

$$X_{dB} = 10 \cdot \log_{10} X$$

$$X = 10^{X_{dB}/10}$$

$$\log(X \cdot Y) = \log X + \log Y$$

$$\log(X/Y) = \log X - \log Y$$

$$\log X^y = y \cdot \log X$$

$$10 \cdot \log_{10} 1 = 0 \text{ dB}$$

$$10 \cdot \log_{10} 10 = 10 \text{ dB}$$

$$10 \cdot \log_{10} 2 \approx 3 \text{ dB}$$

$$10 \cdot \log_{10} 3 \approx 5 \text{ dB}$$

$$S/N = EIRP/L_0 \times G/T \times 1/kB \times 1/L_a \rightarrow S/N_{dB} = EIRP - L_0 + G/T - k - B - L_a$$

$$EIRP = 50 \text{ dBW}$$

$$L_0 = 10 \log_{10} (4\pi d/\lambda)^2 = 20 \log_{10} 4 + 20 \log_{10} \pi + 20 \log_{10} (4 \cdot 10^7) - 20 \log_{10} (\lambda), \quad \lambda f = c, \lambda = 3 \cdot 10^8 / 3 \cdot 10^{10} = 10^{-2}$$

$$L_0 = 4 \cdot 10 \log_{10} 2 + 2 \cdot 10 \log_{10} 3 + 4 \cdot 10 \log_{10} 2 + 14 \cdot 10 \log_{10} 10 + 4 \cdot 10 \log_{10} 10$$

$$= 12 + 10 + 12 + 140 + 40 = 214 \text{ dB}$$

$$G/T = 13 \text{ dB/K}$$

$$k = 10 \cdot \log_{10} (1.38 \cdot 10^{-23}) = 10 \cdot \log_{10} (\sqrt{2}) - 23 \cdot 10 \cdot \log_{10} 10 = 0.5 \cdot 10 \cdot \log_{10} 2 - 23 \cdot 10 \cdot \log_{10} 10 = 1.5 - 230$$

$$= -228.5 \text{ dBW/Hz/K}$$

$$B = 10 \cdot \log_{10} (2.048 \cdot 10^6) = 10 \cdot \log_{10} 2 + 6 \cdot 10 \cdot \log_{10} 10 = 3 + 60 = 63 \text{ dB}$$

$$L_a = 1 + 0.9 = 1.9 \text{ dB}$$

$$S/N = 50 - 214 + 13 + 228.5 - 63 - 1.9 = 12.6 \text{ dB}$$