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DESIGN OF BALUN USING DEFECTED GROUND STRUCTURE

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ABSTRACT

In this paper the microwave balun with defected ground structure has been presented. Here in the ground the slots of different sizes and of shapes have been cut to show the transition of electric field between the microstrip and slots in the ground. This structure has been designed at 2.7GHz frequency; the return loss (S11) is obtained 18dB, bandwidth of the proposed structure is obtained to 54MHz and the phase difference between the balanced ports is 180 degree.

KEYWORDS: Microstrip, Defected Ground Structure (DGS), Microwave Balun

INTRODUCTION

Microwave Balun is the transformer which connects transmission lines of different polarities. It actually converts the unbalanced signals to balanced signals or vice–versa. The balance or differential signal is the one which has equal magnitude at two ports and opposite phase characteristics of 180 degrees; the unbalance port is one which has one port as input/output and another port to ground. Baluns can be configured in many different ways depending upon the operating frequency, bandwidth and its physical architecture. The architecture of balun is used in balanced mixer, balanced modulators, push-pull amplifier, balanced frequency multipliers, phase shifters etc., these all the devices depend on balanced signals to obtain the inter port isolation and unwanted signal cancellation [1]-[3].

In this paper the defects in the ground have been presented .These defects are non-periodically etched in the ground plane which changes the shield current distribution in the ground, This change in ground disturbs the characteristics of structure. This presented structure is an advanced approach of the structure in [4]. The presented structure is very unique to design the balun and all characteristics show its effectiveness.

DESIGN PROCEDURE

The design of the balun depends on the operating frequency, bandwidth and its characteristics. Here the basic structure of the proposed balun is shown in figure 1 in which port 1 is the unbalance port (taken at 50 ohms) or the input port through which signal is made to input. The port 2 and port 3 are the output ports (taken at 25 ohms) are made balanced to have equal magnitude value and the opposite phase characteristics at both ports.

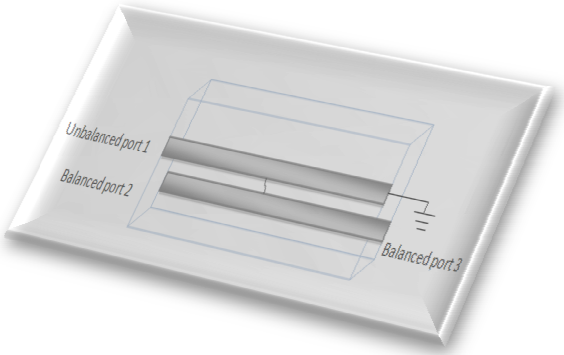

Figure 1: Shows the Basic Structure of the Proposed Balun

This structure of microwave balun has been designed after the calculating all the parameters of the directional coupler on the frequency of 2.7 GHz. These values have been used for the microwave balun configuration by taking port1 as unbalanced port and port 2and 3 as balanced port and the fourth port as grounded.

PROPOSED STRUCTURE

This structure of balun using defected ground structure is the very unique design for this structure. The electric field lines are shown in the figure 2, where these lines are opposite to each other at the balance port that's why this whole process makes the 180 out of phase outputs at balanced ports.

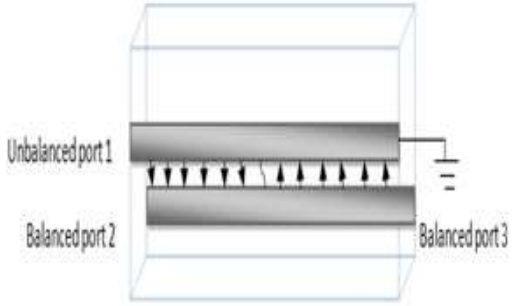

Figure 2: Shows Electric Field Diagram of Balun

The proposed structure is a five layered architecture design of balun in which the upper layer represents the upper part of the balun and then the dielectric of FR4 of height 1.6 is layered and then ground is presented in the structure, here it is noted that there are defects in the ground and these defects are of different shapes and sizes to maintain the results to desired level. The shapes on the ground can be varied according to the desired characteristics, after the ground the dielectric of height 1.6 (FR4) is shown, and in the last the lower part of the balun has been shown. This five layered architecture is highly useful in the designing of the balun to obtain the desired phase shift and magnitude responses. In the figure 3 the structure of the proposed five layered design is shown.

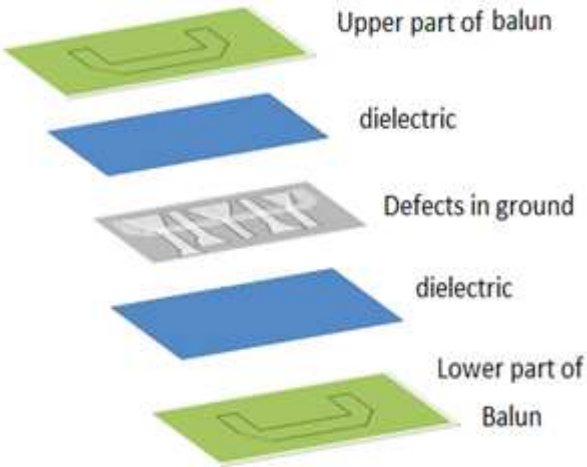

Figure 3: Shows the Five Layered Architecture of the Balun

RESULTS

The microwave balun has been designed at the frequency of 2.7 GHz using CST Studio suite 2010 [5]. Results for this proposed structure are being shown in the figure 4 below, here the value of the return loss is obtained 18 dB (approximate) and the bandwidth of 54 MHz is obtained at -10 dB scale, value of the magnitude at port 2 is 5.2 dB and value of the magnitude at port 3 is 9.2 dB. The phase difference between the port2 and 3 is about 180 degrees.

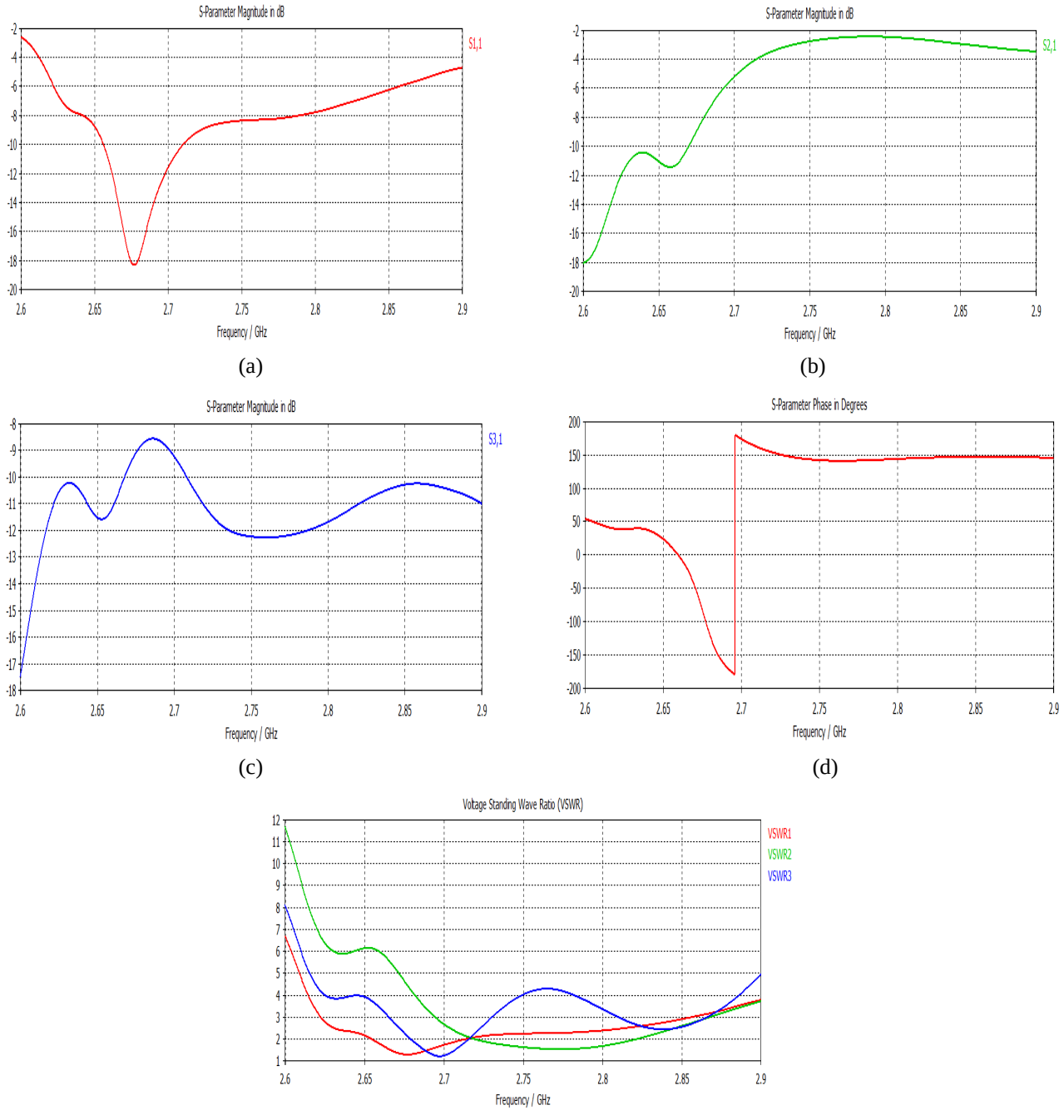

Figure 4: Shows (a) Return Loss (S_{11}), (b) Magnitude at Port 2 (S_{21}), (c) Magnitudes at Port 3 (S_{31}), (d) Phase Difference between S_{21} and S_{31}, (e) VSWR at Port1 (red), at Port 2 (Green), at Port 3 (Blue)

CONCLUSIONS

The design of balun at the frequency of 2.7 GHz has been presented by using defected ground structure. This structure of balun is applied using the five layered architecture and provides the almost equal magnitude at the balanced ports. For this structure the phase difference is taken about 180 degree out of phase at balanced ports. This structure has 18 dB return loss.

REFERENCES

1. J.Rogers, R.Bhatia,"A 6 to 20 GHz PLANNER BALUN USING A WILKINSONDIVIDER AND LANGE COUPLERS", IEEE MTT-S International symposium digest, 1991, pp.865-868.

2. Rajesh Mongia, Inder Bahl, Prakash Bhatia, “RF AND MICROWAVE COUPLED LINE CIRCUITS”, Artech house, Boston, 1991.

3. Dae-Won Lew, Jun-Seok Park, Dal Ahn, Nam-Kee Kang, In-Shig Park, Wook Lim, Chan-Sei Yoo,” A DESIGN OF THE CERAMIC MULTILAYER CHIP BALUN”,IEEE MTT-S International symposium Digest,1991,pp.1893-1896.

4. Rohit Samadhiya, P.K.Singhal, Prashant Gupta, “The design of Directional coupler using defected ground structure,” IJAECS, Issue3 Vol.1, Jan-Feb 2013.

5. CST Studio suite 2010