Abstract

Antennas those demonstrate wide radiation bandwidth are always in demand for wireless communication systems operating in 1 to 20 GHz. The way the power is fed to the antenna plays a vital role in its performance. When compared on the basis of type of feeding, it is found that probe feeding is suitable, economical and easy to handle antenna feeding configuration. An analysis to the feeding mechanism for a polygonal patch antenna fed by a vertical probe is presented by changing feed points to observe changes in scattering, gain and impedance characteristics. In planar antennas, feed and the radiating element together inevitably postulates for overall antennas performance. Different polygonal patch geometries such as triangle, rectangle, pentagon and hexagon available in literature are analyzed and compared with probe feed in L-, S-, C- and X-Band.

The hexagonal geometry, used to design a quarter wave radiator, has smaller dimensions as compared to other polygonal geometries such as triangle, rectangle, pentagon and circle. A polygram shape is obtained by perturbing the edge of polygon. It is observed that wideband characteristics between 12 to 20 GHz of pentagonal and hexagonal patch antennas are retained with pentagram and hexagram geometries. The effect of polygonal slot in vertex-fed polygonal patch antennas is studied and analyzed. It is observed that the slight improvement in the boresight gain achieved when a concentric polygonal slot is introduced in the polygonal patch.

The effect of reduced ground plane (RGP) which may be used as a technique to excite a higher-order mode and suppress spurious frequency radiation, if any, due to probe feeding. The RGP technique is utilized for probe fed slotted hexagonal patch antenna and emphasizes on antenna performance after suppression of a spurious radiation. Monopole like radiation characteristics may be achieved through ground plane reduction. A hexagonal patch antenna

also suffers from high cross polar levels. A RGP technique is optimized to match the impedance and achieve good return loss where monopole radiation characteristics are not an issue.

Probe-fed hexagonal patch antenna suffers from impedance mismatch at lower frequencies especially when fed at vertex of polygon but vertex-fed hexagonal planar antennas excite higher order modes. Hexagonal geometry suffers from serious limitations such as spurious radiation due probe at improper location, poor gain at higher frequencies due to higher mode, low bandwidth in quarter wave radiator design, lower mode suppression due to presence of feed at the vertex of hexagon. This thesis proposes to solve some of the above mentioned issues through simple and straightforward techniques. A capacitive compensation technique to compensate impedance mismatch at a lower mode in a vertex-fed slotted hexagonal antenna is used. A circular parallel-plate capacitor (PPC) is introduced to the antenna structure that improves impedance matching to excite a lower mode for a probe-fed hexagonal patch antenna.

The RGP technique is further exploited along with modifications in shape of ground plane to cover entire UWB range in probe fed hexagonal monopole antenna. UWB antennas are limited to poor gain at higher frequencies due to presence of higher modes, especially when fed with probe. A method to boost the peak gain of a probe fed hexagonal UWB antenna. Artificial magnetic conductor (AMC) based reflector is introduced to the antenna that enhances boresight gain to a wider band as well as peak gain for UWB antenna. A directional and stable radiation pattern for UWB applications is achieved through AMC reflector technique. Average gain improvement AMC reflector technique is 3.74 dB and 5.5 dB in peak and antenna boresight respectively. The reduced ground technique, PPC technique and AMC technique may be further explored for circularly polarized and reconfigurable hexagonal patch antenna for high gain and high bandwidth requirement.