



**PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08**

Sample Tested  
**LEDE-A19-60-1-30D-I**

Prepared for:

**Evan O'Sullivan**

LEDnovation, Inc.  
13053 W. Linebaugh Ave.  
Tampa, FL 33626

Phone: 813-891-9600

**Technical Report Number**  
30017067-2

December 2, 2010

**Prepared by:**

Bryan Cubitt, Technical Team Leader

**Approved by:**

Steven Longo, Technical Manager



## Program Description

Photometric and electrical testing of an “LEDE-A19-60-1-30D-I” replacement lamp to IES LM-79-08.

## Executive Summary

Sample Tested = **LEDE-A19-60-1-30D-I**

<b>Luminous Efficacy*</b> <b>(Lumens/Watt)</b>	<b>Luminous Flux*</b> <b>(Lumens)</b>	<b>Input Power*</b> <b>(Watts)</b>	<b>Power Factor*</b>
<b>70.96</b>	<b>564.1</b>	<b>7.95</b>	<b>0.783</b>

<b>CCT (K)*</b>	<b>CRI*</b>	<b>Stabilization Time</b> <b>(Light &amp; Power)</b>
<b>3116.1</b>	<b>89.8</b>	<b>45 minutes</b>

\* The above results are recorded / derived from measurements made using an Integrating Sphere



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December 2, 2010

**Sample**

The following sample was submitted for evaluation:

LEDnovation, Inc. - **LEDE-A19-60-1-30D-I**

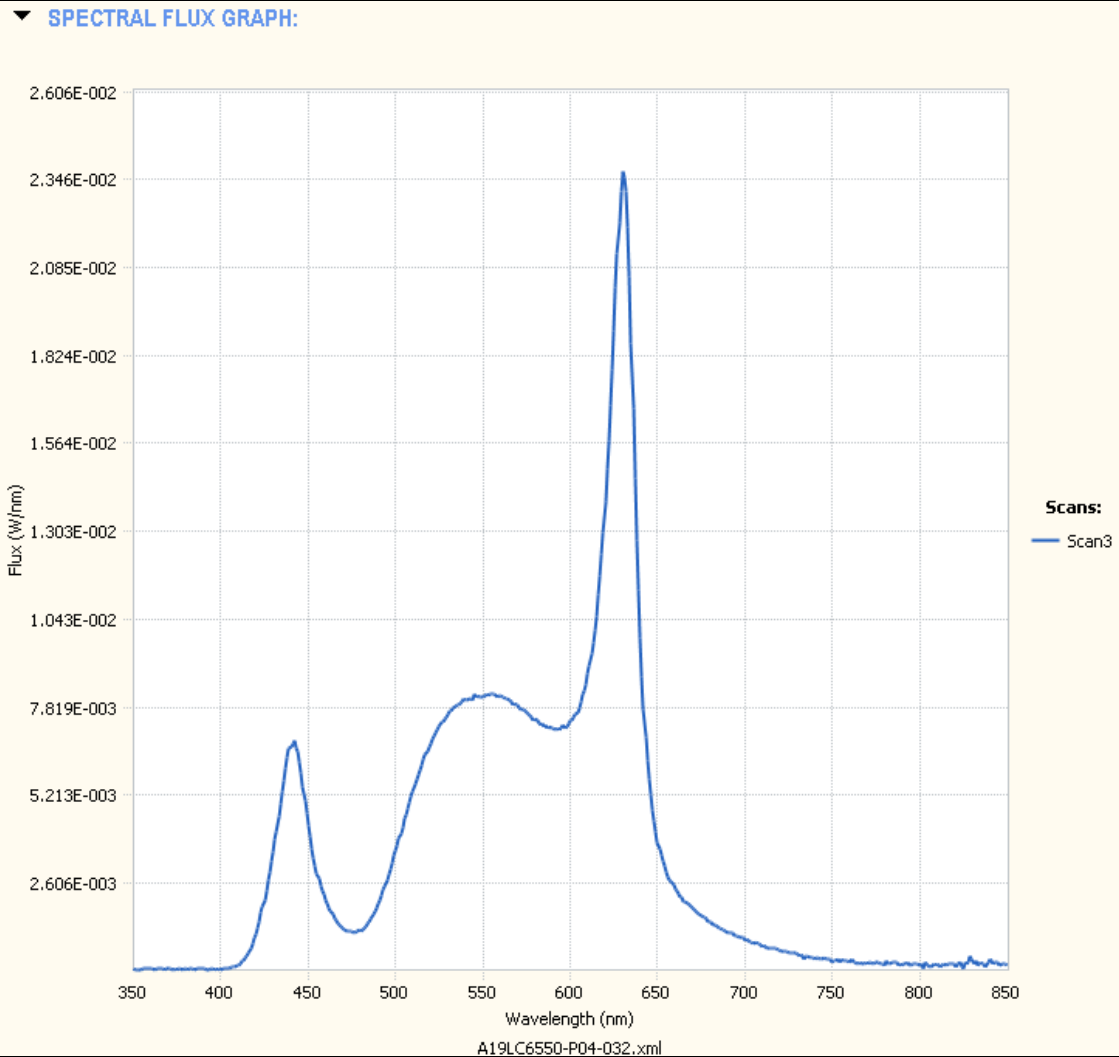


**LEDE-A19-60-1-30D-I**

<b>Test Results –</b>		
The following results were measured after stabilization of the sample in the <b>Integrating Sphere</b> (unless otherwise stated). Stability is reached when the variation of 3 readings of light output and electrical power, taken 15 minutes apart, is less than 0.50% (in accordance with IES LM-79-08).		
<b>Key Photometric Results</b>	<b>Sample Reference</b>	
	<b>LEDE-A19-60-1-30D-I</b>	
	<b>Integrating Sphere</b>	<b>Goniophotometer</b>
Luminous Efficacy (Lumens/Watt)	<b>70.96</b>	<b>69.41</b>
Total Luminous Flux (Lumens)	<b>564.1</b>	<b>548.3</b>
Total Radiant Flux (Watts)	<b>1.73</b>	
Correlated Color Temperature (CCT)	<b>3116.1</b>	
Color Rendering Index (CRI)	<b>89.8</b>	
Chromaticity (Chroma x / Chroma y)	<b>0.4287 / 0.4010</b>	
Chromaticity (Chroma u / Chroma v)	<b>0.2466 / 0.3460</b>	
Chromaticity (Chroma u' / Chroma v')	<b>0.2466 / 0.5190</b>	
D <sub>uv</sub> Value	<b>-0.00005</b>	
Stabilization Time (Light and Power)	<b>Approx. 45 minutes</b>	
Total Run Time – Integrating Sphere	<b>52 minutes</b>	
Total Run Time – Goniophotometer	<b>95 minutes</b>	
Spacing Criteria	<b>NA (0° – 180°) / NA (90° – 270°)</b>	
<b>Electrical Input Results:</b>	<b>Sample Reference</b>	
	<b>LEDE-A19-60-1-30D-I</b>	
	<b>Integrating Sphere</b>	<b>Goniophotometer</b>
Input Power (Watts)	<b>7.95</b>	<b>7.90</b>
Input Voltage (Volts AC)	<b>120.0</b>	<b>120.0</b>
Input Current (Amps)	<b>0.084</b>	<b>0.089</b>
Input Frequency (Hertz)	<b>60.0</b>	<b>60.0</b>
Power Factor	<b>0.783</b>	<b>0.737</b>
<b>Additional Information</b>	<b>Sample Reference</b>	
	<b>LEDE-A19-60-1-30D-I</b>	
Ambient Temperature	<b>25.3°C</b>	
Integrating Sphere Detector	<b>CDS 600 Spectroradiometer</b>	
Absorption Correction used?	<b>Yes</b>	

**Spectral Flux**

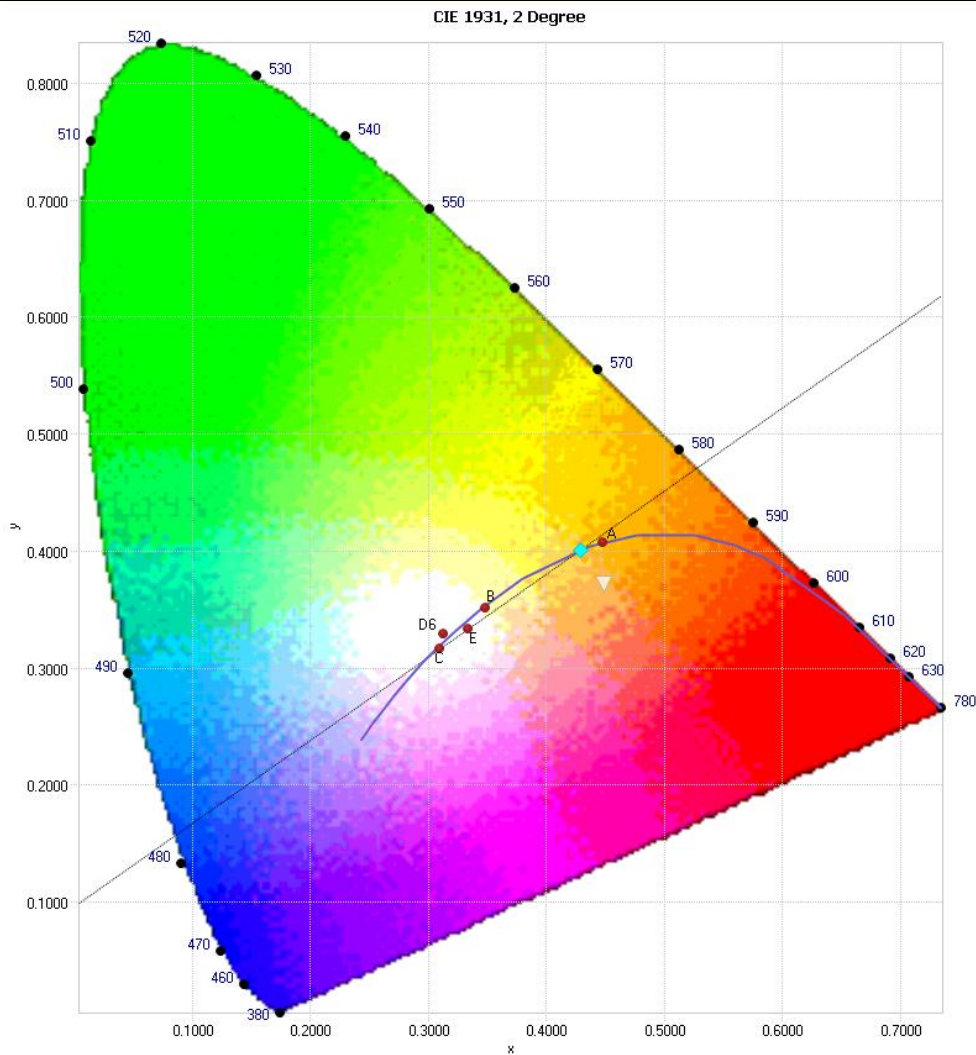
The following graph shows the spectral response curve of the radiant flux for the sample:



**Spectral response of the Radiant Flux**  
(350nm to 850nm – calibrated range of the Spectroradiometer).

**Chromaticity Diagram**

The following image shows the chromaticity diagram for the sample:



**Tristimulus values (from page 5):**  
**x / y = 0.4287 / 0.4010**

The locations on the diagram of the tristimulus coordinates are indicated by the blue diamond.

**Test Results – Flux Distribution – Zonal Lumen Summary**

The following table depicts the zonal lumen distribution for the sample:

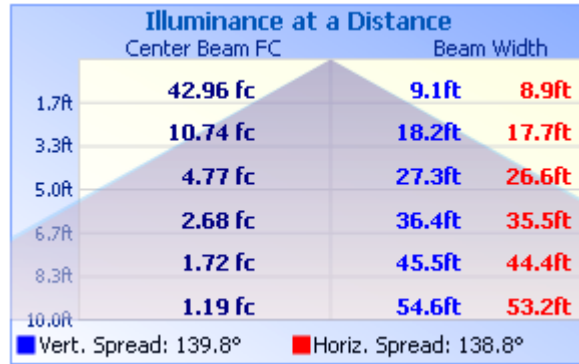
<b>Zone</b>	<b>Lumens</b>	<b>% Total</b>
0 - 10	11.2	2.0%
10 - 20	32.3	5.9%
20 - 30	50.1	9.1%
30 - 40	62.7	11.4%
40 - 50	69.6	12.7%
50 - 60	70.1	12.8%
60 - 70	64.8	11.8%
70 - 80	55.8	10.2%
80 - 90	44.4	8.1%
90 - 100	33.1	6.0%
100 - 110	23.1	4.2%
110 - 120	14.9	2.7%
120 - 130	8.8	1.6%
130 - 140	4.5	0.8%
140 - 150	2.1	0.4%
150 - 160	0.7	0.1%
160 - 170	0.2	0.0%
170 - 180	0.0	0.0%
<b>Total</b>	<b>548.3 Lumens</b>	<b>100%</b>

**Zonal Lumen Summary**

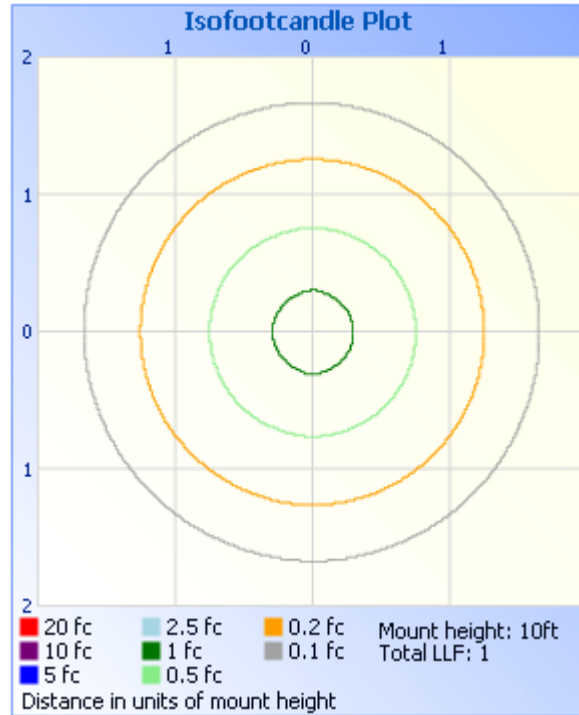
<b>Zone</b>	<b>Lumens</b>	<b>% Lamp / Luminaire</b>
0 - 60	296.1	54.0%
60 - 90	164.9	30.1%
0 - 90	461.0	84.0%
90 - 180	87.3	15.9%
0 - 180	548.3	100%

**Test Results – Illuminance Plots**

The following images depict the illuminance characteristics of the luminaire.



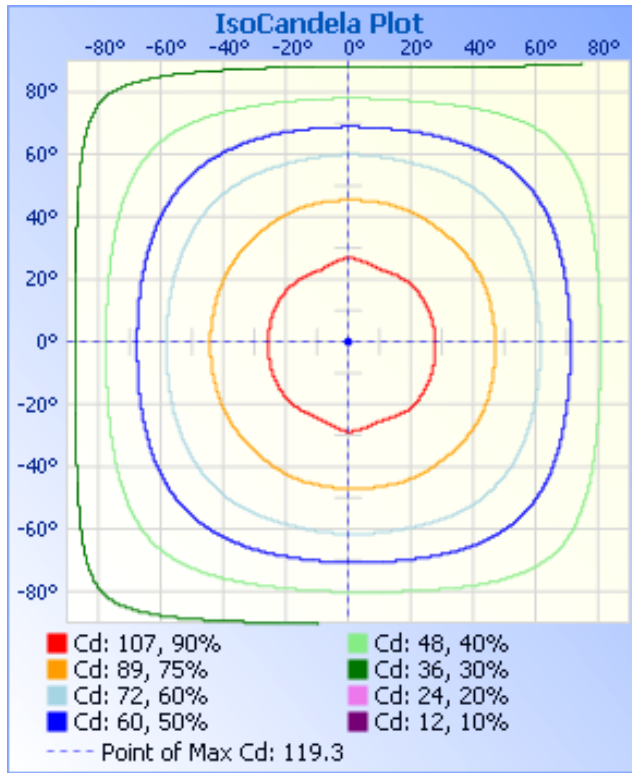
Beam Angle



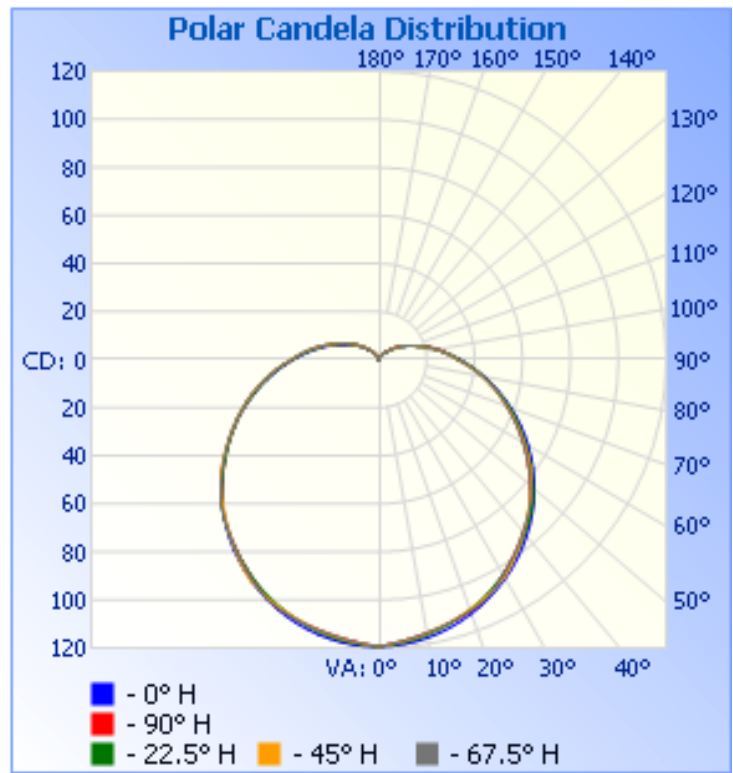
Illuminance Plot (Footcandles)

**Test Results – Candela Plots**

The following images depict the luminous intensity distribution characteristics of the luminaire.



Isocandela Plot



Polar Candela Distribution

**Test Results – Candela Tabulation**

The following table provides the tabulated Candela measurements:

	0.0	22.5	45.0	67.5	90.0	112.5	135.0	157.5	180.0	202.5	225.0	247.5	270.0	292.5	315.0	337.5	360.0
0.0	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119	119
2.5	119	119	119	118	118	118	119	119	119	119	119	119	119	118	119	119	119
5.0	119	118	118	117	117	117	118	118	119	118	118	118	118	118	118	118	119
7.5	118	117	117	116	116	117	117	118	119	118	117	117	117	117	117	117	118
10.0	117	116	116	115	115	116	116	117	118	117	116	116	116	116	116	116	117
12.5	116	115	114	114	114	115	115	116	117	116	115	115	115	115	115	115	116
15.0	115	114	113	113	114	114	114	114	116	115	114	114	114	114	114	114	115
17.5	114	112	112	112	113	112	112	113	115	113	113	113	114	113	112	113	114
20.0	113	111	111	111	112	111	111	111	113	112	112	113	113	112	111	111	113
22.5	111	109	109	110	111	110	110	110	112	110	111	112	112	111	110	109	111
25.0	109	107	108	109	108	109	108	108	110	109	109	110	110	110	108	108	109
27.5	107	105	106	106	106	106	107	106	108	107	108	108	107	107	107	106	107
30.0	105	104	105	104	103	104	105	104	106	105	107	106	105	105	105	104	105
32.5	103	101	102	101	101	101	103	102	104	103	104	103	103	103	103	102	103
35.0	101	99	100	99	99	99	100	100	102	101	102	101	101	100	100	100	101
37.5	98	97	97	96	96	96	97	98	99	99	99	99	98	98	98	97	98
40.0	96	95	94	94	94	94	95	95	97	96	96	96	96	95	95	95	96
42.5	93	92	91	91	91	92	92	93	94	94	94	94	94	93	92	93	93
45.0	91	90	88	89	89	89	89	91	92	92	91	92	92	91	90	90	91
47.5	88	87	86	86	86	87	86	88	89	89	88	89	89	88	87	88	88
50.0	85	84	83	83	83	83	84	85	86	86	86	86	86	85	84	84	85
52.5	82	81	80	80	79	80	81	82	83	83	83	83	82	82	81	81	82
55.0	79	78	77	76	76	77	78	78	80	79	80	80	79	79	79	78	79
57.5	75	74	74	73	73	74	75	75	77	76	77	77	76	75	75	74	75
60.0	72	71	71	70	70	70	71	72	73	73	74	74	73	72	72	71	72
62.5	69	68	67	66	67	67	68	69	70	70	70	70	70	69	68	68	69
65.0	65	65	64	63	63	64	65	66	67	67	67	67	67	66	65	65	65
67.5	62	62	61	60	60	61	62	63	64	64	64	64	64	63	62	62	62
70.0	59	58	57	57	57	58	59	60	60	61	61	61	61	60	59	59	59
72.5	55	55	54	54	54	55	55	56	57	57	58	58	58	57	55	55	55
75.0	52	52	51	51	51	52	52	53	54	54	55	55	55	54	52	52	52
77.5	49	48	48	48	48	49	49	50	51	51	52	52	52	50	49	49	49
80.0	46	45	45	45	45	46	46	47	48	48	49	49	48	47	46	46	46
82.5	43	42	42	42	42	43	43	44	44	45	46	46	45	44	43	43	43
85.0	40	39	39	39	39	40	41	41	42	42	43	43	42	41	40	40	40
87.5	37	37	36	36	36	37	38	38	39	39	40	40	39	38	37	37	37
90.0	34	34	33	33	33	34	35	36	36	36	37	37	36	35	34	34	34

**Test Results – Candela Tabulation**

The following table provides the tabulated Candela measurements:

	0.0	22.5	45.0	67.5	90.0	112.5	135.0	157.5	180.0	202.5	225.0	247.5	270.0	292.5	315.0	337.5	360.0
92.5	32	31	31	31	31	32	33	33	33	34	34	34	34	33	32	32	32
95	29	29	29	29	29	30	30	31	31	32	32	32	32	31	30	29	29
97.5	27	27	27	27	27	28	28	28	29	29	30	30	30	29	28	27	27
100	24	24	25	25	25	26	26	26	26	27	28	28	28	27	26	25	24
102.5	22	23	22	23	23	24	24	24	24	25	25	26	25	25	23	23	22
105	20	21	20	21	21	22	22	22	22	23	23	23	23	22	21	21	20
107.5	19	19	18	19	19	20	20	20	20	21	21	21	21	20	19	19	19
110	17	17	17	17	17	17	18	18	19	19	19	19	19	18	18	17	17
112.5	15	15	15	15	15	16	17	17	17	17	18	17	17	17	16	16	15
115	14	14	14	14	14	15	15	15	15	16	16	16	16	15	15	14	14
117.5	12	12	13	13	13	13	14	14	14	14	15	15	14	14	13	13	12
120	11	11	11	12	12	12	12	13	12	13	13	13	13	13	12	12	11
122.5	10	10	10	10	11	11	11	11	11	12	12	12	12	12	11	10	10
125	9	9	8	9	10	10	9	10	10	10	10	11	11	10	9	9	9
127.5	8	8	8	8	8	9	8	9	9	9	9	10	10	9	8	8	8
130	7	7	7	7	7	7	8	8	8	8	8	8	8	8	7	7	7
132.5	6	6	6	6	6	6	7	7	7	7	7	7	7	7	7	6	6
135	5	5	5	5	5	6	6	6	6	6	7	6	6	6	6	5	5
137.5	4	4	5	5	5	5	5	5	5	5	6	6	5	5	5	5	4
140	4	4	4	4	4	4	5	4	4	5	5	5	5	5	4	4	4
142.5	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	3	3
145	2	3	3	3	3	3	3	3	3	4	4	4	4	4	3	3	2
147.5	2	2	2	3	3	3	3	3	3	3	3	3	3	3	2	3	2
150	2	2	2	2	2	2	2	2	2	3	2	3	3	2	2	2	2
152.5	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1
155	1	1	1	1	1	1	1	2	1	2	2	2	2	1	1	1	1
157.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
160	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
162.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
165	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
167.5	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0
170	0	0	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0
172.5	0	0	0	0	1	1	0	0	0	0	1	1	1	1	1	0	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
177.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

### Photometric Testing Information

The sample was evaluated for photometric and electrical characteristics using an integrating sphere and a goniophotometer, each located in purpose-built, temperature and humidity-controlled, draft free environments.

The integrating sphere is a 65-inch diameter sphere manufactured by Labsphere (Model# LMS650) which exhibits a “ $4\pi$  geometry” configuration according to IES LM-79-08 and is applicable for all types of LED products (directional and non-directional light projections). Its spectroradiometer is an array-type detector manufactured and calibrated by Labsphere (Model# CDS600).

The integrating sphere uses self-absorption correction to eliminate errors due to mismatches between the standard reference lamp and the test samples being measured. The auxiliary lamp used to perform this task is a halogen type lamp powered by a calibrated *Lamp Power Supply* manufactured and calibrated by Labsphere (model LPS 200). Ambient temperature (for photometric analysis) is measured using a “J-Type” thermocouple located inside the integrating sphere at the same height as the sample under test and not more than 1 meter in horizontal distance away from the sample. The thermocouple is located behind the baffle of the photo detector in order to eliminate any direct optical radiation from the sample under test.

#### Luminaire Stabilization.

The sample was placed inside the integrating sphere and powered by a regulated and conditioned 120.0 Volt, alternating current supply. The correlated color temperature, color rendering index, chromaticity coordinates and electrical power measurements contained in this report are the numeric **averages** of the three readings upon which stabilization is verified. The stabilization times shown on the results pages of this report denote the time of the 1<sup>st</sup> measurement (of the 3 consecutive readings) since this is the minimum time that the sample is assumed to have taken to reach stabilization.

The integrating sphere is calibrated using a quartzline halogen lamp with the following specifications:

Manufacturer: Sylvania

Model# 75Q/CL-28V

Voltage = 28.0 Volt

Wattage = 75.0 Watts

Calibration Current = 2.679 Amperes

Luminous Flux = 1538.8 Lumens

Calibration Date = 8-18-2005 (calibrated by Labsphere – NIST traceable).

Continued.....

**Photometric Testing Information** (continued)

The goniophotometer is calibrated using a frosted tungsten filament FDS/DZE lamp with the following specifications:

Manufacturer: General Electric  
 Part Number: CSB-110  
 Bulb Number: 108-A  
 Voltage: 24.0 Volts  
 Wattage: 150.0 Watts  
 Calibration Current: 4.799 Amperes  
 Luminous Intensity: 150.3 Candelas  
 Calibration Date: 4-14-2009 (NIST traceable)

A *Power Analyzer* was used to measure all electrical characteristics of the sample.

**Equipment List:**

Description	Manufacturer and Model Number	OnSpeX Instrument Reference Number	Calibration Due Date
Integrating Sphere 65"	Labsphere LMS650	IS100	N/A
Spectroradiometer	Labsphere CDS600	CDS600	5-20-2011
Auxiliary Lamp PSU	Labsphere LPS200	LPS200	2-16-2011
Power Analyzer	Voltech PM1000+	PA110	4-27-2011
Power Analyzer	Yokogawa WT210	PA107	3-23-2011
Regulated Power Supply	California Instruments 1001P	AC100	N/A
Regulated Power Supply	Chroma Instruments 61602	AC300	N/A
Thermometer (Thermocouple)	Fluke 52	TH100	8-04-2011

All equipment is calibrated by TMI (Technical Maintenance, Inc.) ISO / IEC 17025-2005 Accredited (Cert. 1378.01) except: Labsphere CDS600 and Labsphere LPS200 which is calibrated by Labsphere, USA.