LOOP ANTENNAS

- Another method of using long wire is by bending and making the wire into a loop shaped pattern and observing its radiational parameters.
- An RF current carrying coil is given a single turn into a loop, can be used as an antenna called as **loop antenna**.
- The currents through this loop antenna will be in phase.
- The magnetic field will be perpendicular to the whole loop carrying the current.
- Frequency Range-
  - around **300MHz to 3GHz**.in **UHF** range.

Construction & Working

- A loop antenna is a coil carrying radio frequency current.
- It may be in any shape such as circular, rectangular, triangular, square or hexagonal according to the designer's convenience.
- Loop antennas are of two types.
  - Large loop antennas
  - Small loop antennas

Large loop antennas

- Large loop antennas are also called as **resonant antennas**.
- They have high radiation efficiency.
- These antennas have length nearly equal to the intended wavelength.

$$L=\lambda$$

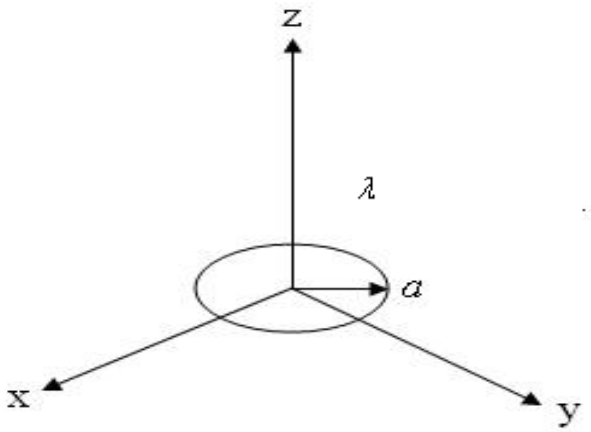
- Where,
  - **L** is the length of the antenna
  - **λ** is the wavelength
- The main parameter of this antenna is its perimeter length, which is about a wavelength and should be an enclosed loop.

Small Loop Antennas

- The small loop antenna is a closed loop.
- have low radiation resistance and high reactance.
- Their impedance is difficult to match to a transmitter.
- As a result, these antennas are most often used as receive antennas.
- also called as **magnetic loop antennas.**

The radius is a, and is assumed to be much smaller than a wavelength ($a << \lambda$). The loop lies in the x-y plane.

Since the loop is electrically small, the current within the loop can be approximated as being constant along the loop, so that $I = I_0$.



- These antennas are of the size of one-tenth of the wavelength.

$$L=\lambda/10$$

- **Frequently Used Loops**
  - Circular loop antennas
  - Square loop antennas
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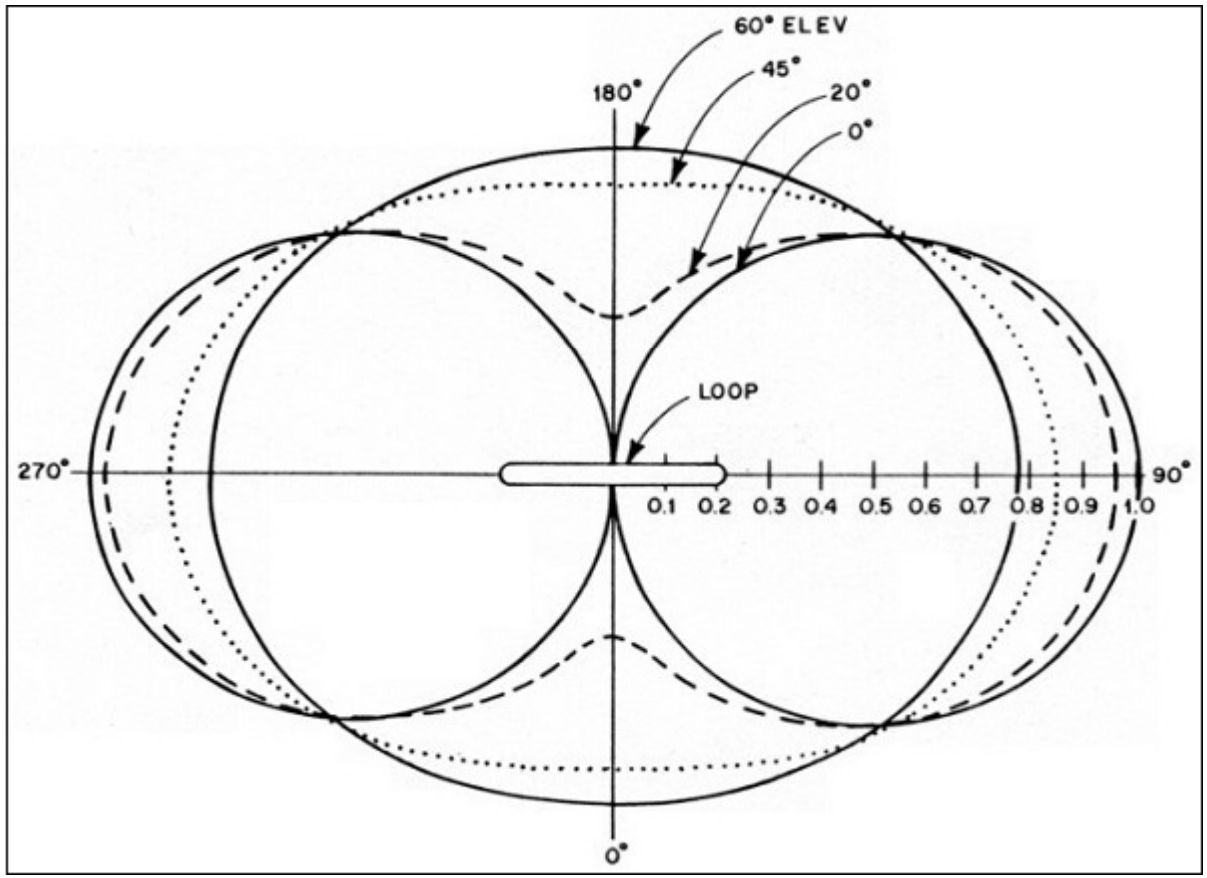
Fig 1: Circular loop antenna

Fig 2: Square loop antenna

Radiation Pattern



- Advantages
  - Compact in size
  - High directivity
- Disadvantages
  - Impedance matching may not be always good
  - Has very high resonance quality factor
- Applications
  - Used in RFID devices
  - Used in MF, HF and Short wave receivers
  - Used in Aircraft receivers for direction finding
  - Used in UHF transmitters