TEST REPORT

Applicant : Mid Ocean Brands B.V.

Address: 7/F., Kings Tower, 111 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong

The following sample(s) and sample information was/were submitted and identified by client as:

Sample Name: Laser pointer in metal;
Multifunctional silver pen

Model: MO8097;MO8193

Receiving Date: 20-Feb-2023

Test Period: From 20-Feb-2023 to 28-Feb-2023

Add Information: -

Test Summary:

#	Test Item(s)	Reference Standard/Method	Result
1	Safety of laser products - Part 1: Equipment classification and requirements	EN 60825-1:2014	**PASS**

****

Signed for and on behalf of STS

Mark Mai
(Technical Director)

GUANGZHOU DEPUHUA TEST SERVICES CO., LTD
TESTING SERVICES

Result:

1. Safety of laser products - Part 1: Equipment classification and requirements
EN 60825-1:2014

EN 60825-1			
Clause	Requirement + Test	Result - Remark	Verdict
4	**CLASSIFICATION PRINCIPLES**		
4.3	Classification rules		---
4.3 a	Radiation of a single wavelength		P
4.3 b	Radiation of multiple wavelengths		N/A
	1) Laser product emits at two or more wavelengths shown as additive in Table 1		N/A
	2) Laser product emits at two or more wavelengths not shown as additive in Table 1		N/A
4.3 c	Radiation from extended sources (see 5.4.3)		N/A
4.3 d	Non-uniform, non-circular or multiple apparent source		N/A
4.3 e	Time bases		---
	1) 0,25 s	Class 2	P
	2) 100 s		N/A
	3) 30000 s		N/A
4.3 f	Repetitively pulsed or modulated lasers		N/A
	1) Any single pulse		N/A
	2) Average power for pulse trains		N/A
	3) Pulse duration t ≤ Ti ..... : Number of pulses N and C5..... :		N/A
	3) Pulse duration t Ti..... : Number of pulses N and C5 ..... :		N/A
4.4	Laser products designed to function as conventional lamps.		N/A
	measured at 200mm distance from closest point of human access(>5 mrad).		N/A
	Un-weighted radiance L measured at 200 mm distance (comparison with LT = 1 MWm-2sr-1 under reasonably foreseeable single fault conditions.		N/A

	Evaluation of emission according to IEC 62471 series (optional): Standard applied (IEC 62471 series)…….: Risk Group…….... : Labelling…… ... : Classification of product based on accessible laser radiation (if no laser radiation accessible: Class 1).		N/A
5	**DETERMINATION OF THE ACCESSIBLE EMISSION LEVEL and PRODUCT CLASSIFICATION**		
5.1	Tests		---
	Compliance under reasonably foreseeable single fault conditions.		--
5.3	Determination of the class of the laser product ... : For Class 1C: vertical safety standard applied with requirements for Class 1C.		---
5.4	Measurement geometry		---
5.4.1	General		---
5.4.2	Default (simplified) evaluation		P
	Conditions applied ..... :	Condition 1, Condition 3	P
	Aperture diameter ..... :	Condition 1: 50 mm Condition 3: 7 mm	P
	Reference point : ..... :	Focal point	P
	Measurement distance ..... : (for each condition)	Condition 1: 2000 mm Condition 3: 100 mm	P
5.4.3	Evaluation condition for extended sources		N/A
	Conditions applied ..... :		N/A
	Most restrictive position ..... : (distance from reference point)		N/A
	Angular subtense of the apparent source and C_6: (for each condition)		N/A
5.4.3 a	Aperture diameters (for each condition). ..... :		N/A
5.4.3 b	Angle of acceptance (for each condition)……..:		N/A
6	**ENGINEERING SPECIFICATIONS**		
6.2	Protective housing		---
6.2.1	General		---

	Protective housing prevents access to energy levels in excess of the AEL for Class 1.		N/A
	Protective housing prevents access to energy levels equivalent to Class 4 and withstands exposures under reasonably foreseeable single fault conditions.	No Class 4 laser source	N/A
	Maintenance of Class 1, 1C, 1M, 2, 2M, or 3R (access to emissions of Class 3B or 4 is prevented).	No maintenance by user	N/A
	Maintenance of Class 3B product (access to emission of Class 4 is prevented).		N/A
6.2.2	Service	Tool is required	P
6.2.3	Removable laser system (laser system complies with requirements of Clauses 6 and 7).		N/A
6.3	Access panels and safety interlocks		---
6.3.1	Panel is intended to be removed during operation (or maintenance) and would give access to higher energy levels (see Table 13).		N/A
	Accessible emission (after removal of the panel) corresponds to product Class (designated by “X” in Table 13)		N/A
	Emission through the opening if interlocked panel of Class 1, 1C, 1M, 2, or 2M is removed (Emission AEL of Class 1M or 2M).		N/A
	Emission through the opening if interlocked panel of Class 3R, 3B, or 4 is removed (Emission AEL of Class 3R).		N/A
	Requirements regarding reasonably foreseeable single fault condition.		N/A
6.3.2	Override mechanism		N/A
	Behaviour of override in operation when the panel is replaced.		N/A
	Visible or audible warning for override mode.		N/A
6.4	Remote interlock connector		N/A
6.5	Manual reset		N/A
6.6	Key control		N/A
6.7	Laser radiation emission warning		---
6.7.1	Laser product is a 3R (λ400 nm; λ700 nm), 1C, 3B or 4 laser systems.		N/A

6.7.2	Audible or visible warning.		N/A
	Warning is failsafe or redundant.		N/A
	Viewing of the visible warning does not require exposure to emissions AEL for Class 1M and 2M .		N/A
6.7.3	Operational control and laser aperture are provided with a warning device when they are separated more than 2 m from warning device.		N/A
6.7.4	Visible indication of output aperture if laser emission may be distributed through more than one output.		N/A
6.7.5	Switch for handheld Class 3R device must be depressed for emission (in lieu of emission indicator).		N/A
6.8	Beam stop or attenuator		N/A
6.9	Controls	No need for class 2 laser	--
6.10	Viewing optics	No viewing optics	N/A
	a) Human access to laser radiation in excess of Class 1M prevented when the shutter is opened or attenuation varied.		N/A
	b) Opening of the shutter or variation of the attenuation prevented when exposure to laser radiation in excess of Class 1M is possible.		N/A
6.11	Scanning safeguard		N/A
6.12	Safeguard for Class 1C products		N/A
	a) Human access to laser radiation in excess of AEL for Class 1 measured under Condition 3 is prevented.		N/A
	b) Human access to laser radiation in excess of AEL for Class 3B measured through 3,5 mm aperture at 5 mm distance from applicator is prevented.		N/A
6.13	Walk-in access		N/A
	a) Means provided so that any person inside the housing can prevent activation of Class 3B or 4 laser hazards.	No walk-in access	N/A
	b) A warning device provides adequate warning of emission to any person within the housing.		N/A

	c) Where “walk-in” access during operation is intended or reasonably foreseeable, emission of laser radiation that is equivalent to Class 3B or 4 while someone is present inside the enclosure of Class 1, Class 2 or Class 3R product is prevented by engineering means.		N/A
6.14	Environmental conditions		---
	- climatic conditions		--
	- vibration and shock		--
6.15	Protection against other hazards		---
6.15.1	Non-optical hazards (product safety standard)	Shall be evaluated according to relevant safety standards	N/A
	- electrical hazards;		N/A
	- excessive temperature;		N/A
	- spread of fire from the equipment;		N/A
	- sound and ultrasonics;		N/A
	- harmful substances;		N/A
	- explosion;		N/A
6.15.2	Collateral radiation		N/A
6.16	Power limiting circuit		N/A

7	**LABELLING**		
7.1	General		---
	Labels durable, permanently affixed		P
	Labels clearly visible		P
	Reading of labels is possible without exposure to laser radiation in excess of AEL for Class 1.		P
	Colour combination		P
	Labelling impractical due to the size or design of the product.	Affix to product	N/A
	Warning label – Hazard symbol (Figure 3)		P
7.2 - 7.7	Text on explanatory label or pictogram (laser class, warning text)	Class 2 laser product	P

7.8	Aperture label		P
7.9	Radiation output and standards information		---
	Max output of laser radiation ..... :	Class 2: <1 mW	P
	Pulse duration ..... :		N/A
	Emitted wavelength(s) ..... :	nm	P
	Name and publication date of the standard..... :	Name: EN 50689:2021, EN 60825-1:2014+ A11:2021	P
7.10	Labels for access panels		---
7.10.1 a) – f)	Labels for panels - warning wording used ..... :		N/A
7.10.2	Labels for safety interlocked panels - Warning wording used ..... :		N/A
7.11	Warning for invisible laser radiation ..... :		N/A
7.12	Warning for visible laser radiation ..... :		P
7.13	Warning for potential hazard to the skin or anterior parts of the eye - warning wording used..... :	Not exceed AEL of class 3B	N/A

8	**OTHER INFORMATIONAL REQUIREMENTS**		
8.1	Information for the user		---
	a) adequate instructions for assembly, maintenance and safe use and description of the classification limitations, if appropriate.		N/A
	b) additional warning for Class 1M and 2M		N/A
	c) laser beam parameters for radiation above the AEL of Class 1		---
	Wavelength ..... :	nm	P
	Beam divergence ..... :	650nm	N/A
	Pulse pattern ..... : (pulse duration, repetition rate, …)		N/A
	Maximum power or energy output ..... :	Class 2: 1 mW	P
	d) safety instruction for embedded laser products and other incorporated laser products.		N/A

	e) MPE and NOHD for Class 3B and 4 laser products; For collimated beam Class 1M and 2M lasers the extended NOHD (ENOHD).		N/A
	f) information for the selection of eye protection.		N/A
	g) reproduction of all required labels and warnings.		N/A
	h) location of laser apertures		P
	i) list of controls, adjustments of procedures for operation and maintenance - and warning statement.		N/A
	j) information (compatibility requirements) about laser energy source if not incorporated.		N/A
	k) additional warning for Class 1, 1M, 2, 2M, and 3R regarding skin or corneal burns.		N/A
	l) Information for Class 1C products (e.g. warning that repeated application may pose a risk).		N/A
8.2	Purchasing and service information		P
	a) safety classification of each laser product stated in all descriptive material (e.g. brochures).		P
	b) adequate instructions for servicing available: warnings and precautions regarding exposure of laser emission above Class 1 maintenance schedule list of controls and procedures that could increase accessible emissions description of displaceable parts protective procedures for service personnel reproduction of labels and hazard warnings		N/A
9	**ADDITIONAL REQUIREMENTS FOR SPECIFIC LASER PRODUCTS**		
9.1	Applicable other parts of the standard series IEC60825		---
	IEC 60825-2 (Safety of optical communication systems)		N/A
	IEC 60825-4 (Laser guards)		N/A
	IEC 60825-12 (Safety of free space optical communication systems used for transmission of information)		N/A
9.2	Medical laser products: Class 3B and Class 4 medical laser products comply with IEC 60601-2-22		N/A

9.3	Laser processing machines: Comply with IEC/ISO 11553 series.		N/A
9.4	Electric toys: Comply with IEC 62115		N/A
9.5	Consumer electronic products: Comply with IEC 60950 (IT-equipment) or IEC 60065 (AV equipment)		N/A

IEC60825_1G - ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict
ATTACHMENT TO TEST REPORT **IEC 60825-1** **EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES** **(Safety of laser products - Part 1: Equipment classification and requirements)**			
Differences according to .....:	EN 60825- 1:2014+A11:2021		
TRF template used..... :	IECEE OD-2020-F2:2020, Ed. 1.1		
Attachment Form No. .....: **Attachment Originator** .....: **Master Attachment** .....:	EU_GD_IEC60825_1G TÜV Rheinland LGA Products GmbH Dated 2021- 11-05		
Copyright © 2021 IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE), Geneva, Switzerland. All rights reserved.			
	CENELEC COMMON MODIFICATIONS (EN)		
1	**Scope and object**		--
	In Clause 1, replace the existing text: —This Part 1 describes the minimum requirements. Compliance with this Part 1 may not be sufficient to achieve the required level of product safety. Laser products may also be required to conform to the applicable performance and testing requirements of other applicable product safety standards. NOTE 3 Other standards may contain additional requirements. For example, a Class 3B or Class 4 laser product may not be suitable for use as a consumer product.‖ Where a laser system forms a part of equipment which is subject to another IEC product safety standard, e.g. for medical equipment (IEC 60601-2-22), IT equipment (IEC 60950 series), audio and video equipment (IEC 60065), audio- video and IT equipment (IEC 62368- 1), equipment for use in hazardous atmospheres (IEC 60079), or electric toys (IEC 62115), this Part 1 will apply in accordance with the provisions of IEC Guide 1042 for hazards resulting from laser radiation. If no product safety standard is applicable, then IEC 61010- 1 may be applied." with the following:		--

	"This Part 1 describes requirements that are considered sufficient to achieve the required level of product safety for general laser products with respect to hazards to the eye and skin posed by laser radiation, provided that consumer laser products comply with EN 506891 (see 9.5 in EN 60825- 1:2014/FprAA:2020). Also, as required in 5.3 b) of EN 60825- 1, that laser products classified as Class 1C comply with the respective applicable part of either the EN 60601 series or the EN 60335 series that contains requirements for the safe exposure of the skin (note that the exposure of the skin is not necessarily limited to the MPE values of the skin), if applicable, as well as specific requirements for the performance and testing of the safeguard that prevents hazardous emission towards the eye. Depending on the type of the product, laser products such as for example medical lasers, machines or toys can be required to conform to the applicable performance and testing requirements of their relevant product safety standards. NOTE 3 See 3.92 for —general laser productǁ . Where a laser system forms a part of equipment which is subject to another IEC product safety standard, e.g. for medical equipment (IEC 60601-2-22), IT equipment (IEC 60950 series), audio and video equipment (IEC 60065), audio-video and IT equipment (IEC 62368- 1), electrical equipment for measurement, control, and laboratory use (IEC 61010- 1), equipment for use in hazardous atmospheres (IEC 60079), or electric toys (IEC 62115), this Part 1 will apply in accordance with the provisions of IEC Guide 1042 for hazards resulting from laser radiation."		--
3	**Terms and definitions** In Clause 3, add the following terms and their definitions:		--
3.9.1	**consumer laser product** any product or assembly of components that: (a) is intended for consumers, or likely to be used by consumers under reasonably foreseeable conditions even if not intended for them; and (b) (b) constitutes or incorporates a laser or laser system		--

3.9.2	**general laser product** laser product that does not fall within the scope of another EN standard that addresses the safety of a specific category of laser products Note 1 to entry: Examples of products where such other EN Standards exist are medical lasers (EN 60601-2-22), electric toys (EN 62115) or laser processing machines (EN ISO 11553- 1, EN ISO 11553-2). Note 2 to entry: General laser products are for instance laboratory equipment, laser products for measurements, laser pointers, display lasers and laser illuminated projectors. Note 3 to entry: EN 506891 is not considered as another EN standard that addresses the safety of a specific category of laser products, since it applies to all consumer laser products.		--

4.3	**Classification rules** *In Note 3 of 4.3 c), replace the following text:* "NOTE 3 A source is considered an extended source when the angular subtense of the source is greater than αmin, where αmin = 1,5 mrad. Most laser sources have an angular subtense α less than αmin, and appear as an apparent —point sourcell (small source) when viewed from within the beam (intra-beam viewing). Indeed a circular laser beam cannot be collimated to a divergence less than 1,5 mrad if it is an extended source, thus any laser where a beam divergence of 1,5 mrad or less is specified cannot be treated as an extended source. For a small source, α is set to αmin = 1,5 mrad and *C*6 = 1." *with:* "NOTE 3 An apparent source is considered an extended source when the angular subtense of the apparent source (i.e. the angular subtense of the image of the source) is greater than αmin, where αmin = 1,5 mrad (note that different accommodation states as well as different positions in the beam have to be considered for the classification of extended sources). Most laser sources have an angular subtense α less than αmin, and appear as an apparent —point sourcell (small source) when viewed from within the beam (intra-beam viewing). Indeed, if a laser beam is to qualify as an extended source, it cannot be collimated to a divergence less than 1,5 mrad unless it is astigmatic (i.e. could be collimated in one dimension only) or scanning. Thus any non-scanning circularly symmetric laser beam, where a beam divergence of 1,5 mrad or less is specified, cannot be treated as an extended source, since accommodation to infinity for intrabeam viewing of such a source produces a retinal image that subtends an angle of less than 1,5 mrad. Also, more generally, any circular, non-scanning high quality Gaussian beam (TEM00) with a beam quality factor M2 equal or close to unity is associated to a small apparent source, as either the beam waist subtends an angular subtense smaller than 1,5 mrad or the divergence is smaller than 1,5 mrad. For a small source, α is set to αmin = 1,5 mrad and *C*6 = 1. See also definitions 3.7, 3.10, 3.36, 3.42. A frequent mistake is to associate the beam diameter, or the beam profile, at the laser aperture with the apparent source; the laser aperture as such has no special distinctiveness that is related to the apparent source. Examples of designs that might constitute an extended source are: transmissions through a diffusor, transmissions through a diffractive optical element (DOE), partially coherent beams (i.e. beams with low beam quality and therefore higher values of the beam quality factor M2), scanned emission, fibres, and astigmatic beams (since the eye cannot accommodate to both waists at the same time). Measurements of the image of the apparent source are expected to be performed with sufficient accuracy, typically with a laser beam profiler CCD camera. As an alternative to characterizing the angular subtense of the apparent source (note that different accommodation states are expected to be considered, as well as different positions in the beam, see 5.4.3), *C*6 can be set to unity (simplified evaluation, see 5.4.2)."	P

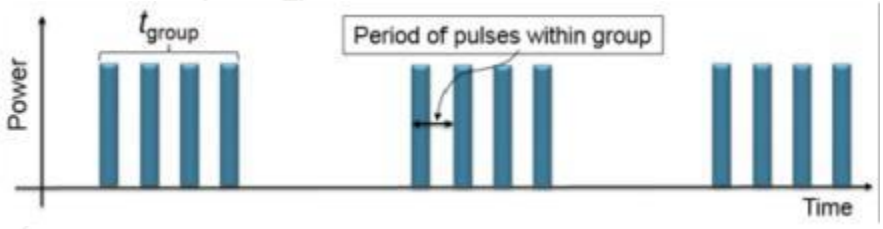
5.3	**Determination of the class of the laser product** *In subclause 5.3, replace the existing text of footnote d of Table 3, footnote f of Table 4, footnote d of Table 6 and footnote c of Table 7:* "In the wavelength range between 1 250 nm and 1 400 nm, the upper value of the AEL is limited to the AEL value for Class 3B." *with:* "In the wavelength range between 1 250 nm and 1 400 nm, two additional limitations apply. The value of the AEL in the table above is limited to the AEL value for Class 3B. The accessible emission, determined with the specified aperture stop, is limited by the following values (these limits are derived from the MPE of the skin and are required as an additional limit to protect the anterior parts of the eye). This limitation for the eye is to be treated as additive with the spectral region of 1400 nm to 10^6 nm listed in Table 1.	N/A

For $t < 10^{-9}$ s:	$7{,}9 \times 10^5$ W	Aperture stop diameter: 1 mm
For 10^{-9} s ≤ $t < 10^{-7}$ s:	$7{,}9 \times 10^{-4}$ J	Aperture stop diameter: 1 mm
For 10^{-7} s ≤ $t <$ 0,35 s:	$4{,}3 \times 10^{-2}\ t^{0{,}25}$ J	Aperture stop diameter: 1 mm
For $t \geq$ 0,35 s:	0,1 W	Aperture stop diameter: 0,35 s ≤ $t <$ 10 s: 1,5 $t^{3/8}$ mm $t \geq$ 10 s: 3,5 mm

6.2.1	**General** *In 6.2. 1, replace the existing first paragraph:* "Each laser product shall have a protective housing which, when in place, prevents human access to laser radiation (including errant laser radiation) in excess of the AEL for Class 1, except when human access is necessary for the performance of the function(s) of the product." *with:* "Each laser product shall have a protective housing which, when in place, prevents human access to laser radiation (including errant laser radiation) in excess of the AEL for Class 1, unless human access to laser radiation is necessary for the performance of the function(s) of the product. Where human access to radiation levels above the AEL for Class 1 is necessary, the product shall be in the lowest feasible class commensurate with this function. NOTE Where such human access is necessary only at certain times and not during routine operation of the product (e.g. to allow specific maintenance procedures, which are described in the information for the user, to be undertaken by the user) the protective housing prevents human access to laser radiation in excess of the AEL for Class 1 during routine operation. This requirement for a protective housing does not mean that the product needs to meet all the requirements for, and to be classified as, Class 1. This is because classification as Class 1 cannot be achieved when access to levels of laser radiation of Class 3B or Class 4 is necessary during maintenance procedures."		N/A

9.5	**Consumer electronic products** *Replace the entire text of subclause 9.5 with the following:* "Consumer laser products shall comply with applicable requirements for laser products of their class as well as with EN 506891. In addition, these products may be subject to specific safety standards such as EN 62368- 1 (AV/ICT equipment). Products that are classified as Class 1C need to comply with the requirements of the respective specific vertical standard of the EN 60335 series or the EN 60601 series. NOTE EN 506891 will be made available after the publication of EN 60825- 1:2014/FprAA:2020. In the period of time until EN 506891 is published, there are no specific requirements for consumer products. It is noted that some EU member states have issued guidance documents and/or legal requirements that apply to consumer laser products and that are not harmonized amongst EU member states."		N/A
ZB	**ANNEX ZB**		--
ZB. 1	**General remarks** This informative annex is added to EN 60825- 1:2014 in order to publish the content of the IEC Interpretation Sheets IEC 60825- 1:2014/ISH1:2017 and IEC 60825- 1:2014/ISH2:2017 by CENELEC. The content is published as an annex to EN 60825- 1, because the publication type —Interpretation Sheet‖ is not available at CENELEC level. Because there are no page-number limitations for an annex (contrary to an Interpretation Sheet), the text of the IEC ISH1 and ISH 2 has been somewhat extended in order to increase the readability and clarity.		--
ZB.2	**Subclause 4.3 Classification rules (IEC 60825-1:2014/ISH1:2017)**		--
ZB.2.1	**General remarks** This subclause ZB.2 contains the text of ISH1; some examples were added for clarity. For some complex extended sources or irregular temporal emissions, the application of the rules of 4.3 may require clarification. In this subclause ZB.2, 4.3 (Classification rules) is clarified. NOTE 1 For the purpose of this annex, the abbreviation —AE‖ is used for —accessible emission‖ . NOTE 2 The clarifications also apply in an equivalent way to MPE analysis, i.e. for Annex A.		--

ZB.2.2	**Subclause 4.3 c) (Radiation from extended sources)** When using the default (simplified) evaluation method (5.4.2) for wavelengths ≥ 400 nm and < 1 400 nm, the angle of acceptance may be limited to 100 mrad for determining the accessible emission to be compared against the accessible emission limit, except in the wavelength range 400 nm – 600 nm for durations longer than 100 s where the circular-cone angle of acceptance is not limited. When evaluating the emissions for comparison to the Class 3B AELs, the angle of acceptance is not limited.		N/A
ZB.2.3	**Subclause 4.3 d) (Non-uniform, non-circular or multiple apparent sources)** In 4.3 d), for comparison with the thermal retinal limits, the requirement to vary the angle of acceptance in each dimension might appear to contradict the labelling in Figure 1 and Figure 2 of 5.4.3 where the field stop is labelled as circular.		N/A
ZB.2.4	**Subclause 4.3 f) 3); determination of α** The parameter αmax is a function of emission duration, i.e. αmax(*t*). For an analysis of pulsed emission and extended sources, αmax(*t*) limits both the value of α for the determination of *C*6(α) as well as the angle of acceptance γ for the determination of the accessible emission (see 4.3 c) and d) and subclause ZB.2.3 of this amendment). In this process, αmax(*t*) is determined for the same emission duration *t* that is used to determine AEL(*t*) (i.e. the pulse duration or the pulse group duration for 4.3 f) 3) and the averaging duration for 4.3 f) 2), respectively). However, the parameter α is also used in 4.3 f) 3) in the criteria to determine which *C*5 is applied to AELs.p.train(*t*). For these criteria to determine *C*5, the parameter α is not limited to αmax(*t*) in the same way as for the determination of *C*6 according to 4.3 d). To determine *T*2(α) and in the criteria of 4.3 f) 3) —For α ≤ 5 mrad‖, —For 5 mrad < α ≤ αmax‖, and, —For α > αmax‖, the quantity α is equal to the —long-term‖ α, i.e. equal to α as determined for a time base of 0,25 s or equal to the value of α of *T*2(α). In the determination of this —long-term‖ α (applying the method specified in 4.3 d)), αmax = 100 mrad. That is, for *T*2 and these inequalities, α is not limited to a value of αmax(*t*) smaller than 100 mrad, and is therefore the same as the value that applies for the determination of *C*6 for the time base of 0,25 s or 100 s, as applicable. As is generally defined (see 4.3 d)) the arithmetic mean is applied to determine α, i.e. it is not necessary that both dimensions satisfy the criterion ‖For α ≤ 5 mrad‖ independently. For the criterion —Unless α > 100 mrad‖, the angular subtense of the apparent source α is not restricted by αmax. For non-uniform (oblong, rectangular, or linear) sources, the inequality needs to be satisfied by both angular dimensions of the source in order for *C*5 = 1 to apply. The value of α determined with αmax = 100		--

	mrad (i.e. the —long-term‖ α) can also be used for this criterion, alternatively: in this case the criterion is written as —Unless α = 100 mrad‖, because for α to become exactly equal to 100 mrad, when applying αmax = 100 mrad, the image of the apparent source has to be larger than 100 mrad in both dimensions. Since the —long-term‖ α is needed for the inequalities in 4.3 f) 3) to determine the applicable *C*5, the usual sequence is as follows. An analysis of the image of the apparent source is performed as given in 4.3 d) while either using AEL(*t* = 0,25 s), or AEL(t = *T*2(α)), depending on the time base. The angle of acceptance (as dimensions of the field of view) is varied between 1,5 mrad and 100 mrad in each dimension. Each field of view is associated to a certain value of *T*2 and therefore AEL(t = *T*2). The accessible emission is also determined for the respective field of view. The result of the process to vary the field of view is the —long-term‖ α that is associated to the field of view that produces the maximum ratio of AE to AEL. For the case of classification as Class 1, this process to determine the —long-term‖ α at the same time determines the value of *T*2(α). This —long-term‖ α is used for *C*6 for AEL(*t* = 0,25 s), or AEL(t = *T*2(α)), respectively, as well as the associated field of view to determine the AE for the comparison with these AEL. Following this step of the determination of the —long-term‖ α, all applicable shorter emission durations have to be analysed. For the analysis of emission durations less than 0,25 s, the —long-term‖ α is used to determine the appropriate *C*5 in the equalities of 4.3 f) 3). *T*2(α) is also relevant for the determination of *N* within *T*2(α) or the time base, whichever is shorter.	
ZB.2.5	**Subclause 4.3 f) 3); groups of pulses with group duration longer than *T*i** For non-uniform repetitive pulse patterns, i.e. groups of pulses (see Figure ZB.2 for an example), when α > 5 mrad and the duration of the group of pulses is longer than *T*i, it is not clearly stated how the thermal additivity expressed by requirement 3) of 4.3 f) is applied. For *uniform* (i.e. constant peak power, duration and period) repetitive pulse trains, it is not necessary to analyse the emission patterns in terms of groupings of pulses. When individual pulses are close together, they are thermally grouped and thermally represent one —effective‖ pulse so that *C*5 also (additionally to analysing the pulse train based on the actual pulses and the average power) applies to these —effective‖ pulses, where *N* is the number of pulse groups within *T*2 or within the time base, whichever is shorter.  **Figure ZB.2 — Example of three groups of pulses (each group duration is longer than *T*i) where each group is considered as one —effective‖ pulse and *C*5 is applied to the AEL that applies to the group duration, where *C*5 is determined with the number of pulse groups within the evaluation duration (in the example of the figure *N* = 3)**	N/A

	For the analysis of pulse groups, the value of AELsingle is determined for the corresponding pulse group duration *t*group. For the determination of *C*5, *N* is the number of pulse groups within *T*2 or the time base, whichever is shorter. The respective value of *C*5 is applied to AELsingle to obtain AELs.p.train that limits the AE of the pulse groups, where AE is the sum of the energy of the pulses contained within the pulse group.	N/A
	For the application of *C*5 to groups of pulses, the AEL(*t*group) applicable to the group needs to be determined, as well as the energy per group (AEgroup). For groups of pulses where the peak power of the pulses within the group varies, the group duration is not well defined. In order to simplify the evaluation, *t*group can be set equal to the integration duration for which the energy per group (i.e. AEgroup) was determined; it is not necessary to determine the group duration based on the FWHM criterion, which for groups of pulses with varying peak power is not well defined. By setting *t*group equal to the integration duration that is used to determine AEgroup (expressed as energy), the application of *C*5 to groups of pulses is a simple extension of requirement 2) of 4.3. f) where the average power per group (equal to the energy within the averaging duration *t*average divided by the averaging duration) needs to be below the AEL(*t*average) determined for the duration over which the power was averaged (AEgroup and AEL(*t*group) expressed as power). As is common for the average power requirement, for irregular pulse trains, the averaging duration window (when expressed as energy: the integration duration window) has to be varied in temporal position and duration (for instance, if there are pulses with relatively low energy per pulse at the beginning or the end of the group of pulses, integration durations that exclude those low-energy pulses need to be considered also, not only the total group).	N/A

	If individual pulses have sufficient temporal spacing (period larger than *T*crit, see below), as a simplified analysis, they need not be considered for an analysis as a pulse group under 4.3 f) 3). The temporal spacing that is necessary for pulses to only be considered separate (and not analysed additionally as a group) depends on the angular subtense of the apparent source and the duration of the pulses *t*pulse within the group. Note that there can be several levels of grouping, so that individual elements (with pulse duration *t*) within the group could themselves be —effective pulses‖, i.e. subgroups. When the — pulse group durations (*t*group) are between *T*i and 0,25 s, and — the angular subtense of the apparent source is larger than 5 mrad, and — the period of the pulses (see Figure ZB.2) is shorter than a critical period *T*crit (if *t*pulse < *T*i, the value of *t*pulse is set equal to *T*i; further, for the determination of *T*crit, αmax is determined for *t*pulse, not the group duration) where: for α ≤ αmax: *T*crit = 2 · *t*pulse where *t*pulse is in seconds for α > αmax: *T*crit = 0,01 α · *t*pulse0,5 where *t*pulse is in seconds, and α is in mrad, not being limited to αmax then these pulses constitute a pulse group which is treated as effective pulses and *C*5 (where *N* is the number of groups within the time base or *T*2, whichever is shorter) is applied to the AEL applicable to the pulse group. For the determination of AE, αmax is determined using the duration of the evaluated pulse group, *t*group. If one or more of the above conditions are not fulfilled, then the pulses within the group of pulses that is considered to be analysed as —effective pulse‖ need not be grouped, i.e. the group of pulses does not need to be analysed as one —effective‖ pulse. Note that if multiple pulses occur within *T*i, the rule as stated in 4.3 f) 3) applies in parallel, i.e. they are counted as a single pulse to determine *N* and the energies of the individual pulses that occur within *T*i are added to be compared to the AELs.p.train of *T*i where the corresponding *C*5 for emission durations *t* ≤ *T*i is applied.		N/A
ZB.2.6	**Subclause 4.3 f); simplifications**		--
	a) Constant peak power but shorter pulses Depending on the angular subtense of the apparent source, it can be the case that the value of *C*5 is more restrictive for pulses with pulse durations less than *T*i than for pulses with durations longer than *T*i which is against general biophysical principles for cases where the peak power is the same.		N/A

	b) Larger image of apparent source For emission durations exceeding *T*i, due to the step-function of *C*5 at 5 mrad and at αmax, the AEL (as a function of *C*5 and *C*6) can be more restrictive for larger values of the angular subtense of the apparent source as compared to smaller ones, which is contrary to general biophysical principles.		N/A
	c) Using a square aperture stop In some cases, such as 2D scanned laser beams, the use of a circular aperture stop to determine the accessible emission creates very complex pulse patterns. Due to the breakpoints in terms of pulse duration with step functions in the value of *C*5, it might not be apparent that the usage of a square aperture is acceptable as a simplified worst case analysis.		N/A
	d) Applicability of simplified default analysis For pulse durations longer than *T*i, the value of *C*5 is smaller (more restrictive) for angular subtense values α larger than 5 mrad compared to α ≤ 5 mrad. The assumption of α = 1,5 mrad is the basis of the simplified (default) evaluation. It is therefore not obvious if the simplified (default) analysis still applies in terms of being a restrictive simplifying analysis even for the case that the angular subtense of the apparent source is actually larger than 5 mrad, where *C*5 < 1.		N/A
	e) Determination of the most restrictive position For the extended analysis, it is necessary to vary the distance relative to the reference point to determine the most restrictive position. For each position in the beam, the accommodation is varied and the most restrictive image is determined. For determining the most restrictive image (where the ratio AE/AEL is maximum) at a given position, requirement 3) of 4.3 f) is not applied. Otherwise a blurred (larger) image of the apparent source, resulting from variation of the accommodation, could appear more restrictive, which is contrary to general biophysical principles. Once the most restrictive image (and associated α) is identified for each position in the beam, all three requirements of 4.3 f) are applied to determine the most restrictive position (identifying the position with the maximum ratio of AE/AEL) and the class of the product.		N/A

	f) Application of the total-on-time-pulse method; For regular pulse trains, as well as for varying pulse durations and/or varying period of pulses (but excluding strongly varying peak powers; see below), the total-on-time pulse (TOTP) method (see also IEC 60825-1 Edition 2.0 subclause 8.3 f) 3b)) may be used as an alternative to requirement 3) of 4.3 f), i.e. as an alternative to the application of *C*5 to the single pulse AEL, provided that αmax is determined for the TOTP (or using the worst case value of 100 mrad). This is more restrictive than the rules of 4.3 f) because it is equivalent to an unlimited *C*5 (*C*5 not limited to 0,2 or 0,4), and because the value of αmax is typically larger for the TOTP as compared to the value applicable to the single pulse. For the total-on-time-pulse (TOTP) method the following applies, as reproduced from Edition 2 of IEC 60825-1: The AEL is determined by the value of the TOTP, which is the sum of all pulse durations within the emission duration or *T*2, whichever is smaller. Pulses with durations shorter than *T*i are assigned pulse durations of *T*i. If two or more pulses occur within a duration of *T*i these pulse groups are assigned pulse durations of *T*i. For comparison with the AEL for the corresponding duration, all individual pulse energies are added. Note that the TOTP method in Edition 2 of IEC 60825-1 (incl. Corrigendum 1) was specified —For varying pulse widths or varying pulse intervals— and did not refer to varying peak powers. For the case of strongly varying peak powers, the TOTP method is not applicable, as adding pulses to the pulse train with small peak powers and low contributing energy-per-pulse values might increase the AEL (by increasing the total-on-time) more than this increases the total energy, and thus would make the emission less critical as compared to an emission based on the pulses with the large peak power only.		N/A

	g) Varying peak power but constant pulse duration For varying peak power but constant pulse durations, requirement 3) of 4.3 f) can be applied by counting the pulses for the determination of *N* based on the relative peak power, i.e. *N* is increased by 1,0 for each pulse with the maximum peak power, and by a value of less than 1,0 for pulses with lower peak power, such as for a pulse with 70 % peak power compared to the maximum peak power in the pulse train, *N* is increased by 0,7. For this, based on the strong nonlinearity of thermally induced injury with temperature, it is justified not to count pulses with peak powers that are more than a factor of 10 below the pulse with the maximum peak power (i.e. less than 10 % of the maximum peak power). Note that the resulting AELs.p.train is applied to the pulse with the largest AE, i.e. the largest energy per pulse, and that the interpretation in this paragraph applies only for the case of pulse trains with constant pulse durations.		N/A
ZB.3	**Subclause 4.4 conventional lamp replacement (**IEC 60825**-** 1**:**2014/ISH2:2017**)**	No conventional lamp	N/A
	This subclause ZB.3 contains the text of IEC 60825- 1:2014/ISH2:2017 with some minor modifications for clarity. Subclause 4.4 introduces a criterion based on radiance, which is a quantity not normally determined for laser products. This interpretation clarifies the determination of radiance and the radiance limit. In this subclause ZB.3 of the Annex ZB, Subclause 4.4 is clarified.		N/A

ZB.4	**Subclause 6.3.2 – safety interlocks** **Introduction** In this subclause, additional interpretations are provided, that were not contained in the IEC Interpretation Sheets, due to limitations on the length of the Interpretation Sheets. The requirements for safety interlocks that are provided with a deliberate override mechanism are specified in 6.3.2. The exception, described in 6.3.2 for automatically returning an overridden interlock to normal operation when an open door is closed, needs clarification. The portion of text that may cause confusion is: —If a deliberate override mechanism is provided, the manufacturer shall also provide adequate instructions about safe methods of working. It shall not be possible to leave the override in operation when the access panel is returned to its normal position. An exception to this requirement is allowed if selection of a service —override‖ mode automatically isolates the laser beam and prevents automatic resumption of operation of the machine. This exception also requires a lockable mode selector and requires a manual override to use the beam .‖	--
ZZ	**Annex ZZ** (informative)	--
	Relationship between this European standard and the safety objectives of Directive 2014/35/EU [2014 OJ L96] aimed to be covered This European Standard has been prepared under a Commission's standardization request relating to harmonized standards in the field of the Low Voltage Directive, M/511, to provide one voluntary means of conforming to safety objectives of Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits [2014 OJ L96]. Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZZ. 1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding safety objectives of that Directive, and associated EFTA regulations. **Table ZZ.1 — Correspondence between this European standard and Annex I of Directive 2014/35/EU [2014 OJ L96]**	--

Safety objectives of Directive 2014/35/EU	Clause(s) / subclause(s) of this EN	Remarks / Notes
1(a) (b)	Clause 7 (labelling) and Clause 8 (information for the user)	
1 (c)	Clause 5 (testing requirements) include intended use and maintenance	

2. (b) Protection against hazards arising from the electrical equipment with measures of a technical nature that ensure that radiation which would cause a danger is not produced.	Clauses 4–9	The scope of EN 60825- 1 is limited to hazards from laser radiation to the eye or skin
3 (c)	Clause 5 (testing requirements) include single fault conditions	
WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union. **WARNING 2 —** Other Union legislation may be applicable to the product(s) falling within the scope of this standard.		

Data:

For Condition 1:

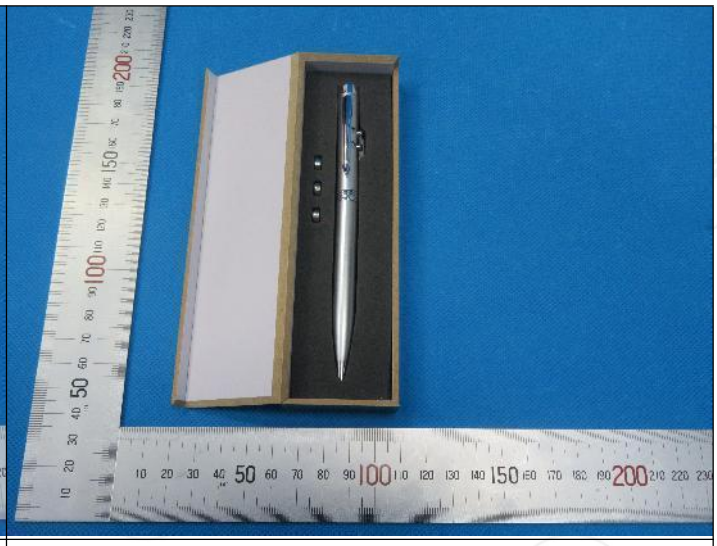
LED Color	Red Laser Light
Measurement distance	2000 mm
Wavelength	653 nm
Measured maximum emission power / energy Normal condition	5.01e-01 mW

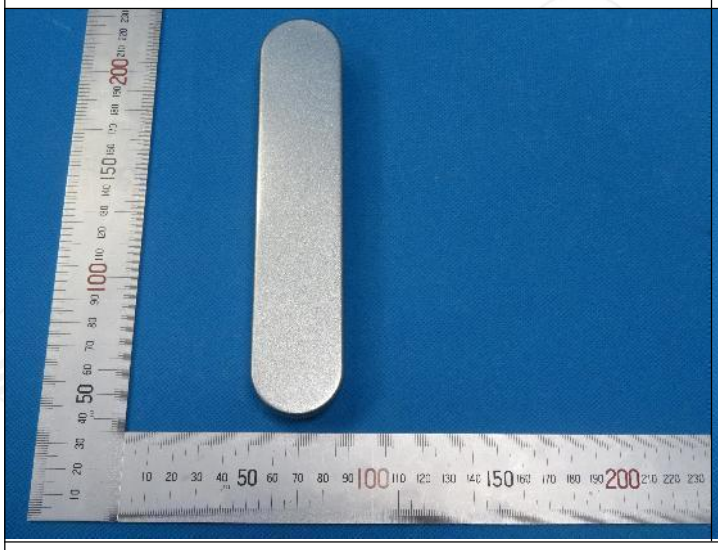
For Condition 3:

LED Color	Red Laser Light
Measurement distance	100 mm
Wavelength	653 nm
Measured maximum emission power / energy Normal condition	5.24e-01 mW

Summary:
Calculated accessible emission limit of Class 2 is 1.00e+00mW. The product is Class 2.

Photo(s):





Test Sample Photo

Customer additional photo

<<< <<< END OF REPORT >>> >>>

声明
Statement

1. 本检测报告首页所列信息中除样品来源、接样日期、检测日期、检测结果和检测结论外，均由委托方提供，委托方对样品的代表性和资料的真实性负责，本实验室不承担任何相关责任。
   The information as listed on the first page of this test report was all provided by the client except the sample from, date received, test period, test results and test conclusion. The client shall be responsible for the representativeness of sample and authenticity of materials, for which STS shall bear no responsibilities.

2. 本检测报告以实测值进行符合性判定，未考虑不确定度所带来的风险，特别约定、标准或规范中有明确规定的除外。此种判定方式所带来的风险由客户自行承担，本实验室不承担相关责任。
   The judgment method of determining the conformity in this test report is according to the measured value without considering the risk caused by uncertainty, unless otherwise clearly stipulated in special agreement, standard or specification. The client shall assume the risk caused by the judgment method, and STS shall not bear related responsibilities.

3. 检测报告无批准人签字及"检验检测专用章"无效，未经本实验室书面同意，不得整体或部分复制本报告。
   The test report is effective only with both signature and specialized stamp. Without written approval of STS, this report can't be reproduced in full or in part.

4. 本检测报告的检测结果仅对送测样品负责，未加盖资质认定标志的检测报告不对社会具有公证证明作用，对于检测数据、结果的使用，所产生的直接或间接损失及一切法律后果，本实验室不承担任何经济和法律责任。
   This test data is only responsible for the tested sample. The data and results provided by the report without CMA accreditation are not to prove to the society, and STS is not responsible for any economic and legal responsibility for the use of the test data, the direct or indirect losses resulting from the use of the test and all legal consequences.

5. 本检测报告中检测项目标注有下划线则该项目不在本实验室资质认定能力范围内，该项目检测结果仅作为客户委托、科研、教学或内部质量控制等目的使用。
   The underlined test item in the report is out of the scope of CMA accreditation. The test result only used for client's requirement, scientific researching ,teaching or internal quality control.

6. 其它声明请查阅报告页脚及书面报告背页。
   For other statements, please refer to the footer of the report.

Guangzhou Depuhua Test Services Co. Ltd.

A301&A401, 3/F.&4/F., Xinghui Building, Guanqiao, Shilou, Panyu District, Guangzhou, Guangdong, China e-mail：stsgz@stsapp.com

Phone: +86 (0)20-6664 1688 Fax：+86 (0)20-6664 1699 Web://www.stsgz.com

签发测试报告条款

Conditions of Issuance of Test Reports

1. 广州市德普华检测技术有限公司(以下简称[公司])为提供符合下述条款的测试和报告,而接受有关样品和货品。本公司基于下述条款提供服务,下述条款为本公司与申请服务的个人,企业或公司(以下简称[客户])的协议。
All samples and goods are accepted by the Guangzhou Depuhua Test Services Co., Ltd. (the "Company") solely for testing and reporting in accordance with the following terms and conditions. The company provides its services on the basis that such terms and conditions constitute express agreement between the Company and any person, firm or company requesting its services (the "Clients").

2. 由此测试申请所发出的任何报告(以下简称[报告]),本公司会严格为客户保密。未经本公司的书面同意,报告的整体或部分不得复制,也不得用于广告或授权的其他用途。然而,客户可以将本公司印制的报告或认可的副本,向其客户、供货商或直接相关的其它人出示或提交。除非相关政府部门、法律或法规要求,否则未经客户同意,本公司不得将报告内容向任何第三方讨论或披露。
Any report issued by Company as a result of this application for testing services (the "Report") shall be issued in confidence to the Clients and the Report will be strictly treated as such by the Company. It may not be reproduced either in its entirety or in part and it may not be used for advertising or other unauthorized purposes without the written consent of the Company. The Clients to whom the Report is issued may, however, show or send it. or a certified copy thereof prepared by the Company to its customer, supplier or other persons directly concerned. The Company will not, without the consent of the Clients, enter into any discussion or correspondence with any third party concerning the contents of the Report, unless required by the relevant governmental authorities, laws or court order.

3. 除非相关政府部门、法律或法院要求,否则未经公司预先书面同意,本公司毋需,也并无义务到法院对有关报告作证。
The Company shall not be called or be liable to be called to give evidence or testimony on the Report in a court of law without its prior written consent, unless required by the relevant governmental authorities, laws or court orders.

4. 除非本公司进行抽样,并已在报告中说明,否则报告中适用于送测的样品(样品信息为客户提供),不适用于批量。
The Report refers only to the tested sample (Sample information is provided by customer) and does not apply to the bulk, unless the sampling has been carried out by the Company and is stated as such in the Report.

5. 如果本公司确定报告被不当地使用,本公司保留撤回报告的权利,并有权要求其它适当的额外赔偿。
In the event of the improper use of the report as determined by the Company, the Company reserves the right to withdraw it, and to adopt any other additional remedies which may be appropriate.

6. 本公司接受样品进行测试的前提是,该测试报告不能作为针对本公司法律行动的依据。
Samples submitted for testing are accepted on the understanding that the Report issued cannot form the basis of, or be the instrument for, any legal action against the Company.

7. 如因使用本公司中心任何报告内的资料,或任何传播信息所描述与之有关的测试或研究导致的任何损失或损害,本公司概不负责。
The Company will not be liable for or accept responsibility for any loss or damage however arising from the use of information contained in any of its Reports or in any communication whatsoever about its said tests or investigations.

8. 若需要在法院审理程序或者仲裁过程中使用测试报告,客户必须在提交测试样品前将该意图告知本公司。
Clients wishing to use the Report in court proceedings or arbitration shall inform the Company to that effect prior to submitting the sample for testing.

9. 该测试报告的支持数据和信息本公司保存 10 年。个别评审机构有特别要求的,检测数据和报告的保存期可依情况变动。一旦超过上述提交的保存期限,数据和信息将被处理掉。任何情况下,本公司不必提供任何被处理的过期数据或信息。即使本公司事先被告知可能会发生相关的损害,本公司在任何情况下也不必承担任何损害,包括(但不限于)补偿性赔偿、利润损失、数据遗失、或任何形式的特殊损害、附带损害、间接损害、从属损害或任何违反约定、违反承诺、侵权(包括疏忽)、产品责任或其他原因的惩罚性损害。
Subject to the variable length of retention time for test data and report stored hereinto as otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of the test report for a period of ten years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after retention period. Under no circumstances shall we be liable for damage of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.

10. 报告的签发记录可通过登录 www.stsgz.com 查询。如需进一步查询报告有效性或核实报告，需与本公司联系。
Issuance records of the Report are available on the internet at www.stsgz.com. Further enquiry of validity or verification of the Report should be addressed to the company.