# Design of New Combined antennas with Linear polarization

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**Abstract—***Today, due to the smaller size of telecommunication systems, antennas have to be as small as possible. However, due to the growing number of various standards, new antennas have to be able to cover several frequency bandwidths, including various radiation properties.*
*From the different researches of antennas with various geometries, and regarding the complexity to combine in a single radiating element several types of polarizations,*
*It is extremely important that the development of the antenna used on the mobile communication devices. In this design, we would like to confidently present a design of new combined antennas with linear polarization using in WLAN and WIMAX frequency.*

**Index Terms**—*Miniature Antenna, Combined Antenna ,Linear Polarization , WIMAX.*

## 1. Introduction

The general trend of smaller hand held devices with an increasing number of wireless functions significantly complicates the antenna selection and integration process. It is now common to have devices combining regular cellular communication capabilities with wireless LAN, GPS and Bluetooth; each system requiring its own antenna. The size reduction is a known problem for the individual performance of each antenna [1].
The polarization of an antenna in a given direction is defined as the polarization of the wave transmitted or radiated by the antenna [3].
When the polarization direction is not specified, the polarization is considered in the direction of maximum gain. In practice, the polarization of the radiated energy varies with the direction from the center of the antenna, which means that different parts of a diagram can have a polarization different. The polarization of the wave radiated by the antenna in a specific direction at a point given in the far field is defined as the polarization of the wave which is Locally flat used to represent the wave radiated at that point.
A combination of dipole antenna and patch antenna has linear polarization and meets a given standard or a single structure where one considers the different resonance modes [ 3].

## II. ANTENNA CONFIGURATION

The simulated results were conducted using the CST Microwave Studio.
The antenna structure is depicted in Fig1.

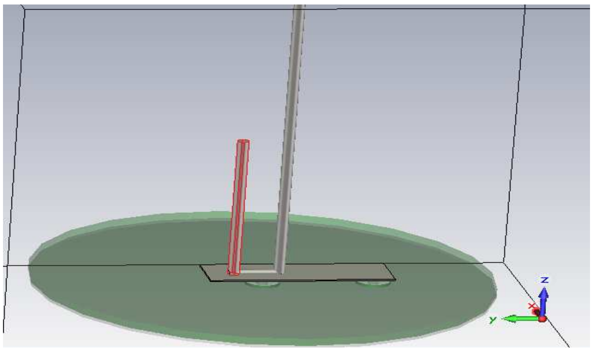
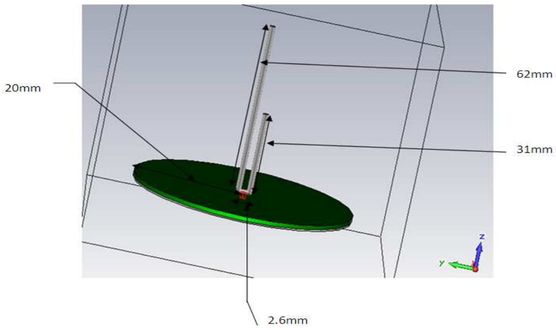


Fig .1 Antenna structure

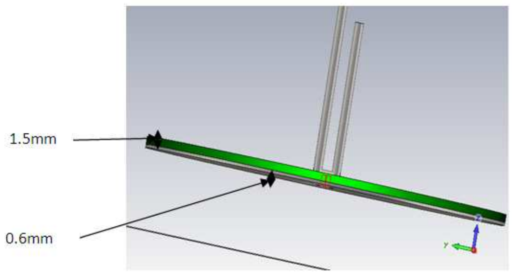
### II.1 Dipole Antenna

The dipole is one of the simplest and the most inexpensive. This antenna is a widely used because it is very simple to make and it ensures coverage of very large areas.

The antenna most famous of this type is the dipole half wave (or λ / 2). This is a transmission line terminated an open circuit (CO) , the dipole antenna presents a multi-standard with linear polarization [4].
Fig 2 illustrate Arrangement of the dipole antenna, the green top layer is made of a low permittivity and low-loss substrate, in order to optimize the antenna efficiency and bandwidth, where $\varepsilon r = 2.32$, $\mu = 1$, thick copper layer is used as a ground plane for the antenna structure .




(a)




(b)

Fig .2 (a) Layer of the dipole U antenna (b) Arrangement of the antenna .

### II.1.1 Radiation properties of antenna

The computed return loss of linear polarization antenna. The simulated antenna by CST Microwave Studio software is well adapted at three resonant frequencies of 1.32 GHz, 2.41 GHz, and 3.48 GHz. The reflected power reaches the values of -30.83 dB,-19.33 dB and -11,005 dB at these resonant frequencies respectively, specially in the Bluetooth and WIMAX band.

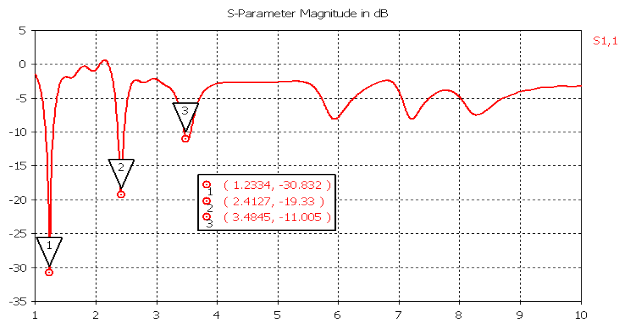
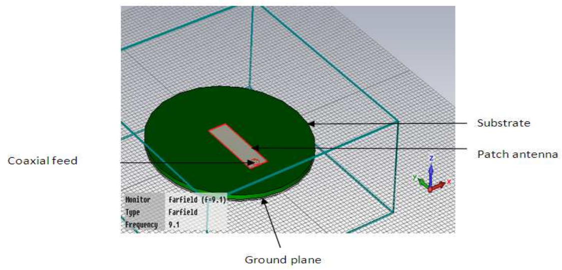
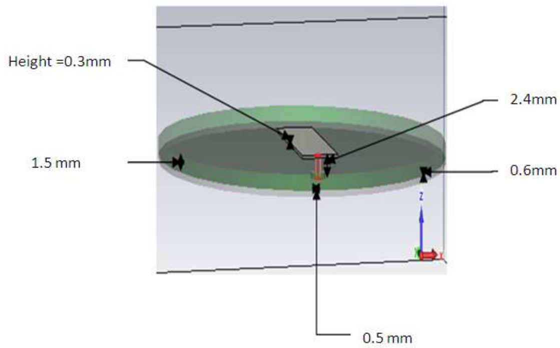



Fig.3 Computed returns loss of the antenna

### II.2 Patch Antenna




(c)




(d)

Fig .4.(c) layer of patch antenna (d) Arrangement of the antenna

Table1: Dimension of the patch

| | |
|---|---|
| Height | 0.3mm |
| lenght | 32 mm |
| **Wigth** | **10mm** |

### II.2.1 Radiation properties of antenna

At the frequency of 9.61 GHz, a resonant mode and a good adaptation are observed. A peak appears at -13.95 dB.

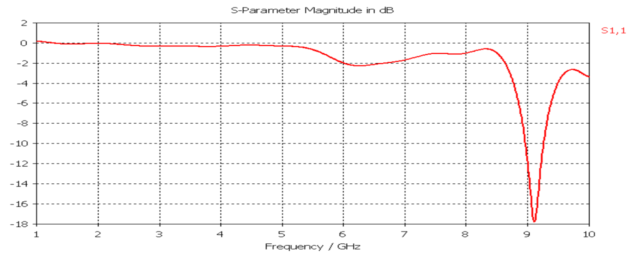



Fig. 5 Computed return loss of the antenna

### II.3 A combination of antenna has Linear Polarization

In this study we will be find a way to combine two antennas with linear polarization without much degradation the performance of one each others. This feeding method couples strongly resonances of each radiating element [5]. This coupling is very strong probably the result of currents of the power source that directly excite each antenna through which it passes [6] .

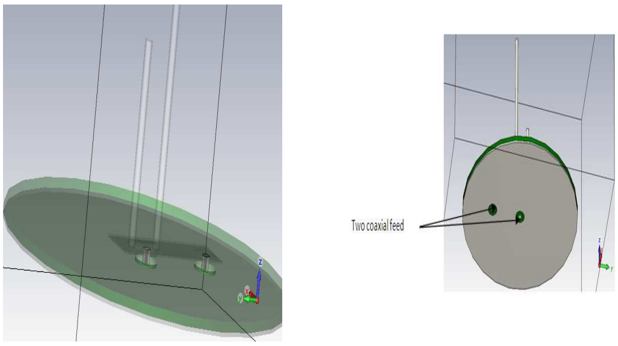



Fig. 6 Combined Antenna with two Coaxial Fied

#### II.3.1 Radiation properties of the antenna

We broke the radiating element and the substrate and we integrate the antenna "U" asymmetric inside patch antenna for antenna combined[7] .

The computed return loss of the combined antenna is well adapted at two resonant frequencies of 2.91 GHz, 9.29 GHz. The reflected power reaches the values of -43.063 dB,-10.083 dB at these resonant frequencies respectively.

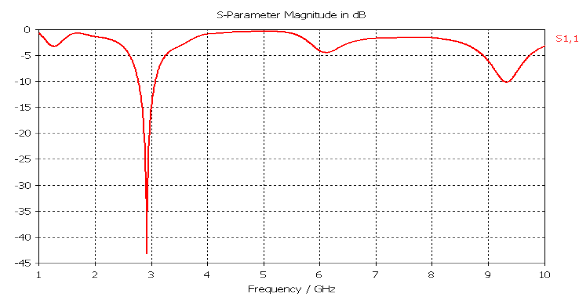



Fig.7 Computed return loss of the antenna

The polar Radiation takes different forms in Fig.8 to Fig .12

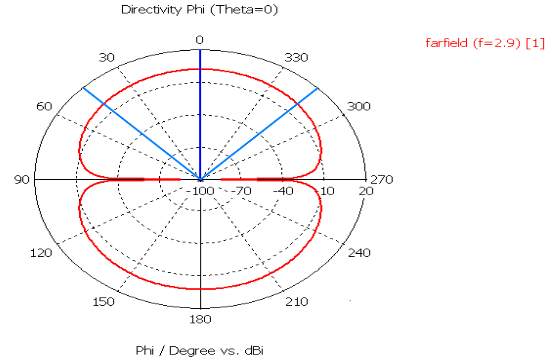



Fig .8 Polar diagrams (theta=0°) at frequency (f =2.9GHz)

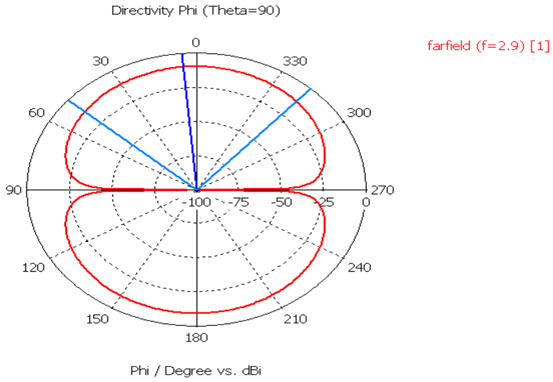



Fig.9 Polar diagrams (theta=90°) at frequency (f=2.9 GHz)

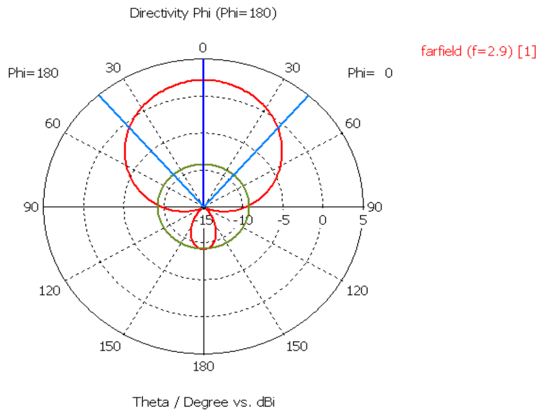



Fig.10 Polar Diagrams (phi=180°) at frequency =2.92GHz

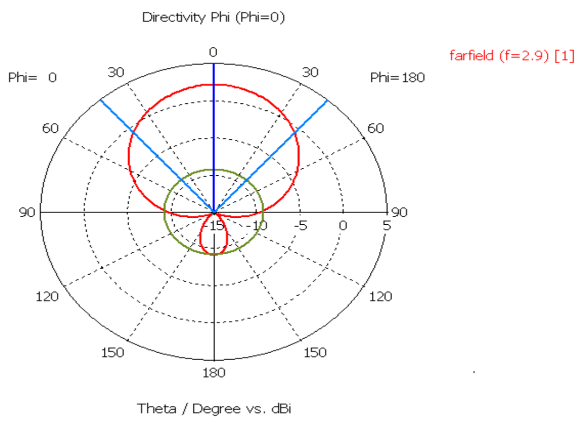



Fig .11 Polar diagrams (phi=0°) at frequency (f=2.9GHz)

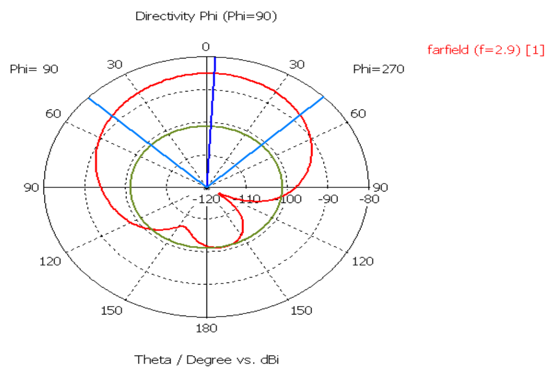



Fig .12 Polar diagrams (phi=90°) at frequency (f =2.9GHz )

## III. CONCLUSION

The main challenges when considering the implementation of multiple antennas into a mobile device have been covered [8].While the antenna size has to be reduced, the band width of operation needs to be increased. In order to maintain high system performances the interaction and coupling between the antennas themselves and other components must be minimized [9]. We conducted a combined antenna with an (U) asymmetrical antenna and patch antenna. The antenna combined exhibit good performance, especially in the WLAN band and WIMAX band .

## IV. REFERENCE

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