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*Supplementary Material*

# Waveguiding and SERS Simplified Raman Spectroscopy on Biological Samples

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**Raman Enhancement Factor**

The enhancement factor (f) (or better, the Raman signal enhancement) compared to spntaneous Raman spectroscopy is 40, calculated as the intensity ratio between the ATP molecule peaks at 1401cm$^{-1}$ (ring stretching vibration) of SERS device ($I_{SERS}$) and spontaneous ($I_{Raman}$): $f = I_{SERS}/I_{Raman}$. The Electric field amplification is $f^{1/4}$, as known from literature. For clarity's sake, the spontaneous Raman spectrum is not reported preferring to evidence the SERS spectra of the three probe molecules.

**Power Loss Estimation**

A rough estimation of optical losses can be estimated about 95%, due to coupling and propagation loss, which is in agreement with other published literature data [36].

The power loss in the waveguide was calculated by comparing peak intensities of phenylalanine measured in the device prism + OWG + SERS surface with the ones obtained on the SERS surface coupled directly by a microscope objective. In particular, the peak used for the comparison was that at 1606 cm$^{-1}$ (in-phase motion of C atoms of the phenyl ring), which together to the peak at 1003 cm$^{-1}$ (ring breathing vibration), is the most representative for that molecule.