Supplementary Material for

Improving the read-out of the resonance frequency of nanotube mechanical resonators

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We quantify the Allan deviation associated to the fluctuations of the temperature as follows. We measure the resonance frequency f_0 as a function of temperature T, yielding -2775 Hz/K for the $f_0 - T$ conversion at 4.2 K. We separately measure the temperature fluctuations by recording the temperature as a function of time at 4.2 K. We calculate the time trace of the corresponding resonance frequency using the measured $f_0 - T$ conversion. We compute the associated Allan deviation (Fig. S1).

The Allan deviation associated to the fluctuations of the voltages applied to the device is obtained in the same way. The $f_0 - V_g$ conversion between the resonance frequency and the gate voltage is 12.1 MHz/V. From the measured time trace of the voltage delivered by our voltage source, we compute the associated Allan deviation (Fig. S1). In addition, we measure the time trace of the amplitude V_{1s} of the oscillating voltage bias applied across the nanotube. Using the relation $[\delta I_{\mathrm{mix}} = I_{\mathrm{mix}} \cdot \frac{\delta V_{1s}}{V_{1s}}]$ between the fluctuations of the mixing current δI_{mix} and the fluctuations δV_{1s}, and using the slope of the measured I_{mix} as a function of the driving frequency in Fig. 2(a) of the main text, we compute the associated Allan deviation.

Figure S1 shows that the Allan deviation measured in the device 1 is not related to the drift of the temperature and the applied voltages.

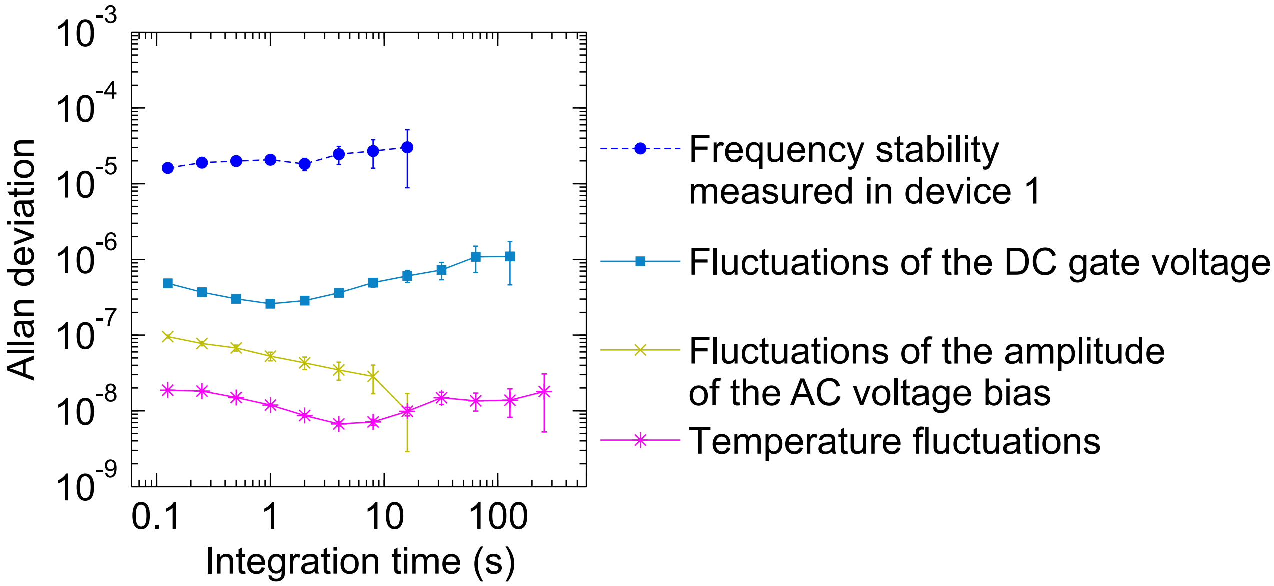

FIG. S1: Allan deviation measured in device 1 compared to the Allan deviation expected from temperature fluctuations and voltage fluctuations.