

Medical applications and wearable antennas need accurate electrical characterization of textile material. Many techniques have been presented before to obtain the dielectric constant of any material and some of these techniques are applied on textile materials. Due to the mechanical characteristics of these materials, such as the small thickness and the flexibility, many presented techniques are not suitable to be deployed. In this paper, the ridge gap waveguide (RGW) structure is used to measure the relative permittivity of textile materials. The RGW is one of the state-of-the-art guiding structures. Its quasi-TEM characteristics simplify the procedure of predicting the unknown permittivity. The second feature of RGW is the small height, which is more suitable for the standard dimensions of the textile material samples. Moreover, the wide bandwidth of the RGW, which is about 2.5:1, enables performing the calculations over the guide operating bandwidth. This property of the RGWs leads to characterize the textile material with a single setup and utilize these results in a wide range of applications. A mathematical algorithm is presented to find the dielectric constant; then, it is applied in the case of many materials to determine the accuracy of the proposed algorithm. The extracted values of the relative permittivity are compared with the expected values, in the case of materials with well-known electrical characteristics, and this step shows very high accuracy with a percentage error less than 2%.