



**Class: 4<sup>th</sup>**

# **MOBILE COMMUNICATIONS**

## **Chapter One**

### **Introduction to Wireless Communication System**

**By**

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## **Lecture Outlines**

- 1.1 History of wireless communications
- 1.2 Classification of mobile radio transmission
- 1.3 Frequency division & Time division
- 1.4 Transmission types
- 1.5 Types of wireless communication systems

## **Teaching Tools:**

- White Board, white board marker and eraser

## **Teaching Methods:**

1. Method of lecture.
2. Method of discussion and dialogue.
3. Brain storming



# **Chapter 1**

## **1.1 History of wireless communications**

Guglielmo Marconi invented the wireless telegraph in 1896. In 1901, he sent telegraphic signals across the Atlantic Ocean (about 3200 km). His invention allowed two parties to communicate by sending each other alphanumeric characters encoded in an analog signal. Over the last century, advances in wireless technologies have led to the radio, the television, the mobile telephone, and communications satellites. All types of information can now be sent to almost every corner of the world. Recently, a great deal of attention has been focused on satellite communications, wireless networking, and cellular technology. Wireless networking is allowing businesses to develop WANs, MANs, and LANs without a cable plant. The cellular or mobile telephone is the modern equivalent of Marconi's wireless telegraph, offering two-party, two-way communication. The first-generation wireless phones used analog technology. These devices were heavy and coverage was patchy, but they successfully demonstrated the inherent convenience of mobile communications. The current generation of wireless devices is built using digital technology. Digital networks carry much more traffic and provide better reception and security than analog networks.

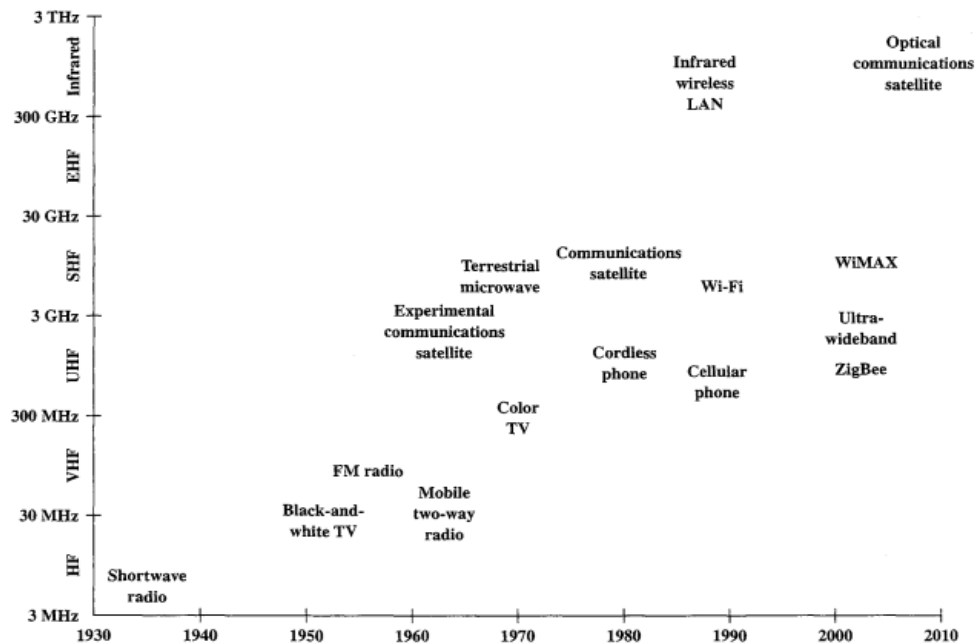


Fig. (1) Some milestones in Wireless Communications

## 1.2 Classification of mobile radio transmission system

Mobile radio transmission systems may be classified as simplex, half-duplex or full-duplex.

- a. **Simplex systems**: communication is possible in only one direction.
- b. **Half-duplex**: radio systems allow two-way communication using the same radio channel for both transmission and reception.
- c. **Full duplex**: systems allow simultaneous radio transmission and reception between a subscriber and a base station, by providing two simultaneous but separate channels (frequency division duplex, or FDD) or adjacent time slots on a single radio channel (time division duplex, or TDD) for communication to and from the user.



### **1.3 Frequency division & Time division**

Provides simultaneous radio transmission channels for the subscriber and the base station, so that they both may constantly transmit while simultaneously receiving signals from one another. At the base station, separate transmit and receive antennas are used to accommodate the two separate channels.

At the subscriber unit a single antenna is used for both transmission to and reception from the base station, and a device called a duplexer is used inside the subscriber unit to enable the same antenna to be used for simultaneous transmission and reception.

#### **(A) Frequency division duplexing (FDD)**

A pair of simplex channels with a fixed and known frequency separation is used to define a specific radio channel in the system.

- The channel used to convey traffic to the mobile user from a base station is called the forward channel.
- The channel used to carry traffic from the mobile user to a base station is called the reverse channel. FDD is used exclusively in analog mobile radio systems.

#### **(B) Time division duplexing (TDD)**

Uses the fact that it is possible to share a single radio channel in time, so that a portion of the time is used to transmit from the base station to the mobile, and the remaining time is used to transmit from the mobile to the base station. TDD is only possible with digital transmission formats and digital modulation.



## **1.4 Transmission types**

- Unicast** (point-to-point) transmission is made from one device to a single other device. It means that the packet is addressed to one receiver.
- Broadcast** transmission is made from one device to all other devices. In this case there is just one sender, but the information is sent to all connected receivers.
- Multicast** transmission is made from one device to a subset of the other available devices. In this case there is just one sender, but the information is sent to a group of receivers.

## **1.5 Types of wireless communication systems**

The major types of wireless communication systems are:

- 1- Paging Systems
- 2- Cordless Telephone Systems
- 3- Satellite communication systems
- 4- Wireless LAN systems
- 5- Cellular Telephone Systems

The cost, complexity, performance, and types of services offered by each of these mobile systems are different.

### **1- Paging Systems**

Paging systems are communication systems that send brief messages to a subscriber. Depending on the type of service, the message may be either text or voice messages. In modern paging systems, news headlines, stock quotations, and faxes may be sent.



The issued message is called a page. The paging system then transmits the page throughout the service area using base stations which broadcast the page on a radio carrier.

- Paging systems vary widely in their complexity and coverage area.
- Paging systems are designed to provide reliable communication to subscribers. This necessitates large transmitter powers and low data rates for maximum coverage from each base station.

*Simple paging systems* may cover a limited range of 2 to 5 km, or may even be confined to within individual buildings,

*Wide area paging systems* can provide worldwide coverage. Wide area paging systems consist of a network of telephone lines, many base station transmitters, and large radio towers that simultaneously broadcast a page from each base station (this is called simulcasting)

## **2- Cordless Telephone Systems**

- Provide wireless extension to the telephone network within a limited area
- Two-way (duplex) communications
- Consists of a portable handset, connected to dedicated base station, which is connected to the telephone network
- **1st generation:** household environment
- **2nd generation:** allow mobility in workplace and public use with limited coverage in urban areas.



### **3- Satellite communication Systems**

The main feature of the satellite communication systems

- Very wide range and coverage
- Very useful in sparsely populated areas: rural areas, sea, mountains, etc.
- Target: Vehicles and/or other stationary/mobile uses
- Expensive base station (satellites) systems

### **4- Wireless LAN (WLAN)**

Characterized by these features:

- Low mobility (not for vehicular use)
- High speed data transmission
- Confined regions – buildings and campuses
- Coverage: 100m – 300m per base station
- Uses the following bands (902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz).

### **5- Cellular Telephone Systems**

The basic cellular system consists of: Mobile station (MS), Base stations (BS) and Mobile switching center (MSC) or called Mobile telecommunications switching office (MTSO).