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EE 401: Communication Systems

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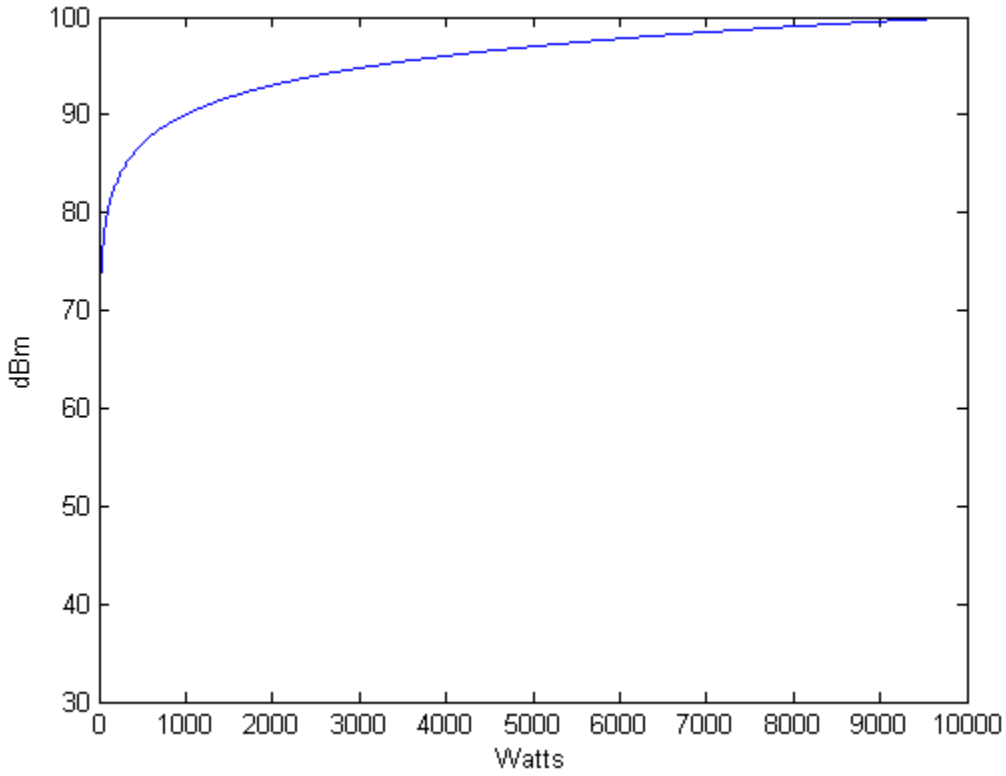
Homework 1: Decibels

This homework contains in it entirety the MATLAB code (see attached) for which a user prompted input (in Watts) returns a value in dBm as well as the plot of the output (dBm) vs. input (Watts). The figure below shows the output of the graph.



EE 401 Homework #1 David Hawthorn

1-4. $\nu = \frac{c}{\lambda} \rightarrow \lambda = \frac{c}{\nu} = \frac{3E8}{108E6} = \frac{300}{108} = 2.78\,m$

$\boxed{\lambda = 2.78\,m}$ or $\boxed{\lambda = 278 \times 10^8\,\text{Å}}$

1-14. $-18\,dB = 10\log_{10}\left(\frac{P_{out}}{2W}\right)$

$10^{-1.8} = \frac{P_{out}}{2W} \rightarrow P_{out} = 2 \cdot 10^{-1.8}\,W$

$\boxed{P_{out} = 31.7\,mW}$

1-19. $dBm = 10\log_{10}\left(\frac{85W}{1mW}\right) \boxed{= 49.3}$

$dBW = 10\log_{10}\left(\frac{85W}{1W}\right) \boxed{= 19.3}$

$dBf = 10\log_{10}\left(\frac{85W}{1fW}\right) \boxed{= 169.3}$

1-32. $P_{out} = 0.5\,W \Rightarrow G_p =$ ~~146.9897 dBf~~ 26.99 dBm $\Rightarrow$ ~~-3.01 dBW~~

$G_1 = 20\,dB$

$L = 200\,dB =$

$N_L = 2\,dBf$

$SNR = 15\,dB$

1-32 cont.

$P_S(dBm) = 26.99$

$P_i(dBm) = 26.99 + 20 - 200 = -153\ dBm$

$(S/N)_{dB} = P_f(dBf) - N(dBf) \quad = -33\ dBf$

$15\ dB = P_f(dBf) - 2\ dBf$

$17\ dBf = P_f(dBf)$

$17\ dBf = -33\ dBf + G_T$

$50\ dB = G_T$

$\boxed{G_T = 50\ dB}$