



## International Journal of Innovative Research in Computer and Communication Engineering

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# Designing a Waveguide Diplexer for the 5G Mobile Network

K. Azhaguvennila, N. Sowmiya B.E., M.E.,

M.E. Communication Systems, Department of Electronics and Communication Engineering, Chendhuran College of Engineering and Technology, Lena Vilakku, Pilivalam Post, Thirumayam Tk, Pudukkottai, Tamilnadu, India  
Assistant Professor, Department of Electronics and Communication Engineering, Chendhuran College of Engineering and Technology, Lena Vilakku, Pilivalam Post, Thirumayam Tk, Pudukkottai, Tamilnadu, India

**ABSTRACT:** A diplexer is a device that combines or splits signals into two different frequency bands, widely used in mobile communication systems. This example simulates splitting properties using a simplified 2D geometry. The computed S-parameters and electric fields at the lower and upper bands will show the diplexer characteristics in the Ka-band.

**KEYWORDS:** Diplexer, 5G Mobile Network, Communications.

### I. INTRODUCTION

This example is based on a WR-28 waveguide for Ka-band applications. The width of the 2D waveguide is 0.28 inches, which is the length of the longer side of a WR-28 waveguide aperture. The model considers only the dominant TE<sub>1</sub> mode. The cutoff frequency of the dominant mode is 21.08 GHz. There are two cavities working as bandpass structures between the input and each output port that are connected with irises. The waveguides, cavities and irises are modeled as copper with finite conductivity using an Impedance Boundary condition to evaluate loss at a high frequency range and the inside of the waveguide is filled with air. On each end of the waveguide, a port boundary condition is applied with the predefined rectangular TE<sub>1</sub> mode. Only one port is excited to observe the S-parameters of the example. S-parameters are plotted in Figure 2. The lower passband is around 28 GHz and the upper passband is around 30.4 GHz. The insertion loss in each passband is about 0.1 dB, mainly caused by the finite conductivity of the copper walls. In Figure 3 and Figure 4, the E-field norm is visualized for each passband, showing that the input power at each passband is not split into two output ports, but separately distributed without being coupled to the other port. The isolation properties between two output ports are not reviewed in this example but users are encouraged to try by exciting port 2 or 3 only.

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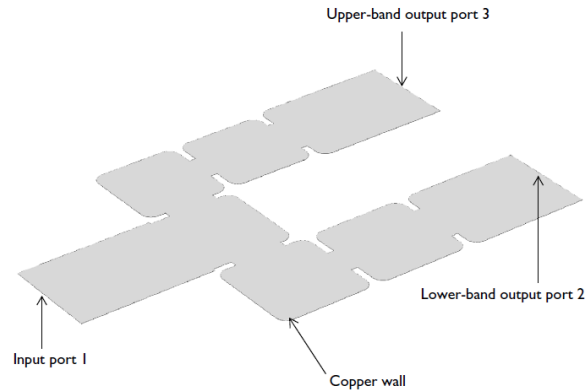


Figure 1: 2D layout of the diplexer composed of 3-port waveguide structures.

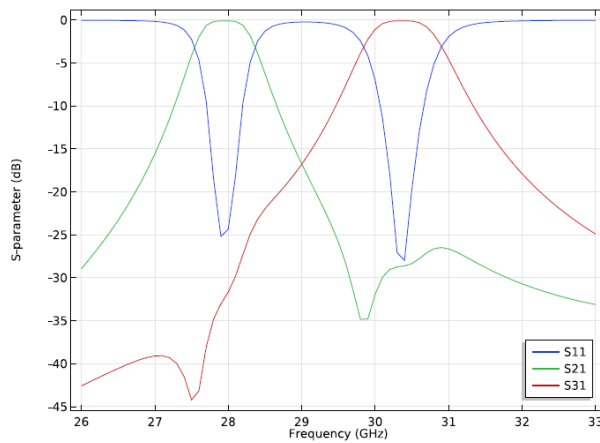


Figure 2: The S-parameter plot shows the lower and upper passband of the diplexer.

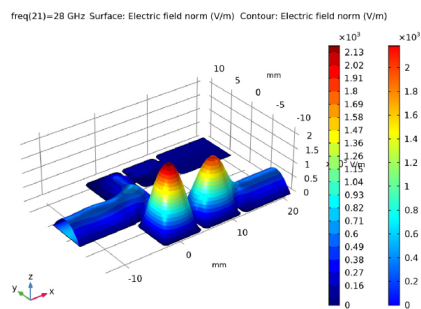


Figure 3: The E-field norm plot for a frequency of 28 GHz. The input power flows into port 2 only.

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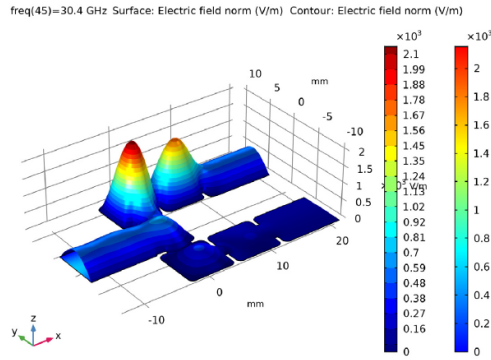
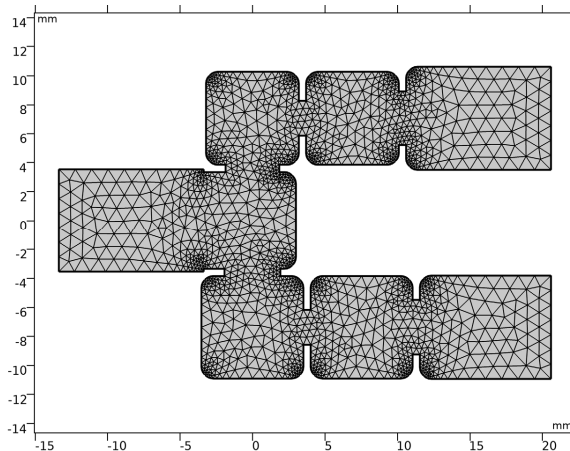
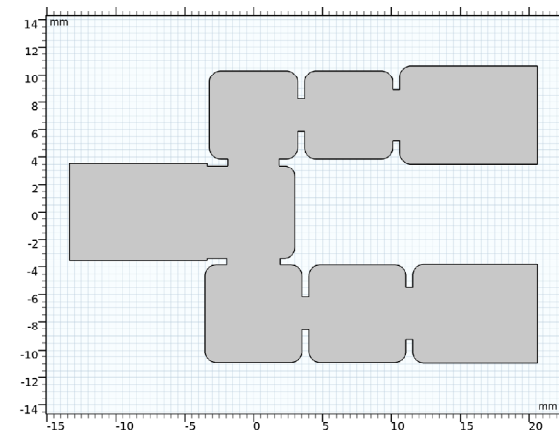


Figure 4: The E-field norm plot for a frequency of 30.4 GHz. The input power flows into port 3 only.

## II. SYSTEM IMPLEMENTATION





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## III. CONCLUSION

Thus the entire work of designing a Waveguide Diplexer for the 5G Mobile Networks is successfully designed and tested with full accuracy.

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