

Laser Classification

Model	VQ580
Serial number	S9998874
Date of test	24. Mai 2012
Tested by	HH/RP

The classification is carried out according to the Standard EN60825-1:2001, "Safety of laser products - Part 1: Equipment classification, requirements and user's guide", equivalent to IEC 60825-1:2001.

The standard outlines conditions for the tests to be performed (Section 9.2, "Measurements Measurement of laser radiation").

The diameters of the measurement apertures and measurement distances to be used for classification measurements are outlined in Table 10.

For scanned systems the standard states (9.3):

"For power and energy measurement of scanned laser radiation, the measurement apertures and distances as specified in table 10 for irradiance or radiant exposure shall be used."

Table 10 states for the wavelength range 400 nm to 1400 nm apertures of 7 mm and 50 mm for the stationary case and an aperture of 7 mm for scanned laser radiation.

The effective angle of acceptance for the detector is defined by (9.3.i) to be 100 mrad.

The time base for Laser Class 1 is 100 sec (8.4.e.ii).

Scanned laser radiation is defined in the standard (compare 3.74) as: *"Laser radiation having a time-varying direction, origin or pattern of propagation with respect to a stationary frame of reference."*

Parameters	
Wavelength	1064 nm
Pulse width	3,3 ns
Transmit Aperture	6 mm
Beam divergence (horizontal)	0,30 mrad
Time base	100 sec
Pulse repetition rate	50000 Hz
Effective pulses per scan	159 Hz
Line rate	10 Hz
Minimum angular increment	0,024°
Measured mean power (within 50 mm aperture)	294 mW
Measured mean power (within 7 mm aperture, 14 mm distance)	276 mW
Measured mean power (within 7 mm aperture, 100 mm distance)	276 mW
Measured mean power (within 7 mm aperture, scanned operation)	8 mW
Calculated pulse energy in 50 mm	5,9 µJ
Calculated pulse energy in 7 mm (14 mm distance)	5,5 µJ
Calculated pulse energy in 7mm (100 mm distance)	5,5 µJ

Stationary Mode (not feasible)		
Class 1		
AEL (pulse energy) 50 mm	fulfilled	11%
AEL (mean power) 50 mm	fulfilled	11%
AEL (pulse energy) 7 mm	fulfilled	3%
AEL (mean power) 7 mm	exceeded	14154%
Class 1M (7 mm aperture, 100 mm distance)		
AEL (pulse energy)	fulfilled	3%
AEL (mean power)	exceeded	14154%
Class 3R		
AEL (pulse energy) 50 mm	fulfilled	2%
AEL (mean power) 50 mm	exceeded	2141%
AEL (pulse energy) 7 mm	fulfilled	1%
AEL (mean power) 7 mm	exceeded	2760%
Class 3B		
AEL (pulse energy) 50 mm	fulfilled	0%
AEL (pulse energy) 7 mm	fulfilled	0%
AEL (mean power)	fulfilled	55%
If stationary operation of the VQ580 would be feasible it would have to be classified as according to IEC 60825-1:2001. Note that stationary operation is not accessible for an operator.		LASER CLASS 3B
Margin to the accessible emission limits of the specified laser class:		45%
NOHD:		377 m

Scanned Mode		
Class 1		
AEL (pulse energy) 7 mm	fulfilled	2%
AEL (mean power) 7 mm	exceeded	431%
AEL (single pulse train)	exceeded	
Class 3R		
AEL (pulse energy) 7 mm	fulfilled	0%
AEL (mean power) 7 mm	fulfilled	84%
AEL (single pulse train)	exceeded	6836%
Class 3B		
AEL (pulse energy) 7 mm	fulfilled	0%
AEL (mean power)	fulfilled	2%
AEL (single pulse train)	fulfilled	
Consequently, the VQ580 operated in scanning mode has to be classified as according to IEC 60825-1:2001.		LASER CLASS 3B
Margin to the accessible emission limits of the specified laser class:		43%
NOHD:		143 m

Conclusion	
The VQ580 can only be operated in the scanned mode. In the case the scanner motor stops, the laser is switched off instantaneously. Therefore, the VQ580 has to be classified as	
CLASS 3B LASER PRODUCT	