A Dual-Band HF/VHF Electrically Small Monopole Antenna with Magneto-Dielectric Loading Structure

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Magneto-dielectric materials, having both relative permeability and permittivity greater than unity, can provide more flexibility to miniaturize antennas (G. H. Mosallaei and K. Sarabandi, *IEEE Trans. Antennas Propagat*., vol. 52, no. 6, pp. 1558–1567, June 2004). For this purpose, several magneto-dielectric materials with promising value of permeability and permittivity have been developed in Temasek Laboratories at NUS through different ferrite ceramics process (L. B. Kong et al, *J. Am. Ceram. Soc*., vol. 90, no. 7, pp. 2104–2112, July 2007; L. B. Kong et al, *IEEE Trans. Magn*., vol. 44, no. 5, pp. 559–656, May 2008). We have applied these newly developed electromagnetic materials to design an electrically small magneto-dielectric coated VHF monopole antenna with its height of 250 mm, which can operate at 71.14 MHz with good matching to 50 Ω SMA connector (C. F. Wang et al, "Electrically small magneto-dielectric coated VHF monopole antenna," *IEEE AP-S Int. Symp. Dig*., IF25.7, 2012). Antenna height reduction factor achieved is less than 1/4. The effectiveness of the newly developed magneto-dielectric material is quite promising. To further shift its resonant frequency to HF band, we introduced several PEC thin wire posts as parasitic elements uniformly distributed around the magneto-dielectric cylinder. The resonant frequency was further shifted to 27.0 MHz if we put four PEC posts uniformly distributed around the magneto-dielectric cylinder. The antenna height reduction factor was about 0.094 (less than 1/10) (C. F. Wang et al, "Electrically small magneto-dielectric coated monopole antenna at HF band," *Asia-Pacific Conf. Antennas Propagat. (APCAP)*, pp. 78-79, 2012). To make those two magneto-dielectric coated monopole antennas work at both HF and VHF bands, we carefully study their resonant behavior and found that introducing proper capacitive and inductive components can make the magneto-dielectric coated monopole work at both HF and VHF bands with good matching to 50 Ω SMA connector. The capacitive and inductive components can be realized through a combination of wire posts and thin copper sheet sleeve. The measured input impedance of the designed antenna clearly shows that its impedance is about (37.03-j0.4045) Ω at 26 MHz and (89.01-j8.582) Ω at 74 MHz. The designed dual-band HF/VHF antenna works reasonably well at 26 MHz and 74 MHz with matching to standard 50 Ω SMA connector. Detailed discussion on the design principle and results will be presented at the conference.