Study Group

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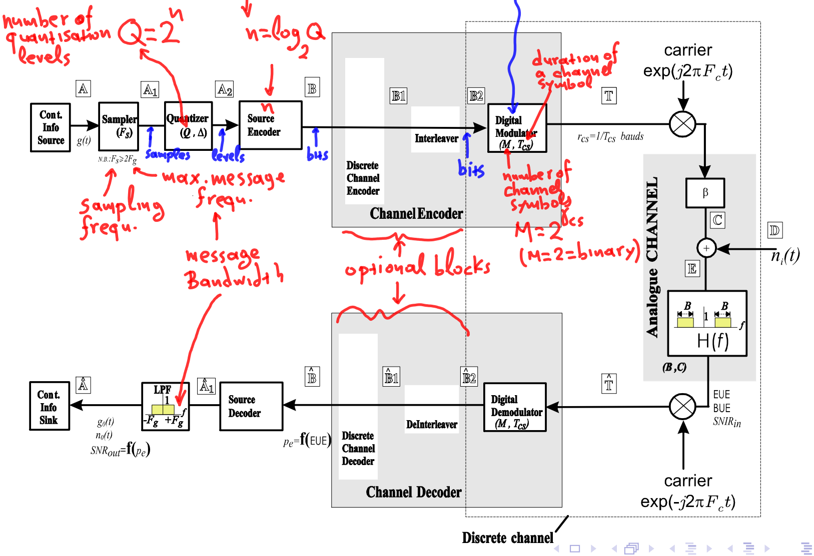
Comms-1

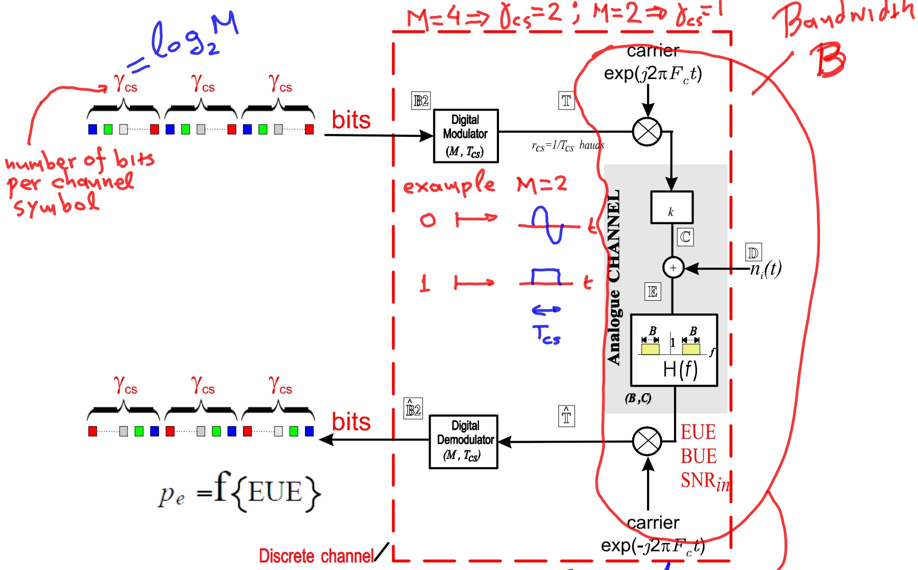
Digital Comm. Systems

Introduction

- General Block Diagram of a Digital Comm. System (DCS)

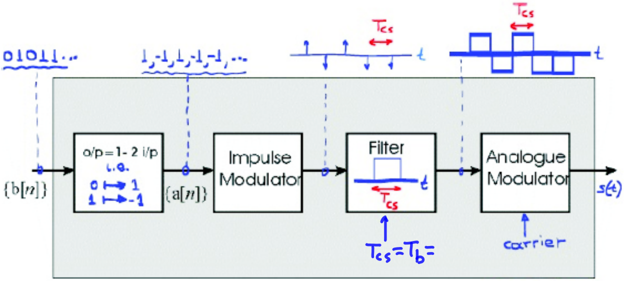


Let us focus on the "discrete channel"



$$B \geq \frac{r_{cs}}{2} = \frac{1}{2T_{cs}}$$

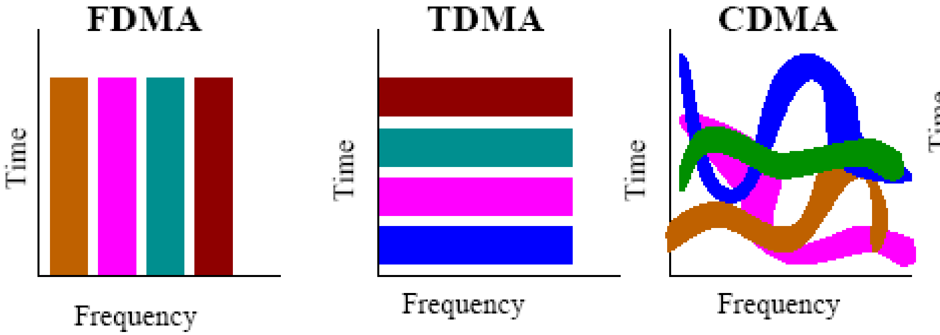
First Modelling of Digital Modulators



e.g. FM : $s(t) = A_c \cos\left(2\pi F_c t + \underbrace{2\pi \underset{\text{Hz/V}}{k_f} \int_{-\infty}^{t} m(u)\,du}_{\phi(t,\, a[n])}\right)$

Note: Transforming a sequence of 0's and 1's to a sequence of ± 1's

$$\boxed{\text{o/p} = 1 - 2\times\text{i/p}} \qquad (1)$$


FDMA
Time
Frequency
TDMA
Time
Frequency
CDMA
Time
Frequency

- Most of the current cellular systems, such as GSM, use frequency division multiplex - time division multiplex (FDM-TDM) techniques to improve the system capacity.

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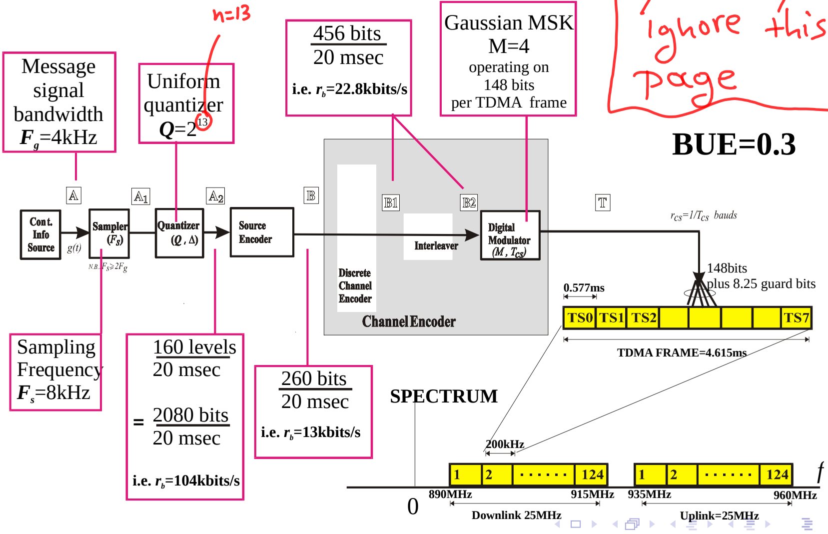
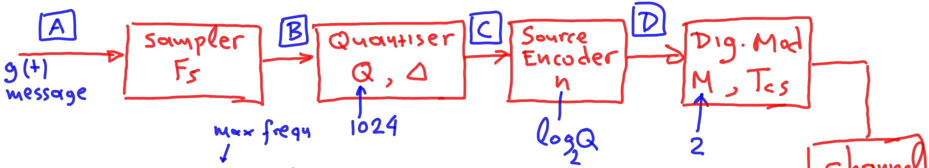
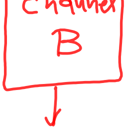


EXAM 2013, Q3(b)





$\boxed{A}$ Bandwidth $= F_g = 4.5\text{MHz}$

$\boxed{B}$ we have samples (in Volts) with sampling rate $= F_s \ \frac{\text{samples}}{\text{sec}}$

$$\boxed{F_s = 10.8\,\text{MHz}} \longleftrightarrow \left\{ \begin{aligned} &= 2 \times F_g \times 1.2 \\ &= 2 \times 4.5\text{M} \times 1.2 \\ &= 10.8\text{M} \ \frac{\text{samples}}{\text{sec}} \end{aligned} \right.$$

$\boxed{C}$ we have quantisation levels (in Volts) with rate $= F_s \ \frac{\text{quantisation levels}}{\text{sec}}$

$\boxed{D}$ we have bits with rate (bit rate) $= n F_s$ $\quad \frac{\text{bits}}{\cancel{\text{level}}} \times \frac{\cancel{\text{levels}}}{\text{sec}}$

$$= \log_2 Q \times F_s$$

$$= \log_2 1024 \times 10.8M$$

$$= 108\,M \frac{\text{bits}}{\text{sec}}$$

equality is the minimum Bandwidth

$$\text{channel Bandwidth} = B \geq \frac{r_{cs}}{2} = \frac{r_b}{2} = \frac{108M}{2} = 54\,MHz$$

$$r_{cs} = \frac{1}{T_{cs}} = \frac{1}{\gamma_{cs} T_b} = \frac{1}{T_b} = r_b$$

bit rate

$$\gamma_{cs} = \log_2 M = \log_2 2 = 1$$