ANTENNA AND WAVE PROPAGATION

Antenna Types and Applications

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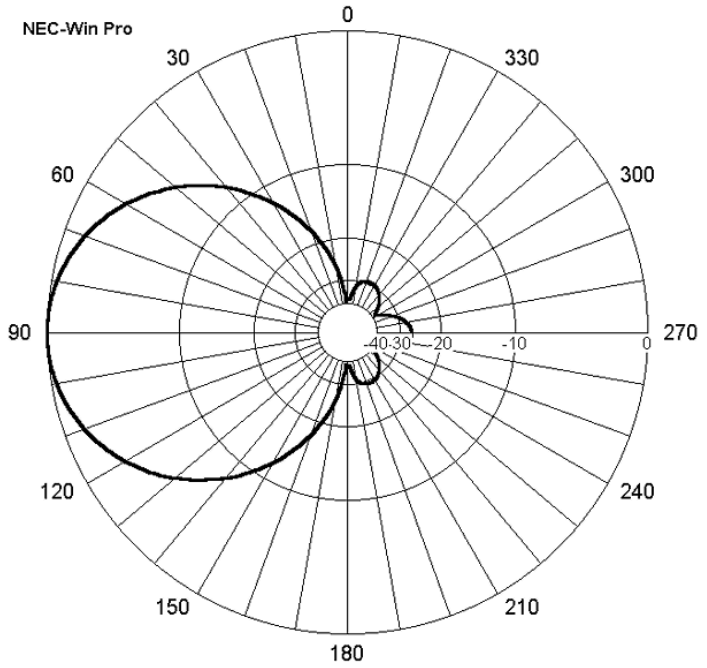
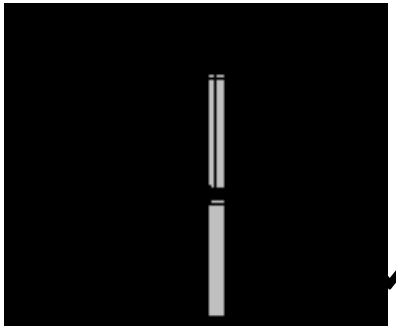
Antenna Principles

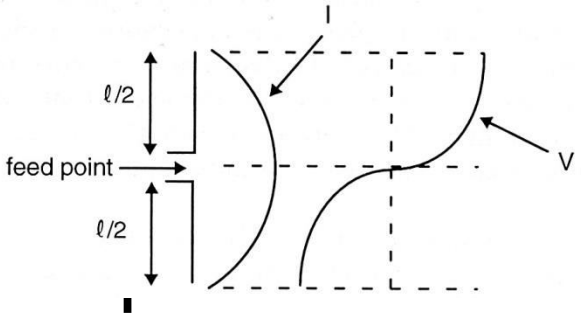
- Radiation Resistance
- Antenna Pattern
- **Directivity and Gain**
- **Bandwidth**
- **Signal-To-Noise Ratio**



Antenna Types

½ Wave Dipole





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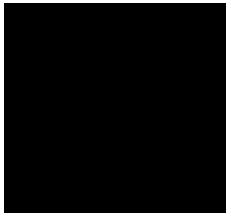

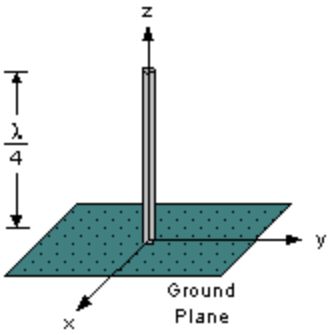

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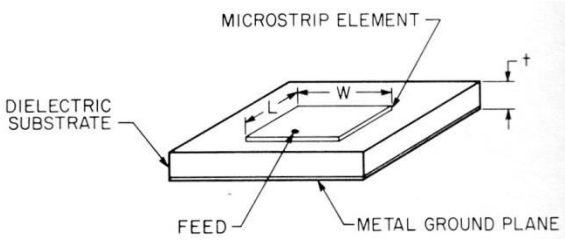
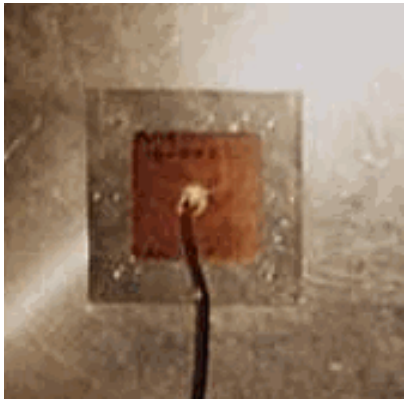
Antenna Types

Loop Antennas

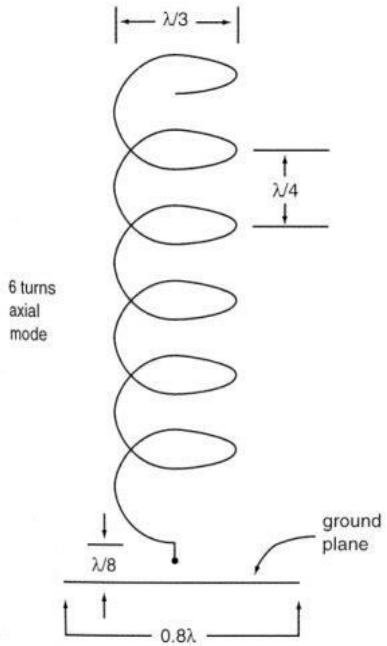
Microstrip Antennas



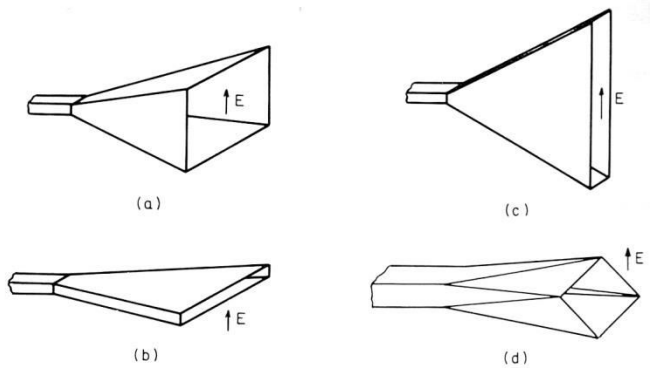


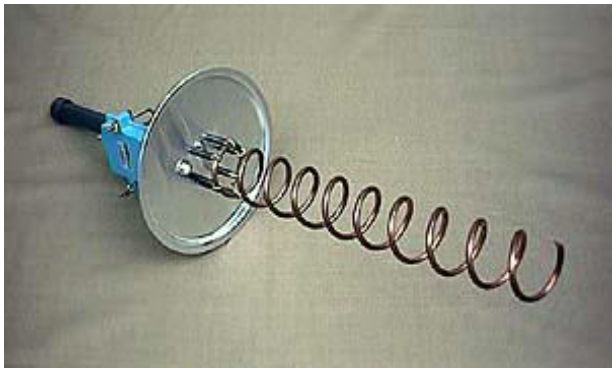
Antenna Types

Horn Antennas



Helical Antennas





FOLDED DIPOLE

- Folded antenna is a single antenna but it consists of two elements.
- First element is fed directly while second one is coupled inductively at its end.
- Radiation pattern of folded dipole is same as that of dipole antenna i.e figure of eight (8).

Advantages

- Input impedance of folded dipole is four times higher than that of straight dipole.
- Typically the input impedance of half wavelength folded dipole antenna is 288 ohm.
- Bandwidth of folded dipole is higher than that of straight dipole.

Microstrip ANTENNA

- The Hertzian dipole is a theoretical short dipole (significantly smaller than the wavelength) with a uniform current along its length.
- A true Hertzian dipole cannot physically exist, since the assumed current distribution implies an infinite charge density at its ends, and significant radiation requires a very high current over its very short length.

LOOP ANTENNA

- A **loop antenna** is a radio antenna consisting of a loop of wire with its ends connected to a balanced transmission line
- It is a single turn coil carrying RF current through it.
- The dimensions of coil are smaller than the wavelength hence current flowing through the coil has same phase.
- Small loops have a poor efficiency and are mainly used as receiving antennas at low frequencies. Except for car radios, almost every AM broadcast receiver sold has such an antenna built inside of it or directly attached to it.

- A technically small loop, also known as a magnetic loop, should have a circumference of one tenth of a wavelength or less. This is necessary to ensure a constant current distribution round the loop.
- As the frequency or the size are increased, a standing wave starts to develop in the current, and the antenna starts to have some of the characteristics of a folded dipole antenna or a self-resonant loop.
- Self-resonant loop antennas are larger. They are typically used at higher frequencies, especially VHF and UHF, where their size is manageable. They can be viewed as a form of folded dipole and have somewhat similar characteristics. The radiation efficiency is also high and similar to that of a dipole.

- Radiation pattern of loop antenna is a doughnut pattern.
- Can be circular or square loop
- No radiation is received normal to the plane of loop and null is obtained in this direction.
- Application: Used for direction finding applications

TURNSTILE ANTENNA

- A **turnstile antenna** is a set of two dipole antennas aligned at right angles to each other and fed [illegible] degrees out-of-phase.
- The name reflects that the ant[illegible] looks like a turnstile when mou[illegible] horizontally.
- When mounted horizontally antenna is nearly omnidirectional on the horizontal plane.

- When mounted vertically the antenna is directional to a right angle to its plane and is circularly polarized.
- The turnstile antenna is often used for communication satellites because, being circularly polarized, the polarization of the signal doesn't rotate when the satellite rotates.

Antenna Applications

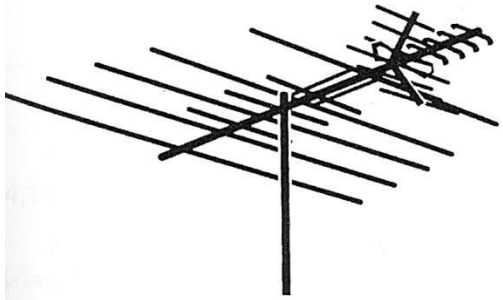
U.S. Navy's ELF system

- Operates at 76 Hz
- 80 miles of wire
- Penetrates to underwater subs
- One-way system

Antenna Applications

VHF and UHF Antennas

Transmitting Tower



UHF/VHF/FM
Receiving Antenna

Antenna Applications

Wireless Communications

¼ Wave Helical

¼ Wave 2-in-1

¼ Wave Whip