A Full Bandwidth H-plane Power Divider Worked in Millimeter Wave Band

Peng Zhao,Shitou Liu ,Liu Chen
School of Physical Electronics, University of Electronic Science and Technology of China, UESTC
Cheng Du, China
zhaopeng122@126.com

Abstract: **A novel kind of compact three-port power divider with full bandwidth is proposed in the paper. The design and simulated results show that the novel power divider has a good performance, which are insert loss 3.016±0.006dB from 26GHz to 40GHz, and return loss less than -25dB, respectively.**

Keywords: power divider; novel; between; insert loss; full bandwidth; return loss

INTRODUCTION

Power dividers are indispensable components commonly used to split an input signal into two or more signals output in e.g. wireless network, RF or microwave communications microwave, and antenna distribution circuits. According to the circuit characteristics of the power divider, it can be divided into two kinds of power divider such as simple power divider [1-2] and Wilkinson power divider [3]. The former has big size and are not easily integrated, and the latter has not enough isolation bandwidth and are quite large. However, rapid development of microwave and millimeter wave communication systems greatly stimulates the demand on high performance power dividers with compact size, low insertion loss, wide isolation bandwidth, and low cost. To obtain high performance power dividers, tremendous efforts have been made to develop new type of power dividers [3-5].

In this letter, we developed a three-port power divider based on cavity. We study theoretically and experimentally the proposed three-port power divider. In our design, we use the 3D commercial EM simulation software 'CST Microwave Studio' to simulate the properties of the novel three-port power divider, The simulation results show that the designed three-port power divider has full bandwidth, compact structure, low insertion loss, perfect power division, easy processing and low cost.

II. Designs and results

This article describes the design structure of the full bandwidth of cavity power divider. For simple structure and easy to calculate, this power divider used symmetric structure .Figure 1 shows the 3 D simulation model of power dividers which is shown in the 'CST Microwave Studio'. The key parameters and variables for the proposed design with a rectangular cavity are indicated in Fig. 2 for reference. In order to make our external cavity other devices easier, we choose five order cavity gradient structure to increase the distance of the port 1 and port 2.

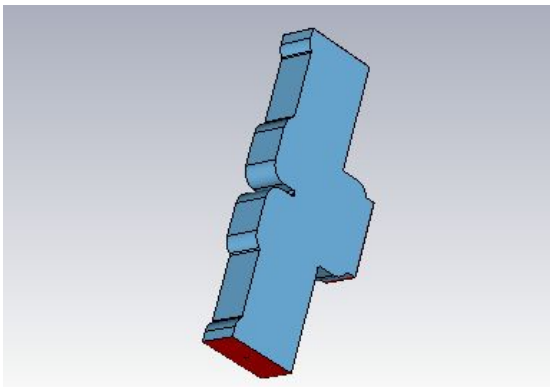
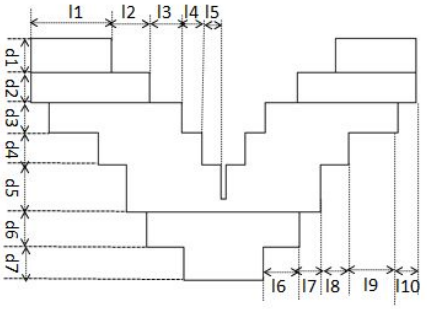


Fig. 1. 3D simulation model of power divider



(a)

(b)

Fig. 2. (a) The top view of power divider
(b) The side view of power divider

.

With the working frequency of Standard waveguide port set at 26 GHz to 40GHz ,optimization scheme is performed to pursue the full bandwidth are for the given structure. Table 1 lists the optimum values for the parameters of this design.

Table 1. Optimum values for the parameters of this design.

Variable	l1	l2	l3	l4	l5
Length (mm)	7.1	3.47	2.825	1.859	1.681
Variable	l6	l7	l8	l9	l10
Length (mm)	3.256	1.873	2.499	4.396	1.571
Variable	d1	d2	d3	d4	d5
Length (mm)	3	2.718	2.713	2.845	4.204
Variable	d6	d7	h1	h2	h3
Length (mm)	3.142	3	3.556	2.473	3.370
Variable	h4				
Length (mm)	3.556				

The simulation results of this cavity power divider are displayed in Figs. 3.In our design, the characteristic impedance Z is set as 50Ω. From the Figure 3, it can be noted that the novel power divider operates with a low insert loss 3.016±0.006dB 26GHz to 40GHz, and return loss less than -25dB

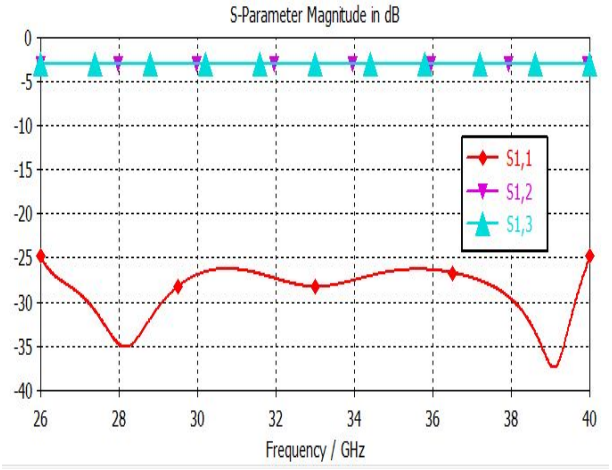


Fig. 3. The simulation results of this cavity power divider

III. Conclusions

In this article, we developed full bandwidth three-port power divider based on cavity. The simulation results show that it can be noted that the novel power divider operates with a low insert loss 3.016±0.006dB 26GHz to 40GHz, and return loss less than -25dB. The novel power divider has many advantages over conventional power divider e.g. the size, weight, simplicity, low insertion loss, cost, and perfect power division. It is a promising device for RF communication systems.

References

1. J.S. Lim, S.W. Lee, C.S. Kim, J.S. Park, D. Ahn, and S. Nam, A4:1unequal Wilkinson power divider, *IEEE Microw. Wireless Compon. Lett*., 11(3): 124–126, 2001
2. J . X. Chen, and Q .Xue , Novel 5:1 unequal Wilkinson power divider using offset double-sided parallel-strip lines, *IEEE Microw. Wireless Compon. Lett*., 17(3): 175–177, 2007
3. J. Li, Y. Zou, Novel Wilkinson power divider based on left-handed transmission lines, *Microwave and optical technology letters*, 49(3):712-715, 2007
4. J. Li, Y. Zou, and S. He, A novel power divider utilizing composite right-left-handed transmission line, *Microwave and optical technology letters*, 48(9): 1776-1779, 2006
5. H. Izumi and H. Arai, Electromagnetic coupled power divider using parasitic element, *In 2000 Asia-Pacific Microwave Conference* (Dec.2000), 233–236