

# **DESIGN OF SQUARE\_RING MICROSTRIP ANTENNA**

MINI PROJECT REPORT

SUBMITTED BY:

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## INTRODUCTION:

The design of a square-ring microstrip antenna with circular polarisation (CP) is presented. To compact the antenna size and overcome the high impedance problem, the CP antenna is excited by a coupling strip located inside the square-ring patch. Several prototypes of the squarering CP antennas with various substrate thicknesses (0.75mm\_ultralam2000 and 1.56mm\_rt\_duroid3003) have been constructed and studied experimentally, and their coupling-strip designs and CP performance are described.

## **THEORY :**

A square-ring microstrip antenna has a smaller size compared to a square or circular microstrip antenna for a given frequency. The small size is an important requirement for portable communication equipment, such as global positioning satellite (GPS) receivers. For the design of the single-feed square-ring microstrip antenna with circular polarisation (CP), the required two orthogonal modes with equal amplitudes and  $90^\circ$  phase difference can be excited by truncating patch corners and protruding a tuning stub. A  $50 \Omega$  input impedance can be easily found in the ring strip if the square-ring antenna has a wider ring strip. However, for the square-ring microstrip antenna with a narrower ring strip, which relatively has more compact size, the edge impedance is large and varies slowly across the strip width. The high-edge-impedance problem can be solved by the technology of placing a cross strip in the ring or using a quarter-wavelength impedance transformer these technologies are only suitable for the square-ring antenna with thin substrate to avoid the large Inductance introduced by the feed probe, which results in a limited CP bandwidth.

## DESIGN

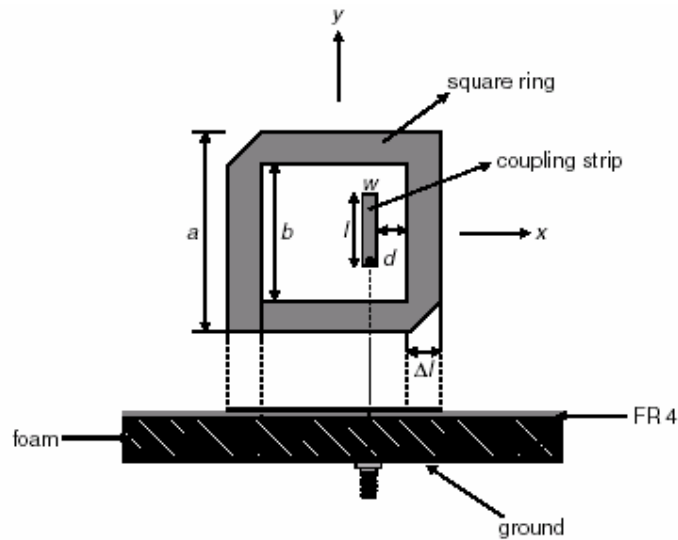


Figure1: Geometry of square ring microstrip antenna fed by coupling strip

Antenna configuration: A square-ring microstrip antenna together with a coupling strip is depicted in Fig. The square-ring microstrip patch, having an outer side length of  $a=36\text{mm}$ . and an inner side length of  $b=28\text{mm}$ ., and the coupling strip, having the dimensions of  $15.3\text{mm} \times 3.4\text{mm}$  are etched on the same layer of Ultralam3003 (thickness  $0.75\text{ mm}$ , permittivity  $2.52$ ) and supported by a foam substrate a distance of  $h=8\text{mm}$ . above the ground plane. A probe feed of radius  $0.6\text{ mm}$  is connected to one end of the coupling strip/ to the center of the coupling strip. The square-ring microstrip antenna has truncated corners for CP operation, which are of equal side length  $\Delta l=5\text{mm}$ .. The gap between the coupling strip and the square-ring patch is  $d=1.6\text{mm}$ . The design of the coupling strip for achieving impedance matching is mainly by adjusting the dimensions of  $d$  and  $l$ . Note that, when the substrate thickness of the square-ring antenna is increased to an extent, the inductance introduced by the feed probe can be cancelled by adjusting  $l$ , and at the same time  $d$  is nearly a fixed value, which is due to a slow decrease of resonant resistance.

## SIMULATED S11 OF THE RING

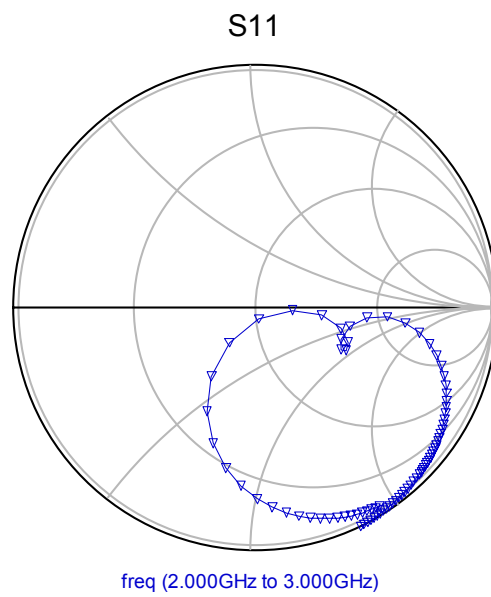
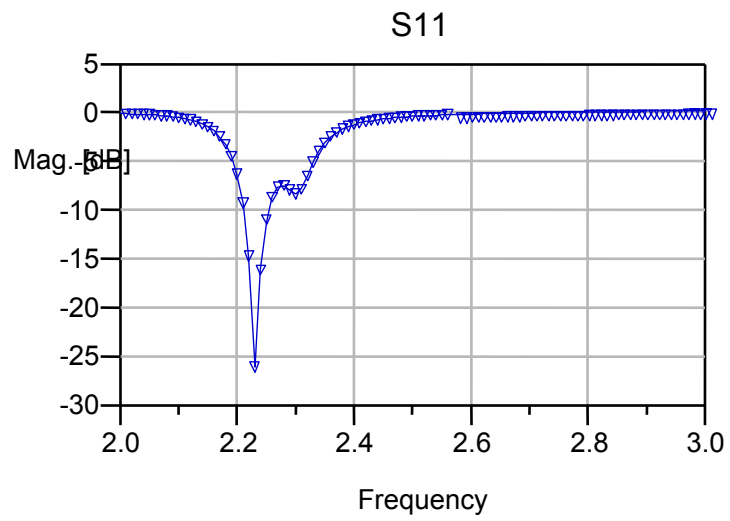


Figure 2: ultralam\_final\_momeed\_edge feed

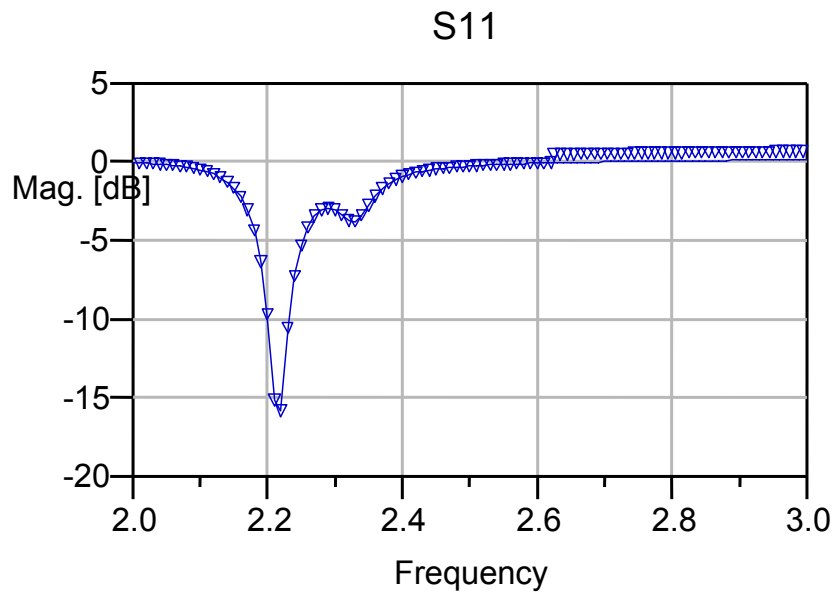


Figure3: ultralam\_final\_1\_mom\_center feed

## EXPERIMENTAL S11

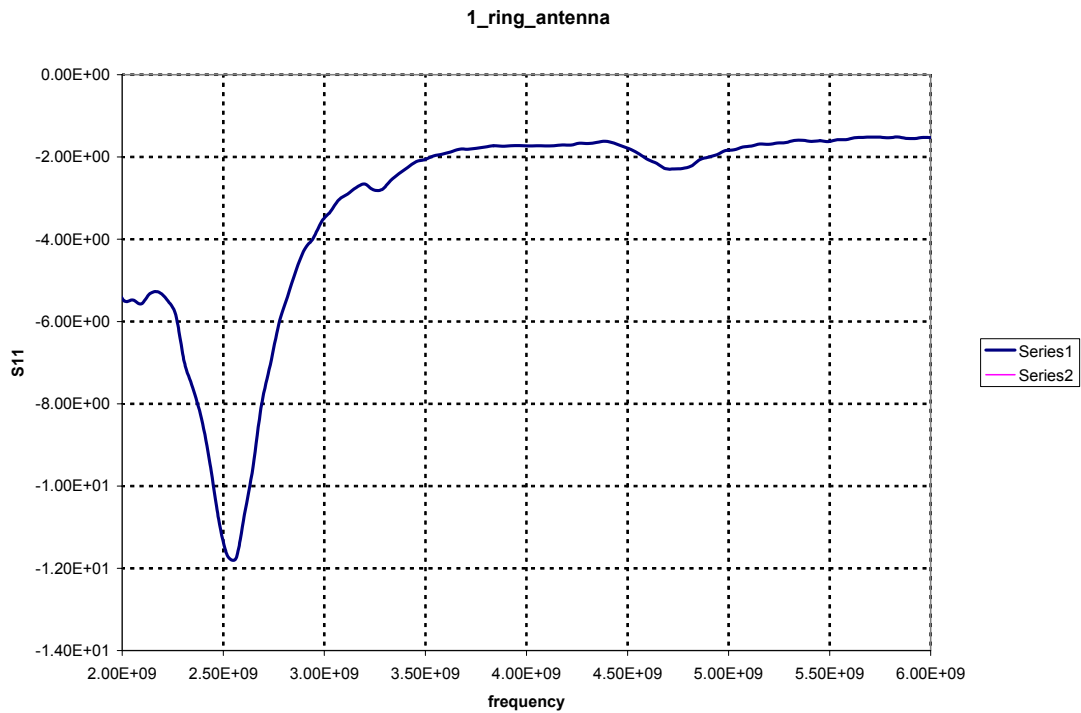


Figure4:  $S_{11}$  plot of ring with capacitive coupling

## CONCLUSION

CP operation of a square-ring microstrip antenna fed by a coupling strip has been proposed. The coupling strip is located inside the square ring, and consequently the proposed design has the advantage of being compact. By decreasing the length of the coupling strip, a 50  $\Omega$  input impedance can be easily obtained when the substrate thickness of the square-ring microstrip antenna is increased

Reference:

Design of Square-ring microstrip antenna for circular polarization. By J.S.ROW  
ELECTRONICS LETTER 22<sup>nd</sup> January 2004 vol.40 No.2