

LASER TYPE OR MODEL	BEAM COLOR Wavelength, nanometers	BEAM SPREAD Divergence, milliradians	LASER POWER, milliwatts	EYE HAZARD DISTANCE (Nominal Ocular Hazard Distance)			FLASHBLINDNESS DIST. (FAA Sensitive Flight Zone Exposure Distance)			GLARE DISTANCE (FAA Critical Flight Zone Exposure Distance)			DISTRACTION DISTANCE (FAA Laser Free Flight Zone Exposure Distance)			SKIN BURN HAZARD DISTANCE		FIRE HAZARD DISTANCE (From NFPA)	
				NOHD in feet	NOHD in miles	NOHD in meters	SFZED in feet	SFZED in miles	SFZED in meters	CFZED in feet	CFZED in miles	CFZED in meters	LFFZED in feet	LFFZED in miles	LFFZED in meters	In feet	In meters	In feet	In meters
				<b>CLASS 2</b> (less than 1 mW)															
0.99 mW red pointer, typical beam spread	635	1.0	0.99	23	0.004	7.0	55	0.01	17	244	0.0	74	2,441	0.5	744	1.5	0.5	1.0	0.3
0.99 mW green pointer, typical beam spread	532	1.0	0.99	23	0.004	7.0	109	0.02	33	488	0.1	149	4,880	0.9	1,487	1.5	0.5	1.0	0.3
0.99 mW red pointer, tighter beam	635	0.5	0.99	46	0.009	14.1	109	0.02	33	488	0.1	149	4,881	0.9	1,488	3.1	0.9	2.0	0.6
0.99 mW green pointer, tighter beam	532	0.5	0.99	46	0.009	14.1	218	0.04	67	976	0.2	297	9,759	1.8	2,975	3.1	0.9	2.0	0.6
<b>CLASS 3R</b> (less than 5 mW)																			
4.99 mW red pointer, typical beam spread	635	1.0	4.99	52	0.010	15.8	123	0.02	37	548	0.1	167	5,480	1.0	1,670	3.4	1.0	2.3	0.7
4.99 mW green pointer, typical beam spread	532	1.0	4.99	52	0.010	15.8	245	0.05	75	1,096	0.2	334	10,955	2.1	3,339	3.4	1.0	2.3	0.7
4.99 mW red pointer, tighter beam	635	0.5	4.99	104	0.020	31.6	245	0.05	75	1,096	0.2	334	10,959	2.1	3,340	6.9	2.1	4.6	1.4
4.99 mW green pointer, tighter beam	532	0.5	4.99	104	0.020	31.6	490	0.09	149	2,191	0.4	668	21,910	4.1	6,678	6.9	2.1	4.6	1.4
<b>CLASS 3B</b> (5 to <500 mW)																			
50 mW green handheld, typical beam spread	532	0.5	50	328	0.062	100.0	1,551	0.29	473	6,936	1.3	2,114	69,356	13.1	21,140	21.7	6.6	14.5	4.4
250 mW green handheld, typical beam spread	532	0.7	250	524	0.099	159.7	2,477	0.47	755	11,078	2.1	3,376	110,775	21.0	33,764	34.7	10.6	23.1	7.0
499 mW green handheld, typical beam spread	532	1.0	499	518	0.098	157.9	2,450	0.46	747	10,955	2.1	3,339	109,552	20.7	33,392	34.3	10.5	22.9	7.0
<b>CLASS 4</b> (500 mW and above)																			
Wicked Lasers S3 Arctic, 700 mW	445	1.5	700	409	0.077	124.7	360	0.07	110	1,610	0.3	491	16,103	3.0	4,908	27.1	8.3	18.1	5.5
Wicked Lasers S3 Arctic, 1.4 Watts	445	1.5	1400	579	0.110	176.3	509	0.10	155	2,277	0.4	694	22,773	4.3	6,941	38.3	11.7	25.5	7.8
Wicked Lasers S3 Arctic, 2 Watts	445	1.5	2000	691	0.131	210.8	609	0.12	186	2,722	0.5	830	27,219	5.2	8,296	45.8	14.0	30.5	9.3
Wicked Lasers S3 Inferno, 750 mW	635	3.0	750	212	0.040	64.5	501	0.09	153	2,239	0.4	683	22,393	4.2	6,825	14.0	4.3	9.3	2.8
Wicked Lasers S3 Krypton, 500 mW	532	1.5	500	346	0.065	105.4	1,635	0.31	498	7,311	1.4	2,228	73,108	13.8	22,283	22.9	7.0	15.3	4.7
1 Watt green laser, typical beam spread	532	1.5	1000	489	0.093	149.0	2,312	0.44	705	10,339	2.0	3,151	103,390	19.6	31,513	32.4	9.9	21.6	6.6
2 Watt green laser, typical beam spread	532	1.5	2000	691	0.131	210.8	3,269	0.62	997	14,622	2.8	4,457	146,216	27.7	44,567	45.8	14.0	30.5	9.3
5 Watt green laser, typical beam spread	532	2.0	5000	820	0.155	249.9	3,877	0.73	1,182	17,339	3.3	5,285	173,391	32.8	52,850	54.3	16.6	36.2	11.0

**How divergence affects hazard distances:** If a laser's divergence (beam spread) is increased, the hazard distances directly decrease.

For example, doubling the divergence will reduce the hazard distances by half. Usually, the more powerful a laser, the larger the typical divergence of the laser. Divergence can be improved (made tighter) using a lens or better engineering of the laser itself.

**How laser power affects hazard distances:** If a laser's power is increased, the hazard distances are longer by the square root of the power increase.

Going from a 5 mW to a 500 mW laser is a 100 times power increase -- but the hazard distances only become 10 times as long. (The square root of 100 is 10.)

**How wavelength affects hazard distances:** For visible lasers, the wavelength (color) does not affect the eye hazard (NOHD), skin hazard or fire hazard distances. But wavelength does affect the three visual interference distances: Flashblindness, glare and distraction.

The human eye is most sensitive to green light of 555 nanometers. This color would appear brightest, and most distracting to pilots, compared to other colors from an otherwise equivalent laser (e.g., having the same power and divergence).

At this time, most consumer lasers emit green light at 532 nanometers. This appears only 88% as bright as 555 nm light. Because it is so common, we will use 532 green as the baseline for "brightest available laser" in the following calculations:

-- Compared with 532 nm light, the common red wavelength 635 nm appears only 27% as bright. This has a square root effect on the visual interference distances. A 532 green laser appears 4 times as bright as a 635 red laser -- but the green visual interference distances are only 2 times the red distances. (The square root of 4 is 2.)

-- Compared with 532 nm light, the common blue wavelength 445 nm appears only 3.5% as bright. Again, there is a square root effect on the distances. A 532 green laser appears 29 times as bright as a 445 blue laser -- but the green visual interference distances are only 5.4 times longer than the blue distances. (The square root of 29 is 5.3.)