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ELECTROMAGNETIC PERFORMANCE OF A WIRE GRID GROUND SCREEN

Ken Stewart, NRL, Code 7211

Recent discussions of the possible need for a ground screen beneath the LWA antennas has led to questions about requirements for the ground screen itself. This memo does not address the question of whether a ground screen will be necessary to meet LWA specifications, but only the question of how closely spaced a wire grid has to be to approximate a solid, perfectly conducting ground screen.

Figure 1 shows a section of a square wire grid used as a model for a simple ground screen consisting of thin wires of diameter $d \ll D$, where D is the center-to-center distance between the wires.

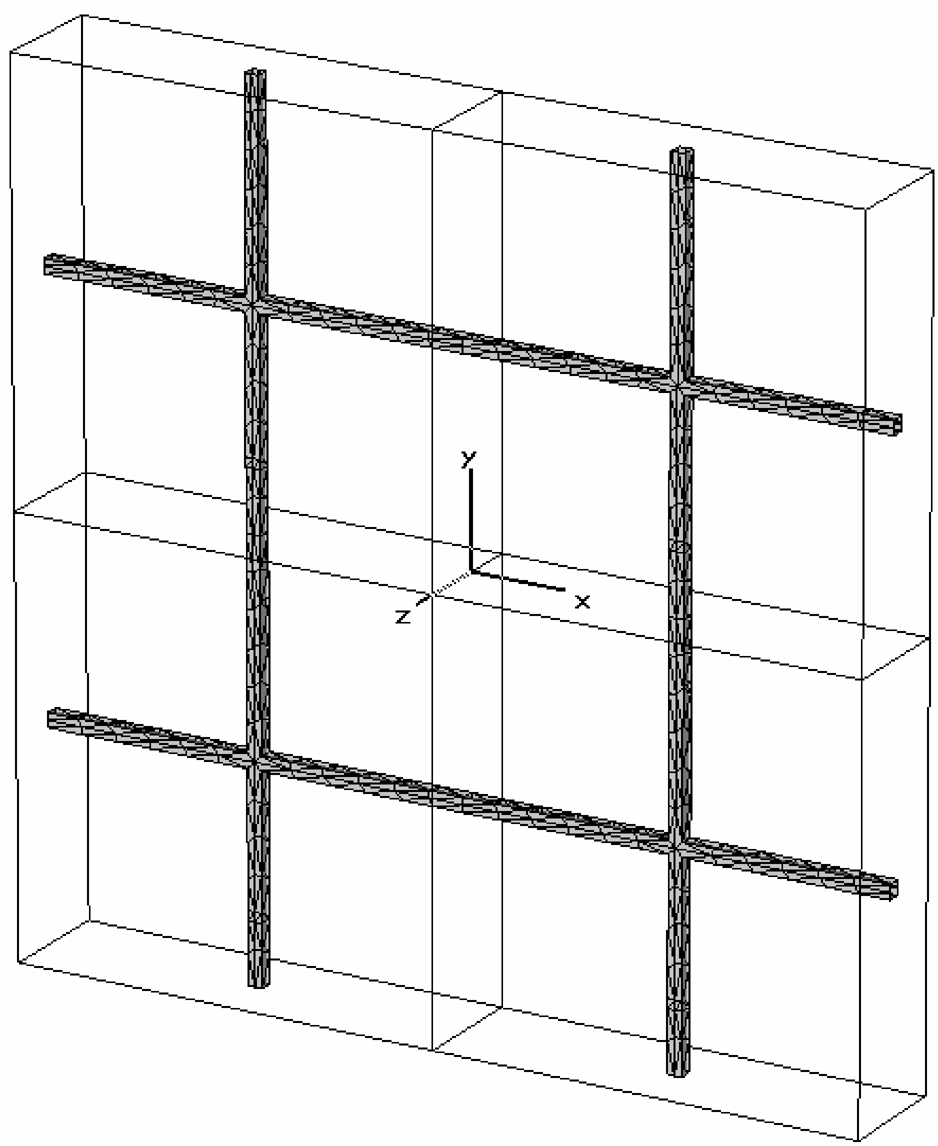

Figure 1. A section of the square grid ground screen used in the simulation.

Figure 2 shows a finite-integral time-domain calculation of the reflectance and transmittance of the wire grid for a plane wave at normal incidence. For this simulation the wire material was assumed to be an excellent conductor such as Cu or Al. Even a relatively poor conductor such as stainless steel, which has a resistivity 40 times that of Cu, differs significantly only above microwave frequencies, and for HF/VHF frequencies looks identical on the scale of Figure 2. This grid reflects 50% of the incident energy when the wavelength is four times the wire spacing, increasing to 90% at $\lambda = 12D$.

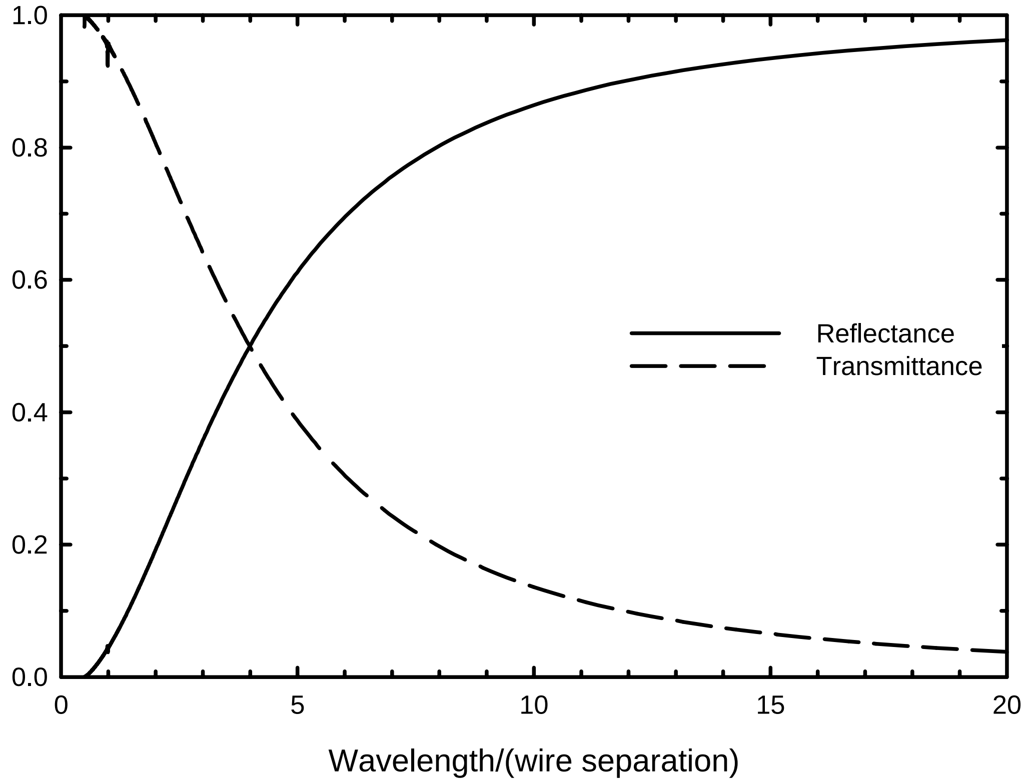

Figure 2. Calculated reflectance and transmittance of a ground screen consisting of a square grid of thin wires.

A specific example for the LWA, a square grid of thin (d = 3 mm) wires 10 cm apart would reflect 98.7% of the incident radiation at 80 MHz, and greater than this at lower frequencies. This same ground screen, if constructed from stainless steel wires, would still reflect 98.5% of incident RF power. These calculations for thin wires at normal incidence are the worst case. For thicker wires, or for angles of incidence other than 0º, as would occur at points other than directly beneath an antenna, the reflectance is even higher.