Mini CSA 2 Concept
Measurement Data
This concept prototype loudspeaker developed by Sausalito Audio uses a 3” woofer and a 3/4” dome tweeter. The enclosure was 3D printed and is 8.5” high and 4” in diameter. This is the smallest embodiment of the CSA so far. This prototype is intended to demonstrate application of CSA waveguides for wireless and voice assistant type speaker products.

The measurement shown here are with static equalization and an 1850Hz crossover only. Dynamic equalization and other bass enhancement techniques are employed in addition to the static processing for actual demonstrations. This is not uncommon in such products to “coax” more bass from very small woofers.

Please note that the 0° vertical reference axis has been shifted up by 10°. So 0H0V as labeled in the charts below is actually 10° up from the physical center of the waveguide. This was done because the use case envisioned for the speaker is for it to be played while sitting on a counter top, coffee table, etc. with the listener’s ears somewhat higher.

All measurements were made at Sausalito Audio which does not have a full anechoic chamber. The data is anechoic to ~500Hz and becomes increasingly corrupted by room reflections below that. Below ~150Hz the data should be largely disregarded.
Figure 1: Spinorama chart for the Mini CSA 2 Concept. For information on how to interpret this chart, please see “Interpreting Spinorama Charts” on the SA web site.

Figure 2: Frequency response curves at the referenced horizontal angles. 0° vertical in this case is taken as 10° above the center of the mouth of the waveguide. For CSA loudspeakers, it has been Sausalito Audio’s convention to use 20° horizontal, 0° vertical as the reference axis.
**Figure 3:** The data from figure 2 normalized to the reference axis of 20° horizontal, 0° vertical to more clearly show how the response of the speaker changes as one moves off the center line.

**Figure 4:** Response curves for 10°, 20° & 30° above the 0° vertical reference which in this case is 10° above the center of the waveguide.
Figure 5: Response curves for 10°, 20° & 30° below the 0° vertical reference which in this case is 10° above the center of the waveguide.

Figure 6: +10° & -10° vertical response normalized to 0° vertical reference axis to better show change over the 20° vertical listening window.
Figure 7: Horizontal polar response at the indicated frequency. Data is normalized to 0dB and smoothed to 1/3 octave per convention for polar plots.

Figure 8: Horizontal polar response at the indicated frequency. Data is normalized to 0dB and smoothed to 1/3 octave per convention for polar plots.
Figure 9: Horizontal polar response at the indicated frequency. Data is normalized to 0dB and smoothed to 1/3 octave per convention for polar plots.

Figure 10: Vertical polar response at the indicated frequency. Data is normalized to 0dB and smoothed to 1/3 octave per convention for polar plots.
Figure 11: Vertical polar response at the indicated frequency. Data is normalized to 0dB and smoothed to 1/3 octave per convention for polar plots.

Figure 12: Vertical polar response at the indicated frequency. Data is normalized to 0dB and smoothed to 1/3 octave per convention for polar plots.
Figure 13: The chart shows the -6dB point as a function of frequency and coverage angle.