Truncated Rectangular Microstrip Antenna with H and U Slot for Broadband

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Abstract:

In this paper we present a novel approach to improve the bandwidth of Microstrip patch antenna using thick substrate and by inserting U slot and H slot in the Truncated rectangular microstrip antenna. By inserting only H slot in the Truncated rectangular microstrip antenna the impedance bandwidth was 21.2% whereas after adding U slot in same design the bandwidth is increase up to 50.7% in the frequency range 1.5 GHz to 2.67 GHz. The U slot is used to tune impedance matching. The radiation pattern has acceptable response at both E and H plane. The antenna is designed at glass epoxy substrate with dielectric constant 4.4, fed by a coaxial feeding technique. Detail of the proposed antenna and the simulated results are presented.

Keywords – Microstrip antenna, band width, return loss, broadband, truncated microstrip antenna (trmsa), VSWR.

I. Introduction:

Because of the booming demand in wireless communication System applications, microstrip patch antenna attracted much interest due to their low profile, light weight, ease of fabrication and compatibility with printed circuits. However they also have some drawbacks ranging from narrow bandwidth to low gain (1-8). To overcome this inherent limitation of narrow impedance bandwidth and low gain many technique have been proposed and investigated e.g., for probe fed stacked antenna, slotted patch antenna and stacked shorted patches, the use of various impedence matching and feeding techniques(2-9).However, bandwidth enhancement and size reduction are becoming major design consideration for practical applications of microstrip antennas. Due to the improvement of one of the characteristic, this normally results in degradation of the other. In recent years, many techniques have been reported to achieve wideband patch antenna for modern wireless communication devices.

In this paper, wide band Truncated rectangular microstrip patch antenna with H and U slot is proposed. The design employs thick substrate and H and U slot shape patches techniques to meet the design requirement. The Bandwidth of Truncated rectangular microstrip patch antenna with H slot is 21.2% and further improvement in bandwidth up to 50.7% is achieve by introducing U slot in same design. It is found that the axial ratio bandwidth could be enhanced considerably when a thicker substrate is used, provided that a U slot are used to tune the impedence matching For a good impedance matching over a wide frequency range, notches are also introduced on the two corners of the rectangular patch antenna as shown in fig 1. Using IE3D software the return loss, VSWR, directivity and the bandwidth are calculated.

II. Antenna Design Specification:

Figure -1 shows the truncated rectangular microstrip patch antenna with H and U slots. The design parameters for the TRMSA structure, length of patch (L) is 47mm, width (W) is 62 mm. and remaining dimensions are shown in fig1.The dielectric constant (Єr) of the substrate is 4.4mm and the thickness of the dielectric substrate is 6.4 mm. The patch is printed on inexpensive glass epoxy FR4 substrate. The 50-ohm coaxial cable with SMA connector is used for feeding. The proposed patch antenna gives wide bandwidth having resonance frequency f_0 = 2.13 GHz with impedance Bandwidth equal to 50.7%, in the frequency range of 1.59 GHz to 2.67 GHz, at appropriate feed point location . Figure 2 show the variation of return loss with frequency for the proposed design, Figure 3 shows the VSWR Vs frequency, Fig 4 & Fig 5 shows the impedance loci and radiation pattern for the proposed design respectively. Figure 6 shows the directivity Vs. frequency graph, At resonance frequency 2.13 GHz the directivity is 7.9dBi, the typical value of directivity for Microstrip patch antenna should be 5-8 dBi .

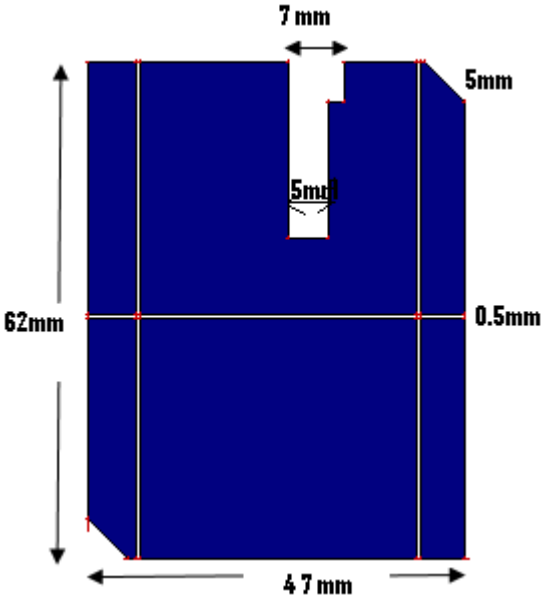

Fig1- truncated rectangular microstrip patch antenna with H&U slot

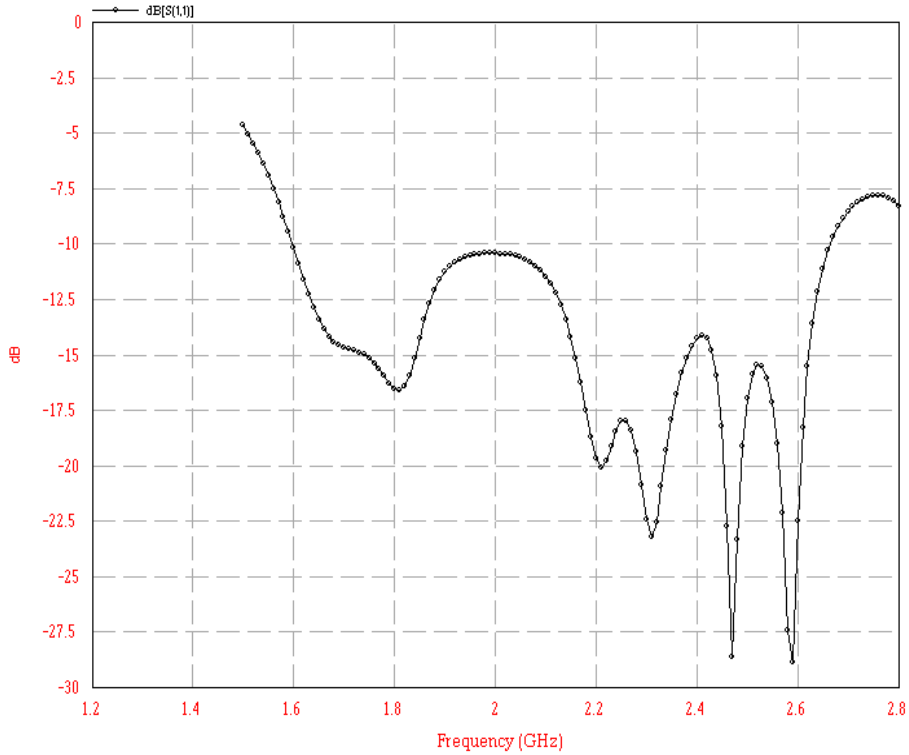

Fig.2 -Variation of return loss with frequency for design 1

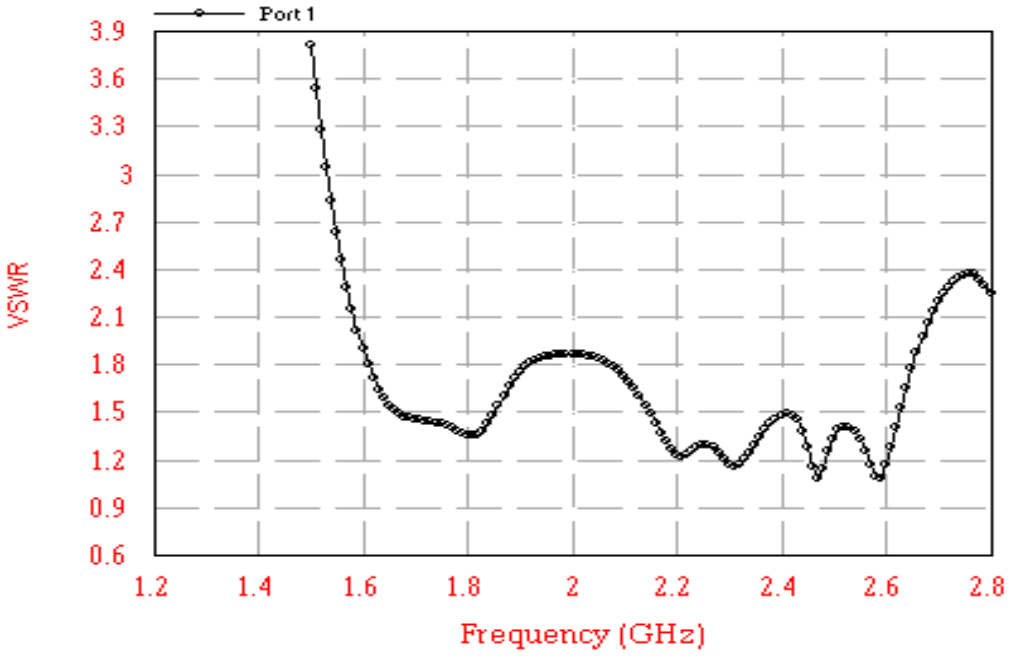

Fig 3- Variation of frequency Vs. VSWR for design 1

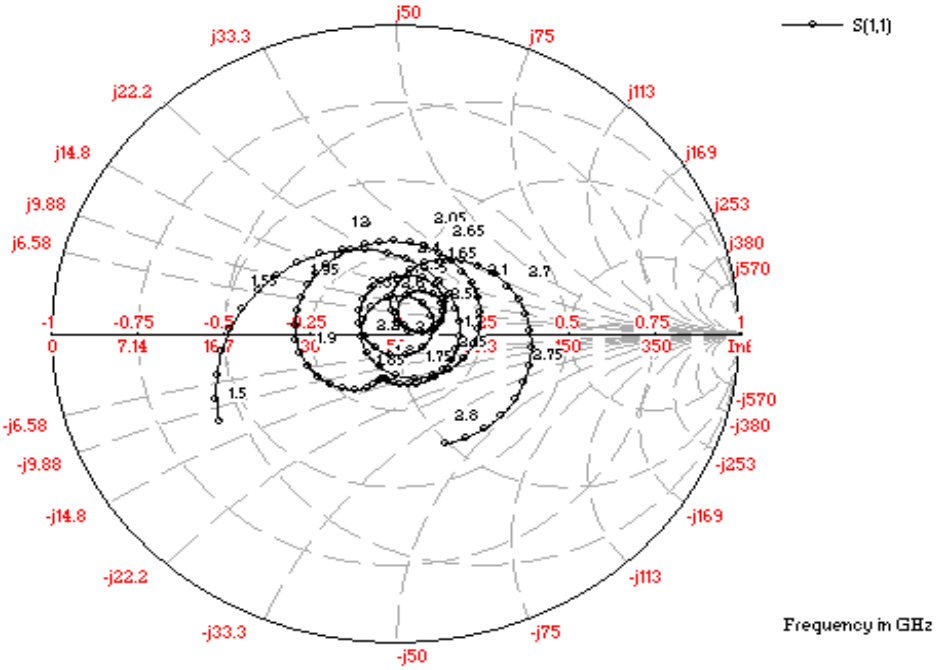

Fig. 4- Impedance Loci for design 1

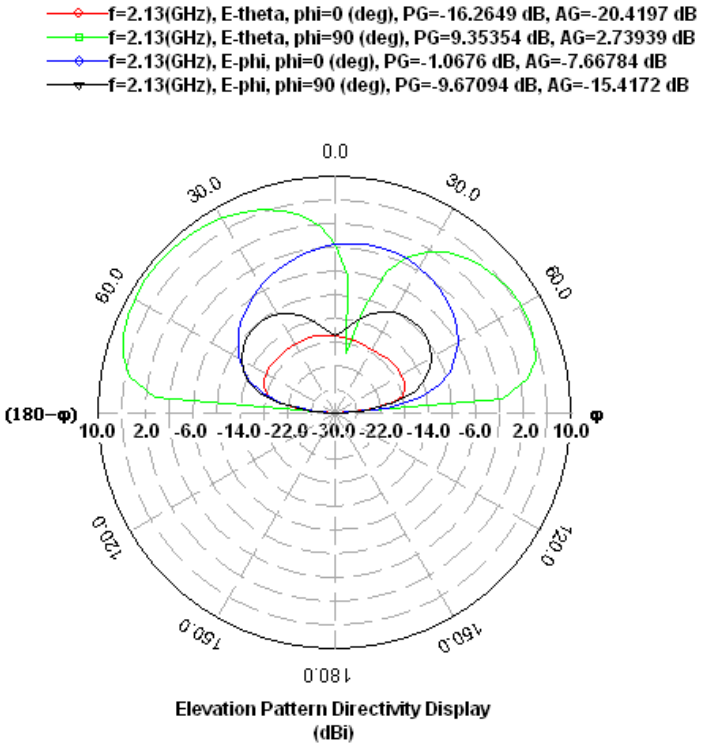

Fig 5- Radiation pattern for design-1

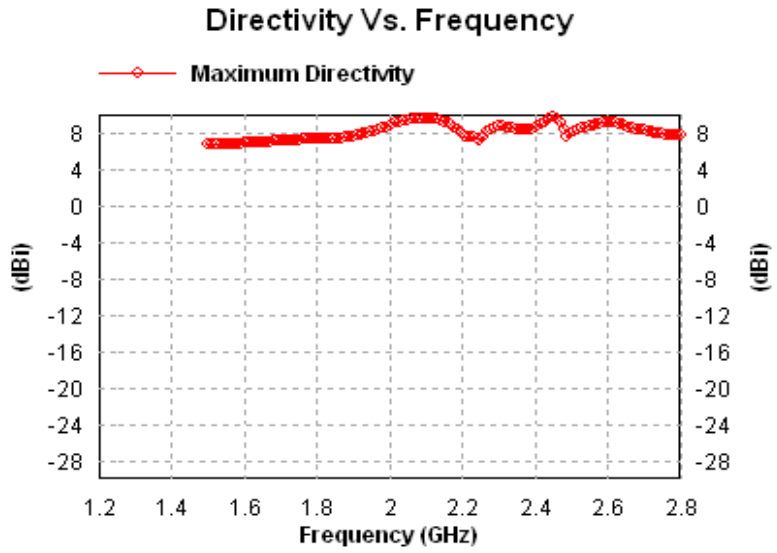

Fig 6- Directivity vs. Frequency for design-1

Conclusion:

The simulation result of the proposed antenna has been carried out by using IE3D software. It is concluded that the designed antennas exhibits wide band operation due to its multi resonance nature. Wide band has achieved by inserting U slot on Truncated rectangular microstrip patch antenna with H slot. By this impedance bandwidth enhancement method the antenna obtain the 10-dB return loss from 1.59 GHz to 2.67 GHz yielding 50.7% bandwidth enhancement. The antenna characteristics and radiation pattern are satisfactory for most of the wireless systems. The radiation pattern is stable over this large bandwidth and directivity is also within acceptable range, so the antenna is acceptable.

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