A novel design for an RF MEMS resistive switch on PCB substrate

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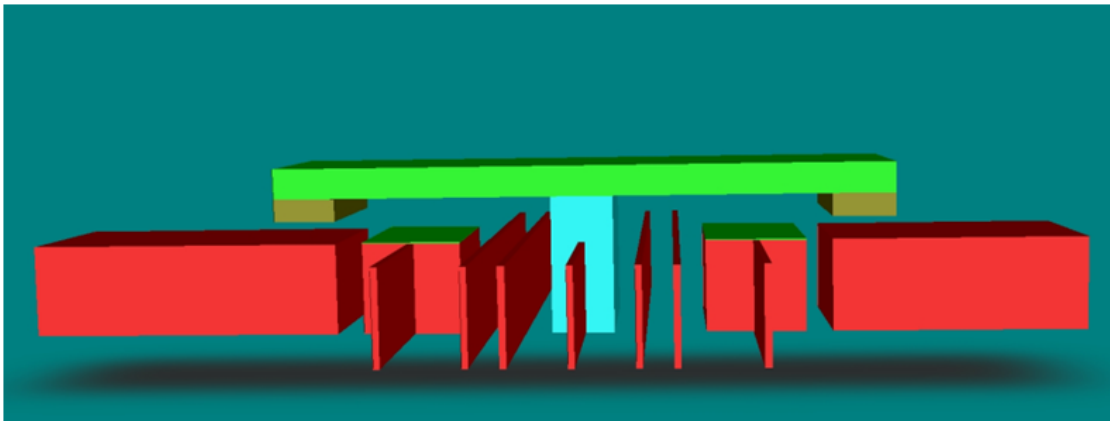
This paper presents a novel RF MEMS switch suitable for reconfigurable, micro-strip RF antennas. The proposed design is built on PCB (Printed Circuit Board) substrate due to the significant advantages over the commonly used silicon ones. Building a MEMS switch on silicon and integrating it with reconfigurable antennas on PCB introduces impedance mismatches and signal loss because of the different dielectric characteristics of the substrates and the packaging wire bonding [1-4]. In addition, having the RF MEMS devices individually packed increases their size and prohibiting high density of subsystems and switches on the micro-strip RF antenna. Consequently, the manufacturing cost is high. Building the RF switches directly on a PCB substrate overcomes these drawbacks resulting on better integration with antenna components and the accompanying control circuitry [5]. Furthermore, the whole assembly can be packed in a single step simplifying the process.



Designing RF MEMS switches on PCB substrate special attention must be paid to certain parameters [6]. The top layer upon where the switches will be built is copper with a thickness in the range of 8-35 micron. Its surface roughness is higher than silicon wafers, in the range of 0.1-0.5 micron. Moreover, the thermal cycles used in processing must be as less as possible to avoid deterioration of the PCB's material properties [7]. The maximum processing temperature should be within 125-350^{o}C depending on the type of the substrate.

The physical, electrical and mechanical investigation of the proposed device has been carried out using CoventorWare ® while the full electromagnetic analysis accomplished in FEKO ® aiming improvement on specific characteristics of previously presented topologies [8].

The presented RF MEMS switch will drive a group of patches in a micro-strip array antenna. Due to the complexity of such a design, extra consideration had to be

paid in the dimensions of each switch, allowing the use of high resistivity biasing tracks in between its segments. The new design comprises:

Actuation Voltage < 30V
Resistance < 1Ω
Capacitance Cup < 33 fF
Switch Time < 50us
Isolation ≈ -50dB at 2GHz
Insertion Loss ≈ -0.15dB at 1-50GHz

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