**Question and Answers**
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ANTENNAS (OR IS IT ANTENNAE?) AND TRANSMISSION LINES

Part III

While we will attempt to continue our Q & A discussion on the subject of Transmission and RF Lines, we need to regress to a discussion format first, for a short review of basic fundamentals. We shall keep it as short as possible

In review, we should remember that a conductor, any conductor, with an electrical current flowing through, it will have a magnetic field surrounding that conductor. Using the electronic theory, if we place our left hand around the conductor, with our thumb pointing in the direction of the electron flow (from negative to positive external to the power source), our fingers will point in the direction of the magnetic field. In fact, our fingers are a rudimentary representation of these magnetic lines. We can not have current flowing through a conductor without producing these magnetic lines of force, nor have moving magnetic lines of force surrounding a conductor without causing an electrical current flow. We should recall that these self-induced lines of force tend to reduce or retard the current flowing through that conductor. This means that the current flowing through the conductor will cause magnetic lines of force that, in turn, work in opposition to that current flow. This is a measured resistance (or a reactance) to that current flow and is called "Inductive Reactance" which is referred to as $X_{L.}$

We need to recall as well, that by definition, a capacitor is any two conducting materials separated by a dielectric, or rather, some insulating material. Thus, if we think of a TV lead-in wire, having two parallel wires held firmly apart by an insulating material, we can envision a capacitor. In fact, a piece of 300 ohm TV lead-in, cut to a length of one inch, approximates a 5 pica Farad capacitor (or condenser). Again, jogging the memory, we recall that a capacitor effectively allows Alternating Current (AC) to pass while blocking a flow of Direct Current (DC). Although current is effectively allowed to flow through the capacitor, it does offer a resistance to the AC current flow and this resistance or Reactance, is referred to as $X_{C.}$

Still thinking of the TV lead-in wire, we can see that any short (or long) section of this wire will have, if it has of current flowing through it, magnetic lines around each conductor, in opposite directions of course, and at the same time will form a capacitor. Thus, we have three forces acting upon a current flow. These are the inductance ($X_L$), offering resistance to the current flow; the capacitor allowing some AC or RF current to pass from one conductor to the other, but with resistance or reactance ($X_C$) if an AC or RF current flows through it. At the same time, we can't forget that the conductor(s) offer a DC resistance (R ) to current flow, as well. Since there are many sources available to show the formulas used to determine the various reactance, either inductive or capacitive, we won't print these at this time.

These three losses figure heavily into our normal use of transmission lines, or feed lines as we refer to them, or further still, RF lines as we often call then when using these phenomena to our advantage. As simple transmission lines, we can refer to published specifications for any type of cable and obtain the Characteristic Impedance (Z), which takes both the Inductive and Capacitive Reactance into consideration and the Resistance of the conductor(s), all causing a loss to our signal. This loss will be shown as the total attenuation, usually measured in dB or dBm in a fixed length, usually per one hundred feet of line length.

In this brief discussion, we have referred to the transmission line as TV lead-in. The same applies to any length of a coaxial cable as well, except for the 5 pica Farad per one inch. The inter-conductor and the inside of the outer shield form a capacitor, the same as the two parallel conductors of the TV lead-in. The same inductance is present on the inter-conductor and the inside of the outer shield as current flows..

As we progress in our review of Transmission Lines, we must keep these few basic facts in mind without the necessity to repeat them often. We realize this session is short and to the point with little new information present, but it will serve us well as our building block for our next few sessions.

(Due to the length of this review and the depth we intend to pursue this field, we will hold our Questions and Answers until next time, in Part IV).