

Microwaves

Series 2

Problem 1

A pulsed RADAR works at a frequency of 10 GHz. Its antenna has a gain of 28 dB, and the emitted pulsed power is of 2 kW. The target of the RADAR has an equivalent radar surface of 12 m², and the detector has a sensitivity of -90 dBm. What is the distance range of the RADAR for this target ?

Problem 2

Two sailboats, located at the equator and at 30° and 31° west respectively are communicating in Short-wave (3 MHz). The transceiver of Boat A emits at a power of 100W. What power will the transceiver of boat B receive? We suppose that the antennas used are isotropic and that the attenuation at 3 MHz at sea level is of 0.01 dB/km

Problem 3

Let us consider a wireless point to point transmission at 4 GHz, covering a distance of 150km over a flat terrain. At which minimal height over the terrain should the antennas be placed?

We consider two different cases:

- a) Both antennas are at the same level above the ground.
- b) The first antenna is at an altitude of 100m over the ground. At which height should the second be?

Problem 4

Find the phasor corresponding to the following field :

$$\mathbf{E}(\mathbf{t}) = 32\mathbf{e}_x \sin(\omega t + \pi/8) + 27\mathbf{e}_y \sin(\omega t + 3\pi/8)$$

Find its real and imaginary parts, and verify that

$$\text{Re}[\mathbf{E}] = \mathbf{E}(t=0), \quad \text{Im}[\mathbf{E}] = -\mathbf{E}(t=T/4)$$