

Frequency Division Multiplexing Broadcast Systems

Session for
“Electronics and Telecommunications”
A Fairfield University E-Course
Powered by LearnLinc

Module: Communication Systems

(in two parts)

- Texts:
 - “Understanding Telephone Electronics,” Bigelow, Newnes, 1997, ISBN 0-7506-9944
- References:
 - [Electronics Tutorial](#) (Thanks to Alex Pounds)
 - [Electronics Tutorial](#) (Thanks to Mark Sokos)
- Part 11 – Broadcast Systems
 - 5 on-line sessions plus one lab
- Part 12 – Transmission & Communications
 - 5 on-line sessions plus one lab
- Mastery Test part 6 follows this Module

Section 11: Broadcast Systems

- Frequency Division Multiplexing
- AM
 - Modulation
 - Demodulation (The Envelope Detector)
- FM
 - Modulation
 - Demodulation (The Phase-Locked-Loop)
- Superhetrodyne receivers
- Television
- Sampling

Section 12:

Transmission and Networks

- Transmission Lines
 - Twisted pair
 - Coaxial Cable
 - Optical Fiber
- Microwave Systems
- Satellite Links
- Telephone Systems
- Local Area Networks
- Cellular Phone Systems

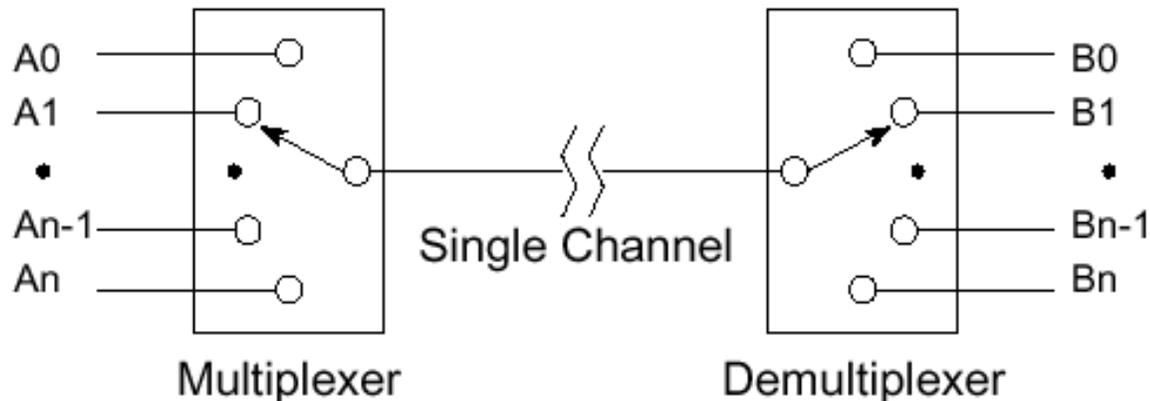
Section 11 Schedule

Session 11a	08/25	Time and Frequency Multiplexing	Notes and Web Sites Bigelow: 167-206
Session 11b	08/27	AM Radio	Notes and Web Sites
Session 11c (Labor Day 09/01)	09/03	FM Radio	Notes and Web Sites
Session 11d	09/08	Transmitters & Receivers	Notes and Web Sites
Session 11e (Lab - 09/13, Sat.)	09/10	Television	Notes and Web Sites
Session 11f (Quiz 11 by 09/21)	09/15	Review for Quiz 11	
Session 11g	09/22	Quiz 11 Results	

Multiplexers and Demultiplexers

4.4 Multiplexer

- Multiplexer - A **data selector** that selects one of many inputs to appear on a single output line
- Demultiplexer - A **data distributor** that takes a single input line and routes it to one of several output lines



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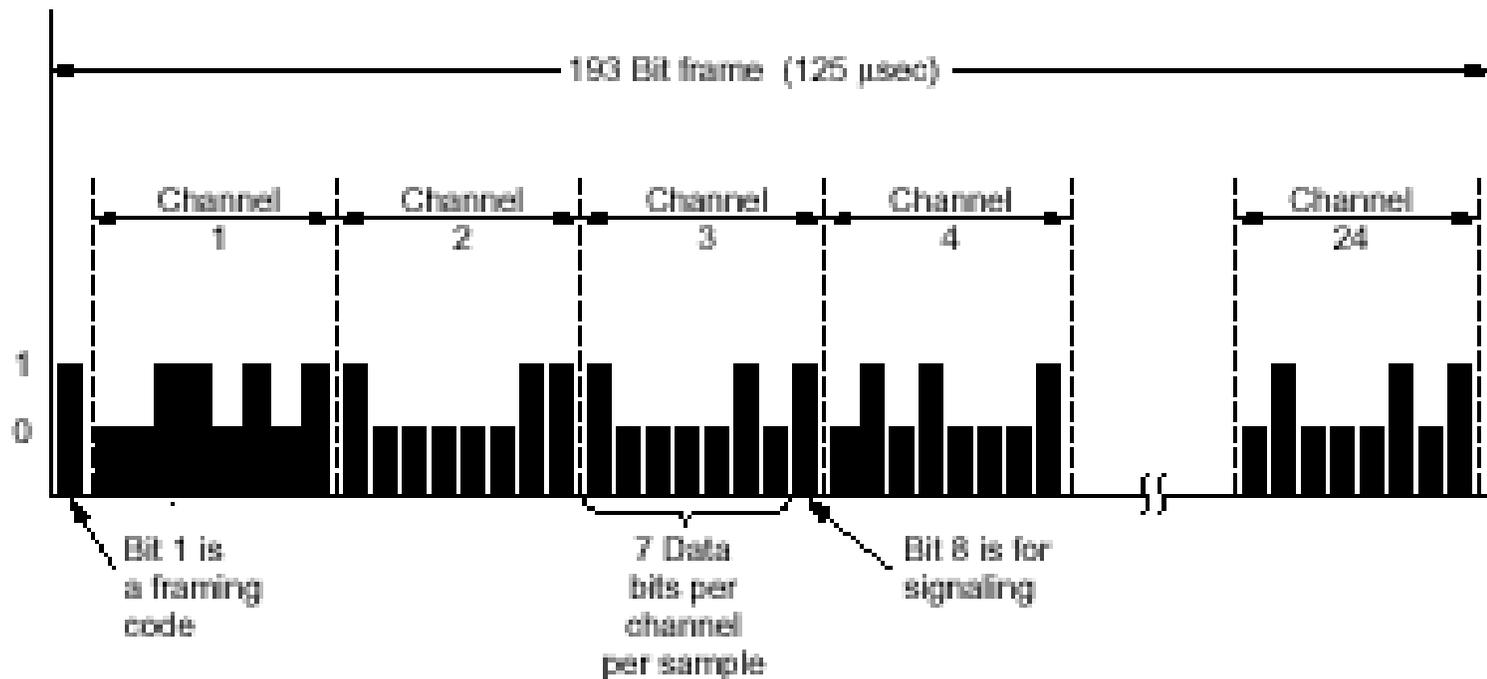
www.ee.ncu.edu.tw/~ccsu

Introduction to Digital Systems

Chapter 4 P.25

T1 - Time Division Multiplexing

- 24 Channels; One byte at a time (192 bits/frame)
- One bit / Frame for synchronization
- 1.544 mbit/sec

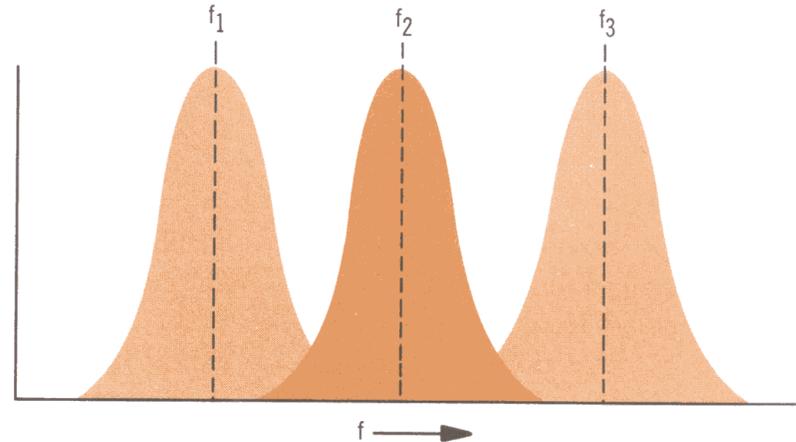
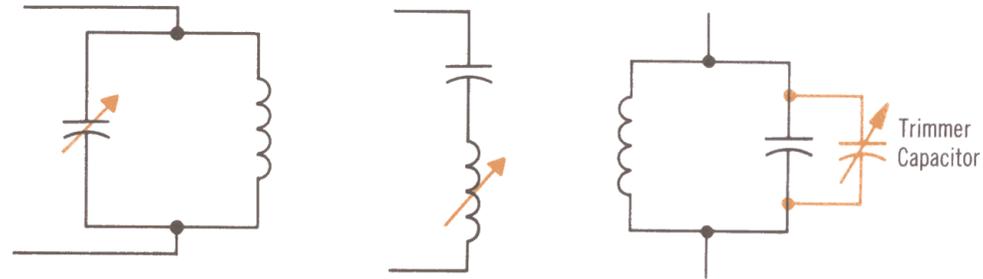


Frequency Division Multiplexing

- Here the Bandwidth of the Transmission medium is divided into “Channels” each with enough bandwidth to carry the desired information
- AM Radio: The RF spectrum from 535 kHz to 1600 kHz is divided into overlapping 20 kHz channels (none overlap in a region)
- FM Radio: the RF spectrum from 88 MHz to 108 MHz is divided into 200 kHz channels (double-width for stereo)
- Broadcast TV: The RF Spectrum from 52 MHz to 88 MHz, 174 MHz to 216 MHz, and 470 MHz to 806 MHz is divided into 6 MHz channels

Tuning

- $f_r = 1/2\pi(LC)^{1/2}$
- Increasing L or C decreases f_r
- Decreasing L or C increases f_r
- A “tuned” resonance can be used to “select” which signal you want to pass or reject



If variable capacitors or inductors are used in resonant circuits, the resonance point and bandpass frequencies can be changed to a variety of frequencies by a simple adjustment.

Modulation

- The process of putting an information signal (Audio, Video, etc) onto a sine wave carrier
 - Produces a narrow-band signal that can travel through a channel centered at the carrier frequency
 - The transmitted signal's bandwidth is at least as wide as the bandwidth of the original information signal (often wider)

Modulation 2

- Examples
 - Amplitude Modulation (AM): dynamically vary the amplitude of the sine wave carrier in proportion to the information signal.
 - Frequency Modulation (FM): dynamically vary the frequency of the sine wave carrier in proportion to the information signal.

Demodulation

- The process of recovering the information signal from the modulated carrier (also called detection)
- The detection technique used is dependent on the modulation method (AM, FM, etc).

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