

<b>TEST REPORT</b> <b>IEC 62471 and/or EN 62471</b> <b>Photobiological safety of lamps and lamp systems</b>	
<b>Report Reference No.</b> .....	GZES160200191131
<b>Tested by (name + signature)</b> .....	Selina Xie <i>Selina Xie</i>
<b>Approved by (name + signature)</b> .....	Anlay Dong <i>Anlay Dong</i>
<b>Date of issue</b> .....	2016-03-03
<b>Total number of pages</b> .....	13 pages
<b>Testing Laboratory</b> .....	SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch
<b>Address</b> .....	198 Kezhu Road, Science City, Economic & Technology Development Area, Guangzhou, Guangdong, China
<b>Applicant's name</b> .....	Shenzhen Runlite Technology Co., Ltd.
<b>Address</b> .....	A15 building, Tantou West, Industrial Zone, Songgang Town, Bao'an District, Shenzhen City, P.R.C.
<b>Test specification:</b>	
<b>Standard</b> .....	<input type="checkbox"/> IEC 62471: 2006 (First Edition) <input checked="" type="checkbox"/> EN 62471: 2008
<b>Test procedure</b> .....	Test report
<b>Non-standard test method</b> .....	N/A
<b>Test Report Form No.</b> .....	IECEN62471A
<b>TRF Originator</b> .....	SGS-CSTC
<b>Master TRF</b> .....	Dated 2012-05
<b>Test item description</b> .....	SMD LED
<b>Trade Mark</b> .....	--
<b>Manufacturer</b> .....	Same as applicant
<b>Model/Type reference</b> .....	SMD LED
<b>Ratings</b> .....	DC 3 V – 4 V, 150 mA, 0,5 W



<p><b>Summary of testing:</b></p> <p>These tests were conducted by test lab that fulfils the requirements of standard ISO/IEC 17025.</p> <p>The tests were conducted under 4 Vd.c., 150 mA.</p> <p>The submitted samples were found to be in compliance with EN 62471: 2008.</p>	
<p><b>Tests performed (name of test and test clause):</b></p> <p>4.3.1 Actinic UV hazard exposure limit for the skin and eye</p> <p>4.3.2 Near-UV hazard exposure limit for eye</p> <p>4.3.3 Retinal blue light hazard exposure limit</p> <p>4.3.4 Retinal blue light hazard exposure limit - small source</p> <p>4.3.5 Retinal thermal hazard exposure limit</p> <p>4.3.6 Retinal thermal hazard exposure limit – weak visual stimulus</p> <p>4.3.7 Infrared radiation hazard exposure limits for the eye</p> <p>4.3.8 Thermal hazard exposure limit for the skin</p>	<p><b>Testing location:</b></p> <p>Refer to page 1.</p>
<p><b>Summary of compliance with National Differences:</b></p> <p>National requirements of EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES for EN 62471: 2008 were taken into account.</p>	
<p><b>Copy of marking plate:</b></p> <p>--</p>	

<b>Test item particulars</b> .....	
Tested lamp .....	<input checked="" type="checkbox"/> continuous wave lamps <input type="checkbox"/> pulsed lamps
Tested lamp system .....	Non-GLS
Lamp classification group .....	<input checked="" type="checkbox"/> exempt <input type="checkbox"/> risk 1 <input type="checkbox"/> risk 2 <input type="checkbox"/> risk 3
Lamp cap .....	--
Bulb .....	--
Rated of the lamp .....	--
Furthermore marking on the lamp .....	--
Seasoning of lamps according IEC standard .....	--
Used measurement instrument .....	Ref. to List of test equipment used
Temperature by measurement .....	25 ± 5 °C
Information for safety use .....	--
<b>Possible test case verdicts:</b>	
– 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)	
<b>Testing:</b>	
Date of receipt of test item .....	: 2016-03-01
Date (s) of performance of tests .....	: 2016-03-03
General remarks:	
<p>The test results presented in this report relate only to the object tested.          This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.          "(See Enclosure #)" refers to additional information appended to the report.          "(See appended table)" refers to a table appended to the report.          Throughout this report a comma is used as the decimal separator.          List of test equipment must be kept on file and available for review.</p> <p>When determining for test conclusion, measurement uncertainty of tests has been considered.</p> <p>This document is issued by the Company subject to its General Conditions of Service, available on request or accessible at <a href="http://www.sgs.com/en/Terms-and-Conditions.aspx">http://www.sgs.com/en/Terms-and-Conditions.aspx</a> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <a href="http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Document.aspx">http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Document.aspx</a>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days.</p>	
<b>General product information:</b>	
The SMD LED can emit white light when powered.	

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
<b>4</b>	<b>EXPOSURE LIMITS</b>		--
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 $10^4 \text{ cd m}^{-2}$		P
4.3	Hazard exposure limits		N/A
4.3.1	Actinic UV hazard exposure limit for the skin and eye		N/A
	The exposure limit for effective radiant exposure is $30 \text{ J m}^{-2}$ 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
	$E_s \cdot t = \sum_{200}^{400} \sum_t E_\lambda(\lambda, t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 30 \quad \text{J m}^{-2}$		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 $10000 \text{ J m}^{-2}$ 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 $10 \text{ W m}^{-2}$ .		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		N/A
	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:		N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	$L_B \cdot t = \sum_{300}^{700} \sum_t L_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t \leq 10^4 \text{ s}$ $t_{\text{max}} = \frac{10^6}{L_B}$	N/A
	$L_B = \sum_{300}^{700} L_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$		N/A
4.3.4	Retinal blue light hazard exposure limit - small source		N/A
	Thus the spectral irradiance at the eye $E_\lambda$ , weighted against the blue-light hazard function $B(\lambda)$ shall not exceed the levels defined by:		N/A
	$E_B \cdot t = \sum_{300}^{700} \sum_t E_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{J} \cdot \text{m}^{-2}$		N/A
	$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \quad \text{W} \cdot \text{m}^{-2}$		N/A
4.3.5	Retinal thermal hazard exposure limit		N/A
	To protect against retinal thermal injury, the integrated spectral radiance of the light source, $L_\lambda$ , 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:		N/A
	$L_{IR} = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50\,000}{\alpha \cdot t^{0,25}} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$		N/A
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		N/A
	For an infrared heat lamp or any near-infrared source where a weak visual stimulus is inadequate to activate the aversion response, the near infrared (780 nm to 1400 nm) radiance, $L_{IR}$ , as viewed by the eye for exposure times greater than 10 s shall be limited to:		N/A
	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{6\,000}{\alpha} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$		N/A
4.3.7	Infrared radiation hazard exposure limits for the eye		N/A
	To avoid thermal injury of the cornea and possible delayed effects upon the lens of the eye (cataractogenesis), ocular exposure to infrared radiation, $E_{IR}$ , over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed:		N/A
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \leq 18\,000 \cdot t^{-0,75} \quad \text{W} \cdot \text{m}^{-2}$		N/A
	For times greater than 1000 s the limit becomes:		N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 100 \quad W \cdot m^{-2}$		N/A
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
	$E_H \cdot t = \sum_{380}^{3000} \sum_t E_{\lambda}(\lambda, t) \cdot \Delta t \cdot \Delta\lambda \leq 20\,000 \cdot t^{0,25} \quad J \cdot m^{-2}$		N/A

<b>5</b>	<b>MEASUREMENT OF LAMPS AND LAMP SYSTEMS</b>		--
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		P
	Operation of the test lamp shall be provided in accordance with:		P
	– the appropriate IEC lamp standard, or		N/A
	– the manufacturer's recommendation		P
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

<b>IEC 62471</b>			
Clause	Requirement + Test	Result – Remark	Verdict
	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		N/A
	The measurements made with an optical system.		N/A
	The instrument shall be calibrated to read in absolute radiant power per unit receiving area and per unit solid angle to acceptance averaged over the field of view of the instrument.		N/A
5.2.2.2	Alternative method		P
	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.		P
5.2.3	Measurement of source size		N/A
	The determination of $\alpha$ , the angle subtended by a source, requires the determination of the 50% emission points of the source.		N/A
5.2.4	Pulse width measurement for pulsed sources		N/A
	The determination of $\Delta t$ , 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.		P
<b>6</b>	<b>LAMP CLASSIFICATION</b>		<b>--</b>
	For the purposes of this standard it was decided that the values shall be reported as follows:	see IEC 62471 table 6.1	P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	– 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	r = 200 mm	P
6.1	Continuous wave lamps		P
6.1.1	Exempt Group		P
	In the exempt 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
	– 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 exempt group but that does not pose:		N/A
	– an actinic ultraviolet hazard ( $E_S$ ) within 10000 s, nor		N/A
	– a near ultraviolet hazard ( $E_{UVA}$ ) within 300 s, nor		N/A
	– a retinal blue-light hazard ( $L_B$ ) within 100 s, nor		N/A
	– a retinal thermal hazard ( $L_R$ ) within 10 s, nor		N/A
	– an infrared radiation hazard for the eye ( $E_{IR}$ ) within 100 s		N/A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard ( $L_{IR}$ ), within 100 s are in Risk Group 1.		N/A
6.1.3	Risk Group 2 (Moderate-Risk)		N/A
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:		N/A
	– an actinic ultraviolet hazard ( $E_S$ ) within 1000 s exposure, nor		N/A
	– a near ultraviolet hazard ( $E_{UVA}$ ) within 100 s, nor		N/A



IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	– a retinal blue-light hazard ( $L_B$ ) within 0,25 s (aversion response), nor		N/A
	– a retinal thermal hazard ( $L_R$ ) within 0,25 s (aversion response), nor		N/A
	– an infrared radiation hazard for the eye ( $E_{IR}$ ) within 10 s		N/A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard ( $L_{IR}$ ), within 10 s are in Risk Group 2.		N/A
6.1.4	Risk Group 3 (High-Risk)		N/A
	Lamps which exceed the limits for Risk Group 2 are in Group 3.		N/A
6.2	Pulsed lamps		N/A

EN 62471			
Clause	Requirement + Test	Result - Remark	Verdict
	<b>CENELEC COMMON MODIFICATIONS (EN)</b>		
<b>4</b>	<b>EXPOSURE LIMITS</b>		—
	Contents of the whole Clause 4 of IEC 62471:2006 moved into a new informative Annex ZB		—
	Clause 4 replaced by the following:		P
	Limits of the Artificial Optical Radiation Directive (2006/25/EC) have been applied instead of those fixed in IEC 62471:2006	See EN 62471 table 6.1	P
4.1	General		P
	First paragraph deleted		—

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

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

\* 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

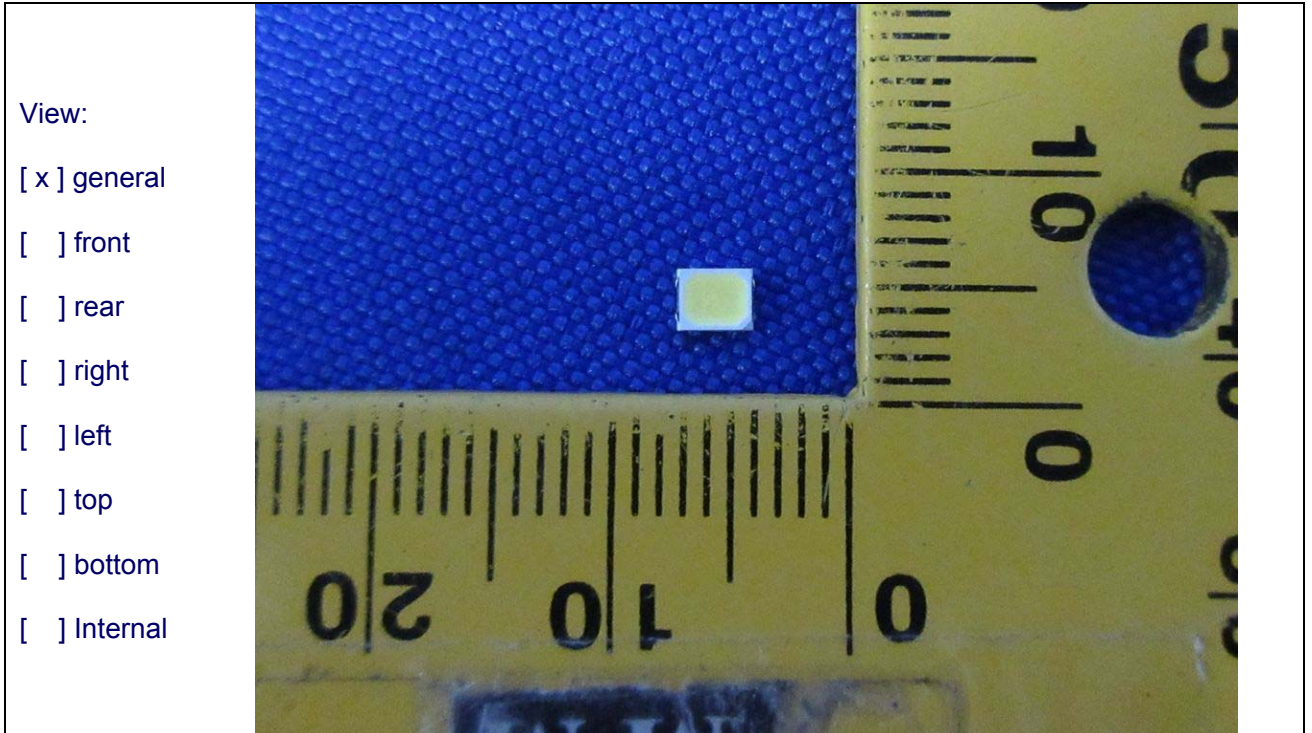
EN 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1		Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC)							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	-	-	-	-	
Near UV	--	$E_{UVA}$	$W \cdot m^{-2}$	0,33	0	-	-	-	-	
Blue light	$B(\lambda)$	$L_B$	$W \cdot m^{-2} \cdot sr^{-1}$	100	49,2	10000	--	4000000	--	
Blue light, small source	$B(\lambda)$	$E_B$	$W \cdot m^{-2}$	0,01*	--	1,0	--	400	--	
Retinal thermal	$R(\lambda)$	$L_R$	$W \cdot m^{-2} \cdot sr^{-1}$	$28000/\alpha$	47423	$28000/\alpha$	--	$71000/\alpha$	--	
Retinal thermal, weak visual stimulus**	$R(\lambda)$	$L_{IR}$	$W \cdot m^{-2} \cdot sr^{-1}$	545000	--					
				$0,0017 \leq \alpha \leq 0,011$						
IR radiation, eye	--	$E_{IR}$	$W \cdot m^{-2}$	$6000/\alpha$	--					
				$0,011 \leq \alpha \leq 0,1$						
IR radiation, eye	--	$E_{IR}$	$W \cdot m^{-2}$	100	--	570	--	3200	--	

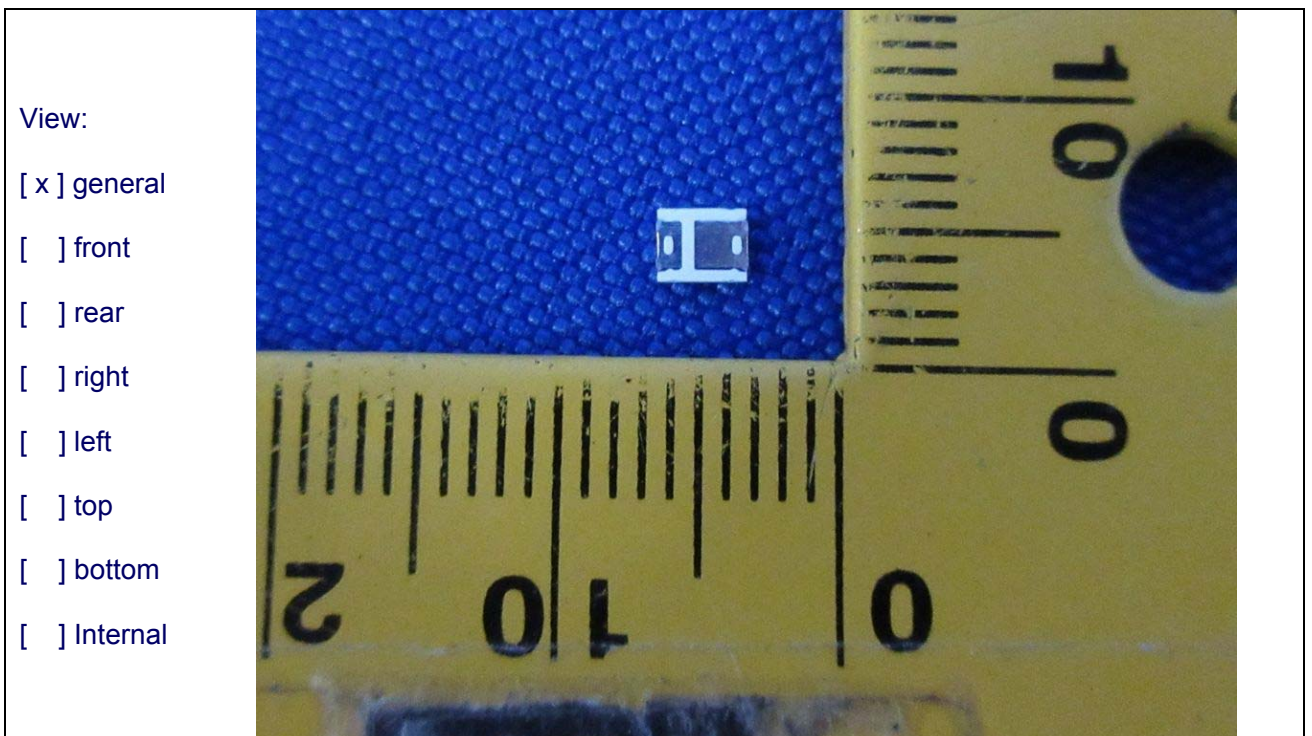
\* Small source defined as one with  $\alpha < 0,011$  radian. Averaging field of view at 10000 s is 0,1 radian.  
 \*\* Involves evaluation of non-GLS source

## Photo documentation

Details of: \_\_\_\_\_



Details of: \_\_\_\_\_



— End of report —