ABSTRACT

The issue in high-frequency equipment concerning heat generation revolves around the substantial thermal energy produced by the high-power RF components during operation. With the recent advancement of the commercial silicon beamforming chipsets, the heat generated by the chips in the beamforming network (BFN) attached with the antenna aperture can cause degradation of EM performance, and hence cooling arrangement via heatsink should be included to solve this.

In order to avoid the external cooling system and also without violating the antenna properties, an antenna can be designed as a heatsink radiator. So it will serve as both antenna and thermal cooling system. It is a significant issue in ISRO 2023 from Vikram Sarabhai Space Centre which is given as a problem statement. In proposed work, heatsink property of 4x4 phased array antenna comprised of 3-D metallic radiator serving also as heat sink, is presented for 10GHz. Four single radiator, each with height nearly equal to 15mm which is surrounded by metallic ring of square cross section with overall dimension of 60mm x 60mm. The proposed concept was tested as a working model with patch antenna and the material used for patch was FR4 and fin was Acrylonitrile Butadiene Styrene(ABS) material.

Heatsink is modeled and antenna parameters are analyzed in Computer Simulation Technology (CST) and thermal cooling properties are analyzed in ANSYS ICEPAK Software. The purpose of the project is to design a suitable heatsink model which satisfies both EM performance and thermal properties. It is observed that the heatsink does not affect the EM performance of the antenna and the temperature is also gets reduced.