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# Adaptive Antenna Array Approach in the Processing Of Weakest GPS Signals

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## ABSTRACT

A new planar, wideband feed for a slot spiral antenna is presented This paper describes a spiral antenna on RT DUROID Substrate for the operating frequency range of 1.2 -1.6 GHz These specifications should be satisfied at the frequencies of 1.227 GHz (L2) and 1.575 GHz (Ll). Array of spiral antennas can be used to increase the gain. Spiral antennas are reduced size antennas with its windings making it an extremely small structure.. This paper presents the return loss, gain, radiation patterns and VSWR.The analysis is based on the results of the simulations obtained using the software Ansoft HFSS.

**Keywords:** *Spiral antenna, RT Duroid Substrate*

## 1. INTRODUCTION

Spiral antennas are particularly known for their ability to produce very wideband, almost perfectly circularly-polarized radiation over their full coverage region slot spiral is not burdened with many of these difficulties and as is demonstrated in this paper, the balun and feed structure can be integrated into the planar radiating structure.The traveling wave, formed on spiral arms, allows for broadband performance, fast wave due to mutual coupling phenomenon occurring between arms of spiral and leaky wave leaks the energy during propagation through the spiral arms to produce radiation. The antenna includes two conductive spirals or arms, extending from the center outwards. The antenna may be a flat disc, with conductors resembling a pair of loosely-nested clock springs, or the spirals may extend in a three-dimensional shape like a screw thread. The direction of rotation of the spiral defines the direction of antenna polarization. Additional spirals may be included as well, to form a multi-spiral structure. Usually the spiral is cavity-backed, that is there is a cavity of air or non-conductive material or vacuum, surrounded by conductive walls; the cavity changes the antenna pattern to a unidirectional shape [1].

## 2. SUBSTRATE MATERIAL

The choice of dielectric substrate will play an important role in the design and simulation of the antennas. The substrate choice depends upon permittivity, dielectric loss tangent, thermal expansion and conductivity, cost and manufacturability. In this present work we used a RT-DUROID substrate material .The RT-DUROID materials are preferable due to low cost, low dielectric constant and having low loss tangent.

## 3. DESIGN SPEICIFICATIONS

An adaptive antenna for a handheld GPS receiver needs to possess a number of electrical and physical characteristics.The first electrical characteristic is three-dimensional interference suppression. To provide this, the antenna needs to have at least three elements. The second electrical characteristic is satellite signal reception. For this, the antenna needs to have a broad right-hand circularly polarized (RHCP)radiation pattern across a 24 MHz bandwidth at L1 (1575MHz) frequency bandsThe antenna uses spiral elements to achieve the required number of elements in the array, the dual-band radiation coverage, and to have a small aperture, small volume, and be lightweight.[5] The antenna and integrated feed parameters are optimized for the L1 and L2 band radiation coverage, and the size of the antenna and feed with four elements is 4"x4"x0.02 With such a small size, the antenna can easily be used for a handheld device. Also, in addition to being able to receive satellite signals in the L1 and L2 bands, the antenna has good interference suppression performance.

GPS receivers have been used in numerous applications. Most relate either to the ability of the receiver to determine the position of the antenna in space, or to the ability of the receiver to determine time to great precision.[3] The ability of GPS receivers to determine time to great precision makes them ideal clock drivers. The process of transmitting, receiving and detecting the GPS signal is a physical process which, like any other physical process, contains sources for errors. Some of the errors are obvious: the satellite clock is not exactly correct, even when the broadcast correction terms are used to adjust it. The location of the satellite in space is not necessarily correct since it is determined by observations made on the ground, and the ephemeris values only yield a solution accurate to about 30 cm. And the receiver computing its own position can only resolve the received signals to some specific precision determined by the wavelength of either the carrier or the code bit length and the resolution of the code or phase shifter in the receiver.[4]

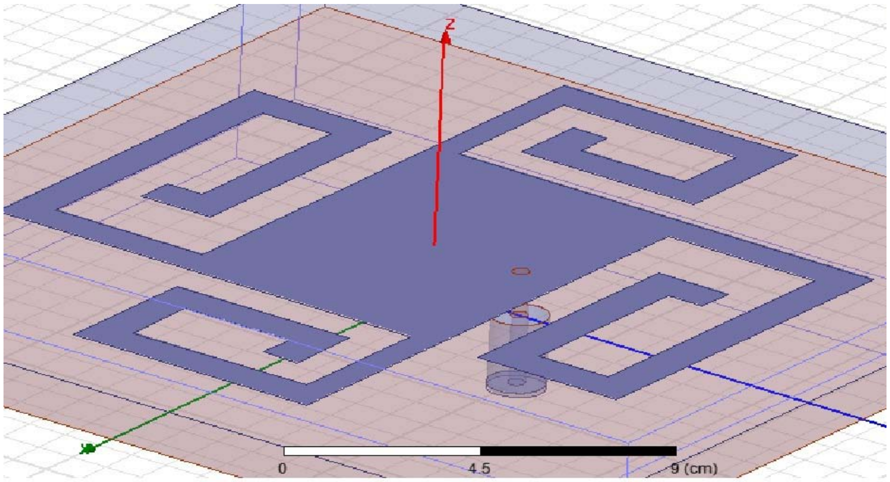


**Figure 1:** Spiral Antenna

The spiral element is composed of four square Archimedean spirals arranged 2x2 with the center arms shorted together. spiral antennas are reduced size antennas with its windings making it an extremely small structure. Lossy cavities are usually placed at the back to eliminate back lobes because a unidirectional pattern is usually preferred in such antennas.

## 4. RESULTS

### 4.1 Return loss

Return loss or Reflection loss is the loss of signal power resulting from the reflection caused at a discontinuity in a transmission line or optical fiber. This discontinuity can be a mismatch with the terminating load or with a device inserted in the line. It is usually expressed as a ratio in decibels (dB);

$$RL(\mathrm{dB}) = 10\log_{10}\frac{P_\mathrm{i}}{P_\mathrm{r}}$$

At 1.35GHz we got -13.74dB of gain and we can reduce 76% of return losses during transmission.


**Figure 1:** Return Loss

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### 4.2 VSWR

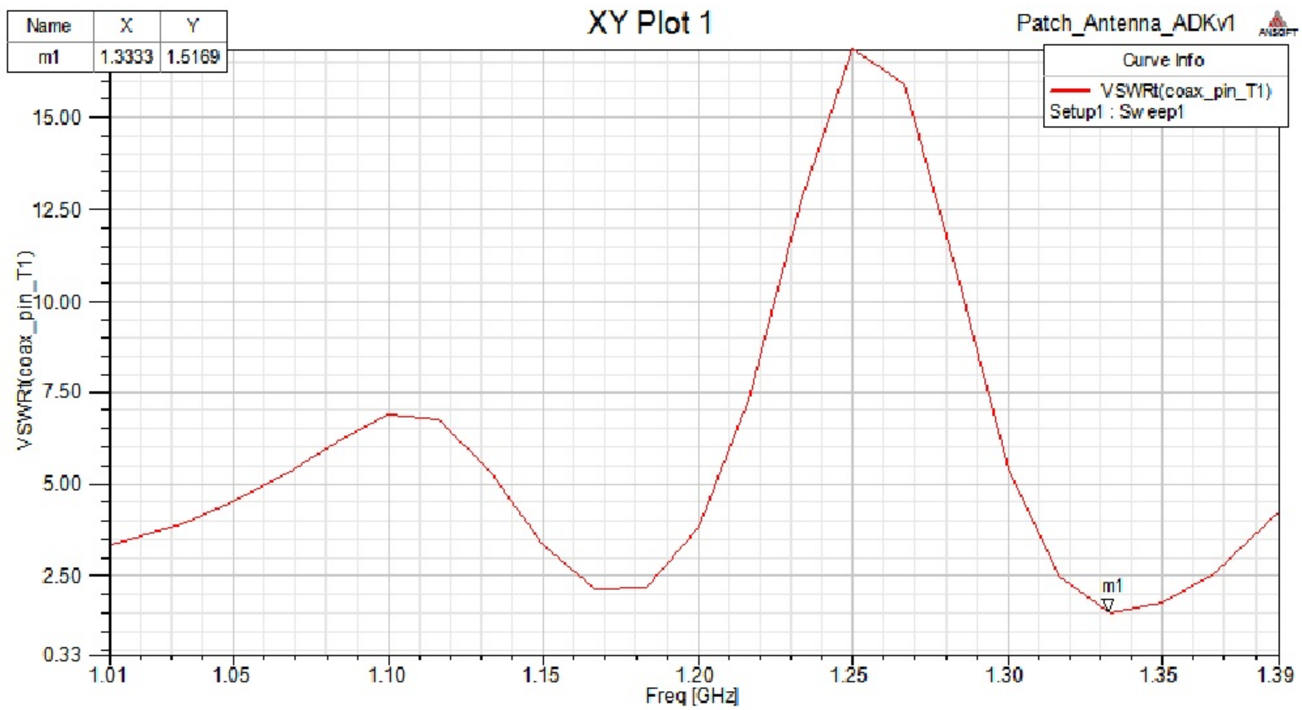


**Figure 3:** VSWR

### 4.3 Gain

Gain as a parameter measures the directionality of a given antenna. An antenna with a low gain emits radiation in all directions equally, whereas a high-gain antenna will preferentially radiate in particular directions.

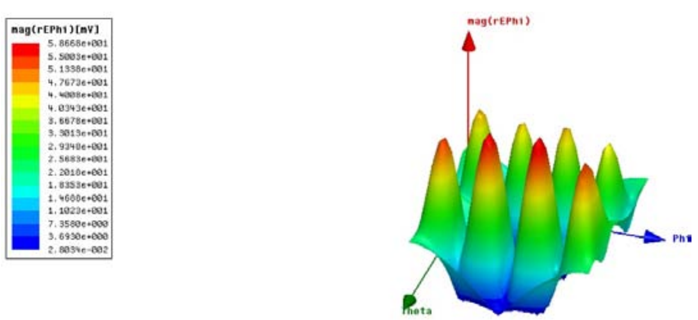


**Figure 4(a):** 3D Gain phi

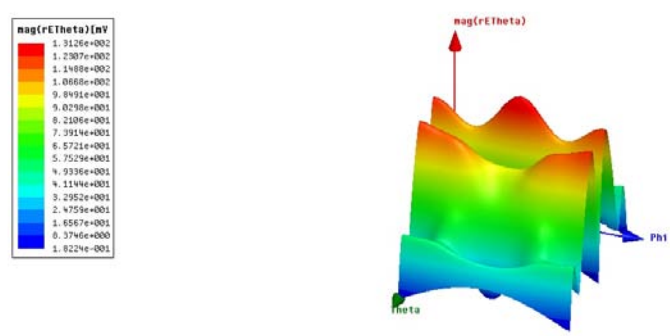


**Figure 4(a):** 3D Gain theta

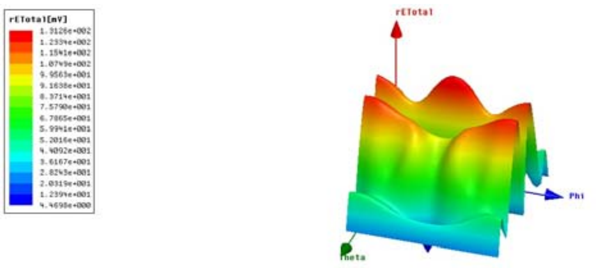


**Figure 4(a):** 3D Gain total

### 4.4 Radiation pattern

The radiation pattern is a graphical depiction of the relative field strength transmitted from or received by the antenna, and showssidelobes and backlobes. As antennas radiate in space often several curves are necessary to describe the antenna.

In this radiation pattern the main lobe can be accurate and sidelobes are nullified at 0 angle with frequency 1.5GHz.

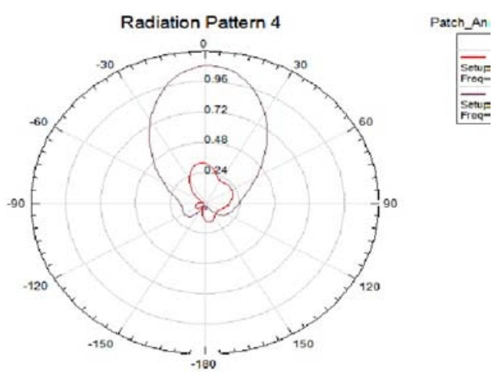


**Figure 5:** Radiation pattern

## 5. CONCLUSION

This paper presents the design and detailed results of the Spiral Antenna with the selection of RT DURIOD substrate material. This antenna is showing remarkable performance over the entire frequency range between 1-2 GHz with high gain of 12 db and high directivity

## 6. ACKNOWLEDGMENT

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