ESI 1

**Fig. 1** High resolution confocal scan of $L=150$ nm NR-LH2 hybrid oriented parallel ($\parallel$) or perpendicular ($\perp$) with respect to the excitation light, $\lambda=800$ nm. Focusing a x-polarized excitation beam with a high NA objective results mostly in x-polarisation in the central spot, but a fraction of the light is distributed in four lobes and polarized in the orthogonal y-direction.\textsuperscript{1} These four lobes are clearly visible for the $\perp$-NR as the depolarized light is resonant with the longitudinal antenna-mode leading to enhanced excitation.

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ESI 2

**Fig. 2** The antenna efficiency as function of dipole position. The dipole source was positioned at three locations: (1) in front and in line with the antenna long-axis, (2) on top of the antenna and in line, and (3) in front tilted 45° with respect to the antenna long-axis, as indicated in the figure. The largest Purcell factor is found for the dipole in line and parallel with respect to the antenna long-axis, however the antenna efficiency is comparable for the different orientations.

Reference