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Q-band Feeding Microstrip Antenna

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ABSTRACT

In this paper, we present the simulations results of two types of patch antenna feeding in Q-band. The conception of this patch antenna is realized by software HFSS "Ansoft-High Frequency Structure Simulator" v13. The first Feeding uses a uniplanar corner-fed patch antenna presented with single-point microstrip. The second uses the coaxial feed. The aim of our study is to determine the optimal position increasing the return loss.

Keywords: Patch antenna, Q-band, HFSS, Uniplanar corner fed, Coaxial feed.

1. INTRODUCTION

The enormous development of wireless communication systems requires new wireless devices and systems from scientists to satisfy the requirements of multimedia applications. Multi-frequency and multi-mode devices such as cell phones, wireless LAN networks (WLAN) and wireless personal area networks (WPAN) place more demands on antennas. That's why the antennas must have a high gain, small physical size, bandwidth, integrated installation [1-4].

Currently, different systems work with different standards such like cellular phones, WLAN and satellite communications [5, 6].

However, the patch antenna should promote the industrial world of new technologies that are capable of supporting the speed of development of existing systems. For all these reasons, the bandwidth impedance ratio, polarization axial radiation patterns and gain are becoming the most important factors that affect the application of contemporary and future communication systems by wireless satellite [7].

Feeding methods have great impact in the study and design of patch antennas. These methods can be grouped into two broad categories [8]: the power contact (probe or line microstrip) and power by proximity (online or by electromagnetic coupling slot). The technique used can significantly change the operation of the antenna.

In this paper, we be interested the effect of feeding on the characteristics of a patch antenna (gain, bandwidth, and radiation pattern) especially on loss return, by using two different types of feeding at the point (dx, dy): With microstrip line that is inserted into the corner of the part in feed [9], and coaxial probe. This can be achieved by varying the same position for dx and dy values that promote the increase of bandwidth and give the advantage of low radiation losses of the line.

2. ANTENNAS STRUCTURE

A rectangular microstrip antenna with a single radiating element and dimension well defined, feeding with two different ways by changing the coordinates of feeding.

The configuration of the antenna 1 is shown in Figure 1. The antenna 1 is a 7.46mm × 6.54mm rectangular patch [9]. The substrate selected for this design is an DiClad 880 with dielectric constant (εr) =2.2 and height of the substrate (h) =0.508mm. Co-axial probe feed of radius 0.5 mm with a simple ground plane arrangement is used at the point (dx,dy) where the centre of the patch is considered at point (0, 0).Figure 2 shows the configuration of proposed antenna which is designed with the similar substrate. The antenna 2 is also a 7.46mm × 6.54mm rectangular patch. A uniplanar corner-fed patch antenna presented with single-point microstrip. (as shown in the figure 2). The location of the Microstrip line feeding is designed by dx and dy.

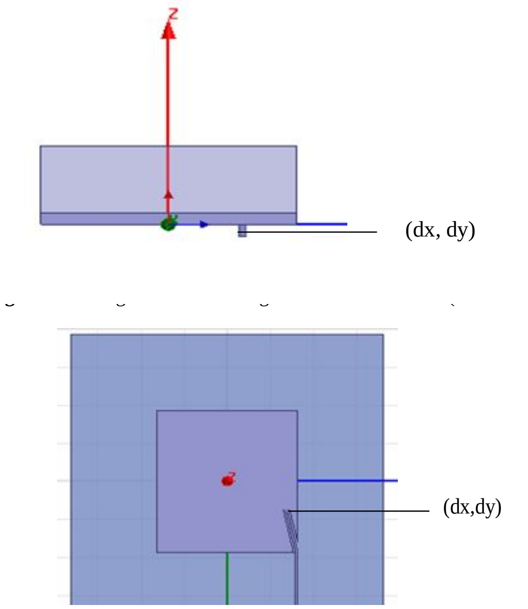
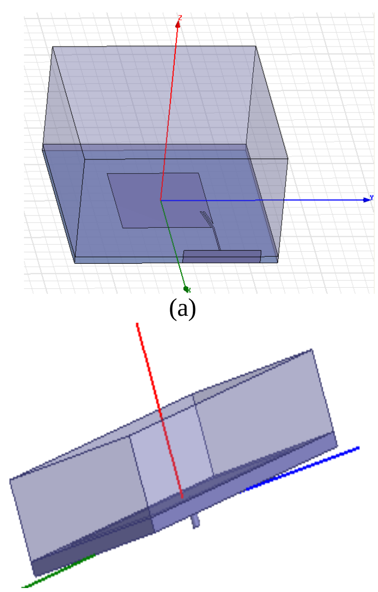


Figure.2: Configuration of feeding by microstrip line feed (antenna 2)

We have opted for the realization of our antenna configuration shown below in Figure.3. The substrate used is DiClad 880 (ε_r = 2.2) with a thickness of 0.508mm and the patch dimensions equal to (7.46 × 6.54) mm^2 [7].



(a)

(b)

Figure.3: Design of the rectangular patch antenna by HFSS (a) Fed by microstrip line (b) Fed by coaxial prob

3.SIMULATIONS RESULTS

The position of the feed line microstrip designated by *dx* takes the following values: 1, 1.5 and 2 mm; while *dy* is fixed at 2.6 mm (Figure.2). Results are obtained by Ansoft HFSS simulation below (Figure. 4).

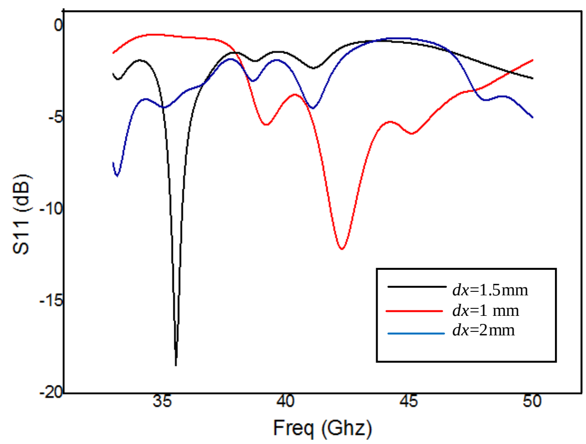


Figure.4: Variation in Return loss S11 depending on the frequency Q-band with *dy* = 2.6 mm (microstrip line feed)

After analyses the S11-parameter simulation result from Table I for the microstrip line feed. The result has shown that the value maximal return loss |S11| is 18.44 dB; for *dx*=1.5 mm; with a resonance frequency 35.54 GHz.

Table 1: Results of simulation of the antenna

Value of *dx* (mm)	Resonance frequency (GHz)	Return loss |S11| (dB)
1	42.6	11.44
1.5	35.54	18.44
2	35	< 10

Through the same way, the position of the coaxial feed takes the following values: 1, 1.5 and 2 mm; while *dy* is fixed at 2.6 mm (Figure.1). Results are obtained by Ansoft HFSS simulation below (Figure. 5).

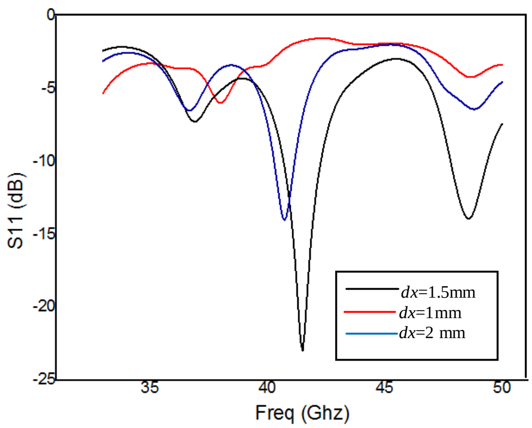


Figure.5: Variation in Return loss S11 depending on the frequency Q-band with dy = 2.6 mm (coaxial feed)

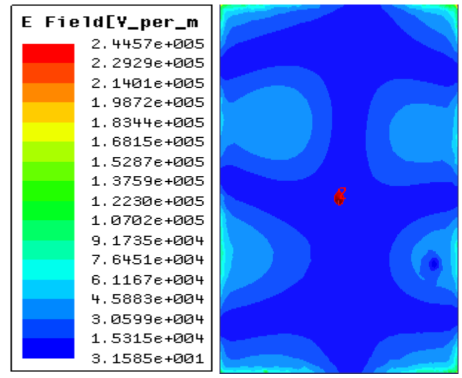


Figure.6: E-field coaxial feed

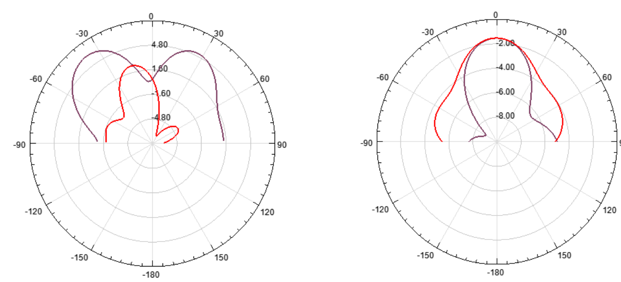
After analyses the S11-parameter simulation result from Table II for the microstrip line feed. The result has shown that the maximal value return loss |S11| is 22.97 dB; for *dx*=1.5 mm; with a resonance frequency 41.5 GHz.

Table 2: Results of simulation of the antenna

Value of *dx* (mm)	Resonance frequency (GHz)	Return loss |S11| (dB)
1	38	< 10
1.5	41.5	22.97
2	40.73	13.99

We deduce that in Q-band that the best position of the feeding line and the feeding coax is the position *dx* = 1.5mm which gives return loss of 22.97 dB compared to other positions (Figure.4 and Figure.5). The position of the feed line microstrip designated by *dy* takes the following values 1.5, 2 and 2.5 mm while *dy* is fixed at 1.5 mm. Results are obtained by Ansoft HFSS simulation below.

It takes the same work but varying *dx*. The most of the energy was absorbed by the antenna for both types of feeding in the position *dy* = 2.5 mm. The return loss is approximately equal to 35dB.



(a) (b)

Figure.7: Radiation Pattern fed by (a) coaxial probe (b) feed line

Radiation patter results have been presented in Figure.7. The patterns are directive and notice that the antenna configuration is the same, feeding by two different methods. The coaxial probe gives the best results.

4.CONCLUSION

The choice of the position of the feeding depends on their performance of the patch. The conception of antennas using HFSS bases essentially on the shape of the patch antenna and the feeding method and the substrate in order to obtain a result which return loss wished. In this study the return loss is maximum in the position *dx*=1.5 mm and *dy*=2.6 mm. The advantage of the fed by a coaxial cable compared to the feed Microstrip line is that the impedance corresponding to the Q- band can be adjusted. For all this the coaxial feeding stays the preferred feeding compared to microstrip line feeding.

REFERENCES

[1] M.Iftissane, S.Bri, L.Zenkouar, A.Mamouni, "Conception of Patch Antenna at Wide Band", Int. J. Emerg. Sci., 1(3), pp. 400-417, September 2011.

[2] S.Bri, A. Nakheli, A. EL fadl , "Conception of Patch Antenna at Wide Band: Dual and Broadband Patch Antenna na", ISN: 978-3-8484-8921-3, Edition LAP - Lambert Academic publishing Germany, 2012.

[3] M.Iftissane, S.Bri, L.Zenkouar, A.Mamouni, "Design and Modelling of Broad band Patch Antennas", AMSE: A General Physics and Electrical Applications Vol. 84, Issue 2, pp.78-98, November 2011.

[4] T.Shanmuganantham, Dr. S. Raghavan, ''Suspended Microstrip Patch Antenna for Wireless Applications'', Vol.5, N°.3, May 2010

[5]. Peroulis, D., K. Sarabandi, and P. B. K. Katehi, "Design of reconfigurable slot antennas," IEEE Transactions on Antennas and Propagation, Vol. 53, 645-654, 2005.

[6]. Behdad, N., K. Sarabandi, and W. B. Hong, "Tri-band reconfigurable antenna for RF ID applications," IEEE Antennas and Propagation Society Internation Symposium, 2669, 2006.

[7] A. G. Derneryd, "A Theoretical Investigation of the Rectangular Microstrip Antenna Element", IEEE Trans. Antennas Propagat., Vol. AP-27, No. 2, pp. 137-145, Mars 1979.

[8] P. Bartia, K, V,S,Rao, R,S, Tomar, ''Millimeter wave microstrip and printed circuit antennas '', Artech House, Boston, London, 1991.

[9] Wang. M, Wu. W, Fang. DG, ''Uniplanar single corner-fed dual-band dual-polarization patch antenna array '', Progress in Electro magnetic Research letters, 30, 41-48, 2012.