WIDTH FEEDING STRIPLINE OPTIMISE OF CURVED MICROSTRIPLINE ARRAY VARIANS ANTENNA IN MULTIBAND FREQUENCY FOR RADAR COMMUNICATIONS

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ABSTRACT

This study proposed to design of curved microstripline array antenna with more optimal characteristics parametric through optimise in width feeding stripline and its application for radar communications. Numeric analysis with an empirical formula in curved microstripline array antenna supports the counting in relation to the characteristics antenna that is optimally applied in communications. The simulations was created by using CST software. The result of simulation is to indicate Voltage Standing Wave Ratio (VSWR), Reflection coefficient, Return Loss and Gain with Vertical Linear Polarization. The optimise of curved microstripline array varians with the varians array and optimise varians in width of the feeding stripline. Based on this simulated result, curved microstripline array varians antenna is potential to developed antenna in radar communication in multiband frequency.

KEYWORDS

Simulation, Curved Microstripline, Multi Band Frequency, Radar Communication

1. INTRODUCTION

To design and analyze the shape and size of the antenna required special knowledge regarding the electromagnetic field theory. Electromagnetic fields generated depend on the distance of the source access and terrain [2]. The further course of electromagnetic fields produced less meaning in the spread process electromagnetic waves from the transmitter to the receiver experiencing attenuation (weakening) signals. Therefore, the required antenna design with specific dimensions that have a high gain value and high directivity with return loss is very small [3]. Various studies have been conducted on microstrip antenna [1,7,8,9,12,17]. In this research proposed new type of antenna that will be designed to have the characteristics in question are Curved Microstripline Array Antenna Design. This antenna is an antenna type Microstrip with the characteristics of a thin cross section, the mass that is lightweight, easy to make, can be easily integrated with Microwave Integrated Circuits (MICs) and can be made to multifrequency [4,5,6]. In this research, Novel curved microstripline array antenna design and its optimise is propose to develope in Multiband frequency for radar communications. The optimise in width feeding stripline will be done to get optimal result in antenna parametric that as a good performance indicator in multiband frequencies for radar communication application. The proposed Novel curved microstripline array antenna is afford to operate in Multiband frequency. The target of Novel curved microstripline array antenna is in multiband frequency, reflection coefficient less than –10dB, Voltage Standing Wave Ratio (VSWR) less than 2, gain more than 5dB, respectively.

2. EMPIRICAL ANALYSIS AND DESIGN

The first calculating is to find the total electricity permittivity (ε_{rtot}) using the capacitor equation:

$$\frac{1}{c_{tot}} = \frac{1}{c_1} + \frac{1}{c_2}$$

$$\frac{1}{\varepsilon_o \varepsilon_{r\ tot}\ A / d\ tot} = \frac{1}{\varepsilon_o \varepsilon_{r_1}\ A_1 / d_1} + \frac{1}{\varepsilon_o \varepsilon_{r_2}\ A_2 / d_2}$$

where ε_{r1} is ε_r for air ($\varepsilon_{r1} = 1$), ε_{r2} is ε_r for substrate (εr $FR_4 = 4.3$), d_1 thick of substrate and d_2 distance of substrate to the reflector, with dtot is d_1+d_2.
And then using the following equation:

$$\varepsilon_{eff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left(1 + 10\frac{h}{w}\right)^{-0,555}$$

To calculate the effective permittivity electricity (ε_{eff}). Where ε_r is the same with εr_{tot}, h is d_{tot} and w is the various wide for patch and stripline side.
The following equation is to know the maximum dimension in the patch side (w_1):

$$f = \frac{2c}{3w\sqrt{\varepsilon_r}}$$

$$w_1 = \frac{2c}{3\sqrt{\varepsilon_r}\ f}$$

where c is lightspeed in air, ε_r is electricity permittivity and f is frequency.

And to calculate the effective width stripline side ($w_{2,3}$), using the following figure:

$$W_{2,3} = \frac{1}{2f\sqrt{\mu_0 . Z_o}}\sqrt{\frac{2}{\varepsilon_r + 1}}$$

Where f is frequency, μo is permeability constant and Zo is characteristic impedance.

The calculation wavelength of the substrate (λg), using the following equation:

$$\lambda g = \frac{\lambda}{\sqrt{\varepsilon_{eff}}}$$

From the analysis above we find to fix the parameter of antenna fabrication.

The following figure is the Curved Microstripline Antenna Design in array varians.

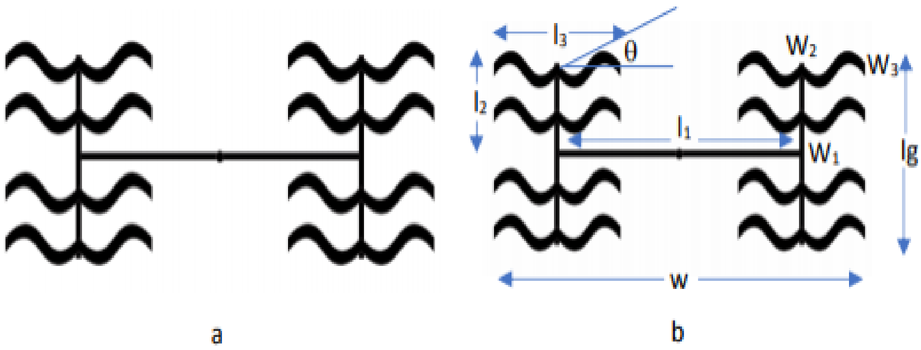
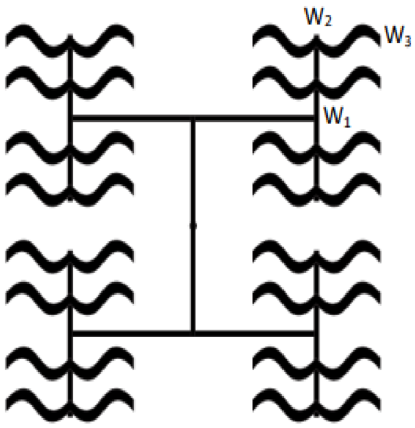
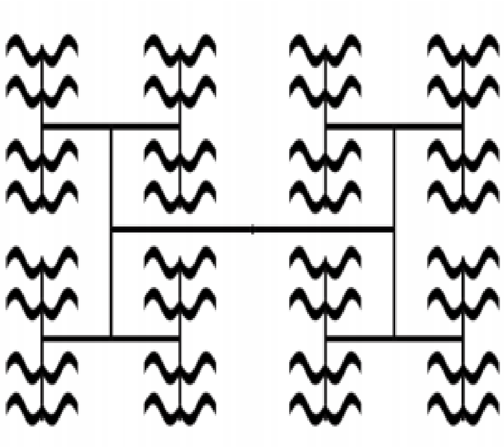


Figure 4. (a) Curved Microstripline 2x2 Array Antenna Design
(b) Dimension of Curved Microstripline 2x2 Array Antenna Design



Model 1		Model 2	
w_1 (mm)	1	w_1 (mm)	1
w_2 (mm)	2	w_2 (mm)	1
w_3 (mm)	2	w_3 (mm)	2

Figure 5. Model 1 and 2 width feeding stripline varians
(Curved Microstripline 2x4 Array Antenna Design)



Model 1		Model 2	
w_1 (mm)	1	w_1 (mm)	1
w_2 (mm)	2	w_2 (mm)	1
w_3 (mm)	2	w_3 (mm)	2

Figure 6. Model 1 and 2 width feeding stripline varians
(Curved Microstripline 4x4 Array Antenna Design)

3. RESULT AND DISCUSSION

The simulation result of Curved Microstripline 2x2 Array Antenna Design:

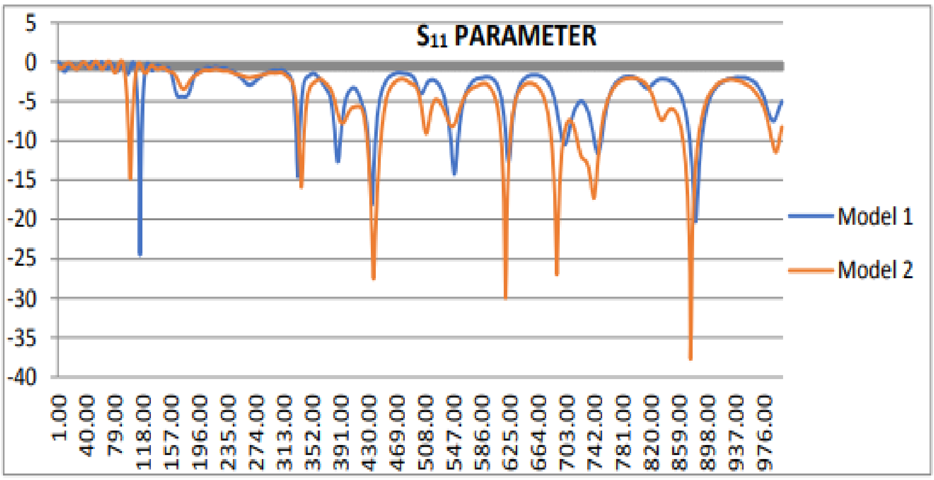


Figure 7. Model 1 and 2 width feeding stripline varians
(S_{11} Parameter Simulation)

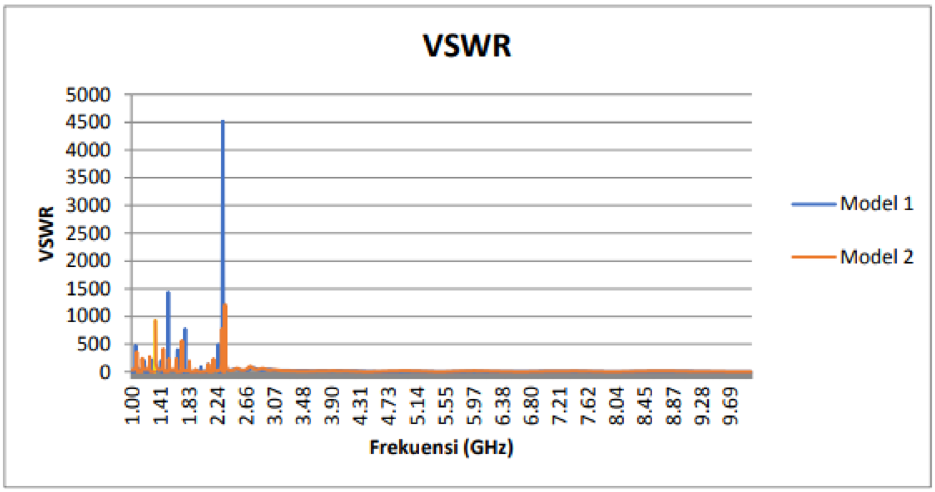


Figure 8. Model 1 and 2 width feeding stripline varians
(VSWR Parameter Simulation)

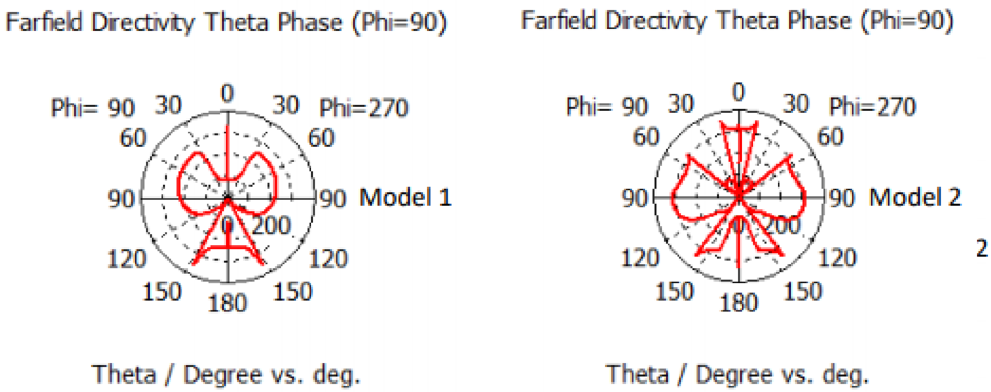


Figure 9. Model 1 and 2 width feeding stripline varians
(Radiation Pattern Parameter Simulation)

The result indicate that the Curved Microstripline 2x2 Array Antenna Design work in multi band frequency (f=2GHz, f=4.5GHz, f=5.5GHz, f=8GHz, f=9.8GHz) with approximately VSWR $\leq$ 2, Return Loss $\leq$ -10dB and 5.27dB Gain in Omnidirectional radiation pattern.

The simulation result of Curved Microstripline 2x4 Array Antenna Design:

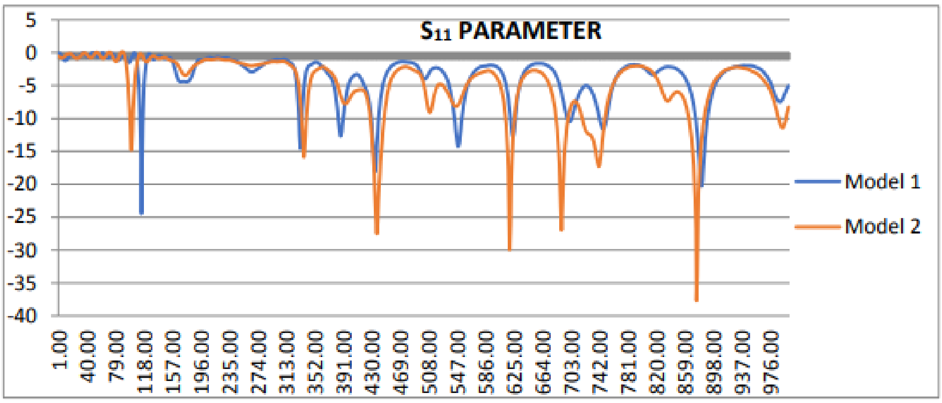


Figure 10. Model 1 and 2 width feeding stripline varians(S_{11} Parameter Simulation)

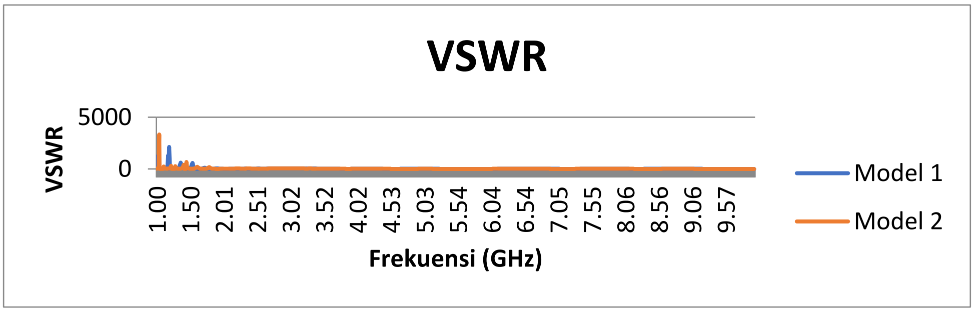


Figure 11. Model 1 and 2 width feeding stripline varians(VSWR Parameter Simulation)

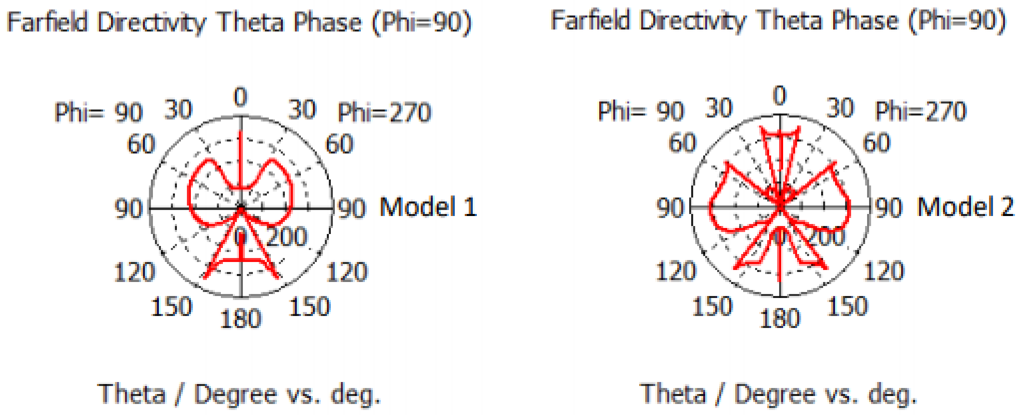


Figure 12. Model 1 and 2 width feeding stripline varians
(Radiation Pattern Parameter Simulation)

The result indicate that the Curved Microstripline 2x4 Array Antenna Design work in multi band frequency (f=4.6GHz, f=5.4GHz, f=7.2GHz, f=9.8GHz) with approximately VSWR ≤ 2, Return Loss ≤ -10dB and 4.50dB Gain in Omnidirectional radiation pattern.

The simulation result of Curved Microstripline 4x4 Array Antenna Design:

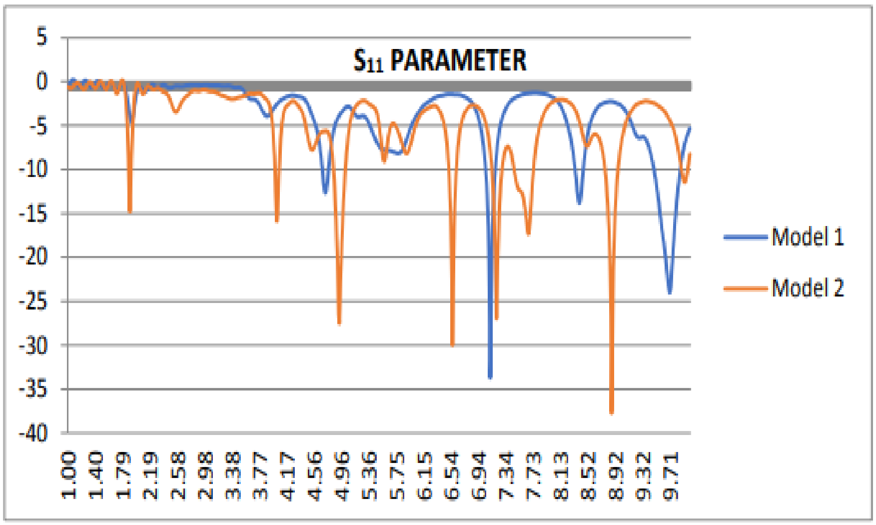


Figure 13. Model 1 and 2 width feeding stripline varians
(S_{11} Parameter Simulation)

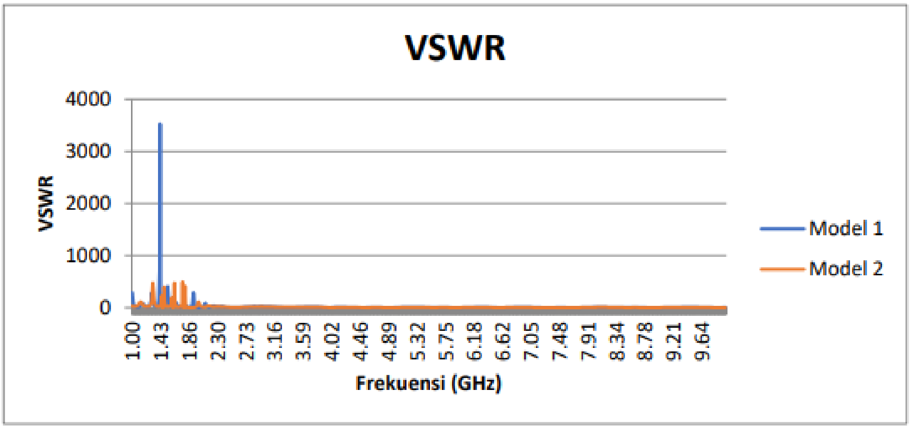


Figure 14. Model 1 and 2 width feeding stripline varians
(VSWR Parameter Simulation)

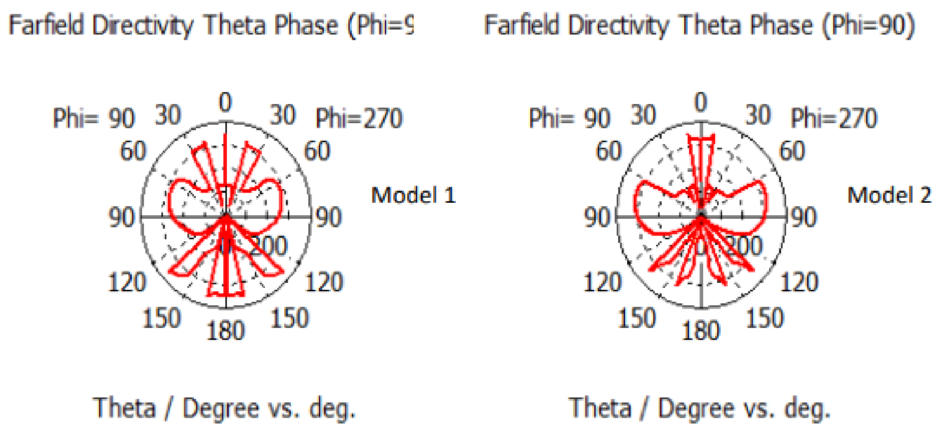


Figure 15. Model 1 and 2 width feeding stripline varians
(Radiation Pattern Parameter Simulation)

The result indicate that the Curved Microstripline 4x4 Array Antenna Design work in multi band frequency (f=2.0GHz, f=3.9GHz, f=4.5GHz, f=4.9GHz, f=5.8GHz, f=6.6GHz, f=7.7GHz, f=8.9GHz) with approximately VSWR $\leq$ 2, Return Loss $\leq$ -10dB and 6.14dB Gain in Omnidirectional radiation pattern.

4. Conclusion

Width feeding stripline optimise of Curved Microstripline Array Varians Antenna in multiband frequency for radar communications has been presented in this paper. In general, the result was indicate that Curved Microstripline Array Varians Antenna design work in multiband frequency and its can be operated in radar communication application recently. The satisfy indicator parameter characteristic are obtain in term of reflection coeficient, voltage standing wave ratio, return loss, axial ratio and radiation pattern. But, the gain in this antenna still small less than 10dB. This gain result influenced by the dimension in stripline feeding and need more analysis increasing the gain. Based on this result, the proposed Curved Microstripline Array Varians Antenna can be implemented in Radar communication systems.

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