PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested
iPAR30S27161N

Prepared for:

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Technical Report Number
30019342

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Program Description

Photometric and electrical testing of an "iPAR30S27161N" replacement lamp to IES LM-79-08.

Executive Summary

Sample Tested = iPAR30S27161N

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
52.27	623.7	11.932	0.920

CCT (K)*	CRI*	Stabilization Time (Light & Power)
2750.7	82.1	66 minutes

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

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Sample
The following sample was submitted for evaluation:
MSI SSL – **iPAR30S27161N**

iPAR30S27161N

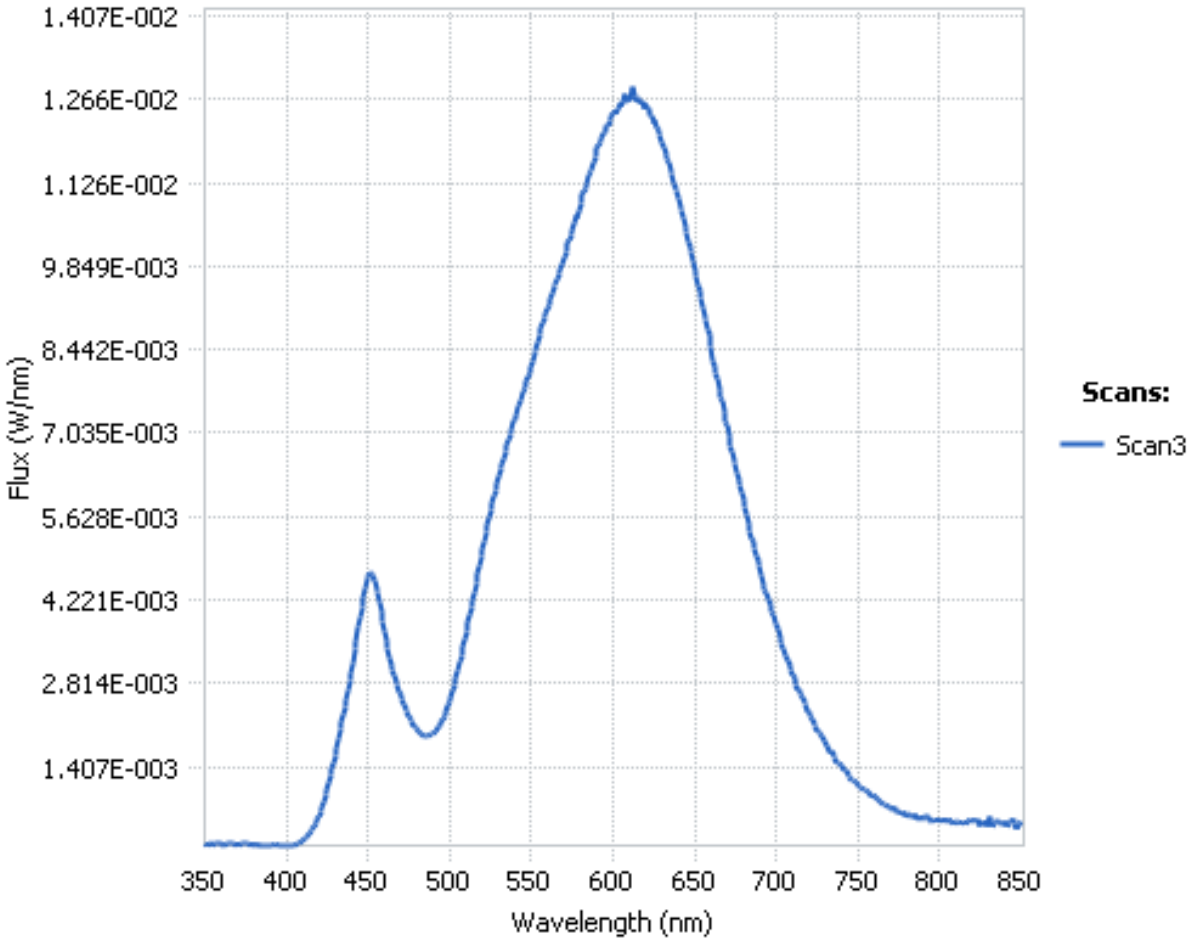
Test Results –

The following results were measured after stabilization of the sample in the **Integrating Sphere** (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).

Key Photometric Results	**Sample Reference**	
	iPAR30S27161N	
	Integrating Sphere	**Goniophotometer**
Luminous Efficacy (Lumens/Watt)	**52.27**	**51.65**
Total Luminous Flux (Lumens)	**623.7**	**625.05**
Total Radiant Flux (Watts)	**11.932**	
Correlated Color Temperature (CCT)	**2750.7**	
Color Rendering Index (CRI)	**82.1**	
R9 Value	**22.8**	
Chromaticity (Chroma x / Chroma y)	**0.4550 / 0.4085**	
Chromaticity (Chroma u / Chroma v)	**0.2603 / 0.3505**	
Chromaticity (Chroma u' / Chroma v')	**0.2603 / 0.5258**	
D_{uv} Value	**-0.00037**	
Stabilization Time (Light and Power)	**Approx. 63 minutes**	
Total Run Time – Integrating Sphere	**66 minutes**	
Total Run Time – Goniophotometer	**132 minutes**	
Spacing Criteria	**0.28 (0° – 180°) / 0.28 (90° – 270°)**	
Electrical Input Results:	**Sample Reference**	
	iPAR30S27161N	
	Integrating Sphere	**Goniophotometer**
Input Power (Watts)	**11.932**	**12.1**
Input Voltage (Volts AC)	**120.0**	**120.0**
Input Current (Amps)	**0.108**	**0.112**
Input Frequency (Hertz)	**60.0**	**60.0**
Power Factor	**0.920**	**0.900**
Additional Information	**Sample Reference**	
	iPAR30S27161N	
Ambient Temperature	**24.5°C**	
Integrating Sphere Detector	**CDS 600 Spectroradiometer**	
Absorption Correction used?	**Yes**	

Spectral Flux

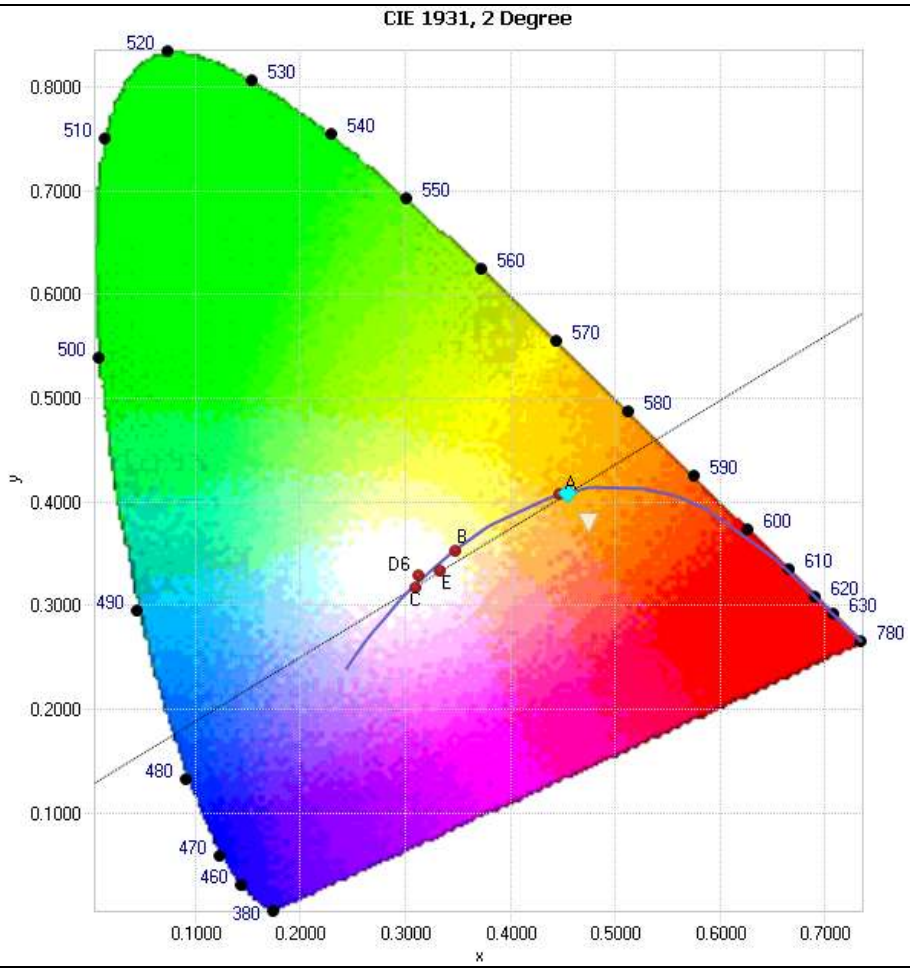
The following graph shows the spectral response curve of the radiant flux for the sample:



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 6):
x / y = 0.4550 / 0.4085

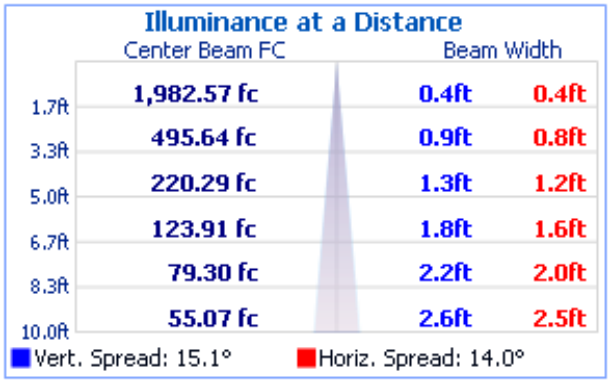
The locations on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Test Results – Flux Distribution – Zonal Lumen Summary		
The following table depicts the zonal lumen distribution for the sample:		
Zone	**Lumens**	**% Total**
0 - 10	**320.8**	**51.30%**
10 - 20	**128.8**	**20.60%**
20 - 30	**70.6**	**11.30%**
30 - 40	**27.3**	**4.40%**
40 - 50	**21.1**	**3.40%**
50 - 60	**19.8**	**3.20%**
60 - 70	**16**	**2.60%**
70 - 80	**9.5**	**1.50%**
80 - 90	**3**	**0.50%**
90 - 100	**1.1**	**0.20%**
100 - 110	**1.1**	**0.20%**
110 - 120	**1**	**0.20%**
120 - 130	**0.8**	**0.10%**
130 - 140	**0.8**	**0.10%**
140 - 150	**1**	**0.20%**
150 - 160	**1.1**	**0.20%**
160 - 170	**0.8**	**0.10%**
170 - 180	**0.3**	**0%**
Total	**625.05 Lumens**	**100%**

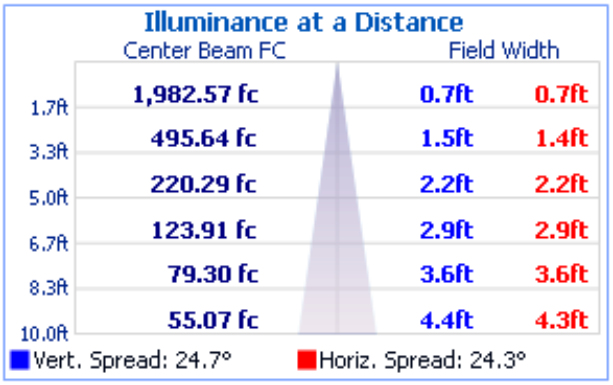
Zonal Lumen Summary		
Zone	**Lumens**	**% Lamp / Luminaire**
0 - 60	**588.4**	**94.1 %**
60 - 90	**28.5**	**4.6 %**
0 - 90	**616.9**	**98.7 %**
90 - 180	**8.2**	**1.3 %**
0 - 180	**625.1**	**100 %**

Test Results – Illuminance Plots

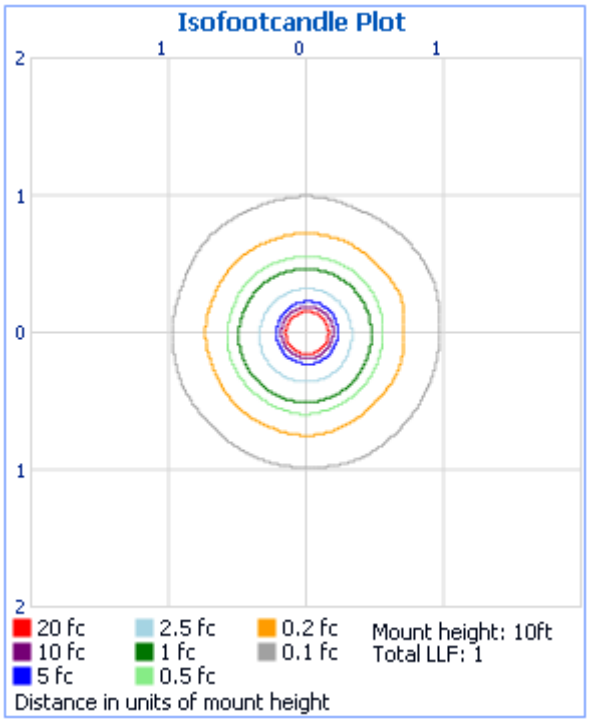
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



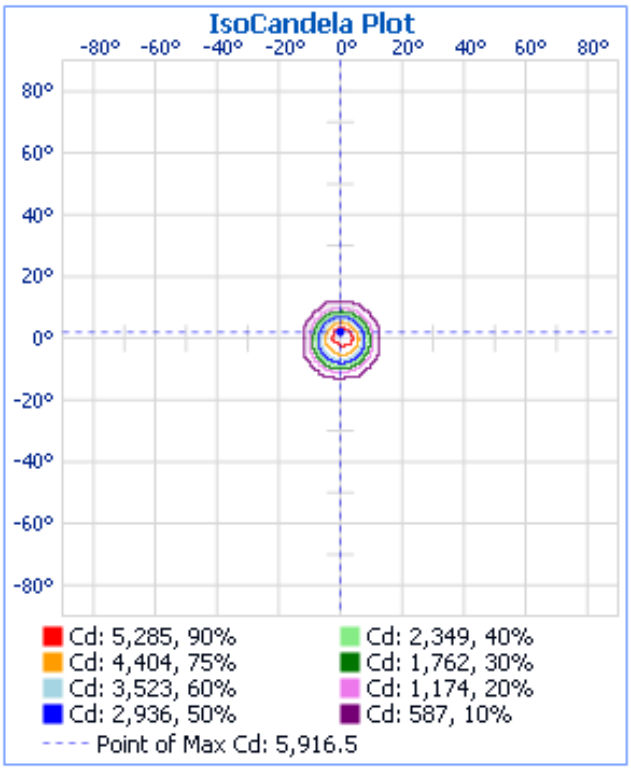
Field Angle



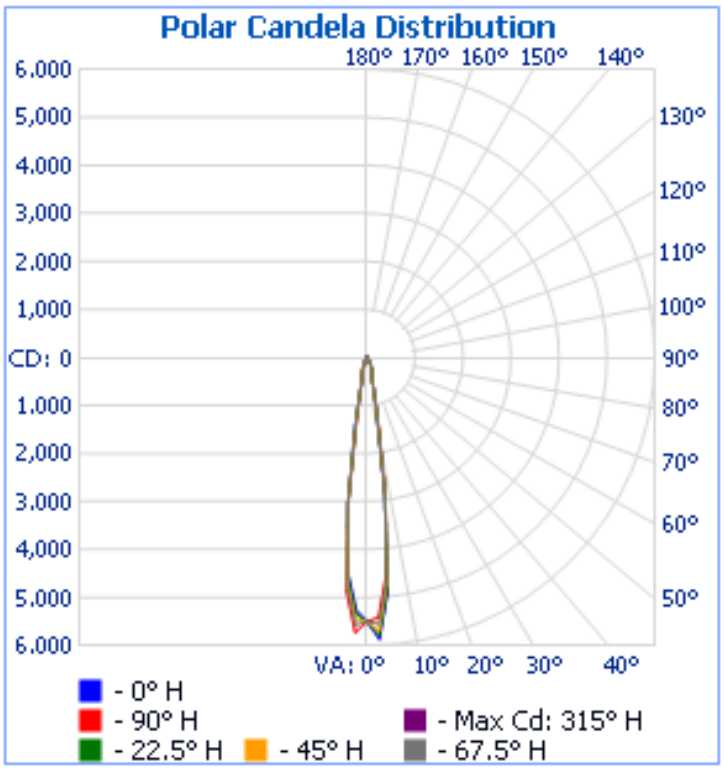
Illuminance Plot (Footcandles)

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	5507	5507	5507	5507	5507	5507	5507	5507	5507	5507	5507	5507	5507	5507	5507	5507	5507
2.5	5872	5800	5712	5561	5422	5277	5181	5215	5261	5345	5460	5574	5735	5851	5916	5907	5866
5.0	4897	4852	4732	4666	4556	4564	4549	4534	4542	4607	4711	4796	4898	4903	4874	4874	4883
7.5	2811	2826	2865	2848	2923	3033	3107	3155	3101	3050	3058	3045	2995	2856	2781	2773	2806
10.0	1091	1120	1139	1153	1225	1332	1410	1453	1421	1342	1311	1251	1204	1150	1077	1050	1088
12.5	515	529	519	514	534	566	600	607	592	570	557	551	535	518	506	499	505
15.0	390	389	375	366	364	374	384	386	383	375	376	383	387	389	386	390	390
17.5	337	332	324	310	304	303	306	307	309	310	313	320	327	336	338	339	336
20.0	288	281	267	252	245	244	247	244	244	249	255	265	280	286	287	289	288
22.5	234	225	208	195	188	188	187	187	186	193	199	212	226	230	231	234	234
25.0	177	166	151	141	133	137	137	137	136	142	150	157	170	173	173	177	177
27.5	124	110	100	92	89	96	99	97	94	99	108	111	117	124	121	123	124
30.0	83	72	64	61	60	67	69	69	69	69	76	73	78	82	77	80	83
32.5	57	50	44	47	43	49	48	51	52	51	54	52	56	56	53	57	57
35.0	44	40	36	38	36	40	38	40	41	40	42	41	44	41	42	42	44
37.5	36	34	33	33	33	36	33	34	35	35	36	34	36	33	35	34	36
40.0	31	31	30	29	31	32	30	30	31	31	32	30	31	30	31	30	31
42.5	28	29	28	27	28	30	29	27	29	29	31	28	28	28	28	28	28
45.0	27	28	26	26	26	28	28	27	28	28	28	27	27	27	26	27	27
47.5	25	25	25	25	26	27	27	26	28	26	27	26	25	25	25	26	25
50.0	24	24	23	24	26	26	26	25	27	25	25	24	23	24	23	24	24
52.5	23	24	22	23	24	25	24	25	25	24	24	23	22	24	22	22	23
55.0	22	22	21	22	23	24	23	24	23	23	22	22	21	21	20	21	22
57.5	20	20	20	21	22	23	22	22	23	22	21	20	20	20	19	20	20
60.0	19	19	18	20	21	21	21	20	21	20	20	18	18	19	18	18	19
62.5	17	17	17	19	19	19	19	19	19	19	18	17	17	17	17	17	17
65.0	15	15	15	17	17	17	17	17	17	17	16	15	15	15	16	16	15
67.5	14	14	14	15	15	16	15	15	15	15	15	14	13	14	14	14	14
70.0	12	12	12	13	13	14	14	13	13	13	13	12	12	12	12	12	12
72.5	10	10	10	11	11	12	12	12	12	11	11	10	10	10	10	10	10
75.0	8	8	8	9	9	10	10	10	9	10	9	9	8	8	8	8	8
77.5	7	6	6	7	7	8	8	8	8	8	8	7	7	7	6	6	7
80.0	5	5	5	5	6	6	6	6	6	6	6	6	5	5	5	5	5
82.5	3	3	3	3	4	4	5	5	4	4	4	4	4	3	3	3	3
85.0	2	2	2	2	2	3	4	3	3	3	3	3	2	2	2	2	2
87.5	1	1	1	1	1	2	2	2	1	2	2	2	2	1	1	1	1
90.0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1

Continued…..

Test Results – Candela Tabulation Cont.

	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	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
95.0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
97.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
100.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
102.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
105.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
107.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
110.0	1	2	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
112.5	2	2	1	1	1	1	1	0	0	1	1	1	1	1	1	1	2
115.0	1	2	1	1	1	1	1	1	0	1	1	1	2	1	1	1	1
117.5	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
120.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
122.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
125.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
127.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
130.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
132.5	2	2	1	1	1	1	1	0	0	0	1	1	1	1	1	1	2
135.0	2	2	1	1	1	1	1	0	0	0	1	1	1	1	1	1	2
137.5	2	2	1	1	1	1	1	0	0	0	1	1	1	1	2	2	2
140.0	2	2	2	2	1	1	1	0	0	0	1	1	2	1	2	2	2
142.5	3	2	2	2	1	1	1	0	0	0	1	1	2	2	2	2	3
145.0	4	3	2	2	1	1	1	0	0	0	1	1	2	2	3	3	4
147.5	4	3	2	2	2	1	1	0	0	0	1	1	2	2	3	3	4
150.0	4	4	3	3	2	1	1	0	0	0	1	2	2	3	3	4	4
152.5	4	4	4	3	2	1	1	0	0	0	1	2	2	3	4	4	4
155.0	5	4	4	3	2	2	1	0	0	0	1	2	3	3	4	4	5
157.5	5	5	4	4	3	2	1	0	0	0	1	2	3	4	4	4	5
160.0	5	5	5	4	3	2	1	1	1	1	1	2	2	3	4	4	5
162.5	5	5	4	4	3	2	2	1	1	1	2	2	3	3	4	4	5
165.0	5	5	4	4	3	2	2	1	1	1	2	3	3	3	4	4	5
167.5	4	4	4	4	3	3	2	2	2	2	3	3	3	3	4	4	4
170.0	4	4	4	4	3	3	3	3	2	3	3	3	3	3	4	4	4
172.5	4	4	4	4	3	3	3	3	3	2	3	3	3	3	4	4	4
175.0	4	4	4	3	3	3	3	2	2	2	2	3	3	3	3	4	4
177.5	3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
180.0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	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 76-inch diameter sphere manufactured by Labsphere (Model# LMS760) which exhibits a "4π 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 1st 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).

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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.

CSA is an accredited Test Laboratory (TL-430)
to IESNA LM79-08 by IAS
(International Accreditation Service)

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Equipment List:

Description	Manufacturer and Model Number	CSA Instrument Reference Number	Calibration Due Date
Integrating Sphere 76”	Labsphere LMS760	SPH200	N/A
Spectroradiometer	Labsphere CDS600	CDS600	5/2012
Auxiliary Lamp PSU	Labsphere LPS200	LPS200	2/2012
Power Analyzer	Yokogawa WT210	PA111	1/2012
Power Analyzer	Yokogawa WT210	PA108	5/2012
Regulated Power Supply	Chroma Instruments 61603	AC303	N/A
Regulated Power Supply	Chroma Instruments 61602	AC301	N/A
Thermometer (Thermocouple)	Fluke 52	TH100	8/2011

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