A BRIEF DESCRIPTION OF THE CONCEPT OF THE EH ANTENNA

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In the 1880's (about 120 years ago) Mr. Hertz developed the basic antenna that is used today. About the same time, **John Henry Poynting** developed a theorem which specifies the relationship of the E and H fields required to produce radiation. That theorem has been proven to be true for all forms of radiation. To satisfy the Poynting Theorem and thus effect radiation, an antenna (or radiating source) must develop E and H fields in proper physical relationship (the H field must encircle the E field), have a ratio of 377 ohms, and both the E and H fields must be developed simultaneously (in phase).

The EH Antenna consists of two elements having natural capacity between them. When a voltage is applied to a capacitor, an electric (E) field will be developed which causes current (displacement current) through the capacitor, which in turn develops the (H) field (magnetic field) at right angles to encircle the E field. However, when current flows through a capacitor, the phase of the current leads the phase of the applied voltage. Therefore, the difference in phase prevents satisfaction of the Poynting Theorem for this configuration. If the phase is corrected by an external network, the "capacitor" becomes a leaky capacitor. The equivalent circuit is a radiation resistance in series with an inductance (due to the displacement current) and in series with the natural capacity.

If the external power applied to the EH antenna is first applied to a network between the source and the antenna, the network can retard the phase of the current through the capacitor relative to the voltage applied to the "leaky" capacitor. Therefore, within the antenna, the time phase of the E and H fields can be made to be the same. This network allows satisfaction of the Poynting Theorem and radiation occurs at the frequency where the network produces the proper phase relationship.

> The resulting antenna concept has been named the EH Antenna. The concept includes various shapes including elementary dipoles and bi-cones.
> Due to the high efficiency of the integration of the E and H fields within the physical sphere of the antenna, the antenna need only be a very small fraction (less than 2%) of a wavelength. This is due to the very strong fields.
> The Poynting Theorem says Radiation = E x H.
> Since the space between the antenna elements is only a fraction of a meter, the E field, measured in volts/meter, is large even for small applied voltages. The current density in that small area is also large, providing a large H field.

The EH Antenna can be physically configured to allow antenna pattern gain. This is most evident in the Bi-cone version of the EH Antenna, although the length of the dipole elements in the dipole version of the EH Antenna has a significant effect on the radiation pattern.

Due to containment of the E and H fields within the physical sphere of the antenna, Electro Magnetic Interference (EMI) is virtually eliminated. Further, since the **antenna is not a resonant structure**, *the frequency of operation is totally dependent on the external phasing network*.

Since the typical phasing network only covers a small range of frequencies, ***the EH Antenna virtually eliminates harmonic radiation***, yet has an instantaneous **bandwidth typically wider than a conventional Hertz antenna.** A network with well controlled phase can extend the instantaneous bandwidth. Typically, the 2:1 VSWR bandwidth is equivalent to a phase change of +/- 3 degrees.

Since antennas are reciprocal, the EH Antenna offers full performance for both transmitting and receiving. Used as a receiving antenna, the E and H fields are primarily contained within the physical sphere of the antenna, thus the antenna rejects external E or H fields and receives only radiation. Thus, the **EH Antenna is exceptionally quiet in the presence of man made noise.**

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