

Using a Radial, Switchable, Sector Ground Screen to Produce Azimuthal Directivity for a Monopole Antenna

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Ground-mounted monopole antennas are usually driven against a radial-wire ground system to control the input impedance and to improve the radiation efficiency. This results in a radiation pattern that is uniform in azimuth angle with a front-to-back ratio of 1, or 0 dB.

The use of a sectorial ground screen, one whose radial or angular extent is varied to produce a radiation pattern having azimuthal directivity has received some attention (James R. Wait and Lillie C. Waters, National Bureau of Standards Monograph 60, April 15, 1963). In this discussion the effect of varying the number of “active” radials in an otherwise uniform ground system of radial wires is explored, an active radial being one that is electrically connected to the base of the monopole. A “passive” radial on the other hand is one that is separated from the monopole by a switch. By varying the number and angular locations of the active and passive ground wires, the resulting azimuth pattern can be varied in angle and directive gain. This arrangement makes possible a steerable pattern, something not usually associated with ground-mounted monopoles.

The antenna and ground screen are modeled using the well-known NEC package. For convenience in modeling here, the active radials are made into passive ones by adding a large resistance between the base of the monopole and a given radial. Directive gains of 5 dB and more are found to be possible in the initial work reported here. A more thorough exploration of this kind of ground system is being planned. An example of one system is shown in the figure below as the number of active radials is varied from 0 to 30.

