Chapter 1

Introduction

Communication can be broadly defined as the transfer of information from one point to another. The transfer of information within the communication system is commonly achieved by superimposing or modulating the information onto an electromagnetic wave which acts as a carrier for the information signal. At the required destination, the modulated carrier is then received and the original information signal can be recovered by demodulation. Over the years, sophisticated techniques have been developed for this process using electromagnetic carrier waves operating at radio frequencies as well as microwave and millimeter wave frequencies.

In today’s modern communication industry, antennas are the most important components required to create a communication link. Through the years, microstrip antenna structures are the most common option used to realize millimeter wave monolithic integrated circuits for microwave, radar and communication purposes. Due to its many advantages over the conventional antenna, the microstrip antenna have achieved importance and generated interest to antenna designers for many years.

![Fig 1. A General Communication System](image)

Microstrip Antenna

Microstrip Antennas are relatively new area of antenna engineering. In fact, microstrip antenna can now be considered an established type of antenna that is used by designers, especially when low profile radiators are required. The application of this type of antennas started in early 1970
by Deschamps. It consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side. The patch is generally made of conducting material such as copper or gold and can take any possible shape [7].

![Structure of a Microstrip Patch Antenna](image)

**Fig 2. Structure of a Microstrip Patch Antenna**

In order to simplify analysis and performance prediction, the patch is generally square, rectangular, circular, triangular, and elliptical or some other common shape as shown [7]

![Common Shapes of Microstrip Patch Elements](image)

**Fig 3. Common Shapes of Microstrip Patch Elements**
Methods of analysis

- Transmission line model
- Cavity model
- Method of moment model

Advantages & Disadvantages of Microstrip Antennas:

Microstrip antennas have several advantages and therefore, it can accommodate many applications over the broad frequency range from 100 MHz to 50 GHz. Some of the outstanding advantages of the microstrip antennas are:

- Light in weight, small in size.
- Low profile planar configuration.
- Low fabrication cost.
- Can be made thin so that the aerodynamics of any aerospace vehicles would not be affected.
- Can be easily mounted onto missiles, rockets and satellites.
- Possible to achieve linear, circular (left hand or right hand) polarizations.
- Capable of dual and triple frequency operations.

Nevertheless, the disadvantages of the microstrip antennas are:

- Narrow bandwidth.
- Low efficiency.
- Lower Gain.
- Low power handling capacity
- Extraneous radiation from feeds and junctions
Applications

Due to the fact that most present-day systems demand for small size, lightweight, low cost and low profile antennas, the employment of microstrip technology arises extensively over the years. With continuing research and development and increased usage of the microstrip antenna, it is expected that they will ultimately replace conventional antennas for most applications. Some typical system applications which employ microstrip technology are given below-

- Satellite communications
- Doppler and other radars
- Radio altimeter
- Missile telemetry
- Remote Sensing