VHF Propagation

For a medium which has a dielectric constant ‘ε’ and a conductivity ‘σ’

$$\nabla \times H = \varepsilon \dot{E} + \sigma E$$

If the variation of E with time is sinusoidal,

$$E = E_0 \, e^{j\omega t}$$

$$\dot{E} = j\omega E$$

$$\nabla \times H = \left(\varepsilon + \frac{\sigma}{j\omega} \right) \dot{E}$$

$$= \varepsilon' \dot{E}$$

Partially conducting dielectric can be considered as a dielectric that has a complex dielectric constant ε'

$$\varepsilon' = \varepsilon \left(1 + \frac{\sigma}{j\omega\varepsilon} \right)$$

The wave equations and reflection coefficient derived for perfect dielectrics will apply directly to dielectric having loss or conductance, if the dielectric ε is replaced by an equivalent complex dielectric constant

$$\varepsilon' = \left(\varepsilon + \frac{\sigma}{j\omega} \right)$$

θ is the angle of incidence measured from the normal in dealing with reflection by the earth, it is usual to express the direction of the incident wave in terms of angle ψ which is measured from the Earth’s surface.

$$\psi = 90° - \theta$$

so that

$$\cos\theta = \sin\psi$$

$$\sin\theta = \cos\psi$$

Γ_h

Γ_v

1) surface wave is neglected

2) ψ is very small

so that Γ_v or $\Gamma_h \cong -1$

$$\left| E \right| = \frac{60I}{d} \left| 1 + \Gamma_{\substack{v \\ h}} \angle -\alpha \right|$$
$$= \frac{60I}{d} \left| 1 - 1 \angle -\alpha \right|$$

where

$$\alpha = \frac{2\pi}{\lambda}(R_2 - R_1)$$