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Bandwidth Enhancement of Patch Antenna using Array

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Abstract: ***In this paper a compact E shape Microstrip Patch Antenna working at ISM band frequency 5.8 GHz is designed and its performance is optimized using array concept. By designing array of E shape microstrip patch antenna good return loss is found, also aim of higher bandwidth is achieved. So this antenna can provide a wider application option for electronic communications.***

Keywords: Microstrip Patch Antenna, Array, VSWR, Return loss, Smith Chart etc.

1. Introduction

A microstrip antenna consists of conducting patch on a ground plane separated by dielectric substrate. This concept was undeveloped until the revolution in electronic circuit miniaturization and large-scale integration in 1970. G.A Deschamps [1] conceived first microstrip antenna in 1953, in USA. H. Gutton and G. Baissinot [2] in 1955 patented a flat aerial that can be used in the UHF region in France. L. Levin [3] in 1960 studied the radiation from the discontinuities in striplines. E.V Byron [4] in the early 1970's conceived the first practical microstrip radiator. The basic rectangular and circular patch antennas were designed by J.Q Howell [5]. Recently, development and analysis of broadband microstrip antennas have become an interesting area in personal communication systems due to the need of high speed data transmission.

The bandwidth of microstrip antennas can be increased by increasing the substrate thickness, decreasing the dielectric constant, and many more as investigated by different researchers [6-7]. Here Array concept is used for enhancing the bandwidth on E shape patch antenna.

2. Proposed Antenna Design

Our requirement is to design patch antenna which can operate at 5.8 GHz. So that it can be used by all users as it is available worldwide. Patch antenna at this frequency have very narrow bandwidth, which limits its applications. So Patch antenna is modified into new shape that looks like English alphabet "E" for a better result. Further antenna array is proposed for better result and higher bandwidth.

RT/DUROID Thickness (h) = 1.580mm
Loss Tangent = 0.001
Dielectric Constant =2.2
Antenna design:
Rectangular Patch Antenna of dimension
Length L= 29 mm
Width W = 18.35 mm

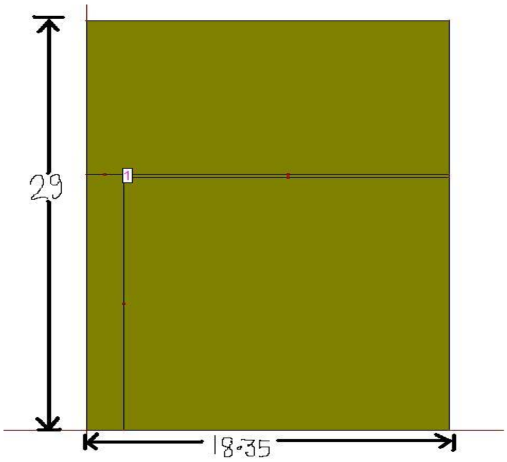

Figure 1: Rectangular Patch Antenna

Proposed Antenna design 1:
Patch Antenna of geometry alphabet E shape

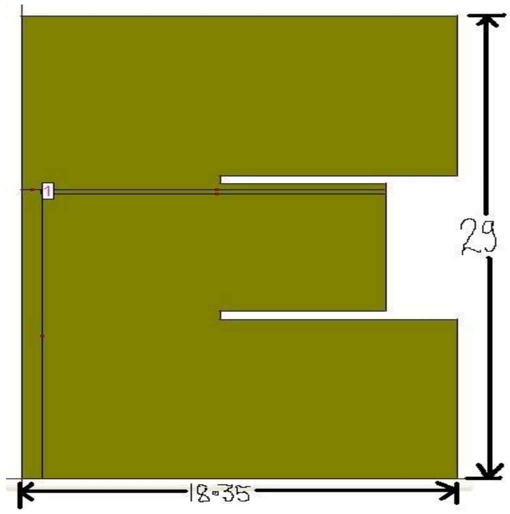

Figure 2: E-Shape Patch Antenna

Proposed Antenna design 2:
Array of E shape Patch Antenna

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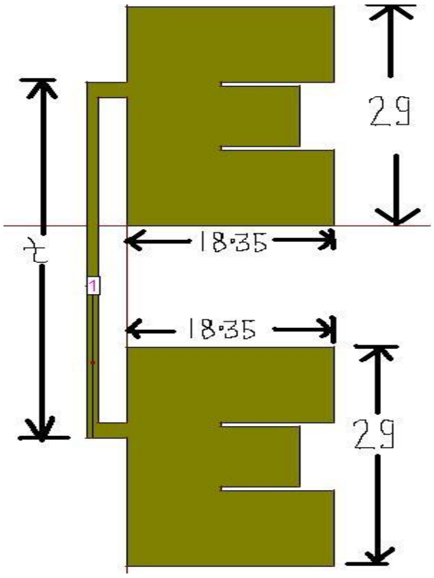

Figure 3: Array of E-Shape Patch Antenna

3. Result

On designing of patch antennas on electromagnetic simulator IE3D using above parameters return loss and smith chart is obtained. Return loss of rectangular patch antenna is found as -24.0412 but at frequency 6.8 GHz and very narrow bandwidth but our requirement is fulfil by proposed antenna and the result is shown below

(i) Return Loss:

Antenna Design 1
Frequency: 5.8 GHz
Return Loss: -23.3053dB
Bandwidth: 140 MHz

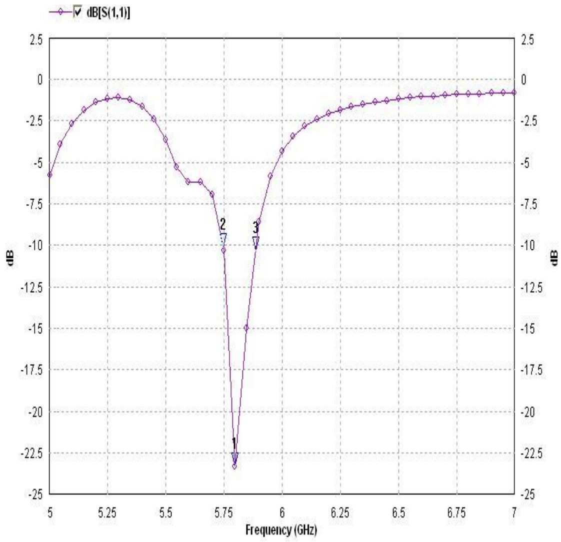

Figure 4: Return Loss of E-Shape Patch Antenna

Antenna Design 2
Frequency: 5.84 GHz
Return Loss:-25.8449dB
Bandwidth: 186MHz

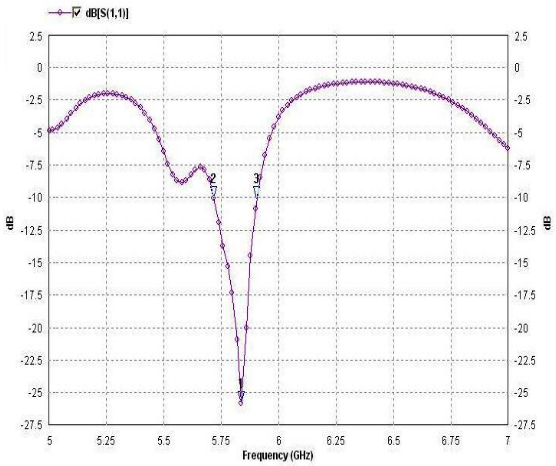

Figure 5: Return Loss of Array of E-Shape Patch Antenna

(ii) Smith Chart :
Antenna Design 1

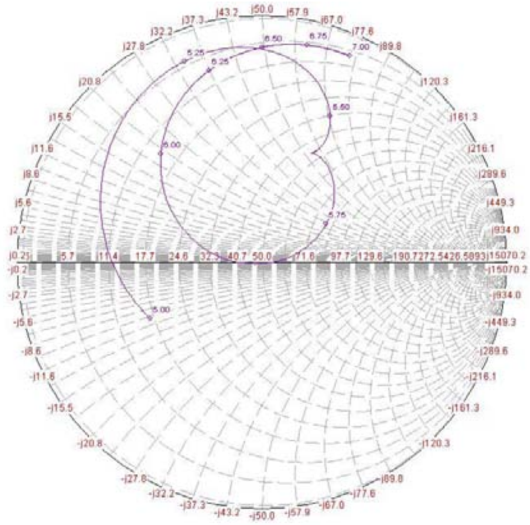
Figure 6: Smith Chart of E-Shape Patch Antenna

Antenna Design 2

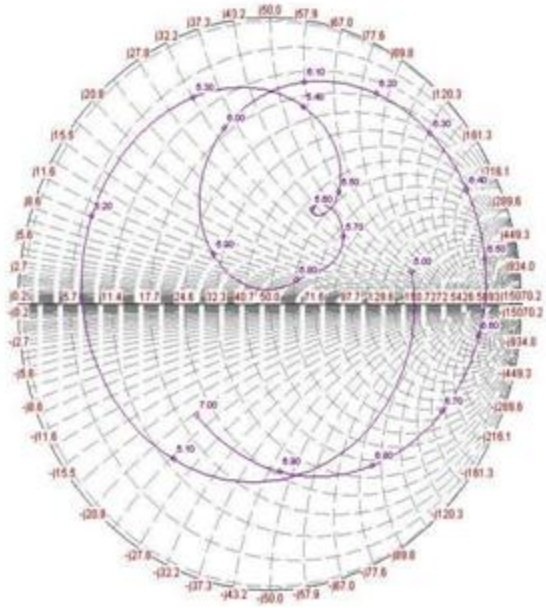
Figure 7: Smith Chart of Array of E-Shape Patch Antenna

4. Conclusion

A compact E shape Microstrip Patch Antenna working at ISM band frequency 5.8 GHz is designed and its performance is optimised by modifying its geometry in E shape we get good return loss and higher bandwidth . By designing array of E shape microstrip patch antenna good return loss is found also aim of higher bandwidth is achieved. So this antenna can provide a wider application option for electronic communications. The results is good enough to satisfy our requirements to fabricate it on hardware which can be used wherever needed. The investigated results can be used to design the microstrip patch antenna to be used in the applications such as Wi-Fi, Bluetooth, Amateur Radio, Earth Station, Microwave links & Radar. For future work this design can further optimize by the help of Artificial Neural Network. ANN provides various algorithms to improve design and its working.

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