

Lasermet Limited
Lasermet House
137 Hankinson Road
Bournemouth BH9 1HR
United Kingdom
Tel: 44 (0) 1202 770740
Fax: 44 (0) 1202 770730
office@lasermet.com
www.lasermet.com

Report Date: 1st July 2020
Test Date: 30th June 2020
Report Number: 2355

Laser Classification Report to BS EN 60825-1:2014

Product Name: SEKO-RANGEFINDER-GEVK
Product Serial Number: 23062020a

SUMMARY

The product is a Time of Flight sensor, that uses one pulsed IR VCSEL as its laser source.

This product meets the power requirements for a Class 1 Laser product to BS EN 60825-1:2014 under normal operating conditions and those of single fault failure.

Client
ON Semiconductors Slovakia a.s.
Vrbovska cesta 2617/102
Piestany
921 01
Slovak Republic

Manufacture/Supplier
Exel s.r.o,
Zvolenská cesta č.14
Banská Bystrica
97403
Slovak Republic

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1) Optical sources

a) Manufacturer(s) and type details

One SPL_PL90_3, manufactured by Osram.

b) Wavelength(s)

905 nm to 909 nm with a peak at 907 nm

Measured on Spectrometer LM-SPC-001; see Annex A for spectrum.

c) Pulsed or continuous

Pulsed

If pulsed:

i) Manufacturers stated data:

Pulse Repetition Frequency: 1042 Hz
Pulse Duration: 22 ns

ii) Measured data:

Pulse Repetition Frequency: 1042 Hz
Pulse Duration: 22 ns

d) Other relevant data

Beam is narrowly divergent, beam is more than 7 mm at 100 mm.

e) Accessibility of Radiation

Radiation is directly accessible during normal operation.

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2) Apparent Source size/angular subtense.

a) Manufacturer's data.

None given.

b) Measured.

The apparent source size was measured with a CCD camera (LM-CAM-001) and an oscilloscope (LM-OSC-001) following Procedure LM-PROC-003.

The apparent source size was measured to be 0.643 mm, equating to an angular subtense (α) of 6.43 mrad at 100 mm.

Source size measurements were taken in accordance with Research Report 345 'Investigation of a measurement technique to determine the apparent source size for light emitting diodes, prepared by National Physical Laboratory and Europtics Ltd for the Health & Safety Executive 2005.

3) Measurement Conditions:

a) Control Settings

Unit was operated according to manufacturer's instructions.

b) Location of test:

Lasermet, Bournemouth.

c) AEL (give details)

i) Correction Factors

$$C_4 = 2.59$$

$$C_5 = 0.481$$

$$C_6 = 4.29$$

ii) Time Bases:

$$T = 100 \text{ s}$$

$$T_2 = 11.2 \text{ s}$$

$$T_i = 5.0 \text{ } \mu\text{s}$$

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iii) Equations:

$$\text{Class 1 AEL}_T = 7 \times 10^{-4} \times C_6 \times C_4 \times T_2^{-0.25} = 4.25 \text{ mW}$$

$$\text{Class 1 AEL}_{\text{single}} = 7.7 \times 10^{-8} \times C_4 \times C_6 = 665 \text{ nJ}$$

$$\text{Class 1 AEL}_{\text{sp train}} = \text{AEL}_{\text{single}} \times C_5 = 412 \text{ nJ}$$

d) Measurement Apertures and distances.

All measurements were taken at 100 mm from the apparent source using a 7 mm collecting aperture, in accordance with Condition 3.

4) Measurements.

a) Meter(s) used for measurement:

The optical output was measured with Lasermet's calibrated Ophir Starlite power meter LM-PM-008.

Lasermet's power meters are regularly cross-checked for calibration against a power meter calibrated by the UK National Physical Laboratory.

b) Maximum Readings

Average power = 379.3 μ W

Energy per pulse = 364 nJ

EHV = 8.92% PASS Class 1

EHV = 88.3% PASS Class 1

c) Corrections, if any.

None

d) Reasonably foreseeable failures

The only potential faults identified were shorts on TP33 and TP31. These were simulated via the provided software. The result was termination of emission.

e) CONCLUSION (tentative classification)

The accessible emission does not exceed the Class 1 limits under any hazard condition.

5) Required Accuracy of Measurements, Uncertainties.

The peak output was less than 91% of the class limit under any hazard condition. The total estimated measurement uncertainty was $\pm 5.51\%$ at 95% confidence.

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6) Engineering Controls:

The only engineering control required for Class 1 products is:

- Each laser product shall have a protective housing, that when in place, prevents access to laser radiation above Class 1, except where necessary for the correct functioning of the product. (Present)

7) Labelling:

The following label shall be required to meet Class. All labels shall be legible, durable and permanently attached.



(Present)

8) User Information:

If the product is Class 1, the following user information shall be required:

- Adequate instructions for proper assembly, maintenance, and safe use, including clear warnings concerning precautions to avoid possible exposure to hazardous laser radiation; (Present)
- A description of any embedded radiation pattern(s). Where applicable, this shall include a statement in appropriate units of wavelength, maximum power and pulse structure; (Present)
- Legible reproductions of all required labels and hazard warnings to be affixed to the laser product or provided with the laser product. The corresponding position of each label affixed to the product shall be indicated; (Present)
- List of controls, adjustments and procedures for operation and maintenance, including the warning "Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure" (or alternatively, equivalent appropriate warnings). (Present)

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9) Class Awarded:

Class 1

Conditions (state changes required for full conformity)

This classification is based on the performance of the lasers supplied to us for testing and is only valid for the products listed in this report. The manufacturer is responsible for ensuring that sufficient quality control during manufacturing is in place.

Signature



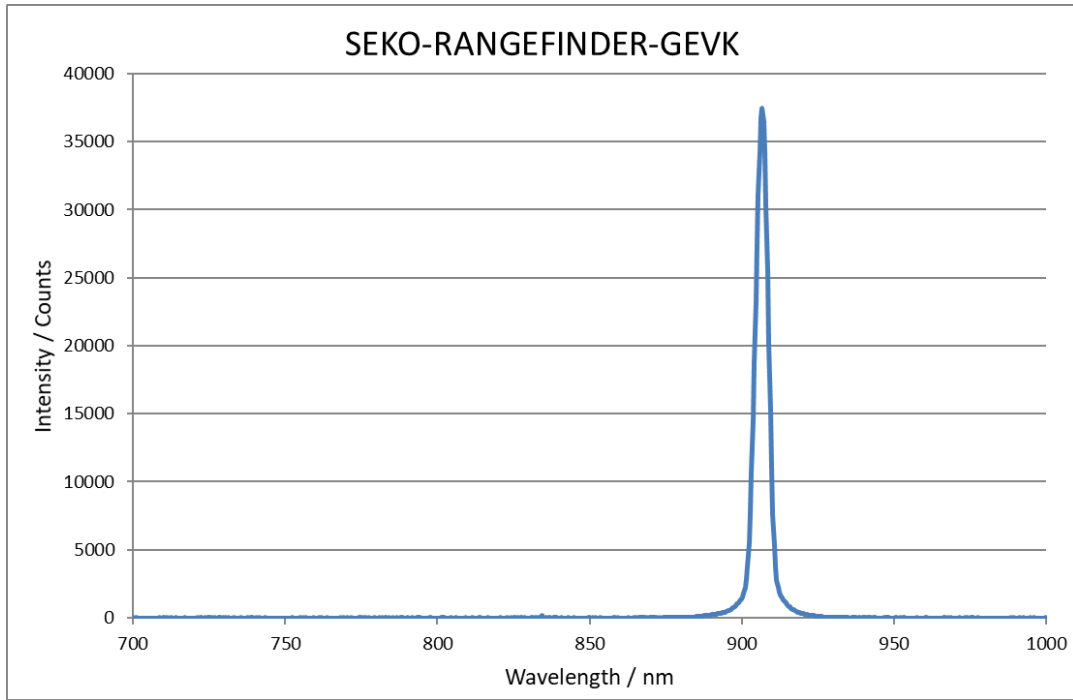
Fiona Robertson

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Annex A



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Annex B

Source of uncertainty	value (\pm)	prob distribution	diviso	c_i	u_i	$(u_i)^2$	v_i
power meter calibration	3.00%	normal	2	1	1.50%	0.02%	∞
Experimental set up	2.00%	Normal	2	1	1.00%	0.01%	∞
Continuous Power Laser	Yes						
CW Laser power resolution, power meter reading	0.53%	rectangular	1.732	1	0.31%	0.00%	∞
Pulse Laser by Peak Power	No						
Pulse Laser Peak power resolution	0.53%	rectangular	1.732	1	0.31%	0.00%	∞
oscilloscope resolution, (voltage representing current, 70 is the voltage reading)	0.19%	rectangular	1.732	1	0.11%	0.00%	∞
oscilloscope resolution, (sig-gen peak power)	0.19%	rectangular	1.732	1	0.11%	0.00%	∞
Oscilloscope resolution, (photodiode peak power)	0.19%	rectangular	1.732	1	0.11%	0.00%	∞
Oscilloscope voltage uncertainty, (quoted)	0.50%	normal	2	1	0.25%	0.00%	∞
Pulse laser by Average Power	No						
Pulse Laser Average power resolution	0.53%	rectangular	1.732	1	0.31%	0.00%	∞
oscilloscope resolution, (voltage representing current, 70 is the voltage reading)	0.19%	rectangular	1.732	1	0.11%	0.00%	∞
oscilloscope resolution, (sig-gen peak power)	0.19%	rectangular	1.732	1	0.11%	0.00%	∞
Oscilloscope resolution, (photodiode peak power)	0.19%	rectangular	1.732	1	0.11%	0.00%	∞
Oscilloscope voltage uncertainty, (quoted)	0.50%	normal	2	1	0.25%	0.00%	∞
osc pulse length resolution (quoted)	5.00%	rectangular	1.732		2.89%	0.00%	∞
Source Size Measurement	Yes						
Measuring Element	0.85%	rectangular	1.732	1	0.49%	0.00%	∞
Voltage Cal: Oscilloscope	0.50%	normal	2	1	0.25%	0.00%	∞
Time Cal: Oscilloscope	0.50%	normal	2	1	0.25%	0.00%	∞
Trigger jitter	0.79%	rectangular	1.732	1	0.46%	0.00%	∞
Repeatability	2.00%	normal	2	1	1.00%	0.01%	∞
Optical attenuator	2.00%	rectangular	1.732	1	1.15%	0.01%	∞
Measuring distance	2.00%	rectangular	1.732	2	1.15%	0.01%	∞
For 62471 - Spectrometrer Uncertainty	No						
Is the most limiting EHV Blue Light?	No						
Spectrometer Uncertainty	0.00%	rectangular	1.732	1	0.00%	0.00%	∞
Standard deviation of the mean	0.04%	normal	2	1	0.02%	0.00%	9
combined standard uncertainty		normal			2.75%	0.08%	>500
expanded uncertainty		normal ($k=2$)			5.51%		>500