PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested
iPAR30S30161N

Prepared for:

Rakesh Reddy

MSI SSL
1342 S Powerline Rd
Deerfield Beach FL-33442

Phone: 425-420-7080

Technical Report Number

30019118-LM79 (iPAR30S30161N)

June 8, 2011

Prepared by:

Clay Magerfleisch, Senior Technician

Approved by:

Jesse Whalen, Product Group Manager

CSA INTERNATIONAL

U.S. Department of Energy

Lighting Facts℠ Uniform LM-79 Reporting Template

lighting facts
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Laboratory Information

Name of test lab	CSA International
Date of test report	June 8, 2011
Test report number	30019118-LM79 (iPAR30S30161N)
Laboratory contact name	Jesse Whalen
Laboratory contact signature*	

*** By signing this form, the signatory is attesting that the information on the form is correct and the same as on the original, complete test report(s). The signatory also attests that all of the results on this form were measured entirely in accordance with IES LM-79-08.**

Product Information

Manufacturer	MSI SSL Inc.	
Brand name	N/A	
Model number	iPAR30S30161N	
SKU (if available)	N/A	
Type of luminaire (for integral lamps, list base type and lamp type)	PAR30 (E26 Base)	
Luminaire aperture (downlights)	3.25	in.
Luminaire length	3.53	in.
Luminaire width	3.74	in.
Number of units (modular products)	-	

Electrical Measurements	**Integrating sphere output**	**Goniophotometer output**	
Input wattage	11.874	12.1	W
Input current	0.107	0.112	A
Input voltage (AC)	120.0	120.0	V
Power factor	0.921	0.898	
Off-state power	0.00	0.00	W

Photometric Characteristics

Total initial lumen output	657.2	658.65	lm
Initial luminaire efficacy	55.35	54.43	lm/W
Correlated color temperature / CCT	2976.8	K	
Color rendering index / CRI	81.9		
R_9 value	23.4		
Duv	-0.00044		

Luminous Intensity Distribution	**Goniophotometer output**	
Center beam candlepower (if applicable)	5860	cd
Beam angle (if applicable)	12.4	°
Zonal lumens in the 0°-60° zone	93.9	%
Zonal lumens in the 60°-90° zone	4.7	%
Zonal lumens in the 90°-120° zone	N/A	%
Zonal lumens in the 120°-180° zone	N/A	%

Program Description

Photometric and electrical testing of an “iPAR30S30161N” replacement lamp to IES LM-79-08.

Executive Summary

Sample Tested = **iPAR30S30161N**

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
55.35	657.2	11.874	0.921

CCT (K)*	CRI*	Stabilization Time (Light & Power)
2976.8	81.9	16 minutes

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

2210 Justin Trail
Alpharetta, Georgia 30004
www.csa-international.org

Telephone: 678-992-0134
Fax: 770-500-3948

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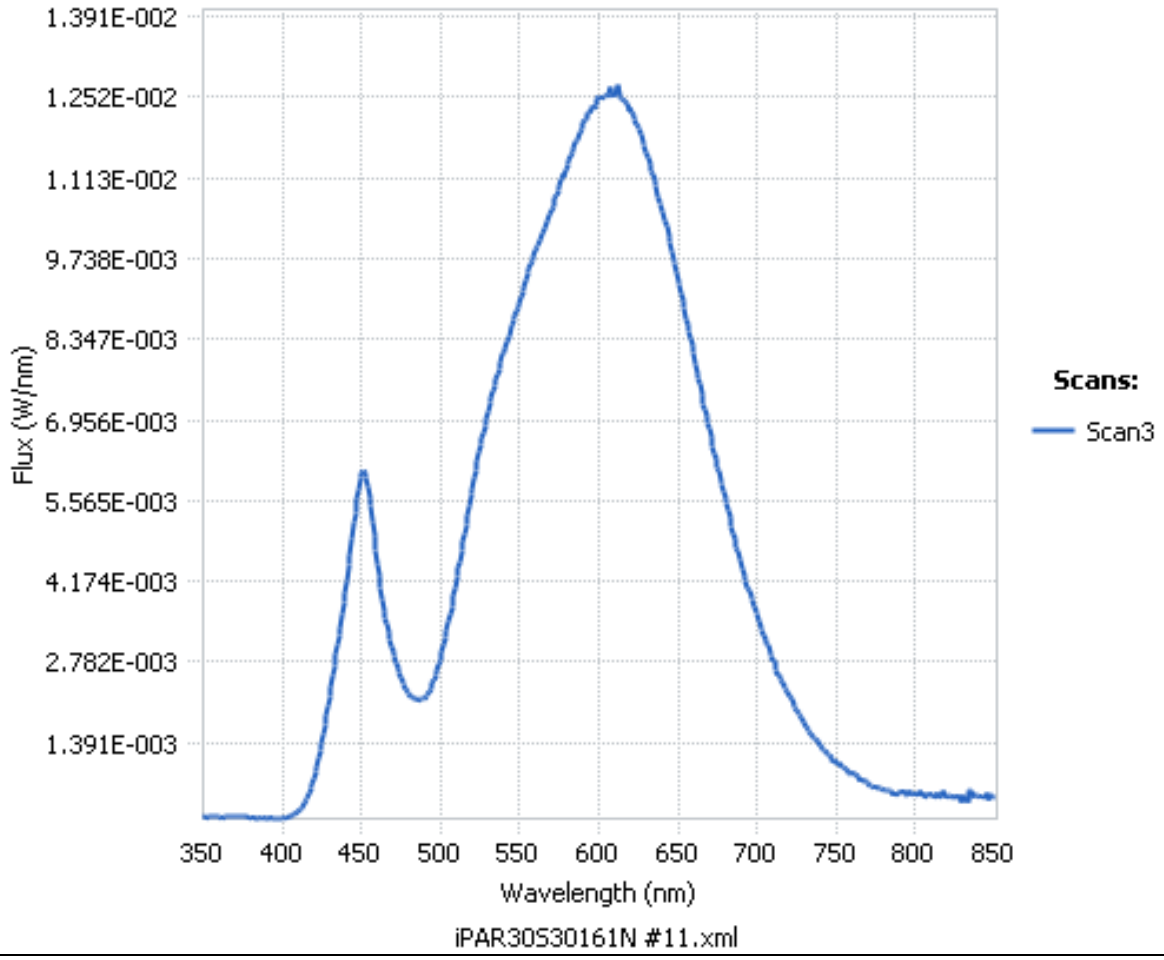
Sample
The following sample was submitted for evaluation:
MSI SSL - **iPAR30S30161N**

iPAR30S30161N

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**	
	iPAR30S30161N	
	Integrating Sphere	**Goniophotometer**
Luminous Efficacy (Lumens/Watt)	**657.2**	**658.65**
Total Luminous Flux (Lumens)	**55.35**	**54.43**
Total Radiant Flux (Watts)	**11.874**	
Correlated Color Temperature (CCT)	**2976.8**	
Color Rendering Index (CRI)	**81.9**	
Chromaticity (Chroma x / Chroma y)	**0.4378 / 0.4033**	
Chromaticity (Chroma u / Chroma v)	**0.2515 / 0.3475**	
Chromaticity (Chroma u' / Chroma v')	**0.2515 / 0.5212**	
D_{uv} Value	**-0.00044**	
Stabilization Time (Light and Power)	**Approx. 16 minutes**	
Total Run Time – Integrating Sphere	**49 minutes**	
Total Run Time – Goniophotometer	**86 minutes**	
Spacing Criteria	**0.28 (0° – 180°) / 0.28 (90° – 270°)**	
Electrical Input Results:	**Sample Reference**	
	iPAR30S30161N	
	Integrating Sphere	**Goniophotometer**
Input Power (Watts)	**11.874**	**12.1**
Input Voltage (Volts AC)	**120.0**	**120.0**
Input Current (Amps)	**0.107**	**0.112**
Input Frequency (Hertz)	**60.0**	**60.0**
Power Factor	**0.921**	**0.898**
Additional Information	**Sample Reference**	
	iPAR30S30161N	
Ambient Temperature	**24.5°C**	
Integrating Sphere Detector	**CDS 600 Spectroradiometer**	
Absorption Correction used?	**Yes**	

Spectral Flux

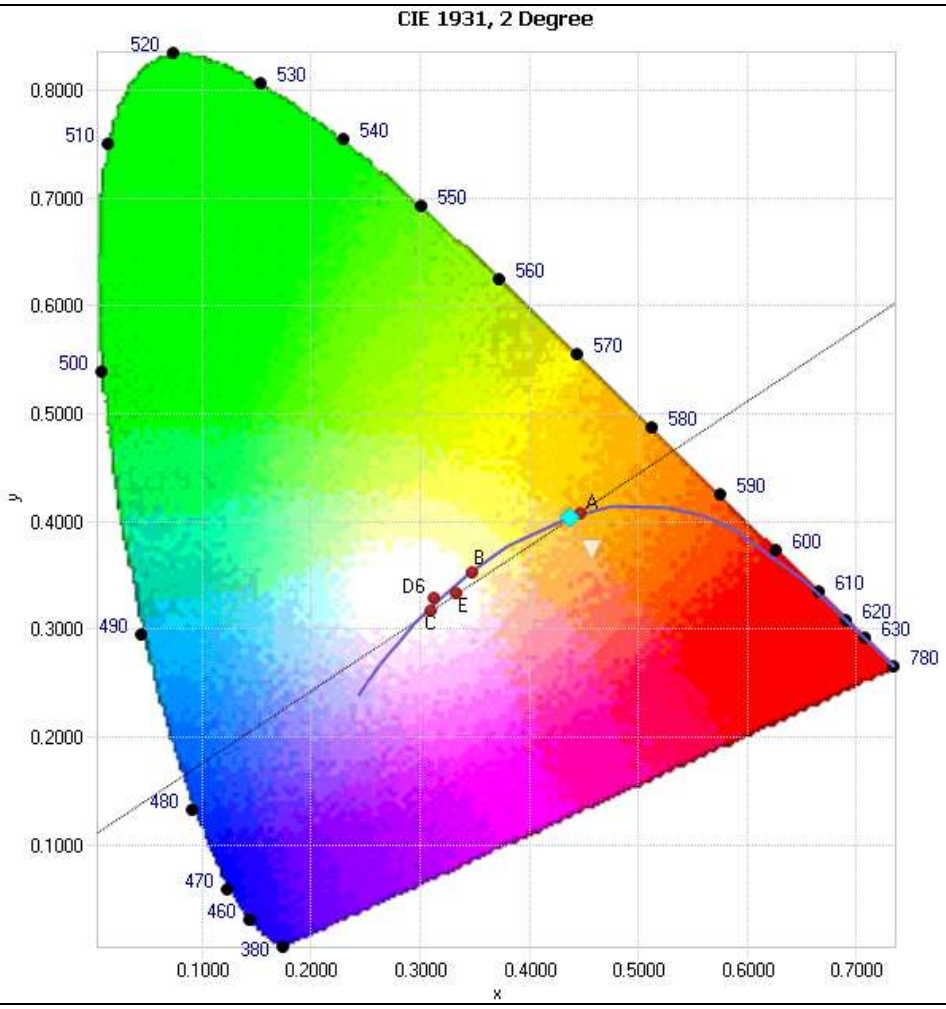
The following graph shows the spectral response curve of the radiant flux for the sample:



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 = 0.4378 / 0.4033

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:

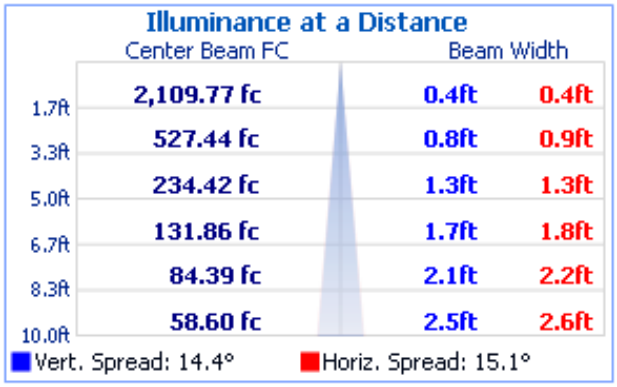
Zone	Lumens	% Total
0 - 10	338.5	51.40%
10 - 20	140.8	21.40%
20 - 30	69	10.50%
30 - 40	26.9	4.10%
40 - 50	22.3	3.40%
50 - 60	20.8	3.20%
60 - 70	17	2.60%
70 - 80	10.5	1.60%
80 - 90	3.7	0.60%
90 - 100	1.3	0.20%
100 - 110	1.2	0.20%
110 - 120	1.2	0.20%
120 - 130	1	0.10%
130 - 140	0.9	0.10%
140 - 150	1.1	0.20%
150 - 160	1.3	0.20%
160 - 170	0.9	0.10%
170 - 180	0.3	0%
Total	**658.65 Lumens**	**100%**

Zonal Lumen Summary

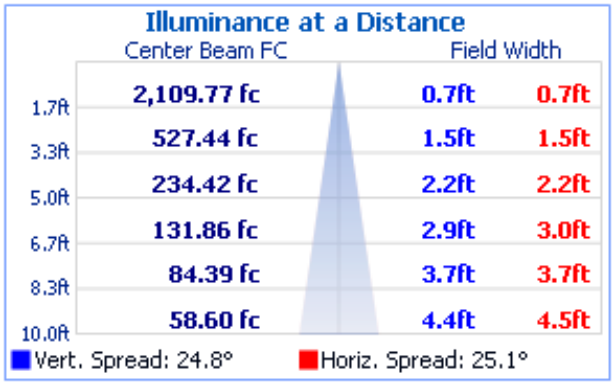
Zone	Lumens	% Lamp / Luminaire
0 - 60	618.2	93.9 %
60 - 90	31.3	4.7 %
0 - 90	649.5	98.6 %
90 - 180	9.2	1.4 %
0 - 180	658.7	100 %

Test Results – Illuminance Plots

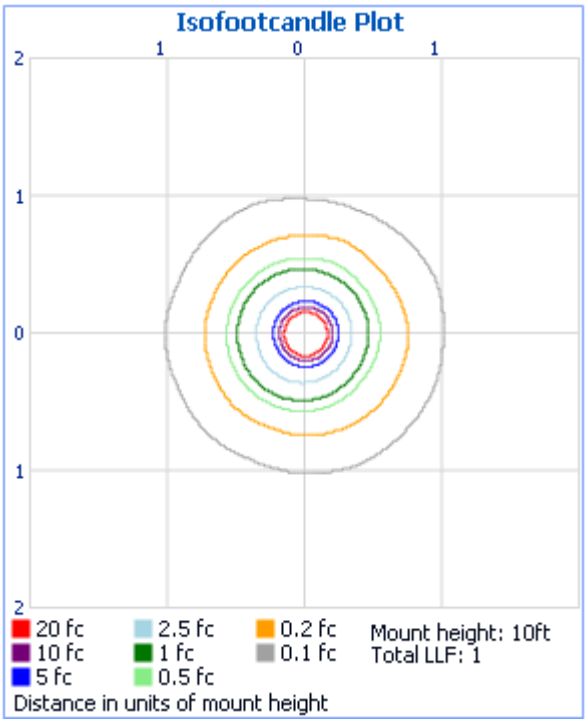
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



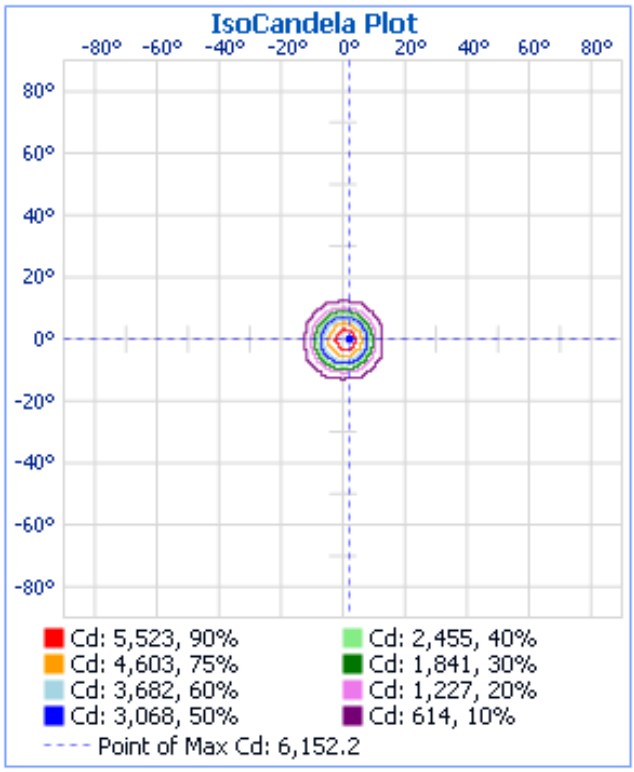
Field Angle



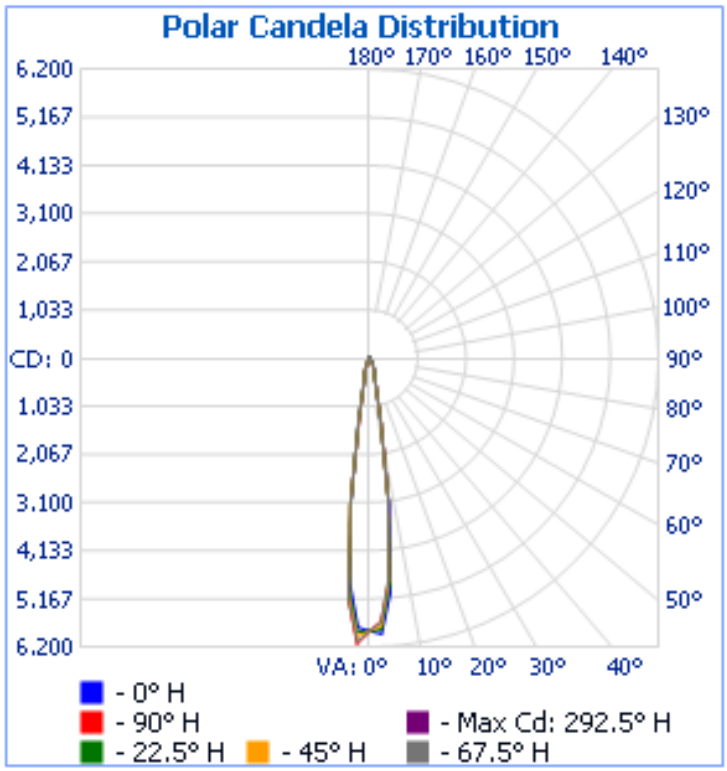
Illuminance Plot (Footcandles)

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	5860	5860	5860	5860	5860	5860	5860	5860	5860	5860	5860	5860	5860	5860	5860	5860	5860
2.5	5923	5831	5753	5676	5650	5630	5626	5684	5782	5885	5971	6090	6137	6152	6085	5978	5918
5.0	5070	4895	4789	4721	4781	4788	4717	4800	4859	5016	5140	5197	5200	5184	5175	5135	5059
7.5	3137	3050	2994	3026	3090	3136	3156	3096	3107	3131	3191	3167	3085	3055	3095	3127	3123
10.0	1339	1334	1329	1348	1412	1432	1451	1411	1376	1355	1336	1305	1240	1223	1251	1286	1326
12.5	624	606	611	617	634	646	650	625	606	601	621	609	584	582	590	609	613
15.0	421	411	412	409	410	421	424	419	419	420	430	432	427	421	424	428	420
17.5	347	336	327	324	325	329	331	336	339	344	351	358	359	356	361	358	347
20.0	283	269	254	251	249	258	256	258	265	276	288	294	295	292	299	299	285
22.5	218	205	187	183	185	188	189	189	201	212	225	233	232	229	235	233	218
25.0	153	140	124	121	127	127	131	132	141	152	164	172	171	169	171	169	153
27.5	97	89	77	77	83	84	84	90	91	96	108	114	116	116	116	111	98
30.0	68	59	56	57	62	59	59	67	63	64	67	72	75	76	77	71	68
32.5	51	46	47	46	50	45	46	52	48	48	48	49	53	53	55	50	51
35.0	42	41	41	40	42	39	38	41	39	39	39	39	41	40	42	40	42
37.5	36	37	37	38	38	36	34	35	34	35	35	35	36	36	37	35	36
40.0	33	34	33	33	34	34	32	31	31	32	32	31	33	32	33	31	33
42.5	31	31	31	31	30	32	30	29	29	30	31	30	31	30	31	30	31
45.0	29	30	29	29	28	30	29	27	27	29	29	28	30	29	29	28	29
47.5	27	28	28	28	27	28	27	27	27	27	27	26	28	27	28	26	27
50.0	25	27	26	26	26	27	26	25	25	27	26	25	27	26	26	25	25
52.5	24	25	24	25	24	26	24	24	24	26	24	24	25	24	24	24	24
55.0	23	23	23	24	23	25	23	23	23	24	22	23	24	23	23	23	23
57.5	22	22	22	22	22	23	22	22	22	22	21	21	23	22	22	21	22
60.0	20	21	21	21	21	22	21	21	21	21	20	19	21	21	21	20	20
62.5	18	18	19	19	19	19	20	19	20	20	19	18	19	19	19	18	18
65.0	16	17	17	17	17	17	18	18	18	18	17	17	17	17	17	16	16
67.5	15	16	15	16	15	16	16	16	16	16	15	15	16	15	15	15	15
70.0	13	14	13	14	13	14	14	15	14	14	13	13	14	13	14	13	13
72.5	11	11	11	12	11	12	12	13	12	13	12	12	12	11	11	11	11
75.0	9	9	9	10	9	10	10	11	10	10	10	10	10	9	9	9	9
77.5	8	7	7	8	8	8	9	9	9	9	9	9	8	7	8	7	8
80.0	6	6	5	6	7	7	8	8	7	7	7	7	7	6	6	6	6
82.5	5	4	4	4	5	6	6	6	5	5	6	5	5	4	4	4	5
85.0	3	2	2	3	3	4	4	4	3	3	4	4	3	2	2	2	3
87.5	2	1	1	1	2	2	2	3	1	2	2	2	2	1	1	1	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	2	2	1
95.0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	2	2	1
97.5	2	1	1	1	1	1	1	0	0	0	1	1	1	1	2	1	2
100.0	2	2	1	1	1	1	1	0	0	0	1	1	1	1	1	1	2
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	2	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	2
110.0	2	1	1	1	1	1	1	1	0	1	1	1	1	1	2	1	2
112.5	2	1	1	1	1	1	1	1	0	1	1	1	1	1	2	2	2
115.0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	2	2	1
117.5	1	1	1	2	1	1	1	0	0	1	1	1	1	1	2	1	1
120.0	1	1	1	1	1	2	1	0	0	1	1	1	1	1	1	1	1
122.5	1	1	1	1	1	1	1	0	0	1	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	2	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	2
130.0	2	2	1	1	1	1	1	0	0	0	1	1	1	1	1	2	2
132.5	2	2	1	1	1	1	1	0	0	0	1	1	1	1	1	2	2
135.0	2	2	1	2	1	1	1	0	0	0	1	1	1	1	2	2	2
137.5	2	2	2	2	2	1	1	0	0	0	1	1	1	2	2	2	2
140.0	2	2	2	2	2	1	1	0	0	0	1	1	1	2	2	2	2
142.5	3	2	2	2	2	1	1	0	0	0	1	1	2	2	2	3	3
145.0	3	3	2	2	2	1	1	0	0	0	1	1	2	2	3	4	3
147.5	4	4	3	2	2	2	1	0	0	0	1	2	2	3	3	4	4
150.0	4	4	4	3	2	2	1	0	0	0	1	2	2	3	4	4	4
152.5	5	5	4	4	2	2	1	0	0	0	1	2	3	4	4	5	5
155.0	5	5	4	4	3	2	1	0	0	0	1	2	3	4	4	6	5
157.5	6	6	4	4	3	2	1	0	0	0	1	2	4	4	5	6	6
160.0	6	6	4	4	3	2	1	1	1	1	1	2	3	4	5	6	6
162.5	6	6	4	4	3	2	2	1	1	1	2	2	3	4	5	6	6
165.0	6	5	4	4	3	3	2	1	1	2	3	3	3	4	5	6	6
167.5	4	4	4	4	3	3	3	2	2	2	3	3	3	4	4	4	4
170.0	4	4	4	4	4	3	3	3	2	3	3	3	3	4	4	4	4
172.5	4	4	4	4	4	3	3	2	2	3	3	3	3	4	4	4	4
175.0	4	4	4	4	3	3	3	2	2	2	3	3	3	3	4	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 65-inch diameter sphere manufactured by Labsphere (Model# LMS650) 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)

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Equipment List:

Description	Manufacturer and Model Number	CSA Instrument Reference Number	Calibration Due Date
Integrating Sphere 65”	Labsphere LMS650	IS100	N/A
Spectroradiometer	Labsphere CDS600	CDS600	5/2012
Auxiliary Lamp PSU	Labsphere LPS200	LPS200	2/2012
Power Analyzer	Voltech PM1000+	PA110	4/2012
Power Analyzer	Yokogawa WT210	PA107	3/2012
Regulated Power Supply	California Instruments 1001P	AC100	N/A
Regulated Power Supply	Chroma Instruments 61602	AC300	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 and Labsphere LPS200 which is calibrated by Labsphere, USA.