Subject: Re: Basshorn or Transmission Line
Posted by Tom Danley on Sat, 28 May 2005 14:04:24 GMT
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Hi WayneOne way to look at this (I believe) is that all horns are based on resonant operation.If one looks at the formula's that predict the response, the difference between a pipe and a horn is in the end area's being different.It is the resistance at each end (radiation at one end, the driver source resistance at the other) sets the "Q" for the resonance, just like how the ratio of reactance's to resistance governs the "Q" of electrical resonators.If one has an ideal situation at each end, then the "Q" is low, the structure combines and the resonant structure is invisible (and just like resonant electrical impedance matchers in RF, it appears to be an impedance transformer).On the other hand, the fact that the horn is a resonator (I think) can be seen even in a "full size" horn in that even when the mouth is optimally large, one finds there is a throat reactance (negative capacitance) remaining at the low cutoff. Reactance annulling is choosing a positive capacitance (driver and back volume total compliance) that cancels the negative capacitance of the horn extending the low cutoff by making the system "resistive" for a greater range..Additionally like some wide band radio antenna's, the horn is a "flexible" resonator in that it's acoustic lengths self adjust once one is above the low cutoff. A Biconical or Conical antenna (with a ground plane) is such a device for example, it can present a very even electrical load (for an antenna) for a considerable bandwidth once above its low cutoff (also a dimension governed thing).The impedance transformation part of the horn ends (for what ever frequency) about where the horn area is about 1 wl in circumference although the portion that follows afterward does ultimately define directivity.Also, one finds the efficient range of operation for a horn is when the path length is ½ wl or more.This is because the driver sitting at one end, is at the velocity minimum at a ¼ wl resonance. The Back EMF which produces the increased resistive electrical impedance when horn loaded, requires radiator motion, when the horn is ½ wl long, it has a velocity maximum at both ends.It is interesting to note (and common practice) that when voltage driven, a horn can produce nominally flat or usable acoustic output over a much wider bandwidth than it can do so efficiently.That can be seen when one compares the acoustic power vs frequency to that dissipated in the VC due to I^2 *R heating, the ratio of which defines efficiency.Well, I should get to house cleaning, its Saturday morning.ByeTom Danley