

Sub-Terahertz Passive Devices and Test Metrology

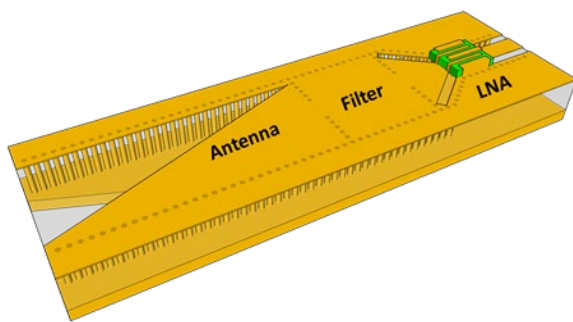
James C. M. Hwang, Guest Speaker

Cornell University, Ithaca, New York 14853 USA

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10:00 A.M. ~ BHEE 317

<https://purdue-edu.zoom.us/j/94773420629>



As 6G wireless communications push the operation frequency above 100 GHz, it is critical to have low-loss passive devices that can be accurately tested. To this end, D-band (110 GHz to 170 GHz) substrate-integrated waveguides (SIWs) are designed on a 100- μm -thick SiC substrate. The fabricated SIWs are characterized in a single sweep from 70 kHz to 220 GHz with their input/output transitioned to grounded coplanar waveguides (GCPWs). From CPW-probed scattering parameters, two-tier calibration is used to extract the intrinsic SIW characteristics after de-embedding the SIW-GCPW

transitions. In general, the record low loss measured agrees with that obtained from finite-element full-wave electromagnetic simulation. For example, across the D band, the average insertion loss is approximately 0.2 dB/mm, which is several times better than that of coplanar or microstrip transmission lines fabricated on the same substrate. A 3-pole filter exhibits a 1-dB insertion loss at 135 GHz with a 20-dB selectivity and an 11% bandwidth, which is order-of-magnitude better than typical on-chip filters. These results underscore the potential of using SIWs to interconnect transistors, filters, antennas, and other circuit elements on the same substrate for monolithic integration.



James Hwang is a professor in the Department of Materials Science and Engineering at Cornell University. He graduated from the same department with a Ph.D. degree. After years of industrial experience at IBM, Bell Labs, GE, and GAIN, he spent most of his academic career at Lehigh University. He cofounded GAIN and QED; the latter became the public company IQE and remains the world's largest compound semiconductor epitaxial wafer supplier. He used to be a Program Officer at the U.S. Air Force Office of Scientific Research for GHz-THz Electronics. He had been a visiting professor at Cornell University in the US, Marche Polytechnic University in Italy, Nanyang

Technological University in Singapore, National Yang Ming Chiao Tung University in Taiwan, and Shanghai Jiao Tong University in China. He is an IEEE Life Fellow and a Distinguished Microwave Lecturer. He is also a Track Editor for the IEEE Transactions on Microwave Theory and Techniques. He has published approximately 400 refereed technical papers and been granted nine U.S. patents. He has researched the design, modeling and characterization of optical, electronic, and micro-electromechanical devices and circuits. His current research focuses on devices and circuits above 110 GHz for 6G wireless communications.