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High Efficiency Carbon Nanotube Thread Antennas ELIE BENGIO, Department of Chemical and Biomolecular Engineering, Rice University, DAMIR SENIC, NIST Communications Technology Laboratory, LAUREN TAYLOR, DMITRI TSENTALOVICH, Department of Chemical and Biomolecular Engineering, Rice University, PEIYU CHEN, Department of Electrical and Computer Engineering, Rice University, CHRISTOPHER HOLLOWAY, DAVID NOVOTNY, NIST Communications Technology Laboratory, AYDIN BABAKHANI, Department of Electrical and Computer Engineering, Rice University, CHRISTOPHER LONG, JAMES BOOTH, NATHAN ORLOFF, NIST Communications Technology Laboratory, MATTEO PASQUALI, Department of Chemical and Biomolecular Engineering, Rice University — Although previous research has explored the underlying theory of high-frequency behavior of carbon nanotubes (CNTs) and CNT bundles for antennas, there is a gap in the literature for direct experimental measurements of radiation efficiency. Here we report a novel measurement technique to accurately characterize the radiation efficiency of quarter-wavelength monopole antennas made from CNT thread. At medical device (1 GHz) and Wi-Fi (2.4 GHz) frequencies, we measured the highest absolute values of radiation efficiency in the literature for CNT antennas, matching that of copper wire. We also report the first direct experimental observation that, contrary to metals, the radiation efficiency of the CNT thread improves significantly at higher frequencies. These results pave the way for practical applications of CNT thread antennas, particularly in the aerospace and wearable electronics industries where weight saving is a priority.

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