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PHOTOMETRIC  
TEST REPORT

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Report Number	GNC-19586
Customer	Astro Lighting Limited
Contact	Ross Dickson
Product Type	LED Downlight
Test Purpose	Generation of Photometric Data
Sales Order Ref	Q-LUX17-21659
Works Order Number	WO-10233
Test Item Reference	TI-13775
LAB Test Method Reference	TES-102000
Test Standards	LM-79-08; (BS) EN 13032-4:2015; CIE S025:2015
Lab Location Reference	LUX-TSI
Tested by	Mike Sewell
Date of Test	13/06/2017
Reviewed by	Menno Schakel
Number of products tested	1

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Signed: 



7882 - Cromarty LED

Date: 13/06/2017

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### Nomenclature

Lamp Orientation described below relates to the position in which a lamp is designed to operate for maximum performance and safety, these include:

BD - Base Down (bulb is vertically positioned with the metal base at the bottom, glass up)

BU - Base Up (bulb is vertically positioned with the metal base at the top, glass hanging down)

HBD - Horizontal +15° to Base Down

H45 - Horizontal to -45° only

VBU - Vertical Base Up ±15°

VBD - Vertical Base Down ±15°

HBU - Base Up +/- 90° (bulb can be operated in a base up or horizontal position)

HOR - Horizontal Burn (bulb is positioned with the metal base parallel to the ground)

H75 - Horizontal +/- 75° (bulb should not be operated within 15° of vertical)

U - Universal Burn (burn can be operated in any position)

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### Test Conditions

Measurements were made with an ambient temperature of 25°C +/- 1°C. Measurements were taken only after sufficient time for thermal stabilisation has been allowed. Thermal stabilisation according to LM-79-08 was achieved before measurements are measured and reported.

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### Calibrations

The far field Type C Goniophotometer is calibrated using an intensity lamp calibrated by a NVLAP accredited calibration laboratory.

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### Test Equipment

UL LSI Custom Far-Field Type C Moving Mirror Goniophotometer measures intensity as a function of angle. On-axis spectral measurements taken using spectrometer, for which these measurements and outputs are not accredited.

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### Data Formats

IES (15 deg azimuth and 2.5 deg inclination) and LDT (15 deg C planes and 2.5 deg gamma angles)

Spectral Data file from which the calculation of chromaticity and CRI etc. have been performed and the derived results from the LightMtrX software are provided as a text file format.

All photometric data for LED products will be provided in ABSOLUTE photometric format and all non-LED data will be in relative photometric format with lamp lumens measured separately, where possible, for LOR estimation.

Product Name	Cromarty LED
Part/Serial Number	1378002
Type of Product	LED Downlight
Base Type	Not Applicable - Luminaire
Driver Type	Internal
Test Time	30 mins
Operating Orientation	Base Up
Test Orientation	Base Up
Ambient Temperature	24.8°C
Manufacturer	Astro Lighting Limited
Date of Manufacture	Not Available
Thermal Management	Passive
Dimmable	No
Pre-Burning Time	0 hours
Stabilisation Time	120 mins
Humidity	34.4% RH
Averaging Applied	NONE



Driver Details		
Manufacturer		N/A
Model		N/A
Part/Serial #		N/A
Rated Voltage		N/A
Output	Current	N/A
	Voltage	N/A

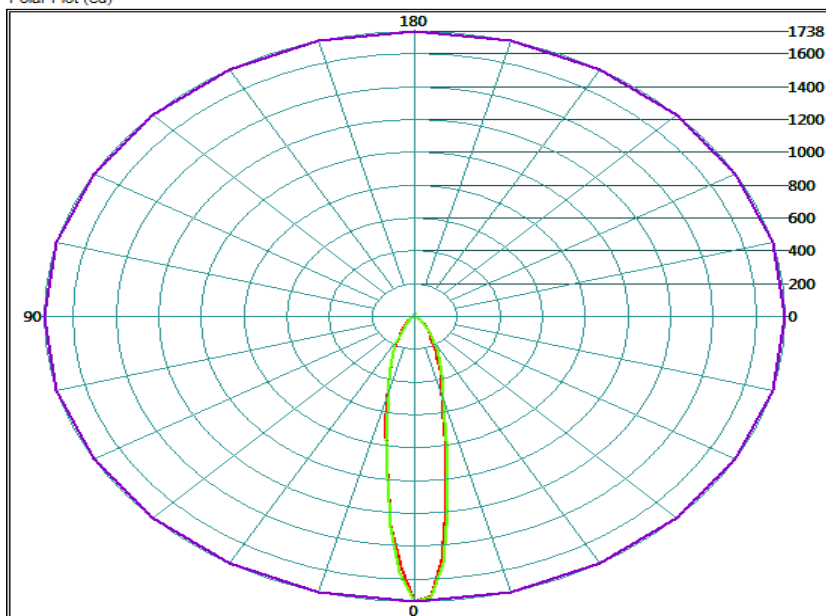
Photometric Measurements	
Luminous Flux	507 lm
Luminous Efficacy	59 lm/W

Dimension	Sample	Luminous Opening
Diameter/Width	106 mm $\Phi$	55 mm $\Phi$
Length		
Height/Depth	155 mm	0 mm

Electrical Measurements	
Frequency	50 Hz
Voltage	229.260 V
Current	0.045 A
Power	8.6 W
Power Factor	0.844
Apparent Power	10.2 VA

Goniophotometric Measurements		
Beam Angle	Horizontal	19°
	Vertical	19°
On-axis Intensity		1738 cd
Peak Intensity		1738 cd
Peak Direction	Horizontal	0°
	Vertical	0°

Polar Plot (cd)



0.00	0.00
180.00	0.00
90.00	0.00
270.00	0.00
0.00	0.00

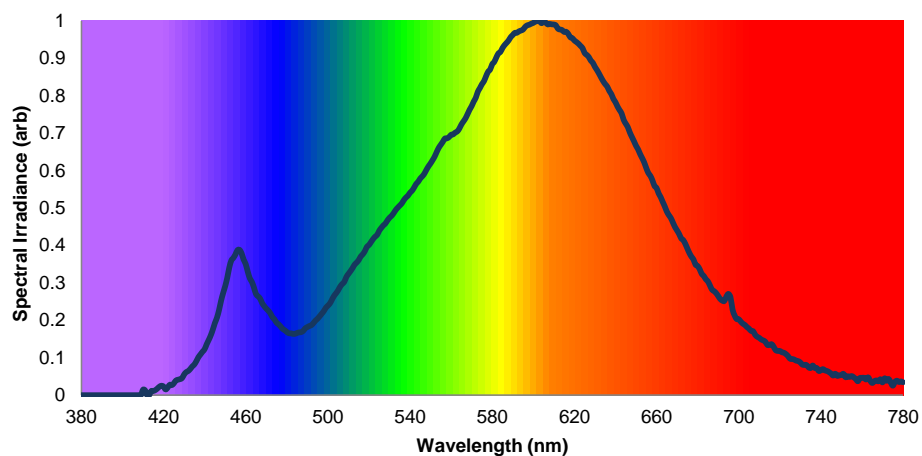
Mounting Height (m)	Beam Cone Width (m)	Orthogonal Beam Cone Width (m)	Projected Illuminance (lux)
0.5	0.16	0.17	6950.0
1	0.33	0.34	1737.5
2	0.65	0.67	434.4
3	0.98	1.01	193.1
4	1.30	1.34	108.6
5	1.63	1.68	69.5
6	1.96	2.01	48.3
8	2.61	2.68	27.1
10	3.26	3.35	17.4
20	6.52	6.71	4.3

## Appendices

### *On-axis Spectral Measurement*

The following data was determined from an on-axis spectral measurement using a SP1000 spectrometer at a distance of 500mm, for which these measurements and outputs are not accredited.

**Spectral Irradiance versus Wavelength**

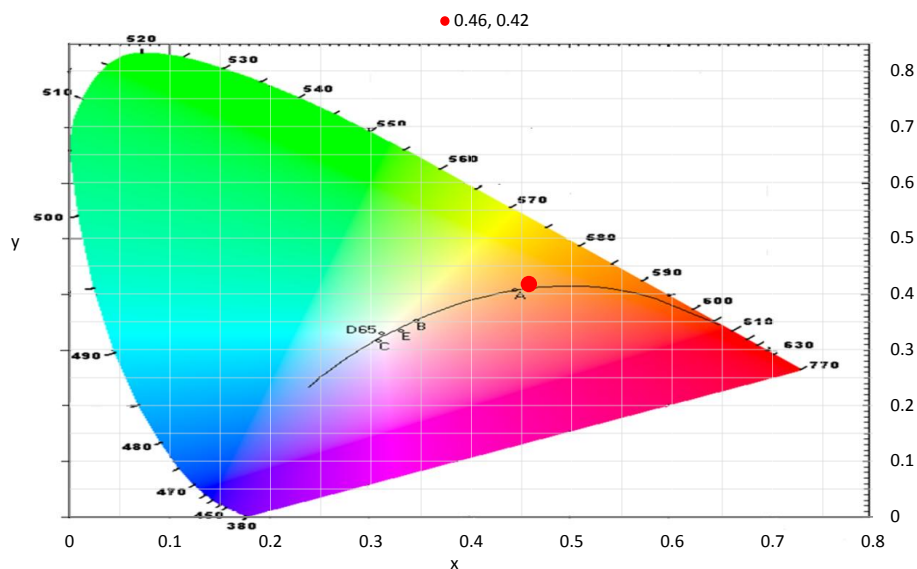


Colour Rendering Index Detail			
R1	78	R8	58
R2	89	R9	7
R3	97	R10	74
R4	77	R11	73
R5	77	R12	63
R6	85	R13	80
R7	84	R14	98

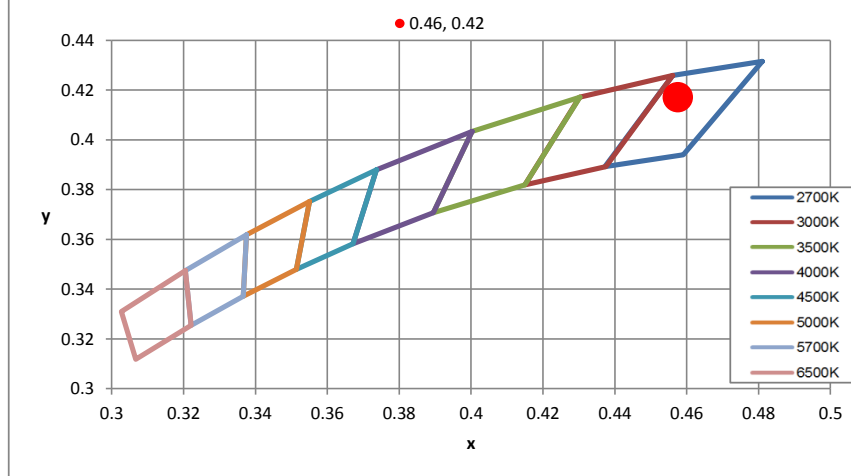
Colorimetric Details	
CCT	2781K
CRI (Ra)	81

Chromaticity Coordinates		
CIE 1931	x	0.4576
	y	0.4171
CIE 1960	u	0.2582
	v	0.3530
CIE 1976	u'	0.2582
	v'	0.5295
Duv		0.0025

CIE 1931 Colour Chart



CIE 1931 x, y Chromaticity Diagram - Nominal CCT Quadrangles



### Spectral Power Distribution

$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units
380	0.00E+00	430	5.50E-02	480	1.69E-01	530	4.74E-01
381	0.00E+00	431	6.15E-02	481	1.66E-01	531	4.79E-01
382	0.00E+00	432	6.45E-02	482	1.65E-01	532	4.86E-01
383	0.00E+00	433	6.99E-02	483	1.64E-01	533	4.95E-01
384	0.00E+00	434	7.68E-02	484	1.64E-01	534	5.01E-01
385	0.00E+00	435	8.21E-02	485	1.66E-01	535	5.07E-01
386	0.00E+00	436	9.11E-02	486	1.68E-01	536	5.13E-01
387	0.00E+00	437	1.02E-01	487	1.69E-01	537	5.21E-01
388	0.00E+00	438	1.09E-01	488	1.72E-01	538	5.28E-01
389	0.00E+00	439	1.16E-01	489	1.79E-01	539	5.33E-01
390	0.00E+00	440	1.23E-01	490	1.82E-01	540	5.41E-01
391	0.00E+00	441	1.36E-01	491	1.85E-01	541	5.47E-01
392	0.00E+00	442	1.48E-01	492	1.87E-01	542	5.55E-01
393	0.00E+00	443	1.60E-01	493	1.93E-01	543	5.65E-01
394	0.00E+00	444	1.75E-01	494	2.00E-01	544	5.71E-01
395	0.00E+00	445	1.93E-01	495	2.04E-01	545	5.79E-01
396	0.00E+00	446	2.07E-01	496	2.11E-01	546	5.85E-01
397	0.00E+00	447	2.27E-01	497	2.18E-01	547	5.92E-01
398	0.00E+00	448	2.52E-01	498	2.24E-01	548	6.03E-01
399	0.00E+00	449	2.73E-01	499	2.33E-01	549	6.12E-01
400	0.00E+00	450	2.91E-01	500	2.39E-01	550	6.20E-01
401	0.00E+00	451	3.13E-01	501	2.45E-01	551	6.28E-01
402	0.00E+00	452	3.41E-01	502	2.55E-01	552	6.38E-01
403	0.00E+00	453	3.60E-01	503	2.65E-01	553	6.50E-01
404	0.00E+00	454	3.67E-01	504	2.72E-01	554	6.61E-01
405	0.00E+00	455	3.76E-01	505	2.80E-01	555	6.69E-01
406	0.00E+00	456	3.88E-01	506	2.90E-01	556	6.78E-01
407	0.00E+00	457	3.88E-01	507	2.97E-01	557	6.86E-01
408	0.00E+00	458	3.79E-01	508	3.03E-01	558	6.86E-01
409	0.00E+00	459	3.62E-01	509	3.16E-01	559	6.90E-01
410	1.44E-02	460	3.51E-01	510	3.24E-01	560	6.96E-01
411	1.33E-02	461	3.30E-01	511	3.31E-01	561	6.97E-01
412	0.00E+00	462	3.13E-01	512	3.40E-01	562	7.02E-01
413	0.00E+00	463	3.03E-01	513	3.49E-01	563	7.05E-01
414	1.10E-02	464	2.88E-01	514	3.54E-01	564	7.13E-01
415	1.13E-02	465	2.71E-01	515	3.61E-01	565	7.23E-01
416	1.35E-02	466	2.64E-01	516	3.71E-01	566	7.32E-01
417	1.78E-02	467	2.58E-01	517	3.77E-01	567	7.40E-01
418	2.27E-02	468	2.46E-01	518	3.85E-01	568	7.51E-01
419	2.53E-02	469	2.38E-01	519	3.97E-01	569	7.63E-01
420	2.32E-02	470	2.31E-01	520	4.01E-01	570	7.73E-01
421	1.53E-02	471	2.26E-01	521	4.09E-01	571	7.85E-01
422	2.01E-02	472	2.19E-01	522	4.17E-01	572	7.95E-01
423	2.79E-02	473	2.09E-01	523	4.24E-01	573	8.11E-01
424	2.67E-02	474	2.03E-01	524	4.29E-01	574	8.21E-01
425	3.16E-02	475	1.94E-01	525	4.39E-01	575	8.31E-01
426	3.90E-02	476	1.89E-01	526	4.47E-01	576	8.39E-01
427	4.13E-02	477	1.84E-01	527	4.54E-01	577	8.52E-01
428	4.28E-02	478	1.77E-01	528	4.59E-01	578	8.64E-01
429	4.55E-02	479	1.74E-01	529	4.67E-01	579	8.70E-01
						580	8.84E-01



### Spectral Power Distribution

$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units
581	8.91E-01	631	8.69E-01	681	3.37E-01	731	8.16E-02
582	9.03E-01	632	8.59E-01	682	3.24E-01	732	8.09E-02
583	9.13E-01	633	8.49E-01	683	3.19E-01	733	8.07E-02
584	9.17E-01	634	8.39E-01	684	3.10E-01	734	7.45E-02
585	9.28E-01	635	8.31E-01	685	3.04E-01	735	7.24E-02
586	9.36E-01	636	8.25E-01	686	2.93E-01	736	7.94E-02
587	9.42E-01	637	8.13E-01	687	2.82E-01	737	7.26E-02
588	9.48E-01	638	8.05E-01	688	2.78E-01	738	7.26E-02
589	9.57E-01	639	7.92E-01	689	2.73E-01	739	6.47E-02
590	9.63E-01	640	7.83E-01	690	2.65E-01	740	6.66E-02
591	9.68E-01	641	7.71E-01	691	2.57E-01	741	6.97E-02
592	9.68E-01	642	7.62E-01	692	2.53E-01	742	6.60E-02
593	9.72E-01	643	7.53E-01	693	2.52E-01	743	6.46E-02
594	9.75E-01	644	7.36E-01	694	2.64E-01	744	6.16E-02
595	9.77E-01	645	7.26E-01	695	2.71E-01	745	5.74E-02
596	9.84E-01	646	7.17E-01	696	2.62E-01	746	5.24E-02
597	9.88E-01	647	7.02E-01	697	2.29E-01	747	5.73E-02
598	9.90E-01	648	6.90E-01	698	2.13E-01	748	5.15E-02
599	9.93E-01	649	6.79E-01	699	2.03E-01	749	5.32E-02
600	9.95E-01	650	6.67E-01	700	2.03E-01	750	5.39E-02
601	9.98E-01	651	6.57E-01	701	1.97E-01	751	5.70E-02
602	1.00E+00	652	6.45E-01	702	1.91E-01	752	4.79E-02
603	1.00E+00	653	6.34E-01	703	1.88E-01	753	5.07E-02
604	9.94E-01	654	6.22E-01	704	1.82E-01	754	4.89E-02
605	9.99E-01	655	6.07E-01	705	1.78E-01	755	5.12E-02
606	9.96E-01	656	5.94E-01	706	1.72E-01	756	4.77E-02
607	9.91E-01	657	5.86E-01	707	1.71E-01	757	4.32E-02
608	9.92E-01	658	5.74E-01	708	1.61E-01	758	3.72E-02
609	9.91E-01	659	5.59E-01	709	1.56E-01	759	4.59E-02
610	9.91E-01	660	5.54E-01	710	1.53E-01	760	4.63E-02
611	9.88E-01	661	5.40E-01	711	1.49E-01	761	4.66E-02
612	9.79E-01	662	5.29E-01	712	1.46E-01	762	4.19E-02
613	9.77E-01	663	5.17E-01	713	1.43E-01	763	4.77E-02
614	9.76E-01	664	5.04E-01	714	1.34E-01	764	3.87E-02
615	9.71E-01	665	4.91E-01	715	1.34E-01	765	3.25E-02
616	9.71E-01	666	4.81E-01	716	1.36E-01	766	3.73E-02
617	9.66E-01	667	4.73E-01	717	1.29E-01	767	3.95E-02
618	9.57E-01	668	4.61E-01	718	1.20E-01	768	3.70E-02
619	9.54E-01	669	4.49E-01	719	1.18E-01	769	4.27E-02
620	9.48E-01	670	4.40E-01	720	1.18E-01	770	3.41E-02
621	9.44E-01	671	4.31E-01	721	1.15E-01	771	4.51E-02
622	9.39E-01	672	4.19E-01	722	1.13E-01	772	3.85E-02
623	9.33E-01	673	4.14E-01	723	1.10E-01	773	4.34E-02
624	9.27E-01	674	4.05E-01	724	1.04E-01	774	3.39E-02
625	9.14E-01	675	3.92E-01	725	9.73E-02	775	2.53E-02
626	9.10E-01	676	3.80E-01	726	9.67E-02	776	3.51E-02
627	9.04E-01	677	3.70E-01	727	9.53E-02	777	3.87E-02
628	8.94E-01	678	3.62E-01	728	9.22E-02	778	3.52E-02
629	8.88E-01	679	3.49E-01	729	9.10E-02	779	3.68E-02
630	8.77E-01	680	3.45E-01	730	8.74E-02	780	3.45E-02

### Measurement Uncertainty

The following is the reported expanded uncertainty of the UL 6440T Type C Mirror Goniophotometer.

Parameter	Uncertainty
Total Luminous Flux (%)	$\pm 4.9$
Luminous Intensity (%)	$\pm 4.9$
Temperature (°C)	$\pm 1.0$
Voltage DC TY720 (%)	$\pm 0.02$
Current DC TY720 (%)	$\pm 0.10$
Voltage AC WT210 (%)	$\pm 0.0585$
Current AC WT210 (%)	$\pm 0.0251$
Power AC WT210 (%)	$\pm 0.2261$
Frequency (50/60 Hz) WT210 (%)	$\pm 0.0040$
Power Factor WT210 (%)	$\pm 0.0601$

The reported expanded uncertainty is based on the combined standard uncertainty multiplied by a coverage factor of  $k = 2$ . This value of  $k$  gives a coverage probability of approximately 95%, assuming a normal distribution. This determination of the measurement uncertainty has been done in accordance with international requirements including UKAS, BIPM Guide to the Expression of Uncertainty in Measurement and CIE 198:2011 and CIE S 025/E:2015.

Electrical measurement equipment used for the determination of results for this report, are compliant and meet the performance requirements of the measurement standards used.

----- END OF REPORT -----