

King Saud University
College of Engineering
Electrical Engineering Department
Communications Systems

Course: Communication System's
Credit Hours: 3
Second Test

Time: 50 minutes

Course code: EE 424
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Student Name

ID

Boltzman's constant $k = 1.38 \times 10^{-23}$ J/K

$L(dB) = 32.44 + 20 \log D(km) + 20 \log f(MHz)$ Free-Space Attenuation

$U_{ndp} = 2.5 \times 10^{-6} \times abf(GHz)D^3(miles) \times 10^{-F(dB)/10}$ Unavailability (non-diversity protected)

1. Consider a microwave radio system operating at an RF carrier frequency of 12 GHz, with a transmitter power of 0.5 watt. Transmit and receive antenna gains are 25dB and 35 dB, respectively. Branching and feeder losses are 3dB and 6 dB at either side. The terrain is smooth and the area has a humid climate. The distance between stations is 35 km and a reliability objective of 99.98 is required. Determine:

a. The system gain

b. The minimum received signal level

2. Define with words (not equation):

a. Free space path loss

b. Receiver threshold

c. Fade margin

d. Diversity

3. Determine the minimum C/N ratio for a 16QAM system when the transmission rate is 80 Mbps, the minimum energy of bit-to-noise density ratio is 18 dB, and the receiver bandwidth is equal to the minimum Nyquist frequency.

4. An earth station receiver has an equivalent input temperature of 220° K, a noise bandwidth of 30 MHz, and a receiver antenna gain of 60 dB. Determine: the gain-to-equivalent noise temperature ratio (G/T_e), noise power density (N_o) and noise power (N).

5. Describe words (not equation):

a. *footprint*

b. *back-off loss* and its relationship to saturated and transmit power

c. *effective isotropic radiated power*

d. Define the “Satellite Elevation Angle” and explain its effect on reception