



Report: 70150753
Project: 70150753
Client: Man-D-Tec

PHOTOMETRIC TESTING & EVALUATION

Sample Tested
Man-D-Tec UNILED-12-4K

Prepared for:

Man-D-Tec
8175 E. Paradise Lane
Scottsdale, AZ 85260

Phone: 480-998-0325

Technical Report Number
70150753

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Prepared by:

A handwritten signature in black ink, appearing to be 'M Anderson'.

Mauricio Anderson, Project Manager

Approved by:

A handwritten signature in black ink, appearing to be 'J Whalen'.

Jesse Whalen, Operations Manager

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Program Description

Photometric and electrical testing of a “UNILED-12-4K” fixture.

Executive Summary

Sample Tested = **UNILED-12-4K**

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
110.21	838.7	7.61	1.00

CCT (K)*	CRI*	Stabilization Time (Light & Power)
4221	81.17	60 minutes

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

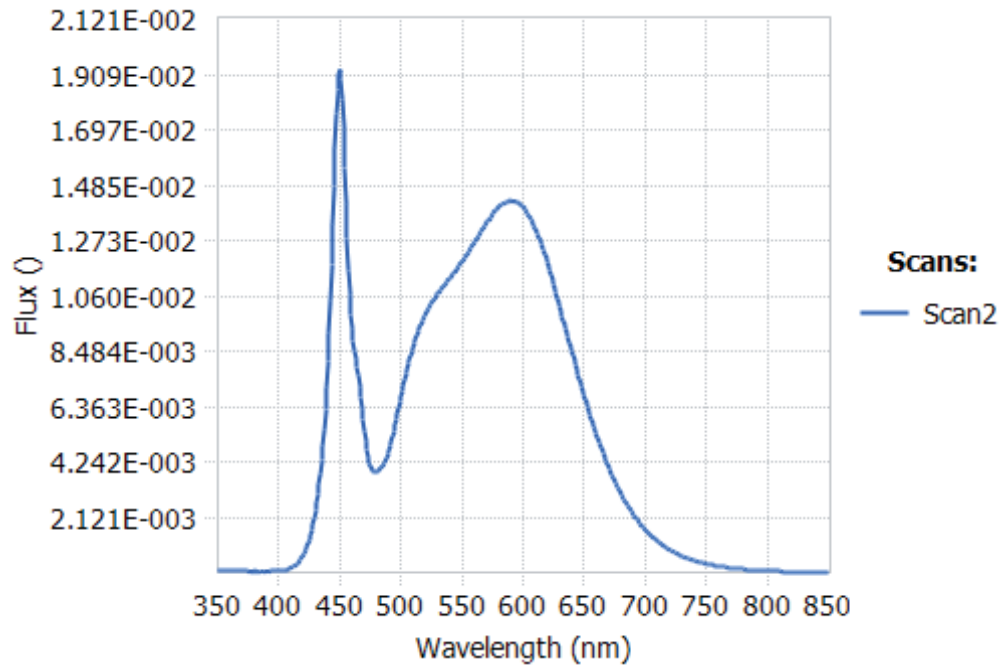
TABLE OF CONTENTS

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.....	12
Equipment List:.....	14

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%.		
Key Photometric Results	Sample Reference	
	UNILED-12-4K	
	Integrating Sphere	Goniophotometer
Luminous Efficacy (Lumens/Watt)	110.21	107.09
Total Luminous Flux (Lumens)	838.7	815.03
Total Radiant Flux (Watts)	2.53	
Correlated Color Temperature (CCT)	4221	
Color Rendering Index (CRI) (Ra)	81.17	
R9 Value	1.5	
Chromaticity (Chroma x / Chroma y)	0.3715 / 0.3724	
Chromaticity (Chroma u / Chroma v)	0.2209 / 0.3322	
Chromaticity (Chroma u' / Chroma v')	0.2209 / 0.4983	
D _{uv} Value	0.0004	
Stabilization Time (Light and Power)	Approx. 60 minutes	
Total Run Time – Integrating Sphere	64 minutes	
Total Run Time – Goniophotometer	61 minutes	
Spacing Criteria	1.30 (0° – 180°) / 1.34 (90° – 270°)	
Scotopic/Photopic ratio $\Phi(v')/\Phi(v)$	1.72	
Electrical Input Results:	Sample Reference	
	UNILED-12-4K	
Input Power (Watts)	7.61	
Input Voltage (Volts DC)	24.05	
Input Current (Amps)	0.31647	
Input Frequency (Hertz)	60.0	
Power Factor	1.00	
1Additional Information	Sample Reference	
	UNILED-12-4K	
Ambient Temperature	24.8°C	
Integrating Sphere Detector	CDS 1100 Spectroradiometer	
Absorption Correction used?	Yes	

Spectral Flux

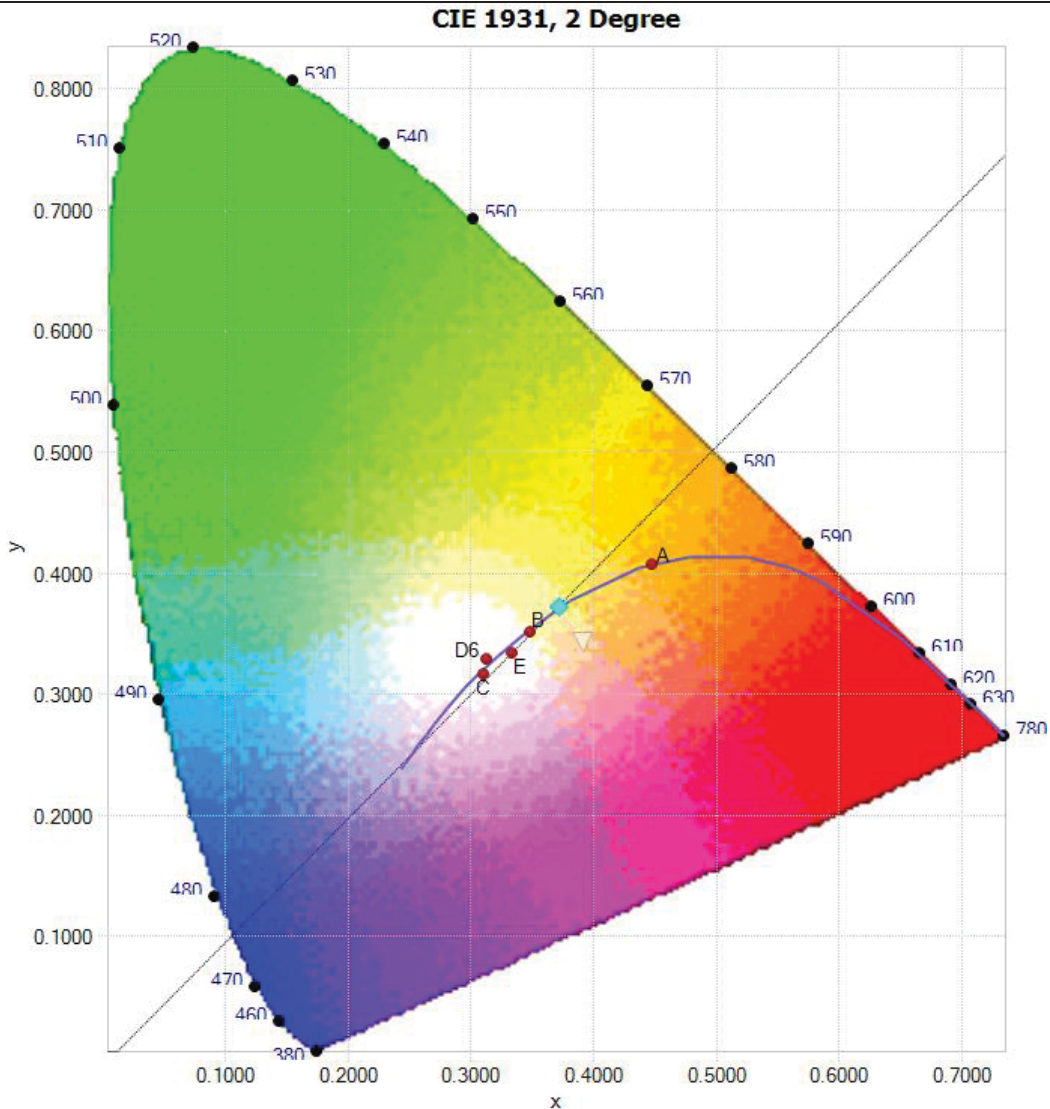
The following graph shows the spectral response curve of the radiant flux for the sample:



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):
 $x / y = 0.3715 / 0.3724$

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:

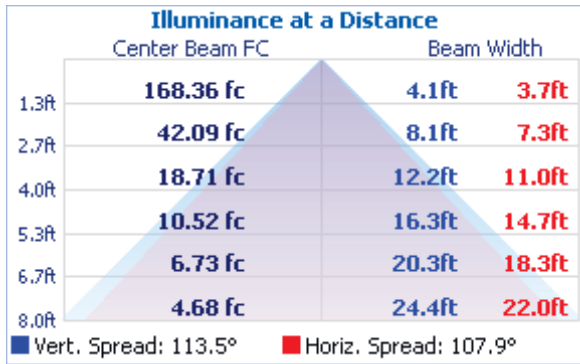
Zone	Lumens	% Total
0-10	28.5	3.5%
10-20	82.4	10.1%
20-30	126.5	15.5%
30-40	156.6	19.2%
40-50	168.3	20.7%
50-60	140.6	17.2%
60-70	79.2	9.7%
70-80	29.3	3.6%
80-90	3.7	0.4%
Total	815.1 LUMENS	100%

Zonal Lumen Summary

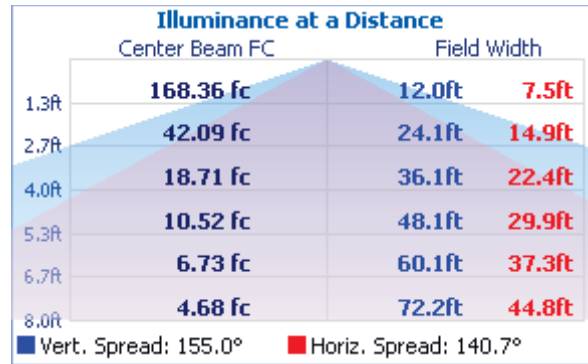
Zone	Lumens	%Luminaire
0-30	237.4	29.1%
0-40	393.9	48.3%
0-60	702.9	86.2%
60-90	112.2	13.8%
70-100	33.0	4%
90-120	0	0%
0-90	815.1	100%
90-180	0	0%
0-180	815.1	100%

Test Results – Illuminance Plots

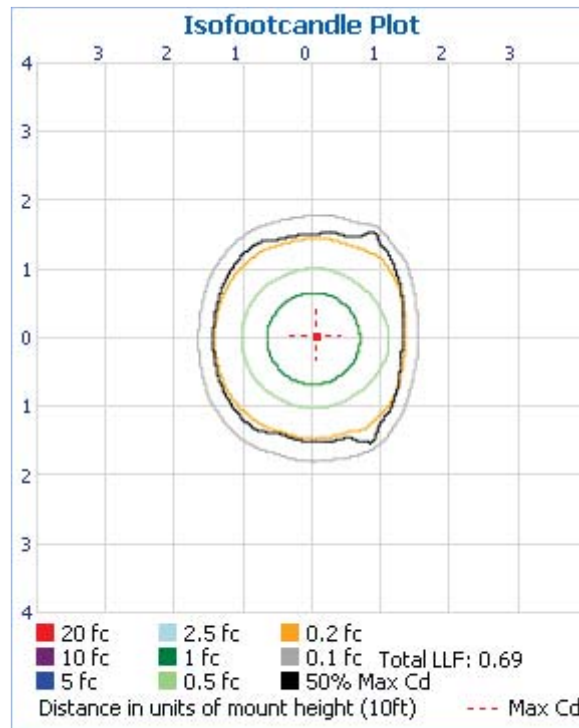
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



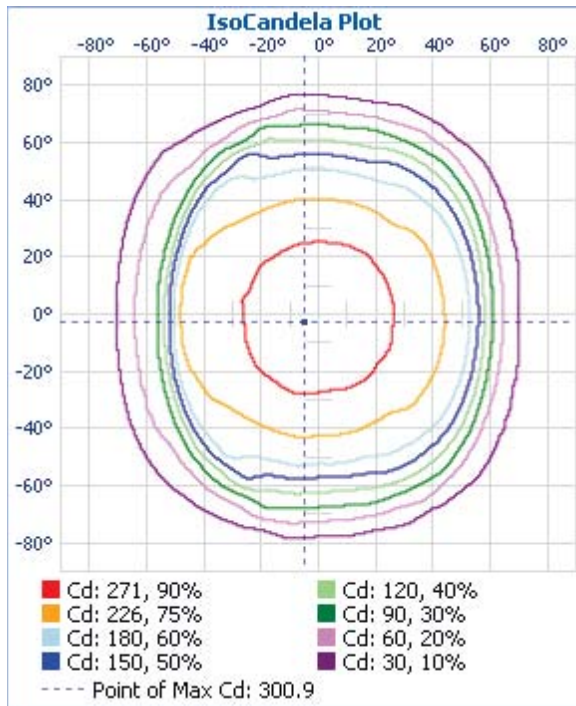
Field Angle



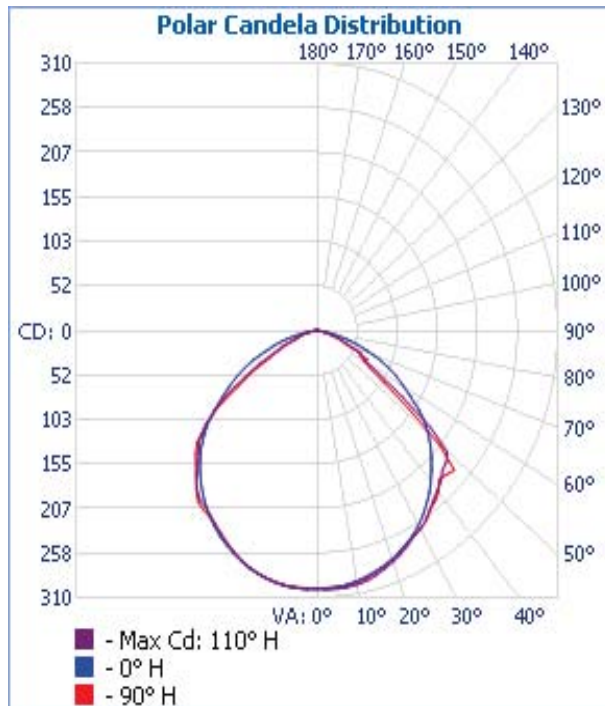
Illuminance Plot (Footcandles)

Test Results – Candela Plots

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



Isocandela Plot



Polar Candela Distribution

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50				30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0	
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00	
1	1.10	1.06	1.02	.99	1.07	1.04	1.00	.87	.99	.97	.94	.95	.93	.91	.92	.90	.88	.86	
2	1.01	.93	.87	.82	.98	.91	.86	.75	.88	.83	.79	.85	.81	.77	.82	.78	.75	.73	
3	.92	.82	.75	.69	.90	.81	.74	.64	.78	.72	.67	.75	.70	.66	.73	.68	.65	.62	
4	.85	.73	.65	.58	.82	.72	.64	.55	.69	.63	.57	.67	.61	.57	.65	.60	.56	.54	
5	.78	.65	.57	.50	.76	.64	.56	.48	.62	.55	.50	.60	.54	.49	.59	.53	.49	.47	
6	.72	.59	.50	.44	.70	.58	.50	.43	.56	.49	.44	.55	.48	.43	.53	.47	.43	.41	
7	.67	.53	.45	.39	.65	.53	.45	.38	.51	.44	.39	.50	.43	.38	.48	.42	.38	.36	
8	.62	.49	.40	.35	.60	.48	.40	.34	.47	.40	.34	.46	.39	.34	.44	.38	.34	.32	
9	.58	.45	.37	.31	.56	.44	.36	.31	.43	.36	.31	.42	.35	.31	.41	.35	.31	.29	
10	.54	.41	.33	.28	.53	.41	.33	.28	.40	.33	.28	.39	.32	.28	.38	.32	.28	.26	



Test Results – Candela Tabulation

The following table provides the tabulated Candela measurements:

Candela Table - Type C																																								
	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360			
0	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299	299		
2.5	300	298	298	298	299	298	299	300	298	299	298	301	301	299	300	299	300	301	300	299	298	298	300	297	300	300	297	299	299	300	298	300	298	300	299	300	300	300	300	299
5	299	298	297	297	298	298	299	299	298	299	298	301	301	299	299	299	300	301	300	298	298	298	299	297	300	301	297	299	299	300	298	300	298	300	298	299	299	299	299	
7.5	297	296	296	296	297	297	298	298	298	297	300	300	299	299	298	300	300	299	297	297	297	297	297	299	296	299	300	297	299	299	299	299	296	299	297	298	298	297		
10	295	294	295	295	295	296	296	297	296	296	295	299	299	298	298	296	299	298	297	295	296	296	298	294	298	299	296	297	298	297	298	295	298	296	296	296	295	295		
12.5	293	292	292	292	293	294	294	295	295	294	293	297	297	296	296	294	297	296	295	293	294	295	297	293	297	297	294	295	296	295	296	294	296	294	294	294	293	293		
15	290	289	289	289	290	292	291	291	291	291	290	294	294	295	295	294	292	295	293	292	290	291	293	294	290	294	295	291	292	293	292	293	291	293	291	291	290	290		
17.5	286	285	287	286	286	289	287	287	288	287	286	290	291	292	291	288	292	290	289	287	288	288	290	291	287	291	292	288	288	288	289	288	289	287	290	287	287	286	286	
20	282	281	283	282	282	284	283	282	284	283	283	286	287	287	287	285	289	286	285	283	285	286	287	284	287	287	284	284	285	284	285	283	286	284	283	282	282	282		
22.5	278	277	278	278	277	280	279	278	280	278	278	281	282	283	282	281	284	282	280	278	280	281	282	279	282	282	278	278	279	279	278	281	279	279	277	277	278	278		
25	273	272	273	273	272	275	273	272	275	273	273	276	277	278	277	277	279	277	275	274	276	276	277	274	275	276	273	272	273	273	273	275	274	274	274	272	273	273		
27.5	267	267	268	266	266	269	268	267	270	269	269	270	270	272	271	272	273	272	269	268	270	270	270	267	269	269	267	266	267	266	267	266	268	268	266	267	267	267		
30	261	260	261	260	260	263	264	264	268	266	267	266	266	266	266	265	266	267	266	263	262	264	264	263	260	261	263	262	261	261	260	260	259	260	261	261	260	261		
32.5	254	253	254	253	253	258	260	260	263	261	262	262	261	261	258	259	261	260	256	256	258	257	255	253	255	257	257	257	256	255	253	250	252	254	253	253	254	254		
35	246	246	247	246	248	251	253	252	256	254	255	254	255	255	252	253	253	253	249	249	251	249	247	245	249	253	255	254	252	250	247	243	244	246	245	245	246	246		
37.5	238	237	238	238	239	243	245	246	252	250	250	247	247	247	245	245	245	245	241	242	243	240	238	239	245	252	252	251	250	247	242	235	235	238	237	237	238	238		
40	228	229	229	229	231	235	240	241	246	244	246	241	238	239	236	237	236	237	232	233	234	231	229	234	242	244	242	241	240	240	239	229	225	227	228	228	228	228		
42.5	218	220	220	220	222	227	234	233	235	234	237	237	233	230	227	226	227	228	223	224	224	220	221	231	233	232	232	230	229	229	230	226	216	217	218	217	218	217		
45	209	211	209	209	212	222	227	226	235	236	233	229	230	223	218	216	216	218	213	215	213	210	218	222	221	221	221	220	219	217	218	217	209	205	207	207	209	209		
47.5	198	200	197	198	205	219	220	231	242	240	238	226	223	220	208	206	205	208	202	204	201	199	210	208	209	210	212	212	209	207	205	205	202	193	195	196	198	198		
50	187	188	185	188	202	208	217	215	209	206	215	219	213	218	199	194	194	196	190	192	188	192	198	194	199	201	202	201	199	198	193	190	192	182	183	184	187			
52.5	175	175	173	176	200	195	191	167	152	149	161	184	197	202	199	183	181	184	177	179	174	183	183	183	187	184	182	180	180	180	181	182	178	178	173	169	172	175		
55	160	160	159	174	181	169	149	118	109	106	114	135	166	179	196	171	167	169	161	164	161	171	168	171	166	162	159	157	159	160	163	166	162	162	154	157	160	160		
57.5	143	144	145	171	148	138	105	87	82	81	86	98	125	150	173	164	151	152	145	145	147	156	154	149	144	135	126	120	125	136	140	145	149	149	138	140	143	143		
60	128	127	133	152	124	101	77	69	69	69	70	75	90	124	135	158	133	135	131	128	131	138	135	127	119	106	98	97	99	104	118	123	131	131	122	124	128	128		
62.5	115	113	123	108	101	72	61	65	72	73	69	63	68	91	109	139	119	122	117	115	118	117	113	107	95	79	70	69	73	82	94	102	107	111	109	112	115	115		
65	101	99	114	78	71	55	63	63	58	58	60	64	57	65	90	102	109	108	102	100	105	98	91	89	66	55	55	55	56	71	85	86	93	97	96	101	101	101		
67.5	86	85	92	66	48	52	47	41	40	40	41	45	55	51	66	72	99	92	88	85	87	77	74	60	48	48	43	42	43	47	64	68	75	84	81	86	86	86		
70	70	72	59	52	40	34	33	33	33	33	34	33	35	45	43	58	84	76	71	71	68	59	61	40	38	31	29	29	30	31	37	37	58	57	65	65	70	70		
72.5	55	60	37	33	27	24	29	25	26	26	26	27	28	27	39	48	61	63	58	57	51	48	33	28	25	25	25	25	25	25	26	36	43	48	50	55	55	55		
75	42	45	29	24	18	20	20	18	20	20	19	19	21	22	23	31	36	49	44	44	34	34	22	20	22	21	20	19	21	24	22	18	22	34	32	37	42	42	42	
77.5	28	29	21	13	13	15	15	15	14	14	14	15	15	16	15	21	23	35	29	29	25	20	15	17	15	14	16	16	16	16	15	16	13	19	20	24	28	28		
80	16	12	11	8	8	10	9	9	8	8	8	9	10	11	10	11	16	21	16	16	14	10	12	10	12	9	8	8	8	9	11	9	10	9	12	15	16	16	16	
82.5	8	6	5	4	5	5	4	4	4	4	4	5	5	6	6	6	8	10	9	7	7	6	6	6	5	4	4	4	4	4	5	6	4	5	5	5	5	5		
85	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
87.5	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Continued.....

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 by Labsphere 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.

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. 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 Voltage 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:

Sphere D	Sphere B & C
Manufacturer: Sylvania	Sylvania
Model# 75Q/CL-28V	796
Voltage = 28.0 Volt	12.0 Volt
Wattage = 75.0 Watts	32.0 Watts
Calibration Current = 2.679 Amperes	2.600 Amperes
Luminous Flux = 1538.8 Lumens	554.0 Lumens
Calibration Date = 8-18-2005	11-13-2013
(calibrated by Labsphere – NIST traceable).	

Continued.....

Photometric Testing Information (continued)

The goniophotometer Mayer Engineering Type C is calibrated using a frosted tungsten filament FDS/DZE lamp with the following specifications:

Manufacturer: GE
Part Number: DZE 88
Bulb Number: 114-A
Voltage: 16.59 Volts DC reference
Calibration Current: 4.810 Amperes
Luminous Intensity: 154.7 Candelas
Calibration Date: 7/12/12 (NIST traceable)

Manufacturer: GE
Part Number: DZE 88
Bulb Number: 114-B
Voltage: 16.61 Volts DC reference
Calibration Current: 4.819 Amperes
Luminous Intensity: 150.6 Candelas
Calibration Date: 7/12/12(NIST traceable)

Manufacturer: GE
Part Number: DZE 88
Bulb Number: 114-C
Voltage: 16.66 Volts DC reference
Calibration Current: 4.815 Amperes
Luminous Intensity: 155.4 Candelas
Calibration Date: 7/12/12 (NIST traceable)

A Yokogawa WT210 Power Analyzer was used to measure all electrical characteristics of the sample.



Equipment List: Goniophotometer Type C (Mirror 1)			
Description	Manufacturer and Model Number	CSA Instrument Reference Number	Calibration Due Date
Optometer	Gigahertz Optik P9801	N/A	N/A
Regulated Power Supply	Chroma Instruments 61602P-80-60	DCP401	N/A
Regulated Power Supply	Chroma Instruments 61602	DCP301	N/A
Power Analyzer	Yokogawa WT210	POA400	11/2017
Equipment List: Sphere C Equipment			
Description	Manufacturer and Model Number	CSA Instrument Reference Number	Calibration Due Date
Integrating Sphere 76"	Labsphere LMS760	SPH300	N/A
Spectroradiometer	Labsphere CDS1100	CDS1100	N/A
Auxiliary Lamp PSU	Labsphere LPS100	LPS100	N/A
Power Analyzer	Yokogawa WT210	PA118	12/2017
Regulated Power Supply	Chroma Instruments 61603	AC302	N/A

All equipment is calibrated to ISO / IEC 17025-2005 guidelines.