International Journal of Electronics Engineering (ISSN: 0973-7383)
Volume 11 • Issue 1 pp. 1050-1054 Jan 2019-June 2019 www.csjournals.com

Dual frequency patch antenna for wireless applications

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Abstract

A dual frequency microstrip patch antenna structure can be considered to avoid the use of separate antennas. For this, a critical overview of possible solutions can be found out and future properties are outlined. Dual frequency microstrip antennas will provide alternative to large bandwidth antennas. In which applications a large bandwidth is needed for operating at two transmitting and receiving bands. When these two operating frequencies far apart(away),

Introduction

Microstrip patch antennas are popular for their well-known attractive features, are widely used because of their many advantages, such as low profile, light weight with monolithic microwave integrated circuits. Modern communication systems such as those for satellite links (GPS, Vehicular etc) as well as emerging applications. Indeed, the optimal antenna for a specific application is one that ensures the matching of the bandwidth of the transmitted and/or the received signal. Dual-frequency antennas exhibit a dual-resonant behaviour in a single radiating structure. Despite the convenience that they may provide in terms of space and cost, little attention has been given to dual-frequency patch antennas[1-2]. Their main disadvantage is an intrinsic limitation in bandwidth, which is due to the resonant nature of the patch structure.

The patch is connected to a feed line, which provides the energy that is radiated by the antenna. The operating frequency bands can be achieved by adjusting the size, shape, and dielectric constant of the substrate material. In recent years, wireless communication technology has developed rapidly, and as a result, WLAN communication systems have also seen significant growth and an expanding range of applications in the market [3]. Wireless communication systems require quick, efficient, and dependable two-way data transmission, which is reflected in the design of their antenna subsystem. The antenna plays a vital role in such systems [4]. In today's information-based society, there is a growing demand for antennas that not only have a broad frequency band and are compact and easy to install but also exhibit high radiation efficiency, anti-interference performance, and other desirable characteristics. It is need to operate, at dual frequency can arise in vehicular satellite communication systems, where low cost antennas like patterns. When the system operated at two frequencies too far, dual frequency microstrip antenna may avoid the use of two different antennas.

. The microstrip patch antenna is a type of directional antenna, meaning it transmits signals in a specific direction [6]. It can be designed to have omnidirectional or directional characteristics, which is beneficial in WLAN applications as it can provide higher gain in specific directions and overcome obstacles that may block signals. The microstrip antenna functions as a resonant radiator, emitting electromagnetic waves continuously between its top

radiation patch edges and the ground plate, creating a radiation field via the mutual electromagnetic interaction between these two objects. Hence, a dual-band microstrip patch antenna is designed to operate in two different frequency bands in the WLAN (Wireless Local Area Network) spectrum.

The literature on dual-band microstrip patch antennas has explored various aspects of antenna design, optimization techniques, and performance analysis. Researchers have investigated novel designs that enable simultaneous operation in different frequency bands, aiming to improve antenna efficiency, gain, bandwidth, and radiation pattern characteristics. Additionally, studies have focused on antenna performance enhancements specific to the WLAN frequency bands, such as coverage improvement, interference reduction, and capacity optimization for high-speed wireless communication systems.

Two frequency techniques for microstrip patch antennas

The simplest way to operate at dual frequencies is to use first resonance of the two orthogonal dimensions of the rectangular microstrip antenna patch TM_{100} and TM_{010} modes. In this paper, the frequency ratio is approximately equal to the ratio between two orthogonal sides of the patch. The limitation of this approach is that the two different frequencies excite two orthogonal polarisations. This is very useful in low-cost short range applications where polarisation requirement is not met. The above approach characterizes a first classification that dual frequency patch antennas. It is extended to any kind of patch shape that offers two cross polarized resonant modes. Most of the dual frequency microstrip antennas found in two ways. Multi patch dual frequency antennas and reactively loaded dual frequency patch antennas.

In Principle, dual frequency planar antennas will operate with similar features, in terms of both radiation and impedance matching at two separate frequencies. For getting these features using planar technologies, particularly when the structural and technological simplicity such type of microstrip patch antennas can be preserved.

A single-feed dual matching may be obtained by using slot coupling, in which the slot is inclined with respect to the microstrip feed line. The two projections can be thought of as the length of two equivalent slots that excite the patch at the two separate polarizations

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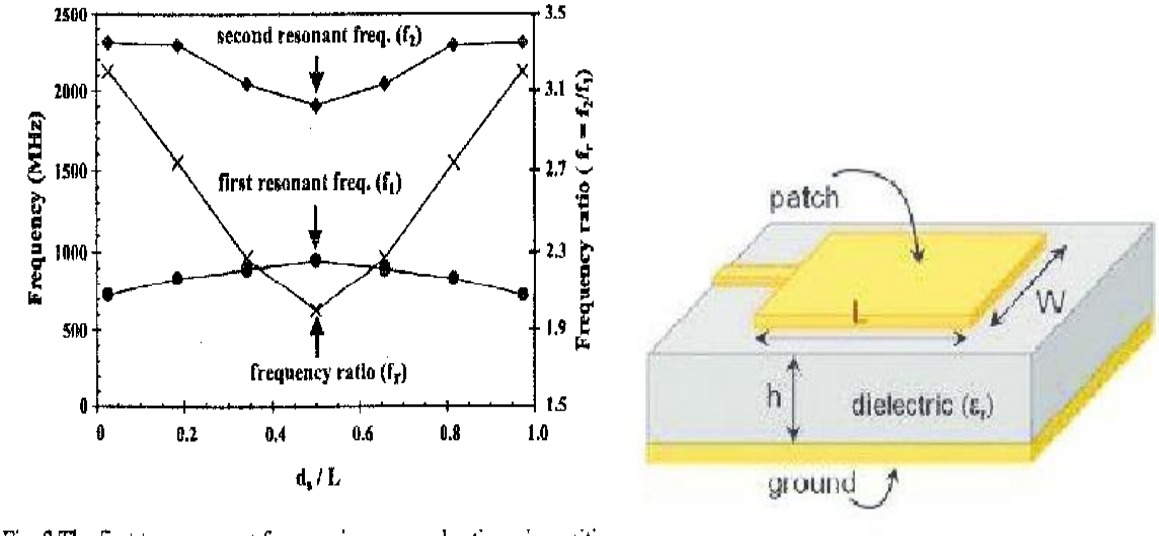

Fig1. . Microstrip patch antenna with two frequency resonant frequencies.

Multiple patch dual frequency microstrip antennas.

In these given structures, the dual frequency behaviour is obtained by means of multiple radiating elements, each of these supported by two strong circuits and radiation will be at the resonance. This includes multilayer stacked patches, that can use rectangular, annular, triangular patches. The same multilayer structures can also be used to broadening the bandwidth of a single frequency. The lower patch can be fed by a conventional arrangement. The upper proximity will be coupling with the lower patch. Multifrequency elements can also be obtained by etching or printing more resonators on the same substrate. For a large separation between the two frequencies the criteria of a drastic change in separation of the patch antennas associated with each frequency may be adopted.

Reactively loaded patch antennas

The reactive loading technique approach first introduced, where an adjustable coaxial stub employed. This structure will provide both tuning and design of the frequency ratio in a simple manner. It is not well suited for high frequency. One more method that notches can be introduced, slots can be used just by placing on either side of the patch or placing three or more slots in equal placing on the particular patch. The most important technique for obtaining a dual frequency behaviours is to introduce a reactive loading into to a single patch. The simple way is to connect a stub to one radiating edge. And further introducing resonant length that is responsible for the operating frequency.

Previous research

The design and optimization of dual-band microstrip patch antennas for WLAN applications have garnered significant attention in recent years. With the rapid advancement of wireless communication technology and the increasing demand for compact and versatile antennas. researchers have focused on developing antenna designs capable of operating in multiple frequency bands while maintaining a low-profile form factor.

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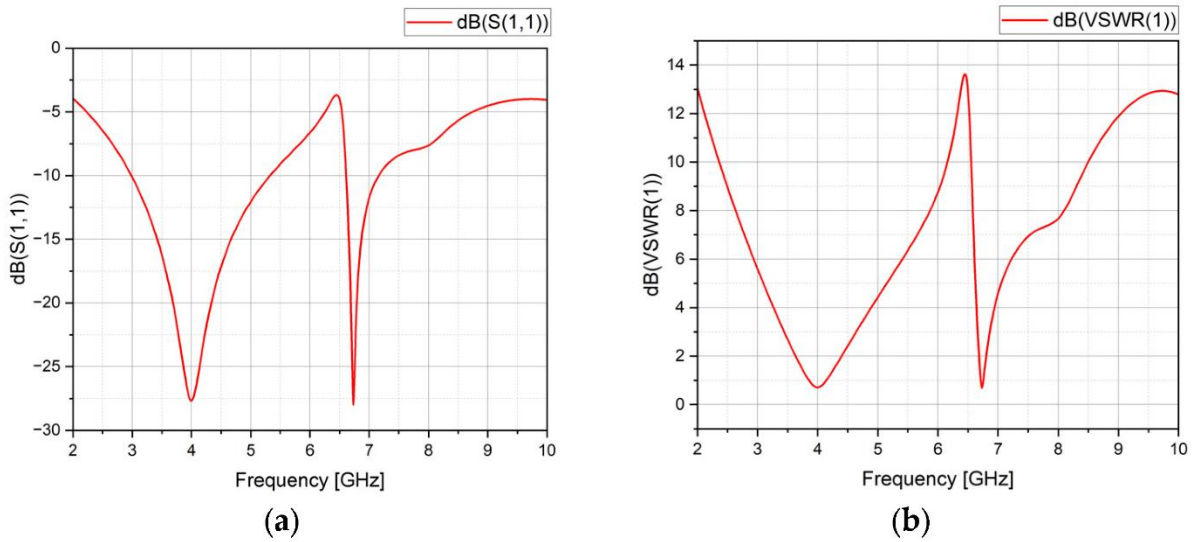

Fig.2. Stimulated results (**a**) reflection coefficient (**b**) VSWR Graph for dual frequency

Conclusion

The work carried out in this literature it is insufficient and research is going on. The use of single feed network for both frequencies may be practically only when the two frequencies are close to each other. For large separations between the two frequencies, two different microstrip have to be introduced. Overview of dual frequency microstrip antennas has been carried out, with special configuration that are attractive for their simplicity and well-designed flexibly. Focusing on geometry of the radiators, avowing the significant problems which will occur on the dual frequency feed network. he appropriate dual-band microstrip patch antenna features are tiny, uncomplicated, and easy to produce on a substrate at a fair price. In terms of antenna size, impedance bandwidth, and notch characteristics, throughout the publications, the implementation of the envisioned work is contrasted with the performances of other contemporary antennas.

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