

Dipole Horbach-Keele Mid-High-System

Purpose: Testing / Extending the Horbach-Keele Theorem onto a Dipole Subsystem (170-20'000Hz) and non-ideal, real-world Drivers within a Hobbyists environment.



Early Prototype with $x_1=50\text{mm}$, $x_2=141\text{mm}$, $x_3=322\text{mm}$

Tweeter: Peerless/Vifa XT25SC

Midranges: Peerless 830983

Mid Midranges: Seas/Excel W12CY

Low Midranges: Seas/Excel W22EX

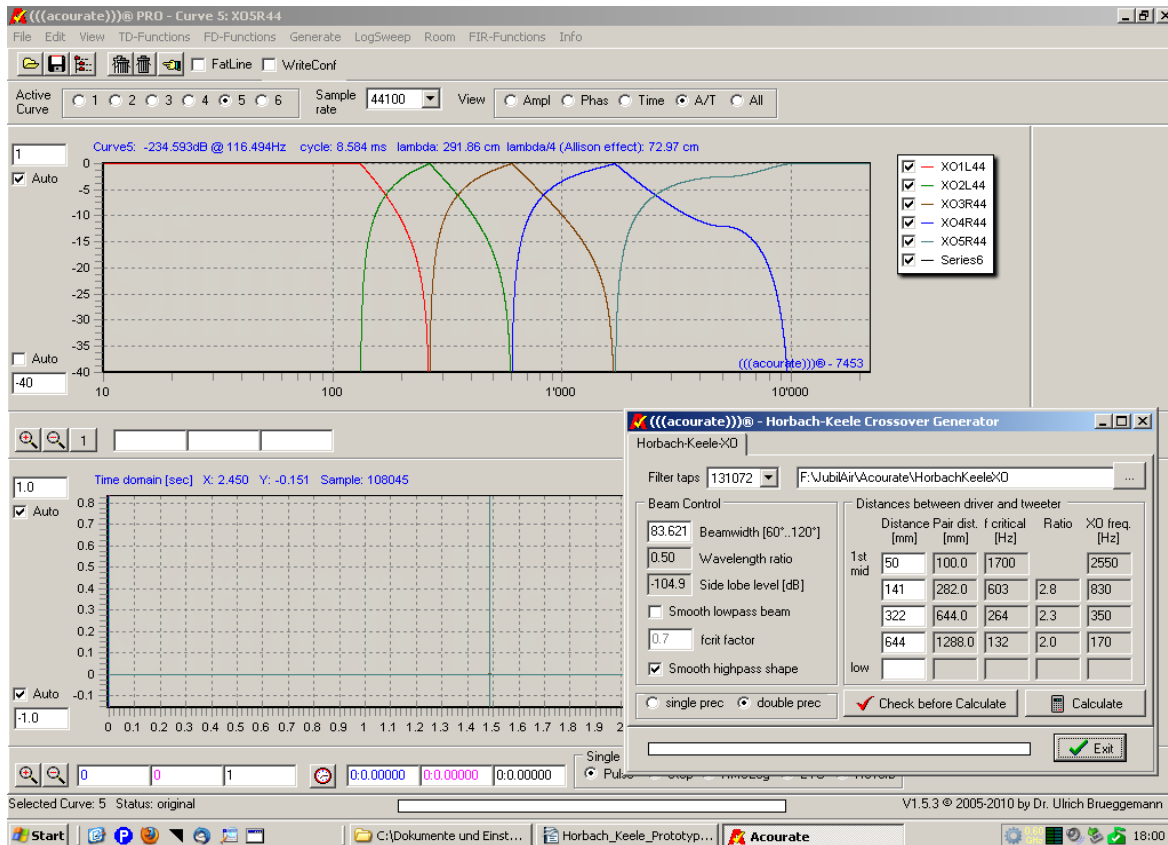
Filters: Acourate

Convolver Unit: Linux/Brutefir, DA-Section RME HDSP 9632 and AIO4S-192

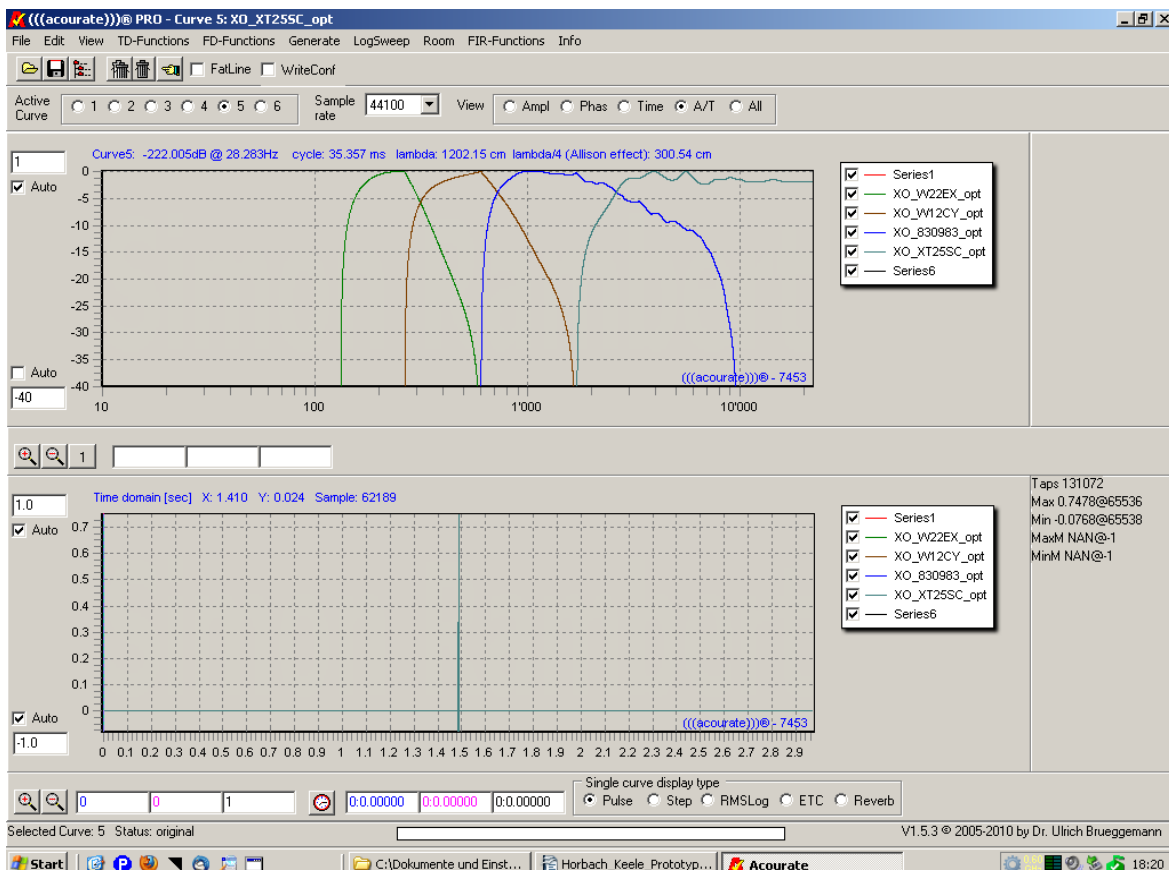
Amplifiers: Conventional Analogue Technique

Measuring Gear: ARTA / EMU0404USB

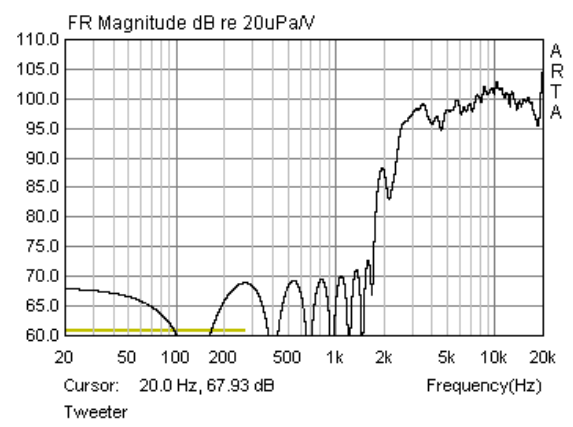
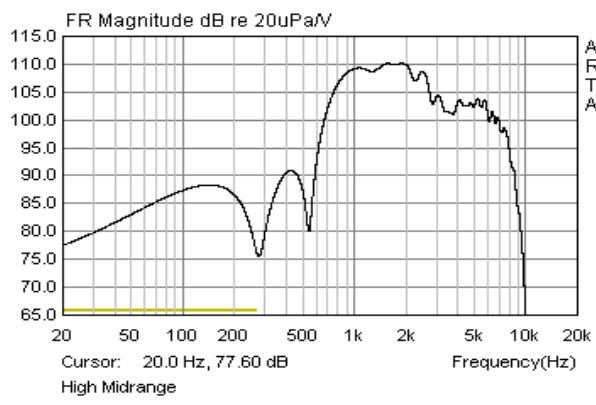
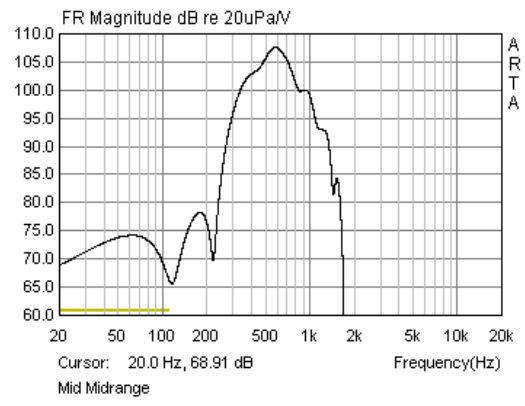
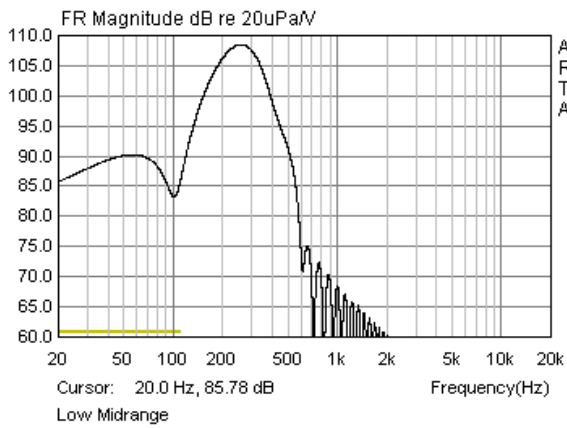
Initial Filter Generation within Acurate:



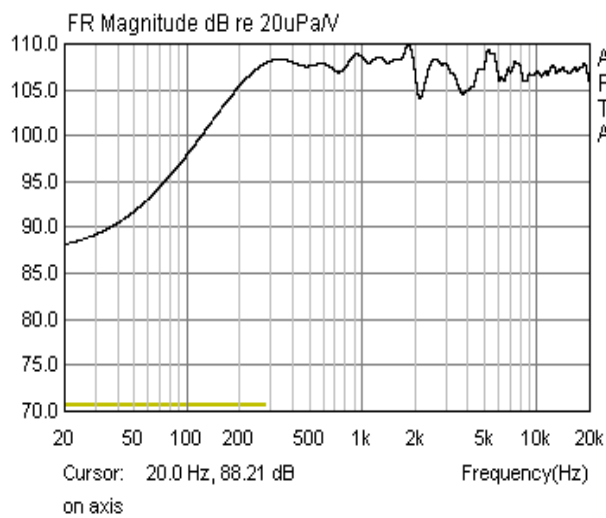
... and the Result after having processed them to match the acoustical behavior of the Drivers mounted to the Baffle. Notice the "Tilt" in the filters of the three Driver pairs due to the inherent Dipole Baffle Correction of the individual Drivers:



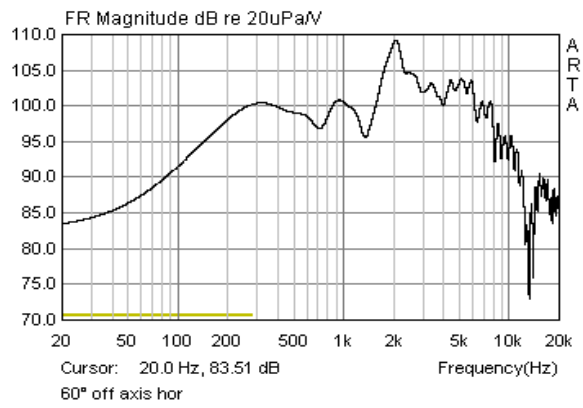
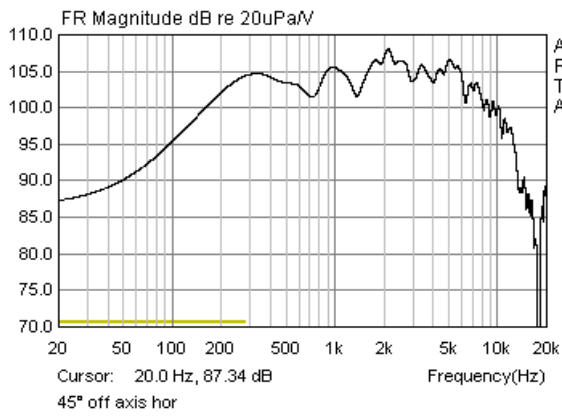
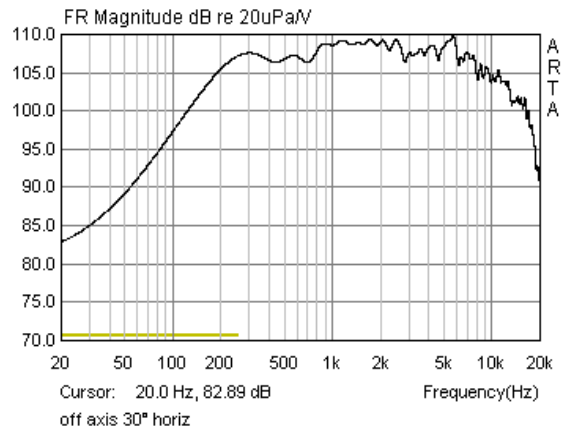
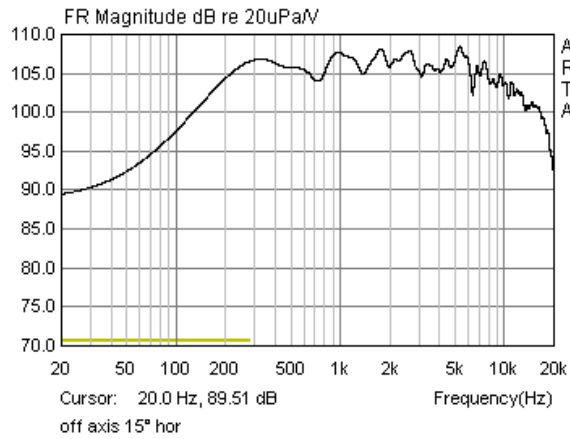
Measured Real-Time-Response of the three Driver Pairs and the central Tweeter processed by the Filters through the convolution Engine:



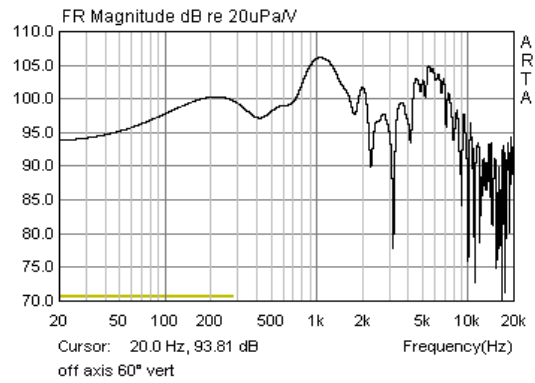
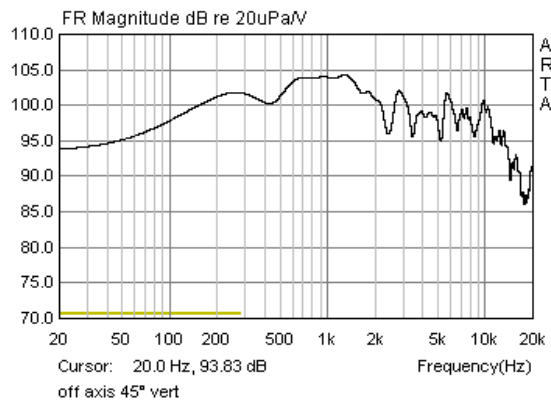
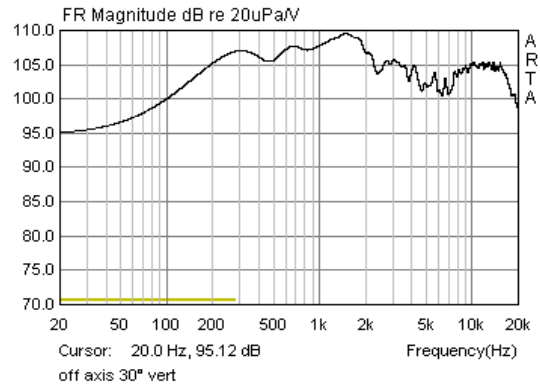
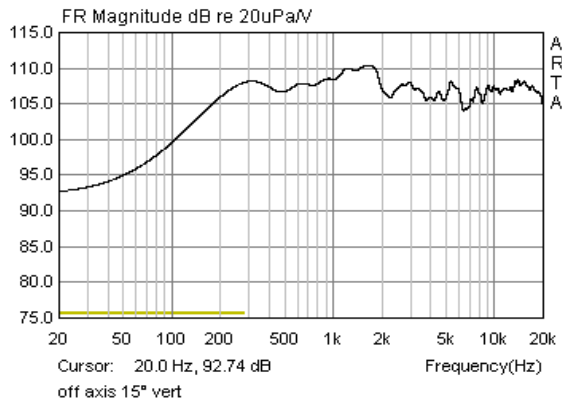
On Axis Frequency response of the 4-Way-system. The sharp delta-6-dB-Step around 2kHz is one of the Anomalies of the Prototype which will have to be tracked down in one of the next desing step:



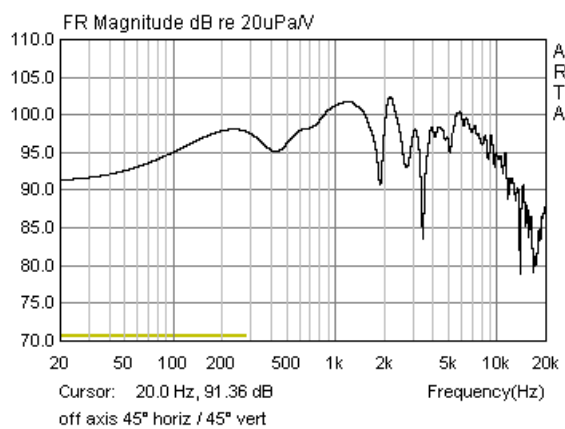
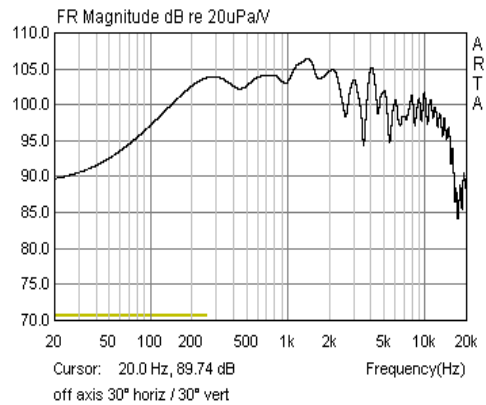
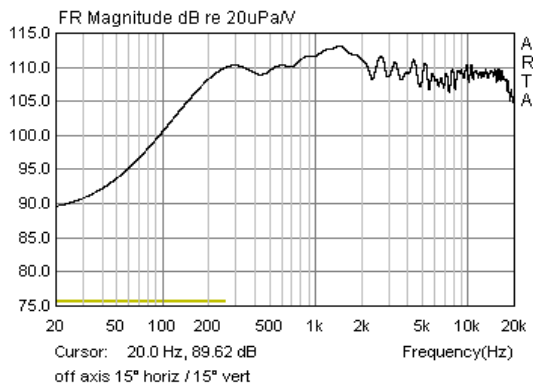
Horizontal Off-Axis Response.



Vertical Off-Axis Response



Oblique Response



Comment:

As expected, Horbach-Keele-Filters seem to be suited not only for ideal monopoles as published by its Authors, but seem to be promising also for real-world Dipoles. Horbach-Keele-Filters are easily generated within Acourate and have provided a surprisingly appealing result in a first, truncated (no Bass) Hobbyists Prototype (actually max. ± 5 dB Deviation of the SPL horizontally and vertically over 0 to $\pm 45^\circ$ from 250 to 10'000Hz).

Please note that the presented Results have a very preliminary character and are based on a very simplistically theoretically designed (only Design goal: d as small as possible, but as to insure >100 dB/1m), first and non-refined, simply machined MDF (with untreated Resonances) Dipole Baffle Prototype, as shown in the Picture above. All measurements were done under non-ideal, "domestic" conditions (some outside noise, room and gear reflections), do include errors (flaws of the AD-unit/USB interface) and are reflecting the actual and very early status of a Project, "as is". So all measurements can and must be interpreted as "worst-case" and are very transitory.

The actual State is a Dipole Subsystem and it will have to be extended for a full Dipole Bass response, making up a 2 x 5-way System. The tweeter section also will have a dipole characteristic in a further prototype. Refinements will hopefully show substantial improvements over the actual results in terms of the polar behavior (Goal max. ± 2.5 dB over all angles up to min. 45°).

Simon Rambert, July 2010