

Rectangular Patch Array Antenna with a Partial Ground

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Abstract

In this research paper simple rectangular patch array antenna has been proposed. The microstrip technique is used to feed the signal to the array. This antenna has a partial ground structure. The proposed antenna has been simulated using FR4 substrate and observed simulated impedance bandwidth is 2.278GHz in the frequency band 2.09GHz -4.372GHz. The gain of antenna has been achieved up to 1.05dBi at 3.75GHz. The simulated results of radiation patterns and current distribution has been presented and discuss in this work.

Keyword : *Partial ground, array, feed*

1. Introduction

Today's Wireless communication needs a device which is suitable and fulfill today's requirement of small size, mobile, effortlessly integrate with systems. Most of the applications needs wide bandwidth Microstrip Patch Antenna.

Many of the researchers carried out work on Bio-medical applications. FCC defines UWB band which is suitable for biomedical application from 3.1GHz to 10.6GHz.

Slotting and partial ground technique is preferred to enhance impedance bandwidth of design antenna. Different shapes of slot like U slot, T slot have been incorporated on patch antenna to be used for Microwave imaging technology. High permittivity material is used to design array antenna. [1-5].

2. Design of 1 × 2 Simple Square Patch Array:

The geometrical structure of 1x2 simple rectangular patch antenna with a partial ground is as shown in the Figure 3.26.1. In this antenna the two simple rectangular patch antennas are created on a single copper plate. These antennas are separated by a distance $d = 0.15\lambda$. The microstrip technique is used to feed the signal to the array. This antenna has a partial ground structure.

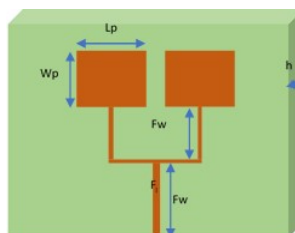


Figure.1: 1 × 2 square patch array radiating patch.

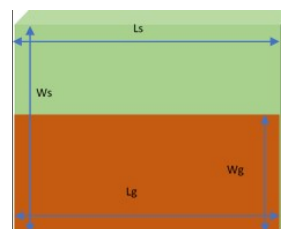


Figure.2: 1 × 2 square patch array ground planes.

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The antenna array is designed for the resonance frequency $f_r = 6G$. The dimensions of the designed antenna is length of the rectangular patch $L_p = 15mm$, Width of the rectangular patch $W_p = 15$, Length of microstrip feed1 $f_{l1} = 15mm$, Width of the microstrip feed1 $f_{w1} = 2mm$, Length of microstrip feed2 $f_{l2} = 15mm$, Width of the microstrip feed2 $f_{w2} = 3mm$, the length of the partial ground $L_g = 27mm$, and width of the partial ground $W_g = 70mm$.

The 1×2 Simple Square Patch Array Antenna is designed at $L_g = 27mm$, $W_g = 70mm$, $L_p = 15mm$, $W_p = 15mm$, $h = 1mm$, $F_{l1} = 15mm$, $F_{w1} = 2mm$, $F_{l2} = 15mm$, $F_{w2} = 3mm$. It is simulated using CADFEKO simulation software.

The results of the simulated antenna are presented here.

Reflection and VSWR Bandwidth:

The plot of reflection coefficient vs frequency and VSWR vs frequency of are shown in Figure 4.272 and 4.273 respectively

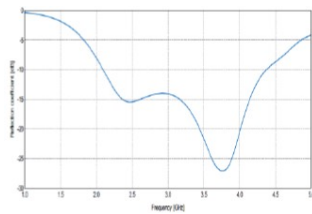


Figure 3: Reflection Coefficient Vs Frequency and of 1×2 Simple Square Patch Array Antenna.

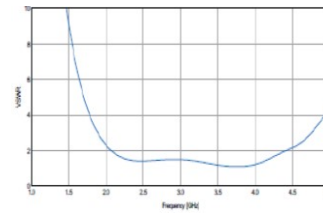


Figure 4: VSWR Vs Frequency and of 1×2 Simple Square Patch Array Antenna.

From Figure 3 it is observed that the 1×2 Simple Square Patch Array Antenna is resonating at single frequency. The resonance frequency is 3.75GHz and the corresponding reflection coefficient is -27.08 dB. The reflection bandwidth is 2.278GHz in the frequency band 2.09GHz -4.372GHz. From Figure 4 VSWR is observed below 2 in the frequency band 2.073GHz-4.411GHz and VSWR bandwidth is 2.33GHz.

Surface Current Distribution:

The Surface Current Distribution patterns of the simulated 1×2 Simple Square Patch Array Antenna at the resonance frequencies 3.75GHz is as shown in Figure 5

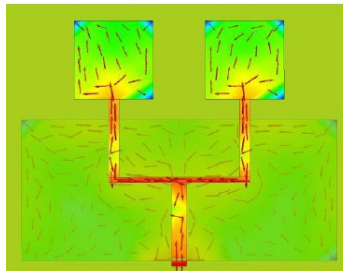


Figure 5: Surface Current Distribution on Radiating Patch 1×2 Square Array Antenna at 3.75GHz.

It is observed that, Surface current is linearly distributed at resonance frequency 3.75GHz.

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Impedance:

The plot of impedance vs frequency of the simulated 1×2 Simple Square Patch Array Antenna at the resonance frequencies 3.75GHz is shown in Figure 6.

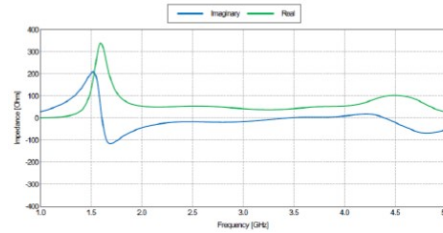


Figure 6: Impedance Vs Frequency of 1×2 Square Array Antenna.

From the Figure 6 it is found that the impedance of the simulated antenna is $50.8 + j4.39$ ohm at resonance frequency 3.75GHz. The corresponding magnitude of the impedances is $|z| = 50.98$ ohm for the resonating frequency 3.75 GHz. It is observed that the impedance is matched with the ideal value for resonance frequency at 3.75GHz.

3. Conclusion

Presented array antenna is resonating at single frequencies and the bandwidth is improved from 80MHz to 2.33GHz by using the concept of array. It has a moderate gain; more directed radiation pattern and impedance is near to the ideal value.

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