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Analysis of Inset Feed Microstrip Patch Antennas with Gap on Low-*k* Substrate

Pamungkas Daud

Abstract

Inset feed patch antennas with a gap on low-k substrate are proposed for radio-over-fiber applications. Strong electric field is induced across the gap for optical modulation. The antenna are analyzed for microwave x-band operation. Analysis of the effect from vary narrow gap width (G) on planar patch antennas which cause changes the parameters such as the frequency shift, electric field strength, and the radiation pattern of the planar patch antennas was reported. The limitation cut-off value between gap width and antenna lenght also discuss here. The analysis using HFFS software application was done.

Keywords—Patch, Antenna, Gap, Low-k substrat, Electric-Field

1. Introduction

Wireless microwave technology has always been an issue of interest in the field of telecommunication and measurement [1.2]. Research activities to create a prototype Inset feed patch antennas with a gap on Low-*k* optical substrate used for converter of microwaves to lightwaves are hot issues [3,4]

The converter consists of antennas and optical modulators, there are some converters that will be developed both converters are arranged in discrete , integrated and dissolved (fusion). The converter will be used to support the application of telecommunication and measurement systems using Radio technology over fiber (ROF). So that the telecommunication system with wide bandwidth (broadband) and measurement system with a low induction disorders can be realized. Given the wide bandwidth needs in the field of telecommunications and accurate results with low induction interference in the measurement field, the light waves can be used to resolve the problem. The technology we commonly refer to ROF converter between wireless microwave and wave of light is needed on this technology.

In this paper, a converter of wireless microwave to the lightwaves proposed. The converter is composed of an antenna and an optical modulator is made on the substrate / crystal electro-optic coefficient (EO) is high (EO crystal) such as $LiNbO_3$, $LiTaO_3$, or other polymer. Basic operations of converter is a wireless microwave received by the antenna, accepted microwave then converted into light waves through the EO effect of the substrate. So that microwaves can be modulated in to the light waves and propagated through an optical fiber cable with propagation loss very low about 0.2 dB/km. Other advantages are the low induction effect and low power consumption.

2. Methode

The methode to design of the rectangular patch antenna with inset-fed can be determine using flow chart which describe at fig.1.

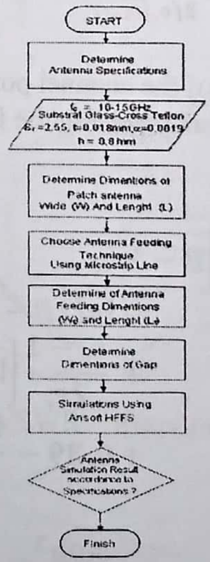

Fig. 1. Flow Chart of Design

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The simulation carried out with Ansoft HFFS after decide the spesification of the antenna and calculating process using some equations to detemine the dimensions of the rectanguler patch antenna[3,4]. Variety of the gap distance has taken to find the best respond of Electric field and other parameter such as VSWR, frequency drift, gain and distribution pattern of electric field on the antenna surface.

$$W = \frac{c}{2fo\sqrt{\frac{(\varepsilon r+1)}{2}}} \quad (1)$$

Where :

W = Patch wide (mm)

c = Light Velocity in Free Space, 3×10^8 (m/s)

f_o = Frequency Osilation (Hz)

ε_r = Dielectric Constanta of substrate (F/m)

$$\Delta L = 0,412h \frac{(\varepsilon_{reff}+0,3)(\frac{W}{h}+0,264)}{(\varepsilon_{reff}-0,258)(\frac{W}{h}+0,8)} \quad (2)$$

$$L = L_{eff} - 2\Delta L \quad (3)$$

$$L_{eff} = \frac{c}{2fo\sqrt{\varepsilon_{reff}}} \quad (4)$$

The width of the channel portion antennas can be calculated using the following equation:

$$W = \frac{2h}{\pi}\left\{B-1 - \ln(2B-1) + \frac{\varepsilon_r - 1}{2\varepsilon_r}\left[\ln(B-1) + 0,39 - \frac{0,61}{\varepsilon_r}\right]\right\} \quad (5)$$

$$B = \frac{60\pi^2}{Z_0\sqrt{\varepsilon_r}} \quad (6)$$

Transformator $\lambda/4$ is a technique of matching impedance in transmission lines $\lambda/4$ length of the channel transformer.

$$l_f = \frac{\lambda_g}{4} \quad (7)$$

λ_g is a dielectric wave length , obtained from the equation:

$$\lambda_g = \frac{\lambda_0}{\sqrt{\varepsilon_{reff}}} = \frac{c}{f\sqrt{\varepsilon_{reff}}} \quad (8)$$

2.1. Simulations And Analysis

Specifications of the antenna to be design and simulated :

Operational frequency : (10.5 – 12.0) GHz

Central frequency : 11.0 GHz

Gap width : 5,10,20,30,40,50 [µm]

Input Port : micro-strip(50Ω), SMA connector

The simulation follow the process as shown on fig.1. Microstrip antenna to be simulated with gap was rectangular patch antenna with inset-Fed as describe in Fig.2 , which will be arranged in the substrate material with substrate characteristics as follows :

Dielectric relative permittivity (ε_r) : 2.55

Dielectric thick (h) : 0.3 mm

Cu Conductor thickness (t) : 0.018 mm

Tangent loss (α) : 0.0019

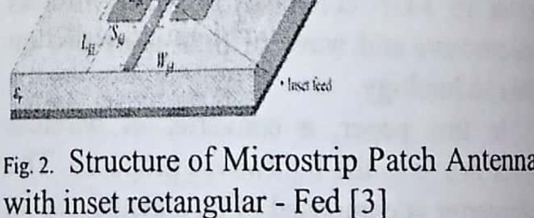

Fig. 2. Structure of Microstrip Patch Antenna with inset rectangular - Fed [3]

The patch antenna with gap structure on fig.3, and the dimension result of the

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antenna after calculation using some equations can be seen on table-1,below :

TABLE I. DIMENSIONS OF PATCH ANTENNA

ε_r	h [mm]	F [GHz]	L [mm]	W [mm]	L_{in} [mm]	W_{fd} [mm]	L_{fd} [mm]	S_{fd} [mm]
5	0.80	11	7.30	10.2	2.09	2.13	5.23	1.89

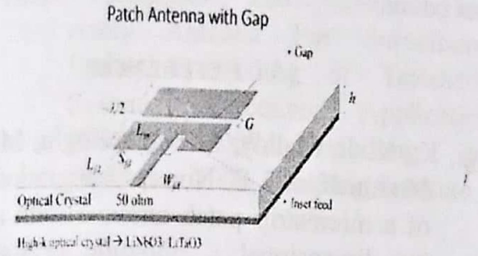

Fig. 3. Structure Patch Antenna with Gap

2.2. Result And Disccusion

Based on the results of simulations there is a two drift frequency resonance category; spread from zero gap distance (G=0 um) to G=100 um. The first drift frequency is Δf_1 band ≅ (11,7-11) GHz and the second drift frequency Δf_2 Band ≅ (11.7-11.6) GHz as shown in figure-5, with relatively Δf_2 band have a good VSWR respon more better than Δf_1 band as shown at fig.6.

The electric field has the best magnitude [V/m] for gap distance at G=5μm. Variation of the gap distance from more than G=5μm up to G=100μm, make the result of the electric field magnitude trend getting weak as shown at figure-4. The phenomenon of electric field weakness happened is equal with equations mention by electric field caused of two flat paralel conductors with high-κ dielectric between[5,6].

Electric field distribution pattern on antenna surface with no gap spread out in the edge side of Rectangular Patch Antenna with antenna gain as shown on fig.7 and fig.8, the inset-fed area has a good electric field shown by the red colour. High-κ dielectrics are used in semiconductor manufacturing processes where they are usually used to replace a silicon dioxide gate dielectric or another dielectric layer of a device. The implementation of high-κ gate dielectrics is one of several strategies developed to allow further miniaturization of microelectronic components, it can be concluded antenna parameters such as VSWR, return loss, bandwidth is in conformity with the specifications required for Wireless communication system. Realization of these antennas will be combined with the optical modulator for a microwave to lightwave converter to support the application of telecommunication and measurement system using radio-over-fiber (ROF) technology.

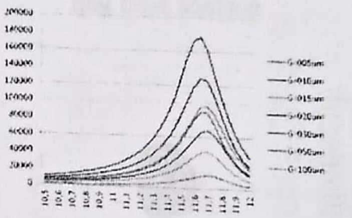

Fig. 4. Electric Fields – Response

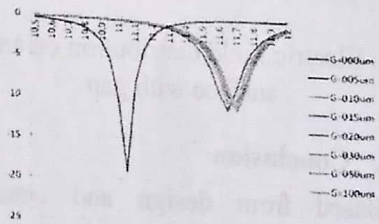

Fig. 5. S11 – Response

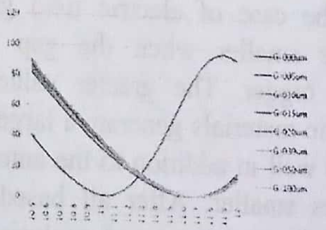

Fig. 6. VSWR – Response

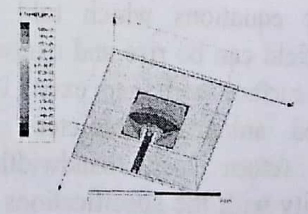

Fig. 7. Electric Field distribution on antenna surface with no gap

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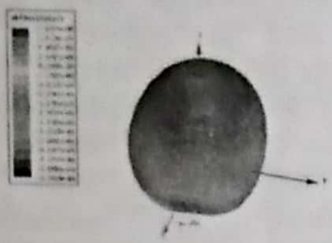

Fig. 8. Gain of antenna with no gap

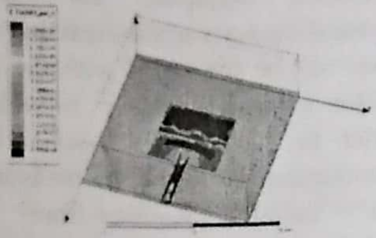

Fig. 9. Electric Field distribution on antenna surface with gap

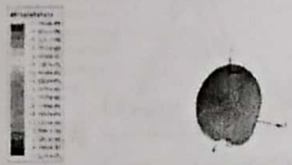

Fig. 10. Electric Field distribution on antenna surface with gap

3. Conclusion

Based from design and simulation results obtained as follows: the gap on the center of antena surface raises the electric field, the case of electric field generated will be smaller when the gap distance getting bigger. The greater value of the dielectric materials generate a large electric field as well in addition to the antenna size becomes smaller. After all based on the results of simulations and analysis are not much different from that expected compare with the equations which told that the electric field can be rise and exceed on the antenna surface with gap exist, it can be concluded antenna parameters such as VSWR, return loss, bandwidth is in conformity with the specifications required for Wireless communication system.

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References

Agi, K., K. J., Malloy, E. Schamiloglu, M. Mojahedi, and E. Niver, "Integration of a microstrip patch antenna with a two-dimensional photonic crystal substrate," Electromagnetics, Vol. 19, 277–290, 1999.

Parker, G. and M. Charlton, "Photonic crystals," Physics World, Vol.13, 29–34, Aug. 2000.

Balanis, Constantine A. 1982. Antenna Theory - Analysis and Design. United States of America: John Wiley and Sons, Inc.

The definition and types of antennas. [On Line].Available: http://adibdevc.blogspot.com/2012/02/definisi-dan-jenis-jenis-antena-dalam.html [February 2, 2014]

Kraus, John. D. 1997. Antennas Second Edition. New York: McGraw-Hill.

Maula, Akbar Muhammad Rusdi.2012. Design and Realization of Microstrip Antenna Using Array Methods. IT Telkom Bandung: Unpublished.

P. Daud, S. Hardiati, D. Mahmudin, T.T. Estu, A.A. Fathnan, Y.N. Wijayanto, and N. Armi, "1x2 Array of U-Slotted Rectangular Patch Antennas for High-Speed LTE Mobile Networks," International Conference on Engineering and Technology for Sustainable Development (IECT4SD), Yogyakarta, 11-12 Nov. 2015.

Scanned by CamScanner

Y.N. Wijayanto, P. Daud, H. Murata, A. Kanno, D. Mahmudin, N. Yamamoto, and Y. Okamura, "Slotted Patch Antenna on LiNbO3 Optical Modulator for Free Space Radio-Wave and Optical Fiber Up-Link," in 10th International Symposium on Modern Optics and its Applications, pp. CP-6, Institut Teknologi Bandung, Bandung – Indonesia, 10 - 13 Aug. 2015.

Daud, Pamungkas, 2007."Coupled Patch Array Antenna For Survelliance Radar, Proceeding of Telematics System Services,and Applications (TSSA) 2007, Bandung 6-7 December 2007, Bandung Institute of Technology,Indonesia,ISSN:1693-993X

Tobing, Artios Lemuel L. 2010. Characteristics Analysis of Microstrip Transmission Line. University of North Sumatra: Unpublished.

Class Module Antennas and Propagation 2008. IT Telkom Bandung: Unpublished .

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