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Title:Mode Content Determination of Terahertz Corrugated Waveguides Using Experimentally Measured Radiated Field Patterns

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Abstract:This work focuses on the accuracy of the mode content measurements in an overmoded corrugated waveguide using measured radiated field patterns. Experimental results were obtained at 250 GHz using a vector network analyzer with over 70 dB of dynamic range. The intensity and phase profiles of the fields radiated from the end of the 19 mm diameter helically tapped brass waveguide were measured on planes at 7, 10, and 13 cm from the waveguide end. The measured fields were back propagated to the waveguide aperture to provide three independent estimates of the field at the waveguide exit aperture. Projecting that field onto the modes of the guide determined the waveguide mode content. The three independent mode content estimates were found to agree with one another to an accuracy of better than 0.3%. These direct determinations of the mode content were compared with indirect measurements using the experimentally measured amplitude in three planes, with the phase determined by a phase retrieval algorithm. The phase retrieval technique using the planes at 7, 10, and 13 cm yielded a mode content estimate in excellent agreement, within 0.3%, of the direct measurements. Phase retrieval results using planes at 10, 20, and 30 cm were less accurate due to truncation of the measurement in the transverse plane. The reported measurements benefited greatly from a precise mechanical alignment of the scanner with respect to the waveguide axis. These results will help to understand the accuracy of mode content measurements made directly in cold test and indirectly in hot test using the phase retrieval technique.

Number of references:26

Inspec controlled terms:waveguides

Uncontrolled terms:mode content measurement - terahertz corrugated waveguide - radiated field pattern - overmoded corrugated waveguide - vector network analyzer - intensity profile - phase profile - helically tapped brass waveguide - waveguide aperture - phase retrieval algorithm - transverse plane - mechanical alignment - waveguide axis - frequency 250 GHz - wavelength 19

mm - wavelength 7 cm - wavelength 10 cm - wavelength 13 cm - wavelength 20 cm - wavelength 30 cm

Inspec classification codes: B1310 Waveguides and striplines

Numerical data indexing: frequency 2.5E+11 Hz; wavelength 1.9E-02 m; wavelength 7.0E-02 m; wavelength 1.0E-01 m; wavelength 1.3E-01 m; wavelength 2.0E-01 m; wavelength 3.0E-01 m

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