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MEMS Switchable Combline Filter with An Ultra-Wide Tuning Range

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Patent pending

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Background

Electronic communication systems widely use bandpass filters. In conventional radio transceivers with fixed band(s) of operation, bandpass filters operate for a predetermined center frequency and bandwidth. Fixed RF filtration is usually realized using lumped element L-C resonators, transmission-line and waveguide resonators, ceramic resonators, surface acoustic wave (SAW) resonators, or film bulk acoustic resonators (FBAR). However, in multi-standard single-platform radio applications, such as software-defined radio (SDR) transceivers, the frequency range of interest spans nearly two powers, from approximately 30 to 3000 MHz, which is typically divided into a number of narrower bands. Radio frequency (RF) bandpass filters in existing SDR transceivers are realized in the form of switchable filter banks. As the number of bands is generally large for wideband SDR, using the filter bank approach drastically increases the size, weight, and manufacturing cost of the SDR RF front-end. Furthermore, the filter technology used generally differs for different bandwidths, and integrating a large number of these filters in a single module can prove challenging.

Invention Description

To address these issues, a compact programmable bandpass filter solution that can be used for applications in the RF front-end of multi-band transceivers has been developed. The filter is based on integration of RF-MEMS switches within a self-scaled filter topology, providing very wideband tuning capability and a low-complexity tuning scheme.

Potential Applications

- SDR-defined radio architectures
- Ultrawide bandwidth (UWB) applications
- Orthogonal frequency-division multiplexing (OFDM)

Benefits and Advantages

- **A Small Footprint** –filter is very compact at only 1 x 2cm
- **High Linearity** – frequency response of the filter is insensitive to the levels of the input RF power, up to nearly 10 watts
- **Low Insertion Loss** –attenuation of the signal due to the filter is minimal, allowing for increased system performance
- **High Power Handling** –ability to handle low power consumer devices and higher power requirements of SDR radio equipment
- **Low Variation Due to Temperature** – adaptable to various environments
- **Minimum Complexity** –single filter reduces overall system complexity and will help increase reliability