

# (SD2022-068) LIQUID CRYSTAL BASED RECONFIGURABLE DIELECTRIC RESONATOR ANTENNAS AND SMART SURFACES

Tech ID: 33222 / UC Case 2021-Z08-1

## BACKGROUND

Antennas are transducers that convert electronic signals into electromagnetic (EM) waves and vice-versa. An antenna can be electrically excited by a transmission line, an aperture coupling, or wirelessly by another source of electromagnetic wave. One type of antenna is a patch antenna formed by mounting a first sheet of metal over a second sheet of metal serving as a ground plane. Patch antennas have a low profile and are thus suitable for mounting on a surface. However, patch antennas may be less efficient and exhibit higher than desirable return loss. A dielectric resonator antenna (DRA), which includes a dielectric resonator disposed on top of another substrate in which the dielectric resonator is housed, may exhibit significantly lower losses than traditional metallic patch antennas. Nevertheless, conventional dielectric resonator antennas have limited beam steering capabilities. In particular, conventional dielectric resonator antennas exhibit a low quality factor (Q factor) at millimeter wave (mm-wave) frequencies.

## TECHNOLOGY DESCRIPTION

Researchers from UC San Diego and the Univ. British Columbia have invented a metamaterial based smart surface and antenna that utilize voltage-dependence of liquid crystal dielectric for electromagnetic wave manipulations such as reflection, refraction and retro-reflection

The smart surface consists of metasurfaces that are designed to facilitate phase shifting operation by using a voltage-controlled liquid dielectric material such as nematic liquid crystal, so that the wave can be reflected, refracted, and retro-reflected in a controlled fashion. The smart surface can be placed either on top of the dielectric resonator array as superstrate or below as a secondary substrate, to facilitate wave manipulations. When the wave impinges on the smart surface, owing to engineered unit cell geometry and spatial variation of the dielectric constant over the surface, controlled by different bias voltages imparted upon the liquid crystal layer, operations such as reflection, refraction and retro-reflection of the electromagnetic wave can be performed.

## APPLICATIONS

## CONTACT

Skip Cynar  
scynar@ucsd.edu  
tel: 858-822-2672.



## OTHER INFORMATION

### KEYWORDS

Dielectric resonator antennas,  
wireless communication,  
electromagnetic wave manipulation

### CATEGORIZED AS

- **Communications**
- Wireless

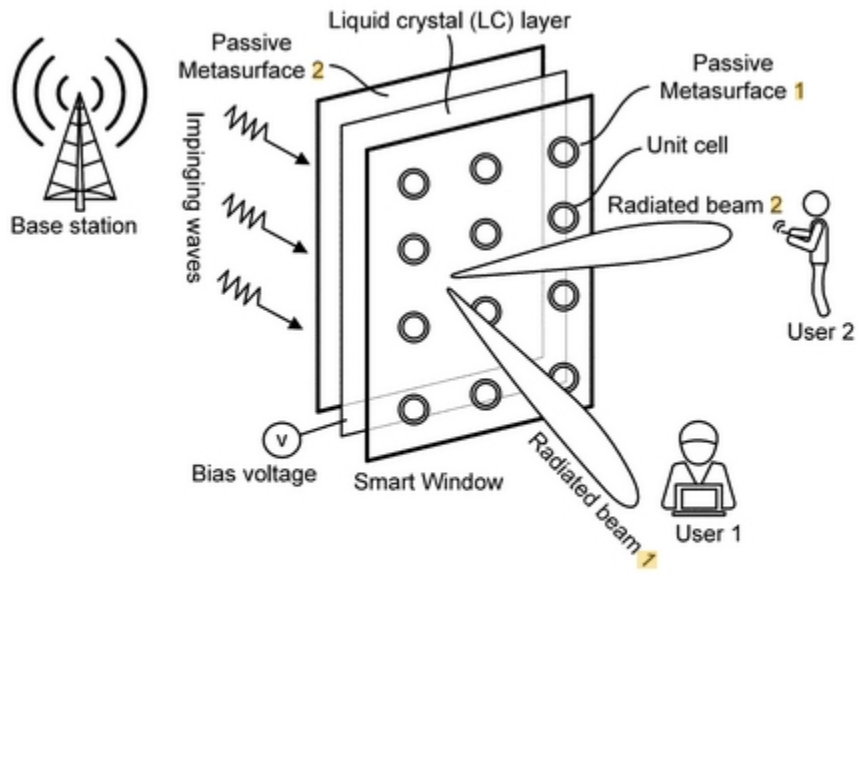
### RELATED CASES

2021-Z08-1

## ADVANTAGES

## STATE OF DEVELOPMENT

The electromagnetic wave manipulation apparatus may accumulate and refract electromagnetic waves constructively originating from a source such as a base station towards one or more user devices.



## INTELLECTUAL PROPERTY INFO

## RELATED MATERIALS

University of California, San Diego  
Office of Innovation and Commercialization  
9500 Gilman Drive, MC 0910, ,  
La Jolla, CA 92093-0910

Tel: 858.534.5815  
innovation@ucsd.edu  
<https://innovation.ucsd.edu>  
Fax: 858.534.7345

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