3D-Printed Metasurface Units for Potential Energy Harvesting Applications at the 2.4 GHz Frequency Band

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Supplementary Material
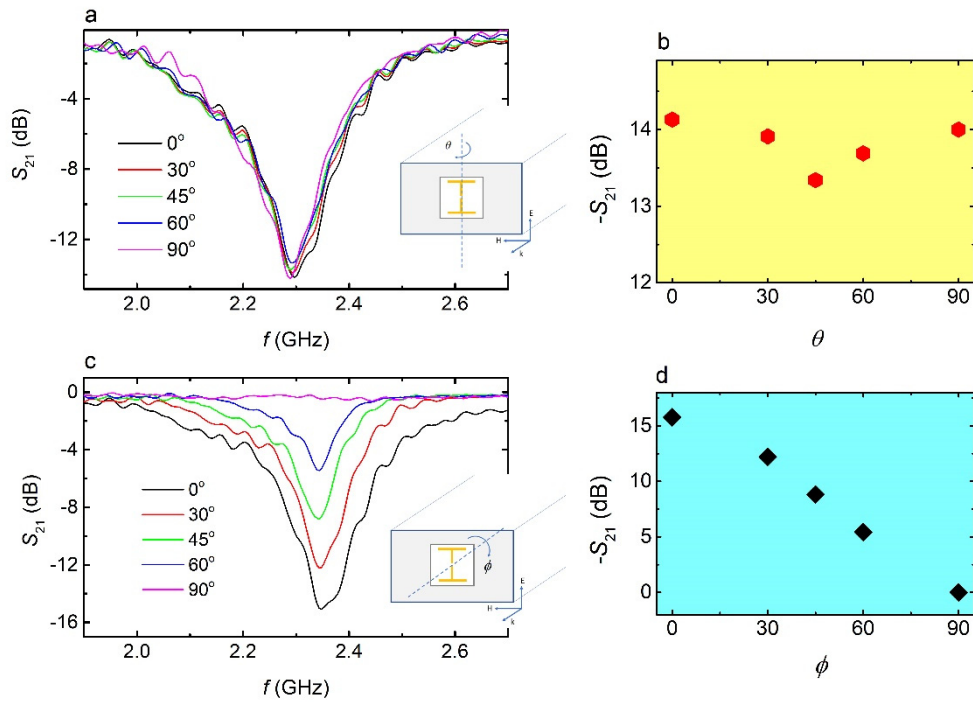
Figure S1. Electromagnetic response of the FR-4 built MS, with repsect to polarization angles. (a) S_{21} vs. f for the FR-4 based MS for various angles θ. The drawing shows the position of the MS unit with respect to the incident wave into the waveguide. **(b)** Maximum values of S_{21} as a function of θ, as extracted from panel (a). The S_{21} value remains unaffected. **(c)** S_{21} vs. f for several angles ϕ. The drawing shows the position of the MS unit with respect to the incident wave into the waveguide. **(d)** Maximum values of S_{21} as a function of ϕ, as extracted from panel (c). The S_{21} value gradually decreases and it is eliminated, as the MS turns to $\phi = 90^{o}$.
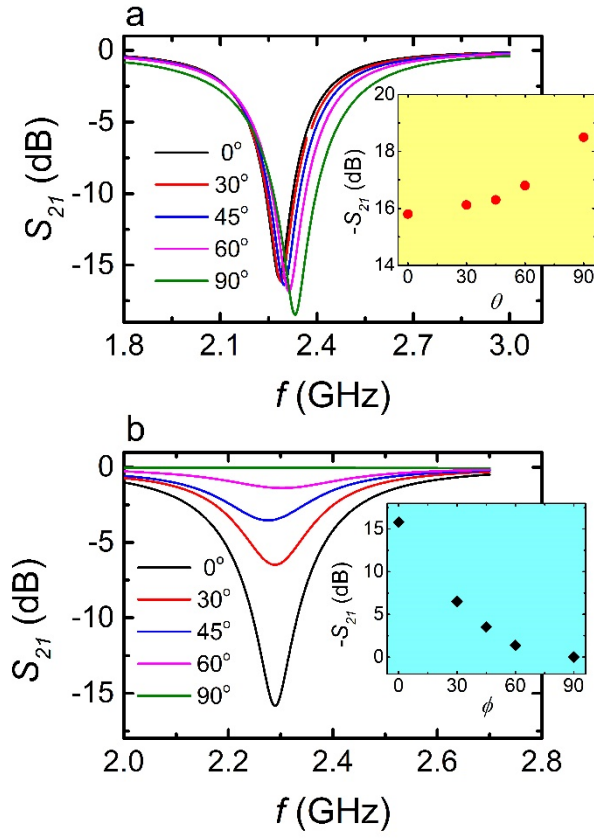
Figure S2. Simulations for the FR-4 built MS, with respect to polarization angles. (**a**) Simulation derived S_{21} vs. f for the FR-4 based MS for various angles θ. **Yellow inset:** Maximum values of S_{21} as a function of θ, as extracted from panel (a). The S_{21} value is slightly increased with the increasing angle. (**b**) Simulation derived S_{21} vs. f for several angles ϕ. **Blue inset:** Maximum values of S_{21} as a function of ϕ, as extracted from panel (b). The S_{21} value gradually decreases and it is eliminated, as the MS turns to $\phi = 90^o$.
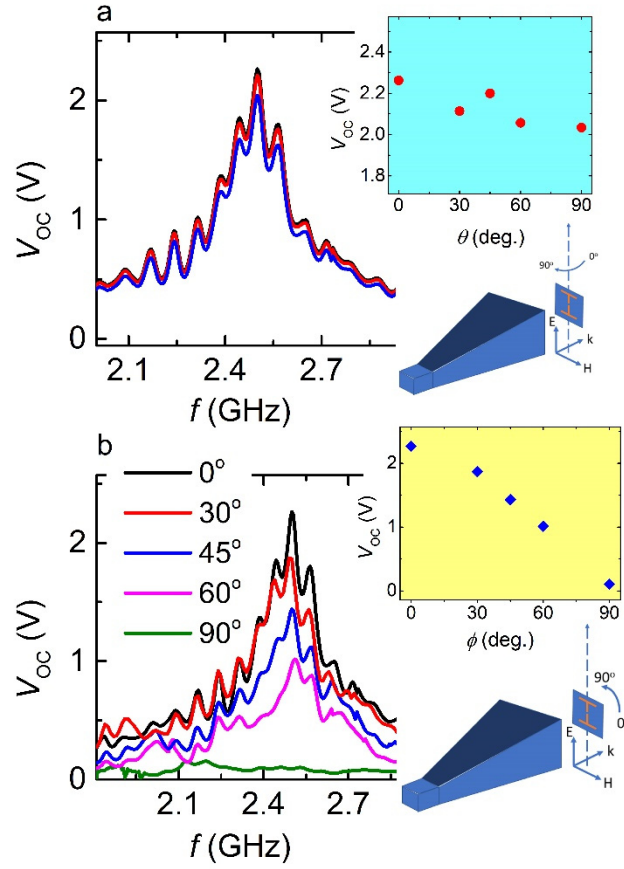
Figure S3. Output voltage, with respect to polarization angles, for the Ag/PLA MS. (a) V_{OC} vs. f for the Ag/PLA MS for angles $\theta = 0$ (black line), $\theta = 45^o$ (red line), and $\theta = 90^o$ (blue line), respectively. **Blue inset:** V_{OC} vs. angle θ. The drawing shows the position of the MS unit with respect to the horn. (**b**) Maximum values of S_{21} as a function of θ, as extracted from panel (a). The S_{21} value remains unaffected. (**c**) V_{OC} vs. f for the Ag/PLA MS for angles ϕ. **Yellow inset:** V_{OC} vs. angle ϕ, as extracted from the main panel. The drawing shows the position of the MS unit with respect to the horn.