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Wideband THz Sources Using Waveguide Diplexers

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***Abstract*—This talk will discuss the development of wideband THz sources for use as local oscillators in astronomical receivers. VDI's THz sources typically consist of a cascade of high efficiency varactor doublers followed by one or more broadband varistor multipliers. The frequency coverage of these sources is set by the varactor multipliers, which have narrower bandwidth than the varistor multipliers. In order to achieve wide bandwidth while retaining the high output power achievable with varactors, a waveguide diplexer is used to frequency multiplex two varactor chains together at the input of a single cascade of varistor multipliers. As an example, a source configuration covering 1.2-1.6 THz is shown in Fig. 1. The diplexer, in the range 130-180 GHz, consists of lowband and highband filters feeding into a single waveguide. The frequency gap at the crossover between the filters can be centered on the water absorption line. Based upon existing varactor-based VDI sources we expect an output power of 5-10 uW over the two output bands.**

A prototype WR-10 (75-110 GHz) waveguide diplexer has been designed, and a schematic and the predicted performance are shown in Fig. 2. Initial measurements of the lowband filter verified the filter frequency response and yielded an insertion loss of 0.3 dB in the passband. The nominal frequency bands of the WR-10 diplexer are 75-91.5 GHz and 93-110 GHz. VDI has developed broadband high power varactor chains at these two bands, with measured output power of 250-500 mW over the lowband, and 200-400 mW over the highband. The diplexer is being machined, and test results of the diplexer and THz sources using the diplexer will be presented at the conference.

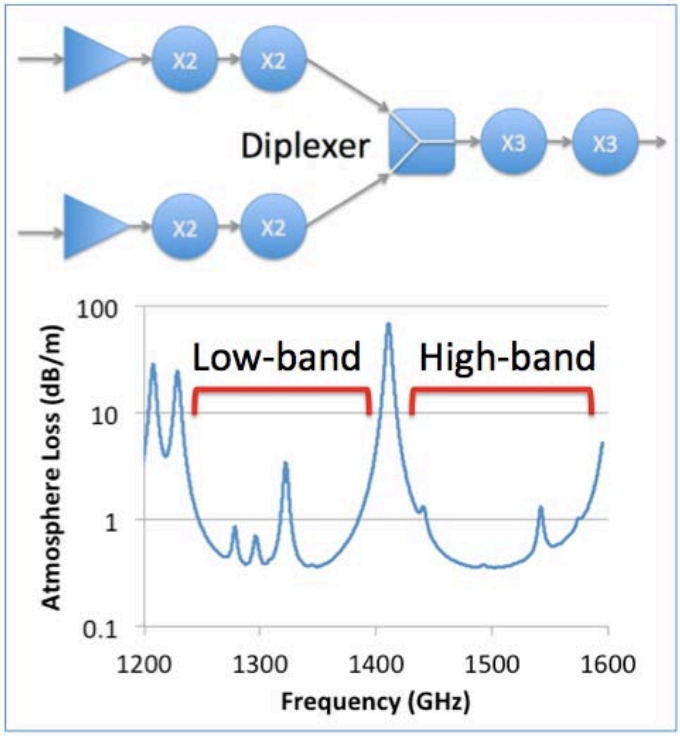

Fig. 1. Proposed configuration for a broadband 1.2-1.6 THz source, with output bands compared to atmospheric attenuation. The gap between the diplexer bands can be centered on the absorption line.

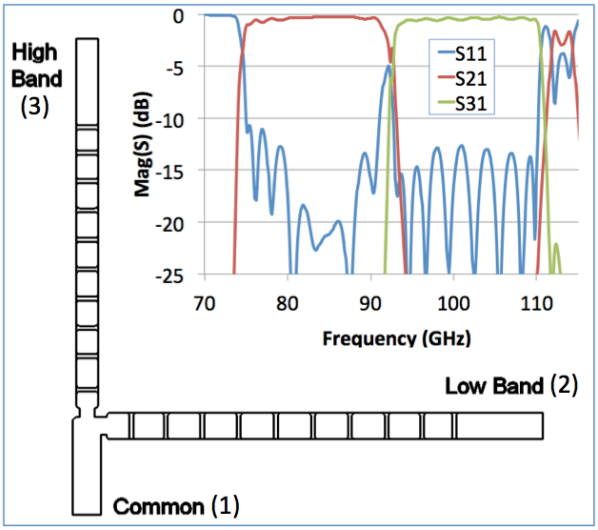

Fig. 2. Schematic and simulated performance of a WR-10 waveguide diplexer.