DIY kit

SEAS Lucid

A High-Performance active loudspeaker kit featuring the SEAS Metamodal TPCD drivers T29X and W16NX005

Designed at the SEAS R&D laboratory.

This loudspeaker was made during the development of the Metamodal TPCD drivers to use as a platform for listening tests in parallel with the extensive measurements. We enjoyed it so much that we decided to put this into a kit to share with everyone.

Drive units

The tweeter is the new 1" SEAS Metamodal TPCD dome tweeter T29X. This is an excellent choice in any speaker with the TPCD dome that finely balance the stiffness, weight, and damping, ensuring clear and accurate high-frequency reproduction. The tweeter also features a patented HEXADYM magnet system and a Titanium voice coil that together minimises damping and allows for a good force transfer to reproduce all the nuances in the music.

The low end is taken care of by the SEAS Metamodal TPCD woofer W16NX005. It has a large excursion capability for its size to bring out that low end punch. The compact size also means that we get a nice and wide dispersion to make a smooth transition into the tweeter. This woofer also has an FEA optimized magnet system and titanium voice coil former that lowers the distortion and improves the dynamics.

The Enclosure

The enclosure was chosen to be a 14L closed box to avoid the issues of port noise, midrange leakage and resonances that you can often get from ported speakers. To get the transients as good as possible we chose a size that was larger than the typical maximally flat alignment with Qbox = 0.707. Instead, we opted for a size that was closer to the critically damped tuning with Qbox = 0.5. The wider baffle lowers the baffle step frequency and helps to put some more body into the midrange.

The Crossover

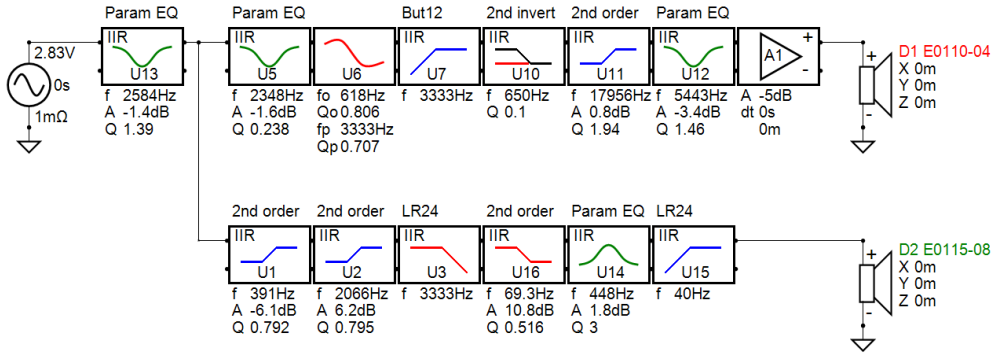
We chose to use an active crossover since that makes it possible to test many different setups in a short time and fine tune the sound balance. Another benefit is that it gives the ability to EQ the low end since the closed box starts the roll off at a higher frequency than ported or horn loaded enclosures.

In this kit we used a miniDSP 2x4HD to do the dsp task, but it could also be implemented on most other dsp platforms.

With the crossover we aimed for a balance between a smooth and slightly falling response in the listening window and a smooth power response. The listening win-

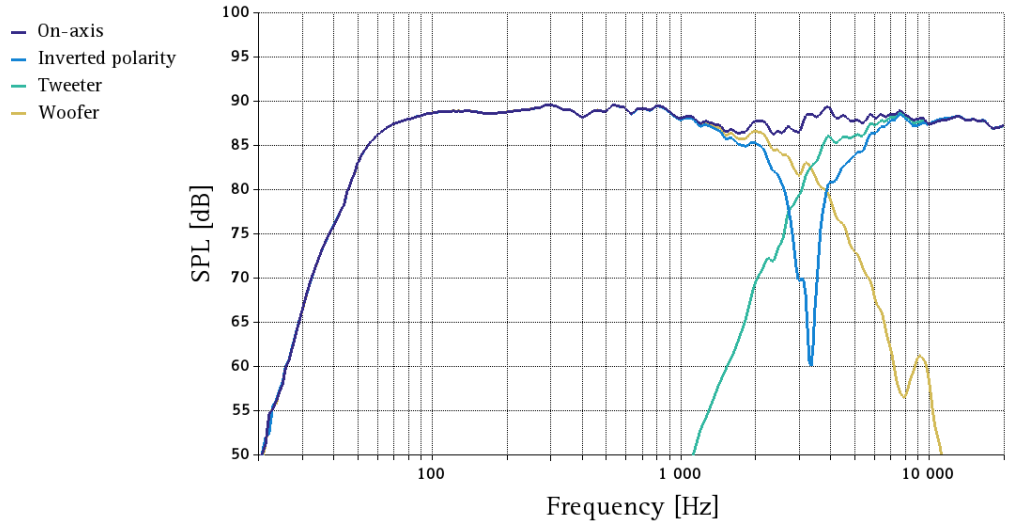
dow is here defined as the average response within 0-30 degrees. To achieve this, we have used a selection of parametric EQ's, Pole shift, high and low pass filter, shelving and an all-pass. The all-pass filter is used to get the two drivers in phase over a large frequency range for a seamless crossover between them. The woofer has a high pass filter at 40Hz to supress distortion from excessive low frequency excursion. This filter can be set to a lower frequency or turned off at the cost of a more limited max SPL output.

The schematic for the dsp setup is shown in the below graph. The setup file for the miniDSP is available as a download on our web, SEAS_Lucid_files. This also includes the measurements of the drivers in the box and the VituixCAD file for simulating the crossover. This can be used to explore other ways of tuning the dsp or even make a passive crossover if that is preferred.

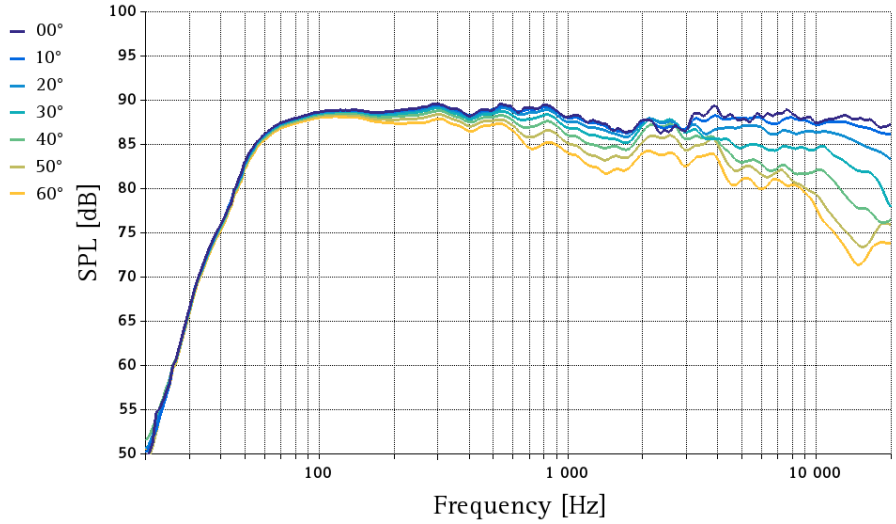


Measurement Results

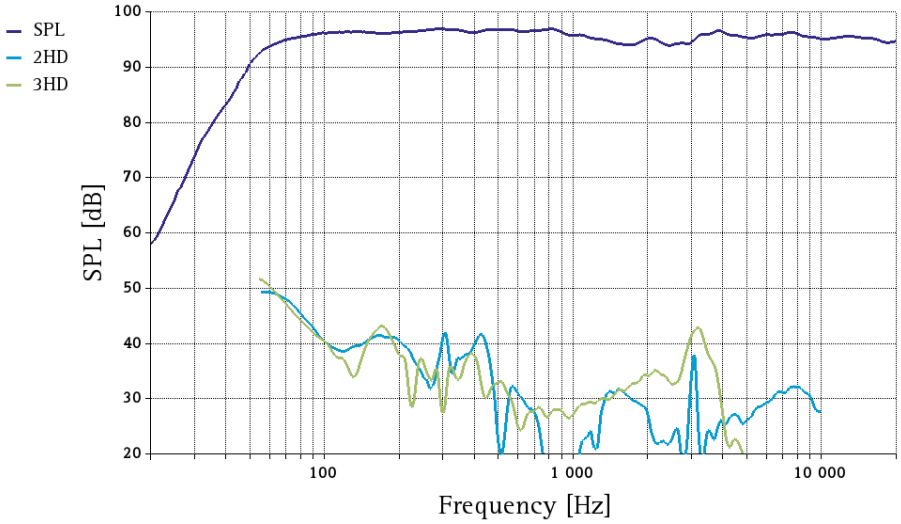
The on-axis measurement of the SEAS Lucid kit, including the individual drivers and a measurement with the tweeter polarity inverted is shown below. The crossover frequency is at 3333Hz, and we can see that the drivers have a symmetric roll-off. From the inverted tweeter polarity measurement we see that it gives a deep cancellation that tells us that the drivers are in phase.



The next graph shows the off-axis response. Here we can see a nice and controlled off-axis dispersion. Then we know that the room reflections also have a smooth frequency response so that we get a large and natural sound stage.

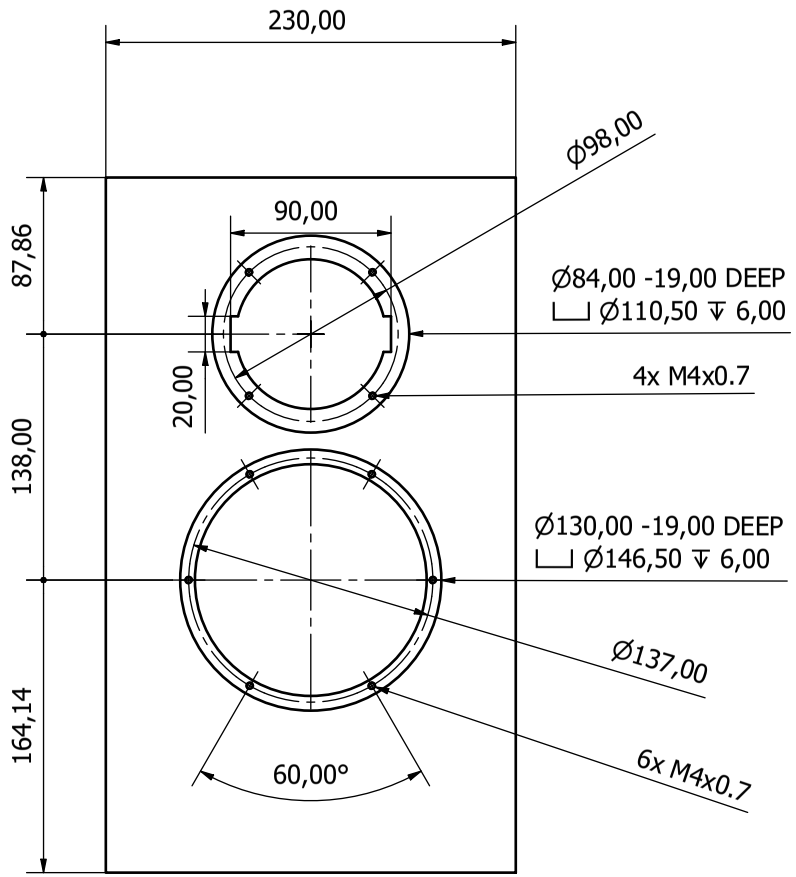


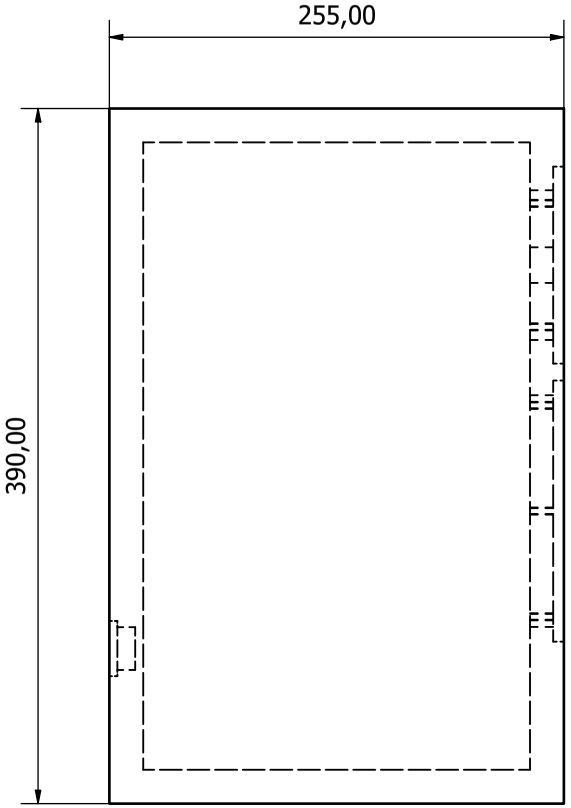
The harmonic distortion is shown in the last graph below. Here we have set the on-axis SPL to be 96dB averaged from 100Hz-10kHz. Then we can see that this speaker has a very low distortion, even at a high SPL output.

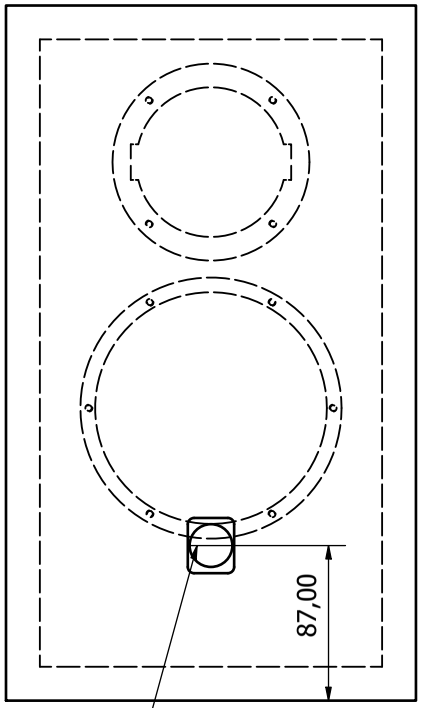


Listening Room and Placement

High quality stands should be used to bring the tweeter approximately to ear level or slightly above. Even if your listening room is good, and large enough, it is important to determine those positions where the loudspeakers can perform at their best. Placing the cabinets close to the walls or corners will result in more powerful bass, but may also bring about response irregularities in the bass or midrange area. Some experimentation is recommended in order to find cabinet positions and toe-in which result in a good tonal balance, defined sound stage and freedom from coloration.







Material: 19mm MDF
Finish: To your liking!
Damping material: Wool or polyester foam. Lightly fill the whole cabinet.

Designed by	Checked by	Approved by	Date		Date	
haavard					17.03.2023	

seas
The Art of Sound Perfection

SEAS_Lucid_cab	Edition	Scale