# 1 SU 1: Introduction

*Chapter 1*
*Chapter 2: sec 2.1 & 2.4*

## 1.1 Chapter 1

Mostly theory, be able to convert from wavelength to freq:

$$\lambda = \frac{1}{f} * c$$

Where c is the speed of light (299 792 458 m / s)

## 1.2 Chapter 2

Tuned circuits

$$X_C = \frac{1}{2\pi f c}$$
$$X_L = 2\pi f L$$

Decibel gain:

$$G_{db} = 10 \log_{10}\left(\frac{out_{watt}}{in_{watt}}\right)$$
$$G_{db} = 20 \log_{10}\left(\frac{out_{volt}}{in_{volt}}\right)$$

Q factor, Bandwidth and resonant requency:

$$\begin{aligned} Q &= \frac{X_L}{R} \\ f_r &= \frac{1}{2\pi\sqrt{LC}} \\ BW &= \frac{f_r}{Q} \\ X_L &= \text{Inductive reactance} \\ R &= \text{Resistance} \\ BW &= \text{Bandwidth} \\ f_r &= \text{resonant frequency, where:} X_L = X_C \end{aligned}$$

# 2 SU 2

*Chapter 3*
*Chapter 5*
*Chapter 7.1-7.4*

## 2.1 Chapter 3

Modulation index:

$$
\begin{aligned}
m &= \frac{V_m}{V_c} \\
V_m &= \text{Modulating Signal Voltage} \\
V_m &= \text{Carrier Voltage}
\end{aligned}
$$

AM power:

$$
\begin{aligned}
P &= \frac{(V_{RMS})^2}{R} i \\
P_T &= P_C + P_{LSB} + P_{USB} \\
P_T &= P_c \left(1 + \frac{m^2}{2}\right) \\
P_{SB(both)} &= P_T - P_C \\
P_{SB(one)} &= \frac{P_{SB(both)}}{2}
\end{aligned}
$$

SSB Power:

$$
\begin{aligned}
PEP &= \frac{V_{RMS}^2}{R} \\
PEP &= V_s I_{max} \\
V_S &= \text{Supply voltage} \\
PEP &= \text{Peak envelope Power}
\end{aligned}
$$

## 2.2 Chapter 5

Modulation Index:

$$
\begin{aligned}
m_f &= \frac{f_d}{f_m} \\
f_d &= \text{frequency deviation} \\
f_m &= \text{Modulating Frequency}
\end{aligned}
$$

### 2.3 Chapter 7

Data conversion:

$$
\begin{aligned}
f_N &\geq 2f_m \\
f_a &= f_s - f_m \\
V_n &= \frac{q}{\sqrt{12}} \\
ENOB &= \frac{SINAD - 1.76}{6.02} \\
ENOB &= \text{Effective number of bits} \\
SINAD &= \text{Signal-to-noise and distortion ratio} \\
V_n &= \text{quantization noise} \\
q &= \text{Weight of LSB} \\
f_s &= \text{sampling frequency} \\
f_a &= \text{alias} \\
f_N &= \text{Nyquist frequency} \\
f_m &= \text{max frequency of Analog signal}
\end{aligned}
$$

# 3 SU 3

*Chapter 8*
*Chapter 9*

### 3.1 Chapter 8

PLL(Phase locked loop) frequency synthesizer: NB!!! figure out role of M, N and A counters. so far, $R = MN + A$

$$
\begin{aligned}
R &= \frac{f_o}{f_r} \\
R &= \text{Overall Divider ratio} \\
f_o &= \text{Output frequency} \\
f_r &= \text{Reference frequency}
\end{aligned}
$$

DDS (Direct digital synthesizer)

$$
\begin{aligned}
f_o &= \frac{Cf_{clk}}{n^N} \\
C &= \text{Constant value} \\
f_{clk} &= \text{Clock freq} \\
N &= \text{Number of Bits}
\end{aligned}
$$

L Networks: Match a source impedance ($R_i$) to a load impedance($R_L$)
Determine $X_C$ and $X_L$ using the formulae and work out C and L using the impedance formulae in reverse.

$$X_L = \sqrt{R_i R_L - (R_i)^2}$$

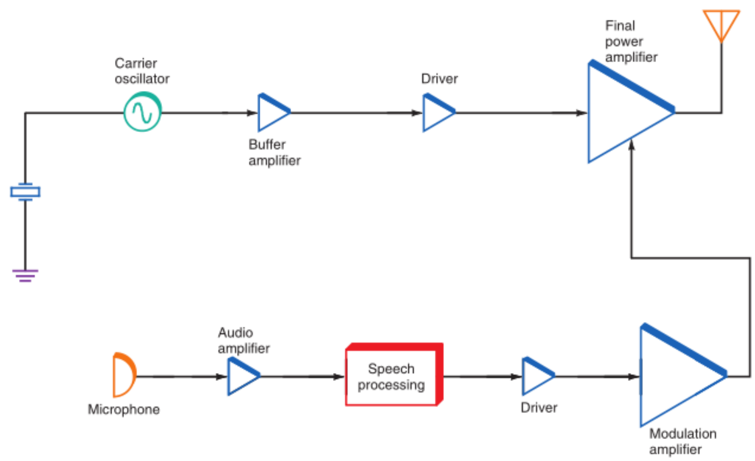
$$\text{or} X_L = \sqrt{R_i R_L - (R_L)^2}$$

$$\text{Depending on whether } R_i \text{ or } R_L \text{ is greater} X_C = \frac{R_L R_i}{X_L}$$

## 3.2 Chapter 9

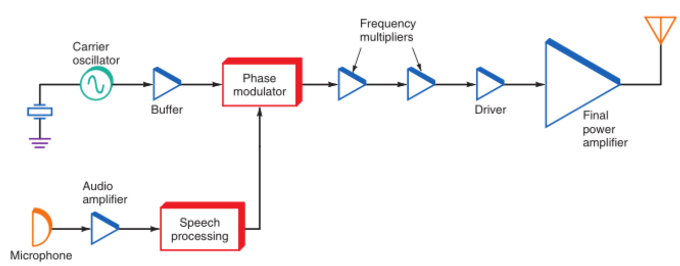
Block Diagrams: Basic Transmitter(AM):

**Figure 8-2** An AM transmitter using high-level collector modulation.




Basic Transmitter(FM):

**Figure 8-3** A typical FM transmitter using indirect FM with a phase modulator.

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Basic Transmitter(SSB):

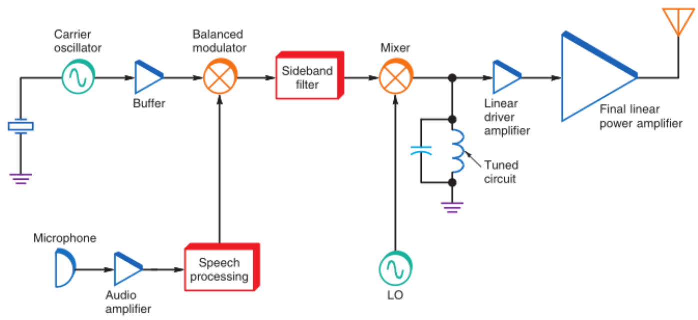


**Figure 8-4** An SSB transmitter.

Short Distance radio Transmitter

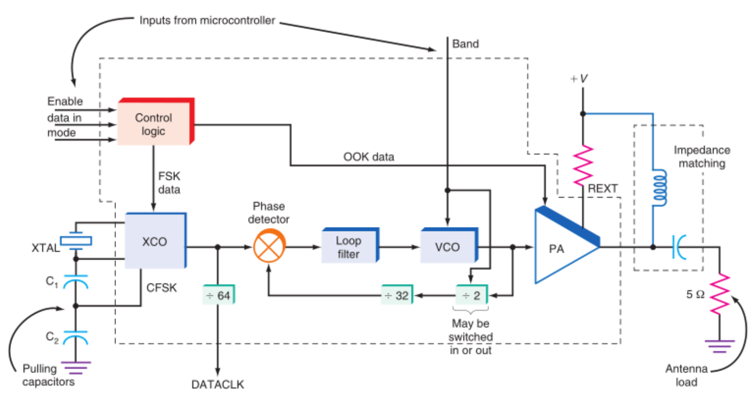


**Figure 8-50** The Freescale MC 33493D UHF ISM transmitter IC.

General Receiver: Superheterodyne Receiver:

**Figure 9-5** Block diagram of a superheterodyne receiver.