

1. A surface to air missile (SAM) site is receiving position information about your aircraft. Jamming seems like a good idea, so you turn on your jamming equipment. The parameters for the radio transmitter and your jamming equipment are given below. If the SAM site needs a signal to noise ratio of 0.06 to process and receive the communication signal, is your jamming effective?

<b>SAM radio communications</b>	<b>Your jamming equipment</b>
Power transmitted = 1 kW	Power transmitted = 2.0 kW
Transmit Antenna Gain = 3	Transmit Antenna Gain = 20
Receive Antenna Gain = 3	
Frequency = 750 MHz	Frequency = 750 MHz
Distance = 80 km	Distance = 75 km

- (a) What is the wavelength of the signal?

$$\lambda = 400 \text{ mm}$$

- (b) What is  $P_{received}$  of the SAM radio without jamming, i.e. the signal power? Hint: Use Friis.

$$P_R = 1.425 \text{ nW}$$

- (c) What is  $P_{received}$  of the SAM site due to the jammer transmission, i.e. the noise power? Hint: Use Friis.

$$P_R = 21.62 \text{ nW}$$

- (d) What is the SNR at the SAM site?

$$\text{SNR} = .0659 > .06, \text{ effective!}$$

2. An adversary parabolic antenna at sea level is scanning the area for your aircraft flying at 30,000 feet AGL. Jamming seems like a good idea, so you turn on your jamming equipment. The parameters for the ground antenna and your jamming equipment are given below. If the ground antenna needs a signal to noise ratio of 0.01 to process and receive information about your aircraft, is your jamming effective *at the max LOS range*?

Ground Antenna	Your jamming equipment
Power transmitted = 20 kW	Power transmitted = 200 W
Transmit Antenna Gain = 2500	Transmit Antenna Gain = 10
Frequency = 9 GHz	RCS = 3 m <sup>2</sup>

- (a) What is the max LOS range?

$\lambda =$

394.37 km

- (b) What is  $P_{received}$  of the transmitting ground antenna without jamming? Hint: Use Radar Equation.

$P_R =$

8.66 aW

- (c) What is  $P_{received}$  of the transmitting ground antenna due to the jammer transmission, i.e. the signal power? Hint: Use Friis.

$P_R =$

226 pW

- (d) What is the SNR at the transmitting ground antenna, i.e. the noise power?

SNR =

$38.3 \times 10^{-9}$ , ineffective!