

Fact Sheet Chapter 3

Friis TX Eq²

$$P_r(d) = \frac{P_t G_t G_r \lambda^2}{(4\pi)^2 d^2 L} = \frac{|E|^2}{120\pi} A_e$$

↑ Loss Factor

$$EIRP = P_t G_t$$

Path Loss

$$PL(dB) = 10 \log \frac{P_t}{P_r}$$

Reflection

See Fig 3.4

$$\Gamma_{||} = \frac{-\epsilon_r \sin \theta_i + \sqrt{\epsilon_r - \cos^2 \theta_i}}{\epsilon_r \sin \theta_i + \sqrt{\epsilon_r - \cos^2 \theta_i}} \quad \theta_i = \theta_r$$

$$\Gamma_{\perp} = \frac{\sin \theta_i - \sqrt{\epsilon_r - \cos^2 \theta_i}}{\sin \theta_i + \sqrt{\epsilon_r - \cos^2 \theta_i}}$$

Ground Bounce

$$E_{TOT}(d) \approx \frac{2 E_0 d_0 2\pi h_t h_r}{d^2 \lambda} \quad \left(\frac{V}{m}\right)$$

$$P_r = P_t G_t G_r \frac{h_t^2 h_r^2}{d^4}$$

Diffraction

$$v = h \sqrt{\frac{2(d_1 + d_2)}{\lambda d_1 d_2}}$$

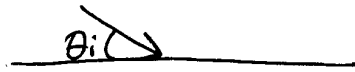
$$\phi = \frac{\pi}{2} v^2$$

$$v_n = \text{radius of Fresnel zone} = \sqrt{\frac{n \lambda d_1 d_2}{d_1 + d_2}}$$

$$n = 0, 1, 2, \dots$$

Rough Surface Scattering

$$h_c = \frac{\lambda}{8 \sin \theta_i} \quad f_s = \exp\left(-8 \left(\frac{\pi \sigma_h \sin \theta_i}{\lambda}\right)^2\right)$$



$$\Gamma_s = f_c \Gamma$$

Log-distance Path Loss

$$P_r = P_0 \left(\frac{d}{d_0}\right)^{-n} \quad \left\| \begin{array}{l} \overline{PL}(d) = \overline{PL}(d_0) + 10n \log\left(\frac{d}{d_0}\right) \\ \text{Table 3.2 for } n \end{array} \right.$$

Okumura model

$$L_{50}(\text{dB}) = L_F + A_{mu} - G(h_{te}) - G(h_{re}) - G_{AREA}$$

$$G(h_{te}) = 20 \log(h_{te}/200)$$

$$G(h_{re}) = 10 \log(h_{re}/3)$$

$$G(h_{re}) = 20 \log(h_{re}/3)$$

$$h_{re} \leq 3\text{m}$$

$$10\text{m} > h_{re} > 3\text{m}$$

Figures 3.23 + 3.24

Hata Model

See text