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za 14 dní není cvičení
26. 10. 12, 13, 14 měřící vůz

www.rfprop.com

<http://pitbul.wz.cz>

software Radiolab

$$S = \frac{P_v}{4\pi r^2} \quad \lambda = \frac{c}{f}$$

$$A_{eff} = \frac{G \lambda^2}{4\pi}$$

$$P_p = S \cdot A_{eff} = \frac{P_v G_v}{4\pi r^2} \cdot \frac{G_p \lambda^2}{4\pi}$$

$$P_p = P_v \cdot G_v \cdot G_p \cdot \left(\frac{\lambda}{4\pi r} \right)^2$$

křivky prokreslí $\frac{1}{L}$

$$G = D \cdot \mu$$

$$G_{dB} = 10 \log G$$

$$L = \left(\frac{4\pi r}{\lambda} \right)^2$$

$$P_{dBm} = 10 \log P_p [\text{mW}]$$

$$P_p [\text{dBm}] = P_v [\text{dBm}] + G_v [\text{dB}] + G_p [\text{dB}] - L [\text{dB}]$$

$$L_{dB} = 20 \log \left(\frac{4\pi r}{\lambda} \right)$$

FSL .. free space loss

Modif model

P_h

$$E = 50 \cdot 10^{-6} \text{ V/m}$$

$$f = 900 \text{ MHz}$$

$$E = 10 \log \left[\frac{(50 \cdot 10^{-6})^2}{10^{-6}} \right] = 34 \text{ dB } \mu\text{V/m}$$

$$P = 6 \cdot 10^{-14} \text{ W}$$

výkon prijatý isotropickým
karcem

$$P = -102 \text{ dBm}$$

$$P = A_g \cdot W$$

$$A_g = \frac{\lambda^2}{4\pi} \cdot G$$

$$W = |E H| = \frac{E^2}{120\pi}$$

$$\lambda = \frac{300}{f_{\text{MHz}}}$$

P_h Hypermarket, WiFi AP

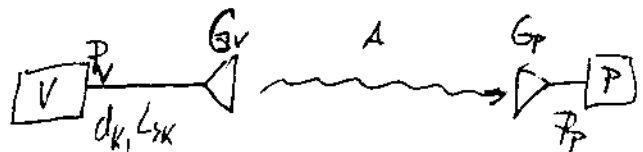
$$G_v = 4 \text{ dB}$$

$$d_k = 10 \text{ m}$$

$$L_{sk} = 0,5 \text{ dB/m}$$

$$f = 2450 \text{ MHz}$$

$$P_v = 10 \text{ dBm}$$



$$G_p = 2 \text{ dB}$$

$$P_p = -91 \text{ dBm} \text{ nako na prijímaní pro 2 mbps}$$

$$A = 15 \text{ dB} \text{ (rezerva na únik)}$$

$$R = ? \text{ m} \text{ dosah vysílače}$$

výbereme si 15M

$$L(d) = L_1 + 10n \log d$$

$$L_1 = 10 \log \left[\left(\frac{4\pi \cdot 1}{\lambda} \right)^2 \right] = 40,2 \text{ dB}$$

$$m_1 = 2$$

$$m_2 = 3$$

vezmeme 2 možnosti

$$P_T = P_v + G_v + G_p - A - \underbrace{L - L_{sk} \cdot d_k}_{-L_1 - 10n \log d}$$

$$10n \log d = -P_T + P_v + G_v + G_p - L_1 - A - L_{sk} \cdot d_k$$
$$d = 10^{\frac{-P_T + P_v + G_v + G_p - L_1 - A - L_{sk} \cdot d_k}{10n}}$$

$$d = 10^{\frac{9,1 + 10 + 4 + 2 - 40,2 - 15 - 10 \cdot 0,5}{10 \cdot 2_{(3)}}}$$

$$d|_{n=2} = 218 \text{ m}$$

$$d|_{n=3} = 36 \text{ m}$$

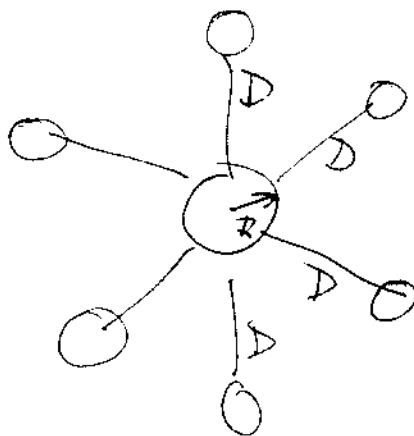
$$P_T = -83 \text{ dBm} \text{ pro } 11 \text{ mbps}$$

$$d|_{n=2} = 87 \text{ m}$$

$$d|_{n=3} = 20 \text{ m}$$

Bunhová síť
 $N=7$

$$\frac{D}{R} = \sqrt{3N}$$



$$P_v = 15 \text{ W}$$

$$R = 14 \text{ km}$$

$$f = 900 \text{ MHz} \quad n = 3,5$$

$$L(d) = L_0(1 \text{ km}) + 10 n \log d_{\text{km}}$$

2) $\frac{C}{I} = 15,4 \text{ dB}$ *úroveň / rušivý sig.*

2) $P_P = \text{dBm}$ *přijímaný výkon na okraji bunty*

$$\frac{C}{I} = \frac{C}{\Sigma I} = \frac{R^{-n}}{6 \cdot D^{-n}} = \frac{1}{6} \left(\frac{D}{R} \right)^n = \frac{\sqrt{21}^{3,5}}{6}$$

$$C: P_P = P_v \cdot G \cdot K \cdot \frac{1}{R^n}$$

$$I: P_P = P_v \cdot G \cdot K \cdot \frac{1}{D^n}$$

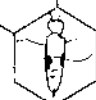
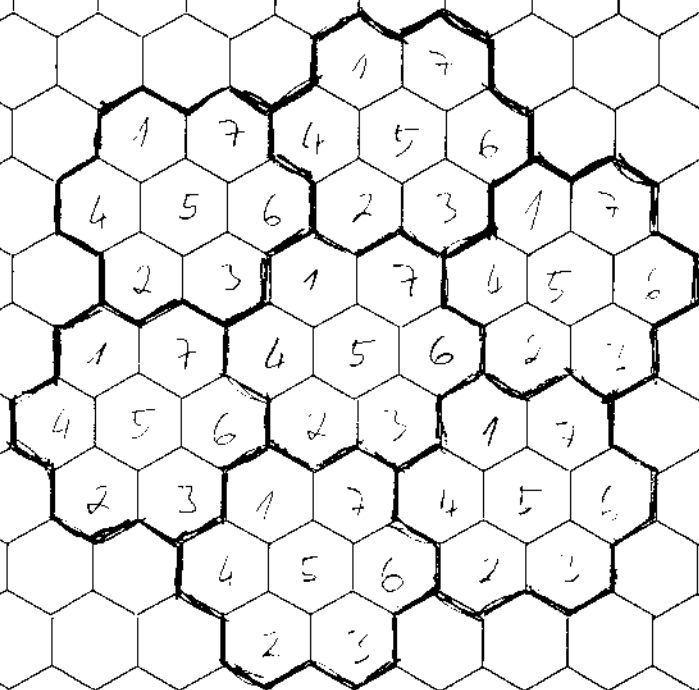
L

$$2) P_P = P_v - L$$

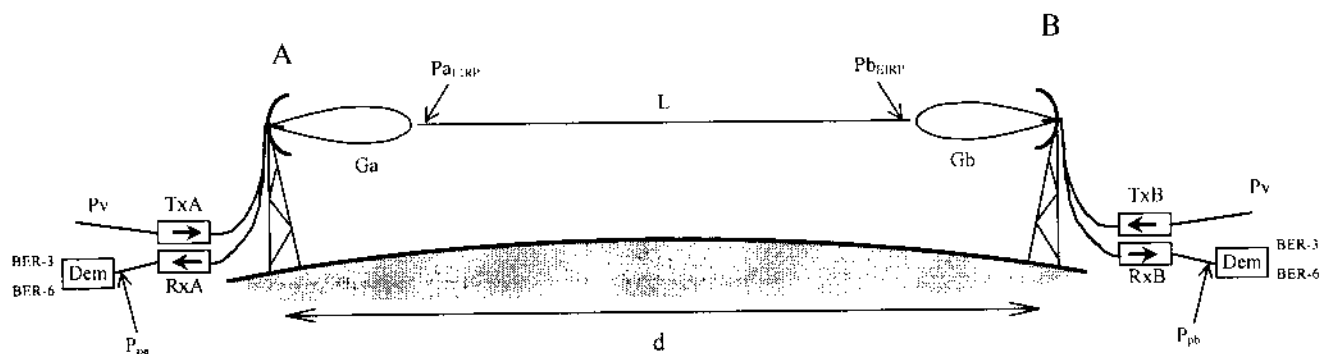
$$P_P = P_v - L_0(1 \text{ km}) - 10 \cdot 3,5 \cdot \log 14$$

$$P_P = 41,8 - 91,5 - 40,1$$

$$P_P = -89,8 \text{ dBm}$$



Pomocí programu RadioLab navrhnete mikrovlnný směrový spoj (více skoků) mezi stanicemi HORNE OTROKOVCE a BENUS



frekvence spoje:	$f = 18 \text{ GHz}$
výkon vysílače:	$P_v = 10 \text{ dBm}$
zisk antén:	$G_a = G_b = 40 \text{ dB}$
prahová úroveň BER-3:	$\text{BER}_3 = -90 \text{ dBm}$
prahová úroveň BER-6:	$\text{BER}_6 = -80 \text{ dBm}$
přídavné útlumy:	$R_{xA} = R_{xB} = T_{xA} = T_{xB} = 5 \text{ dB}$
výšky stožárů:	10-50m