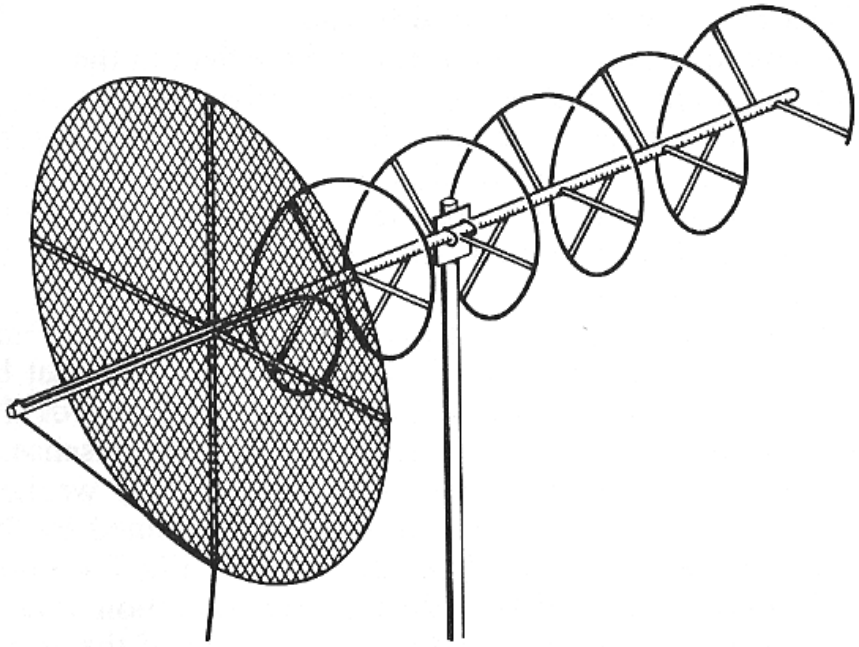
Design and Fabrication of a Helical Antenna for 3.3 GHz Frequency



This all done by **Eng. Taha Mahia**

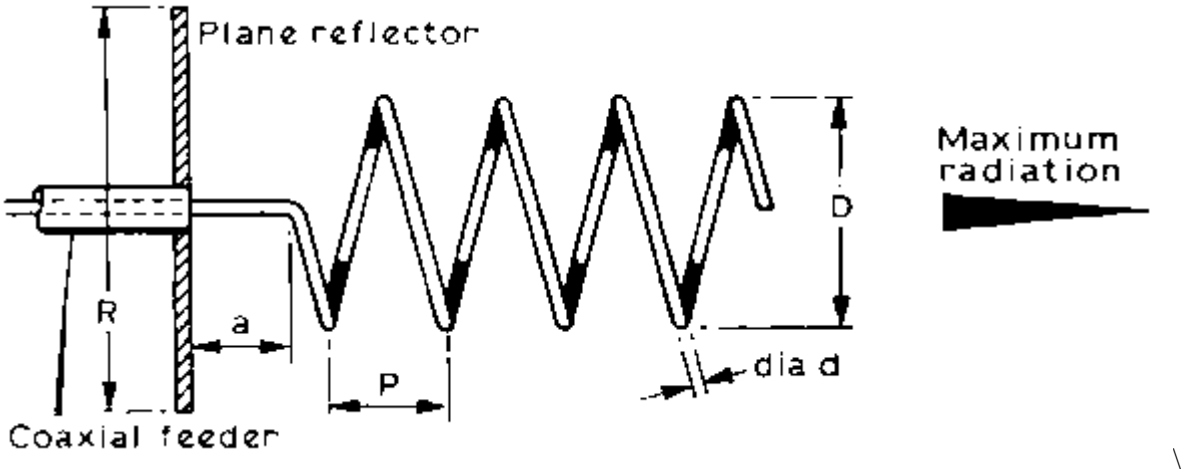


Fig.1 Helical Antenna Sketch

Objective:

The purpose of this project is to design and fabricate a helical antenna tuned for a frequency of 3.3 GHz. The antenna's dimensions are calculated based on the wavelength of the target frequency to optimize its performance for FPV drone video signal reception.

Calculations:

To determine the dimensions of the antenna, the wavelength (λ) is calculated using the formula:

$$\lambda = \frac{c}{f}$$

Where:

- c : Speed of light in vacuum ($3 \times 10^8 m / s$)
- f: Frequency (3.3 GHz)

$$\lambda = 90.9\, mm$$

Antenna Dimensions:

Based on the calculated wavelength, the antenna's dimensions are as follows:

- **Helix Diameter (D)**: $\lambda/\pi \approx 28.9$ mm
- **Turn Spacing (S)**: $0.23\lambda \approx 20.9$ mm
- **Reflector Diameter**: $2\lambda \approx 181.8$ mm
- **Spacing Between Antenna and Reflector**: 0.25λ to 0.5λ = 22.5 mm to 45 mm

Material and Construction:

- **Material**: Copper
- **Wire Diameter**: 1 mm
- **Reflector Thickness**: 1 mm
- **Polarization**: Right-Hand Circular Polarization (RHCP)
  Note: Can be modified to Left-Hand Circular Polarization (LHCP) in the SCAD code.

Application:

This antenna is intended for FPV drone video reception. Two variants of the antenna are used in this project: a 3-turn and a 10-turn helical antenna.

Performance Comparison:

Specification	3-Turn Antenna	10-Turn Antenna
Gain	7 to 9 dBi	14 to 16 dBi
Beamwidth	60° to 70°	30° to 40°
Range	5 to 10 km (with 3W VTX)	15 to 20+ km (with 3W VTX)
Use Case	Near-field applications	Far-field applications

SCAD Code and 3D Model in This GitHub Repository: