Microstrip Antenna for GPS Band

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Abstract **- In recent years, microstrip antennas have received much attention and have become one of the most successful topics in the telecommunications field. This success stems from well-known advantages, such as, low profile, low cost, ease of construction, conformal geometry and flexibility in terms of radiation pattern, gain and polarization. The use of microstrip antennas has been boosted by the wireless revolution of the information society technologies aiming at universal access to data and voice services. Microstrip patch antennas are used nowadays in most of the modern handsets, personal digital assistants and laptop computers.**

I. INTRODUCTION

The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil and commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a GPS receiver.

All satellites broadcast at the same two frequencies, 1.57542 GHz (L1 signal) and 1.2276 GHz (L2 signal). The satellite network uses a CDMA spread-spectrum technique where the low-bit rate message data is encoded with a high-rate pseudo-random (PRN) sequence that is different for each satellite. The receiver must be aware of the PRN codes for each satellite to reconstruct the actual message data. The C/A code, for civilian use, transmits data at 1.023 million chips per second, whereas the P code, for U.S. military use, transmits at 10.23 million chips per second. The actual internal reference of the satellites is 10.22999999543 MHz to compensate for relativistic effects that make observers on Earth perceive a different time reference with respect to the transmitters in orbit.

TABLE I.

GPS frequency overview		
Band	Frequency	Description
L1	1575.42 MHz	Coarse-acquisition (C/A) and encrypted precision P(Y) codes, plus the L1 civilian (L1C) and military (M) codes on future Block III satellites.
L2	1227.60 MHz	P(Y) code, plus the L2C and military codes on the Block IIR-M and newer satellites.

The design gives best output that is return loss for 1.5GHz which is used for The Global Positioning System (GPS)

II. ANTENNA DESIGN AND FABRICATION

New designs for obtaining dual-band C P radiation with a single-feed square microstrip antenna have been proposed and experimentally studied. The proposed single-feed dual-band CP designs are achieved by inserting four T-shaped slits at the patch edges or four Y-shaped slits at the patch corners of a square microstrip antenna. In the experiments, a patch size reduction of 36% for the proposed design compared to a conventional CP design without inserted slits was obtained.

The two resonant modes TM10 and TM30 are used for dual-band CP radiation. Due to the inserted T-shaped or Y-shaped slits, the excited patch surface current path of theTM10 mode is greatly lengthened, which effectively lowers its resonant frequency and gives the proposed designs a reduced patch size for the fixed lower frequency of dual-band CP radiation. For the

TM30 mode, the inserted slits not only considerably lower its resonant frequency, but also modify its three-lobe radiation pattern to become similar to that of the TM10 mode. By further embedding a narrow slot in the patch center and using a single probe feed at the diagonals of the slit-loaded square patch, the perturbed TM10 and TM30 modes can be split into two near-degenerate modes for dual-band CP radiation.

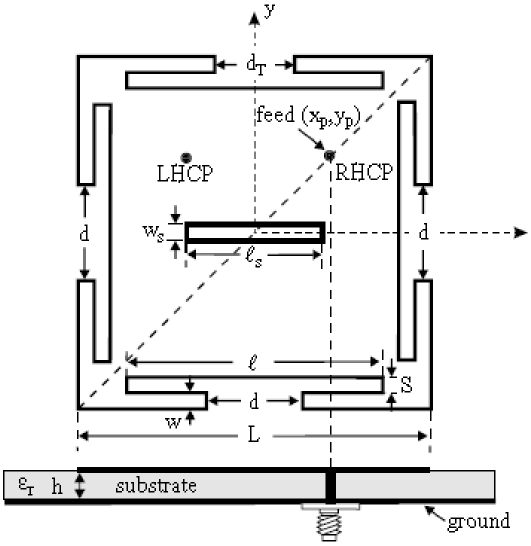

Fig. 1 : Four T-shaped slit Antenna

After some modifications in the above design we get our new design with better results as shown below.

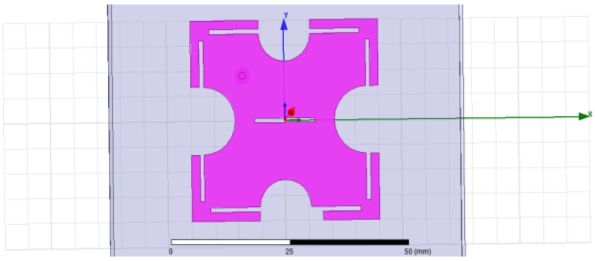

Fig. 2: Top view of modified antenna

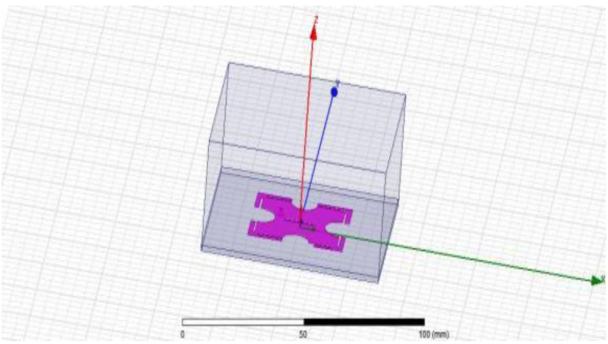

Fig. 3 : Side View

In the slit-loaded square patch in Figure , four T-shaped slits are inserted at the edge centers; their upper arms have the same dimensions, a narrow width *S* and a length , and their center arms have dimensions *d* × *w*, with the slit along the positive *y* axis having a different arm width *d*T (_=*d*). This arrangement is very effective for fine tuning the perturbed TM30 mode (upper operating band in this design) into two near-degenerate modes with equal amplitudes and a 90◦ phase shift for CP radiation.

Measured return loss for design A shown in Figure 9.26(a); *ε*r = 4.4, *h* = 1.6mm, and ground-plane size = 75 × 75 mm2. (a) Antenna A1 with left-hand CP radiation: (*x*P,*y*P)=(−9 mm, 9 mm), *L* =40 mm, =32 mm, *d* =13.5 mm, *d*T =11 mm, *ws* =1 mm, s =12.5 mm, *S* = 1 mm, and *w* = 1 mm; (b) antenna A2 with right-hand CP radiation: (*x*P, *y*P) =(7 mm, 7 mm), *L* = 36 mm, = 28.8 mm, *d* = 1.8 mm, *d*T = 3.5 mm, *ws* = 0.9 mm, s = 13mm, *S* = 0.9 mm, and *w* = 1.8 mm. And further 4 semicircles are cut from the centre.

The antenna is modelled and optimised using high frequency structure simulator (HFSS).The parametric simulation is carried out with HFSS in which the numerical analysis is based on the Finite Element Method (FEM). The parametric study helps to optimise the antenna performance before the antenna is manufactured and tested experimentally. Different antenna parameters are considered for optimisation the operated bandwidth subject to suitable radiated power gain.

Some of these parameters are the length of the patch, feed position, and position of slots on ground patch and width of s-shape cut. To check the influence of these parameters on the impedance bandwidth, one parameter is varied and the remaining parameters remain fixed. Simulation result shows that the effect of changing these dimensions of antenna has appreciable change in the resonant frequency and return loss.

III RESULTS

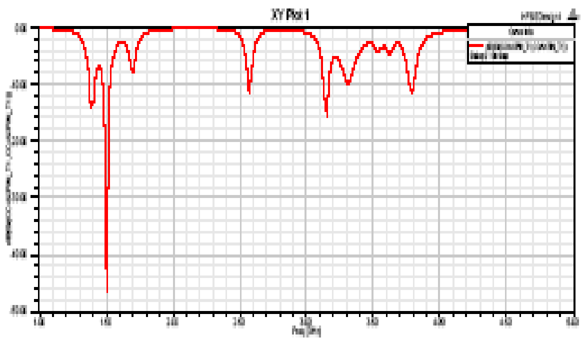

Fig.4 : Return loss

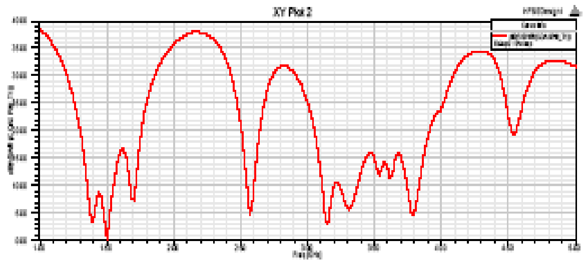

Fig. 5. VSWR

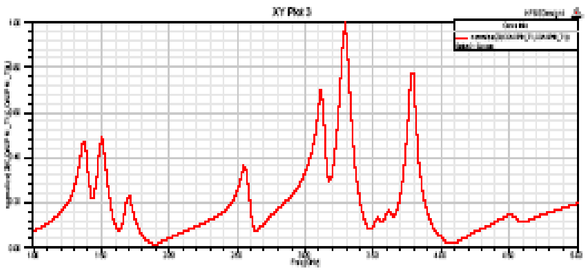

Fig. 6. Impedance

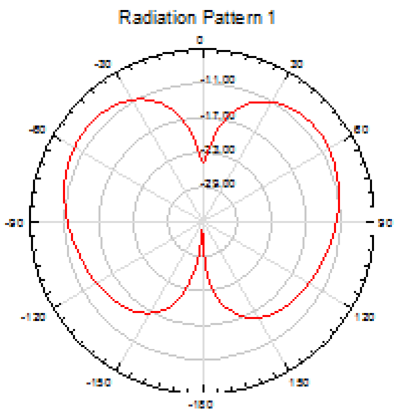

Fig. 7 : Gain at 1.5GHz frequency.

IV. LIMITATION OF APPLICATIONS

Please contact us before using our products for the applications listed below which require especially high reliability for the prevention of defects, which might directly cause damage to the third party's life, body or property.

(1) Aircraft equipment

(2) Aerospace equipment

(3) Undersea equipment

(4) Medical equipment

(5) Disaster prevention / crime prevention equipment

(6) Traffic signal equipment

(7) Transportation equipment (vehicles, trains, ships, etc.)

(8) Applications of similar complexity and /or reliability requirements to the applications listed in the above.

V. CONCLUSION

We designed a Microstrip Antenna working on 1.5 GHz for GPS applications in various mobiles and laptops with good efficiency.

VI. REFERENCES

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