Compact Microwave Absorbers Utilizing Single Negative Metamaterial Layers

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The research on Radar Absorbing Materials (RAMs) dates back to the mid of 1930s, before World War II. Despite this long history, the subject has continued to attract interest these days, owing to the rapid increase in the number of telecommunication devices. In addition to defense applications, indeed, one of the potential applications of RAMs is in electromagnetic compatibility problems, where reduction of the mutual interactions between different devices is desired. Other typical uses of microwave absorbers are in the antenna field, to reduce the back-radiation and to improve the radiation pattern, and in the measurement of the scattering features of objects and antennas.

One of the challenging aspects in the design of microwave absorbers is to achieve reduced electrical dimensions, while maintaining good performances in terms of both angular and frequency bandwidths. Several designs of ultra-compact absorbers employing Artificial Magnetic Conductors (AMCs) have been recently proposed by several groups worldwide. In some cases, the performances of such components strongly depend on the polarization and/or on the angle of incidence, thus reducing the effectiveness for several application fields. In addition, most of these layouts are inherently narrowband.

The idea of a novel compact absorber employing metamaterial complementary pairs has been recently presented by us (A. Alù, F. Bilotti, N. Engheta, and L. Vegni, "*A Thin Absorbing Screen Employing Metamaterial Complementary Pairs*," ICEAA 2005, Turin, Italy, Sept. 2005). Due to the inherent resonance at the interface between such a pair of materials, which arises independent on what surrounds the bilayer, we have shown how in principle this configuration may be formed to be less affected by the incidence angle of the incoming electromagnetic field and may exhibit a reduced dependence on the field polarization and acceptable frequency stability. Some new insights on the physical phenomena characterizing this compact absorber and the possibility of reducing the complexity of the final layout using single negative (SNG) metamaterials will be presented at the conference. In addition, some new results showing the performances of realistic lossy metamaterials, with properly designed inclusions will be also presented.