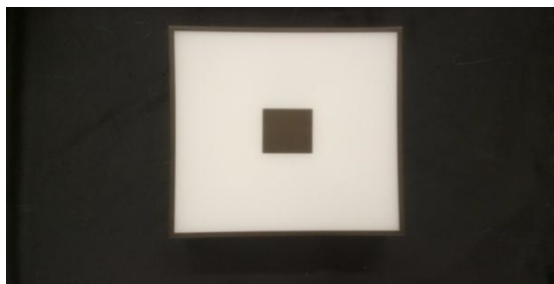


astro

PHOTOMETRIC
TEST REPORT

Report Number	GNC-21848
Customer	Astro Lighting Limited
Contact	David Green
Product Type	LED Ceiling light
Test Purpose	Generation of photometric data
Quote Reference	Q-LUX18-22691
Works Order Number	WO-12495
Test Item Reference	TI-15508
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	04/09/2018
Reviewed by	Gareth Jones
Number of products tested	1

Address: LUX-TSI Ltd.,
Pencoed Technology Park,
Pencoed, Bridgend,
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Telephone: +44 (0) 1656 864618
Authorised by: G. Jones
Email: CustomerService@lux-tsi.com
Signed: 



CL211 MASHIKO TPS2

Date: 04/09/2018

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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 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. On-axis spectral measurements taken using spectrometer, for which these measurements and outputs are not accredited.

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	Mashiko 400 Square LED (Phase Dim)
Part/Serial Number	1121067
Type of Product	LED Ceiling light
Base Type	Not Applicable - Luminaire
Driver Type	Internal
Test Time	30 mins
Operating Orientation	Base Up
Test Orientation	Base Up
Ambient Temperature	24.9°C
Manufacturer	Astro Lighting Limited
Date of Manufacture	Not Available
Thermal Management	Passive
Dimmable	No
Pre-Burning Time	0 hours
Stabilisation Time	60 mins
Humidity	47.1% 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	2458 lm
Luminous Efficacy	90 lm/W

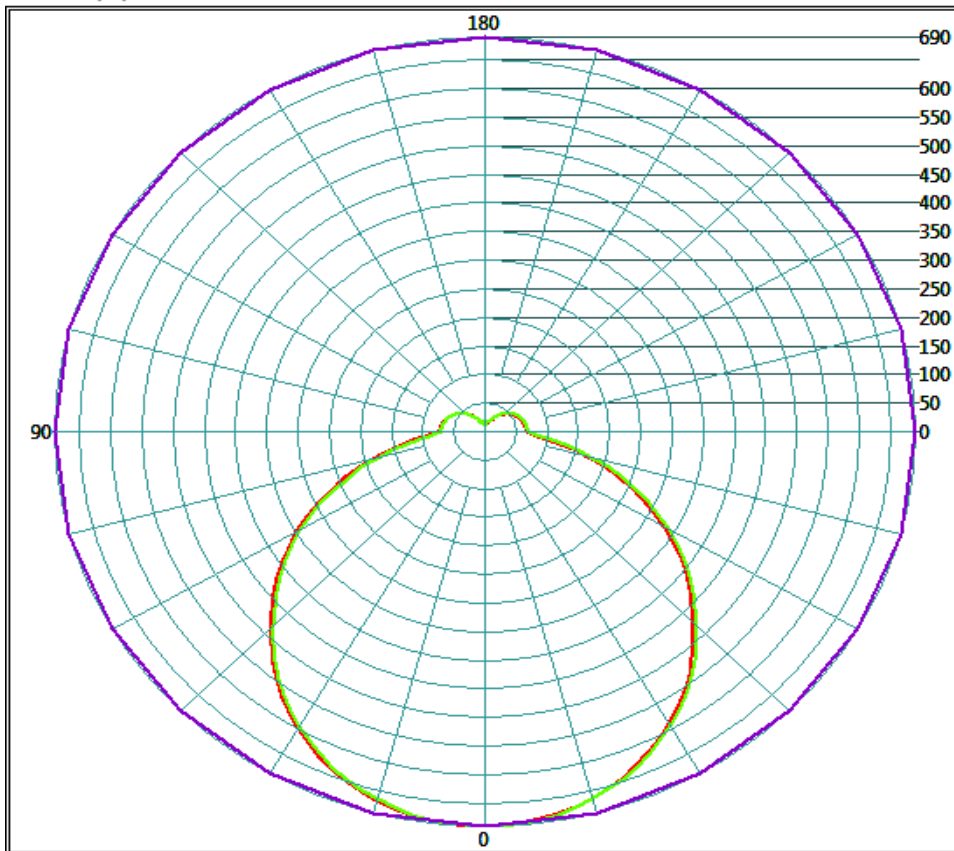
Dimension	Sample	Luminous Opening
Diameter/Width	400 mm	380 mm
Length	400 mm	380 mm
Height/Depth	90 mm	50 mm

Electrical Measurements	
Frequency	50 Hz
Voltage	230.0 V
Current	0.122 A
Power	27.4 W
Power Factor	0.974
Apparent Power	28.1 VA

Goniophotometric Measurements

Beam Angle	Horizontal	119°
	Vertical	119°
On-axis Intensity		690 cd
Peak Intensity		690 cd
Peak Direction	Horizontal	0°
	Vertical	0°

Polar Plot (cd)



Mounting Height (m)	Beam Width (m)		Projected Illuminance (lux)
	C0-C180 plane	C90-270 plane	
0.5	1.7	1.7	2760
1	3.4	3.4	690
2	6.7	6.7	172
3	10.1	10.1	77
4	13.5	13.5	43
5	16.9	16.9	28
7.5	25.3	25.3	12
10	33.7	33.7	7
20	67.4	67.4	2

Appendices & non-accredited results

On-axis Spectral Measurement

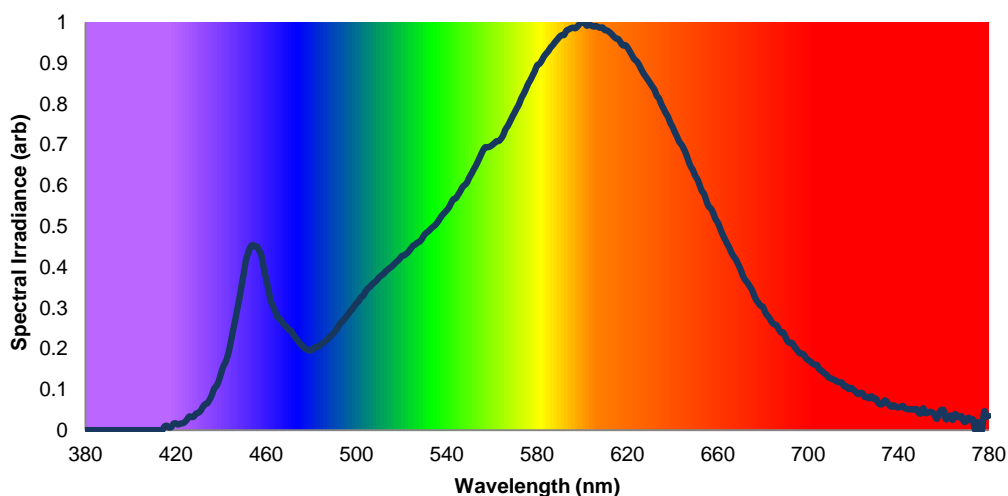
The following data was determined from an on-axis spectral measurement using a SP1000 spectrometer at a distance of 1500mm, for which these measurements and outputs are not accredited.
Results may differ if compared to spatially averaged colourimetric result (e.g. measured in an integrating sphere).

LM79 requires spatially averaged colourimetric results (i.e. from a sphere, or from a full goniometric scan).

The colourimetric results in this report do not follow those requirements.

BS (EN) 13032 and CIE S025 do not state this requirement.

Spectral Irradiance versus Wavelength



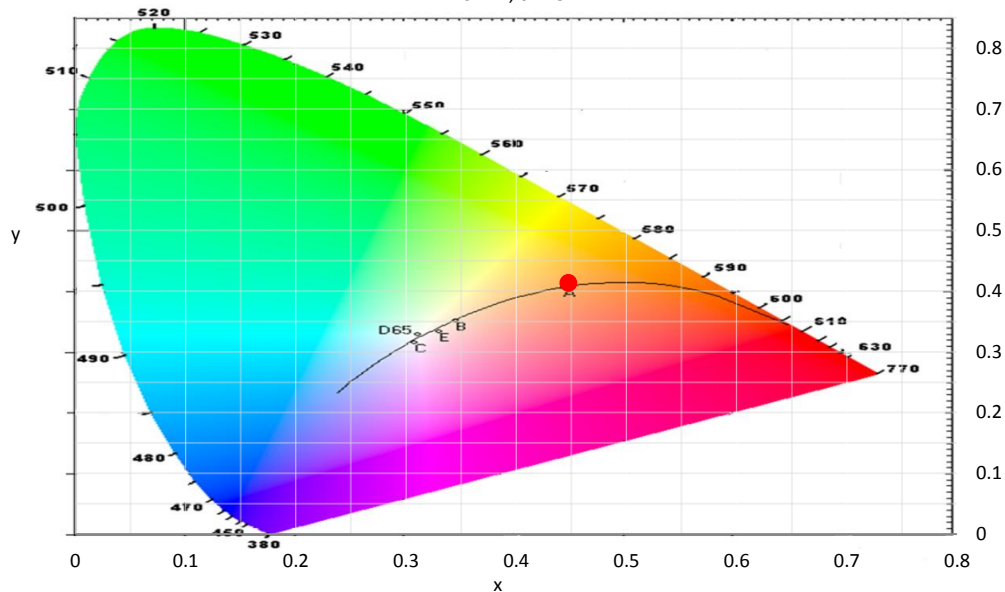
Colour Rendering Index Detail			
R1	79	R8	58
R2	91	R9	6
R3	96	R10	78
R4	78	R11	76
R5	79	R12	68
R6	88	R13	82
R7	83	R14	99

Colorimetric Details	
CCT	2901K
CRI (Ra)	81

Chromaticity Coordinates		
CIE 1931	x	0.4474
	y	0.4132
CIE 1960	u	0.2534
	v	0.3510
CIE 1976	u'	0.2534
	v'	0.5265
Duv		0.0018

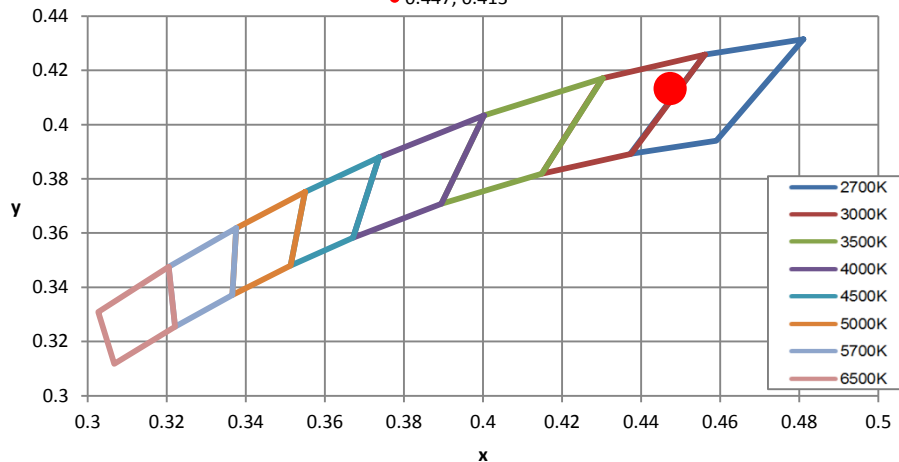
CIE 1931 Colour Chart

• 0.447, 0.413



CIE 1931 x, y Chromaticity Diagram - Nominal CCT Quadrangles

• 0.447, 0.413



Spectral Power Distribution

λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units
380	0.00E+00	430	4.26E-02	480	1.95E-01	530	4.78E-01
381	0.00E+00	431	4.77E-02	481	2.01E-01	531	4.84E-01
382	0.00E+00	432	5.69E-02	482	2.04E-01	532	4.88E-01
383	0.00E+00	433	6.35E-02	483	2.03E-01	533	4.94E-01
384	0.00E+00	434	6.60E-02	484	2.09E-01	534	4.99E-01
385	0.00E+00	435	7.48E-02	485	2.13E-01	535	5.04E-01
386	0.00E+00	436	8.59E-02	486	2.16E-01	536	5.11E-01
387	0.00E+00	437	1.01E-01	487	2.22E-01	537	5.19E-01
388	0.00E+00	438	1.08E-01	488	2.28E-01	538	5.27E-01
389	0.00E+00	439	1.20E-01	489	2.33E-01	539	5.33E-01
390	0.00E+00	440	1.38E-01	490	2.39E-01	540	5.39E-01
391	0.00E+00	441	1.56E-01	491	2.46E-01	541	5.46E-01
392	0.00E+00	442	1.66E-01	492	2.54E-01	542	5.57E-01
393	0.00E+00	443	1.82E-01	493	2.63E-01	543	5.66E-01
394	0.00E+00	444	2.05E-01	494	2.68E-01	544	5.69E-01
395	0.00E+00	445	2.34E-01	495	2.75E-01	545	5.77E-01
396	0.00E+00	446	2.61E-01	496	2.81E-01	546	5.86E-01
397	0.00E+00	447	2.89E-01	497	2.90E-01	547	5.96E-01
398	0.00E+00	448	3.17E-01	498	2.96E-01	548	6.01E-01
399	0.00E+00	449	3.49E-01	499	3.04E-01	549	6.08E-01
400	0.00E+00	450	3.80E-01	500	3.11E-01	550	6.20E-01
401	0.00E+00	451	4.14E-01	501	3.17E-01	551	6.29E-01
402	0.00E+00	452	4.33E-01	502	3.26E-01	552	6.40E-01
403	0.00E+00	453	4.48E-01	503	3.30E-01	553	6.50E-01
404	0.00E+00	454	4.54E-01	504	3.40E-01	554	6.61E-01
405	0.00E+00	455	4.50E-01	505	3.47E-01	555	6.73E-01
406	0.00E+00	456	4.50E-01	506	3.52E-01	556	6.85E-01
407	0.00E+00	457	4.40E-01	507	3.58E-01	557	6.93E-01
408	0.00E+00	458	4.28E-01	508	3.62E-01	558	6.94E-01
409	0.00E+00	459	3.97E-01	509	3.68E-01	559	6.95E-01
410	0.00E+00	460	3.72E-01	510	3.74E-01	560	6.99E-01
411	0.00E+00	461	3.46E-01	511	3.79E-01	561	7.03E-01
412	0.00E+00	462	3.19E-01	512	3.83E-01	562	7.08E-01
413	0.00E+00	463	3.05E-01	513	3.89E-01	563	7.09E-01
414	0.00E+00	464	2.92E-01	514	3.94E-01	564	7.15E-01
415	8.87E-03	465	2.77E-01	515	3.99E-01	565	7.23E-01
416	1.08E-02	466	2.73E-01	516	4.03E-01	566	7.38E-01
417	6.72E-03	467	2.66E-01	517	4.09E-01	567	7.46E-01
418	7.54E-03	468	2.59E-01	518	4.14E-01	568	7.57E-01
419	1.57E-02	469	2.54E-01	519	4.19E-01	569	7.68E-01
420	1.67E-02	470	2.46E-01	520	4.26E-01	570	7.78E-01
421	1.36E-02	471	2.44E-01	521	4.28E-01	571	7.89E-01
422	1.61E-02	472	2.35E-01	522	4.32E-01	572	7.99E-01
423	1.68E-02	473	2.27E-01	523	4.37E-01	573	8.14E-01
424	1.99E-02	474	2.20E-01	524	4.44E-01	574	8.24E-01
425	2.60E-02	475	2.12E-01	525	4.52E-01	575	8.36E-01
426	3.37E-02	476	2.08E-01	526	4.55E-01	576	8.49E-01
427	3.22E-02	477	2.01E-01	527	4.60E-01	577	8.58E-01
428	3.32E-02	478	1.98E-01	528	4.62E-01	578	8.69E-01
429	4.06E-02	479	1.96E-01	529	4.69E-01	579	8.81E-01
						580	8.94E-01

Spectral Power Distribution

λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units
581	8.98E-01	631	8.43E-01	681	2.89E-01	731	6.77E-02
582	9.06E-01	632	8.35E-01	682	2.81E-01	732	6.32E-02
583	9.16E-01	633	8.20E-01	683	2.74E-01	733	6.49E-02
584	9.23E-01	634	8.13E-01	684	2.64E-01	734	7.32E-02
585	9.30E-01	635	7.99E-01	685	2.59E-01	735	6.80E-02
586	9.38E-01	636	7.88E-01	686	2.57E-01	736	6.16E-02
587	9.44E-01	637	7.77E-01	687	2.48E-01	737	5.72E-02
588	9.52E-01	638	7.68E-01	688	2.40E-01	738	6.10E-02
589	9.58E-01	639	7.54E-01	689	2.40E-01	739	5.68E-02
590	9.65E-01	640	7.44E-01	690	2.28E-01	740	5.57E-02
591	9.69E-01	641	7.31E-01	691	2.18E-01	741	5.75E-02
592	9.69E-01	642	7.19E-01	692	2.14E-01	742	5.92E-02
593	9.80E-01	643	7.07E-01	693	2.14E-01	743	5.32E-02
594	9.82E-01	644	7.00E-01	694	2.04E-01	744	5.18E-02
595	9.85E-01	645	6.90E-01	695	1.98E-01	745	5.11E-02
596	9.87E-01	646	6.77E-01	696	1.90E-01	746	5.13E-02
597	9.85E-01	647	6.61E-01	697	1.88E-01	747	5.02E-02
598	9.91E-01	648	6.47E-01	698	1.86E-01	748	5.14E-02
599	9.97E-01	649	6.38E-01	699	1.77E-01	749	4.26E-02
600	1.00E+00	650	6.24E-01	700	1.72E-01	750	4.12E-02
601	1.00E+00	651	6.15E-01	701	1.68E-01	751	5.36E-02
602	9.92E-01	652	6.01E-01	702	1.63E-01	752	4.20E-02
603	9.95E-01	653	5.86E-01	703	1.61E-01	753	4.31E-02
604	9.92E-01	654	5.78E-01	704	1.59E-01	754	4.50E-02
605	9.90E-01	655	5.62E-01	705	1.49E-01	755	4.34E-02
606	9.91E-01	656	5.49E-01	706	1.46E-01	756	3.73E-02
607	9.89E-01	657	5.43E-01	707	1.40E-01	757	2.75E-02
608	9.87E-01	658	5.32E-01	708	1.37E-01	758	4.19E-02
609	9.87E-01	659	5.18E-01	709	1.30E-01	759	4.95E-02
610	9.81E-01	660	5.09E-01	710	1.27E-01	760	4.88E-02
611	9.80E-01	661	4.96E-01	711	1.24E-01	761	2.70E-02
612	9.76E-01	662	4.81E-01	712	1.22E-01	762	3.16E-02
613	9.71E-01	663	4.70E-01	713	1.18E-01	763	3.57E-02
614	9.65E-01	664	4.59E-01	714	1.18E-01	764	2.52E-02
615	9.60E-01	665	4.49E-01	715	1.16E-01	765	3.97E-02
616	9.59E-01	666	4.36E-01	716	1.07E-01	766	3.41E-02
617	9.51E-01	667	4.26E-01	717	1.08E-01	767	3.10E-02
618	9.43E-01	668	4.19E-01	718	1.01E-01	768	3.40E-02
619	9.44E-01	669	4.07E-01	719	1.04E-01	769	2.12E-02
620	9.39E-01	670	3.96E-01	720	9.94E-02	770	2.19E-02
621	9.29E-01	671	3.81E-01	721	9.46E-02	771	3.05E-02
622	9.20E-01	672	3.70E-01	722	8.87E-02	772	2.55E-02
623	9.10E-01	673	3.63E-01	723	9.13E-02	773	2.60E-02
624	9.05E-01	674	3.54E-01	724	9.06E-02	774	0.00E+00
625	8.98E-01	675	3.46E-01	725	8.19E-02	775	2.04E-02
626	8.86E-01	676	3.32E-01	726	8.12E-02	776	0.00E+00
627	8.76E-01	677	3.20E-01	727	7.82E-02	777	0.00E+00
628	8.68E-01	678	3.12E-01	728	8.33E-02	778	4.56E-02
629	8.60E-01	679	3.05E-01	729	7.68E-02	779	3.40E-02
630	8.51E-01	680	3.02E-01	730	7.71E-02	780	3.52E-02

Measurement Uncertainty

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

Parameter	Uncertainty
Total Luminous Flux (%)	± 4.9
Luminous Intensity (%)	± 4.9
Temperature ($^{\circ}\text{C}$)	± 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 -----