



PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested
iMR1630320N-UUT2

Prepared for:

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Program Description

Photometric and electrical testing of an “iMR1630320N-UUT2” replacement lamp to IES LM-79-08.

Executive Summary

Sample Tested = iMR1630320N-UUT2

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
75.44	327.5	4.341	0.564

CCT (K)*	CRI*	Stabilization Time (Light & Power)
2988.2	80.9	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 – iMR1630320N-UUT2



iMR1630320N-UUT2

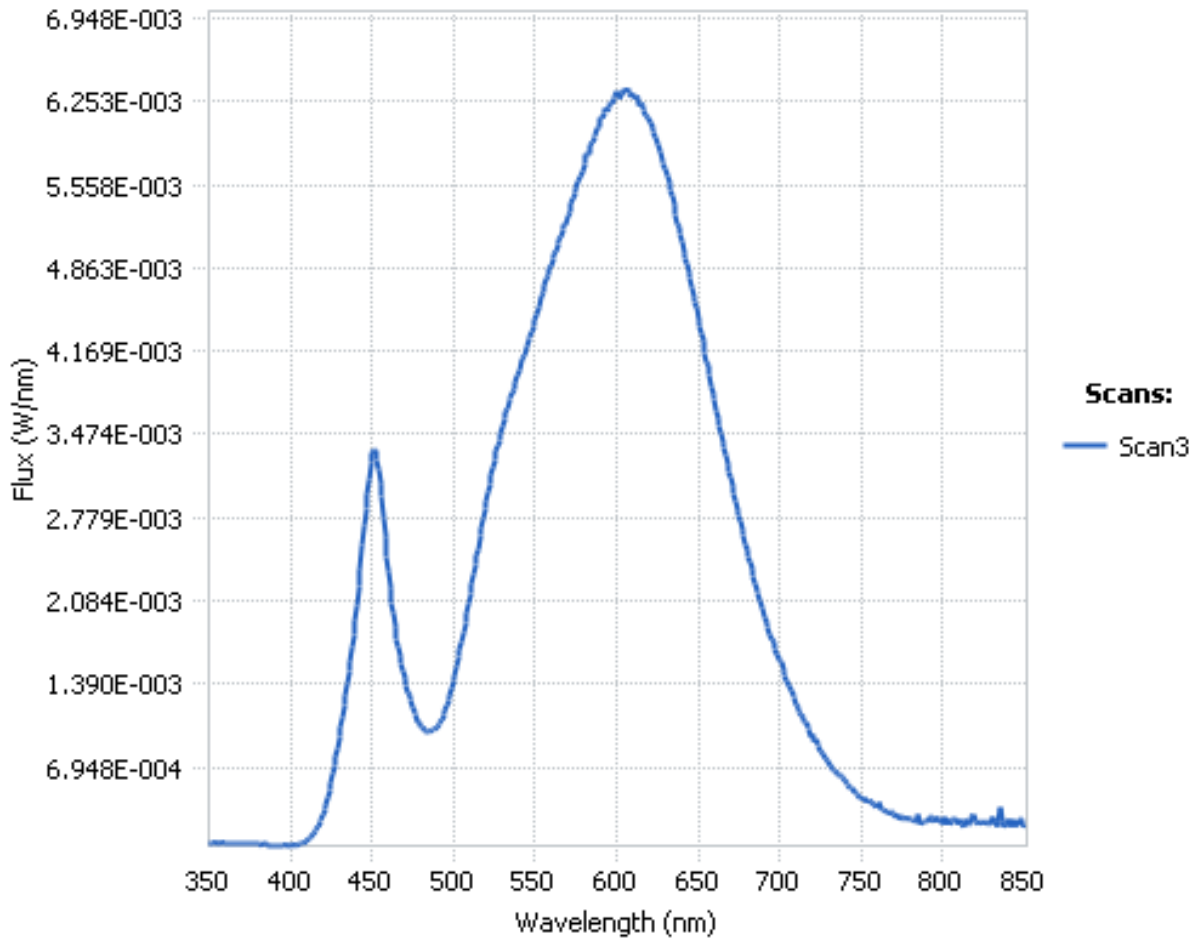


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Test Results –		
The following results were measured after stabilization of the sample in the Integrating Sphere (unless otherwise stated). Stability is reached when the variation of 3 readings of light output and electrical power, taken 15 minutes apart, is less than 0.50% (in accordance with IES LM-79-08).		
Key Photometric Results	Sample Reference	
	iMR1630320N-UUT2	
	Integrating Sphere	Goniophotometer
Luminous Efficacy (Lumens/Watt)	75.44	73.82
Total Luminous Flux (Lumens)	327.5	317.45
Total Radiant Flux (Watts)	4.341	
Correlated Color Temperature (CCT)	2988.2	
Color Rendering Index (CRI)	80.9	
R9 Value	16.2	
Chromaticity (Chroma x / Chroma y)	0.4369 / 0.4027	
Chromaticity (Chroma u / Chroma v)	0.2511 / 0.3472	
Chromaticity (Chroma u' / Chroma v')	0.2511/ 0.5208	
D _{uv} Value	-0.00055	
Stabilization Time (Light and Power)	Approx. 35 minutes	
Total Run Time – Integrating Sphere	38 minutes	
Total Run Time – Goniophotometer	93 minutes	
Spacing Criteria	0.56 (0° – 180°) / 0.58 (90° – 270°)	
Electrical Input Results:	Sample Reference	
	iMR1630320N-UUT2	
	Integrating Sphere	Goniophotometer
Input Power (Watts)	4.341	4.3
Input Voltage (Volts AC)	12.0	12.0
Input Current (Amps)	0.640	0.649
Input Frequency (Hertz)	60.0	60.0
Power Factor	0.564	0.552
Additional Information	Sample Reference	
	iMR1630320N-UUT2	
Ambient Temperature	25.5°C	
Integrating Sphere Detector	CDS 600 Spectroradiometer	
Absorption Correction used?	Yes	

Spectral Flux

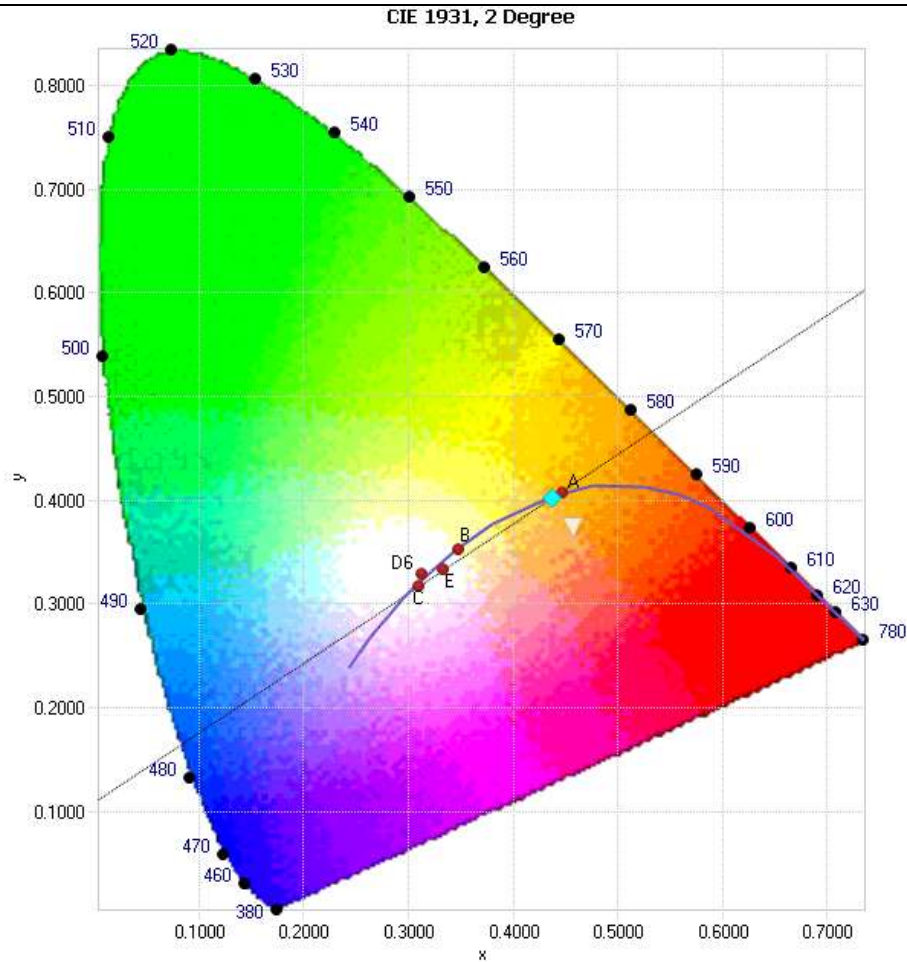
The following graph shows the spectral response curve of the radiant flux for the sample:



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):
 $x / y = 0.4369 / 0.4027$

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:

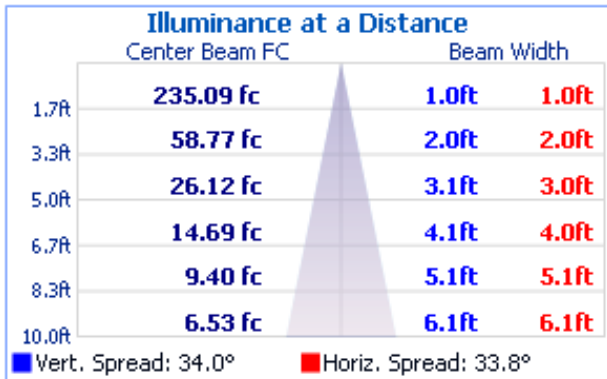
Zone	Lumens	% Total
0 - 10	55.6	17.50%
10 - 20	103.8	32.70%
20 - 30	65.7	20.70%
30 - 40	35.9	11.30%
40 - 50	22.1	7.00%
50 - 60	13.7	4.30%
60 - 70	8.5	2.70%
70 - 80	4.8	1.50%
80 - 90	2	0.60%
90 - 100	0.8	0.30%
100 - 110	0.8	0.20%
110 - 120	0.9	0.30%
120 - 130	0.8	0.30%
130 - 140	0.5	0.20%
140 - 150	0.4	0.10%
160 - 170	0.5	0.20%
170 - 180	0.4	0.10%
Total	317.45 Lumens	100%

Zonal Lumen Summary

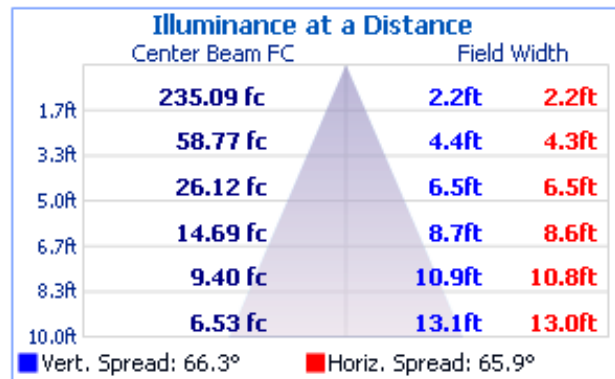
Zone	Lumens	% Lamp / Luminaire
0 - 60	296.8	93.5 %
60 - 90	15.3	4.8 %
0 - 90	312.1	98.3 %
90 - 180	5.4	1.7 %
0 - 180	317.5	100 %

Test Results – Illuminance Plots

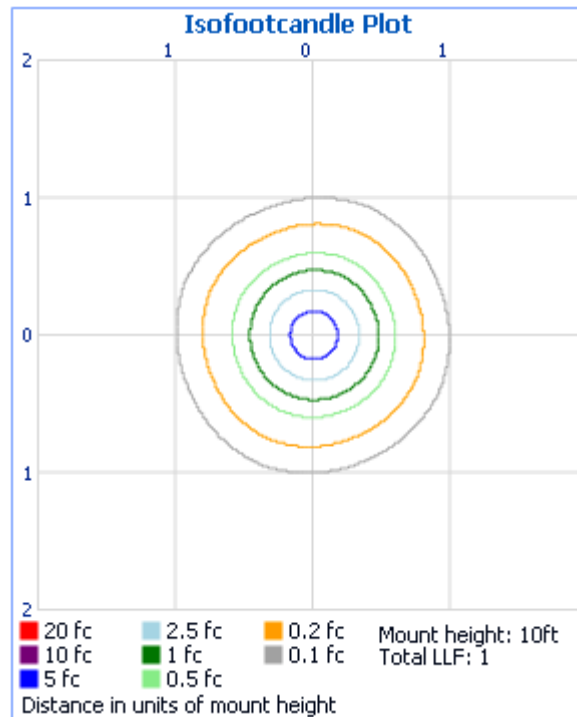
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



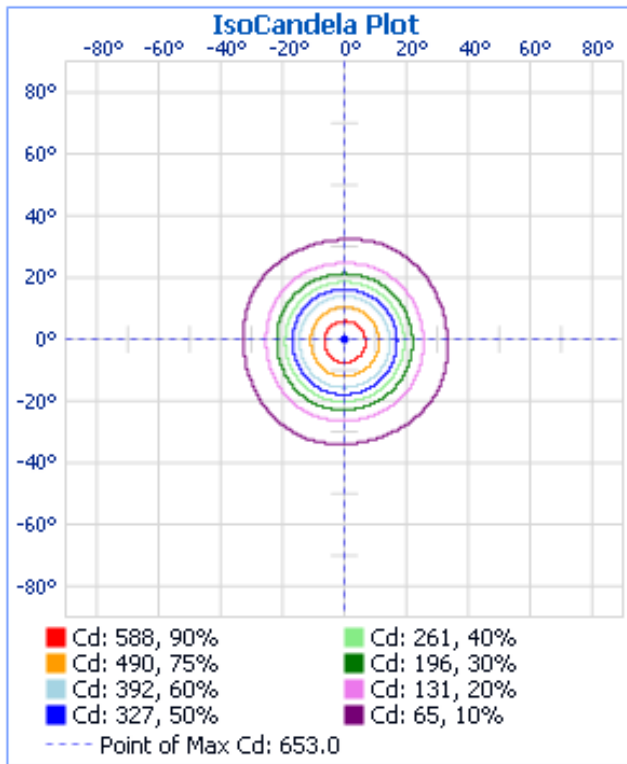
Field Angle



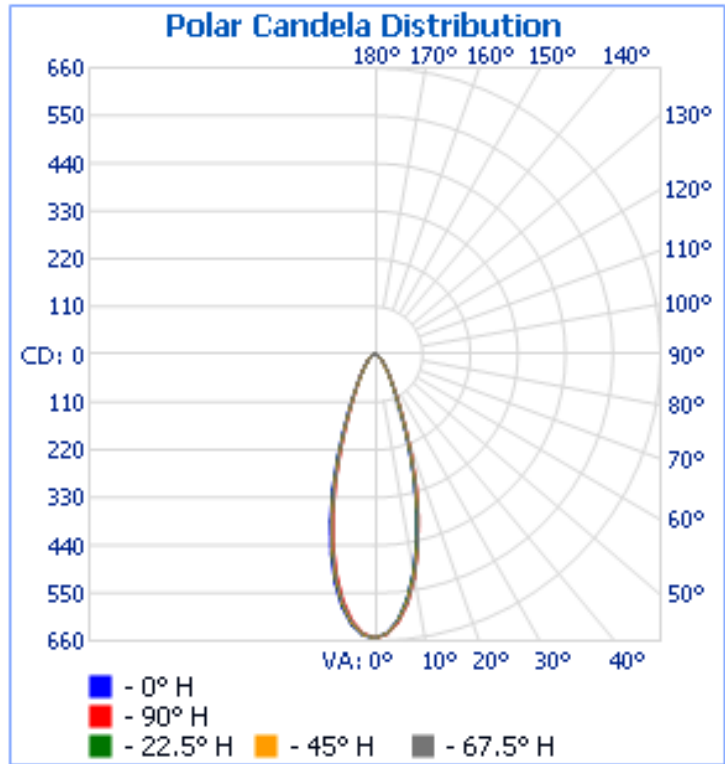
Illuminance Plot (Footcandles)

Test Results – Candela Plots

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



Isocandela Plot



Polar Candela Distribution



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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	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653	653
2.5	641	642	643	644	645	646	647	647	647	646	646	644	642	641	640	640	641
5.0	612	613	615	617	619	621	624	625	625	623	621	618	614	611	610	611	612
7.5	567	568	572	576	578	579	584	589	587	583	580	575	570	565	565	566	567
10.0	510	511	517	522	522	524	531	537	534	527	524	520	513	508	507	509	510
12.5	444	446	453	458	458	460	468	475	471	462	458	454	447	442	441	442	444
15.0	372	375	382	387	388	391	398	404	400	392	386	381	375	370	367	367	370
17.5	297	301	309	312	315	319	327	331	327	319	312	306	301	296	293	294	297
20.0	229	233	240	244	246	248	256	259	255	248	242	236	232	226	225	226	229
22.5	173	176	182	185	187	187	194	198	194	187	183	179	174	170	170	171	173
25.0	132	133	137	140	141	140	146	149	146	140	138	136	132	129	129	130	131
27.5	102	102	105	108	107	107	111	114	112	108	107	106	103	100	101	102	102
30.0	81	80	83	85	84	84	87	90	88	84	85	85	82	80	81	82	81
32.5	66	65	67	69	68	67	70	73	71	68	69	70	67	65	66	68	66
35.0	55	53	55	57	55	55	58	60	58	55	57	58	56	54	55	57	55
37.5	46	44	46	47	46	45	48	50	48	46	48	49	47	45	47	48	46
40.0	39	37	38	40	38	38	40	42	40	38	40	42	39	38	40	41	39
42.5	33	31	32	33	32	32	34	36	34	32	34	35	33	32	33	35	33
45.0	28	26	27	28	27	27	29	30	29	27	28	30	28	27	28	29	28
47.5	24	23	23	24	23	23	24	26	25	23	24	25	24	23	24	25	24
50.0	20	19	20	20	20	19	21	22	21	20	20	21	20	20	21	22	20
52.5	17	17	17	18	17	17	18	19	18	17	17	18	17	17	18	18	17
55.0	15	14	15	15	15	14	15	16	15	15	15	16	15	15	15	16	15
57.5	13	12	13	13	13	13	13	14	13	13	13	14	13	13	13	14	13
60.0	11	11	11	11	11	11	11	12	11	11	11	12	11	11	11	12	11
62.5	10	9	9	10	9	9	10	10	10	9	10	10	10	10	10	10	10
65.0	8	8	8	8	8	8	9	9	9	8	8	8	8	8	8	9	8
67.5	7	7	7	7	7	7	7	8	7	7	7	7	7	7	7	8	7
70.0	6	6	6	6	6	6	6	7	6	6	6	6	6	6	6	6	6
72.5	5	5	5	5	5	5	5	6	5	5	5	5	5	5	5	5	5
75.0	5	5	4	4	4	5	5	5	5	5	4	4	4	5	5	5	5
77.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
80.0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
82.5	2	3	2	3	2	3	3	3	2	2	2	2	2	2	2	2	2
85.0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
87.5	1	1	1	1	1	1	1	1	0	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.....



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	0	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	2	1	1	1
122.5	1	1	1	1	0	2	1	0	0	0	1	1	1	2	1	1	1
125.0	1	2	1	1	0	1	1	0	0	0	1	1	1	2	1	1	1
127.5	1	2	1	1	0	1	1	0	0	0	1	1	0	2	1	1	1
130.0	1	2	1	0	0	1	0	0	0	0	0	1	0	1	1	1	1
132.5	2	1	1	0	0	1	0	0	0	0	0	1	0	1	1	1	2
135.0	2	1	1	0	0	1	0	0	0	0	0	1	0	1	1	1	2
137.5	2	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	2
140.0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	1	2	2
142.5	2	1	1	0	0	0	0	0	0	0	0	0	0	0	1	2	2
145.0	2	2	1	0	0	0	0	0	0	0	0	0	0	1	1	2	2
147.5	2	2	1	1	0	0	0	0	0	0	1	0	1	1	1	2	2
150.0	2	2	1	1	0	0	0	1	1	1	1	1	1	1	1	2	2
152.5	2	2	1	1	1	1	0	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	2	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	2	1	2	2	2	2	2	2
172.5	2	2	2	2	2	1	1	1	1	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.....

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.