

## Electromagnetic Spectrum:

Antennas are used in the Radio Waves Region of Electromagnetic Spectrum.

30kHz-300GHz (Wavelength 10km-1mm)

See Electromagnetic Spectrum for the Radio Waves.

### Radio waves are transmitted in two ways.

1. Guided waves (Transmission lines, waveguides, fibre optic cables etc.)
2. Unguided waves (require antennas) radiation (in some applications there is no other choice)

### Where do we use Antennas?

1. Broadcasting (TV or radio) One transmitter, multiple receiver
2. Communication
  - a. Mobile phones
  - b. Satellite Communication
  - c. Aircraft-spacecraft
  - d. Wi-fi-Computer
  - e. Ship (Ship-Ship, Ship-Land, Ship-Satellite)
  - f. Microwave Radio Link (Point to Point) (10-300GHz) and (1-10mm)



3. Radar (Military, air traffic)
4. Remote Sensing
5. Defence (Electronic direction finding, jamming)
6. Medical Applications

Class			Frequency	Wave-length	Energy
Ionizing radiation	Γ	Gamma rays	300 EHz	1 pm	1.24 MeV
			30 EHz	10 pm	124 keV
	HX	Hard X-rays	3 EHz	100 pm	12.4 keV
			300 PHz	1 nm	1.24 keV
	SX	Soft X-rays	30 PHz	10 nm	124 eV
			3 PHz	100 nm	12.4 eV
Visible	EUV	Extreme ultraviolet	3 PHz	100 nm	12.4 eV
			300 THz	1 μm	1.24 eV
	NUV	Near ultraviolet	30 THz	10 μm	124 meV
NIR			Near infrared		

	MIR	Mid infrared			
			3 THz	100 $\mu\text{m}$	12.4 meV
	FIR	Far infrared			
			300 GHz	1 mm	1.24 meV
Micro- waves and radio waves	EHF	Extremely high frequency			
			30 GHz	1 cm	124 $\mu\text{eV}$
	SHF	Super high frequency			
			3 GHz	1 dm	12.4 $\mu\text{eV}$
	UHF	Ultra high frequency			
			300 MHz	1 m	1.24 $\mu\text{eV}$
	VHF	Very high frequency			
			30 MHz	10 m	124 neV
	HF	High frequency			
			3 MHz	100 m	12.4 neV
MF	Medium frequency				
		300 kHz	1 km	1.24 neV	
LF					

		Low frequency	30 kHz	10 km	124 peV
	VLF	Very low frequency	3 kHz	100 km	12.4 peV
	ULF	Ultra low frequency	300 Hz	1 Mm	1.24 peV
	SLF	Super low frequency	30 Hz	10 Mm	124 feV
	ELF	Extremely low frequency	3 Hz	100 Mm	12.4 feV