



PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested
iMR1627230N-UUT2

Prepared for:

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Program Description

Photometric and electrical testing of an “iMR1627230N-UUT2” replacement lamp to IES LM-79-08.

Executive Summary

Sample Tested = iMR1627230N-UUT2

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
70.23	309.8	4.411	0.564

CCT (K)*	CRI*	Stabilization Time (Light & Power)
2719.8	82.7	36 minutes

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



TABLE OF CONTENTS

Sample.....	4
Test Results.....	5
Spectral Flux.....	6
Chromaticity Diagram.....	7
Flux Distribution – Zonal Lumen Summary.....	8
Illuminance Plots.....	9
Candela Plots.....	10
Candela Tabulation.....	11
Photometric Testing Information.....	13
Equipment List:.....	14

Sample

The following sample was submitted for evaluation:

MSI SSL – iMR1627230N-UUT2



iMR1627230N-UUT2

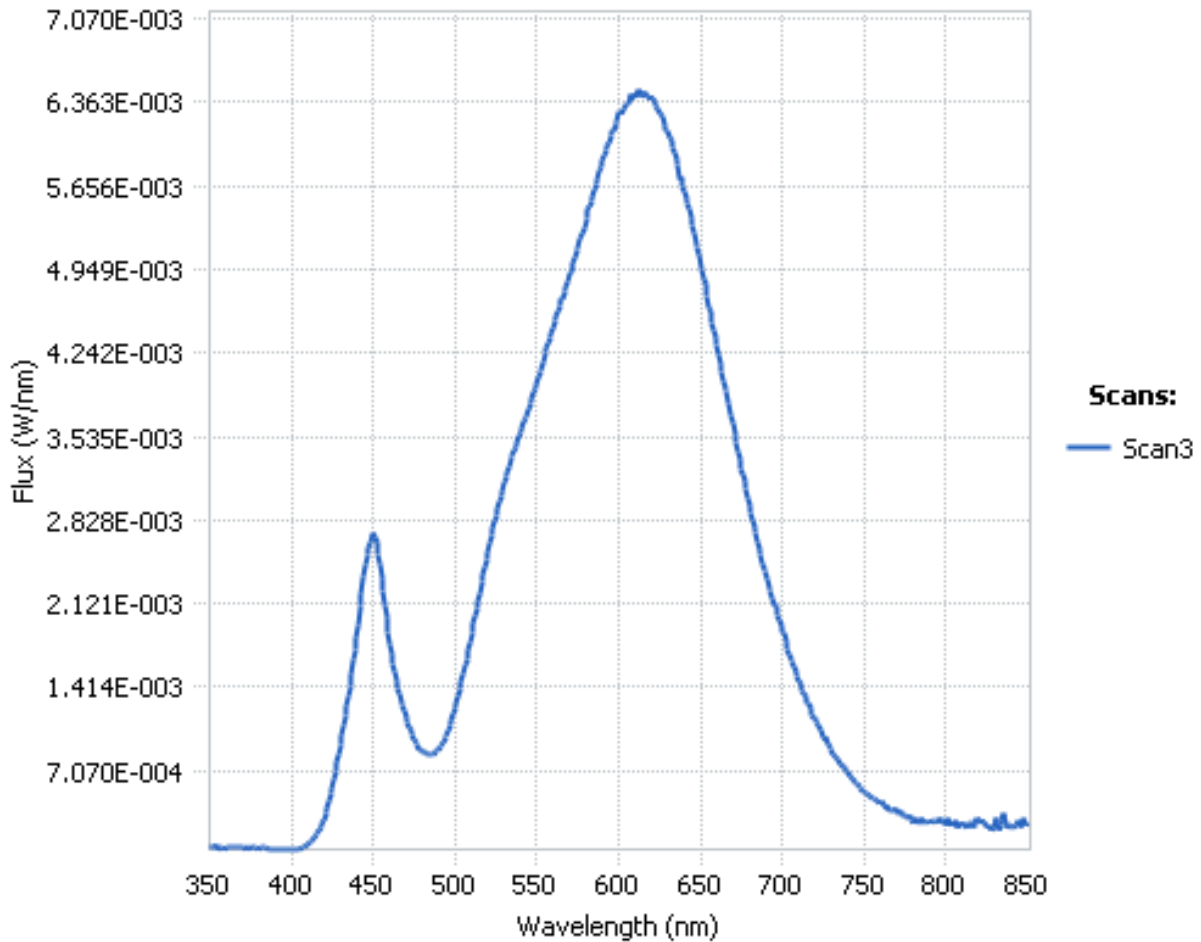


June 7, 2011

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	
	iMR1627230N-UUT2	
	Integrating Sphere	Goniophotometer
Luminous Efficacy (Lumens/Watt)	70.23	69.07
Total Luminous Flux (Lumens)	309.8	303.91
Total Radiant Flux (Watts)	4.411	
Correlated Color Temperature (CCT)	2719.8	
Color Rendering Index (CRI)	82.7	
R9 Value	24.8	
Chromaticity (Chroma x / Chroma y)	0.4537 / 0.4021	
Chromaticity (Chroma u / Chroma v)	0.2623 / 0.3488	
Chromaticity (Chroma u' / Chroma v')	0.2623 / 0.5231	
D _{uv} Value	-0.00266	
Stabilization Time (Light and Power)	Approx. 35 minutes	
Total Run Time – Integrating Sphere	38 minutes	
Total Run Time – Goniophotometer	93 minutes	
Spacing Criteria	0.40 (0° – 180°) / 0.38 (90° – 270°)	
Electrical Input Results:	Sample Reference	
	iMR1627230N-UUT2	
	Integrating Sphere	Goniophotometer
Input Power (Watts)	4.411	4.4
Input Voltage (Volts AC)	12.0	12.0
Input Current (Amps)	0.650	0.665
Input Frequency (Hertz)	60.0	60.0
Power Factor	0.564	0.551
Additional Information	Sample Reference	
	iMR1627230N-UUT2	
Ambient Temperature	24.0°C	
Integrating Sphere Detector	CDS 600 Spectroradiometer	
Absorption Correction used?	Yes	

Spectral Flux

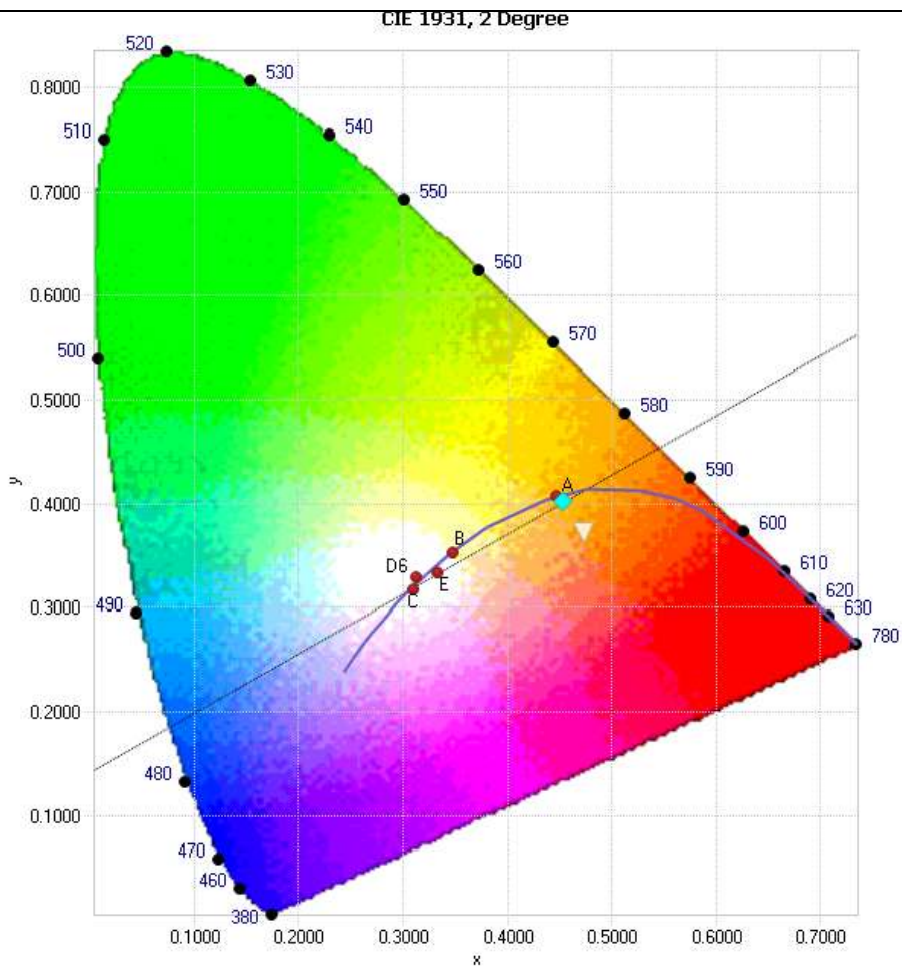
The following graph shows the spectral response curve of the radiant flux for the sample:



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):
 $x / y = 0.4537 / 0.4021$

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



June 7, 2011

Test Results – Flux Distribution – Zonal Lumen Summary

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

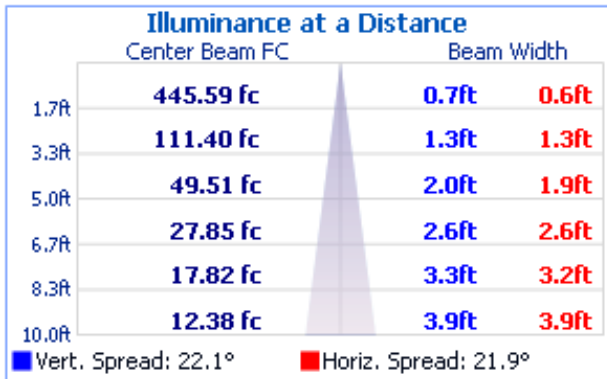
Zone	Lumens	% Total
0 - 10	92.8	30.50%
10 - 20	95.2	31.30%
20 - 30	45.1	14.80%
30 - 40	26.7	8.80%
40 - 50	16.7	5.50%
50 - 60	10.8	3.60%
60 - 70	7.2	2.40%
70 - 80	4.0	1.30%
80 - 90	1.5	0.50%
90 - 100	0.6	0.20%
100 - 110	0.5	0.20%
110 - 120	0.6	0.20%
120 - 130	0.6	0.20%
130 - 140	0.4	0.10%
140 - 150	0.3	0.10%
160 - 170	0.4	0.10%
170 - 180	0.4	0.10%
Total	303.91 Lumens	100%

Zonal Lumen Summary

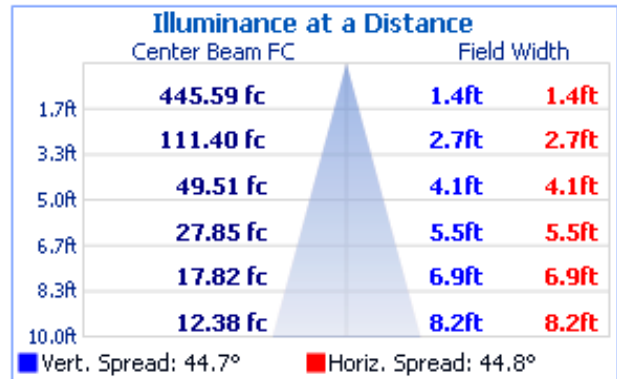
Zone	Lumens	% Lamp / Luminaire
0 - 60	287.2	94.5 %
60 - 90	12.6	4.2 %
0 - 90	299.9	98.7 %
90 - 180	4.0	1.3 %
0 - 180	303.9	100 %

Test Results – Illuminance Plots

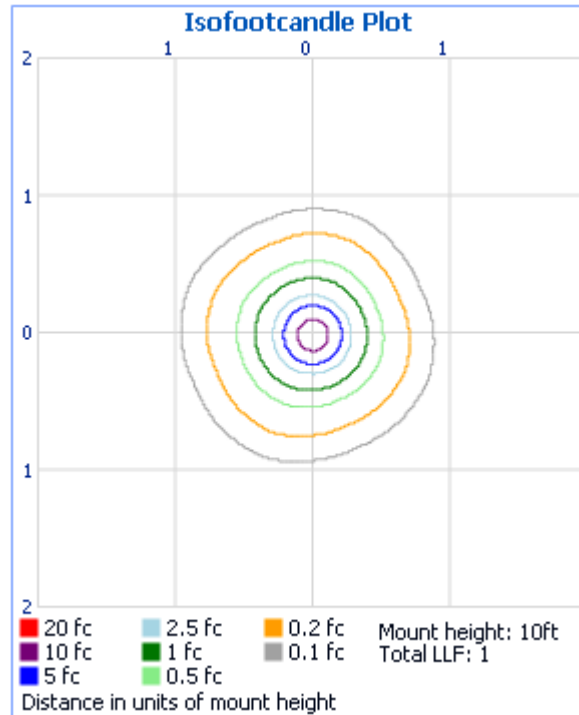
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



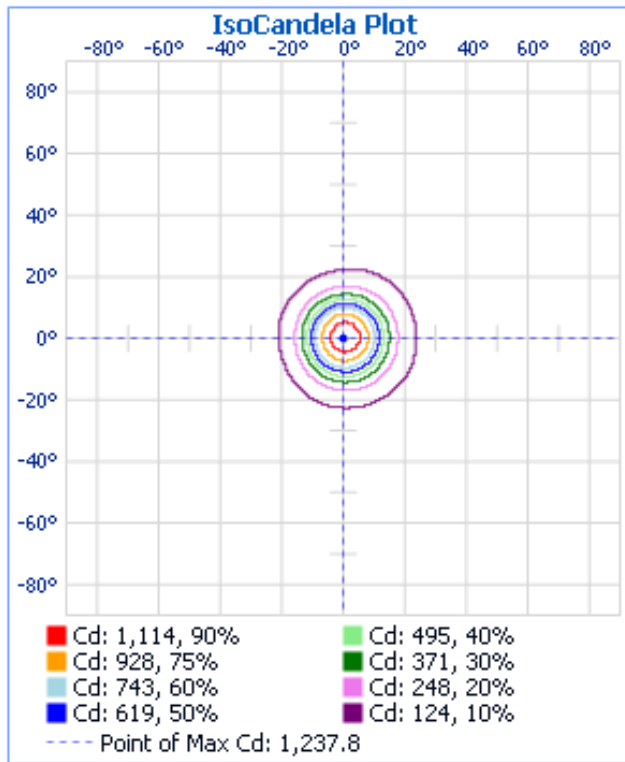
Field Angle



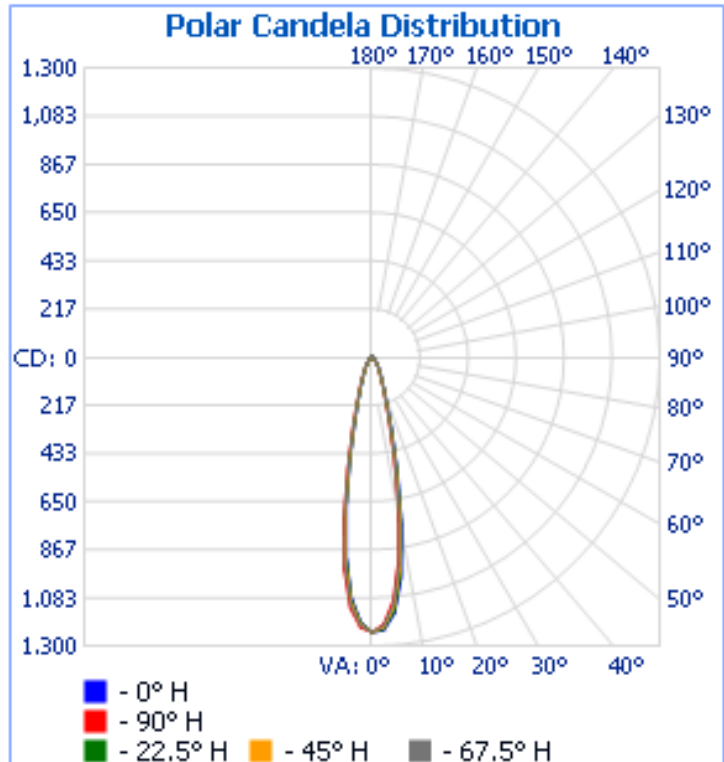
Illuminance Plot (Footcandles)

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	1238	1238	1238	1238	1238	1238	1238	1238	1238	1238	1238	1238	1238	1238	1238	1238	1238
2.5	1230	1224	1218	1209	1203	1197	1193	1192	1194	1197	1203	1210	1218	1225	1229	1231	1229
5.0	1158	1148	1131	1114	1098	1086	1080	1080	1084	1092	1103	1118	1134	1147	1157	1161	1158
7.5	1002	987	964	938	915	898	892	892	898	908	923	944	966	985	1002	1007	1002
10.0	769	751	731	702	675	659	653	659	667	676	690	711	736	758	774	778	768
12.5	528	511	496	473	450	437	436	445	455	465	476	492	512	531	545	542	527
15.0	344	330	321	306	290	282	285	294	304	312	323	333	347	359	364	356	338
17.5	228	218	212	204	195	191	196	204	213	220	228	234	242	249	250	243	228
20.0	163	156	152	148	141	137	142	150	156	160	166	172	177	180	181	175	163
22.5	124	116	114	113	107	103	107	116	119	121	126	133	136	136	137	133	124
25.0	96	89	89	89	84	79	83	92	94	93	98	106	107	105	107	105	96
27.5	77	70	71	71	66	62	66	74	75	73	78	86	86	84	85	85	77
30.0	62	56	57	58	53	49	53	60	61	59	63	71	71	68	70	70	62
32.5	51	46	46	47	43	40	43	49	50	48	52	59	59	55	58	58	51
35.0	43	38	38	39	36	33	35	41	41	39	43	50	49	46	48	49	43
37.5	36	31	32	33	30	27	29	34	35	33	36	42	42	39	41	42	36
40.0	30	26	27	28	25	23	24	29	29	28	30	36	35	32	35	36	30
42.5	26	22	23	23	21	19	21	24	25	23	26	30	30	27	29	30	26
45.0	22	19	19	20	18	17	18	20	21	20	22	26	25	23	25	26	22
47.5	19	17	17	17	16	15	15	17	18	17	18	22	21	20	21	22	19
50.0	16	14	14	15	14	13	13	15	15	15	16	18	18	17	18	18	16
52.5	14	13	13	13	12	12	12	13	13	13	14	16	15	15	15	16	14
55.0	12	11	11	11	11	10	10	11	12	12	12	14	13	13	14	14	12
57.5	11	10	10	10	9	9	9	10	10	10	11	12	12	11	12	12	11
60.0	10	9	9	9	9	8	8	9	9	9	9	10	10	10	10	11	10
62.5	8	8	8	8	8	7	7	8	8	8	8	9	9	9	9	9	8
65.0	7	7	7	7	7	7	6	7	7	7	7	8	8	8	8	8	7
67.5	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7	6
70.0	5	5	5	5	5	5	5	5	5	5	5	6	6	6	6	6	5
72.5	5	5	5	4	4	4	4	4	4	4	4	5	5	5	5	5	5
75.0	4	4	4	4	4	3	3	3	4	3	3	4	4	4	4	4	4
77.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3
80.0	2	3	3	2	2	2	2	2	2	2	2	2	2	3	3	3	2
82.5	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	2
85.0	1	2	2	1	1	1	1	1	1	1	1	1	1	1	2	2	1
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	0	1	1	1	1	1	1	1
97.5	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1	1	1
100.0	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1	1	1
102.5	0	1	1	1	0	1	1	0	0	1	0	1	0	1	1	1	0
105.0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0
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	0	0	1	1	0	0	0	0	1	0	1	1	1	1
130.0	1	1	1	0	0	1	0	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	0	1	1	1
137.5	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1
140.0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1
142.5	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1
145.0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1
147.5	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1
150.0	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1
152.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
155.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
157.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
160.0	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	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	2	1	1	1	1	1	1	1	1	1	2	2	2	2
167.5	2	2	2	2	2	2	1	1	1	1	1	2	2	2	2	2	2
170.0	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2
172.5	2	2	2	2	2	2	2	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.....

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.