Tech Note - Theory - 02 Operation of the Dipole Antenna

Suppose we were to take a wire having an infinite length and place a charge on it (that is, an accumulation of electrons) at one end. These electrons would immediately begin to disperse themselves along the length of wire, forming an electric current and eventually coming to rest, having dissipated their energy in heating the wire.

However, where the wire is of finite length and of a rather low resistance as in fig. X the action is quite different. As the electrons disperse along the wire (antenna) they set up a magnetic field which reaches its maximum when all electrons are dispersed and current would normally cease to flow. This magnetic field will then collapse and induce a voltage tending to maintain current flow in the same direction, thus placing a charge upon the other end of the wire. When the magnetic field has completely collapsed this charge begins to return again through the wire and oscillation continues just as in all oscillatory circuits. The charge is said to be reflected back from the end of the wire just as if a ball were rolled along a trough having barriers at each end from which it could bounce back and forth.

Naturally, if oscillation is to be maintained we must provide periodic charging impulses from some outside source of power, otherwise the original charge would dissipate itself in radiation and in heating the wire, and a damped oscillation would result. These charging impulses must also be so timed that they will occur at the right instant to assist the oscillating current and the time between impulses must therefore be equal to the time required for the charge to flow from one end of the wire and back.

This is just another way of saying that the frequency of the charging source must be the same as the frequency of our oscillatory circuit. This, of course, has been known all along but in dealing with methods of feed we will find our problem a little easier if we have examined the oscillatory action in a little greater detail.

It should also be remembered that while all this magnetic action as going on the same action is tasking place with an electric field (however it is perpendicular to the magnetic field). Remember we are dealing with a composite ELECTROMAGNETIC FIELD. One cannot exist without the other. A moving magnetic field about a conductor will automatically create an electric field and vice versa.

The magnetic field was chosen as the illustration for reasons of simplicity. It could just as well have been explained using the action of the electric field in the oscillator circuit. We know the two fields are perpendicular to each other and at right angles to the direction of travel, and since the dipole is an open oscillatory circuit (spread over a large area) the energy will escape and be radiated into space as an electromagnetic WAVE.

The preceding actions describe a situation with the dipole antenna known as Resonance, or all actions were in step.