RF Antennas

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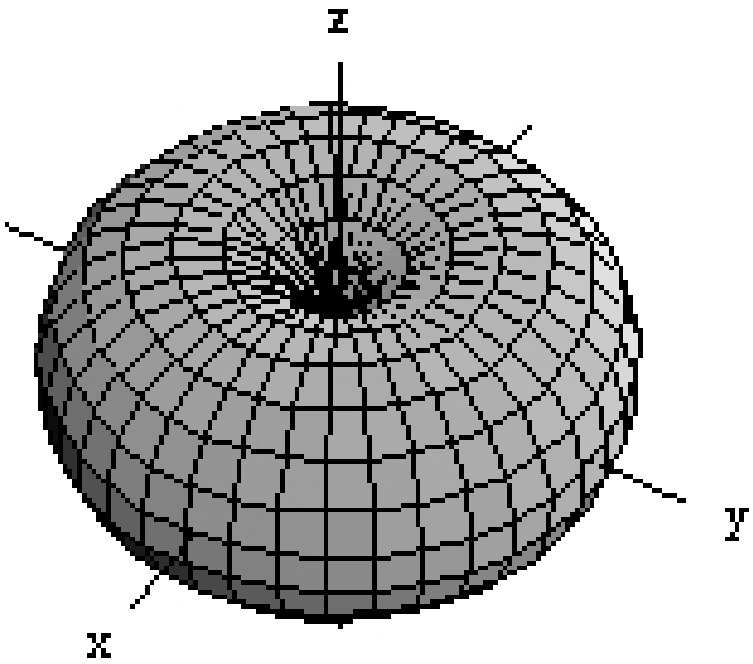
- An RF antenna is a device used to convert high frequency (RF) signals on a transmission line (a cable or waveguide) into propagated waves in the air. The electrical fields emitted from antennas are called *beams or lobes. There are three generic categories of RF* antennas:
- Omni-directional
- Semi-directional
- Highly-directional
- Each category has multiple types of antennas, each having different RF characteristics and appropriate uses.

Omni-directional (Dipole) Antennas

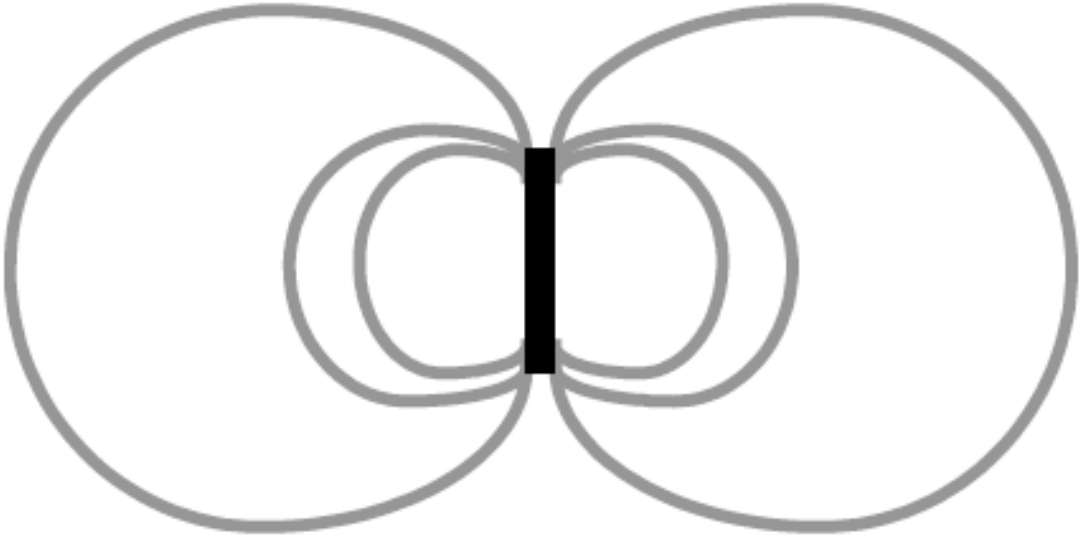
- The most common wireless LAN antenna is the Dipole antenna. Simple to design, the dipole antenna is standard equipment on most access points. The dipole is an omnidirectional antenna, because it radiates its energy equally in all directions around its axis. Directional antennas concentrate their energy into a cone, known as a "beam." The dipole has a radiating element just one inch long that performs an equivalent function to the "rabbit ears" antennas on television sets.

- Figure shows that the dipole's radiant energy is concentrated into a region that looks like a doughnut, with the dipole vertically through the "hole" of the "doughnut."



- The dipole radiates equally in all directions around its axis, but does not radiate along the length of the wire itself - hence the doughnut pattern. Notice the side view of a dipole radiator as it radiates waves in Figure. This figure also illustrates that dipole antennas form a radiation pattern if viewed standing beside a perpendicular antenna.

Dipole side-view

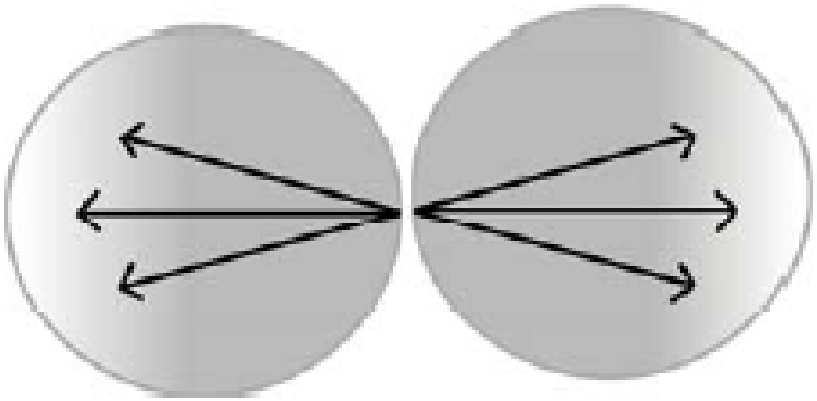


Usage

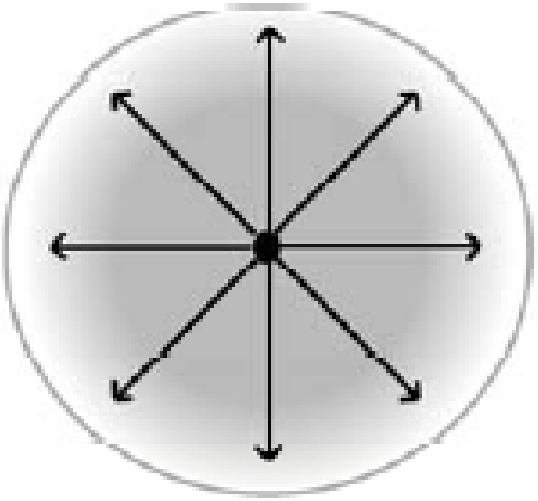
- Omni-directional antennas are used when coverage in all directions around the horizontal axis of the antenna is required. Omni-directional antennas are most effective where large coverage areas are needed around a central point. For example, placing an omnidirectional antenna in the middle of a large, open room would provide good coverage. Omni-directional antennas are commonly used for *point-to-multipoint designs with a* hub-n-spoke topology (See Figure 5.6). Used outdoors, an omni-directional antenna should be placed on top of a structure (such as a building) in the middle of the coverage area. For example, on a college campus the antenna might be placed in the center of the campus for the greatest coverage area.

Coverage area of an omni-directional antenna

Side View



Top View

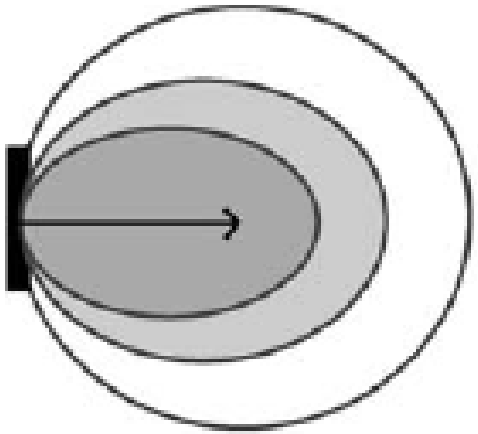


Semi-directional Antennas

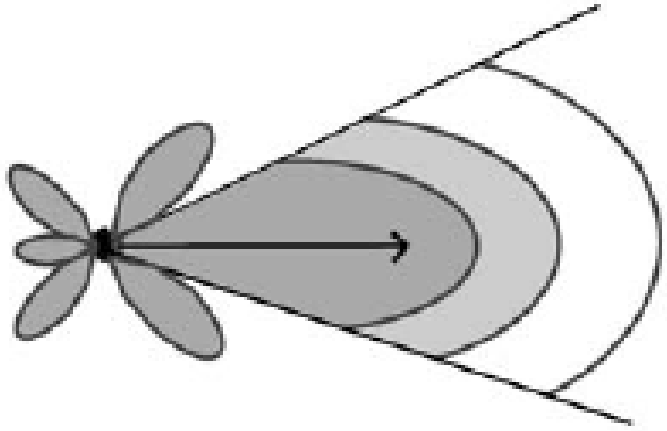
- Semi-directional antennas come in many different styles and shapes. Some semidirectional antennas types frequently used with wireless LANs are Patch, Panel, and Yagi (pronounced “YAH-gee”) antennas. All of these antennas are generally flat and designed for wall mounting. Each type has different coverage characteristics.
- These antennas direct the energy from the transmitter significantly more in one particular direction rather than the uniform, circular pattern that is common with the omnidirectional antenna. Semi-directional antennas often radiate in a hemispherical or cylindrical coverage pattern as can be seen in Figure

Coverage area of a semi-directional antenna

Directional Patch Antenna



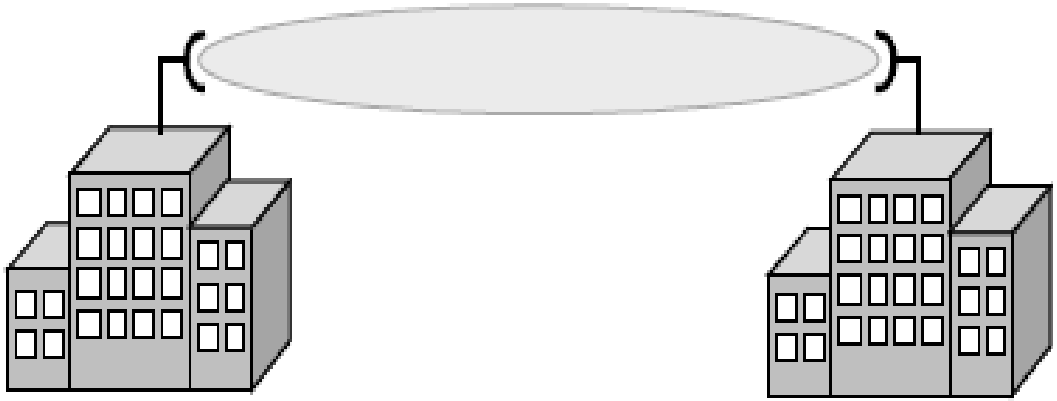
Directional Yagi Antenna



Usage

- Semi-directional antennas are ideally suited for short and medium range bridging. For example, two office buildings that are across the street from one another and need to share a network connection would be a good scenario in which to implement semidirectional antennas.

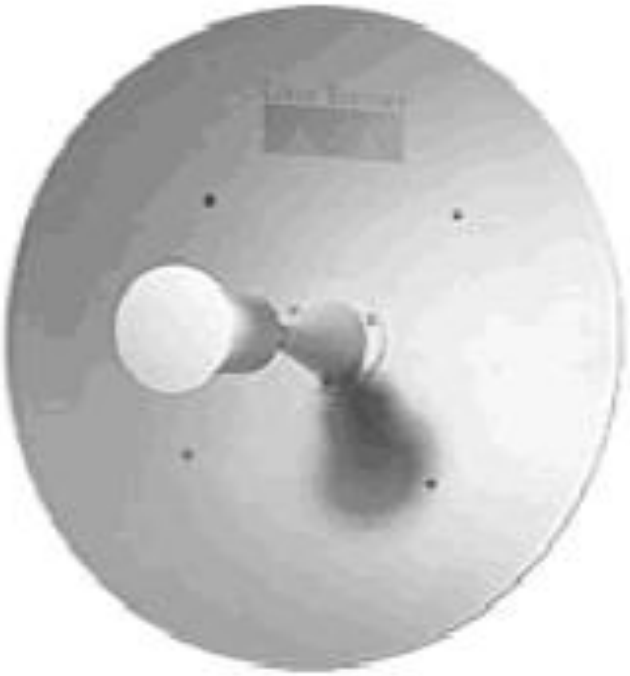
Point-to-point link using semi-directional antennas



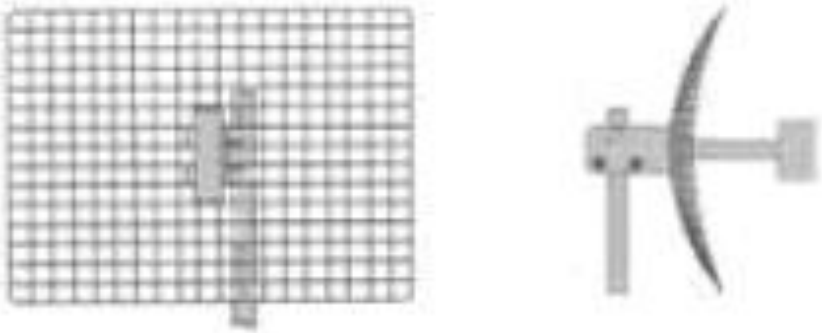
Highly-directional Antennas

- As their name would suggest, highly-directional antennas emit the most narrow signal beam of any antenna type and have the greatest gain of these three groups of antennas. Highly-directional antennas are typically concave, dish-shaped devices, as can be seen in Figures. These antennas are ideal for long distance, point-to-point wireless links. Some models are referred to as *parabolic dishes because they resemble small* satellite dishes. Others are called *grid antennas due to their perforated design for* resistance to wind loading.

Sample of a highly-directional parabolic dish antenna



Sample of a highly-directional grid antenna



Usage

- High-gain antennas do not have a coverage area that client devices can use. These antennas are used for point-to-point communication links, and can transmit at distances up to 25 miles. Potential uses of highly directional antennas might be to connect two buildings that are miles away from each other but have no obstructions in their path.

Thanks