

Course Summary

Lecture 26, 2009-1-4

Communication System

- A communication system is designed to transmit information.
- We have four concerns:
 - Selection of the information-bearing waveform
 - Bandwidth and power of the waveform
 - Effect of system noise on the received information
 - Cost of the system

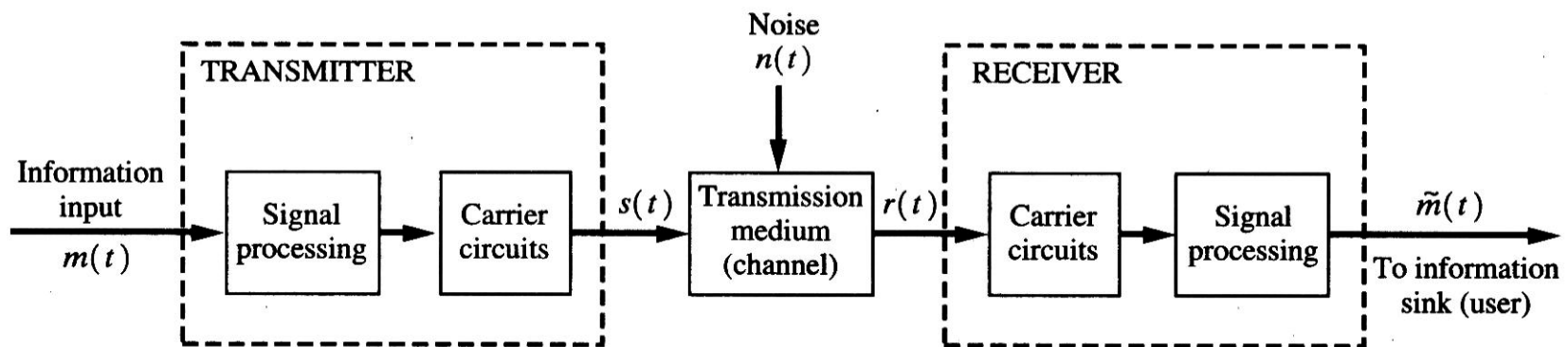
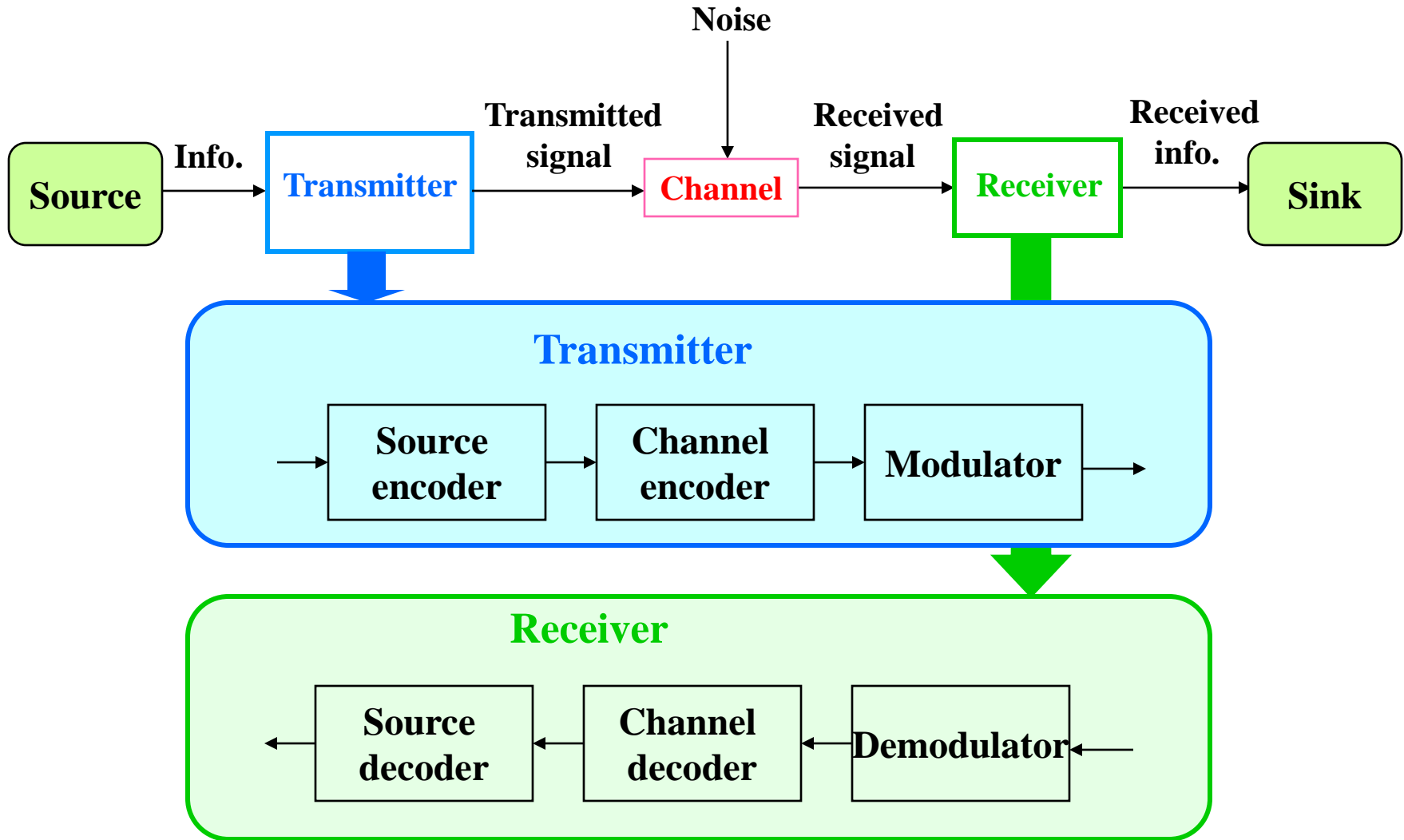


Figure 1-1 Communication system.

Communication System

- Analog and Digital Information
- Deterministic and Random Waveform
- Baseband and Bandpass
- Modulation

Digital Communication System



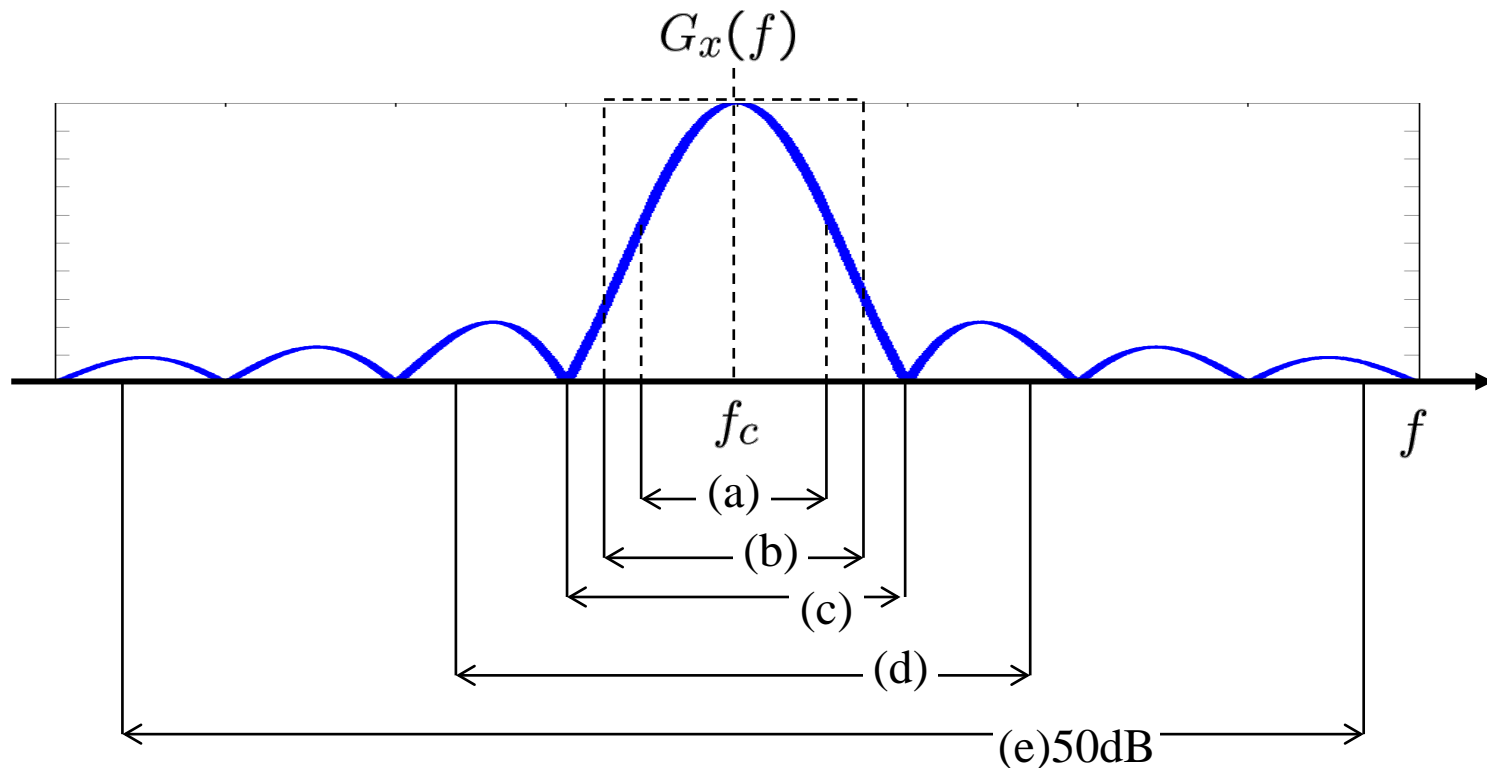
Digital Communication System

- Source Coding vs. Channel Coding
- Information, Entropy
- Channel Capacity

Bandwidth

■ Different Definitions

- a) 3-dB bandwidth
- b) Equivalent noise bandwidth
- c) Null-to-null bandwidth
- d) Power bandwidth
- e) Bounded spectrum bandwidth
- f) Absolute bandwidth



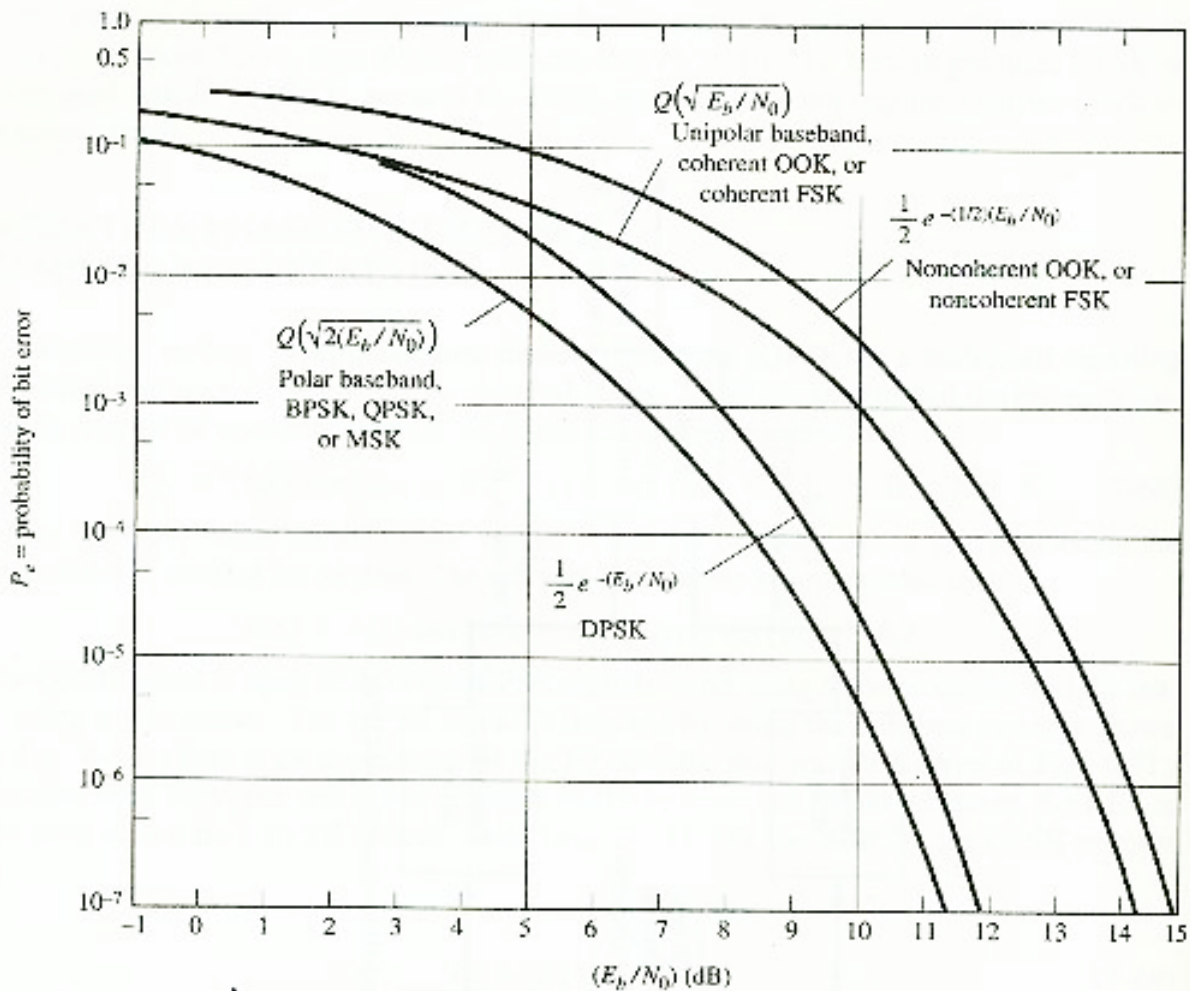
Baseband Digital System

- Sampling Theorem
- PAM, natural and instantaneous sampling
- Sampling, quantizing, and encoding
- Digital signal representation
- Line codes and their spectra
- Inter-symbol interference, equalizing filter and Nyquist's method
- DPCM and DM
- Eye pattern
- Matched filter
- Gaussian noise and baseband performance

Bandpass Digital System

- OOK
- BPSK
- DPSK
- FSK
- MASK
- MPSK, QPSK
- QAM
- OQPSK
- MSK
- Constellation
- Required Bandwidth
- Coherent Detection
- Noncoherent
Detection
- OFDM
- Spread Spectrum

BER Comparison



Comparison of Digital Signaling Methods

	Minimum Required Bandwidth	Error Performance	
		Coherent Detection	Noncoherent Detection
OOK	2R	$Q \left[\sqrt{\frac{E_b}{N_0}} \right]$	$\frac{1}{2} e^{-(1/2)(E_b/N_0)}$
BPSK	2R	$Q \left[\sqrt{2 \left(\frac{E_b}{N_0} \right)} \right]$	Requires coherent detection
FSK	$2(\Delta F + R)$	$Q \left[\sqrt{\frac{E_b}{N_0}} \right]$	$\frac{1}{2} e^{-(1/2)(E_b/N_0)}$
DPSK	2R	Not used in practice	$\frac{1}{2} e^{-(E_b/N_0)}$
QPSK	R	$Q \left[\sqrt{2 \left(\frac{E_b}{N_0} \right)} \right]$	Requires coherent detection
MSK	1.5R	$Q \left[\sqrt{2 \left(\frac{E_b}{N_0} \right)} \right]$	$\frac{1}{2} e^{-(1/2)(E_b/N_0)}$

About the Examination

- Time: 1:10-3:10 PM, Jan. 14, 2009
- Venue: XiaYuan 406
- Close book
- You are allowed to bring one page of A4 paper with necessary formula and one calculator.
- Show all intermediate steps. No credit will be given for final results only.
- All the answers must be written in English.

Thank you!

All the best wishes!

Good luck in future!

Good luck in the exam!