

## Phase shift in the EH-Antenna

As there has been a rather bemusing discussion about the “be or not to be” possibility of a phase shift with an intended value in the EH antenna – I just wanted to show a very simplified Spice model for the L+T EH-antenna.

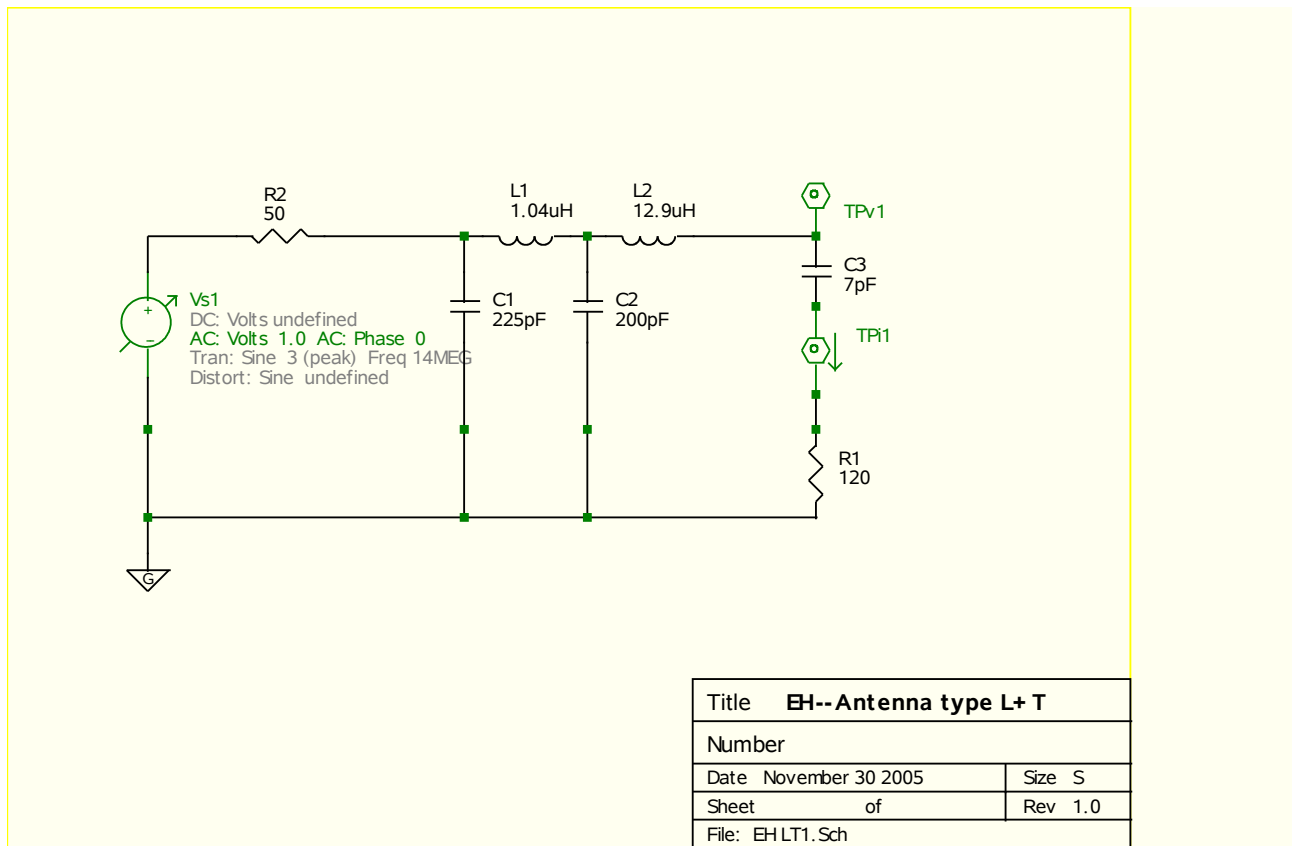
First, the simplified electric model. Please note the missing spurious capacitances. They are not important in this simulation. The EH shows a number of spurious frequency responses due to these extra (now missing) capacitances but there are no radiation from the EH on these spurious frequencies to bother about anyway!

The electric model is based on Ted's “Example 2” document and his 20 L+T EH-Antenna.

I swept the design with a sinusoidal signal from 10MHz to 20MHz and probed the upper and lower part of the cylinders. Please note that the cylinders are substituted by a capacitor. To be able to simulate the current flows in the cylinders, I need a professional tool like Ansoft's 3D-Maxwell or the HFSS package. As most of you don't have that software, I refrain from using it here.

I also refrained from any complicated stimuli setup or any Montecarlo definition. I just nicked a ready made sample from Ted's earlier documents.

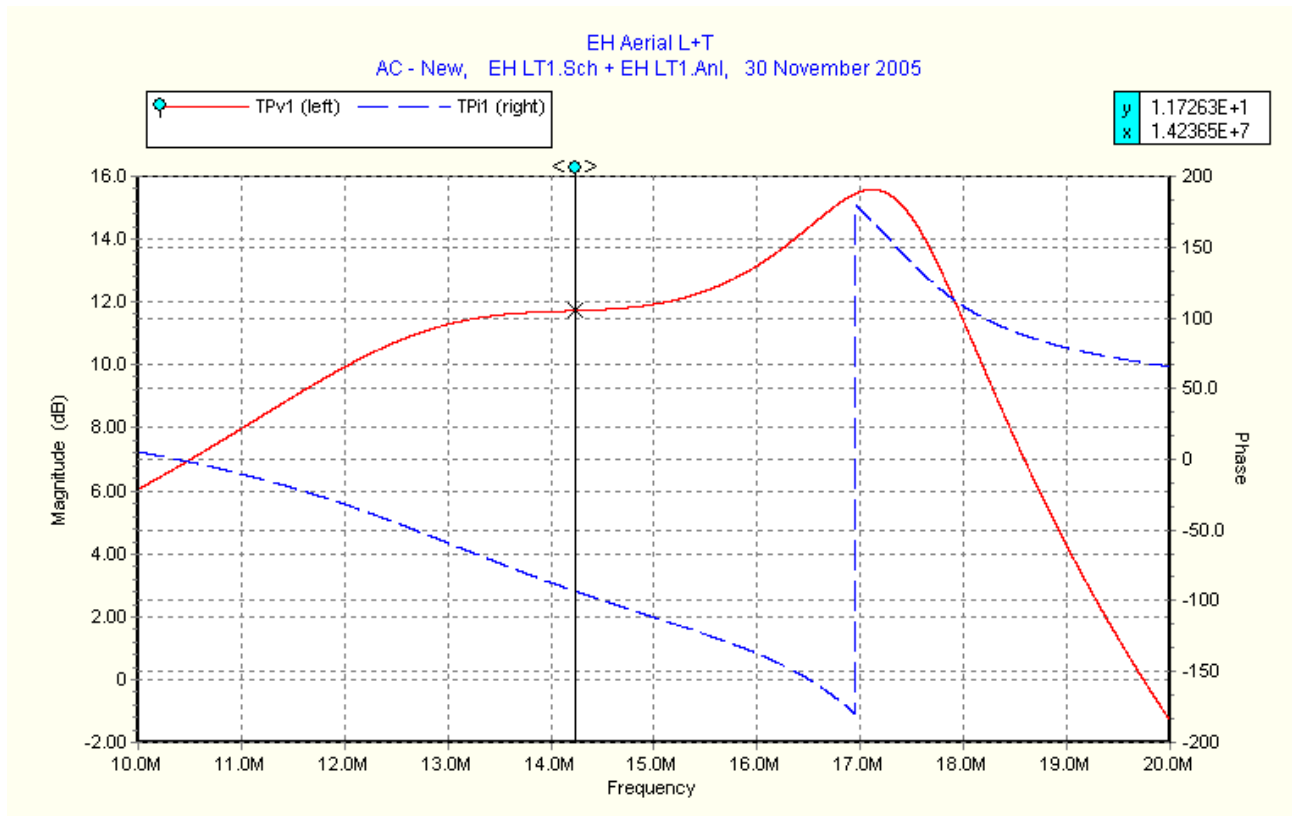
The Schematic:



Nothing complicated as we can see in the schematic. This model fits all Spice software I tested on my SuSE 10.0 Linux desktop computer.

The resulting plot contains the voltage on the upper cylinder and I compare the voltage and the current on each cylinder. The TPV1, testpoint 1 is a Voltage probe. The TPI1 is a current probe, which is the reason for having it in series with the wiring.

Now to the plot:



I placed the marker at -90 degrees to make it easier to see where the intended point of operation is located.

Please note the very important peak on 17 Mhz where the voltage are at the maximum. This is probably where you believe the antenna to be designed for. However, we have repeatedly pointed out that the antenna does not work when in resonance! The phase shift can only occur at a complex load, never at a pure resistive load. You can see the phase curve change polarity at the point where we have resonance of the antenna. The operating point of this EH are at approximately 14.2MHz, almost 2.7MHz lower than the resonance frequency.

As all of you can recreate this simple model, I don't need to upload the schematic to the EH Group and I also tried to simply the model as much as possible for everyone to understand.

Anyone interested in the EH-Antenna can of course create a STAR EH model and test it. You will get similar results from the simulations again.

All these simulations are based on standard AC theory even if Spice uses a bit cumbersome numeric analysis occasionally.

With this document, I close this phase shift thread!