



PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested
iMR1630440N

Prepared for:

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30019342

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Program Description

Photometric and electrical testing of an “iMR1630440N” replacement lamp to IES LM-79-08.

Executive Summary

Sample Tested = iMR1630440N

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
77.76	341.3	4.389	0.562

CCT (K)*	CRI*	Stabilization Time (Light & Power)
3026.7	81.2	36 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 – iMR1630440N



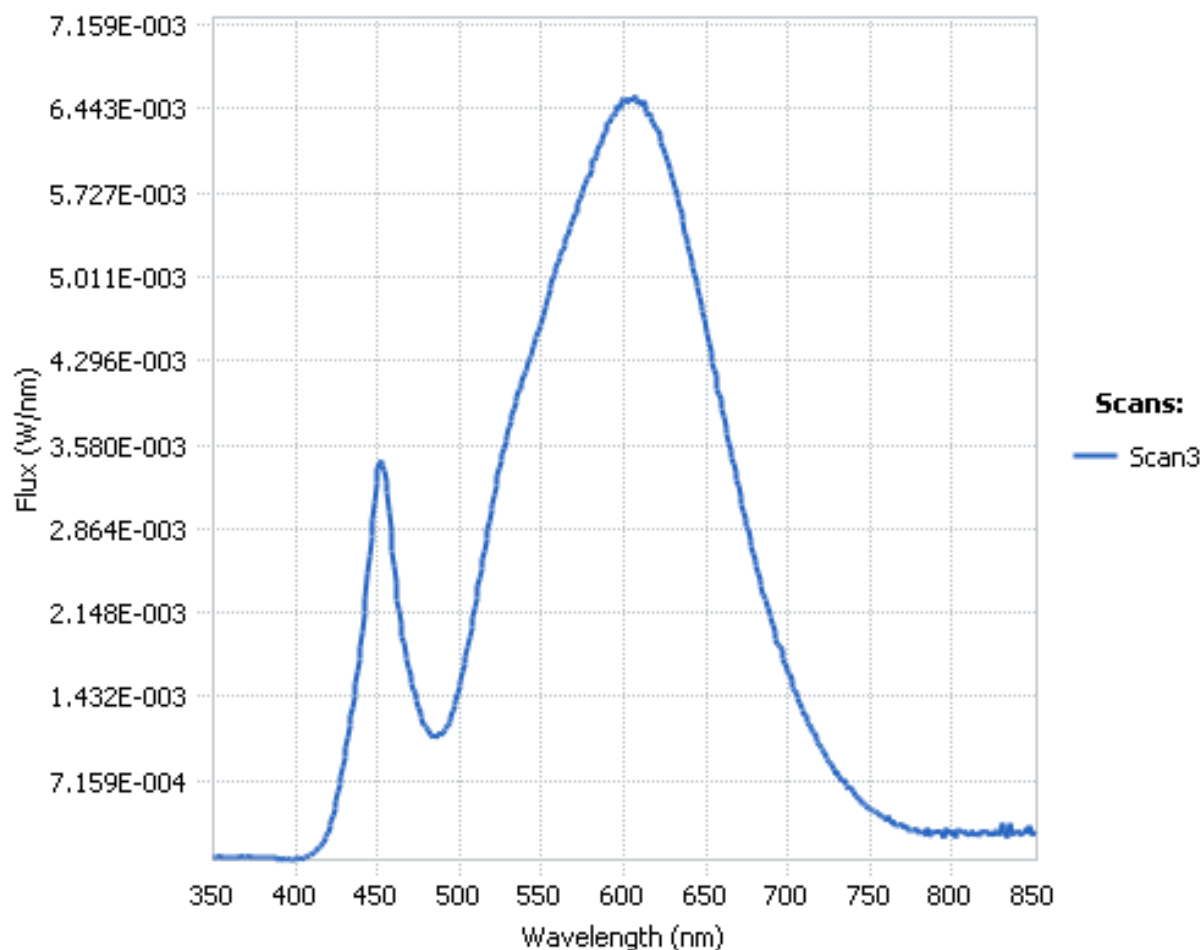
iMR1630440N

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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	
	iMR1630440N	
	Integrating Sphere	Goniophotometer
Luminous Efficacy (Lumens/Watt)	77.76	76.24
Total Luminous Flux (Lumens)	341.3	327.87
Total Radiant Flux (Watts)	4.389	
Correlated Color Temperature (CCT)	3026.7	
Color Rendering Index (CRI)	81.2	
R9 Value	17.3	
Chromaticity (Chroma x / Chroma y)	0.4353 / 0.4042	
Chromaticity (Chroma u / Chroma v)	0.2495 / 0.3475	
Chromaticity (Chroma u' / Chroma v')	0.2495/ 0.5512	
D _{uv} Value	0.00027	
Stabilization Time (Light and Power)	Approx. 34 minutes	
Total Run Time – Integrating Sphere	37 minutes	
Total Run Time – Goniophotometer	92 minutes	
Spacing Criteria	0.86 (0° – 180°) / 0.86 (90° – 270°)	
Electrical Input Results:	Sample Reference	
	iMR1630440N	
	Integrating Sphere	Goniophotometer
Input Power (Watts)	4.389	4.3
Input Voltage (Volts AC)	12.0	12.0
Input Current (Amps)	0.649	0.639
Input Frequency (Hertz)	60.0	60.0
Power Factor	0.562	0.561
Additional Information	Sample Reference	
	iMR1630440N	
Ambient Temperature	25.4°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:

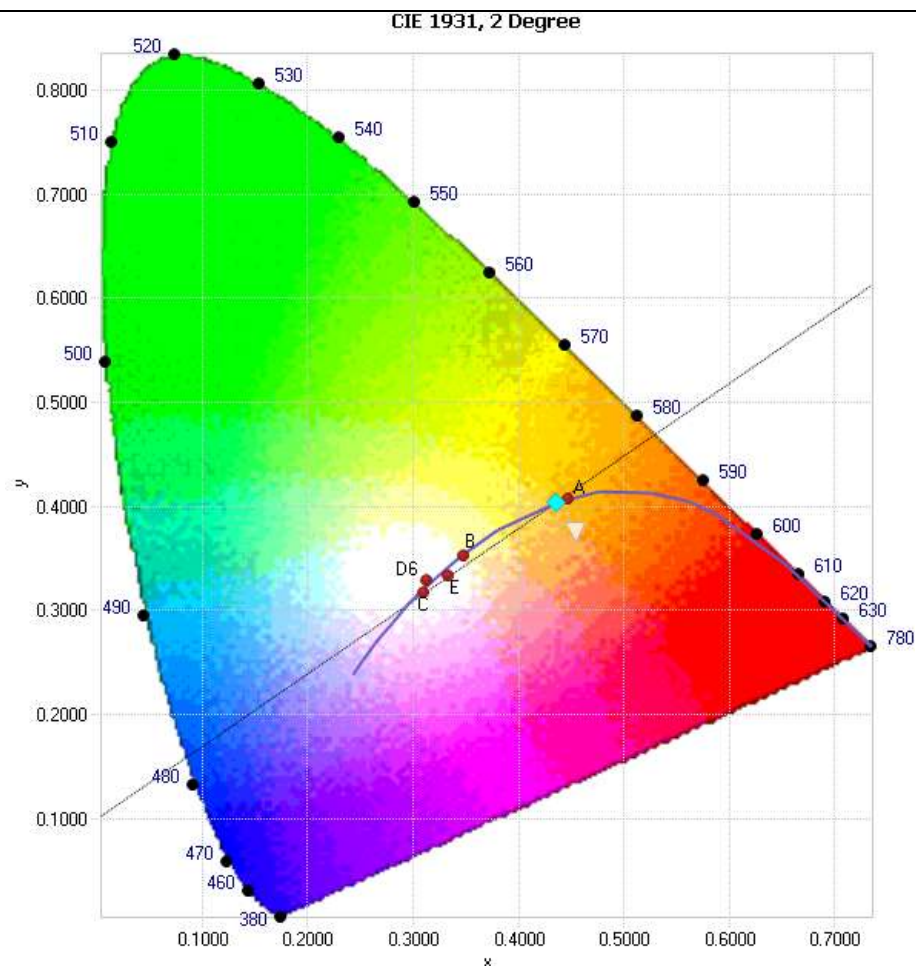


Spectral response of the Radiant Flux
(350nm to 850nm – calibrated range of the Spectroradiometer).

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Chromaticity Diagram

The following image shows the chromaticity diagram for the sample:



Tristimulus values (from page 6):

$x / y = 0.4353 / 0.4042$

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	36.6	11.20%
10 - 20	99.3	30.30%
20 - 30	96.4	29.40%
30 - 40	48	14.60%
40 - 50	20.6	6.30%
50 - 60	10.9	3.30%
60 - 70	6.4	1.90%
70 - 80	3.5	1.10%
80 - 90	1.5	0.40%
90 - 100	0.7	0.20%
100 - 110	0.7	0.20%
110 - 120	0.7	0.20%
120 - 130	0.7	0.20%
130 - 140	0.5	0.10%
140 - 150	0.5	0.10%
160 - 170	0.5	0.20%
170 - 180	0.4	0.10%
Total	327.87 Lumens	100%

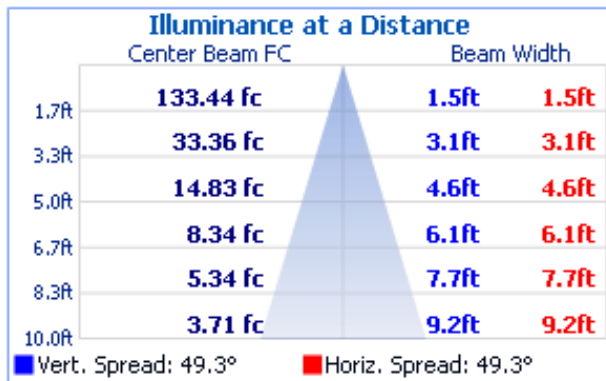
Zonal Lumen Summary

Zone	Lumens	% Lamp / Luminaire
0 - 60	311.7	95.1 %
60 - 90	11.3	3.4 %
0 - 90	323.0	98.5 %
90 - 180	4.8	1.5 %
0 - 180	327.9	100 %

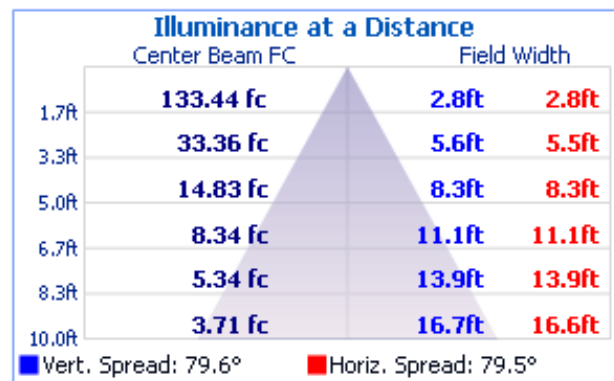
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Test Results – Illuminance Plots

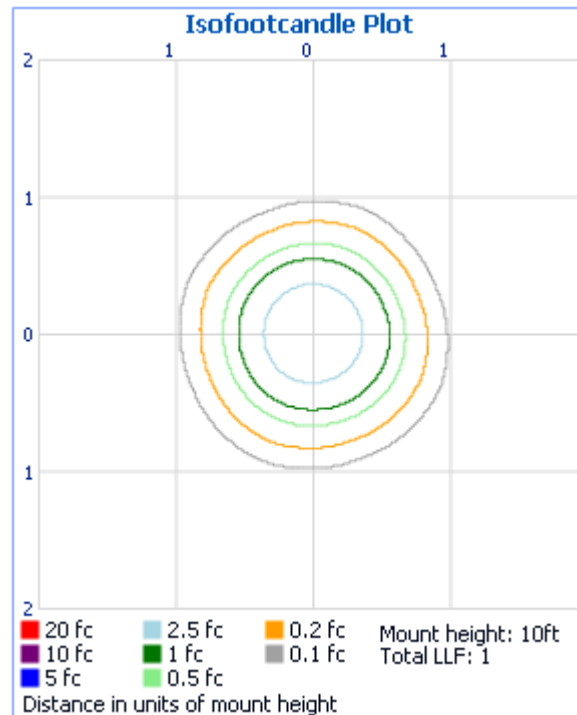
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



Field Angle

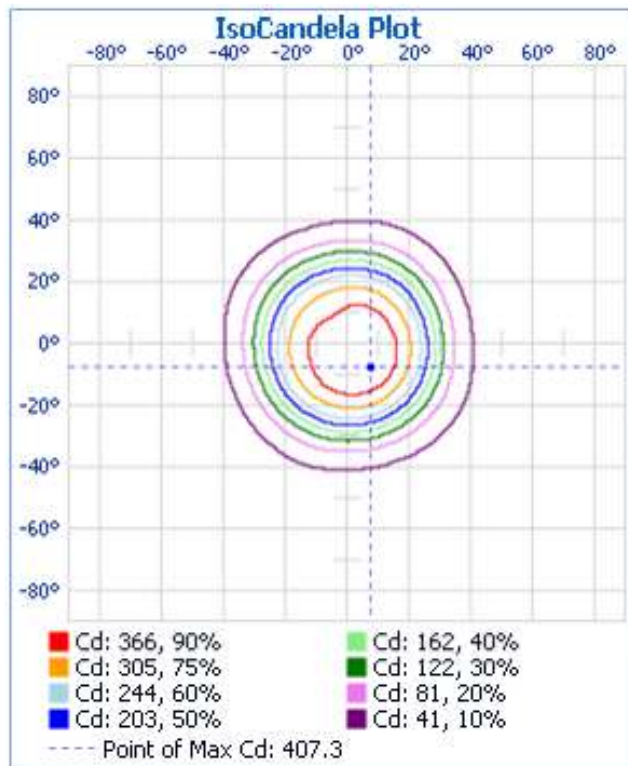


Illuminance Plot (Footcandles)

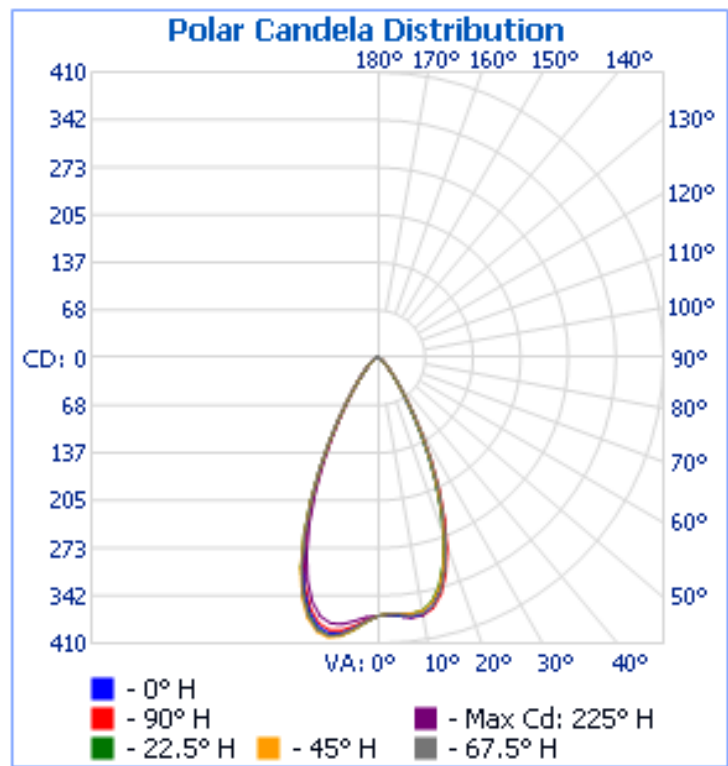
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Test Results – Candela Plots

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



Isocandela Plot



Polar Candela Distribution



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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	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371	371
2.5	369	368	367	368	369	371	374	376	378	380	380	379	377	375	373	371	369
5.0	372	369	369	370	372	376	380	386	390	392	392	390	386	383	379	375	372
7.5	375	371	371	373	376	380	386	394	399	402	403	400	395	389	385	381	375
10.0	374	368	369	373	375	379	387	396	402	405	407	404	397	390	387	382	374
12.5	365	358	360	365	368	371	380	390	395	399	403	400	390	383	380	374	364
15.0	345	340	342	348	351	354	363	372	378	382	387	384	373	365	362	355	344
17.5	316	312	314	320	325	328	336	344	351	356	360	356	345	338	334	326	316
20.0	281	278	280	286	291	294	301	308	314	320	322	317	308	302	298	290	281
22.5	241	239	242	247	251	253	259	265	271	276	276	272	264	259	255	249	241
25.0	200	198	202	206	209	209	214	220	224	228	227	225	218	213	211	206	199
27.5	159	158	162	166	167	166	170	176	179	181	180	180	172	169	168	165	159
30.0	123	122	126	130	129	126	130	136	138	138	138	139	132	129	130	129	123
32.5	92	91	95	99	96	93	97	103	103	103	104	106	99	96	98	98	92
35.0	69	68	71	75	71	68	72	77	77	76	77	80	74	71	74	74	69
37.5	52	50	54	57	53	50	53	58	57	56	58	60	56	53	56	56	52
40.0	40	38	41	44	40	38	40	44	43	41	44	47	42	40	43	44	40
42.5	31	29	32	34	31	29	31	34	33	32	34	36	33	31	33	34	31
45.0	24	23	25	27	25	23	24	27	26	25	27	29	26	25	26	27	24
47.5	20	19	20	22	20	19	20	22	21	20	21	23	21	20	21	22	20
50.0	16	16	17	18	16	15	16	18	17	16	17	19	17	16	17	18	16
52.5	14	13	14	15	14	13	13	15	14	14	14	15	14	14	15	15	14
55.0	12	11	12	12	12	11	11	12	12	11	12	13	12	12	12	13	12
57.5	10	10	10	10	10	9	10	10	10	10	10	11	10	10	11	11	10
60.0	9	9	9	9	8	8	8	9	9	8	9	9	9	9	9	9	9
62.5	7	7	8	8	7	7	7	7	7	7	7	8	7	8	8	8	7
65.0	6	6	7	6	6	6	6	6	6	6	6	6	6	6	7	7	6
67.5	5	6	6	5	5	5	5	5	5	5	5	5	5	6	6	6	5
70.0	5	5	5	5	4	4	4	4	5	5	4	4	5	5	5	5	5
72.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
75.0	3	4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3
77.5	3	3	3	3	3	3	2	2	3	3	2	2	3	3	3	3	3
80.0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
82.5	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2
85.0	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1
87.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
90.0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1

Continued.....



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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	1	0	1	1	1	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	1	0	1	1	1	1	1	1	1	1
105.0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1
107.5	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1
110.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
112.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
115.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
117.5	1	1	1	1	1	1	1	0	0	0	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	0	1	1	0	0	0	1	1	1	1	1	1	1
125.0	1	1	1	1	0	1	1	0	0	0	1	1	1	1	1	1	1
127.5	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1	1	1
130.0	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1	1	1
132.5	1	1	1	0	0	1	0	0	0	0	0	1	0	1	1	1	1
135.0	1	1	1	0	0	1	0	0	0	0	0	0	0	1	1	1	1
137.5	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1
140.0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1
142.5	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1
145.0	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1
147.5	2	1	1	1	0	0	0	1	1	1	1	1	1	1	1	2	2
150.0	2	2	1	1	1	1	0	1	1	1	1	1	1	1	1	2	2
152.5	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
155.0	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
157.5	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
160.0	2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
162.5	2	2	2	1	1	1	1	1	1	1	1	1	1	1	2	2	2
165.0	2	2	2	1	1	1	1	1	1	1	1	1	1	2	2	2	2
167.5	2	2	2	2	1	1	1	1	1	1	1	1	2	2	2	2	2
170.0	2	2	2	2	1	1	1	1	1	1	2	2	2	2	2	2	2
172.5	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2
175.0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
177.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
180.0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	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 12.0 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.....

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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)



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.