

Receiving and Transmitting Antennas:

Abstract-The report is divided into three main sections: history and definition(introduction), classification and how the antennas are related to electromagnetic(Theory).

I-Introduction:

The origin of the word *antenna* relative to wireless apparatus is attributed to [Guglielmo Marconi](#). In 1895, while testing early radio apparatus in the [Swiss Alps](#) at [Salvan, Switzerland](#) in the [Mont Blanc](#) region, Marconi experimented with early wireless equipment. A 2.5 meter long pole, along which was carried a wire, was used as a radiating and receiving aerial element. In Italian a tent pole is known as *l'antenna centrale*, and the pole with a wire alongside it used as an aerial was simply called *l'antenna*. Until then wireless radiating transmitting and receiving elements were known simply as aerials or terminals. Marconi's use of the word *antenna* ([Italian](#) for *pole*) would become a popular term for what today is uniformly known as the *antenna*

An **antenna** is a [transducer](#) designed to [transmit](#) or [receive electromagnetic waves](#). In other words, antennas convert electromagnetic waves into electrical currents and vice versa. Antennas are used in systems such as [radio](#) and [television](#) broadcasting, point-to-point radio communication, [wireless LAN](#), [radar](#), and [space exploration](#). Antennas usually work in air or [outer space](#), but can also be operated under water or even through soil and rock at certain frequencies for short distances.

Physically, an antenna is an arrangement of [conductors](#) that generate a radiating [electromagnetic field](#) in response to an applied alternating voltage and the associated alternating [electric current](#), or can be placed in an electromagnetic field so that the field will [induce](#) an alternating current in the antenna and a voltage between its terminals. Some antenna devices ([parabolic antenna](#), [Horn Antenna](#)) just adapt the free space to another type of antenna



Short Wave "[Curtain](#)" Antenna (Moosbrunn, Austria)

II-Classification:

There are two fundamental types of antennas, which, with reference to a specific three dimensional (usually horizontal or vertical) plane are either:

1. Omni-directional (radiates equally in all directions), such as a [vertical rod](#) or
2. Directional (radiates more in one direction than in the other).

In colloquial usage omni-directional usually refers to all horizontal directions with reception above and below the antenna being reduced in favor of better reception (and thus range) in other directions. Also directional antennas are usually meant to refer to one targeting a single specific direction such as a telescope, satellite dish, or possibly a 120°

horizontal reception and transmission area

III-Theory:How the antennas are related to electromagnetic:

There are several critical parameters affecting an antenna's performance that can be adjusted during the design process. These are [resonant frequency](#), [impedance](#), [gain](#), [aperture](#) or [radiation pattern](#), [polarization](#), efficiency and [bandwidth](#). Transmit antennas may also have a maximum power rating, and receive antennas differ in their noise rejection properties. All of these parameters can be [measured](#) through various means. In this section I will concentrate on polarization parameter because it is the most parameter that is related to the main topic:

The [polarization](#) of an antenna is the orientation of the electric field ([E-plane](#)) of the radio wave with respect to the Earth's surface and is determined by the physical structure of the antenna and by its orientation. It has nothing in common with antenna directionality terms: "horizontal", "vertical" and "circular". Thus, a simple straight wire antenna will have one polarization when mounted vertically, and a different polarization when mounted horizontally. "Electromagnetic wave polarization filters" are structures which can be employed to act directly on the electromagnetic wave to filter out wave energy of an undesired polarization and to pass wave energy of a desired polarization.

Reflections generally affect polarization. For radio waves the most important reflector is the [ionosphere](#) - signals which reflect from it will have their polarization changed unpredictably. For signals which are reflected by the ionosphere, polarization cannot be relied upon. For

[line-of-sight communications](#) for which polarization can be relied upon, it can make a large difference in signal quality to have the transmitter and receiver using the same polarization; many tens of dB difference are commonly seen and this is more than enough to make the difference between reasonable communication and a broken link.

Polarization is largely predictable from antenna construction but, especially in directional antennas, the polarization of side lobes can be quite different from that of the main propagation lobe. For radio antennas, polarization corresponds to the orientation of the radiating element in an antenna. A vertical [omnidirectional WiFi](#) antenna will have vertical polarization (the most common type). An exception is a class of elongated waveguide antennas in which vertically placed antennas are horizontally polarized. Many commercial antennas are marked as to the polarization of their emitted signals.

Polarization is the sum of the E-plane orientations over time projected onto an imaginary plane perpendicular to the direction of motion of the radio wave. In the most general case, polarization is elliptical (the projection is oblong), meaning that the antenna varies over time in the polarization of the radio waves it is emitting. Two special cases are [linear polarization](#) (the ellipse collapses into a line) and [circular polarization](#) (in which the ellipse varies maximally). In linear polarization the antenna compels the electric field of the emitted radio wave to a particular orientation. Depending on the orientation of the antenna mounting, the usual linear cases are horizontal and vertical polarization. In circular polarization, the antenna continuously varies the electric field of

the radio wave through all possible values of its orientation with regard to the Earth's surface. Circular polarizations, like elliptical ones, are classified as right-hand polarized or left-hand polarized using a "thumb in the direction of the propagation" rule. Optical researchers use the same rule of thumb, but pointing it in the direction of the emitter, not in the direction of propagation, and so are opposite to radio engineers' use.

In practice, regardless of confusing terminology, it is important that linearly polarized antennas be matched, lest the received signal strength be greatly reduced. So horizontal should be used with horizontal and vertical with vertical. Intermediate matchings will lose some signal strength, but not as much as a complete mismatch. Transmitters mounted on vehicles with large motional freedom commonly use circularly polarized antennas so that there will never be a complete mismatch with signals from other sources. In the case of radar, this is often reflections from rain drops.

Conclusion: Through this report I gave an overview of antennas and its different type. Also, I talked about the most important part which consider how this topic is related to Electromagnetics.

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