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Wave guiding properties of ribbed surface waveguides in three frequency domains

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Abstract A longitudinally structured surface waveguide is examined and the effect of the structuring on the wave guiding properties is explored. The waveguide structure is examined in three distinct wavelength regions and the results are discussed and compared. The Frequency domains are the microwave region around $f = 400$ MHz, the terahertz region around $f = 400$ GHz and the optical region around $f = 400$ THz. Special emphasis is placed on regarding the opposing behaviour of the wave attenuation versus the field extension.

Keywords Plasmonics · Surface waves · Terahertz · Wave guiding · Structuring

1 Introduction

The area of plasmonics has garnered a lot of attention and work in the last decade or so (Stockman 2011). Its ability to combine the advantages of integrated electronics with those of communications optics holds considerable promise for the future. However, many small and large problems are yet to be resolved before full commercial breakthroughs can be achieved. One of the problems for wave guiding surface plasmon waves on a metal/dielectric surface is the high attenuation due to the dissipative losses of the noble metal. In conventional plasmonic waveguides a decrease in the attenuation correlates directly with an increased field extension. Decreasing the losses without increasing the field extension into the surrounding dielectric media is a challenge that could possibly be solved by structuring the waveguide along its length. From the microwave domain it is known that such structuring can have great influence on the field expansion and this knowledge is to be transferred to the

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