IES LM-79-19

MEASUREMENT AND TEST REPORT

For

Millennium Lighting LLC.

105 Declaration Dr McDonough, GA 30253 USA

Test Model: LEDRAS10-SB

Report Type:	Electrical and Photometric tests including: Luminous Flux, Power Factor, Chromaticity, Luminous Intensity Distribution
Reviewed By:	Hexy He
Report Number:	P2DG211208051-10
Test Date:	2021-12-14 to 2021-12-17
Report Date:	2022-02-15
Approved by:	Bill Xiong / EE Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan). No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China. Tel: +86-0769-86858888 Fax:+86-0769-86858588

1. Product Description

General Information:

One test sample was in good condition and received on 2021-12-08, and used for testing.

Model Tested:	LEDRAS10-SB
Manufacturer:	Millennium Lighting LLC.
Brand Name:	Millennium
Product Designation:	10”LED angle shade fixture SY1
Burning Time Before Test:	0hour(For New Products)

#Rated Values:

Rated Voltage/Frequency:	120 V AC 60Hz
Rated Power:	11W
Nominal CCT:	3000K
Nominal Lumen Output:	800lm (for LED Light Engine)

2. Standards Used

- ANSI/IES LM-79-19: Approved method :Optical and Electrical Measurements of Solid-State Lighting Products
- ANSI C82.77-10-2014: Harmonic Emission Limits – Related Power Quality Requirements for Lighting
- IES TM-30-18: IES Method for Evaluating Light Source Color Rendition (This method is not in IAS accreditation scope)

3. Description of Test Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
2.0m integrating sphere	EVERFINE	R98	11010018	2021-09-27	2022-09-26
spectroradiometer	EVERFINE	HAAS-2000	G112048TS81331121	2021-09-27	2022-09-26
Digital Power Meter	EVERFINE	PF2010A	1011004	2021-09-27	2022-09-26
Digital CC&CV DC Power Supply	EVERFINE	WY305-V1	1101047	2021-06-30	2022-06-29
Standard Light Source	EVERFINE	D204	N/A	2021-10-15	2022-10-14
Special zero-voltage synchronous switching AC	EVERFINE	DPS1010-YF	1011001T	2021-01-04	2022-01-03
AC POWER SUPPLY	EVERFINE	VPS1030 PWM	1012017	2021-01-04	2022-01-03
Digital CC&CV DC Power Supply	EVERFINE	WY12010	1009009	2021-01-04	2022-01-03
Digital power meter	YOKOGAWA	WT-210	91j926132	2021-01-04	2022-01-03
full-field speed goniophotometer	EVERFINE	GO-R5000	YG108492N10120001	2021-03-12	2022-03-11
wireless remote thermohygrometer	N/A	433MHz	N/A	2021-04-27	2022-04-26
Standard Light Source	EVERFINE	D908	1012003	2021-10-15	2022-10-14

Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

4. Test Method

Product was tested with no seasoning. All stabilization and measurements were made in compliance with ANSI/IES LM-79-19. The product was operated at rated voltage or at voltage required by manufacturer. The ambient temperature of the sample was maintained at 25°C±1.2°C during measurement. And relative humidity is maintained between 10% and 65%.The air flow around the SSL product is less than 0.2m/s.

Integrating Sphere System

The system includes AC power source, digital power meter, DC power supply, Spectroradiometer, and integrating sphere. The integrating sphere system is calibrated by standard spectrum light source before measurement.

4π geometry was used during measurement. The product was operated in its intended orientation in application and was recorded in this report.

The uncertainty of the light output (luminous flux) measurements is U=2.1% (K=2), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is U=22K (K=2), at the 95% confidence level. The uncertainty of the CRI is U=2.1(K=2), at the 95% confidence level.

The uncertainty of power meter AC current U=0.19 % of rdg, AC Voltage U=0.18% of rdg, Power U=0.46%) (K=2), at the 95% confidence level.

Goniophotometer System

The goniophotometer system is calibrated by standard light source before measurement.

Type C goniophotometer was used for measuring total luminous flux, luminous intensity distribution, and color spatial uniformity. The product was operated in its intended orientation in application and was recorded in this report. For luminous intensity distribution, The vertical angle (γ) test intervals were set no more than 2.5 degree ,The horizontal angle (C plane) test intervals were set no more than 22.5 degree. For color spatial uniformity, The vertical angle (γ) test intervals were set no more than 90 degree ,The horizontal angle (C plane) test intervals were set no more than 10 degree

The uncertainty of the luminous intensity is U=2.00% (K=2), at the 95% confidence level.

Fidelity Index and Gamut Index Calculation

The R_f, R_g was calculated according to IES TM-30-18 by using calculation tools. The calculation was based on the measured SPD from 380nm to 780nm with 1nm intervals. All the colors in this report is for reference only.

5. Test Result

[Integrating Sphere System]

Total operating time for integrating sphere test: **1.0 hour**

Test orientation: **Downward**

Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1121	12.24	0.9091	646.82	52.86

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
2.2663	2980	-0.00427	0.4322	0.3919	0.2528	0.5158

Color Rendering Index

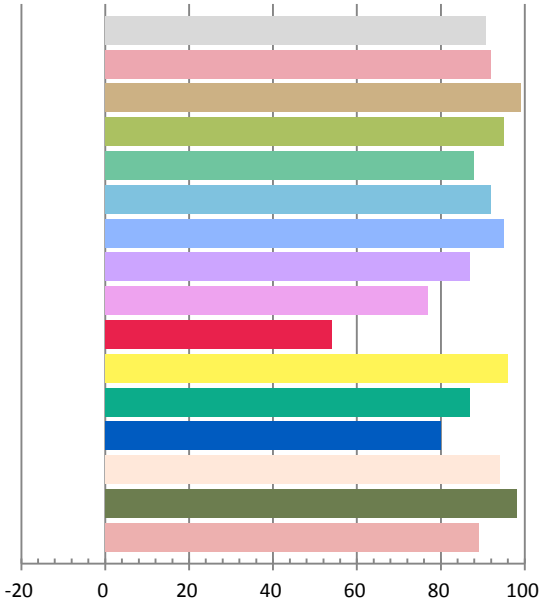
Ra
90.6

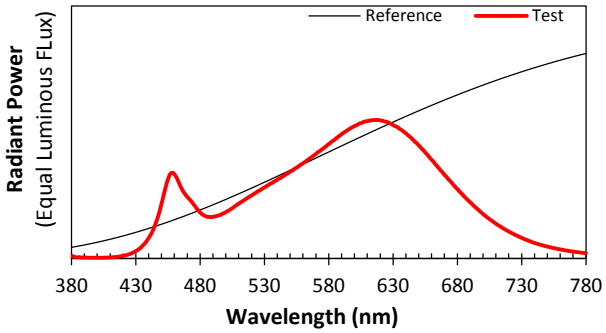
R1	R2	R3	R4
92	99	95	88

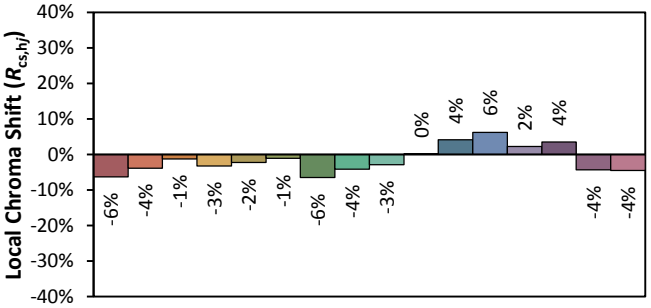
R5	R6	R7	R8
92	95	87	77

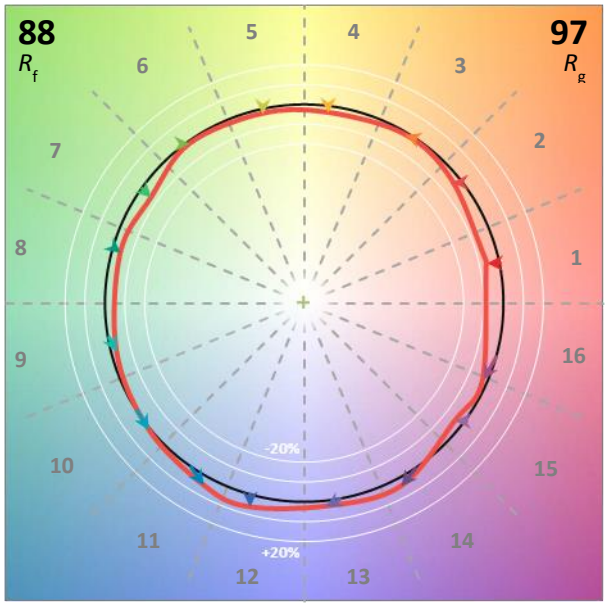
R9	R10	R11	R12
54	96	87	80

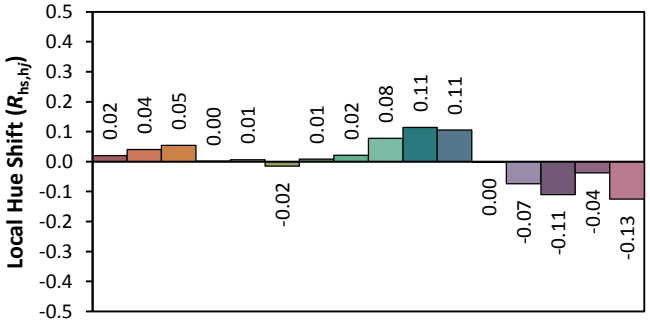
R13	R14	R15
94	98	89

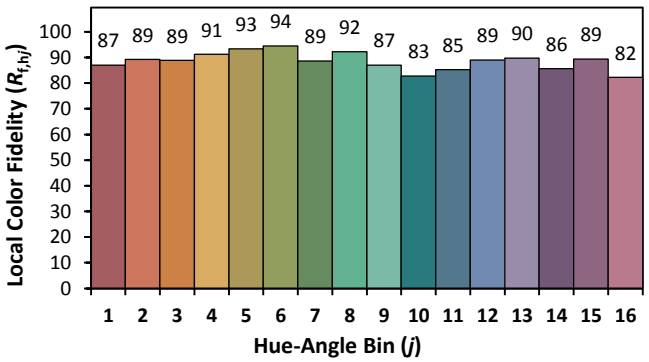


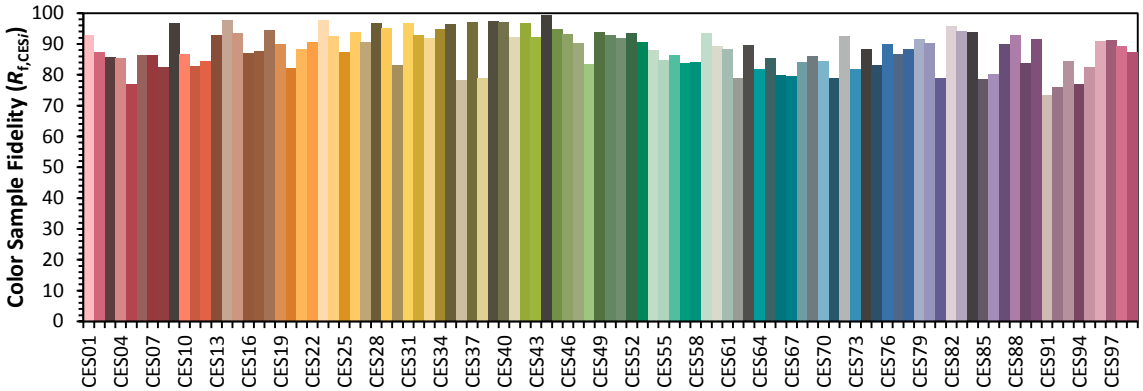

Reference
Test
Radiant Power
(Equal Luminous FLux)
380 430 480 530 580 630 680 730 780
Wavelength (nm)


Local Chroma Shift ($R_{cs,hj}$)
40% 30% 20% 10% 0% -10% -20% -30% -40%
-6% -4% -1% -3% -2% -1% -6% -4% -3% 0% 4% 6% 2% 4% -4% -4%

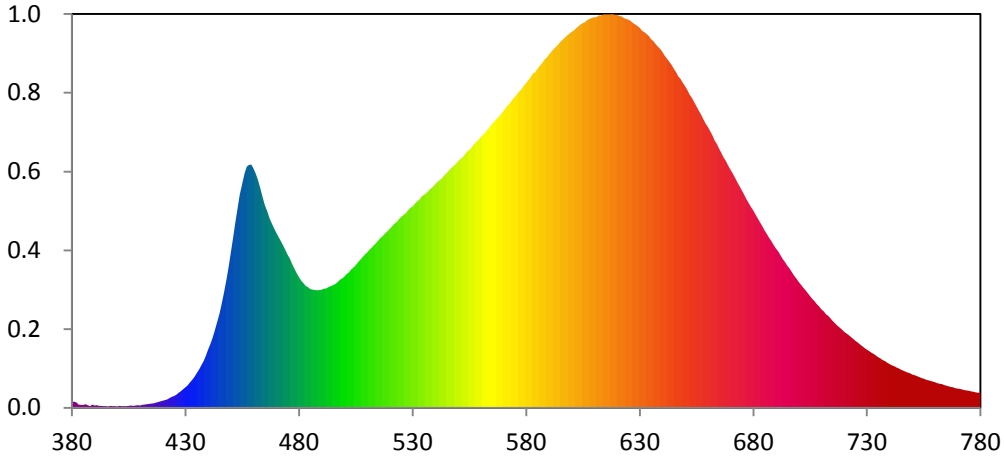

88
R_f
97
R_g
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
-20%
+20%


Local Hue Shift ($R_{hs,hj}$)
0.5 0.4 0.3 0.2 0.1 0.0 -0.1 -0.2 -0.3 -0.4 -0.5
0.02 0.04 0.05 0.00 0.01 -0.02 0.01 0.02 0.08 0.11 0.11 0.00 -0.07 -0.11 -0.04 -0.13


Local Color Fidelity ($R_{f,hj}$)
100 90 80 70 60 50 40 30 20 10 0
87 89 89 91 93 94 89 92 87 83 85 89 90 86 89 82
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Hue-Angle Bin (j)


Color Sample Fidelity ($R_{f,CESi}$)
100 90 80 70 60 50 40 30 20 10 0
CES01 CES04 CES07 CES10 CES13 CES16 CES19 CES22 CES25 CES28 CES31 CES34 CES37 CES40 CES43 CES46 CES49 CES52 CES55 CES58 CES61 CES64 CES67 CES70 CES73 CES76 CES79 CES82 CES85 CES88 CES91 CES94 CES97

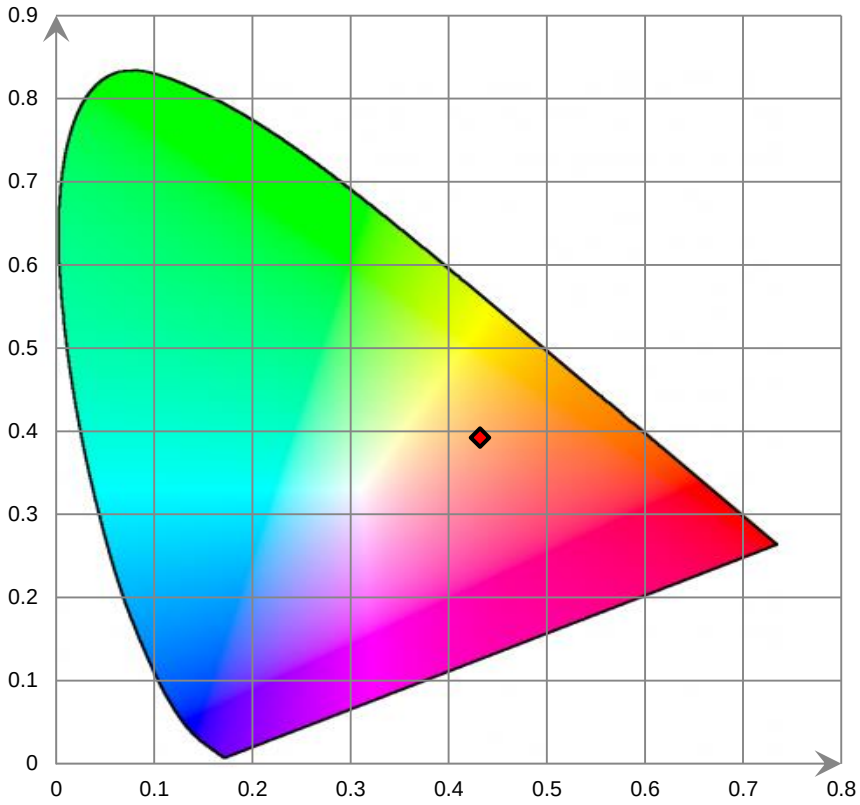
Relative Spectral Power Distribution



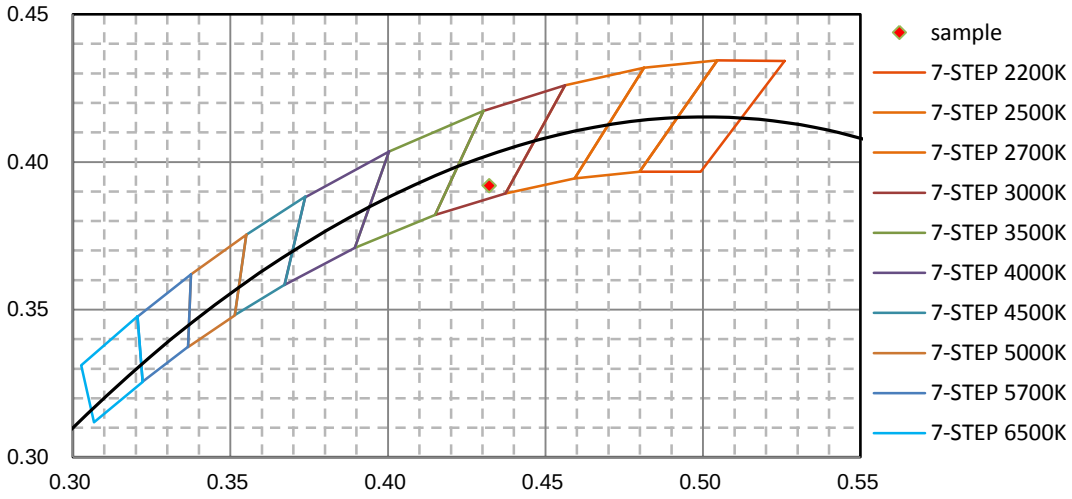
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	2.023E-01	421	2.565E-01	462	7.500E+00	503	4.553E+00	544	7.659E+00
381	1.944E-01	422	2.711E-01	463	7.236E+00	504	4.620E+00	545	7.732E+00
382	1.767E-01	423	3.149E-01	464	6.955E+00	505	4.698E+00	546	7.817E+00
383	1.010E-01	424	3.545E-01	465	6.688E+00	506	4.790E+00	547	7.899E+00
384	8.935E-02	425	3.896E-01	466	6.469E+00	507	4.883E+00	548	7.968E+00
385	9.036E-02	426	4.364E-01	467	6.246E+00	508	4.966E+00	549	8.037E+00
386	1.185E-01	427	4.961E-01	468	6.078E+00	509	5.055E+00	550	8.128E+00
387	7.982E-02	428	5.455E-01	469	5.915E+00	510	5.116E+00	551	8.192E+00
388	5.249E-02	429	6.107E-01	470	5.766E+00	511	5.214E+00	552	8.255E+00
389	1.069E-01	430	6.762E-01	471	5.635E+00	512	5.280E+00	553	8.349E+00
390	6.703E-02	431	7.422E-01	472	5.495E+00	513	5.360E+00	554	8.439E+00
391	8.438E-02	432	8.365E-01	473	5.361E+00	514	5.436E+00	555	8.499E+00
392	5.882E-02	433	9.183E-01	474	5.212E+00	515	5.519E+00	556	8.582E+00
393	5.721E-02	434	1.014E+00	475	5.054E+00	516	5.601E+00	557	8.669E+00
394	5.427E-02	435	1.149E+00	476	4.906E+00	517	5.673E+00	558	8.762E+00
395	5.533E-02	436	1.270E+00	477	4.722E+00	518	5.760E+00	559	8.827E+00
396	4.573E-02	437	1.397E+00	478	4.576E+00	519	5.820E+00	560	8.922E+00
397	6.066E-02	438	1.544E+00	479	4.430E+00	520	5.903E+00	561	8.995E+00
398	4.951E-02	439	1.718E+00	480	4.306E+00	521	5.978E+00	562	9.072E+00
399	5.517E-02	440	1.913E+00	481	4.188E+00	522	6.064E+00	563	9.171E+00
400	4.569E-02	441	2.098E+00	482	4.104E+00	523	6.122E+00	564	9.252E+00
401	6.387E-02	442	2.306E+00	483	4.021E+00	524	6.211E+00	565	9.353E+00
402	5.023E-02	443	2.554E+00	484	3.973E+00	525	6.291E+00	566	9.433E+00
403	5.131E-02	444	2.817E+00	485	3.914E+00	526	6.352E+00	567	9.516E+00
404	5.316E-02	445	3.125E+00	486	3.891E+00	527	6.417E+00	568	9.601E+00
405	6.181E-02	446	3.465E+00	487	3.882E+00	528	6.511E+00	569	9.694E+00
406	7.073E-02	447	3.813E+00	488	3.874E+00	529	6.588E+00	570	9.781E+00
407	6.298E-02	448	4.214E+00	489	3.881E+00	530	6.637E+00	571	9.881E+00
408	7.515E-02	449	4.646E+00	490	3.890E+00	531	6.720E+00	572	9.983E+00
409	8.185E-02	450	5.119E+00	491	3.923E+00	532	6.801E+00	573	1.005E+01
410	7.792E-02	451	5.601E+00	492	3.940E+00	533	6.862E+00	574	1.016E+01
411	9.772E-02	452	6.109E+00	493	3.974E+00	534	6.959E+00	575	1.024E+01
412	9.965E-02	453	6.574E+00	494	4.004E+00	535	7.018E+00	576	1.033E+01
413	1.131E-01	454	7.033E+00	495	4.044E+00	536	7.071E+00	577	1.042E+01
414	1.235E-01	455	7.410E+00	496	4.082E+00	537	7.154E+00	578	1.051E+01
415	1.346E-01	456	7.735E+00	497	4.149E+00	538	7.224E+00	579	1.063E+01
416	1.470E-01	457	7.951E+00	498	4.216E+00	539	7.296E+00	580	1.071E+01
417	1.662E-01	458	8.008E+00	499	4.258E+00	540	7.378E+00	581	1.080E+01
418	1.863E-01	459	8.020E+00	500	4.330E+00	541	7.449E+00	582	1.091E+01
419	2.065E-01	460	7.883E+00	501	4.404E+00	542	7.513E+00	583	1.101E+01
420	2.316E-01	461	7.713E+00	502	4.466E+00	543	7.568E+00	584	1.107E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	1.117E+01	626	1.276E+01	667	8.248E+00	708	3.414E+00	749	1.136E+00
586	1.127E+01	627	1.270E+01	668	8.129E+00	709	3.344E+00	750	1.098E+00
587	1.136E+01	628	1.264E+01	669	7.986E+00	710	3.248E+00	751	1.071E+00
588	1.147E+01	629	1.258E+01	670	7.833E+00	711	3.172E+00	752	1.044E+00
589	1.154E+01	630	1.252E+01	671	7.711E+00	712	3.084E+00	753	1.015E+00
590	1.165E+01	631	1.243E+01	672	7.575E+00	713	3.027E+00	754	9.817E-01
591	1.173E+01	632	1.238E+01	673	7.425E+00	714	2.943E+00	755	9.556E-01
592	1.181E+01	633	1.233E+01	674	7.301E+00	715	2.859E+00	756	9.316E-01
593	1.189E+01	634	1.226E+01	675	7.168E+00	716	2.789E+00	757	9.057E-01
594	1.196E+01	635	1.215E+01	676	7.030E+00	717	2.713E+00	758	8.819E-01
595	1.205E+01	636	1.209E+01	677	6.877E+00	718	2.649E+00	759	8.608E-01
596	1.212E+01	637	1.200E+01	678	6.757E+00	719	2.582E+00	760	8.426E-01
597	1.220E+01	638	1.191E+01	679	6.625E+00	720	2.515E+00	761	8.156E-01
598	1.227E+01	639	1.182E+01	680	6.495E+00	721	2.442E+00	762	7.919E-01
599	1.233E+01	640	1.173E+01	681	6.362E+00	722	2.389E+00	763	7.754E-01
600	1.240E+01	641	1.161E+01	682	6.232E+00	723	2.329E+00	764	7.439E-01
601	1.244E+01	642	1.151E+01	683	6.109E+00	724	2.265E+00	765	7.272E-01
602	1.251E+01	643	1.141E+01	684	5.978E+00	725	2.200E+00	766	7.107E-01
603	1.258E+01	644	1.131E+01	685	5.847E+00	726	2.148E+00	767	6.851E-01
604	1.264E+01	645	1.118E+01	686	5.732E+00	727	2.083E+00	768	6.698E-01
605	1.268E+01	646	1.107E+01	687	5.604E+00	728	2.026E+00	769	6.464E-01
606	1.272E+01	647	1.093E+01	688	5.492E+00	729	1.969E+00	770	6.363E-01
607	1.279E+01	648	1.085E+01	689	5.369E+00	730	1.918E+00	771	6.184E-01
608	1.282E+01	649	1.072E+01	690	5.254E+00	731	1.870E+00	772	5.980E-01
609	1.286E+01	650	1.059E+01	691	5.144E+00	732	1.813E+00	773	5.849E-01
610	1.287E+01	651	1.047E+01	692	5.021E+00	733	1.767E+00	774	5.655E-01
611	1.288E+01	652	1.032E+01	693	4.899E+00	734	1.718E+00	775	5.545E-01
612	1.294E+01	653	1.021E+01	694	4.797E+00	735	1.668E+00	776	5.395E-01
613	1.294E+01	654	1.008E+01	695	4.683E+00	736	1.626E+00	777	5.238E-01
614	1.296E+01	655	9.935E+00	696	4.592E+00	737	1.575E+00	778	5.085E-01
615	1.296E+01	656	9.804E+00	697	4.475E+00	738	1.535E+00	779	4.971E-01
616	1.297E+01	657	9.678E+00	698	4.362E+00	739	1.484E+00	780	4.980E-01
617	1.297E+01	658	9.527E+00	699	4.262E+00	740	1.445E+00		
618	1.298E+01	659	9.377E+00	700	4.155E+00	741	1.403E+00		
619	1.296E+01	660	9.248E+00	701	4.056E+00	742	1.370E+00		
620	1.295E+01	661	9.117E+00	702	3.958E+00	743	1.329E+00		
621	1.291E+01	662	8.980E+00	703	3.871E+00	744	1.295E+00		
622	1.290E+01	663	8.807E+00	704	3.772E+00	745	1.255E+00		
623	1.285E+01	664	8.690E+00	705	3.680E+00	746	1.224E+00		
624	1.282E+01	665	8.531E+00	706	3.585E+00	747	1.194E+00		
625	1.280E+01	666	8.401E+00	707	3.517E+00	748	1.165E+00		

CIE 1931 x y Chromaticity Diagram



7-Step Chromaticity Quadrangles



[Goniophotometer System]

Total operating time for luminous intensity distribution: **1.0 hour**

Test orientation: **Downward**

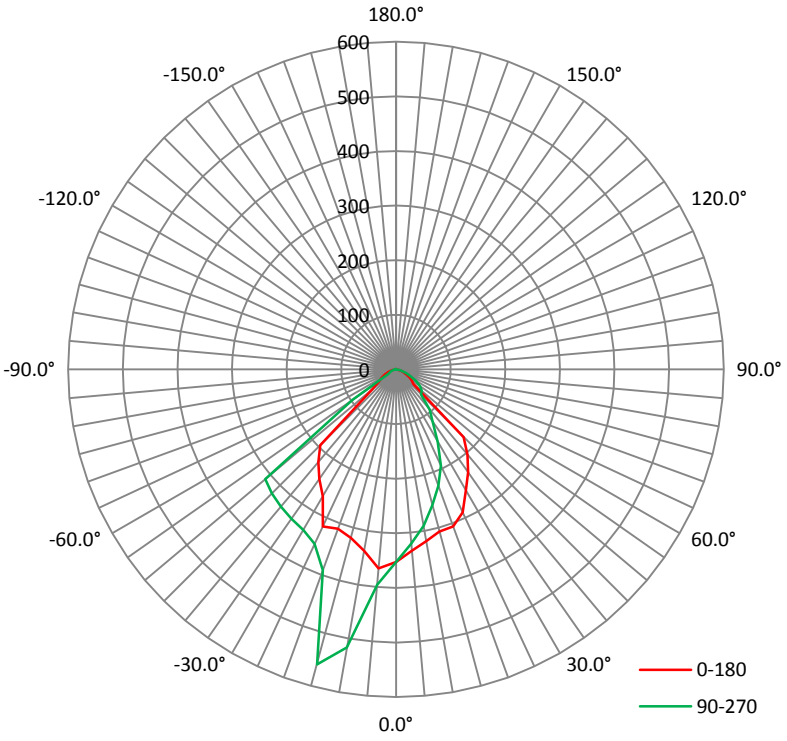
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.1	60	0.1115	12.22	0.9132

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I_{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
649.445	53.15	635.5	1.10	0.79

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I_{max}):	90.7	77.2	52.8	77.0	74.4
Field Angle (10% I_{max}):	109.2	113.5	103.7	112.1	109.6

Luminous Intensity (cd) Distribution Data

C / γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0°	352	352	352	352	352	352	352	352
1°	356	359	360	360	359	357	354	351
2°	361	366	370	370	367	362	357	351
3°	365	375	381	382	375	366	357	349
4°	367	381	396	398	385	370	357	347
5°	366	384	410	420	396	372	356	344
6°	361	381	418	446	408	374	354	341
7°	354	374	417	478	425	376	354	338
8°	348	368	408	514	447	378	354	337
9°	342	363	396	545	477	383	354	336
10°	337	359	387	564	517	387	354	335
11°	333	355	380	565	567	394	354	333
12°	330	352	374	558	614	404	354	332
13°	326	347	370	561	636	421	355	331
14°	323	343	367	576	615	446	358	330
15°	319	340	365	603	559	480	364	330
16°	317	339	366	625	500	513	375	330
17°	314	338	371	618	456	521	389	332
18°	312	339	379	583	427	493	409	337
19°	311	342	391	531	407	449	433	343
20°	311	347	410	478	391	412	442	349
21°	311	353	435	435	379	388	420	356
22°	312	362	455	403	370	372	389	357
23°	314	371	457	381	363	362	367	342
24°	317	373	432	367	357	355	353	325
25°	317	362	395	358	352	350	343	314
26°	316	341	368	352	349	346	336	308
27°	297	326	352	347	346	343	332	303
28°	282	317	343	344	344	341	328	299
29°	274	310	337	342	342	339	325	296
30°	268	306	333	340	340	337	322	293
31°	263	302	329	338	338	335	320	290
32°	258	298	326	336	337	333	318	287
33°	254	295	323	334	335	332	315	284
34°	249	292	321	333	334	331	313	281
35°	245	289	319	332	334	329	311	278
36°	240	286	317	330	333	328	309	275
37°	235	283	314	329	331	326	307	272
38°	231	280	312	328	330	325	305	269
39°	226	277	310	326	329	324	303	265
40°	221	273	308	325	328	322	300	261
41°	217	270	306	324	327	320	298	258
42°	212	267	303	322	326	319	295	254
43°	207	263	301	320	324	317	292	250
44°	201	259	299	319	323	315	290	245
45°	196	255	296	317	321	313	287	241
46°	191	251	293	315	320	311	284	237
47°	185	246	291	313	318	309	281	232
48°	154	242	288	311	316	307	277	216
49°	86	238	285	309	314	304	274	133

Luminous Intensity (cd) Distribution Data

C / γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
50°	57	225	281	306	312	302	270	65
51°	51	133	278	304	310	299	259	54
52°	45	60	275	301	308	294	178	43
53°	39	49	270	298	301	221	79	33
54°	38	40	217	281	223	104	60	31
55°	37	30	101	177	97	75	42	30
56°	36	29	73	63	69	47	24	29
57°	34	28	47	45	43	20	23	28
58°	33	27	22	31	18	19	22	27
59°	32	26	21	17	17	18	21	26
60°	30	25	20	17	16	17	20	25
61°	29	24	19	16	15	17	20	24
62°	27	23	18	15	15	16	19	23
63°	26	22	17	15	14	15	18	21
64°	25	21	16	14	13	14	17	20
65°	23	19	15	13	13	14	16	19
66°	22	18	15	12	12	13	15	18
67°	20	17	14	12	11	12	14	17
68°	19	16	13	11	11	11	13	16
69°	18	15	12	10	10	11	12	15
70°	16	14	11	10	9	10	11	14
71°	15	13	10	9	9	9	11	13
72°	14	12	10	8	8	9	10	12
73°	13	11	9	8	8	8	9	11
74°	12	10	8	7	7	7	8	10
75°	11	9	8	7	6	7	8	9
76°	10	8	7	6	6	6	7	8
77°	9	8	6	6	5	6	6	7
78°	8	7	6	5	5	5	6	7
79°	7	6	5	4	4	5	5	6
80°	6	5	4	4	4	4	4	5
81°	6	5	4	4	3	4	4	4
82°	5	4	3	3	3	3	3	4
83°	4	3	3	3	3	3	3	3
84°	3	3	2	2	2	2	2	3
85°	3	2	2	2	2	2	2	2
86°	2	2	2	2	2	2	2	2
87°	2	1	1	1	1	1	1	1
88°	1	1	1	1	1	1	1	1
89°	1	0	0	0	0	0	0	0
90°	0	0	0	0	0	0	0	0
91°	0	0	0	0	0	0	0	0
92°	0	0	0	0	0	0	0	0
93°	0	0	0	0	0	0	0	0
94°	0	0	0	0	0	0	0	0
95°	0	0	0	0	0	0	0	0
96°	0	0	0	0	0	0	0	0
97°	0	0	0	0	0	0	0	0
98°	0	0	0	0	0	0	0	0
99°	0	0	0	0	0	0	0	0

Luminous Intensity (cd) Distribution Data

C / γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
100°	0	0	0	0	0	0	0	0
101°	0	0	0	0	0	0	0	0
102°	0	0	0	0	0	0	0	0
103°	0	0	0	0	0	0	0	0
104°	0	0	0	0	0	0	0	0
105°	0	0	0	0	0	0	0	0
106°	0	0	0	0	0	0	0	0
107°	0	0	0	0	0	0	0	0
108°	0	0	0	0	0	0	0	0
109°	0	0	0	0	0	0	0	0
110°	0	0	0	0	0	0	0	0
111°	0	0	0	0	0	0	0	0
112°	0	0	0	0	0	0	0	0
113°	0	0	0	0	0	0	0	0
114°	0	0	0	0	0	0	0	0
115°	0	0	0	0	0	0	0	0
116°	0	0	0	0	0	0	0	0
117°	0	0	0	0	0	0	0	0
118°	0	0	0	0	0	0	0	0
119°	0	0	0	0	0	0	0	0
120°	0	0	0	0	0	0	0	0
121°	0	0	0	0	0	0	0	0
122°	0	0	0	0	0	0	0	0
123°	0	0	0	0	0	0	0	0
124°	0	0	0	0	0	0	0	0
125°	0	0	0	0	0	0	0	0
126°	0	0	0	0	0	0	0	0
127°	0	0	0	0	0	0	0	0
128°	0	0	0	0	0	0	0	0
129°	0	0	0	0	0	0	0	0
130°	0	0	0	0	0	0	0	0
131°	0	0	0	0	0	0	0	0
132°	0	0	0	0	0	0	0	0
133°	0	0	0	0	0	0	0	0
134°	0	0	0	0	0	0	0	0
135°	0	0	0	0	0	0	0	0
136°	0	0	0	0	0	0	0	0
137°	0	0	0	0	0	0	0	0
138°	0	0	0	0	0	0	0	0
139°	0	0	0	0	0	0	0	0
140°	0	0	0	0	0	0	0	0
141°	0	0	0	0	0	0	0	0
142°	0	0	0	0	0	0	0	0
143°	0	0	0	0	0	0	0	0
144°	0	0	0	0	0	0	0	0
145°	0	0	0	0	0	0	0	0
146°	0	0	0	0	0	0	0	0
147°	0	0	0	0	0	0	0	0
148°	0	0	0	0	0	0	0	0
149°	0	0	0	0	0	0	0	0

Luminous Intensity (cd) Distribution Data

C / γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
150°	0	0	0	0	0	0	0	0
151°	0	0	0	0	0	0	0	0
152°	0	0	0	0	0	0	0	0
153°	0	0	0	0	0	0	0	0
154°	0	0	0	0	0	0	0	0
155°	0	0	0	0	0	0	0	0
156°	0	1	1	0	0	0	1	1
157°	1	1	1	1	1	1	1	1
158°	1	1	1	1	1	1	1	1
159°	1	1	1	1	1	1	1	1
160°	1	1	1	1	1	1	1	1
161°	1	1	1	1	1	1	1	1
162°	1	1	1	1	1	1	1	1
163°	1	1	1	1	1	1	1	1
164°	1	1	1	1	1	1	1	1
165°	1	1	1	1	1	1	1	1
166°	1	1	1	1	1	1	1	1
167°	1	1	1	1	1	1	1	1
168°	1	1	1	1	1	1	1	1
169°	1	1	1	1	1	1	1	1
170°	1	1	1	1	1	1	1	1
171°	1	1	1	1	1	1	1	1
172°	1	1	1	1	1	1	1	1
173°	1	1	1	1	1	1	1	0
174°	1	1	1	1	1	1	1	0
175°	1	1	1	1	1	1	0	0
176°	1	1	1	1	1	0	0	0
177°	0	0	1	1	0	0	0	0
178°	0	0	0	0	0	0	0	0
179°	0	0	0	0	0	0	0	0
180°	0	0	0	0	0	0	0	0

Luminous Intensity (cd) Distribution Data (cont.)

C / γ	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0°	352	352	352	352	352	352	352	352
1°	349	347	345	345	345	348	350	353
2°	346	342	339	338	339	342	347	354
3°	342	337	333	332	333	337	344	353
4°	338	332	328	325	326	331	340	350
5°	334	327	323	319	320	326	334	346
6°	330	323	317	314	315	320	329	341
7°	327	319	312	308	309	315	323	334
8°	324	315	307	302	303	309	317	328
9°	322	311	301	296	297	303	311	322
10°	319	307	296	290	291	297	305	316
11°	317	303	291	284	284	290	299	311
12°	314	299	286	278	278	283	293	307
13°	312	295	280	272	271	277	287	302
14°	309	291	275	266	264	270	282	298
15°	307	287	270	260	258	264	276	294
16°	305	283	266	254	251	258	271	290
17°	304	280	260	248	245	252	267	287
18°	303	276	255	242	239	246	262	284
19°	304	273	250	235	233	241	258	281
20°	306	270	245	229	227	236	255	279
21°	308	268	240	223	221	231	251	276
22°	308	266	235	218	215	225	245	273
23°	306	264	230	212	209	219	238	270
24°	299	260	226	206	202	212	232	268
25°	289	251	220	199	194	204	225	263
26°	280	242	212	191	186	196	216	251
27°	273	234	202	182	178	187	208	240
28°	266	226	193	173	169	179	201	234
29°	261	219	185	165	161	172	195	228
30°	256	213	178	157	153	165	188	222
31°	251	206	171	150	145	158	182	217
32°	245	200	164	142	138	151	176	211
33°	240	194	157	134	131	143	170	205
34°	235	188	150	127	124	136	163	200
35°	230	182	142	121	117	129	157	194
36°	225	175	135	114	111	122	151	189
37°	220	169	128	108	106	115	145	183
38°	215	163	120	104	102	110	138	178
39°	209	157	113	100	99	105	131	172
40°	204	150	107	96	96	100	124	166
41°	199	143	102	94	93	96	117	161
42°	193	136	97	91	90	90	110	155
43°	187	128	93	85	73	74	98	149
44°	181	120	87	68	67	65	77	143
45°	175	112	71	64	65	64	62	115
46°	131	84	59	63	65	63	59	88
47°	87	64	57	62	64	62	57	66
48°	57	51	57	62	63	61	56	51
49°	43	49	56	61	62	60	56	49

Luminous Intensity (cd) Distribution Data (cont.)

C / γ	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
50°	41	47	55	60	61	59	55	48
51°	40	46	53	59	60	58	53	47
52°	39	45	52	57	59	57	52	45
53°	38	44	51	56	57	56	51	44
54°	37	43	50	54	56	54	50	43
55°	36	41	48	53	54	52	48	42
56°	34	40	46	51	52	50	46	40
57°	33	38	45	49	50	48	45	39
58°	31	37	43	47	48	46	43	37
59°	30	35	41	44	45	44	41	35
60°	29	33	39	42	43	41	39	34
61°	27	31	37	40	40	39	36	32
62°	26	30	34	37	38	37	34	30
63°	24	28	32	35	35	34	32	29
64°	23	26	30	33	33	32	30	27
65°	21	25	28	30	31	30	28	25
66°	20	23	26	28	29	28	26	24
67°	18	21	24	26	26	26	24	22
68°	17	20	22	24	24	24	22	20
69°	16	18	21	22	22	22	21	19
70°	15	17	19	20	20	20	19	17
71°	14	15	17	18	19	18	18	16
72°	12	14	16	17	17	17	16	15
73°	11	13	14	15	15	15	15	14
74°	10	12	13	14	14	14	13	12
75°	9	11	12	12	13	13	12	11
76°	8	9	10	11	11	11	11	10
77°	8	8	9	10	10	10	10	9
78°	7	8	8	9	9	9	9	8
79°	6	7	7	8	8	8	8	7
80°	5	6	6	7	7	7	7	6
81°	4	5	6	6	6	6	6	5
82°	4	4	5	5	5	5	5	5
83°	3	3	4	4	4	4	4	4
84°	3	3	3	3	4	4	3	3
85°	2	2	2	3	3	3	3	2
86°	1	1	2	2	2	2	2	2
87°	1	1	1	1	1	1	1	1
88°	0	0	0	1	1	1	1	1
89°	0	0	0	0	0	0	0	0
90°	0	0	0	0	0	0	0	0
91°	0	0	0	0	0	0	0	0
92°	0	0	0	0	0	0	0	0
93°	0	0	0	0	0	0	0	0
94°	0	0	0	0	0	0	0	0
95°	0	0	0	0	0	0	0	0
96°	0	0	0	0	0	0	0	0
97°	0	0	0	0	0	0	0	0
98°	0	0	0	0	0	0	0	0
99°	0	0	0	0	0	0	0	0

Luminous Intensity (cd) Distribution Data (cont.)

C / γ	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
100°	0	0	0	0	0	0	0	0
101°	0	0	0	0	0	0	0	0
102°	0	0	0	0	0	0	0	0
103°	0	0	0	0	0	0	0	0
104°	0	0	0	0	0	0	0	0
105°	0	0	0	0	0	0	0	0
106°	0	0	0	0	0	0	0	0
107°	0	0	0	0	0	0	0	0
108°	0	0	0	0	0	0	0	0
109°	0	0	0	0	0	0	0	0
110°	0	0	0	0	0	0	0	0
111°	0	0	0	0	0	0	0	0
112°	0	0	0	0	0	0	0	0
113°	0	0	0	0	0	0	0	0
114°	0	0	0	0	0	0	0	0
115°	0	0	0	0	0	0	0	0
116°	0	0	0	0	0	0	0	0
117°	0	0	0	0	0	0	0	0
118°	0	0	0	0	0	0	0	0
119°	0	0	0	0	0	0	0	0
120°	0	0	0	0	0	0	0	0
121°	0	0	0	0	0	0	0	0
122°	0	0	0	0	0	0	0	0
123°	0	0	0	0	0	0	0	0
124°	0	0	0	0	0	0	0	0
125°	0	0	0	0	0	0	0	0
126°	0	0	0	0	0	0	0	0
127°	0	0	0	0	0	0	0	0
128°	0	0	0	0	0	0	0	0
129°	0	0	0	0	0	0	0	0
130°	0	0	0	0	0	0	0	0
131°	0	0	0	0	0	0	0	0
132°	0	0	0	0	0	0	0	0
133°	0	0	0	0	0	0	0	0
134°	0	0	0	0	0	0	0	0
135°	0	0	0	0	0	0	0	0
136°	0	0	0	0	0	0	0	0
137°	0	0	0	0	0	0	0	0
138°	0	0	0	0	0	0	0	0
139°	0	0	0	0	0	0	0	0
140°	0	0	0	0	0	0	0	0
141°	0	0	0	0	0	0	0	0
142°	0	0	0	0	0	0	0	0
143°	0	0	0	0	0	0	0	0
144°	0	0	0	0	0	0	0	0
145°	0	0	0	0	0	0	0	0
146°	0	0	0	0	0	0	0	0
147°	0	0	0	0	0	0	0	0
148°	0	0	0	0	0	0	0	0
149°	0	0	0	0	0	0	0	0

Luminous Intensity (cd) Distribution Data (cont.)

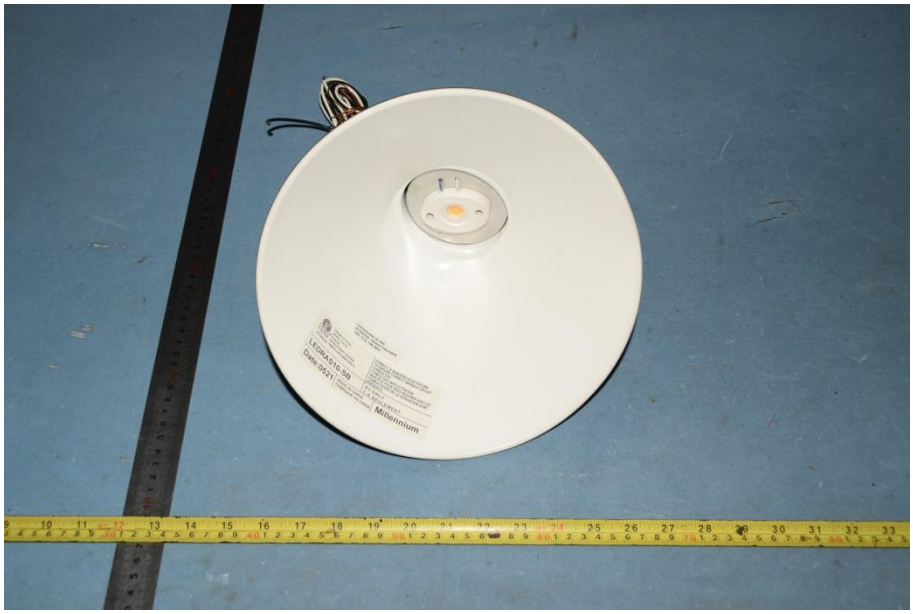
C / γ	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
150°	0	0	0	0	0	0	0	0
151°	0	0	0	0	0	0	0	0
152°	0	0	0	0	0	0	0	0
153°	0	0	0	0	0	0	0	0
154°	0	0	0	0	0	0	0	0
155°	0	0	0	0	0	0	0	0
156°	0	0	0	0	0	0	0	0
157°	0	0	0	0	0	0	0	0
158°	0	0	0	0	0	0	0	0
159°	0	0	0	0	0	0	0	0
160°	0	0	0	0	0	0	0	0
161°	0	0	0	0	0	0	0	0
162°	0	0	0	0	0	0	0	0
163°	0	0	0	0	0	0	0	0
164°	0	0	0	0	0	0	0	0
165°	0	0	0	0	0	0	0	0
166°	0	0	0	0	0	0	0	0
167°	0	0	0	0	0	0	0	0
168°	0	0	0	0	0	0	0	0
169°	0	0	0	0	0	0	0	0
170°	0	0	0	0	0	0	0	0
171°	0	0	0	0	0	0	0	0
172°	0	0	0	0	0	0	0	0
173°	0	0	0	0	0	0	0	0
174°	0	0	0	0	0	0	0	0
175°	0	0	0	0	0	0	0	0
176°	0	0	0	0	0	0	0	0
177°	0	0	0	0	0	0	0	0
178°	0	0	0	0	0	0	0	0
179°	0	0	0	0	0	0	0	0
180°	0	0	0	0	0	0	0	0

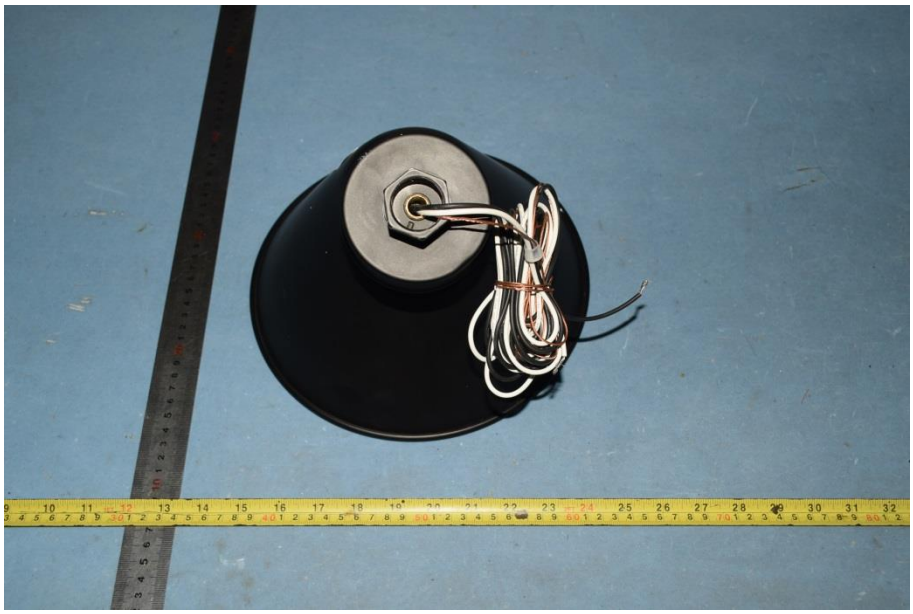
Zonal Lumen Density Measurement

Deg	Flux (lm)	%
0-5	8.5	1.30
5-10	25.3	3.90
10-15	41.8	6.43
15-20	55.7	8.58
20-25	64.6	9.95
25-30	68.2	10.50
30-35	71.5	11.00
35-40	73.8	11.37
40-45	73.9	11.37
45-50	65.8	10.13
50-55	47.0	7.24
55-60	17.8	2.74
60-65	12.4	1.91
65-70	9.3	1.44
70-75	6.5	1.00
75-80	4.0	0.62
80-85	2.1	0.33
85-90	0.6	0.08
90-95	0.0	0.00
95-100	0.0	0.00
100-105	0.0	0.00
105-110	0.0	0.01
110-115	0.0	0.00
115-120	0.0	0.00
120-125	0.0	0.00
125-130	0.0	0.01
130-135	0.0	0.01
135-140	0.1	0.01
140-145	0.1	0.01
145-150	0.1	0.01
150-155	0.1	0.01
155-160	0.1	0.02
160-165	0.1	0.01
165-170	0.1	0.00
170-175	0.0	0.01
175-180	0.0	0.00

Deg	Flux (lm)	%
0-5	8.5	1.30
0-10	33.8	5.20
0-15	75.6	11.63
0-20	131.2	20.21
0-25	195.9	30.16
0-30	264.1	40.66
0-35	335.5	51.66
0-40	409.3	63.03
0-45	483.2	74.40
0-50	549.0	84.53
0-55	596.0	91.77
0-60	613.8	94.51
0-65	626.2	96.42
0-70	635.6	97.86
0-75	642.0	98.86
0-80	646.1	99.48
0-85	648.2	99.81
0-90	648.7	99.89
0-95	648.8	99.89
0-100	648.8	99.89
0-105	648.8	99.89
0-110	648.8	99.90
0-115	648.8	99.90
0-120	648.8	99.90
0-125	648.8	99.90
0-130	648.9	99.91
0-135	648.9	99.92
0-140	649.0	99.93
0-145	649.0	99.94
0-150	649.1	99.95
0-155	649.2	99.96
0-160	649.3	99.98
0-165	649.4	99.99
0-170	649.4	99.99
0-175	649.4	100.00
0-180	649.4	100.00

6. Product Photo





Directions

1. The information marked “superscript #” is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report.
2. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
3. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
4. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K=2 with the 95% confidence interval.
5. This report cannot be reproduced except in full, without prior written approval of the Company.
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**********END OF REPORT**********