Gap Waveguide Bandpass Filter with Reduced Height Pins for Easy Fabrication

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Groove gap waveguide (GGW) has been proposed in the last years as an interesting alternative to the rectangular waveguide for the design of microwave and millimeter-wave space components. This technology consists of two parallel metal plates, where one of them has a λ/4-height pin bed that provides a high impedance condition at the plane over the pins, avoiding electrical contact requirement with the upper plate and hence facilitating the fabrication process. However, the manufacture by CNC milling of the pins may be troublesome, especially for devices operating at high frequency. Therefore, some alternatives have been presented to ease the manufacturing [1, 2], modifying the topology or reducing the pin height but at the cost of being necessary the machining of pins in both plates.

In this work, a novel topology with reduced pin height is proposed and these pins are only included in one of the plates to facilitate the fabrication process. Moreover, this configuration allows us to maintain the standard dimension ports of the equivalent rectangular waveguide and the operation in its corresponding bandwidth. The insertion loss parameter of the proposed GGW structure (with standard WR22 ports) compared with the classical one is shown in Figure 1. While the manufacturing is eased, the performance of the technology is maintained (even improved) in the whole WR22 frequency range (33-50 GHz). In order to validate this configuration for the design of components, a Q-band filter for satellite communications has been designed and the results are shown in Figure 2. This work has been funded by the Spanish Ministerio de Ciencia e Innovación –Agencia Estatal de Investigación (MCIN/AEI/ 10.13039/501100011033) under Project PID2020-112545RB-C53.

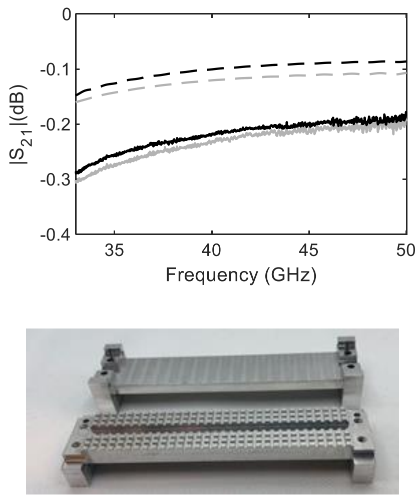

Figure 1. Simulated (dashed line) and measured (solid line) insertion loss parameter of the classical GGW (grey line) and the proposed configuration with reduced pin height (black line).

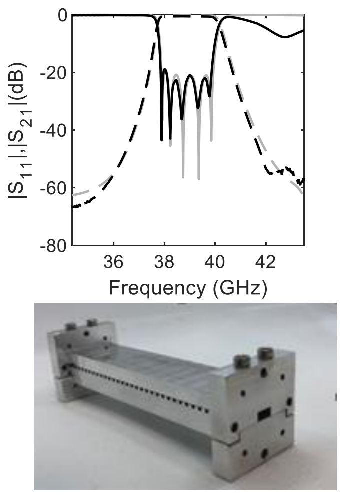

Figure 2. Example of BPF implemented in the proposed GGW with reduced pin height. Simulated (grey line) and measured results (black line). $|S_{11}|$ in solid line and $|S_{21}|$ in dashed line.

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2. D. Sun, X. Chen, J. Deng, L. Guo, W. Cui, K. Yin, Z. Chen, C. Yao, and F. Huang, "Gap Waveguide with Interdigital-Pin Bed of Nails for High-Frequency Applications," *IEEE Transactions on Microwave Theory and Techniques*, **67**, 7, May 2019 ,pp. 2640-2648, doi: 10.1109/TMTT.2019.2914907.