

Losses in Transmission Lines

Generally losses in transmission lines can be classified in to three types.

1) Radiation Loses

They occur because transmission line may act as antenna if separation of the conductor is an appreciable fraction of wavelength. This applies more to parallel line as compared to co-axial cables. They are difficult to estimate, and are normally calculated rather than being measured . These losses increase with the increase in frequency.

2) Conductor Heating

Conductor heating or I^2R loss is proportional to current and inversely promotional to characteristic impedance. It also increases with frequency. Similarly Dielectric material temperature also increases. Dielectric heating is proportional to voltage across dielectric and inversely proportional the characteristic impedance for any power transmitted. These losses are given by the manufacturers in charts , and are expressed in decibels per 100 meter. For example for a coaxial cable at 1 GHz these losses may vary as much as 200db/100m

3) Velocity Factor

The velocity of light and all other EM waves depend on medium through which they propagates. It is nearly 3×10^8 in a vacuum and slower in other medium..

Velocity of light in a medium is given by

$$V = V_c / \sqrt{k}$$

Where

V= Velocity in medium

V_c= Velocity of light in a vacuum

K= dielectric constant of medium