



LM-79-08 Test and ISTMT Report

for

A.L.P. Lighting Components, Inc.

6333 Gross Point Road, Niles, IL 60714

1x4 LED Recessed Interior Luminaire

Model: ELNV14-3735-1

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ15100009i

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

Review by:

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Dec. 11, 2015

Approved:



1 Manager: Jim Zhang
Dec. 11, 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: ELNV14-3735-1

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
86.3	2352.2	27.25	0.9939
CCT (K)	CRI	Stabilization Time (Light & Power)	
3621	84.0	60	

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Oct. 09, 2015
Date of Test	: Nov. 27, 2015 to Dec. 10, 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	: 1x4 LED Recessed Interior Luminaire
Model	: ELNV14-3735-1
Brand Name	: A.L.P Lighting
Electrical Ratings	: AC120~277V, 50/60Hz, 37W
Product Description	: 1x4 Panel Light, 3500K, Dimmable Driver: PIFC-C201R Manufacturer of light source: LG Model of light source: LGITLED1-28-35K
Manufacturer	: A.L.P. Lighting Components, Inc.
Address	: 6333 Gross Point Road, Niles, IL 60714

TEST RESULTS

Test ambient temperature was 24.3°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)	0.228	0.108
Power Factor	0.9939	0.9219
Test Power (W)	27.25	27.68
Off-State Power (W)	0	0
THD A%	6.57	18.22
Luminous Efficacy (lm/W)	86.3	85.0
Total Luminous Flux (lm)	2352.2	2351.7
Color Rendering Index (CRI)	84.0	
R9	11	
Correlated Color Temperature (CCT) (K)	3621	
Chromaticity (Chroma x, Chroma y)	(0.3980, 0.3851)	
Chromaticity (Chroma u, Chroma v)	(0.2332, 0.3385)	
Chromaticity (Chroma u', Chroma v')	(0.2332, 0.5078)	
Duv	0.0008	
Average Beam Angle (°)	111.3	
Center Beam Candle Power (cd)	839	
Spacing Criteria	1.28 (0°-180°)/ 1.21 (90°-270°)	
Zonal Lumens in the 0°-60°Zone	79.17%	
Zonal Lumens in the 60°-90°Zone	20.65%	
Zonal Lumens in the 90°-120°Zone	0.08%	
Zonal Lumens in the 120°-180°Zone	0.10%	

Special Rendering Indices	Color
R1	83
R2	92
R3	96
R4	82
R5	83
R6	89
R7	84
R8	63
R9	11
R10	81
R11	81
R12	69
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

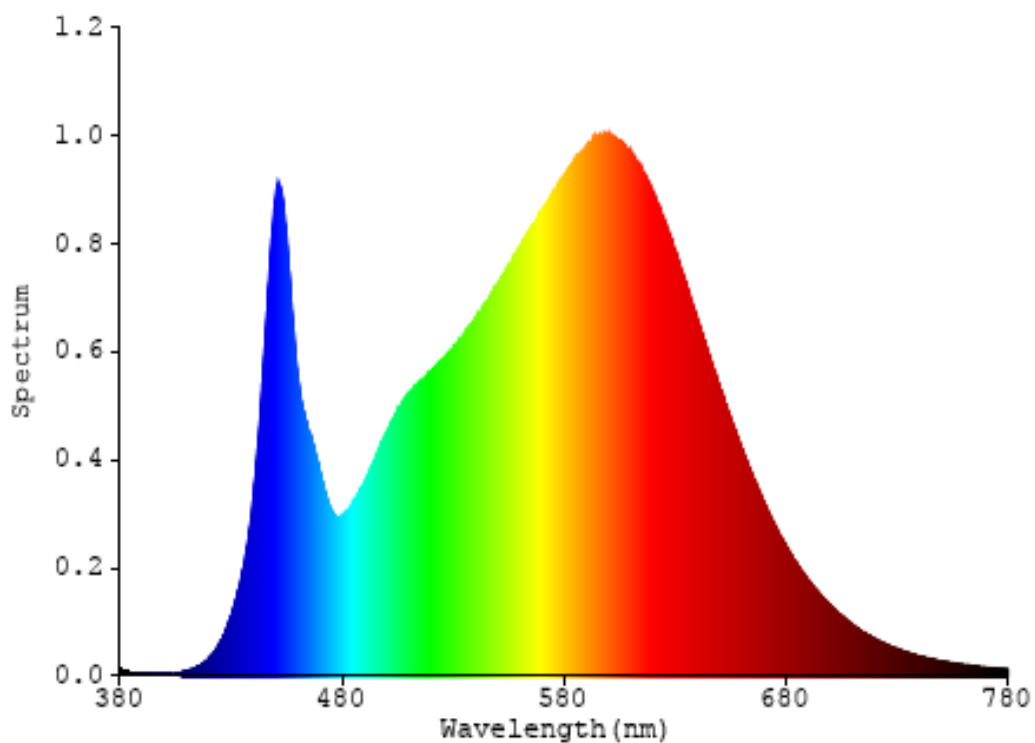


Chart 1: Spectral Power Distribution

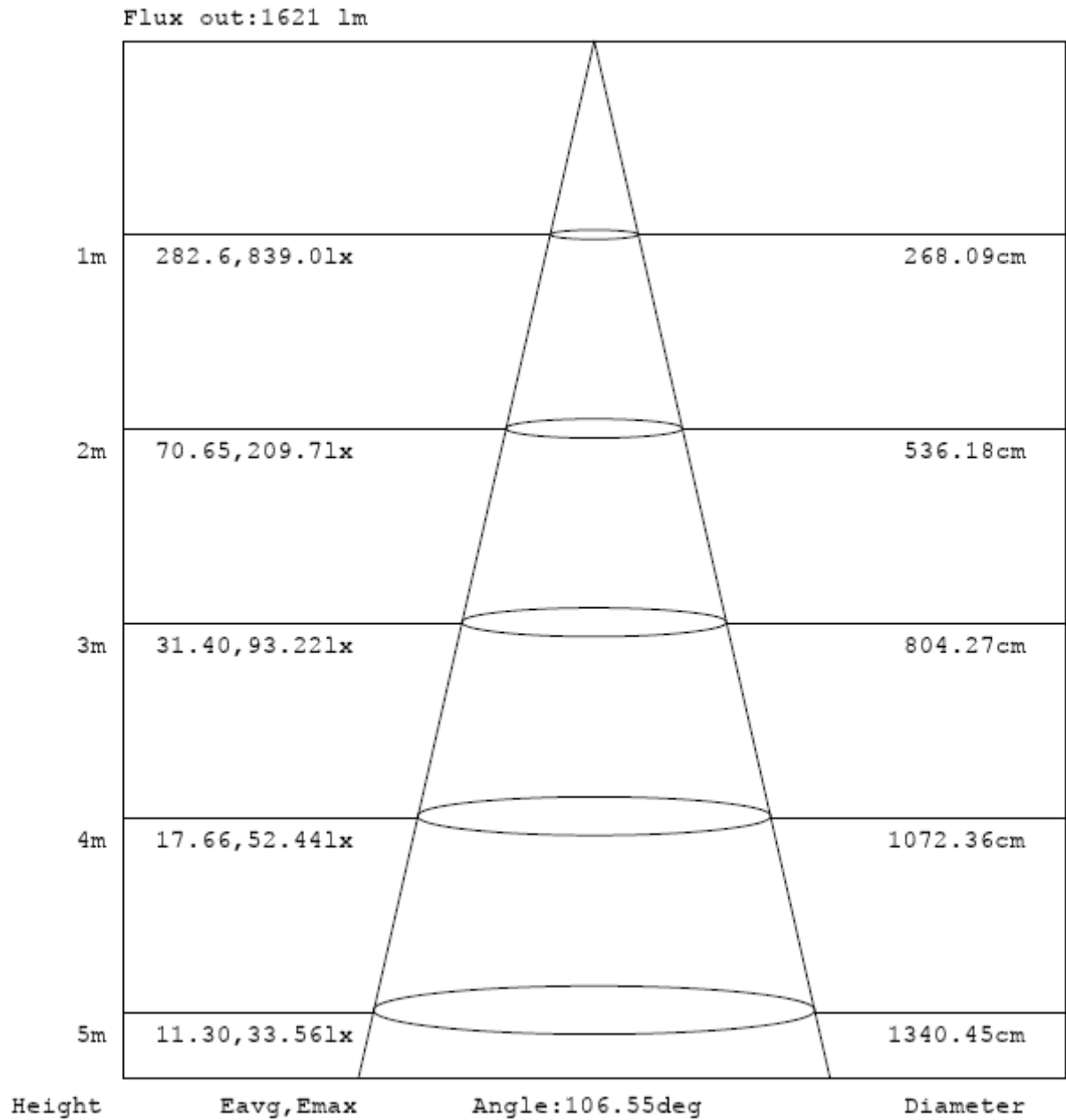
Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	79.263	3.37%
10- 20	226.13	9.61%
20- 30	341.03	14.50%
30- 40	409.613	17.41%
40- 50	423.984	18.03%
50- 60	382.227	16.25%
60- 70	287.525	12.22%
70- 80	157.803	6.71%
80- 90	40.327	1.71%
90-100	0.7	0.03%
100-110	0.653	0.03%
110-120	0.639	0.03%
120-130	0.598	0.03%
130-140	0.57	0.02%
140-150	0.481	0.02%
150-160	0.361	0.02%
160-170	0.213	0.01%
170-180	0.081	0.00%
Total	2352.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1862.247	79.17%
60- 90	485.655	20.65%
0-90	2347.902	99.82%
90- 180	4.296	0.18%
0- 180	2352.2	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

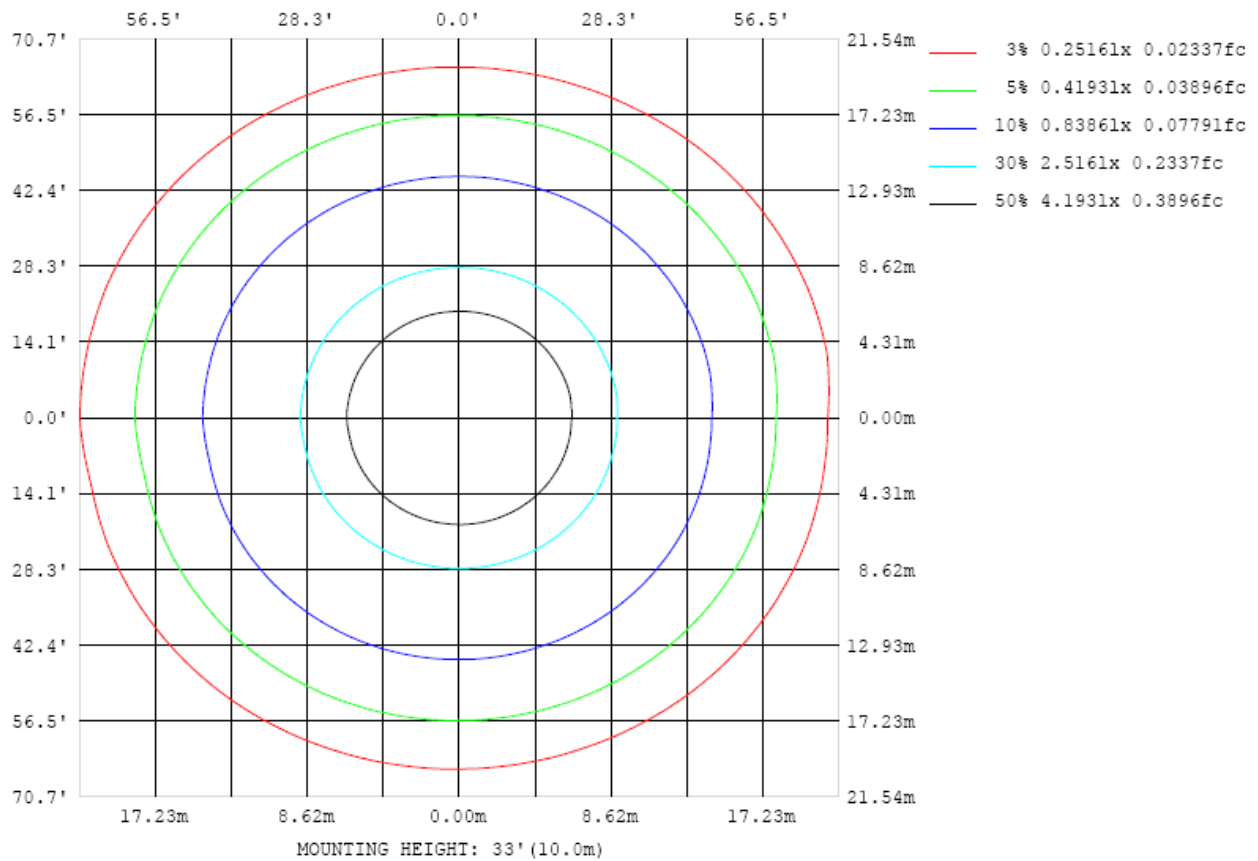


Chart 3: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots

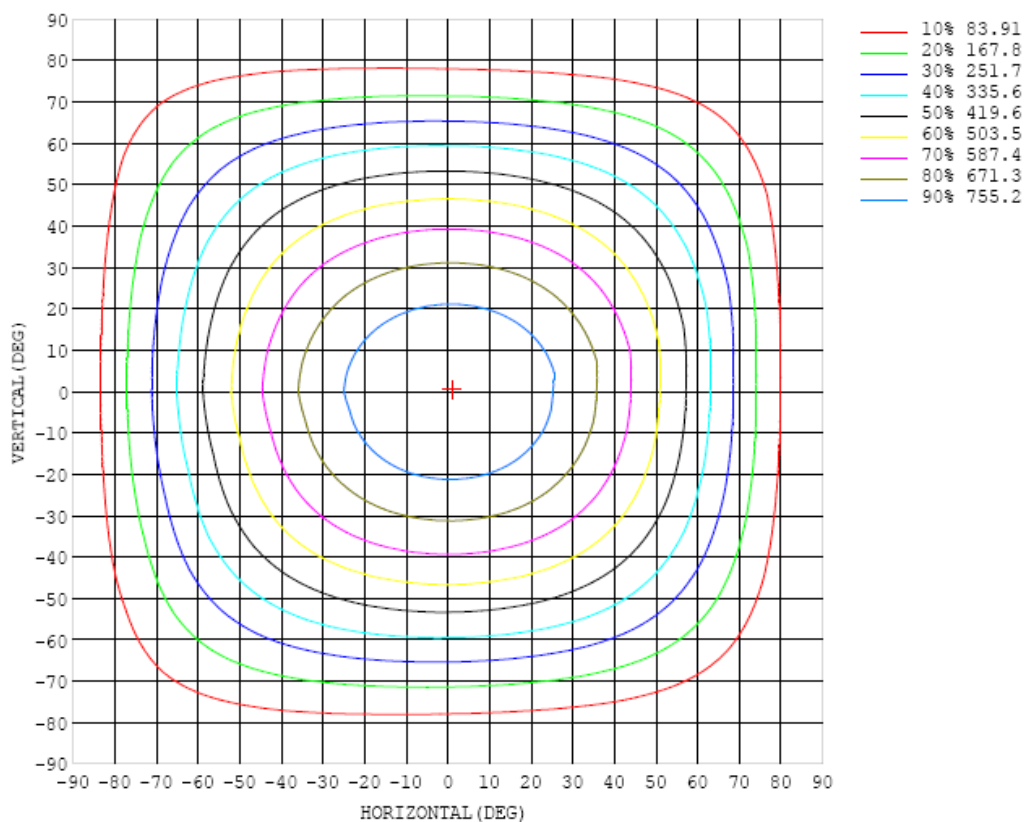


Chart 4: Isocandla Plot

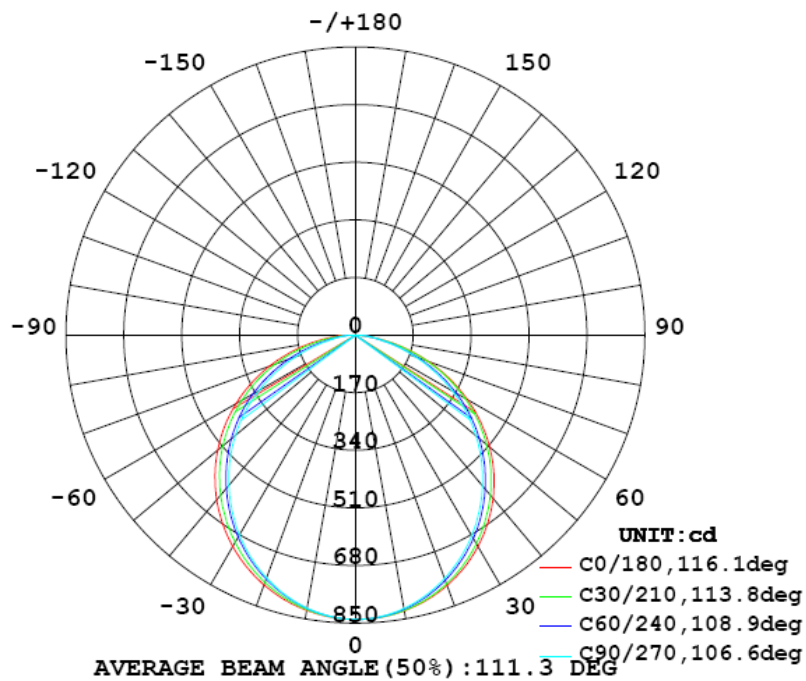


Chart 5: Polar Candela Distribution

Luminous Intensity Data

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839
5	836	836	836	836	835	835	835	834	834	834	834	834	834	834	834	834	834	834	835
10	826	826	826	825	824	823	821	820	819	819	819	819	820	821	821	821	822	823	825
15	809	810	808	807	804	802	800	797	796	795	795	796	797	799	801	803	804	804	808
20	786	786	784	781	777	774	770	767	765	764	764	765	768	770	773	776	779	780	785
25	756	756	753	749	744	739	734	730	728	727	727	729	732	735	739	744	747	749	755
30	720	719	716	710	704	698	693	688	684	683	684	686	690	695	700	705	710	713	720
35	678	677	672	666	659	652	645	639	635	634	635	638	643	649	655	661	667	671	680
40	629	628	623	616	609	600	592	586	582	581	582	585	592	599	606	613	619	623	634
45	575	573	568	562	553	544	536	529	525	523	525	529	536	544	553	561	567	571	584
50	515	513	509	503	493	484	475	468	464	463	464	469	477	486	496	505	511	515	528
55	449	448	445	438	429	419	410	403	399	398	400	406	414	424	435	444	451	454	469
60	379	378	377	370	361	351	342	334	329	328	332	339	349	360	371	381	388	389	405
65	305	305	305	298	289	279	269	261	257	257	261	268	279	291	303	314	321	323	338
70	229	232	230	223	214	204	196	190	187	187	191	198	208	220	233	244	252	254	269
75	153	157	154	147	139	131	125	122	120	121	125	131	140	150	162	173	181	185	198
80	81.3	84.4	79.9	74.5	70.2	65.6	65.2	66.3	66.3	67.4	69.0	71.3	75.5	84.9	93.6	103	111	116	130
85	20.4	20.1	18.4	21.0	23.5	25.9	28.0	29.8	31.2	32.6	34.1	35.5	36.9	38.0	38.8	40.7	47.2	52.1	65.6
90	0.75	0.74	0.45	0.40	0.42	0.13	0.07	0.02	0.03	0.16	1.08	3.40	4.35	5.24	5.65	5.49	4.98	4.38	11.5
95	1.10	1.00	0.48	0.45	0.45	0.28	0.27	0.31	0.40	0.40	0.37	0.24	0.26	0.34	0.26	0.54	0.68	0.93	0.87
100	1.19	0.92	0.44	0.41	0.46	0.31	0.38	0.47	0.48	0.48	0.46	0.33	0.29	0.35	0.30	0.54	0.61	0.89	1.19
105	0.98	0.87	0.43	0.43	0.48	0.44	0.49	0.56	0.54	0.54	0.54	0.48	0.36	0.37	0.32	0.46	0.62	0.77	1.14
110	0.75	0.84	0.48	0.57	0.66	0.54	0.62	0.60	0.59	0.60	0.59	0.56	0.48	0.41	0.36	0.47	0.57	0.70	0.96
115	0.64	0.62	0.51	0.63	0.63	0.77	0.66	0.63	0.64	0.64	0.64	0.61	0.60	0.57	0.48	0.46	0.54	0.65	0.80
120	0.64	0.61	0.54	0.61	0.71	0.72	0.70	0.67	0.68	0.69	0.69	0.66	0.64	0.64	0.55	0.48	0.59	0.63	0.69
125	0.71	0.56	0.58	0.67	0.78	0.73	0.74	0.73	0.73	0.74	0.74	0.72	0.68	0.64	0.65	0.55	0.57	0.60	0.69
130	0.78	0.63	0.65	0.77	0.78	0.75	0.76	0.77	0.76	0.77	0.78	0.76	0.71	0.68	0.73	0.63	0.62	0.63	0.64
135	0.78	0.68	0.69	0.76	0.77	0.77	0.77	0.79	0.78	0.80	0.80	0.78	0.73	0.70	0.73	0.66	0.71	0.71	0.71
140	0.79	0.68	0.67	0.77	0.74	0.77	0.79	0.80	0.79	0.80	0.80	0.79	0.76	0.72	0.72	0.66	0.70	0.69	0.83
145	0.80	0.72	0.70	0.73	0.74	0.78	0.81	0.82	0.82	0.82	0.81	0.80	0.78	0.73	0.70	0.69	0.65	0.68	0.75
150	0.61	0.56	0.66	0.78	0.81	0.79	0.80	0.82	0.84	0.84	0.80	0.80	0.78	0.75	0.74	0.72	0.56	0.52	0.69
155	0.65	0.74	0.66	0.71	0.80	0.84	0.84	0.81	0.81	0.80	0.81	0.83	0.83	0.83	0.74	0.61	0.64	0.71	0.67
160	0.69	0.78	0.69	0.75	0.71	0.76	0.83	0.84	0.85	0.85	0.85	0.82	0.77	0.72	0.65	0.65	0.66	0.65	0.67
165	0.73	0.77	0.73	0.63	0.64	0.67	0.68	0.71	0.72	0.72	0.71	0.72	0.67	0.61	0.64	0.70	0.69	0.69	0.69
170	0.77	0.79	0.79	0.78	0.75	0.72	0.75	0.75	0.78	0.72	0.72	0.78	0.80	0.78	0.75	0.74	0.74	0.74	0.74
175	0.94	0.95	0.95	0.96	0.95	0.89	0.93	0.84	0.88	0.85	0.85	0.88	0.89	0.89	0.89	0.89	0.90	0.91	0.91
180	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92

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	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839	839		
5	835	834	834	834	834	833	833	833	833	834	834	834	835	836	836	837	837		
10	824	823	822	821	820	819	818	818	818	819	820	821	822	824	826	827	828		
15	807	805	803	800	798	796	795	794	794	795	797	799	802	805	808	811	812		
20	783	780	777	773	769	766	764	763	763	764	766	770	774	778	783	787	790		
25	753	749	744	739	734	730	727	725	725	726	729	734	739	745	751	757	761		
30	718	712	706	700	694	689	684	682	681	683	687	692	699	706	713	720	725		
35	677	670	663	656	649	642	636	633	632	634	638	644	653	661	669	677	684		
40	630	623	616	608	598	590	584	580	578	580	585	592	601	611	621	629	636		
45	579	572	564	555	544	535	527	523	521	523	528	536	545	557	567	576	583		
50	524	517	508	497	486	476	468	463	460	462	467	475	485	497	509	518	524		
55	464	458	449	437	425	414	405	399	396	397	403	411	422	434	445	455	460		
60	401	395	385	373	360	348	338	330	327	328	333	342	354	366	377	387	392		
65	334	330	319	306	292	278	267	259	256	256	261	270	281	294	306	315	320		
70	267	261	250	237	222	208	197	190	186	186	190	197	207	219	232	241	246		
75	198	191	180	166	152	141	131	125	121	121	123	128	136	145	156	166	172		
80	130	122	110	98.3	87.5	76.6	71.5	69.0	67.2	66.2	66.0	66.2	68.1	75.8	83.4	91.7	99.2		
85	63.6	55.6	46.9	41.5	39.6	37.6	35.7	33.9	32.3	31.3	30.3	29.0	27.7	26.5	25.4	26.5	31.1		
90	10.0	7.68	6.45	5.70	5.20	4.70	4.20	3.70	3.20	3.10	3.00	2.90	2.80	2.70	2.60	2.50	2.40		
95	1.16	0.54	0.61	0.57	0.41	0.39	0.41	0.49	0.51	0.50	0.35	0.37	0.47	0.39	0.76	1.02	1.12		
100	1.05	0.55	0.64	0.61	0.44	0.48	0.54	0.60	0.60	0.60	0.53	0.41	0.51	0.45	0.67	0.85	1.11		
105	0.96	0.58	0.59	0.56	0.54	0.58	0.64	0.67	0.67	0.67	0.66	0.53	0.52	0.46	0.66	0.82	1.20		
110	0.85	0.56	0.64	0.68	0.59	0.66	0.68	0.70	0.70	0.70	0.69	0.66	0.59	0.50	0.62	0.72	1.11		
115	0.81	0.56	0.65	0.66	0.79	0.69	0.66	0.70	0.70	0.70	0.68	0.69	0.92	0.56	0.54	0.65	0.71		
120	0.65	0.53	0.63	0.65	0.67	0.66	0.65	0.70	0.70	0.69	0.67	0.68	0.73	0.62	0.50	0.63	0.67		
125	0.64	0.55	0.63	0.68	0.66	0.66	0.67	0.70	0.70	0.69	0.69	0.68	0.71	0.66	0.54	0.66	0.63		
130	0.57	0.58	0.70	0.72	0.70	0.69	0.70	0.73	0.73	0.72	0.74	0.71	0.70	0.71	0.60	0.72	0.68		
135	0.64	0.65	0.76	0.73	0.73	0.73	0.76	0.79	0.79	0.78	0.78	0.75	0.72	0.74	0.60	0.79	0.76		
140	0.66	0.71	0.76	0.75	0.76	0.77	0.79	0.82	0.83	0.82	0.82	0.81	0.76	0.75	0.63	0.81	0.72		
145	0.64	0.69	0.79	0.77	0.79	0.81	0.83	0.86	0.87	0.87	0.86	0.85	0.80	0.76	0.72	0.76	0.79		
150	0.58	0.60	0.83	0.83	0.81	0.83	0.86	0.88	0.91	0.89	0.89	0.87	0.83	0.85	0.69	0.55	0.56		
155	0.66	0.61	0.73	0.85	0.91	0.88	0.88	0.90	0.91	0.90	0.90	0.92	0.95	0.86	0.71	0.69	0.74		
160	0.67	0.61	0.65	0.75	0.86	0.92	0.94	0.98	0.98	1.00	0.98	0.90	0.85	0.75	0.83	0.75	0.79		
165	0.69	0.65	0.63	0.66	0.72	0.76	0.82	0.87	0.89	0.89	0.85	0.80	0.77	0.82	0.82	0.77	0.79		
170	0.75	0.75	0.73	0.73	0.72	0.75	0.79	0.76	0.76	0.79	0.87	0.87	0.87	0.84	0.82	0.80	0.77		
175	0.91	0.92	0.94	0.94	0.95	0.95	0.95	0.89	0.80	0.83	0.90	0.85	0.97	0.93	0.94	0.93	0.91		
180	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		

Table 5: Luminous Intensity Data

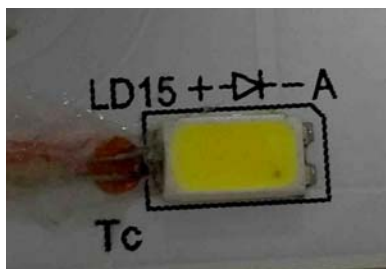
ISTMT TEST DATA:

Sample Tested: **ELNV14-3735-1**

Test ambient temperature was 22.3°C.

Test orientation was Light Down.

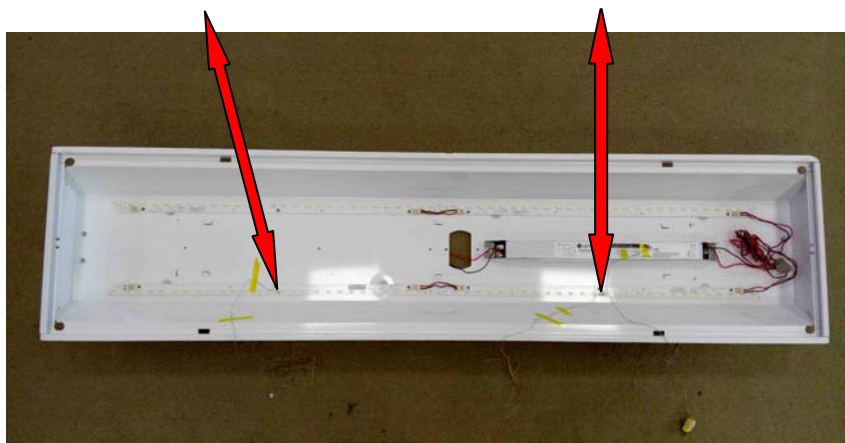
The stabilization time of the sample was 7.5 hours.



View of In-Situ Point- Ts

Point A Location- Near LED driver

Point B Location-In middle of the LED board



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	27.25	148.7	39.6	42.4	38.8
277.0	27.68	148.7	39.7	42.3	38.9

Table 6: ISTMT test data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 17, 2015	Jul. 16, 2016
Digital Power Meter	PF2010A	HZTE028-01	Jul. 17, 2015	Jul. 16, 2016
AC Power Supply	PCR 500L	HZTE001-08	Jul. 17, 2015	Jul. 16, 2016
DC Power Supply	WY12010	HZTE004-03	Jul. 17, 2015	Jul. 16, 2016
Temperature Meter	TES1310	HZTE017-01	Jul. 17, 2015	Jul. 16, 2016
Standard source	D908	HZTE012-01	Jul. 23, 2015	Jul. 22, 2016
Digital Power Meter	WT210	HZTE008-01	Jul. 17, 2015	Jul. 16, 2016
AC Power Supply	PCR 500L	HZTE001-07	Jul. 17, 2015	Jul. 16, 2016
DC Power Supply	6154	HZTE004-04	Jul. 17, 2015	Jul. 16, 2016
Temperature and humidity recorder	JR900	HZTE018-01	Jul. 21, 2015	Jul. 20, 2016
Multi-Meter	FLUKE 289	HZTE020-03	Nov. 10, 2015	Nov. 09, 2016

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 $k=2$.

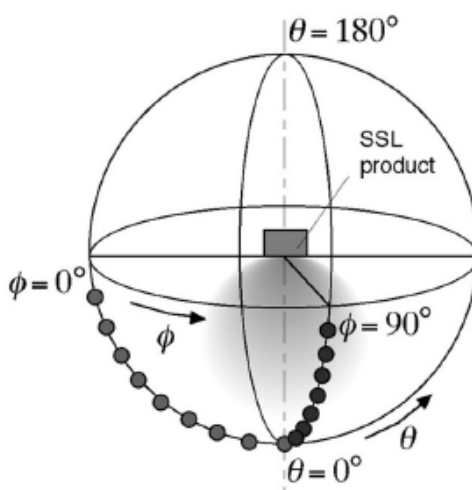
Color Characteristics Measurements

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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