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Title:Miniaturized-element frequency selective surfaces for millimeter-wave to terahertz applications

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Abstract:This paper presents a single-face, membrane-supported, miniaturized-element frequency selective surface (MEFSS) for image rejection of a *J*-band upconverter mixer. In this design, a new miniaturized-element patch-wire MEFSS configuration is proposed to select the upper-side band (USB) response of a wave radiated from an upconverter. The proposed MEFSS produces a single pole and an adjacent transmission zero to suppress the lower sideband. It is shown that the frequency response of this MEFSS can be predicted by an equivalent circuit model and that the location of pole and zero can be tuned independently with physical parameters. MEFSS elements are supported and protected by a 10 μm thick low-loss polymer membrane which allows flexible handling and minimizes substrate losses. Thickness of the metallic traces is increased to reduce the conductor loss. A salient feature of this design is low sensitivity of its frequency response to the angle of incidence and the absence of a harmonic response. This feature allows placement of the spatial filter in close proximity to radiating elements with spherical wavefronts. The membrane-supported MEFSS is fabricated using a microfabrication method with tolerances that allow such filter implementations up to terahertz frequencies. Performance of the fabricated device is experimentally verified using a free-space measurement setup. Experimental results show that the transmission response has 0.6 dB insertion loss in the passband (221-223 GHz) and more than 25 dB rejection out-of-band (206-208 GHz) which is in good agreement with full-wave simulation and its circuit model prediction.

Number of references:14

Inspec controlled terms:band-pass filters - conductors (electric) - equivalent circuits - frequency selective surfaces - microfabrication - millimetre wave antennas - millimetre wave filters - millimetre wave mixers - millimetre wave radar - polymers - sensitivity - spatial filters - terahertz wave devices

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single-face selective surface - membrane-supported selective surface - image rejection - J-band upconverter mixer - miniaturized-element patch-wire MEFSS configuration - upper-side band response - wave radiation - frequency response - equivalent circuit model - pole location - physical parameters - MEFSS elements - low-loss polymer membrane - substrate losses - metallic trace thickness - conductor loss - incidence angle - harmonic response - spatial filter - radiating elements - spherical wavefronts - microfabrication method - filter implementations - terahertz frequencies - free-space measurement setup - transmission response - dB insertion loss - full-wave simulation - circuit model prediction

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