GP265/EE355
HOMEWORK SET NO. 1

1) a) Using a spread sheet of the form given in Handout no. 3, page 11, calculate the signal to noise ratio for the following system:

Transmit power: 2500 w

Cable losses: 1 dB

Antenna efficiency: 50%

Antenna size: 1×0.5 m

Noise temperature: 900 K

System bandwidth: 1 MHz

Wavelength: 24 cm

Distance: 15 Km

Object size: 10×5 m

Object σ^0: -15 dB

b) Keeping the other system parameters the same, reevaluate the SNR for a wavelength of 3 cm. Why the difference?

2) Design a radar (that is, generate a dB table spreadsheet) that can map a 5000 m wide swath from an aircraft flying at an 8000 m altitude. Set the incidence angle at the center of the swath to 45^{o}. Use a fixed antenna length of 2 m. Let σ^0 be -15 dB, and use a transmitted pulse length of 1.0 μs. Assume cable and other losses of 1 dB, and use reasonable values for transmit power, noise temperature, and antenna efficiencies.

a) Design an L-band ($\lambda = 24$ cm) system first. Achieve an SNR of > 10 dB.

b) Reevaluate system performance at C-band ($\lambda = 6$ cm) and at K_U-band ($\lambda = 2$ cm), keeping as many of the system parameters as possible unchanged from the values used in part (a). However, ensure that the swath width remains 5000 m.

c) Contrast changes in SNR vs. frequency with the frequency sensitivity you found in question (1).