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Review of Large Bandwidth Microstrip Patch Filter for Wireless Applications

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Abstract- The use of the microstrip filter at the particular layers of the substrates, offers a wide range of application in modern communication, hence it is an area of research with creating interest among the researchers in recent years. Advancement in fabrication techniques of filter designing made possible to built ultra wide-band filter for RF and microwave applications. This manuscript is a novel collection the latest advances in the field of Microwave Filter and an extent of procedures that are causative to its improvement are shown. The unique features of this paper consolidate trade of different novel microstrip filter design with improvement in bandwidth and isolating qualities, we likewise survey the design of two band pass metamaterial filters with high selectivity based on the coupling matrix technique, the design methods discussed in the base paper are applied to metamaterial split ring resonators (SRRs) of second order but of differing feed structure for wireless application, this theory of split ring resonators (SRRs) will act as our base for research study, and their discoveries are accounted for in this examination.

Index Terms— Wide-band Bandpass Filters (WBPFs), Microstrip Filters, Microstrip Structure.

I. INTRODUCTION

With the increase of innovation in wireless communication system and advancement in fabrication techniques made it possible to construct microstrip filter on printed circuit board. Filter is needed in various devices like routers, cell phone base station, and TV tuners are some of the common examples. The prototyping in field of bandpass filter using microstrip structures is hot topic in the researchers arena in present days. Due to various advantages of microstrip filter such as its low cost, simple feeding methods, easy to fabricate and simple complexity in terms of design and time and made microstrip filter most attractive not only for prototyping but in industrial production as well. The contents of this paper is organized in such a way that Section II, describe the basic equations related with the designing of microstrip structure. Section III discuss different papers describing microstrip filters with techniques to improve the bandwidth. In section IV outline the conclusion and future work associated with this paper.

II. CHARACTERISTIC OF MICROSTRIP LINES

As a rule, the outline of microstrip filter includes with the determination of microstrip line and resonating structure, changing over transmission line equivalent lumped component segments for a filter and its qualities are then gotten by comparing the impedances of the transmission lines to the impedances of lumped components of microstrip line and resonating structure utilized in composed filter. The decision of the sort of reaction will rely upon the required particulars of channel. The diverse parameters which impacts the outline of microstrip filter is talked about in this segment.

Transmission attributes of microstrips are portrayed by two parameters, in particular, the effective dielectric constant ε_{re} and characteristic impedance Zc, which may then be acquired by quasi-static analysis [1][2],

$$\varepsilon_{re} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left(1 + \frac{10}{u}\right)^{-ab} \quad \textbf{(1)}$$

where $u = W/h$, and

$$a = 1 + \frac{1}{49}\ln\left(\frac{u^4 + \left(\frac{u}{52}\right)^2}{u^4 + 0.432}\right) + \frac{1}{18.7}\ln\left[1 + \left(\frac{u}{18.1}\right)^3\right] \quad (2)$$

$$b = 0.564\left(\frac{\varepsilon_r - 0.9}{\varepsilon_r + 3}\right)^{0.053} \quad (3)$$

The accuracy of this model is better than 0.2% for $\varepsilon_r \leq 128$ and $0.01 \leq u \leq 100$.
The expression for the characteristic impedance is

$$Z_c = \frac{\eta}{2\pi\sqrt{\varepsilon_{re}}}\ln\left[\frac{F}{u} + \sqrt{1 + \left(\frac{2}{u}\right)^2}\right] \quad (4)$$

where $u = W/h$, η= 120**π**ohms, and

$$F = 6 + (2\pi - 6)\exp\left[-\left(\frac{30.666}{u}\right)^{0.7528}\right] \quad (5)$$

III. REVIEW OF BASE PAPER

Following section describes some of the latest paper based on microstrip filter designs, after review and a conclusion is drawn from the combined study.

Title: High Selective SRR-Based Narrow Band Filter with 0º Feed Structure

Author: Zeinab K. Fouda, Ahmed A. Ibrahim, Mahmoud A. Abdalla

Publication: IEEE International Conference on Radio Science, Misr International University (MIU), Cairo, Egypt 2018.

The design of two band pass metamaterial filters with high selectivity based on the coupling matrix technique is presented. The design methods discussed below are applied to metamaterial split ring resonators (SRRs) of second order but of differing feed structure. The proposed band pass filters are devised to adhere to wireless LAN application requirements with a center frequency of 2.4 GHz. Both the simulated and measured results of the proposed filters show an insertion loss below 0.7 dB within the pass band range. The final proposed filter boasts a compact size of only 3 × 2 cm2 due to the use of SRRs.

Title: Compact Tunable Dual-band Bandpass Filter using Edge-open Split Ring Resonators for X-Band Applications.

Author: Sushmeetha R R, Natarajamani S.

Publication: IEEE International Conference on Advances in Computing, Communications and Informatics (ICACCI) 2018.

In this paper an edge open split ring resonator (SRR) is used to design a dual band pass filter (BPF) which is obtained by modifying the conventional SRRs. To achieve dual passbands with improved filter characteristics , connect the inner ring and outer ring of the edge open SRRs to stubs. The rings of the SRR are stacked with vacractor diode to tune the individual passbands of the proposed band pass filter.The first passband can be tunned freely by shifting the capacitance of varactor diode D1 while the second passband stays unaltered by fixing the capacitance of varactor diode D2 and vice-versa . Hence, the proposed filter helps in tunning both the passbands freely of about 0.66 GHz for the first passband and 0.3GHz for the second passband and accomplishes minimization in size of about 20mm x14mm . The ring equivalent of every ring and acquired S parameter after effects of the proposed band pass filter (BPF) while tunning the individual passbands are examined in this paper.

Title: Bandpass Filter Microstrip Using Octagonal Shape for S-Band Radar.

Author: Teguh Praludi, Yaya Sulaeman, Yana Taryana, and Bagus Edy Sukoco

Publication: Published in IEEE International Conference on Radar, Antenna, Microwave, Electronics, and Telecommunications 2017.

In this paper, the simulation and realization of Bandpass filter with octagonal shaped hairpin have been done to investigate dimension and filter responses. This filter is designed with open loop resonators and the half wavelength octagonal. Bandpass filters are made in the form of microstrip line filter using fully ground plane at the button of the substrate with a center frequency is 3 GHz. Patch and ground plane used comes from the copper layer, substrate having a 4350B Rogers Duroid with dielectric constant of 3.48 and the value of the loss tangent of 0.0004.

IV. CONCLUSION

In this paper, a comprehensive examination is shown on the fundamental idea of microstrip structure and condition for bandwidth improvment using various techniques for bandpass filters. Here we examine three latest papers as our base of studies in first paper we can conclude with the fact that Split ring resonator (SRR) technique is very effective in bandwidth enchantment of microstrip filter. Second paper is employed for the increasing number of radiation band by using SRR as well, hence SRR is one of the very useful technique in order to improve bandwidth and multiple band of operation. With the help of third paper we can see the impact of electromagnetic band gap (EBG) and higher polynomials structure is utilized for the improvement of bandwidth for the proposed filters. Further research can be implemented with the polygonal shape SRR to get a desired ultra bandwidth microstrip filter.

V. REFERENCES

[1] Zeinab K. Fouda, Ahmed A. Ibrahim, Mahmoud A. Abdalla "High Selective SRR-Based Narrow Band Filter with 0º Feed Structure," IEEE International Conference on Radio Science, Misr International University (MIU), Cairo, Egypt 2018.

[2] Sushmeetha R R, Natarajamani S., "Compact Tunable Dual-band Bandpass Filter using Edge-open Split Ring Resonators for X-Band Applications," IEEE International Conference on Advances in Computing, Communications and Informatics (ICACCI) 2018.

[3] Teguh Praludi, Yaya Sulaeman, Yana Taryana, and Bagus Edy Sukoco, "Bandpass Filter Microstrip Using Octagonal Shape for S-Band Radar," IEEE International Conference on Radar, Antenna, Microwave, Electronics, and Telecommunications 2017.

[4] Chengying Du, Kaixue Ma, Shouxian Mou, "A Controllable and Low Loss Dual-Band Bandpass Filter by using a Simple Ring Resonator," IEEE conference IMWS-AMP, 2016.

[5] Lakhpat Singh Purohit, and Lokesh Tharani, "Band configurable multi-band BPF using step impedance resonator structure," IEEE International Conference on Control, Computing, Communication and Materials (ICCCCM), 2016.

[6] P. Mondal and M. K. Mandal, "Design of dual-band bandpass filters using stub-loaded open-loop resonators,"

IEEE Trans. Microw. Theory Techn., vol. 56, no. 1, pp. 150–155, Jan. 2008.

[7] J.-W. Fan, C.-H. Liang, and D. Li, "Design of cross-coupled dual-band filter with equal-length split-ring resonators," Prog. Electromagn. Res., vol. 75, no. 1, pp. 285–293, 2007.

[8] H. Liu, B. Ren, X. Guan, J. Lei, and S. Li, "Compact dual-band bandpass filter using quadruple-mode square ring loaded resonator (SRLR)," IEEE Microw. Wireless Compon. Lett., vol. 23, no. 4, pp. 181–183, Apr. 2013.

[9] M. Zhou, X. Tang, and F. Xiao, "Compact dual band bandpass filter using novel E-type resonators with controllable bandwidths," IEEE Microw. Wireless Compon. Lett., vol. 18, no. 12, pp. 779–781, Dec. 2008.

[10] X. Y. Zhang and Q. Xue, "Novel dual-mode dual-band filters using coplanar-waveguide-fed ring resonators," IEEE Trans. Microw. Theory Techn., vol. 55, no. 10, pp. 2183–2190, Oct. 2007.

[11] L. M. Wang et al., "Quarter-wavelength stepped-impedance YBCO resonators for miniaturized dual-band high-Tc superconducting filters," IEEE Trans. Appl. Supercond., vol. 19, no. 3, pp. 895–898, Jun. 2009.

[12] K. S. K. Yeo and M. J. Lancaster, "8 pole high temperature superconductor microstrip dual band bandpass filter design," in IEEE MTT-S Int. Microw. Symp. Dig., Jun. 2011, pp. 1–4.

[13] L. Y. Ji, J. Ma, J. Sun, L. Wang, Y. Q. Li, and B. Liu, "Design and performance of dual-band high temperature superconducting filter," Sci. China Inf. Sci., vol. 55, no. 4, pp. 956–961, Apr. 2012.

[14] N. Sekiya and S. Sugiyama, "Design of miniaturized HTS dual-band bandpass filters using stub-loaded meander line resonators and their applications to tri-band bandpass filters," IEEE Trans. Appl. Supercond., vol. 25, no. 3, Jun. 2015, Art. no. 1500805.

[15] F. Song, B. Wei, L. Zhu, B. S. Cao, and X. L. Lu, "Dual-band hightemperature superconducting bandpass filter using quint-mode stubloaded resonators," IEEE Trans. Appl. Supercond., vol. 25, no. 4, Aug. 2015, Art. no. 1501410.