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Subject: Measurement equipment and software

Posted by [Wayne Parham](#) on Sun, 02 Dec 2001 01:59:16 GMT

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I suggest using the Woofer Tester from Parts Express or Speaker Workshop from Audia. You can also measure them yourself using the following technique and formulas: You'll need a signal generator and meter or scope. Put a test resistor in series, something between 10 and 1000 ohms. Find  $R_e$ . It is the DC resistance of the voice coil. Find  $F_s$ . It is the frequency where impedance is highest. To find mechanical and electrical Q values, the following formulas are used:  $Q_{ms} = F_s * (Z_{max}/R_e)^{0.5} / (F_h - F_l)$   $Q_{es} = Q_{ms} / (Z_{max}/(R_e - 1))$   $Q_{ts} = Q_{ms} * Q_{es} / (Q_{ms} + Q_{es})$  where  $F_s$  is the resonant frequency of the speaker in free air (Hz)  $Z_{max}$  is the impedance of the speaker at resonance in free air (ohms)  $R_e$  is the DC resistance of the voice coil (ohms)  $F_h$  is the frequency above  $F_s$  where speaker impedance is  $(Z_{max} * R_e)^{0.5}$   $F_l$  is the frequency below  $F_s$  where speaker impedance is  $(Z_{max} * R_e)^{0.5}$  Note:  $F_l$  and  $F_h$  can also be found at the points where voltage across the test resistor is equal to  $V_q$  in the following formula:  $V_q = (V_{max} * V_{min})^{0.5}$  where  $V_{min}$  is the voltage across the resistor at the speaker's resonant frequency  $V_{max}$  is the voltage across the resistor at a frequency far from resonance To find  $V_{as}$  using the sealed box method, the following formula is used:  $V_{as} = V_b * ((F_b / F_s)^2 - 1)$  where  $V_b$  is volume of the sealed cabinet (ft<sup>3</sup>, m<sup>3</sup> or liters)  $F_b$  is the resonant frequency of the speaker in the box (Hz)  $F_s$  is the free-air resonance of the speaker (Hz)