

1. Fabrication

we fabricated the sample using a Dragonfly 2020 3D printer (Nano Dimension, Israel). Meanwhile, the schematic of the printing process was illustrated in Figure. S1. As shown in Figure. S1, the MHMJM technology enables two-material hybrid printing via two non-contact nozzles. During the printing, photosensitive resin and silver ink were ejected from two separate nozzles. By curing these two materials with UV light (395nm) and infrared light (815nm) respectively and simultaneously, the conductive- and dielectric-layers of the metamaterial absorber can be formed at one time.

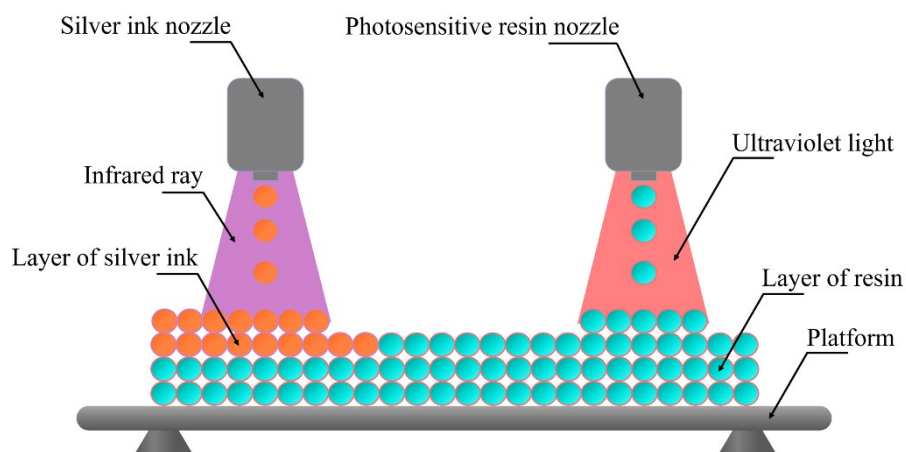


Figure. S1. Schematic of the non-contact inkjet deposition via double nozzles.

2. Measurement

We measured the absorptivity of the sample with a Rohde & Schwarz ZVA 40 vector network-analyzer and three pairs of standard-gain horn-antennas for different frequency band in a microwave chamber. The measurement setup was shown in Figure. S2. The sample was placed on the supporting bar in front of the horn-antennas. One antenna was used to transmit the electromagnetic wave while the other one was used to receive it. The reflection from a copper plate with identical dimension to the

sample, which acting as an ideal reflector, was firstly measured. Then, the reflection of the sample at the same location was measured, and the real reflection from the sample is calculated by subtracting the two reflected powers.

Meanwhile, by rotating the angle between the position of the antenna and the normal direction of the supporting bar, the reflection of the sample at different incident angles under oblique incidence can be obtained.

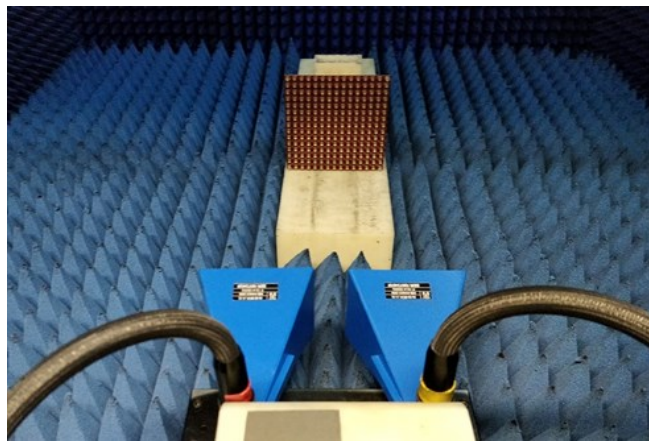


Figure. S2. Measurement setup.