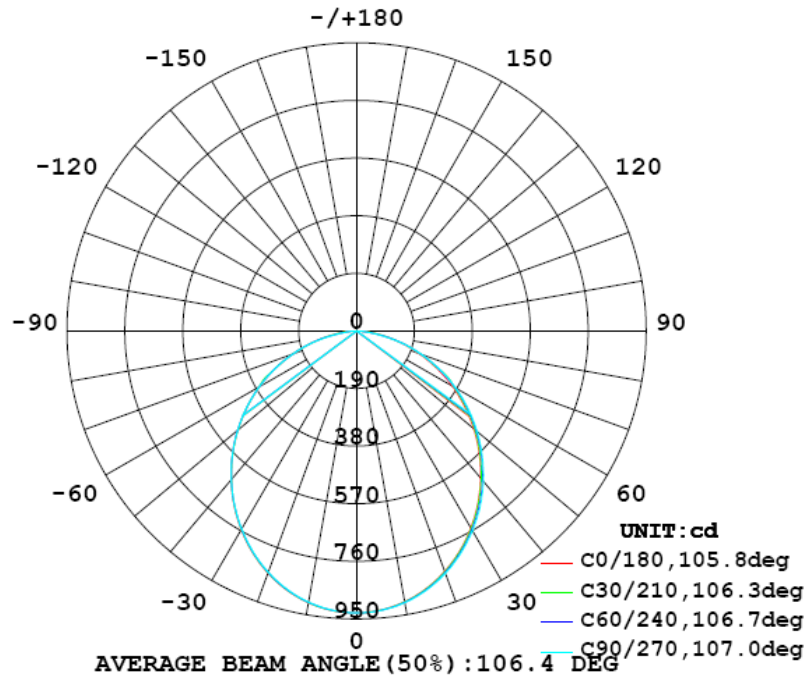


Chart 5: Polar Candela Distribution

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	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930
5	923	924	924	924	924	924	925	925	925	925	925	925	925	925	925	925	925	925	925
10	907	907	907	908	908	908	909	909	910	910	910	911	911	911	911	911	910	910	910
15	880	880	881	881	882	883	883	884	884	885	886	886	886	886	886	885	885	885	885
20	844	844	845	846	847	848	849	850	850	851	852	852	852	852	851	851	850	850	850
25	800	801	802	802	803	805	806	807	808	809	809	810	809	809	809	808	808	807	807
30	750	750	751	752	753	755	756	758	759	760	761	761	760	760	759	758	758	757	757
35	694	694	695	696	698	700	702	704	706	707	707	707	706	704	703	703	702	701	701
40	633	634	635	636	638	641	643	645	646	647	648	647	647	645	644	642	641	641	641
45	569	570	571	573	576	578	579	581	582	583	584	583	583	582	580	578	577	576	576
50	502	502	504	507	510	511	512	514	516	517	517	516	516	515	514	512	509	509	509
55	432	433	435	439	440	442	443	444	446	447	447	447	446	446	444	443	440	438	439
60	361	362	366	368	369	371	372	373	374	375	375	375	375	374	373	371	369	367	367
65	290	291	295	298	297	298	299	299	300	301	301	301	301	301	300	310	297	294	295
70	217	219	231	224	229	225	226	226	226	227	227	227	227	227	230	225	233	221	221
75	147	150	153	153	153	154	154	153	152	152	153	154	155	154	155	153	151	150	151
80	82.7	84.3	85.0	85.9	85.7	81.9	75.8	71.2	69.3	68.8	69.7	72.9	78.1	83.4	85.7	85.3	88.1	84.0	84.9
85	25.8	26.7	27.7	24.6	22.3	20.5	19.7	19.7	19.5	19.4	19.4	19.3	19.4	20.5	22.3	25.8	26.9	26.3	27.1
90	1.00	1.48	1.15	0.94	0.87	0.68	0.44	0.29	0.14	0.14	0.15	0.24	0.46	0.62	0.76	0.86	0.94	1.20	1.04
95	1.41	1.83	1.62	1.34	1.16	0.89	0.63	0.36	0.18	0.16	0.21	0.41	0.71	0.98	1.23	1.45	1.64	1.84	1.51
100	1.48	2.64	2.21	1.51	1.23	1.30	0.67	0.37	0.25	0.20	0.26	0.41	0.73	1.02	1.31	1.47	2.46	2.46	1.52
105	1.45	2.55	1.53	1.27	1.21	0.97	0.64	0.44	0.30	0.24	0.31	0.40	0.67	1.06	1.25	1.70	1.60	2.33	1.90
110	1.43	2.17	1.53	1.68	1.12	0.84	0.74	0.42	0.32	0.29	0.34	0.46	0.59	0.88	1.65	1.30	1.54	1.76	1.52
115	1.33	1.56	1.43	1.07	1.50	0.87	0.61	0.52	0.39	0.40	0.45	0.53	0.59	0.92	1.11	1.13	1.47	1.61	1.39
120	1.28	1.37	1.27	1.11	0.98	0.79	0.61	0.56	0.48	0.49	0.51	0.53	0.66	0.76	0.92	1.37	1.34	1.42	1.23
125	0.97	1.15	1.22	1.13	0.83	0.79	0.70	0.53	0.50	0.51	0.53	0.53	0.68	0.78	0.84	0.82	1.20	1.23	1.02
130	1.04	1.14	1.14	1.00	0.83	0.75	0.74	0.54	0.55	0.57	0.57	0.53	0.71	0.76	0.80	1.03	1.12	1.04	1.02
135	1.10	1.05	1.00	0.95	0.89	0.81	0.67	0.54	0.56	0.59	0.59	0.57	0.61	0.80	0.94	1.06	1.04	1.00	1.07
140	1.00	1.01	0.97	0.97	0.90	0.81	0.68	0.71	0.60	0.64	0.63	0.65	0.65	0.73	0.89	0.98	1.26	0.93	1.00
145	0.99	0.93	1.01	0.94	0.83	0.69	0.65	0.72	0.67	0.67	0.69	0.73	0.64	0.67	0.77	0.91	1.01	0.93	0.99
150	0.99	0.92	0.97	0.87	0.74	0.75	0.76	0.74	0.72	0.69	0.72	0.76	0.81	0.73	0.73	0.78	0.85	0.75	0.82
155	0.76	0.78	0.79	0.80	0.75	0.69	0.80	0.76	0.74	0.73	0.76	0.79	0.83	0.78	0.78	0.81	0.75	0.65	0.69
160	0.80	0.74	0.74	0.76	0.85	0.86	0.76	0.78	0.78	0.74	0.77	0.82	0.86	0.88	0.89	0.79	0.71	0.70	0.79
165	0.90	0.87	0.84	0.88	0.89	0.81	0.80	0.81	0.77	0.75	0.75	0.81	0.81	0.85	0.84	0.85	0.82	0.81	0.85
170	0.84	0.83	0.81	0.81	0.82	0.82	0.83	0.82	0.79	0.76	0.74	0.74	0.77	0.83	0.80	0.77	0.79	0.79	0.84
175	0.95	0.92	0.87	0.86	0.85	0.81	0.78	0.74	0.69	0.68	0.74	0.77	0.79	0.79	0.77	0.77	0.81	0.87	0.90
180	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83

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	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930	930		
5	925	925	925	925	925	924	924	924	924	924	924	924	923	923	923	923	923		
10	910	910	909	909	909	909	908	908	908	907	907	907	907	907	906	906	906		
15	884	884	884	884	883	883	883	882	882	881	881	880	880	880	880	880	880		
20	849	849	849	848	848	848	848	847	847	846	846	845	845	844	844	844	844		
25	806	806	806	805	805	805	805	804	804	803	802	802	801	800	800	800	800		
30	757	756	756	755	755	755	755	755	754	753	752	751	750	750	749	749	750		
35	701	700	700	699	699	699	700	700	699	698	697	696	694	693	693	693	693		
40	640	640	639	639	639	640	640	640	640	639	638	636	634	633	633	633	633		
45	576	575	575	575	576	577	577	577	577	576	574	573	571	570	569	568	569		
50	508	508	508	509	510	510	510	510	509	508	507	506	505	504	502	501	501		
55	438	438	440	441	441	440	440	441	440	439	438	437	436	435	434	432	432		
60	367	367	370	370	369	369	369	369	368	368	367	366	365	365	367	362	362		
65	294	296	297	297	297	296	296	295	295	294	294	293	293	292	301	292	290		
70	222	233	223	225	224	223	222	221	221	220	220	220	220	224	222	227	219		
75	152	157	152	153	152	151	150	148	148	148	149	150	150	150	150	151	150		
80	86.5	85.6	85.1	84.6	80.5	74.1	69.6	67.0	66.0	67.0	69.5	74.2	80.5	83.3	84.2	88.6	85.9		
85	27.6	27.8	26.0	22.9	21.4	20.1	19.6	19.3	19.0	19.0	19.2	19.5	20.7	22.4	26.2	27.4	27.2		
90	1.36	1.22	1.01	0.97	0.82	0.65	0.40	0.24	0.23	0.25	0.43	0.67	0.85	0.97	1.19	1.22	1.62		
95	1.99	1.95	1.74	1.38	1.07	0.75	0.51	0.33	0.30	0.34	0.54	0.82	1.09	1.35	1.74	1.81	1.99		
100	2.33	3.14	2.19	1.39	1.11	0.84	0.53	0.41	0.37	0.44	0.59	0.89	1.34	1.36	1.69	2.79	2.36		
105	2.45	1.76	1.64	1.54	1.04	0.83	0.57	0.48	0.44	0.51	0.62	0.88	1.16	1.41	1.82	1.78	2.72		
110	2.32	1.66	1.32	1.24	0.97	0.69	0.58	0.49	0.48	0.51	0.63	0.94	1.04	1.53	1.49	1.70	1.87		
115	1.65	1.59	1.15	1.11	0.82	0.66	0.60	0.52	0.52	0.55	0.63	0.71	1.10	1.22	1.29	1.70	1.72		
120	1.48	1.33	1.07	0.94	0.79	0.65	0.54	0.53	0.53	0.57	0.59	0.71	0.83	1.00	1.44	1.36	1.46		
125	1.18	1.17	0.87	0.84	0.74	0.67	0.51	0.48	0.51	0.56	0.54	0.71	0.80	0.83	0.89	1.22	1.30		
130	1.06	1.02	0.97	0.80	0.73	0.68	0.50	0.52	0.56	0.59	0.54	0.69	0.77	0.84	1.02	1.13	1.11		
135	1.08	0.92	0.90	0.91	0.80	0.62	0.58	0.56	0.59	0.61	0.56	0.65	0.84	0.95	1.15	1.02	0.94		
140	1.00	0.95	0.95	0.87	0.72	0.64	0.64	0.64	0.64	0.65	0.74	0.67	0.84	0.87	0.95	1.02	0.87		
145	1.01	1.14	0.92	0.76	0.71	0.64	0.73	0.70	0.70	0.70	0.76	0.64	0.71	0.87	0.98	1.01	0.92		
150	0.76	0.84	0.78	0.73	0.67	0.75	0.73	0.73	0.67	0.71	0.77	0.78	0.69	0.77	0.93	0.93	0.85		
155	0.66	0.73	0.80	0.77	0.81	0.83	0.76	0.76	0.72	0.75	0.77	0.84	0.83	0.76	0.85	0.75	0.69		
160	0.91	0.77	0.72	0.87	0.88	0.84	0.82	0.81	0.76	0.80	0.80	0.80	0.88	0.91	0.75	0.70	0.80		
165	0.86	0.83	0.80	0.82	0.87	0.85	0.84	0.78	0.77	0.80	0.83	0.87	0.86	0.84	0.84	0.86	0.88		
170	0.85	0.93	0.95	0.78	0.79	0.80	0.79	0.77	0.76	0.80	0.82	0.83	0.79	0.82	0.84	0.93	0.92		
175	0.90	0.92	0.94	1.01	1.01	0.83	0.84	0.86	0.79	0.76	0.81	0.85	0.90	1.00	0.96	0.94	0.93		
180	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83		

Table 5: Luminous Intensity Data

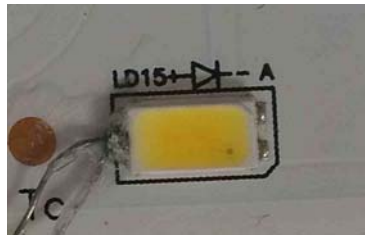
ISTMT TEST DATA:

Sample Tested: **ELNV22-3735-1**

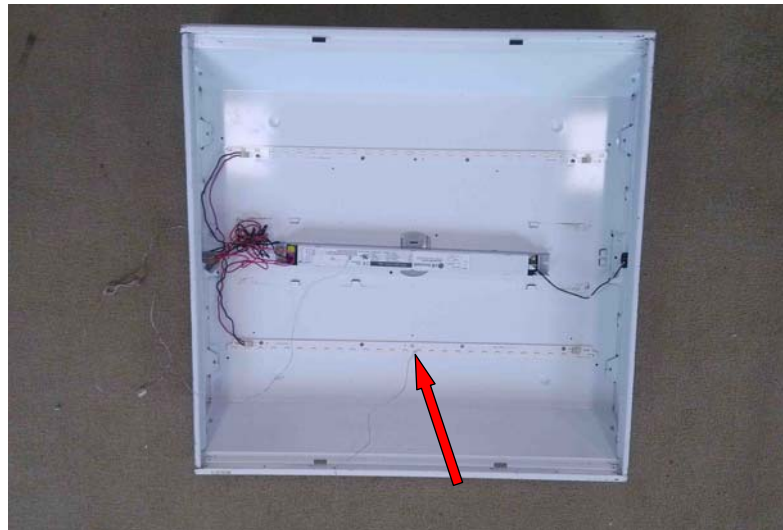
Test ambient temperature was 28.5°C.

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

To get the maximum temperature, Ts point is middle of the LED board.

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)
120.0	28.69	133.2	44.6	49.4
277.0	29.10	133.1	44.8	49.3

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 $k=2$.

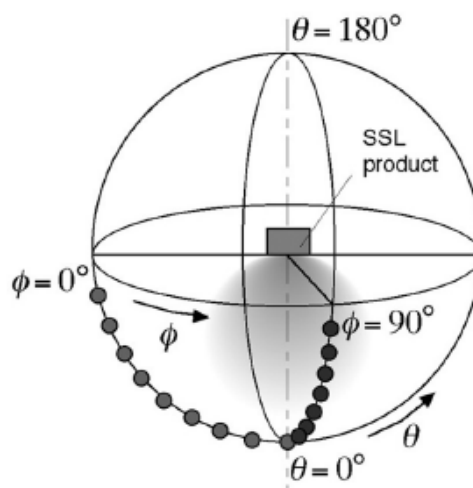
Color Characteristics Measurements

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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