



Optical Radiation Safety Test system

(EN62471-A, EN62471-B, EN62471-C)

Brochure

Global Office of Lisun Electronics Inc.

<http://www.Lisungroup.com>

Lisun Group (Hong Kong) Limited

Add: Room 803, Chevalier House, 45-51 Chatham Road South, Tsim Sha Tsui, KL, HK

Tel: 00852-68852050 Fax: 00852-30785638

Email: SalesHK@Lisungroup.com

Lisun Electronics (Shanghai) Co., Ltd

Add: 113-114, No. 1 Building, Nanxiang Zhidi Industry Park, No. 1101, Huyi Road, Jiading District, Shanghai, 201802, China

Tel: +86(21)5108 3341 Fax: +86(21)5108 3342

Email: SalesSH@Lisungroup.com

Lisun Electronics Inc. (USA)

Add: 445 S. Figueroa Street, Los Angeles, CA 90071, U.S.A.

Email: Sales@Lisungroup.com

Lisun China Factory

Add: NO. 37, Xiangyuan Road, Hangzhou City, Zhejiang Province, China

Tel: +86-189-1799-6096

Email: Engineering@Lisungroup.com

Leader in Lighting & Electrical Test Instruments

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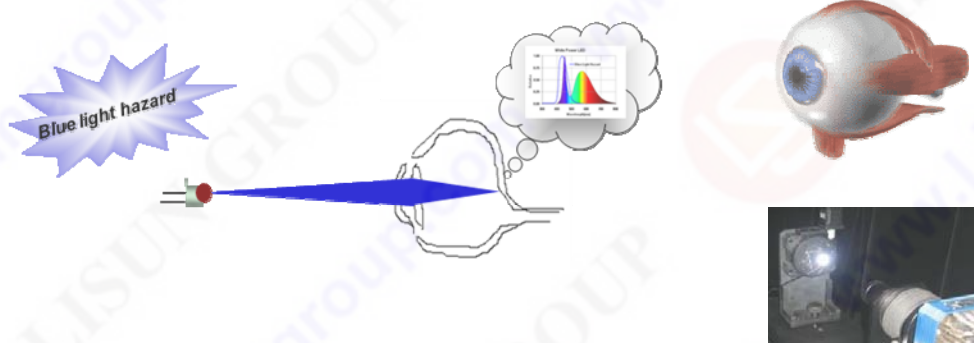
Optical Radiation Safety Test system

Part 1 Introduction

IEC 62471-2006(CIE S009) Photobiological Safety of Lamps and Lamp System and IEC TR62471-2(2009) Guidance on Manufacturing Requirements Relating to Non-laser Optical Radiation Safety have been published addressing hazard to human (mostly eye and skin), and are completely suitable to assess the optical radiation safety of non-laser sources, such as LED products, UV radiation in general lighting products and etc.

It also according to IEC/EN 62471/CIE S009, IEC/TR 62778, GB/T 20145, IEC/EN 60598 Annex P, IEC/EN 60432, IEC/EN 60335, GB 7000.1 and 2009/125/EC

The hazard exposure level of optical radiation of tested sources which may be related from 200nm to 3000nm shall be determined based on the measurement of spectral irradiance and spectral radiance in specified measuring geometry relating with exposure duration.



The IEC 62471 measurement equipment is specialized for determination of the optical radiation hazard exposures specified in IEC 62471, including as follows:

1. Actinic UV hazard exposure (weighted irradiance from 200nm to 400nm) for the skin and eye,
2. Near-UV hazard exposure (irradiance from 315nm to 400nm) for the eye,
3. Retinal blue light hazard exposure (weighted radiance from 300nm to 700nm),
4. Retinal Blue light hazard exposure (weighted irradiance, 300-700nm) - small light source,
5. Retinal thermal hazard exposure (weighted radiance from 380nm to 1400nm),
6. Retinal thermal hazard exposure (weighted radiance; 780-1400nm) - weak visual stimulus,
7. Infrared radiation hazard exposure (irradiance from 780nm to 3000nm) for the eye,
8. Thermal hazard exposure (irradiance from 380nm to 3000nm) for the skin,

Part 2 Principles

The system mainly includes UV-VIS-IR (ultraviolet to infrared) photobiological spectroradiometer, retinal radiometer for testing spectral radiation, light source receiver for testing spectral radiation illuminance, motorized two-axis rotation angle meter for determining the maximum exposure value in space, a light track for measuring ordinary lighting sources at 200 mm and 500lx, a calibrated light source with spectral radiation illuminance in the wavelength range of 200nm to 3000nm, and its spectral radiation wavelength in the range of 300nm to 1400nm.

According to the IEC 62471 standard, the system is effective for evaluating the safety level of various non-laser radiation sources, especially for the field of weighted radiation related to 1.7mrad to 110mrad and radiation specified receiving angle measurement, as well as for the determination of the maximum exposure space related hazard classification and corresponding apparent light sources, etc.

The system is used for general measurements of optical radiation safety according to the requirements of IEC-CTL for laboratories and in accordance with IEC 62471.



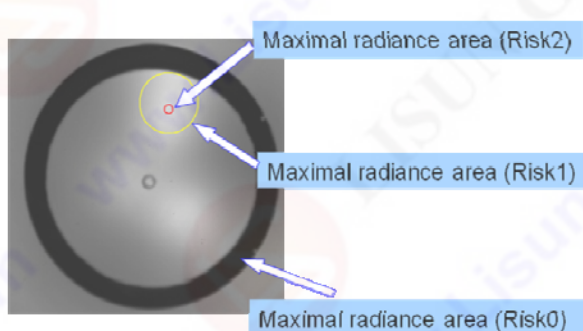
IEC62471 Measurement equipment for the photobiological safety assessment

1、 The measurement of spectral irradiance for wavelength 200nm ~ 3000nm

The UV-VIS-IR spectroradiometer is used to measure the spectral irradiance and radiance of the wavelength range from 200nm to 3000nm. It has the following advantages, such as high SNR, high wavelength resolution and accuracy, very low stray light to meet requirements of the safety evaluation related to IEC62471. The incidence radiation can be detected by the cosine-receptors with the aperture of $\Phi 7\text{m}$ and $\Phi 20\text{m}$. It is calibrated by the calibrated spectral irradiance sources, which are traceable to national metrology laboratory for UV irradiance from 200nm to 400nm and VIS-IR irradiance from 300nm to 3000nm.

2、 The measurement of spectral radiance for wavelength from 300nm to 1400nm:

For non-laser radiation sources, such as the LED products, the spatial radiance distribution is quite complicated. The retinal radiance meter simulating the human eyes' optics system [3] is specialized for optical radiation safety measurements, in accordance with the measurement geometry (acceptance aperture and observation fields) related to IEC62471 classifications to measure the effective radiance of photochemical damage from 300nm to 700nm and the effective radiance of thermal damage from 380nm to 1400nm. The maximum effective radiance can be quickly determined by the the VIS-IR CCD imaging camera and the spectroradiometer. Meanwhile, for infrared radiation sources the subtense angle of the apparent source for the determination of exposure limit of thermal damage can also measured. The uniform spectral radiance source with the wavelength range from 300nm to 1400nm is traceable to national metrology laboratory for calibrating spectral radiance measurement system.



3、 The maximum effective radiance/irradiance measurement

Some lamps and LED products have complicated spatial distributions, especially for the LED lighting luminaries, it is needed to identify the direction, and area on the apparent source, which will cause the greatest potential hazard to the retina.

The motorized two-axis rotation goniometric system and the auto-focusing track are used to determine the maximum exposure of tested sources.

4、 Measuring distance

The measuring distance of non-general lighting sources is at 200mm from viewing point to apparent sources, while the distance of general lighting source is the corresponding distance to produce illuminance 500lx over 6m optical rail.

5、 Calibration Sources

For photobiological safety measurement, it is needed to use four calibration sources:

UV spectral irradiance calibration source is a long-life deuterium lamp powered by 300mA constant current source, used for the spectral range of 200nm~400nm. Visible and near infrared irradiance calibration source is a stable tungsten lamp powered by the constant current source, used for the spectral range of 380nm ~3000nm.

Blue light hazard calibration source is a tungsten radiance source powered by the constant current source, can be used for the spectral radiance and irradiance from 300nm ~700nm. Thermal hazard radiance calibration source is a tungsten high radiance source powered by the constant current source, used for the spectral radiance of 380nm ~1400nm. The calibration sources are calibrated, and traced to NIM.

6、 Evaluation and classification of the photobiological safety

The safety evaluation based on the IEC 62471 classification can be completed by the evaluation software according to the measured data of spectral irradiance and spectral radiance in specified geometric conditions, visible and infrared radiance distributions of the apparent source, pulse waveform etc.

Part 3 Specifications

- Wavelength range: **200nm to 800nm (EN62471-A), 200-1500nm (EN62471-B) and 200-3000nm (EN62471-C)**
- Wavelength accuracy: 0.1nm(UV), 0.2nm(VIS), 0.4nm(IR)
- Optical path design: Simulate the imaging optical path of the human eye to accurately evaluate the effective radiation of the human eye's retina
- Incident aperture: $\Phi 7\text{mm}$ light-receiving aperture, suitable for measurement requirements in all scenarios
- Measuring field of view (fully meeting the standard requirements according to the radiation duration):
 - 1) Effective radiant luminance measurement: 1.5mrad~110mrad (1.7mrad, 11mrad, 100mrad)
 - 2) Effective irradiance measurement: 100mrad, 1.4rad and $2\pi\text{sr}$
- Testing distance: 200mm~20.0m (optional) with a constant field of view FOVs and input aperture
- 16-bit scientific-grade camera: Resolution 2048*1536, High-precision programmable electric focus
- Calibration traceability: Traceable to the National Institute of Metrology (NIM)
- Maximum exposure scanning range: 2π -space
- Dynamic range: 10^8
- High-precision double monochromator spectrometer (optional):

PMT/InGaAs/Si/PbS (optional);

- LISUN goniophotometer [LSG-1890B/LSG-1800A](#) (optional)

Part 4 System Configurations:

No.	Product Name	Remark
1: Photobiological safety test system		
1.1	Photobiological UV hazard test system	EN62471-A: 200-800nm EN62471-B: 200-1500nm EN62471-C: 200-3000nm
1.2	RetiLum photobiological retinal brightness meter system	
1.3	Photobiological near-infrared retinal brightness meter system	
1.4	Photobiological thermal hazard irradiance system	
1.5	Photobiological safety test analysis software	
1.6	Industrial control computers and displays	
2: Optical track		
2.1	High-precision optical guide rail	6m
2.2	Sample Rotating Stage	Used to clamp the sample to be measured and adjust the sample measurement angle
2.3	Sample lifting table	Used to set the sample to be tested
2.4	Aperture	Used to eliminate stray light
2.5	Laser Alignment Device	Assisted measurement and aiming
3: Standard Lamp for calibrate		
3.1	UV Standard Lamp	200-400nm with NIM certificate
3.2	VIS Visible Light Standard Lamp	380-3000nm with NIM certificate
3.3	Standard brightness source	800-1400nm with NIM certificate
3.4	Standard illuminance meter	NIM certificate
4: Testing instruments cabined		
4.1	Digital DC Power Source	LSP-500VARC
4.2	AC Power Source	DC3005
4.3	Digital Power Meter	LS2012
4.4	19inch Cabinet	CASE-19IN

Detailed Specifications:

1.1 Photobiological UV hazard test system

- (1) Non-cross C-T structure high-precision array spectral measurement platform;
- (2) Spectral range: 200nm-400nm;
- (3) Measurement spectrum interval: 1nm;
- (4) Wavelength accuracy: 0.2nm
- (5) Ultra-high measurement dynamic range: 100,000:1

1.2 RetiLum Photobiological Retinal Brightness Meter System - One set

- (1) Non-cross C-T structure high-precision array spectral measurement platform;
- (2) Spectral range: 300nm-1100nm; Accuracy: 0.2nm;
- (3) Measurement spectrum interval: 1nm;
- (5) Ultra-high measurement dynamic range: 100,000:1
- (6) Scientific-grade two-dimensional array image chip: ultra-million-pixel high resolution;
- (7) Radiant brightness measurement aperture: 7mm, meets all lighting conditions;
- (8) Measurement field of view: including 100 mrad, 11mrad, 1.7mrad, meet the standard requirements;

1.3 Photobiological near-infrared retinal brightness meter system

- (1) Non-crossed C-T structure high-precision array spectral measurement platform;
- (2) Spectral range: 900nm-1400nm;
- (3) Measurement spectrum interval: 1nm;
- (4) Wavelength accuracy: 0.4nm
- (5) Ultra-high measurement dynamic range: 100,000:1
- (6) Radiant brightness measurement aperture: 7mm, meeting all lighting conditions;
- (7) Measurement field of view: including 11mrad, 1.7mrad, meeting standard requirements;

1.4 Photobiological thermal hazard irradiance system

- (1) Spectral range: 380-3000nm, 780-3000nm

2. Optical rail system**2.1 Optical rail and bracket**

- (1) Length: 6m
- (2) Including bracket

2.2&2.3 Sample rotation lift

- (1) Used to clamp the sample to be measured
- (2) Can be moved on the rail
- (3) Manual two-dimensional rotation;

2.4 & 2.5 Aperture and laser alignment device

- (1) Size 40*40cm
- (2) Center hole 10cm
- (3) Adjustable

3. Standard light source system**3.1 UV irradiance standard source**

- (1) Spectral range: 200nm-400nm
- (2) Traceable to NIM China Institute of Metrology

3.2 Visible and near-infrared irradiance standard source

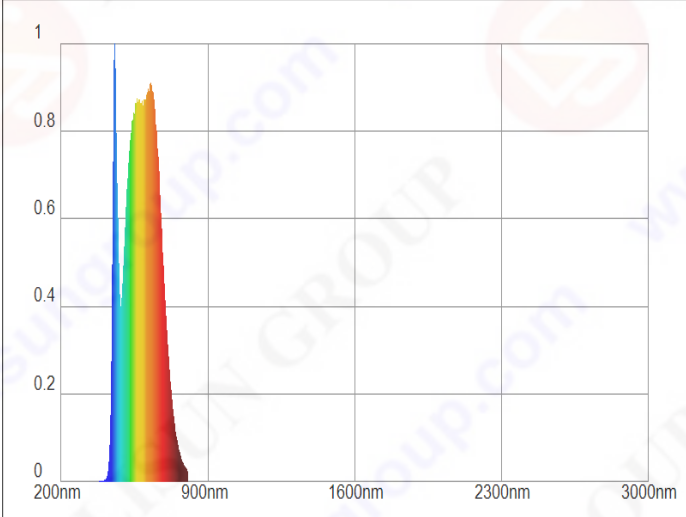

- (1) Spectral range: 380nm-3000nm
- (2) Traceable to NIM China Institute of Metrology

3.3 Spectral radiation brightness standard source

- (1) Spectral range: 300nm-1400nm
- (2) Traceable to NIM China Institute of Metrology

The next pages are the test report for EN62471

Photobiological Safety Test Report of Light source1/3

Product Information							
Name	CT-T004S35W(Track light)	Made by	YOOHUN LIGHTING				
SN	S01	Sent by	YOOHUN LIGHTING				
Model	CT-T004S35W(Track light)	Sent Date	2016-2-18				
Test condition							
Measure Distance [mm]	3000.0	Stable Time[min]	1				
Ref.FILE	IEC62471,GBT20145	Test Lab	Anbotek compliance Laborator				
Lamp Type	CW	Tested by	Rain				
Temperature[°C]	25.3	Approved by	VIC				
Humidity[%]	60.0	Testing Time	2016-2-18				
Test Results							
							
Spectral distribution		Luminance distribution					
Emission Limits for Risk Group of Continuous Wave Lamps							
Risk	Exempt		Low Risk		Mod Risk		RG
	Limit	Result	Limit	Result	Limit	Result	
Es[W·m-2]	0.001	1.92e-08	0.003	1.92e-08	0.03	1.92e-08	RG0
Euva[W·m-2]	10	4.24e-04	33	4.24e-04	100	4.24e-04	RG0
Lb[W·m-2·sr-1]	100	1.23e+00	10000	2.05e+01	4000000	3.06e+01	RG0
Eb[W·m-2]	-	-	-	-	-	-	
Lr[W·m-2·sr-1]	1.06e+06	2.89e+02	1.06e+06	4.32e+02	2.68e+06	4.32e+02	RG0
Lir[W·m-2·sr-1]	2.26e+05	2.16e-01	2.26e+05	2.16e-01	2.26e+05	2.16e-01	RG0
Eir[W·m-2]	100	7.21e-03	570	7.21e-03	3200	7.21e-03	RG0
a(mrad)	26.5						
RG	RG0						
Electric Results							
Voltage[V]	220.0000		Current[A]	0.0000			
Watt [W]	0.0000		Power Factor	0.0000			