

10 GHz Satellite Array

Overview

You must design a compact steerable antenna array at 10 GHz for a low-earth orbit (LEO) satellite to communicate with an earth station. A single element must be designed, fabricated, and tested as part of the design project.

Antenna Array Specifications

The antenna should have a center frequency of 10 GHz and a bandwidth of 800 MHz. The array should transmit with circular polarization with an axial ratio of less than 3 dB across the entire band. The array should be able to provide at least 20 dBW of EIRP across a +/- 50 degree sweep, using an RF input power of no more than 1 Watt.

There are 5 major components to completing this project:

Design – Choose an antenna design and explain your rationale in your report.

Simulation – Use the numerical tool of your choice (NEC, HFS, CST, and/or other) to simulate the performance of the antenna element and array and hone your design parameters.

Fabrication – Build a single array element by any means necessary. The antenna must be SMA-connectorized and contain only passive components.

Measurement – Measure your antenna impedance on the network analyzer as a function of frequency, estimating the 3dB bandwidth. Measure the antenna on the LabVolt antenna ranges at 10 GHz to verify pattern and calculate peak gain, half-power beamwidth, sidelobe level, axial ratio, etc.

Array Properties – Design an antenna array and show, based on your element measurements, how the final expected design properties are met.

Documentation – Document the process in a final PDF report to be submitted electronically on the last day of class.