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Course Name: Data Communication

Section: D

Theory Assignment: 01

Semester: 2021-2022 Fall

Submission Date: 29-11-2021

Here, my id is 20-42196-1

A = 2, B = 0, C = 4, D = 2, E = 1, F = 9, G = 5, H = 1

Data element $n = 2$

Level $L = 2^n = 2^2 = 4$.

Data rate $N_1 = (D+1)$ kbps $= (2+1) = 3$ kbps $= 3000$ bps

Data rate $N_2 = (E+1)$ kbps $= (1+1) = 2$ kbps $= 2000$ bps

Data rate $N_3 = (F+1)$ kbps $= (9+1) = 10$ kbps $= 10000$ bps

Data rate $N_4 = (G+1)$ kbps $= (5+1) = 6$ kbps $= 6000$ bps

Here,

FSK, $d = 1$, Guard Band $= (H+2)$ kHz $= (1+2)$ kHz $= 3$ kHz $= 3000$ Hz

FDM, Guard Band $= (H+7)$ kHz $= (1+7)$ kHz $= 8$ kHz $= 8000$ Hz

Now, $BW(ds1) = (1+1) \times \frac{3}{2} \times 4 + 9 = 21$ kHz

$BW(ds2) = (1+1) \times \frac{2}{2} \times 4 + 9 = 17$ kHz

$BW(ds3) = (1+1) \times \frac{10}{2} \times 4 + 9 = 49$ kHz

$BW(ds4) = (1+1) \times \frac{6}{2} \times 4 + 9 = 33$ kHz

a) Here,

Carrier frequency for ds1 ⇒ f_{c_1} (250+21 = 271 KHz)
= 260.5 KHz

Carrier frequency for ds_2 ⇒ f_{c_2} (310+17 = 327 KHz)
= 318.5 KHz

Carrier frequency for ds_3 ⇒ f_{c_3} (400+49 = 449 KHz)
= 424.5 KHz

Carrier frequency for ds4 ⇒ f_{c_4} (500+33 = 533 KHz)
= 516.5 KHz

b) Different carrier frequency values:

$f_{c_{11}} = (500+506)/2 = 503$ kHz

$f_{c_{22}} = (509+515)/2 = 512$ kHz

$f_{c_{33}} = (518+524)/2 = 521$ kHz

$f_{c_{44}} = (527+533)/2 = 530$ kHz

C) Bandwidth values:

$BW(ms1) = 21\ kHz$

$BW(ms2) = 17\ kHz$

$BW(ms3) = 49\ kHz$

$BW(ms4) = 33\ kHz$

d) Bandwidth required for $x(t)$:

$$BW = BW(ms1) + BW(ms2) + BW(ms3) + BW(ms4) + 3 \times 8$$

$$= 21 + 17 + 49 + 33 + 24$$

$$= 144\ kHz$$

e) Here, in receiver side, we'll assume that received signal is same as transmitted signal. Now, here is demodulator which will separate those signal from their carrier signal. As well as, here is a filter which

Produces a cutoff frequency and also

Separates signal from $x(t) = ms1 + ms2 + ms3 + ms4 + 3x8$.

Now,

Filter = (250 kHz – 280 kHz) $\Rightarrow ds_1$

Filter = (300 kHz – 390 kHz) $\Rightarrow ds_2$

Filter = (390 kHz – 460 kHz) $\Rightarrow ds_3$

Filter = (490 kHz – 540 kHz) $\Rightarrow ds_4$

In this way, we can separate from the received composite signal x(t).