Note

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Experimental investigation on dual-frequency broad band microstrip antenna with swastika slot

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Abstract : This note presents a novel design of dual-frequency (J- and X-band) microstrip antenna and the experimental results of its performance are reported In this design, a 'swastika' slot has been cut out from the square microstrip patch antenna The antenna unit can be incorporated into arrays, and offer the possibility of a compact, light-weight and cost effective antenna array design for various applications such as television broad casting, mobile communications and radar systems In this note dual frequency band has been obtained with lower frequency 10 dB bandwidth of 200 MHz and higher frequency bandwidth of about 1 4 GHz which is quite broad

Keywords : Dual frequency, microstrip antenna

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Microstrip patches are an attractive type of antenna and are widely employed in many practical applications because of their low cost, conformability, and ease of manufacture, integration with RF devices *etc.* Dual frequency microstrip antennas with a single feed, are required in various radar and communications system such as synthetic aperture radar (SAR), dual-band GSM/DCS 1800 mobile communications system, and Global positioning system (GPS) [1–3]. Dual frequency microstrip antennas with square slot has been reported in Ref. [4]. A compact dual frequency microstrip antenna has been proposed in Ref. [5], which has used the rectangular microstrip patch loaded with one shorted pin. The characteristics of a dual frequency compact antenna which uses a rectangular microstrip patch with different number of shorting pins has been reported in Ref. [6]. An aperture-stacked patch microstrip antenna has been studied in Ref. [7] to increase the band width. In applications such as broadcasting, personal communications, and radar systems, considerable efforts have been devoted to the development of dual-frequency patch antennas [8,9] and antennas with dual polarizations. In addition, when

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multi-frequencies are closer to each other, the antenna may have a broad operating band width [10]. This note focuses on the development of a novel microstrip antenna to enhance the band width by cutting a 'swastika' slot on a square patch The characteristic of the present proposed dual-frequency design method using a single coaxial feed is experimentally studied; typical results of the proposed design are presented and discussed.

Figure 1 shows the proposed probe-fed dual frequency microstrip patch antenna The antenna has been probe-fed at the corner of the square patch. A swastika slot is etched out from the center of the square patch having a side length L = 26 mm and is fabricated on a substrate (PTFE) of thickness h = 1 5875 mm and relative permittivity ε_r = 2.4 The other dimensions are shown in Figure 1.

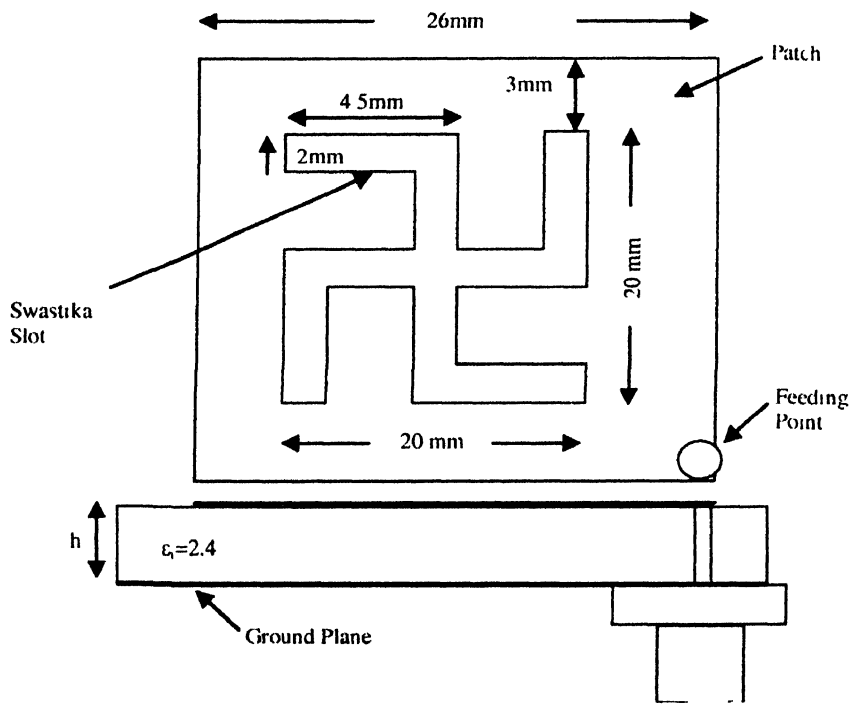

Figure 1. Geometry of square microstrip patch antenna unit with swastika slot.

The experimental results are shown in Figures 2(a), 2(b). Figure 2(a) gives the antennas return loss. The lower band has a center frequency of 7.006 GHz at which the return loss is −16.5 dB. The return loss is lower than −10 dB from 6.906 GHz to 7.106 GHz, giving a bandwidth of 200 MHz. The higher frequency band has a center frequency 10.604 GHz at which the return loss is −26.3 dB. The return loss is lower than −10 dB from 10.204 GHz to 11.604 GHz, giving a wide band with of 1.4 GHz Figure 2(b) gives the phase plot against frequency which shows that the phase angle becomes 0 degree *i.e.*, microstrip patch antenna unit resonate at frequencies 7 906 GHz, 9.105 GHz, 10.704 Ghz.

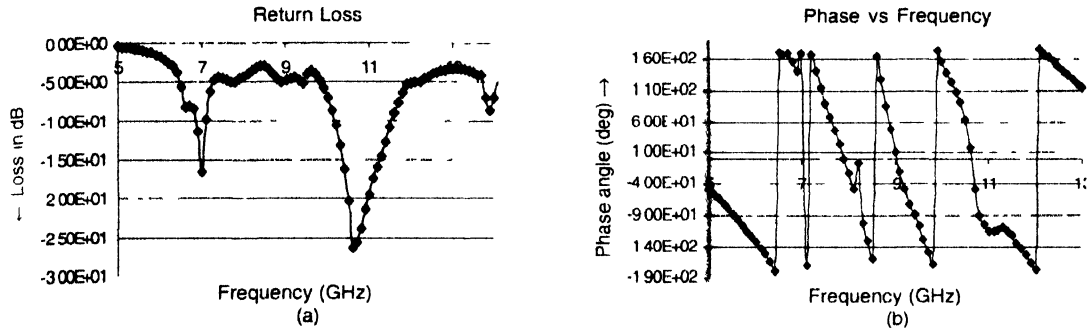

Figure 2. (a) Return and (b) phase spectrum for microstrip antenna unit

A dual frequency broadband square microstrip antenna with a swastika slot using a single probe feed has been successfully designed. Presently, extensive efforts have been provided for size reduction of antennas But in this note our goal is to broaden the bandwidth of the antenna. In this work 1.4 GHz antenna bandwidth below 10 dB return loss has been successfully achieved

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