Abstracts

Microwave signal rectification using artificial composite materials composed of diode-loaded electrically small dipole antennas

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The electromagnetic properties of composite materials composed of dipole or loop antennas (also called molecules) loaded with different linear passive electronic circuits are summarized. These molecules are extended to those molecules whose loads contain some basic nonlinear elements. Several examples are discussed. The simplest nonlinear load is the clamping circuit: a diode and a resistor are connected in series to an electrically small dipole antenna. This is generalized to a more complicated molecule based on a diode bridge. Numerical results generated with a finite-difference time-domain (FDTD) simulator demonstrate how an incident narrow-bandwidth pulse interacts with these materials and can be transformed into a baseband, rectified signal, or a signal containing selected harmonics of the fundamental frequency. Potential applications of these artificial material-based signal convertors include target identification and signal modulation.

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