Figure 7 - A 3D drawing view of the dedicated amplifier design.

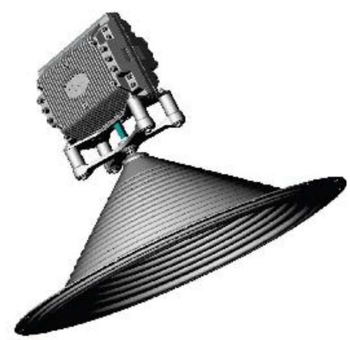

Figure 8 - A 3D drawing view of moving magnet transducer attached to a 30" cone.

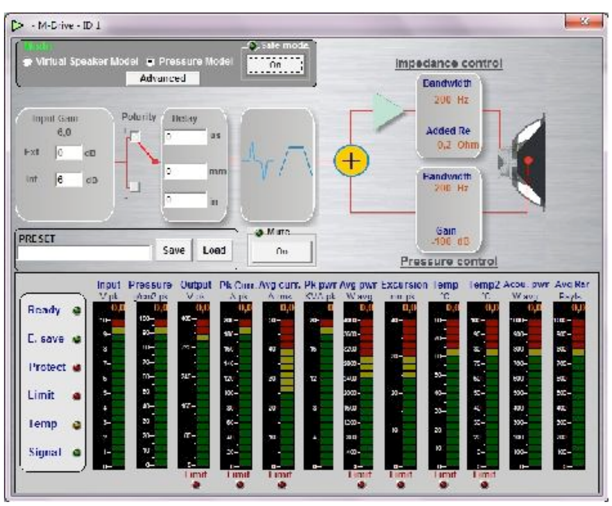


Figure 9 - Amplifier Computer Interface

## 7. SYSTEM EXAMPLES

We present here a short review of some examples of subwoofer systems that have been developed as case studies of practical applications of the novel moving magnet transducer. There are three simple examples here that have been chosen, among others, in order to give some ideas of application.

There will be shown a vented direct radiation box, designed for very high output and very high Q at the lowest frequency, tuned at 30Hz. Its volume was kept reasonably small but port size has been kept very generous. The second example represents ad vented box of the smallest possible dimensions to contain just the motor, the cone and the amplifier, and it was vented at slight higher than the previous one at about 34Hz. This box also features a small cavity in the front of the speaker that creates a sort of acoustic loading in front of the cone that increase a little bit the efficiency of the system in the upper bass range. Everything in this case was optimized, anyway, for the minimum possible dimension. Final box external dimensions, in fact, ended up at 80cm x 80cm x 80cm (31.5in x 31.5in x 31.5in).

The third design that is taken into consideration is an hybrid short transmission line design that is a particular design that combines some of the advantages of a short ¼ wavelength transmission line but trying to keep it as small as possible, with some advantages of an over damped vented box design. This third solution, both in terms of output and in terms of physical dimension it seems to be very interesting because it increases the overall output compared to a direct radiating while keeping dimensions and weight still very reasonable. Overall dimensions were 80cm x 96cm x 107cm (31.5in x 37in x 42 in). Also bandwidth seemed to be relatively wide and easy to equalize.

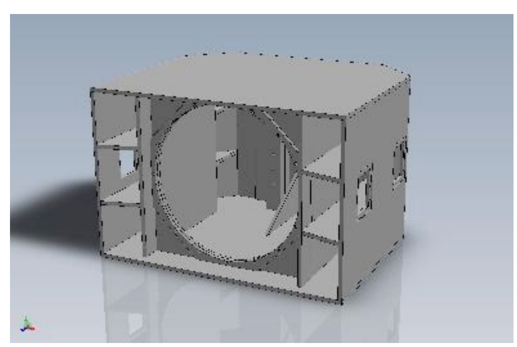

Figure 10 - High output, Hi Q vented box design tuned at 30Hz

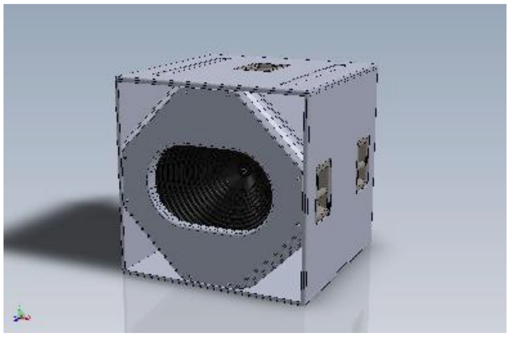

Figure 11 - Small size compact vented design tuned at 34Hz

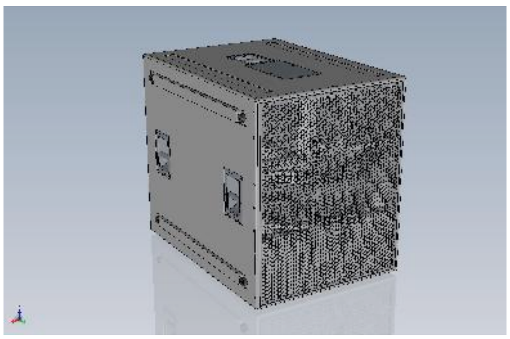

Figure 12 - Hybrid short transmission line

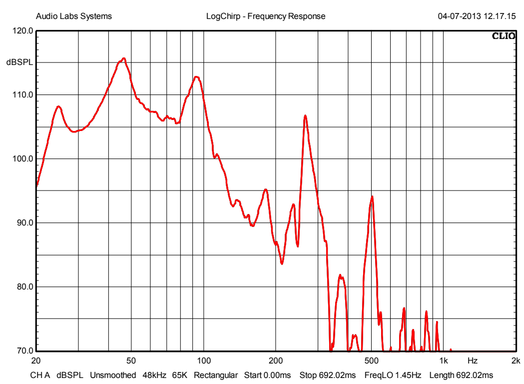


Figure 13 - Frequency response of the Hybrid short transmission line without output virtual resistance. Adding 0.2 to 0.3 ohm of virtual resistance the 3 peaks on the frequency response will considerable smooth down

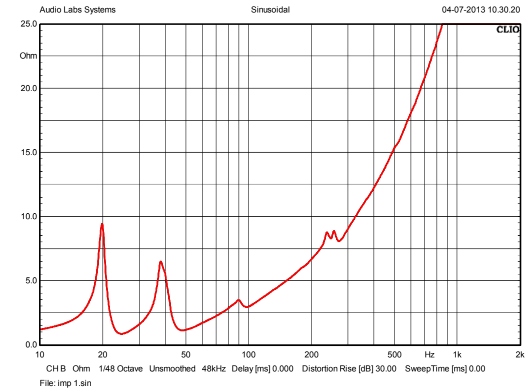


Figure 14 - Impedance curve of the hybrid transmission line design. Note the very evident rise of the impedance curve at the high frequency is due to the high driver inductance

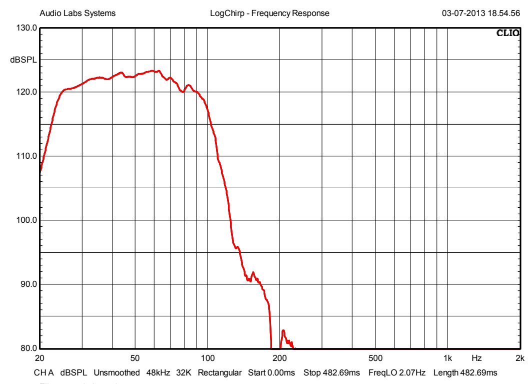


Figure 15 – Frequency response capability of the hybrid transmission line design after the proper DSP processing and equalization.

Figures 13, 14 and 15 show some of the characteristics of the hybrid transmission line design. The resulting natural frequency response, in fact, even though seems to be very troublesome, will be equalized and matched to the desired pass band shown in figure 15, using a combination of amplifier output impedance adjustment and overall filtering and eq. processing.

## 8. ADDITIONAL TESTS AND MEASUREMENTS

Some additional test measurements are reported in this section just to give a perception of other performance parameters. Figures 16 and 17 they report the THD level for the moving magnet transducer and for a dual high power 18" subwoofer, both driven at -10dB in respect to their maximum power. It is interesting to see how lower are the distortion figures in the 30 to 50 Hz range, comparing figures 16 and 17. In addition to that, in figure 18 there is an example of a fourth example of box of very small size that is using the moving magnet transducer.

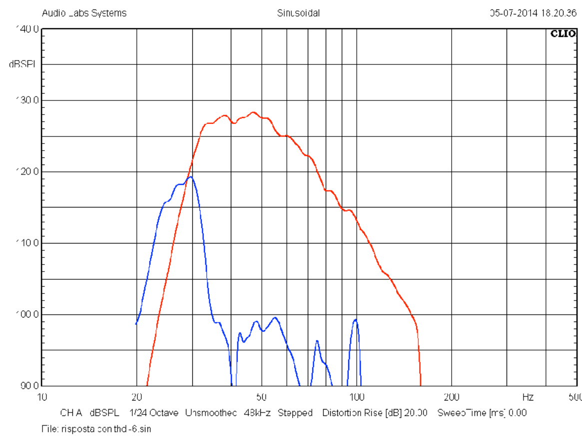


Figure 16 – THD of the moving magnet transducer at -10dB level from the maximum power

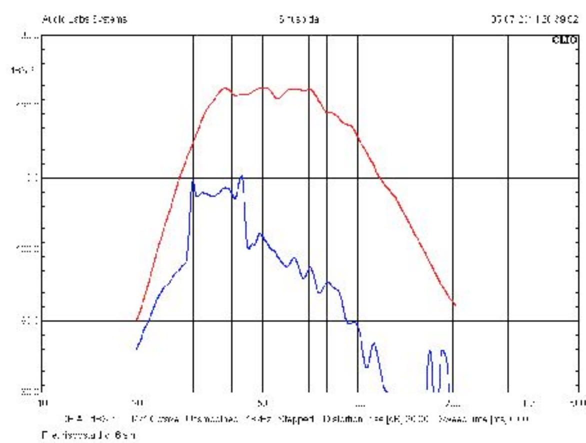


Figure 17 – THD of a dual 18" subwoofer at -10 dB level from the maximum power

The measurement in figure 18 is referred to an additional fourth type of design. Also in this case the comparison between the natural response and the processed final response clearly show how they can be different each other. Also in this case, the final result is obtained only with amplifier impedance compensation, in addition to EQ and Xover settings.

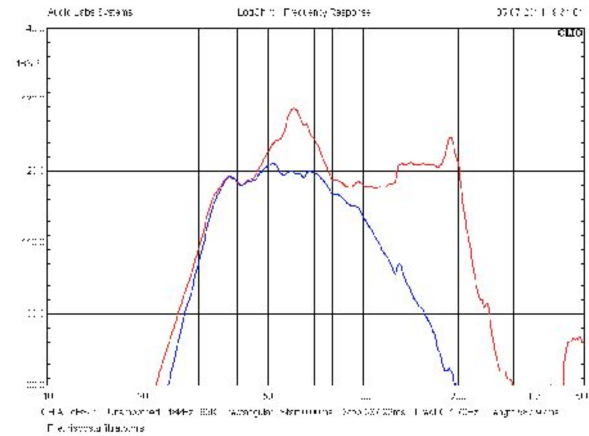


Figure 18 – Example of unfiltered response featuring only complex impedance compensation and filtered response

In the following section, from figure 19 to 21 there are three example of MOL measurements (Maximum Output Level) performed with the ANSI/CEA standard method. These measurements take in consideration both the acoustic and transducer side and in addition to that, they also take into consideration the electrical limitations in terms of voltage and current that may occur into the driving amplifier. These curves are not calculated but are really measured and they represents the continuous level that these systems can produce at 1m of distance in half space, also considering the overall distortion level to be below a certain threshold at each frequency. The distortion threshold is determined by following a curve contour that is somewhat related to the human hearing at low frequency.

In figure 19 is possible to compare the MOL for the moving magnet system compared to the extrapolated value of MOL after the power compression could take over. As it might be seen, the power compression effect for this driver is almost negligible.