Design and Simulation of CMF with Three Conductor Model

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Abstract - In This Abstract For the design of Common Mode Filter (CMF), Practically not possible because of substrate unreliability or un predictability and process deviations always giving the more stop band offset of the Common Mode Filter at high frequencies. To overcome the stop band offset, in this paper, A general method for increasing the Wide Bandwidth of common mode filter is proposed. A three conductor model is used to increase the band width and also placed the one etched slot on the ground plane -2 we will increase the stop band bandwidth. The central frequency of wide band CMF around 22 GHz the differential signals is design.

Keywords**:** *Three Conductor Model, Differential Lines, Coplanar Common Mode Filter (CMF), Resonator, Stop band.*

I. INTRODUCTION

In Modern high speed digital circuits, The differential signal[3] are widely used because of High immunity to noise and low Electromagnetic Interference(EMI).Compared to the single ended signals ,the differential signals have more advantageous .The Common Mode Filters(CMF) [1], based on the low temperature co-fire ceramic is used to compress the common mode noise. In olden days CMF's are developed in Electromagnetic Band Gap structure(EBG), in this structures all the components are placed in the different layers , it will be cause the circuit more complex structures and high cost. But it will be giving more accurate results. Due to this problem we will propose the (PCB). In the PCB design all the components common mode filter (CMF) [1] in Printed Circuit Board are placed in the same plane. And it will be eliminating the circuit complexity. Therefore the coplanar CMF(usually is a quarter-wavelength resonator) and differential lines are on the same PCB layer as shown in the Figure: 1. Unfortunately, the commonly used coplanar CMF is a resonant structure, of which the stop band bandwidth is too narrow. To overcome this we placing the one rectangular slot in the Ground-2 plane will be improving the wide stop band bandwidth. A three conductor model[4], is presented to evaluate the coupling between the differential lines and the resonator. More coupling gives the more bandwidth.

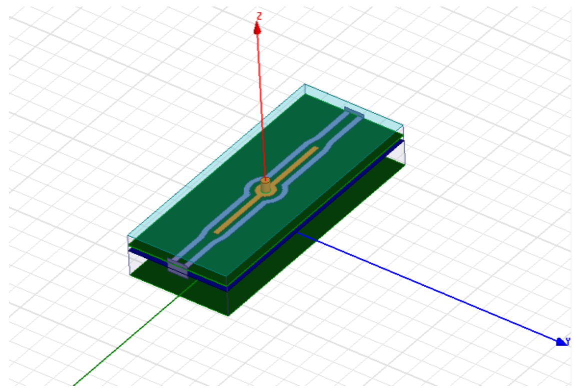

Fig.1: Coplanar common mode filter with three conductors

II. BRIEF EXPLANATION ABOUT EXISTING SYSTEM

In the existing design of a Common Mode Filter (CMF) fallows the one strategy was given below,

Coupling co efficient between the differential lines and resonator: in this strategy depending upon the coupling of both resonator and differential lines decides the system performance. That is more coupling will be giving the more efficiency depending upon the the efficiency will get the more results. But in the existing system the coupling between the differential lines and resonator will be narrow.

Differential signals [3], propagated as odd mode it will act as the perfect electrical wall it act as the electrical field and the common mode signals will propagated in even mode it will be act as the perfect magnetic wall. In addition the common mode noise will be eliminated. This is the principle of the Common Mode Filter(CMF).

But in the existing system will have the very less coupling so, it will give the very narrow bandwidth. In order to avoid the drawback of the existing system we will propose the proposed system. In the proposed system placing the etched slot on the ground plane we will improve the coupling coefficient between differential lines and the resonator and also increase the bandwidth.

III. BRIEF EXPLANATION ABOUT PROPOSED SYSTEM AND SIMULATION

Here, the proposed system follows 2 strategies. These two strategies used to overcome the drawback of the existing system design. The two strategies are:

3.1 Reducing the distance between conductors:

It is the first strategy used to improve the coupling co -efficient of resonator and differential lines. By varying the distance between conductor's means, by varying the ove the coupling coefficient. It will be improving the bandwidth or wide stop band. The minimum distance between the conductors (resonator and differential lines) is 4 mill.

3.2 Changing the reference plane for differential lines and resonator:

It is the second strategy of proposed system. In the first strategy we will discuss about reducing the distance, but it is not feasible approach because we are continuously changing the distance it will be effect to the other components. So, we will go for the second strategy.

For the improving the coupling coefficient of conductors and bandwidth we can place the etched slot in the ground-2 plane. In the existing system etched slot is not placed on ground-2 the reference plane for the conductors is ground-2 but, after placing [7], the slot in the proposed system the reference plane for the conductor structures is ground-3 i.e, the reference plane changing from ground-2 to ground-3.

It will be improving the more bandwidth with help of placing the etching slot on the ground-2.

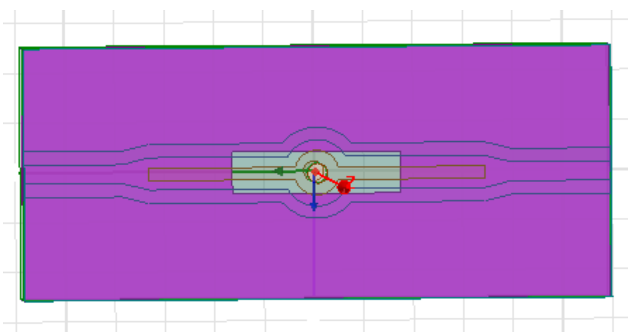

Fig.2: CMF with etched slot

3.2.1 Operation of CMF (Common Mode Filter):

In the operation of the proposed system when giving the input to the structure of the Common Mode Filter (CMF) i.e., the above all conductors placed in the one substrate material is Megtron 6 with a dielectric constant of 3.3 and loss tangent of 0.004. The input to the structure is given DC to 40GHz signal giving to the system. The all the signals will passing through the structure of resonator it will be stopping the our required frequency i.e., it will work on the 22 GHz band of frequencies it will be stopping that frequencies only, and remaining frequencies as shown in the Figure: 2 it will be allowing. Depending upon the resonator structure is a rounded structure this structure will be stopping the band of frequencies only.

IV. BASIC PARAMETERS FOR DESIGNING PROPOSED SYSTEM

The basic parameters to designing a proposed system values are given below,

Length = 238.25 mill
Breath = 101.25 mill
Height 1 = 0 mill
Height 2 = 19.69 mill
Height 3 = 32.27 mill
Slot width = 136 mill* 80 mill.

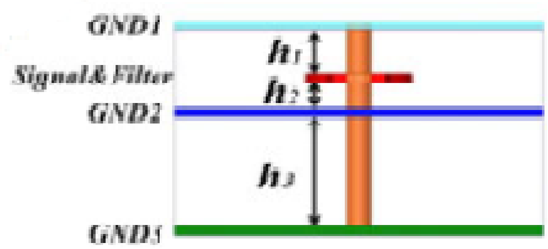

Fig.3: Heights indication of the structure arrangement.

These are the required parameter as shown in the Figure: 3 values to design the common mode filter.

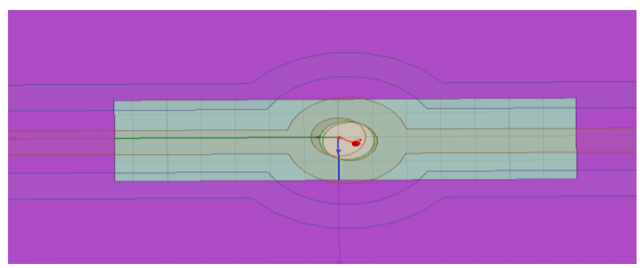

Fig.4: Rectangular Etched Slot Diagram

V. PERFORMANCE & DIFFERENCE BETWEEN EXISTING AND PROPOSED SYSTEM

(i) *Performance:* Compared to the existing system the proposed system has the more performance given. The existing system will not having the wide bandwidth and high return losses and it will having the narrow stop band.

But in the proposed system having the more bandwidth and low return losses. It having a wide stop band.

(ii) *Differences*: the difference between the existing system and proposed system only the etched rectangular slot. In the existing system the ground-2 does not having the rectangular etched slot placed in between the ground-1 and ground-3. But in the proposed system the rectangular etched slot placed in between the ground-1 and ground-3 on the ground-2 , due to placing this slot we could be increasing the wide stop band and also increasing the bandwidth.

VI. RESULTS

After design of Common Mode Filter we will simulated it. After getting the simulation results we will be observed that are band width are improved. That is wide stop band bandwidth will be provided.

6.1 Proposed System Plot:

Here in the proposed system results verifying the bandwidth value and how much band of frequencies it will be stopping the signals stop band it will be indicating.

Placing the etched rectangular slot on the ground-2 Plane we will be increasing the bandwidth and return losses. The results will shown in the given plot Figure:5.

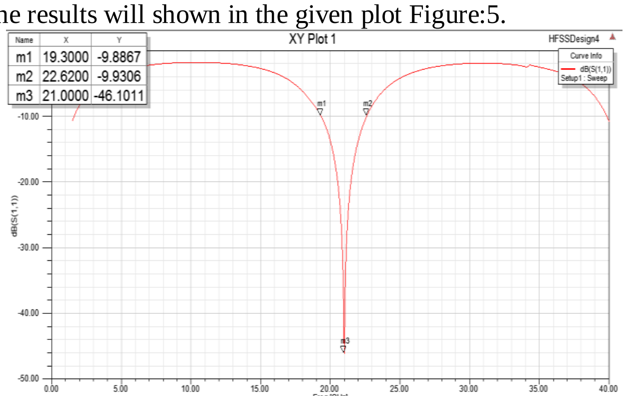

Fig.5: bandwidth plot of the proposed System.

The proposed system shows the more stop band at the 22GHz frequency. It has more bandwidth compared to the existing system and less return losses

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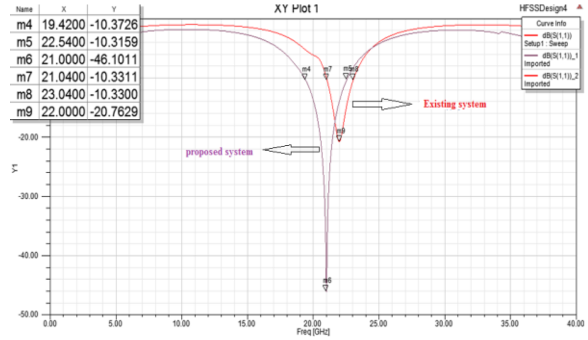

Fig.6 Comparison of existing and proposed system results.

The above plot Figure: 6 shows that the comparison between the existing system design and proposed system design of band width and return losses.

6.2 Comparison Table:

Table 1: comparison of existing and proposed system

PARAMETER	**EXISTING SYSTEM DESIGN**	**PROPOSED SYSTEM DESIGN**
BANDWIDTH	2 GHz	3.32 GHZ
RETURN LOSSES	-20.79 dB	-46.1 dB
VSWR	1.01	1.1

VII. CONCLUSION

In this paper, we propose an improved design of the high frequency co planar CMF with a wide band common-mode stop band. The major benefit of the proposed CMF is that it can compensate the dielectric constant and fabrication uncertainties by its wideband. This is useful for massive production of PCB'S. The simulation and measurement results have shown the effectiveness of the improved method . It should be noted that the proposed method is a general method for improving the current CMF design. It can be extended to other types of coplanar CMF based on different resonators.

VIII. REFERENCES

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