



# Optical Radiation Safety Test system

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

## Brochure

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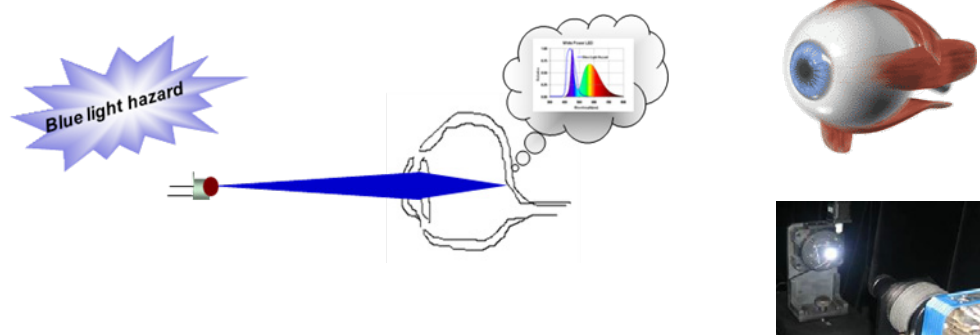
# Optical Radiation Safety Test system

## Part 1 Introduction

IEC62471-2006(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:

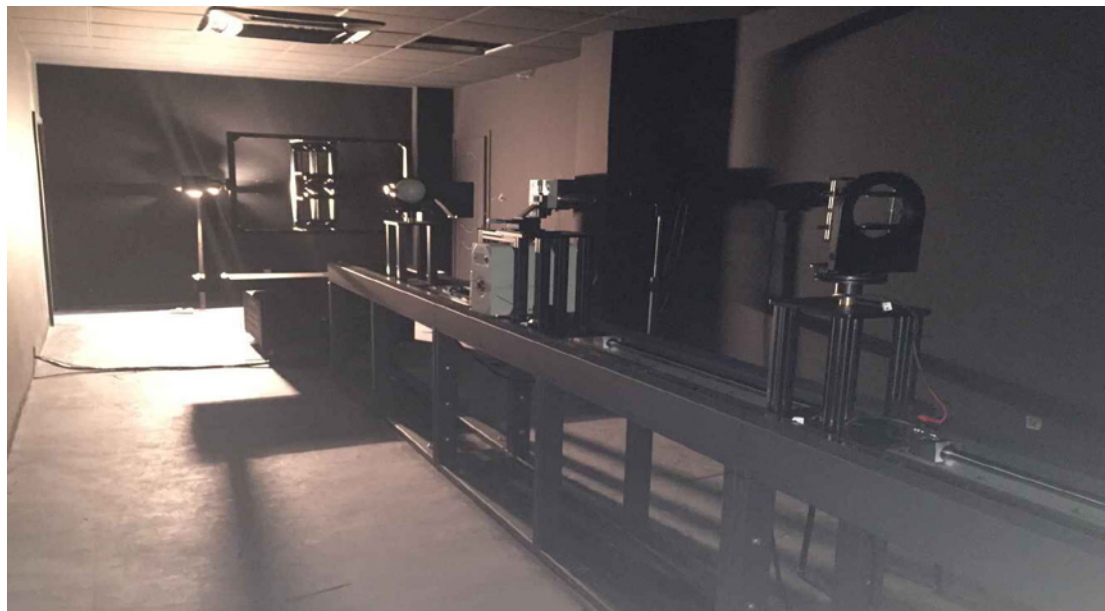
1. Actinic UV hazard exposure (weighted irradiance from 200nm to 400nm) for the skin and eye,
2. Near-UV hazard exposure (irradiance from 315nm to 400nm) for the eye,
3. Retinal blue light hazard exposure (weighted radiance from 300nm to 700nm),
4. Retinal Blue light hazard exposure (weighted irradiance, 300-700nm) - small 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 consists of a UV-VIS-IR spectroradiometer, a retina radiance meter for the measurement of spectral radiance, a light receiver for the measurement of spectral irradiance, a motorized two-axis rotation goniometer for the measurement of spatial maximum exposure value, an optical rail for the measurement at 200mm and 500lx condition of general lighting sources, calibrated sources of spectral irradiance with the wavelength from 200nm to 3000nm and that of spectral radiance with the wavelength from 300nm to 1400nm.

According to IEC62471, this system is advantageous specially to evaluate the safety class of various non-laser radiation sources, especially for the measurement of weighted radiance within related 1.7mrad to 110mrad fields of viewing and irradiance in the specified receiving angles, the determination of maximum exposure related to hazard classification in the space and corresponding apparent source, etc.

The system can be applied for general measurement of optical radiation safety addressing IEC62471 in according with IEC-CTL decision for laboratory requirements.



IEC62471 Measurement equipment for the photobiological safety assessment

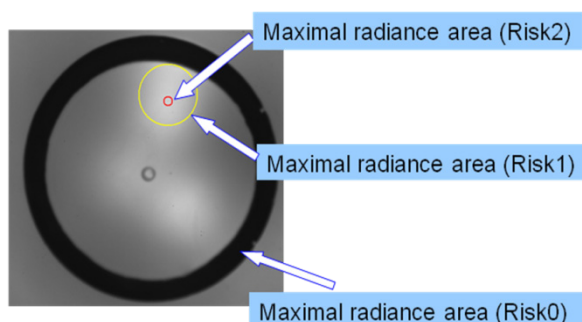
### 1、 The measurement of spectral irradiance for wavelength 200nm ~ 3000nm

The UV-VIS-IR spectroradiometer is composed of the double dispersion optics of a three-grating monochromator and a multi-band filter wheel, a motor-controllable five detectors 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  $\Phi 7m$  and  $\Phi 20m$ . 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 IEC62471 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

1. Wavelength range: **200nm to 800nm (EN62471-A), 200-1500nm (EN62471-B) and 200-3000nm (EN62471-C)**
2. Radiance geometry: optics simulating human eye's retina
3. Acceptance aperture: Dia. 7mm for radiance; Dia. 20mm & 7mm for irradiance
4. FOV range: 1.5mrad to 110mrad (1.7mrad, 11mrad, 100/110mrad) according to exposure duration of radiance measurement; and 100mrad, 1.4rad and 6.28rad for irradiance measurement
5. Testing distance: 200mm to 6.0m(optional) with constant FOVs and input aperture
6. Image resolution: 1600×1200
7. Maximum exposure scanning rang: 2pi-space,
8. Calibration: It can be traced to NIM
9. Detectors: PMT/InGaAs/Si/PbS
10. Imaging radiance meter: scientific grade 16bit CCD camera with TEC,
11. Sampling speed of pulse source: 20 us to 10 s
12. Wavelength accuracy: 0.1nm(UV), 0.2nm(VIS), 0.4nm(IR)
13. Goniophotometer (LSG-1800B/LSG-1700B) is option

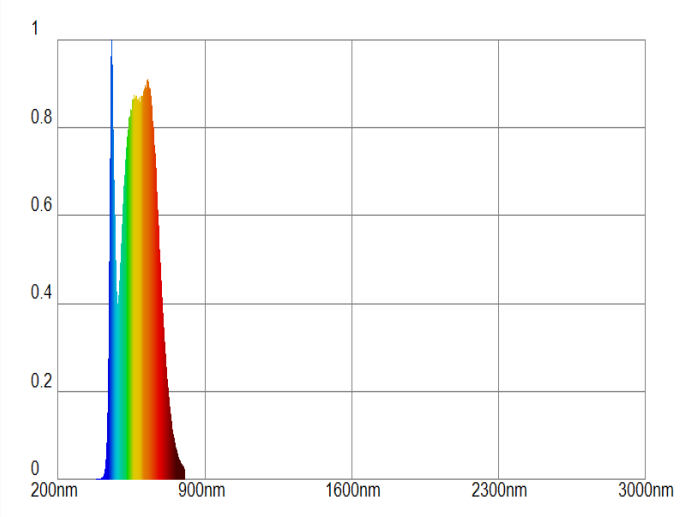
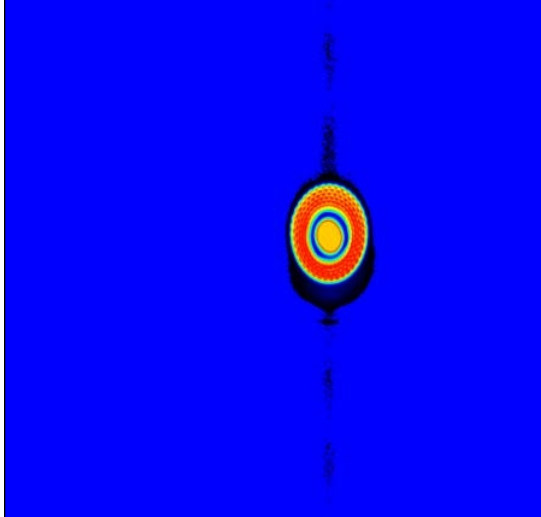
## Part 4 System Configurations:

No.	Product Name	Remark
<b>Part 1: Spectroradiometer and Software</b>		
1	Photobiological Spectroradiometer	EN62471-A: 200-800nm EN62471-B: 200-1500nm EN62471-C: 200-3000nm
2	UV quartz fiber and Cosine Detector	
3	Evaluation Software for Photobiological Safety	
<b>Part 2: Radiance Meter</b>		
1	Retinal Radiance Meter	
2	Baffle	
<b>Part 3: Optical Rail and accessories</b>		
1	Precision programmable testing bench	
2	High Precision Optical Rail	
3	Optical Rail Base	
4	Motorizd Movable Table	
5	3-D Rotation Goniometer	
6	Diaphragm to Eliminate Stray Light	
7	Laser Alignment Device	
8	4 sets of Jigs for testing lamp	
<b>Part 4: Standard Lamp for calibrate</b>		
1	UV Standard Lamp	200-400nm with NIM certificate
2	VIS Standard Lamp with NIM certificate	380-800nm with NIM certificate
3	NIR or IR Standard Lamp with NIM certificate	800-1500nm or 890-3000 with NIM certificate
4	UV lamp Calibrating Power Source	NIM certificate
<b>Part 5: Testing instruments cabined</b>		
1	Digital DC Power Source	
2	AC Power Source	
3	Digital Power Meter	
4	Standard luminance source	
5	UV Radiation Meter	
6	VIS Luxmeter	
7	19inch Cabinet	

**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		