

astro

PHOTOMETRIC
TEST REPORT

Report Number	GNC-21860
Customer	Astro Lighting Limited
Contact	David Green
Product Type	LED Downlight
Test Purpose	Generation of photometric data
Quote Reference	Q-LUX18-22691
Works Order Number	WO-12507
Test Item Reference	TI-15514
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	06/09/2018
Reviewed by	Gareth Jones
Number of products tested	1

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Kos Round 140

Date: 07/09/2018

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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 $+15^{\circ}$ to Base Down

H45 - Horizontal to -45° only

VBU - Vertical Base Up $\pm 15^{\circ}$

VBD - Vertical Base Down $\pm 15^{\circ}$

HBU - Base Up $\pm 90^{\circ}$ (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 $\pm 75^{\circ}$ (bulb should not be operated within 15° of vertical)

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

Test Conditions

Measurements were made with an ambient temperature of $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$. 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.

Calibrations

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

Test Equipment

UL LSI Custom Far-Field Type C Moving Mirror Goniophotometer measures intensity as a function of angle. Spectral measurements are measured using a Labsphere 1 metre integrating sphere.

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	Kos Square 140 LED
Part/Serial Number	1326033
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	25.4°C
Manufacturer	Astro Lighting Limited
Date of Manufacture	Not Available
Thermal Management	Passive
Dimmable	No
Pre-Burning Time	0 hours
Stabilisation Time	45 mins
Humidity	41.4% 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	900 lm
Luminous Efficacy	76 lm/W

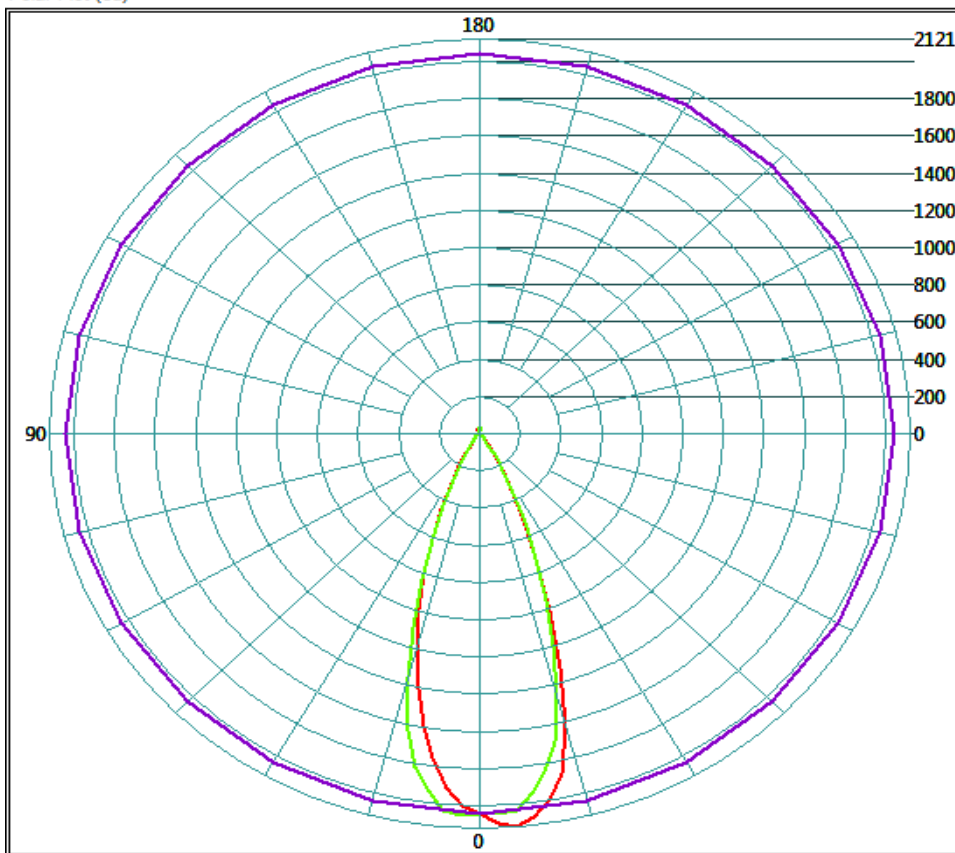
Dimension	Sample	Luminous Opening
Diameter/Width	115 mm Φ	95 mm Φ
Length		
Height/Depth	140 mm	0 mm

Electrical Measurements	
Frequency	50 Hz
Voltage	230.0 V
Current	0.052 A
Power	11.9 W
Power Factor	0.993
Apparent Power	12.0 VA

Goniophotometric Measurements

Beam Angle	Horizontal	36°
	Vertical	36°
On-axis Intensity		2042 cd
Peak Intensity		2121 cd
Peak Direction	Horizontal	165°
	Vertical	5°

Polar Plot (cd)

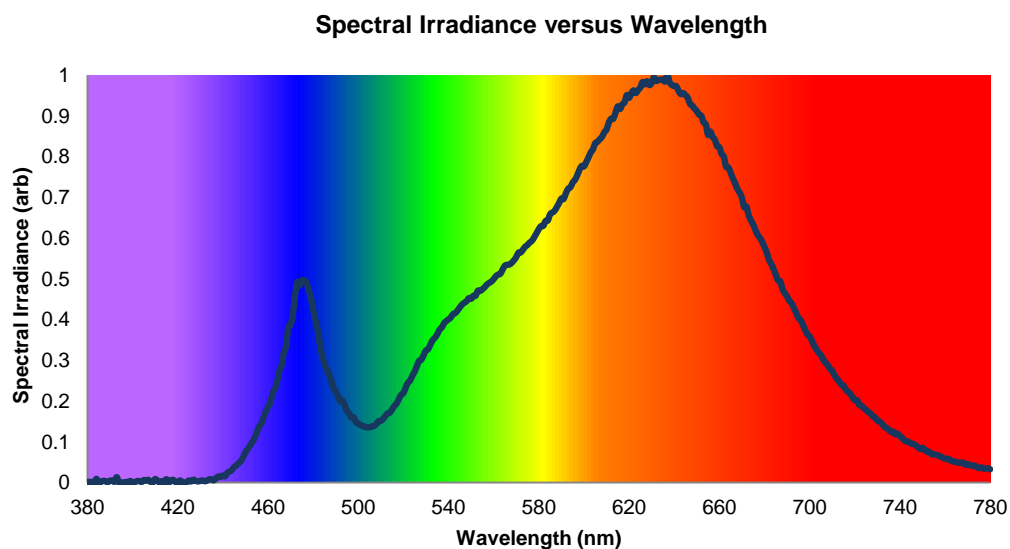


Mounting Height (m)	Beam Width (m)		Projected Illuminance (lux)
	C0-C180 plane	C90-270 plane	
0.5	0.3	0.3	8169
1	0.6	0.7	2042
2	1.3	1.3	511
3	1.9	2.0	227
4	2.6	2.6	128
5	3.2	3.3	82
7.5	4.9	4.9	36
10	6.5	6.5	20
20	13.0	13.1	5

Spectral Results

Integrated Spectral Measurement using spectroradiometer and 1 metre integrating sphere

The following data was determined from an integrated spectral measurement using a spectrometer. This will produce spatially averaged spectroradiometric results measured in an integrating sphere.



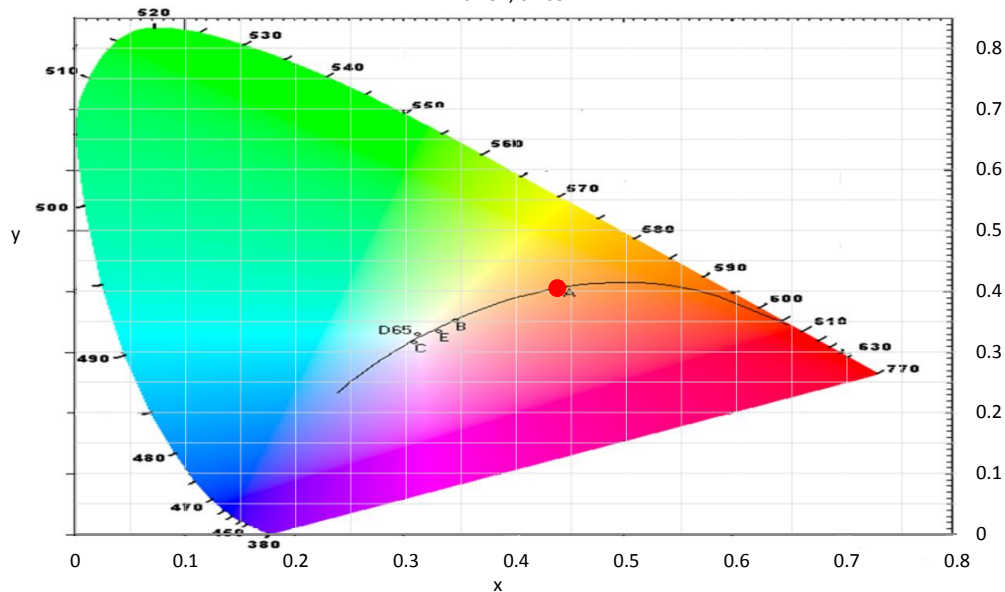
Colour Rendering Index Detail			
R1	79	R8	58
R2	88	R9	2
R3	97	R10	74
R4	80	R11	79
R5	79	R12	72
R6	86	R13	81
R7	83	R14	98

Colorimetric Details	
CCT	2995K
CRI (Ra)	81

Chromaticity Coordinates		
CIE 1931	x	0.4374
	y	0.4048
CIE 1960	u	0.2506
	v	0.3478
CIE 1976	u'	0.2506
	v'	0.5217
Duv		0.0001

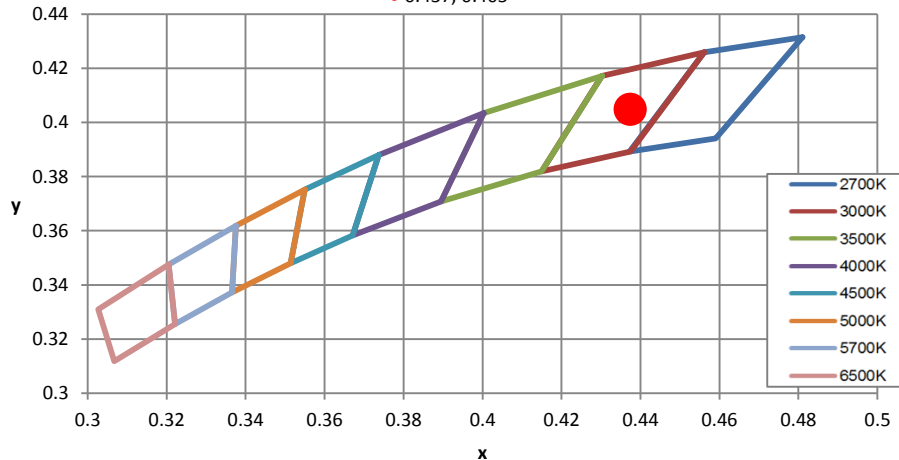
CIE 1931 Colour Chart

• 0.437, 0.405



CIE 1931 x, y Chromaticity Diagram - Nominal CCT Quadrangles

• 0.437, 0.405



Spectral Power Distribution

λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units
380	1.49E-03	430	3.94E-03	480	4.26E-01	530	3.24E-01
381	1.72E-03	431	5.27E-03	481	4.00E-01	531	3.28E-01
382	1.16E-03	432	3.19E-03	482	3.75E-01	532	3.40E-01
383	0.00E+00	433	4.77E-03	483	3.41E-01	533	3.50E-01
384	9.27E-03	434	8.07E-03	484	3.12E-01	534	3.56E-01
385	0.00E+00	435	7.81E-03	485	2.93E-01	535	3.64E-01
386	1.54E-03	436	5.44E-03	486	2.78E-01	536	3.75E-01
387	4.21E-03	437	1.08E-02	487	2.67E-01	537	3.81E-01
388	3.18E-03	438	1.48E-02	488	2.52E-01	538	3.91E-01
389	8.87E-04	439	1.41E-02	489	2.33E-01	539	3.96E-01
390	4.76E-03	440	1.72E-02	490	2.24E-01	540	4.01E-01
391	4.61E-03	441	1.54E-02	491	2.12E-01	541	4.05E-01
392	1.99E-03	442	2.38E-02	492	2.00E-01	542	4.14E-01
393	1.33E-02	443	2.70E-02	493	2.01E-01	543	4.16E-01
394	0.00E+00	444	3.08E-02	494	1.89E-01	544	4.22E-01
395	0.00E+00	445	3.79E-02	495	1.76E-01	545	4.30E-01
396	2.53E-04	446	4.21E-02	496	1.69E-01	546	4.37E-01
397	1.35E-03	447	4.78E-02	497	1.60E-01	547	4.41E-01
398	1.18E-03	448	5.25E-02	498	1.60E-01	548	4.45E-01
399	3.92E-03	449	6.22E-02	499	1.48E-01	549	4.53E-01
400	0.00E+00	450	7.42E-02	500	1.45E-01	550	4.51E-01
401	9.86E-04	451	8.18E-02	501	1.41E-01	551	4.59E-01
402	3.70E-03	452	9.01E-02	502	1.39E-01	552	4.59E-01
403	3.52E-03	453	9.89E-02	503	1.37E-01	553	4.71E-01
404	1.27E-03	454	1.09E-01	504	1.36E-01	554	4.71E-01
405	6.30E-03	455	1.22E-01	505	1.36E-01	555	4.75E-01
406	4.69E-03	456	1.37E-01	506	1.38E-01	556	4.80E-01
407	6.77E-03	457	1.44E-01	507	1.39E-01	557	4.86E-01
408	1.79E-03	458	1.59E-01	508	1.44E-01	558	4.90E-01
409	0.00E+00	459	1.73E-01	509	1.51E-01	559	4.94E-01
410	8.72E-03	460	1.86E-01	510	1.52E-01	560	5.00E-01
411	4.60E-03	461	1.96E-01	511	1.56E-01	561	5.07E-01
412	0.00E+00	462	2.18E-01	512	1.64E-01	562	5.11E-01
413	3.62E-03	463	2.30E-01	513	1.70E-01	563	5.13E-01
414	1.39E-03	464	2.44E-01	514	1.72E-01	564	5.24E-01
415	8.41E-03	465	2.73E-01	515	1.80E-01	565	5.33E-01
416	0.00E+00	466	2.86E-01	516	1.88E-01	566	5.35E-01
417	5.36E-03	467	3.19E-01	517	1.94E-01	567	5.35E-01
418	6.71E-03	468	3.35E-01	518	2.05E-01	568	5.40E-01
419	1.23E-03	469	3.81E-01	519	2.15E-01	569	5.46E-01
420	0.00E+00	470	3.87E-01	520	2.20E-01	570	5.54E-01
421	5.34E-03	471	4.11E-01	521	2.33E-01	571	5.65E-01
422	1.61E-03	472	4.58E-01	522	2.45E-01	572	5.65E-01
423	1.41E-04	473	4.93E-01	523	2.51E-01	573	5.72E-01
424	8.02E-04	474	4.83E-01	524	2.63E-01	574	5.79E-01
425	5.21E-03	475	4.97E-01	525	2.73E-01	575	5.84E-01
426	2.63E-03	476	4.97E-01	526	2.87E-01	576	5.90E-01
427	7.16E-03	477	4.92E-01	527	2.99E-01	577	5.94E-01
428	4.10E-03	478	4.73E-01	528	3.02E-01	578	6.03E-01
429	2.78E-03	479	4.53E-01	529	3.14E-01	579	6.12E-01
						580	6.22E-01

Spectral Power Distribution

λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units
581	6.30E-01	631	9.95E-01	681	5.65E-01	731	1.50E-01
582	6.30E-01	632	9.86E-01	682	5.47E-01	732	1.45E-01
583	6.42E-01	633	9.88E-01	683	5.37E-01	733	1.38E-01
584	6.43E-01	634	9.90E-01	684	5.24E-01	734	1.34E-01
585	6.59E-01	635	9.89E-01	685	5.10E-01	735	1.30E-01
586	6.63E-01	636	9.85E-01	686	4.96E-01	736	1.24E-01
587	6.67E-01	637	1.00E+00	687	4.94E-01	737	1.25E-01
588	6.77E-01	638	9.83E-01	688	4.75E-01	738	1.18E-01
589	6.86E-01	639	9.76E-01	689	4.66E-01	739	1.20E-01
590	6.97E-01	640	9.74E-01	690	4.57E-01	740	1.14E-01
591	6.96E-01	641	9.73E-01	691	4.46E-01	741	1.10E-01
592	7.10E-01	642	9.61E-01	692	4.40E-01	742	1.03E-01
593	7.21E-01	643	9.54E-01	693	4.30E-01	743	1.02E-01
594	7.25E-01	644	9.56E-01	694	4.17E-01	744	9.93E-02
595	7.37E-01	645	9.51E-01	695	4.05E-01	745	9.53E-02
596	7.43E-01	646	9.45E-01	696	3.99E-01	746	9.49E-02
597	7.54E-01	647	9.30E-01	697	3.88E-01	747	9.12E-02
598	7.68E-01	648	9.25E-01	698	3.75E-01	748	8.72E-02
599	7.77E-01	649	9.18E-01	699	3.64E-01	749	8.22E-02
600	7.76E-01	650	9.12E-01	700	3.59E-01	750	8.54E-02
601	7.87E-01	651	9.04E-01	701	3.48E-01	751	8.08E-02
602	7.98E-01	652	9.00E-01	702	3.37E-01	752	7.56E-02
603	8.11E-01	653	8.85E-01	703	3.27E-01	753	7.57E-02
604	8.18E-01	654	8.80E-01	704	3.19E-01	754	6.96E-02
605	8.33E-01	655	8.54E-01	705	3.13E-01	755	6.96E-02
606	8.37E-01	656	8.62E-01	706	3.02E-01	756	6.79E-02
607	8.43E-01	657	8.49E-01	707	2.95E-01	757	6.68E-02
608	8.49E-01	658	8.42E-01	708	2.89E-01	758	6.40E-02
609	8.60E-01	659	8.26E-01	709	2.80E-01	759	6.14E-02
610	8.67E-01	660	8.24E-01	710	2.74E-01	760	5.87E-02
611	8.84E-01	661	8.07E-01	711	2.63E-01	761	5.81E-02
612	8.93E-01	662	8.00E-01	712	2.56E-01	762	5.70E-02
613	8.93E-01	663	7.75E-01	713	2.49E-01	763	5.21E-02
614	9.09E-01	664	7.74E-01	714	2.41E-01	764	5.17E-02
615	9.24E-01	665	7.60E-01	715	2.38E-01	765	5.07E-02
616	9.17E-01	666	7.46E-01	716	2.29E-01	766	4.86E-02
617	9.29E-01	667	7.35E-01	717	2.23E-01	767	4.88E-02
618	9.34E-01	668	7.21E-01	718	2.18E-01	768	4.91E-02
619	9.52E-01	669	7.12E-01	719	2.10E-01	769	4.34E-02
620	9.44E-01	670	6.99E-01	720	2.02E-01	770	4.58E-02
621	9.56E-01	671	6.76E-01	721	2.02E-01	771	4.24E-02
622	9.63E-01	672	6.78E-01	722	1.91E-01	772	4.15E-02
623	9.56E-01	673	6.57E-01	723	1.89E-01	773	4.20E-02
624	9.64E-01	674	6.43E-01	724	1.83E-01	774	3.79E-02
625	9.70E-01	675	6.34E-01	725	1.78E-01	775	3.58E-02
626	9.84E-01	676	6.20E-01	726	1.73E-01	776	3.76E-02
627	9.78E-01	677	6.08E-01	727	1.70E-01	777	3.41E-02
628	9.85E-01	678	6.01E-01	728	1.62E-01	778	3.45E-02
629	9.76E-01	679	5.91E-01	729	1.60E-01	779	3.50E-02
630	9.81E-01	680	5.78E-01	730	1.52E-01	780	3.26E-02

Measurement Uncertainty

The following is the reported expanded uncertainty of the UL 6440T Type C Mirror Goniophotometer. Colrimetric expanded uncertainty is estimated using the 1 metre integrating sphere

Parameter	Uncertainty
Total Luminous Flux (%)	± 4.9
Luminous Intensity (%)	± 4.9
Correlated Color Temperature	± 100 K
CRI	± 2
Chromaticity x	± 0.005
Chromaticity y	± 0.005
Temperature ($^{\circ}$ C)	± 1.0
Voltage DC TY720 (%)	± 0.017
Current DC TY720 (%)	± 0.10
Voltage AC WT210 (%)	± 0.059
Current AC WT210 (%)	± 0.025
Power AC WT210 (%)	± 0.23
Frequency (50/60 Hz) WT210 (%)	± 0.004
Power Factor WT210 (%)	± 0.06

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 -----