



PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested
iPAR30S27221N

Prepared for:

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Program Description

Photometric and electrical testing of an “iPAR30S27221N” replacement lamp to IES LM-79-08.

Executive Summary

Sample Tested = iPAR30S27221N

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
53.01	635.6	11.99	0.920

CCT (K)*	CRI*	Stabilization Time (Light & Power)
2757.9	80.9	56 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 – iPAR30S27221N



iPAR30S27221N

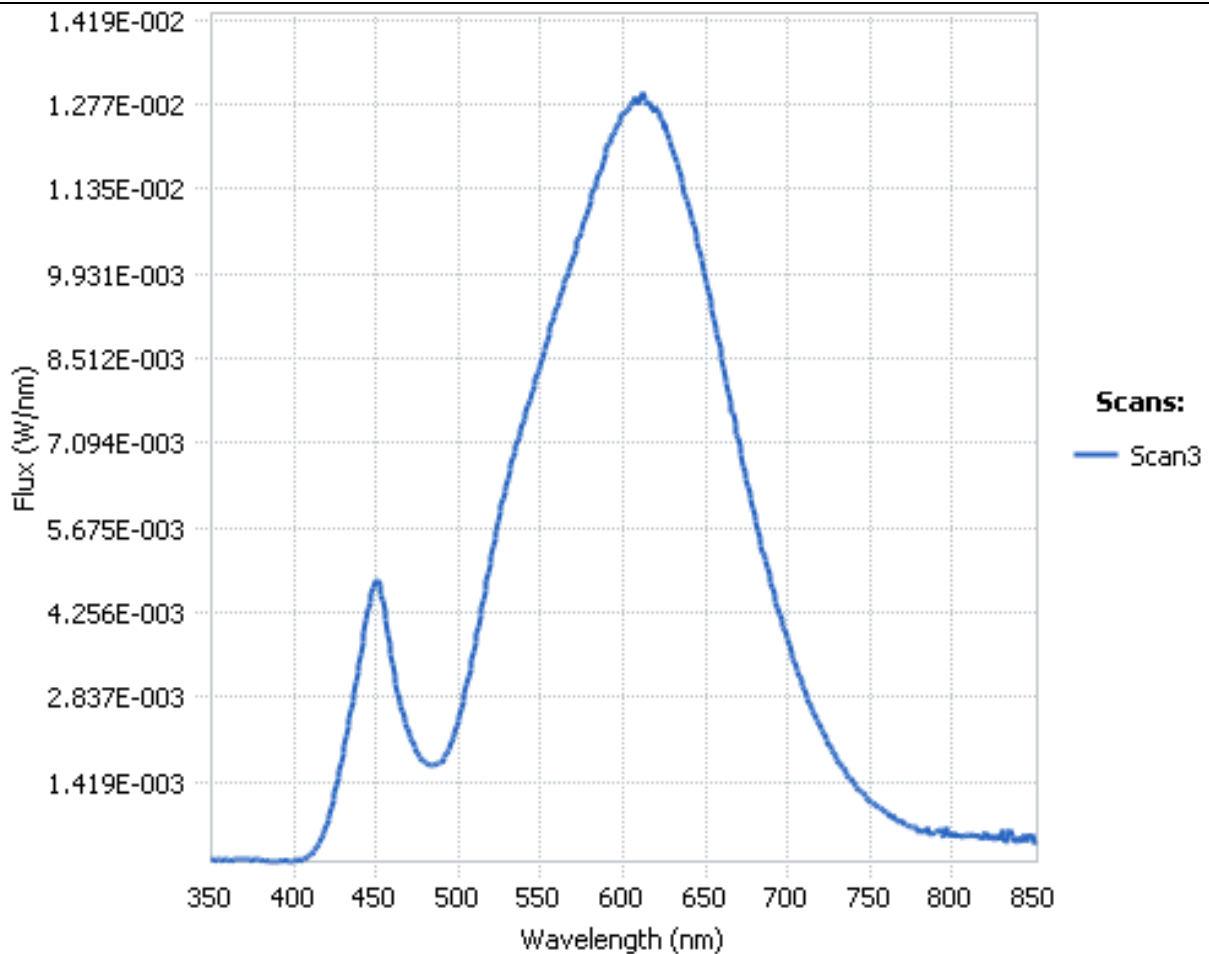


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Test Results –		
The following results were measured after stabilization of the sample in the Integrating Sphere (unless otherwise stated). Stability is reached when the variation of 3 readings of light output and electrical power, taken 15 minutes apart, is less than 0.50% (in accordance with IES LM-79-08).		
Key Photometric Results	Sample Reference	
	iPAR30S27221N	
	Integrating Sphere	Goniophotometer
Luminous Efficacy (Lumens/Watt)	53.01	53.03
Total Luminous Flux (Lumens)	635.6	636.47
Total Radiant Flux (Watts)	11.99	
Correlated Color Temperature (CCT)	2757.9	
Color Rendering Index (CRI)	80.9	
R9 Value	19.4	
Chromaticity (Chroma x / Chroma y)	0.4554 / 0.4100	
Chromaticity (Chroma u / Chroma v)	0.2599 / 0.3510	
Chromaticity (Chroma u' / Chroma v')	0.2599/ 0.5265	
D _{uv} Value	0.00020	
Stabilization Time (Light and Power)	Approx. 56 minutes	
Total Run Time – Integrating Sphere	60 minutes	
Total Run Time – Goniophotometer	128 minutes	
Spacing Criteria	0.28 (0° – 180°) / 0.28 (90° – 270°)	
Electrical Input Results:	Sample Reference	
	iPAR30S27221N	
	Integrating Sphere	Goniophotometer
Input Power (Watts)	11.99	12.0
Input Voltage (Volts AC)	120.0	120.0
Input Current (Amps)	0.108	0.115
Input Frequency (Hertz)	60.0	60.0
Power Factor	0.920	0.872
Additional Information	Sample Reference	
	iPAR30S27221N	
Ambient Temperature	23.5°C	
Integrating Sphere Detector	CDS 600 Spectroradiometer	
Absorption Correction used?	Yes	

Spectral Flux

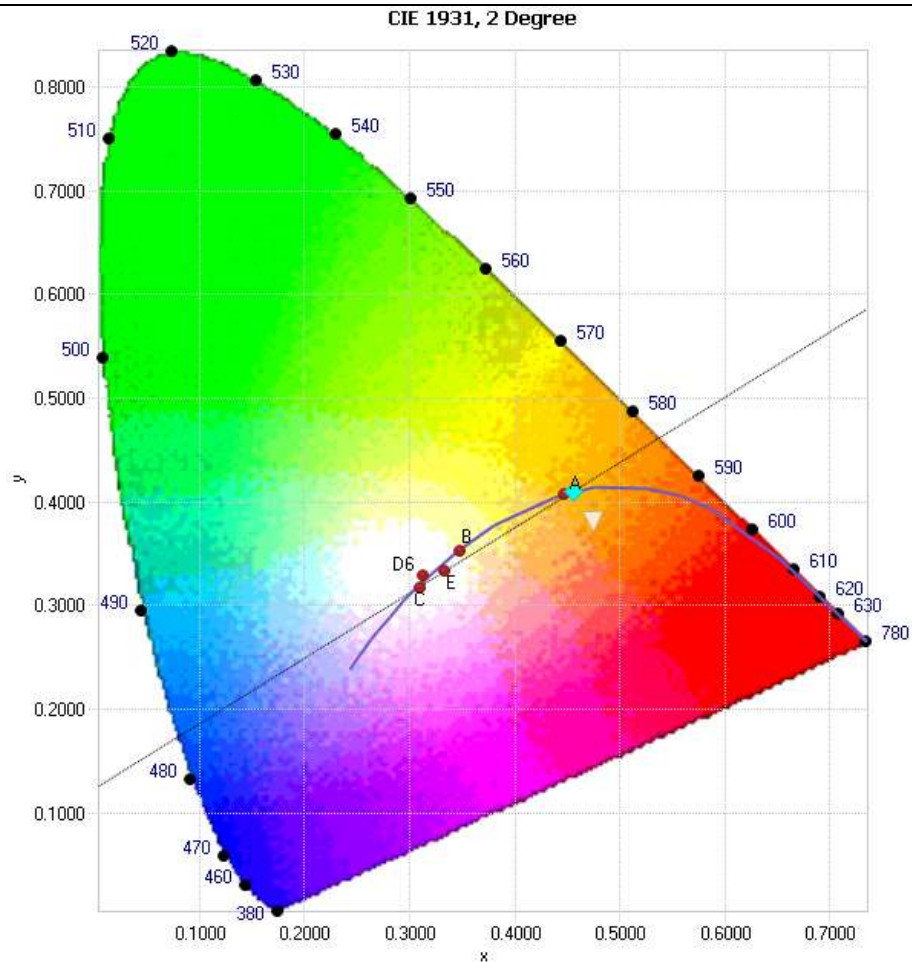
The following graph shows the spectral response curve of the radiant flux for the sample:



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):
 $x / y = 0.4554 / 0.4100$

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



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Test Results – Flux Distribution – Zonal Lumen Summary

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

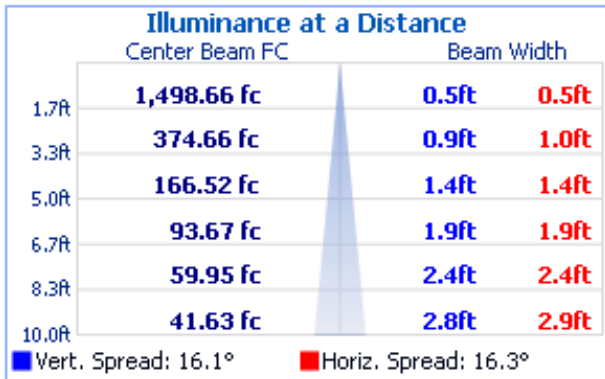
Zone	Lumens	% Total
0 - 10	239.4	37.60%
10 - 20	219.5	34.50%
20 - 30	70.5	11.10%
30 - 40	24.2	3.80%
40 - 50	19.5	3.10%
50 - 60	18.8	2.90%
60 - 70	17	2.70%
70 - 80	14	2.20%
80 - 90	4.8	0.80%
90 - 100	1.2	0.20%
100 - 110	1.2	0.20%
110 - 120	1.1	0.20%
120 - 130	0.9	0.10%
130 - 140	0.9	0.10%
140 - 150	1	0.20%
150 - 160	1.2	0.20%
160 - 170	0.8	0.10%
170 - 180	0.3	0%
Total	636.47 Lumens	100%

Zonal Lumen Summary

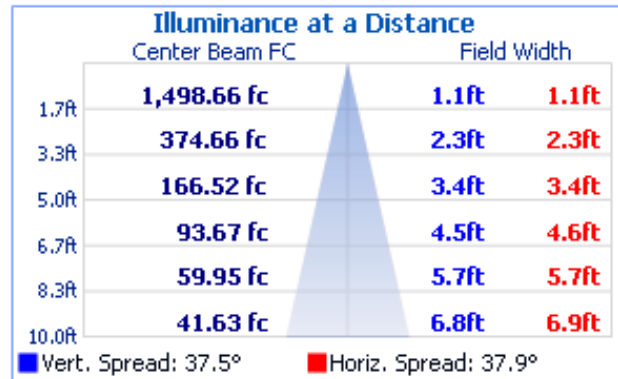
Zone	Lumens	% Lamp / Luminaire
0 - 60	591.9	93.0 %
60 - 90	35.9	5.6 %
0 - 90	627.8	98.6 %
90 - 180	4.8	1.5 %
0 - 180	636.5	100 %

Test Results – Illuminance Plots

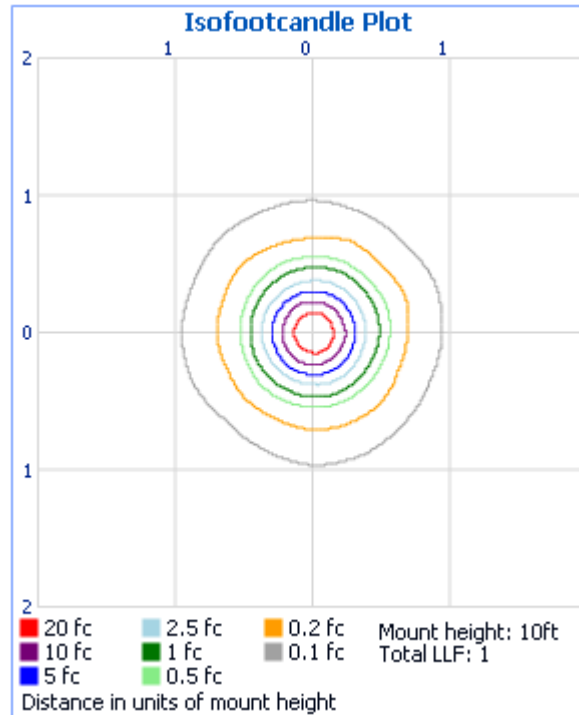
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



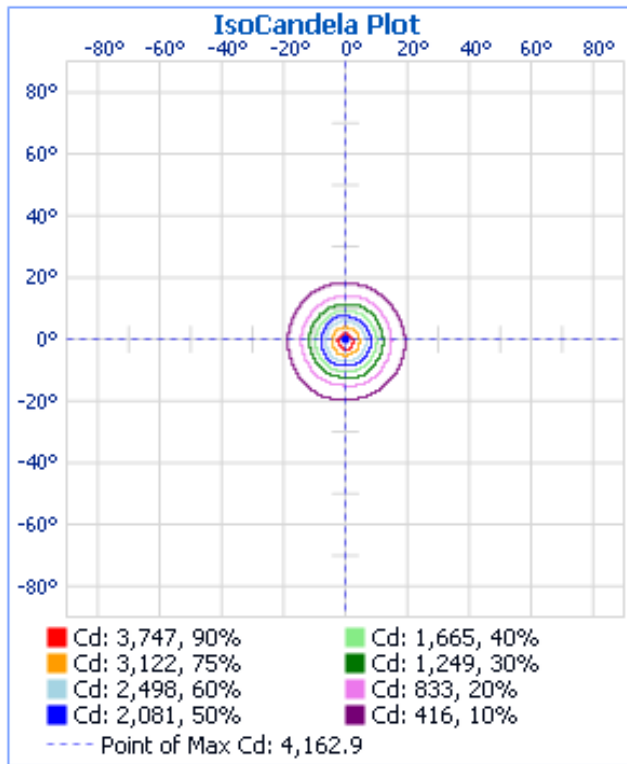
Field Angle



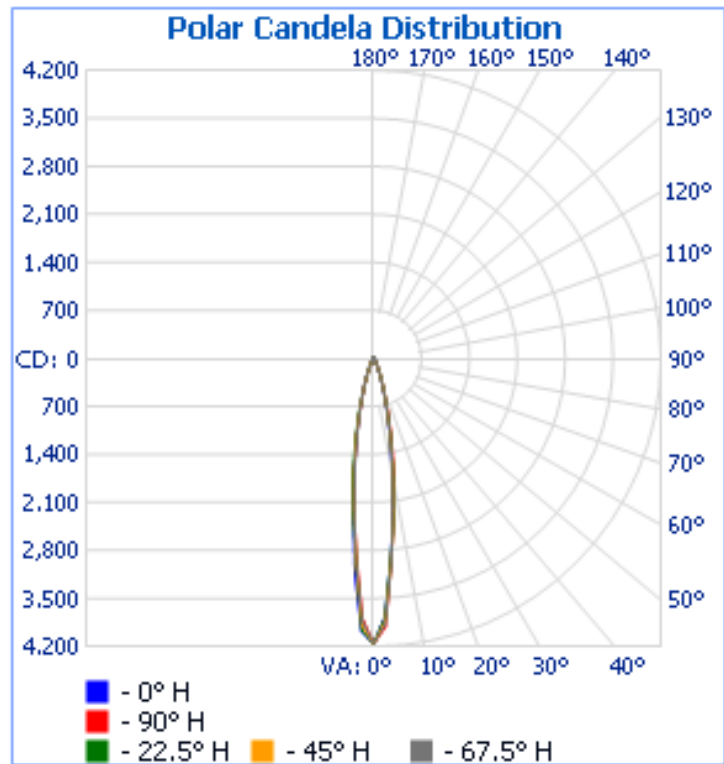
Illuminance Plot (Footcandles)

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	4163	4163	4163	4163	4163	4163	4163	4163	4163	4163	4163	4163	4163	4163	4163	4163	4163
2.5	3775	3790	3838	3878	3922	3934	3942	3979	3985	3967	3902	3827	3794	3759	3749	3759	3768
5.0	2932	2917	2961	2983	2963	3067	3096	3175	3142	2990	2990	2967	2901	2866	2780	2776	2927
7.5	2176	2266	2243	2206	2246	2243	2350	2414	2260	2282	2209	2196	2220	2117	2097	2096	2173
10.0	1541	1617	1602	1592	1690	1622	1694	1714	1656	1730	1640	1580	1625	1556	1604	1607	1539
12.5	1060	1116	1100	1104	1198	1119	1160	1154	1135	1231	1157	1113	1148	1081	1136	1140	1047
15.0	700	735	731	736	794	751	788	779	771	822	775	766	765	711	751	759	699
17.5	474	507	496	491	515	511	547	553	519	531	514	510	511	476	472	478	473
20.0	314	342	333	325	342	350	375	385	360	354	348	351	346	316	303	308	313
22.5	197	216	213	209	222	235	249	253	240	229	218	222	216	200	185	188	197
25.0	121	134	131	133	149	157	160	166	154	146	140	133	124	119	115	117	121
27.5	78	82	81	87	96	105	96	106	101	96	90	82	77	74	79	78	78
30.0	56	57	54	56	63	72	65	70	67	67	64	58	57	53	57	55	56
32.5	43	46	44	39	42	51	46	50	46	47	50	44	46	40	42	39	43
35.0	37	37	37	32	33	40	36	40	36	36	40	37	37	33	34	33	37
37.5	32	32	31	29	30	33	31	35	32	32	34	32	33	31	30	30	32
40.0	29	29	27	26	28	29	28	30	30	30	31	28	29	28	26	27	29
42.5	27	27	26	25	26	27	26	27	28	28	28	27	27	27	24	25	27
45.0	26	26	24	25	25	26	25	25	27	27	27	26	26	25	23	24	26
47.5	25	24	23	23	24	25	24	24	25	24	26	24	25	24	21	22	25
50.0	23	23	21	22	22	23	22	22	23	23	23	22	24	22	21	21	23
52.5	22	22	21	21	22	22	21	22	22	22	22	22	23	21	21	20	22
55.0	21	21	21	21	21	21	21	22	22	21	22	21	22	21	20	20	21
57.5	20	20	20	20	20	21	20	20	21	20	21	21	20	20	20	19	20
60.0	19	19	19	19	19	21	20	20	20	19	20	19	19	19	19	19	19
62.5	18	18	18	18	19	19	18	19	19	19	19	18	18	18	18	18	18
65.0	17	17	17	17	18	18	17	17	18	17	18	17	17	17	17	17	17
67.5	16	16	16	17	16	16	16	15	16	16	16	16	16	15	16	16	16
70.0	15	15	16	16	16	16	15	14	15	14	15	15	14	15	16	15	15
72.5	15	14	15	16	15	15	14	14	14	14	15	14	13	15	15	15	15
75.0	15	12	14	14	14	14	13	14	14	14	14	14	13	14	14	14	15
77.5	13	11	12	12	13	13	12	12	13	13	13	12	11	12	12	12	13
80.0	9	8	8	9	9	10	10	10	10	11	11	10	10	10	9	9	9
82.5	6	5	5	6	6	7	7	7	7	8	9	7	7	6	6	6	6
85.0	4	3	3	3	4	4	5	5	4	5	6	4	3	3	3	3	4
87.5	2	1	1	2	2	2	3	3	2	3	3	2	2	2	2	2	2
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	2	1
95.0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	2	1	1
97.5	1	1	1	1	1	1	1	1	0	1	1	2	1	1	1	1	1
100.0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
102.5	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1
105.0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
107.5	1	1	1	1	1	1	1	1	0	1	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	1	2	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
115.0	1	2	1	1	1	1	1	1	0	1	1	1	1	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	1	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	2	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	2	1	1	1	1	0	0	0	1	1	1	1	1	2	2
137.5	2	2	2	1	1	1	1	0	0	0	1	1	2	1	2	2	2
140.0	2	2	2	2	1	1	1	0	0	0	1	1	2	2	2	2	2
142.5	3	2	2	2	1	1	1	0	0	0	1	1	2	2	2	2	3
145.0	3	3	2	2	2	1	1	0	0	0	1	1	2	2	3	3	3
147.5	4	3	3	2	2	1	1	0	0	0	1	2	2	2	3	4	4
150.0	4	4	3	3	2	1	1	0	0	0	1	2	3	3	4	4	4
152.5	5	4	4	3	2	1	1	0	0	0	1	2	3	3	4	5	5
155.0	5	5	4	3	3	2	1	0	0	0	1	2	3	4	5	5	5
157.5	6	5	4	4	3	2	1	0	0	0	1	2	3	4	5	5	6
160.0	6	5	4	4	3	2	1	1	1	1	1	2	2	3	5	5	6
162.5	5	5	4	4	2	2	1	1	1	1	1	2	3	3	5	4	5
165.0	5	5	4	4	3	2	2	1	1	1	2	2	3	3	4	5	5
167.5	4	4	4	3	3	3	2	2	2	2	2	3	3	3	4	4	4
170.0	4	4	4	3	3	3	3	3	3	3	3	3	3	3	4	4	4
172.5	4	4	4	3	3	3	3	3	3	3	3	3	3	3	4	4	4
175.0	4	4	3	3	3	3	3	2	2	2	3	3	3	3	3	4	4
177.5	3	3	3	3	3	3	3	3	3	3	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).

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.

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



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.