

**ANALYSIS OF BROADBAND ABSORBING NON-MAGNETIC  
MATERIALS**

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## ABSTRACT

An analytical approach, through the lossy transmission line technique is used to design Wave Absorbing Non-Magnetic Materials (WANMMs). These WANMMs are made of several dielectric layers, usually on top of a conducting plane. The total absorption of the electromagnetic energy is done in the last lossy layer. Other layers are used to match the wave impedance of the WANMM to that of the incidence media for the normal incidence only at different microwave frequencies. The approach is easy, practical and flexible, allowing the design of WANMM for specific applications such as Radar Absorbing Materials (RAMs) and Wireless Local Area Networks (WLANs). A wide range of frequencies is considered to maintain a minimum range of reflection.

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# CHAPTER 1

## 1. INTRODUCTION

### 1.1 General

The interaction of electromagnetic fields with material is determined by the electromagnetic properties of the material, characterized by the electrical permittivity  $\epsilon$ , the magnetic permeability  $\mu$ , and the electrical conductivity  $\sigma$  and the frequency of operation. For all non-magnetic media,  $\mu$  may be taken to be equal to the magnetic permeability of free space,  $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$ .

An exact mathematical description of the reflection loss performance of an absorptive material of known thickness on a metal structure requires only the four terms of complex magnetic permeability ( $\mu = \mu' - j\mu''$ ) and dielectric permittivity ( $\epsilon = \epsilon' - j\epsilon''$ ) of the component materials. One version of an ideal absorber might comprise a single, thin layer of material having numerically equal values of complex permeability and permittivity and high loss tangents ( $\mu''/\mu'$  and  $\epsilon''/\epsilon'$ ) over a wide range of frequencies. The former ensures efficient matching of the incident wave into the absorber, and the latter promotes rapid attenuation thereafter [1].