

SPIRAL ANTENNA – Study Material

Two-arm log spiral antenna

In microwave systems, a **spiral antenna** is a type of RF antenna. It is shaped as a two-arm spiral, or more arms may be used. Spiral antennas were first described in 1956. Spiral antennas belong to the class of frequency independent antennas which operate over a wide range of frequencies. Polarization, radiation pattern and impedance of such antennas remain unchanged over large bandwidth. Such antennas are inherently circularly polarized with low gain. Array of spiral antennas can be used to increase the gain. Spiral antennas are reduced size antennas with its windings making it an extremely small structure. Lossy cavities are usually placed at the back to eliminate back lobes because a unidirectional pattern is usually preferred in such antennas. Spiral antennas are classified into different types; archimedean spiral, square spiral and star spiral etc. Archimedean spiral is the most popular configuration.

Working

These antennas operate in 3 ways: traveling wave, fast wave, and leaky wave.

The traveling wave, formed on spiral arms, allows for broadband performance. Fast wave is due to mutual coupling phenomenon occurring between arms of spiral. Leaky wave “leaks” the energy during propagation through the spiral arms to produce radiation.

Ring theory (band theory) explains the working principle of spiral antenna. The theory states that spiral antenna radiates from an *active region* where the circumference of spiral equals the wavelength.

Applications

A spiral antenna transmits EM waves having a circular polarization. It will receive linearly polarized EM waves in any orientation, but will attenuate signals received with the opposite circular polarization. A spiral antenna will reject circularly polarized waves of one type, while receiving perfectly well waves having the other polarization.

One application of spiral antennas is wideband communications. Another application of spiral antennas is monitoring of the frequency spectrum. One antenna can receive over a wide bandwidth, for example a ratio 5:1 between the maximum and minimum frequency. Usually a pair of spiral antennas are used in this application, having identical parameters except the polarization, which is opposite (one is right-hand, the other left-hand oriented). Spiral antennas are useful for microwave direction-finding.