ISSN 2320 - 2599
Volume 6, No. 5, September - October 2017
International Journal of Microwaves Applications
Available Online at http://www.warse.org/IJMA/static/pdf/file/ijma01652017.pdf

Conception and realization of UWB antenna and conception of this one for diversity

S. Mouna[1], H. El mir[2] and H. Ammor[3]
[1] CRMEF, P.O. Box 255, Meknes 50000, Morocco, Smouna7@yahoo.fr
[2]Physical Department, Moulay Ismail University, BP.11201, Av. Zitoune, Meknes- MOROCCO
[3]Communications and Electronic Laboratory, Mohammadia Engineering Institute, Av. Ibn Sina. P.Box 765, Rabat –MOROCCO

ABSTRACT

In this paper, we propose Ultra Wide Band planar monopole antenna for wireless communication. It consist of a rectangular patch with a simple meander line slot is inserted into the radiating patch, and a partial ground plane operate for the frequency 6 GHz to 13GHz. As well as the conception of this one to ensure the antenna diversity operate for the frequency 2 GHz to 6GHz. The antennas are printed on FR4 substrate with dielectric constant of 4.4 and substrate thickness of 1.578 mm.

Key words: Ultra wide band antenna, antenna diversity, wireless communication.

1. INTRODUCTION

The evolution of the systems of wireless communication did not cease being impulse by increasing demand in services of wireless data transmission, as mobile telephony, television by satellite, the systems of video conference, etc. . . The users became increasingly demanding and want some always more in terms of debits, reliability and security. What aroused a great interest for the ad hoc mobile networks in which the participants (computer portable, mobile GPRS…) are free to move around randomly and to organize arbitrarily (without using a third party hardware such as a access point) to form an autonomous mesh network wireless auto configurable. Therefore for several years, many researches have been carried out in order to find a technology which will make it possible to satisfy the requirements in service of the multi-media type with the customers. These research efforts were done directed by several organizations of standardization all over the world with the aim of leading to standards and principles which will make it possible mobile telecommunications to provide services wide band similar to those of the fixed networks. However, the development of these technologies is accompanied naturally by a saturation of the transmission networks of information. A solution consists in deploying the new ones and many networks like the fiber optics, the coaxial cables and the copper. All times the installation of such supports of transfer of data proves very expensive. Another way, more economic is to use the microwave as support of propagation for the transmission of information. In this context, the antenna is an essential element to ensure the emission and the reception of the information materialized by the waves being propagated in the atmosphere. This type of connection requires high gain antennas to enable laid long communications and broad bandwidths to ensure broadband. The requirements are also on a low cost.

Also, inside the buildings, the signals received on the mobile terminals undergo a certain number of deformations due to the nature of the walls or obstacles met. The attenuated signal can be considered or diffracted and arrives of various directions, at different moments. One is then in an environment multi waves or the channel of propagation is variable temporally, because of movement of the objects where people are present in the parts. These conditions generate on the one hand sharp variations of the level of the received signal “fading” by destroying combinations of the phases of the signals multi waves) and on the other hand a temporal widening of the Complex Impulse Response (C.I.R) which will limit the flow of the communication. The techniques of equalization make it possible to be freed from these difficulties, but they are costly and consuming. On the other hand, diversity in the broadest sense-based techniques [1] and [2] can be a competitive at low cost.

The work presented in this article, concerns the elements of conception and realization of antenna patch Ultra Wide Band (UWB) of radiant elements in form "mander-line" operate for the frequency 6 GHz to 13GHz. As well as the conception of this one to ensure the diversity of antenna operate for the frequency 2 GHz to 6GHz. The basic structure that we adopted for these antennas is a simple structure. It consist of a rectangular patch with a simple meander line slot is inserted into the radiating patch, and a partial ground plane. The antennas are printed on FR4 substrate with dielectric constant of 4.4 and substrate thickness of 1.578 mm.

2. CONCEPTION AND REALIZATION OF THE ULTRA WIDE BAND PATCH ANTENNA

2.1 Structure of UWB antenna

As presented in figure 1, the configuration of the proposed small planar monopole antenna which consists of a rectangular patch with a single slot on the patch, and a partial ground plane. The antenna, which has compact dimensions of 21 x 21 mm^2, is constructed on FR4 substrate with thickness h of 1.578 mm and relative dielectric constant ε_r of 4.4. The dimension of the patch is 11.2 X 10.5 mm^2 and the slot, and the dimension of the partial ground plan is 5.9 X 21 mm^2.

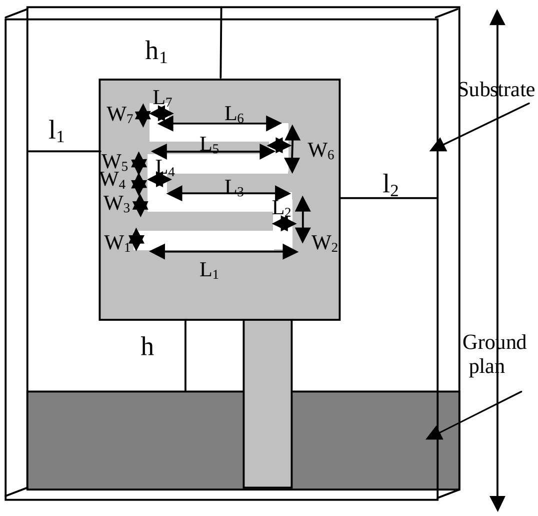

Figure1: Geometry of the antenna.

2.2 Realization UWB antenna

The dimensions of partial ground plan are also recognized as important parameters for determining the sensitivity of impedance matching at lower frequencies [3], [4] and [5]. The optimal dimensions selected for the realization of the antenna, as determined from many simulation results are as follows: h = 2 mm, h_1= 2.5 mm, l_1= 4.5 mm and l_2= 6.5 mm. And the slot dimensions are: L_1= 6.5 mm, W_1= 0.62 mm, L_2= 0.5 mm, W_2 = 1 mm, L_3= 6 mm, W_3= 0.62 mm, L_4 = 0.5 mm, W_4= 0.78 mm, L_5= 6 mm, W_5 = 0.6 mm, L_6= 6 mm, W_6= 0.5 mm, L_7= 0.62 mm, W_7= 1 mm. The prototype of this antenna is shown in figure 2.

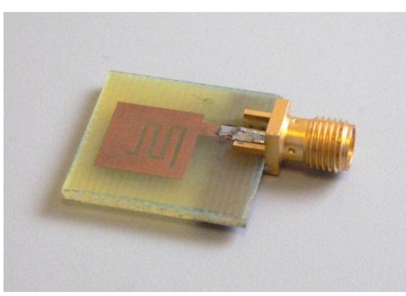

Figure 2: UWB antenna prototype

2.3 Return loss

Based on the design parameters illustrated in figure 1, the proposed antenna was constructed and its characteristics were analyzed. The numerical analyze was performed using the simulation software High Frequency Structure Simulation (HFSS) [6]. The simulated and measured return losses with his height are presented in figure 3. This measure is made at the laboratory of the IETR in Rennes (France) by using the analyzer of networks of the type WILTRON 360 B. The realized antenna satisfies the -10 dB return loss requirement form 6 GHz to 13GHz.

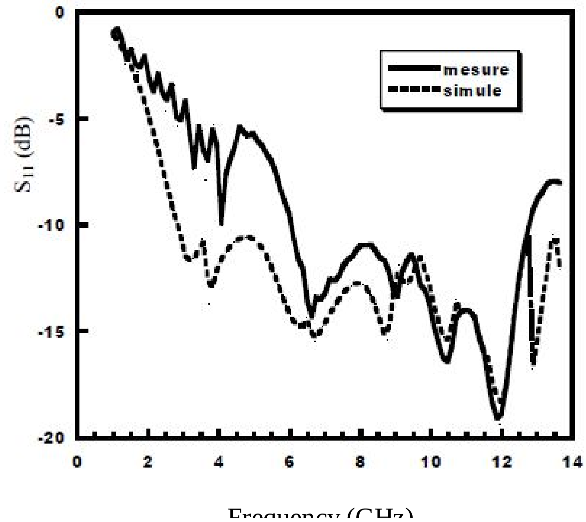

Figure 3: Measured and simulated return losses for the antenna.

2.4 Radiation patterns

Figure 4 to 7 show the E_θ and E_φ measured radiation patterns for the proposed antenna at F= 4.078 Ghz and F=.902 Ghz. This measure is made by considering only the direct way and by eliminating all the multiple routes. They are made in the anechoic chambers of type STARGATE32, with a frequency bands 0.8 GHz - 6 GHz. This device of measure includes a network of 32 bipolarized probes and recovering the automation of the sequences of measure software, as well as the acquisition and the data processing. This technique of measure allows having radiation patterns in 3D.

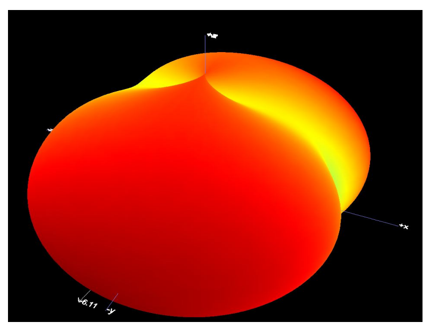

Figure 4 E_θ (dB) measured radiation patterns at F= 4.7566 Ghz

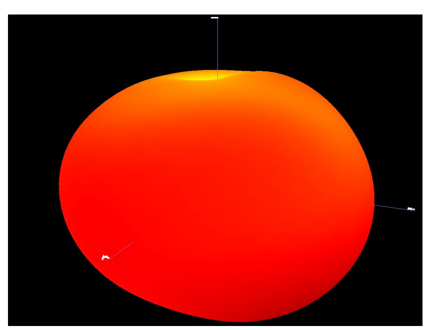

Figure 5 E_θ (dB) measured radiation patterns at F= 5.902 GHz

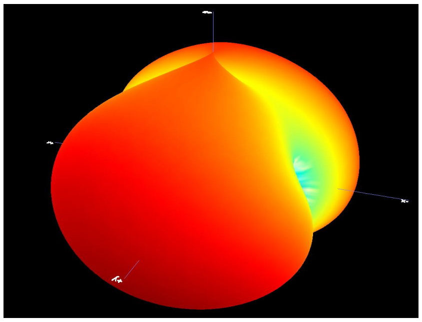

Figure 6: E_{φ} (dB) measured radiation patterns at F=4.078 GHz

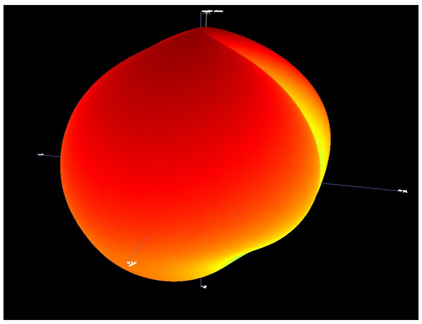

Figure 7: E_{φ} (dB) measured radiation patterns at F=5.902 GHz

2.4 Radiation efficiency

The measure of the radiation efficiency is made in the reverberation chambers the IETR of size 2.9 m x 3.7 m x 8.7 m in the functioning a base frequency 200 Mhz. The measure radiation efficiency antenna is a measure in double weighed. It is thus about a relative measurement compared to an antenna of reference.

Table1 : Radiation efficiency

Frequency (GHz)	Efficiency
4.078e	32%
5.902	90.7%

3. CONCEPTION THE ANTENNE A DIVERSITY

Diversity is by definition, the transmission of the same message of information via several paths distinct of which the statistics of fading are independent. The average intensity of the signal of the trajectories must also be of the same order of magnitude. The adequate combination of these multiple signals makes it possible to have significant reduction of these profound fading and consequently to improve the reliability of the transmission.

A system with diversity makes to reduce, on the one hand the margin of power necessary to fight fading and brings a profit to the reception. In addition, the obliteration of the hollows of fading makes it possible to avoid a certain number of disadvantages.

3.1 Prototype of the antenna with diversity

The antenna with diversity we conceived is represented on figure 8. It is a structure of UWB antenna that we realized, is fed by two lines microrubans of width 2.2 mm each one and two finished ground plane of dimensions 5.9 mm X 21 mm and 5.1mm X 15.1 mm. The role of both feeding is to generate two fields of the same amplitude in phase quadrature.

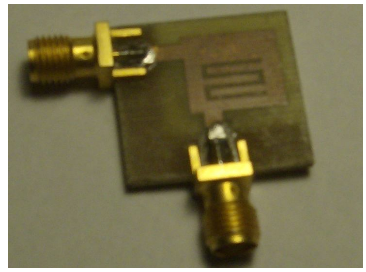

Figure 8: Prototype of the antenna a diversity

3.2 Return loss

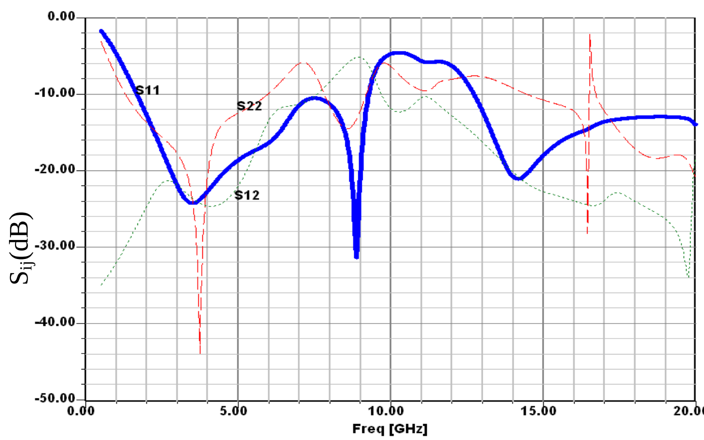

Figure 9: Return loss

The figure 9 presented above shows us at which point the performances of the antenna respect the standards of conception. Actually, it is seen well that the coefficient S11 is well adapted enters 2-9 GHz. Also the coefficient S22, it is well adapted enters 2-6 GHz. As for the coefficient S12, it is adapted enters 2-6 GHz. The realized antenna satisfies the -10 dB return loss requirement form the frequency 2 GHz to 6 GHz

4. CONCLUSION

A Ultra Wideband patch antenna for wireless communication has been presented. The proposed antenna has a simple configuration and is printed on FR4 substrate with dielectric constant of 4.4 and substrate thickness of 1.578mm operate for the frequency 6 GHz to 13GHz. As well as the conception of this one to be able to be used to ensure the diversity operate for the frequency 2 GHz to 6GHz.

REFERENCES

[1] J. F. LERNIEUX, M. S. Tanany, and H. M. Bafez, "**Experimental evaluation of space/ frequency/ polarization diversity in the indoor wireless channel**", *IEEE Trans. Veh. Technol.*, vol. 40, pp. 569-574, Aug. 1991.

[2] J.E. MITZLAFF. "**Radio Propagation and Anti-Multipath Techniques in the WIN Environment**", *IEEE Network Magazine*, p.21-28, Nov. 1991.

[3] F.R. Hsiao, K.L. Wong. "**An internal ultra-wideband metal-plate monopole antenna for UMTS/WLAN dual mode mobile phone"**, *Microwave Opt Technol Lett*; 45, 265-268, 2004.

[4] W.S. Lee, K.J. Kim, D.J. Kim, J.W. Yu. "**Compact Frequency notched wideband planar monopole antenna with a L-shape ground plane**", *Microwave Opt Technol Lett*; 46, 563–566, 2005.

[5] Vaishali S. Varpe, Dr.R.P.Labade, Prof.R.S.Pawase, "**Design Of Rectangular Slot Microstrip Antenna For Ultra wide band Applications**", *International Journal of Microwaves Applications*, Vol 5, No.3, May–June2016

[6] **Ansof High-Frequency Structure Simulation** (HFSS) *ver 10, Ansoft Corporation*.