

Topic 4.3.4 - Comparison of AM and FM



Learning Objectives:

At the end of this topic you will be able to;

- compare the merits of AM and FM;

Comparison of Amplitude Modulation and Frequency Modulation

The purpose of this unit is to draw together the last two topics and compare the relative merits of both AM and FM.

The Advantages of AM

1. The modulators and demodulators are very simple and straightforward to build. This makes the cost of receivers very low and therefore available to the majority of people.
2. AM requires only a very small bandwidth to transmit the same information compared to FM where the bandwidth requirement is significantly higher.

The Disadvantages of AM

1. All communication signals pick up interference and noise, and these usually affect the amplitude of the carrier. In an AM system (where the information is contained in the amplitude) the noise adds to the information and thus pollutes it. It is virtually impossible to remove this additional component unless the original signal is available for comparison and this is hardly ever the case.
2. In AM transmissions a significant amount of the transmitted power is contained within the carrier, which is eventually discarded at the receiver. Only a limited amount ($\frac{1}{4}$) of the original power is located in the sideband where the information signal is located. This makes AM an inefficient system.

The Advantages of FM

1. In an FM system, the amplitude of the carrier remains constant; the information is contained in the frequency deviation of the carrier. During transmission it will pick up noise just like any other signal, however, as there is no information contained in the amplitude of the carrier, it is relatively straightforward to remove any noise picked up during transmission at the receiver. FM transmissions therefore have greater immunity to the effect of noise.
2. In a wideband FM signal, the amplitude of the carrier component is relatively small: most of the transmitted power goes into the sidebands, where the information is carried. Therefore FM is a much more efficient process than AM.
3. Using FM, it is possible to transmit the same quality of information using a lower power transmitter.

The Disadvantages of FM

1. The circuitry involved in modulating and demodulating FM signals is much more complex than that of AM receivers. This makes FM transmitting and receiving equipment more expensive, and less attractive to purchase.
2. The transmission range of FM signals is lower than that of AM signals, meaning that more repeater stations will be required to cover a large area.
3. At high frequency, the carrier signal travels in straight lines, sometimes referred to as 'line-of-sight' communication, meaning that in hilly areas more repeaters will be required.

You may wonder why AM is still used by broadcasters when FM is clearly the superior system. i.e. the points in favour of FM might appear to outweigh the points against. The dominating factor, however, is bandwidth: in telecommunications, bandwidth is a precious commodity. The important fact is that wideband FM requires a much greater bandwidth than AM to transmit the same information, and this places many restrictions on its use.




For the Enthusiast - Future Developments

At the present time major changes to the communications network are taking place. Already introduced is the DAB (Digital Audio Broadcast) Radio, which uses a completely different technique to broadcast information by using digital signals instead of analogue signals. The terrestrial television service which is currently analogue (AM for video information and FM for sound) is also undergoing serious changes and by 2012 all analogue TV Broadcast signals will be switched off, in favour of a new digital service. This will mean that every TV set in the country will have to be changed if they want to receive their programs through an aerial.

Sky, NTL, and Virgin Media have been using digital services for some time now, but you still need a special box to be able to decode the signals being received either from a mini-dish on the side of your house for sky, or through a fibre optic cable brought to your front door, NTL and Virgin Media.

What happens to the area of the radio-wave spectrum vacated by the TV companies is unclear, it may pave the way for lots more FM radio stations, as more bandwidth becomes available, but what is clear is that this is a very important period in the history of communications technology, and is going to provide many opportunities for engineers for many years to come as technology keeps lowering the barriers and more and more information is passed through the bandwidth we have available.

Self Evaluation Review

| Learning Objectives | My personal review of these objectives: | | |
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| |  |  |  |
| compare the merits of AM and FM. | | | |

Targets: 1.

 2.
