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Design of a Compact Printed MIMO Antenna with AMC

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Abstract
*A compact multiple-input–multiple-output (MIMO) antenna is presented for ultra wideband (UWB) applications. The antenna consists of two open L-shaped slot (LS) antenna elements. The antenna elements are placed perpendicularly to each other to obtain high isolation .The proposed MIMO antenna has a compact size 32*32 mm^2, and the antenna parameters is measured. The objective is to design compact printed MIMO antenna with AMC structure which are suitable for portable UWB applications.*

Keywords
Slot, multiple-input–multiple-output (MIMO) antenna, open L-shaped slot (LS) antenna, IE3D software, Ultra wideband, AMC structure.

I . Introduction

Since the late 1990's MIMO *(*Multiple-Input Multiple-Output*)* antenna systems are the subject of the enormous interest among engineers and researchers. The reason is that the theoretical capacity offered by these systems significantly exceeds the Shannon bound. Taking into consideration the fact, that such a channel is typical for wireless access networks, it is obvious that MIMO systems might be a solution for the limited bandwidth and the bottleneck in unlimited broadband information access [1].In recent years ultra wideband (UWB) communication systems have been investigated to meet the demand for high data rate, low cost, and low power. UWB communication has become a hot topic in the wireless communication area. The challenges of feasible UWB antenna design include wide impedance matching ,radiation stability , low profile, compact size and low cost. To solve this problem multiple input multiple output (MIMO) technology is introduced in UWB systems to provide multiplexing gain and diversity gain, making further improvement of the capacity and link quality .Two major challenges are faced in the design process of MIMO antennas for the UWB systems. One is to minimize the antenna elements for the MIMO systems. The other one is to enhance the isolation between the antenna elements. In most cases, the antenna elements should have directional gains. The methods employed to reduce mutual coupling should have little effect on wideband impedance matching for UWB applications. Many methods can be employed to overcome these challenges. These can be devided into three categories. The first method is using UWB diversity antennas. The principle of this method is similar to that of dual polarized antenna. Due to the orthogonality of gain pattern of antenna elements, Low coupling between the elements can be achieved. Second method is using decoupling structures such as tree like structure[3].Third method is hybrid method[9] which combine first two methods .In this paper a compact MIMO antenna for UWB application is proposed.AMC (Artificial magnetic conductor) structure can be used in antenna direction. AMC is high impedance surface.AMC surfaces have two important and interesting properties that do not occur in nature and have led to a wide range of microwave circuit applications.

II. Materials & Methods

The geometry of the proposed UWB MIMO antenna, with a small size of 32*32 mm . It is printed on an FR4 substrate with relative permittivity 4.4 and a thickness 0.8 mm. FR4 in comparison has a higher dielectric constant which results in a smaller patch size. The UWB open L shaped slot antenna proposed in is used as reference, and the antenna's dimensions are optimized to get a smaller size. The proposed MIMO antenna consists of two L-shaped slot antenna elements. The two LSs are placed perpendicularly to each other to achieve good isolation between the two antenna elements. In order to enhance the isolation between the antenna elements at the low band.

A. Antenna Parameters

Antenna ground is finite and volume of antenna is 32mm*32mm. The dimentions of antenna listed in table 1.

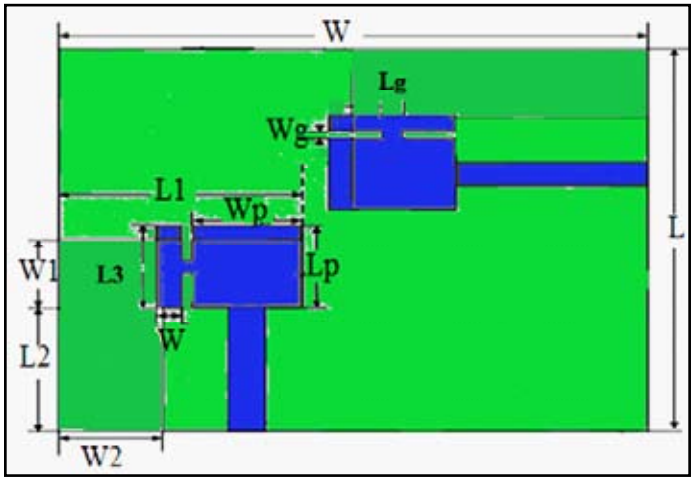

Fig.1: Geometry of Antenna

Table 1 : Antenna parameters

Parameters	W	L	L1	L2	L3	W1	W2
Unit(mm)	32	32	16	8	7	6	5
Parameters	Lg	Wg	Lp	Wp			
Unit(mm)	1.5	0.6	7	6			

B. Artificial Magnetic Conductors (AMC)

Artificial magnetic conductors (AMC), also known as high-impedance surface have received considerable attention in recent years. An AMC is a type of electromagnetic band-gap (EBG) material or artificially engineered material with a magnetic conductor surface for a specified frequency band. AMC takes advantage of both the suppression of surface waves and the unusual reflection phase. This can be applied to a variety of antenna designs, including patch antennas, which often suffer from the effects of surface waves.AMC surfaces have very high surface impedance within a specific limited frequency range, where the tangential magnetic field is small, even with a large electric field

along the surface.AMC surface can function as a new type of ground plane for low-profile wire antennas, which is desirable in many wireless communication. The characterstics of AMC structure are:

- AMC structure used in antenna increase antenna gain.
- Improves directivity.
- Increase Bandwidth.

The antenna using AMC is shown in figure2. Various graphs of return loss, gain, directivity and efficiency are shown .It can be notice that performance of antenna increase by using AMC structure.

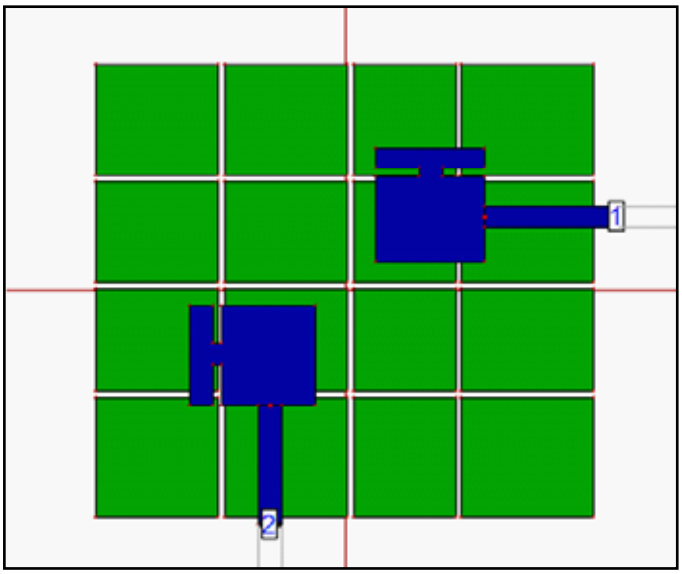

Fig 2 : Antenna design with AMC

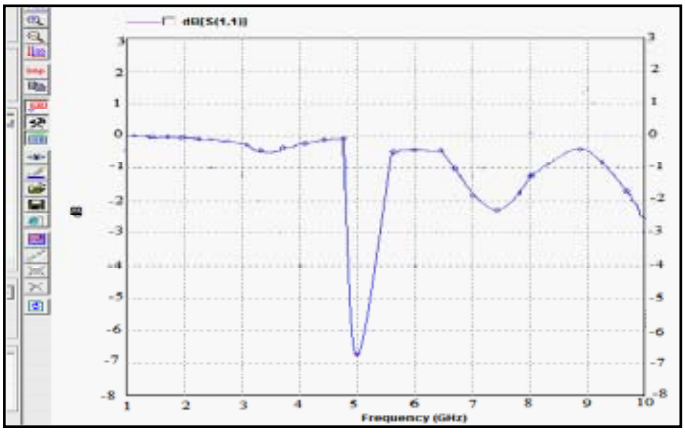

Fig. 3 : Return loss of antenna without AMC

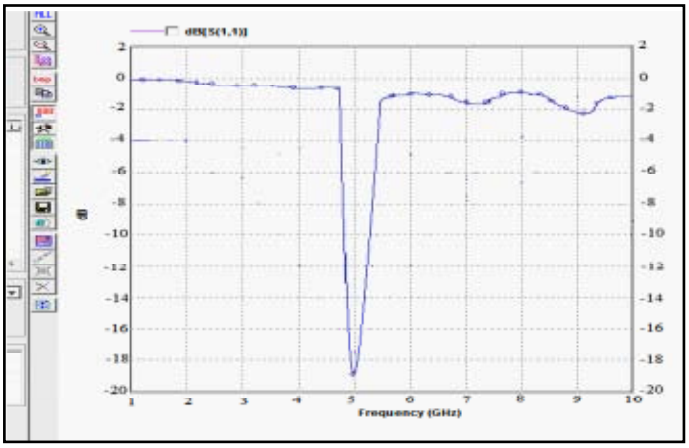

Fig 4 : Return loss of antenna with AMC

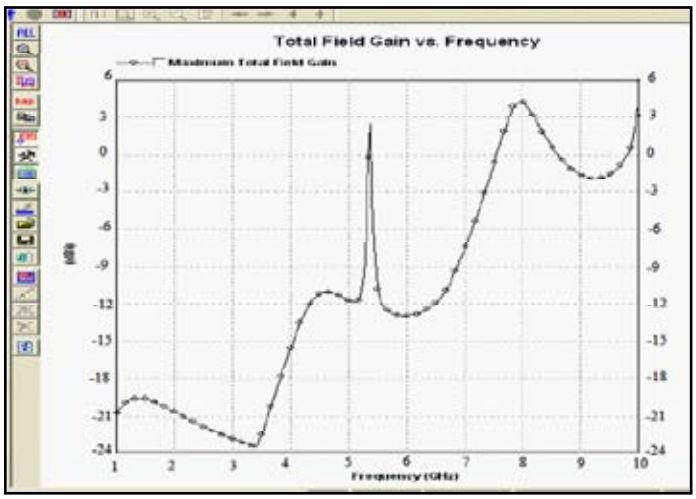

Fig. 5 : Gain of antenna without AMC

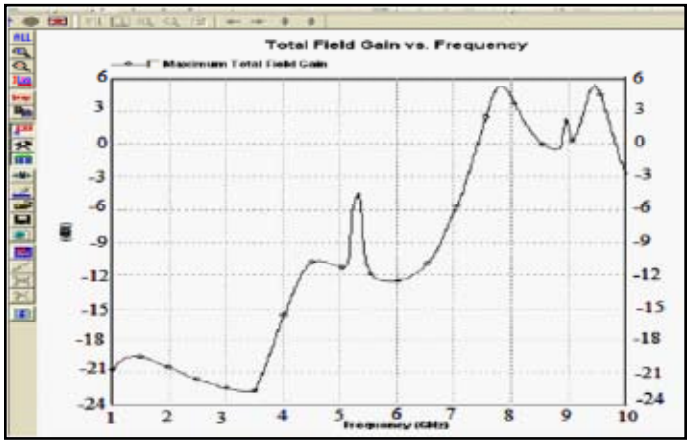

Fig. 6 : Gain of antenna with AMC

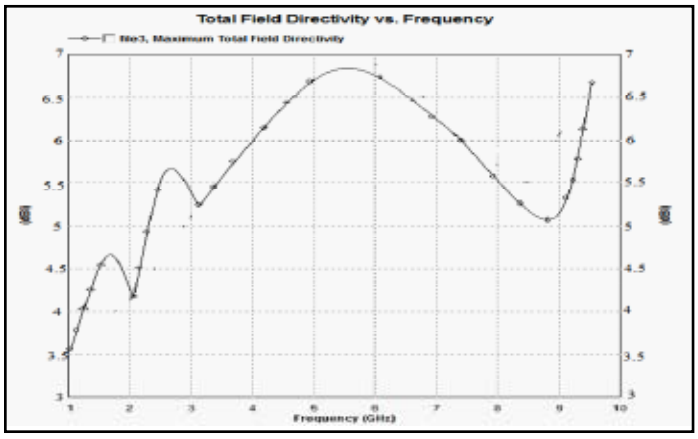

Fig. 7 : Total directivity of antenna without AMC

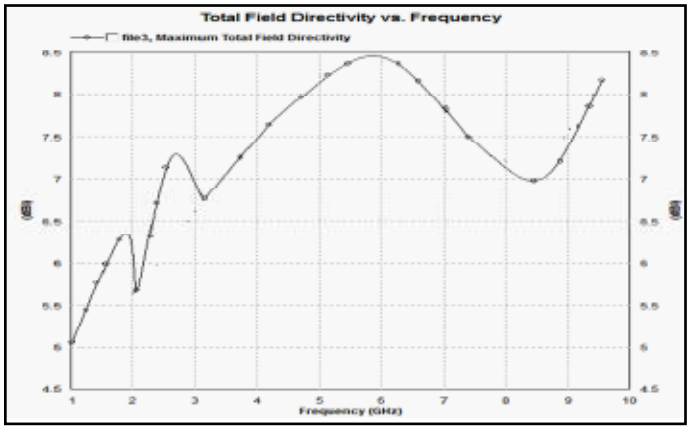

Fig. 8 : Total directivity of antenna with AMC

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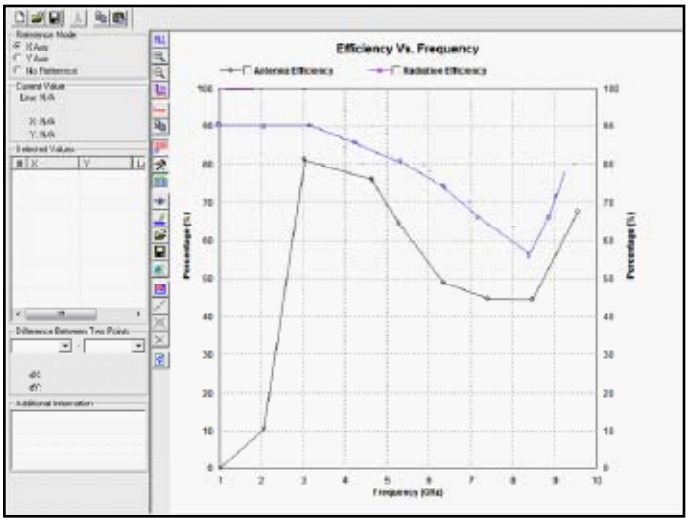

Fig. 9 : Efficiency of antenna without AMC

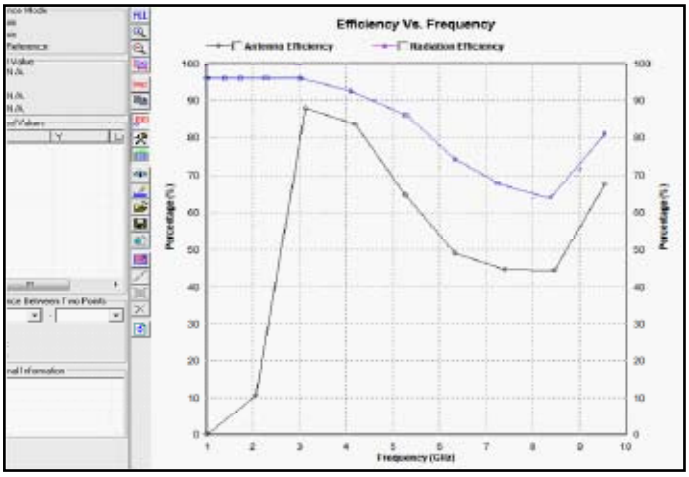

Fig. 10 : Efficiency of antenna with AMC

III. Conclusion

A compact MIMO antenna is proposed and two open L-shaped slot elements is presented in this paper for UWB applications. High isolation can be achieved by placing two L shape slot antenna element perpendicular to each other. The antenna parameters are measured. Further AMC structure is used with antenna .The performance of antenna also been studied in this paper .By using AMC structure performance of antenna can be increased.

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Author Profile

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