CHAPTER: 1

METAMATERIAL WITH ANTENNAS

[1]JAIMINI SHAH
[1]School of engineering and technology
Apeejay stya university Sohna-Palwal road, Gurugram

[2]Dr. PARIKSHIT VASISHT
[2]School of engineering and technology
Apeejay stya university Sohna-Palwal road, Gurugram

[3]Dr. SUDHAKAR RANJAN
[3]School of engineering and technology
Apeejay stya university Sohna-Palwal road, Gurugram

Ch.Id:-ASU/GRF/EB/RPETHEAT/2022/Ch-01
DOI: https://doi.org/10.52458/9789391842888.2022.eb.grf.asu.ch-01

INTRODUCTION

This rapid evaluation shows use of structured metamaterial (MTM) in microstrip patch antenna design for improvement of antenna performance. In recent years, the demand for antenna size reduction and integration with many of telecommunication equipment is of great interest, widely and rapidly used system such as communication systems like mobile, smart phones, GPS, wireless Internet devices, etc. for satisfying demands, the wireless device and their components must be compact and capable of multifunction, multifrequency band operation. For an device, antenna must be conformal to the body of device, reduced in size, and capable to operating at multiple frequencies of wireless system. Nowadays, many technical solutions approaching for microstrip antenna used for miniaturized antenna. However, these methods have disadvantage such as narrow bandwidth and low gain. A new solution that is electromagnetic metamaterials which is use for reduces the size of the antenna, improve other antenna parameters such as enhancing bandwidth, increasing gain, or generating multiband freq uencies of antennas operations. Metamaterial having property of negative permeability μ and negative permittivity Ɛ (DNG) which is not obtained naturally. This concept presents a use of metamaterial, its properties and applications pertaining to antenna design and developments to escalate the transmission rate and control of direction of transmission in antenna.

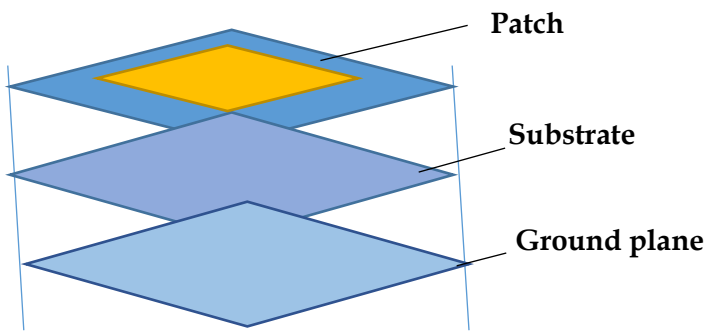

Figure-1.1 Microstrip antenna design

METAMATERIAL

The rapid use of wireless communication devices, now days miniaturized, low gain, high performance antennas are in demand. Micro-strip antenna also called patch antenna. MSA Invented by Bob Munson in 1972 as most useful antenna at microwave frequencies (f > 1 GHz) and micro strip antenna consists of a metal "patch" on top of a

dielectric substrate in middle with bottom ground .

The patch is also in a very style of shapes, but rectangular and circular are the foremost common the utilization of one patch isn't enough to create it efficient for broadband or high- frequency wireless transmissions. inclusion of framing one patch on another into an acceptable structure so it are often effective to use it in multiple frequency operations and also it'll easily support both the circular and linear polarizations at the identical time or simultaneously. Usually, a patch within the antenna acts as a resonant cavity nothing but a hollow metallic conductor which can induce a powerful current when placed during a particular field and can produce the radiation.

These antennas are used widely for the ultra-wideband applications where signals with high-frequency ranges are transmitted over a short-range of areas leading to high data rates and improved bandwidth and quality-factors. it's to be noted that there should be an ideal impedance matching required between the feed and cargo points and a relentless gain throughout the matching frequency range and will be cost-effective. Low profile, multiband antennas are one in all the foremost significant and interesting subjects in communication fields. Since the start of radio communication, the will for tiny and versatile antennas has been increasing.

Today's requirement evolving more multifunctional devices like tiny mobile terminals including cell-phones, handheld portable wireless devices for internet connection, short and long range communication equipment's, frequency Identification (RFIDs), etc. These applications together with continuing growth of wireless devices still challenge the community to form low profile multifrequency antennas like microstrip antenna. In recent decades, scientists have spent lots of your time and energy . MTMs are artificial structures to produce unique electromagnetic properties that don't seem to be available in natural materials. The unique properties of materials allow the involvement of high-performance antennas, filters, and microwave devices.

Firstly 1968 by Veselago studied the metamaterials with negative permittivity and permeability (DNG),then termed this material like media left-hand (LH) which is made by triad's of vectors: field of force, field, and phase propagation, the consequences by metamaterials will be observed in transmission of electromagnetic waves. This phenomenon occurs due to an antiparallel group and therefore the phase velocity ends up in the inversion of the wave fronts, while in design its energy is moving far-away from the source. Different metamaterial structure used for microwave and ultra-wide frequency and tera-frequency fields in devices with integrated network sensors within different field of communication, science and technology.

Antenna loaded with the one, two, and three-dimensional MTM structures with a periodic subwavelength unit leads a RLC resonant structures and allows to take control over electromagnetic waves within the antenna system. These structures offer low resonant frequency which leads antenna to miniaturization and manipulation of electromagnetic waves helps in enhancing the gain and bandwidth, and achieving circular polarization (CP) of an antenna system.

CONCLUSION

Researching with new artificial materials that are sooner switching to natural materials, which have brought many beneficial changes in various areas of life like Metamaterials. it's artificial modified electrical and magnetic property.