

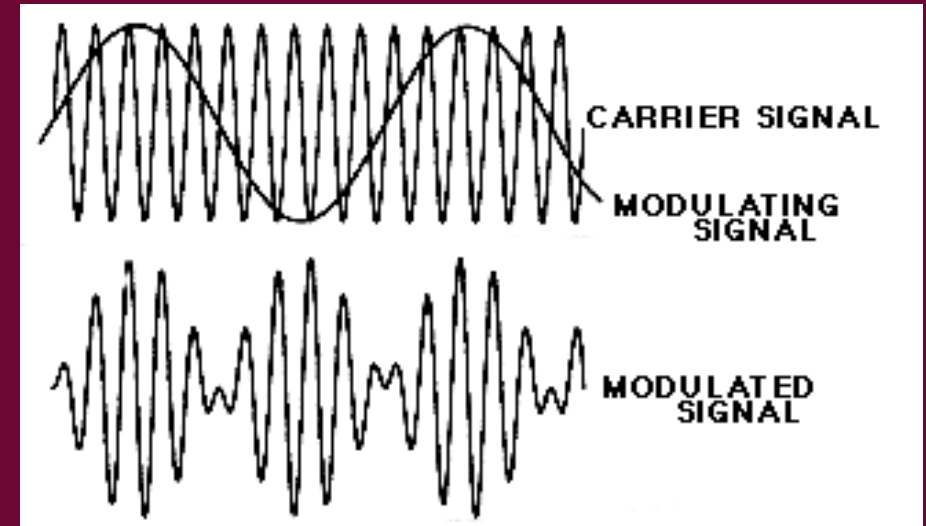
Advantages and Disadvantages of AM & FM Communications

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Amplitude Modulation (AM)

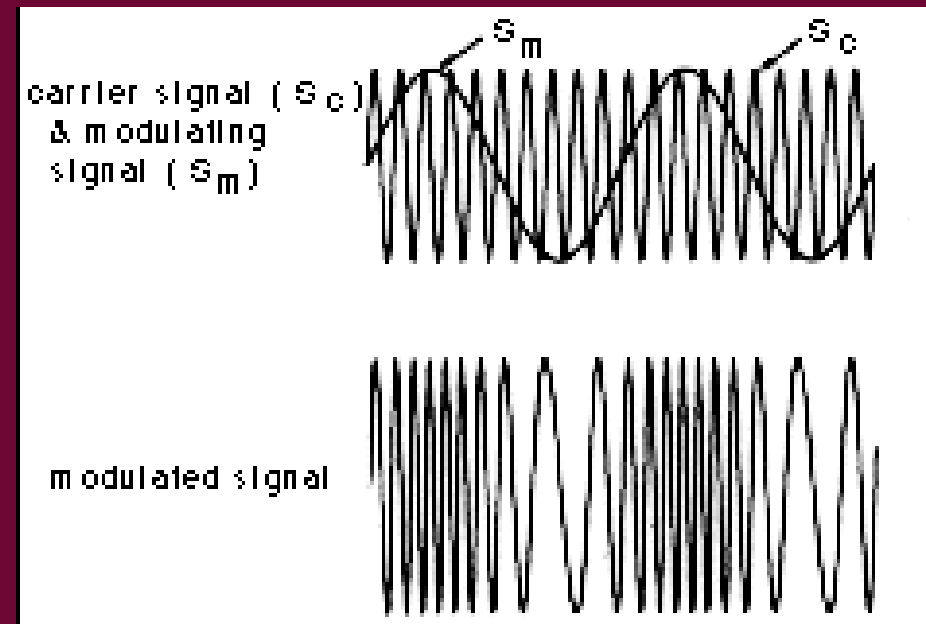
The AM modulation¹ scheme embeds the information that is transmitted into the amplitude (or height) of a high-frequency sinusoidal wave, called the *carrier* [1].



¹The cited IEEE source does not include the information about the “message signal”, but simply that the carrier amplitude is varied. This is done as “modulation” implies this based on their definitions.

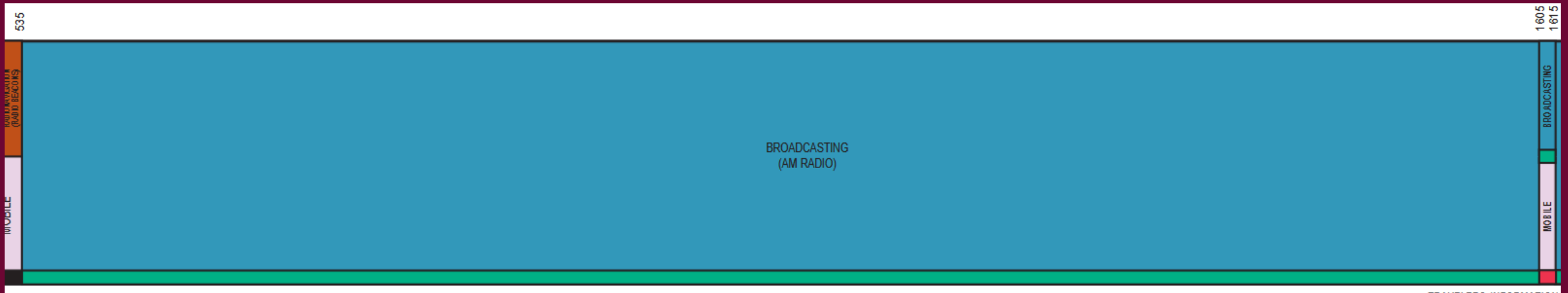
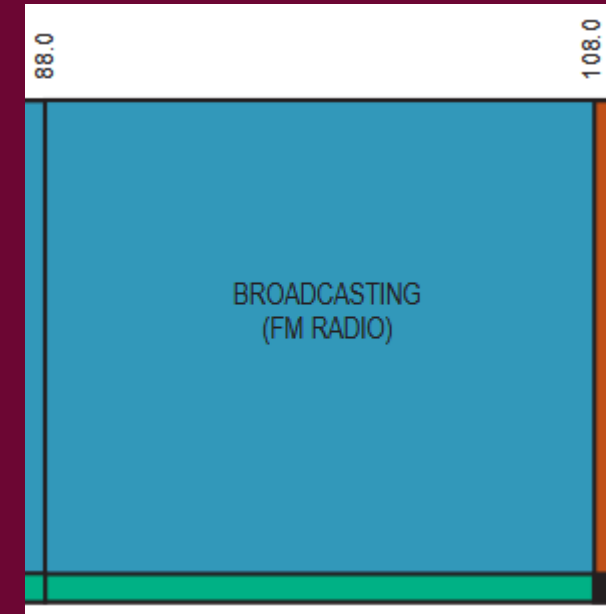
Frequency Modulation (FM)

The **FM Modulation scheme** embeds the information signal into the instantaneous frequency of the carrier wave [1].



Frequency Allocations

- AM is allocated in the 535-1605kHz range [2].
- FM is allocated in the 88-108MHz range [2].

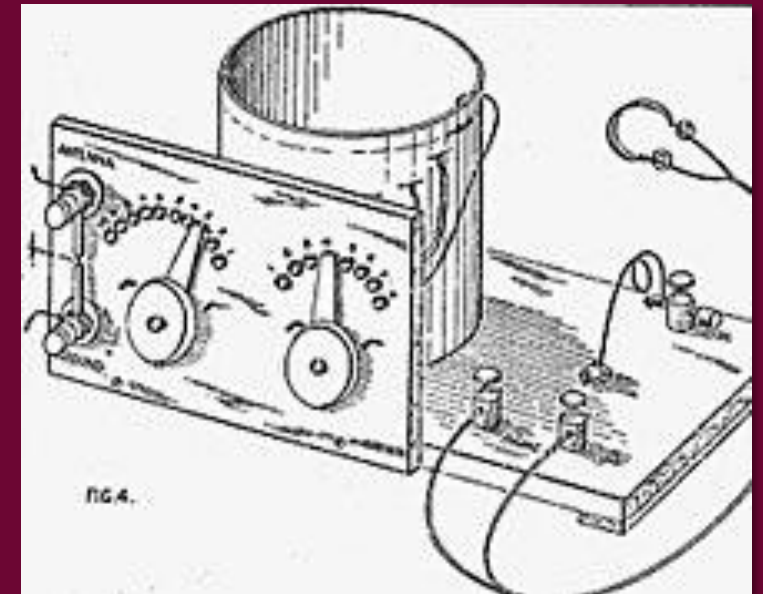


Simplicity of AM

An advantage to Amplitude Modulation is its simplicity.

The modulation can be achieved with simple transistor-based analog circuits, or larger AC RF electronics (RF transformers).

Simplicity in scheme allows for easier access of technology to a large group.

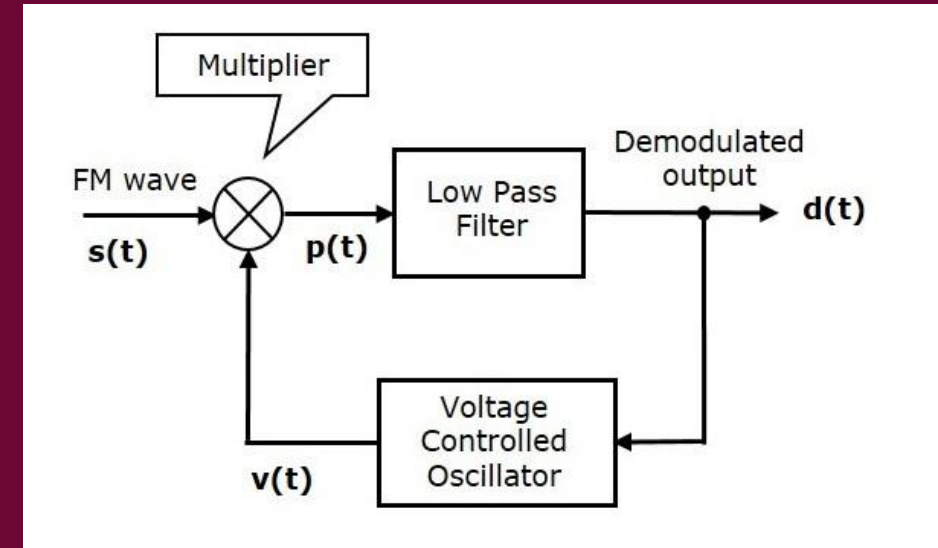


[3]

Complexity of FM

FM differs from AM by being a more complicated scheme. The complication being somehow making the instantaneous frequency of the carrier proportional to the message signal.

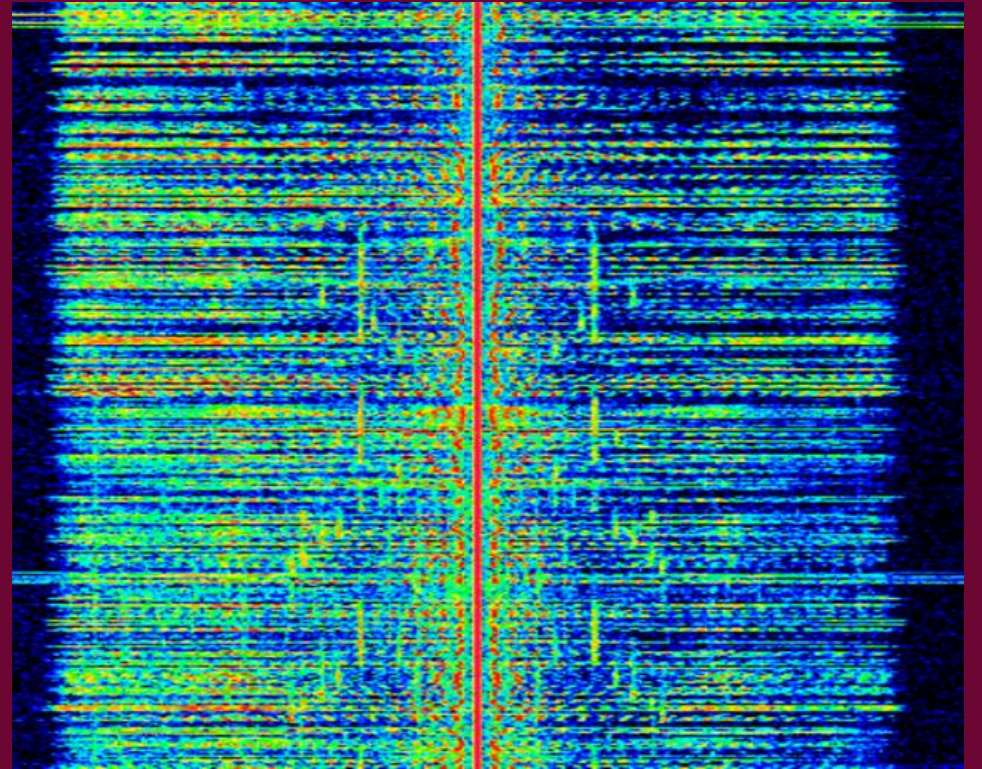
A way of producing this can be through a VCO as shown in the figure.



AM is Sensitive to Noise

Since the AM modulated wave has information embedded in the voltage amplitude of the signal, it is forced to be subject to thermal noise radiation.

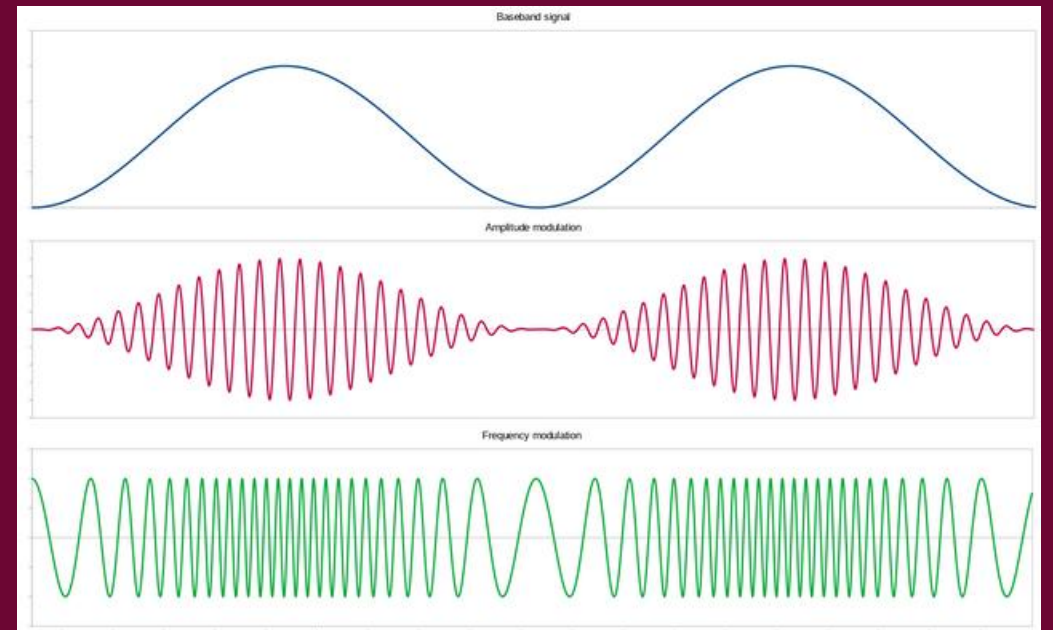
(Disadvantage of AM)



FM is Robust to Noise

Because the transmitted FM signal has a constant modulation, the modulated signal itself cannot be distorted by thermal noise in circuit or out of channel and lose signal integrity.

(Advantage of FM)

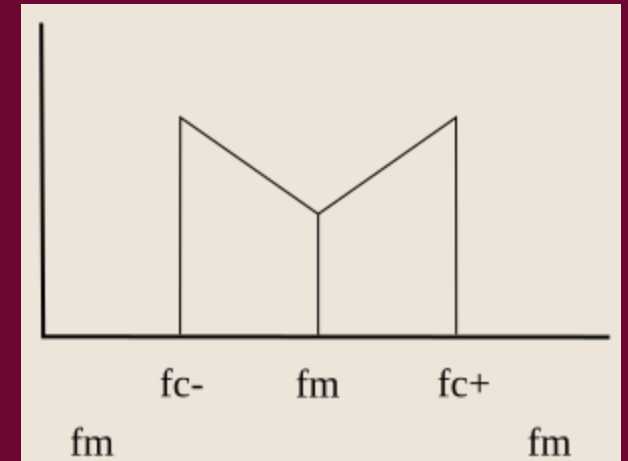


Colors of AM

A benefit to AM are the different ways of sending modulated signals for different applications.

Double Sideband Suppressed Carrier (DSB-SC) for lower power requirements.

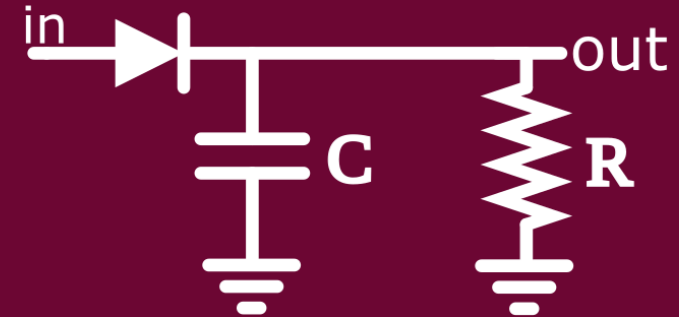
Vestigial Sideband which is widely used in analog television broadcasting.



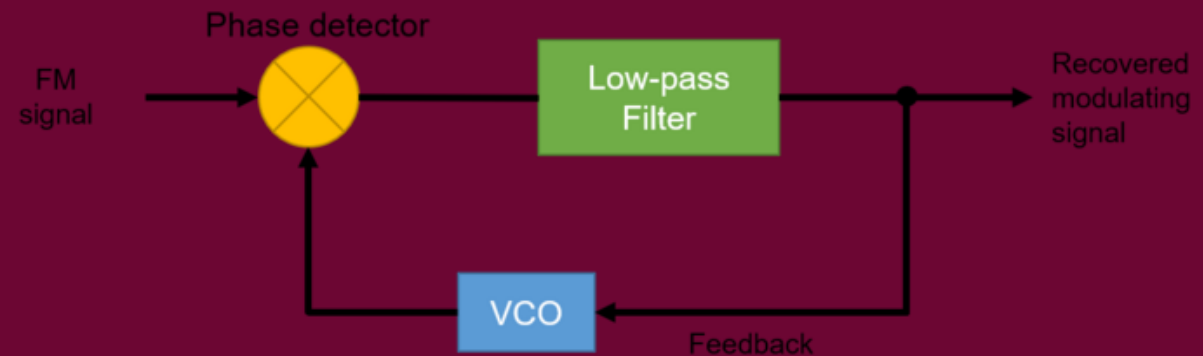
[7]

Demodulators

- Advantage for AM is the demodulators are typically simple; like simple rectifiers or coherence detectors.
- Disadvantage of FM demodulators is they're more complicated, requiring VCOs with local access to the carrier.



[8]



[9]

Recap

- Overall, AM and FM are ways to take information and send it over the electromagnetic spectrum so we can communicate over long distances.
- AM Modulation is the simplest way of doing this, putting information in voltage levels.
- FM Modulation is more sophisticated, putting information in a carrier wave's frequency.



REFERENCES

- [1] "IEEE Standard Definitions of Terms for Modulation Systems," in IEEE No 170-1964 , vol., no., pp.1-7, 15 May 1964, doi: 10.1109/IEEESTD.1964.7368864.
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