

# Radio Frequency (RF) Electronics

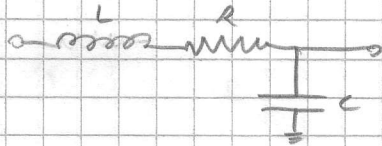
High Frequency  $\rightarrow$  Domain where:

- interelectrode capacitance
- wiring inductance
- stored charge
- short wavelength

are important

low pass  $\rightarrow F_{cutoff} = \frac{1}{2\pi RC}$

$Z_C = \frac{1}{j\omega C}$        $Z_L = j\omega L$



All connections have some L, R, & C. At Lf. Freq. this starts to matter.

## Wavelength:

$c = \lambda \nu$  ← radiation in vacuum

$\lambda = \frac{c}{\nu}$        $c = 3 \times 10^8 \frac{m}{s}$

For  $\nu = 10 \text{ kHz}$ ,  $\lambda = 30 \text{ km}$

For  $\nu = 1 \text{ MHz}$ ,  $\lambda = 300 \text{ m}$  ← (AM radio)

For  $\nu = 100 \text{ MHz}$ ,  $\lambda = 3 \text{ m}$  ← (FM, TV)

For  $\nu = 1 \text{ GHz}$ ,  $\lambda = 30 \text{ cm}$  ← (mobile phone)

For  $\nu = 100 \text{ GHz}$ ,  $\lambda = 3 \text{ mm}$

For circuits of characteristic size  $l \ll \lambda$ , we can think of the transmission of voltages & currents as instantaneous. We have been doing this implicitly in our circuit diagrams until now.

