MEMS Platform for Planar Broadband Dual-Linearly Polarized Antenna

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In this work we will present the fabrication process and preliminary experimental results of a MEMS steerable broadband antenna. Our previous work focused on the design of the broadband dual-linear polarized antennas based on the Fourpoint antenna. The antenna is designed to fit on a 1cm × 1cm silicon platform and operate between 4-9GHz. The modified Fourpoint antenna is simulated using ANSOFT High Frequency Structure Simulator (HFSS) and has a return loss of less than -10dB in the operating band.

The fundamental principles for cantilever beams are used as a starting point for the platform design. The platform is modeled using COMPSOL Multiphysics and ANSYS Multiphysics software packages. The motion of the hinge is studied using these numerical simulations and will be compared to the experimental measurements.

The proposed platform processing steps are classified as bulk micromachining and use a 400μm heavily doped n-type wafer with a double sided polish. Through-holes are machined using a Deep Reactive Ion Etch (DRIE) to serve as alignment marks to accurately arrange the features on both sides of the substrate. The proposed moveable platform is defined using DRIE with small hinges to anchor the platform to the substrate. The structure is anodically bonded to a glass substrate containing metallic pads. Creating a bias between the contact pads and the platform causes the hinges to deform resulting in a mechanical movement of the platform.

This work will detail the fabrication processes used along with the experimentally measured results. The amount of deformation allowed by the hinges will be measured for various hinge configurations. One method to measure the deformation is using a laser beam and measuring the angle of the reflected beam. Many factors including the thickness and shape of the hinges, the position of the bias and the amount of bias induced will control the amount of mechanical movement. Preliminary analysis indicates that the platform will have a movement of approximately 6° when using silicon hinges. Polymer hinges will be considered in the future to increase the platform rotation. Various hinge configurations will be investigated and presented in the conference.