A Country Boy Explanation of the EH Antenna

First, if anyone disagrees with my analogy, please jump in.

Let's start with the familiar term of VSWR. If you measure a low VSWR the "transmitter" is happy. This indicates the transmitter is looking at a 50 ohm resistive load. If we connect a pure resistive 50 ohm dummy load to a transmitter we should read a (near) perfect VSWR when switched to any band and at any frequency in the band.

Now let's add an antenna to the equation, a simple dipole, and see what happens. If we cut it using known formulas and install it in free space, the transmitter will see a 50 ohm resistive load at the resonant frequency. If we tune the transmitter up/down from this frequency, the VSWR will go up. This is because we are introducing reactance. Go up in frequency we add inductive reactance and down we add capacitive reactance.

If we use an antenna tuner we can now tune out the reactance that the transmitter is seeing. The antenna is still reactive. The antenna tuner does not change the characteristics of the antenna; it only changes what the transmitter sees. This of course applies to conventional Hertz antennas. If an antenna tuner is used at the operating position and the antenna is an EH Antenna, a change in phase any where between the transmitter and antenna will cause the characteristics of the antenna to change.

The common theory is that a Hertz antenna works by current in a wire. The EH Antenna works by Displacement current (Current through a capacitor is displacement current. For an explanation of this, look up Maxwell's laws). For a Hertz antenna, the voltage/current phasing has little effect, but for an EH Antenna it is critical

The Poynting Theorem states in so many words for radiation to occur you MUST have both the Electrical (E) and magnetic (H) field in time phase and of the same curvature. Again, if you are curious, look it up. With a Hertz antenna, radiation occurs at approximately 1/3 of a wavelength from the antenna (far field). With an EH Antenna, radiation occurs at the antenna (effectively moving the far field to the antenna).

If you apply RF voltage to a capacitor, the current through the capacitor will lead the voltage by 90 degrees (again, look it up). For the EH Antenna to radiate, the voltage/current MUST be in time phase across the antenna. The applied voltage develops the E field while the current develops the H field. To make this happen, a network is used ahead of the antenna to cause the current applied to the antenna to lag the phase by 90 degrees. There is some hidden inductance and resistance in the antenna, but these values are small compared to the large capacitive reactance. The radiation resistance of a EH Dipole antenna is approx. 32 ohms. In addition to developing proper phasing, the network must cancel the capacity of the antenna and match the 32 ohms.

The network accomplishes this in two steps. The "L" section provides a reduction in impedance to an intermedant value of about 45 degree current lag and an impedance of about 25 ohms. The "Tee" section converts the intermedant impedance to the final impedance of 32 ohms and the final 45 degree current lag. The T section also adds inductance to cancel the capacity of the antenna. Olalla, we have radiation.

And there you have it.

If you introduce a tuner into the equation and you know that it does not cause a voltage/current phase difference, you are, as they say, in like Flynn; otherwise as you can see from the above explanation the result at the antenna is incorrect. Some have said that they can, with a tuner, get a good VSWR reading on other bands. Well, you have just converted the EH Antenna into a short fat Hertz Dipole on the other bands.

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