

RADIO COMMUNICATION

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Abstract— A panoramic view on the study and design of digital radio communication systems is the focus of this paper. The Radio Communications System (RCS) consists of several exterior communications subsystems which, in combination, provide all exterior communications requirements for the ship with the exception of the Special Intelligence Communications requirements . The use of radio in communicating is not only reliable but cost-effective as well and these are just some of the reasons why it remained to be very popular today and why so many organizations have used them until today . Its importance has been recognized and organizations were able to communicate effectively and accurately using this communication system . One of the most popular radio communication systems popularly used today is two-way communications. THE science and practice of radio communication have developed so rapidly during the past ten or fifteen years, and now cover such a wide field, that it has become impossible to confine an adequate technical description of the subject within the covers of a single volume. Whatever alteration may take place on the practical engineering side, however, it is unlikely that the fundamental principles of the generation, transmission, and reception of electromagnetic waves will be materially changed. In this research paper we will discuss about various communication system used in radio communication nowadays.

Index Terms- antenna , amplitude modulation , transmitter , resonance

I. INTRODUCTION

Radio is the radiation (wireless transmission) of electromagnetic signals through the atmosphere or free space. Information, such as sound, is carried by systematically changing (modulating) some property of the radiated waves, such as their amplitude frequency, phase , or pulse width. When radio waves strike an electrical conductor, the oscillating fields induce an alternating current in the conductor. The information in the waves can be extracted and transformed back into

its original form. Radio systems need a transmitter to modulate some property of the energy produced to impress a signal on it. Some types of modulation include amplitude modulation and frequency modulation . Radio systems also need an antenna to convert electric currents into radio waves, and vice versa. An antenna can be used for both transmitting and receiving. The electrical resonance of tuned circuits in radios allow individual stations to be selected. The electromagnetic wave is intercepted by a tuned receiving antenna. A radio receiver receives its input from an antenna and converts it into a form usable for the consumer, such as sound, pictures, digital data, measurement values, navigational positions, etc Radio frequencies occupy the range from a 3 kHz to 300 GHz, although commercially important uses of radio use only a small part of this spectrum. A radio communication system sends signals by radio. The radio equipment involved in communication systems includes a transmitter and a receiver, each having an antenna and appropriate terminal equipment such as a microphone at the transmitter and a loudspeaker at the receiver in the case of a voice-communication system.

II. PROCESSES

Radio systems used for communication have the following elements.

Transmitter and modulation

Each system contains a transmitter. This consists of a source of electrical energy, producing alternating current of a desired frequency of oscillation. The transmitter contains a system to modulate some property of the energy produced to impress a signal on it. This modulation might be as simple as turning the energy on and off, or altering more subtle properties such as amplitude, frequency, phase, or combinations of these properties. The transmitter sends the modulated electrical energy to a tuned resonant antenna; this structure converts the rapidly changing alternating current into an electromagnetic wave that can move through free space (sometimes with a particular polarization).

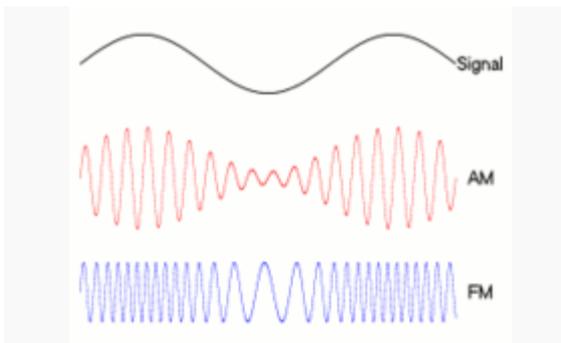


Figure 1. amplitude modulation and frequency modulation

An audio signal (top) may be carried by an AM or FM radio wave.

Amplitude modulation of a carrier wave works by varying the strength of the transmitted signal in proportion to the information being sent. For example, changes in the signal strength can be used to reflect the sounds to be reproduced by a speaker, or to specify the light intensity of television pixels. It was the method used for the first audio radio transmissions, and remains in use today. "AM" is often used to refer to the medium wave broadcast band (see AM radio). Frequency modulation varies the frequency of the carrier. The instantaneous frequency of the carrier is directly proportional to the instantaneous value of the input signal. Digital data can be sent by shifting the carrier's frequency among a set of discrete values, a technique known as frequency-shift keying. FM is commonly used at VHF radio frequencies for high-fidelity broadcasts of music and speech (see FM broadcasting). Normal (analog) TV sound is also broadcast using FM. Angle modulation alters the instantaneous phase of the carrier wave to transmit a signal. It is another term for phase modulation.

Antenna



Figure 2. Antenna

An *antenna* (or *aerial*) is an electrical device which converts electric currents into radio waves, and

vice versa. It is usually used with a radio transmitter or radio receiver. In transmission, a radio transmitter supplies an electric current oscillating at radio frequency (i.e. high frequency AC) to the antenna's terminals, and the antenna radiates the energy from the current as electromagnetic waves (radio waves). In reception, an antenna intercepts some of the power of an electromagnetic wave in order to produce a tiny voltage at its terminals, that is applied to a receiver to be amplified. An antenna can be used for both transmitting and receiving.

Propagation

Once generated, electromagnetic waves travel through space either directly, or have their path altered by reflection, refraction or diffraction. The intensity of the waves diminishes due to geometric dispersion (the inverse-square law); some energy may also be absorbed by the intervening medium in some cases. Noise will generally alter the desired signal; this electromagnetic interference comes from natural sources, as well as from artificial sources such as other transmitters and accidental radiators. Noise is also produced at every step due to the inherent properties of the devices used. If the magnitude of the noise is large enough, the desired signal will no longer be discernible; this is the fundamental limit to the range of radio communications.

Resonance

Electrical resonance of tuned circuits in radios allow individual stations to be selected. A resonant circuit will respond strongly to a particular frequency, and much less so to differing frequencies. This allows the radio receiver to discriminate between multiple signals differing in frequency.

Receiver and demodulation

The electromagnetic wave is intercepted by a tuned receiving antenna; this structure captures some of the energy of the wave and returns it to the form of oscillating electrical currents. At the receiver, these currents are demodulated, which is conversion to a usable signal form by a detector sub-system. The receiver is "tuned" to respond preferentially to the desired signals, and reject undesired signals. Early radio systems relied entirely on the energy collected by an antenna to produce signals for the operator. Radio became more useful after the invention of electronic devices such as the vacuum

tube and later the transistor, which made it possible to amplify weak signals. A *radio receiver* receives its input from an antenna, uses electronic filters to separate a wanted radio signal from all other signals picked up by this antenna, amplifies it to a level suitable for further processing, and finally converts through demodulation and decoding the signal into a form usable for the consumer, such as sound, pictures, digital data, measurement values, navigational positions, etc

Radio band

Radio frequencies occupy the range from a 3 kHz to 300 GHz, although commercially important uses of radio use only a small part of this spectrum.^[7] Other types of electromagnetic radiation, with frequencies above the RF range, are infrared, visible light, ultraviolet, X-rays and gamma rays. Since the energy of an individual photon of radio frequency is too low to remove an electron from an atom, radio waves are classified as non-ionizing radiation.

Classical radio communications systems use frequency-division multiplexing (FDM) as a strategy to split up and share the available radio-frequency bandwidth for use by different parties communications concurrently. Modern radio communication systems include those that divide up a radio-frequency band by time-division multiplexing (TDM) and code-division multiplexing (CDM) as alternatives to the classical FDM strategy. These systems offer different tradeoffs in supporting multiple users, beyond the FDM strategy that was ideal for broadcast radio but less so for applications such as mobile telephony. A radio communication system may send information only one way. For example, in broadcasting a single transmitter sends signals to many receivers. Two stations may take turns sending and receiving, using a single radio frequency; this is called "simplex." By using two radio frequencies, two stations may continuously and concurrently send and receive signals - this is called "duplex" operation.

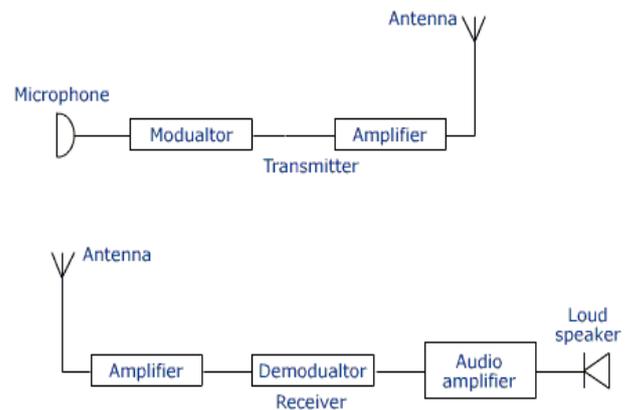
III. PRINCIPLES OF RADIO COMMUNICATIONS

Radio waves belong to the electromagnetic radiation family, which includes x-ray, ultraviolet, and visible light. Much like the gentle waves that form when a stone is tossed into a still lake, radio signals radiate outward, or propagate, from a

transmitting antenna. However, unlike water waves, radio waves propagate at the speed of light. We characterize a radio wave in terms of its amplitude, frequency, and wavelength

1. Radio wave amplitude, or strength, can be visualized as its height being the distance between its peak and its lowest point. Amplitude, which is measured in volts, is usually expressed in terms of an average value called root-mean-square, or RMS.
2. The frequency of a radio wave is the number of repetitions or cycles it completes in a given period of time. Frequency is measured in Hertz(Hz); one Hertz equals one cycle per second. Thousands of Hertz are expressed as kilohertz (kHz), and millions of Hertz as megahertz (MHz).Radio wave amplitude, or strength, can be visualized as its height being the distance between its peak and its lowest point.
3. Radio wavelength is the distance between crests of a wave . The product of wavelength and frequency is equal to a constant that is equal to the speed of propagation . Thus as the frequency increases ,wavelength decreases and vice versa.

IV. Block diagram of radio communication



V. USES OF RADIO COMMUNICATION

Audio

AM radio uses amplitude modulation, in which the amplitude of the transmitted signal is made proportional to the sound amplitude captured (transduced) by the microphone, while the transmitted frequency remains unchanged.

Transmissions are affected by static and interference because lightning and other sources of radio emissions on the same frequency add their amplitudes to the original transmitted amplitude. FM broadcast radio sends music and voice with less noise than AM radio. It is often mistakenly thought that FM is higher fidelity than AM, but that is not true. AM is capable of the same audio bandwidth that FM employs. AM receivers typically use narrower filters in the receiver to recover the signal with less noise. AM stereo receivers can reproduce the same audio bandwidth that FM does due to the wider filter used in an AM stereo receiver, but today, AM radios limit the audio bandpass to 3–5 kHz. In frequency modulation, amplitude variation at the [microphone](#) causes the transmitter frequency to fluctuate. Because the audio signal modulates the frequency and not the amplitude, an FM signal is not subject to static and interference in the same way as AM signals. Due to its need for a wider bandwidth, FM is transmitted in the Very High Frequency (VHF, 30 MHz to 300 MHz) radio spectrum.

Telephony

Mobile phones transmit to a local cell site (transmitter/receiver) that ultimately connects to the public switched telephone network (PSTN) through an optic fiber or microwave radio and other network elements. When the mobile phone nears the edge of the cell site's radio coverage area, the central computer switches the phone to a new cell. Cell phones originally used FM, but now most use various digital modulation schemes. Recent developments in Sweden (such as DROPme) allow for the instant downloading of digital material from a radio broadcast (such as a song) to a mobile phone. Satellite phones use satellites rather than cell towers to communicate.

Video

Analog television sends the picture as AM and the sound as AM or FM, with the sound carrier a fixed frequency from the video carrier. Analog television also uses a vestigial sideband on the video carrier to reduce the bandwidth required.

. A Reed–Solomon error correction code adds redundant correction codes and allows reliable reception during moderate data loss. Although many current and future codecs can be sent in the MPEG transport stream container format, as of 2006 most systems use a standard-definition format almost identical to DVD : MPEG-2 video

in Anamorphic widescreen and MPEG layer 2 (MP2) audio. High-definition television is possible simply by using a higher-resolution picture, but H.264/AVC is being considered as a replacement video codec in some regions for its improved compression. With the compression and improved modulation involved, a single "channel" can contain a high-definition program and several standard-definition programs.

Data (digital radio)



Figure 3 .digital radio

Most new radio systems are digital, including Digital TV, satellite radio, and Digital Audio Broadcasting. The oldest form of digital broadcast was spark gap telegraphy, used by pioneers such as Marconi. By pressing the key, the operator could send messages in Morse code by energizing a rotating commutating spark gap. The rotating commutator produced a tone in the receiver, where a simple spark gap would produce a hiss, indistinguishable from static. Spark-gap transmitters are now illegal, because their transmissions span several hundred megahertz. This is very wasteful of both radio frequencies and power.

VI. CONCLUSIONS

Radio systems need a transmitter to modulate some property of the energy produced to impress a signal on it. Some types of modulation include amplitude modulation and frequency modulation. In this paper I have provided a brief sketch of parts of radio communication and the segment of the radio communication. We've also discussed about the uses of radio along with their respective functions. The process of the radio communication and the issues related to the radio have been discussed in the paper. Now-a-day the radio communication become very beneficial and important.

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