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ANALYSIS OF DIFFERENT SHAPES OF DEFECTED MICROSTRIP STRUCTURE (DMS) AND THEIR STOP-BAND PERFORMANCE

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ABSTRACT

In this paper the study of different shapes of defected microstrip structure is made with standard 50-ohm transmission line is perturbed with to generate rejection band at S and C-Band that is beneficial to higher order harmonic suppression. A comparison of G shaped, T shaped and Hash shaped Defected microstip structure has been evaluated and a comparative study is made.

Keywords: defected microstrip structure, rejection band, S and C-band.

INTRODUCTION

In modern wireless communication systems, compact and high performance filter is required to reduce the size and to enhance the performance of the system. Recently, the defected ground structure (DGS) for microstrip line has become more interesting area research in microwave circuits [1]. Defected ground structure was firstly proposed by park *et al*. based on the idea of photonic band gap (PBG) structure in 1990 [2], and this application is used in filters. Compared to PBG structure, defected ground structure requires only one defected unit to obtain a forbidden gap property [3] Recently, defected microstrip structure (DMS) has attracted more interests of researchers and engineers because of the simple circuit topology, and the properties of rejecting electromagnetic waves in certain frequencies and directions which are similar to the widely applied DGS, however, there is no harmful radiation from ground plane. DMS is made by etching a periodic or non-periodic pattern over the microstrip line (commonly over 50-ohm conductor strip), and there is no etching in ground plane. In DMS, the radiation from conductor strip defection can greatly reduce for existence of image current as before [5].

Microwave discontinuity like gap, T-shape, bend, step and etc. are some common changes that apply to microwave structures for leading to specific design performances. In this paper, gap structure studying in microstrip and presenting new structure using defected microstrip structures (DMS) has been discussed [4].

CIRCUIT MODEL AND IMPLEMENTATION

A. G- shaped DMS structure

Figure-1 shows the G shaped defected microstrip structure which is etched in the microstrip 50ohm line. The measurement of the design is presented in the Figure. The overall width of the slot which is etched is 0.1mm. two capacitor combines with the same inductor which will implies dual band rejection at 2.5Ghz and 6.4Ghz in Figure-2, the return loss is good in-between them at 18db which means it has good transmission signal .

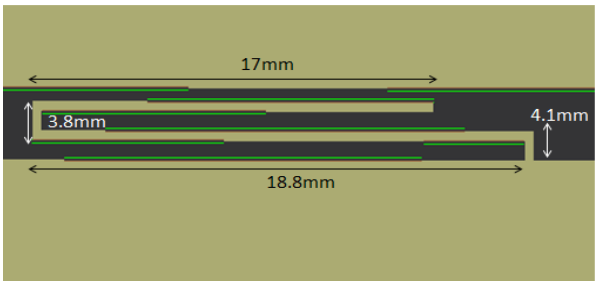

Figure-1. Design of G shaped DMS design.

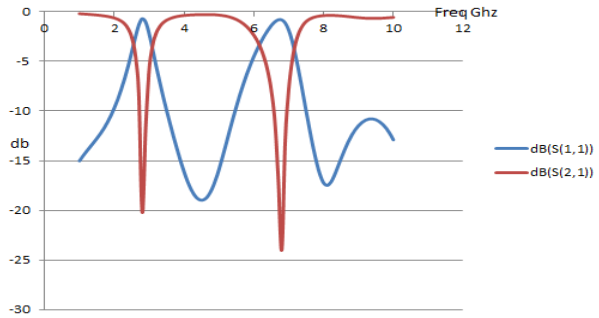

Figure-2. Result of G shaped design DMS.

B. T- shaped DMS structure

Frequency responses of the single-band stop filter are shown in Figure-3, and relationships of operation frequency with parameter of vertical slot are shown in Figure-4. It can be seen the operation frequency of the single stopband decrease with horizontal slot, the single-band operate at 5.5GHz, respectively, and has low loss.

As the vertical slot lengths is increased the stop-bands also gets increased as the combination gets increased with the inductor and capacitor. While having small slots one single stop-band is produced, and by increasing the vertical slot the stop band increased to the three at different frequencies , which is because of the inductor level gets increased with the increase in slot.

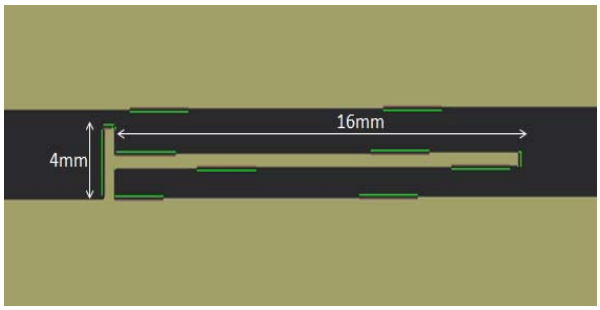

Figure-3. Design of T- shaped DMS.

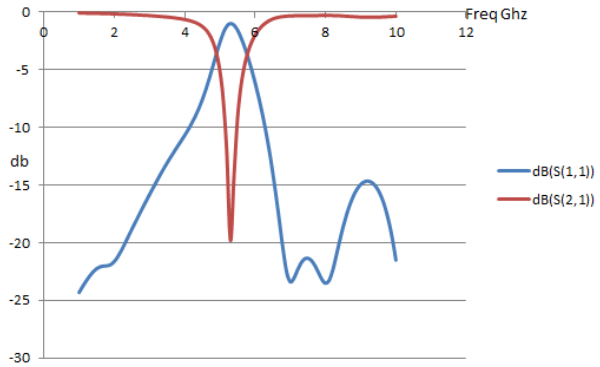

Figure-4. Result of T-shaped DMS design.

When vertical slot increases to 16 mm, a tri-band band stop filter is introduced for the effective inductance increases [4]. Figure-6 shows the simulated frequency responses of the tri-band band stop filter, and Figure-5 shows the relationships of operation frequency and parameter vertical slot. Seen when horizontal line increases the tri-band band stop filter operates at 2.3 GHz, 7GHz, and 11 GHz, respectively, and its operation frequency has similar variation trend with that of the dual-band one, and the operation frequency variation of the third band is more obvious than the other operation bands.

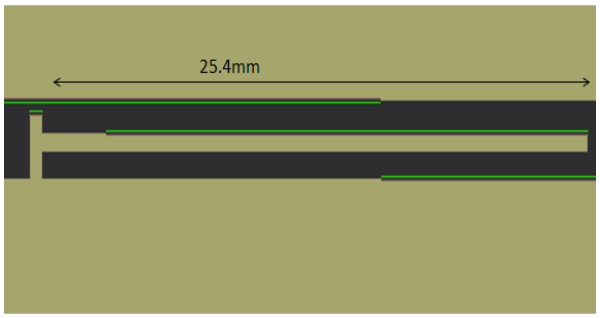

Figure-5. Design of T-shaped with increased length.

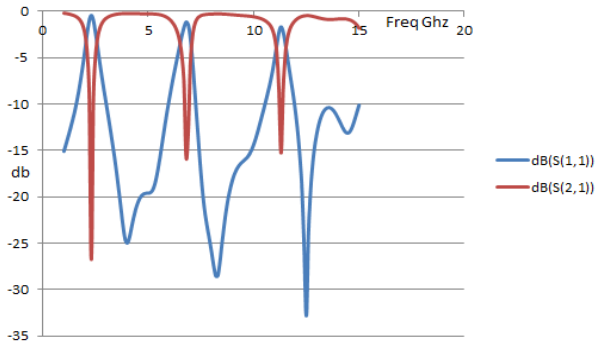

Figure-6. Result of T-shaped DMS with increased length.

C. Hash shaped DMS structure

A new hash shaped DMS design from the Figure-7, implies that the vertical two slots indicates the capacitor and the horizontal two thin slots indicates the inductor [6]. As the result in the Figure-8 indicates the wide pass band at s-c bands. The signal rejection is obtained at 8 GHz for the suppression of 16db. The work will be carried out for increasing the band rejection.

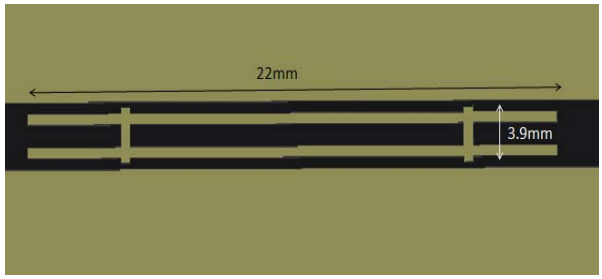

Figure-7. Design of Hash shaped DMS structure.

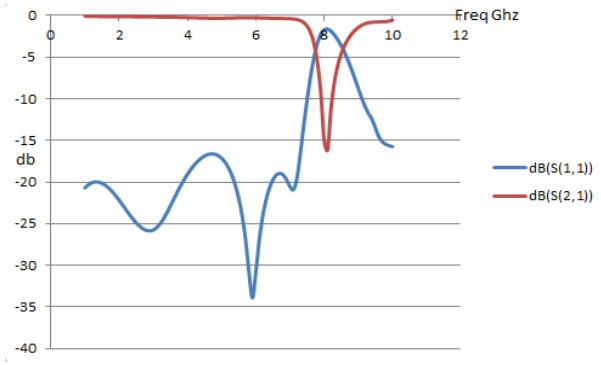

Figure-8. Result of Hash shaped DMS design.

Different shapes of defective microstrip structure	No. of Band rejection	Frequencies of Band rejection	Selectivity of the rejected band
G - Shaped	Two Bands	2.5 GHz, 6.4 GHz	-20 db, -24 db
T - Shaped (with small length)	One Band	5.5 GHz	-20 db
T - Shaped (with long length)	Three Bands	2.3 GHz, 7 GHz, 11 GHz	-27 db, -16 db, -15 db
Hash - Shaped	One Band	8 GHz	-16 db

D. Implementing hash shaped DGS

In the previous hash shaped defected microstrip structure will rejects the signal for only up to 16db, here we implement same shaped defected ground structure in Figure-9, which will increase the mutual coupling between the stripline and ground plane. This will leads to the increase in the selectivity of band rejection to 19.5db in Figure-10.

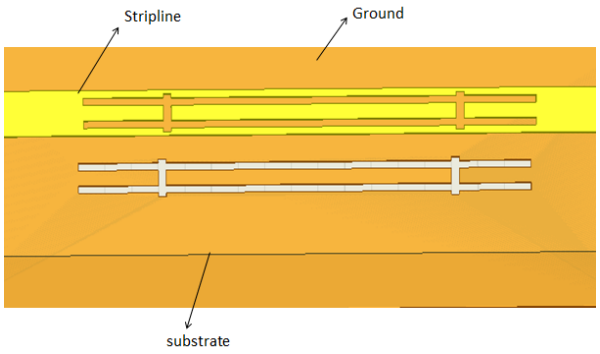

Figure-9. Hash shaped design etched in microstrip and ground.

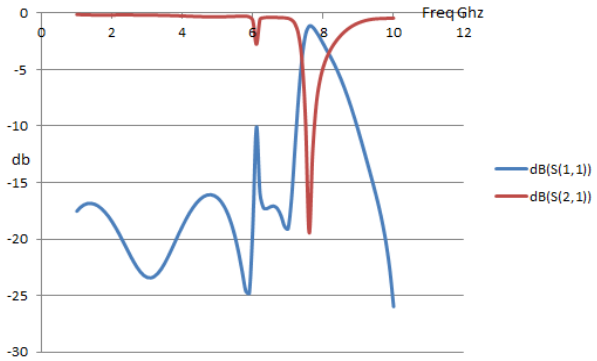

Figure-10. Result of Hash shaped design etched in microstrip and ground.

Hash - Shaped defective microstrip structure	Frequency rejection with selectivity of -16 db
Hash - Shaped defective microstrip structure with defected ground structure	Frequency rejection with selectivity of -19.5 db

CONCLUSIONS

In this paper, defected microstrip structure (DMS) which has no problem in study, and new band stop filters with a single band, dual-band and tri-band are proposed using different structures of DMS. The parametric analysis of different shapes of DMS plane and their different stop-band performance with optimized result for the applications for frequency for C and S band.

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