

LOW PROFILE UNCONVENTIONAL MULTI BAND INTERNAL ANTENNAS

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In the rapidly expanding mobile and data communication technology, apart from the multi band and multi systems capabilities, the miniaturization of the size of the radio device is foremost in the system design consideration. For the evolving technology of internal antennas, the reduction in the size of the radio device has imposed a severe constraint on available volume earmarked for the radiating element. For PIFA, which is a most commonly used internal antenna in the commercial mobile communication applications, the reduction in the available overall volume for its radiating element has profound negative impact on both the realizable bandwidth as well as the gain of the antenna. With the growing trend of restricting the allowable height for the cellular internal antenna to 3-5 mm, the prospect of successful multi band PIFA design with requisite bandwidth and the gain tends to be an involved task. Therefore alternative antenna configurations featured with some or most of the advantages of the PIFA and yet requiring a smaller volume than a PIFA are of great interest to antenna and system designers. This paper proposes several configurations of single feed multi band planar and printed antennas of extremely compact as well as low profile.

In the multi band planar antenna category, the antenna structure facilitates the formation of the radiating element on the top surface of a dielectric carriage. In particular, the case studies proposed in this paper cover the design of single feed Tri or multi band planar antennas whose height can even be of the order of 3 mm. Unlike PIFA, the antenna configurations proposed in this paper warrants the absence of ground plane directly underneath its radiating element. The profile of the radiating element of the multi band antenna of this paper closely resembles the conventional meander line with the following distinction. The radiating element of the proposed antenna has a shorting strip connecting it to the ground plane. As is well known, the radiating element of the meander line type of antenna will not involve connecting short. The design embodiments of the multi band planar antenna of this paper include the radiating element whose surface profile can be either parallel or perpendicular to the ground plane. The technique proposed in this paper has been implemented in the successful design of single feed multi band antenna (33(W) x13 (L) x3 (H) mm) that simultaneously covers the Tri cellular (AMPS/PCS/DCS) as well as non cellular (Bluetooth) frequency bands.

In an alternative antenna configuration, this paper presents the design of multi band printed antenna whose radiating element can be formed on the printed circuit board (PCB) of the radio device itself. Similar to the above planar antennas, the design of printed multi band antennas proposed in this paper has been optimized for unbalanced condition. In an unbalanced condition, the design of the proposed multi band printed antenna is realized with the direct connection between the segment of a radiating element and the ground plane. The multi band printed antenna proposed in this paper can be classified as a multi band printed IFA. Since the radiating element has been formed on the printed circuit board, the profile of the above referred printed antenna tantamount to be of zero height or thickness. The realized Tri band (AMPS/PCS/BT) performance of a printed antenna with a radiating element of cross sectional area of 37(w) X12 (L) mm substantiates the proposed novel concept. This paper also deals with the realizable bandwidth as well as the gain characteristics of the proposed low profile multi band planar and printed antennas.