A Compact Broadband Horizontally Polarized Omnidirectional Antenna Using Folded Dipoles

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Omnidirectional antennas have been widely used in wireless communication devices, including the cellphone base station, Wi-fi routers and many portable devices. It is also adopted for omnidirectional imaging radar systems. Usually vertically polarized antennas are applied for these systems since they could easily achieve wide bandwidth and good omnidirectional radiation pattern. However, for more advanced commuinaction and radar applications where polarization diversity is considered, a horizontally polarized (HP) omnidirectional antenna is also required to obtain higher efficiency in communication and improved in imaging radar systems. Many of these systems operate with wide bandwidth. However, many of traditional HP antennas suffer from narrow bandwidth. There are several designs reported to increase the bandwidth omni-directional HP antennas recently, but none of these have bandwdith more than 50%.

This paper reports a compact HP omnidirectional antenna with an almost an octave bandwidth and dimensions $0.34\lambda \times 0.34\lambda \times 0.11\lambda$, λ is the wavelength at the lowest frequency of operation. The antenna topology is based on four modified folded dipole antennas arranged around the perimeter of square box as shown in Fig. 1. The folded dipole antenna is reported to have a bandwidth more than 50 % (Tanaka, S. Yongho Kim, et al. Antennas and Propagation, 56, 5, 1223-1228, 2008). In order to reduce the mutual coupling of different dipole elements and increase the bandwidth, some geometric modifications are made. Four dipole elements are feed with microstrip baluns and connected by an appropriate matching network to a coaxial feed. The proposed antenna is fabricated and measured. Fig. 2 shows the measured and simulated reflection coefficients of the antenna. The 10 dB return loss bandwidth is shown to cover the frequency range covering from 1.19GHz to 2.05GHz. The measured gain variation in H plane is shown to be less than 2 dB for the frequency lower than 1.9 GHz, and goes as high as 3 dB at 2 GHz. The isolation between HP and VP is better than 20 dB in the H-plane over the entire bandwidth.

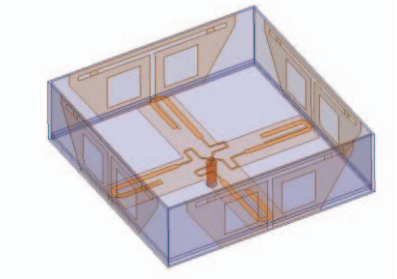

Fig. 1. The geometry of the proposed antenna

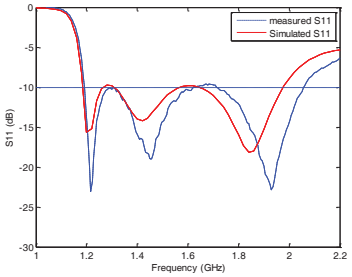

Fig. 2. Return loss comparison of the measured and simulated result of the HP antenna.