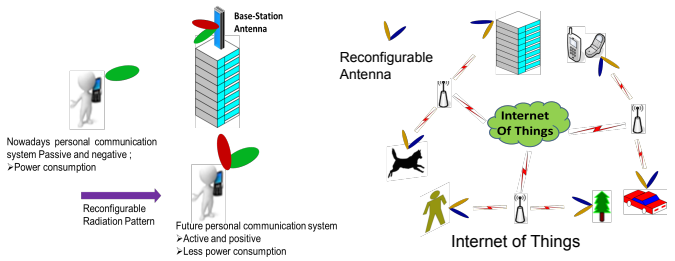
Active Metamaterials Antenna Using RF-MEMS Switches

Yong Luo, Zhengli Han, Kazutaka Kikuta, Takuya Takahashi, Akira Hirose,Hiroyuki Fujita, Hiroshi Toshiyoshi

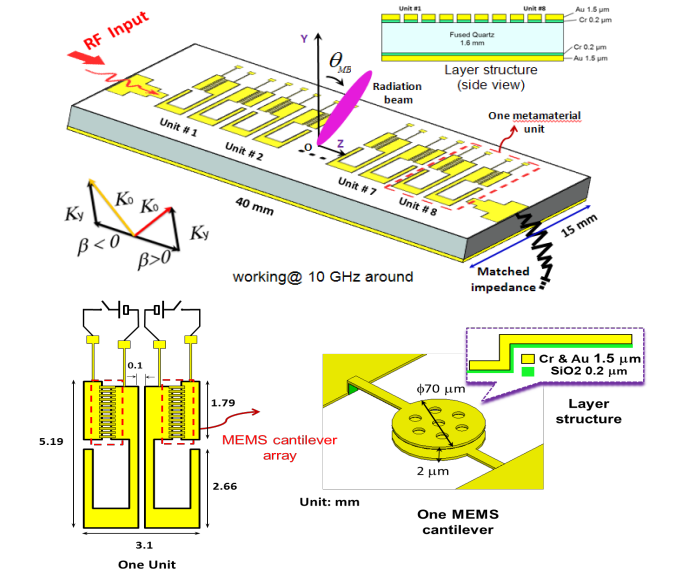
An active CRLH (Composite-Right-Left-Handed)Meta-material antenna for cognitive radio using RF-MEMS (Micro-Electro-Mechanical-Systems) switches to realize reconfigurable radiation patterns is reported. By discretely actuating the RF-MEMS switches on/off, dispersion property of antenna is controlled, and the radiation pattern are tuned from the backward to forward in the frequency around 10 GHz.

Introduction

Cognitive wireless network requires intelligent miniaturization, multi-function antennas.

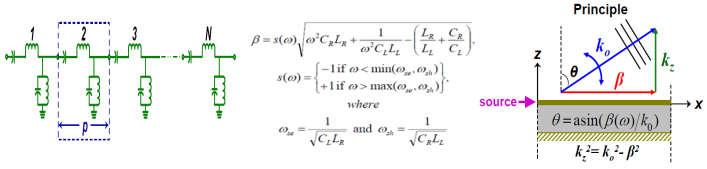


Design

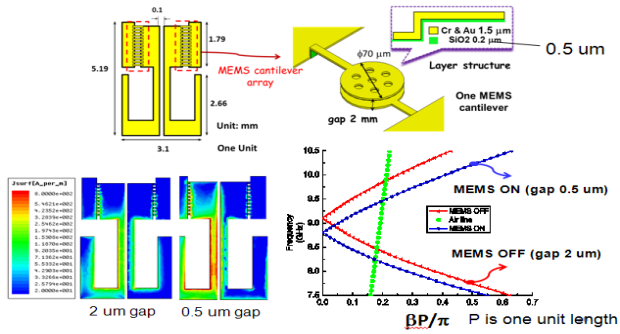


The design consists of 8 periodical J-shaped units which has CRLH property. RF-MEMS switches are used in each CRLH unit to tune the dispersion property

CRLH

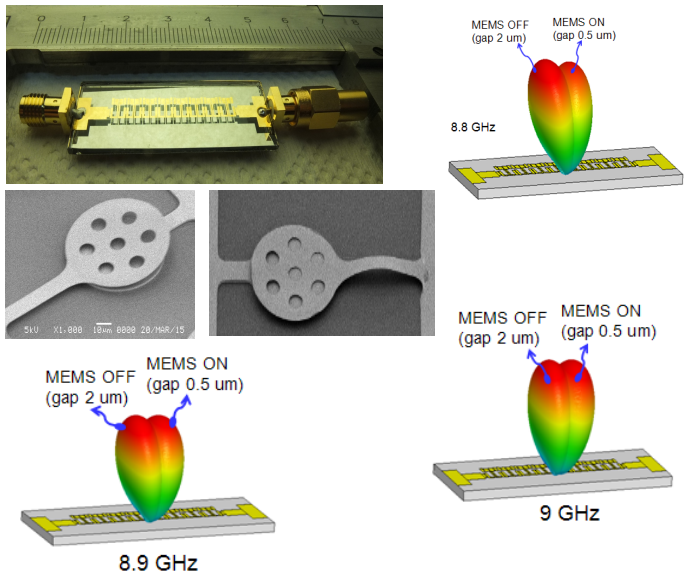


Tunable phase constant β



By actuating the RF-MEMS switches, the current of unit is perturbed and redistributed therefore the L, C parameters of the CRLH model are tuned, so that the propagation constant β is controlled by the ON/OFF state of RF-MEMS switches.

Reconfigurable radiation patterns



Radiation patterns at 8.8/8.9/9 GHz are tuned from backward in the state of MEMS-All-OFF (state 000000) to the forward in the state of MEMS-All-ON (state 111111). Contact: yluo@iis.u-tokyo.ac.jp