



A NOVEL ANALYSIS OF ULTRA-WIDEBAND PLANAR DIPOLE ARRAY ANTENNA

SVSPrasad¹, K Nishanth Rao²,

Ch.Umasankar³, G Bhaskar Phani Ram⁴,

^{1,2,3}Department of Electronics and Communication
Engineering, MLR Institute of Technology,
Hyderabad, India

⁴Department of Electronics and Communication
Engineering, Vardhaman College of Engineering,
Shamshabad, Hyderabad, India.

July 23, 2018

Abstract

The proposed paper, it was designed by a planar array dipole antenna having two arms which is shape of rectangular and two or two layer FSS with ultra-wideband (UWB). For enhancement of bandwidth each and every arm having concentric divide hexagonal-ring shaped resonator (LC-Tank) and multiple chip resonators are used. Another way for improving the bandwidth is able use the Two-layer FSS, it is calculated and placed at another side of the array. It is helpful to an important of gain improvement with in-phase reflection of the antenna. The dimension and simulated results are shown the planar antenna which include the two-layer FSS, which operating at the frequency range of lower range of L and S-band frequencies, also the return loss of < -10 dB.

1 Introduction

1.1 Ground-Penetrating Radar

In recent trends, the signals are transmitting and receiving by using the mechanism of GPR [1]. It is one of the current and brilliant nondestructive mechanisms in the acknowledgment of things masked underground. It has been useful in various domains [2], Radar and military [3] and mapping [4]. This system provide example metaphors from the chosen mediums, which can then be advance studied. The greater part GPR works in the time domain and waves.

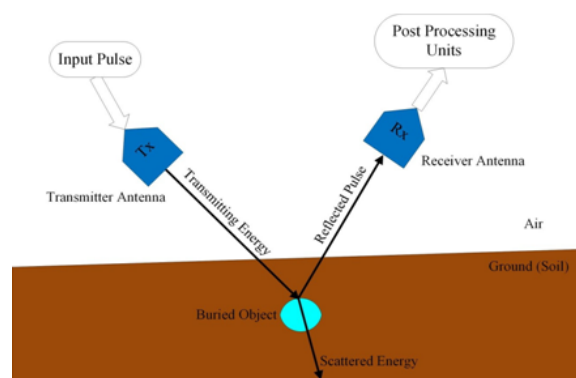


Figure 1-1. Schematic of GPR

The transmitter or sender (Tx) exhibit in Figure 1-1 excite a short electromagnetic wave into the earth. Apart of the forwarding wave is reflected on the sub-surface of masked items and there mining travel through masked objects bottom the earth until it disseminates and fade left in the mud. The destination station, Rx collects reflected waves moderately as well as forwards them to image and post-processing unit to manufacture cross-section metaphors from the items.

1.2 Ultra-Wideband Techniques to GPR

An UWB method, it is gradually working for RADAR recognitions and communications. Consider many advantages of UWB, an improved demand for ultra-wideband wireless technology. As a result,

a frequency band of 0.2GHz to 2.6 GHz. since UWB, envelop a huge bandwidth, and they received extra concentration in a multiplicity of wireless application.

2 UWB Antenna Enhancement

These technologies have been helpful to get better the presentation of the dipole antenna to its finest position. First, in this case notch method is designed to amplify the bandwidth of a narrow-band antenna. Second, in this case the loaded passive elements of inductance and capacitance move toward are working to extra resonant frequency in order to attain a better return loss for the antenna. Then, a two-sheet FSS planar reflector is incorporated with the antenna building to intensify antenna parameters.

2.1 Notches in Planar Dipole Antenna

The UWB, planar arrangement, and absolutely planar antennas, It having substantial consideration of the small profile, with broad bandwidth, normal gain, directive characteristic, casual configuration, minor weight, and slight manufacture cost for wireless systems. A monopole antenna has a moderately low gain and a non-resonance radiation pattern [9-10]. A printed planar antenna without any adjustment has a slim frequency bandwidth. In adding up, kept the electrical dimension of the antenna is small and EM waves properties of the antenna i.e. radiation pattern, power gain, antenna efficiency unaffected or even developed is also very challenging. One of the important methods for growing bandwidth is to use mechanical or electrical switching. One more approach for improving bandwidth is to utilize parasitic patches [3]. One of the important techniques for achieve highest impedance is to be relevant notches at suitable positions of the exciting arm of the antenna.

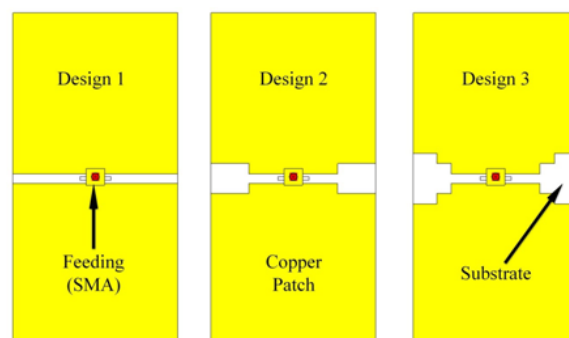


Figure 2. Schematic diagram of the planar dipole

The above figure 2, show a rectangular dipole, which is printed on a dielectric substrate, and the input is 50 SMA connector.

2.2 LC-Loaded

The important techniques for monopole antennas are use many strips to produce a number of ways on the strips. The existing method on each path having its specific resonant frequency. Then they obtain the suitable size and position of the strips on the dielectric, preferred resonant frequencies. Another side of this method is that it is challenging to adjust the used frequency band to the preferred bandwidth, and it radically improves the total size of the antenna due to the great land size [5].

3 Frequencies Selective Surface

A characteristic FSS is a 2-D planar construction with symmetric metallic covers mounted on the upper layer of a substrate. FSS can be separated into 2-classification of filters i.e., band pass and stop band filters, with every group having narrowband and wideband sub-category filters.

3.1 Band-Pass filters and Band-Stop filters

The incident wave excite on to an FSS region, it will emitted a power flow on patches, which are detected on dielectric mediums. The polarization of Electric filed is orthogonal to the patch, and

construct a capacitive component. Similarly the polarization of Electric field is normal to the patch and construct a inductive component [6]. Then, each and every unit cell of FSS having both the normal and orthogonal patches, it can be following to an inductance and capacitance-tank circuit in a sequence manner. Then calculating the lumped values of capacitance and inductance [7-8].

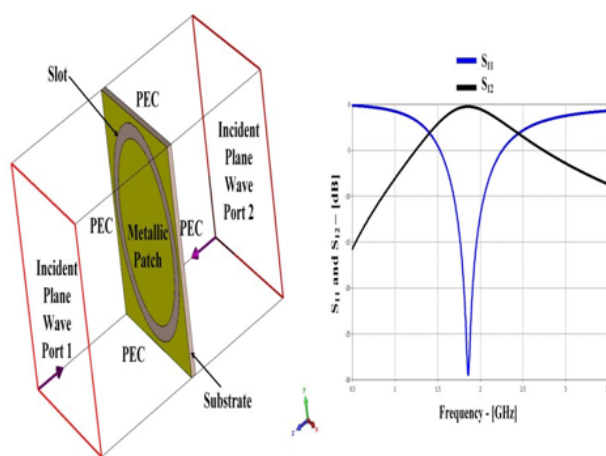


Figure 3-1. Band-pass filter (left) and Scattering values

The above figure 3 exhibits a single unit cell of a band-pass filter. The conductive layer is coated with copper material with a conductivity of 5.8:10 S/m on an FR4 material with dielectric permittivity of 4.3 and thickness of 1.6 mm.

4 The Proposed Mechanism

The construct of the antenna is exhibits in Figure 4, whereas the figure 4(a) exhibits the constructed 3-D view of the total plan and Figure 4(b) shown a single arm of the antenna. The proposed dimensions antenna is in Table I.

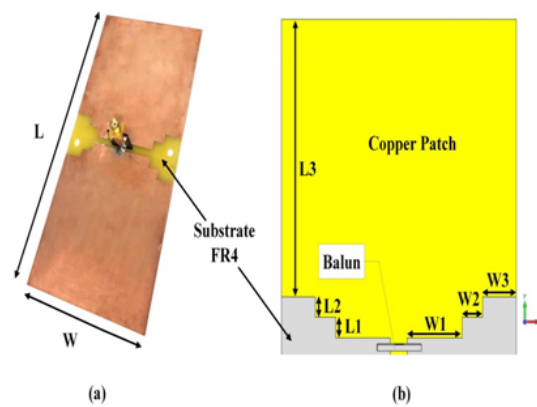


Figure 4. Fabricated 3-D antenna (a) antenna Design (b)

Table 1. Antenna parameters

Length (L)	160mm	Width (W)	80mm
Length 1 (L1)	5mm	Width 1 (W1)	18.6mm
Length 2 (L2)	5mm	Width 2 (W2)	7mm
Length 3 (L3)	68mm	Width 3 (W3)	11.5mm

5 Simulations and Measurements

The simulation of this antenna using the CST tools, The CST solver gives fast and accurate results of antenna parameter and S-parameters

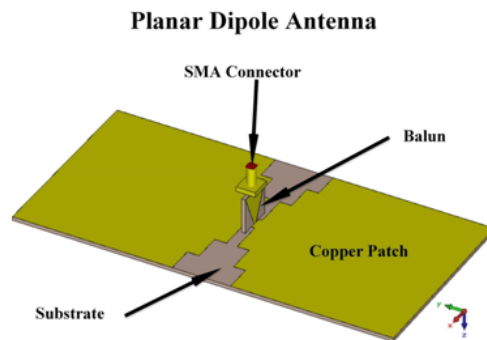


Figure 5.1. planned planar dipole

To examine the importance and implementing the antenna method for the planned planar antenna, the dimensions are (see Figure 4.1) is shown in Figure 5.1. Based on the values of W_2 , the bandwidth and reflection coefficient will be changed.

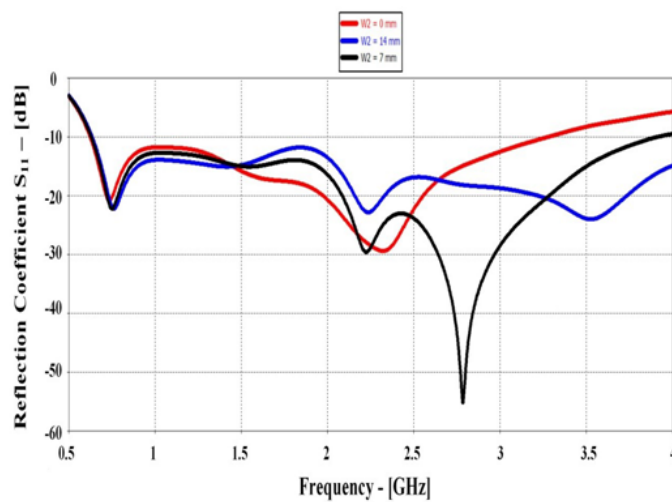


Figure 5-1. Frequency vs Reflection coefficient

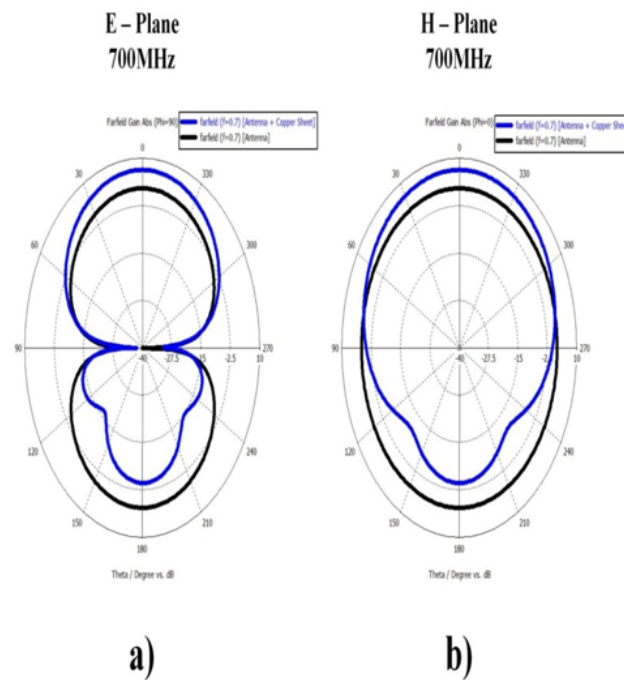


Figure 5.2. (a) Electric (E) -plane and (b) Magnetic (H)- plane at 0.7 GHz

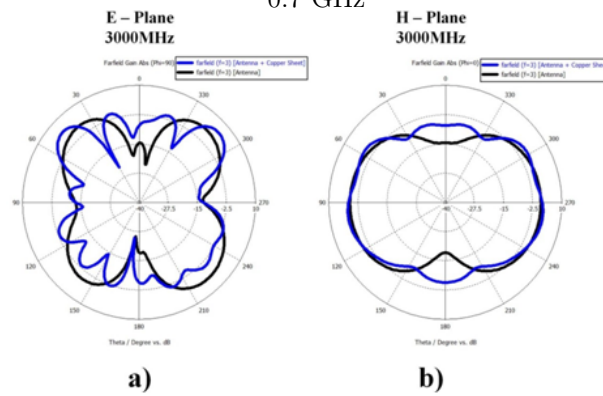


Figure 5.3. (a) Electric (E) -plane and (b) Magnetic (H)- plane at 1.9 GHz

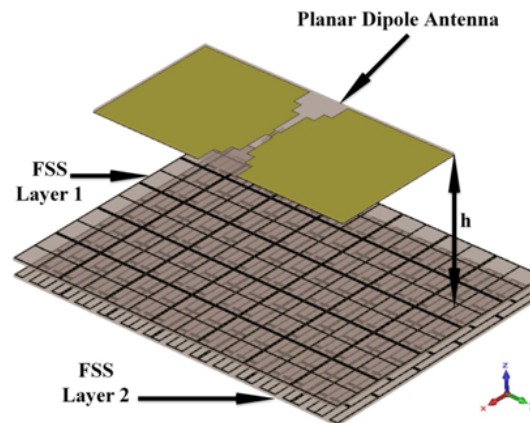


Figure 5.4. Two-layer FSS

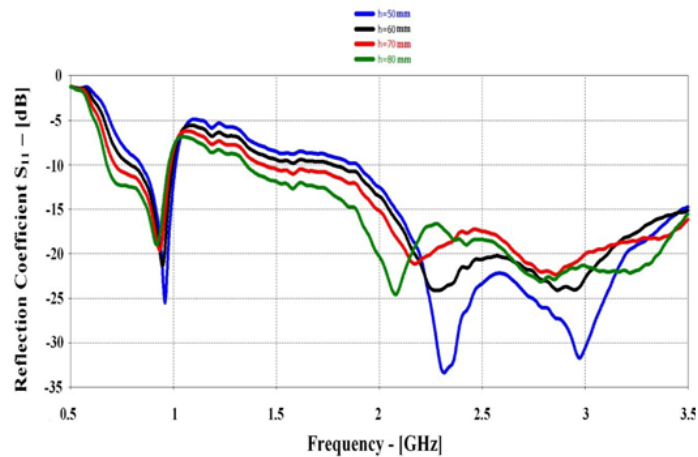


Figure 5.5. Frequency vs Reflection coefficient of two layer FSS

6 Conclusion

The proposed paper used the LC-tank, two layer FSS are combined into the planar antenna to design and it will reduce the size, and improvement of gain and bandwidth. These antennas are used RADAR and communication applications.

References

- [1] L. B. Conyers and D. Goodman, Ground Penetrating Radar: An Introduction for Archaeologists. Altimira Press, Walnut Creek, 1997.
- [2] G. Grandjean, J. C. Gourry, and A. Bitri, Evaluation of GPR techniques for civil- engineering applications: study on a test site, Appl. Graph., vol. 45, no. 3, pp. 141- 156, 2000.
- [3] D. J. Daniels, Ground penetrating radar. vol. 1, let. 2004.
- [4] R. S. Cloude and K. P. Papathanassi, Polarimetric SAR interferometry, IEEE Trans., vol. 36, no. 5, pp. 1551-1565, 1998.
- [5] H. Wang and M. Zheng, Triple-band wireless local area network monopole antenna, Microw. Antennas Propag., IET, vol. 2, no. 4, pp. 367-372, Jun. 2008.
- [6] B. Garima and et al., Circular ring frequency selective surface: A novel synthesis technique, IEEE Contemporary Computing (IC3), Sixth Int. Conf., 2013.
- [7] R. J. Langley and E. A. Parker, Equivalent circuit model for arrays of square loops, Electron. Lett., vol. 18, no. 7, pp. 294-296, Apr. 1982.
- [8] J. KumudRanjan, S. Ghanshyam, and J. Rajeev, A Simple Synthesis Technique Of Single-Square-Loop Frequency Selective Surface, Progress In Electromagnetics Research, vol. B, no. 45, 2012.
- [9] A. G. Roberto and G. D. Rogerson, Ultra-wideband wireless systems, Microw. Mag., vol. 4.2, pp. 36-47, 2003.
- [10] I. Oppermann, M. Hamalainen, and J. Iinatti, UWB Theory and Applications. John Wiley Sons, Ltd., 2004.

