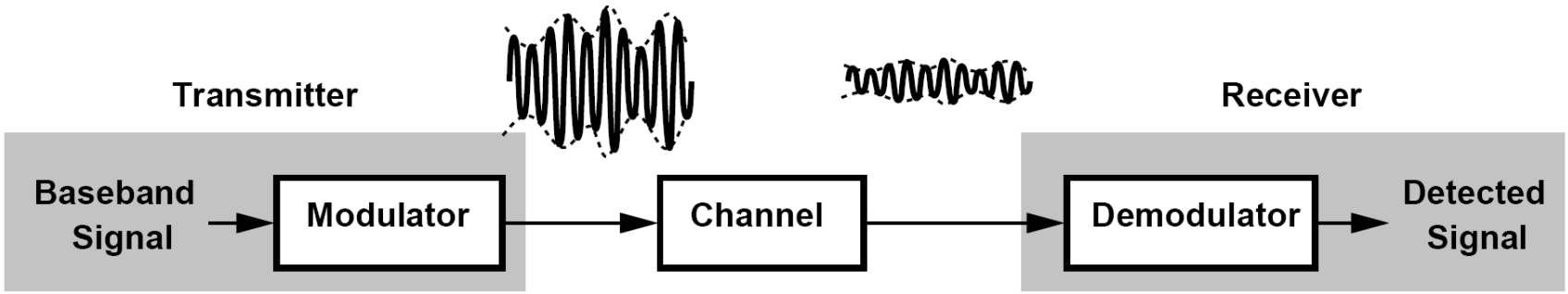
Lecture 1:
Introduction to RF Communication

ELEC 404

Acknowledgement: *RF Microelectronics.* B. Razavi

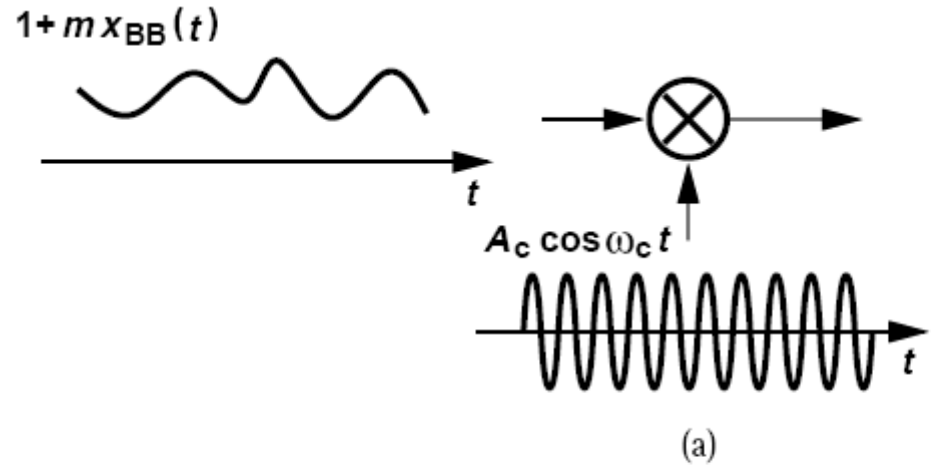
Signal Modulation

- Vary the amplitude, frequency or phase of a "carrier" signal with the baseband signal (AM/FM/PM)

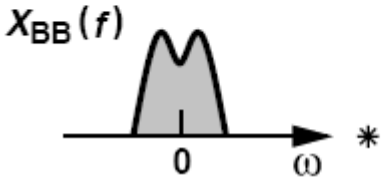


- Why carrier frequency?
- How to modulate? How much to modulate?

Amplitude Modulation



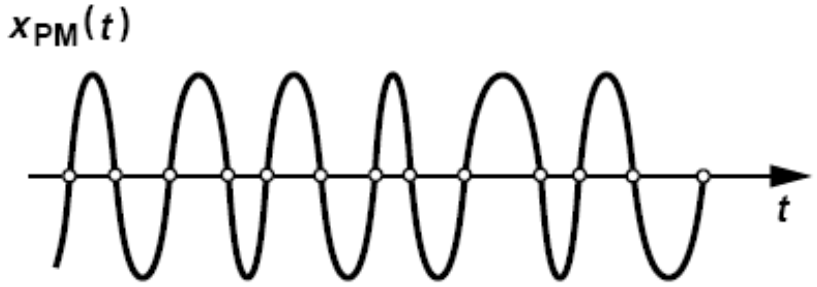
(a)



$$x_{AM}(t) = A_c[1 + mx_{BB}(t)]\cos\omega_c t$$

- ***m = modulation index***

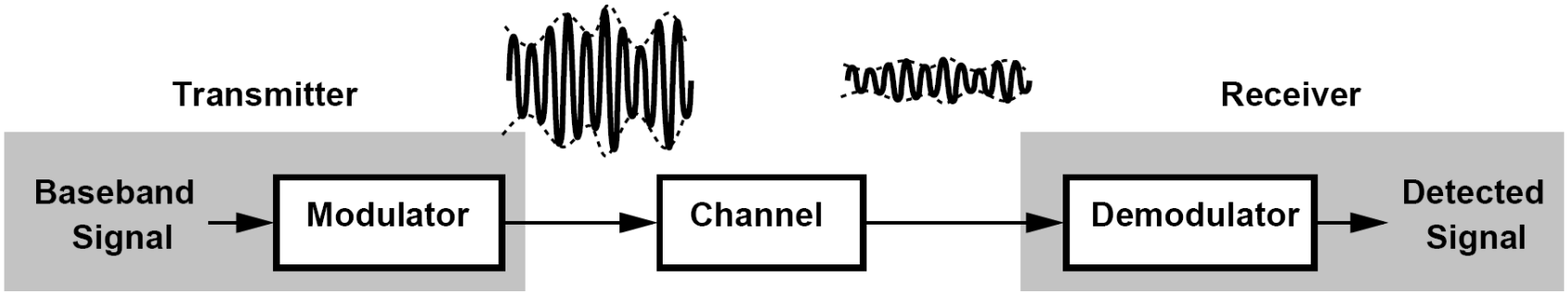
Phase Modulation, Frequency Modulation

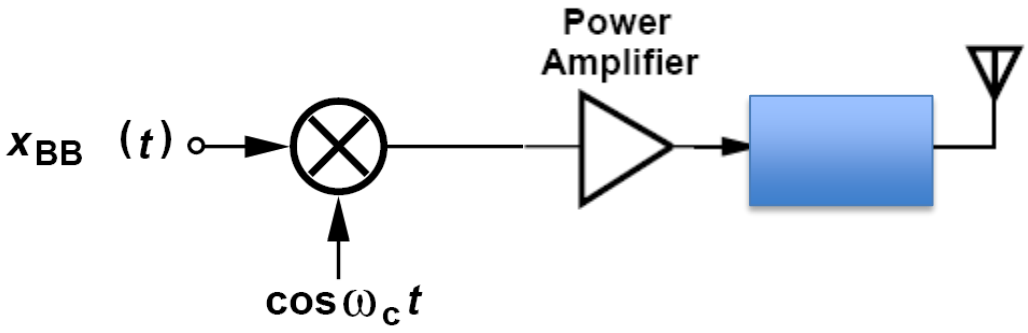


$$x_{PM}(t) = A_c \cos[\omega_c t + m x_{BB}(t)]$$

- **PM: Excess phase α BB signal**
- **FM: Excess frequency α BB signal**

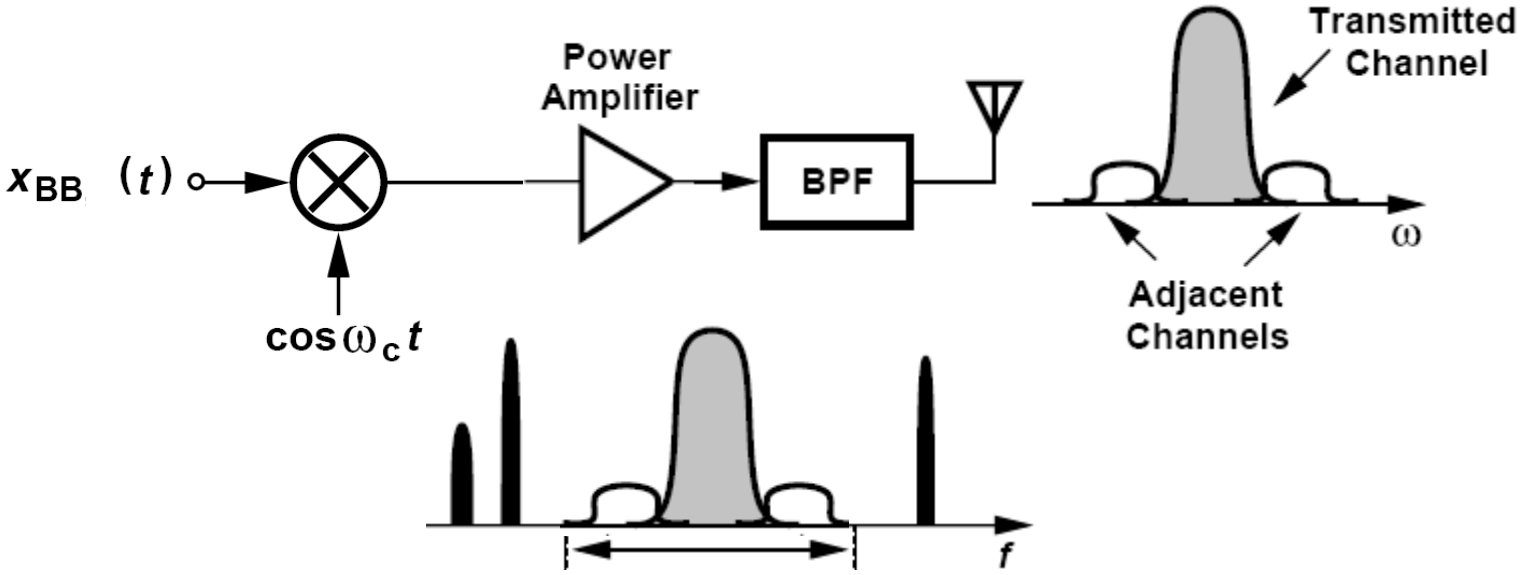
A Simple Radio Transceiver





- **Why 50 Ohm antenna impedance?**

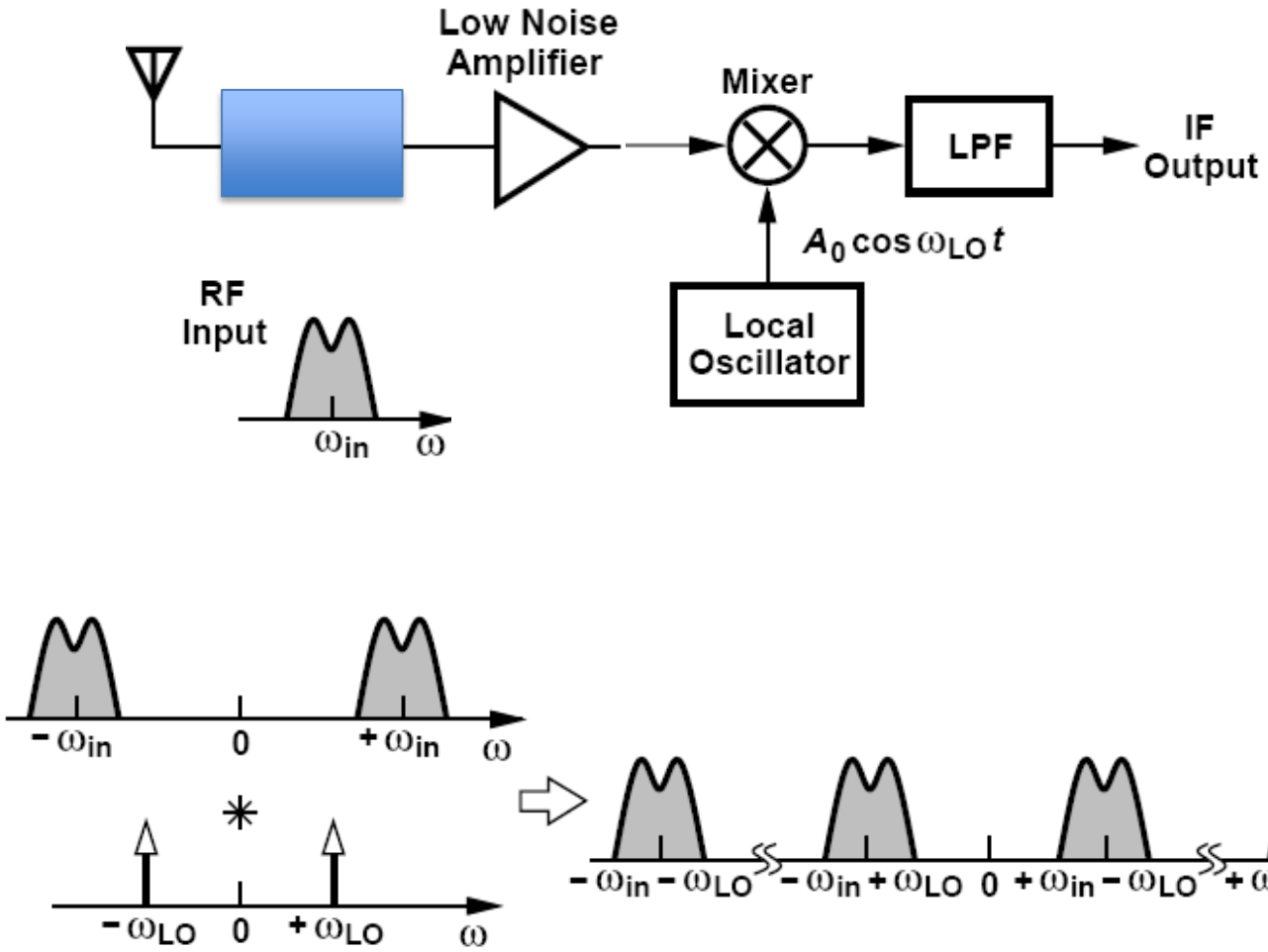
A Simple Radio Transmitter



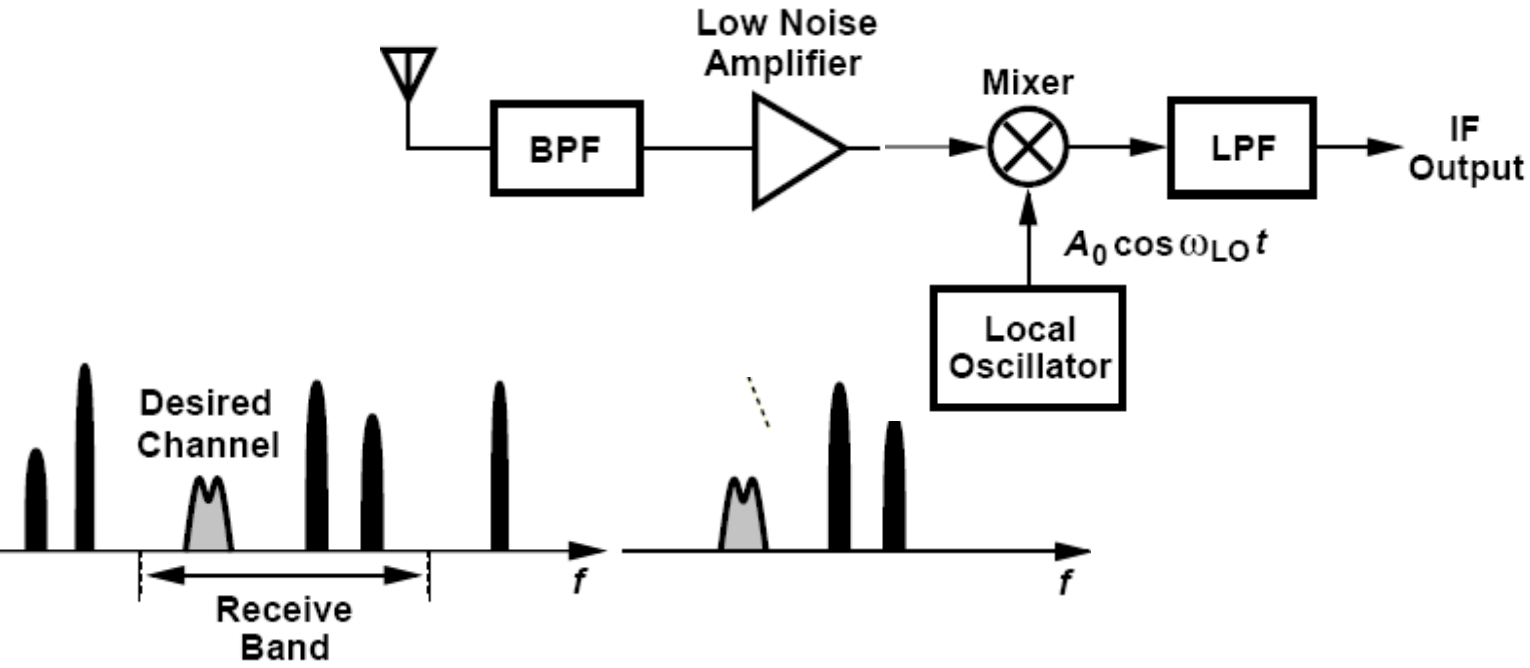
Wireless Standard Specifications:-

- **Frequency bands and channels**
- **Type of modulation**
- **Data Rates**
- **TX output power**
- **TX spectral Mask**

A Simple Radio Receiver



A Simple Radio Receiver



Wireless Standard Specifications:-

- **RX Sensitivity**
- **RX Dynamic Range**

Hobbies of an RF Engineer

- MOS/R/C → L, Transformer (Xfmr), T-Line
- Communications
- Circuit Design (Analog, Digital, Mixed-signal)
- Network Theory
- Control Systems
- Electromagnetism
- Microwave
- CAD and Optimization
- DSP
- MEMS!

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