RAINBOW CANYONS AMATEUR RADIO CLUB

CEDAR CITY, UTAH 84720

Antenna Basic Basics

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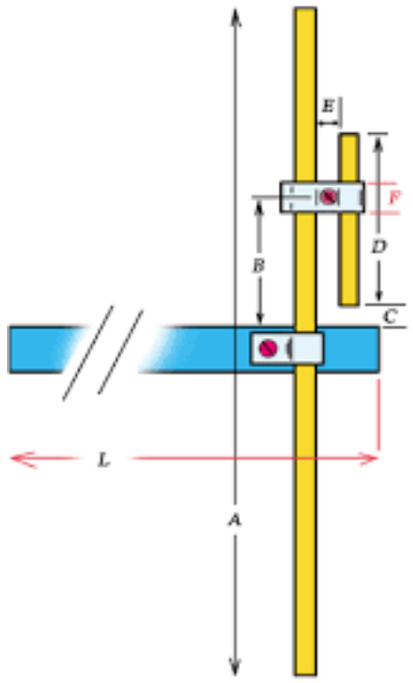
Your enjoyment of Amateur Radio will increase as you come to know how things work. When you understand what really happens when you press the mic button or press the code key a new world opens to you. Tonight we will be discussing basically (simplified) how a simple radio antenna works. This discussion will be based on what you most likely already know. We will be following the rules of KIS (Keep it simple!)

The antennas we will discuss are effective, easy to build and can be built with inexpensive readily available materials.



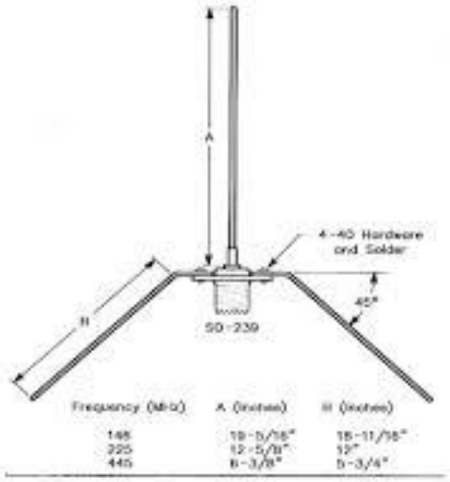
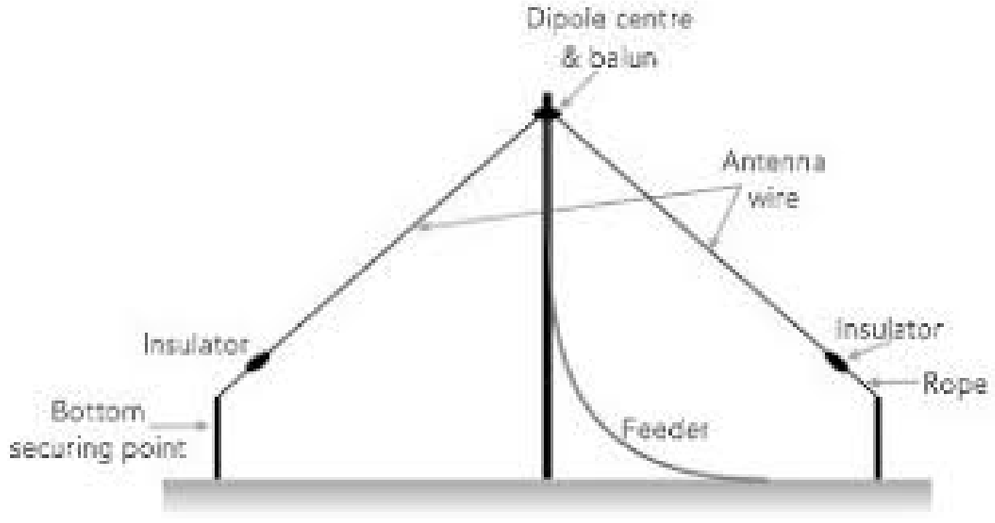


Fig 32—Simple ground-plane antenna for the 144-, 222- and 440-MHz bands. The vertical element and radials are ¼- or ⅛-in. brass welding rod. Although ⅛-in. rod is preferred for the 144-MHz antenna, #10 or #12 copper wire can also be used.



- A term you may have heard is TRANSDUCER. What is a transducer?

- Siri says “A transducer is a device that converts energy from one form to another. Usually a transducer converts a signal in one form of energy to a signal in another form. The process of converting one form of energy to another is known as transduction.”

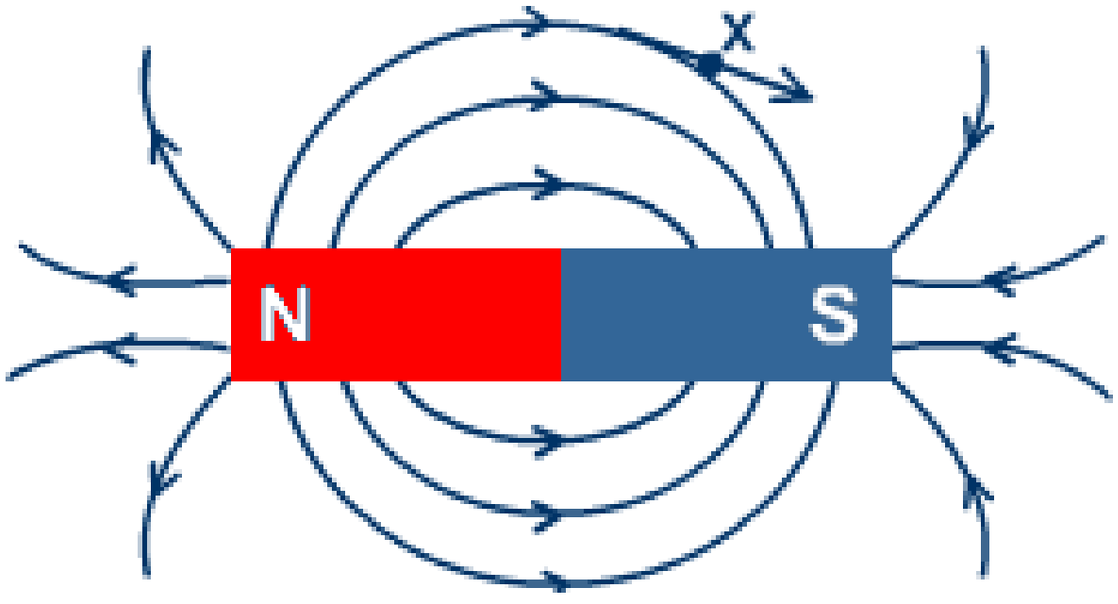
- What are some common transducers you might be familiar with? Headphones, Microphones, Egg beaters, Auto engine, light bulbs, your eyes and ears to just name a few.

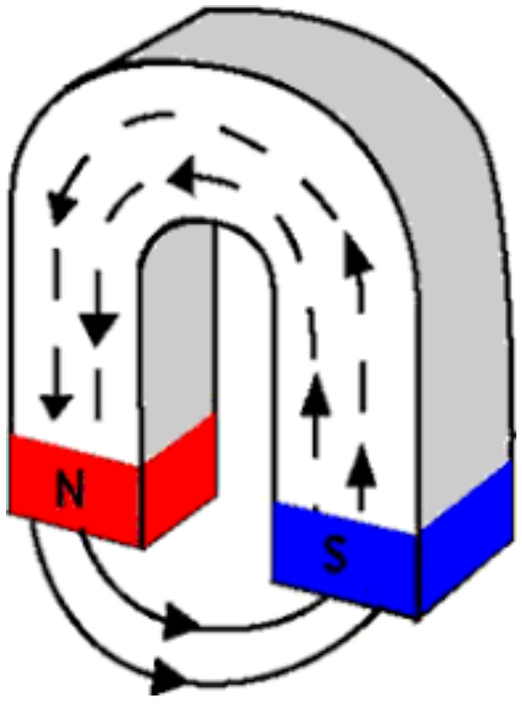
An Antenna is a special kind of transducer used to convert alternating voltage and currents into Transverse Electro Magnetic Waves (TEM) and TEM waves into voltage and current. Did I just hear someone say “Thats not simple!”? Lets see if we can make it simple.

Let’s take a few minutes and review a magnet with it’s special characteristics and electrical current in a wire and how the two tie together.

Let’s begin by reviewing the magnet.

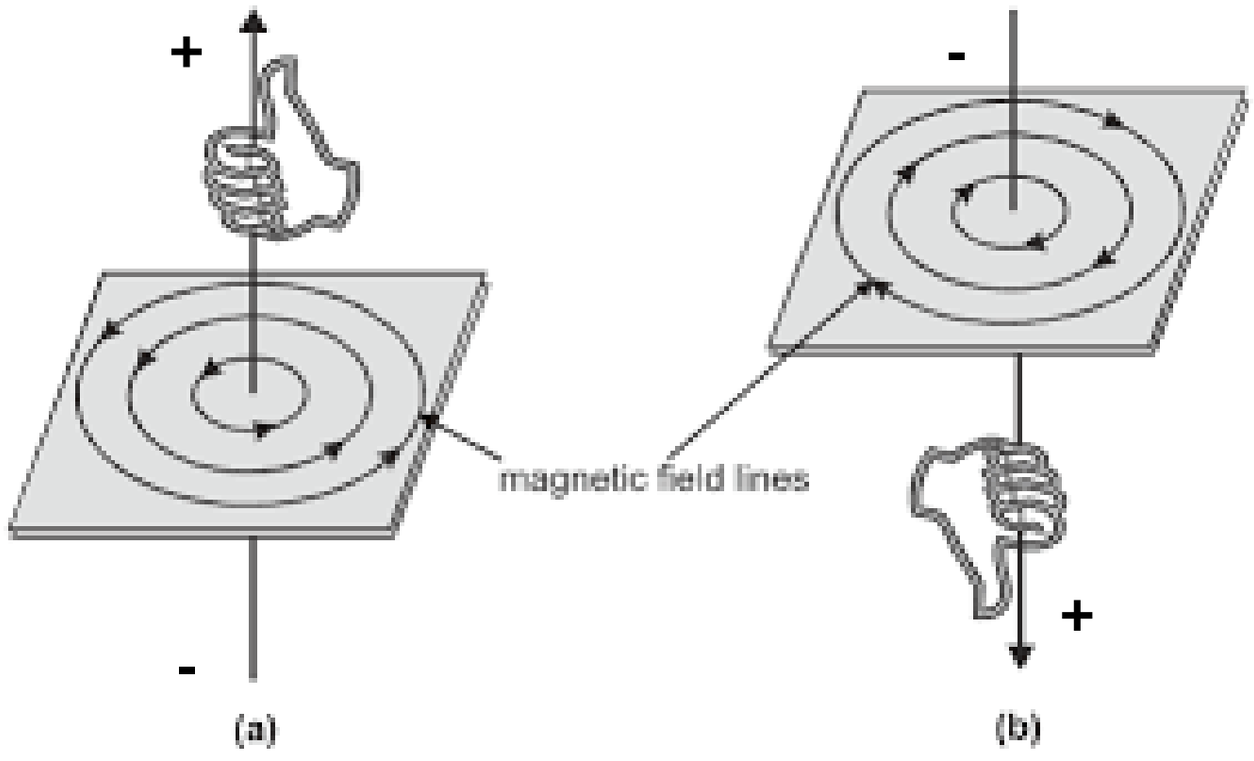
Magnets have a North Pole and a South Pole. Magnetic fields surro





Wires carrying current also have magnet fields.

- When current flows through a wire, magnetic fields develop around the wire. These fields also have a rule to follow. The rule is known as the RIGHT HAND RULE. It simply states that if you wrap your right hand around a wire with your thumb pointing in the direction of the electron flow (toward the + of the battery) your fingers will be pointing in the direction of the magnetic fields surrounding the wire.

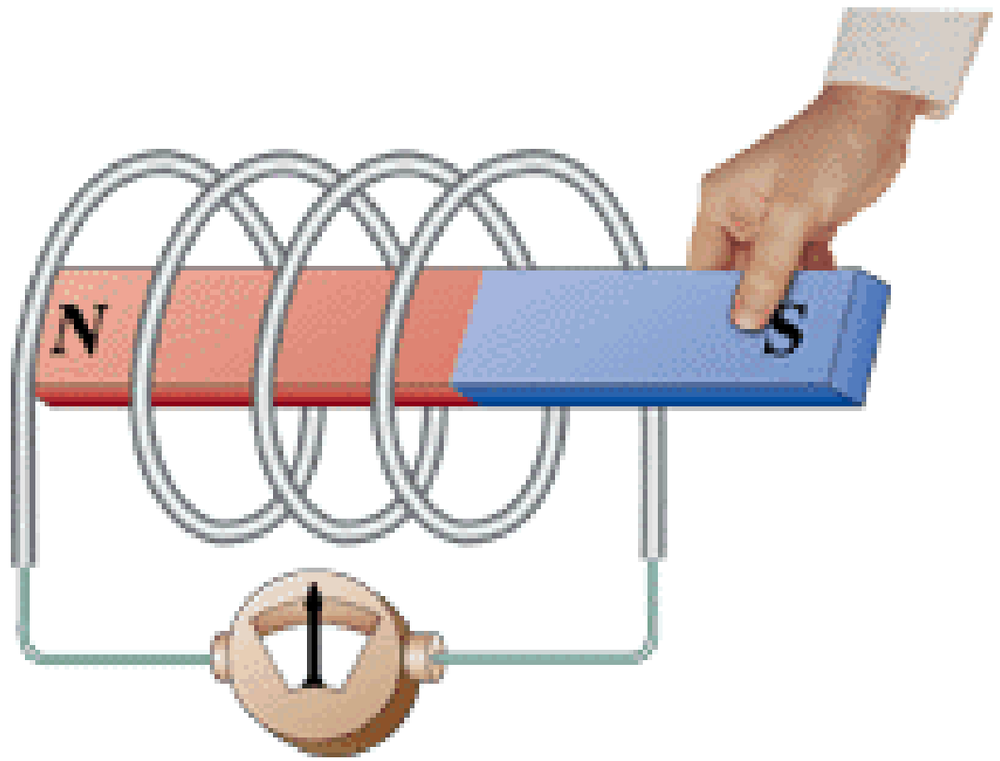


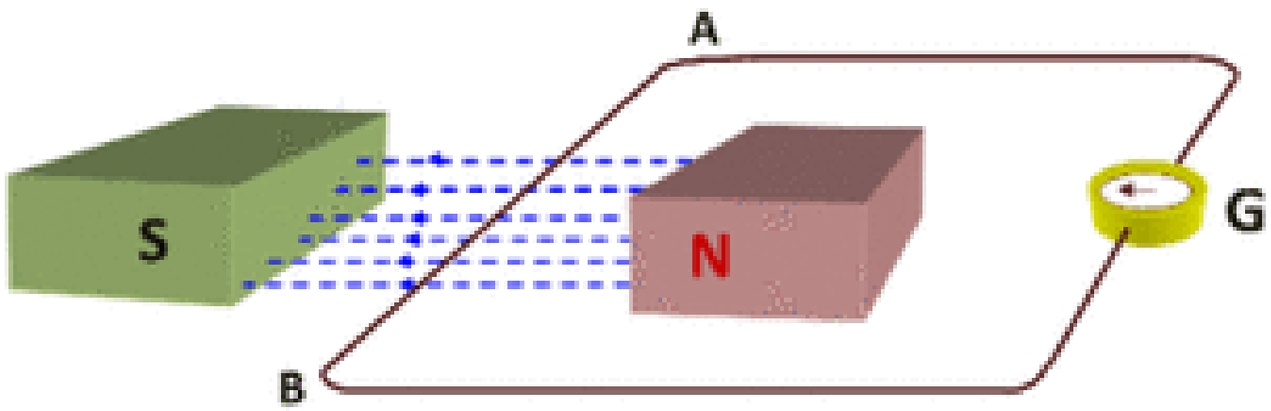
An interesting thing is how magnets interact with wires and wires interact with magnets.

When a magnetic field, in motion, cuts across a wire it produces current and voltage in, and across the wire.

When current flows through a wire it produces magnetic fields around the wire.

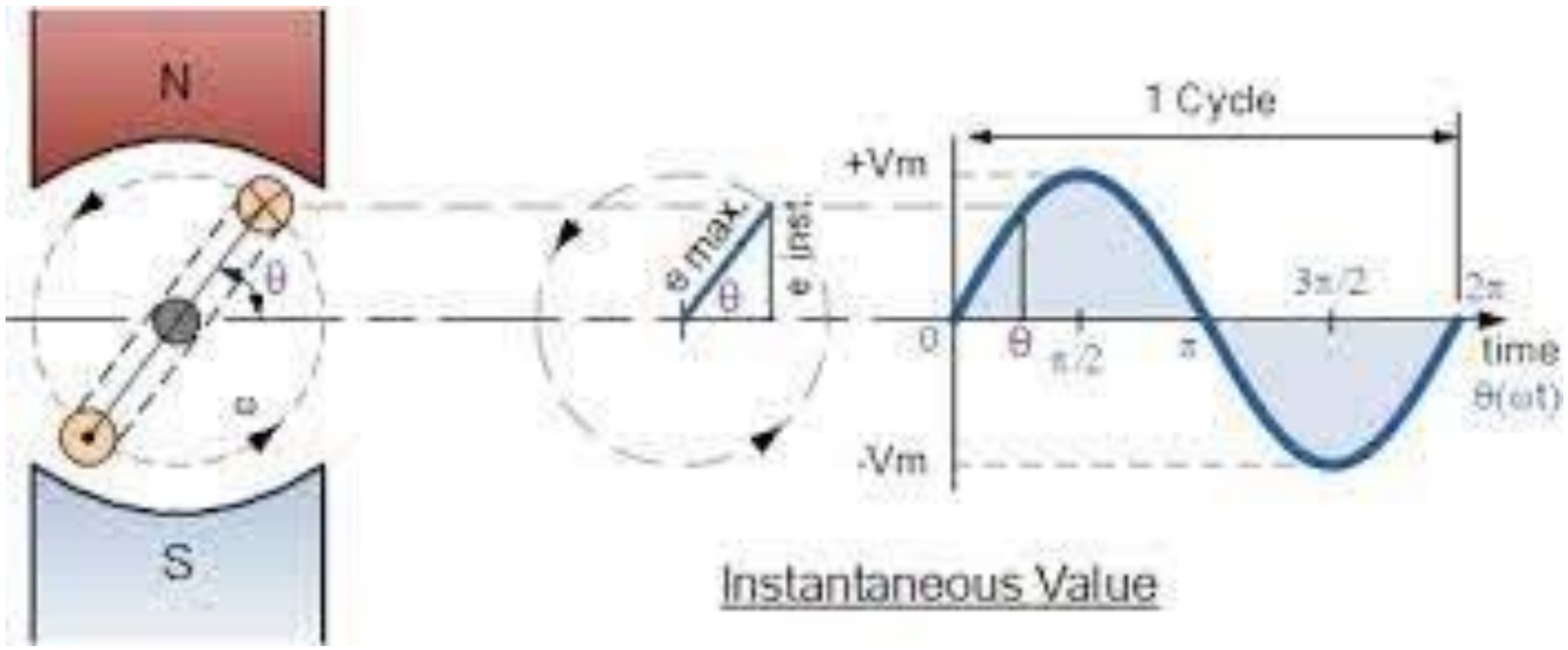
Induction





Alternating current wave form

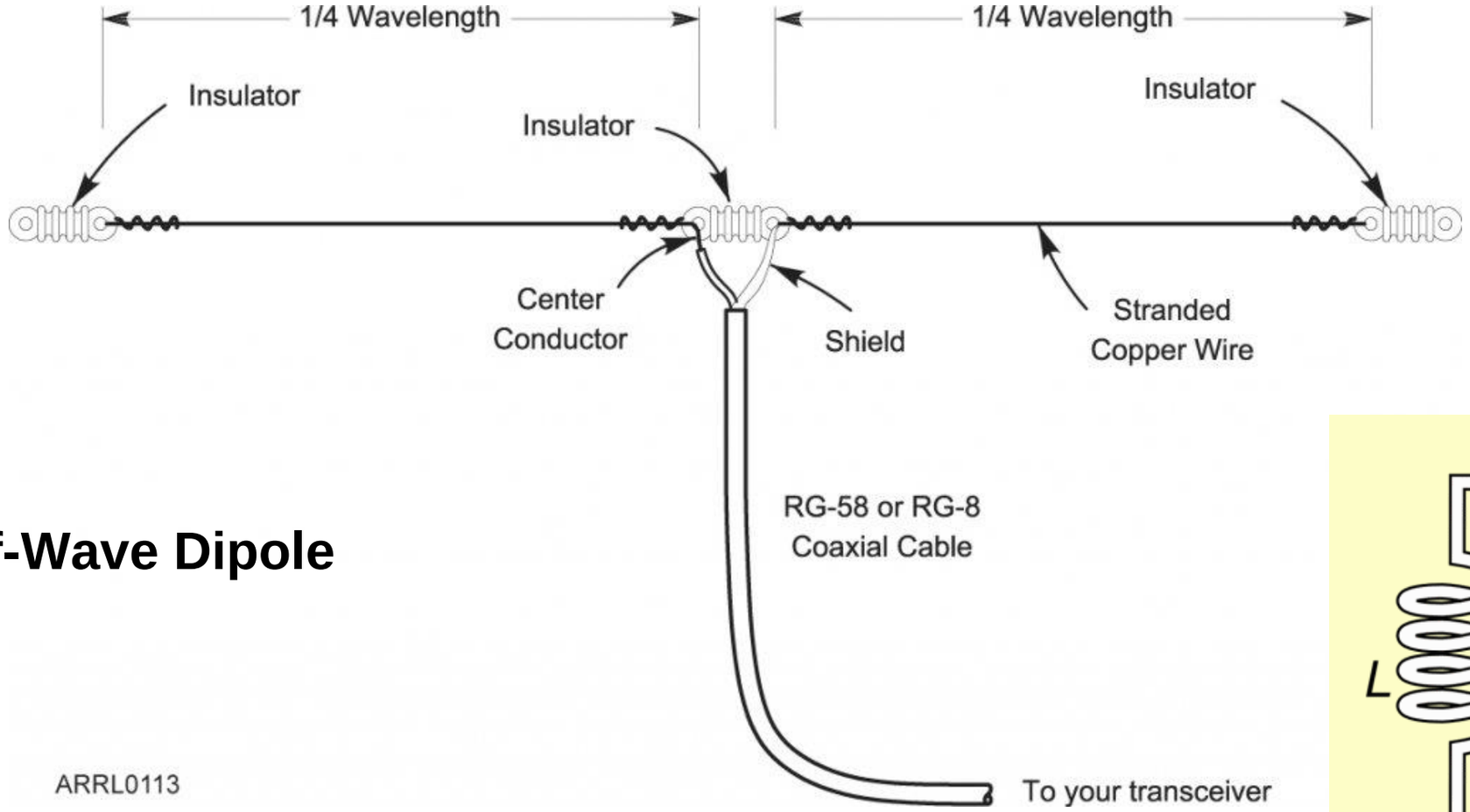
If we rotate a loop of wire through a magnetic field we have created an AC generator and the wave produced is called a sine wave.

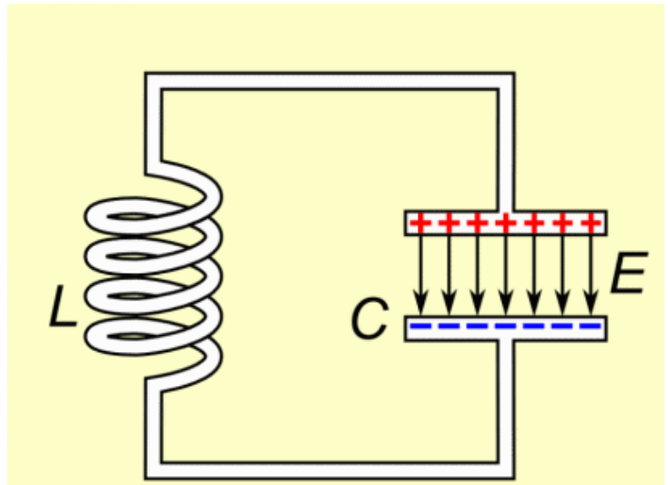


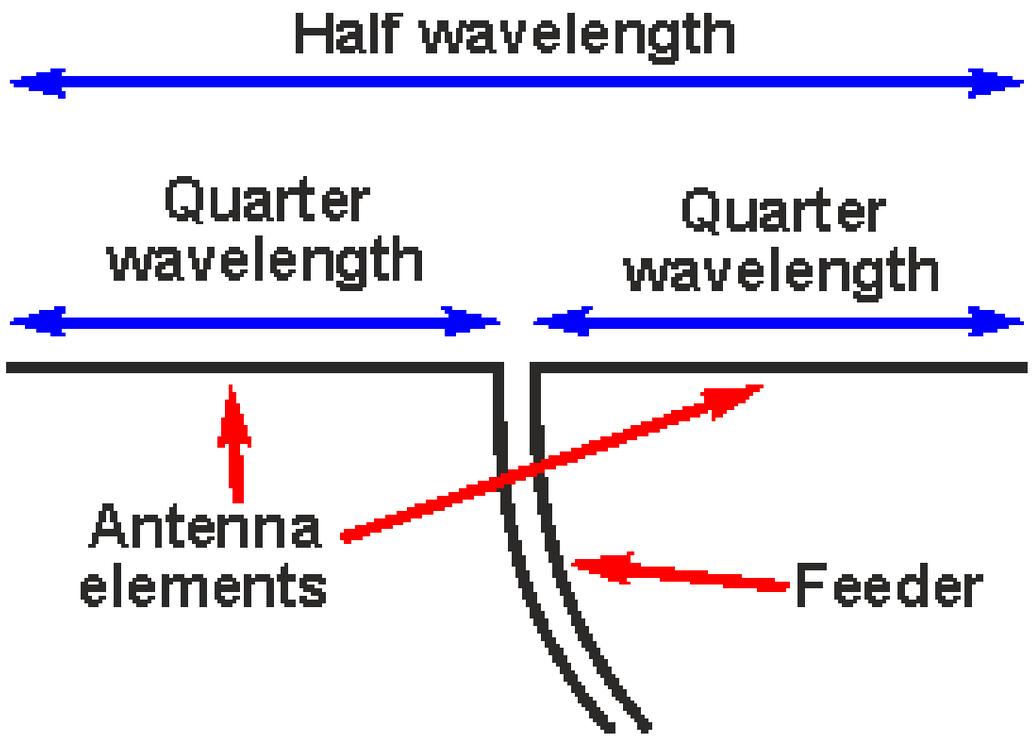
<u>Time =1/Frequency and Frequency =1/Time</u>

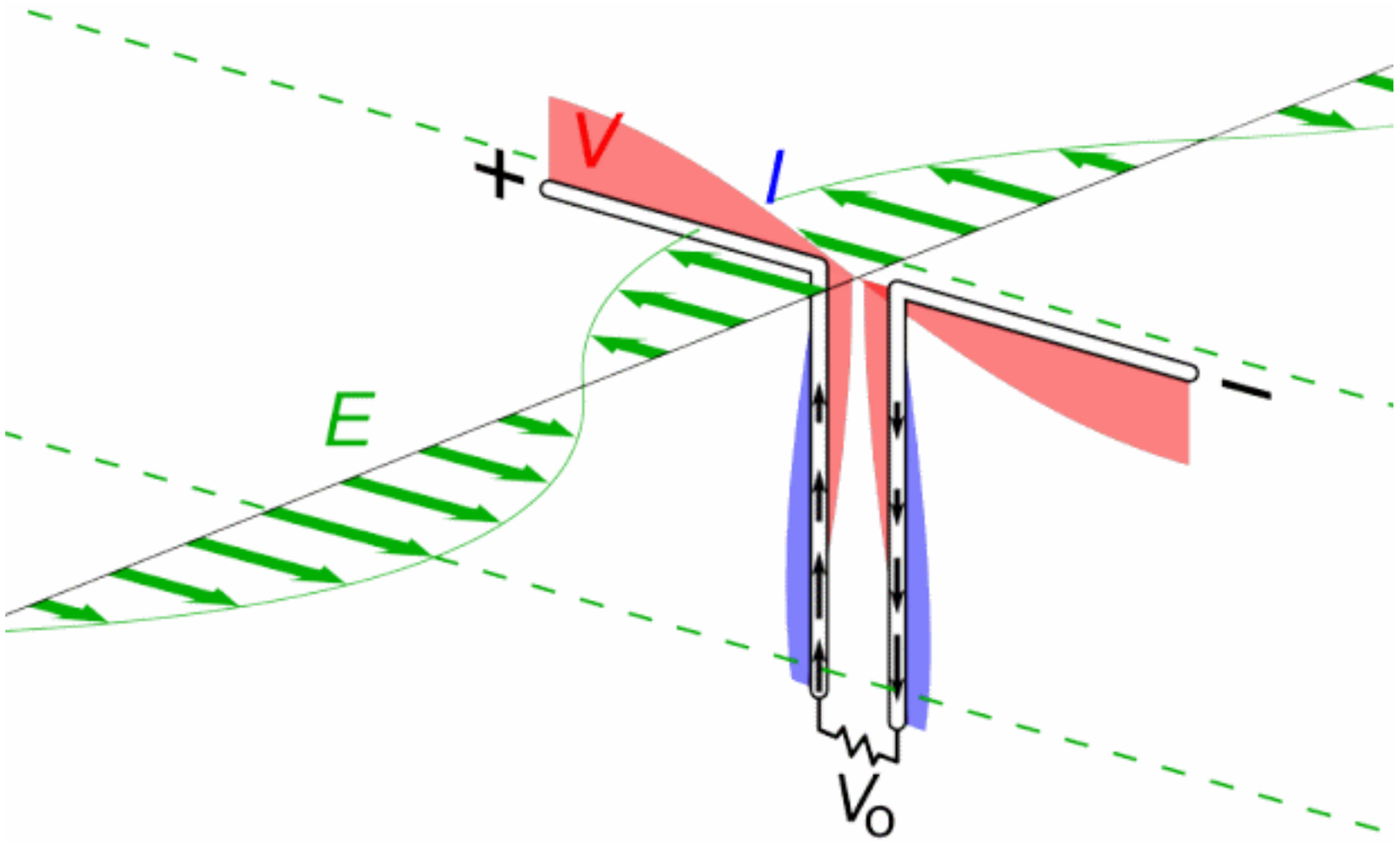
An example: If a sine wave repeats its self ten times a second Then it requires 1/10 of a second to complete its cycle.

Half-Wave Dipole





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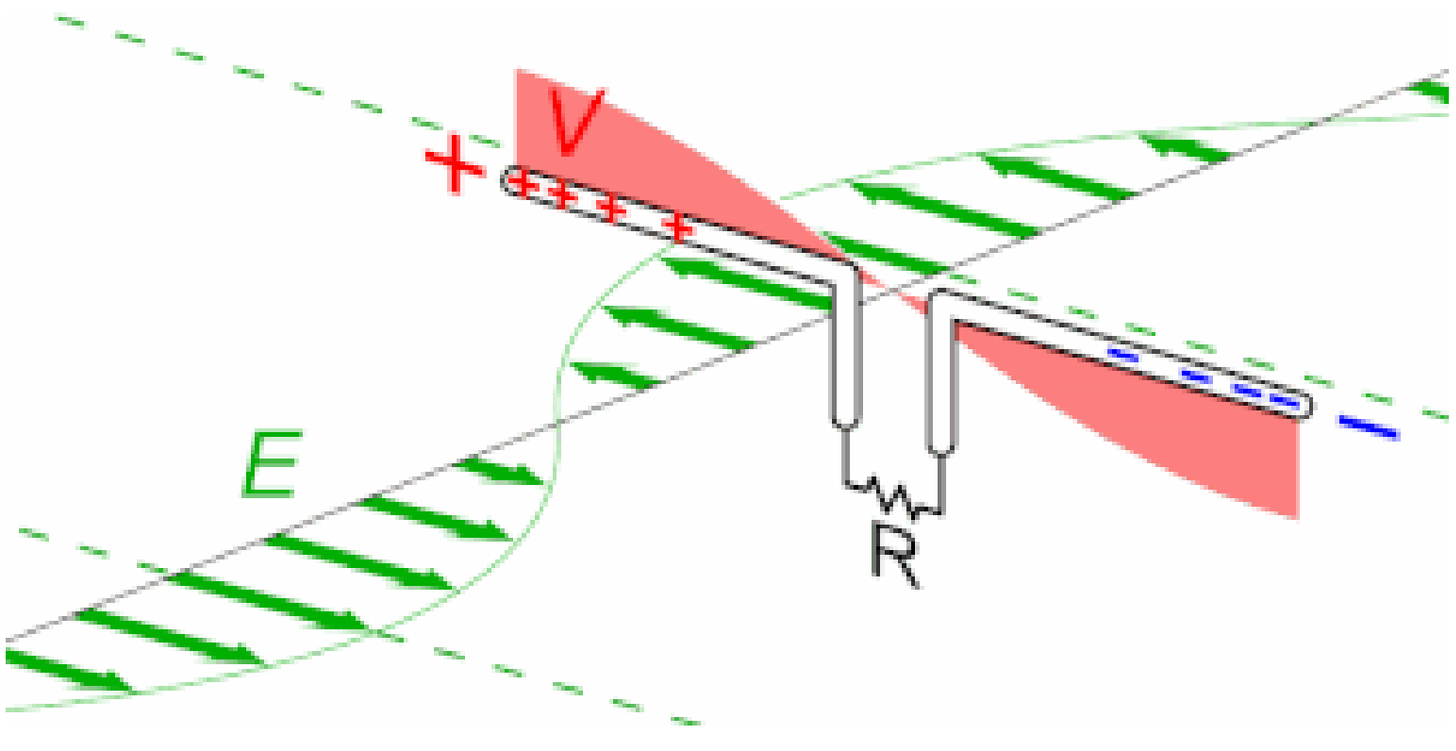
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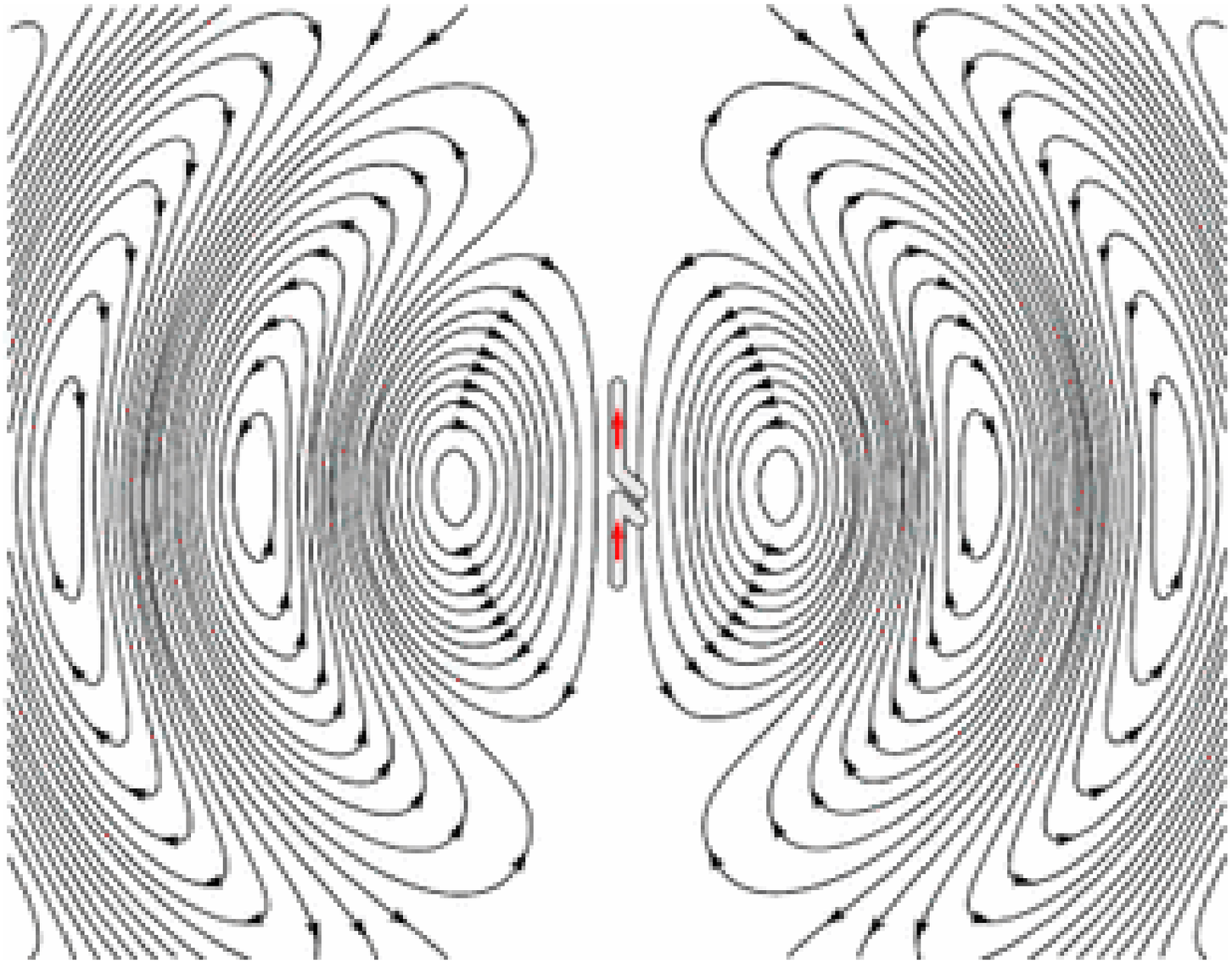
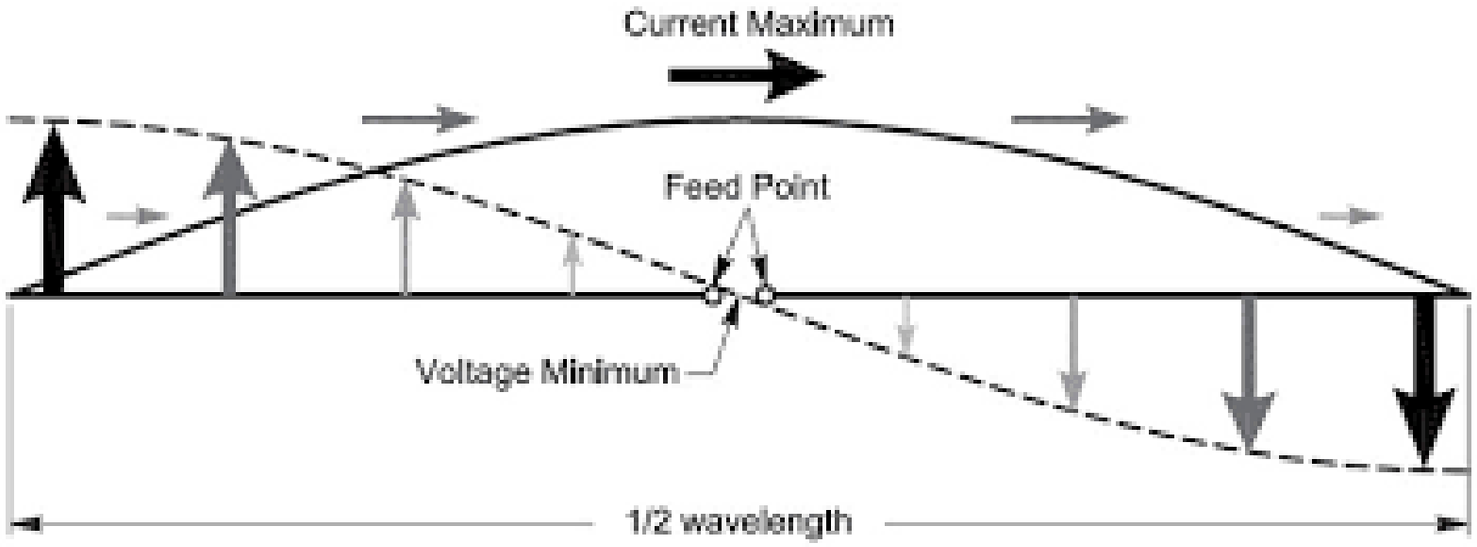
Dipole Radiation



We are looking at the Electric Fields the magnetic field are coming in and out of the scr



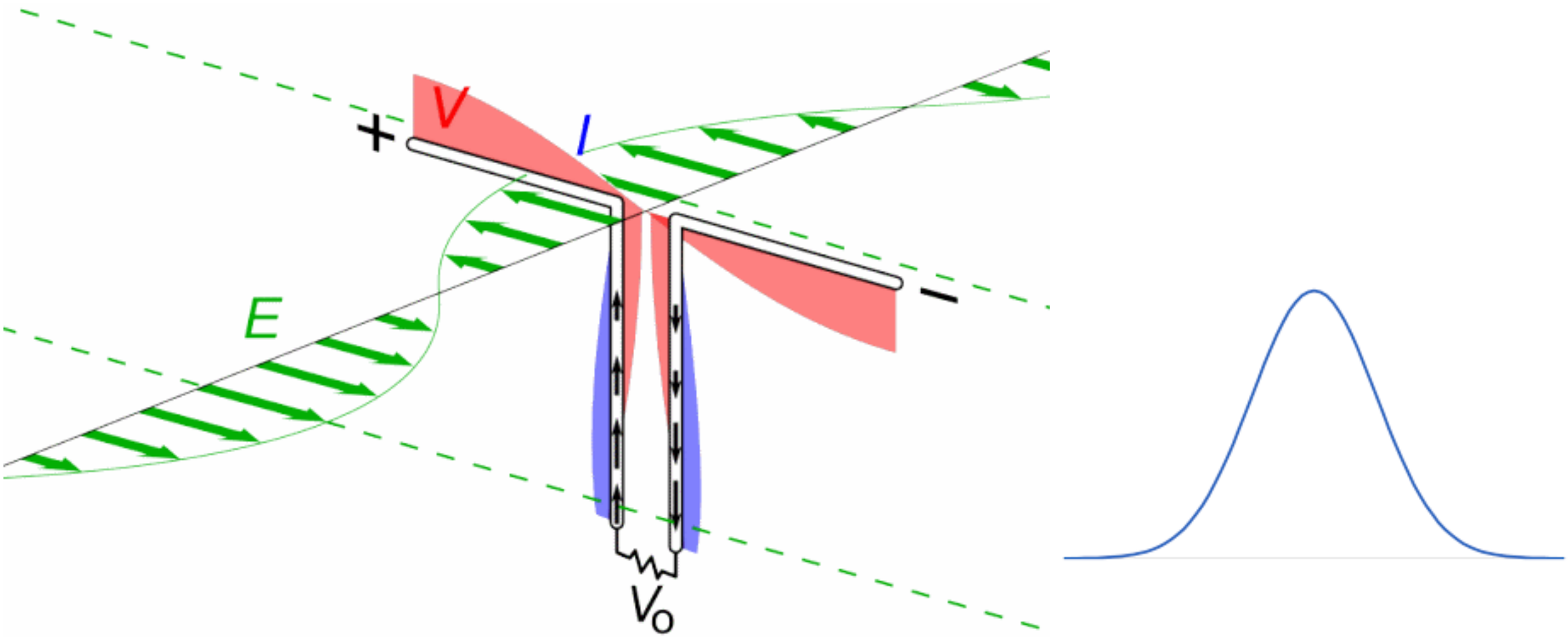
Notice the voltage is maximum at the ends of the dipole and the currents are maximum in the center.

You remember Ohms law R=E/I. If we measure the average voltage and current at center of the antenna we can determine the impedance (resistance) at that point. Interestingly the ratio of voltage and current at the center of a basic resonant dipole is always close to 72 Ohms in free space.

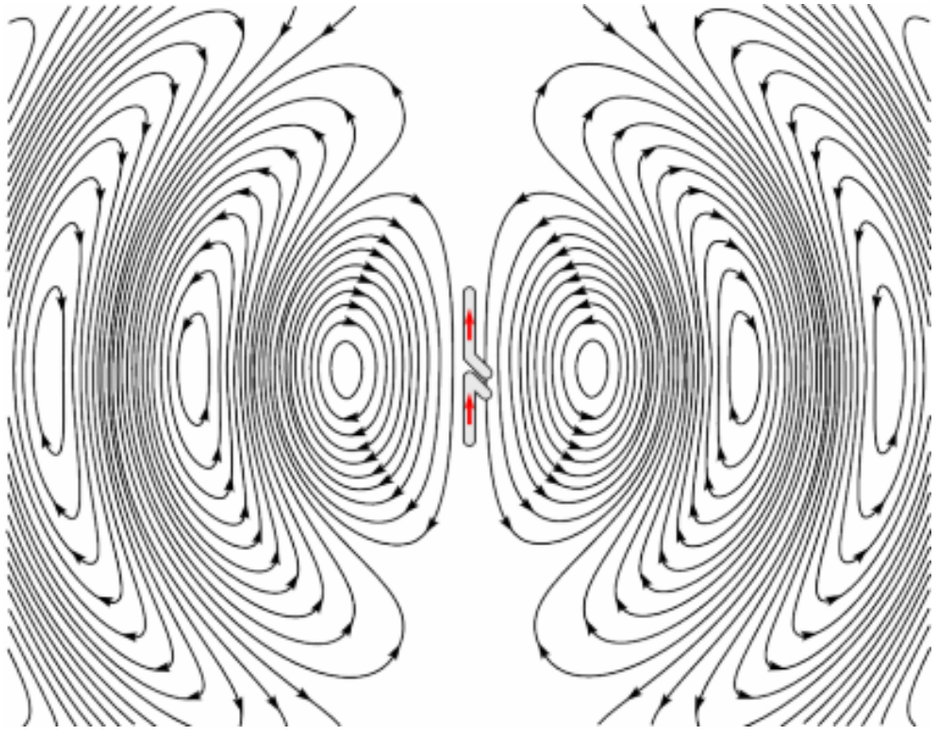
What do we mean by “resonant” Dipole?
Can we put an Ohm meter on an antenna and measure 72 Ohms at the center?

Resonance:

Notice the antenna must be the right length. When the current gets to the end of the wire, the polarity changes and a new current flows the other way. What would happen if the antenna wire was too short or too long?



The power radiated by an antenna is a little different.

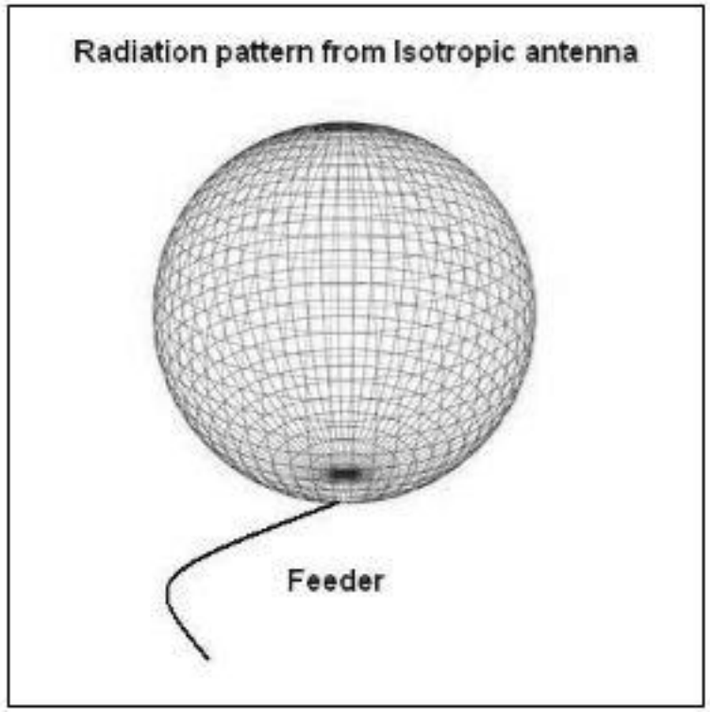


The power for the most part is not given off as heat but is rather radiated as an Trans

A dipole antenna has a feed point impedance of very close to 75 Ohms therefore if a 75 Volts signal is applied, 1 Amp of current will flow in the antenna and a TEM wave of power would be radiated.

Note: You can't measure the antenna resistance with an Ohm meter. This resistance is referred to as the antennas radiation resistance.

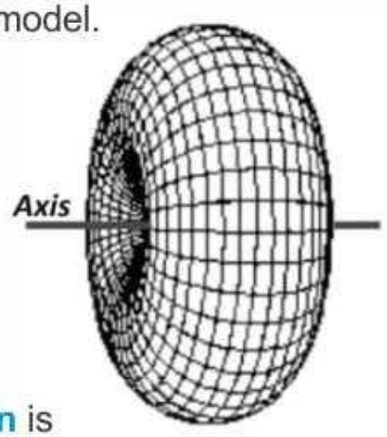
Isotropic vs. Dipole gain.



0 dB, called dBi

The **isotropic pattern** is equal in all directions, like a sphere of equal signal strength.

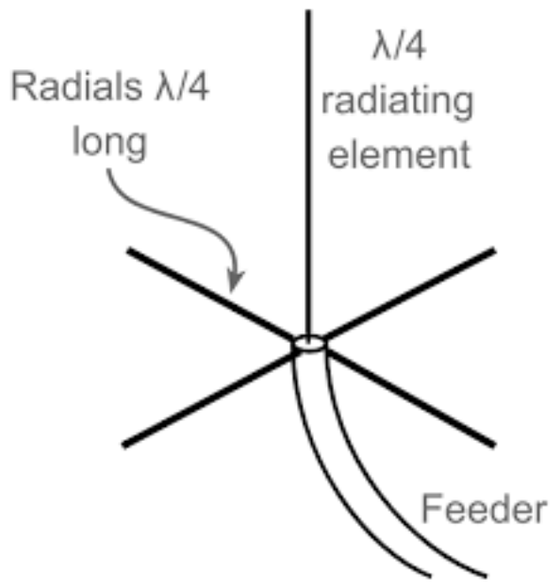
The **dipole pattern** is like a fat donut about the radiating element, exhibiting gain in the lobes broadside to the axis of the radiator as compared to the isotropic model.

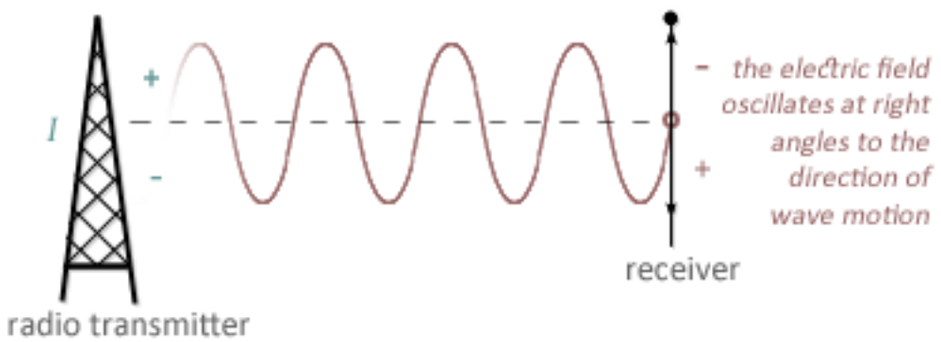


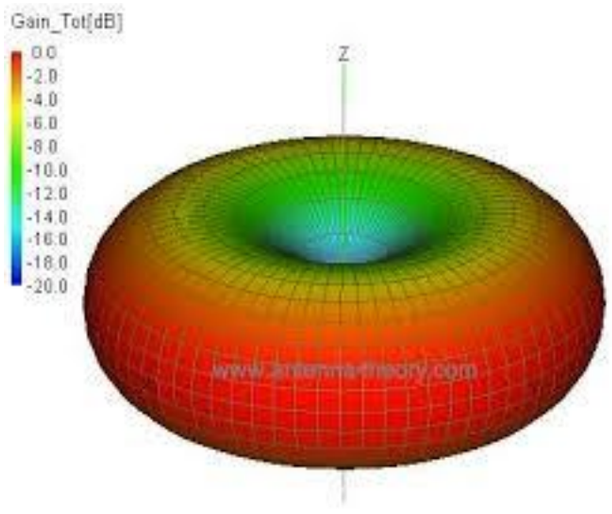
2.15 dB, called dBd

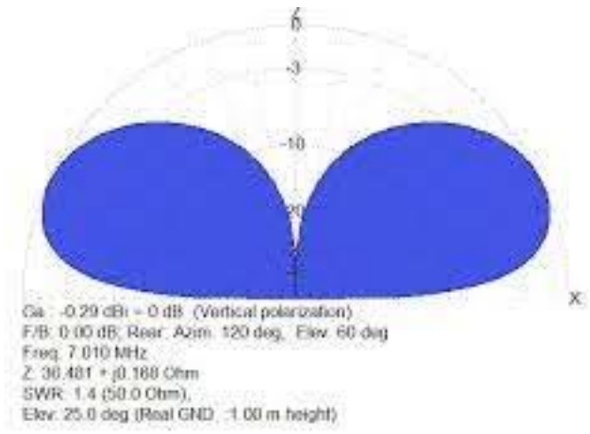
The **omnidirectional pattern** is like a horizontal disk of signal strength, exhibiting gain in the horizontal pattern, as compared to the isotropic model.

Quarter Wave Verticals



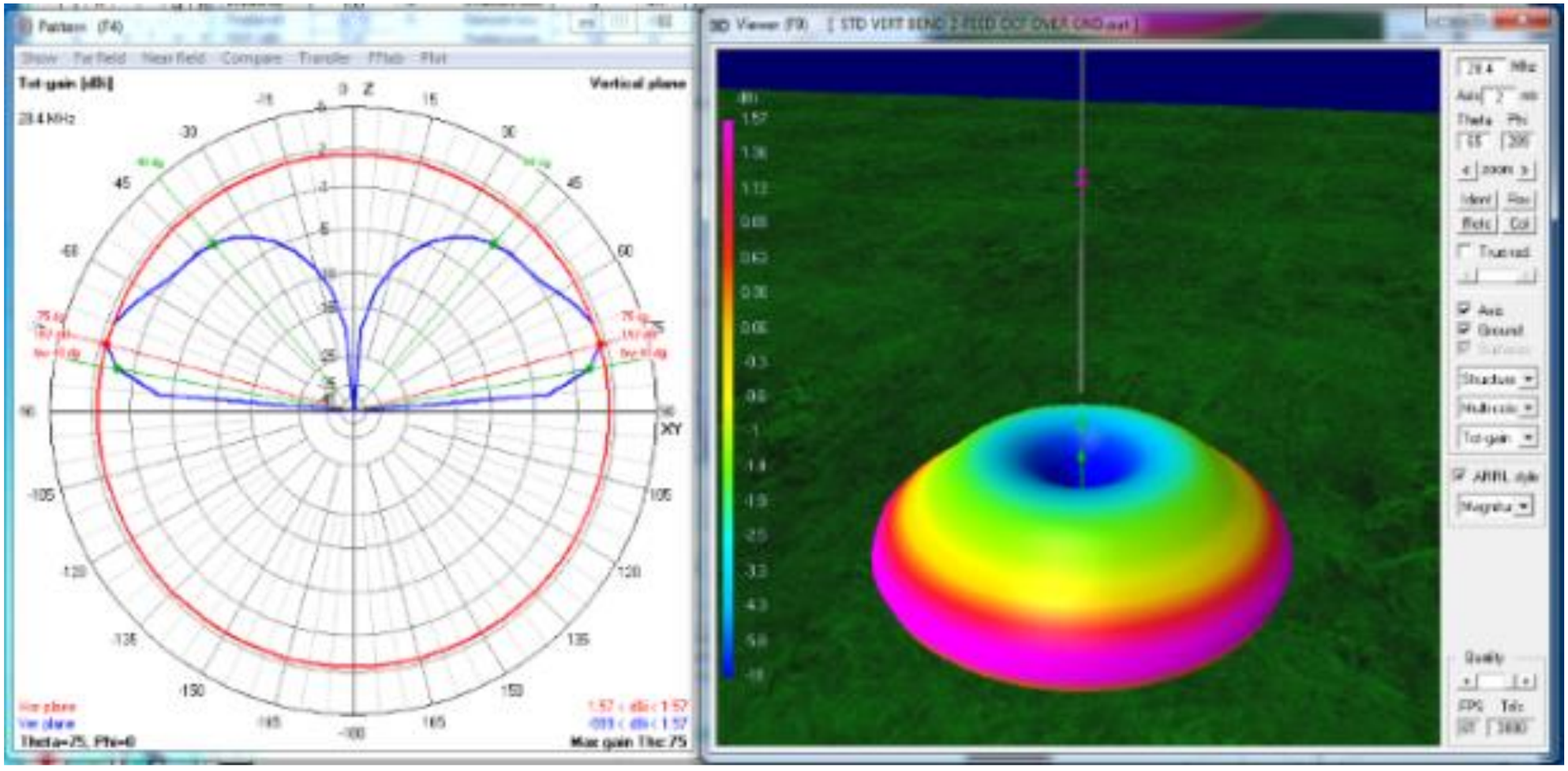






Verticals are OMNI-DIRECTIONAL

Vertical antenna



Each of these antenna are both easy and cheap to build!

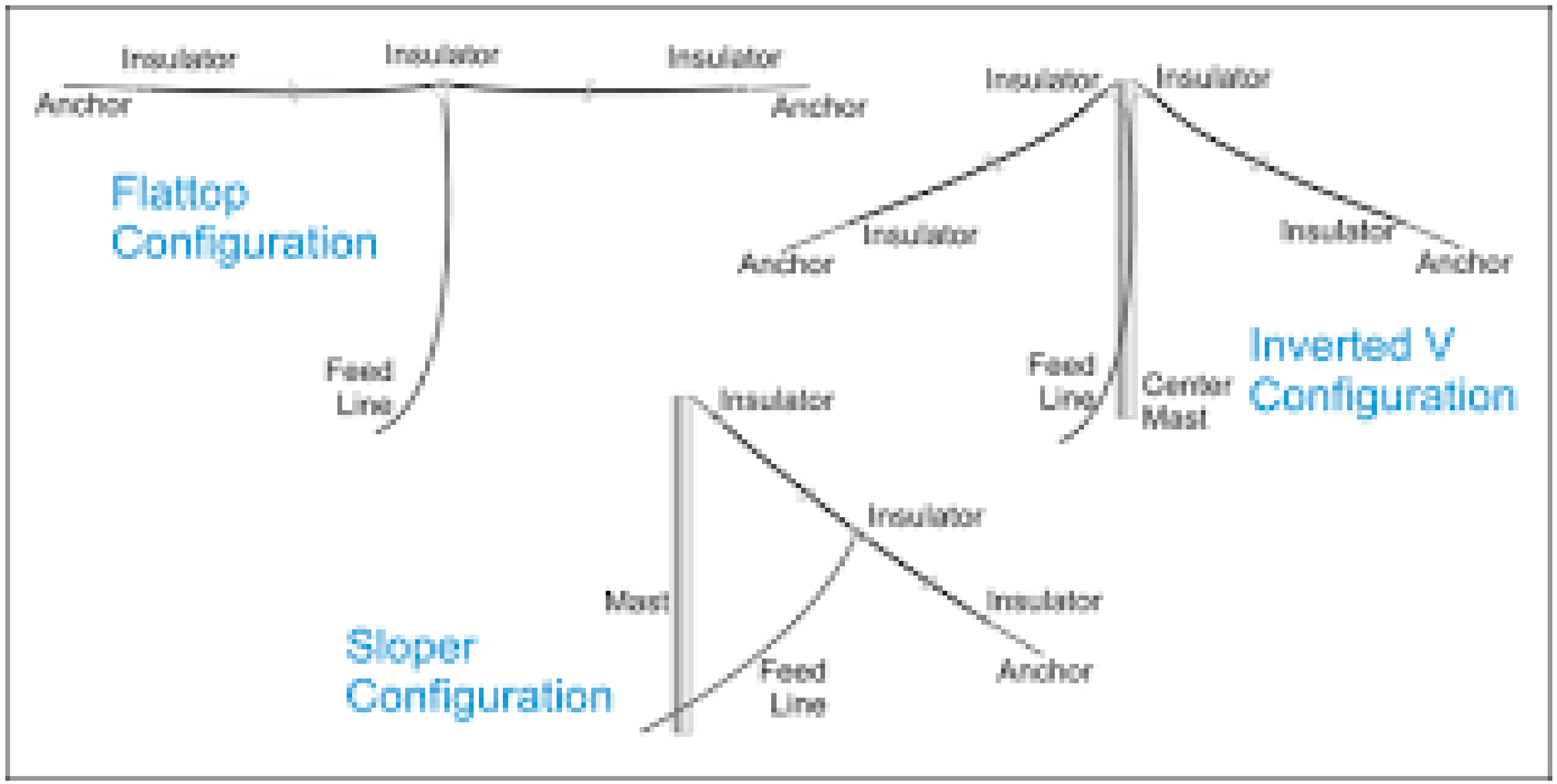
What is needed?

1. **Wire, whatever you have! 24-14 gauge stranded works well for most simple antennas.**
2. **A feed line of some kind . Coax 52 Ohm or 72 Ohms will work fine.**
3. **A center and end insulator. Even an old toothbrush about 3 inch long with a hole in each end has worked for me on occasion.**
4. **A tape measure, wire cutters and a soldering pencil.**
5. **An appropriate connector to hook to your radio**
6. **A tree or pole with rope or twine to hang the antenna with.**

Here's all you need to build a simple working dipole:

The Math: (468 is half the speed of light in millions of feet per second and 143 is half the speed of light in millions of meters per second, each value is shorten by five %.) Why? That's a story for another day.

- **If you like feet, Antenna length= 468/F(Mhz)**
- **If you prefer meters, Antenna length= 143/F(MHz)**
- **Cut wire as calculated.**
- **Fold wire in half and cut it. Now insert center insulator.**
- **Solder feed line to the two haves.**
- **It's good idea to make some kind of strain relief.**
- **Solder the appropriate connector on the end of your feed line.**



Hang your antenna however is handy. Hook the feed line to your radio and enjoy! It won't be perfect but play with it until it is. There are lots of hams around that will be happy to help you experiment.