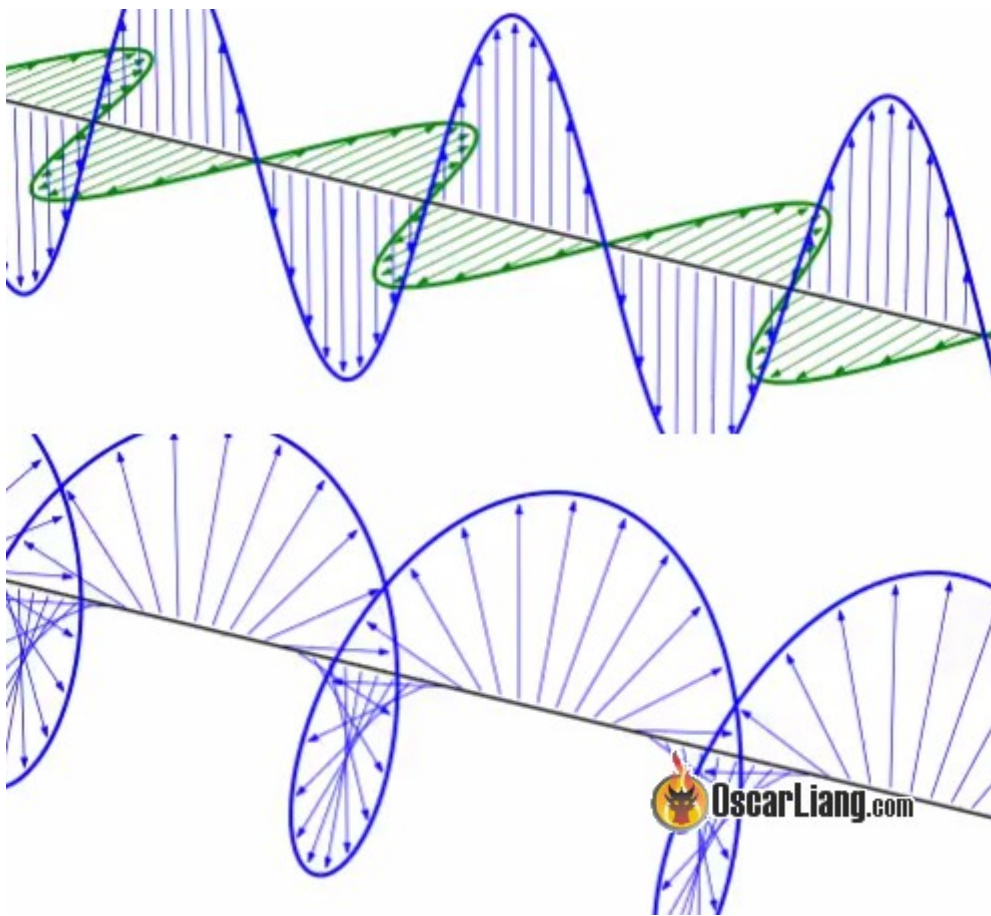


CIRCULAR OR LINEAR POLARIZED ANTENNA FOR FPV



Share this:



Antennas for FPV can be categorized by their polarization: linear and circular. In this article we will discuss the differences between linear and circular polarized antennas.

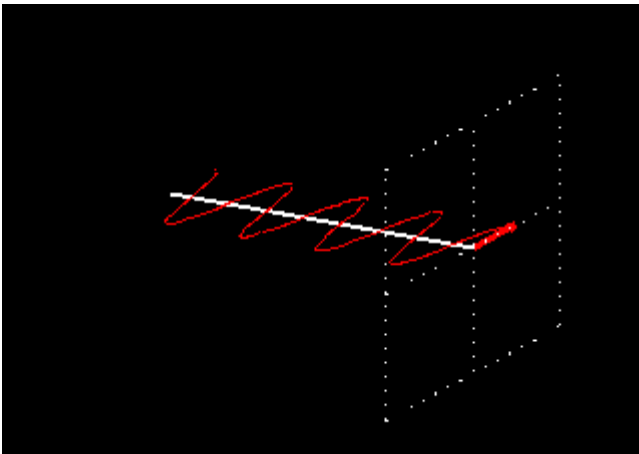
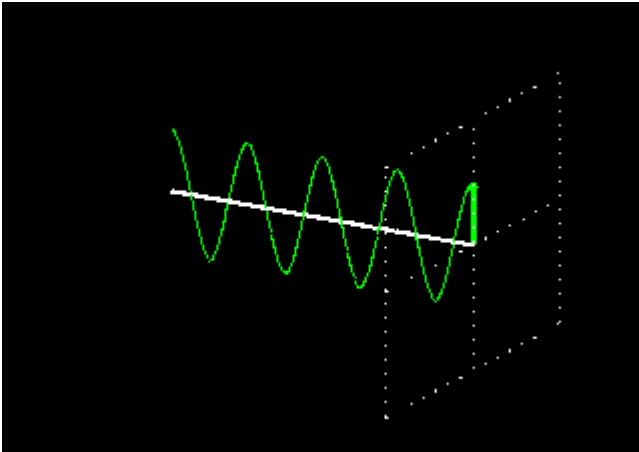
To learn more about [FPV antenna basics and our recommendations](#). If you are new to FPV, you should read up on this [guide for FPV system](#).

Types of Polarization

Polarization means the way radio signal travels in space. It's often mentioned in discussion of FPV antennas. In this section we will discuss the differences, pro's and con's of Linear and Circular Polarization to FPV system performance.

Linear Polarization

Linear polarized signal oscillates horizontally or vertically in one plane while travelling.



Linear Polarization is used in some of the most basic antennas, such as the stock dipole antennas that comes with your VTX and VRX, or even in your home WiFi.



Pros and Cons of Linear Polarization

Linear polarized antennas are widely used due to its structural simplicity, which can be as simple as a piece of wire. The antennas tend to be smaller, cheaper and easier to build and repair.

In general linear polarization is great for long range as all the energy is focused on a single plane. The range advantage is seldom realized due to multipath interference which we will discuss shortly.

In order to get the best reception, both transmitting and receiving linear polarized antennas have to be aligned to ensure maximum radiation overlap.

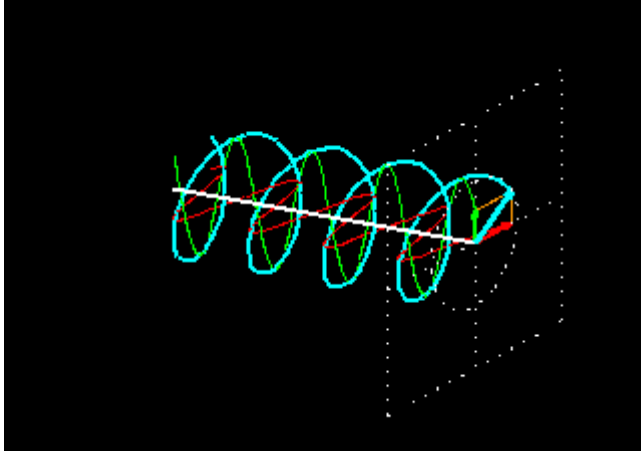
The most extreme case is when the transmitter and receiver antennas are 90 degrees to one another, resulting in the least amount of signal overlap. This results in 30dB loss in signal strength and it's referred to as **cross polarization**.

Our multirotor is moving constantly in the sky, it's simply impossible to keep the antennas aligned at all times and therefore resulting in unstable FPV signal.

To solve this problem, we normally use circular polarized antennas.

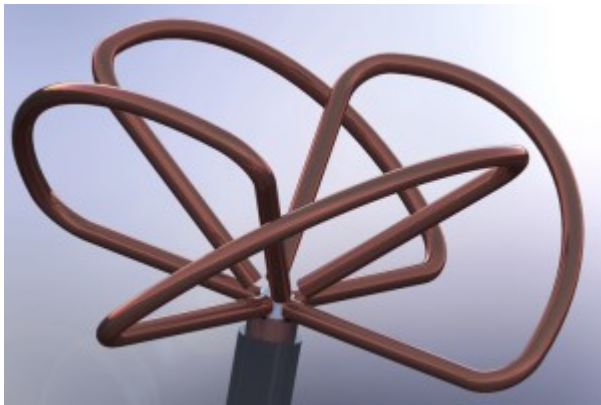
Circular Polarization

In circular polarization, signal are transmitted on both horizontal and vertical planes with 90 degree phase shift that looks like a spinning corkscrew.

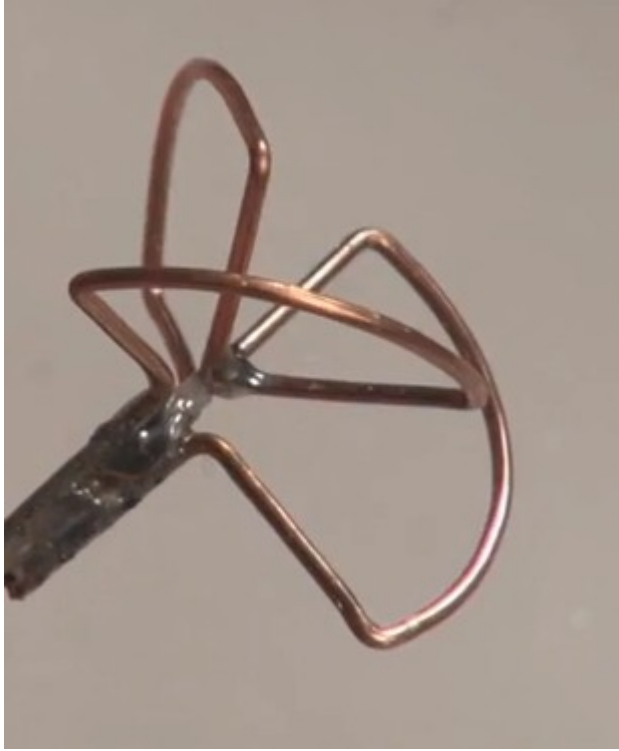


Here are some of the common circular polarized antennas for FPV.

Skew-Planar Wheel antenna is circularly polarized and has excellent multipath rejection capability. This antenna is used for general purpose flying where aerodynamic drag (e.g. wind) is not a critical factor. While generally regarded as a receiver antenna, it works well as a transmit antenna too.



The Cloverleaf antenna is more commonly seen on a transmitter. It can be coupled with a Skew Planar wheel for better range and signal penetration.



Pros and Cons of Circular Polarization

Circular polarized signal always overlap no matter what orientation or angle your mini quad is flying at relative to your receiving antenna. For this reason circular polarized antennas have become the standard in FPV flying.

Another advantage of circular polarized antennas is their ability to reject **multipath interference**.

Multipath interference is the most common reason for bad video quality, in the form of random color change, static, scrambled image and drop-outs. It happens when the signal is reflected from object and gets distorted with phase delay, and it interferes with the main signal.



Circular polarized antennas are either left-hand (LHCP) or right-hand (RHCP). Transmitter and receiver need to have matching antennas otherwise it could result in significant signal loss.

CP antennas can benefit from this property against multipathing. Every time a CP signal bounces off object it changes its polarization direction. And LHCP antenna rejects RHCP signal and vice versa (cross polarization).



When to use circular polarization

- When flying close to large objects such as trees, buildings, or in enclosed environment such as car parks and stadiums
- Acrobatic flying where the aircraft orientation and angle are constantly changing
- Low altitude flying (proximity flying)

When to use linear polarization

- Long distance flying in the open without any obstacles
- Stable flying without too much roll or pitch
- When antenna size, weight and durability are the most important consideration

Edit History

- Oct 2013 – article created
- May 2017 – article revised