Scratch design a 1/4λ Dipole:

This paper will use techniques that were used over 50 years ago to design a 1/4λ Dipole. The parameters of the first rendition will be in free space ignoring environmental variables e.g., proximity to earth, other objects, and the resistance of the wire. It will use common math that can be understood by most, and logic scripts and sequences to provide intuitive understanding.

The parameters will include the wire size #18, diameter .0403’, and an electrical 1/4λ wire. This will be a high-level overview first, followed by dissecting each of the concepts.

1. To anchor the calculations, the Z0 or surge impedance of the wire will be calculated.

The equation is LOG (L/D) • 138 = surge impedance. D = radius, L = 1 Meter.

Using inches: LOG (39.37/.02015) • 138 = (3.290924559 • 138) = 454.1475892R the surge impedance of the wire.

2. The Radiation Resistance of each of the 1/8λ legs of the Dipole, scratch calculated.

3.14159 ÷ 2 = 1.57079 Radians

.9739502^1.570795 = .95938646

1 - .950938646 = .040613538

1 ÷ .040613578 = 24.622332 The radiation Q of the leg

454R ÷ 24.622332 = 18.43854595

18.43854595 ÷ 2 = 9.219272975

9.219272975 • .707 = 6.518025993 The Radiation resistance of one leg.

3. The reactance of each leg.

Tan 45° = 1

454R ÷ 1 = -j 454

4. Legs combined.

RADIATION RESISTANCE = (6.518025993 • 2 = 13.03605199r)

REACTANCE = 454 • 2 = -j 908