

ANTENNA REFERENCE SHEET

IMPEDANCE = AC Resistance found in radio waves

Antennas include characteristics of **Capacitors** (store current electrostatically), **Inductors** (store current magnetically) and **Resistors** (impede current flow). These components, Capacitors and Inductors can cancel each other out because they store the energy in different ways. This opposition is known as **Reactance**. **Reactance** is the imaginary part of electrical impedance, a measure of opposition to a sinusoidal alternating current. **Reactance** arises from the presence of inductance and capacitance within a circuit, and is denoted by the symbol x , the SI unit is the ohm represented by the Greek letter Omega Ω .

Both **reactance X** and **resistance R** are required to determine the **impedance Z** although in some circumstances the reactance may dominate the **impedance**, at least an approximate knowledge of the **resistance** is required to establish this.

$$\tilde{Z} = R + jX$$

The combined response of these component parts to alternating currents (radio waves) is called **Impedance**

- Moving electrons in an antenna create a magnetic field
- This changing magnetic field create an electric field
- Waves travel by the back and forth between magnetic and electric fields
- One complete change between magnetic and electric fields equals the distance a radio wave travels during one cycle. This is the **wavelength** represented by the Greek letter lamda λ . The formula to compute the wavelength is 300 divided by the frequency in megahertz equals the

wavelength in meters. For **example**, the wavelength of a 145.470 Mhz radio wave is $300/145.470=2.062$ meters or 6.77 feet or $81 \frac{1}{4}$ inches.

- For a **half wavelength dipole antenna** compute the length in feet of antenna by **dividing 468** by frequency in megahertz. For example for a half wavelength dipole on 3.912 Mhz $468/3.912=119.63$ feet or 59.82 feet for each part.
- The RF (Radio Frequencies) are divided into 8 **bands** or groups of frequencies that have similar characteristics.

Very Low Frequency VLF 3khz to 30 khz

Low Frequency LF 30khz to 300 khz

Medium Frequency MF 300 khz to 3000 khz (3mhz) AM

High Frequency HF 3mhz to 30 mhz Ham DX

Very High Frequency VHF 30 mhz to 300 mhz FM

Ultra High Frequency UHF 300 mhz to 3000 mhz (3 ghz)

Extremely High Frequency EHF 3 ghz to 30 ghz

Super High Frequency SHF 30 ghz to 300 ghz

Resonance means the frequency the antenna receives and transmits best which is where **reactance is zero (capacitance and inductance cancel each other out** leaving only resistance.

Modulation means **turning the wave on and off**. Different modulation techniques called **Modes**.

Antennas have a characteristic **impedance** usually **50 ohms** but depends on: antenna design, height above ground, frequency of operation, distance to surrounding objects, other factors.

Match feed line impedance to antenna impedance. Ratio of energy radiating out of antenna compared with energy

reflected back to transmitter is called **SWR (Standing Wave Ratio)**

.Ground Plane Antenna is a vertical dipole with one half of it replaced by the earth or ground. To compute the length of the vertical element divide **234** by desired frequency. For example a 145.470 Mhz ground plane vertical element would be $234/145470=1.6$ feet. Also known as a $\frac{1}{4}$ wavelength antenna.

Inverters convert DC to AC; Generator creates AC **Rectifiers** convert AC to DC using diodes.

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