Philadelphia University **Student Name:**
Faculty of Engineering **Student Number:**

Dept. of Communications & Electronics
Second Exam, First Semester: 2009/2010
Solutions

Course Title: Mobile Communications	**Date: 22/12/2009**
Course No: (650539)	**Time Allowed: 1 Hours**
Lecturer: Dr. Abdel-Rahman Al-Qawasmi	**No. of Pages: 2**

Question1 ***5 marks***

Find the median path loss using Okumura's model if the free space path loss $L_F = 122.4dB$, the median attenuation relative to free space $A_{mu} = 42$ dB, $h_{te} = 111m$, $h_{re} = 2m$ and $G_{AREA} = 10dB$ in a suburban environment. If the base station transmitter radiates an EIRP of 1.05 kW, find the power at the receiver. (Assume $G_r(dB) = 3$). Compute the distance d if the carrier frequency is 900 MHz.

Solution: $G(h_{te}) = 20\log(\frac{h_{te}}{200}) = 20\log(\frac{111}{200}) = -5.114$, $G(h_{re}) = 10\log(\frac{h_{re}}{3}) = 10\log(\frac{2}{3}) = -1.76$

$L_{50}(dB) = 122.4 + 42 - (-5.114) - (-1.76) - 10 = 161.274dB$,

$P_r(d) = 60.21 - 171.274 + 3 = -98.064dBm$

$\frac{\lambda^2}{(4\pi)^2 d^2} = 10^{L_F/10}$, $d^2 = \frac{\lambda^2}{(4\pi)^2 10^{L_F/10}} = \frac{0.11111}{157.9(10^{-12.24})} = \frac{0.11111}{9.08\times10^{-11}} = 1.22\times10^9$, $d \approx 35km$

Question2 ***10 marks***

1- Cell Splitting is the process by which we :

a) Subdivide a congested cell into smaller cells to increase the capacity of cellular system.
b) Subdivide a congested cell into smaller cells, each with its own base station and corresponding reduction in antenna height and receiver power.
c) Subdivide a congested cell into smaller cells by creating a new number of channels are in each cell.
d) a+b+c
e) None of the above.

2- Sectoring is used in cellular systems to :

a) Increase the capacity of the system by increasing the size of antenna.
b) Increasing the capacity of the system by keeping the cell radius unchanged and reducing the cluster size.
c) Improve the SIR by using omindirectional antennas.
d) Increase the system performance by using directional antennas and portioning the cell into 180^o sectors.
e) None of the above

3- The far-field distance for antenna with maximum dimension of 1.6 m and operating frequency 928 MHz is

a) 16.03 m
b) 15.84 m
c) 160 m.
d) 6 cm.
e) None of the above.

4- If 48 W is applied to an antenna with $G_T = 1.2$ and a 835 MHz carrier frequency, then the received power in dBm at a free space distance of 130 m from the antenna is (assume unity gain o the receiver antenna and unity system loss factor)

a) - 267
b) - 7.43
c) -55.55
d) -34.89
e) None of the above

5- The Fresnel reflection coefficient (Γ) is

a) a function of the dielectric properties, and generally depends on the wave polarization, angle of incidence, and the frequency of the propagating wave
b) a function of the metallic properties, and generally depends on the wave polarization, angle of incidence, and the frequency of the propagating wave
c) a function of the material properties, and generally depends on the wave polarization, angle of incidence, and the frequency of the propagating wave

d) a function of the material properties, and generally depends on the wave polarization, angle of incidence, and the height of antenna
e) None of the above.

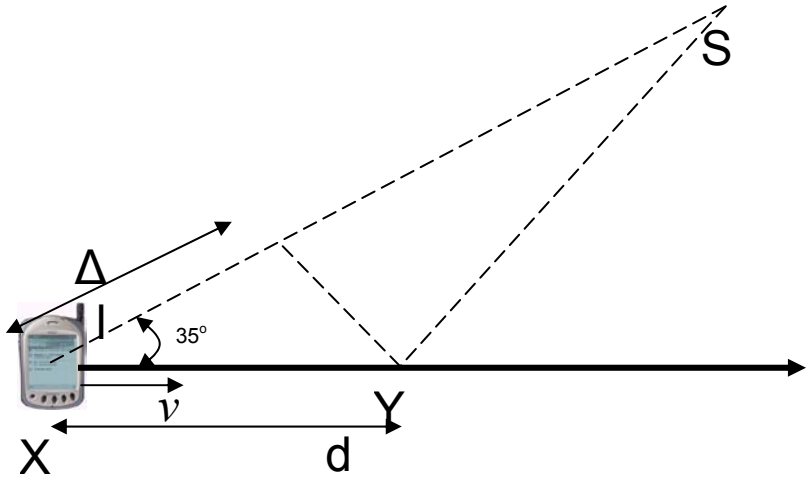
6- RCS of scattering object is defined as

a) the ratio of the power density of the signal scattered in the direction of the receiver to the power density of the radio wave incident upon the scattering object
b) the ratio of the power density of the signal diffracted in the direction of the receiver to the power density of the radio wave incident upon the scattering object
c) the ratio of the power density of the signal reflected in the direction of the receiver to the power density of the radio wave incident upon the scattering object
d) the ratio of the power density of the signal scattered in the direction of the transmitter to the power density of the radio wave incident upon the scattering object
e) None of the above.

7- Longley-Rice Model is

a) Applicable to point-to-point communication terms in the frequency range from 40MHz-100GHz over different kinds of terrain
b) applicable for the frequency range of 1500MHz-1920MHz, distances of 1km-100km, and BS antenna heights ranging from 30-1000m
c) applicable for the frequency range of 150MHz-1920MHz, distances of 10km-100km, and BS antenna heights ranging from 30-1000m
d) Applicable to point-to-point communication terms in the frequency range from 400MHz-100GHz over different kinds of terrain
e) None of the above.

8- Consider a transmitter which radiates a sinusoidal carrier frequency of 1900 MHz. For a vehicle moving 75 km/hr, the received carrier frequency if the mobile is moving as shown in figure below is



a) 108.06 Hz
b) 131.92 Hz
c) 1900.000108 MHz
d) 1900.00013192 MHz
e) None of the above.

9- Direct RF Channel impulse Measurements is sounding techniques that have been developed to

a) Determine the small-scale fading effects.
b) Measure the interference and noise
c) Measure the individual multipath components such as phase.
d) Enhance the cellular systems by measuring the received spread spectrum signal
e) None of the above.

10- Spread Spectrum Sliding correlator Channel Sounding uses

a) A narrowband filter to improve the dynamic range of the system.
b) The sliding factor and the post-correlator filter bandwidth to adjust the Sensitivity
c) Noncoherent detector , so that phases of individual multipath components can not be measured
d) a+b+c
e) None of the above.