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Wideband MSA for Dual Band Operation using Slot Loaded Finite Ground

Rankovska
Faculty of Electrical Engineering and Electronics at Technical University of Gabrovo

Research Article

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ABSTRACT: This work proposes a modified square compact microstrip patch antenna with a slot-loaded finite ground plane for dual band operation. By making a corner cut and inserting slits within the margins of the radiating patch with a slot-loaded finite ground plane, a dual band modified square microstrip patch antenna with wideband is produced. Two operational frequencies of 3.21 and 4.03 GHz are shown to be achievable. with these operating frequencies, the obtained impedance bandwidths with 10 dB return loss are 15.58% (500 MHz) and 27.8% (1120 MHz), respectively. This antenna's high bandwidth, dual band operation, and compact size make it suitable for many wireless communication systems.

KEYWORDS: Wideband, Return Loss, Impedance Loci, Dual Band, and Finite Ground

INTRODUCTION

Conventional microstrip antennas, which typically contain a conducting patch printed on a grounded microwave substrate, are desirable because to their low profile, compact configuration, cheap cost, light weight, ease of production, and ability to connect with microwave integrated circuits. However, the bandwidth of microstrip antennas is intrinsically limited, and practical applications often need bandwidth augmentation. For real-world microstrip antenna applications, size reduction and bandwidth increase are increasingly important design factors. Because of this, research into tiny and broadband microstrip antenna operations has significantly risen [1–10]. Many commercial wireless communication applications make extensive use of microstrip patch antennas. Small phones will probably become more necessary as the need for more technological mobility rises. Printed circuit technology is used in the manufacturing of microstrip patch antennas to enable low-cost mass production.

In multichannel applications, a small instantaneous bandwidth is required over a large frequency range. Accordingly, tunable antennas provide an alternative to a broadband antenna in which an antenna with a small bandwidth is tuned over a large frequency range. In some applications, the system must work within two frequency bands that are far apart. Here dual
band antenna with wideband is used. If the antenna operates at two spot frequencies, then it is known as a dual band antenna. The electromagnetic simulation of the proposed antenna has been carried out using IE3D software of Zeland Software. Return loss, Smith chart, directivity etc. are being evaluated using IE3D software.

ANTENNA DESIGN AND RESULTS

This patch antenna design uses a corner cut and slits inserted within the margins of the radiating patch with a slot-loaded finite ground plane to create a dual band modified square microstrip patch antenna with wideband. The microstrip patch antenna is fed via a 50-ohm coaxial cable with a SMA connection. The front view of a modified square microstrip patch antenna with a slot-loaded finite ground plane is shown in Fig. 1. Within the frequency range of 2.5 GHz to 5 GHz with step frequency = 0.01 GHz, it is found that two operational frequencies at 3.21 and 4.03 GHz may be attained. This modified square patch antenna design has a patch length of L = 30 mm, a patch width of W = 30 mm, a slot loaded and corner cut finite ground plane of dimensions L = 45 mm and W = 45 mm, and a square slot measuring 10 mm × 10 mm at the center position. The feed point locations at the patch are (11.825, -12.375). The rear view of a modified square microstrip patch antenna with a slot loaded and corner-cut finite ground plane is shown in Fig. 2. For antenna design, Fig. 3 illustrates how return loss varies with frequency; the impedance bandwidth is derived from the 10-dB return loss. The radiation patterns for antenna

designs at lower resonance frequencies (3.21 GHz) and higher resonance frequencies (4.03 GHz) are shown in Figures 4 and 5, respectively. The efficiency fluctuation with frequency for antenna design is seen in Fig. 6. The impedance loci (Smith chart) for antenna design are shown in Fig. 7. The computed input impedance of the antenna agrees well with the 50 ohm impedance at both lower and higher working frequencies. The obtained impedance bandwidth for 10 dB return loss for these operating frequencies is 15.58% (500 MHz) and 27.8% (1120 MHz), respectively, because of the modified square microstrip patch antenna with corner cut and inserting slits inside the edges of the radiating patch with slot loaded finite ground plane. For these operating frequencies, the additional radiation parameters of the suggested antenna design are also proving to be suitable.

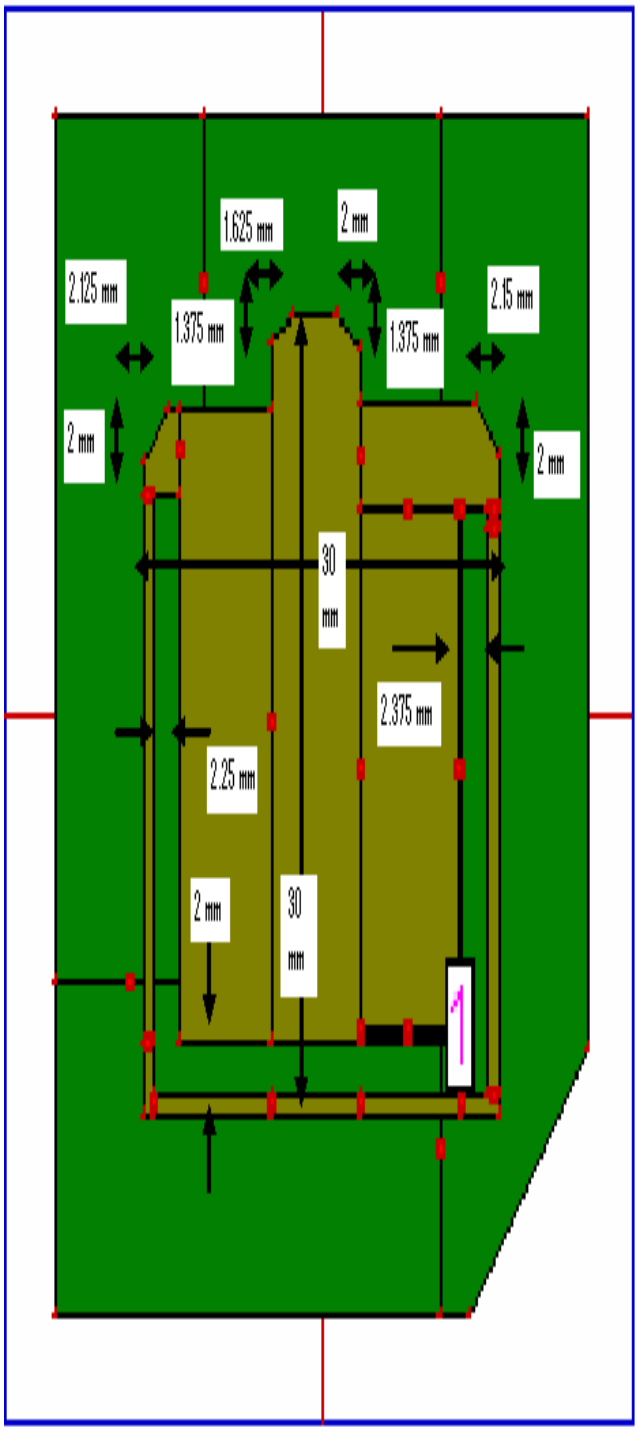


Fig. 1: Front view of modified square microstrip patch antenna with slot loaded finite ground

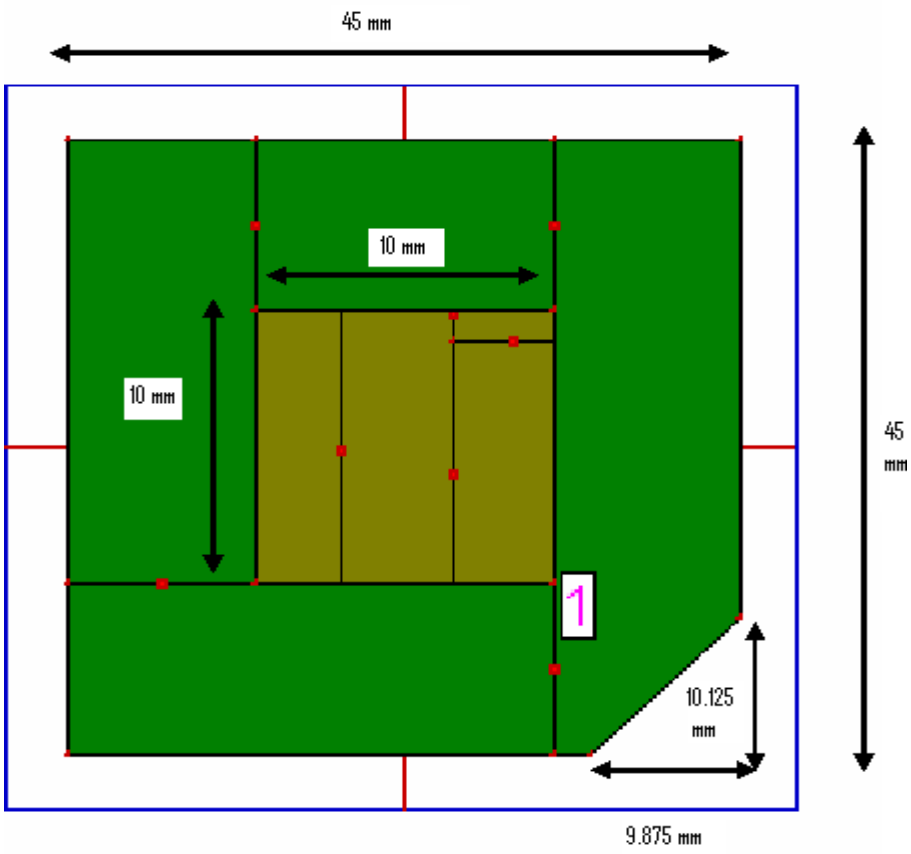


Fig. 2: Back view of modified square microstrip patch antenna with slot loaded finite ground

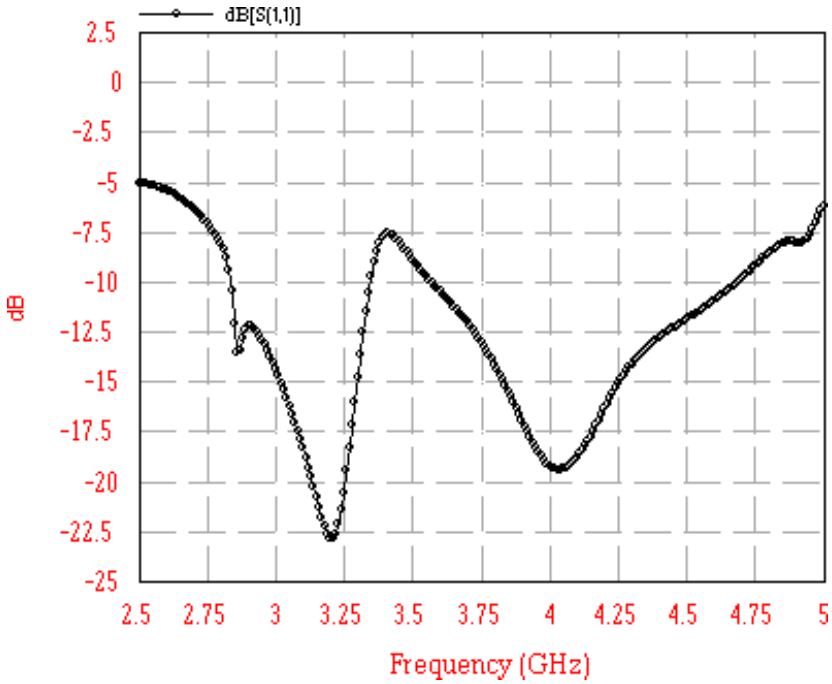


Fig. 3: Variation of return loss with frequency for proposed antenna design

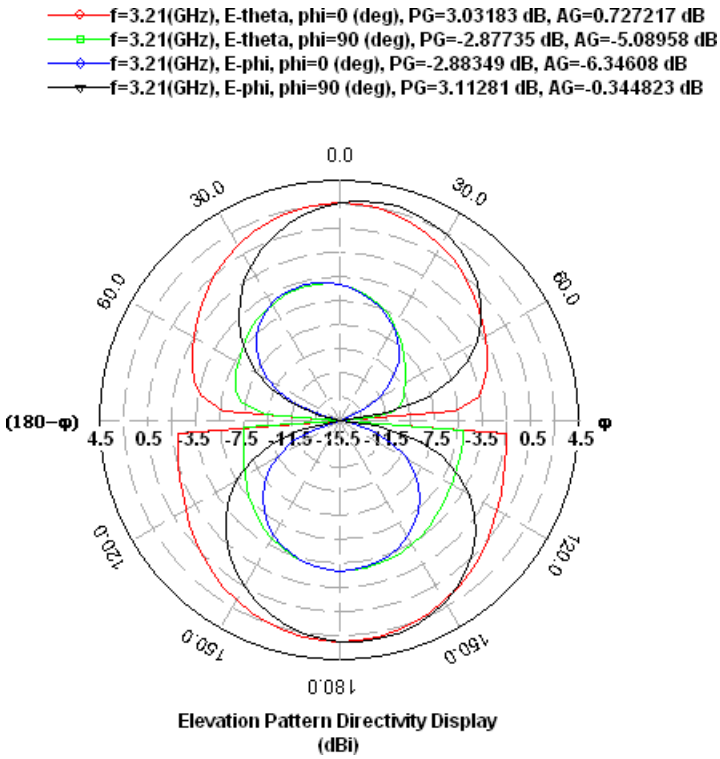


Fig. 4: Radiation Pattern for antenna design at lower resonance frequency f_1 = 3.21 GHz

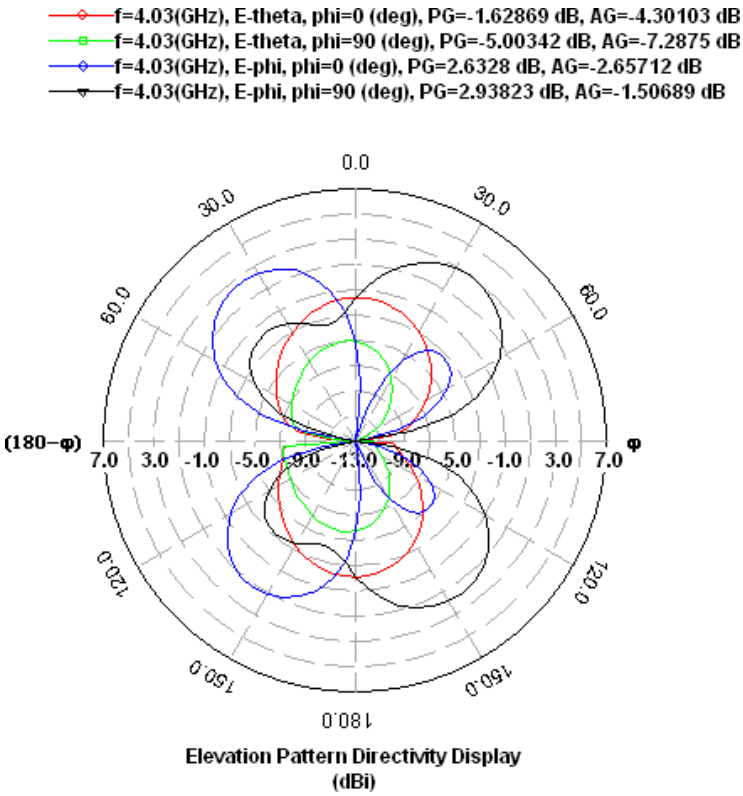


Fig. 5: Radiation Pattern for antenna design at higher resonance frequency f_2 = 4.03 GHz

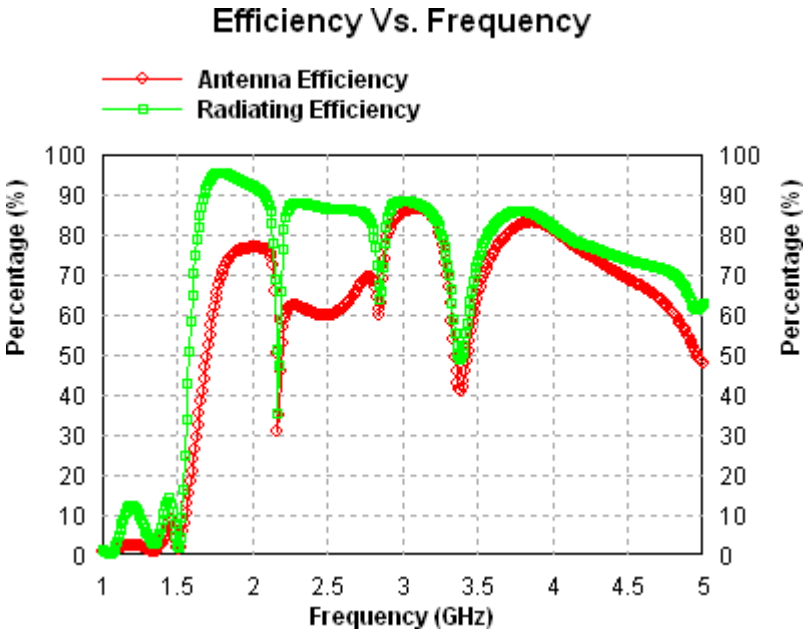


Fig. 6 Variation of Efficiency with frequency for proposed antenna design

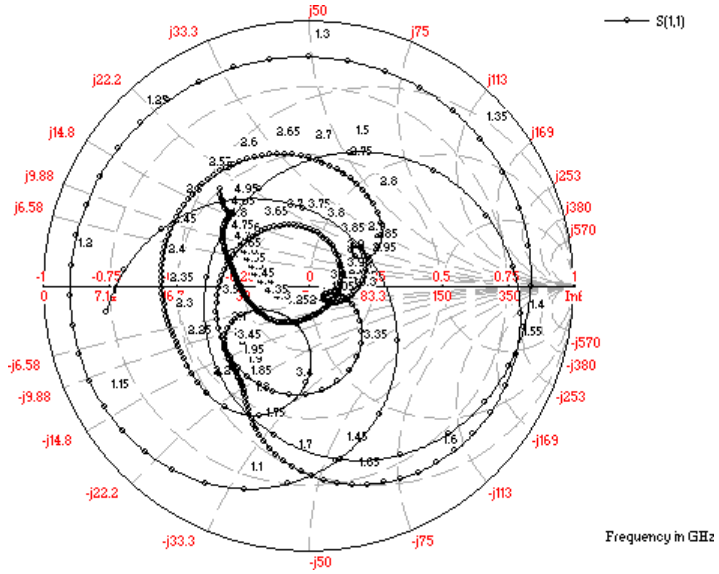


Fig. 7: Impedance loci for proposed antenna design

CONCLUSION

IE3D software was used to simulate the suggested antenna. Two working frequencies at 3.21 and 4.03 GHz are found for a dual band modified square microstrip patch antenna with a corner cut and slits inserted within the radiating patch's borders with a slot-loaded finite ground plane. For these working frequencies, the obtained impedance bandwidth for 10 dB return loss is 15.58% (500 MHz) and 27.8% (1120 MHz), respectively. These results show excellent agreement for the usefulness of wireless communication systems.

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