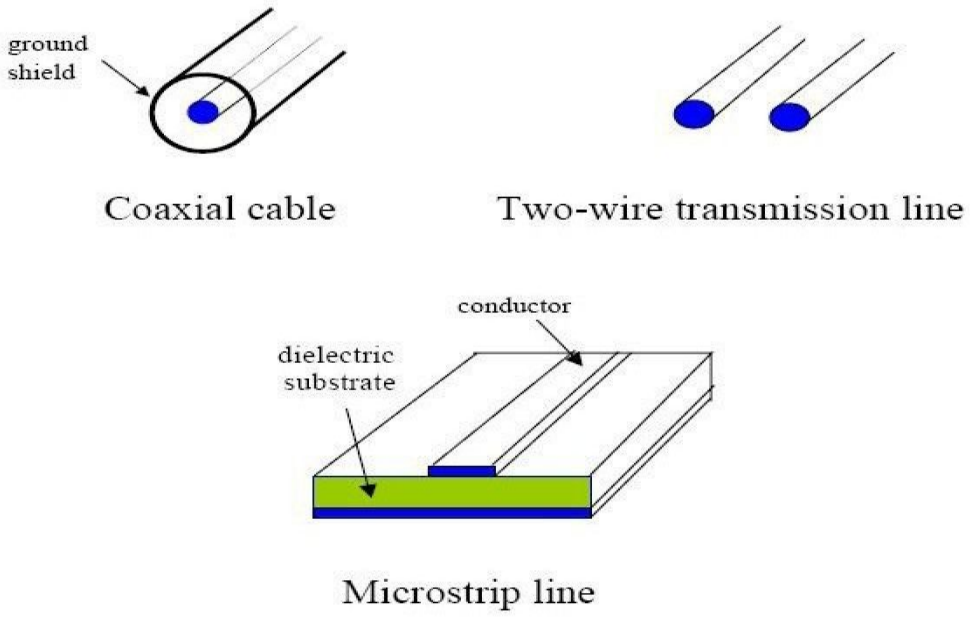
MICROWAVE TRANSMISION LINES

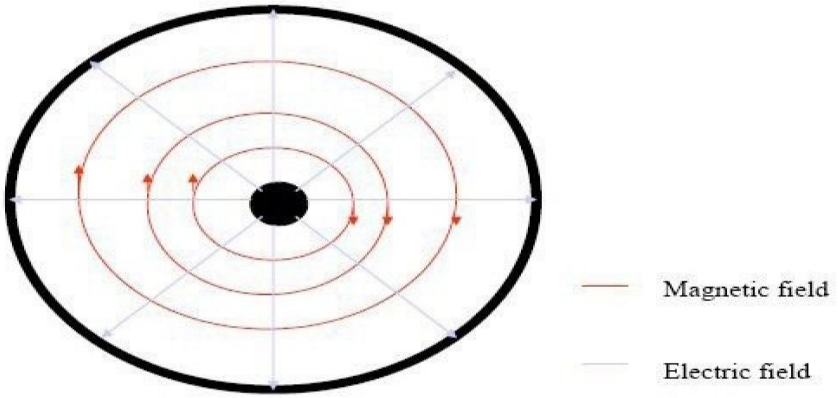
INTRODUCTION:

Any pair of wires and conductors carrying currents in opposite directions form transmission lines. Transmission lines are essential components in any electrical/communication system. They include coaxial cables, two-wire lines, microstrip lines on printed-circuit-boards (PCB).

The characteristics of transmission lines can be studied by the electric and magnetic fields propagating along the line. But in most practical applications, it is easier to study the voltages and currents in the line instead.



Different types of transmission lines

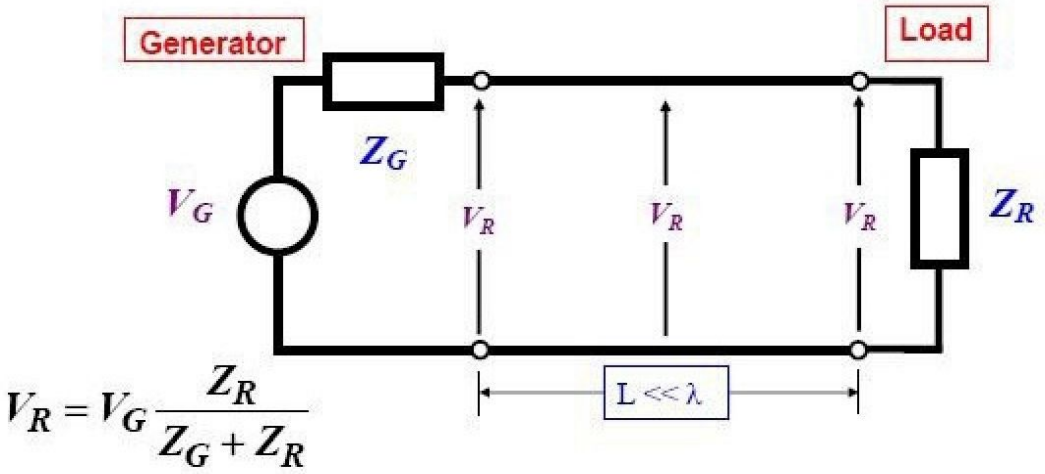


Cross-section of a coaxial cable showing the electric and magnetic fields

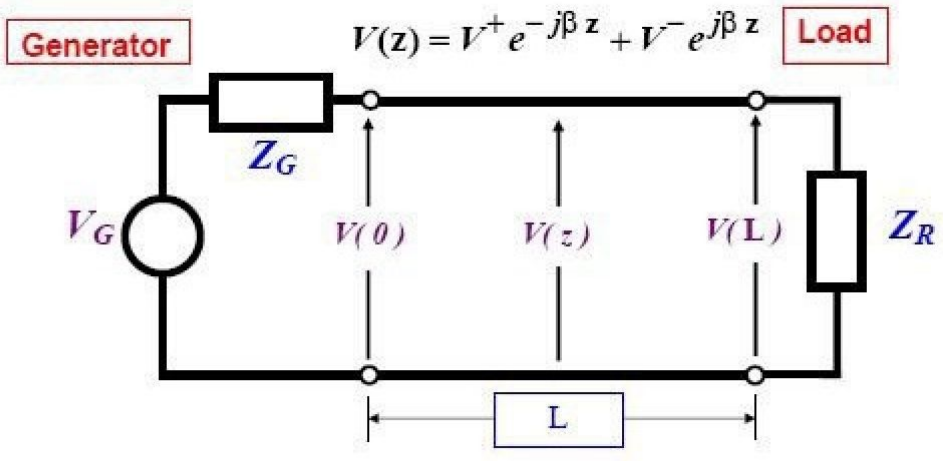
A typical engineering problem involves the transmission of a signal from a generator to a load. A transmission line is the part of the circuit that provides the direct link between generator and load.

Transmission lines can be realized in a number of ways. Common examples are the parallel-wire line and the coaxial cable. For simplicity, we use in most diagrams the parallel-wire line to represent circuit connections, but the theory applies to all types of transmission lines.

If you are only familiar with low frequency circuits, you are used to treat all lines connecting the various circuit elements as perfect wires, with no voltage drop and no impedance associated to them (lumped impedance circuits). This is a reasonable procedure as long as the length of the wires is much smaller than the wavelength of the signal. At any given time, the measured voltage and current are the same for each location on the same wire.



For sufficiently high frequencies the wavelength is comparable with the length of conductors in a transmission line. The signal propagates as a wave of voltage and current along the line, because it cannot change instantaneously at all locations. Therefore, we cannot neglect the impedance properties of the wires.



Source : http://elearningatria.files.wordpress.com/2013/10/ece-v-microwaves-and-radar-10ec54-notes.pdf