

Commercial In Confidence

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LED Risk Group Report to IEC/EN 62471-1:2009

Product Name: FX1R0077395D4SA
Product Serial Number: 188529

SUMMARY

The product is a UV curing system, intended to be used as an OEM component. The product uses as its source of illumination an array of LEDS, which have a peak emission of 395 nm.

The LEDs in this component meet the requirements for Risk Group 3 LED Product to IEC/EN 62471-1:2009 under normal operating conditions.

1) Product Data

a) Client

Prophotonix
3020 Euro Business Park
Little Island
Cork
Ireland

b) Manufacture/Supplier

Prophotonix
3020 Euro Business Park
Little Island
Cork
Ireland

A NOTE ON STANDARDS

Lasers and LEDs have been classified according to their hazard since the 1970's in the standard IEC 825 (later IEC 60825).

In 2001 the standard governing the safety of laser products (IEC/EN 60825-1) in Europe (EN) and Internationally (IEC) was substantially revised and the classification system was overhauled. This resulted in the introduction of three new classes (1M,2M,3R) and the abolition of Class 3A. At this point the standard applies equally to lasers and LEDs.

In 60825-1:2001 the distance for the magnifier measurement condition (Condition 2) ranges from 14 mm to 100 mm and is determined by the apparent source size of the light.

In 2005 LEDs were shifted into IEC 62471-1:2005 "The LED and Lamp Standard". The measurement conditions for this standard were set at 200 mm and are detailed in this report.

IEC 60825-1 was further revised in 2007 and the revisions included the removal of most LEDs from being tested under the same standard as Lasers and a change to Condition 2 meaning the magnifier condition is now fixed at 70mm within the retinal hazard region.

As 60825-1(2001) was the last standard to implicitly apply to LEDs the 2001 standard is often still used to assess LEDs as it is the most restrictive due to the potential for a short measuring distance. Additionally this version of the standard is still referenced by other standards and directives.

In 2014 the most recent version of the standard came out. This revised how pulse lasers were handled as well as introducing the new Class 1C. In addition the Condition 2 measurement of 70 mm was removed and now the closest distance for measurement is the Naked Eye condition (condition 3) at 100 mm

However as IEC 60825-2 "Safety of optical fibre communication systems (OFCS)" has not yet been updated it retains a condition 2 measurement of 70 mm and as such products used in Optical fibre systems must still be evaluated to IEC 60825-1 (2007).

c) Optical sources

i) Manufacturer(s) and type details if different from 1 (a)

Seoul Viosys UV1000 -39L27.

ii) Wavelength(s) (State whether measured or manufacturers data.)

388 – 400 nm, with a peak at 394.55 nm.

iii) Pulsed or continuous

Continuous wave

iv) If pulsed (data for each laser):

Manufacturers stated data:

N/A

Measured data (or reasons for not measuring):

N/A

v) Other relevant data (e.g. beam diameter, beam divergence)

Radiation is divergent.

vi) Accessibility of Radiation

The product is intended to be used as an OEM component.
Hence, under normal use, radiation is not accessible.

2) Radiation Measurements:

a) Control Settings (give details of settings used to maximize output)

Device was operated according to manufacturer's instructions. Device was supplied with 48 V and 10 A.

b) Measured Output (give details of limiting aperture etc)

i) Meter(s) used for measurement:

The optical output was measured with Lasernetmet's calibrated ADM 1000 power meter LM-PM-002.

Lasermet's power meters are regularly cross-checked for calibration against a power meter calibrated by the UK National Physical Laboratory.

ii) Apparent Source size/angular subtense.

Manufacturer's data.

None provided.

Measured.

It was assumed that the apparent source was a point source, as this is the most limiting case. Hence, angular subtense $\alpha = 1.5$ mrad at 200 mm.

Source size measurements were taken in accordance with Research Report 345 'Investigation of a measurement technique to determine the apparent source size for light emitting diodes, prepared by National Physical Laboratory and Europtics Ltd for the Health & Safety Executive 2005.

iii) Measurement Aperture.

All measurements were taken at 200 mm from the apparent source, using a 7 mm aperture at the power meter.

For the Actinic UV Skin & Eye tests the field of view was unlimited.

For the Eye UV-A tests the field of view was unlimited.

For the Blue Light Hazard Exempt test the field of view was restricted to 100 mrad using a 22 mm field stop. For the Low risk tests the field of view was restricted to 11 mrad using a 2.2 mm

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field stop. For the Mod risk test the field of view was averaged over 1.7 mrad but the values from the Low risk test were used for the calculations.

For the Blue Light Small Source Hazard tests the field of view was restricted to 11 mrad using a 2.2 mm field stop.

For the Retinal Thermal (L_R) Hazard Exempt test and Low risk tests the field of view was restricted to 11 mrad using a 2.2 mm field stop. For the Mod risk test the field of view was averaged over 1.7 mrad but the values from the Low risk test were used for the calculations.

For the Skin Thermal tests the field of view was unlimited.

iv) Measurements.

	Measuring Distance mm	Collecting Aperture mm	Field Stop mm	Power mW
Skin Thermal	200	7	None	7.66
Actinic UV / UV-A	200	7	337	7.66
Blue Light Exempt	200	7	22	2.12
Blue Light Low / mod Risk	200	7	2.2	0.265
Blue Light Small Source (exempt/low/mod)	200			
Retinal Thermal (exempt/low/mod)	200			

v) Corrections, if any.

Under 62471 the calculation of source hazard values is performed by weighting the spectral scan by the appropriate function and calculating the total weighted power.

For the Spectra recorded the application of the hazard functions produced a weighting factor of 0.00402% for the UV, 10.8% for the Blue Light Hazard and Blue Light Hazard Small Source, 109% for the Thermal Hazard.

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	Power mW	Irradiance / Wm ⁻²	Radiance / W/m ⁻² sr ⁻¹	
Eye / Skin Actinic UV exempt	7.66	0.006389		Fail Exempt
Eye / Skin Actinic UV low	7.66	0.006389		Fail Low
Eye / Skin Actinic UV mod	7.66	0.006389		Pass Mod
Eye UV-A exempt	7.66	159.04		Fail Exempt
Eye UV-A low	7.66	159.04		Fail Low
Eye UV-A mod	7.66	159.04		Fail Mod
Skin Thermal	7.66	196.17		No Skin Hazard
Blue Light Exempt	2.12	5.8625	746.6021	Fail Exempt
Blue Light Low Risk	0.265	0.73282	7711.24	Pass Low
Blue Light Small Source (exempt/low)	0.265	0.74352		Pass Exempt
Retinal Thermal (exempt/low)	0.265	7.39757	77842.211	Pass Exempt

c) EL (give details)

	Exempt	EHV	P/F	Low risk	EHV	P/F	Mod Risk	EHV	P/F	Units
Eye UV-A	10	1590%	Fail	33	477%	Fail	100	159%	Fail	Wm ⁻²
Eye / Skin Actinic UV	0.001	639%	Fail	0.003	213%	Fail	0.03	21.3%	Pass	Wm ⁻²
Blue light	100	747%	Fail	10000	77%	Pass	4000000	8.07%	Pass	Wm ⁻² sr ⁻¹
Retinal Thermal	2545454.545	3.05%	Pass	2545454.545	3.05%	Pass	6454545.455	7.84%	Pass	Wm ⁻² sr ⁻¹
Skin Thermal	3556.6	5.52%	Pass	3556.6	5.52%	Pass	3556.6	5.52%	Pass	Wm ⁻²
Blue Light Small Source	1	74.4%	Pass	1	74.4%	Pass	400	74.4%	Pass	Wm ⁻²

d) Hazard Distance

The hazard distance for non-visible lamps is the distance at which the recorded emission falls below the emission limits for an exempt product. This distance was measured as 1.0 m. This is the RG₁-RG₀ threshold.

e) CONCLUSION (tentative classification)

The output of this device is Risk Group 3.

3) Required Accuracy of Measurements, Uncertainties.

The peak output was greater than 1590% of the Risk Group Limit under the most restrictive hazard condition. The total estimated measurement uncertainty was $\pm 10\%$ at 95% confidence.

4) Engineering Controls:

None required.

5) Labelling:

The following labelling is present on the product. This is adequate for the product to meet the standard's requirements.

Risk Group 3
WARNING UV emitted from this product.
Avoid eye and skin exposure to unshielded product.

6) User Information:

- A clear statement that the lamp or lamp system is in excess of the Exempt Group and that the viewer-related risk is dependent upon how the users install and use the product; (Present)
- The most restrictive optical radiation hazard and other optical radiation hazards in excess of Exempt Group (see Table 1); (Present)
- Exposure hazard values (EHVs) and hazard distances; (Present)
- Adequate instructions for proper assembly, installation, maintenance and safe use, including clear warnings concerning precautions to avoid possible exposure to hazardous optical radiation; (Present)
- Advice on safe operating procedures and warnings concerning reasonably foreseeable malpractices, malfunctions and hazardous failure modes. Where maintenance procedures are detailed, they should, wherever possible, include explicit instructions on safe, procedures to be followed;
- Reproduction of the required labelling; (Present)
- Information on what type of user controls may be considered. (Present)

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7) Class Awarded:

Risk Group 3

Conditions (state changes required for full conformity)

This classification is based on the performance of the lasers supplied to us for testing and is only valid for the products listed in this report. The manufacturer is responsible for ensuring that sufficient quality control during manufacturing is in place.

Signature



Fiona Robertson

Checked



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Annex A

