

## Two Way Equal Power Divider

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**Abstract** - This paper presents design of Two Way Equal Power Divider. It is a symmetric structure with two transmission lines and one resistor of  $100\Omega$  connecting the two transmission lines. The micro-strip medium here has both top and bottom layers to create broadband configuration using defected ground plane structure (DGS). The bottom layer is of floating conductor so to achieve selective bandwidths. The isolation between the paths is more than 10dB with better return loss along the band of 2GHz to 5GHz. The simulation of the proposed structure is done by using Ansys HFSS 19.0. A prototype has been made and the results are verified against the full wave simulations and it is observed that they maintain good agreement between the results.

**Key Words:** Microstrip, broadband, Defected Ground Plane Structure (DGS), floating conductor, isolation

### 1. INTRODUCTION

Emerging applications of microwave technologies and radio frequency demand for miniaturized broadband components that have multiple functionalities with high performance at low cost. Broadband Power dividers have applications in Microwave imaging systems, high data rate wireless communications, SDP, UWB, cognitive Radio etc. Broadband power dividers are used for signal distribution and signal tapping in different microwave communication & radio-frequency subsystems. These have different structures as reported in [1] – [12].

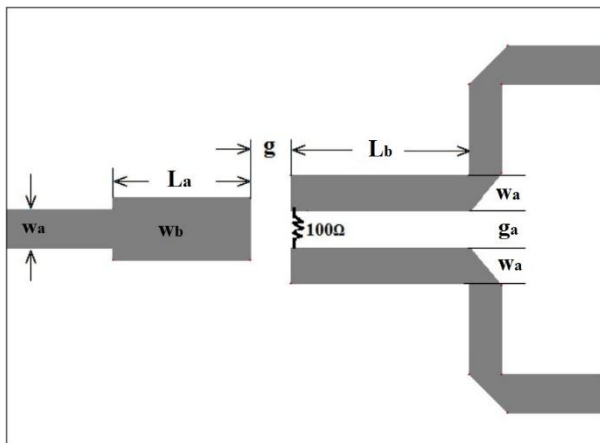
In [1] – [2], Lange couplers are used for designing the broadband power divider. Using Lange couplers give the advantage of broadband frequency, but due to critical issue of wire bonding it limits the highest frequency of operation. With the use of N stage transformers in [3] – [7] power dividers they operate in wide bandwidth. Multistage transformers though occupy more space; they are easy to design in realization. In [8], design of ultra wide power divider is done using non uniform directional couplers but this requires more space during implementation. Even though the 3db based couplers on left handed materials which offers broad bandwidth needs more space for their circuits [9].

In [10], with the help of short circuited stubs and coupled lines design ultrawide power divider for sharp roll off and good isolation. From [11] we know that broad band coupler made us realize with the help of layer alignments and multilayer construction in electrical characteristics.

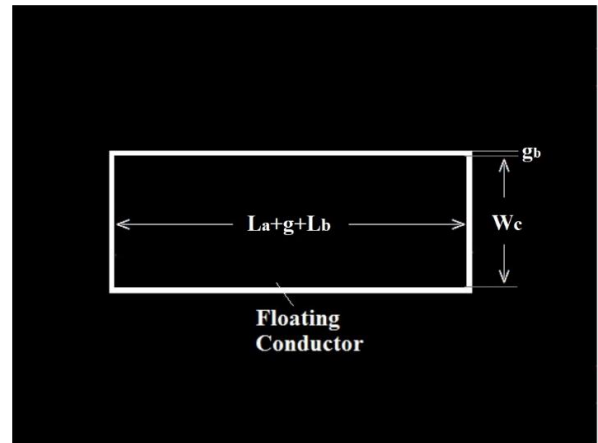
### 2. DESIGN APPROACH

In this, the proposed power divider is designed over FR4 substrate. The design is on 40mmx16mm rectangular substrate. This is composed of one input port and two output ports along with  $100\Omega$  resistor connecting both the transmission lines.

Next the floating conductor in the ground plane is designed with gap  $g$ , along with gap  $g$  that is between the rectangular patches.



(a) Top Layer



(b) Bottom Layer

Fig -1 Power divider structure

For better results the floating conductor is moved in different directions, placed in different positions so to make power equally divided into the output ports. The power divider structure is as shown in above fig. with all its dimensions mentioned in the below table.

Table -1: Dimensions of Equal Power Divider

Dimensions	Values(mm)
$L_a$	8.65
$L_b$	8.9
$W_a$	2.4
$W_b$	4
$W_c$	6
$g$	2.5
$g_a$	2.25
$g_b$	0.3

### 3. EVOLUTION OF DESIGN

In this section we make out the design of power divider.

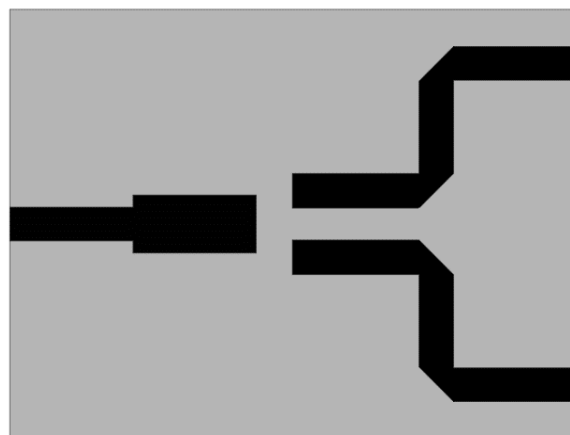
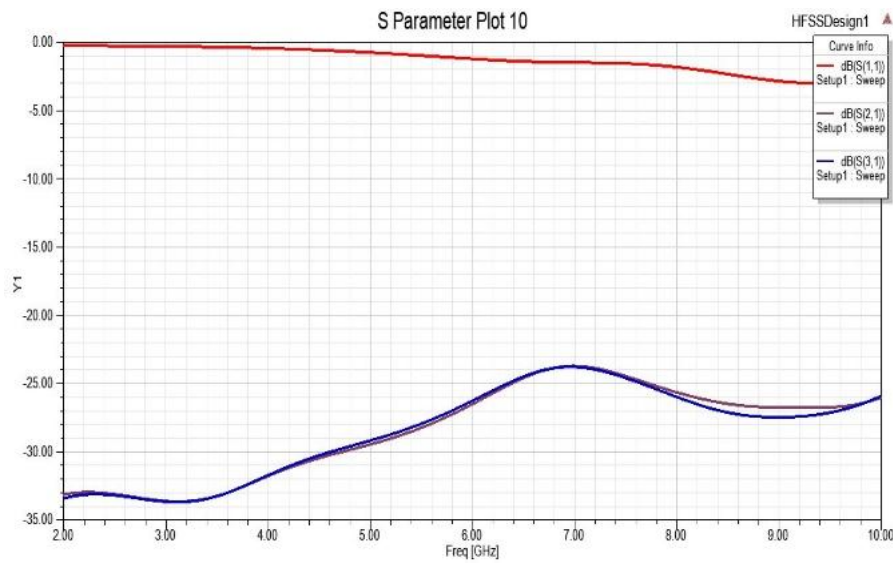


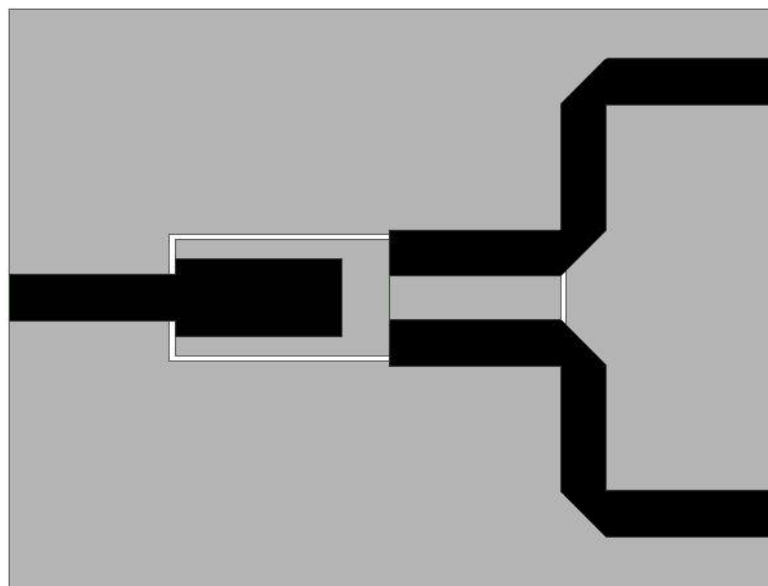
Fig -2 Power divider without floating conductor and resistor

Initially, resistor and floating conductor for ground is not made and simulated this gives results as shown in figure.



**Fig -3** Simulation results of power divider without floating conductor and resistor

The above results depict that no power division occur without floating conductor. For improving these results, a floating conductor is designed in the ground plane in a microstrip medium as shown in figure.



**Fig -4** Design of proposed power divider

This design is finalized as it divides the input power equally at output ports. Also because of improved bandwidth, from range of to which are useful in applications.

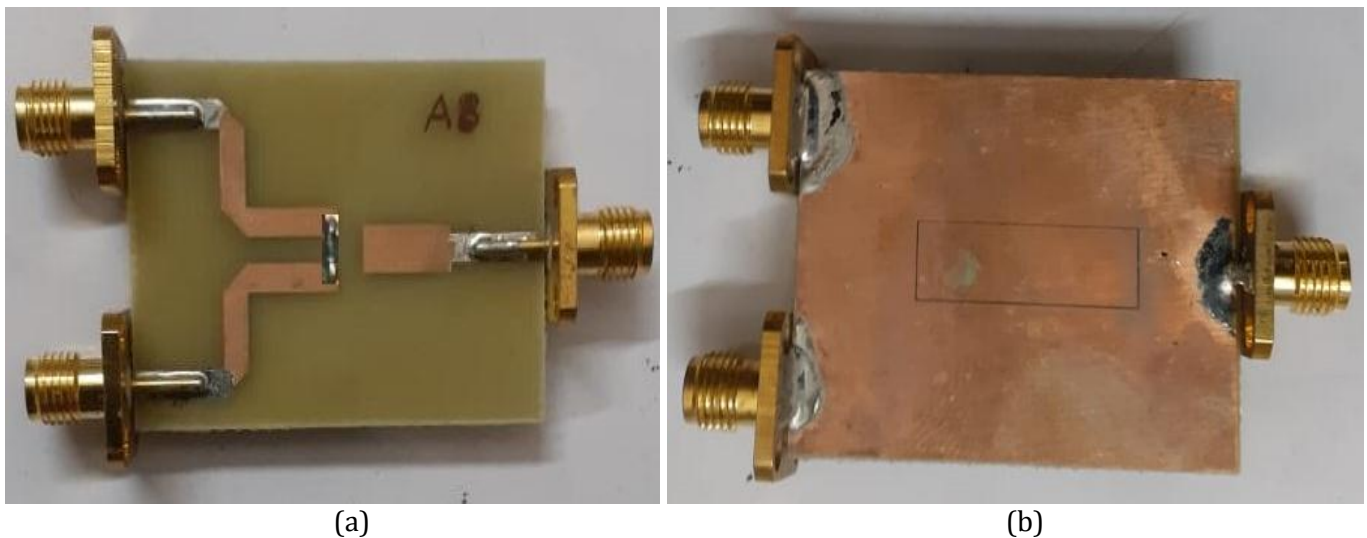


Fig -5 Photograph of fabricated power divider. a) Top layer, b) Bottom layer

The above figures represent the fabricated two way equal power divider.

#### 4. SIMULATION RESULTS

The modified Power divider is demonstrated and results are discussed. Simulations of this are performed on commercially available tool, Ansoft HFSS version 19. This is popular for simulating high-performance fields based on finite element method(FEM) which is used for solving any 3D geometry mostly at high range frequencies.

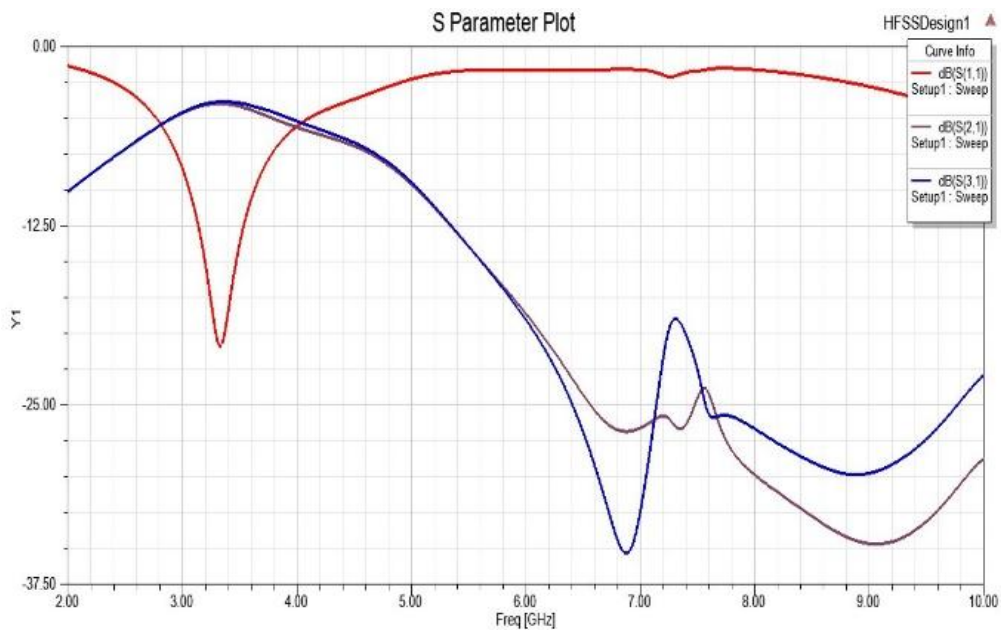


Fig -6 Simulated S-Parameters of power divider

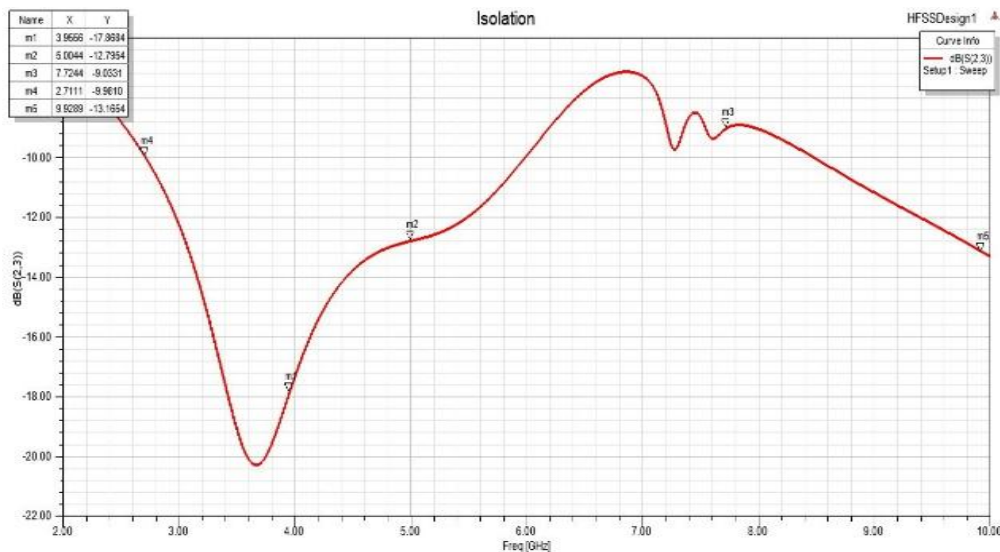


Fig -7 Isolation

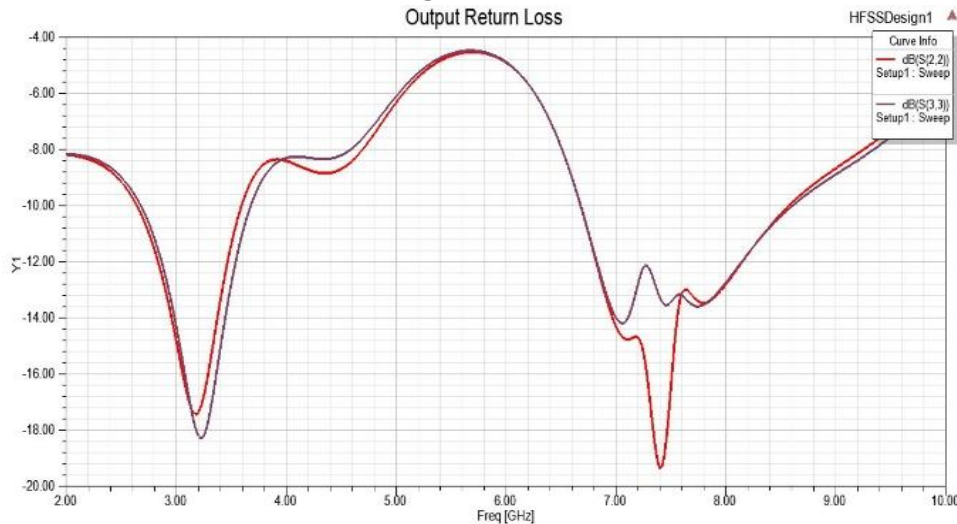


Fig -8 Output return loss

The above figures show the power division and return loss characteristics of equal power divider at input port.

The isolation measured between the ports is more than 10dB. Return loss of both input and output return loss are better than 15dB.

## 5. CONCLUSION

This paper has presented the design of a two way equal power divider. It has a symmetric structure with coupled transmission lines and one resistor of 100Ω connecting the coupled lines. The micro-strip medium here has both top and bottom layers to create broadband configuration using defected ground plane structure (DGS). A floating conductor was created in the bottom layer to achieve selective bandwidths. The isolation between the paths is about 15dB with better return loss along the band of 2GHz to 5GHz. The power divider is perfectly designed and simulated for applications like Microwave imaging systems, high data rate wireless communications, SDP, UWB, cognitive Radio etc.

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