

Abstract Submitted  
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**Second harmonic generation as nonlinear bifurcation phenomenon at various positions in plasma-metamaterial composite** AKINORI IWAI, Kyoto University, The University of Shiga Prefecture, YOSHIHIRO NAKAMURA, Kyoto University, OSAMU SAKAI, Kyoto University, The University of Shiga Prefecture — Plasma has been a research target as a nonlinear material to generate harmonic waves because of its dynamics. Its nonlinearity has been limited due to the cutoff density beyond which permittivity is negative. Metamaterial is a novel artificial material with extraordinary electromagnetic responses, and an array of double split ring resonators (DSRRs) is a typical one with negative permeability [1]. So far we have successfully confirmed microwave propagation in composites of negative-permeability DSRRs and negative-permittivity plasma whose high electron density enhances its nonlinear phenomena; one of them is second harmonic generation detected at one fixed position along the microwave propagation. In this report, we demonstrate the experimental results about the spatial profiles of the monitored fundamental (2.45 GHz) and the second harmonic (4.9 GHz) wave signals with corresponding measurement of electron density profiles. A significant intensity of the second harmonic wave was detected at a spatially separated position from the input port, which implies that the nonlinearity by the combination of plasma and DSRRs is sustained at overall parts of this composite.

[1] J. B. Pendry, A. J. Holden, D. J. Robbins, and W. J. Stewart, *IEEE Trans. Microw. Theory Tech.* 47, 2075 (1999).

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