

Non-foster impedance matching sensitivity of electrically small electric and magnetic spherical dipole antennas - DTU Orbit (09/11/2017)

Non-foster impedance matching sensitivity of electrically small electric and magnetic spherical dipole antennas

The impedance bandwidth (BW) improvement property of a self-resonant folded spherical helix electric dipole and a spherical split ring (SSR) magnetic dipole is compared when a negative reactance element is loaded on the parasitic resonator of the antennas. They have the same electrical size of $ka = 0.38$ and both approach each lower Q-bound. It is found that the impedance characteristic reacts more sensitively to the loaded element for the SSR antenna due to the inherent two-times higher Q of the magnetic antenna. It is also found that a conventional non-Foster circuit composed of a series negative inductor and a capacitor cannot be used for wide impedance matching of the SSR antenna due to the high sensitivity. Subsequently, a circuit topology that enables more precise matching of the reactive values for widened impedance matching in the high-Q SSR antenna and satisfies the stable operating condition is proposed. It is observed that the improvement ratio of the BW is limited in practical situation. Nevertheless, the measured reflection coefficient of the 3D-printed SSR antenna loaded with the designed active matching circuit shows two-times wider impedance BW than passive matching, verifying the simulated result from the circuit and electromagnetic (EM) simulations.

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Authors: Yoon, I. (Ekstern), Christensen, S. (Ekstern), Zhurbenko, V. (Intern), Kim, O. S. (Intern), Breinbjerg, O. (Intern)

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