

# Appendix B: Some Useful Data

Frequency-band designations:

Designation	Band
Extremely low frequencies (ELF)	0–3 kHz
Very low frequencies (VLF)	3–30 kHz
Low frequencies (LF)	30–300 kHz
Medium frequencies (MF)	300–3000 kHz
High frequencies (HF)	3–30 MHz
Very high frequencies (VHF)	30–300 MHz
Ultra high frequencies (UHF)	300–3000 MHz
L-band	1–2 GHz
S-band	2–4 GHz
C-band	4–8 GHz
X-band	8–12 GHz
Ku-band	12–18 GHz
K-band	18–27 GHz
Ka-band	27–40 GHz

NB Microwaves are normally considered to be the frequencies between 3 GHz and 300 GHz.

Some physical constants:

Name	Value
Velocity of light in free space	$c_0 = 2.998 \times 10^8$ metres per second
Charge on an electron	$e = -1.602 \times 10^{-19}$ coulombs
Boltzman's constant	$k = 1.381 \times 10^{-23}$ joules per kelvin
Mass of an electron	$m = 9.107 \times 10^{-31}$ kilogrammes
Permittivity of free space	$\epsilon_0 = 8.854 \times 10^{-12}$ farads per metre
Permeability of free space	$\mu_0 = 12.57 \times 10^{-7}$ henries per metre

Some typical electrical properties:

Material	Relative Permittivity	Conductivity (S/m)
Aluminium	—	$3.8 \times 10^7$
Copper	—	$5.8 \times 10^7$
Steel	—	$10^7$
Glass	4.8	$2 \times 10^{-12}$
Silicon	11.9	$10^3$
Fresh water	80	$10^{-3}$
Sea water	81	5
Pastoral soil	10	$10^{-2}$
Sandy soil	10	$10^{-3}$
Concrete	5	$10^{-4}$
Bitumen	2.7	$10^{-12}$
Forest	1.1	$10^{-4}$