

Student S.N.

COLLEGE OF ELECTRONIC TECHNOLOGY

SUBJECT: - Communications Systems
COURSE NO. : - CM 404
Fall 2019

DATE: - 29 - 02 - 2020
Final Exam
Time: 2 hours

Student Name:-

Student Number:-

Q1. a) What is meant by Process Gain (PG) in spread spectrum systems? Is it better to have large value or small value of PG in DSSS? And why? (5)

b) What is meant by signaling process? (5)

c) What is the function of the Add/Drop Multiplexer in SDH systems? (5)

d) State the two main advantages of using Decibel representation? And why we multiply the logarithm value by 10? (5)

e) In Space diversity, Explain the effect of the link distance “d”, and the antenna separating distance “S” on the Space Diversity Improvement Factor “SDIF”? (5)

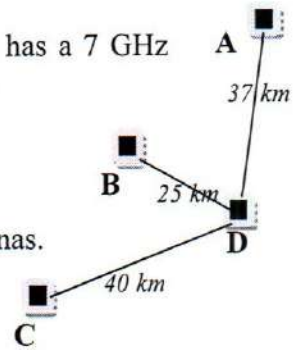
f) A service of TETRA network allows some members call specific subscribers after their approval. What do we call this service? Also state whether is it simplex, semi-duplex, or full duplex mode ? (5)

g) What are the advantages of DWDM over CWDM? (5)

h) Why a single frequency signal reflected at certain height of the troposphere and refracted at other height with a same incident angle? (5)

Q2/A company has 4 branches in 4 different locations A, B, C and D. It has a 7 GHz private DMR link to connect these branches as shown. The system has:-

- $P_T = -2$ dBW and the Equalizer Improvement Factor = 3 dB
- The area has average train and worst case climate condition
- The radio equipment located in the top of the tower and next to 1m antennas.
- All areas are flat and 5m kept for future height expansion is used.
- Minimum fade margin is 35 dB.



What is the reliability of the B - D link?

(20)

Good luck for every body
Dr. T. Benmusa

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Q1. a) What is meant by Process Gain (PG) in spread spectrum systems? Is it better to have large value or small value of PG in DSSS? And why? (5)

PG is the ratio between the coded signal bandwidth to the information bandwidth. Higher PG spread the power of the signal in much high bandwidth with very low power density.

b) What is meant by signaling process? (5)

Signaling process is the process that controls the establishing and termination the connection between the parties of the channel.

c) What is the function of the Add/Drop Multiplexer in SDH systems? (5)

The Add/Drop MUX has the ability to breakout and insert low speed channels into an STM stream?

d) State the two main advantages of using Decibel representation? And why we multiply the logarithm value by 10?

Simplify the representation and to converting multiplication and division process to addition and subtraction process.

Multiplying by 10 to increase the accuracy.

e) In Space diversity, Explain the effect of the link distance "d", and the antenna separating distance "S" on the Space Diversity Improvement Factor "SDIF"? (5)

SDIF decreases by incising the "d" because the two antenna looks one antenna, where SDIF increases by increasing "S".

f) A service of TETRA network allows some members call specific subscribers after their approval. What do we call this service? Also state whether is it simplex, semi-duplex, or full duplex mode? (5)

We call it acknowledgment group call. It is semi-duplex mode.

g) What are the advantages of DWDM over CWDM?

- more channels are possible within the same fiber; 160 channels vs. 8channels.
- Can stay completely in C-band (Less attenuation and dispersion – EDFA's working).

h) Why a single frequency signal reflected at certain height of the troposphere and refracted at other height with a same incident angle? (5)

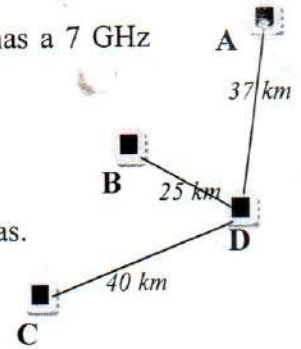
Because of the difference in the electron density at different heights. Which change the refraction index, and accordingly this will change the critical angle.

Q2. A SDH network connecting eight locations as show below. The carried traffic is given in the traffic table. The links capacities are shown on the diagram.

What is the maximum number of extra E1's that can be carried between "H" and "F" without any expansion in network capacity.

Q2. A company has 4 branches in 4 different locations A, B, C and D. It has a 7 GHz private DMR link to connect these branches as shown. The system has:-

- $P_T = -2$ dBW and the Equalizer Improvement Factor = 3 dB.
- The area has average terrain and worst case climate condition
- The radio equipment located in the top of the tower and next to 1m antennas.
- All areas are flat and 5m kept for future height expansion is used.
- Minimum fade margin is 35 dB.



What is the reliability of the B - D link?

(20)

The minimum fade margin is obtained in the longest link (C-D link), i.e. 40 km distance

$$L_s = 92.4 + 20 \log D_{km} + 20 \log F_{GHZ} = 92.4 + 20 \log 40 + 20 \log 7 = 143.34 \text{ dB}$$

$$G = 18.5 + 20 \log d + 20 \log F_{GHZ} = 18.5 + 20 \log 1 + 20 \log 7 = 35.4 \text{ dB} \quad \rightarrow 39.54$$

$$P_r = P_t + G_t + G_r - L_s - L_f - L_b - L_{rain} + AEQIF = 28 + 35.4 + 35.4 - 143.34 + 3 = -42.54 \text{ dBm}$$

$$C_{min} = P_r - FM = -42.54 - 35 = -77.54 \text{ dBm} \quad \rightarrow 74.54$$

For B - D Link the distance is 25 km

$$L_s = 92.4 + 20 \log D_{km} + 20 \log F_{GHZ} = 92.4 + 20 \log 25 + 20 \log 7 = 137.26 \text{ dB}$$

$$P_r = P_t + G_t + G_r - L_s - L_f - L_b - L_{rain} + AEQIF = 28 + 35.4 + 35.4 - 137.26 + 3 = -35.46 \text{ dBm}$$

$$FM = P_r - C_{min} = -35.46 - (-77.54) = 42.08 \text{ dB} \quad \rightarrow 39.08$$

$$FM = 30 \log D_{km} + 10 \log 6 A B F_{GHz} - 10 \log(1 - \text{Reliability}) - 70 \text{ dB}$$

$$10 \log(1 - \text{Reliability}) = 30 \log D_{km} + 10 \log 6 A B F_{GHz} - FM - 70 \text{ dB}$$

$$= 30 \log 25 + 10 \log (6 \times 1 \times 1 \times 7) - 42.08 - 70 \text{ dB} = -53.9 \quad \rightarrow -50.9$$

$$\text{Reliability} = 1 - 10^{\frac{-53.9}{10}} = 0.999999 \quad \rightarrow 39.08$$

Good luck for every body

Dr. T. Benmusa