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Design of a Wideband Stack Array Antenna For Ka-band Satellite Communication Application

Background

Significantly the number of satellites has increased in low earth orbits (LEO). In satellite communication application, it has popularly used circularly polarized antennas on account of being convenient for the polarization matching, while in terms of satellite communications the growth requirement of high speed data rates result in the operational frequencies which are upward shifted at the band of Ka or even higher frequency band. However, a planar antenna which is circularly polarized array of high gain and high efficiency is really challenging to be realized. Because a planar circularly polarized array antenna must have a good performance which includes axial ratio, refection coefficient and gain variation over a wide range of frequency.

Antenna Element

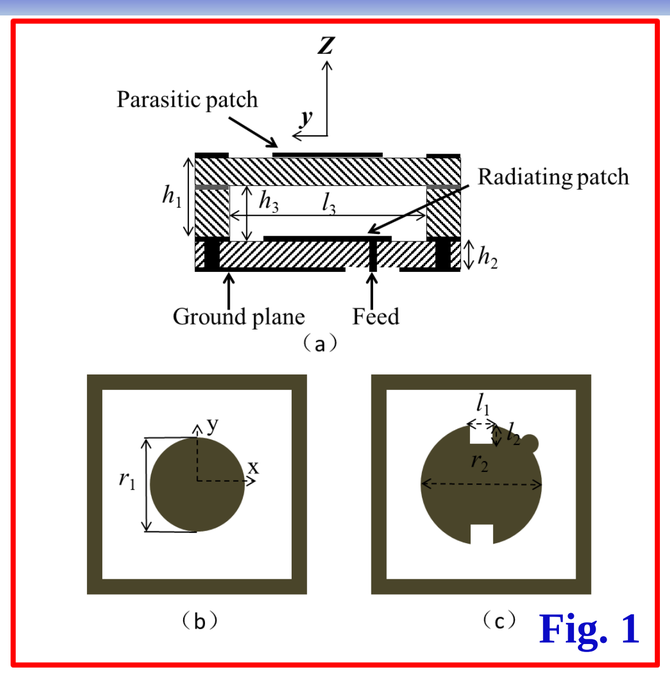

Fig. 1

Fig.1 demonstrates the configuration of the designed antenna unit. The dimension of the ground plane is 5.5 mm × 5.5 mm in the antenna element. The dielectric constant of two layer substrates is Ɛ (3.0). The antenna implementation which is choosed is TSM-DS3.

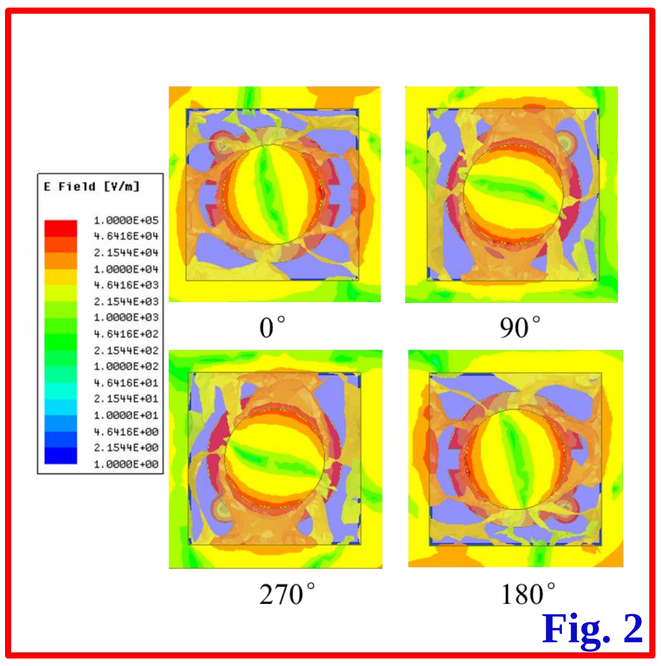

Fig. 2

Fig. 2 exhibits the antenna of current distributions, at ωt = 0, 90, 180, and 270, respectively. The currents which are circularly rotated are seen from the circular-formed patch and the circular parasitic patch.

CP Array Antenna And Results

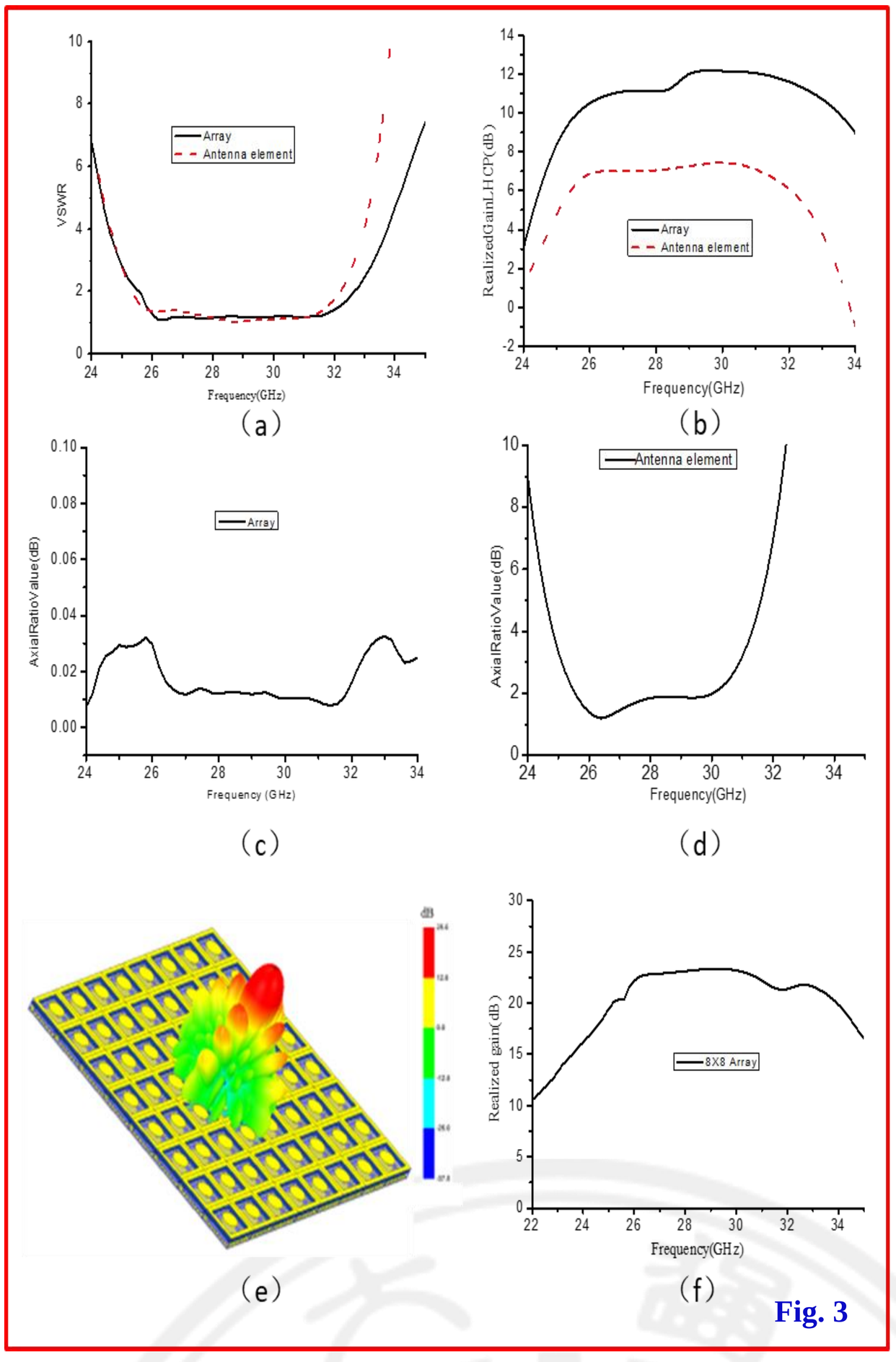

Fig. 3

The property is contrasted with the best circularly polarized antenna unit and the antenna which is 2×2 array. As exhibited in Figs. 3. (a), (b), (c), and (d).
Fig. 3 (e), and (f), exhibit the structure of the 8×8 circularly polarized array antenna with best gain.

Conclusion

A stack circular-formed patch with parasitic radiator antenna which is circular has been designed for the wide frequency band circularly polarized radiation at Ka frequency band. The designed array antennas of circular polarization are thin shape of broadband characteristics. It is expected for satellite Communication application in Ka frequency band.