**Method Section**

**Method 1: Solidification**

For the resonator, we use silicone oil with a refractive index of n = 1.41. The surrounding cladding medium is a photochemical polymer (My Polymers Ltd., QF-133-V3) with a low refractive index (n=1.33). We pour the polymer, while in its liquid phase, to a chamber that is made from two microscope slides that further improve rigidity. We then submerge a droplet made of silicone oil and a tapered-fiber coupler in the liquid polymer. We use the taper to evanescently couple light into the droplet resonator (*26*), from a tunable 780 nm laser, while monitoring its spectral transmission via the other side of the same tapered fiber. We fine-tune the coupling efficiency through moving the tapered coupler with respect to the resonator. Once we achieve a satisfactory result, we solidify the photochemical polymer with a 365 nm UV illuminator (Vilber Lourmat, VL-6.L). While the silicon oil resonator is still liquid, it is surrounded by solid walls. We did not measure any degradation of performance over weeks of operation.

**Method 2: Materials**

For the resonator, we use one droplet of n-heptane oil (CAS Number: 142-82-5, Sigma-Aldrich). For the surrounding, we use deionized water. For softening the water-oil interface, we use NaCl emulsifier in 30 mM concentration and 1 mM concentration of Dioctyl sulfosuccinate sodium salt (Aerosol OT) (CAS Number 577-11-7, Sigma-Aldrich). The concentration here is relative to 1 liter of water.

**Method 3: Making the Droplets**

We prefill the chamber with the water-AOT-NaCl solution (Methods), fill a syringe with n-heptane and equipped it with a150-micron inner diameter needle. We then apply pressure on the syringe piston to ensure a steady flow of n-heptane through the syringe needle and pulled it at a steady speed through the prefilled chamber. Depending on the pulling speed and flow velocity, and in agreement with the Plateau-Rayleigh instability, we generate droplets in the desired diameter range, spatially separated from each other. Refractive index of our droplets is 1.3855 and that of their surrounding liquid is 1.3298.

**Methods 4: Numerical Simulation**

We simulate the directional emission for a deformed cavity using a two-dimensional model to avoid unnecessary numerical difficulties. We utilize a 2D FEM frequency domain simulations run on COMSOL computational platform, where we compute the field emitted by a two-dimensional resonator in the form of a semicircle adjoint to an ellipse with the semiaxes 86 μm and 75 μm. This shape agrees most closely with the image of the deformed droplet as determined from its micrograph. The emission was associated with a WGM excited by a fiber coupler at the frequency in the vicinity of 780 nm. We did the frequency sweep around this value to find the best coupling with the waveguide.