

astro

PHOTOMETRIC
TEST REPORT

Photometric Test Report

Report Number: POTS/GJ13102	Report Date: 15-03-2013	Prepared By: G John
Test Laboratory: Photometric and Optical Testing Services, Cotswold Business Centre, 42 A P Ellis Road, Rissington Business Park, Upper Rissington, Gloucestershire, GL54 2QB		
Company Registration Number: Registered in England & Wales No. OC352911		
Registered Address: Thistle Down Barn, Holcot Lane, Sywell, Northampton, NN6 0BG		

Client Details

Company: Astro Lighting	Email: technical@astrolighting.co.uk
Address: Astro Lighting Limited, G2 River Way, Harlow CM20 2DP, Great Britain	

Details of Product Tested

Manufacturer: Astro Lighting	Source Type: Domestic light
Model: OSLO 160 LED	Serial Number: 1298002
Lamp Type: LED	
Power Supply Used: Uninterruptible AC power supply	
Voltage(AC V) = 245.3	Current (mA)= 50
Power (Watts)= 6.02	Power factor= 0.4936

Integrating Sphere Test

Date of Test: 12-03-2013	Ambient Temperature: 25°C
Measurement Filename: OSLO 160 LED	
Instrument Used: Labsphere model CSLMS HALOGEN 4060 integrating sphere spectroradiometer	
Integrating Sphere Size: 1m	Measurement Geometry ($2\pi / 4\pi$): 4π
Sample Orientation: Horizontal	Auxiliary Correction Applied: YES
Comments:	
Date of Last Calibration (Operating Hours): 08-11-2012 (02:36)	Spectral Flux Standard Lamp Used: SCL-1400
Standard Lamp Serial Number: K75	Traceable: to NIST standards
Calibration Certificate Number: DM-02008-001	Calibration Certificate Date: 19 th February 2010
Calibration Lamp Uncertainty: $\pm 0.67\%$ ($k=2$)	
Results	
Flux (lumens): 99.37	
CIE 1931 Chromaticity Cx: 0.4396	CIE 1931 Chromaticity Cy: 0.4057
CRI (%): 85.39	CCT (K): 2967

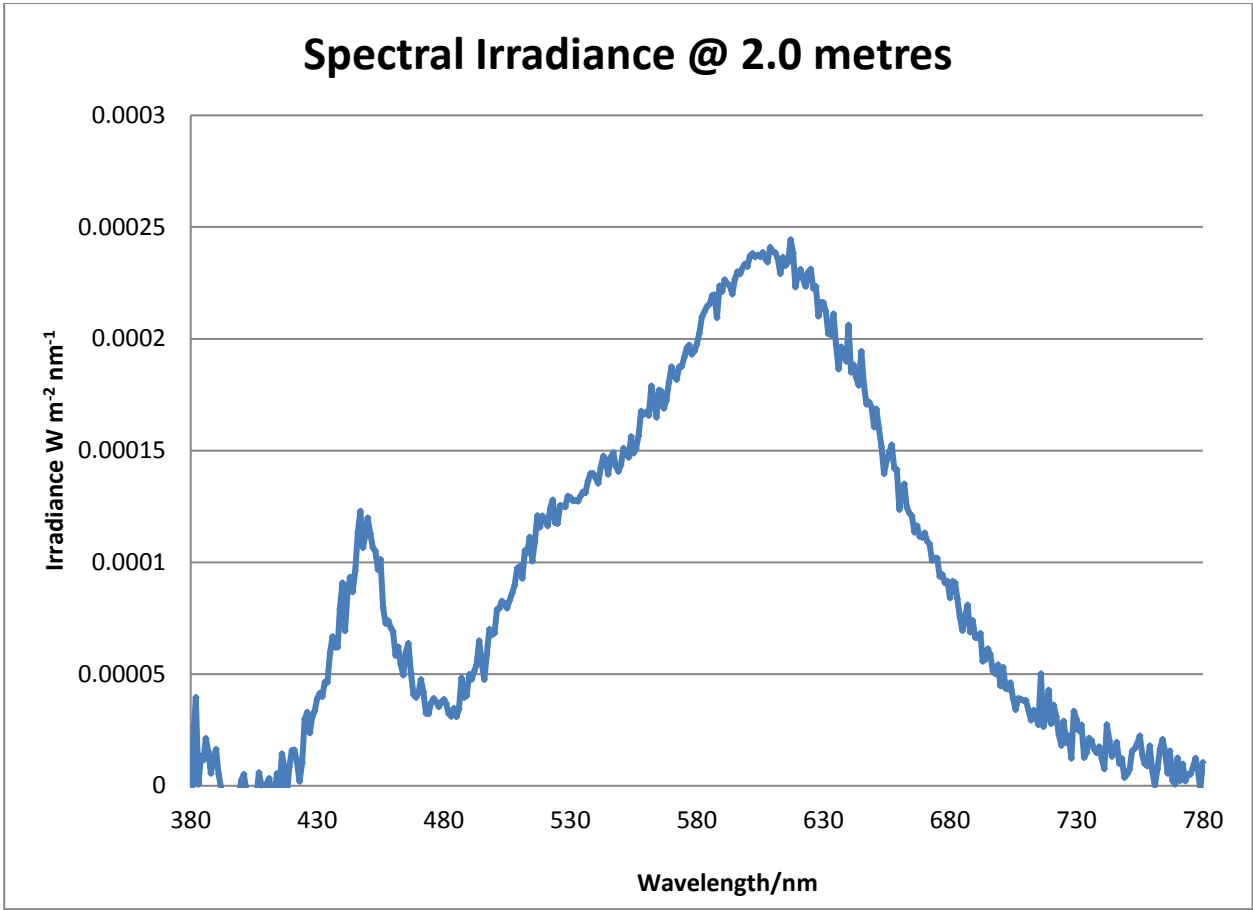


Figure 1: Spectral Irradiance

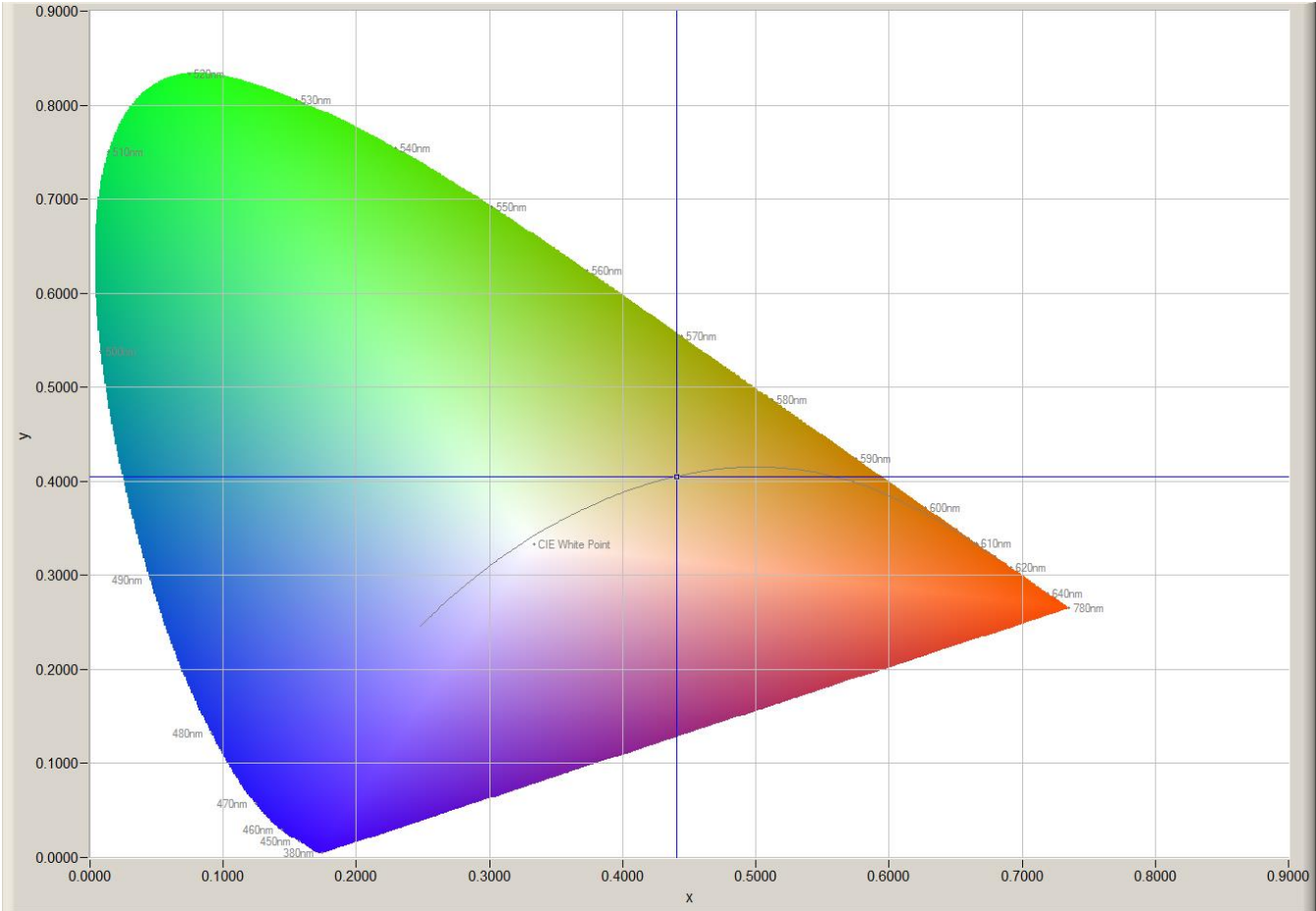


Figure 2: CIE 1931 diagram.

Goniophotometer Test		
Date of Test: 13-03-2013		Ambient Temperature: 25°C
Measurement Filename: OSLO 160 LED		
Instrument Used: Radiant Imaging NFMS0800 Goniometer with ProMetric PM-1200N-1 Imaging Photometer		
Photometer Working Distance: 2.0 m		Measurement Geometry: Near-Field
Comments:		
Reference Photometer Used: Specbos1201		Reference Photometer Serial Number: 2911670
Traceable: to NPL standards, UKAS Accredited		Calibration Certificate Number: 121104
Calibration Certificate Date: 25 th October 2011		Sample Stabilisation Time (minutes): 60
Reference Photometer Calibration Uncertainty: $\pm 2.4\%$ ($k=2$, 20-200 lux, CIE illuminant A source)		
Scan Set Up		
Direction	Range	Increment
Inclination Zone 1	0-180°	3°
Azimuth	0-360°	10°
Results		
Integrated Luminous Flux (lumens): 99.37	Peak Intensity (3° Spot, candelas): 69.2	Efficacy (lumens/Watt): 16.50
Beam Angle (50% of max intensity C0-180, degrees): 47.6		
Photometric Filename (IES LM-63-2002): OSLO 160 LED		
IES File – Absolute or Relative Format? Absolute		
Photometric Filename (EULUMDAT): OSLO 160 LED		
EULUMDAT File – Absolute or Relative Format? Absolute		

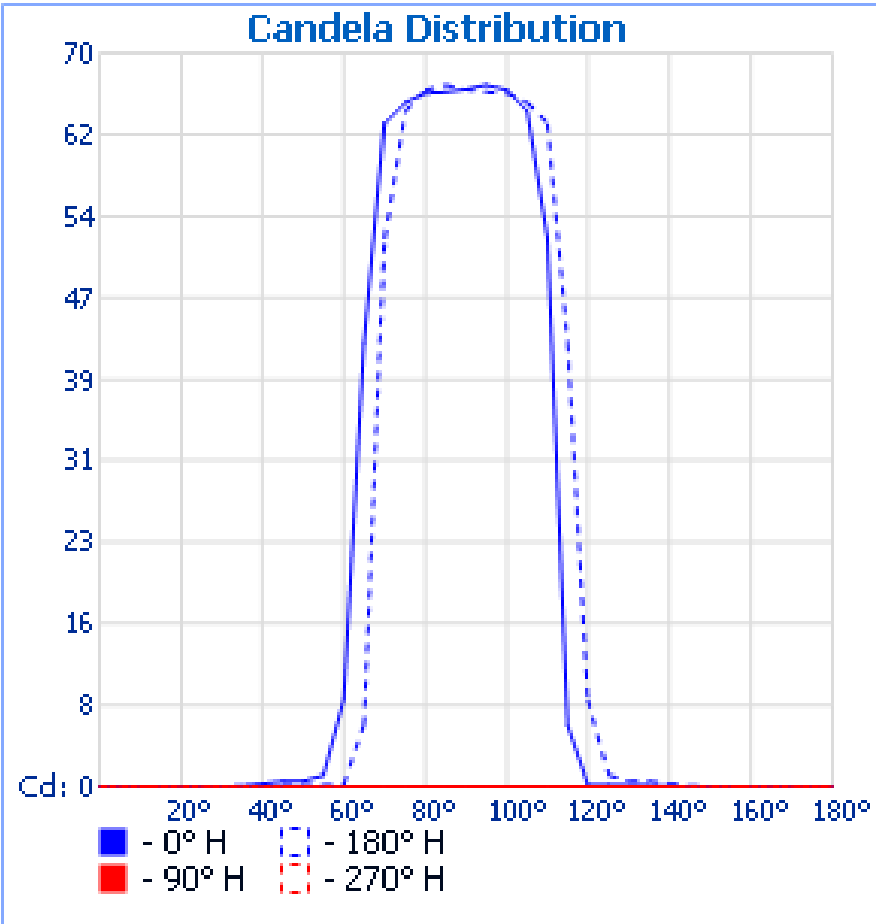


Figure 3: Far-Field Luminous Intensity (C0-180, Cartesian Coordinates)

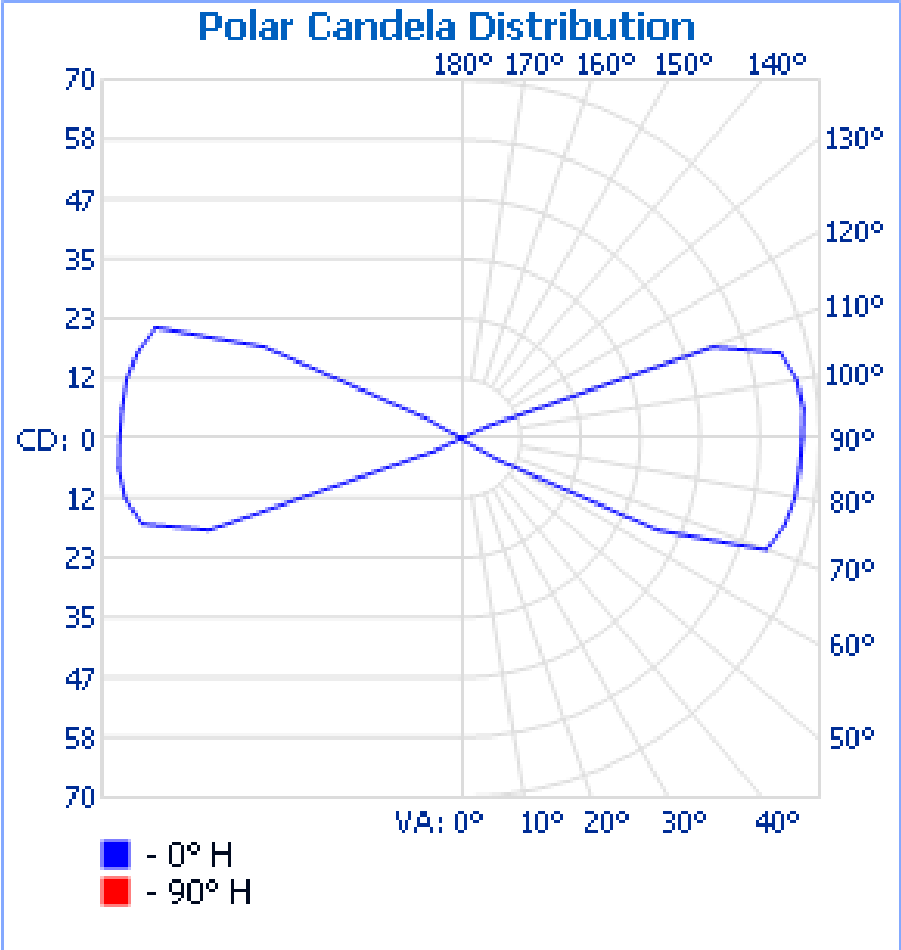


Figure 4: Far-Field Luminous Intensity (C0-180, C90-270, Polar Coordinates)

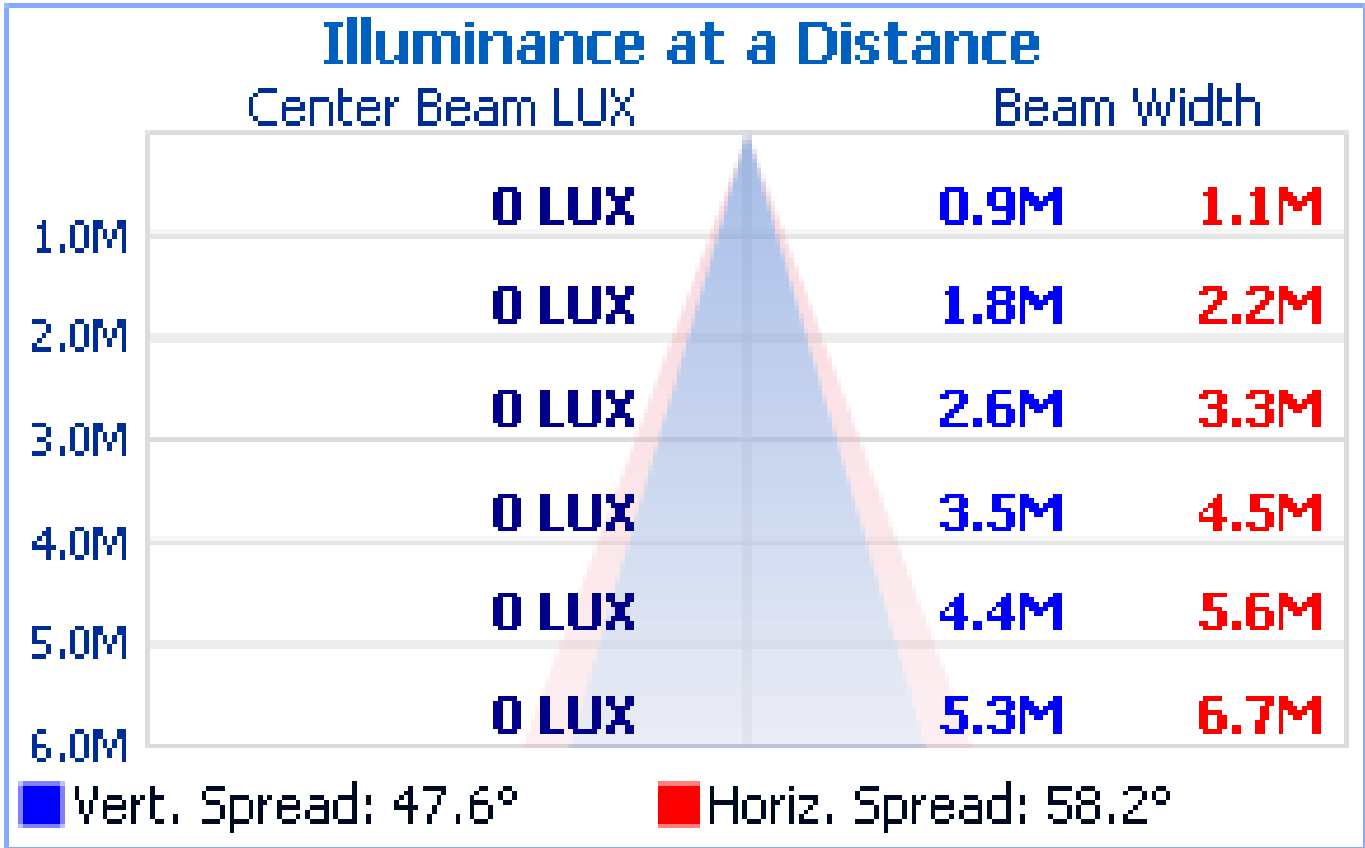


Figure 4. Illuminance cone diagram.

Reflectance of		0.7					0.7				
Ceiling		0.7	0.7	0.5	0.5	0.3	0.7	0.7	0.5	0.5	0.3
Walls		0.5	0.3	0.5	0.3	0.3	0.5	0.3	0.5	0.3	0.3
Floor Cavity		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Room dimension		Viewed crosswise					Viewed endwise				
x	y										
2H	2H	10.4	11.6	11.3	12.5	13.8	<10.0	<10.0	<10.0	<10.0	<10.0
	3H	23.7	24.8	24.6	25.7	27.0	<10.0	<10.0	<10.0	<10.0	<10.0
	4H	27.3	28.3	28.2	29.3	30.6	<10.0	<10.0	<10.0	<10.0	<10.0
	6H	30.3	31.3	31.2	32.3	33.6	<10.0	<10.0	<10.0	<10.0	<10.0
	8H	31.7	32.7	32.6	33.7	35.0	<10.0	<10.0	<10.0	<10.0	<10.0
	12H	33.2	34.2	34.1	35.2	36.5	<10.0	<10.0	<10.0	<10.0	<10.0
4H	2H	10.9	11.9	11.8	12.9	14.2	<10.0	<10.0	<10.0	<10.0	<10.0
	3H	24.2	25.2	25.1	26.2	27.4	<10.0	<10.0	<10.0	<10.0	<10.0
	4H	28.0	28.9	28.9	29.9	31.2	<10.0	<10.0	<10.0	<10.0	<10.0
	6H	31.3	32.1	32.2	33.1	34.4	<10.0	<10.0	<10.0	<10.0	<10.0
	8H	33.0	33.8	33.9	34.8	36.1	<10.0	<10.0	<10.0	<10.0	<10.0
	12H	34.8	35.6	35.8	36.6	37.9	<10.0	<10.0	<10.0	<10.0	<10.0
8H	4H	28.1	29.0	29.1	30.0	31.3	19.6	20.4	20.5	21.4	22.7
	6H	31.7	32.4	32.7	33.4	34.8	19.5	20.2	20.4	21.2	22.5
	8H	33.6	34.3	34.6	35.3	36.7	19.5	20.1	20.4	21.2	22.5
	12H	35.8	36.4	36.7	37.4	38.7	19.4	20.0	20.4	21.1	22.4
12H	4H	28.1	28.9	29.1	29.9	31.2	23.0	23.8	24.0	24.8	26.1
	6H	31.8	32.5	32.7	33.5	34.8	23.8	24.4	24.7	25.5	26.8
	8H	33.8	34.4	34.7	35.4	36.7	23.7	24.3	24.7	25.4	26.7

Table 1. UGR values

	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
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
3	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
6	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
9	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
12	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
15	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
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
21	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0
24	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1
27	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1
30	0.6	0.5	0.3	0.1	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	0.1	0.2
33	1.1	0.6	0.3	0.1	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	0.1	0.2
36	8.3	3.8	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	1.4	0.2
39	42.3	34.7	2.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	5.5	5.9
42	63.3	56.9	7.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	6.6	41.6	52.3
45	65.3	64.5	12.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	13.9	63.0	64.5
48	66.2	65.7	7.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	12.7	66.3	66.5
51	66.3	66.2	8.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	10.1	66.7	67.0
54	66.6	65.6	12.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	12.4	65.6	66.6
57	67.0	66.7	10.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	8.7	66.2	66.3
60	66.5	66.3	12.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	7.6	65.7	66.2
63	64.5	63.1	13.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	12.2	64.5	65.3
66	52.3	41.6	6.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	7.9	56.9	63.3
69	5.9	5.5	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	2.1	34.7	42.3
72	0.2	1.4	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	3.8	8.3
75	0.2	0.1	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	0.1	0.3	0.6	1.1
78	0.2	0.1	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	0.1	0.3	0.5	0.6
81	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.5	0.5
84	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3
87	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
90	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
93	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

96	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
99	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
102	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
105	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
108	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
111	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
114	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
117	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
120	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
123	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
126	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
129	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	0.1	0.0	0.0	0.0	0.0	0.0
132	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0
135	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1
138	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1
141	0.6	0.5	0.3	0.1	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	0.1	0.2
144	1.1	0.6	0.3	0.1	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	0.1	0.2
147	8.3	3.8	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	1.4	0.2
150	42.3	34.7	2.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	5.5	5.9
153	63.3	56.9	7.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	6.6	41.6	52.3
156	65.3	64.5	12.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	13.9	63.0	64.5
159	66.2	65.7	7.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	12.7	66.3	66.5
162	66.3	66.2	8.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	10.1	66.7	67.0
165	66.6	65.6	12.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	12.4	65.6	66.6
168	67.0	66.7	10.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	8.7	66.2	66.3
171	66.5	66.3	12.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	7.6	65.7	66.2
174	64.5	63.1	13.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	12.2	64.5	65.3
177	52.3	41.6	6.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	7.9	56.9	63.3
180	5.9	5.5	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	2.1	34.7	42.3

Table 2a. Luminous intensity values, azimuth 0-180°

	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
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
3	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
6	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
9	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
12	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
15	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
18	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
21	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
24	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3
27	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.4
30	0.2	0.1	0.2	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.5	0.5
33	0.2	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.4	1.0	1.6	1.5
36	0.7	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.6	5.4	8.2	9.4
39	8.0	4.3	3.3	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	7.2	19.0	28.1	38.8
42	46.1	32.0	21.1	7.3	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.2	1.1	18.3	44.2	57.3	64.2
45	64.6	58.3	45.4	24.5	1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.2	1.8	36.4	60.1	64.5	67.0
48	68.1	65.7	59.9	37.3	2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.3	2.8	45.0	60.6	65.7	67.8
51	69.2	66.2	60.9	45.3	3.6	0.4	0.0	0.0	0.0	0.0	0.0	0.4	3.4	47.0	60.9	66.1	68.7
54	68.8	66.5	61.8	47.8	3.1	0.5	0.1	0.1	0.0	0.1	0.1	0.5	3.1	47.8	61.8	66.5	68.8
57	68.7	66.1	60.9	47.0	3.4	0.4	0.0	0.0	0.0	0.0	0.0	0.4	3.6	45.3	60.9	66.2	69.2
60	67.8	65.7	60.6	45.0	2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.3	2.8	37.3	59.9	65.7	68.1
63	67.0	64.5	60.1	36.4	1.8	0.2	0.0	0.0	0.0	0.0	0.0	0.2	1.1	24.5	45.4	58.3	64.6
66	64.2	57.3	44.2	18.3	1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.5	7.3	21.1	32.0	46.1
69	38.8	28.1	19.0	7.2	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	3.3	4.3	8.0
72	9.4	8.2	5.4	1.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.7
75	1.5	1.6	1.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.2
78	0.5	0.5	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.2	0.1	0.2
81	0.4	0.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
84	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
87	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
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
93	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

96	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
99	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
102	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
105	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
108	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
111	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
114	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
117	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
120	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
123	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
126	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
129	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
132	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
135	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3
138	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.4
141	0.2	0.1	0.2	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.5	0.5
144	0.2	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.4	1.0	1.6	1.5
147	0.7	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.6	5.4	8.2	9.4
150	8.0	4.3	3.3	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	7.2	19.0	28.1	38.8
153	46.1	32.0	21.1	7.3	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.2	1.1	18.3	44.2	57.3	64.2
156	64.6	58.3	45.4	24.5	1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.2	1.8	36.4	60.1	64.5	67.0
159	68.1	65.7	59.9	37.3	2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.3	2.8	45.0	60.6	65.7	67.8
162	69.2	66.2	60.9	45.3	3.6	0.4	0.0	0.0	0.0	0.0	0.0	0.4	3.4	47.0	60.9	66.1	68.7
165	68.8	66.5	61.8	47.8	3.1	0.5	0.1	0.1	0.0	0.1	0.1	0.5	3.1	47.8	61.8	66.5	68.8
168	68.7	66.1	60.9	47.0	3.4	0.4	0.0	0.0	0.0	0.0	0.0	0.4	3.6	45.3	60.9	66.2	69.2
171	67.8	65.7	60.6	45.0	2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.3	2.8	37.3	59.9	65.7	68.1
174	67.0	64.5	60.1	36.4	1.8	0.2	0.0	0.0	0.0	0.0	0.0	0.2	1.1	24.5	45.4	58.3	64.6
177	64.2	57.3	44.2	18.3	1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.5	7.3	21.1	32.0	46.1
180	38.8	28.1	19.0	7.2	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	3.3	4.3	8.0

Table 2b. Luminous intensity values, azimuth 190-350°

Signature:



Print Name:

GH JOHN

Date:

_15-03-2013_____

Partner / Director

Duly authorised to sign on behalf of:

Photometric and Optical Testing Services LLP