Magnetic Field on Radio Waves

The earth's magnetic field exerts a deflecting force on the moving electrons. This force on an electron is proportional to the product of instantaneous velocity of the electron and the component of earth's magnetic field at right angles to the velocity of the electron. The direction of this force is at right angles to both the velocity of the electron and to the component of the magnetic field exerting force. The electrons move along the electric field of the radio wave. A component of earth's magnetic field at right angles to this electric field exerts a force at right angles to both the electric field and this magnetic field. The electron then follows an elliptical path. In following this elliptical path the electron develops components of velocity at right angles to the electric field of the wave. Out of the total energy absorbed from the electric field of the wave the electron now re radiated a part thereof with a polarization rotated by ninety degree in space with respect to the polarization of the incident electro magnetic wave. This re radiated field in general differs in time phase from the field of the incident wave. The resultant wave which is now a combination of the incident wave and the re radiated wave is thus elliptically polarized. Thus the component of earth's magnetic field at right angles to the electric field of the incident plane polarized wave causes a radio wave to get elliptically polarized after it has traveled some distance in the ionosphere.

The average velocity of the electron in the ionized medium is inversely proportional to frequency hence the effect of earth's magnetic field on the paths of the vibrating electrons is greater, the lower the frequency of the incident wave. At very high frequencies the elliptical path followed by the electron is very narrow. As the frequency is reduced, both the major and minor axis of the ellipse increases. With reduction in frequency the size of the ellipse continuously grows until at some frequency in the proximity of fourteen hundred kilo hertz called the gyro frequency. Cyclotron, resonance occurs and the electron follows a spiral path of continuously increasing radius and continuously increasing velocity. At frequencies lower than the gyro frequency the electrons follow rather complicated paths with components of velocity both parallel and at right angles with the plane of polarization. It is the component of the earth's magnetic field at right angles to the electric filed of the wave which influences the polarization of the radio wave. If the earth's magnetic field is in the same direction as the electric field of the radio wave then the magnetic field fails to have any influence on the radio wave.

About the Author

Tymon Hytem has worked in the electronics field for the past 15 years. He enjoys helping people decide on electronic gadgets from finding the right phone for your business and can help you choose the perfect Background Music for your business needs.

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