

Waveguide Bandpass Filters for Millimeter-Wave Radiometers - DTU Orbit (09/11/2017)

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A fundamental requirement for most mm-wave heterodyne receivers is the rejection of the input image signal which is located close to the local oscillator frequency. For this purpose we use a bandpass filter, which for heterodyne receivers is also called an image rejection filter. In this paper we present a systematic approach to the design of a waveguide bandpass filter with a passband from 100 to 110 GHz and upper rejection bandwidth in the range from 113 to 145 GHz. We consider two non-tunable filter configurations: the first one is relatively selective with 11 sections (poles) whereas the second one is simpler with 5 sections. We used established design equations to propose an initial guess for the geometries of the filters, optimized the geometries, constructed the filters using two different milling methods, measured their transmission and reflection characteristics, and compared the measurements with numerical simulations. Measurements of both filters agree well with simulations in frequency response and rejection bandwidth. The insertion loss of the 11-pole filter is better than 10 dB and that of the 5-pole filter is better than 5 dB. The 11-pole filter has a sharper attenuation roll-off compared with the 5-pole filter. The upper out-of-band rejection is better than 40 dB up to 145 GHz for the 11-pole filter and up to 155 GHz for the 5-pole filter.

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