



Test Report issued under the responsibility of:



TEST REPORT
IEC 62471
Photobiological safety of lamps and lamp systems

Report Reference No.: E324690-4788722591-1 Amendment 1
Date of issue: 2019-06-19
Total number of pages: 20

Name of Testing Laboratory preparing the Report.....: Underwriters Laboratories Taiwan Co., Ltd /
260 Da-Yeh Road TW-112 Peitou Taipei City, Chinese Taipei

Applicant's name.....: VIVOTEK INC
Address: 6F, No.192, Lien-Cheng Rd., Chung-Ho, New Taipei City, 235,
Taiwan

Test specification:

Standard: IEC 62471:2006
Test procedure.....: CB
Non-standard test method.....: N/A

Test Report Form No......: IEC62471B
TRF Originator: VDE Testing and Certification Institute
Master TRF: Dated 2018-08-16

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Test item description	Network Camera	
Trade Mark		
Manufacturer	VIVOTEK INC 6F, No.192, Lien-Cheng Rd., Chung-Ho, New Taipei City, 235, Taiwan	
Model/Type reference	1) IB9387-EH 2) IB9387-H 3) IB9387-EHT 4) IB9387-HT and IB9387-LPR	
Ratings	1) PoE 42.5-57 Vdc,0.46-0.34 A ; DC 12 V, 1.25 A 2) PoE 37-57 Vdc,0.22-0.14 A ; DC 12 V, 0.5 A 3) PoE 42.5 to 57 Vdc,0.55 to 0.41 A ; DC 12 V, 1.58 A 4) PoE 37 to 57 Vdc,0.33 to 0.21 A ; DC 12 V, 0.83 A	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	CB Testing Laboratory:	
Testing location/ address	Underwriters Laboratories Taiwan Co., Ltd / 260 Da-Yeh Road TW-112 Peitou Taipei City, Chinese Taipei	
Tested by (name, function, signature)	Stanley Tsai / Project handler	
Approved by (name, function, signature) ..	Jerry Lin / Reviewer	
<input type="checkbox"/>	Testing procedure: CTF Stage 1:	
Testing location/ address		
Tested by (name, function, signature)		
Approved by (name, function, signature) ..		
<input type="checkbox"/>	Testing procedure: CTF Stage 2:	
Testing location/ address		
Tested by (name + signature)		
Witnessed by (name, function, signature). :		
Approved by (name, function, signature) ..		
<input type="checkbox"/>	Testing procedure: CTF Stage 3:	
<input type="checkbox"/>	Testing procedure: CTF Stage 4:	
Testing location/ address		
Tested by (name, function, signature)		
Witnessed by (name, function, signature). :		
Approved by (name, function, signature) ..		


Supervised by (name, function, signature) :		

<p>List of Attachments (including a total number of pages in each attachment):</p> <p>Enclosure - Photos (total 5 pages)</p> <p>Table – Additional test table (total 7 page)</p>	
<p>Summary of testing:</p>	
<p>Tests performed (name of test and test clause):</p> <p>The product was tested and classified according to the following clauses.</p> <p>Irradiance Measurement – 5.2.1</p> <p>Radiance Measurement – 5.2.2</p>	<p>Testing location:</p> <p>Underwriters Laboratories Taiwan Co., Ltd Lab 3: No.2, Wenming 1st St. Guishan, Taoyuan City TW-333 Taiwan Chinese Taipei</p>
<p>Summary of compliance with National Differences (List of countries addressed):</p> <p><input type="checkbox"/> The product fulfils the requirements of _____ (insert standard number and edition and delete the text in parenthesis, leave it blank or delete the whole sentence, if not applicable)</p>	


Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.





IB9387-H
Network Camera



MAC:0002D1XXXXXX



12V $\overline{\text{---}}$ 0.5A
PoE 37-57V $\overline{\text{---}}$ 0.22-0.14A

RoHS


This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

6F, No. 192, Lien-Cheng Rd., Chung-Ho, New Taipei City, 235, Taiwan, R.O.C.
Pat. 6, 930, 709 www.vivotek.com Made in Taiwan

IB9387-EH
Network Camera




MAC:0002D1XXXXXX



12V $\overline{\text{---}}$ 1.25A
PoE 42.5-57V $\overline{\text{---}}$ 0.46-0.34A






RoHS

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

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IB9387-EHT
Network Camera



MAC:0002D1XXXXXX



12V $\overline{\text{---}}$ 1.58A
PoE 42.5-57V $\overline{\text{---}}$ 0.55-0.41A







RoHS

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.





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IB9387-HT
Network Camera

MAC:0002D1XXXXXX



12V \approx 0.83A
PoE 37-57V \approx 0.33-0.21A



RoHS

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

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IB9387-LPR
Network Camera

MAC:0002D1XXXXXX



12V \approx 0.83A
PoE 37-57V \approx 0.33-0.21A



RoHS

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

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Pat.6, 930, 709 www.vivotek.com Made in Taiwan

Test item particulars	See below
Tested lamp	<input checked="" type="checkbox"/> continuous wave lamps <input type="checkbox"/> pulsed lamps
Tested lamp system	See general product information
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	N/A
Bulb	N/A
Rated of the lamp	N/A
Furthermore marking on the lamp.....	N/A
Seasoning of lamps according IEC standard	Not covered in this report
Used measurement instrument.....	N/A
Temperature by measurement.....	20~25 °C
Information for safety use.....	Not covered in this report
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	2019-05-13
Date (s) of performance of tests.....	2019-05-16
General remarks:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p>	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC60068-2-21:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies).....	VIVOTEK INC 5TH FL, 168 LIEN CHENG RD CHUNG HO DISTRICT NEW TAIPEI, 235 TAIWAN

General product information and other remarks:**<Report Summary>**

This test report (UL Flex project number: 4788992952) shall be read in conjunction with the original report, number:

(1) E324690-4788722591-1 Original, issue date 2018-11-13

This report has been technical amended, due to:

(1) Add three models (IB9387-EHT, IB9387-HT and IB9387-LPR) with new front cover, IR LED board and lens module.

(2) Add new input ratings for new models used.

<Product Description>

The equipment is a Class III Network Camera which consists of electronic components mounted on PWB, houses within metal/plastic enclosure.

Optical LED information:

Infrared LED made by:

For IR LED board, type 1:

LD1, LD2: Lextar / TYPE: PR35F0B (370016100G), 850nm, 150 mW/sr for each.

(CW mode, total two Infrared LEDs on module)

For IR LED board, type 2:

LD1, LD5: Lextar / TYPE: PR88F03, 850nm, 210 mW/sr for each.

(CW mode, total two Infrared LEDs on module)

LD2, LD3: Lextar / TYPE: PR35F0A (370015500G), 850nm, 150 mW/sr for each.

(CW mode, total two Infrared LEDs on module)

LD4, LD6: Lextar / TYPE: PR35F0B (370016100G), 850nm, 150 mW/sr for each.

(CW mode, total two Infrared LEDs on module)

Only photobiological hazards have been addressed.

Model difference:

All models are similar except for model designation, input ratings, heater, internal card slot, front cover, Lens module, IR LED board and relevant circuit and PCB layout.

See below table and photo documentation in attachment for details.

Model	IB9387-EH	IB9387-H	
Input Rating	PoE 42.5-57 Vdc, 0.46-0.34 A or DC 12 V, 1.25 A	PoE 37-57 Vdc, 0.22-0.14 A or DC 12 V, 0.5 A	
Heater	With	Without	
Tma	50°C		
IR LED board	Type 1		
Front cover	Type 1		
Lens module	Type 1		
Internal card slot	With		
Model	IB9387-EHT	IB9387-LPR	IB9387-HT
Input Rating	PoE 42.5-57 Vdc, 0.55-0.41 A or DC 12 V, 1.58 A	PoE 37-57 Vdc, 0.33-0.21 A or DC 12 V, 0.83 A	
Heater	With	Without	
Tma	55°C		
IR LED board	Type 2		
Front cover	Type 2		
Lens module	Type 2		

Internal card slot	With	Without	
Additional Information: N/A			

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IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
4	EXPOSURE LIMITS		P
4.1	General		P
	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		P
	Detailed spectral data of a light source are generally required only if the luminance of the source exceeds $10^4 \text{ cd}\cdot\text{m}^{-2}$	see clause 4.3	P
4.3	Hazard exposure limits		P
4.3.1	Actinic UV hazard exposure limit for the skin and eye		N/A
	The exposure limit for effective radiant exposure is $30 \text{ J}\cdot\text{m}^{-2}$ within any 8-hour period		N/A
	To protect against injury of the eye or skin from ultraviolet radiation exposure produced by a broad-band source, the effective integrated spectral irradiance, E_s , of the light source shall not exceed the levels defined by:		N/A
	$E_s \cdot t = \sum_{200}^{400} \sum_t E_\lambda(\lambda, t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta\lambda \leq 30 \quad \text{J}\cdot\text{m}^{-2}$		N/A
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:		N/A
	$t_{\max} = \frac{30}{E_s} \quad \text{s}$		N/A
4.3.2	Near-UV hazard exposure limit for eye		N/A
	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 $10 \text{ W}\cdot\text{m}^{-2}$.		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:		N/A
	$t_{\max} \leq \frac{10\,000}{E_{UVA}} \quad \text{s}$		N/A
4.3.3	Retinal blue light hazard exposure limit		P
	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:		P
	$L_B \cdot t = \sum_{300}^{700} \sum_t L_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta\lambda \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t \leq 10^4 \text{ s}$ $t_{\max} = \frac{10^6}{L_B}$	P

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Clause	Requirement + Test	Result – Remark	Verdict
	$L_B = \sum_{300}^{700} L_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad W \cdot m^{-2} \cdot sr^{-1}$	for $t > 10^4$ s	P
4.3.4	Retinal blue light hazard exposure limit - small source		P
	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:	The sources of LED are small source. See table 6.1 for details.	P
	$E_B \cdot t = \sum_{300}^{700} \sum_t E_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad J \cdot m^{-2}$	for $t \leq 100$ s	P
	$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \quad W \cdot m^{-2}$	for $t > 100$ s	P
4.3.5	Retinal thermal hazard exposure limit		P
	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:		P
	$L_R = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50\,000}{\alpha \cdot t^{0,25}} \quad W \cdot m^{-2} \cdot sr^{-1}$	($10 \mu s \leq t \leq 10$ s)	P
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		P
	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:		P
	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{6\,000}{\alpha} \quad W \cdot m^{-2} \cdot sr^{-1}$	$t > 10$ s	P
4.3.7	Infrared radiation hazard exposure limits for the eye		P
	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:		P
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \leq 18\,000 \cdot t^{-0,75} \quad W \cdot m^{-2}$	$t \leq 1000$ s	P
	For times greater than 1000 s the limit becomes:		P
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \leq 100 \quad W \cdot m^{-2}$	$t > 1000$ s	P
4.3.8	Thermal hazard exposure limit for the skin		N/A
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:		N/A

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Clause	Requirement + Test	Result – Remark	Verdict
	$E_H \cdot t = \sum_{380}^{3000} \sum_{\lambda} E_{\lambda}(\lambda, t) \cdot \Delta t \cdot \Delta \lambda \leq 20\,000 \cdot t^{0,25} \quad \text{J} \cdot \text{m}^{-2}$		N/A
5	MEASUREMENT OF LAMPS AND LAMP SYSTEMS		P
5.1	Measurement conditions		P
	Measurement conditions shall be reported as part of the evaluation against the exposure limits and the assignment of risk classification.		P
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		P
	For specific test conditions, see the appropriate IEC lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations.		P
5.1.3	Extraneous radiation		P
	Careful checks should be made to ensure that extraneous sources of radiation and reflections do not add significantly to the measurement results.		P
5.1.4	Lamp operation		N/A
	Operation of the test lamp shall be provided in accordance with:		N/A
	– the appropriate IEC lamp standard, or		N/A
	– the manufacturer's recommendation		N/A
5.1.5	Lamp system operation		P
	The power source for operation of the test lamp shall be provided in accordance with:		P
	– the appropriate IEC standard, or		N/A
	– the manufacturer's recommendation		P
5.2	Measurement procedure		P
5.2.1	Irradiance measurements		P
	Minimum aperture diameter 7mm.		P
	Maximum aperture diameter 50 mm.		P
	The measurement shall be made in that position of the beam giving the maximum reading.		P
	The measurement instrument is adequate calibrated.		P
5.2.2	Radiance measurements		P
5.2.2.1	Standard method		P
	The measurements made with an optical system.		P
	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		P

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	view of the instrument.		
5.2.2.2	Alternative method		N/A
	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.		N/A
5.2.3	Measurement of source size		P
	The determination of α , the angle subtended by a source, requires the determination of the 50% emission points of the source.		P
5.2.4	Pulse width measurement for pulsed sources		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		P
5.3.1	Weighting curve interpolations		P
	To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals desired.	see table 4.1	P
5.3.2	Calculations		P
	The calculation of source hazard values shall be performed by weighting the spectral scan by the appropriate function and calculating the total weighted energy.		P
5.3.3	Measurement uncertainty		P
	The quality of all measurement results must be quantified by an analysis of the uncertainty.	see Annex C in the norm	P
6	LAMP CLASSIFICATION		P
	For the purposes of this standard it was decided that the values shall be reported as follows:	see table 6.1	P
	– 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		P
6.1	Continuous wave lamps		P
6.1.1	Except Group		P
	In the except group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose:		P
	– an actinic ultraviolet hazard (E_s) within 8-hours exposure (30000 s), nor		P

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Clause	Requirement + Test	Result – Remark	Verdict
	– a near-UV hazard (E_{UVA}) within 1000 s, (about 16 min), nor		P
	– a retinal blue-light hazard (L_B) within 10000 s (about 2,8 h), nor		P
	– a retinal thermal hazard (L_R) within 10 s, nor		P
	– an infrared radiation hazard for the eye (E_{IR}) within 1000 s		P
6.1.2	Risk Group 1 (Low-Risk)		N/A
	In this group are lamps, which exceeds the limits for the except group but that does not pose:		NA
	– an actinic ultraviolet hazard (E_S) within 10000 s, nor		NA
	– a near ultraviolet hazard (E_{UVA}) within 300 s, nor		NA
	– a retinal blue-light hazard (L_B) within 100 s, nor		NA
	– a retinal thermal hazard (L_R) within 10 s, nor		NA
	– an infrared radiation hazard for the eye (E_{IR}) within 100 s		NA
	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.		NA
6.1.3	Risk Group 2 (Moderate-Risk)		NA
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:		NA
	– an actinic ultraviolet hazard (E_S) within 1000 s exposure, nor		NA
	– a near ultraviolet hazard (E_{UVA}) within 100 s, nor		NA
	– a retinal blue-light hazard (L_B) within 0,25 s (aversion response), nor		NA
	– a retinal thermal hazard (L_R) within 0,25 s (aversion response), nor		NA
	– an infrared radiation hazard for the eye (E_{IR}) within 10 s		NA
	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.		NA
6.1.4	Risk Group 3 (High-Risk)		NA
	Lamps which exceed the limits for Risk Group 2 are in Group 3.		N/A
6.2	Pulsed lamps		N/A
	Pulse lamp criteria shall apply to a single pulse and to any group of pulses within 0,25 s.		NA
	A pulsed lamp shall be evaluated at the highest nominal energy loading as specified by the manufacturer.		NA

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Clause	Requirement + Test	Result – Remark	Verdict
	The risk group determination of the lamp being tested shall be made as follows:		NA
	– a lamp that exceeds the exposure limit shall be classified as belonging to Risk Group 3 (High-Risk)		NA
	– 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		NA
	– 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		NA

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Clause	Requirement + Test	Result – Remark	Verdict

Table 4.1	Spectral weighting function for assessing ultraviolet hazards for skin and eye			P
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.

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Clause	Requirement + Test	Result – Remark	Verdict

Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources	P
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

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Clause	Requirement + Test	Result – Remark	Verdict

Table 5.4 Summary of the ELs for the surface of the skin or cornea (irradiance based values)						P
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)						P
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	0,011·√(t/10)	10 ⁶ /t	
			10-100	0,011	10 ⁶ /t	
			100-10000	0,0011·√t	10 ⁶ /t	
			≥ 10000	0,1	100	
Retinal thermal	$L_R = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	380 – 1400	< 0,25	0,0017	50000/(α·t ^{0,25})	
			0,25 – 10	0,011·√(t/10)	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	

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Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1 Emission limits for risk groups of continuous wave lamps									P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	0.000E+00	0,003	0.000E+00	0,03	0.000E+00
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	0.000E+00	33	0.000E+00	100	0.000E+00
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	--	--	--	--	--	--
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1.0*	9.778E-05	1.0	9.778E-05	400	9.778E-05
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	3.409E+06	5.338E+03	3.409E+06	5.338E+03	8.645E+06	1.301E+04
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	7.306E+05	5.289E+03	7.306E+05	5.289E+03	7.306E+05	5.289E+03
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	3.801E+00	570	3.801E+00	3200	3.801E+00

* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source
Angular subtense of apparent source: $\alpha=8.21$ mrad (**For LED module board, type 1**)
Test condition: Normal condition (CW mode)
Conclusion: Infrared LEDs (LD1, LD2: Lextar / TYPE: PR35F0B (370016100G)) was assigned as Exempt Group.

List of test equipment used:

A completed list of used test equipment shall be provided in the Test Reports when a Customer's Testing Facility according to CTF stage 1 or CTF stage 2 procedure has been used.

Note: This page may be removed when CTF stage 1 or CTF stage 2 are not used. See also clause 4.8 in OD 2020 for more details.

Clause	Measurement / testing	Testing / measuring equipment / material used, (Equipment ID)	Range used	Last Calibration date	Calibration due date
N/A					

Fig.1: Overall view-1



Fig 2: Overall view-2 (For LED Module, type 1)

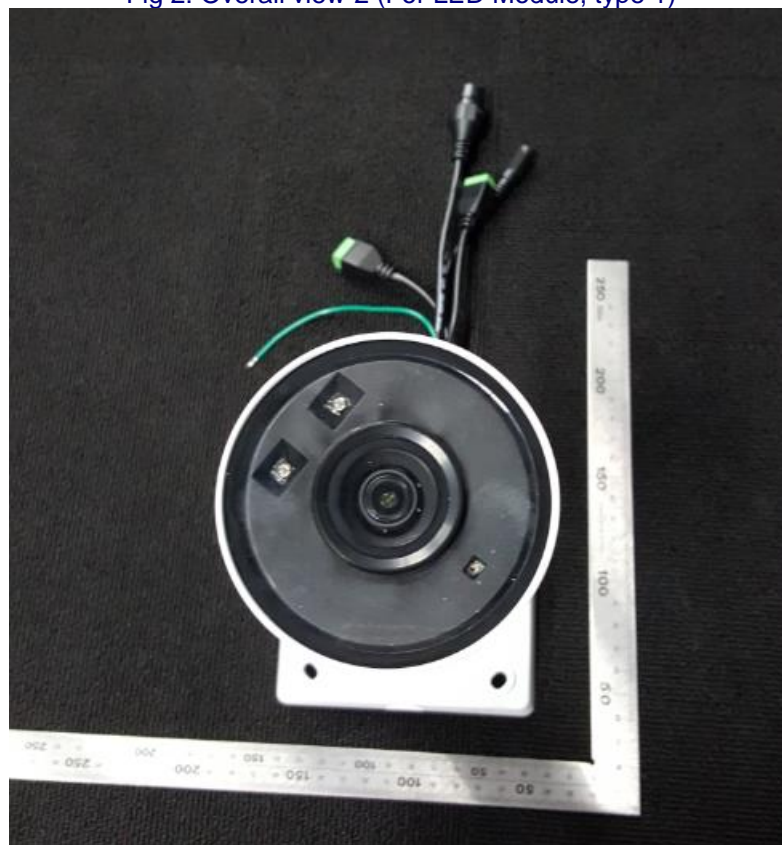


Fig.3: LED Module view-1, type 1

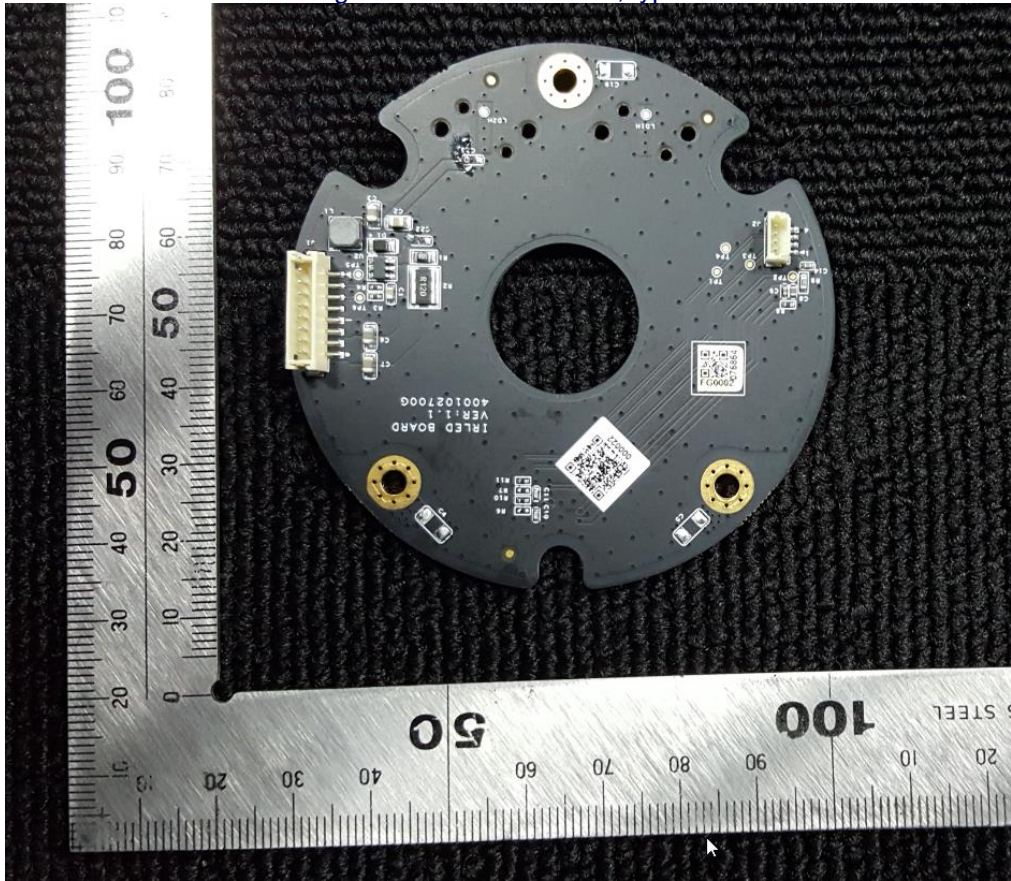


Fig.4: LED Module view-2, type A

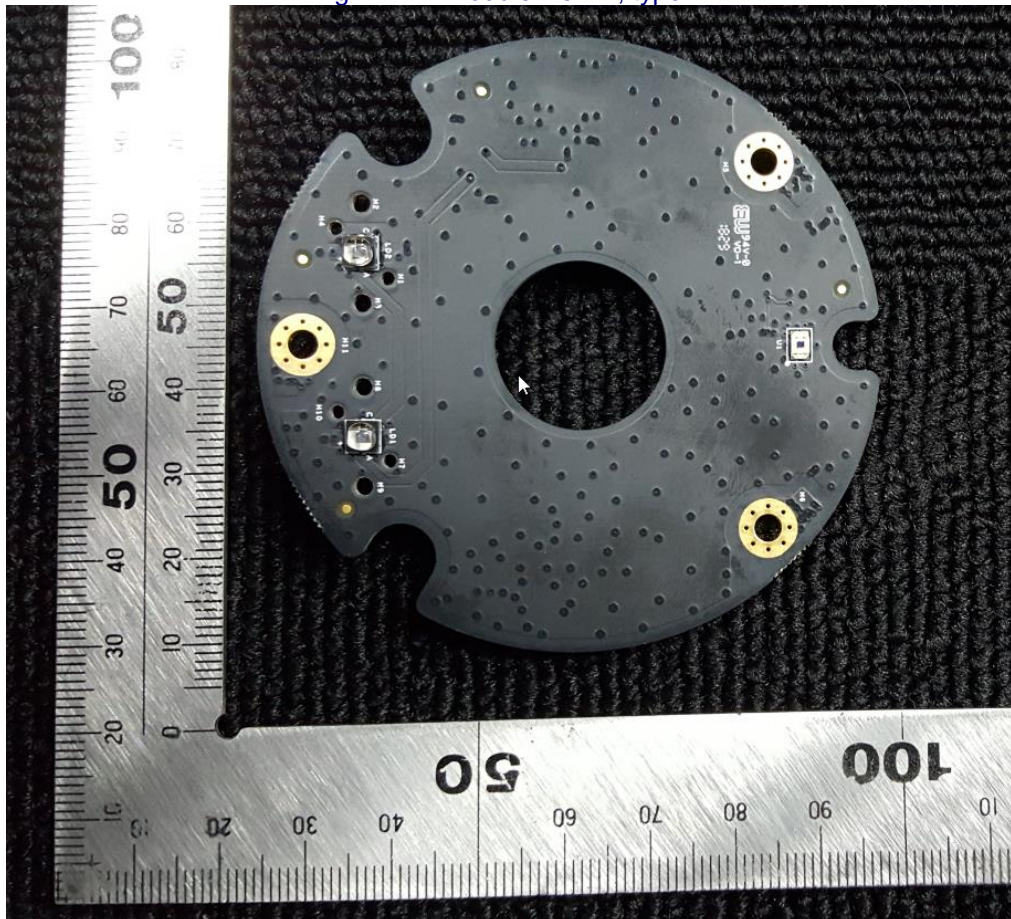


Fig.5: LED location (For LED Module, type 1)

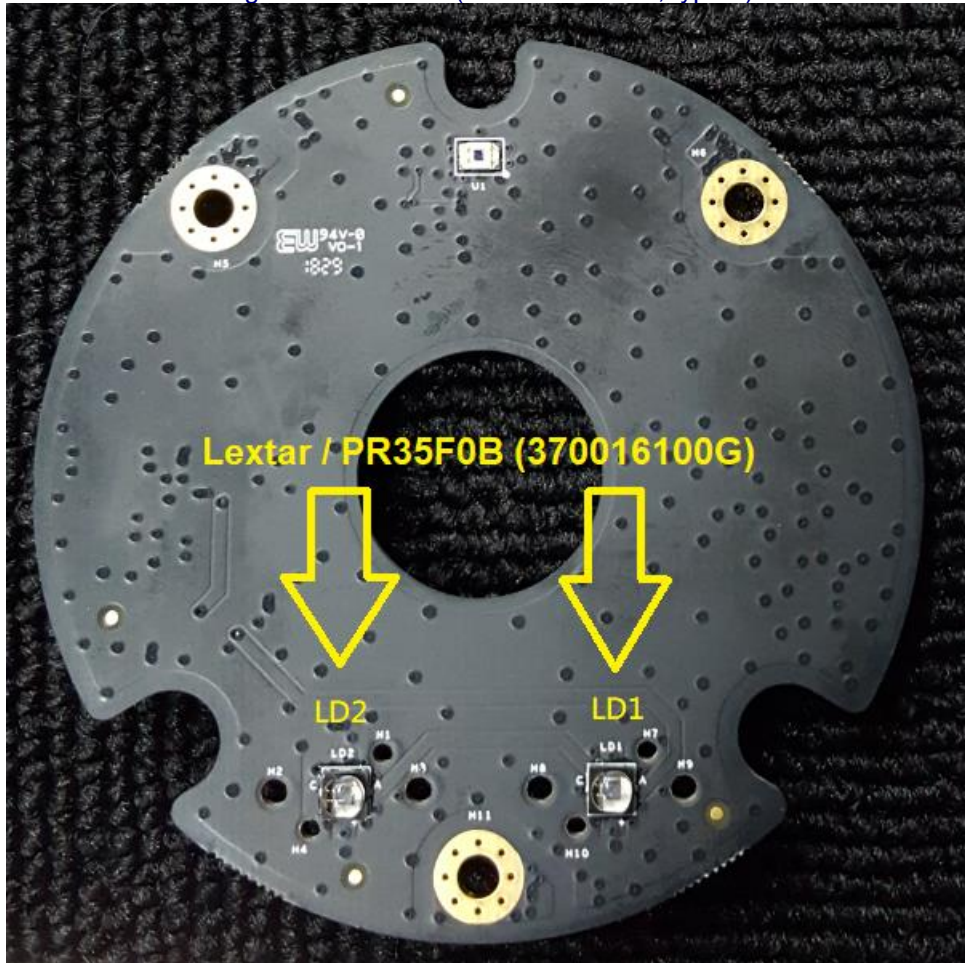


Fig 6: Overall view-2 (For LED Module, type 2)



Fig.7: LED Module view-1, type 2

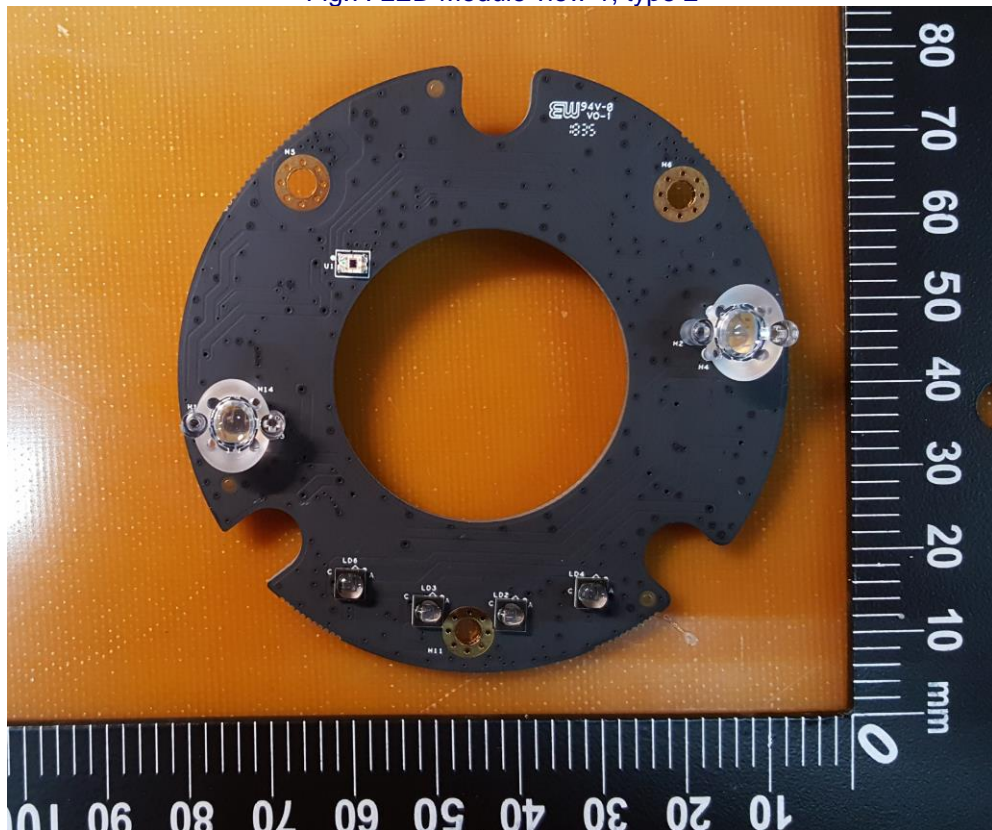


Fig.8: LED Module view-1, type 2

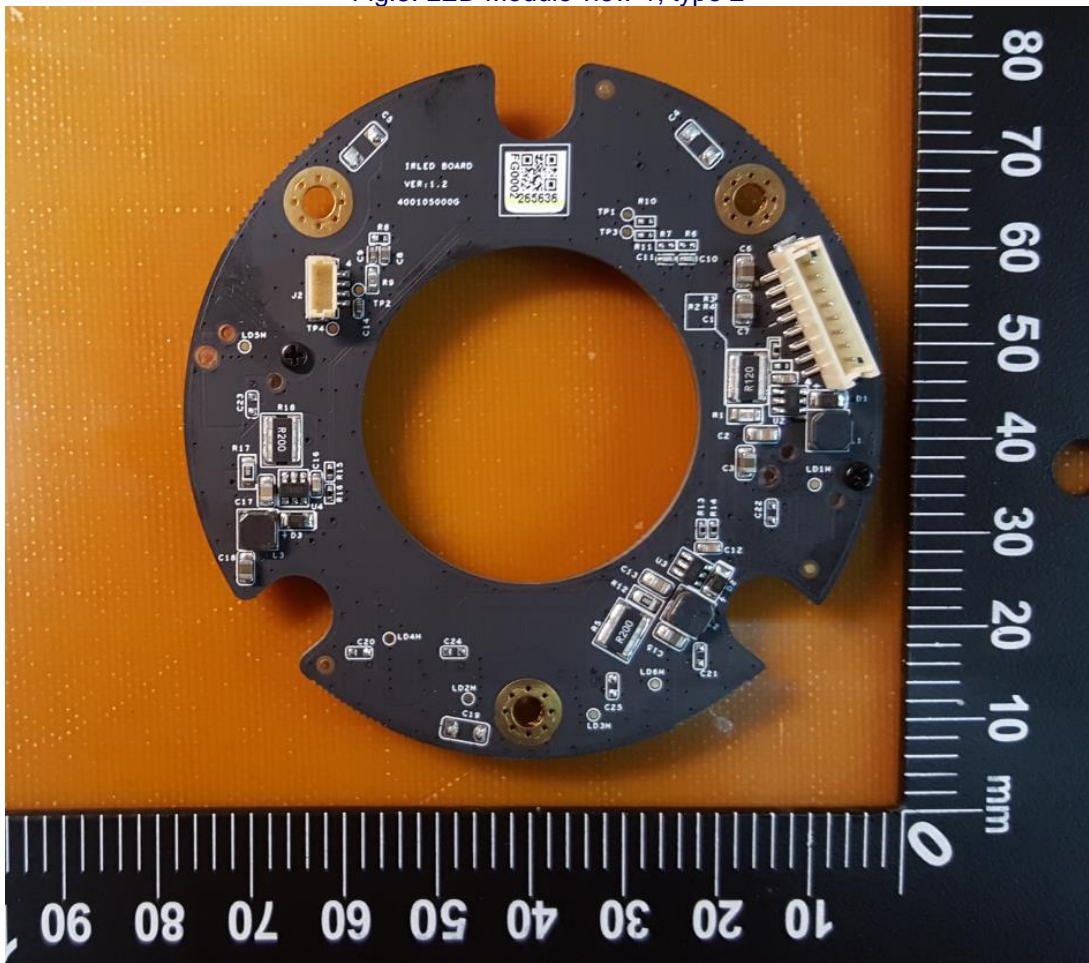


Fig.9: LED location (For LED Module, type 2)

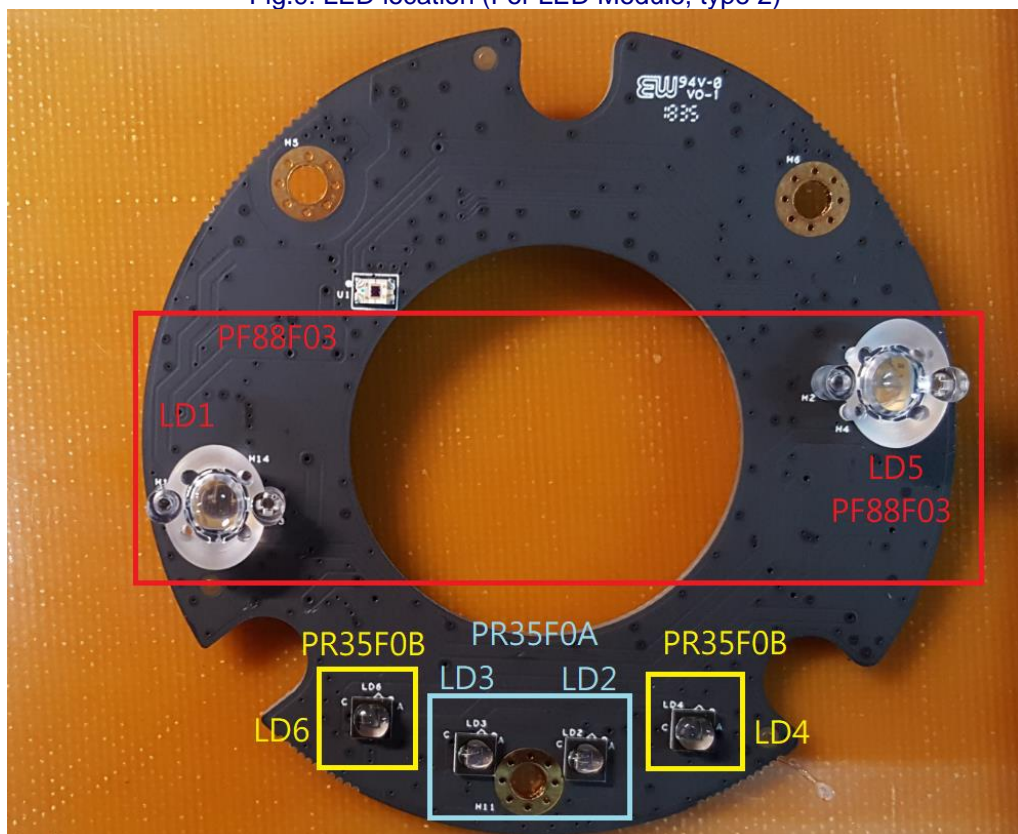


Table 6.1 Emission limits for risk groups of continuous wave lamps									P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0.001	0.000E+00	0.003	0.000E+00	0,03	0.000E+00
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	0.000E+00	33	0.000E+00	100	0.000E+00
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	--	--	--	--	--	--
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1.0*	1.564E-04	1.0	1.564E-04	400	1.564E-04
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	3.41E+06	8.540E+03	3.41E+06	8.540E+03	8.65E+06	2.081E+04
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	7.31E+05	8.462E+04	7.31E+05	8.462E+04	7.31E+05	8.462E+04
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	6.081E+01	570	6.081E+01	3200	6.081E+01

* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.

** Involves evaluation of non-GLS source

Angular subtense of apparent source: $\alpha=8.14$ mrad (**For LED module board, type 1**)

Test condition: Fault condition (driving single LED by 1.5A directly)

Conclusion: Infrared LED LD1, LD2: Lextar / PR35F0B (370016100G) was assigned as Exempt Group.

Table 6.1		Emission limits for risk groups of continuous wave lamps								P
Risk	Action spectrum	Symbol	Units	Emission Measurement						
				Exempt		Low risk		Mod risk		
				Limit	Result	Limit	Result	Limit	Result	
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	0.000E+00	0,003	0.000E+00	0,03	0.000E+00	
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	0.000E+00	33	0.000E+00	100	0.000E+00	
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	6.999E-02	10000	2.717E+00	4000000	5.296E+00	
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1.0*	--	1.0	--	400	--	
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	4.653E+05	6.325E+03	4.653E+05	6.325E+03	1.180E+06	1.233E+04	
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	9.970E+04	6.209E+03	9.970E+04	6.209E+03	9.970E+04	6.209E+03	
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	1.708E+01	570	1.708E+01	3200	1.708E+01	

* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.

** Involves evaluation of non-GLS source

Angular subtense of apparent source: $\alpha=60.18$ mrad (**For LED module board type 1**)

Test condition: Normal condition (CW mode)

Conclusion: Infrared LEDs LD2, LD3: Lextar / TYPE: PR35F0A (370015500G) was assigned as Exempt Group.

Table 6.1 Emission limits for risk groups of continuous wave lamps									P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	0.000E+00	0,003	0.000E+00	0,03	0.000E+00
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	0.000E+00	33	0.000E+00	100	0.000E+00
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	2.310E-01	10000	8.966E+00	4000000	1.748E+01
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1.0*	--	1.0	--	400	--
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	4.653E+05	2.087E+04	4.653E+05	2.087E+04	1.180E+06	4.069E+04
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	9.970E+04	2.049E+04	9.970E+04	2.049E+04	9.970E+04	2.049E+04
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	5.636E+01	570	5.636E+01	3200	5.636E+01

* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.

** Involves evaluation of non-GLS source

Angular subtense of apparent source: $\alpha=60.18$ mrad (**For LED module board type 2**)

Test condition: Fault condition (driving single LED by 1.4A/5.23V directly)

Conclusion: Infrared LED LD2, LD3: Lextar / TYPE: PR35F0A (370015500G) was assigned as Exempt Group.

Table 6.1		Emission limits for risk groups of continuous wave lamps								P
Risk	Action spectrum	Symbol	Units	Emission Measurement						
				Exempt		Low risk		Mod risk		
				Limit	Result	Limit	Result	Limit	Result	
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	0.000E+00	0,003	0.000E+00	0,03	0.000E+00	
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	0.000E+00	33	0.000E+00	100	0.000E+00	
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	6.913E-02	10000	2.698E+00	4000000	5.215E+00	
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1.0*	--	1.0	--	400	--	
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	6.719E+05	5.239E+03	6.719E+05	5.239E+03	1.704E+06	1.013E+04	
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	1.440E+04	5.180E+03	1.440E+04	5.180E+03	1.440E+04	5.180E+03	
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	1.570E+01	570	1.570E+01	3200	1.570E+01	

* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

Angular subtense of apparent source: $\alpha=41.67$ mrad (**For LED module board type 2**)

Test condition: Normal condition (CW mode)

Conclusion: Infrared LEDs LD4, LD6: Lextar / TYPE: PR35F0B (370016100G) was assigned as Exempt Group.

Table 6.1 Emission limits for risk groups of continuous wave lamps									P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	0.000E+00	0,003	0.000E+00	0,03	0.000E+00
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	0.000E+00	33	0.000E+00	100	0.000E+00
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	1.106E-01	10000	4.317E+00	4000000	8.344E+00
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1.0*	--	1.0	--	400	--
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	6.719E+05	8.382E+03	6.719E+05	8.382E+03	1.704E+06	1.621E+04
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	1.440E+04	8.288E+03	1.440E+04	8.288E+03	1.440E+04	8.288E+03
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	2.512E+01	570	2.512E+01	3200	2.512E+01

* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.

** Involves evaluation of non-GLS source

Angular subtense of apparent source: $\alpha=41.67$ mrad (**For LED module board type 2**)

Test condition: Fault condition (driving single LED by 1.5A directly)

Conclusion: Infrared LED LD4, LD6: Lextar / TYPE: PR35F0B (370016100G) was assigned as Exempt Group.

Table 6.1		Emission limits for risk groups of continuous wave lamps								P
Risk	Action spectrum	Symbol	Units	Emission Measurement						
				Exempt		Low risk		Mod risk		
				Limit	Result	Limit	Result	Limit	Result	
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	0.000E+00	0,003	0.000E+00	0,03	0.000E+00	
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	0.000E+00	33	0.000E+00	100	0.000E+00	
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	6.859E-02	10000	2.228E+00	4000000	2.638E+00	
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1.0*	--	1.0	--	400	--	
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	2.032E+06	1.669E+04	2.032E+06	1.669E+04	5.153E+06	1.976E+04	
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	4.355E+05	1.643E+04	4.355E+05	1.643E+04	4.355E+05	1.643E+04	
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	1.495E+01	570	1.495E+01	3200	1.495E+01	

* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

Angular subtense of apparent source: $\alpha=13.78$ mrad (**For LED module board type 2**)
Test condition: Normal condition (CW mode)
Conclusion: Infrared LEDs LD1, LD5: Lextar / TYPE: PR88F03 was assigned as Exempt Group.

Table 6.1 Emission limits for risk groups of continuous wave lamps									P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	0.000E+00	0,003	0.000E+00	0,03	0.000E+00
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	0.000E+00	33	0.000E+00	100	0.000E+00
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	1.029E-01	10000	3.342E+00	4000000	3.957E+00
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1.0*	--	1.0	--	400	--
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	2.032E+06	2.504E+04	2.032E+06	2.504E+04	5.153E+06	2.964E+04
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	4.355E+05	2.465E+04	4.355E+05	2.465E+04	4.355E+05	2.465E+04
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	2.243E+01	570	2.243E+01	3200	2.243E+01

* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.

** Involves evaluation of non-GLS source

Angular subtense of apparent source: $\alpha=13.78$ mrad (**For LED module board type 2**)

Test condition: Fault condition (driving single LED by 1.5A/5V directly)

Conclusion: Infrared LED LD1, LD5: Lextar / TYPE: PR88F03 was assigned as Exempt Group.