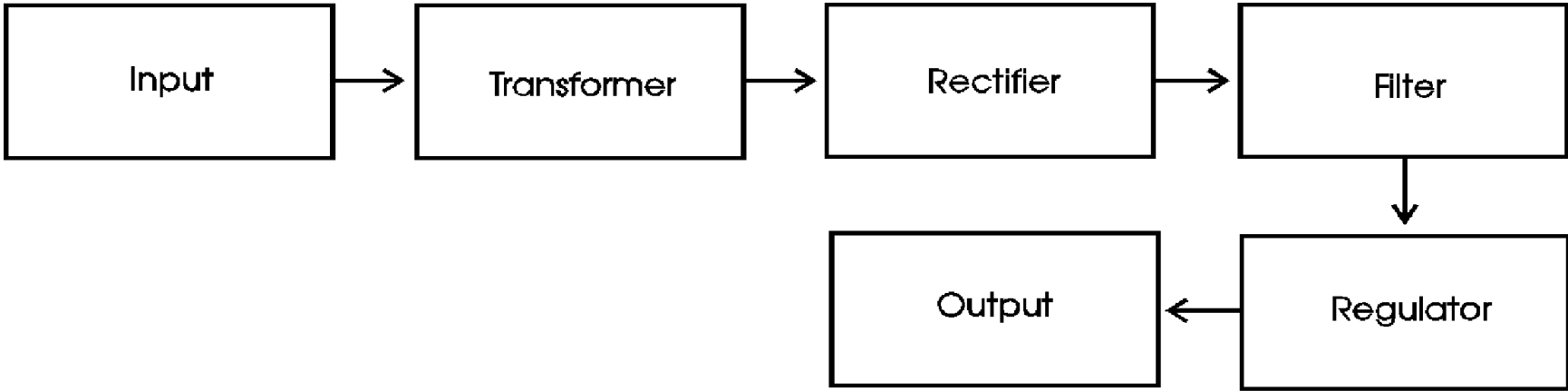


Block Diagrams Definitions & Safety

Regulated Power Supply



Power supply

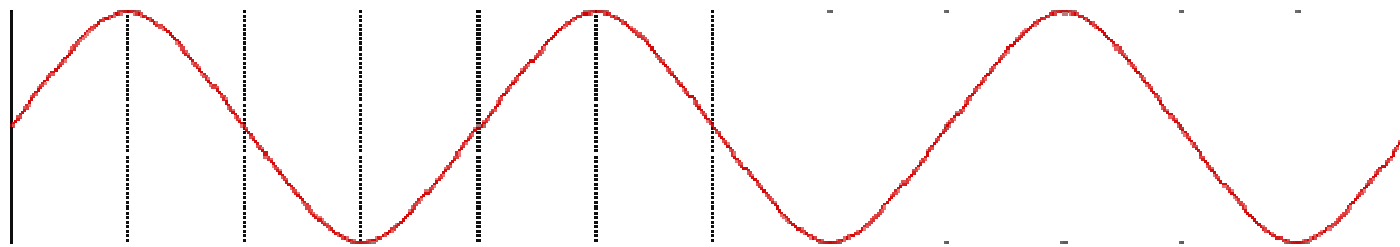
- A power supply (sometimes known as a power supply unit or PSU) is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

Transformer

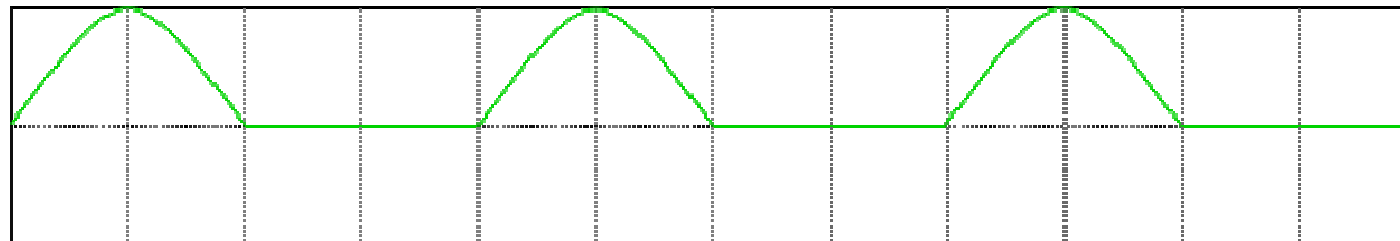
- A transformer is a device that transfers electrical energy from one circuit to another through a shared magnetic field. A changing current in the first circuit (the primary) creates a changing magnetic field; in turn, this magnetic field induces a changing voltage in the second circuit (the secondary). By adding a load to the secondary circuit, one can make current flow in the transformer, thus transferring energy from one circuit to the other.

Rectifier

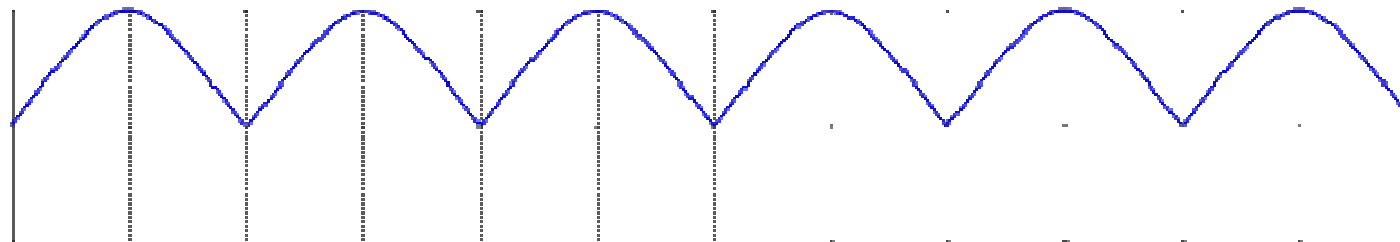
- A rectifier is an electrical device that converts alternating current to direct current, a process known as rectification. Rectifiers are used as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid state diodes, vacuum tube diodes, mercury arc valves, and other components.
- A circuit which performs the opposite function (converting DC to AC) is known as an inverter.



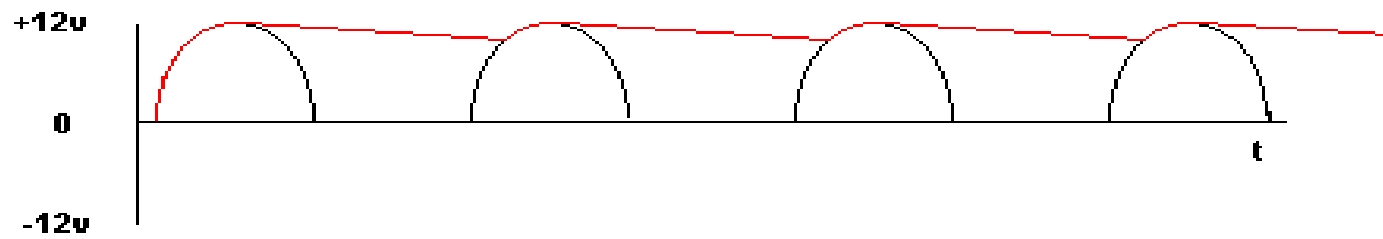
Sinusoidal Signal



Half wave Rectification



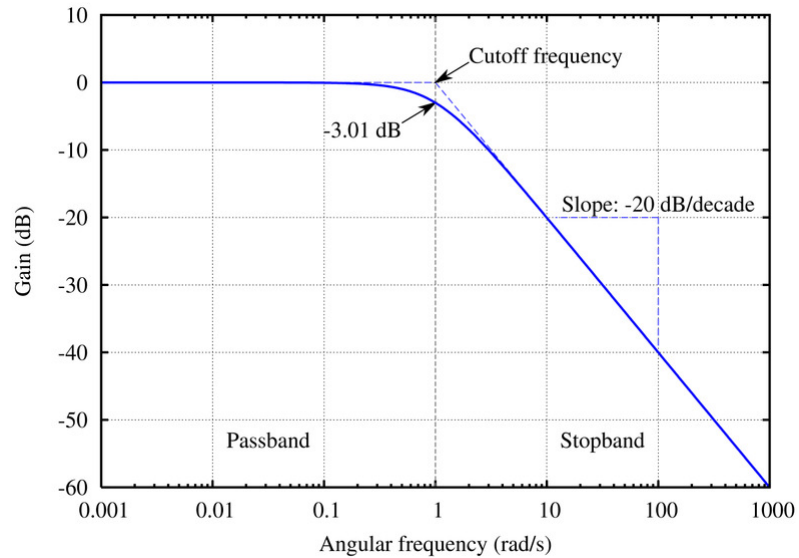
Full wave Rectification



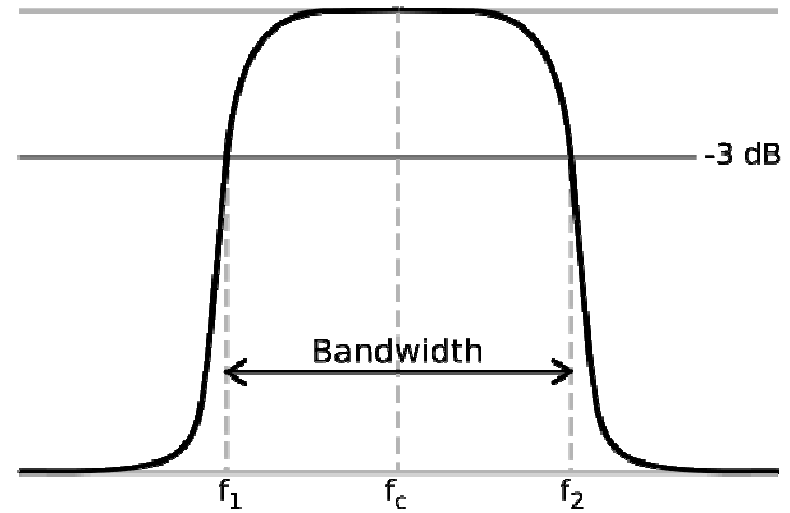
Filter

- Electronic are electronic circuits which perform signal processing functions, specifically intended to remove unwanted signal components and/or enhance wanted ones.
- Low-pass filter - Low frequencies are passed, high frequencies are attenuated.
- High-pass filter - High frequencies are passed, Low frequencies are attenuated.
- Band-pass filter - Only frequencies in a frequency band are passed.
- Band-stop filter - Only frequencies in a frequency band are attenuated
- Attenuated or Attenuation is the reduction in amplitude and intensity of a signal

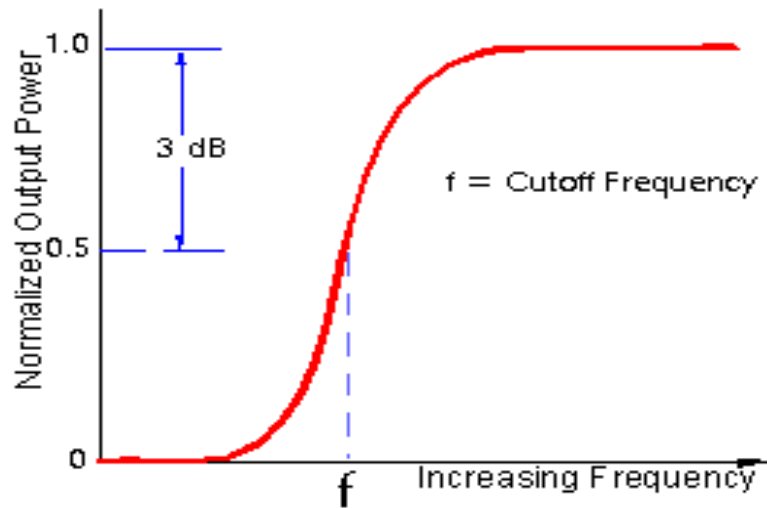
Filters



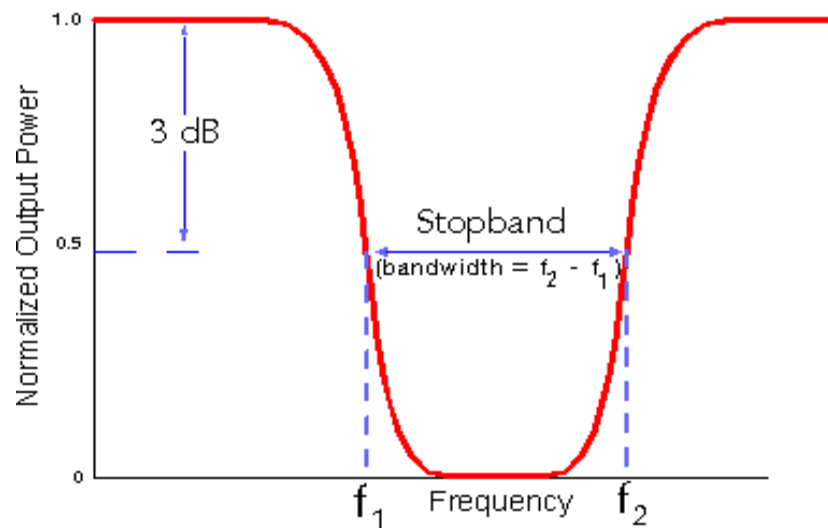
LOW PASS



BAND PASS



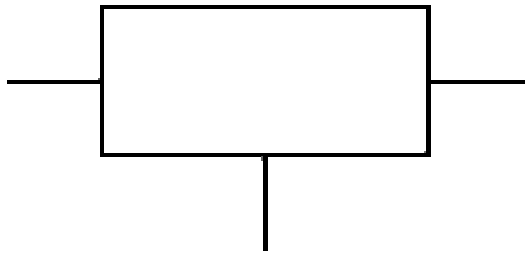
HIGH PASS



BAND STOP

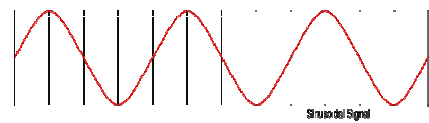
Regulator

- A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level.

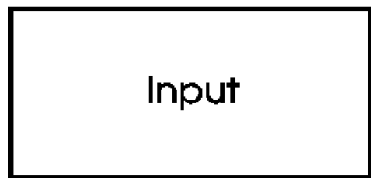
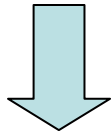


Voltage-Regulator-IEC-Symbol

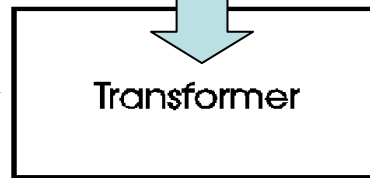
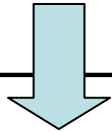
Regulated Power Supply



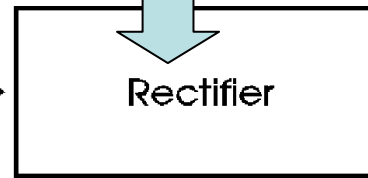
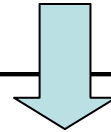
120 or 240 volt AC



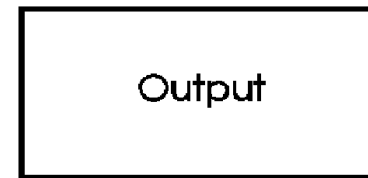
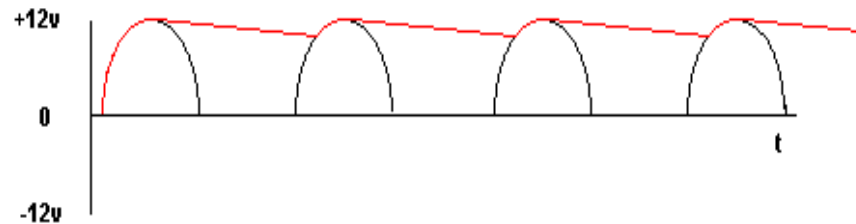
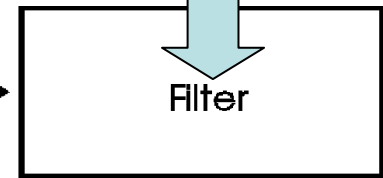
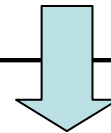
Transfers electrical energy from one circuit to another



Converts alternating current to direct current



Remove unwanted signal components and/or enhance wanted ones

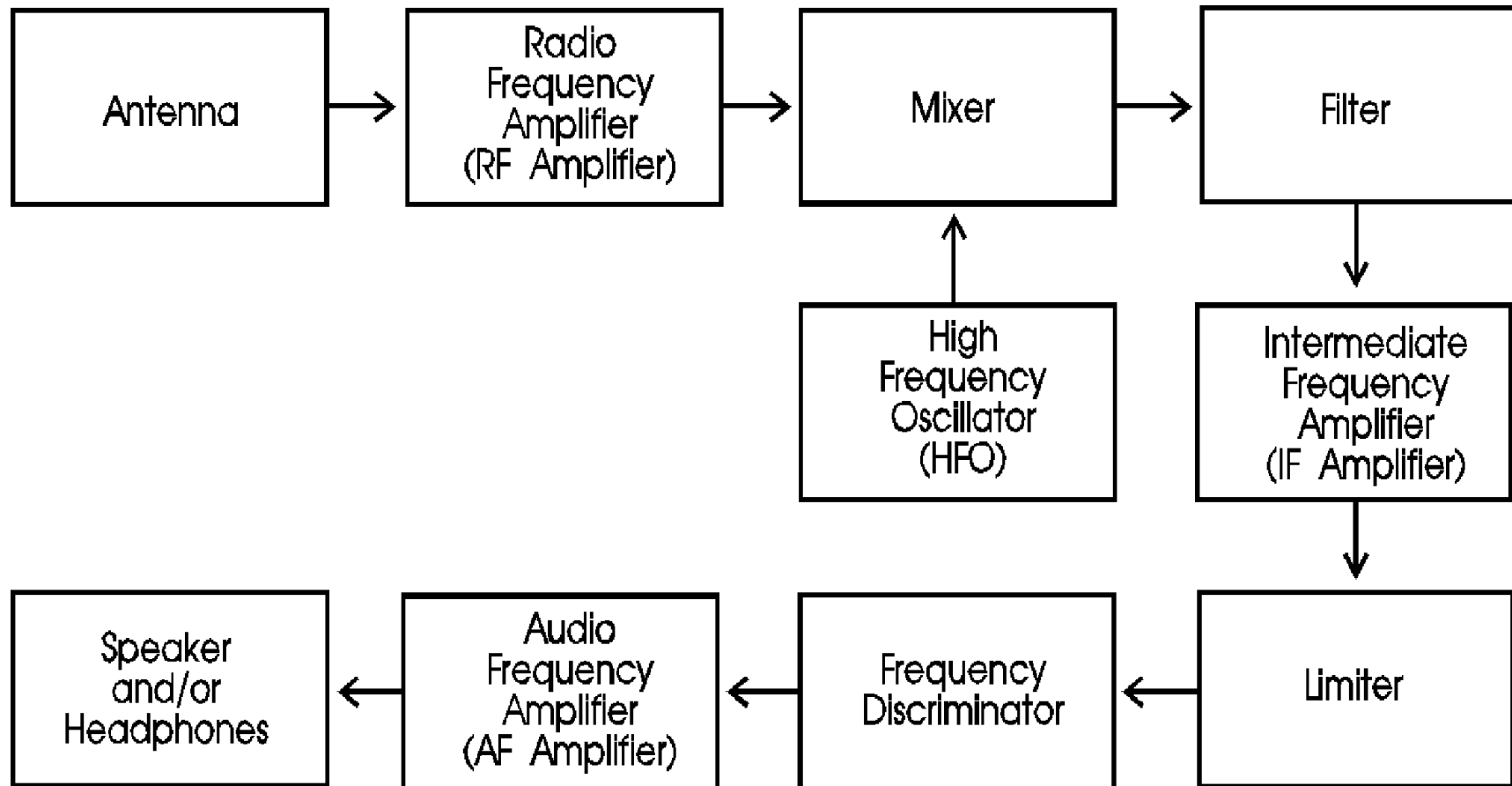


Well-regulated lower voltage DC 12v



Automatically maintain a constant voltage level

Frequency Modulation Receiver



Heterodyning

- Heterodyning is the generation of new frequencies by mixing two or more signals in a nonlinear device such as a vacuum tube, transistor, diode mixer.
- The mixing of each two frequencies results in the creation of two new frequencies, one at the sum of the two frequencies mixed, and the other at their difference.
- A heterodyne receiver is a telecommunication receiver which uses this effect to produce frequency shifts.

Superheterodyne Receiver

- The word *heterodyne* is derived from the Greek roots *hetero-* "different", and *-dyne* "power".
- A Superheterodyne Receiver converts any selected incoming frequency by heterodyne action to a preselected common intermediate frequency, for example, 455 kilohertz or 10.7 megahertz, and provides amplification and selectivity, or filtering.
- The term *heterodyne* is sometimes also applied to one of the new frequencies produced by heterodyne signal mixing.

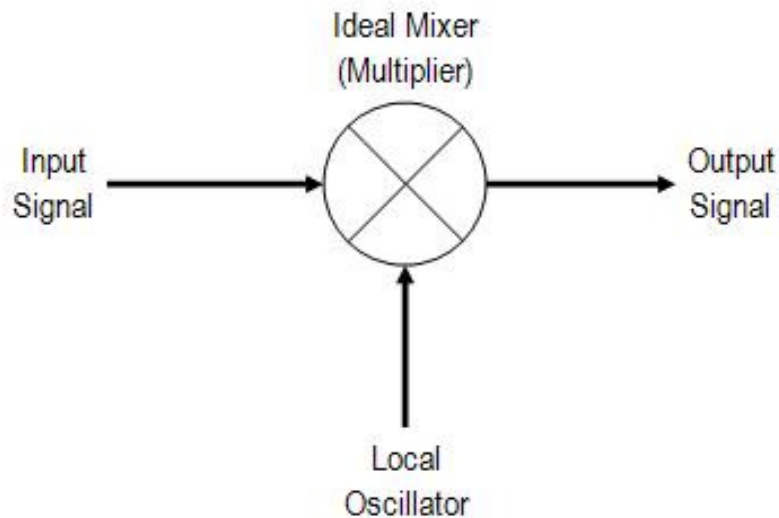
Superheterodyne Receiver

- incoming radio frequencies from the antenna are made to mix (or multiply) with an internally generated radio frequency from the VFO in a process called mixing.
- The mixing process can produce a range of output signals:
 - * at all the original frequencies,
 - * at frequencies that are the sum of each two mixed frequencies
 - * at frequencies that equal the difference between two of the mixed frequencies
 - * at other, usually higher, frequencies.
- If the required incoming radio frequency and the VFO frequency were both rather high (RF) but quite similar, then by far the lowest frequency produced from the mixer will be their difference.
- In very simple radios, it is relatively straightforward to separate this from all the other spurious signals using a filter, to amplify it and then further to process it into an audible signal. In more complex situations, many enhancements and complications get added to this simple process, but this mixing or heterodyning principle remains at the heart of it.

Amplifier

- amplifier is any device that will use a small amount of energy to control a larger amount of energy.
- The relationship of the input to the output of an amplifier is usually expressed as a function of the input frequency and is called the transfer function of the amplifier, and the magnitude of the transfer function is termed the gain.
- gain is a measure of the ability of a circuit to increase the power or amplitude of a signal. It is usually defined as the mean ratio of the signal output of a system to the signal input of the same system. It may also be defined as the decimal logarithm of the same ratio.

Mixer



- mixer is a nonlinear circuit or device that accepts as its input two different frequencies and presents at its output a mixture of signals at several frequencies:
- the sum of the frequencies of the input signals
- the difference between the frequencies of the input signals
- both original input frequencies — these are often considered parasitic and are filtered out.
- The manipulations of frequency performed by a mixer can be used to move signals between bands, or to encode and decode them. One other application of a mixer is as a product detector

Local Oscillator

- A local oscillator is a device used to generate a signal which is beat against the signal of interest to mix it to a different frequency.
- The oscillator produces a signal which is injected into the mixer along with the signal from the antenna in order to effectively change the antenna signal by heterodyning with it to produce the sum and difference (with the utilization of trigonometric angle sum and difference identities) of that signal one of which will be at the intermediate frequency which can be handled by the IF amplifier.
- These are the beat frequencies. Normally the beat frequency is associated with the lower sideband, the difference between the two.

Limiter

- a limiter is a circuit that allows signals below a set value to pass unaffected, as in a Class A amplifier, and clips off the peaks of stronger signals that exceed this set value, as in a Class C amplifier.
- Removes all traces of AM from the received signal, improves S2N ratio, removes static crashes

Demodulator

- A demodulator is an electronic circuit used to recover the information content from the carrier wave of a signal. The term is usually used in connection with radio receivers, but there are many kinds of demodulators used in many other systems.
- Another common one is in a modem, which is a contraction of the terms modulator/demodulator.

Frequency Discriminator

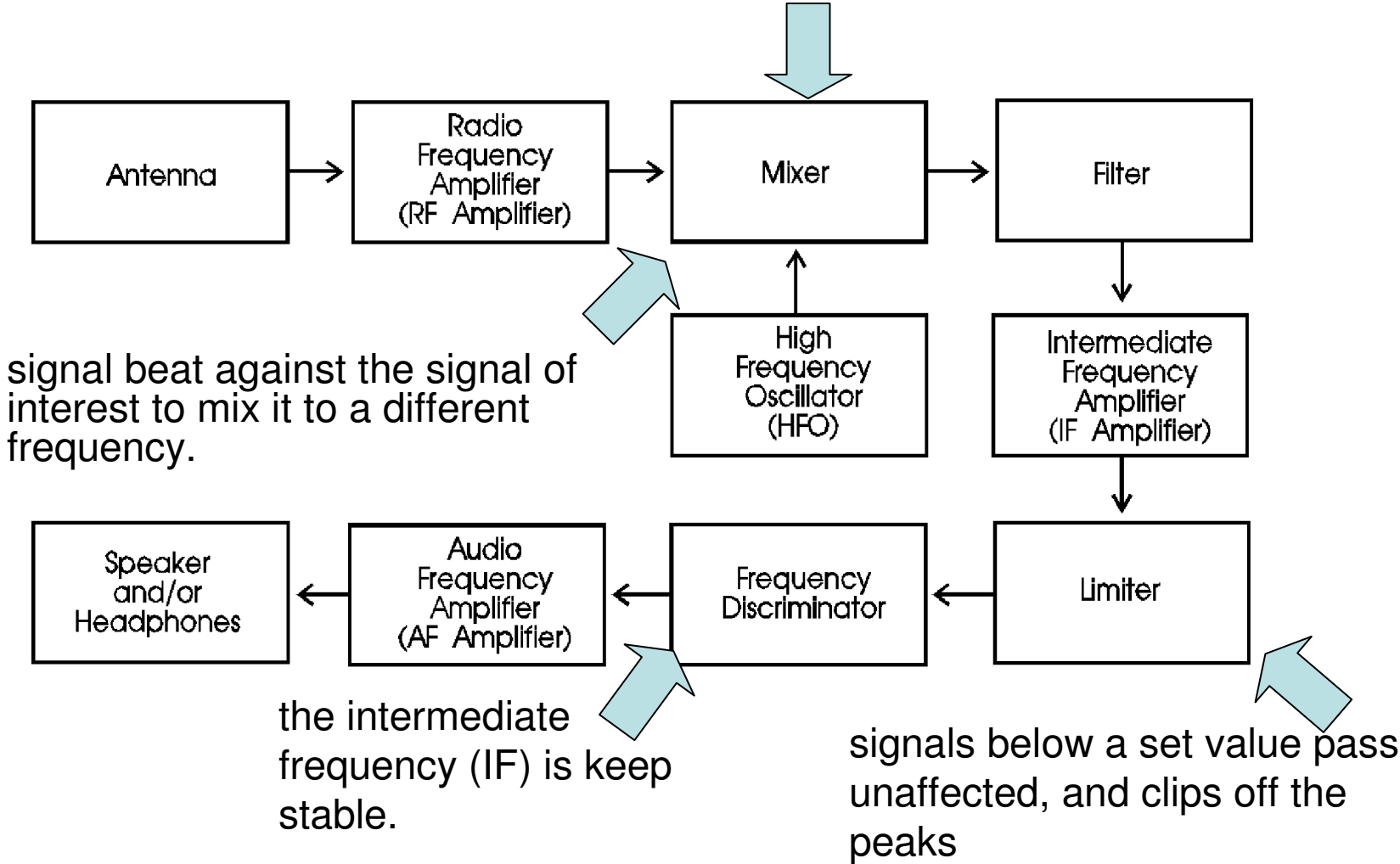
- The frequency discriminator controls the varicap. A varicap is used to keep the intermediate frequency (IF) stable.
- Gives our a faithful reproduction of the original audio
- Converts frequency variations to voltage variation
- varicap diode, varactor diode or tuning diode is a type of diode which has a variable capacitance
- Capacitance is a measure of the amount of electric charge stored

Intermediate Frequency

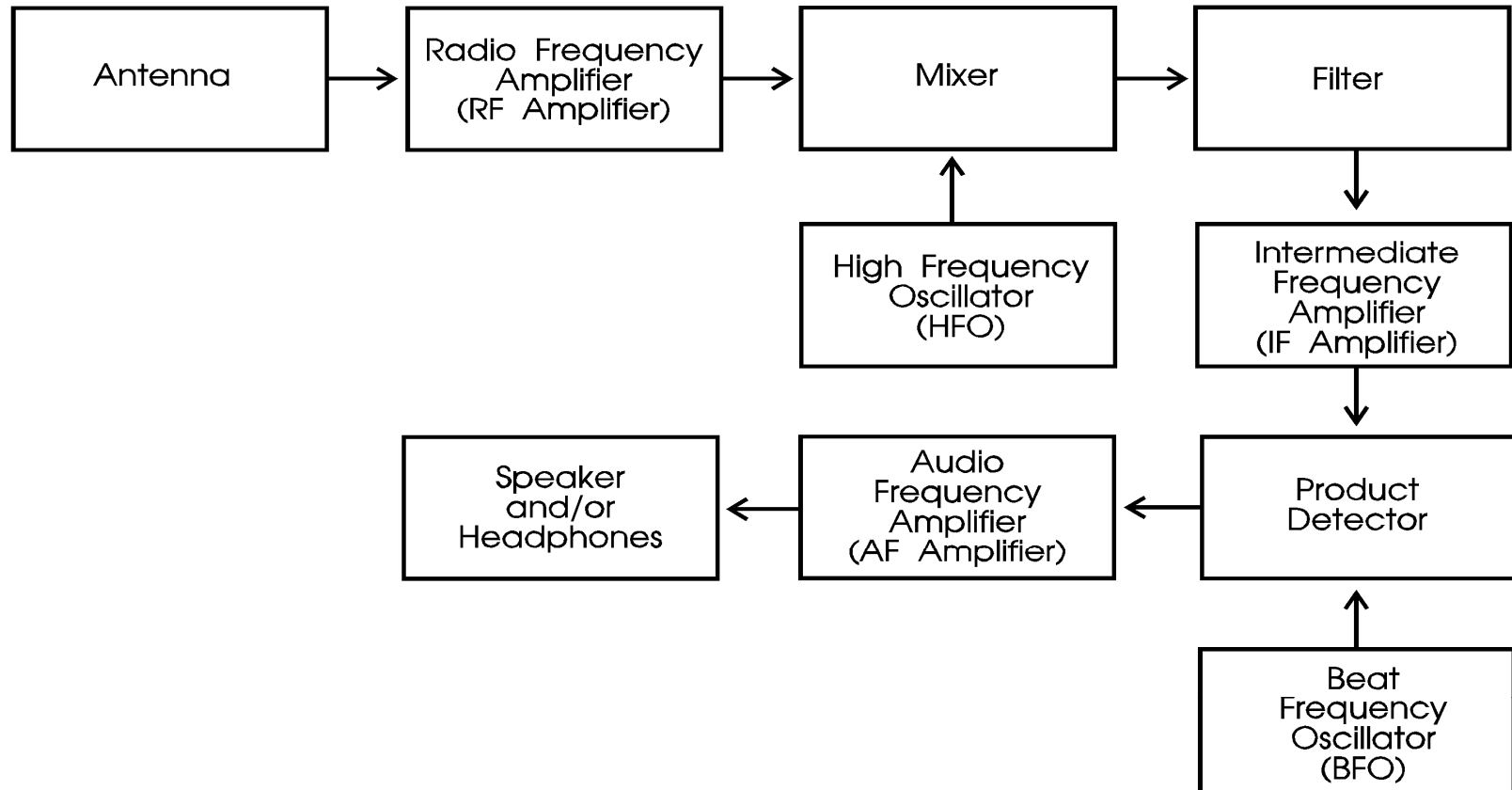
- **An intermediate frequency (IF) is a frequency to which a carrier frequency is shifted as an intermediate step in transmission or reception.**
- **It is the beat frequency between the signal and the local oscillator in a radio detection system.**
- **IF is also the name of a stage in a superheterodyne receiver. It is where an incoming signal is amplified before final detection is done. There may be several such stages in a superheterodyne radio receiver.**

Frequency Modulation Receiver

heterodyne action to a pre-selected common intermediate frequency, 455 kilohertz



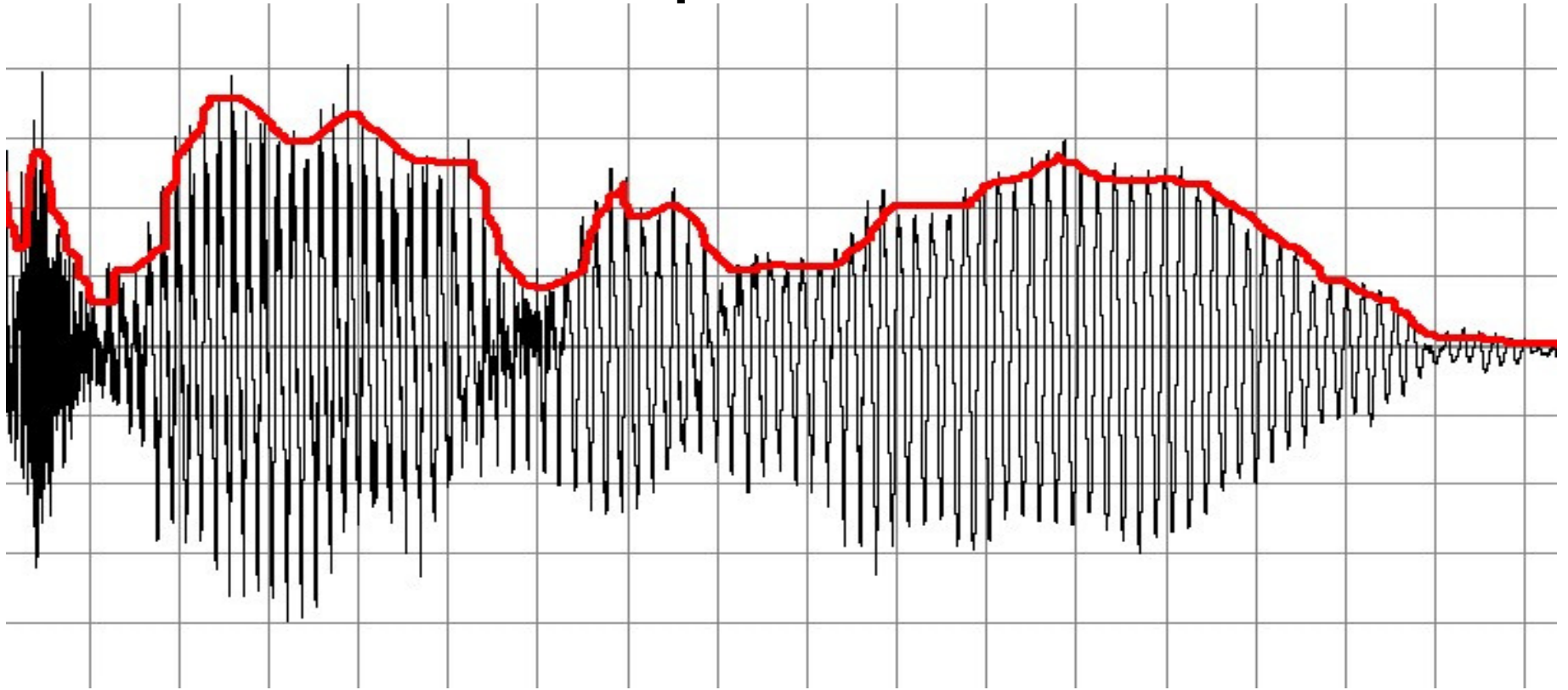
Single-Sideband and CW Receiver



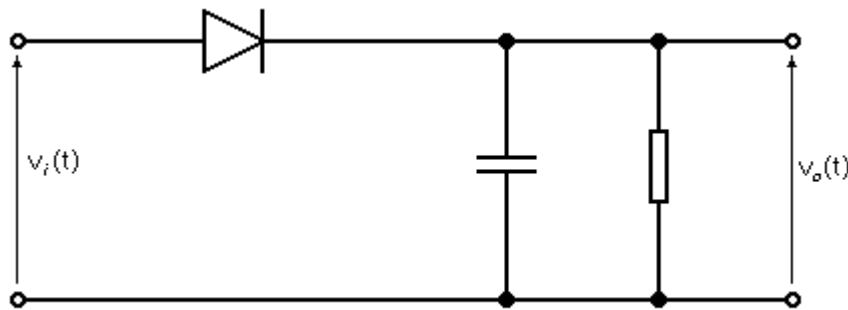
Envelope Detector

- An envelope detector is an electronic circuit that takes a high-frequency signal as input, and provides an output which is the "envelope" of the original signal.
- The capacitor in the circuit stores up charge on the rising edge, and releases it slowly through the resistor when the signal falls. The diode in series ensures current does not flow backward to the input to the circuit.
- Most practical envelope detectors use either half-wave or full-wave rectification of the signal to convert the AC audio input into a pulsed DC signal.
- Filtering is then used to smooth the final result. This filtering is rarely perfect and some "ripple" is likely to remain on the envelope follower output, particularly for low frequency inputs such as notes from a bass guitar. More filtering gives a smoother result, but decreases the responsiveness of the design, so real-world solutions are a compromise.

Envelope Detector



A signal and its envelope marked with red

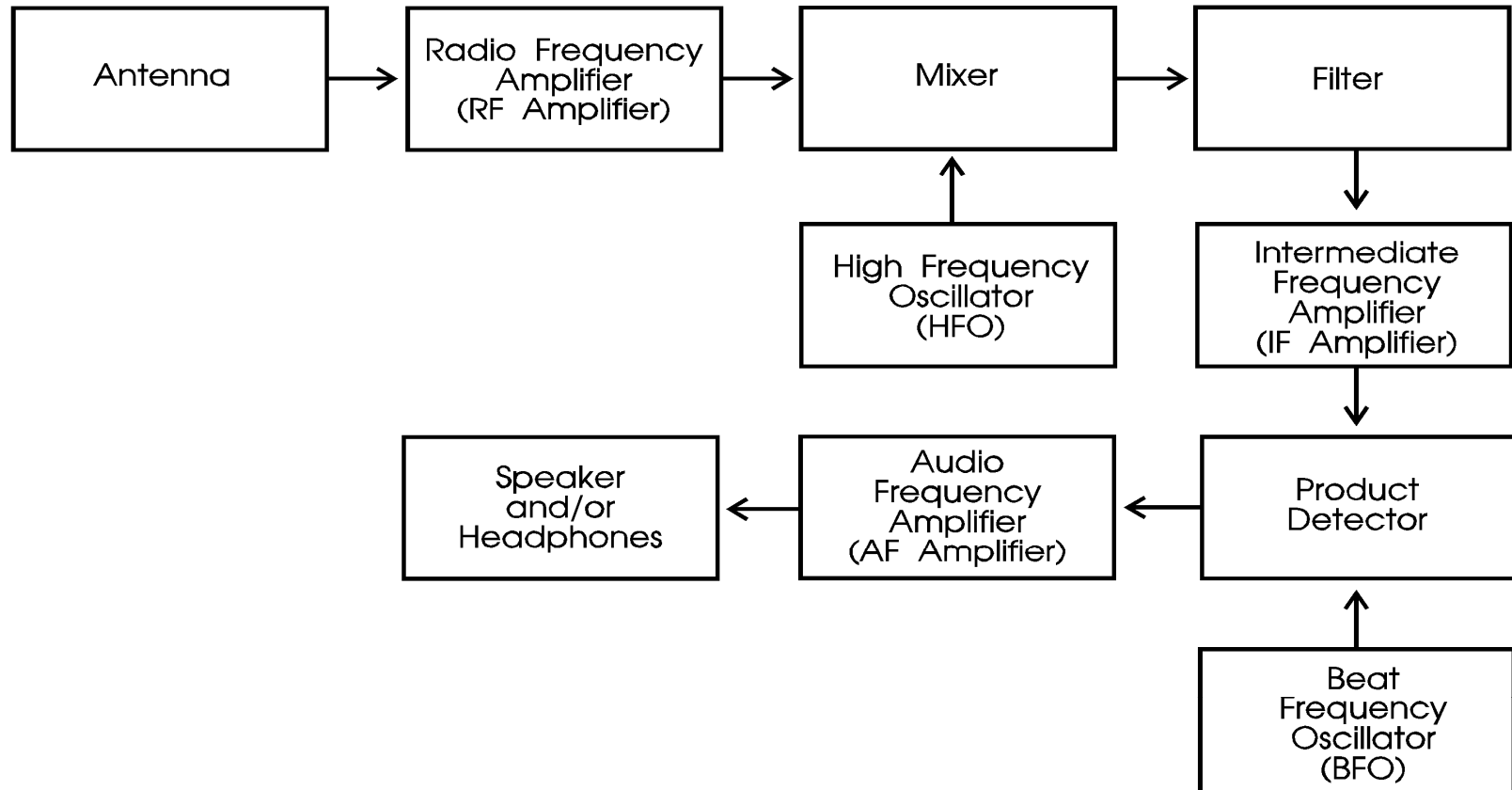


simple envelope demodulator circuit.

Product Detector

- A product detector is a type of demodulator used for AM and SSB signals. Rather than converting the envelope of the signal into the decoded waveform like an envelope detector, the product detector takes the product of the modulated signal and a local oscillator, hence the name. A product detector is a frequency mixer.
- Product detectors can be designed to accept either IF or RF frequency inputs. A product detector which accepts an IF signal would be used as a demodulator block in a superheterodyne receiver, and a detector designed for RF can be combined with an RF amplifier and a low-pass filter into a direct-conversion receiver.

Single-Sideband and CW Receiver



Receiver

- Receiver is an electronic circuit that 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.

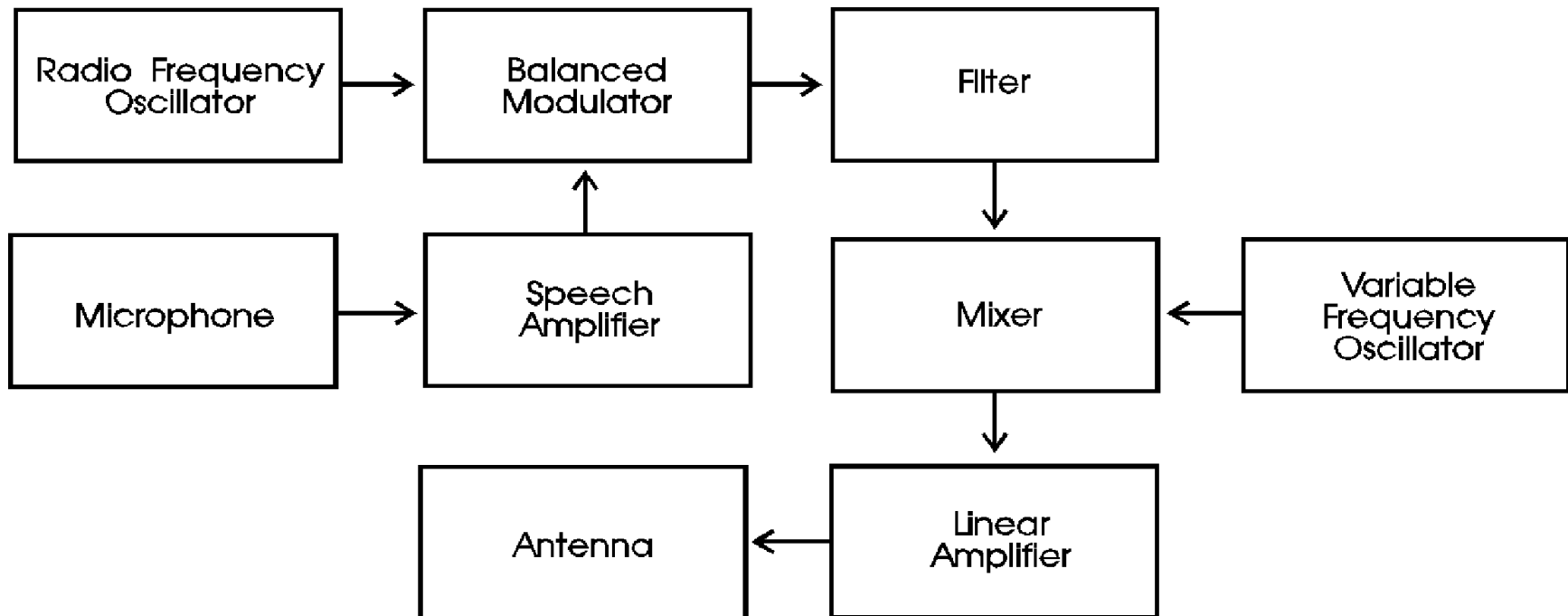
Beat Frequency Oscillator or BFO

- A beat frequency oscillator or BFO in radio telegraphy, is a dedicated oscillator used to create an audio frequency signal from carrier wave transmissions to make them audible, as they are not broadcast as such.
- The signal from the BFO is then heterodyned with the intermediate frequency signal to create an audio frequency signal.

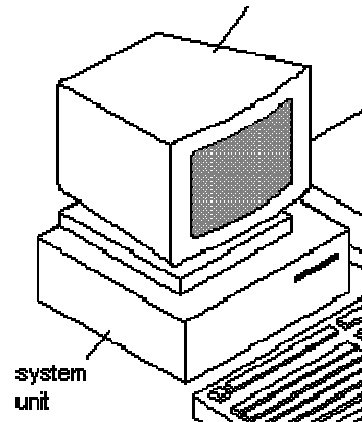
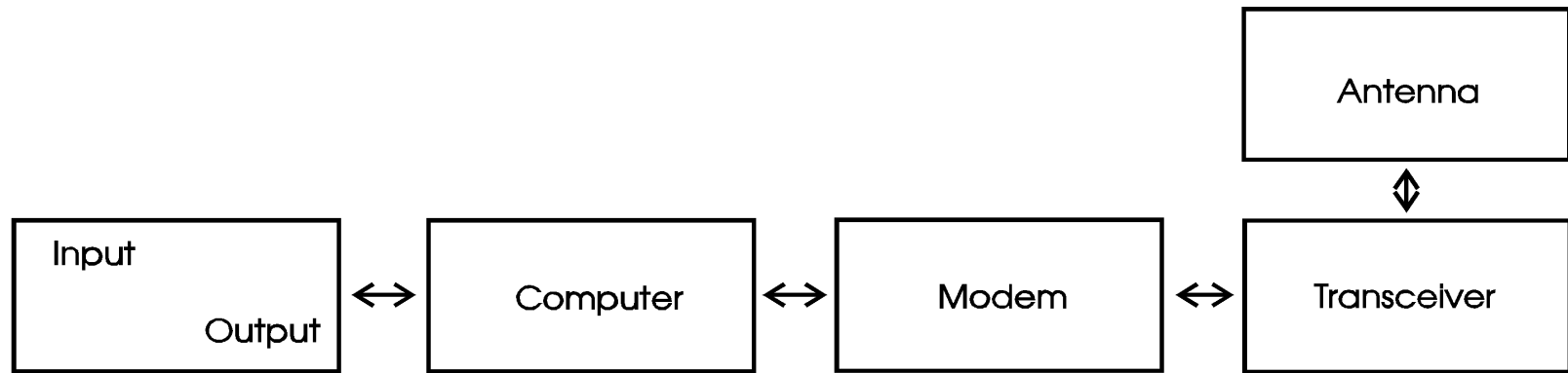
Variable Frequency Oscillator

- A variable frequency oscillator (VFO) is a component in a radio receiver or transmitter that controls the frequency to which the apparatus is tuned.
- It is a necessary component in any radio receiver or transmitter that works by the superheterodyne principle, and which can be tuned across various frequencies.

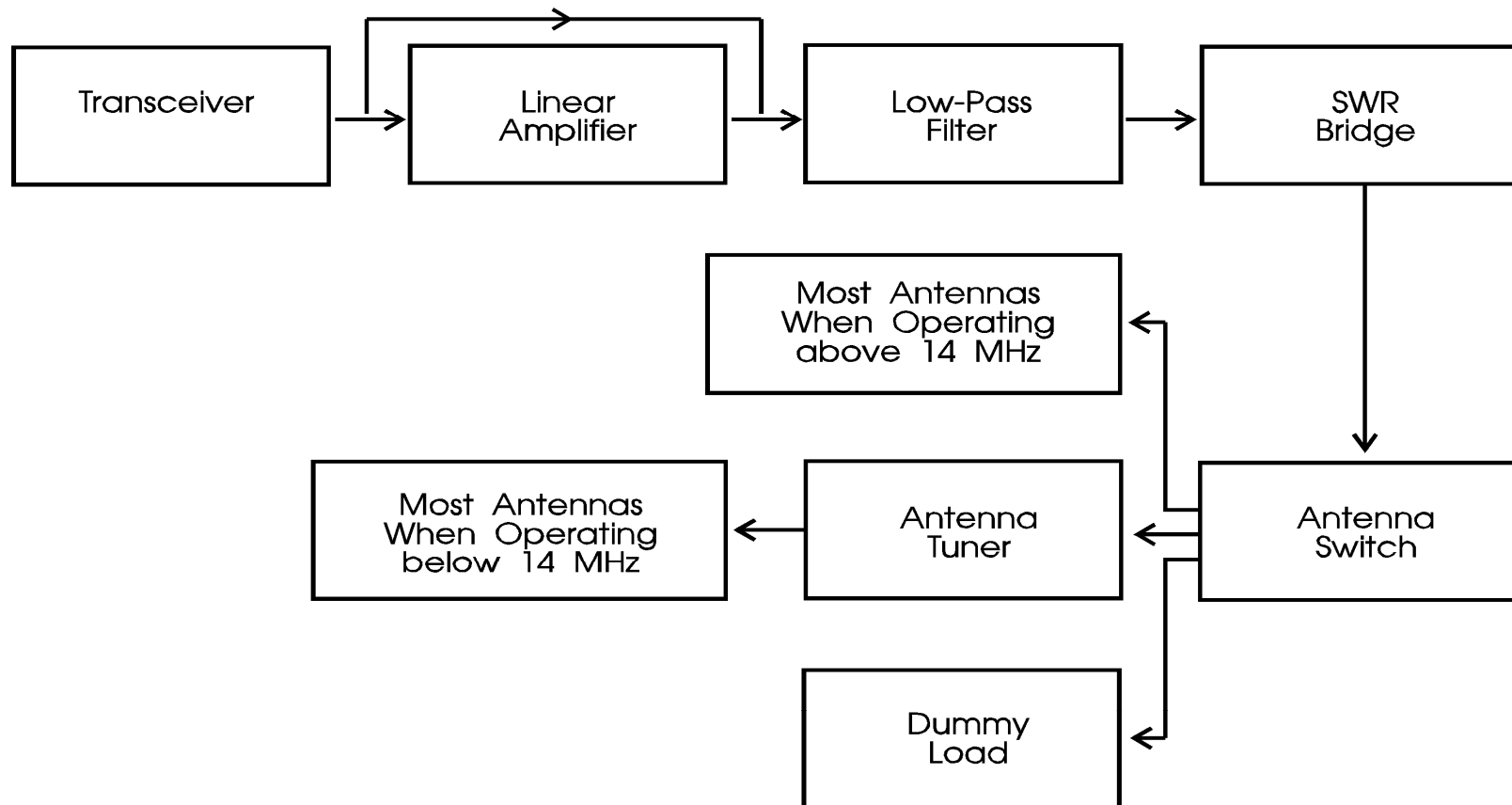
Single-Sideband Transmitter



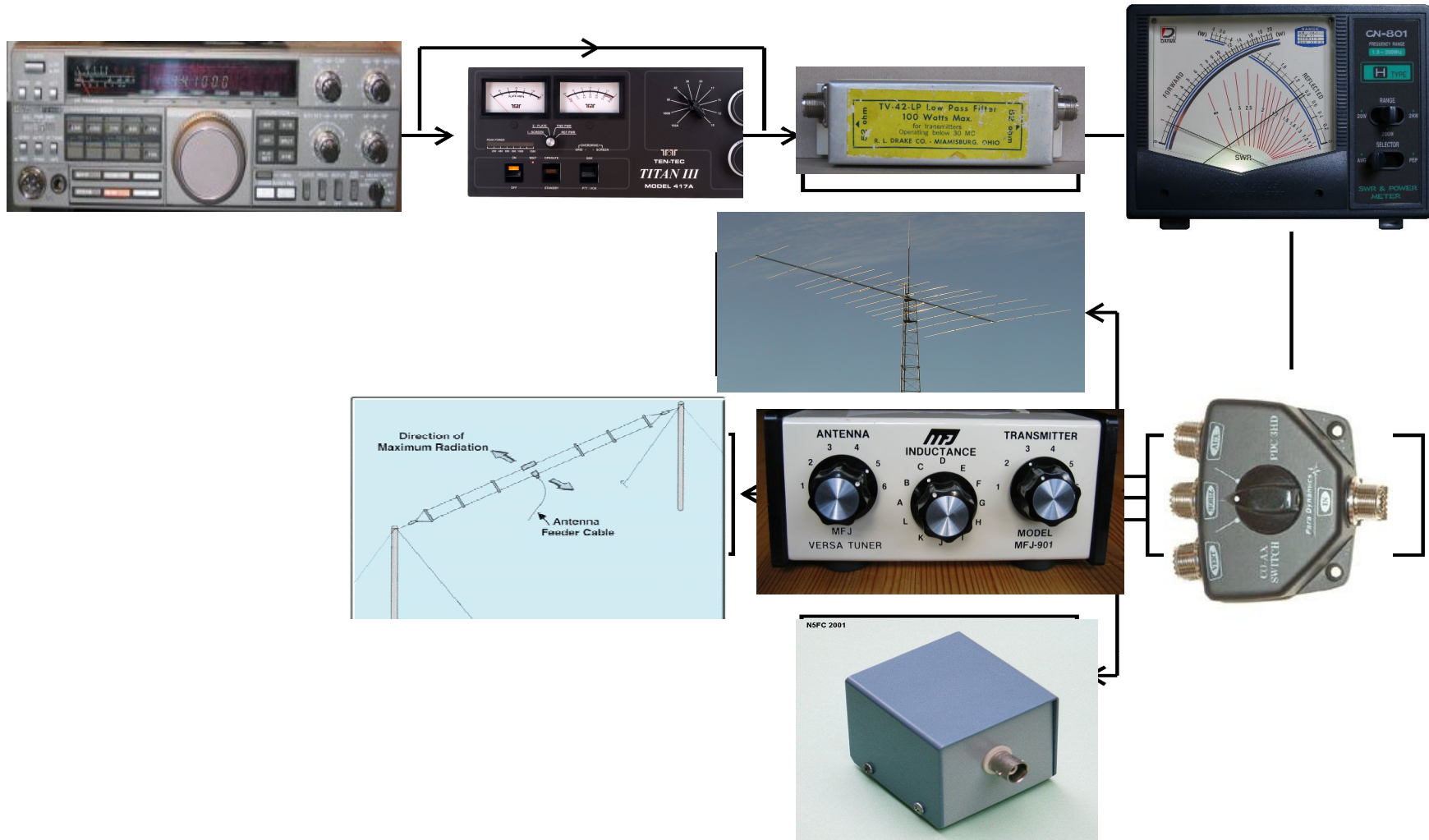
Digital System



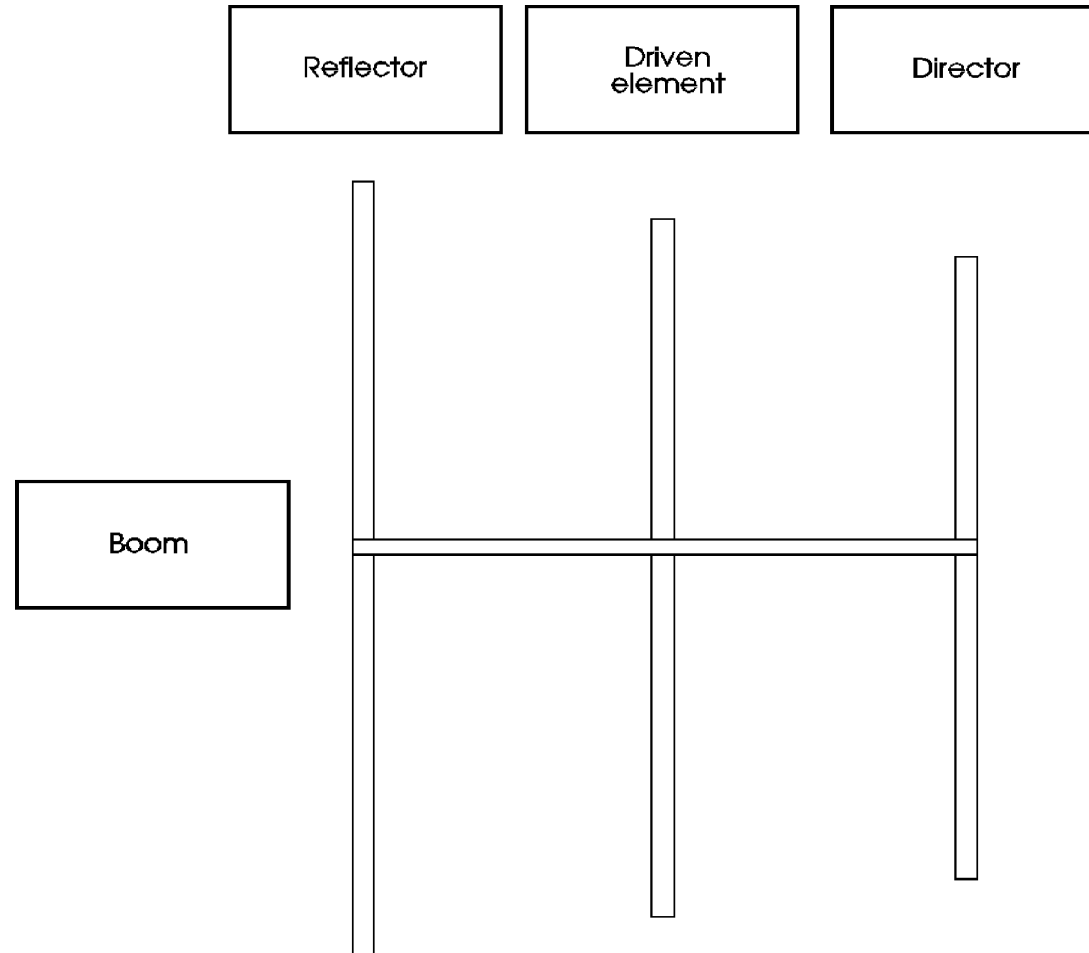
Placement of Component in a HF Station



Placement of Component in a HF Station



Yagi-Uda Three-Element Directional Antenna



SAFETY

Building and operating a “ham” radio station is a perfectly safe pastime.

- However, carelessness can lead to severe injury, burns or even death by electrocution. .
- **Antenna Safety – Look Up and Live!**

SAFETY

- **Assume all overhead power lines are energized and dangerous. They are not covered!** This includes the service drop, which typically runs from the power pole to your home or shack.
- **Look for power lines** which can be hidden by trees and buildings.
- **Plan the work and work the plan.** Before you put up or take down an antenna, assess the job; discuss the project's activities with your helpers and agree on specific assignments. Ask yourself... "at any time can arms, legs, head, the antenna, wires or tools come in contact with power lines?"
- **Use a safety spotter.** Nobody can do the work alone and assess safety distances. A safety spotter's *only* job it to keep people and equipment safely away from power lines.
- **Remember the 10-foot rule.** Keep all equipment, tools, your antenna, guy wire and tower at least 10 feet away from power lines.

SAFETY

- **Never use metal ladders or long-handled metal tools** when working near power lines.
- **Make sure the antenna cannot be rotated into power lines.** Or that it cannot fall into a power line if the guy wires fail and the tower falls.
- **Use non-conductive guys.**
- **Have a solid earth ground for your antenna and operating equipment.** This helps reduce the risk of electrical shock and also provides a low-impedance path to ground for stray RF.

SAFETY

- Outdoor antennas should be grounded with an approved lightning arresting device. Local codes may apply.
- The radio should also be grounded to an earth ground to help protect both the radio and its user
- Antenna mast, cable, and guy wires are all excellent conductors of electrical current.
- If the tower assembly starts to drop . . . get away from it and let it fall.
- DO NOT use hot water pipes or gas lines as a ground source.
- DO NOT place antennas where People or Animals are likely to run into or encounter
- DON'T BE AFRAID TO ASK QUESTSION OR ASK FOR ASSISTANCE

"Safety Code 6"

- The rules and guidelines covering the subject of RF Safety, are published by the Federal Government in a document entitled "**Safety Code 6**"
- Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 KHZ to 300 GHZ - Safety Code 6

"Safety Code 6"

- RF energy has *thermal effects* (i.e., it can cause body heating) if the power density is high enough.
- The thermal effects of RF energy can include blindness and sterility, among other health problems

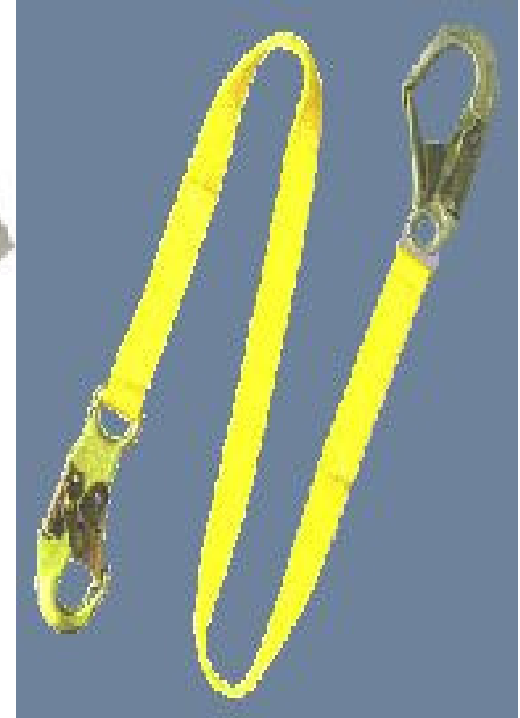
Good practices to follow when putting up your antenna's

- At least two people to do the job. Three is better.
- Equipment
- Safety Belt
- Safety Rope / use of it while climbing No Mold inside (twist open to inspect it) Proper Length
- Tool Pouch: Roomy, not packed full
- Clothing
- Close fitting, not sloppy, not tight
- Gloves (for protection and warmth)
- NO Sneakers, Hard Soles, Good fit

Safety belt

- For your safety it is of the uttermost importance that you borrow or buy a **safety belt**.
- This is in fact a generic term that we must divide in 2 elements : first, the leather belt, at least 5 cm wide or 2", which length is adjustable to the perimeter of the tower like an ordinary belt.
- It is independent of the security hardness (but has to be attached on it). Then you need either of a **strap snap** or a **safety belt with seat harness** that you will attach around your waist. This is a 10 cm wide (4") belt including a leather belt and some fasteners to attach various steel loops or tools.

Safety belt



What is a gin pole?

- **A gin pole, or raising fixture, provides this safety by giving the tower climber the needed heavy lifting ability the ground person provides.**
- **A gin pole consists of 3 basic parts: (1) a pulley assembly to provide mechanical advantage when lifting, (2) a pole to gain height needed for the lift, and (3) the clamp assembly to attach everything to the tower.**
- **Typically the ground person does the heavy lifting, while the tower person above has the freedom to guide and fasten the tower and antenna components together.**
- **Proper use of a gin pole provides a controllable and safe method to erect and maintain a tower and antenna assembly, use it!**

What is a gin pole?

