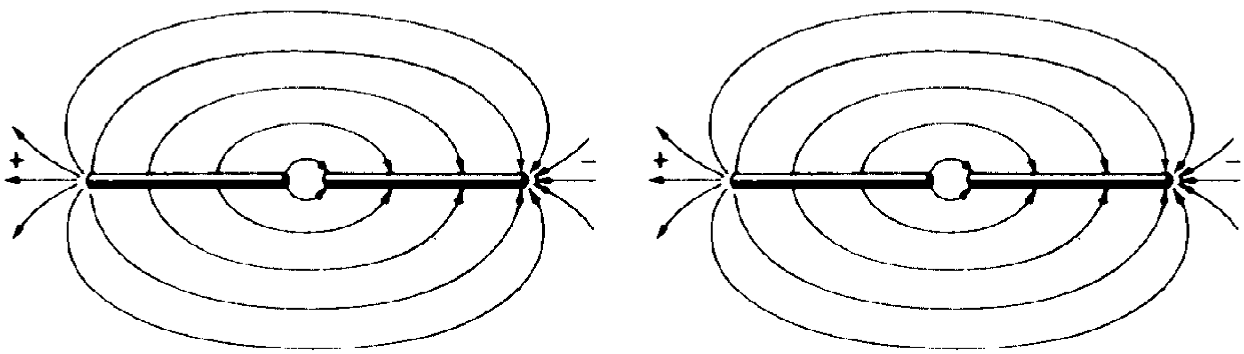
 Updated on 2013.12.26 at 02:02.

It is believed that radiation from an antenna occurs in the following manner, as in Figure A., electric lines of force surround the antenna during the major part of one half cycle. As the generator output approaches the zero point of its sine wave output however, the difference in potential between one end of the antenna and the other also decreases to zero. Theoretically, the strength of an electric field is always directly proportional to the causative difference in potential, and the electric field should also decrease, causing the electric lines of force to shrink back (or collapse) to the antenna. Electric lines of force, however, tend to repel one another: consequently, as the voltage approaches zero, some of the outer lines of force are retarded in the process of returning to the antenna. This retardation is great enough so that when the voltage reaches zero, some of the lines of force are left in space, where they form closed loops that propagate radially outward.



A B

Electostatic **A** and magnetic **B** lines of force on a center-fed dipole at one instant.

Simultaneously, magnetic line of force are snapped free of the antenna (They are always perpendicular to the electric lines). The continuously varying electric lines are accompanied by a displacement current which gives rise to the changing magnetic field. The magnetic field (with the electric field and its displacement current) exists in the propagated electromagnetic wave, the magnetic field producing the electric field, and the electric field (by virtue of its displacement current) re-establishing the magnetic field.

The two fields support each other, a radio wave can never exist with either absent. The electric field orientation in space is always parallel to the antenna *(horizontal dipole) while the magnetic field is always perpendicular to the antenna.

Thus if the dipole is horizontal relative to the earths surface it will radiate horizontally polarized waves. The plane of the electric field component is the determining factor, because the electric field component of the radiated wave is the one that produces the current in the receiving antenna.

Displacement current results from propagation at the speed of light of the electromagnetic field between the two points and it is not to be confused with conduction current which is electron movement. Displacement current is directly proportional to how fast the voltage is changing.

Displacement current is more commonly associated with AC capacitor action but this does not preclude its presence in conductors/antennas and coils. The function of displacement current is another very good way to reason how Xc is manifest in a capacitor.

Conduction current is caused by electron movement, a completely independent event promoted by the application of a potential difference to an electron circuit.

The fields associated with the energy stored in the resonant circuit (antenna) are called the induction fields. These fields decrease with the square of the distance from the antenna. They are only local in effect and play no part in the transmission of electromagnetic energy. They represent only the stored energy in the antenna and are responsible only for the resonant effects which the antenna reflects to the generator (transmitter). The fields set up in the transfer of energy through space are known as the radiation fields. Although these fields get weaker with the distance from the antenna, this decrease is much less rapid than the decrease of the induction fields. This is because it is linear and is not according to the square law rule. Therefore the radiation fields reach great distances from the antenna. It is the radiation fields that are responsible for electromagnetic radiation.

No matter how high the frequency may be there are always a few electromagnetic lines of force very close to the antenna that have sufficient time to completely collapse before the alternating current in the antenna produce a rising field of opposite polarity. This portion of the field is not radiated but rises and falls about the antenna like the magnetic field in a transformer core. This induction field must be taken into account when making tests and adjustments on the radiative field strength of the test antenna. If the measuring device is brought too close to the antenna the induction field will induce additional signal voltage and give an entirely false indication of the ability of the antenna to radiate in a particular direction (beam antenna).

At a distance equal to one sixth of a wave length from the antenna the induction and radiation fields are equal and at a distance of about three eighths of the wavelength the induction field may be considered negligible.