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Intelligent Circular Patch Antenna for Wireless Applications

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Abstract

With an aim of finding a symmetrical radiation diagram with less of the secondary lobes. For this reason one will study a rectangular network of 12 patch antennas functioning to 2,3 GHz for the warless communications applications (radiation diagram , its directivity, dispatcher of the beam in 3dB, and the deviation angle) while varying the excitation phase in the two plans E (XOZ) and H (YOZ), the other factors are fixed. Simulations of rectangular network will be made on two software MATLAB and PCAAD.

1. Introduction

The use of a single patch antenna proves often insufficient to answer the imposed constraints of radiation. Specific characteristics like a high profit or a formed principal lobe can generally be obtained only by the regrouping of several sources radiant to form a system called "network". The main interest of the antennas networks is the possibility of creating a beam radiation and directional in all the directions according to the law of food and the number of elements [3]. The grouping in the simplest network is obtained with identical sources which result from/to each other by translation to form linear and plane networks. For the linear network, one seeks to conform the radiation diagram only in the plan containing the sources [2]. During a modification of the radiation diagram on the whole of the hemisphere, the elementary sources must be laid out according to the two-dimensional network. In an antenna network, energy is distributed between the various radiant sources according to a given law: the radiation characteristics of the system depend at the same time on the radiation diagram of the basic element, of the excitation coefficients in amplitude and phase on each source and of the distance between elements. This paper present the characteristics of network radiation of 12 circular patch antennas in a plan (Diagram Radiation Network) simulations were made on MATLAB and PCAAD.

2. Rectangular network

Let us consider a network of MxN elementary antennas (Figure 1), with M the number of patch according to the axis X, and N the number of patch according to axis Y. The field radiated by this network is obtained by multiplying the field radiated by a patch isolated by the factor from rectangular network from MxN patch antennas [4], [5],[6].

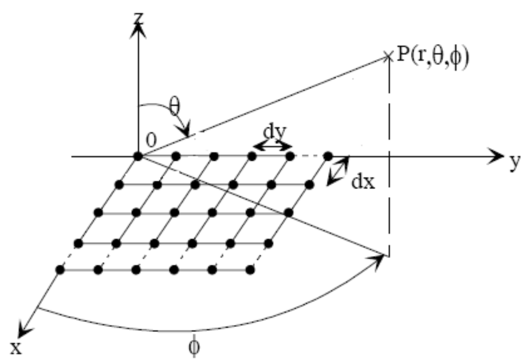


Figure 1. Rectangular Network

With:

$$\psi_x = kd_x \sin\theta \cos\varphi + \beta_x$$

$$\psi_y = kd_y \sin\theta \cos\varphi + \beta_y$$

θ: Angle enters the direction of the radiation and axis Z

d_x : Space between the elements according to axis X

d_y : Space between the elements according to the axis there

β_x: Radiation dephasing of the elements patch according to axis X

β_y : Radiation dephasing of the elements patch according to the axis there

3. Simulation of a rectangular network of 12 circular patch antennas

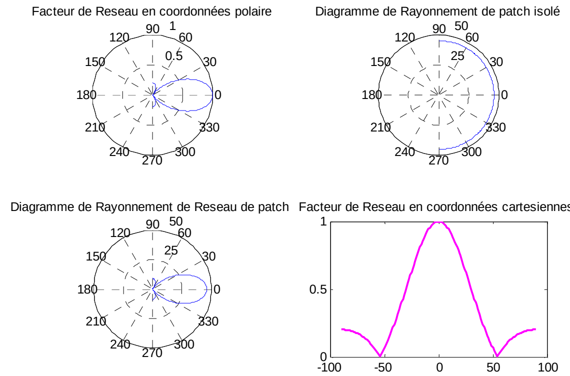
The elements d' a network made provisions on certain plans of surface (example - the rectangular network). The parameters of our antenna are:

The patch ray a =3cm
The permittivity ε_r =2.33
The dielectric thickness h=0.159cm
The Resonance Frequency f_r =2.3GHz
The Wavelength λ =3cm

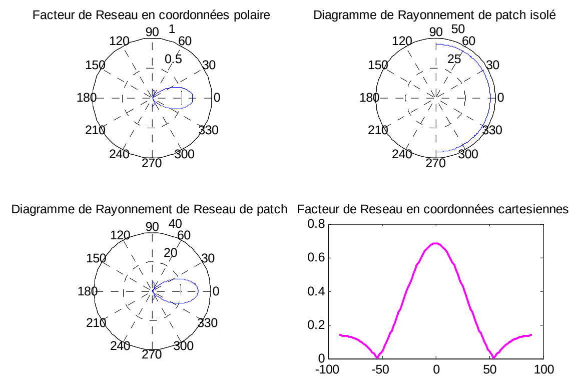
3.1. In the plan E(φ =0°)

One varying the excitation phases of network β_x and β_y according to axis X and Y. One centers it respectively visualizes there the diagram radiation of rectangular network in the two plans E and H. The circular number of patch in direction X equalizes 4 and in the direction is worth there 3, spacing between the elements aerial equal to 4cm in the direction of axis X, and 4.5cm in the direction of axis Y.

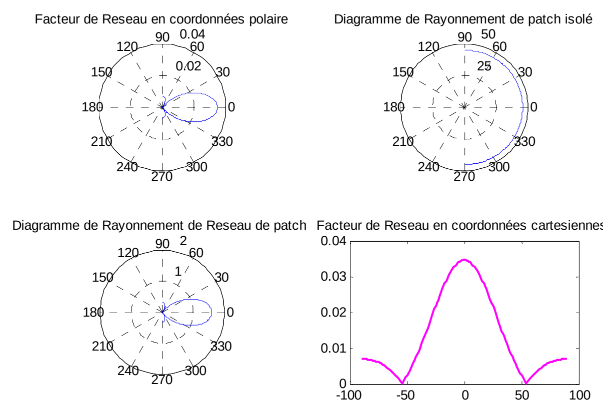
The results are assembled below in the figure 2 and the comparison with the result found by software PCAAD in figure 3. According to these tow figures one notes that the results found by our program MATLAB are same the result found by software PCAAD. And one observes that the increase in phase of excitation according to the axis there of 0° with 180° such as is fixed has an effect only on the amplitude of radiation diagram of network, the amplitude of radiation decreases by increasing .The width of the beam in 3dB remains constant, and the angle of principal deviation of the lobe remains always null at this stage. But in the case and the radiation diagram changes direction, and one observes increase in the amplitude of the secondary lobes.



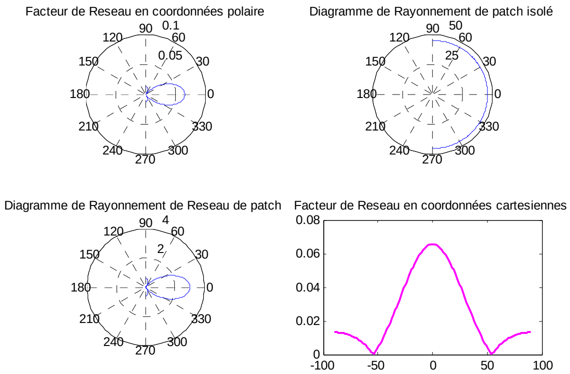
(1) $\beta_x = 0, \beta_y = 0$



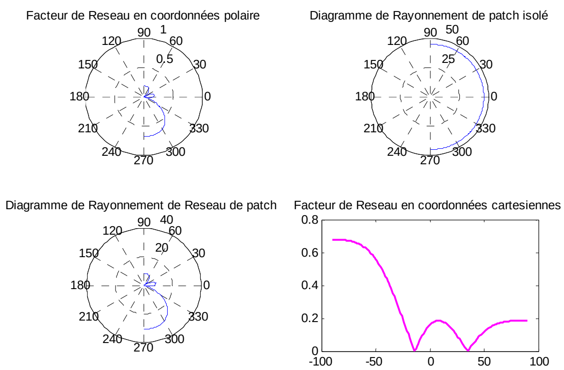
(2) $\beta_x = 0, \beta_y = 45$



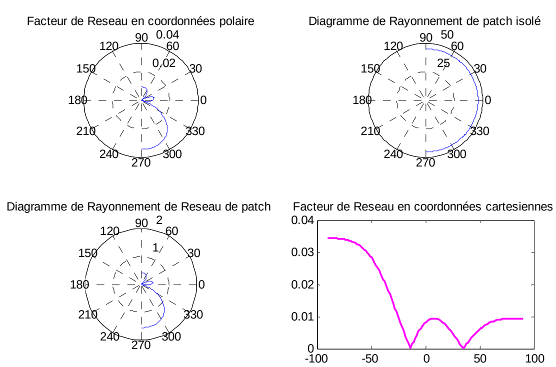
(3) $\beta_x = 0, \beta_y = 90$



(4) $\beta_x = 0, \beta_y = 180$



(5) $\beta_x = 90, \beta_y = 45$



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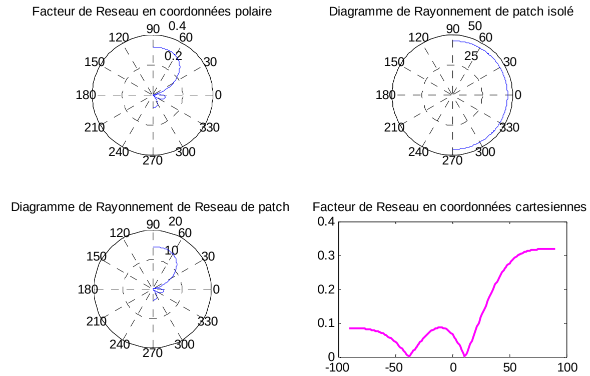
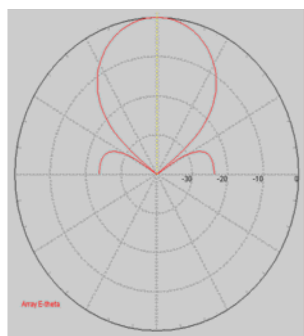
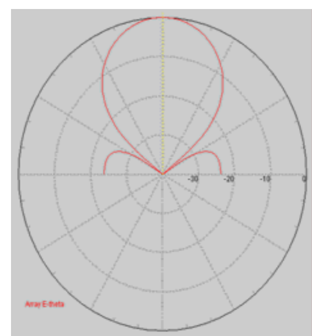


(7) $\beta_x = 130, \beta_y = 300$

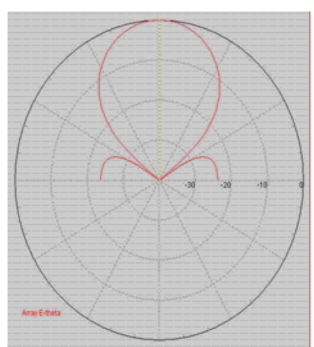
Figure 2. Radiation diagrams of rectangular network of 12 circular patchs antennas in the plan E (MATLAB)



(1) $\beta_x = 0, \beta_y = 0$



(2) $\beta_x = 0, \beta_y = 45$



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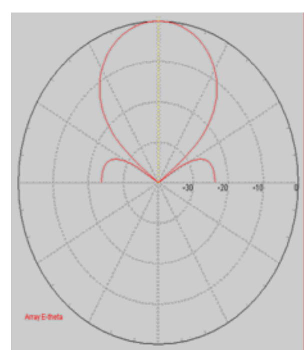
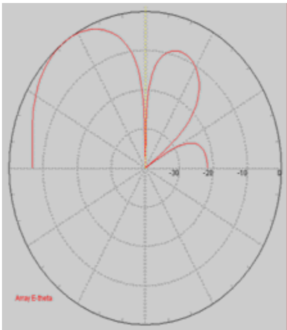
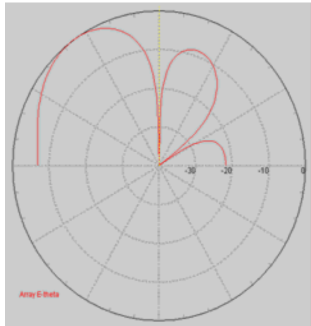


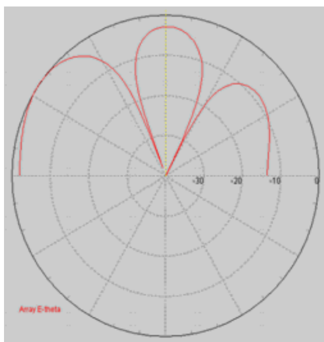
(4) $\beta_x = 0, \beta_y = 180$



(5) $\beta_x = 90, \beta_y = 45$



(6) $\beta_x = 90, \beta_y = 90$



(7) $\beta_x = 130, \beta_y = 300$

Figure 3. Radiation diagrams of rectangular network of 12 circular patchs antennas in the plan E (PCAAD)

3.2. In the plan H(φ =90°)

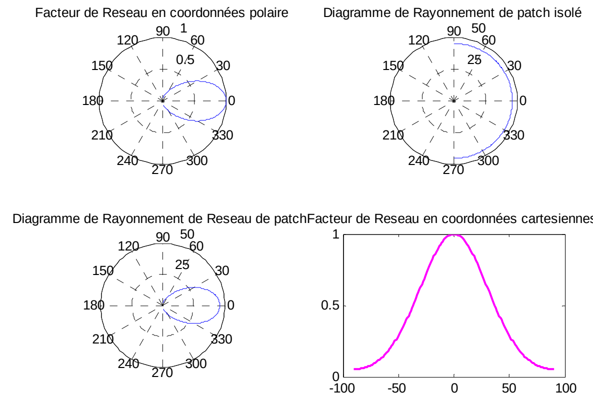
The result found by our program in MATLAB software in figure 4 and and the comparison with the result found by software PCAAD in figure 5

The results of simulation in term of radiation in the plan H found by our program in MATLAB and software PCAAD show a reduction in amplitude of radiation diagram while varying the excitation phase β_y of 0° until 90°, with the excitation phase β_x fixed at the value 0°.

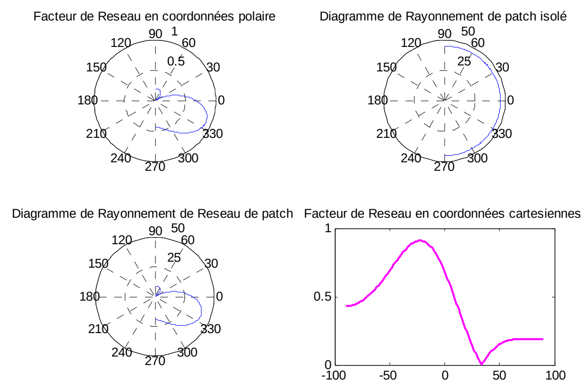
In the case or β_y =90° one observes the appearance of a secondary lobe but with low amplitude.

In the case β_y =180° one observes the change of direction of digraph of radiation.

Now one fixes β_x at 90° and one varies starting β_y from 45° the amplitude of principal lobe and of secondary lobe continue with decreased, except in the particular case where β_y =90°, β_y =120° one notes a light principal increase in lobe. The good directivity of diagram of radiation is if β_y =0°, β_y =0° (13,5dB), and in this case the dispatcher of beam in 3dB is maximum (44°), and the angle of principal deviation of lobe is worth 0°.



(1) $\beta_x = 0, \beta_y = 0$



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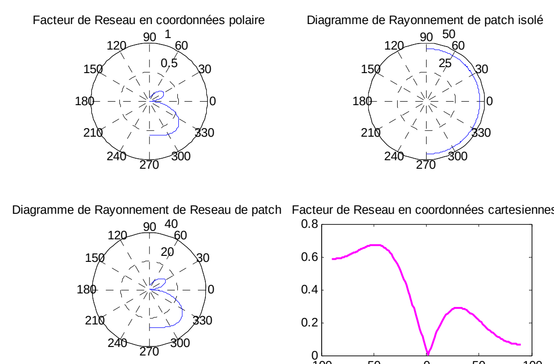
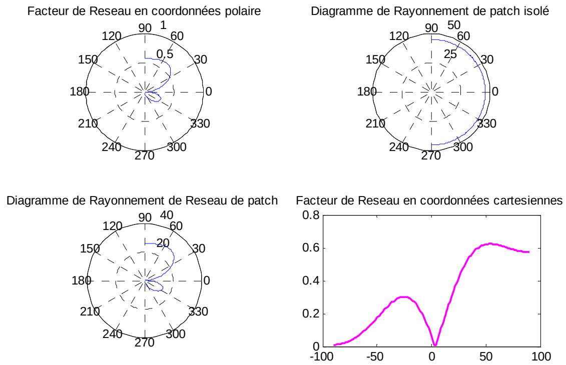
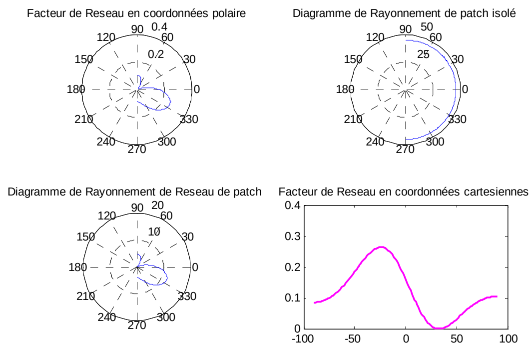


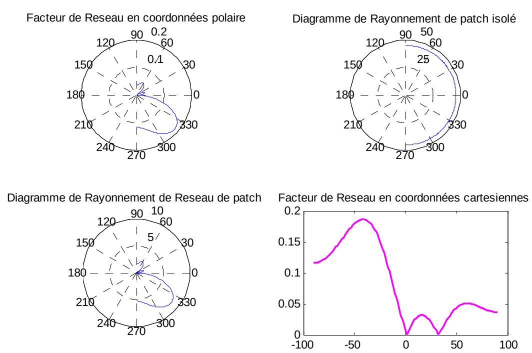
(2) $\beta_x = 0, \beta_y = 90$



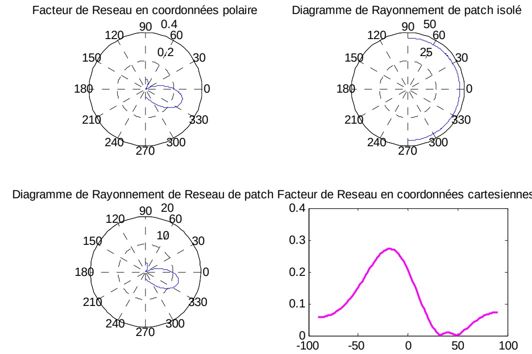
(3) $\beta_x = 0, \beta_y = 180$



(4) $\beta_x = 90, \beta_y = 45$

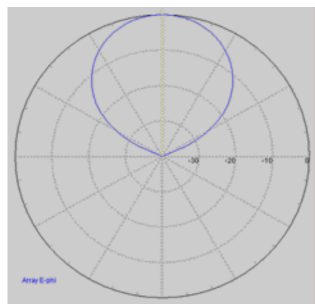


(5) $\beta_x = 90, \beta_y = 90$



(6) $\beta_x = 90, \beta_y = 120$

Figure 4. Radiation diagrams of rectangular network of 12 circular patchs antennas in the plan H (MATLAB)



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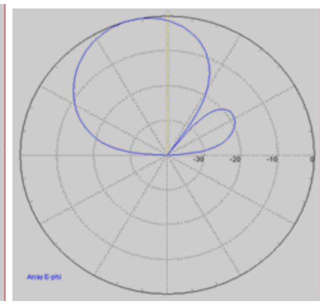
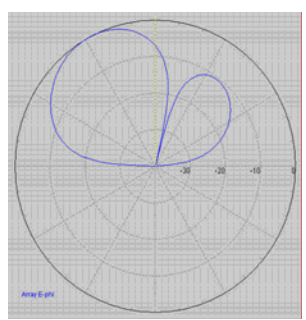
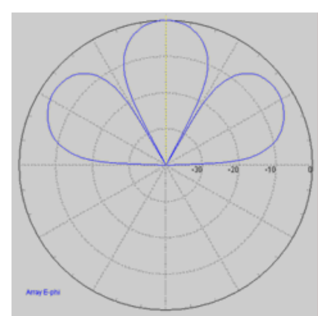


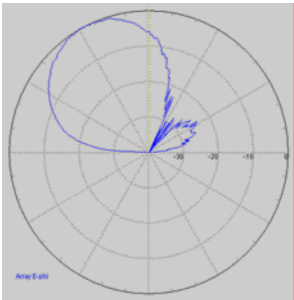
(2) $\beta_x = 0, \beta_y = 45$



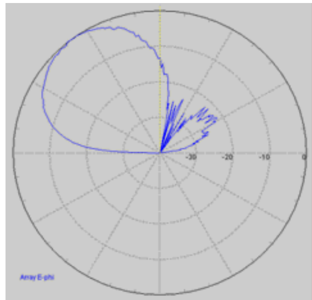
(3) $\beta_x = 0, \beta_y = 90$



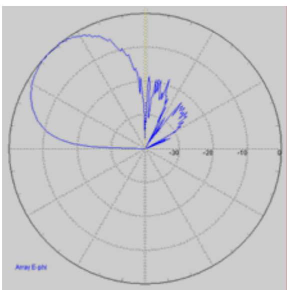
(4) $\beta_x = 0, \beta_y = 180$



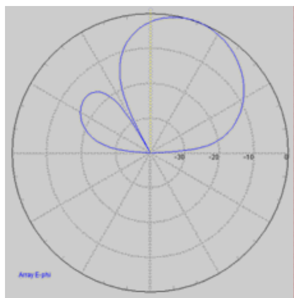
(5) $\beta_x = 90, \beta_y = 45$



(6) $\beta_x = 90, \beta_y = 90$



(7) $\beta_x = 90, \beta_y = 120$



(8) $\beta_x = 130, \beta_y = 300$

Figure 5. Radiation diagrams of rectangular network of 12 circular patchs antennas in the plan H (PCAAD)

9. Conclusion

The goal of this paper it is the design of a circular network patch antenna either in rectangular network, while varying the phase of excitation with the other fixed factors and one visualizes his effect on the amplitude, directivity, dispatcher of beam in 3dB, and the angle of principal deviation of lobe, radiation diagram of network, by using simulator PCAAD and our program under MATLAB in the two plans E and H. According to the results found in terms of radiation one shows that the directivity of a network rectangular and definitely higher than that found by the linear network, also one has diagrams of radiation with secondary month of lobe,

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