**Signal Strength Calculation Plan**

**Purpose**

To calculate the signal strength between drones or between a drone and its operator. The calculation will depend on the propagation model, communication type, and environmental conditions.

**Parameters**

1. **Propagation Models** (user-selectable):
   * **Free-Space Path Loss**: Models signal attenuation in open space.
   * **Two-Ray Ground-Reflection**: Considers direct and ground-reflected rays.
   * **Knife-Edge Diffraction**: Accounts for signal bending around obstacles.
2. **Communication Types** (user-selectable):
   * **WiFi**: Higher frequencies with shorter range.
   * **Radio**: Lower frequencies with longer range.
3. **Environmental Factors**:
   * Distance between transmitter and receiver.
   * Transmitter and receiver heights.
   * Frequency of operation.
   * Environmental obstacles (used in Knife-edge diffraction).

**The signal strength function**

* **Input:** 
  + **Propagation Model**
  + **Communication Types**
  + **Environmental Factors:**
    - Distance between transmitter and receiver (d)
    - Transmitter height (h\_t​)
    - Receiver height (h\_r​)
    - Frequency (f)
    - Environmental obstacles
* **Output:**
  + signal strength between drones or between a drone and its operator
* **Equations:**

1. **Free-Space Path Loss:**

* **P\_t - Transmitted power**
* **G\_t, G\_r ​- Gains of transmitter and receiver antennas**
* **d - Distance between transmitter and receiver (in meters)**
* **f - Frequency of operation (in Hz)**
* **c - Speed of light**

1. **Two-Ray Ground-Reflection**

* **h\_t, h\_r - Heights of transmitter and receiver (the drone) antennas**

1. **Knife-Edge Diffraction**

* **d\_1, d\_2 - Distances from the obstacle to transmitter and receiver**
* **d\_t, d\_r - Distance from the transmitter and receiver to the obstacle**
* **h\_eff - Effective height of the obstacle**
* **- Wavelength (c/f)**
* **v - is the Fresnel-Kirchhoff diffraction parameter - It quantifies the relative height of the obstacle in the path of the signal and determines the amount of diffraction loss.**