Bandwidth Enhancement and Size Reduction of Patch Antenna by etching linear slots in the ground plane

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Conventional patch antenna suffers from very narrow broadband and of larger size. This poses a design challenge for the patch antenna designer to meet the broadband techniques especially for compact size antenna. However, the bandwidth and the size of an antenna are generally mutually conflicting properties, that is, improvement of one of the characteristics normally results in degradation of the other. In this work, a novel type patch antenna with slotted ground plane is presented to achieve broad band performance with miniaturized size.

The construction of the patch antenna under consideration is shown in Fig. 1. The antenna is designed on popular FR4 substrate ($\varepsilon_r = 4.3$, loss tangent of 0.021 and the thickness is 1.6 mm). As shown in Fig. 1(a) the air gap between the patch and the ground plane is 1.25 cm. Fig. 1 (b) shows the top view of the ground plane with all the slots positions and dimensions. The ground plane size is 8 cm × 5 cm and the patch size is equal to the ground plane size.

The obtained area reduction, by using CST and HFSS simulators, is 40% by comparison of original patch antenna (with the same radiated size and large ground plan size without slots).

Fig. 2(a) clearly shows the effect of adding slots that enlarge the bandwidth by introducing a second resonant frequency in the bandwidth. The peak gain for slotted ground case is 5.2 dBi (Fig. 2(b)) in compare to 7.68 dBi of the original antenna (without slotted ground).

The developed method can be used to reduce the size and to enhance the bandwidth of the antenna. The experimental tests are in progress and a comparison with the theoretical results will be presented and discussed in the final paper.