

Introduction to Microwave Engineering & Microwave frequencies

Introduction to Microwaves

* Micro $\rightarrow$ tiny (small) $\rightarrow$ wavelengths. $\rightarrow$ 1 meter $\rightarrow$ 1 mm.

* freq. of microwave varies from 300 MHz $\rightarrow$ 300 GHz.

f : 300 MHz to 300 GHz $\therefore \lambda$: 1 m $\rightarrow$ 1 mm

we know $f = \frac{c}{\lambda} \Rightarrow \lambda = \frac{c}{f}$

for 300 MHz, $\lambda = \frac{3 \times 10^8 \text{ m/sec}}{300 \times 10^6 \text{ 1/sec}}$

$$\lambda = 1 \text{ m}$$

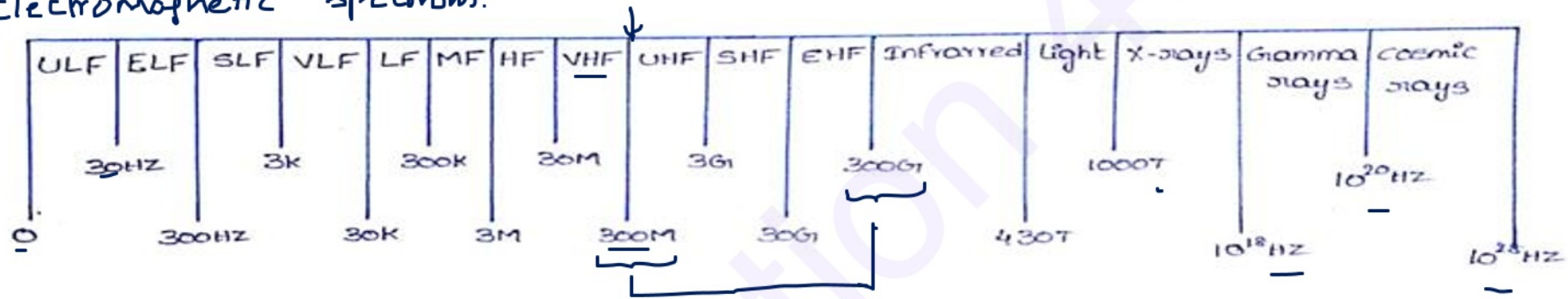
for 300 GHz; $\lambda = \frac{3 \times 10^8 \text{ m/sec}}{300 \times 10^9 \text{ 1/sec}}$

$$= 10^{-3} \text{ m}$$

$$\lambda = 1 \text{ mm}$$

Microwave frequency spectrum

Electromagnetic spectrum.



ULF - ultra low frequency

ELF - Extra low frequency

SLF - Super low frequency

VLF - Very low frequency

LF - Low frequency

MF - Medium frequency

HF - High frequency

VHF - Very high frequency

UHF - ultra High frequency

SHF - Super High frequency

EHF - Extreme high frequency

MW → UHF, SHF, EHF.

Microwave letter band designations

* Satellite $\rightarrow$ $\overset{\curvearrowright}{2G-4G}$.

Radar $\rightarrow$ $\leftrightarrow$

* ITU. $\rightarrow$ IEEE standards for letter band designation.

1G $\rightarrow$ 1000 GHz

$\rightarrow$ L $\rightarrow$ 1 GHz $\rightarrow$ 2 GHz

S $\rightarrow$ 2 GHz $\rightarrow$ 3 GHz.

$$\lambda = \frac{c}{f}$$

Designation	Frequency range	Wavelength range
<u>L</u> band	1 to 2 GHz	15 cm to 30 cm
<u>S</u> band	2 to 4 GHz	7.5 cm to 15 cm
<u>C</u> band	4 to 8 GHz	3.75 cm to 7.5 cm
<u>X</u> band	9.5 GHz $\rightarrow$ Reflex 8 to 12 GHz	25 mm to 37.5 mm

K _u band	12 to 18 GHz	16.7 mm to 25 mm
 K band	18 to 26.5 GHz	11.3 mm to 16.7 mm
 K _a band	26.5 to 40 GHz	5.0 mm to 11.3 mm
Q band	33 to 50 GHz	6.0 mm to 9.0 mm
U band	40 to 60 GHz	5.0 mm to 7.5 mm

V band	50 to 75 GHz	4.0 mm to 6.0 mm
W band	75 to 110 GHz	2.7 mm to 4.0 mm
F band	90 to 140 GHz	2.1 mm to 3.3 mm
D band	110 to 170 GHz	1.8 mm to 2.7 mm

SC, RE, NWE.