

SYSC 5608 - Wireless Communications Systems Engineering

Term 1, Question 3.

$$(a). \bar{P}_L = \left(\frac{4\pi d_0}{\lambda}\right)^2 \left(\frac{d}{d_0}\right)^n \Rightarrow \bar{P}_L [\text{dB}] = 20 \log \frac{4\pi}{\lambda} + (2-n)10 \log d_0 + 10n \log d$$

thus $n_1 = 3$ $n_2 = 3.5$. $\lambda = \frac{c}{f} = 0.15$

$$\begin{cases} 20 \log \frac{4\pi}{\lambda} + (2-3)10 \log d_{01} = 28.92 \\ 20 \log \frac{4\pi}{\lambda} + (2-3.5)10 \log d_{02} = 31.31 \end{cases} \Rightarrow \begin{cases} d_{01} \approx 8.99 \text{ m} \\ d_{02} \approx 2.99 \text{ m} \end{cases}$$

$$(b). P_{RX} = P_{TX,BS} + G_{RS} - PL_{BS-RS} - PL_{RS-UE} \quad \nearrow G(0, 8\sqrt{2})$$

$$= 43 [\text{dBm}] + 100 [\text{dB}] - 28.92 - 30 \log 900 - 31.31 - 35 \log d_2 - (X_1 + X_2)$$

$$\text{SINR} = P_{RX} - P_{I+N} = 90.1633 [\text{dB}] - 35 \log d_2 - (X_1 + X_2).$$

$$\downarrow G(90.1633 - 35 \log d_2, 8\sqrt{2}).$$

$$P(\text{SINR} \geq 4 \text{ dB}) \geq 92\% \Rightarrow Q\left(\frac{-86.1633 + 35 \log d_2}{8\sqrt{2}}\right) \geq 92\%$$

$$Q\left(\frac{86.1633 - 35 \log d_2}{8\sqrt{2}}\right) \leq 8\% \Rightarrow \frac{86.1633 - 35 \log d_2}{8\sqrt{2}} \geq 1.4$$

$$d_{2 \max} \approx 102.16 \text{ m}$$

$$\text{max size } (900 + 102.16) \text{ m} \Rightarrow \approx 1002.16 \text{ m}$$

Jiachen Sun