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Antenna characterization using a Rydberg atom field sensor ERIC PARADIS, Eastern Michigan University, CHRISTOPHER L. HOLLOWAY, NIST - Boulder, GEORG RAITHEL, University of Michigan, DAVID ANDERSON, Rydberg Technologies — Atom-based sensing and measurement techniques of microwave electric fields bear certain advantages over traditional dipole antennas, allowing for absolute field calibration, precision field measurements, and sub-wavelength spatial resolution [1, 2, 3]. Here we present recent work demonstrating atomic radio-frequency (RF) electric-field measurements and two-dimensional spatial imaging of the near-field of a Kμ-band pyramidal horn at 13.488 GHz, using a small (5.5 x 5.5 mm cross-section) rubidium vapor cell sensing element [4]. The field is measured using electromagnetically-induced transparency (EIT) spectroscopy of off-resonant AC Stark shifts of Rydberg states, allowing for atom-based RF electric field measurements. The method is applicable over a wide range of RF frequency and RF field amplitude [5]. In the present demonstration, we image the field distribution in the near-field of the antenna with a spatial resolution of lambda/10 covering a field-amplitude range from 50 to 350 V/m. Results are compared to finite-element field simulations, which are found to be in good agreement. [1] Nat. Phys. 5.8 (2009): 581, [2] APL 104, 244102, [3] Phys. Rev. Appl. 5, 034003, [4] EMC EUROPE 2018 (pp. 391-393) IEEE, [5] U.S. Patent No. 9,970,973.

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