CARBON NANOTUBE RADIO: DEMONSTRATION OF A CNT BASED AM DEMODULATOR

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ABSTRACT

The use of carbon nanotubes (CNT) as components in high-frequency electronics has attracted much attention recently with their application in RF amplifiers, interconnects, mixers, etc.. Here we demonstrate a simple application for a carbon nanotube based radio receiver where by the CNT would function in the critical role as the demodulator of the received amplitude-modulated (AM) RF signal. The CNT is capable of this due to its non-linear current-voltage (IV) characteristics. It is know such nonlinearities can rectify a portion of the applied RF-current which to first order is $I_{rectified} = 1/4 * (d^2I/dV^2) * V_{RF}{}^2$, where V_{RF}, the voltage of the applied RF signal is and the second derivative, the non-linear current-voltage (IV) characteristics of the CNT. A schematic of the CNT radio setup is shown in Fig 1. The demodulated signal can be maximized by properly biasing the CNT such that V_{RF} is centered on the nonlinear portion of the IV curve. Modulation frequencies up to 100 kHz were also tested and the demodulated signal was found to have a sudden roll-off with the -3dB corner at 60Hz, a -30dB minimum at 2kHz followed by a recovery with a -16dB local maximum at 28kHz. Although obviously not competitive with other methods of AM-demodulation, we hope to demonstrate a simple, real world RF-application for the use of carbon nanotubes. The effect is from the nanotube itself and not the electrodes, since the metal electrodes are linear and hence would not cause rectification.

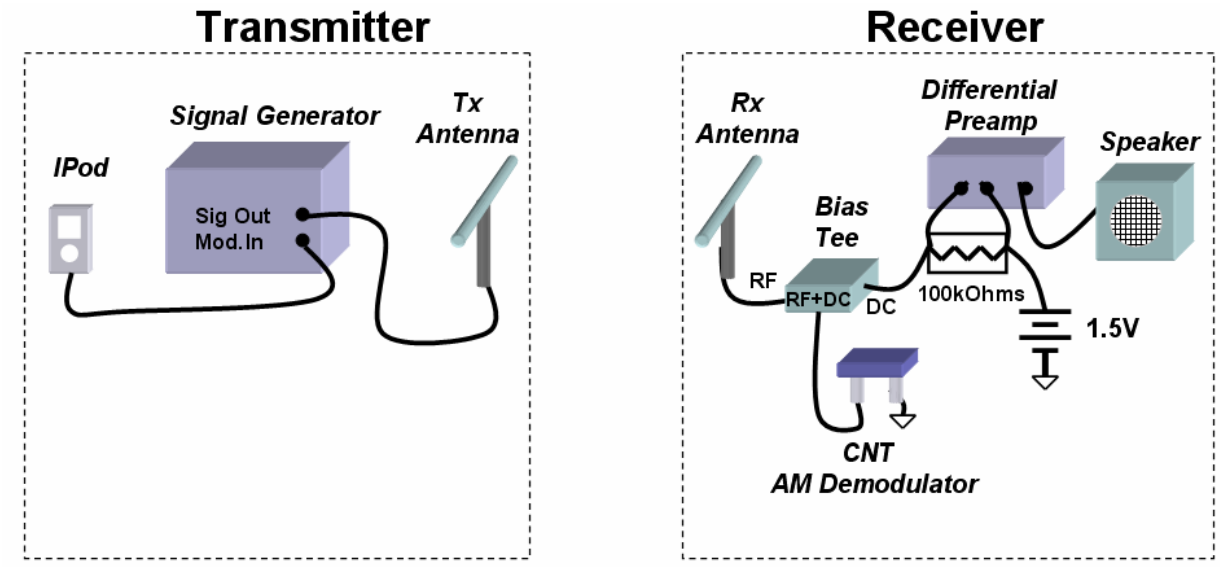

Figure 1. Schematic of CNT based radio setup where the CNT functions in the critical role as an AM demodulator. The battery in included to properly bias the CNT.