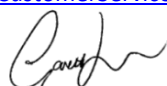


<b>Report Number</b>	GNC-2118
<b>Customer</b>	Astro Lighting Limited
<b>Contact</b>	David Green
<b>Product Type</b>	LED Ceiling light
<b>Test Purpose</b>	Generation of photometric data
<b>Quote Reference</b>	Q-LUX18-300381
<b>Works Order Number</b>	WO-2118
<b>Test Item Reference</b>	TI-20190
<b>LAB Test Method Reference</b>	Goniometric (Type C) Intensity Scan - IES/LDT Files & Report - Scan Increments 15 degrees Azimuth by 2.5 degrees inclination
<b>Test Standards</b>	LM-79-08; (BS) EN 13032-4:2015; CIE S025:2015
<b>Lab Location Reference</b>	LUX-TSI
<b>Tested by</b>	Mike Sewell
<b>Date of Test</b>	18-12-18
<b>Reviewed by</b>	Gareth Jones
<b>Number of products tested</b>	1

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Signed:



Date: 18/12/2018



7412-Osaka350LED

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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  $-45^{\circ}$  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  $15^{\circ}$  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  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ . 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.

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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. Spectral measurements are measured using a Labsphere 1 metre integrating sphere.

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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	7412-Osaka350LED
Part/Serial Number	N/A
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	25.6°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	29.9% 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	1812 lm
Luminous Efficacy	79 lm/W

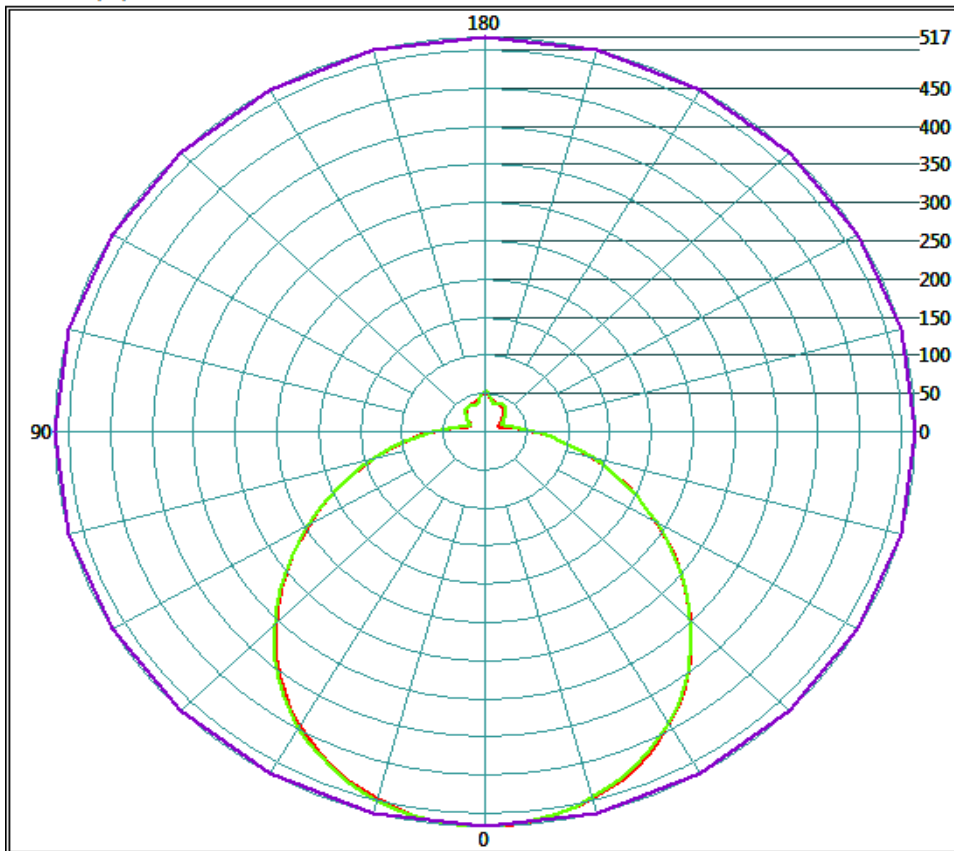
Dimension	Sample	Luminous Opening
Diameter/Width	350 mm $\Phi$	330 mm $\Phi$
Length		
Height/Depth	109 mm	45 mm

Electrical Measurements	
Frequency	50 Hz
Voltage	230.0 V
Current	0.106 A
Power	22.9 W
Power Factor	0.940
Apparent Power	24.3 VA

### Goniophotometric Measurements

Beam Angle	Horizontal	115°
	Vertical	115°
On-axis Intensity		517 cd
Peak Intensity		517 cd
Peak Direction	Horizontal	0°
	Vertical	0°

Polar Plot (cd)

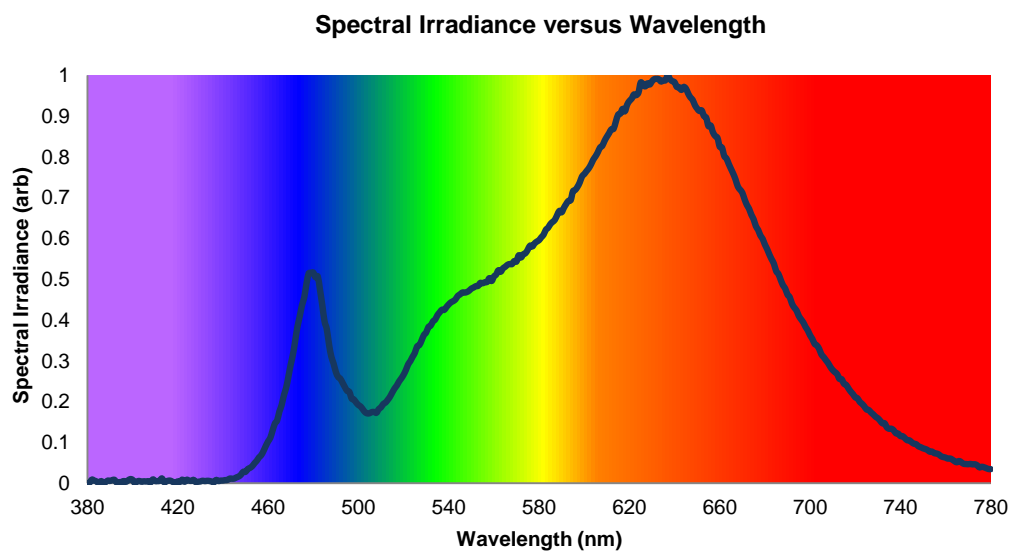


Mounting Height (m)	Beam Width (m)		Projected Illuminance (lux)
	C0-C180 plane	C90-270 plane	
0.5	1.6	1.6	2067
1	3.2	3.2	517
2	6.3	6.3	129
3	9.5	9.5	57
4	12.7	12.7	32
5	15.8	15.8	21
7.5	23.8	23.7	9
10	31.7	31.6	5
20	63.4	63.3	1

## 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.



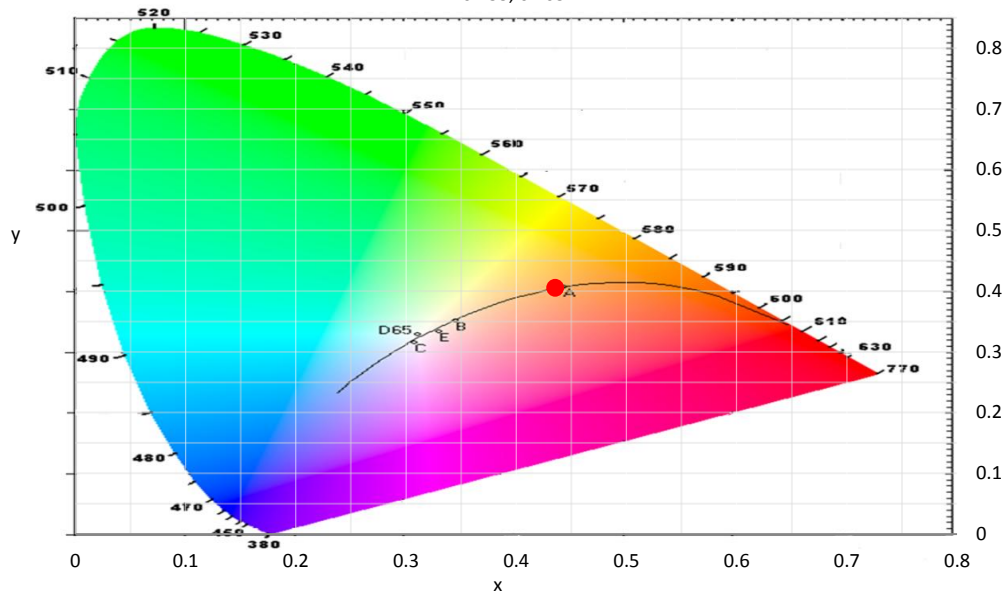
Colour Rendering Index Detail			
R1	83	R8	61
R2	92	R9	11
R3	97	R10	82
R4	84	R11	84
R5	84	R12	77
R6	91	R13	85
R7	84	R14	99

Colorimetric Details	
CCT	3032K
CRI (Ra)	84

Chromaticity Coordinates		
CIE 1931	x	0.4354
	y	0.4049
CIE 1960	u	0.2492
	v	0.3477
CIE 1976	u'	0.2492
	v'	0.5215
Duv		0.0005

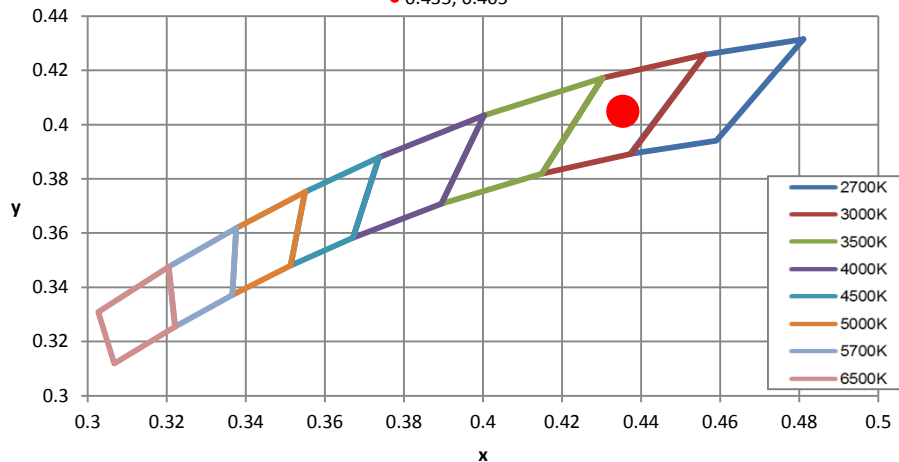
CIE 1931 Colour Chart

• 0.435, 0.405



CIE 1931 x, y Chromaticity Diagram - Nominal CCT Quadrangles

• 0.435, 0.405



### Spectral Power Distribution

$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units
380	0.00E+00	430	4.13E-03	480	5.16E-01	530	3.69E-01
381	1.37E-03	431	5.94E-03	481	5.05E-01	531	3.83E-01
382	8.75E-03	432	4.94E-03	482	5.07E-01	532	3.86E-01
383	6.43E-03	433	5.74E-03	483	4.74E-01	533	3.96E-01
384	4.27E-03	434	5.38E-03	484	4.37E-01	534	4.01E-01
385	0.00E+00	435	3.85E-03	485	3.97E-01	535	4.12E-01
386	5.06E-03	436	1.89E-03	486	3.78E-01	536	4.19E-01
387	2.07E-03	437	7.99E-03	487	3.40E-01	537	4.25E-01
388	2.24E-03	438	5.05E-03	488	3.10E-01	538	4.25E-01
389	6.36E-03	439	6.27E-03	489	2.94E-01	539	4.32E-01
390	5.37E-03	440	6.40E-03	490	2.73E-01	540	4.38E-01
391	7.53E-03	441	7.47E-03	491	2.61E-01	541	4.43E-01
392	8.08E-03	442	7.81E-03	492	2.56E-01	542	4.46E-01
393	1.18E-03	443	1.12E-02	493	2.46E-01	543	4.51E-01
394	2.52E-03	444	1.09E-02	494	2.36E-01	544	4.59E-01
395	2.49E-03	445	1.13E-02	495	2.26E-01	545	4.63E-01
396	5.32E-03	446	1.41E-02	496	2.24E-01	546	4.68E-01
397	2.96E-03	447	1.63E-02	497	2.07E-01	547	4.67E-01
398	6.83E-03	448	2.09E-02	498	2.05E-01	548	4.69E-01
399	9.92E-03	449	2.80E-02	499	1.98E-01	549	4.72E-01
400	8.20E-03	450	2.75E-02	500	1.92E-01	550	4.77E-01
401	0.00E+00	451	3.45E-02	501	1.88E-01	551	4.80E-01
402	4.08E-03	452	3.74E-02	502	1.81E-01	552	4.83E-01
403	5.42E-03	453	4.17E-02	503	1.74E-01	553	4.84E-01
404	3.17E-03	454	4.89E-02	504	1.71E-01	554	4.91E-01
405	4.71E-03	455	5.50E-02	505	1.72E-01	555	4.90E-01
406	3.90E-03	456	6.31E-02	506	1.74E-01	556	4.93E-01
407	4.97E-03	457	6.87E-02	507	1.74E-01	557	4.93E-01
408	1.84E-03	458	7.92E-02	508	1.72E-01	558	5.03E-01
409	9.24E-03	459	9.12E-02	509	1.82E-01	559	4.96E-01
410	5.09E-03	460	1.02E-01	510	1.86E-01	560	5.07E-01
411	5.11E-03	461	1.11E-01	511	1.94E-01	561	5.12E-01
412	5.78E-03	462	1.29E-01	512	1.98E-01	562	5.22E-01
413	1.16E-02	463	1.46E-01	513	2.04E-01	563	5.18E-01
414	1.95E-03	464	1.53E-01	514	2.12E-01	564	5.27E-01
415	4.36E-03	465	1.75E-01	515	2.22E-01	565	5.30E-01
416	6.24E-03	466	1.91E-01	516	2.32E-01	566	5.35E-01
417	5.61E-03	467	2.15E-01	517	2.39E-01	567	5.37E-01
418	2.33E-03	468	2.34E-01	518	2.49E-01	568	5.37E-01
419	4.98E-04	469	2.61E-01	519	2.57E-01	569	5.45E-01
420	4.37E-03	470	2.90E-01	520	2.66E-01	570	5.43E-01
421	2.89E-03	471	3.15E-01	521	2.77E-01	571	5.59E-01
422	8.60E-03	472	3.49E-01	522	2.91E-01	572	5.53E-01
423	3.32E-03	473	3.83E-01	523	2.99E-01	573	5.61E-01
424	8.47E-03	474	4.08E-01	524	3.10E-01	574	5.64E-01
425	6.34E-03	475	4.36E-01	525	3.20E-01	575	5.73E-01
426	5.54E-03	476	4.55E-01	526	3.35E-01	576	5.82E-01
427	8.14E-03	477	4.89E-01	527	3.39E-01	577	5.80E-01
428	2.35E-03	478	5.14E-01	528	3.50E-01	578	5.88E-01
429	3.48E-03	479	5.15E-01	529	3.63E-01	579	5.92E-01
						580	5.96E-01



### Spectral Power Distribution

$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units
581	6.03E-01	631	9.91E-01	681	5.74E-01	731	1.53E-01
582	6.09E-01	632	9.91E-01	682	5.60E-01	732	1.47E-01
583	6.21E-01	633	9.91E-01	683	5.49E-01	733	1.47E-01
584	6.26E-01	634	9.85E-01	684	5.38E-01	734	1.37E-01
585	6.35E-01	635	9.88E-01	685	5.20E-01	735	1.33E-01
586	6.41E-01	636	9.88E-01	686	5.13E-01	736	1.33E-01
587	6.46E-01	637	1.00E+00	687	4.98E-01	737	1.30E-01
588	6.57E-01	638	9.90E-01	688	4.85E-01	738	1.22E-01
589	6.68E-01	639	9.86E-01	689	4.77E-01	739	1.21E-01
590	6.64E-01	640	9.83E-01	690	4.62E-01	740	1.15E-01
591	6.75E-01	641	9.72E-01	691	4.56E-01	741	1.15E-01
592	6.84E-01	642	9.71E-01	692	4.40E-01	742	1.10E-01
593	6.92E-01	643	9.64E-01	693	4.30E-01	743	1.05E-01
594	6.94E-01	644	9.72E-01	694	4.23E-01	744	1.05E-01
595	7.16E-01	645	9.68E-01	695	4.10E-01	745	1.00E-01
596	7.19E-01	646	9.56E-01	696	4.02E-01	746	9.67E-02
597	7.27E-01	647	9.46E-01	697	3.94E-01	747	9.55E-02
598	7.37E-01	648	9.40E-01	698	3.83E-01	748	9.03E-02
599	7.52E-01	649	9.27E-01	699	3.74E-01	749	8.82E-02
600	7.58E-01	650	9.19E-01	700	3.63E-01	750	8.54E-02
601	7.65E-01	651	9.12E-01	701	3.54E-01	751	8.37E-02
602	7.72E-01	652	9.14E-01	702	3.42E-01	752	8.13E-02
603	7.82E-01	653	9.00E-01	703	3.38E-01	753	7.71E-02
604	7.93E-01	654	8.96E-01	704	3.30E-01	754	7.74E-02
605	8.01E-01	655	8.75E-01	705	3.16E-01	755	7.35E-02
606	8.11E-01	656	8.77E-01	706	3.09E-01	756	7.26E-02
607	8.23E-01	657	8.60E-01	707	3.02E-01	757	7.04E-02
608	8.27E-01	658	8.51E-01	708	2.94E-01	758	6.60E-02
609	8.39E-01	659	8.47E-01	709	2.85E-01	759	6.40E-02
610	8.49E-01	660	8.25E-01	710	2.78E-01	760	6.26E-02
611	8.58E-01	661	8.23E-01	711	2.72E-01	761	6.01E-02
612	8.68E-01	662	8.02E-01	712	2.67E-01	762	6.05E-02
613	8.69E-01	663	7.96E-01	713	2.56E-01	763	5.76E-02
614	8.87E-01	664	7.83E-01	714	2.55E-01	764	5.38E-02
615	9.04E-01	665	7.70E-01	715	2.44E-01	765	5.11E-02
616	9.06E-01	666	7.58E-01	716	2.41E-01	766	5.44E-02
617	9.18E-01	667	7.45E-01	717	2.32E-01	767	5.11E-02
618	9.12E-01	668	7.28E-01	718	2.24E-01	768	4.74E-02
619	9.28E-01	669	7.20E-01	719	2.18E-01	769	4.70E-02
620	9.37E-01	670	7.12E-01	720	2.10E-01	770	4.64E-02
621	9.43E-01	671	6.96E-01	721	2.08E-01	771	4.71E-02
622	9.53E-01	672	6.82E-01	722	1.99E-01	772	4.60E-02
623	9.51E-01	673	6.73E-01	723	1.95E-01	773	4.63E-02
624	9.58E-01	674	6.58E-01	724	1.88E-01	774	4.37E-02
625	9.82E-01	675	6.47E-01	725	1.81E-01	775	3.85E-02
626	9.78E-01	676	6.30E-01	726	1.79E-01	776	4.02E-02
627	9.73E-01	677	6.21E-01	727	1.73E-01	777	3.89E-02
628	9.80E-01	678	6.07E-01	728	1.68E-01	778	3.68E-02
629	9.77E-01	679	5.99E-01	729	1.63E-01	779	3.47E-02
630	9.85E-01	680	5.85E-01	730	1.59E-01	780	3.43E-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 ( $^{\circ}\text{C}$ )	$\pm 1.0$
Voltage DC TY720 (%)	$\pm 0.017$
Current DC TY720 (%)	$\pm 0.10$
Voltage AC WT210 (%)	$\pm 0.059$
Current AC WT210 (%)	$\pm 0.025$
Power AC WT210 (%)	$\pm 0.23$
Frequency (50/60 Hz) WT210 (%)	$\pm 0.004$
Power Factor WT210 (%)	$\pm 0.06$

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 -----