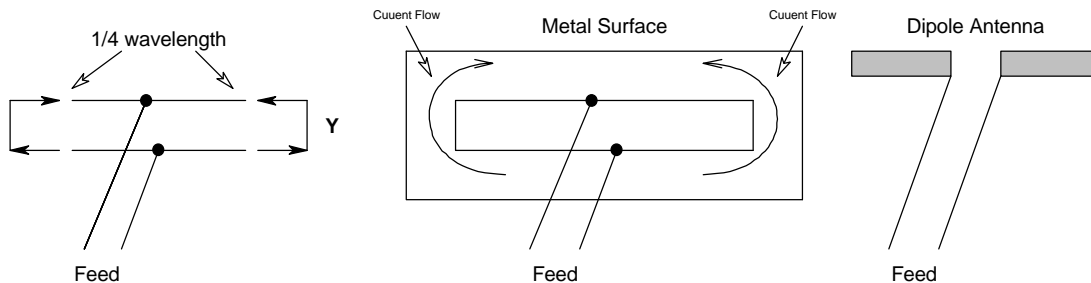


Bobby Brainwave

The Slot Radiator Antenna by Bobby Brainwave, N3VGS+

We are all familiar with a simple metal half-wave dipole antenna in free space and its characteristics. But what would we have in a half-wave dipole made of air and surrounded by metal? The slot radiator antenna, of course. At first glance, it would appear that this is no antenna at all but two shorted transmission lines $1/4$ wave-length long in parallel. The impedance should be infinite with no radiation.



The Slot Radiator Versus The Half Wave Dipole

Currents of opposite phase flow in the stubs and their fields cancel each other. Only in the end sections (y) are the currents in phase and limited radiation occurs. If the half-wave slot is cut out of a metal sheet, the non-canceling (y) circulate about the entire surface yielding a fairly efficient radiator.

What are the characteristics of a slot radiator? As you might have guessed, they are associated with those of a metallic half-wave dipole. The radiation pattern is a figure eight - the same as a dipole. The impedance at the center of the slot is related to dipole impedance by the formula $Z_m \times Z_s = (60 \pi)^2$. The value is approximately 500 ohms with decreasing impedance to zero ohms at the slot ends. Unlike the metallic dipole, the polarization is perpendicular to the slot. In other words, a vertical slot radiator has horizontal polarization while a vertical dipole is vertically polarized.

A special form of the slot radiator is constructed by bending the metallic sheet into a vertical cylinder with the slot vertical on one side. If the ratio of cylinder diameter to wavelength equals $1/8$ then the pattern is omnidirectional with horizontal polarity. Several cylindrical slot antennas can be stacked vertically to reduce high angle radiation and to concentrate the horizontally polarized, omnidirectional signal toward the horizon. Also, slot length is not limited to one half wavelength. It can be any multiple of half waves. The longer slot ($n \times \text{wavelength}/2$) opening yields lower impedance and higher antenna gain. This is a popular antenna array for UHF television, amateur television, and beacon transmitters. It works equally well for receiving.

Another odd antenna configuration is the small annular slot. As the slot radiator is a complement to the metallic dipole, so the small annular slot is a complement to the metallic loop antenna. It is often used as a flush mounted antenna to produce a pattern and polarization similar to a short dipole mounted on a large ground plane.

You should now be convinced that we can transmit and receive with an antenna made of "AIR".