**Nanotube Radio**  
K. Jensen, J. Weldon, H. Garcia, and A. Zettl

**Supporting information**

**Video and audio**

The four videos included in the supporting information demonstrate reception of transmitted FM radio signals by our nanotube radio. At the beginning of each video, the nanotube radio is tuned to a different frequency than that of the transmitted radio signal. Thus, the nanotube does not vibrate, and only static noise, from the field emission current, can be heard. As the radio is brought into tune with the transmitted signal, the nanotube begins to vibrate, which blurs its image on the TEM video, and at the same time, the music becomes audible. The four songs are *Good Vibrations* by the Beach Boys, *Largo* from the opera Xerxes by Handel (this was the first song ever transmitted using radio), *Layla* by Eric Clapton, and the Main Title from Star Wars by John Williams.

**Methods**

Two methods are used to construct the nanotube radio, a bulk method and a single nanotube method. In the bulk method, a macroscopic fiber of multiwalled carbon nanotubes (MWNTs) is attached with conductive epoxy to a platinum wire. The wire, which serves as the cathode, is then installed inside a vacuum chamber and positioned near a copper plate, the anode, using a micromanipulator. Although there are numerous nanotubes in the macroscopic fiber, only a few, which protrude the furthest from the fiber, contribute significantly to the field emission current during radio operation. Thus, only a few of these nanotubes function as nanotube radios. Due to its simplicity, such a bulk construction method could be easily adapted for use with standard lithographic techniques. For the purpose of individually characterizing the nanotubes used in our radio, a more precise single nanotube construction method was also used. In the single nanotube method, a nanomanipulation platform (Nanofactory Instruments AB) operated inside a TEM is used to attach a single MWNT to the end of an etched tungsten tip. The tungsten tip, which serves as the cathode, is then positioned near another wire, which
serves as the anode. The radio is then operated *in-situ* where it is possible to see the vibrations of the nanotube with the TEM as it receives a transmission.