Ham 36 - Antenna counterpoise tigertail

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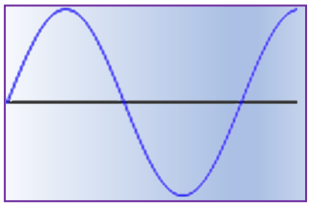
The exact same principles of frequency apply to music. So, think of a frequency as a single note or tone.



We will include several equations for those who like the math shorthand, but will explain more than you need to know in verbiage. If the equations are not your cup of green tea or chai, ignore them, and think of the symbols as a form of modern pictograph, which they literally are.

The standard waveform is a sine. In one cycle (circle, revolution, oscillation), the sine starts at zero, goes to a maximum, continuing back to zero, on to the minimum, then back to zero. Then the next wave continues. Where is the maximum? One-quarter wavelength (1/4 λ).

Frequency is the number of waves that occur in one-second. In other words, frequency is the reciprocal of time. The more repetitions (waves) that occur in a second means each wave occupies less time and is a shorter wavelength.

Wavelength times frequency is the speed of light, a fundamental natural law. $\lambda * f = 300{,}000{,}000$

Antenna is a word which everyone recognizes. What is it? It is a capacitor and inductor combination which tunes to a frequency. You are a ham, so just a little math and science is a good thing. Just roll with it.

The inductor part comes from a wire and the bends or turns in the wire. The capacitor part comes from being next to another conductor.

The inductor is what most think of as the antenna. Stick a piece of metal in the air and it will radiate (transmit). Make it the correct dimensions compared to the wavelength (λ) and it will radiate better.

$f = 1 / t$

Look at the drawing. Where does the maximum occur on a wave? At one-quarter of the length of the wave. In general, one-quarter wavelength (1/4 λ) is the preferred length for an antenna.

$L = N^2 \mu A / l$

Consider the influences on the antenna. Inductance (L) depends on the square of the number of turns (loops or coils), the make-up of the material (μ), how big around the wire is (Area) and the length (l).

$C = \varepsilon A / d$

Ground or earth is commonly the second conductor which forms the capacitor for the antenna. However, ANY conductive surface makes another capacitor, including your face or body, a vehicle, or a wet surface.

$f = 1 / (2\pi \sqrt{L C})$

A *ground-plane* is a metal surface or rods elevated above the earth and connected to the earth. The ground plane essentially raises the earth to the elevation of the ground plane. The elevated ground or earth is closer to the radiator (antenna). So, a better capacitor forms, making the antenna operate better.

In some cases, raising the earth connection is impractical. For example, on a hand-held antenna, we do not want to drag around a wire connected to the earth (grounded). The antenna must still have a capacitor, so one comes from the surroundings. The face and body form a capacitor to make the handi-talkie antenna work. Obviously, many variables arise with this arrangement including the size of the person, the height above ground, and the distance from the face.

A *counter-poise* is a capacitor created with wire or metal connected to the shield or return wire from the antenna, which is ungrounded. The first choice would be how long? Ah, the same length as the antenna, one-quarter wavelength. Fortunately, alternate arrangements of the antenna, and the counterpoise, can make that unnecessary. The capacitance (C) is determined by the make-up of the material (ε), the overlap area (A), and the distance between the surfaces (d).

Other than the amount of power from the radio, the antenna and its counter-poise are the critical part of any radio system.

Consider a typical 4-Watt hand-talkie. In simplex, its range is about how far you can throw it. With a repeater it reaches out better, if it can trigger the repeater. We live rural, on a ranch. The repeater we use is miles away as the eagle flies.

With a standard rubber-duckie, the radio will not trigger the repeater. Change the antenna to a one-quarter wave Compactenna with an *ungrounded* counter-poise plane and it hits solid. Alternately switch to a 14” helix coiled antenna and occasionally, with just the right angles, it will trigger the repeater. Add a 1/4 λ counterpoise, also called a Tiger-Tail, and you can carry on a conversation, just a little scratchy.

The combination of a nominal quarter-wave antenna and quarter-wave counterpoise is a dipole.
It really is that simple.
Balance your L’s & C’s.

Life is good. Enjoy.