Subject: Designing a TL
Posted by Bob Brines on Wed, 01 Jun 2005 12:02:46 GMT
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Ron's suggestion of using a driver with the right Qts is correct but a little lacking in detail. If the Qts is in the low 0.20's or lower, the driver belongs in a back horn. Performance in a quarter-wave pipe will be disappointing. If the Qts is much higher than 0.50, then the driver is going to act as if it is on an Infinite Baffle when mounted in a quarter-wave pipe, so why not put it on an IB in the first place. Drivers with Qts in the .030's work best in short, fat, straight choked pipes -- MLTL's. Drivers with Qts in the 0.40's work best in conventional tapered TL's. There are exceptions, and you can always force any driver into any type cabinet if you are willing to make enough compromises. I continually shake my head at guys who go out an buy expensive drivers, then ask for a cabinet design to put it in.Quarter-wave resonant cabinets have acquired a whole litany of terms, none of which make any sense. First of all, what we call transmission line speakers bare no resemblance to electrical transmission lines or audio wave guides, my understanding of which can be written on the head of a pin. The TL speaker works on the basis of standing waves of odd-order harmonics -- a stopped pipe. The classic TL speaker "fixes" the standing waves by stuffing the bejesus out of the pipe, leaving for all practical purposes an IB. BTW, this is not all bad, since a true IB will give you some of the best bass you will ever hear if you can stand the real estate required.Martin King invented the term Mass Loaded Transmission Line -- MLTL -- a few years ago, which addresses the physics of the problem, but leaves the mathematically challenged bewildered as to the connection between TL's and a 40" pipe that supports an Fp of 40 Hz.This has generated a long, loud and misinformed argument that MLTL's are simply BR's in disguise. They are not -- the physics are entirely different. If you are wondering why your new tower BR tunes way too low and has lumpy mid-bass, I have the answer for you.OK, now to your question. The tuning frequency of a quarter-wave pipe is dependent on the length, cross-sectional area, taper and port dimensions. The greater the taper ratio, the shorter the pipe. TQWT's (Voigt pipes, pointy at the top) are the longest, conventional TL's the shortest. Tuning frequency can be lowered by reducing the size of the port and increasing its length. If you can't run Martin's model and choose to cut-and-try, you chances of getting it right are minimal.A quarter-wave pipe will have a series of harmonic in the pipe output. An end-loaded conventional TL is the worse, followed closely the TQWT. The 3rd or 5th harmonic can be easily suppressed by by placing the driver at the harmonic node. Normal design procedure is to place the driver at the 3rd harmonic in a TQWT and at the 5th harmonic in everything else. The physical dimensions of the pipe make this convenient. With one of these harmonics suppressed, the bottom end of the frequency response smooths dramatically. Further smoothing of the mid-bass is accomplished by moving the port up the pipe a little. Again, this must be modeled. There is no chance of guessing at it. If you have done the design right, you will need very little stuffing. My designs use no stuffing at all. I rely on a fiberglass lining to bring the frequency response to better than +/- 3 dB throughout the bass and mid-range.Bob