

Supplementary Information for

Multiple modes integrated biosensor based on higher order fano metamaterials

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1) Supplementary Table S1- S3.

Supplementary Table S1. ANOVA results for the effect of x-polarized order modes and cells concentration on the measured responses of Δf (GHz).

Variable	Treatment (cells/ml)					
	1×10 ⁴	3×10 ⁴	5×10 ⁴	1×10 ⁵	3×10 ⁵	5×10 ⁵
Q _x	8.03±1.4 ^a	28.9±3.1 ^b	97.5±14.7 ^c	15.8±5.7 ^a	28.2±8.9 ^b	37.4±13.8 ^b
O _x	6.0±0.85 ^a	50.9±4.4 ^e	63.3±0.7 ^f	108.9±7.3 ^g	108.5±39.5 ^g	120.2±42.5 ^g
H _x	3.6±0.06 ^a	59.2±5.6 ^{ef}	86.5±0.02 ^g	96±9.7 ^g	97.1±24.4 ^g	117.6±34.4 ^g

The data of Δf are exhibited as the mean ± standard deviation (SD). For each treatment in the table, means in each column not sharing the same lowercase letters are significantly different ($P \leq 0.05$), while means in each column sharing the same lowercase letters are not significantly different ($P > 0.05$).

Supplementary Table S2. ANOVA results for the effect of y-polarized order modes and cells concentration on the measured responses of Δf .

Variable	Treatment (cells/ml)					
	1×10 ⁴	3×10 ⁴	5×10 ⁴	1×10 ⁵	3×10 ⁵	5×10 ⁵
Q _y	0±15.6 ^a	18.6±3.4 ^b	42.7±2.9 ^c	126.3±14.1 ^d	36.7±7.0 ^c	-8.75±0.7 ^a
O _y	-0.5±8.9 ^a	33.4±4.3 ^c	63.7±9.6 ^e	107.4±5.8 ^d	17.2±15.1 ^b	32.6±13.4 ^c

Supplementary Table S3. Fitting results for x-polarized order modes using above mentioned empirical model with the different refractive index

Variable	constants			
Orders mode	w	ε_f	$h_{cell}(m)$	$l_{field}(m)$
Q _x	38.90	-2.7775	5.00×10 ⁻⁶	1.50×10 ⁻⁵
O _x	107.05	-1.3195	5.00×10 ⁻⁶	1.50×10 ⁻⁵
H _x	95.15	0.7508	5.00×10 ⁻⁶	1.50×10 ⁻⁵