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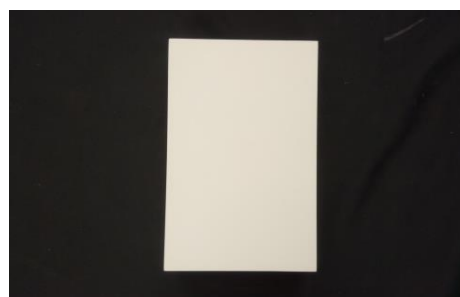
PHOTOMETRIC
TEST REPORT

Report Number	GNC-19601
Customer	Astro Lighting Limited
Contact	Ross Dickson
Product Type	LED Wall light
Test Purpose	Generation of Photometric Data
Sales Order Ref	Q-LUX17-21659
Works Order Number	WO-10248
Test Item Reference	TI-13828
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	28/06/2017
Reviewed by	Menno Schakel
Number of products tested	1

Address: LUX-TSI Ltd.,
Pencoed Technology Park,
Pencoed, Bridgend,
CF35 5AQ, UK
Telephone: +44 (0) 1656 864618
Authorised by: Gareth Jones
Email: gjones@lux-tsi.com
Signed:



Date: 03/07/2017



8054 - Rio 190 LED 2700K Phase Dimmable

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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	8054 - Rio 190 LED 2700K Phase Dimmable
Part/Serial Number	N/A
Type of Product	LED Wall light
Base Type	Not Applicable - Luminaire
Driver Type	Internal
Test Time	30 mins
Operating Orientation	Base Up
Test Orientation	Base Up
Ambient Temperature	24.7°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	54.8% 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	1637 lm
Luminous Efficacy	99 lm/W

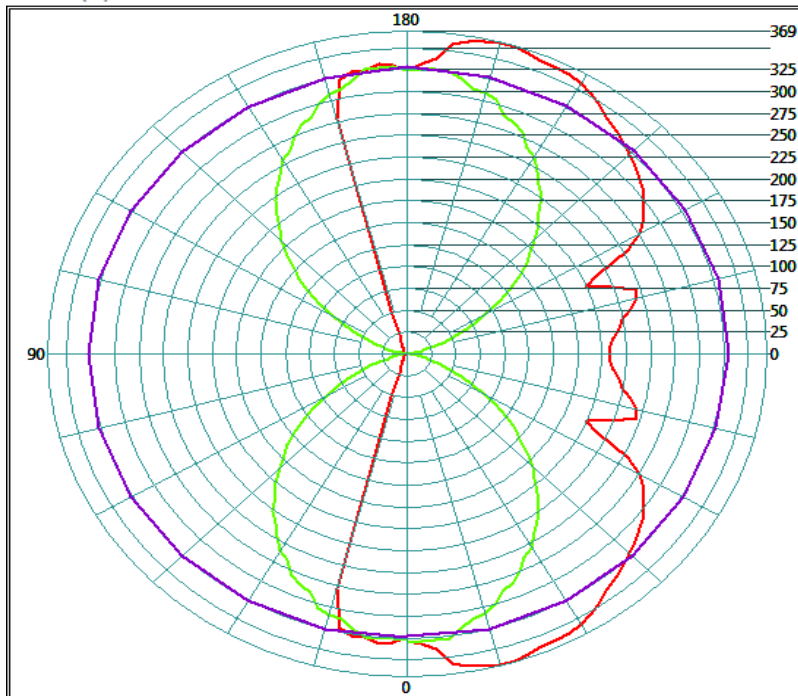
Dimension	Sample	Luminous Opening
Diameter/Width	190 mm	170 mm
Length	55 mm	45 mm
Height/Depth	322 mm	322 mm

Electrical Measurements	
Frequency	50 Hz
Voltage	230.030 V
Current	0.075 A
Power	16.6 W
Power Factor	0.960
Apparent Power	17.3 VA

Goniophotometric Measurements

Beam Angle	Horizontal	96°
	Vertical	106°
On-axis Intensity		324 cd
Peak Intensity		369 cd
Peak Direction	Horizontal	195°
	Vertical	18°

Polar Plot (cd)

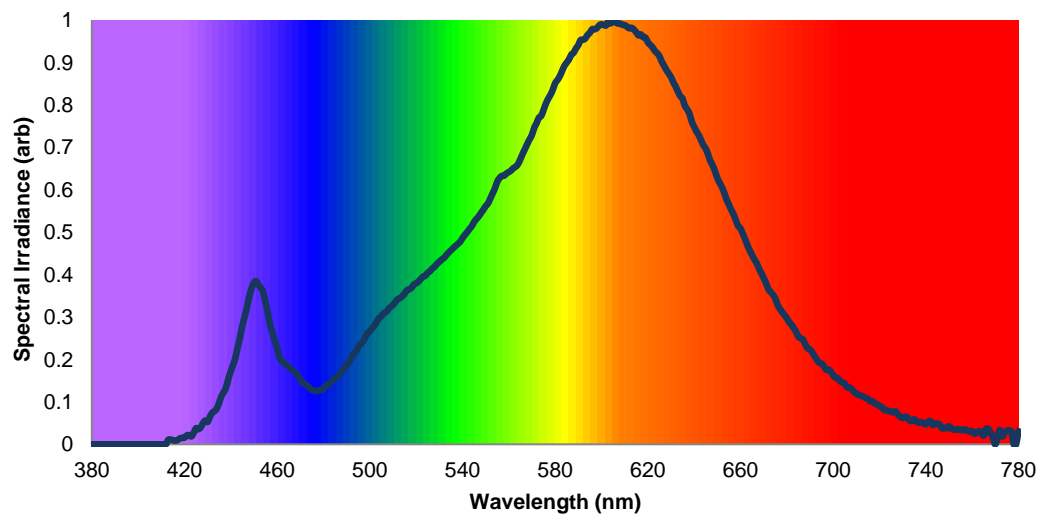


Appendices

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

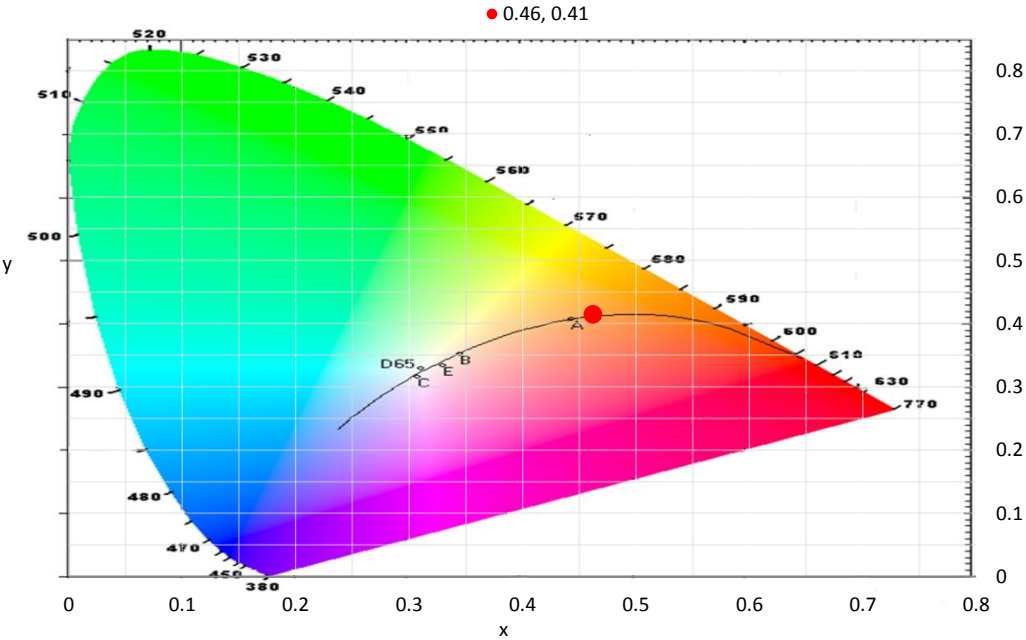


Colour Rendering Index Detail			
R1	78	R8	56
R2	90	R9	3
R3	97	R10	77
R4	78	R11	76
R5	78	R12	70
R6	88	R13	81
R7	82	R14	99

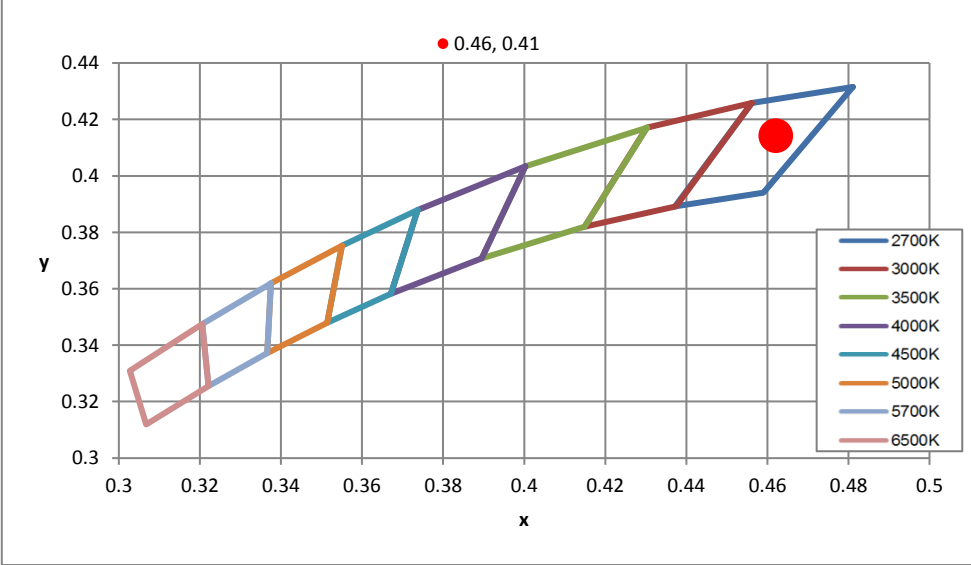
Colorimetric Details	
CCT	2696K
CRI (Ra)	81

Chromaticity Coordinates		
CIE 1931	x	0.4621
	y	0.4143
CIE 1960	u	0.2623
	v	0.3527
CIE 1976	u'	0.2623
	v'	0.5291
Duv		0.0008

CIE 1931 Colour Chart



CIE 1931 x, y Chromaticity Diagram - Nominal CCT Quadrangles



Spectral Power Distribution

λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units
380	0.00E+00	430	5.29E-02	480	1.31E-01	530	4.30E-01
381	0.00E+00	431	6.51E-02	481	1.38E-01	531	4.36E-01
382	0.00E+00	432	7.48E-02	482	1.41E-01	532	4.39E-01
383	0.00E+00	433	7.85E-02	483	1.45E-01	533	4.46E-01
384	0.00E+00	434	8.54E-02	484	1.51E-01	534	4.52E-01
385	0.00E+00	435	9.87E-02	485	1.56E-01	535	4.57E-01
386	0.00E+00	436	1.14E-01	486	1.58E-01	536	4.63E-01
387	0.00E+00	437	1.23E-01	487	1.66E-01	537	4.68E-01
388	0.00E+00	438	1.35E-01	488	1.73E-01	538	4.73E-01
389	0.00E+00	439	1.55E-01	489	1.78E-01	539	4.78E-01
390	0.00E+00	440	1.72E-01	490	1.88E-01	540	4.86E-01
391	0.00E+00	441	1.88E-01	491	1.94E-01	541	4.94E-01
392	0.00E+00	442	2.04E-01	492	2.03E-01	542	5.00E-01
393	0.00E+00	443	2.30E-01	493	2.14E-01	543	5.08E-01
394	0.00E+00	444	2.53E-01	494	2.18E-01	544	5.14E-01
395	0.00E+00	445	2.80E-01	495	2.29E-01	545	5.24E-01
396	0.00E+00	446	3.01E-01	496	2.37E-01	546	5.31E-01
397	0.00E+00	447	3.24E-01	497	2.42E-01	547	5.37E-01
398	0.00E+00	448	3.49E-01	498	2.52E-01	548	5.46E-01
399	0.00E+00	449	3.69E-01	499	2.62E-01	549	5.53E-01
400	0.00E+00	450	3.81E-01	500	2.67E-01	550	5.62E-01
401	0.00E+00	451	3.85E-01	501	2.74E-01	551	5.68E-01
402	0.00E+00	452	3.75E-01	502	2.80E-01	552	5.79E-01
403	0.00E+00	453	3.69E-01	503	2.89E-01	553	5.92E-01
404	0.00E+00	454	3.59E-01	504	2.97E-01	554	6.03E-01
405	0.00E+00	455	3.34E-01	505	3.03E-01	555	6.19E-01
406	0.00E+00	456	3.09E-01	506	3.09E-01	556	6.28E-01
407	0.00E+00	457	2.81E-01	507	3.12E-01	557	6.33E-01
408	0.00E+00	458	2.62E-01	508	3.19E-01	558	6.34E-01
409	0.00E+00	459	2.43E-01	509	3.24E-01	559	6.39E-01
410	0.00E+00	460	2.27E-01	510	3.29E-01	560	6.42E-01
411	0.00E+00	461	2.05E-01	511	3.36E-01	561	6.46E-01
412	0.00E+00	462	1.96E-01	512	3.42E-01	562	6.51E-01
413	1.06E-02	463	1.93E-01	513	3.45E-01	563	6.55E-01
414	1.14E-02	464	1.86E-01	514	3.49E-01	564	6.61E-01
415	9.72E-03	465	1.83E-01	515	3.56E-01	565	6.72E-01
416	9.03E-03	466	1.77E-01	516	3.63E-01	566	6.85E-01
417	1.02E-02	467	1.73E-01	517	3.66E-01	567	6.97E-01
418	1.39E-02	468	1.69E-01	518	3.69E-01	568	7.09E-01
419	1.53E-02	469	1.62E-01	519	3.76E-01	569	7.20E-01
420	1.56E-02	470	1.52E-01	520	3.80E-01	570	7.30E-01
421	2.09E-02	471	1.46E-01	521	3.84E-01	571	7.47E-01
422	2.17E-02	472	1.42E-01	522	3.90E-01	572	7.57E-01
423	1.87E-02	473	1.38E-01	523	3.95E-01	573	7.70E-01
424	2.74E-02	474	1.33E-01	524	3.98E-01	574	7.75E-01
425	3.80E-02	475	1.28E-01	525	4.05E-01	575	7.89E-01
426	3.59E-02	476	1.27E-01	526	4.08E-01	576	8.03E-01
427	3.96E-02	477	1.26E-01	527	4.15E-01	577	8.15E-01
428	5.01E-02	478	1.27E-01	528	4.19E-01	578	8.24E-01
429	5.62E-02	479	1.28E-01	529	4.26E-01	579	8.36E-01
						580	8.52E-01

Spectral Power Distribution

λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units	λ (nm)	Arb units
581	8.59E-01	631	8.54E-01	681	2.89E-01	731	6.47E-02
582	8.68E-01	632	8.44E-01	682	2.82E-01	732	6.41E-02
583	8.80E-01	633	8.32E-01	683	2.74E-01	733	5.65E-02
584	8.92E-01	634	8.21E-01	684	2.66E-01	734	5.51E-02
585	9.00E-01	635	8.15E-01	685	2.54E-01	735	5.93E-02
586	9.08E-01	636	7.99E-01	686	2.50E-01	736	5.40E-02
587	9.19E-01	637	7.90E-01	687	2.47E-01	737	5.09E-02
588	9.23E-01	638	7.80E-01	688	2.36E-01	738	5.26E-02
589	9.34E-01	639	7.61E-01	689	2.27E-01	739	5.05E-02
590	9.41E-01	640	7.49E-01	690	2.24E-01	740	4.74E-02
591	9.53E-01	641	7.38E-01	691	2.17E-01	741	5.32E-02
592	9.54E-01	642	7.29E-01	692	2.08E-01	742	5.48E-02
593	9.57E-01	643	7.17E-01	693	2.00E-01	743	4.59E-02
594	9.65E-01	644	7.05E-01	694	1.93E-01	744	4.87E-02
595	9.70E-01	645	6.98E-01	695	1.91E-01	745	4.88E-02
596	9.79E-01	646	6.84E-01	696	1.85E-01	746	4.71E-02
597	9.79E-01	647	6.68E-01	697	1.76E-01	747	3.75E-02
598	9.81E-01	648	6.58E-01	698	1.76E-01	748	3.89E-02
599	9.88E-01	649	6.44E-01	699	1.72E-01	749	3.78E-02
600	9.90E-01	650	6.29E-01	700	1.63E-01	750	4.25E-02
601	9.89E-01	651	6.17E-01	701	1.58E-01	751	3.81E-02
602	9.88E-01	652	6.07E-01	702	1.56E-01	752	3.47E-02
603	9.97E-01	653	5.94E-01	703	1.49E-01	753	3.50E-02
604	9.93E-01	654	5.78E-01	704	1.46E-01	754	3.60E-02
605	1.00E+00	655	5.66E-01	705	1.43E-01	755	3.42E-02
606	9.96E-01	656	5.53E-01	706	1.35E-01	756	3.28E-02
607	9.92E-01	657	5.43E-01	707	1.34E-01	757	3.58E-02
608	9.93E-01	658	5.29E-01	708	1.30E-01	758	3.21E-02
609	9.89E-01	659	5.15E-01	709	1.24E-01	759	3.06E-02
610	9.89E-01	660	5.09E-01	710	1.20E-01	760	3.15E-02
611	9.85E-01	661	4.97E-01	711	1.17E-01	761	2.51E-02
612	9.81E-01	662	4.84E-01	712	1.15E-01	762	2.74E-02
613	9.82E-01	663	4.70E-01	713	1.12E-01	763	3.15E-02
614	9.78E-01	664	4.57E-01	714	1.09E-01	764	2.75E-02
615	9.72E-01	665	4.47E-01	715	1.08E-01	765	2.05E-02
616	9.65E-01	666	4.36E-01	716	1.02E-01	766	3.64E-02
617	9.67E-01	667	4.27E-01	717	1.02E-01	767	3.63E-02
618	9.60E-01	668	4.14E-01	718	9.66E-02	768	2.69E-02
619	9.59E-01	669	4.04E-01	719	9.44E-02	769	1.61E-02
620	9.49E-01	670	3.92E-01	720	9.05E-02	770	0.00E+00
621	9.42E-01	671	3.81E-01	721	8.79E-02	771	1.75E-02
622	9.37E-01	672	3.67E-01	722	8.14E-02	772	3.42E-02
623	9.28E-01	673	3.60E-01	723	8.07E-02	773	1.88E-02
624	9.23E-01	674	3.53E-01	724	7.84E-02	774	2.64E-02
625	9.16E-01	675	3.45E-01	725	7.69E-02	775	3.23E-02
626	9.03E-01	676	3.29E-01	726	7.56E-02	776	3.27E-02
627	8.93E-01	677	3.20E-01	727	7.78E-02	777	2.99E-02
628	8.83E-01	678	3.12E-01	728	7.02E-02	778	0.00E+00
629	8.75E-01	679	3.05E-01	729	6.49E-02	779	0.00E+00
630	8.66E-01	680	2.98E-01	730	6.21E-02	780	3.13E-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 (°C)	± 1.0
Voltage DC TY720 (%)	± 0.02
Current DC TY720 (%)	± 0.10
Voltage AC WT210 (%)	± 0.0585
Current AC WT210 (%)	± 0.0251
Power AC WT210 (%)	± 0.2261
Frequency (50/60 Hz) WT210 (%)	± 0.0040
Power Factor WT210 (%)	± 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 -----