MOBILNE KOMUNIKACIJE

1. DZ

Br. 0

1. $\sigma = 6.17 dB$ — prigradsko
   $d = 50 km$ — $EIRP = 500 W$
   $h_t = 100 m$ — $f = 900 MHz$
   $h_r = 10 m$ — $G_r = 1$
   $P_{r,min} = -101 dBm$

Okumura:

$$L_{50} = L_F + A(f,d) - a(h_t) - a(h_r) - G_{AREA}$$

- $L_F = 10 \log \left(\frac{4\pi d}{\lambda}\right)^2 = 125.506 dB$
- $A(f,d) = 45 dB$
- $a(h_t) = 20 \log \left(\frac{h_t}{200}\right) = -6 dB$
- $a(h_r) = 10 \log \left(\frac{h_r}{3}\right) = 5.229 dB$
- $G_{AREA} = 9.9 dB$

$L_{50} = 141.577$

$$P_{r,m} = P_t(dBm) + G_t(dB) + G_r(dB) - L_{50}$$

$$P_{r,m} = EIRP(dBm) + G_r(dB) - L_{50} = -104.587 dBm$$

$$P_x(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left[-\frac{(x-\bar{x}_m)^2}{2\sigma^2}\right]$$

$x \in [-101, \infty>$

$x_m = -104.5873\,dBm$

$\sigma = 4.14$

$$P = \int_{x_{min}}^{\infty} P_x(x)\,dx \quad \Rightarrow \quad \text{MATLAB}$$

0.91947

provjeriti

Može i

Ručno: $u = \frac{x - x_m}{\sigma} = 0.9665$

$\phi^* = 0.61405$

$P(x > x_{min}) = 0.17947$

Br. 1

1. $P_{sr} = -60 dBm \Rightarrow \overline{x} = 6,14 \cdot 10^{-4} \frac{V}{m}$

$P_{1max} = -79 dBm \Rightarrow x_{1max} = 8,693 \cdot 10^{-5} \frac{V}{m}$

$P_{2max} = -73 dBm \Rightarrow x_{2max} = 1,395 \cdot 10^{-4} \frac{V}{m}$

$$p(x) = \frac{x}{\sigma^2} \exp\left(-\frac{x^2}{2\sigma^2}\right)$$

$$\overline{x} = \sigma \sqrt{\frac{\pi}{2}} \Rightarrow \sigma^2 = 2,4 \cdot 10^{-9}$$

$$cdf = \int_0^{x_{max}} p(x)\,dx = 1 - \exp\left(-\frac{x_{max}^2}{2\sigma^2}\right) \approx \frac{x^2}{2\sigma^2}$$

- $P(P < -79 dBm) = 0.0155$
- $P(P < -73 dBm) = 0.0396$

(2.) $h_t = 25$ urbano – veliki grad

$h_r = 1.5$

$f = 1.8\,GHz$

$L_{50} = 140\,dB \rightarrow r = ?$

$r_2 = 2r \rightarrow L_{50} = ?$

$$L_{50} = A + B \log r\,(km) - \epsilon$$

$$A = 69.55 + 26.16 \log f\,(MHz) - 13.82 \log h_t$$

$$A = 135.39$$

$$B = 44.9 - 6.55 \log h_t = 35.743$$

$$\epsilon = 3.2\left(\log(11.75 h_r)\right)^2 - 4.97 = -9.19 \cdot 10^{-4}\ dB$$

ZANEMARIVO!

- $L_{50} = 140 \Rightarrow r = 10^{\frac{L_{50} - A}{B}} = 1.345\ km$
- $r_2 = 2r = 2.69\ km \Rightarrow L_{50} = 150.95\ dB$

$$\Delta L_{50} = 150.95 - 140 = 10.95\ dB$$

Po Friisovoj formuli:

$$\Delta L = 20 \log \frac{4\pi r_1}{\lambda} - 20 \log \frac{4\pi r_2}{\lambda}$$

$$= 20 \log\left(\frac{1}{2}\right) = -60\ dB$$

bt.3

(1) $h_b = 60m$ $\quad d = 5km$

$f = 900MHz$ $\quad h_r = 5m$

$P_t = 10W$ $\quad G_r = 3dBi$

$G_b = 10dBi$ $\quad h_p = 400m$

• Okumura - Hata:

$$L(dB) = A + B \log d(km) - E - D$$

$A = 122.26$

$B = 33.25$

$D = 28.51$

$E = 8.94$

$L = 108.05dB$

F-K parametar:

$d_1 = 3km$

$d_2 = 2km$

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

$$h_{LOS} - 60 = \frac{5-60}{5000-0} \cdot 3000$$

$h_{LOS} = 27m$

$h = h_p - h_{LOS} = 373m$

$r = 26.375$

$$G_d(dB) = 20 \log\left(\frac{0.225}{r}\right) = -41.38dB$$

$P_r = P_t + G_b + G_r - L_{o-H} + G_d = -126.43dBW$

Ovaj baš i ne priča :-)

(1) $d = 30\,km$

prigradsko (okumura)

$f = 900\,MHz$

$h_t = 30$ $\qquad h_r = 1.5\,m$

$$L_{50} = L_F + A(f, d) - a(h_t) - a(h_r) - G_{AREA}$$

- $L_F = 20 \log \frac{4\pi d}{\lambda} = 121.09\,dB$
- $a(h_t) = 20 \log\left(\frac{h_t}{200}\right) = -16.48\,dB$
- $a(h_r) = 10 \log\left(\frac{h_r}{3}\right) = -3\,dB$
- $A(f, d) = 35\,dB$
- $G_{AREA} = 9.9\,dB$

$L_{50} = 165.85\,dB$