Abstract

Hexagonal patch antennas are widely used in different RF applications. The hexagonal antennas have current distribution similar to that of circular patch antenna with less area occupation. Along with this, hexagonal antenna has other advantages such as low profile, ease of fabrication, conformability, cost feasibility etc. These advantages enhance interest on hexagonal patch antenna design.

There are basically two types of techniques available for antenna analysis such as analytical methods consisting of Transmission Line Model (TLM), cavity model and Multiport Network Model (MNM), and numerical methods such as integral and differential equations for spectral and spatial domain analysis, full wave techniques etc. Analytical methods are quite easier than numerical method by sacrificing accuracy. However, MNM shows better accuracy (lower than numerical methods) than other analytical techniques. Therefore, in this thesis work, MNM is chosen for the analysis of hexagonal patch antenna. MNM analysis of regular shaped hexagonal patch antenna has been studied previously. That's why, MNM analysis of irregular shaped hexagonal patch is performed here.

Now-a-days, one of the important focuses of the engineers is miniaturization of antenna to place it within small area of any chip or board. Therefore, comparison of antenna performances between full hexagonal patch and half of it has been studied here. From this study, it is observed that half hexagonal patch antenna shows advantages in terms of bandwidth over full hexagonal patch antenna.

Rapid development of wireless communication systems in the last decade has increased thedemand for microstrip antennas with compact size and multiple operating frequencies. Therefore, a circular slotted half hexagonal patch is designed here for multiband operation of the antenna. Radius of the circular slot

has been optimized to tune this antenna for multiple applications such as Bluetooth, WLAN and point to point wireless communication bands. A defected grounded microstrip-line feed hexagonal patch antenna tuned at 5.17 GHz has been designed and analyzed here for wireless communication and aeronautical navigation applications. This antenna provides sufficient gain to establish good communication link.

Fifth generation is the latest iteration of wireless technology which was introduced for enhancing responsiveness and speed of the communication. 5G canallow sharp increase in data transmitted over channel due to high bandwidth based on Shannon's Channel Capacity theorem. Fourth generation (4G) cellular technology demands large and high-power cell towers for radiating signals over long distances whereas 5G signals can be transmitted over large numbers of small cell towers which may be located in places like building roofs, light poles etc. A peripheral slot based dual band hexagonal patch antenna has been designed here. This antenna can be utilized for 2.45 GHz ISM band WLAN and sub 6 GHz 5G. This antenna is radiating over 2.46 – 2.48 GHz with realized gain if 2.67 dBi and 3.69 – 3.71 GHz with 4.29 dBi realized gain. MNM technique is used for analyzing hexagonal patch antenna analytically. Bandwidth and gain enhancement has also been studied in hexagonal patch antenna. The outcome of this work is design of some novel hexagonal patches for different applications such as 5G and wireless communication, aeronautical navigation, multiband operation etc.

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