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Development of the World's First Transparent Liquid Crystal Meta-Surface Reflector for mmWave

- Service area can be expanded in various scenes for the 5G era -

Japan Display Inc. today announced the development of the world's first transparent liquid crystal meta-surface reflector that can change the direction of mmWave reflection to any direction. The transparent liquid crystal meta-surface reflector can be placed on window glass or on advertising media, and generally in any environment or location where transparency offers added benefits, which greatly increases installation flexibility. As a result, the radio communication environment of mmWave is greatly improved, contributing to greater convenience for consumers.



Fig.1 Small prototype of transparent liquid crystal meta-surface reflector for mmWave.

While the mmWave used in 5G can provide ultra-high-speed, high-capacity, and low-latency communication services, the strong directivity of the radio wave creates coverage holes in places such as the shadows of buildings and trees, where it is difficult for the mmWave to reach. Meta-surface reflectors that reflect radio waves from base stations in a specific direction, and deliver them to coverage holes, offer a great solution to this real-world problem. As we announced in October 2021, JDI has been developing direction-variable liquid crystal meta-surface reflector that can reflect mmWave in any direction.

The newly developed transparent mmWave liquid crystal meta-surface reflector has the characteristic of reflecting mmWave in any direction, while still passing through visible light. We have confirmed that the visible light can actually be seen through a prototype in which this technology is applied. The prototype was also confirmed to be able to reflect mmWave in any set direction as shown in Figure 1 and Figure 2.

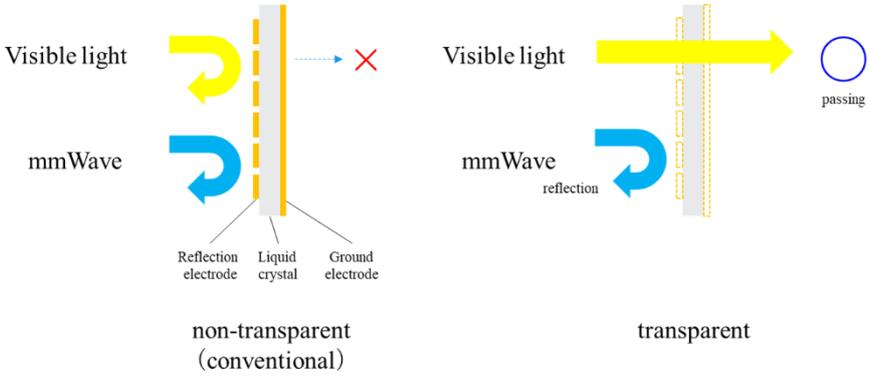


Fig.2 The feature of transparent mmWave liquid crystal meta-surface reflector.

With this achievement, it is expected that transparent mmWave liquid crystal meta-surface reflector can be placed on window glass and advertising media as shown in Figure 3, and that flexible measures for the coverage holes can be taken in various scenes, in accordance with changes in the position of the coverage holes due to changes in radio environment, and with changes in communication traffic at different times of the day. This technology can be applied not only to 5G but also to Beyond5G/6G.

We will continue to develop these technologies for mass production with the aim of wide commercialization.



Fig.3 Installation image of transparent mmWave liquid crystal meta-surface reflector.

The transparent liquid crystal meta-surface reflector will be exhibited at COMNEXT - Next Generation Communication Technology & Solutions Exhibition - to be held at Tokyo Big Sight from June 28 (Wed.) to June 30 (Fri.), 2023.

[COMNEXT Exhibit Information](#)

Liquid crystal meta-surface reflector:

A reflector that can reflect radio waves in a different direction than specular reflection.

Reflectors enable low-cost area expansion by transforming coverage holes in the wireless area into areas where communication is possible, without installing new base stations. With reflectors such as metal, there are restrictions on the physical installation angle because of the mirror reflection, but with liquid crystal meta-surface reflector, it is possible to reflect in a specific direction, reducing installation restrictions. Liquid crystal meta-surface reflector requires a power supply, enabling the feature that direction of reflection can be electrically controlled.

Video of Liquid Crystal Meta-Surface Reflector

<https://youtu.be/0SIXO3F9fw4>

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(October 7, 2021)