Circuits De-mystified:

A.M. “Envelope Detector”

Question:

- In an A.M. (Amplitude Modulated) signal, how does the radio “decode” the signal to get the original audio back out?

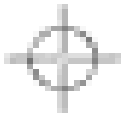
Electronics De-mystified:

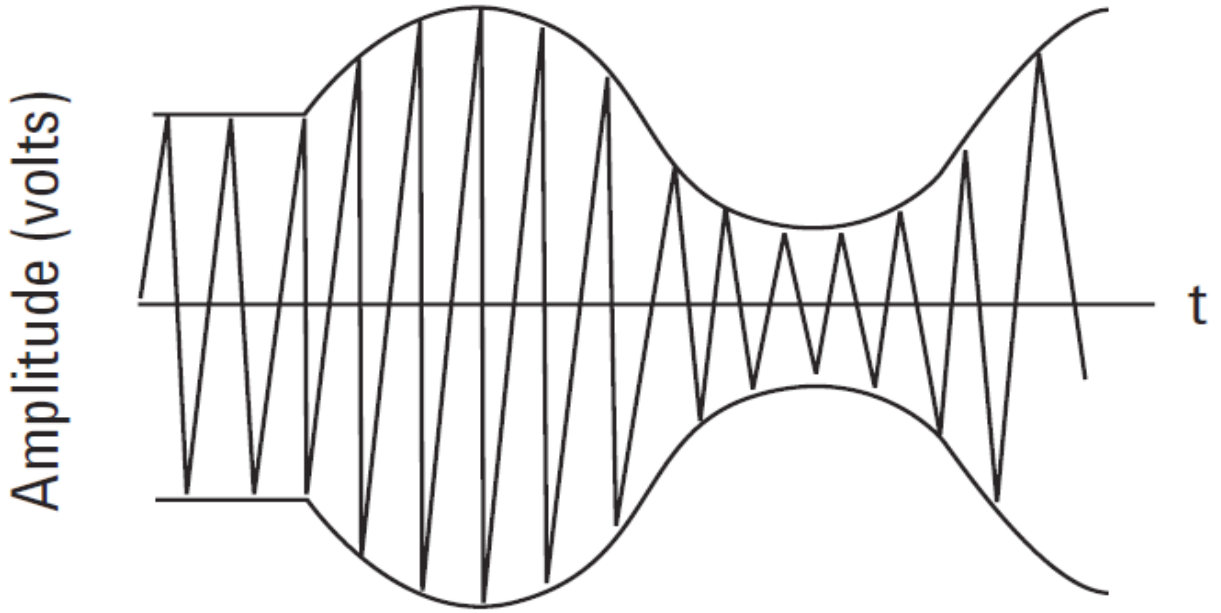
A.M. “Envelope Detector”

Answer:

- An “Envelope Detector” is used

- How does it work?

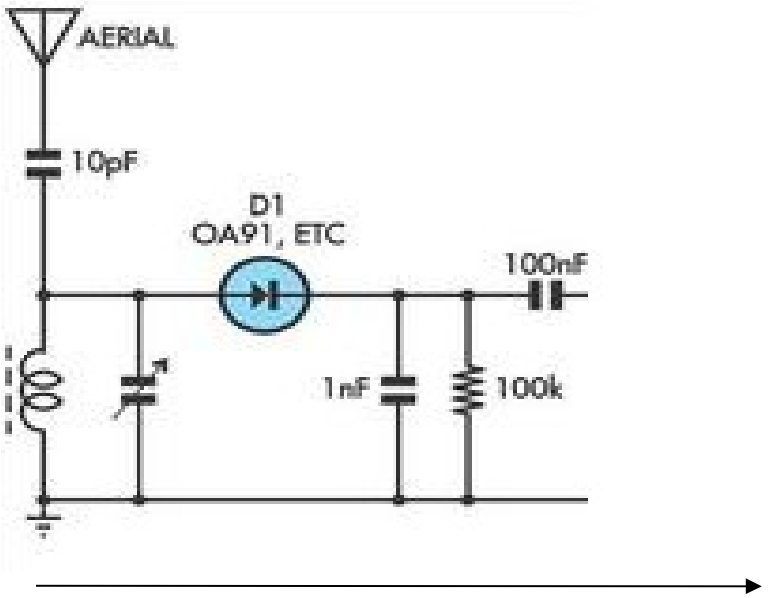




Source: https://literature.cdn.keysight.com/litweb/pdf/5954-9130.pdf

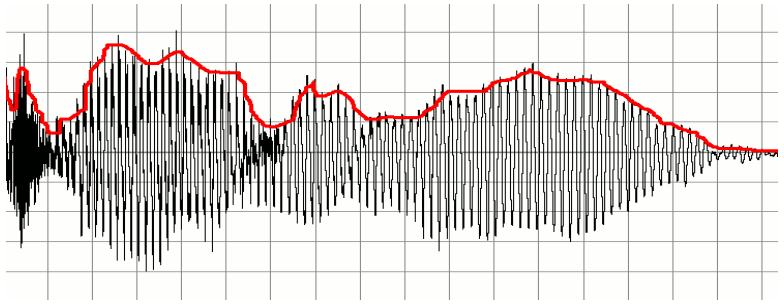
- Recall how an A.M. signal is produced. The "maths" of the modulation make this pattern when an audio frequency modulates a radio frequency

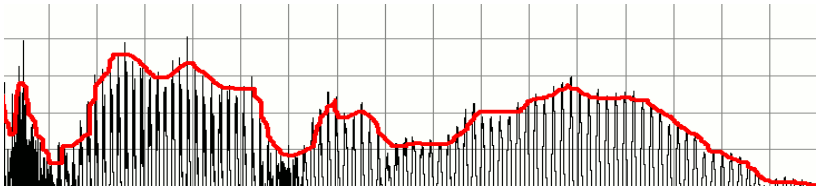
- Our basic reception circuit looks like this:

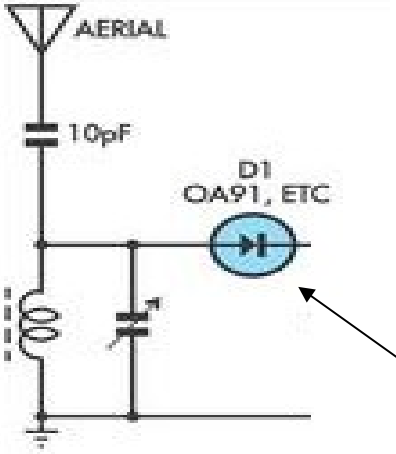


Source: http://www.learningelectronics.net/circuits/simple-am-radio-receiver_13.html

- The antenna, 10pF cap., coil and variable capacitor “tune” the radio frequency received.

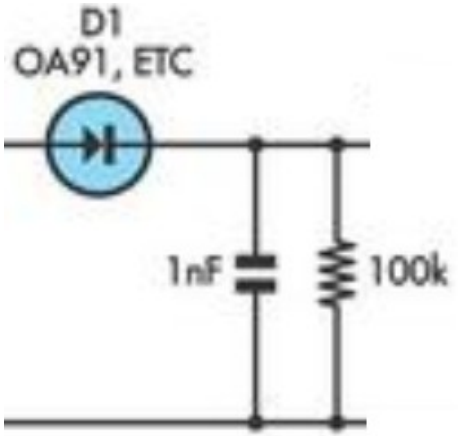


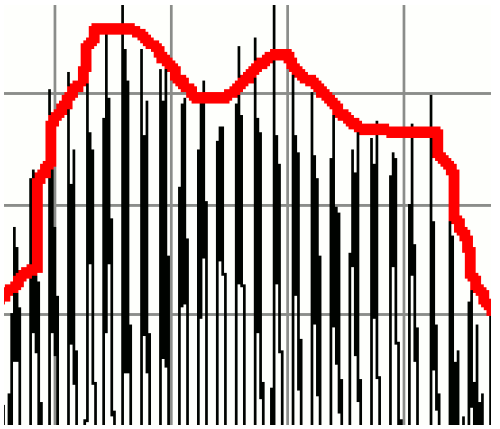




Source: https://en.wikipedia.org/wiki/Envelope_detector#/media/File:C_Envelope_follower.png

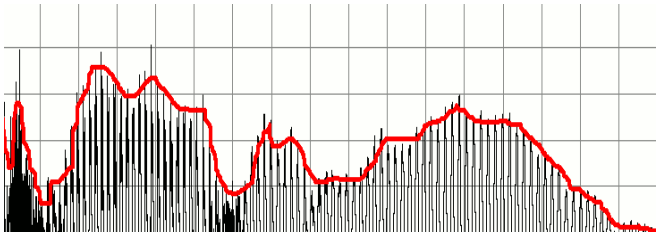
- The “Envelope Detector” is simply a diode after the tuning stage. The function of the diode is to rectify (turn alternating current to direct current). Working in this way it “sees” the positive going part of the AM waveform (red line).

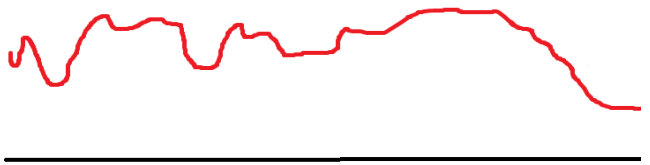


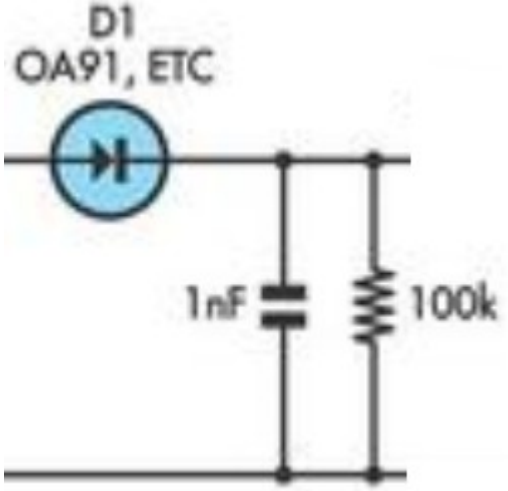


- After the diode, a “RC” circuit “holds the voltage”. (the red line). This is needed as the envelope is actually very choppy. The capacitor charges quickly and discharges slowly (compared to the radio frequency) into the resistor.

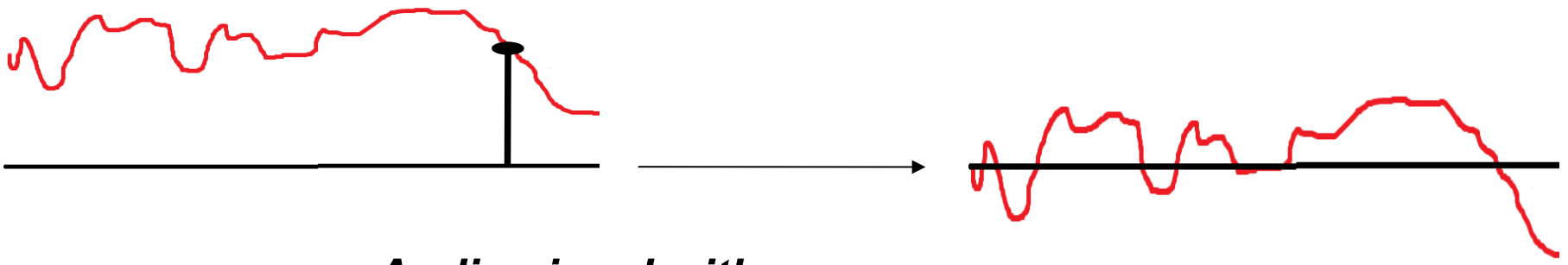
- This is smoothing, in a similar way that a.c. ripple is smoothed in d.c. power supply.





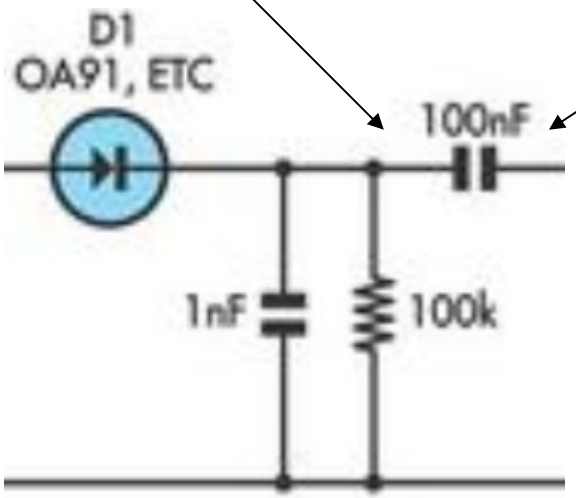


- The time constant of the smoothing circuit is slow compared to the radio frequency of the carrier. The capacitor here looks like a very low impedance to radio frequency which filters out the remainder carrier signal as well.



Audio signal with d.c offset

Audio signal, no d.c offset



- An a.c. coupling capacitor removes any d.c. offset