



TÜRK STANDARDLARI ENSTİTÜSÜ
DENEY ve KALİBRASYON
MERKEZİ BAŞKANLIĞI
Elektroteknik Laboratuvarı Gebze Müdürlüğü



TÜRKISH STANDARDS INSTITUTION
HEADSHIP OF TEST and CALIBRATION CENTER
Electrotechnical Laboratory (Gebze)

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AB-0001-T

600438

04-21

MUAYENE VE DENEY RAPORU
TEST REPORT

Deneyi Talep Eden/Firma : HERA EĞLENCE VE MİMARİ AYDINLATMA SİSTEMLERİ A.Ş.
(Adı, Adresi, Şehir vb.) (GULLUBAĞLAR MAH. KAHRAMANLAR CAD. NO:3-1 Pendik-İSTANBUL)
Requesting/Customer
(Name, Address, City etc.)
Deney Talep Tarihi/No : 26.03.2021 / 549901
Order Date / No
Numunenin Tanımı : 731137, AYDINLATMA ARMATÜRÜ, HERA, Chronopix RGBW, -, -, 1,00 adet
(No, Cins, Marka, Tip, Tür, Model vb.)
Sample Description (No, Type, Model etc.) 731137, LUMINAIRE, HERA, Chronopix RGBW, -, -, 1,00 item
Numune Kabul Tarihi : 26.03.2021
Test Item Receipt Date
Deneylerin Yapıldığı Tarih : 26.03.2021 - 31.03.2021
Date of Test
Uygulanan Standard / Metot : TS EN 62471: 2012-01 Lambaların ve lamba sistemlerinin fotobiyolojik güvenliği
Applied Standard/Method TS EN 62471: 2012-01 Photobiological safety of lamps and lamp systems
Raporun Sayfa Sayısı : 23
Number of pages of the report
Açıklamalar : Yapılan muayene ve deneylerden OLURLU sonuç alınmıştır.
Remarks The sample described above Passed the applied tests.

Deney laboratuvarları olarak faaliyet gösteren TSE Deney ve Kalibrasyon Merkezi Başkanlığı Deney Laboratuvarları TÜRKAK'tan AB-0001-T ile TS EN ISO/IEC 17025:2012 standardına göre akredite edilmiştir.

TSE Headship of Test and Calibration Center Testing Laboratories accredited by TÜRKAK under registration number AB-0001-T for TS EN ISO/IEC 17025:2012 as test laboratory.

TÜRKAK deney raporlarının tanınırlığı konusunda Avrupa Akreditasyon Birliği (EA) ile Çok Taraflı Anlaşma ve Uluslararası Laboratuvar Akreditasyon Birliği (ILAC) ile karşılıklı tanıma anlaşması imzalamıştır.

TURKAK is a signatory to the European co-operation for Accreditation (EA) Multilateral Agreement (MLA) and to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) for the recognition of test reports.

Bu raporda Uygunluk Beyanı verilen deney sonuçları için TSE internet sitesinde yayınlanan LAB-D-PR-18 Karar Kuralı Prosedüründe belirtilen kurallar uygulanmıştır.

Rules described in "LAB-D-PR-18 Decision Rule Procedure", which is published on TSE Web site have been applied to the test results for which Conformity Declaration is given in this test report

Deney ve/veya ölçüm sonuçları, genişletilmiş ölçüm belirsizlikleri (olması halinde) ve deney metodları bu raporun tamamlayıcı kısmı olan takip eden sayfalarda verilmiştir.

The test and/or measurement results, the uncertainties (if applicable) with confidence probability and test methods are given on the following pages which are part of this report.

Numune müşteri tarafından alınmıştır, bu rapordaki sonuçlar numunenin teslim alındığı hali için geçerlidir. Bu rapor özel deney talebine istinaden düzenlenmiş olup, Standartlara Uygunluk Belgesi niteliğinde değildir. Partiyi temsil etmez. Piyasa Gözetim ve Denetim Faaliyetlerine esas oluşturamaz, ilan, reklam ve ihalelerde, 6102 sayılı Türk Ticaret Kanunu'nun 54. ve 55. Maddelerinde yer alan haksız rekabet hükümlerine aykırı şekilde kullanılamaz. Söz konusu hususlara aykırı hareket edilmesi halinde hukuki ve cezai açıdan TSE sorumlu tutulamaz.



Mühür
Seal

Tarih
Date

Deney Sorumlusu
Person in charge of tests

Kontrol Eden
Reviewer

Onaylayan
Approved by

02.04.2021

Edin ÇİFTÇİ
Deney Personeli
Testing Expert

Gülşah GÖKER TAYLI
Bölüm Sorumlusu
Division Head

Dr. Güvenir Kaan ESEN
Laboratuvar Müdürü
Laboratory Manager

Bu rapor, hazırlayan laboratuvarın yazılı izni olmadan kısmen kopyalanıp çoğaltılamaz. İmzasız ve mühürlü raporlar geçersizdir. Bu rapor, sadece deneyi yapılan numune için geçerlidir ve "Ürün Belgesi" yerine geçmez.

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DENEY RAPORU TS EN 62471 Lambaların ve Lamba Sistemlerinin Fotobiyolojik Güvenliği	
Rapor No.....	600438
Yayın Tarihi	12 -04- 2021
Sayfa sayısı	23
Raporu hazırlayan test laboratuvarının adı	TSE Elektroteknik Laboratuvarı Gebze Müdürlüğü
Talep Eden (Başvuru Sahibi Kuruluş)	HERA EĞLENCE VE MİMARİ AYDINLATMA SİSTEMLERİ A.Ş.
Adres	Güllübağlar mah.Kahramanlar cad.no:3-1 Tuzla / İSTANBUL
Test Spesifikasyonları:	
Standart.....	TS EN 62471:2012
IEC karşılığı.....	IEC 62471:2006
Test prosedürü	TSE
Standart dışı metot	NU
Test Rapor Form No.....	TSE62471B
Test Rapor Formunu Oluşturan	TSE
Yayın Tarihi	2020-06
Telif Hakkı © 2020 Türk Standardları Enstitüsü Deney ve Kalibrasyon Merkezi Başkanlığı. Bu dokümanın oluşturulmasında ilgili IEC ve TSE standartları ile TRF'lerinden faydalanılmıştır. Tüm hakları saklıdır.	
Genel sorumluluk reddi:	
Bu deney raporunda sunulan test sonuçları yalnızca test edilen numune ile ilgilidir. Bu deney raporunun tamamı hariç bir bölümü TSE'nin yazılı onayı olmadan çoğaltılamaz. Bu deney raporu ve içeriğinin doğruluğunu TSE ilgili birimleri ile iletişim yoluyla (elektroteknikgebze@tse.org.tr) doğrulanabilir.	





Test item description		Photobiological safety of lamps and lamp systems	
Trade Mark		HERA	
Manufacturer		HERA EĞLENCE VE MİMARİ AYDINLATMA	
Model/Type reference		SİSTEMLERİ A.Ş.	
Ratings		Chronopix RGBW	
		48V DC 2,4 W 0,05A 6,1x11,2x4,7	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	CB Testing Laboratory:	TSE Electrotechnical Laboratory Gebze Directorate	
Testing location/ address		Cumhuriyet Mah. 2258 Sok. No:10 Gebze / KOCAELİ	
Tested by (name, function, signature)		See Cover Page	
Approved by (name, function, signature) ...:		See Cover Page	
☐	Testing procedure: CTF Stage 1:		
Testing location/ address			
Tested by (name, function, signature)			
Approved by (name, function, signature) ...:			
☐	Testing procedure: CTF Stage 2:		
Testing location/ address			
Tested by (name +signature)			
Witnessed by (name, function, signature) ..:			
Approved by (name, function, signature) ...:			
☐	Testing procedure: CTF Stage 3:		
☐	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) :			





List of Attachments (including a total number of pages in each attachment):

- European Group Differences and National Differences (3 pages)

Summary of testing:

Tests performed (name of test and test clause):

- TS EN 62471 with all relevant examinations and tests of TSE IEC TR 62778 standard have been applied. Only Blue Light Hazard measurement has been done.

Testing location:

TSE Electrotechnical Laboratory Gebze Directorate
Cumhuriyet Mah. 2258 Sok. No:10
Gebze / KOCAELİ

Summary of compliance with National Differences (List of countries addressed):-



İşaretleme Plakasının Örneği



Deney numunesinin ayrıntıları.....	☒ Sürekli Dalgalı Lamba ☐ Darbeli Lamba
Test edilen lamba	
Test edilen lamba sistemi	NU
Lamba sınıflandırma grubu	☐ istisnai ☒ risk 1 ☐ risk 2 ☐ risk 3
Lamba başlığı	NU
Ampül	NU
Lambanın beyan değerleri	NU
Lamba üzerinde ilave işaretleme	NU
Lambanın IEC standardına uygun hale getirilmesi.....	NU
Kullanılan ölçüm cihazı	BENTHAM
Ölçüm sırasındaki ortam sıcaklığı.....	23°C
Güvenli kullanım için bilgiler	NU



Possible test case verdicts:

- | | |
|--|----|
| - This test is not applicable for this sample | NA |
| - This result complies with the stated condition(s) | C |
| - This result does not comply with the stated condition(s) | NC |
| - This test is not evaluated since declaration/conditions are not stated | ND |
| - This test is not requested | NR |
| - This test could not be done with the capability of the laboratory | X |
| - This test is not done due to the breakdown of the equipment | EB |

Testing:

Date of receipt of test item : 26.03.2021
Date (s) of performance of tests : 26.03.2021 - 31.03.2021

General remarks:

"(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.

Manufacturer's Declaration per sub-clause 4.2.5 of IEC 60335-1:

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	☐ Yes ☒ Not applicable
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When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies)

General product information and other remarks:

Measurements were made with the transparent cover on the led module.





TS EN 62471

Clause	Requirement + Test	Result – Remark	Verdict
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4	EXPOSURE LIMITS		C
4.1	General		C
	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		C
	Detailed spectral data of a light source are generally required only if the luminance of the source exceeds 10^4 cd m^{-2}	see clause 4.3	C
4.3	Hazard exposure limits		NA
4.3.1	Actinic UV hazard exposure limit for the skin and eye		NA
	The exposure limit for effective radiant exposure is 30 J m^{-2} within any 8-hour period		NA
	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:		NA
	$E_s \cdot t = \sum_{200}^{400} E_\lambda(\lambda, t) \cdot S_{UV}(\lambda) \cdot \Delta\lambda \cdot \Delta t \leq 30 \quad \text{J m}^{-2}$		NA
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:		NA
	$t_{\max} = \frac{30}{E_s} \quad \text{s}$		NA
4.3.2	Near-UV hazard exposure limit for eye		NA
	For the spectral region 315 nm to 400 nm (UV-A) the total radiant exposure to the eye shall not exceed 10000 J 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 W m^{-2} .		NA
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye for time less than 1000 s, shall be computed by:		NA
	$t_{\max} \leq \frac{10000}{E_{UVA}} \quad \text{s}$		NA
4.3.3	Retinal blue light hazard exposure limit		C
	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:		C





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Clause	Requirement + Test	Result – Remark	Verdict
	$L_B \cdot t = \sum_{300}^{700} L_{\lambda}(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t \leq 10^4 \text{ s}$ $t_{\max} = \frac{10^6}{L_B}$	C
	$L_B = \sum_{300}^{700} L_{\lambda} \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t > 10^4 \text{ s}$	C
4.3.4	Retinal blue light hazard exposure limit - small source		NA
	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:	see table 4.2	NA
	$E_B \cdot t = \sum_{300}^{700} E_{\lambda}(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{J} \cdot \text{m}^{-2}$	for $t \leq 100 \text{ s}$	NA
	$E_B = \sum_{300}^{700} E_{\lambda} \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \quad \text{W} \cdot \text{m}^{-2}$	for $t > 100 \text{ s}$	NA
4.3.5	Retinal thermal hazard exposure limit		NA
	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:		NA
	$L_R = \sum_{380}^{1400} L_{\lambda} \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50\,000}{\alpha \cdot t^{0.25}} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	($10 \mu\text{s} \leq t \leq 10 \text{ s}$)	NA
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		NA
	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:		NA
	$L_{IR} = \sum_{780}^{1400} L_{\lambda} \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{6\,000}{\alpha} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	$t > 10 \text{ s}$	NA
4.3.7	Infrared radiation hazard exposure limits for the eye		NA
	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:		NA
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 18\,000 \cdot t^{-0.75} \quad \text{W} \cdot \text{m}^{-2}$	$t \leq 1000 \text{ s}$	NA
	For times greater than 1000 s the limit becomes:		NA
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2}$	$t > 1000 \text{ s}$	NA





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Clause	Requirement + Test	Result – Remark	Verdict
4.3.8	Thermal hazard exposure limit for the skin		NA
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:		NA
	$E_H \cdot t = \sum_{380}^{3000} \sum_i E_{\lambda}(\lambda, t) \cdot \Delta\lambda \cdot \Delta t \leq 20\,000 \cdot t^{0.25} \text{ J} \cdot \text{m}^{-2}$		NA
5	MEASUREMENT OF LAMPS AND LAMP SYSTEMS		C
5.1	Measurement conditions		C
	Measurement conditions shall be reported as part of the evaluation against the exposure limits and the assignment of risk classification.		C
5.1.1	Lamp ageing (seasoning)		NA
	Seasoning of lamps shall be done as stated in the appropriate IEC lamp standard.		NA
5.1.2	Test environment		C
	For specific test conditions, see the appropriate IEC lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations.		NA
5.1.3	Extraneous radiation		NA
	Careful checks should be made to ensure that extraneous sources of radiation and reflections do not add significantly to the measurement results.		NA
5.1.4	Lamp operation		C
	Operation of the test lamp shall be provided in accordance with:		C
	– the appropriate IEC lamp standard, or		C
	– the manufacturer' s recommendation		NA
5.1.5	Lamp system operation		C
	The power source for operation of the test lamp shall be provided in accordance with:		C
	– the appropriate IEC standard, or		NA
	– the manufacturer' s recommendation		C
5.2	Measurement procedure		NA
5.2.1	Irradiance measurements		NA
	Minimum aperture diameter 7mm.		NA
	Maximum aperture diameter 50 mm.		NA
	The measurement shall be made in that position of the beam giving the maximum reading.		NA





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Clause	Requirement + Test	Result – Remark	Verdict
	The measurement instrument is adequate calibrated.		NA
5.2.2	Radiance measurements		C
5.2.2.1	Standard method		C
	The measurements made with an optical system.		C
	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.		C
5.2.2.2	Alternative method		NA
	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.		NA
5.2.3	Measurement of source size		C
	The determination of α , the angle subtended by a source, requires the determination of the 50% emission points of the source.		C
5.2.4	Pulse width measurement for pulsed sources		NA
	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.		NA
5.3	Analysis methods		C
5.3.1	Weighting curve interpolations		C
	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	C
5.3.2	Calculations		C
	The calculation of source hazard values shall be performed by weighting the spectral scan by the appropriate function and calculating the total weighted energy.		C
5.3.3	Measurement uncertainty		C
	The quality of all measurement results must be quantified by an analysis of the uncertainty.	see Annex C in the norm	C
6	LAMP CLASSIFICATION		C
	For the purposes of this standard it was decided that the values shall be reported as follows:	see table 6.1	C
	– for lamps intended for general lighting service, the hazard values shall be reported as either irradiance or radiance values at a distance		C





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Clause	Requirement + Test	Result – Remark	Verdict
	which produces an illuminance of 500 lux, but not at a distance less than 200 mm		
	– for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm		NA
6.1	Continuous wave lamps		NA
6.1.1	Except Group		NA
	In the except group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose:		NA
	– an actinic ultraviolet hazard (E_s) within 8-hours exposure (30000 s), nor		NA
	– a near-UV hazard (E_{UVA}) within 1000 s, (about 16 min), nor		NA
	– a retinal blue-light hazard (L_B) within 10000 s (about 2,8 h), nor		NA
	– a retinal thermal hazard (L_R) within 10 s, nor		NA
	– an infrared radiation hazard for the eye (E_{IR}) within 1000 s		NA
6.1.2	Risk Group 1 (Low-Risk)		C
	In this group are lamps, which exceeds the limits for the except group but that does not pose:		C
	– 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		C
	– 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





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Clause	Requirement + Test	Result – Remark	Verdict
	– 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.		NA
6.2	Pulsed lamps		NA
	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
	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
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Table 4.1		Spectral weighting function for assessing ultraviolet hazards for skin and eye		C
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		NA
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	





TS EN 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)					NA
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)					C
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	$0,011 \cdot \sqrt{(t/10)}$ 0,011 $0,0011 \cdot \sqrt{t}$ 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 $0,011 \cdot \sqrt{(t/10)}$	$50000/(\alpha \cdot t^{0,25})$ $50000/(\alpha \cdot t^{0,25})$
Retinal thermal (weak visual stimulus)	$L_{IR} = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	780 – 1400	> 10	0,011	6000/α





TS EN 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1 Emission limits for risk groups of continuous wave lamps									C
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	NA	0,003	NA	0,03	NA
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	NA	33	NA	100	NA
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	NA	10000	$1.52E+03$	4000000	NA
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1,0*	NA	1,0	NA	400	NA
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	$28000/\alpha$	NA	$28000/\alpha$	NA	$71000/\alpha$	NA
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	$6000/\alpha$	NA	$6000/\alpha$	NA	$6000/\alpha$	NA
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	NA	570	NA	3200	NA
* 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									



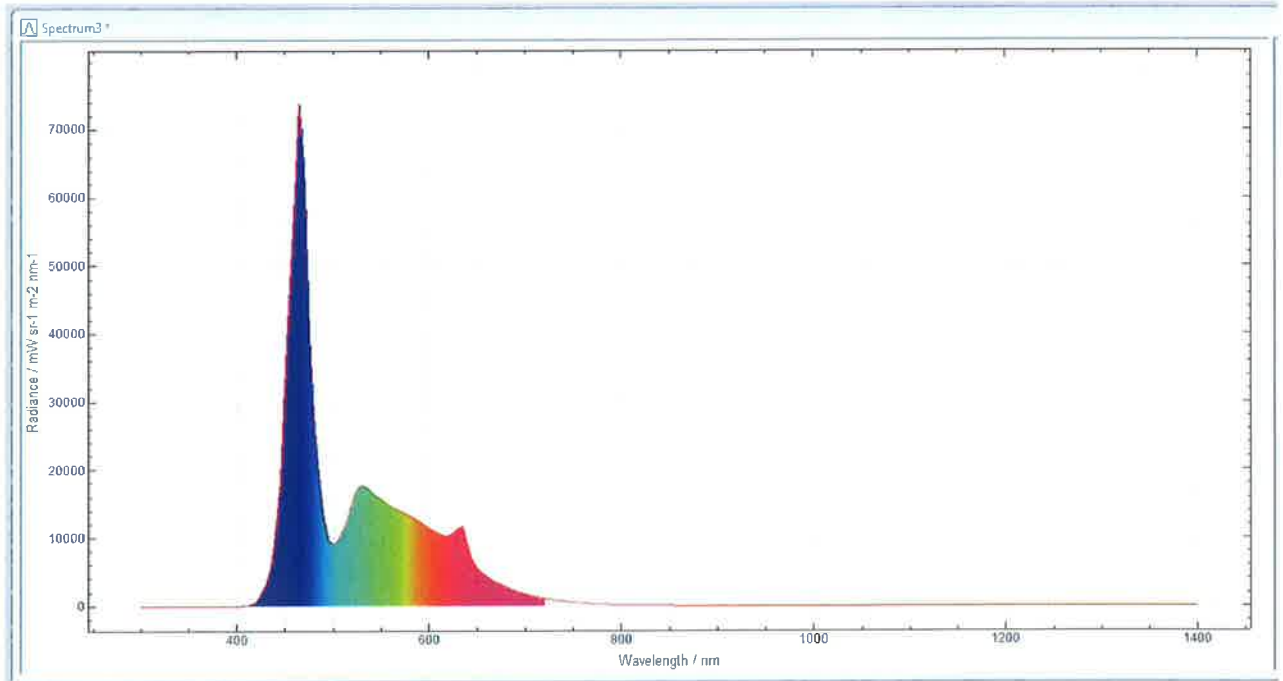
Measurement Results of Photobiological Safety Test

5. Blue Light Hazard

Spectral Range
Luminance

300 – 780 nm
1.05E+06 cd m⁻²

Hazard	Measured value	RG1 Limit	Classification	E _{thr} (lx)
Blue Light Radiance 11mrad FOV (W m ⁻² sr ⁻¹)	1.52E+03	1E+04	RG1	NA





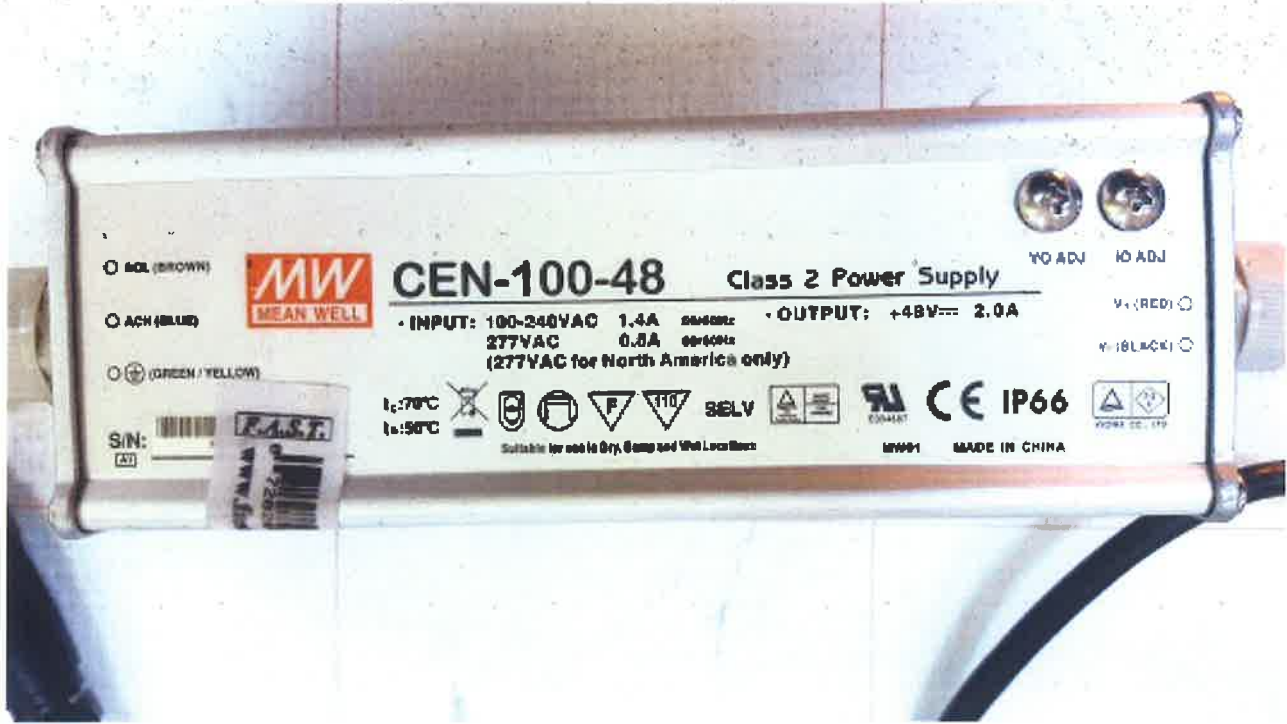
Photographs of the Samples







Auxiliary test equipment used with the sample



Note: Images represent the sample and sample sizes.





TSE62471B - ATTACHMENT

Clause	Requirement + Test	Result - Remark	Verdict
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ATTACHMENT TO TEST REPORT TS EN 62471
EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES
Photobiological safety of lamps and lamps systems

Standard: TS EN 62471:2012

Differences according to: EN 62471:2008

Annex Form No: EU_GD_TSE62471B

Annex Form Originator: TSE

Master Annex Form: 2019-12

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	CENELEC COMMON MODIFICATIONS (EN)	C
4	EXPOSURE LIMITS	C
	Contents of the whole Clause 4 of IEC 62471:2006 moved into a new informative Annex ZB	—
	Clause 4 replaced by the following:	C
	Limits of the Artificial Optical Radiation Directive (2006/25/EC) have been applied instead of those fixed in IEC 62471:2006	C
4.1	General	NA
	First paragraph deleted	—





Table 6.1		Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC)							C
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	NA	-	-	-	-
Near UV		E_{UVA}	$W \cdot m^{-2}$	0,33	NA	-	-	-	-
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	NA	10000	1.52E+03	4000000	NA
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	0,01*	NA	1,0	NA	400	NA
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/ α	NA	28000/ α	NA	71000/ α	NA
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	545000 $0,0017 \leq \alpha \leq 0,011$	NA				
				6000/ α $0,011 \leq \alpha \leq 0,1$	NA				
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	NA	570	NA	3200	NA





Table 6.1	Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC)	C
* ** NOTE	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 The action functions: see Table 4.1 and Table 4.2 The applicable aperture diameters: see 4.2.1 The limitations for the angular subtenses: see 4.2.2 The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5.	

