Understanding A Single Wire Transmission Line

The following is a rewrite from memory of a logic script written in 1968 by K9AXN

**The single wire transmission line:**

A single wire is a transmission line, the same as a pair of conductors. It has a calculable and measurable surge impedance at the source or at any break point along its path to destination.

The lossless single wire transmission line in space for simplicity. Keep in mind the **surge impedance** is called resistance, but is truly a gating effect. It allows a specific amount of current per volt to enter the conductor but does not consume energy: It is a gate keeper and is calculated as volts and amps per meter, Joules per meter in transit or power. Once accelerated into the wire it is a wave with no allegiance to the source or destination. The impedance at any point on the wire remains the same without regard for distance from the source. The power inserted at the source will exponentially decline with distance traveled per radian, due to

radiation. Even though the power decreases with wire length, the surge impedance remains the same as that at the source.

**Calculate the surge impedance of a single wire transmission line:**

Using a #12 .0808” diameter wire, calculate as follows.

(39.37” ÷ .0404” = 974.5) (LOG 974.5 = 2.9888) (2.9888 • 138 = 412.5r)

The surge impedance of a #12 wire is 412 Ohms.

Or: (Ln 974.5 = 6.8819r) (6.8819 • 60 = 412.94r)

The inductance of the wire will be: (412.5r ÷ 299792458 = 1375.95nH)

The capacity will be (1 ÷ 412.5 = .002424242a) (.00242424 ÷ 299792458 = 8.0864pF)

The inductance will be slightly higher and capacity lower due to the velocity factor, but the impedance will remain the same.

The loss due to radiation will be .026048 or 2.6048 % of the voltage and current per radian per radian of the traveling wave.

Regards Jim K9AXN