Frequency Reconfigurable Antenna Using Cantilever MEMS Switches

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Abstract

A) Abstract:
There has been a spectacular growth in the field of wireless communication in recent years. Current trends in mobile wireless communications demand technologies that allow a single device or system to operate across multiple frequency bands and protocols. This cannot be achieved using traditional antennas with fixed functionalities. Here comes the role of reconfigurable and multifunctional antennas which offer substantial advantages over traditional fixed antennas whose performance is restricted to a particular application in a particular environment. Reconfigurable antennas can change their fundamental characteristics like frequency, polarization or radiation pattern based upon changing conditions.
Several wireless standards can be supported on one platform with the help of frequency reconfigurable antennas. This is made possible by introducing structural, mechanical or material changes or by integrating switches into the antenna structure. Optoelectronic switches, PIN or varactor diodes are commonly used as switches but they have a lot of limitations like performance degradation at high frequency, poor linearity, large insertion loss and high power consumption. So RF mems cantilever switches with near zero power consumption, excellent linearity and low insertion loss provide a promising solution. Behaviour of RF mems cantilever switch is simulated using COMSOL® software.So here we aim at creating a cantilever mems-switch enabled frequency reconfigurable antenna.

B) Objective:
The objective is to fabricate mems cantilever switches and integrate them into the slots of developed patch antenna structure to enable frequency reconfigurabilit by developing a slotted patch antenna, simulating a cantilever MEMS switch, fabricating it by transferring cantilever patterns in GDSII format from glass masks onto cleaned silicon wafer and integrating slotted patch antenna and the cantilever switch into a single structure thereby enabling frequency reconfigurability.

Use of COMSOL Multiphysics® software:

Cantilever model from the MEMS module® has been used in the design. Length, width, thickness and air gap for the cantilever beam could be decided. Electric field distribution could be noted at different sections of the beam. Also the pull in voltage required for observing a noticeable displacement in the beam could be decided.

Results obtained:

a) S11 when switches are on :

Resonace at 2 Ghz, 2.4 Ghz (wifi) and 3.2 Ghz (WiMax)
b) S11 when switches are in off state:

Resonace at 1.8 Ghz (GSM), 3.1 Ghz and 5.4 Ghz (Wifi)
Cantilever beam dimensions:
(Measured using COMSOL Multiphysics®)
Length: 200 micrometre, Width:10 micrometre, thickness:200 nanometre, air gap:2 micrometre