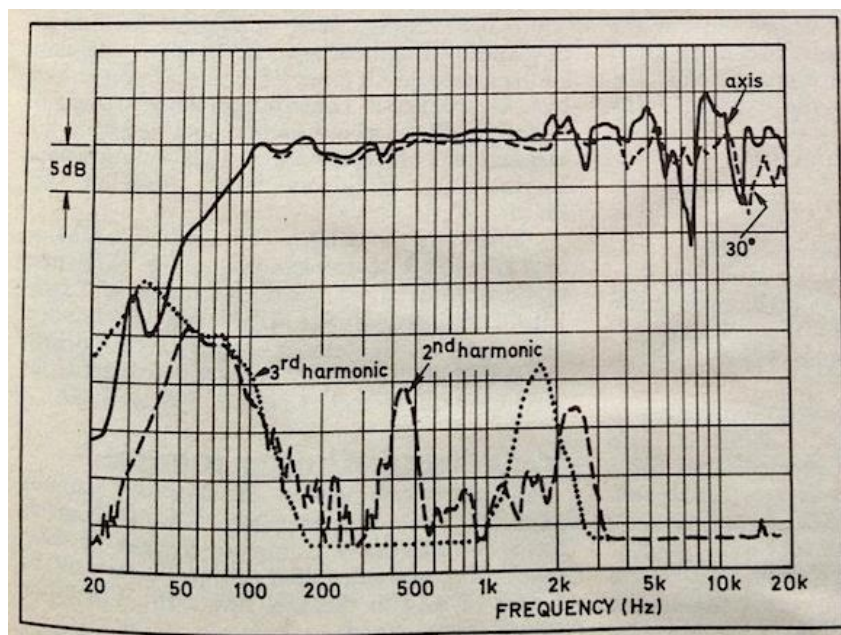


The JR149Plus: Upgrade to the Venerable JR149 Loudspeaker, Part 2 of 2

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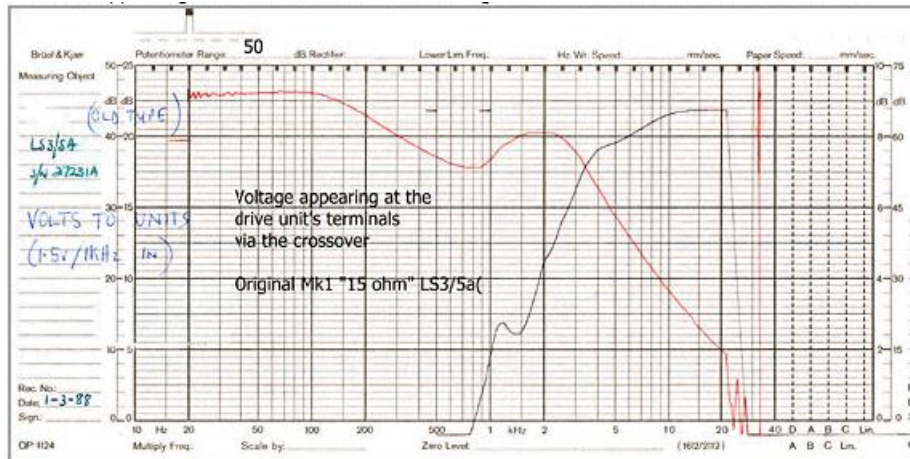
Comparison to original JR149

The JR149 was tuned for a much flatter response than the LS3/5A, with perceptually deeper but less balanced bass. I'm guess that the lack of adequate tweeter diffraction control from the woofer cone and end caps leads to the on axis peaking and dips.

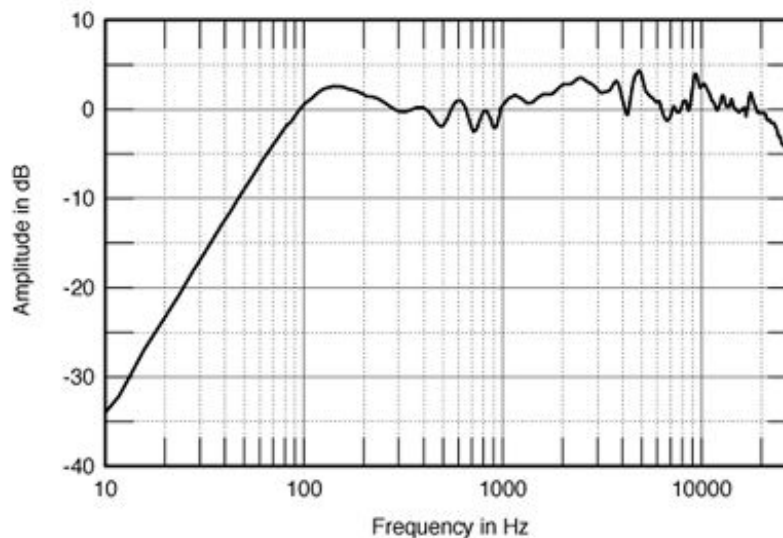


Comparison to LS3/5A

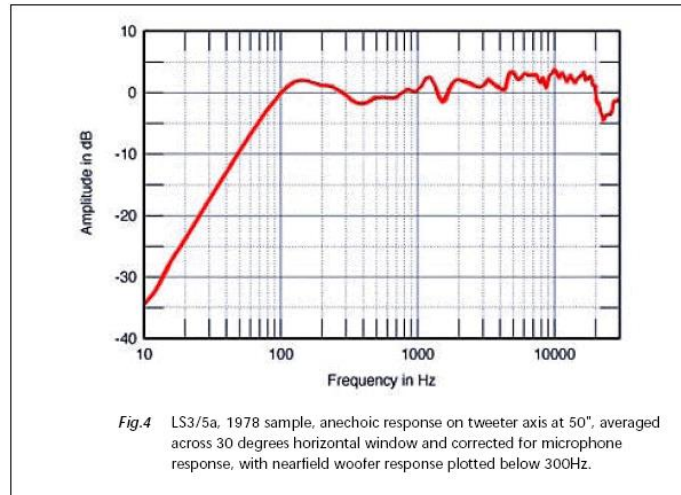
The LS3/5A features a too-small cabinet tuned to provide a bass peak at 100 Hz, lending a usefully misleading impression of some bass, and +2.5 dB equalization to the woofer at 2 kHz, the latter probably a major factor in the design's famous mid-range. This equalization boosts the summed response over a range of frequencies which would tend to enhance voice intelligibility, a well-known trick in sound reinforcement.



From Stereophile:



The response was a bit smoother averaged over the frontal 30 degrees:



The Wrap Up

After many crossover iterations, I'm satisfied with the results these simple drivers offer, and the upgrade compared to the LS3/5As and JR149s is significant, for my tastes. In the end, the outcome is limited by the B110 and the driver shows its age, providing less bass depth, dynamic range and far less detail and cleanliness than a modern driver that I consider it's natural descendent, the Tang band W4-1720.

With those caveats in mind, and after multiple iterations in the voicing stage, I find the final result well optimized, non-fatiguing and enjoyable.

While they are a niche design, these JRs are sticking around.

Appendix A: Alternative Crossovers

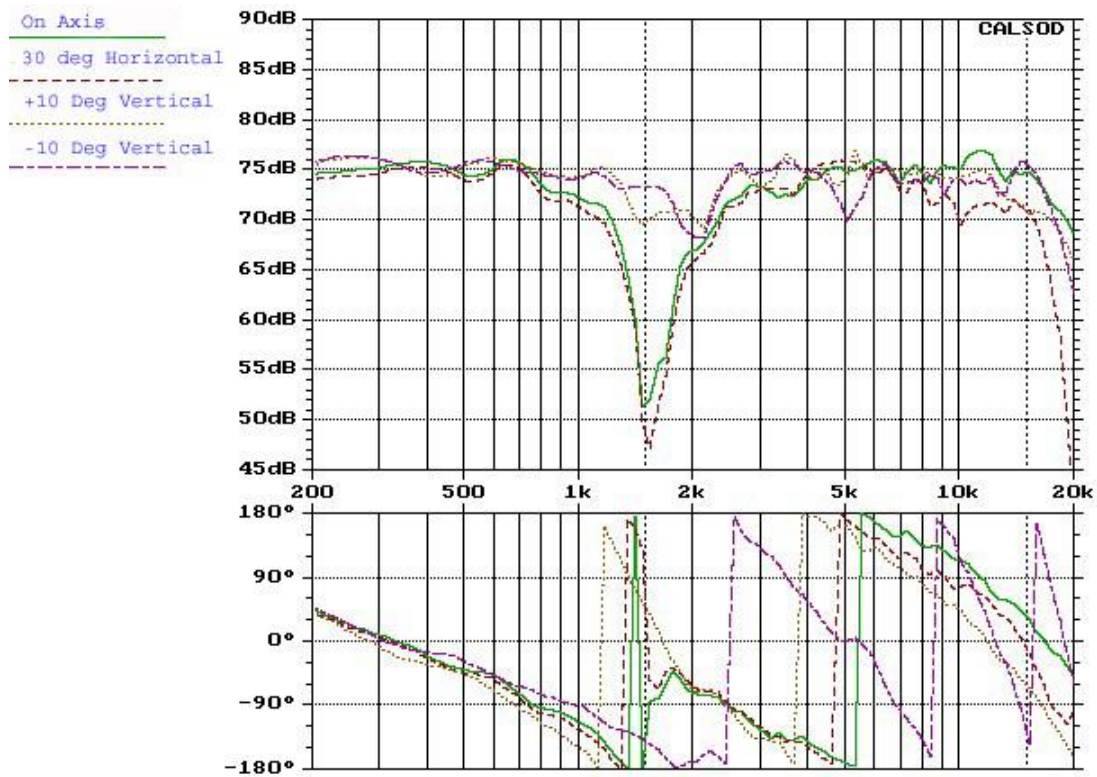
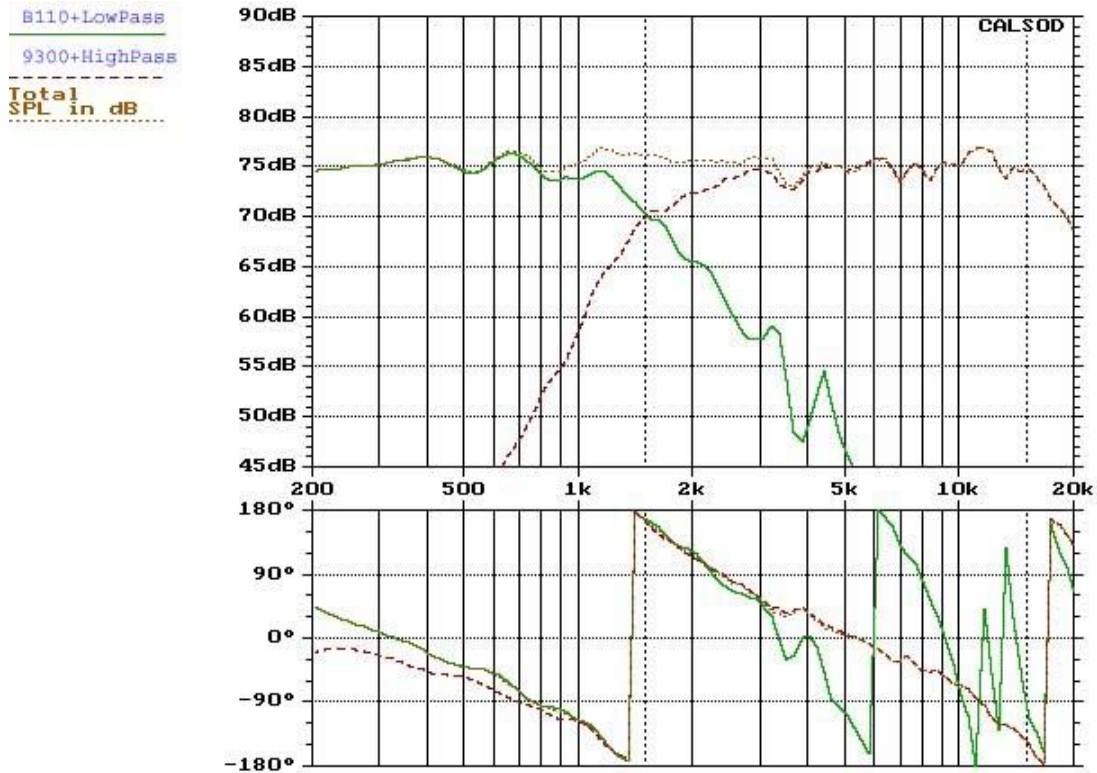
The initial crossover strove for flat response, a strong inverse null, and flat off axis response out to 30 degrees horizontal. After several years of listening and tweaking, it was abandoned for a simpler topology that was more natural and neutral in my room. The initial crossover is still shown here as it may provide more satisfying results in a large or heavily damped room.

The initial crossover design utilized 10 elements, with most values easy to source save the 50.9 uF capacitor (Solen may still carry it). Attempts were made to reduce the capacitor size, but all resulted in unfavourable trade-offs such as an off axis depression from 3 to 6 kHz which sounded more like an 8 kHz bump, with attendant low level glare. This crossover has no such residual tendency. The crossover is shown below. Slightly larger coil resistance is allowable, but at the expense of slightly increased low-end bloom.

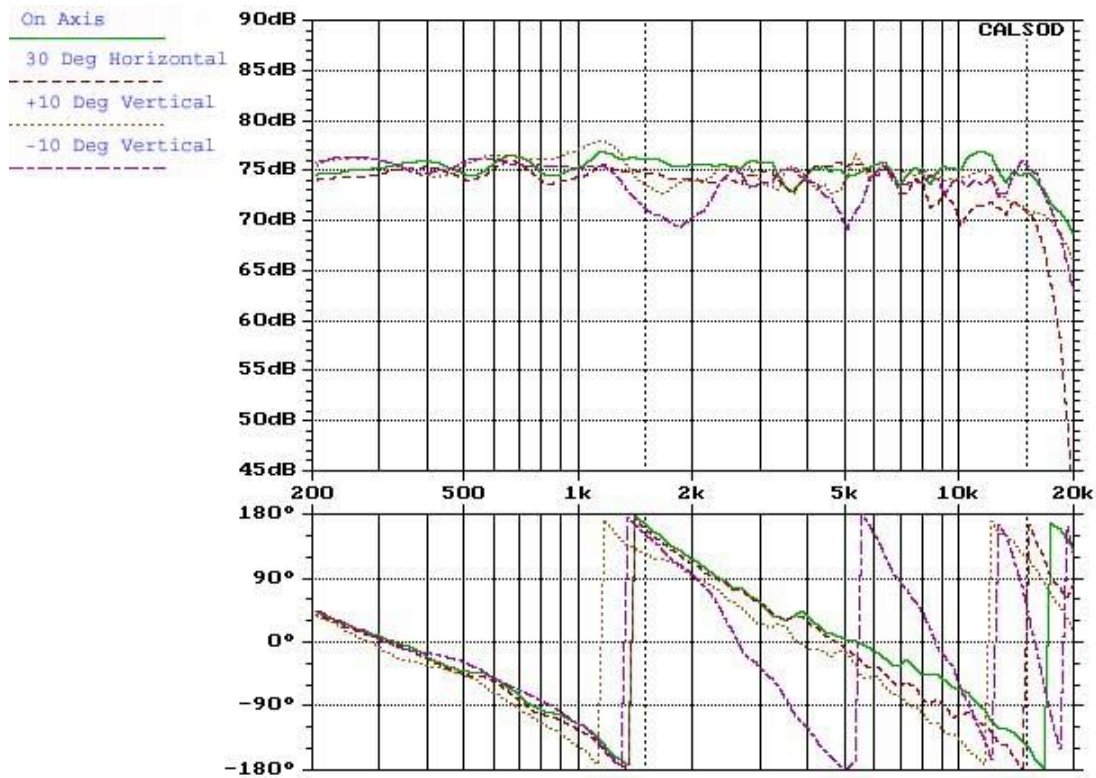
NO	TYPE	VALUE	TOPOLOGY
1	VIN	2.8284 V	0 1
2	IND	1.7900 mH + 0.4900	1 2
3	RES	6.8000	1 2
4	CAP	18.4000 uF	1 2
5	IND	1.1400 mH + 0.2700	2 3
6	CAP	50.9000 uF	0 3
7	CAP	4.3000 uF	1 4
8	IND	0.7500 mH + 0.2900	0 4
9	RES	8.0000	4 5
10	CAP	2.2000 uF	0 5
11	RES	33.0000	0 5
1	KEFB110		0 3 Positive Connection
2	Scan 9300		0 5 Positive Connection

The low pass topology consists of a parallel LCR trap followed by an electrical second order. The high pass is electrically second order. The L-Pad values were chosen so that a capacitor could be placed across the shunt L-pad resistor, and not drive low system impedances at high frequencies.

The on-axis response of the woofer+low pass and the tweeter+high pass, and their summed response, is shown following with the resonances down 15 to 20 dB. The reverse null depth is shown in the subsequent diagram. The depth of approximately 25 dB indicated good phase matching, and the equivalency of depth for +10 degrees vertical and -10 degrees vertical indicate a reasonably well-centered lobe. No attempt was made to chase classical filter shapes in the acoustic domain, but every attempt was made to keep the woofer and tweeter in phase through crossover, to maximize correlated addition and minimize any phasiness through the listening window.

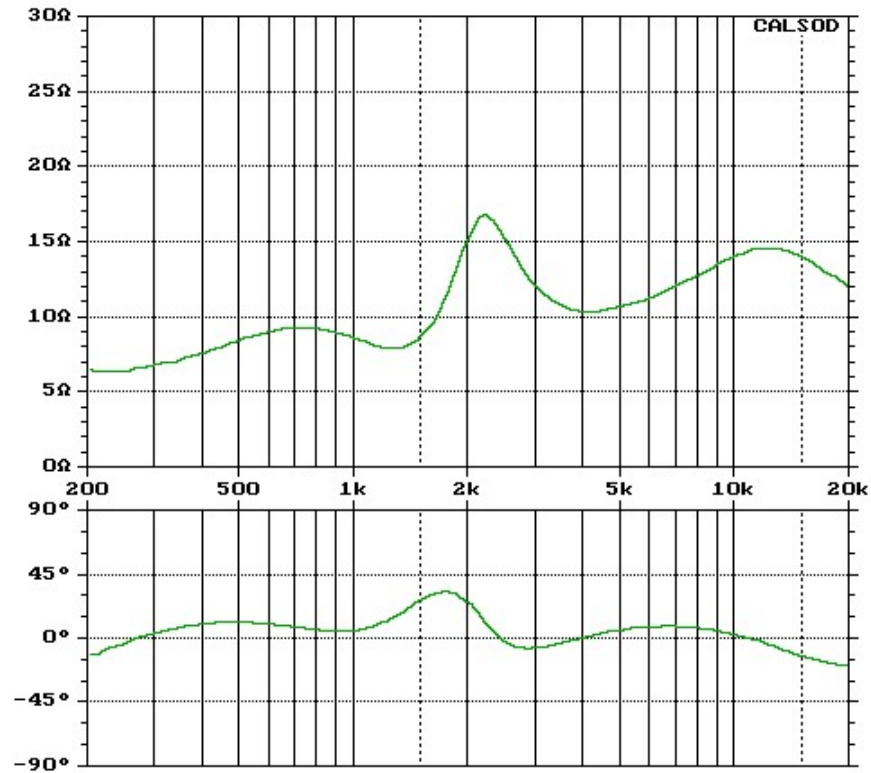


The off axis responses follow. It can be noted that the -10 degree response has two dips, one centered at 2 kHz and another at 5 kHz. These are not audible and represent a listening angle that would not be used in practice. While the source of the dips is unknown, they show up in the raw driver responses and are assumed to be a side effect of the felt above the woofer.



The design presents an extremely easy load to an amplifier, as shown in the following curves. The phase spends most of its time between ± 15 degrees except for a slight inductive reactance near crossover, and the magnitude of impedance is always above 6 ohms, typically greater than 8 ohms.

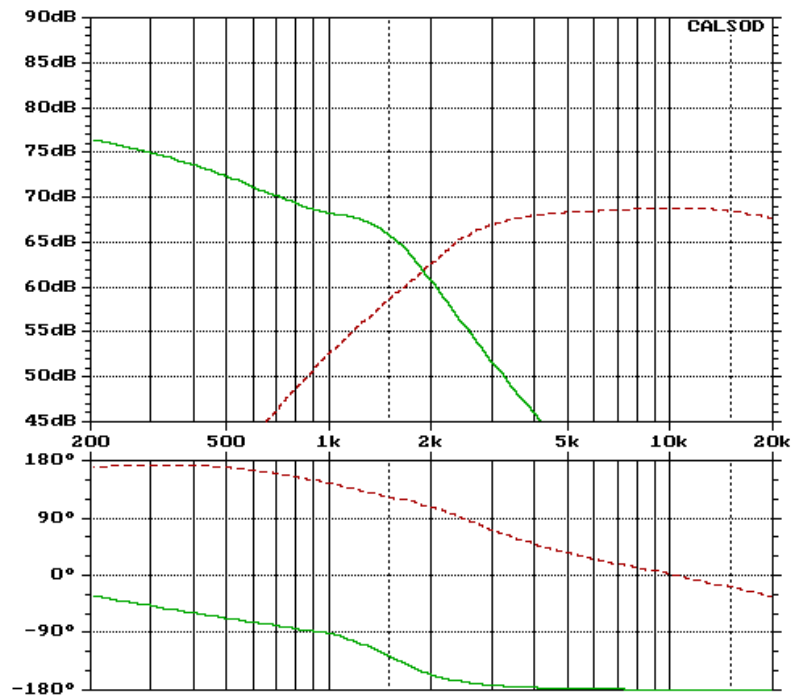
Input Impedance



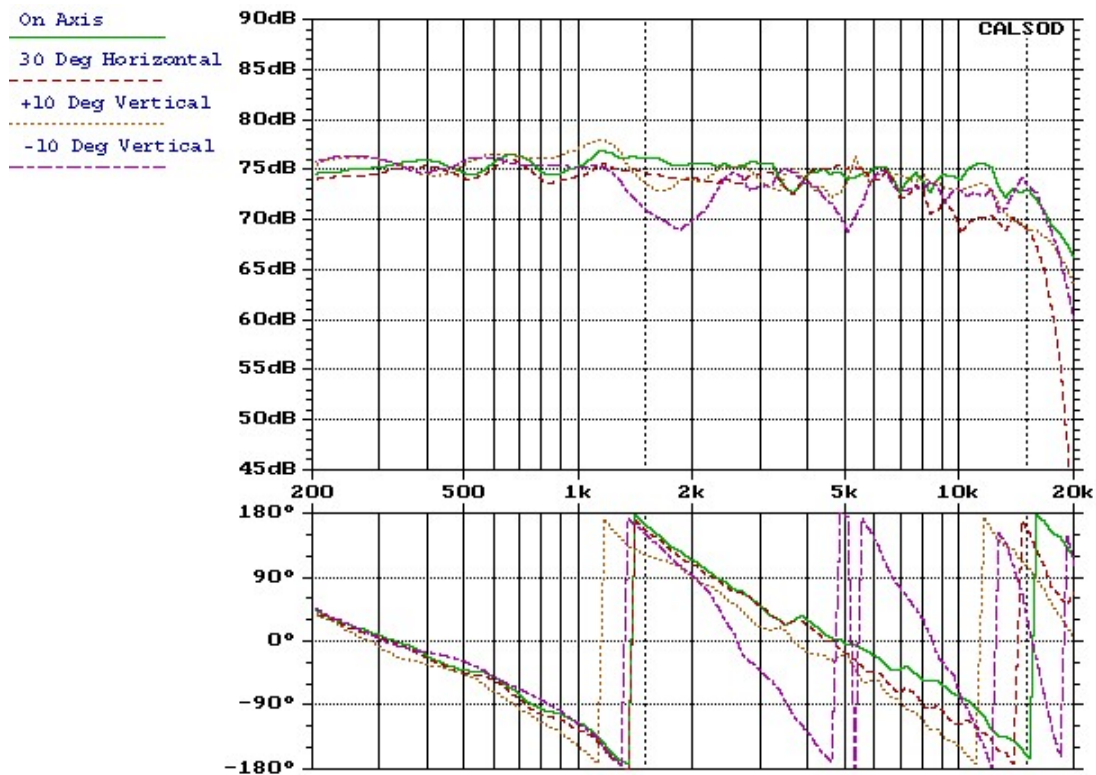
The impedance will always be at least 8 ohms at high frequencies due to the 8 ohm series resistor.

The crossover electrical response is now shown.

DATA BODE Filter dB

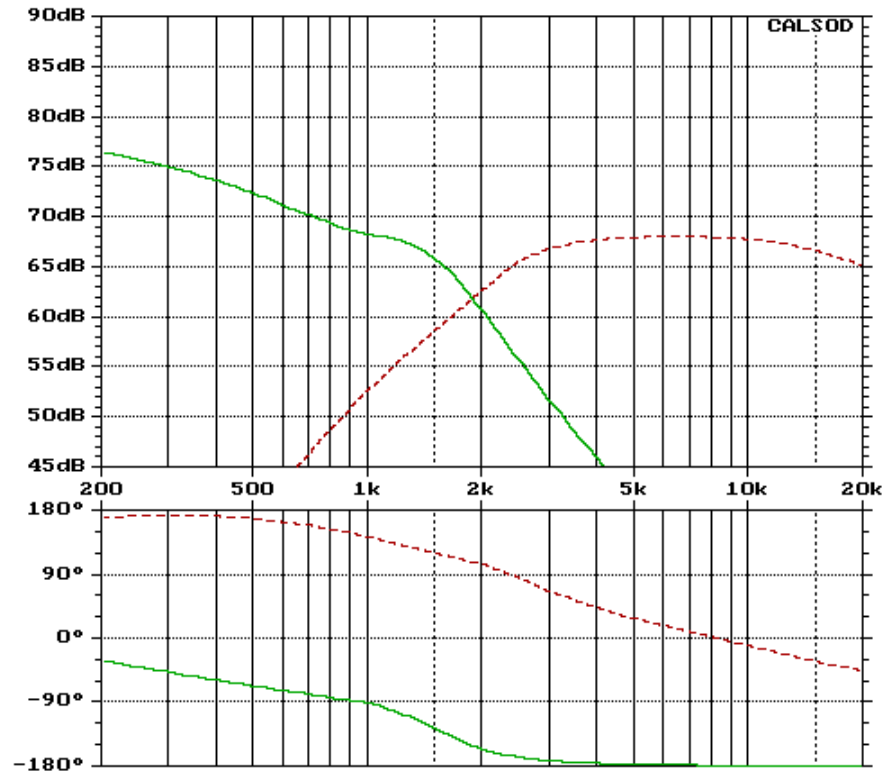


Additional options were trialed. One was to gently slope the very top end by increasing the 2.2 uF capacitor across the shunt resistor. The first graph following illustrate the responses with the capacitance across the 33 ohm resistor increased to 3.3 uF (along with electrical crossover response), and the last with the capacitor at 4 uF. The L-pad design ensures the impedance never drops below 8 ohms, and the phase angle of impedance with these changes stays above -15 degrees from 10 to 20 kHz.



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Filter dB

DATA BODE
Filter dB

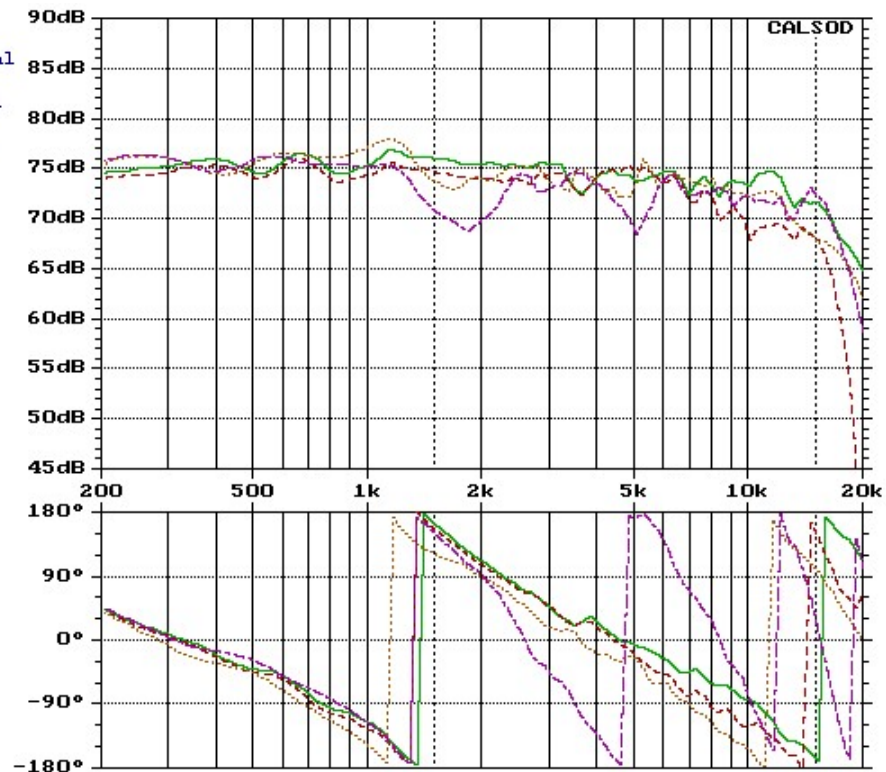


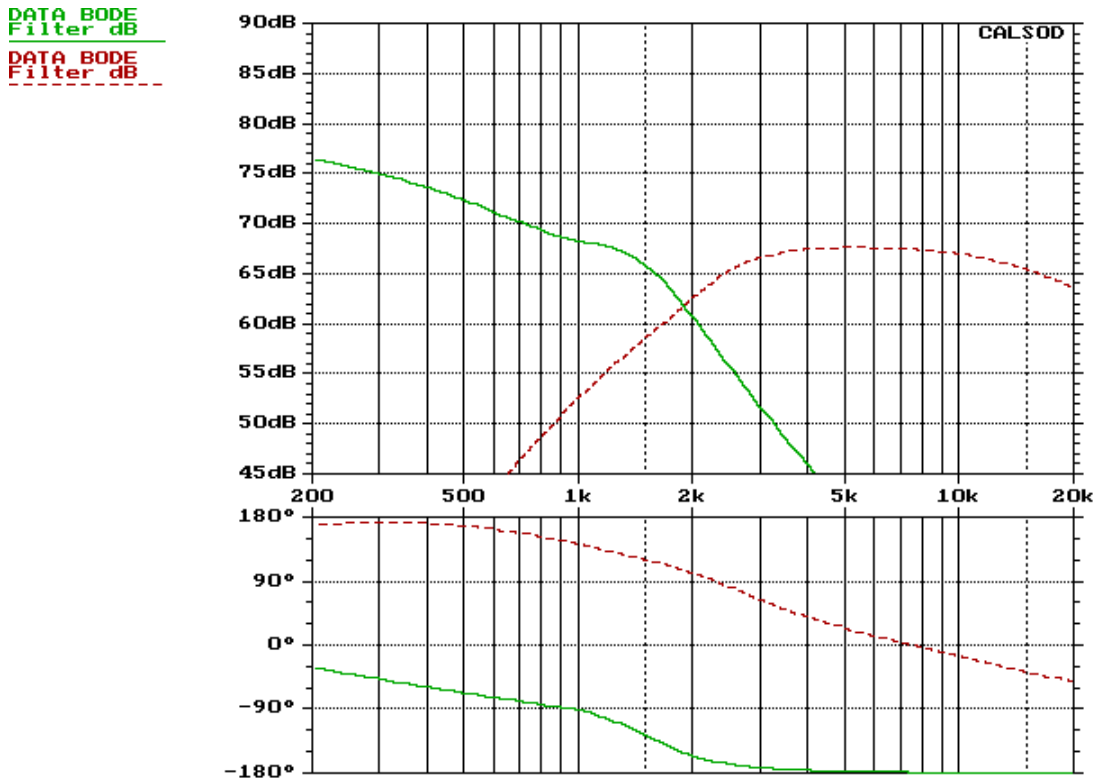
On Axis

30 Deg Horizontal

+10 Deg Vertical

-10 Deg Vertical





Several other response shapes were explored. This speaker clearly did not like a “BBC dip”, resulting in unfocussed vocals. More significant baffle diffraction compensation provided too much mid bass bloom. Finally, the limited low end resulted in a bright speaker if the tweeter’s rising impedance wasn’t compensated for.

The final “initial” design resulted in a focussed and fairly open sounding speaker, if perhaps being occasionally just a bit hot in the very top end, in my very lively room. Neutral recordings still sound properly balanced, but this was not an old style euphonic speaker by any means, it is quite neutral as indicated by the responses. As it stands, the speakers sounded best toed in approximately 15 degrees. This lent focus to the sound stage and the most favourable top end, without removing the sense of air.