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Microstrip Logarithmic Array Antenna (MLAA) for Ku Band

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Abstract
In this paper, we propose a design of Microstrip Logarithmic Array Antenna (MLAA) with a rectangular slot etched ground plane as DGS. The Defected Ground Structure has drastically improved bandwidth and impedance matching. The bandwidth 2530MHz with respect to center frequency 13.835GHz. The percentage bandwidth of 18.28% and the average gain of 3.6dBi are achieved.

Keywords
Logarithmic Array, Microstrip Array, DGS, Ku Band

I. Introduction

The Log-Periodic Dipole Array (LPDA) consists of a system of driven elements, but not all elements in the system are active on a single frequency of operation. Depending upon its design parameters, the LPDA can be operated over a range of frequencies having a ratio of 2:1 or higher, and over this range its electrical characteristics like gain, feed-point impedance. This is not true of any Multielement Directive Array Antenna, for either the gain factor or the front-to-back ratio, or both, deteriorate rapidly as the frequency of operation departs from the design frequency of the array. And because the antenna designs discussed earlier are based upon resonant elements, off-resonance operation introduces reactance which causes the SWR in the feeder system to increase. The log-periodic array consists of several dipole elements which each are of different lengths and different relative spacing's.

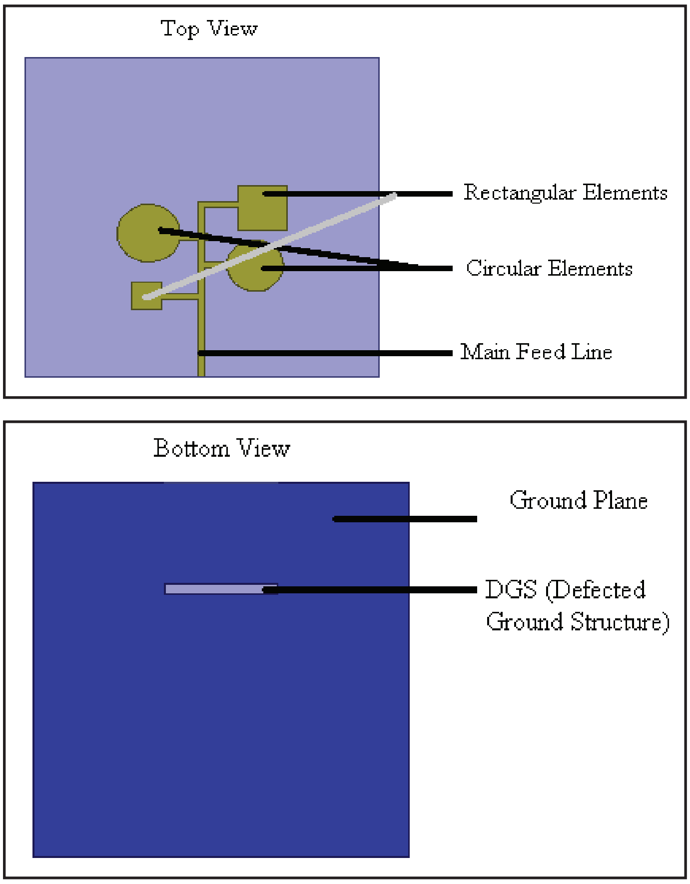

Fig. 1(a): The Top View of LAA, (b) Bottom View of LAA (Ground Plane)

Logarithmic Array Antenna has been designed by additional drilling suitable slots on the ground plane as DGS (Defected ground Structure). Ground plane consists of a rectangular slot of length 6mm and width 0.6mm.

II. Antenna Design

The antenna is fabricated on substrate of FR4_epoxy with relative permittivity (ε_r) is 4.4 and the thickness of 1.6mm. The radius, length and width elements of the MLAA is calculated using the formulas given in [1].

III. Simulated Results

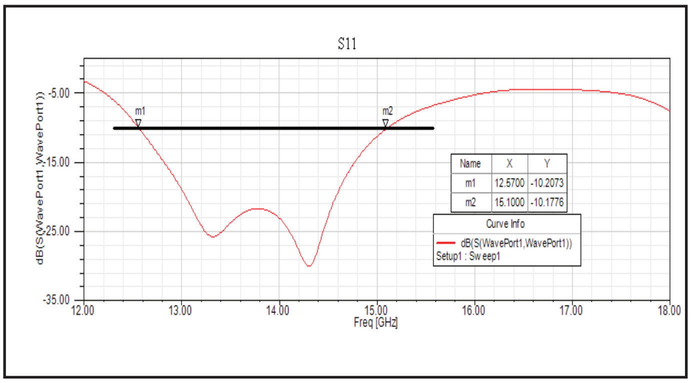

Fig.2 Simulated return loss versus frequency

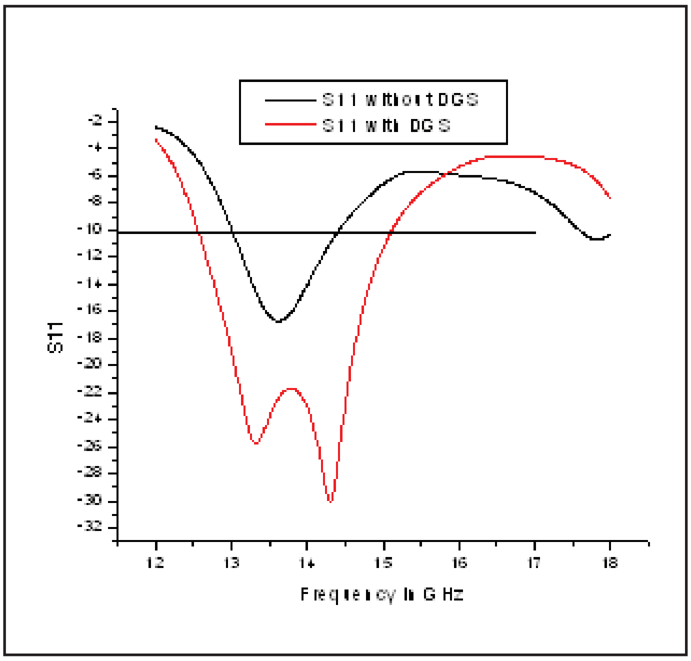

Fig.3 Simulated s11 with DGS and without DGS

Simulated s11 can be seen from fig.2 refection co-efficient is very less at resonance return loss of the antenna is less than -10dB from 12.57GHz to 15.1GHz with 2530MHz bandwidth and minimum of -30dB reflection co-efficient which satisfies the Ku band.

DGS effect can be clearly observed with fig 3. It has increased the bandwidth from 880MHz to 2530MHz.

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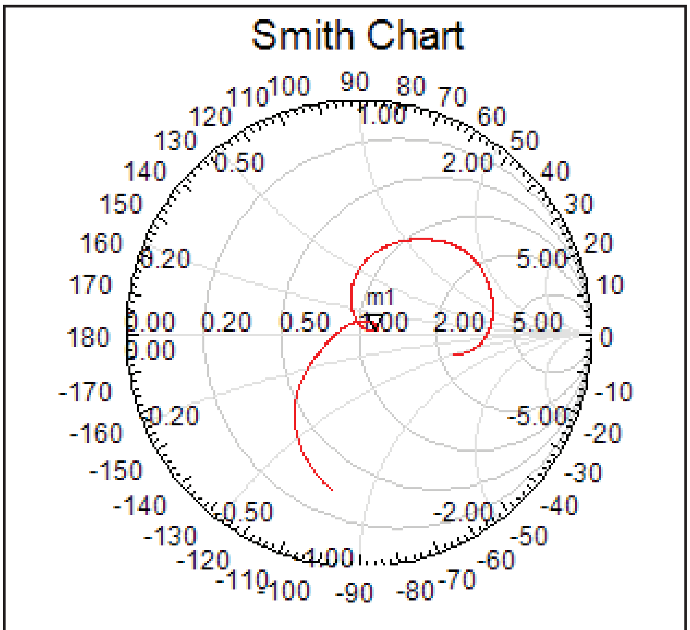
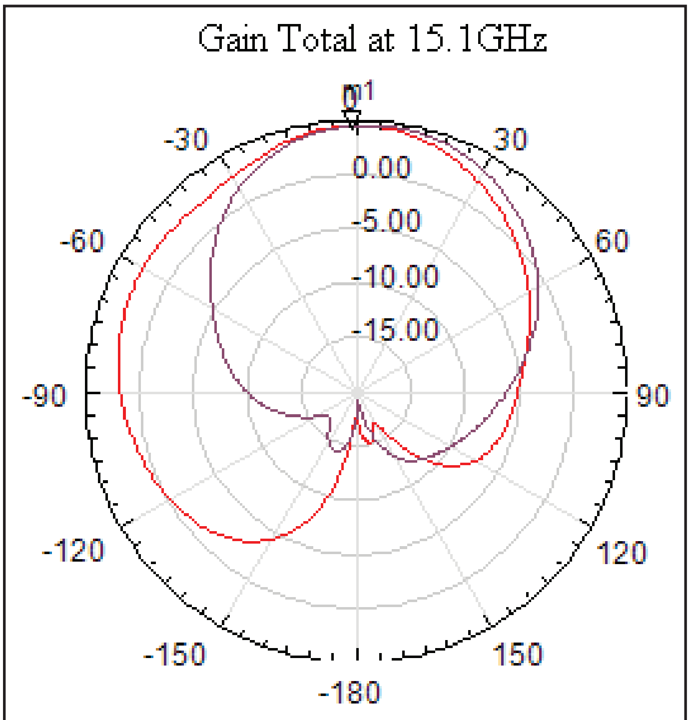


Name	Freq	Ang	Mag	RX
m1	13.9000	14.3217	0.0786	1.1639 + 0.0455i

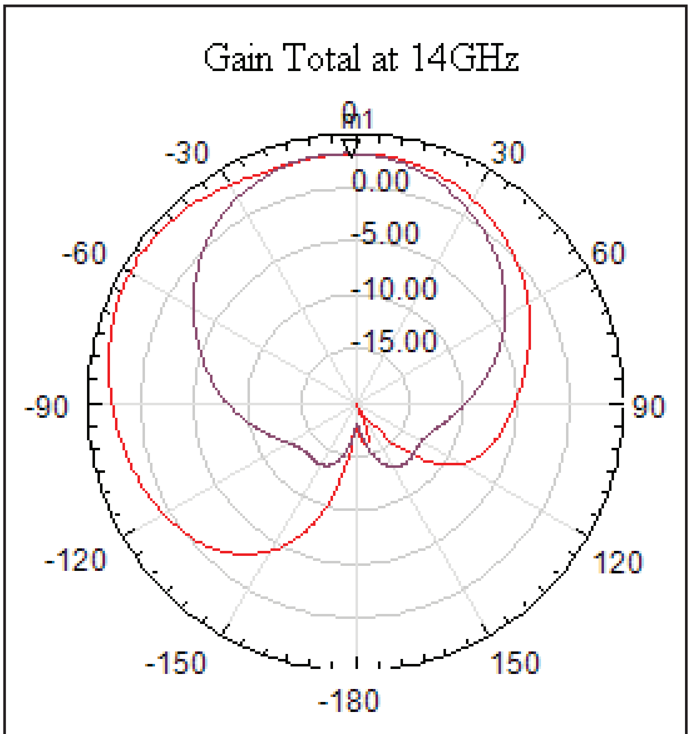
Fig. 4: Impedance Match

Impedance match of this antenna can be seen in fig.4, this clearly illustrating that the frequency of the interest is very near to point 1. Which is due to the DGS the impedance matching increased, this reduces the loss.

The radiation pattern of the proposed antenna showing the Gain total at 14GHz and 15.1GHz is 3.01dBi and 4.5 dBi respectively.



Name	Theta	Ang	Mag
m1	0.0000	0.0000	4.4942



Name	Theta	Ang	Mag
m1	0.0000	0.0000	3.1079

Fig. 5: Gain total at 14GHz and 15.1GHz.

The important property of any antenna is VSWR in our proposed antenna we have achieved VSWR < 2 over the operating frequency. This can be seen in fig. 6

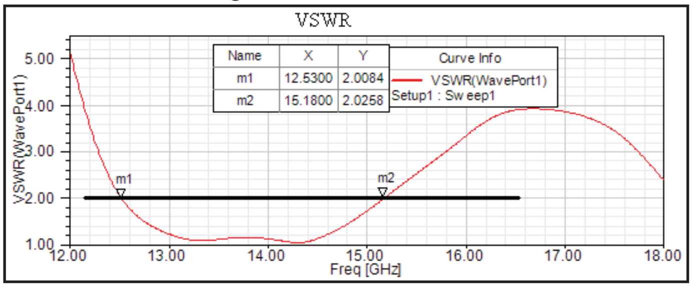


Fig. 6: VSWR of Proposed Antenna

IV. Conclusion

In this design we used effectively the DGS to improve the bandwidth and reduce the return loss. The LAA is designed and good characteristics are observed. With DGS is has yielded 2530MHz bandwidth is achieved and average gain of 3.6dBi is observed.

V. Acknowledgement

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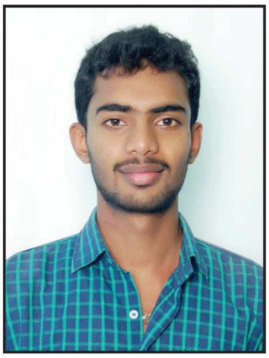

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