Reconfigurable Miniaturized Filters

DESCRIPTION OF THE INVENTION

SIW technology is becoming increasingly important for implementing circuits and antennas operating in the RF, microwave and millimeter-wave bands. The approach is based on the integration of waveguide cavities in planar dielectric substrates using periodic arrays of plated via holes for creating virtual metallic walls. This paradigm could lead to the integration of waveguide passive components, active devices and radiating elements on the very same substrate, providing small size and low fabrication costs. Furthermore, SIW devices present better Q factor and power handling capabilities than conventional planar structures because of its three-dimensional nature.

Researchers from the ITEAM and the I3M of the Universitat Politècnica de València (UPV) have developed a frequency tunable microwave filter, as well as its design methodology, production and packaging.

The employed tuning elements can be implemented using different technologies as semiconductors, ferroelectrics or micro-electromechanical systems (MEMS), depending on the specifications and requirements of the end user.

The filter can be packaged using the same substrate, and access to the input/output ports and the biasing and control signals provided at the bottom side of the device using castellated plated vias or land grid array (LGA) footprint. This allows the integration of the filter on any other circuit or system using conventional surface-mount device (SMD) soldering techniques.

The manufacturing process is simple, low-cost and very well suited for massive production, which is of great interest for companies in the telecommunications market.

APPLICATIONS

- Radio-communications, satellites, radar, mobile communications, space and test equipment
- Tunable pre-selection channel filters for improved interference and spurious signals rejection.
- Reduction of filter banks size in multi-band multi-standard transmitters and receivers.
- Trimming of device response due to manufacturing tolerances or operating conditions with changing environmental factors (e.g. space communications).

TECHNICAL ADVANTAGES AND INDUSTRIAL BENEFITS

- Continuous and/or discrete electronic tuning for radio transmitters and receivers, satellite, radar and mobile communications.
- Reduction on the number of filters required in communications systems and consequently reduction of size and weight.
- Conventional single-side PCB batch fabrication process, widely used in consumer electronic industry, and suitable for mass production resulting in low costs.
- Miniaturization (e.g. less than 3 x 3 cm for a 4-pole filter in ceramic-filled substrate) and SMD packaging
- Lower insertion losses and higher rejection compared to tunable filters in planar technology, being able to obtain resonator unloaded Q-factors ranging from 200 to 500 depending on the substrate material and tuning elements.
- Ultra short reconfiguration times using semiconductor tuning elements with negligible power consumption in case of GaAs varactors or MEMS switches.
- Compatible with advanced multi-layer PCB or Low Temperature Co-fired Ceramics (LTCC) manufacturing enlarging the potential advantages and applications.
- Integrated bias network reducing the number of external passive components required for biasing.

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STATE OF DEVELOPMENT

Filters with analog and digital tuning capabilities have been designed at S, C, and X-bands. Fully functional demonstrators have been developed, manufactured and measured showing an excellent agreement with the simulations and confirming the outstanding performance of the technology.

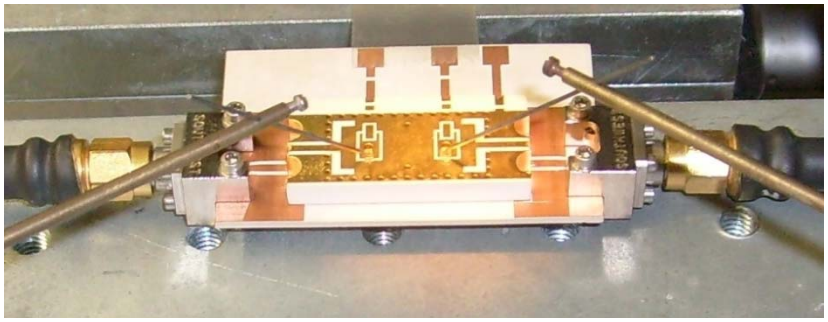
IP

The technology has been patented by the UPV, with a registered Spanish patent pending number P201131618 with a priority listing dated 07/10/2011.

DESIRED COOPERATION

The Universitat Politècnica de València offers the integration of the technology into the customer application with the required specifications. The work will be regulated in a contract with the UPV.

RELATED PICTURES



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