CLASSIFICATION OF ELECTROMAGNETIC RADIATION

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Basic Conversions:
$c = \lambda\nu = \nu/k$
$\nu = c/\lambda = ck$
$\lambda = c/\nu = 1/k$
$k = \nu/c = 1/\lambda$
c = speed of light = 2.99792458×10^8 m/s

Frequency (ν)	Wavelength (λ)	Wave number (k)	Names of bands	Approximate photon energies
3×10^0 — 3×10^1 Hz 3 — 30 Hz	10^8 — 10^7 m 100 — 10 Mm	10^{-8} — 10^{-7} m^{-1} 10 — 100 Gm^{-1}	ELF-(ELF 1), ITU band no. 1	
3×10^1 — 3×10^2 Hz 30 — 300 Hz	10^7 — 10^6 m 10 — 1 Mm	10^{-7} — 10^{-6} m^{-1} 100 Gm^{-1} — 1Mm^{-1}	SLF-(ELF 2), ITU band no. 2, megameter waves	
3×10^2 — 3×10^3 Hz 300 Hz — 3 kHz	10^6 — 10^5 m 1 Mm — 100 km	10^{-6} — 10^{-5} m^{-1} 1 — 10 Mm^{-1}	ULF-(ELF 3), ITU band no. 3	
3×10^3 — 3×10^4 Hz 3 — 30 kHz	10^5 — 10^4 m 100 — 10 km	10^{-5} — 10^{-4} m^{-1} 10 — 100 Mm^{-1}	VLF, ITU band no. 4, myriameter waves	
3×10^4 — 3×10^5 Hz 30 — 300 kHz	10^4 — 10^3 m 10 — 1 km	10^{-4} — 10^{-3} m^{-1} 100 Mm^{-1} — 1 km^{-1}	LF, ITU band no. 5, kilometer waves	
3×10^5 — 3×10^6 Hz 300 kHz — 3 MHz	10^3 —10^2 m 1 km — 100 m	10^{-3} — 10^{-2} m^{-1} 1 — 10 km^{-1}	MF, ITU band no. 6, hectometer waves	
3×10^6 — 3×10^7 Hz 3 — 30 MHz	10^2 — 10^1 m 100 — 10 m	10^{-2} — 10^{-1} m^{-1} 10 — 100 km^{-1}	HF, ITU band no. 7, decameter waves	
3×10^7 — 3×10^8 Hz 30 — 300 MHz	10^1 — 10^0 m 10 — 1 m	10^{-1} — 10^0 m^{-1} 100 km^{-1} — 1 mm^{-1}	VHF, ITU band no. 8, meter waves	
3×10^8 — 3×10^9 Hz 300 MHz — 3 GHz	10^0 — 10^{-1} 1 m — 100 mm	10^0 — 10^1 m^{-1} 1 — 10 m^{-1}	UHF, ITU band no. 9, decimeter waves[a]	
3×10^9 — 3×10^{10} Hz 3 — 30 GHz	10^{-1} — 10^{-2} 100 —10 mm	10^1 — 10^2 m^{-1} 10 — 100 m^{-1}	SHF, ITU band no. 10, centimeter waves[a]	
3×10^{10} — 3×10^{11} Hz 30 — 300 GHz	10^{-2} — 10^{-3} m 10 —1 mm	10^2 — 10^3 m^{-1} 100 m^{-1} — 1 mm^{-1} (1 — 10 cm^{-1})	EHF, ITU band no. 11, millimeter waves	
3×10^{11} — 3×10^{12} Hz 300 GHz — 3 THz	10^{-3} — 10^{-4} 1 mm — 100 μm	10^3 — 10^4 m^{-1} (1 — 10 mm^{-1}) (10 — 100 cm^{-1})	Part of micrometer waves, includes part of far or thermal infrared; ITU band no. 12	
3×10^{12} — 3×10^{13} Hz 3 — 30 THz	10^{-4} — 10^{-5} 100 — 10 μm	10^4 — 10^5 m^{-1} 10 — 100 mm^{-1} (100 — 1000 cm^{-1})	Part of micrometer waves includes part of far (thermal) infrared	
3×10^{13} — 3×10^{14} Hz 30 — 300 THz	10^{-5} — 10^{-6} m 10 — 1 μm (100,000 — 10,000 Å)	10^5 — 10^6 m^{-1} 100 mm^{-1} — 1μm^{-1}	Part of μm waves, part of infrared	(1.6 — 16) × 10^{-20} joule {0.1 — 1 eV}
3×10^{14} — 3×10^{15} Hz 300 THz — 3 PHz	10^{-6} — 10^{-7}m 1 μm — 100 m (10,000 — 1000 Å)	10^6 — 10^7 m^{-1} 1 — 10 μm^{-1}	Near infrared, visible, near ultraviolet	(1.6 — 16) × 10^{-19} joule {1 — 10 eV}
3×10^{15} — 3×10^{16} Hz 3 — 30 PHz	10^{-7} — 10^{-8}m 100 — 10 nm (1000 — 100 Å)	10^7 — 10^8 m^{-1} 10 — 100 μm^{-1}	Part of vacuum ultraviolet	(1.6 — 16) × 10^{-18} joule {10 — 100 eV}
3×10^{16} — 3×10^{17} Hz 30 — 300 PHz	10^{-8} — 10^{-9} m 10 —1 nm (100 — 10 Å)	10^8 — 10^9 m^{-1} 100 μm^{-1} — 1 nm^{-1}	Part of soft X-rays	(1.6 — 16) × 10^{-17} joule {100 — 1000 eV}
3×10^{17} — 3×10^{18} Hz 300 PHz — 3 Ehz	10^{-9} — 10^{-10} m 1 nm — 100 pm (10 — 1 Å)	10^9 — 10^{10} m^{-1} 1 — 10 nm^{-1}	Part of soft X-rays	(1.6 — 16) × 10^{-16} joule {1 — 10 keV}
3×10^{18} — 3×10^{19} Hz 3 — 30 Ehz	10^{-10} — 10^{-11} m 100 — 10 pm (1 — 0.1 Å)	10^{10} — 10^{11} m^{-1} 10 — 100 nm^{-1}	Hard X-rays and part of soft γ-rays	(1.6 — 16) × 10^{-15} joule {10 — 100 keV}
3×10^{19} — 3×10^{20} Hz 30 — 300 Ehz	10^{-11} — 10^{-12} m 10 — 1 pm (0.1 — 0.01 Å)	10^{11} — 10^{12} m^{-1} 100 nm^{-1} — 1 pm^{-1}	Part of soft and part of hard γ-rays (limit at 510 keV)	(1.6 — 16) × 10^{-14} joule {100 keV — 1 MeV}
3×10^{20} — 3×10^{21} Hz 300 — 3000 EHz	10^{-12} — 10^{-13} m 1 pm — 100 fm (0.01 — 0.001 Å)	10^{12} — 10^{13} m^{-1} 1 — 10 pm^{-1}	Part of hard γ-rays and part of "cosmic" γ-rays	(1.6 — 16) × 10^{-13} joule {1 — 10 MeV}
3×10^{21} — 3×10^{22} Hz 3000 — 30,000 EHz	10^{-13} — 10^{-14} m 100 — 10 fm (0.001 — 0.0001 Å)	10^{13} — 10^{14} m^{-1} 10 — 100 pm^{-1}	γ-rays produced by cosmic rays	(1.6 — 16) × 10^{-12} joule {10 — 100 MeV}

Note: Abbreviations used in this table: Å— ångstrom (1 Å=10^{-10} m); EHz—exahertz (10^{18} hertz); EHF—extremely high frequency; ELF— extremely low frequency; eV—electron volt (1 eV = 1.60218×10^{-19} joule); fm—femtometer (10^{-15} m); GHz—gigahertz (10^{9} hertz); Gm—gigameter (10^{9} m); HF—high frequency; Hz—hertz (s^{-1}); ITU—International Telecommunications Union; keV— kiloelectron volt (10^{3} eV); km—kilometer (10^{3} m); LF—low frequency; m—meter; MeV— megaelectron volt (10^{6} eV); MF—medium frequency; MHz—megahertz (10^{6} hertz); Mm—megameter (10^{6} meter); mm—millimeter (10^{-3} meter); µm—micrometer (10^{-6} meter); nm—nanometer (10^{-9}meter); PHz—petahertz (10^{15} hertz); pm—picometer (10^{-12} meter); SHF—super high frequency; SLF—super low frequency; THz—terahertz; UHF— ultra high frequency; ULF—ultra low frequency; VHF—very high frequency; VLF—very low frequency.

[a] Also called "microwaves"; not to be confused with "micrometer waves".

LETTER DESIGNATIONS OF MICROWAVE BANDS

Frequency (GHz)	Wavelength (cm)	Wavenumber (cm^{-1})	Band
1—2	30—15	0.033—0.067	L-Band
1—4	15—7.5	0.067—0.133	S-Band
4—8	7.5—3.7	0.133—0.267	C-Band
8—12	3.7—2.5	0.267—0.4	X-Band
12—18	2.5—1.7	0.4—0.6	Ku-Band
18—27	1.7—1.1	0.6—0.9	K-Band
27—40	1.1—0.75	0.9—1.33	Ka-Band