*Table 2.4*

**Exposure limit values for laser exposure of skin**

| Wavelength [a] [nm] | | Aperture | Duration [s] | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | $< 10^{-9}$ | $10^{-9}$ - $10^{-7}$ | $10^{-7}$ - $10^{-3}$ | $10^{-3}$ – $10^{1}$ | $10^{1}$ - $10^{3}$ | $10^{3}$ - $3 \cdot 10^{4}$ |
| UV (A, B, C) | 180-400 | 3, 5mm | $E = 3 \cdot 10^{10}$ [W m$^{-2}$] | Same as eye exposure limits | | | | |
| Visible and IRA | 400-700 | 3, 5mm | $E = 2 \cdot 10^{11}$ [W m$^{-2}$] | $H = 200\ C_A$ | $H = 1{,}1 \cdot 10^{4}\ C_A\ t^{0{,}25}$ [J m$^{-2}$] | | $E = 2 \cdot 10^{3}\ C_A$ [W m$^{-2}$] | |
| | 700 -1 400 | | $E = 2 \cdot 10^{11}\ C_A$ [W m$^{-2}$] | [J m$^{-2}$] | | | | |
| IRB and IRC | 1 400-1 500 | | $E = 10^{12}$ [W m$^{-2}$] | Same as eye exposure limits | | | | |
| | 1 500-1 800 | | $E = 10^{13}$ [W m$^{-2}$] | | | | | |
| | 1 800-2 600 | | $E = 10^{12}$ [W m$^{-2}$] | | | | | |
| | 2 600-$10^{6}$ | | $E = 10^{11}$ [W m$^{-2}$] | | | | | |

a If the wavelength or another condition of the laser is covered by two limits, then the more restrictive applies.

*Table 2.5*

**Applied correction factors and other calculation parameters**

| Parameter as listed in ICNIRP | Valid spectral range (nm) | Value |
|---|---|---|
| $C_A$ | $\lambda < 700$ | $C_A = 1{,}0$ |
| | 700 — 1 050 | $C_A = 10^{\,0{,}002(\lambda - 700)}$ |
| | 1 050 — 1 400 | $C_A = 5{,}0$ |
| $C_B$ | 400 — 450 | $C_B = 1{,}0$ |
| | 450 — 700 | $C_B = 10^{\,0{,}02(\lambda - 450)}$ |
| $C_C$ | 700 — 1 150 | $C_C = 1{,}0$ |
| | 1 150 — 1 200 | $C_C = 10^{\,0{,}018(\lambda - 1\,150)}$ |
| | 1 200 — 1 400 | $C_C = 8{,}0$ |
| $T_1$ | $\lambda < 450$ | $T_1 = 10$ s |
| | 450 — 500 | $T_1 = 10 \cdot [10^{\,0{,}02\,(\lambda - 450)}]$ s |
| | $\lambda > 500$ | $T_1 = 100$ s |
| Parameter as listed in ICNIRP | Valid for biological effect | Value |
| $\alpha_{min}$ | all thermal effects | $\alpha_{min} = 1{,}5$ mrad |
| Parameter as listed in ICNIRP | Valid angular range (mrad) | Value |
| $C_E$ | $\alpha < \alpha_{min}$ | $C_E = 1{,}0$ |
| | $\alpha_{min} < \alpha < 100$ | $C_E = \alpha/\alpha_{min}$ |
| | $\alpha > 100$ | $C_E = \alpha^2/(\alpha_{min} \cdot \alpha_{max})$ mrad with $\alpha_{max}$ = 100 mrad |
| $T_2$ | $\alpha < 1{,}5$ | $T_2 = 10$ s |
| | $1{,}5 < \alpha < 100$ | $T_2 = 10 \cdot [10^{\,(\alpha - 1{,}5)\,/\,98{,}5}]$ s |
| | $\alpha > 100$ | $T_2 = 100$ s |

| Parameter as listed in ICNIRP | Valid exposure time range (s) | Value |
|---|---|---|
| $\gamma$ | $t \leq 100$ | $\gamma = 11$ [mrad] |
| | $100 < t < 10^4$ | $\gamma = 1{,}1\ t^{0,5}$ [mrad] |
| | $t > 10^4$ | $\gamma = 110$ [mrad] |

*Table 2.6*

**Correction for repetitive exposure**

Each of the following three general rules should be applied to all repetitive exposures as occur from repetitively pulsed or scanning laser systems:

1. The exposure from any single pulse in a train of pulses shall not exceed the exposure limit value for a single pulse of that pulse duration.

2. The exposure from any group of pulses (or sub-group of pulses in a train) delivered in time t shall not exceed the exposure limit value for time t.

3. The exposure from any single pulse within a group of pulses shall not exceed the single-pulse exposure limit value multiplied by a cumulative-thermal correction factor $C_p=N^{-0,25}$, where N is the number of pulses. This rule applies only to exposure limits to protect against thermal injury, where all pulses delivered in less than $T_{min}$ are treated as a single pulse.

| Parameter | Valid spectral range (nm) | Value |
|---|---|---|
| $T_{min}$ | $315 < \lambda \leq 400$ | $T_{min} = 10^{-9}$ s (= 1 ns) |
| | $400 < \lambda \leq 1\,050$ | $T_{min} = 18 \cdot 10^{-6}$ s (= 18 µs) |
| | $1\,050 < \lambda \leq 1\,400$ | $T_{min} = 50 \cdot 10^{-6}$ s (= 50 µs) |
| | $1\,400 < \lambda \leq 1\,500$ | $T_{min} = 10^{-3}$ s (= 1 ms) |
| | $1\,500 < \lambda \leq 1\,800$ | $T_{min} = 10$ s |
| | $1\,800 < \lambda \leq 2\,600$ | $T_{min} = 10^{-3}$ s (= 1 ms) |
| | $2\,600 < \lambda \leq 10^6$ | $T_{min} = 10^{-7}$ s (= 100 ns) |

**Ippubblikat mid-Dipartiment tal-Informazzjoni (doi.gov.mt) — Valletta** — *Published by the Department of Information (doi.gov.mt) — Valletta*
**Mitbugh fl-Istamperija tal-Gvern fuq karta riċiklata** — *Printed at the Government Printing Press on recycled paper*

**Prezz/*Price***
**€2.24**