# USEFUL FORMULAS

**The following sections show many different commonly used formulas of interest to hams. This is by no means a complete lit of formulas but merely a compilation of the more mainstream formulas. The ARRL Handbook is a great source of not only additional information, but also detailed information on those below. Happy calculating.**

### OHM's LAW

**Some basics: Voltage = E, Current = I, Power = P**

**For simple voltage, current and resistive DC loads**

**To find current E/R.**

**To find resistance E/I**

**To find voltage I*R**

**For simple power calculations of DC circuits**

**To find power E*I**

**To find current $E^2$/I**

**To find resistance $E^2$/I**

**To find power $I^2$*R**

## SERIES & PARALLEL RESISTANCE

**Series is easy, just add $R_1$ + $R_2$ + $R_3$, etc. as required.**

**Parallel is just slightly more complicated.**

**For two resistors in parallel calculate using : $R_1$* $R_2$/$R_1$ + $R_2$. Example: two 100 ohm resistors in parallel would be 100*100=10,000 divided by 100 + 100 or 200. 10,000/200=50 ohms.**

**For 3 or more resistors in parallel use this formula: 1/(1/$R_1$ + $R_2$ + $R_3$...) = result. Example using three 100 ohm resistors. 1/100 + 1/100 + 1/100 which is then .01 + .01 + .01 or .03. Now we do the reciprocal of .03, or 1/.03, and we get 33.33 ohms.**

## INDUCTIVE REACTANCE

**This formula is very simple. Just use $X_L$=2p*F*L*. (p equals 3.1416), *f* = frequency in MHz, *L*= inductance in henrys.**

## CAPACITIVE REACTANCE

**Capacitive reactance is a little more complicated but still fairly easy. Xc= 1/( [2 p*f*c]) So take two p (3.1416*2 or 6.2832) times frequency in MHz times capacitance in farads and then find the reciprocal of that and you have capacitive reactance.**

## Calculating dipole and vertical antenna length

**The official formula for a half wave antenna in free space is 492/*f* where *f* is in Megahertz (MHz) and the length is in feet. For a practical 1/2 wavelength dipole length is feet use general formula of 468/*f* where *f* is in megahertz (MHz). A half wave antenna length (in inches) in free space is calculated by the official 5904/f where *f* is in megahertz (MHz) and the calculated length is in inches. If capacitive loading, end effects, etc. are taken into consideration this formula would then become 5616/*f* where *f* is in Megahertz (MHz). These formulas will work fairly well for a dipole mounted at least 1/4 wavelength above ground. Some tweaking might be in order due to capacitive loading from nearby objects. End effect may also change resonance requiring slight adjustment in length. It is best to cut a dipole a few percent longer then the calculated length then prune it for resonance. Starting longer is a LOT better then starting at the calculated length or shorter! It is easy to trim but a bit harder to stretch. Using the official free space formula is likely to be way to long. Proximity to ground, trees, homes, even the feedline greatly influence resonance so make sure you check it. The nominal feedpoint impedance of a dipole is generally 72 ohms but this can vary widely. The lower to ground it is, the lower the impenitence.**

**For a 1/4 wave vertical the above numbers would be half. Therefore, the height of a simple 1/4 wave vertical can be calculated by 234/*f* where *f* is in Megahertz (MHz). Since ground (including radials) act as the other half of the antenna a vertical is really a half wave antenna with a vertical polarization.**

## Making coaxial matching stubs

**The simple 1/4 wave coaxial stub can be used for a number of things. It can be used to match two different impedances or even as an attenuator. For example, let's say you have but a UHF transverter but the local oscillator (L.O.) signal is fairly strong and you want to attenuate it before the linear amplifier. A quarter wave stub might be ideal. Since a quarter wave stub will act at one end exactly the opposite of what the other end is. So we can then take a quarter wave stub that is resonant at the L.O. frequency and hang it on the output of the transverter before the amplifier. It will then look like a short circuit at the resonant frequency at the output of the transverter. The effect on the desired frequency will be minimal. A great but very simple filter.**

**To calculate the length of the stub in inches use 5904/f, devide by two and then multiply the length by the velocity factor (VF) of the coaxial cable. To find the VF of a cable you will need to look it up. The ARRL handbook is a terrific reference for this. Most RG-8 and RG-58 type cables have a VF of .69 while Teflon cables tend to be higher. The air dielectric cables are higher yet. The insulation around the center conductors actually slows the radio wave down and that is known as velocity factor. You can also go HERE to see a VF listing of the more common cables.**

### Energy Related Conversions:

**Horsepower (HP) to Kilowatt (KW) divide HP by .7465**

**KW to HP, multiply by .7465**

**KW to BTU/Hr, multiply BTu by 3413**

**BTU to KW, divide by 3413**

**HP to BTU, divide HP by .7465, multiply result by 3413**

**Tons of AC cooling to BTU, multiply tons by 12,000**

**BTU to tons, divide by 12,000**

**Kilovolt ampere (KVA), multiply voltage by current in amperes**

**KVA to KWH, multiply KVA by power factor (PF)**

**KW to KWH, multiply KW by number of hours**

**Equivilents:**

**1 gallon of water = 8.31 lbs @ 68 F**

**1 cubic foot of water = 62.427 lbs @ 4C**

**BHP (boiler HP) = 33,500 BTU/Hr**

**BHP = 34.5 lbs of steam**

**1 GPM flow = 500 lbs/Hr**

**1 cubic foot of natural gas = 1026 BTU**

**1 gallon #2 fuel oil = 139,000 BTU**

**10 KW = 1 BHP ouput**

**Go back**