

Supplementary File

## HF-VHF NEMS Resonators Enabled by 2D Semiconductor ReSe<sub>2</sub>

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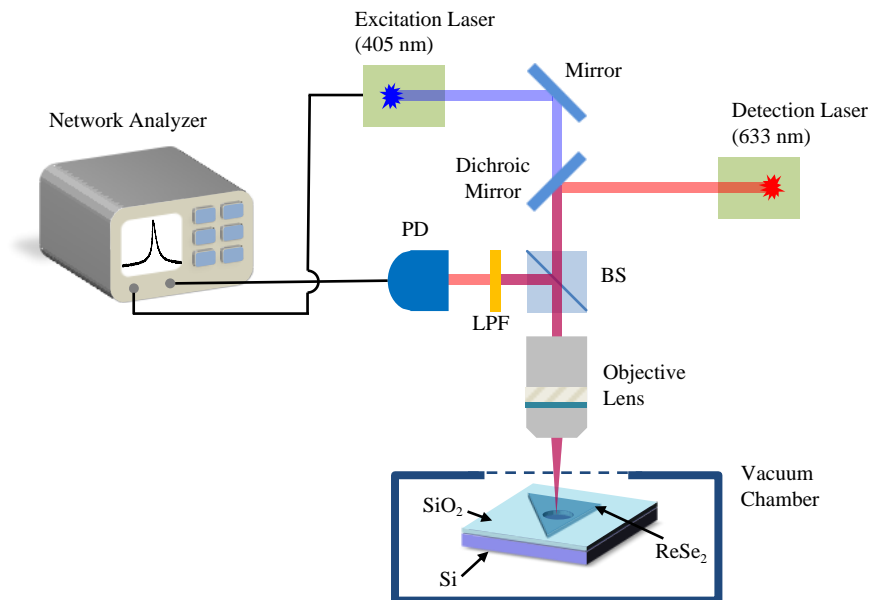
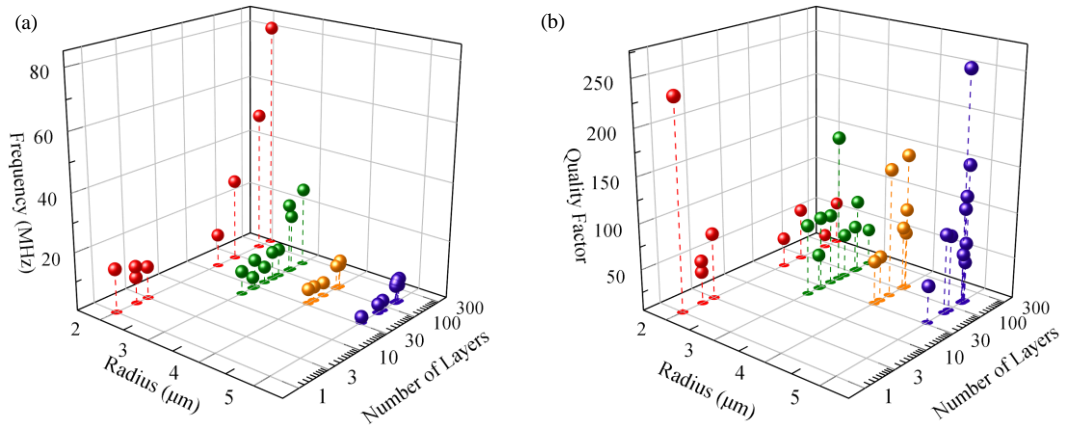
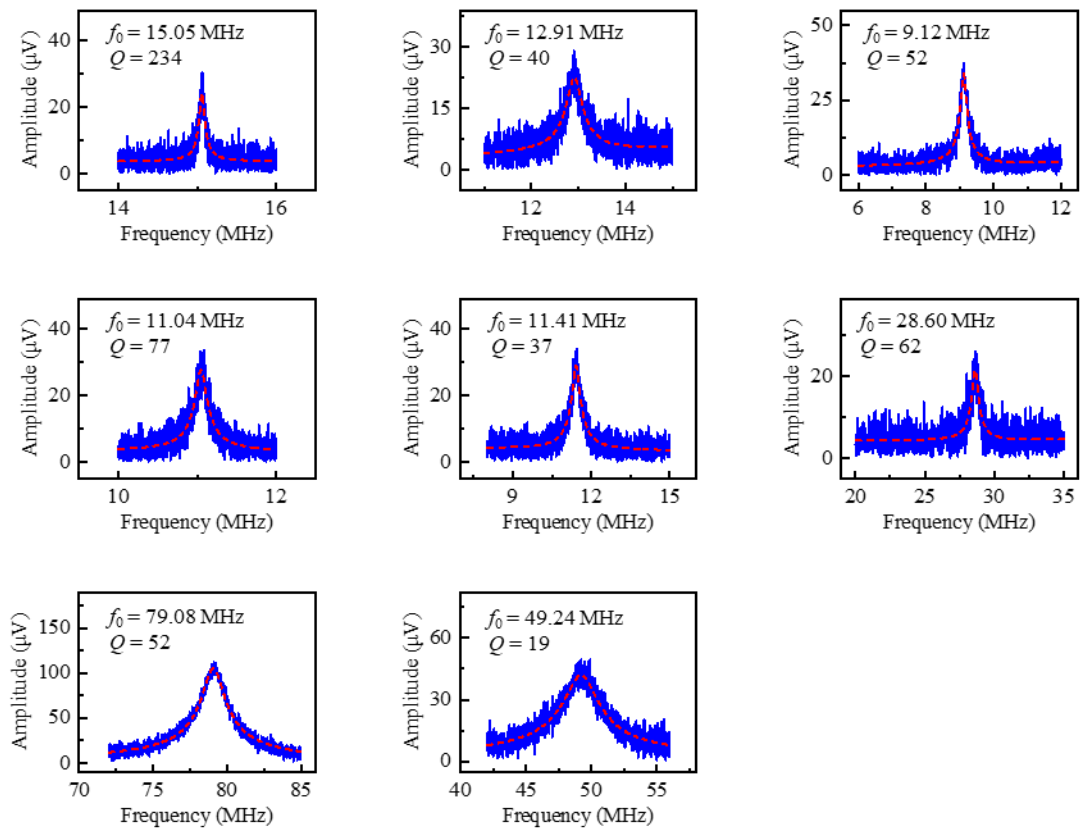


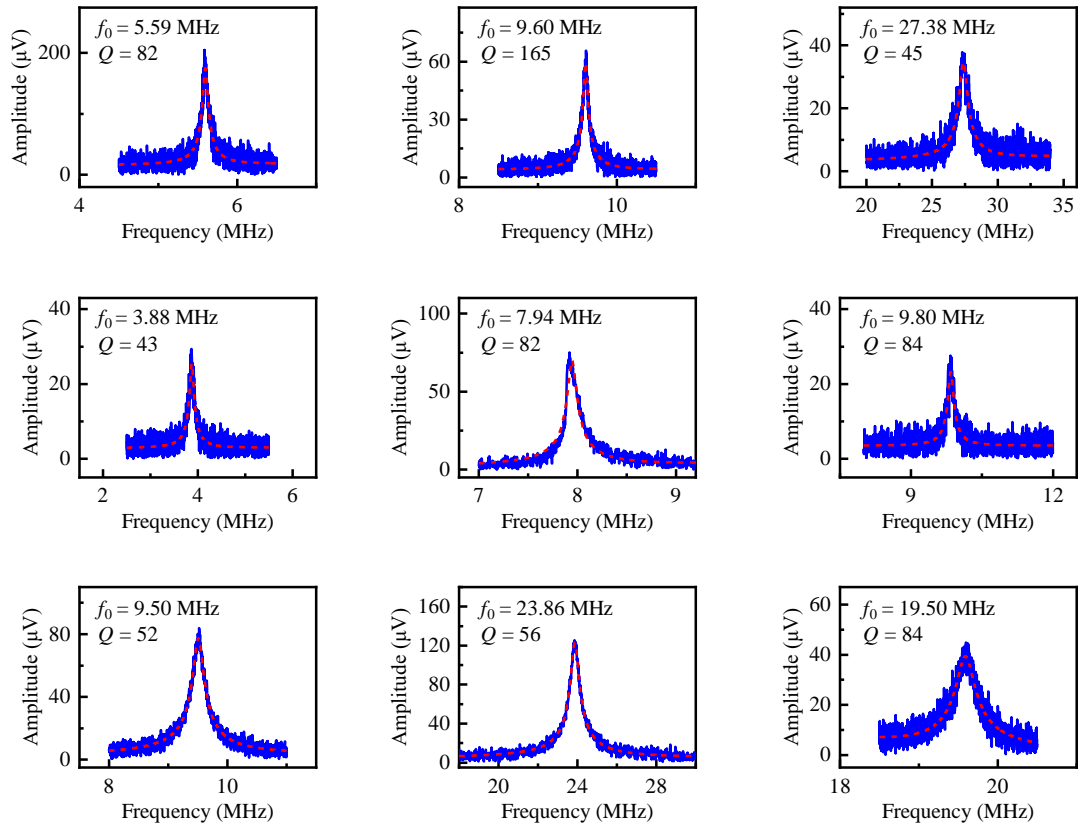
Figure S1 Schematic of our custom-built resonant NEMS measurement setup. BS: Beam Splitter; PD: Photodetector; LPF: Long-Pass Filter.



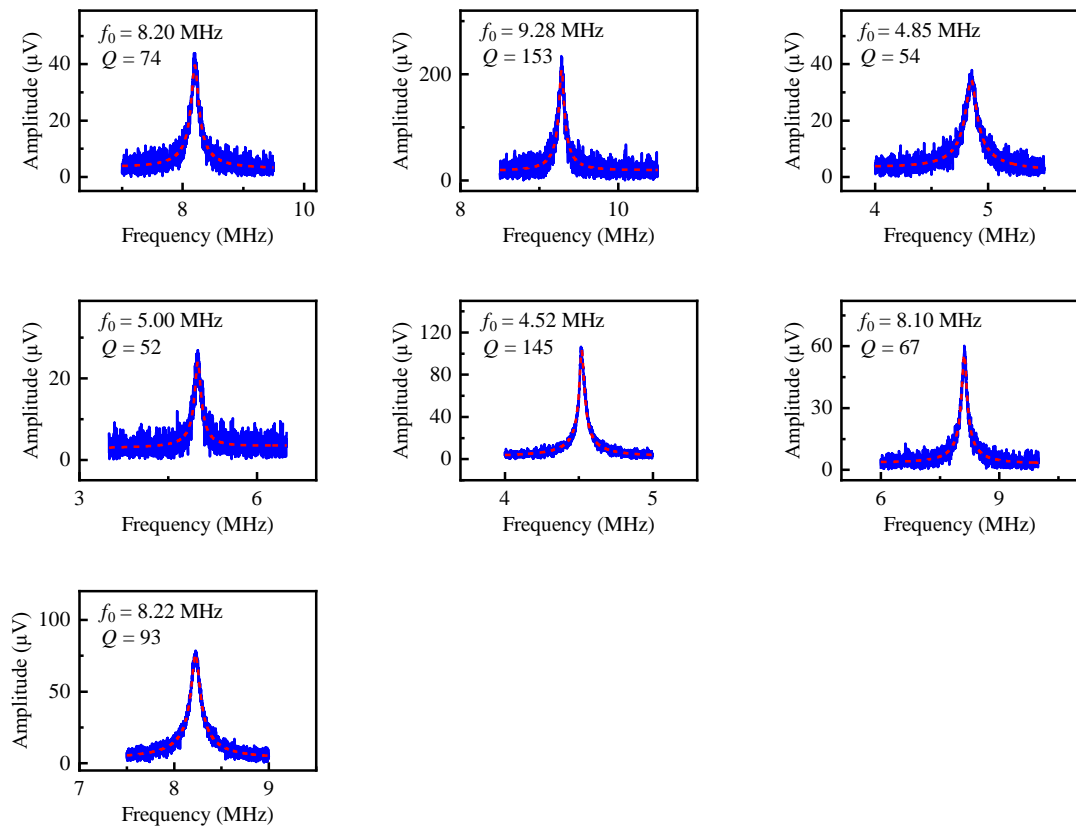
**Figure S2** Performance of all the ReSe<sub>2</sub> nanomechanical resonators. (a) Measured fundamental mode resonance frequency and (b) quality factor ( $Q$ ) as function of device diameter and thickness (number of layers). Color coding is consistent with that in Figure 1(d) of the main text.



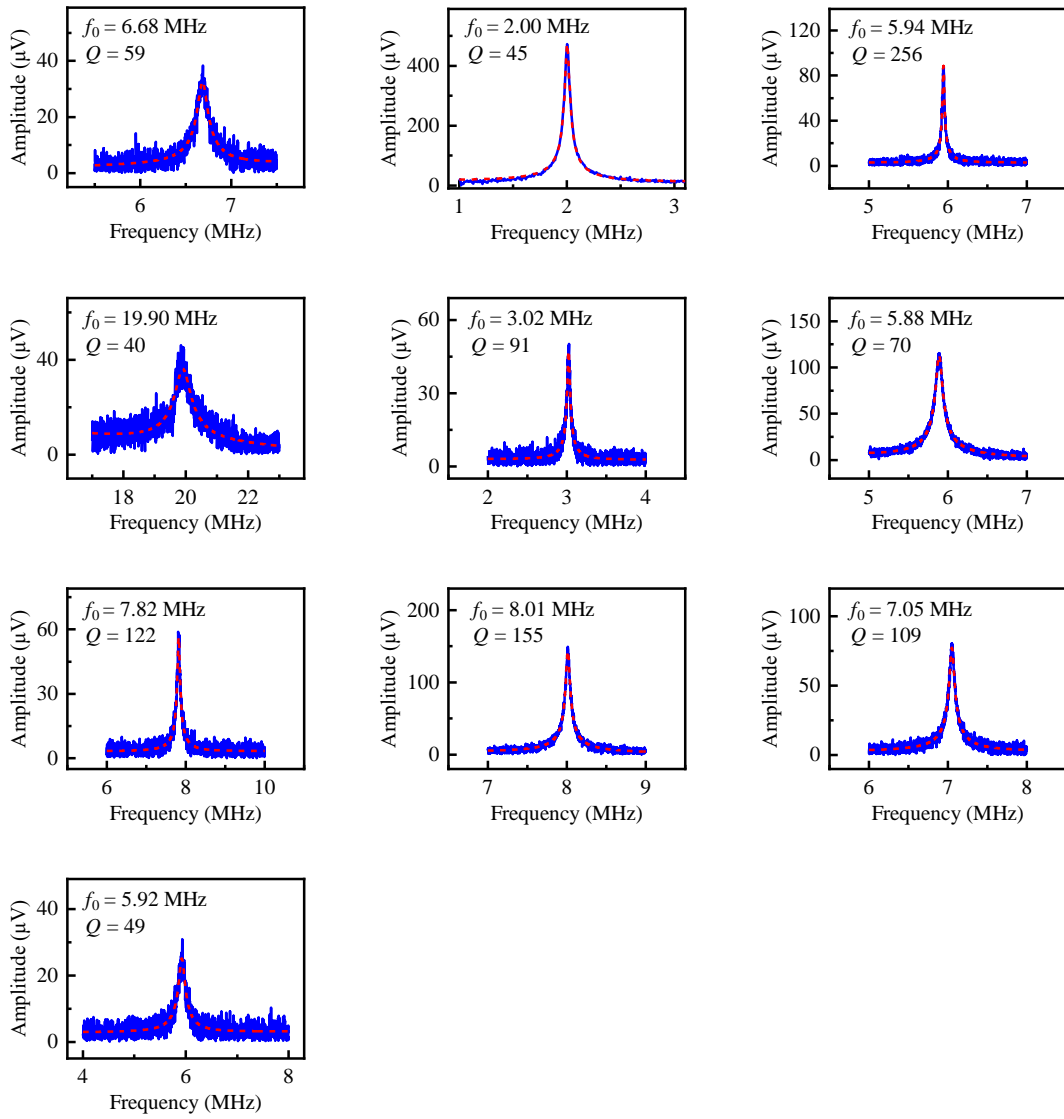
**Figure S3** Measured resonance responses of ReSe<sub>2</sub> resonators with a radius of 2 µm. Blue lines are measured data and red dashed lines show corresponding fitting to the simple harmonic model. Extracted resonance frequencies and quality factors are labeled in panels.



**Figure S4** Measured resonance responses of ReSe<sub>2</sub> resonators with a radius of 3 μm. Blue lines are measured data and red dashed lines show corresponding fitting to the simple harmonic model. Extracted resonance frequencies and quality factors are labeled in panels.



**Figure S5** Measured resonance responses of ReSe<sub>2</sub> resonators with a radius of 4 μm. Blue lines are measured data and red dashed lines show corresponding fitting to the simple harmonic model. Extracted resonance frequencies and quality factors are labeled in panels.



**Figure S6** Measured resonance responses of ReSe<sub>2</sub> resonators with a radius of 5  $\mu\text{m}$ . Blue lines are measured data and red dashed lines show corresponding fitting to the simple harmonic model. Extracted resonance frequencies and quality factors are labeled in panels.

Device #	Device Radius ( $\mu\text{m}$ )	Resonance Frequency $f_0$ (MHz)	Quality Factor $Q$	Number of Layers*	Thickness (nm)	Thickness/Radius <sup>2</sup> ( $\text{m}^{-1}$ )
1	2	15.05	234	1	0.7	175
2	2	12.91	40	2	1.4	350
3	2	9.12	52	2	1.4	350
4	2	11.04	77	3	2.1	525
5	2	28.60	62	85	60	7500
6	2	11.41	37	42	30	15000
7	2	49.23	19	167	117	29250
8	2	79.08	52	277	194	48500
9	3	5.59	82	42	30	3292
10	3	9.60	165	58	41	4556
11	3	27.38	45	210	148	16400
12	3	3.88	43	26	19	2056
13	3	7.94	82	17	12	1334
14	3	9.80	84	28	20	2222
15	3	9.50	52	75	53	5889
16	3	23.86	56	117	82	9111
17	3	19.50	84	128	90	10000
18	4	8.20	74	107	75	4689
19	4	9.28	153	124	87	5438
20	4	4.85	54	41	29	1819
21	4	5.00	52	33	23	1444
22	4	4.52	145	61	43	2692
23	4	8.10	67	120	84	5250
24	4	8.22	93	121	85	5336
25	5	6.68	59	144	101	4038
26	5	2.00	45	32	23	922
27	5	5.94	256	141	99	3972
28	5	19.90	40	456	320	1860
29	5	3.02	91	66	47	4480
30	5	5.88	70	160	112	4280
31	5	7.82	122	152	107	4600
32	5	8.01	155	164	115	4120
33	5	7.05	109	147	103	2268
34	5	5.92	49	158	111	4432

**Table S1** List of all measured ReSe<sub>2</sub> resonators with device parameters. Note for thickness determination: For thin-layer materials (up to ten layers), the number of layers can be determined using low-frequency Raman spectroscopy. For thicker materials, AFM provides better testing accuracy. However, for thicker materials, the number of layers can only be determined within an approximate range and cannot be considered as an exact value (with asterisk mark).