




Test Report issued under the responsibility of:
The Standard Institution of Israel

TEST REPORT
IEC 62471
Photobiological safety of lamps and lamp systems

Report Reference No.	9712301837
Date of issue	24.04.2017
Total number of pages	19
CB Testing Laboratory	The Standards Institution of Israel
Address	42 Chaim Levanon St., Tel Aviv 69977, Israel
Applicant's name	TzubaVision Eco Light Systems Ltd
Address	Kibbutz Tzuba, 9087000, Israel
Test specification:	
Standard.....	IEC 62471:2006 (First Edition)
Test procedure	CB
Non-standard test method.....	N/A
Test Report Form No.	IEC62471A
TRF Originator	VDE Testing and Certification Institute
Master TRF	Dated 2009-05
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Test item description	Self-Ballasted Linear LED Light Modules
Trade Mark.....	
Manufacturer	TzubaVision Eco Light Systems Ltd
Model/Type reference	LDLS 1120, LDLS 560, LDLS 280, LDLS 140
Ratings	220/240V.a.c 50/60 Hz: 180 mA 36W, 90 mA 18W, 45 mA 9W, 25 mA 4.5W



Testing procedure and testing location:		
<input type="checkbox"/>	Testing Laboratory:	The Standards Institution of Israel
Testing location/ address		42 Chaim Levanon St., Tel Aviv 69977, Israel
<input type="checkbox"/>	Associated CB Laboratory:	
Testing location/ address		
	Tested by (name + signature).....:	Daniel Gottreich <i>Daniel Gottreich</i>
	Approved by (+ signature)	Irina Antonov <i>Irina Antonov</i>
<input type="checkbox"/>	Testing procedure: TMP	
	Tested by (name + signature).....:	
	Approved by (+ signature)	
Testing location/ address		
<input type="checkbox"/>	Testing procedure: WMT	
	Tested by (name + signature).....:	
	Witnessed by (+ signature)	
	Approved by (+ signature)	
Testing location/ address		
<input type="checkbox"/>	Testing procedure: SMT	
	Tested by (name + signature).....:	
	Approved by (+ signature)	
	Supervised by (+ signature).....:	
Testing location/ address		
<input type="checkbox"/>	Testing procedure: RMT	
	Tested by (name + signature).....:	
	Approved by (+ signature)	
	Supervised by (+ signature).....:	
Testing location/ address		

**Summary of testing:****Tests performed (name of test and test clause):**

4.3.3 Retinal blue light hazard exposure limit
4.3.5 Retinal thermal hazard exposure limit
4.3.7 Infrared radiation hazard exposure limits for the eye

Testing location: SII

42 Chaim Levanon St., Tel Aviv 69977, Israel

Summary of compliance with National Differences: N / A**Copy of marking plate : N/A**



Test item particulars	
Tested lamp	<input checked="" type="checkbox"/> continuous wave lamps <input type="checkbox"/> pulsed lamps
Tested lamp system	
Lamp classification group	<input checked="" type="checkbox"/> exempt <input type="checkbox"/> risk 1 <input type="checkbox"/> risk 2 <input type="checkbox"/> risk 3
Lamp cap	
Bulb	LED
Rated of the lamp	Electrical:- 220/240Va.c 50/60 Hz: 180 mA 36W, 90 mA 18W, 45 mA 9W, 25 mA 4.5W
Furthermore marking on the lamp.....	
Seasoning of lamps according IEC standard	
Used measurement instrument.....	
Temperature by measurement.....	25 °C
Information for safety use	
Possible test case verdicts:	
– test case does not apply to the test object	N/A
– test object does meet the requirement	P (Pass)
– test object does not meet the requirement	F (Fail)
Testing:	
Date of receipt of test item.....	02/04/2017
Date (s) of performance of tests.....	04/2017
General remarks:	
<p>The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. "(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. Throughout this report a comma (point) is used as the decimal separator. List of test equipment must be kept on file and available for review.</p>	
<u>General product information:</u>	
<p>LDLS Linear Detachable Light System</p> <ul style="list-style-type: none">• Self-Ballasted & Self Cooled LED modules• 4800 Lumen/Meter• Dimmable• Emergency Light Included <p>LED Details: Manufactured by Lumileds Commercial Shanghai co. LTD. 4000K 240mA, 6.8Vd.c, 0.7W L128-4080CA35Z00T1</p>	

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
4	EXPOSURE LIMITS		
4.1	General		Pass
	The exposure limits in this standard is not less than 0,01 ms and not more than any 8-hour period and should be used as guides in the control of exposure	Not less than 0,01 ms	Pass
	Detailed spectral data of a light source are generally required only if the luminance of the source exceeds 10^4 cd/m^2		N / A
4.3	Hazard exposure limits		
4.3.1	Actinic UV hazard exposure limit for the skin and eye	No UV radiation (LED equipment)	N / A
	The exposure limit for effective radiant exposure is $30 \text{ J}\cdot\text{m}^{-2}$ within any 8-hour period	No UV radiation (LED equipment)	N / A
	To protect against injury of the eye or skin from ultraviolet radiation exposure produced by a broadband source, the effective integrated spectral irradiance, E_s , of the light source shall not exceed the levels defined by:	No UV radiation (LED equipment)	N / A
	$E_s \cdot t = \sum_{200}^{400} \sum_t E_\lambda(\lambda, t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 30 \quad \text{J}\cdot\text{m}^{-2}$	No UV radiation (LED equipment)	N / A
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:	No UV radiation (LED equipment)	N / A
	$t_{\max} = \frac{30}{E_s} \quad \text{s}$	No UV radiation (LED equipment)	N / A
4.3.2	Near-UV hazard exposure limit for eye		
	For the spectral region 315 nm to 400 nm (UV-A) the total radiant exposure to the eye shall not exceed $10000 \text{ J}\cdot\text{m}^{-2}$ for exposure times less than 1000 s. For exposure times greater than 1000 s (approximately 16 minutes) the UV-A irradiance for the unprotected eye, E_{UVA} , shall not exceed $10 \text{ W}\cdot\text{m}^{-2}$.	No Near-UV radiation (LED equipment)	N / A
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye for time less than 1000 s, shall be computed by:	No Near-UV radiation (LED equipment)	N / A
	$t_{\max} \leq \frac{10\,000}{E_{UVA}} \quad \text{s}$	No Near-UV radiation (LED equipment)	N / A
4.3.3	Retinal blue light hazard exposure limit		

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	To protect against retinal photochemical injury from chronic blue-light exposure, the integrated spectral radiance of the light source weighted against the blue-light hazard function, $B(\lambda)$, i.e., the blue-light weighted radiance, L_B , shall not exceed the levels defined by:		Pass
	$L_B \cdot t = \sum_{300}^{700} \sum_t L_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \cdot \Delta t \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t < 10^4 \text{ s}$	N / A
	$L_B = \sum_{300}^{700} L_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t > 10^4 \text{ s}$	Pass
4.3.4	Retinal blue light hazard exposure limit - small source		
	Thus the spectral irradiance at the eye E_λ , weighted against the blue-light hazard function $B(\lambda)$ shall not exceed the levels defined by:	Not small source	N / A
	$E_B \cdot t = \sum_{300}^{700} \sum_t E_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \cdot \Delta t \leq 100 \quad \text{J} \cdot \text{m}^{-2}$		N / A
	$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \quad \text{W} \cdot \text{m}^{-2}$	for $t > 100 \text{ s}$	N / A
4.3.5	Retinal thermal hazard exposure limit		
	To protect against retinal thermal injury, the integrated spectral radiance of the light source, L_λ , weighted by the burn hazard weighting function $R(\lambda)$ (from Figure 4.2 and Table 4.2), i.e., the burn hazard weighted radiance, shall not exceed the levels defined by:	See Appendix 1	Pass
	$L_R = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50\,000}{\alpha \cdot t^{0,25}} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$		Pass
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		
	For an infrared heat lamp or any near-infrared source where a weak visual stimulus is inadequate to activate the aversion response, the near infrared (780 nm to 1400 nm) radiance, L_{IR} , as viewed by the eye for exposure times greater than 10 s shall be limited to:		N / A
	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{6\,000}{\alpha} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	$t > 10 \text{ s}$	N / A
4.3.7	Infrared radiation hazard exposure limits for the eye		N / A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	The avoid thermal injury of the cornea and possible delayed effects upon the lens of the eye (cataractogenesis), ocular exposure to infrared radiation, E_{IR} , over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed:		N / A
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 18\,000 \cdot t^{-0,75} \quad W \cdot m^{-2}$	$t \leq 1000 \text{ s}$	N / A
	For times greater than 1000 s the limit becomes:		
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 100 \quad W \cdot m^{-2}$	$t > 1000 \text{ s}$	N / A
4.3.8	Thermal hazard exposure limit for the skin		
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:		Pass
	$E_H \cdot t = \sum_{380}^{3000} \sum_t E_{\lambda}(\lambda, t) \cdot \Delta t \cdot \Delta\lambda \leq 20\,000 \cdot t^{0,25} \quad J \cdot m^{-2}$		Pass
5	MEASUREMENT OF LAMPS AND LAMP SYSTEMS		
5.1	Measurement conditions		
	Measurement conditions shall be reported as part of the evaluation against the exposure limits and the assignment of risk classification.		Pass
5.1.1	Lamp ageing (seasoning)		N / A
	Seasoning of lamps shall be done as stated in the appropriate IEC lamp standard.		N / A
5.1.2	Test environment		N / A
	For specific test conditions, see the appropriate IEC lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations.		N / A
5.1.3	Extraneous radiation		N / A
	Careful checks should be made to ensure that extraneous sources of radiation and reflections do not add significantly to the measurement results.		N / A
5.1.4	Lamp operation		Pass
	Operation of the test lamp shall be provided in accordance with:		Pass
	– the appropriate IEC lamp standard, or		N / A
	– the manufacturer's recommendation		Pass

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
5.1.5	Lamp system operation		Pass
	The power source for operation of the test lamp shall be provided in accordance with:		Pass
	– the appropriate IEC standard, or		N / A
	– the manufacturer's recommendation		Pass
5.2	Measurement procedure		
5.2.1	Irradiance measurements		Pass
	Minimum aperture diameter 7mm.		Pass
	Maximum aperture diameter 50 mm.	7mm used	N / A
	The measurement shall be made in that position of the beam giving the maximum reading.		Pass
	The measurement instrument is adequate calibrated.		Pass
5.2.2	Radiance measurements	Alternative method	N / A
5.2.2.1	Standard method	Alternative method	N / A
	The measurements made with an optical system.		N / A
	The instrument shall be calibrated to read in absolute radiant power per unit receiving area and per unit solid angle to acceptance averaged over the field of view of the instrument.		N / A
5.2.2.2	Alternative method		Pass
	Alternatively to an imaging radiance set-up, an irradiance measurement set-up with a circular field stop placed at the source can be used to perform radiance measurements.		Pass
5.2.3	Measurement of source size	LED matrix	N / A
	The determination of α , the angle subtended by a source, requires the determination of the 50% emission points of the source.	$\alpha_{\text{matrix LED}} = D/r = [(114+3.5)/2]/200 = 293.75 \text{ mrad}$ $\alpha_{\text{matrix LED}} > \alpha_{\text{max}} = 100 \text{ mrad}$	N / A
5.2.4	Pulse width measurement for pulsed sources	CW LED	N / A
	The determination of Δt , the nominal pulse duration of a source, requires the determination of the time during which the emission is > 50% of its peak value.		N / A
5.3	Analysis methods		
5.3.1	Weighting curve interpolations	Curve interpolations	Pass
	To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals desired.		Pass
5.3.2	Calculations		Pass

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	The calculation of source hazard values shall be performed by weighting the spectral scan by the appropriate function and calculating the total weighted energy.		Pass
5.3.3	Measurement uncertainty	Uncertainty 7.5%,K=2	Pass
	The quality of all measurement results must be quantified by an analysis of the uncertainty.		Pass
6	LAMP CLASSIFICATION		
	For the purposes of this standard it was decided that the values shall be reported as follows:	See table 6.1	N / A
	– for lamps intended for general lighting service, the hazard values shall be reported as either irradiance or radiance values at a distance which produces an illuminance of 500 lux, but not at a distance less than 200 mm		N / A
	– for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm		Pass
6.1	Continuous wave lamps		
6.1.1	Exempt Group		
	In the except group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose:	Exempt Group	Pass
	– an actinic ultraviolet hazard (E_S) within 8-hours exposure (30000 s), nor	Exempt Group	Pass
	– a near-UV hazard (E_{UVA}) within 1000 s, (about 16 min), nor	Exempt Group	Pass
	– a retinal blue-light hazard (L_B) within 10000 s (about 2,8 h), nor	Exempt Group	Pass
	– a retinal thermal hazard (L_R) within 10 s, nor	Exempt Group	Pass
	– an infrared radiation hazard for the eye (E_{IR}) within 1000 s	Exempt Group	Pass
6.1.2	Risk Group 1 (Low-Risk)		
	In this group are lamps, which exceeds the limits for the except group but that does not pose:		N / A
	– an actinic ultraviolet hazard (E_S) within 10000 s, nor	Exempt Group	N / A
	– a near ultraviolet hazard (E_{UVA}) within 300 s, nor	Exempt Group	N / A
	– a retinal blue-light hazard (L_B) within 100 s, nor	Exempt Group	Pass
	– a retinal thermal hazard (L_R) within 10 s, nor	Exempt Group	N / A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	– an infrared radiation hazard for the eye (E_{IR}) within 100 s	Exempt Group	N / A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (L_{IR}), within 100 s are in Risk Group 1.		N / A
6.1.3	Risk Group 2 (Moderate-Risk)		
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:		N / A
	– an actinic ultraviolet hazard (E_S) within 1000 s exposure, nor		N / A
	– a near ultraviolet hazard (E_{UVA}) within 100 s, nor		N / A
	– a retinal blue-light hazard (L_B) within 0,25 s (aversion response), nor		N / A
	– a retinal thermal hazard (L_R) within 0,25 s (aversion response), nor		N / A
	– an infrared radiation hazard for the eye (E_{IR}) within 10 s		N / A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (L_{IR}), within 10 s are in Risk Group 2.		N / A
6.1.4	Risk Group 3 (High-Risk)		
	Lamps which exceed the limits for Risk Group 2 are in Group 3.		N / A
6.2	Pulsed lamps		
	Pulse lamp criteria shall apply to a single pulse and to any group of pulses within 0,25 s.	CW operation	N / A
	A pulsed lamp shall be evaluated at the highest nominal energy loading as specified by the manufacturer.	CW operation	N / A
	The risk group determination of the lamp being tested shall be made as follows:	CW operation	N / A
	– a lamp that exceeds the exposure limit shall be classified as belonging to Risk Group 3 (High-Risk)	CW operation	N / A
	– for single pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance does is below the EL shall be classified as belonging to the Exempt Group	CW operation	N / A
	– for repetitively pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance dose is below the EL, shall be evaluated using the continuous wave risk criteria discussed in clause 6.1, using time averaged values of the pulsed emission	CW operation	N / A

Table 4.1		Spectral weighting function for assessing ultraviolet hazards for skin and eye		-
Wavelength ¹ λ , nm	UV hazard function $S_{uv}(\lambda)$	Wavelength λ , nm	UV hazard function $S_{uv}(\lambda)$	
200	0,030	313*	0,006	
205	0,051	315	0,003	
210	0,075	316	0,0024	
215	0,095	317	0,0020	
220	0,120	318	0,0016	
225	0,150	319	0,0012	
230	0,190	320	0,0010	
235	0,240	322	0,00067	
240	0,300	323	0,00054	
245	0,360	325	0,00050	
250	0,430	328	0,00044	
254*	0,500	330	0,00041	
255	0,520	333*	0,00037	
260	0,650	335	0,00034	
265	0,810	340	0,00028	
270	1,000	345	0,00024	
275	0,960	350	0,00020	
280*	0,880	355	0,00016	
285	0,770	360	0,00013	
290	0,640	365*	0,00011	
295	0,540	370	0,000093	
297*	0,460	375	0,000077	
300	0,300	380	0,000064	
303*	0,120	385	0,000053	
305	0,060	390	0,000044	
308	0,026	395	0,000036	
310	0,015	400	0,000030	
¹ Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths. * Emission lines of a mercury discharge spectrum.				

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources		-
Wavelength nm	Blue-light hazard function B (λ)	Burn hazard function R (λ)	
300	0,01		
305	0,01		
310	0,01		
315	0,01		
320	0,01		
325	0,01		
330	0,01		
335	0,01		
340	0,01		
345	0,01		
350	0,01		
355	0,01		
360	0,01		
365	0,01		
370	0,01		
375	0,01		
380	0,01	0,1	
385	0,013	0,13	
390	0,025	0,25	
395	0,05	0,5	
400	0,10	1,0	
405	0,20	2,0	
410	0,40	4,0	
415	0,80	8,0	
420	0,90	9,0	
425	0,95	9,5	
430	0,98	9,8	
435	1,00	10,0	
440	1,00	10,0	
445	0,97	9,7	
450	0,94	9,4	
455	0,90	9,0	
460	0,80	8,0	
465	0,70	7,0	
470	0,62	6,2	
475	0,55	5,5	
480	0,45	4,5	
485	0,40	4,0	
490	0,22	2,2	
495	0,16	1,6	
500-600	$10^{[(450-\lambda)/50]}$	1,0	
600-700	0,001	1,0	
700-1050		$10^{[(700-\lambda)/500]}$	
1050-1150		0,2	
1150-1200		$0,2 \cdot 10^{0,02(1150-\lambda)}$	
1200-1400		0,02	

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

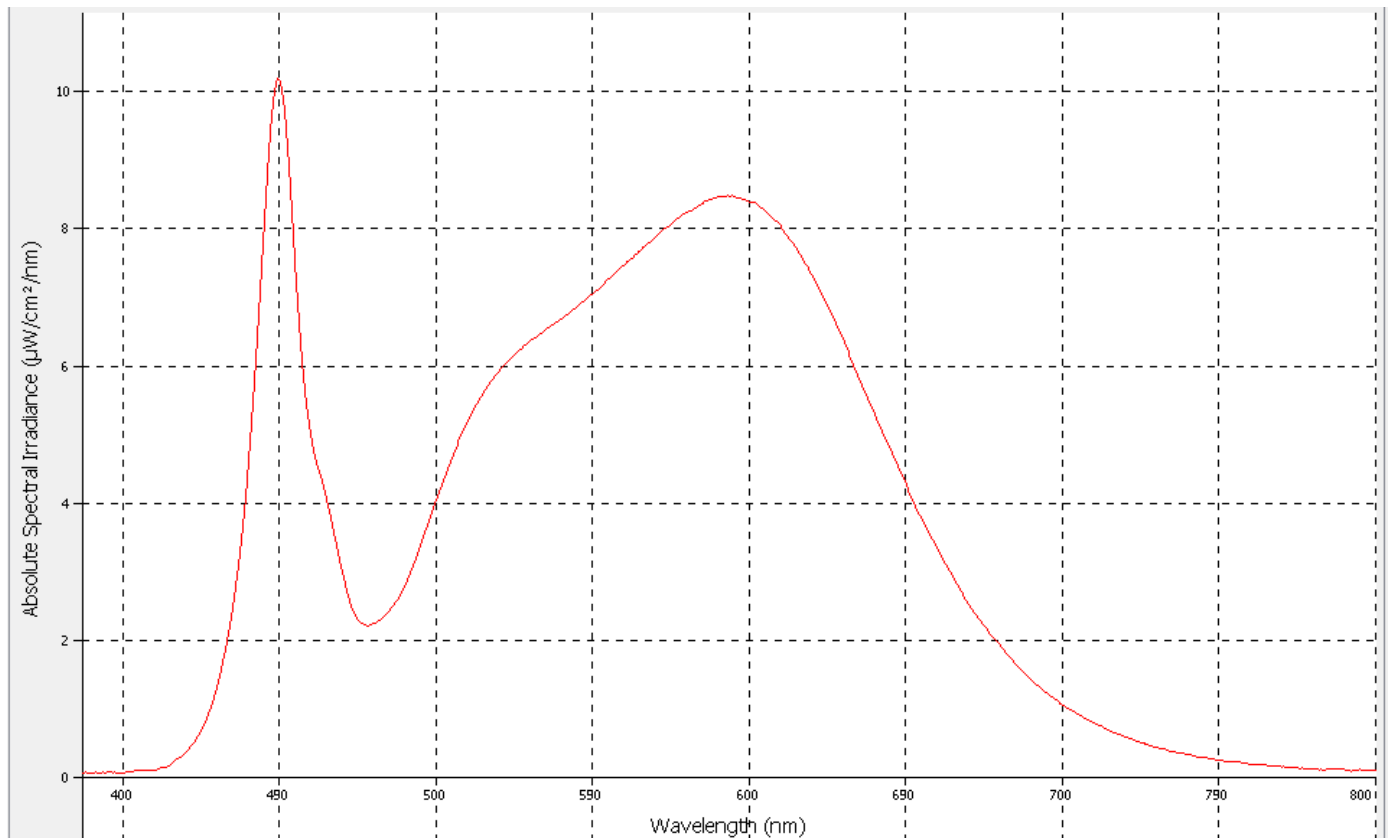
Table 5.4	Summary of the ELs for the surface of the skin or cornea (irradiance based values)					-
Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Limiting aperture rad (deg)	EL in terms of constant irradiance $W \cdot m^{-2}$	
Actinic UV skin & eye	$E_S = \sum E_\lambda \cdot S(\lambda) \cdot \Delta\lambda$	200 – 400	< 30000	1,4 (80)	30/t	
Eye UV-A	$E_{UVA} = \sum E_\lambda \cdot \Delta\lambda$	315 – 400	≤ 1000 >1000	1,4 (80)	10000/t 10	
Blue-light small source	$E_B = \sum E_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	≤ 100 >100	< 0,011	100/t 1,0	
Eye IR	$E_{IR} = \sum E_\lambda \cdot \Delta\lambda$	780 – 3000	≤ 1000 >1000	1,4 (80)	18000/t ^{0,75} 100	
Skin thermal	$E_H = \sum E_\lambda \cdot \Delta\lambda$	380 – 3000	< 10	2π sr	20000/t ^{0,75}	

Table 5.5	Summary of the ELs for the retina (radiance based values)					-
Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Field of view radians	EL in terms of constant radiance $W \cdot m^{-2} \cdot sr^{-1}$	
Blue light	$L_B = \sum L_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	0,25 – 10 10-100 100-10000 ≥ 10000	0,011•√(t/10) 0,011 0,0011•√t 0,1	10 ⁶ /t 10 ⁶ /t 10 ⁶ /t 100	
Retinal thermal	$L_R = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	380 – 1400	< 0,25 0,25 – 10	0,0017 0,011•√(t/10)	50000/(α•t ^{0,25}) 50000/(α•t ^{0,25})	
Retinal thermal (weak visual stimulus)	$L_{IR} = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	780 – 1400	> 10	0,011	6000/α	

Appendix 1

Spectral Irradiance test and calculations

Spectral irradiance for 1.4rad



Measurements were performed at a distance of 200mm from LED

Calculation for classification

With diffuser

IEC 62471									
Clause	Requirement + Test			Result – Remark					Verdict
Table 6.1	Emission limits for risk groups of continuous wave lamps-Tested at 200mm								Pass
Risk	Action spectrum	Sym- bol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	SUV(λ)	Es	W•m-2	0,001	N/A	0,003	N/A	0,03	N/A
Near UV		EUVA	W•m-2	10	N/A	33	N/A	100	N/A
Blue light	B(λ)	LB	W•m-2•sr-1	100	14	10000	N/A	4000000	N/A
Blue light, small source	B(λ)	EB	W•m-2	1,0*	N/A	1,0	N/A	400	N/A
Retinal thermal	R(λ)	LR	W•m-2•sr-1	28,000/α =2,8E5	1122	28000/α	N/A	71000/α	N/A
Retinal thermal, weak visual stimulus**	R(λ)	LIR	W•m-2•sr-1	6000/α	N/A	6000/α	N/A	6000/α	N/A
IR radiation, eye		EIR	W•m-2	100	N/A	N/A	N/A	N/A	N/A
Skin thermal		EH	W•m-2	3556	14.95	N/A	N/A	N/A	N/A
* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.									
** Involves evaluation of non-GLS source									

Calculation for classification

Without diffuser

IEC 62471									
Clause	Requirement + Test			Result – Remark					Verdict
Table 6.1	Emission limits for risk groups of continuous wave lamps- Tested at 200mm								Pass
Risk	Action spec- trum	Sym- bol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	SUV(λ)	Es	W•m-2	0,001	N/A	0,003	N/A	0,03	N/A
Near UV		EUVA	W•m-2	10	N/A	33	N/A	100	N/A
Blue light	B(λ)	LB	W•m-2•sr-1	100	40	10000	N/A	4000000	N/A
Blue light, small source	B(λ)	EB	W•m-2	1,0*	N/A	1,0	N/A	400	N/A
Retinal thermal	R(λ)	LR	W•m-2•sr-1	28,000/α =2,8E5	11447	28000/α	N/A	71000/α	N/A
Retinal thermal, weak visual stimulus**	R(λ)	LIR	W•m-2•sr-1	6000/α	N/A	6000/α	N/A	6000/α	N/A
IR radiation, eye		EIR	W•m-2	100	N/A	N/A	N/A	N/A	N/A
Skin thermal		EH	W•m-2	3556	23.2	N/A	N/A	N/A	N/A
* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.									
** Involves evaluation of non-GLS source									

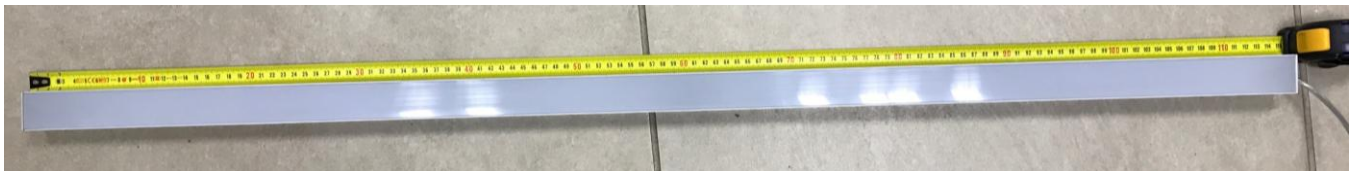
Appendix 2

Photos

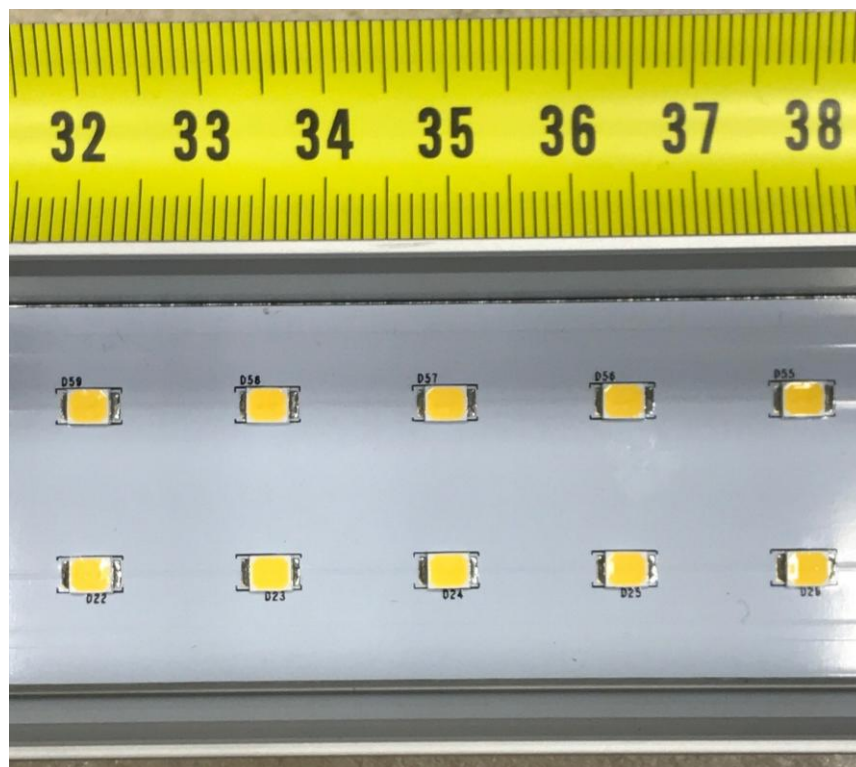
Source without diffuser



Source with diffuser



Distance between led's



Led side



Dilates about source



Appendix 3

Test instruments

SII Ref. No.	Instrument Type	Manufacturer	Model	Expire Cal. Date	SII Location	Accreditation Lab
6501633	Photodiode sensors and integrating spheres	Ophir Optronics	3A-IS	08/17	Telem. Lab	√
6501988	Thermal Head	Ophir Optronics	3A-P-FS-RoHS	12/17	Telem. Lab	√
6500711	CCD Camera	Spiricon	USB-SP620U	-	Telem. Lab	√
606686	Laser Power/Energy Monitor	Ophir Optronics	VEGA Display	08/17	Telem. Lab	√
6501928	Spectro radiometer	OceanOptics	HR2000+ES	--	Telem. Lab	-
5517	Calibration lamp Deuterium +Halogen	OceanOptics	DH-2000	50 h operation	Telem. Lab	√
6501632	Spectro radiometer	Control Development	NIR-256-1.7 T1	05/17	Telem. Lab	-