

PRELIMINARY



## Soraa Internal Report: IES LM79-08

Test results reported for:

Part Number: SM16-09-36D-830-03

**Soraa MR16, GU5.3/12V, 3000K, 80CRI, 9W, 36degree**

### Relevant Standards

IES LM-79

ANSI C78.377

IES PR-16

Soraa Lamp Lab

## 1.0 Description of test sample

Customer reference ID	SM16-09-36D-830-03
Manufacturer reference ID	SM16-09-36D-830-03
Lamp description	Brilliant 3000K 80CRI 9W 36 degree
Rated voltage	12V
Rated power	9W
Nominal CCT	3000K



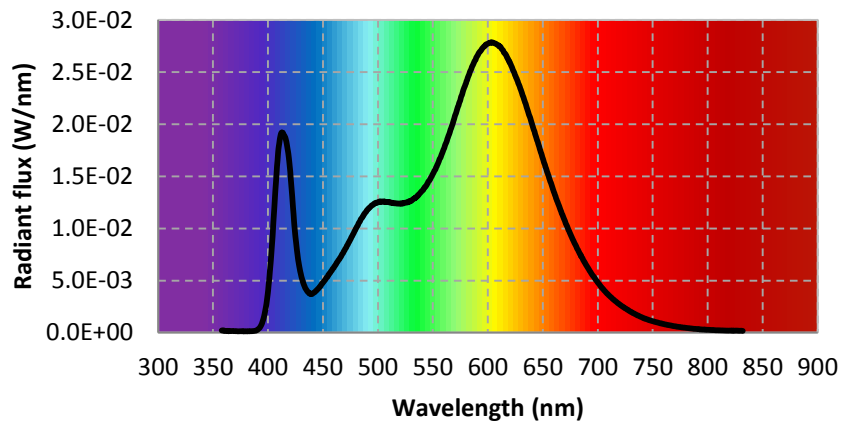
## 2.0 Results - Sphere Measurements

Test conditions	
Orientation	Horizontal
Stabilization time (min)	50-55
Correction factor applied	Self absorption correction
Sphere geometry	65" Sphere
	95% coating reflectance
	2pi geometry
Ambient temperature (°C)	25±1

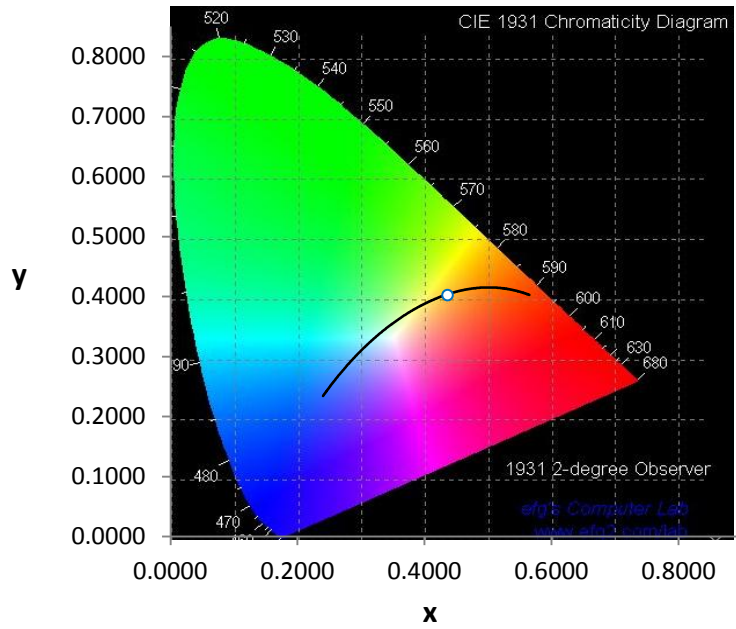
Instrument				
	Instrument	Manufacture	Model	
Photometric	Spectrometer	Instrument systems	CAS 140T	
	Integrating sphere	Labsphere	65"	
	Standard lamp	Labsphere	CSFS-1400 lamp	
Electrical instrument	Power supply for standard lamp	Labsphere	LPS-150-0268	
	Power supply for aux lamp	Labsphere	LPS-100-0833	
	Power supply for test lamps	APT	Variplus 105	
	Power meter for test lamps	Chroma	66202	
Thermometer	Digital multimeter	YOKOGAWA	TY720	

Measurement results				
	Photometric		Electrical	
Total lumen (lm)	588		Input voltage (V)	12.0
Luminous efficacy (lm/W)	65		Current (A)	0.820
Chromaticity coordinates	$u' = 0.2515$		Power (W)	9.0
	$v' = 0.5205$		pf	0.915
	$x = 0.4369$			
	$y = 0.4019$			
CCT (K)	3000			
CRI	86			
R9	16			
Duv				

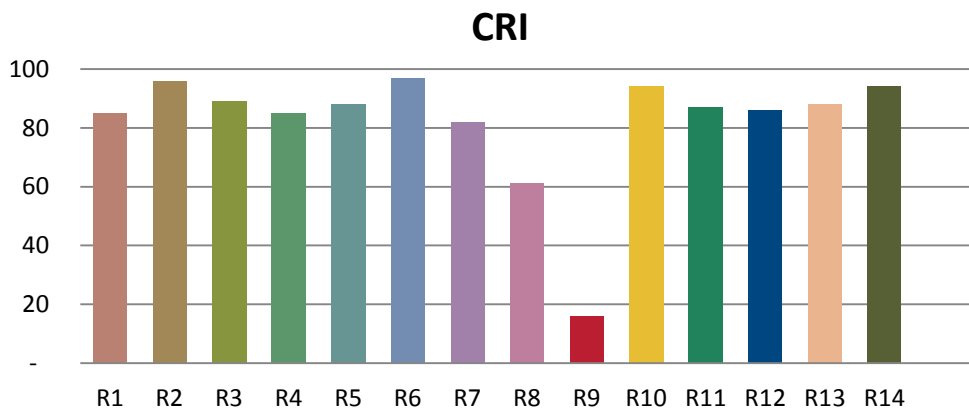
### Spectral power distribution



### Chromaticity on CIE1931



CRI	
R1	85
R2	96
R3	89
R4	85
R5	88
R6	97
R7	82
R8	61
R9	16
R10	94
R11	87
R12	86
R13	88
R14	94
Ra	86



Spectral Power Distribution									
WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)
380	1.32E-04	421	1.44E-02	462	6.60E-03	503	1.26E-02	544	1.41E-02
381	1.30E-04	422	1.31E-02	463	6.77E-03	504	1.25E-02	545	1.43E-02
382	1.36E-04	423	1.17E-02	464	6.94E-03	505	1.26E-02	546	1.45E-02
383	1.30E-04	424	1.03E-02	465	7.07E-03	506	1.26E-02	547	1.46E-02
384	1.39E-04	425	9.16E-03	466	7.24E-03	507	1.26E-02	548	1.48E-02
385	1.42E-04	426	8.22E-03	467	7.43E-03	508	1.25E-02	549	1.50E-02
386	1.50E-04	427	7.33E-03	468	7.60E-03	509	1.25E-02	550	1.52E-02
387	1.57E-04	428	6.63E-03	469	7.81E-03	510	1.25E-02	551	1.54E-02
388	1.77E-04	429	6.04E-03	470	7.99E-03	511	1.25E-02	552	1.56E-02
389	1.93E-04	430	5.56E-03	471	8.15E-03	512	1.25E-02	553	1.59E-02
390	2.49E-04	431	5.14E-03	472	8.38E-03	513	1.25E-02	554	1.61E-02
391	3.36E-04	432	4.79E-03	473	8.56E-03	514	1.25E-02	555	1.63E-02
392	4.27E-04	433	4.51E-03	474	8.75E-03	515	1.24E-02	556	1.66E-02
393	5.71E-04	434	4.26E-03	475	8.95E-03	516	1.24E-02	557	1.68E-02
394	7.67E-04	435	4.10E-03	476	9.18E-03	517	1.24E-02	558	1.71E-02
395	1.05E-03	436	3.95E-03	477	9.37E-03	518	1.24E-02	559	1.74E-02
396	1.39E-03	437	3.82E-03	478	9.57E-03	519	1.24E-02	560	1.76E-02
397	1.85E-03	438	3.75E-03	479	9.79E-03	520	1.24E-02	561	1.80E-02
398	2.40E-03	439	3.73E-03	480	1.00E-02	521	1.24E-02	562	1.82E-02
399	3.11E-03	440	3.71E-03	481	1.02E-02	522	1.24E-02	563	1.85E-02
400	3.96E-03	441	3.79E-03	482	1.04E-02	523	1.24E-02	564	1.88E-02
401	5.01E-03	442	3.86E-03	483	1.06E-02	524	1.25E-02	565	1.91E-02
402	6.23E-03	443	3.94E-03	484	1.08E-02	525	1.25E-02	566	1.95E-02
403	7.56E-03	444	4.04E-03	485	1.10E-02	526	1.25E-02	567	1.97E-02
404	9.02E-03	445	4.15E-03	486	1.11E-02	527	1.25E-02	568	2.01E-02
405	1.08E-02	446	4.26E-03	487	1.13E-02	528	1.26E-02	569	2.04E-02
406	1.25E-02	447	4.40E-03	488	1.14E-02	529	1.26E-02	570	2.08E-02
407	1.41E-02	448	4.52E-03	489	1.16E-02	530	1.27E-02	571	2.11E-02
408	1.57E-02	449	4.67E-03	490	1.17E-02	531	1.27E-02	572	2.14E-02
409	1.70E-02	450	4.81E-03	491	1.19E-02	532	1.28E-02	573	2.17E-02
410	1.80E-02	451	4.95E-03	492	1.20E-02	533	1.29E-02	574	2.21E-02
411	1.87E-02	452	5.07E-03	493	1.21E-02	534	1.29E-02	575	2.24E-02
412	1.91E-02	453	5.24E-03	494	1.22E-02	535	1.30E-02	576	2.27E-02
413	1.92E-02	454	5.35E-03	495	1.22E-02	536	1.31E-02	577	2.30E-02
414	1.90E-02	455	5.56E-03	496	1.23E-02	537	1.32E-02	578	2.34E-02
415	1.89E-02	456	5.68E-03	497	1.24E-02	538	1.34E-02	579	2.36E-02
416	1.86E-02	457	5.83E-03	498	1.25E-02	539	1.35E-02	580	2.39E-02
417	1.81E-02	458	5.97E-03	499	1.25E-02	540	1.36E-02	581	2.42E-02
418	1.75E-02	459	6.14E-03	500	1.25E-02	541	1.37E-02	582	2.45E-02
419	1.67E-02	460	6.28E-03	501	1.26E-02	542	1.39E-02	583	2.48E-02
420	1.57E-02	461	6.44E-03	502	1.26E-02	543	1.40E-02	584	2.51E-02

Spectral Power Distribution									
WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)	WL (nm)	SPD(W/nm)
585	2.53E-02	626	2.44E-02	667	1.15E-02	708	3.81E-03	749	1.13E-03
586	2.56E-02	627	2.42E-02	668	1.13E-02	709	3.71E-03	750	1.10E-03
587	2.58E-02	628	2.39E-02	669	1.10E-02	710	3.59E-03	751	1.08E-03
588	2.61E-02	629	2.36E-02	670	1.07E-02	711	3.50E-03	752	1.04E-03
589	2.62E-02	630	2.33E-02	671	1.05E-02	712	3.40E-03	753	1.01E-03
590	2.65E-02	631	2.30E-02	672	1.02E-02	713	3.30E-03	754	9.86E-04
591	2.67E-02	632	2.27E-02	673	9.96E-03	714	3.20E-03	755	9.57E-04
592	2.69E-02	633	2.24E-02	674	9.73E-03	715	3.12E-03	756	9.27E-04
593	2.70E-02	634	2.21E-02	675	9.48E-03	716	3.03E-03	757	8.99E-04
594	2.71E-02	635	2.17E-02	676	9.25E-03	717	2.95E-03	758	8.67E-04
595	2.73E-02	636	2.14E-02	677	9.01E-03	718	2.86E-03	759	8.47E-04
596	2.74E-02	637	2.11E-02	678	8.79E-03	719	2.79E-03	760	8.29E-04
597	2.75E-02	638	2.08E-02	679	8.56E-03	720	2.70E-03	761	7.95E-04
598	2.76E-02	639	2.05E-02	680	8.37E-03	721	2.62E-03	762	7.75E-04
599	2.77E-02	640	2.01E-02	681	8.12E-03	722	2.54E-03	763	7.51E-04
600	2.77E-02	641	1.97E-02	682	7.95E-03	723	2.48E-03	764	7.30E-04
601	2.78E-02	642	1.94E-02	683	7.72E-03	724	2.41E-03	765	7.15E-04
602	2.78E-02	643	1.91E-02	684	7.53E-03	725	2.33E-03	766	6.98E-04
603	2.78E-02	644	1.87E-02	685	7.32E-03	726	2.27E-03	767	6.71E-04
604	2.78E-02	645	1.84E-02	686	7.15E-03	727	2.20E-03	768	6.50E-04
605	2.78E-02	646	1.81E-02	687	6.93E-03	728	2.14E-03	769	6.28E-04
606	2.78E-02	647	1.77E-02	688	6.76E-03	729	2.07E-03	770	6.16E-04
607	2.77E-02	648	1.74E-02	689	6.57E-03	730	2.01E-03	771	6.02E-04
608	2.77E-02	649	1.71E-02	690	6.40E-03	731	1.95E-03	772	5.72E-04
609	2.76E-02	650	1.67E-02	691	6.23E-03	732	1.89E-03	773	5.61E-04
610	2.75E-02	651	1.64E-02	692	6.06E-03	733	1.84E-03	774	5.49E-04
611	2.75E-02	652	1.61E-02	693	5.88E-03	734	1.78E-03	775	5.33E-04
612	2.73E-02	653	1.58E-02	694	5.71E-03	735	1.72E-03	776	5.22E-04
613	2.72E-02	654	1.54E-02	695	5.55E-03	736	1.66E-03	777	5.00E-04
614	2.71E-02	655	1.51E-02	696	5.41E-03	737	1.63E-03	778	4.84E-04
615	2.68E-02	656	1.48E-02	697	5.27E-03	738	1.57E-03	779	4.83E-04
616	2.68E-02	657	1.45E-02	698	5.10E-03	739	1.52E-03	780	4.61E-04
617	2.66E-02	658	1.42E-02	699	4.97E-03	740	1.48E-03		
618	2.63E-02	659	1.38E-02	700	4.82E-03	741	1.42E-03		
619	2.61E-02	660	1.35E-02	701	4.69E-03	742	1.38E-03		
620	2.59E-02	661	1.32E-02	702	4.55E-03	743	1.36E-03		
621	2.57E-02	662	1.30E-02	703	4.41E-03	744	1.31E-03		
622	2.55E-02	663	1.26E-02	704	4.28E-03	745	1.28E-03		
623	2.52E-02	664	1.24E-02	705	4.17E-03	746	1.23E-03		
624	2.50E-02	665	1.21E-02	706	4.04E-03	747	1.19E-03		
625	2.47E-02	666	1.18E-02	707	3.93E-03	748	1.16E-03		

### 3.0 Results - Goniometric Measurements

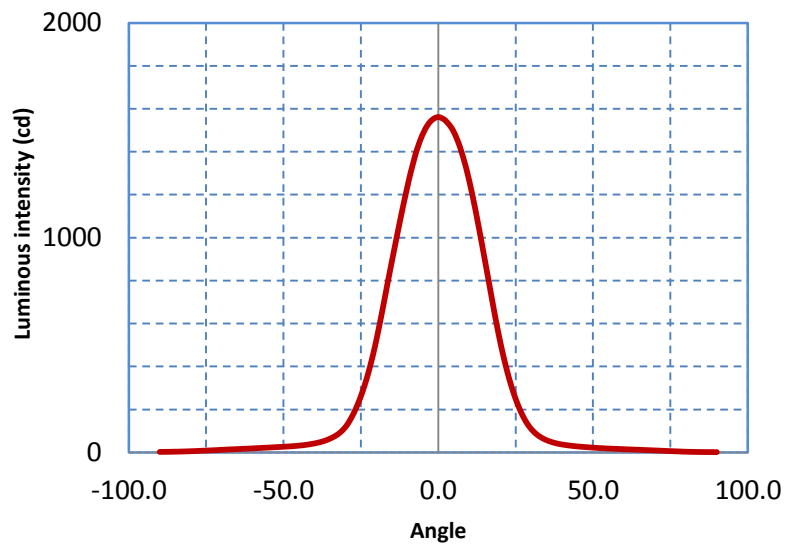
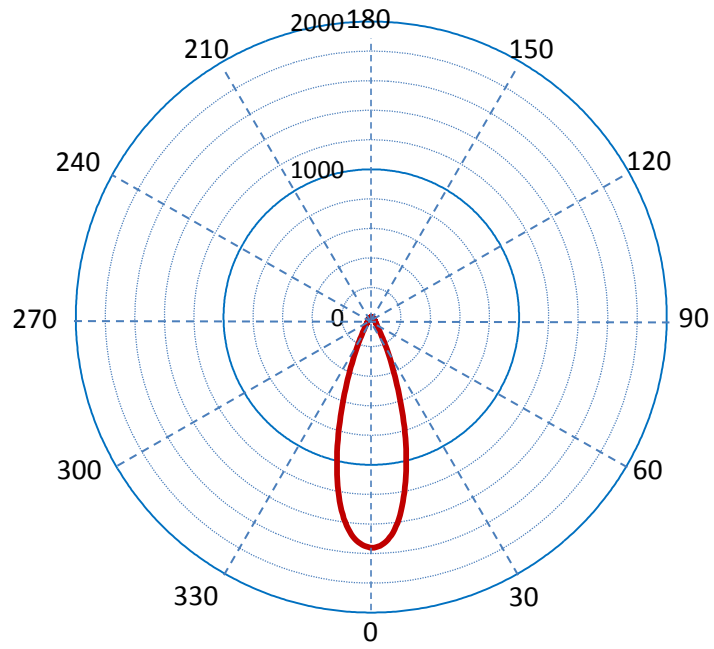
Test conditions	
Goniometer distance (m)	1
Temperature (°C)	25±1
Stabilization time (min)	50

Instrument				
	Instrument	Manufacture	Model	
Photometric	Photometer and color meter	Minolta	CL-200A	
Electrical instrument	Power supply for test lamps	APT	Variplus 105	
	Power meter for test lamps	Chroma	66202	
Thermometer	Digital multimeter	YOKOGAWA	TY720	

Measurement results				
Photometric		Electrical		
Central beam candle power(cd)	1562	Input voltage (V)	12.0	
Beam Angle (°)	33	Current (A)	0.820	
Field Angle (°)	57	Power (W)	9.0	
Chromaticity coordinates	u'= 0.2515	pf	0.9150	
	v'= 0.5205			
	x = 0.4369			
	y = 0.4019			
CCT (K)	3000			



### Luminous intensity distribution

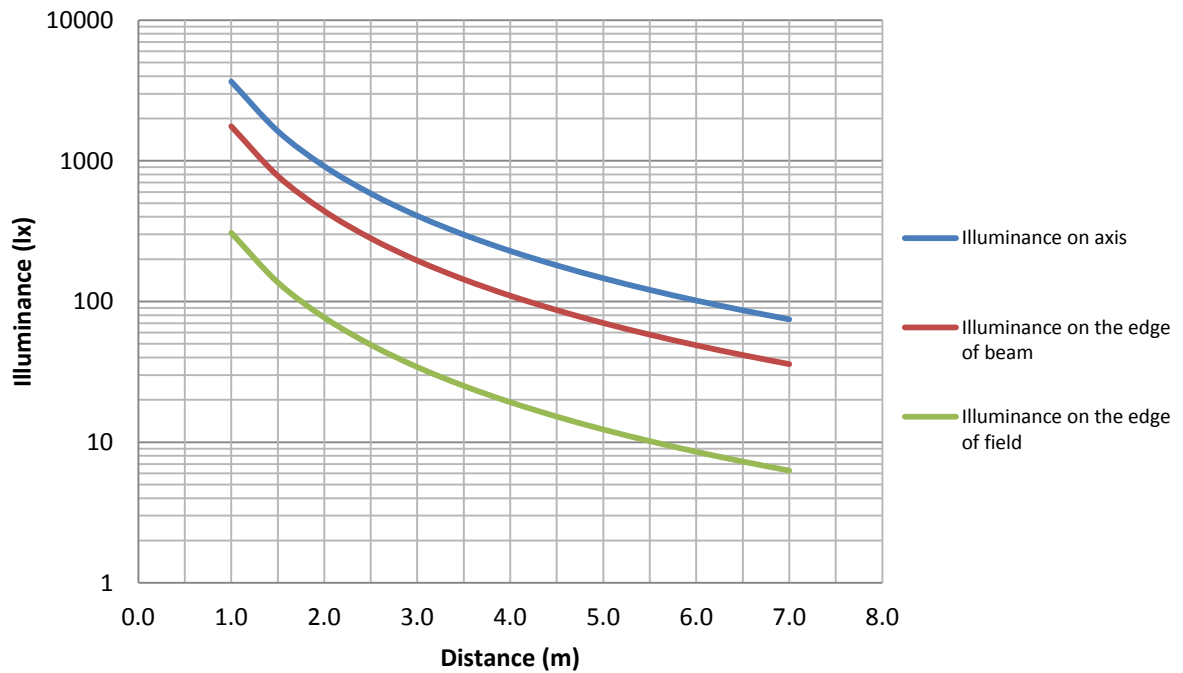


Zonal Lumen Tabulation					
Zones (°)	Lumens	%lamp	Zones (°)	Lumens	%lamp
0-5	36.4	6.2%	45-50	9.9	1.7%
5-10	98.7	16.8%	50-55	8.5	1.5%
10-15	127.9	21.7%	55-60	7.5	1.3%
15-20	114.1	19.4%	60-65	6.5	1.1%
20-25	75.4	12.8%	65-70	5.3	0.9%
25-30	41.1	7.0%	70-75	3.9	0.7%
30-35	22.2	3.8%	75-80	2.4	0.4%
35-40	14.7	2.5%	80-85	1.2	0.2%
40-45	11.6	2.0%	85-90	0.8	0.1%
Total lumen					588

Accumulated Zonal Lumen Tabulation					
Zones (°)	Lumens	%lamp	Zones (°)	Lumens	%lamp
0-5	36.4	6.2%	0-50	551.9	93.8%
0-10	135.1	23.0%	0-55	560.4	95.3%
0-15	263.0	44.7%	0-60	568.0	96.6%
0-20	377.1	64.1%	0-65	574.4	97.7%
0-25	452.5	76.9%	0-70	579.8	98.6%
0-30	493.6	83.9%	0-75	583.7	99.2%
0-35	515.8	87.7%	0-80	586.1	99.7%
0-40	530.4	90.2%	0-85	587.4	99.9%
0-45	542.0	92.1%	0-90	588.2	100.0%

Center and edge illuminance, beam and field diameter					
Distance (m)	E on axis (lx)	Beam D(m)	E on the edge of beam (lx)	Field D(m)	E on the edge of field (lx)
1.0	3657	0.33	1758	0.7	308
1.5	1626	0.49	781	1.0	137
2.0	914	0.65	440	1.4	77
2.5	585	0.81	281	1.7	49
3.0	406	0.98	195	2.1	34
3.5	299	1.14	144	2.4	25
4.0	229	1.30	110	2.8	19
4.5	181	1.47	87	3.1	15
5.0	146	1.63	70	3.5	12
5.5	121	1.79	58	3.8	10
6.0	102	1.95	49	4.2	9
6.5	87	2.12	42	4.5	7
7.0	75	2.28	36	4.9	6
7.5	65	2.44	31	5.2	5
8.0	57	2.61	27	5.6	5
8.5	51	2.77	24	5.9	4
9.0	45	2.93	22	6.3	4
9.5	41	3.09	19	6.6	3
10.0	37	3.26	18	7.0	3

### Beam illuminance vs. distance



### Luminous Intensity Distribution

Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)
-90.0	2.3	-69.5	12.3	-49.0	27.2	-28.5	150.4	-8.0	1353.3
-89.5	2.4	-69.0	12.7	-48.5	27.6	-28.0	163.3	-7.5	1380.4
-89.0	2.4	-68.5	13.1	-48.0	28.0	-27.5	177.2	-7.0	1404.8
-88.5	2.6	-68.0	13.5	-47.5	28.6	-27.0	192.2	-6.5	1426.4
-88.0	2.7	-67.5	13.8	-47.0	29.1	-26.5	208.0	-6.0	1446.7
-87.5	2.7	-67.0	14.2	-46.5	29.6	-26.0	224.8	-5.5	1465.7
-87.0	2.8	-66.5	14.5	-46.0	30.2	-25.5	242.8	-5.0	1481.9
-86.5	3.0	-66.0	14.8	-45.5	30.9	-25.0	262.0	-4.5	1496.8
-86.0	3.1	-65.5	15.0	-45.0	31.5	-24.5	282.3	-4.0	1511.7
-85.5	3.2	-65.0	15.4	-44.5	32.2	-24.0	303.6	-3.5	1522.5
-85.0	3.4	-64.5	15.7	-44.0	33.0	-23.5	326.3	-3.0	1533.3
-84.5	3.5	-64.0	16.0	-43.5	33.8	-23.0	350.1	-2.5	1541.4
-84.0	3.7	-63.5	16.4	-43.0	34.8	-22.5	375.3	-2.0	1548.2
-83.5	3.9	-63.0	16.6	-42.5	35.7	-22.0	402.1	-1.5	1553.6
-83.0	4.1	-62.5	17.1	-42.0	36.8	-21.5	430.5	-1.0	1557.7
-82.5	4.3	-62.0	17.3	-41.5	38.0	-21.0	459.7	-0.5	1560.4
-82.0	4.5	-61.5	17.7	-41.0	39.2	-20.5	491.0	0.0	1561.7
-81.5	4.7	-61.0	18.0	-40.5	40.5	-20.0	523.7	0.5	1560.4
-81.0	5.0	-60.5	18.4	-40.0	41.8	-19.5	557.8	1.0	1557.7
-80.5	5.1	-60.0	18.8	-39.5	43.3	-19.0	592.9	1.5	1553.6
-80.0	5.5	-59.5	19.1	-39.0	44.9	-18.5	628.9	2.0	1549.6
-79.5	5.8	-59.0	19.5	-38.5	46.6	-18.0	665.6	2.5	1542.8
-79.0	6.1	-58.5	19.9	-38.0	48.4	-17.5	702.8	3.0	1534.7
-78.5	6.4	-58.0	20.2	-37.5	50.5	-17.0	740.5	3.5	1526.6
-78.0	6.8	-57.5	20.6	-37.0	52.8	-16.5	778.6	4.0	1517.1
-77.5	7.0	-57.0	21.0	-36.5	55.1	-16.0	815.7	4.5	1506.3
-77.0	7.3	-56.5	21.4	-36.0	57.8	-15.5	852.3	5.0	1492.7
-76.5	7.6	-56.0	21.7	-35.5	60.6	-15.0	888.7	5.5	1477.8
-76.0	8.0	-55.5	22.1	-35.0	63.7	-14.5	924.9	6.0	1460.2
-75.5	8.3	-55.0	22.5	-34.5	67.1	-14.0	960.9	6.5	1442.7
-75.0	8.5	-54.5	22.9	-34.0	70.8	-13.5	996.9	7.0	1422.4
-74.5	8.9	-54.0	23.1	-33.5	74.7	-13.0	1032.7	7.5	1399.3
-74.0	9.2	-53.5	23.5	-33.0	79.0	-12.5	1068.2	8.0	1376.3
-73.5	9.5	-53.0	24.0	-32.5	83.8	-12.0	1103.2	8.5	1350.6
-73.0	9.9	-52.5	24.4	-32.0	89.2	-11.5	1137.6	9.0	1324.9
-72.5	10.2	-52.0	24.8	-31.5	95.3	-11.0	1171.2	9.5	1295.1
-72.0	10.6	-51.5	25.2	-31.0	101.9	-10.5	1203.8	10.0	1265.4
-71.5	10.8	-51.0	25.4	-30.5	109.5	-10.0	1235.7	10.5	1232.9
-71.0	11.2	-50.5	25.8	-30.0	118.0	-9.5	1268.1	11.0	1200.4
-70.5	11.6	-50.0	26.4	-29.5	127.6	-9.0	1297.8	11.5	1165.2
-70.0	12.0	-49.5	26.8	-29.0	138.4	-8.5	1326.3	12.0	1130.0

### Luminous Intensity Distribution

Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)	Angle (°C)	CP (cd)		
12.5	1092.8	33.0	71.7	53.5	19.1	74.0	6.6		
13.0	1055.3	33.5	67.4	54.0	18.7	74.5	6.4		
13.5	1017.3	34.0	63.6	54.5	18.4	75.0	6.1		
14.0	978.7	34.5	60.1	55.0	18.0	75.5	5.8		
14.5	939.5	35.0	56.8	55.5	17.7	76.0	5.5		
15.0	900.0	35.5	54.0	56.0	17.5	76.5	5.1		
15.5	860.6	36.0	51.3	56.5	17.1	77.0	4.9		
16.0	820.9	36.5	48.9	57.0	16.8	77.5	4.6		
16.5	781.1	37.0	46.7	57.5	16.5	78.0	4.3		
17.0	741.5	37.5	44.5	58.0	16.2	78.5	3.9		
17.5	702.0	38.0	42.8	58.5	15.8	79.0	3.7		
18.0	662.7	38.5	41.0	59.0	15.6	79.5	3.5		
18.5	623.9	39.0	39.5	59.5	15.3	80.0	3.2		
19.0	586.5	39.5	38.2	60.0	14.9	80.5	3.1		
19.5	550.7	40.0	36.8	60.5	14.6	81.0	2.8		
20.0	515.8	40.5	35.7	61.0	14.3	81.5	2.7		
20.5	482.5	41.0	34.6	61.5	14.1	82.0	2.4		
21.0	450.8	41.5	33.6	62.0	13.8	82.5	2.3		
21.5	420.6	42.0	32.6	62.5	13.5	83.0	2.2		
22.0	391.9	42.5	31.7	63.0	13.3	83.5	2.2		
22.5	364.6	43.0	30.9	63.5	13.0	84.0	2.0		
23.0	338.6	43.5	29.9	64.0	12.7	84.5	1.9		
23.5	314.4	44.0	29.2	64.5	12.5	85.0	1.8		
24.0	291.4	44.5	28.6	65.0	12.2	85.5	1.8		
24.5	269.6	45.0	27.9	65.5	11.9	86.0	1.6		
25.0	249.1	45.5	27.2	66.0	11.5	86.5	1.6		
25.5	229.9	46.0	26.5	66.5	11.2	87.0	1.5		
26.0	211.9	46.5	26.0	67.0	11.0	87.5	1.5		
26.5	194.9	47.0	25.4	67.5	10.7	88.0	1.5		
27.0	179.2	47.5	24.9	68.0	10.4	88.5	1.5		
27.5	164.7	48.0	24.4	68.5	10.2	89.0	1.4		
28.0	151.4	48.5	23.7	69.0	9.9	89.5	1.4		
28.5	139.4	49.0	23.1	69.5	9.5	90.0	1.4		
29.0	128.4	49.5	22.6	70.0	9.2				
29.5	118.6	50.0	22.2	70.5	8.8				
30.0	109.5	50.5	21.7	71.0	8.5				
30.5	101.4	51.0	21.2	71.5	8.3				
31.0	94.1	51.5	20.7	72.0	7.8				
31.5	87.6	52.0	20.3	72.5	7.6				
32.0	81.6	52.5	19.9	73.0	7.2				
32.5	76.3	53.0	19.5	73.5	6.9				