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Design of Planar Triple Mode Dipole Antenna for 900/1800/2400 MHz Applications

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Abstract-This Paper presents the design and simulation of a low profile planar triple mode dipole antenna which is designed for wireless applications. Three symmetric arms are etched on metallic layer of a single sided printed circuit board (PCB). By changing the size of the arms of the antenna we can adjust the resonant frequency. Computer Simulation Technology (CST) studio software is used for design the antenna which has its peak gain at 900/1800/2400 MHz. The effect of changing length of antenna arms on resonant frequency and parameters S_{11} (return loss) are described. Proposed antenna can also be work as sensor application at different frequency 900/1800/2400 MHz.

Keywords- Computer Simulation Technology (CST), Printed Circuit Board (PCB), Voltage Standing Wave Ratio (VSWR)

I. Introduction

In recent years, focus is shifted towards the design and development of multi-band frequency antenna system due to having a number of attractive features like small size, low cost, low power requirements and easy to fabrication etc. A planar triple mode antenna having all these attractive features. In recent years, many study about multiple frequency band antenna of different types and different shapes has been proposed and widely used in communication systems [1]. Here a triple mode antenna has been designed. Designed antenna has three arms: Lower arms (L_1), Middle arm (L_2), Upper arm (L_3). Each arm is designed to work on a particular resonant frequency. The whole work of designing of an antenna is done on CST software. Different parameters like return loss, co-polarization, cross polarization, voltage standing wave ratio (VSWR), radiation pattern are obtained by using CST software [2]. The lower arm of the proposed antenna is designed to work on 900 MHz, middle arm of the antenna is designed to work on 1800 MHz and upper arm of the antenna is designed to work on 2400 MHz. A single sided PCB is used for fabrication of designed antenna, it reduce the manufacturing cost and suitable for mass production.

In this paper, section I gives the significance of multiple-band antennas, section II gives the detailed overview of Triple band antenna with its block diagram whereas section III presents the simulation work and discussion followed by conclusion in section IV.

II. Antenna Design

Proposed antenna is shown in figure 1. We can adjust the resonant frequency by varying the length parameters of Lower arms (L_1), Middle arm (L_2), Upper arm (L_3). Proposed antenna has a fixed corner length (S) which is 2mm.Antenna is fabricated on PCB having substrate of material FR4 with permittivity 4.4. The dimension of the design antenna is shown in the table I given below:

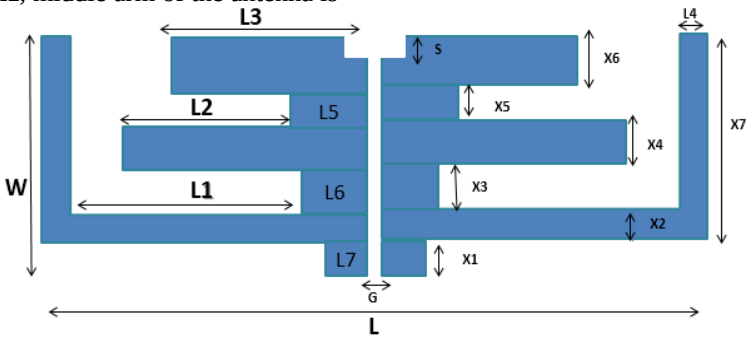


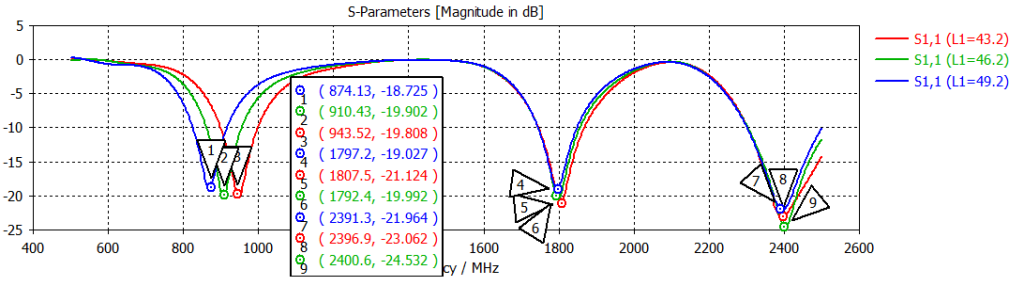
Figure 1. Configuration for the proposed Triple Mode Dipole Antenna

Table I: Different parameter lengths of the proposed antenna

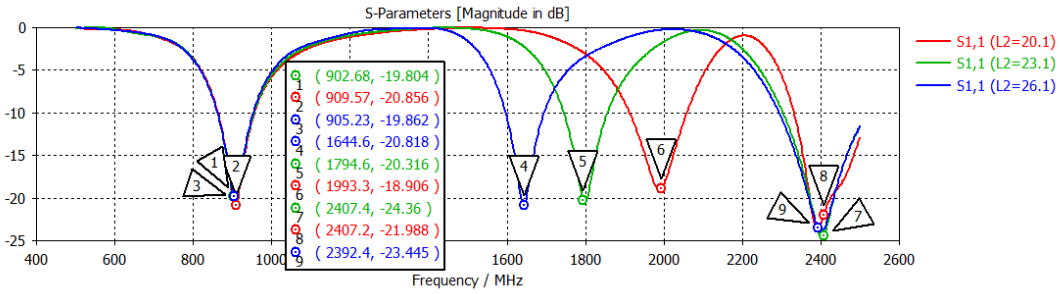
Parameters	Values	Parameters	Values
G	0.45	W	20.00
L1	46.20	X1	2.00
L2	23.10	X2	3.00
L3	26.20	X3	2.50
L4	4.00	X4	2.50
L5	9.00	X5	3.00
L6	7.00	X6	7.00
L7	5.00	X7	18.00
S	2.00		

III. Simulation Results and Discussion

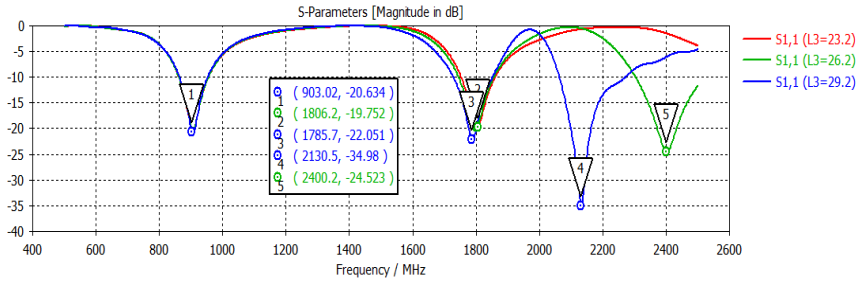
Here in this study, we observe the characteristic variation of the antenna by varying the length of antenna arms i.e. Lower arms (L_1), Middle arm (L_2), Upper arm (L_3). The simulated results at different lengths are performed with the help of CST software. The simulated return loss curve with respect to frequency for varying the length parameters of lower arm are shown in figure 2. Here we observe that if we increase the length of lower arm then frequency is shifted to lower frequency. In same manner, if we reduce the length then frequency is shifted higher than resonant frequency which is shown in figure below.



(a)



(b)



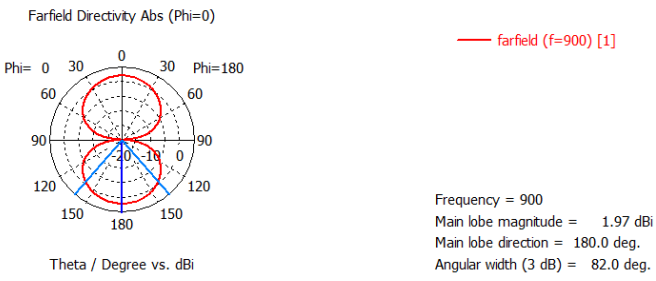
(c)

Figure 2 (a), (b), (c): Simulated Curves of Return Loss against the frequency for varying the lengths L_1, L_2, L_3 respectively of the proposed Triple Mode Dipole antenna

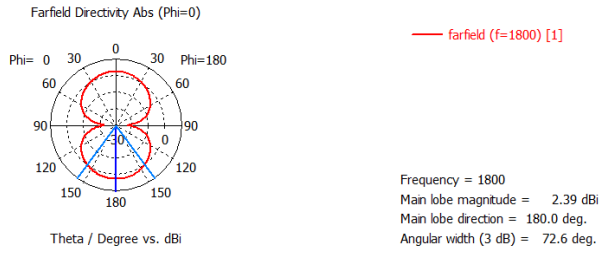
Table II: Simulated Results of varying Length Parameters of the proposed Triple Mode Antenna

L1(mm)	L2(mm)	L3(mm)	Frequency band(GHz)	Resonant Frequency fc(MHz)	Return loss(RL)
43.2	23.1	26.2	Lower	943.52	-19.80
			Middle	1807.5	-21.12
			Upper	2396.9	-23.06
46.2	23.1	29.2	Lower	910.43	-19.90
			Middle	1792.40	-19.92
			Upper	2400.60	-24.53
49.2	23.1	26.2	Lower	874.13	-18.7
			Middle	1797.20	-19.02
			Upper	2391.30	-21.94
46.2	20.1	26.2	Lower	909.57	-20.85
			Middle	1993.30	-18.90
			Upper	2407.20	-21.39
46.2	23.1	26.2	Lower	902.68	-19.80
			Middle	1794.60	-20.31
			Upper	2407.40	-24.36
46.2	26.1	26.2	Lower	905.23	-19.86
			Middle	1644.60	-20.81
			Upper	2392.40	-23.44
46.2	23.1	23.2	Lower	903.02	-20.63
			Middle	1806.20	-19.75
			Upper	2550	-12.00
46.2	26.1	29.2	Lower	903.02	-20.63
			Middle	1806.20	-19.75
			Upper	2400.20	-24.52
46.2	23.1	29.2	Lower	903.02	-20.63
			Middle	1785.70	-22.05
			Upper	2130.50	-34.98

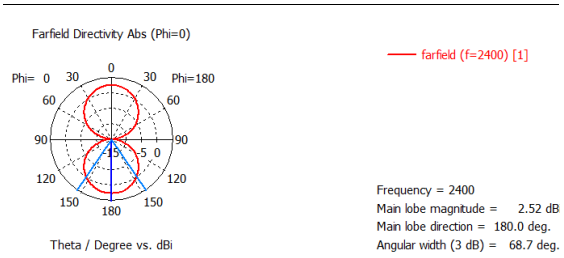
In figure 2 (b) and (c), it is shown that by increasing and decreasing the lengths of arms L_2 and L_3 , return loss minimum at resonant frequency 1800 MHz and 2400 MHz shifted downwards and upwards respectively. Table II shows the resonant frequency and their respective return loss by varying the length parameter of Triple Mode antenna**.**



(a)



(b)



(c)

Figure 3 (a), (b), (c). Radiation Pattern of Antenna in the E-plane at frequency 900/1800/2400 MHz respectively

Figure 3(a), (b), (c) shows radiation pattern of E-field of triple arm antenna at 900/1800/2400 MHz respectively. At 900 MHz frequency maximum gain in directive field 1.97 dBi , 1800 MHz maximum gain is 2.39 dBi and at 2400MHz maximum gain is 2.52 dBi.

Figure 4 and 5 shows that at proposed length of TSAD antenna return loss and VSWR is minimum at desired frequency 900/1800/2400 MHz respectively. The suggested length of the proposed triple mode antenna is L1= 46.2mm, L2 =23.1mm and L3= 26.2mm. At these arm's length antenna shows very good response and gets maximum gain and minimum return loss.

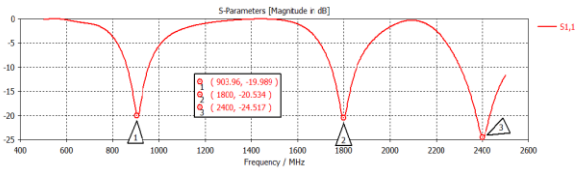


Figure 4. S- Parameter of Triple Mode Antenna at proposed length

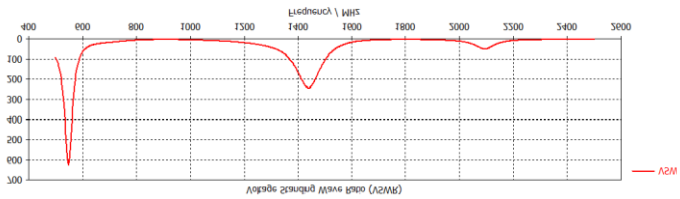


Figure 5. VSWR of Triple Mode Antenna at proposed length

IV. CONCLUSION

A simple planar triple mode dipole Antenna for sensor application has been presented in this paper. The designed antenna can be used in frequency band of 900/1800/2400 MHz. By properly choosing the length parameters of arms, maximum gain has been obtained at desired frequencies. The antenna is fabricated on simple PCB, which reduces the manufacturing cost.

V. REFERENCES

[1] Y.Y. Lu, J.Y. Guo, H.C. Huang, *"Design of Triple Symmetric Arms Dipole Antenna for 900/1800/2450MHz Applications,"* pp.978-1-4799-5390, 2014.

[2] H. Prasad, M. J. Akhtar, *"CPW fed Triple Band Antenna for Sensor Application",*IEEE International Microwave and RF Conference (IMaRC).pp 333-336, 2015.

[3] W. Lin, Q.X. Chu, *"Novel RFID tag antenna for matching complex impedances on 915MHz and 2.45GHz bands",* Proceedings of APMC, pp. 2248-2251, Dec. 2010.

[4] Y.-Y. Lu, S. H. Wu, H. C. Huang, *"Design of Triple-Band Fork-Shaped CPW-fed Antenna,"* Third International Conference on Robot, Vision and Signal processing, DOI: 10.1109, pp. 236-239, 2015.

[5] P. Xu, Z.H. Yan, C. Wang, *"Multi-band modified fork-shaped monopole antenna with dual L-shaped parasitic plane*", Electronics Letters, Vol. 47, no. 6, pp. 364-365, 2011.

[6] W.S. Chen, J.W. Wang, B. Y. Lee, H.Y. Lin, *"A small planar 4G antenna with a coupled-fed monopole and a directed-fed monopole for mobile handset application,".* Proceedings of APMC, pp. 334-336, Dec. 2012.

[7] Y. Y. Lu, J. Y. Kuo, H. C. Huang, "*Design and application of triple-band planar dipole antennas,"* Journal of Information Hiding and Multimedia Signal Processing, Vol. 6, No. 4, pp. 792-805, July.

[8] Y. D. Kim, H. M. Lee, "*Design of compact triple-band meander chip antenna using LTCC technology for mobile handsets,"* Microwave and Opt. Tec. Let., Vol. 48, pp. 160-162, 2006.

[9] Y. A. Lee, H. J. Lim, H. M Lee, *"Triple-band compact chip antenna using coupled meander line structure for mobile,* RFID/PCS/WiBro, IEEE AP-S Int Sy, pp. 2649-2652, 2006.

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