Investigation of Shielding Effectiveness of Waveguide-Below-Cutoff at Super-High Frequencies for Various Liquids

The Oakland University and School of Engineering and Computer Science communities are invited to attend Scott Faust's defense of his Ph.D. dissertation. Seating is limited. RSVP with Katie Loodeen at looden@oakland.edu.

INVESTIGATION OF SHIELDING EFFECTIVENESS OF WAVEGUIDE-BELOW-CUTOFF AT SUPER-HIGH FREQUENCIES FOR VARIOUS LIQUIDS

Committee: Daniel N. Aloi, Ph.D. (Chair), Anthony D. Cooprider, Ph.D., Brian K. Dean, Ph.D., Darrell Schmidt, Ph.D.

Time: **1:30 -4:30 p.m.**
Date: **Friday, October 26, 2018**
Location: **347 EC**

Electromagnetic compatibility testing of liquid-cooled, high-power electronics in accordance with Military Standard MIL-STD-461 introduces the need to not only utilize high voltage/current electrical filters to the power source and load requirements, but also waveguide filters to pass the coolants into and out of the shielded enclosures at frequencies well into the Super High Frequency (SHF) range of 3 GHz to 30 GHz. Maintaining the integrity of the shielded enclosure in the SHF range requires knowledge of the shielding effectiveness performance of both the filters and the waveguides. Various manufacturers provide general formulas to estimate the shielding effectiveness of a particular waveguide configuration, including those with inserts designed to increase the shielding effectiveness and still provide adequate flow rates; however, these formulas do not address the constitutive parameters of the liquids flowing through the waveguide, nor do they adequately predict the shielding performance of a given waveguide configuration at frequencies below the cutoff frequency of the waveguide.

This research consisted of the development of an analytical formula to provide an improved estimate of the shielding effectiveness of a waveguide with inserts when used for liquid cooling. Validation of this analytical formula was first performed using electromagnetic numerical modeling and simulation software for air-filled waveguides. Empirical data was then obtained in the laboratory for not only air-filled waveguides, but also waveguides filled with various liquids of varying potential for use as coolants in power electronics. The data obtained by each method was then compared and potential sources of error identified.