Truextent Tech Brief

Be4016 in Radian 950PB driver

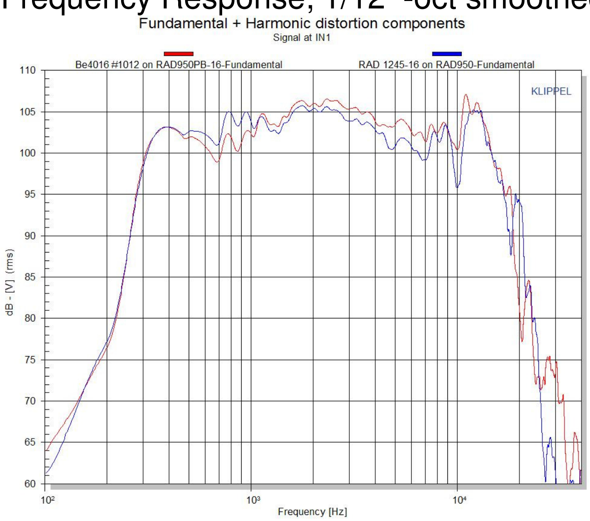
Peter J. Andrews
Sr. Electro-Acoustics Engineer

Recently, our customers have been noticing the high performance of the Truextent Be4008 and Be4016 in the Radian 950PB compression driver. One European distributor has even decided to sell this combination as, effectively, one product.

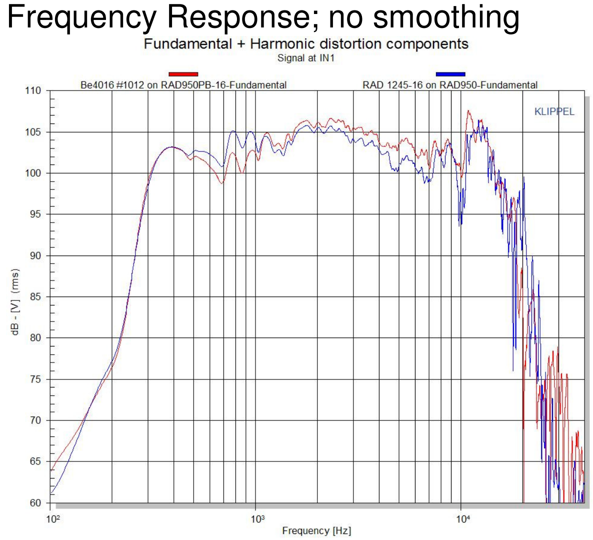
This Tech Brief will compare the performance of two diaphragms: the Truextent Be4016 and Radian's 1245-16, both mounted in a Radian 950PB-16 compression driver. All curves are taken in the Truextent Acoustic Test Chamber with the compression driver mounted on a JBL 2386 horn. Each diaphragm is driven with a 1Vrms sine chirp (log sweep), and the microphone is ~0.5m from the compression driver throat. Similar results would be expected comparing 8-ohm versions.

First we show on-axis frequency responses, both smoothed (12^{th}-octave) and unsmoothed. The beryllium diaphragm is shown in red, the aluminum in blue. The smoothed curves (left) are representative of what one might see in published datasheets. They show that both diaphragms cover roughly the same frequency range at roughly the same level. A casual observer might even think there isn't much difference between the two except for the higher output and flatter response in the critical 2-10kHz range (beryllium shows +3dB near 5kHz).

Frequency Response; $1/12^{th}$-oct smoothed



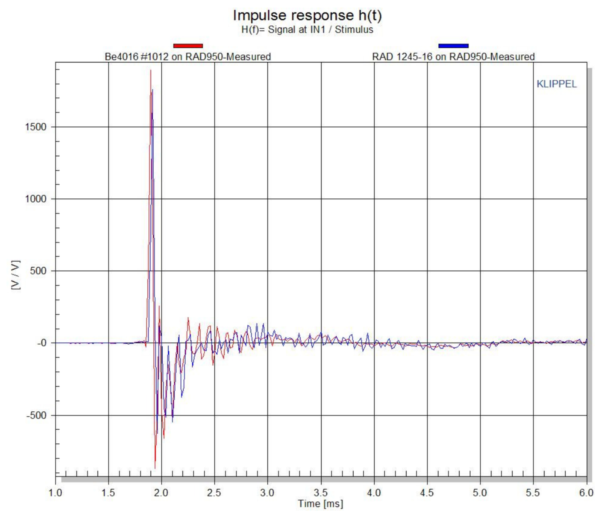
Frequency Response; no smoothing



The unsmoothed curves (right) are a bit harder to read because of what looks like noise, or sharp peaks and dips, in the high-frequency region. Of course, this is not noise, but rather densely packed break-up modes of the diaphragm. The aluminum diaphragm (blue) clearly shows this behavior above ~10kHz, whereas the beryllium diaphragm (red) remains smooth to over 20kHz, with dense modal break-up starting at around 23kHz. This agrees with the theoretical work done in our AES paper of 2010 (predicted ~2.4x higher onset of break-up).

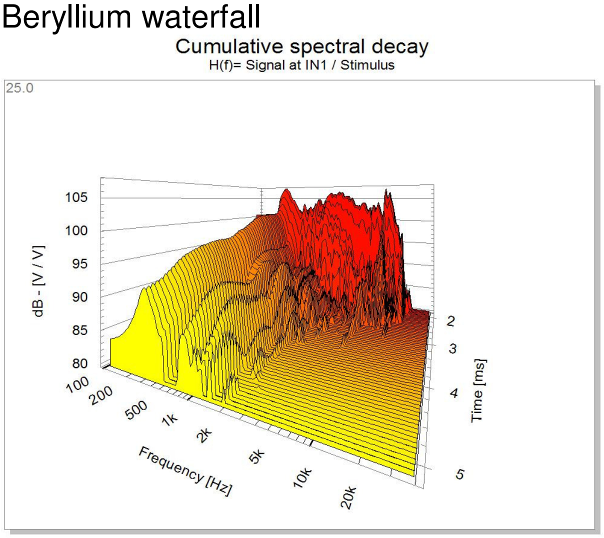
While the frequency response can be (and usually is) smoothed to hide this behavior, the time-domain response (impulse response) gives us a clearer view of what's happening here.

The basic measure of time-domain performance is the impulse response. This shows the pressure vs. time as measured at the microphone when a short-time, wide-frequency pulse is presented to the transducer. The impulse responses of the two diaphragms are compared below. Notice the faster rise time on the beryllium (red), including greater instantaneous pressure peaks, and the faster settling time as well. The rapid fluctuations (high-frequency pressure variations) in the aluminum (blue) continue across most of the graph, while these features die out much more quickly in the beryllium, becoming a smoother curve after about the 2.8ms mark (1ms after first arrival).

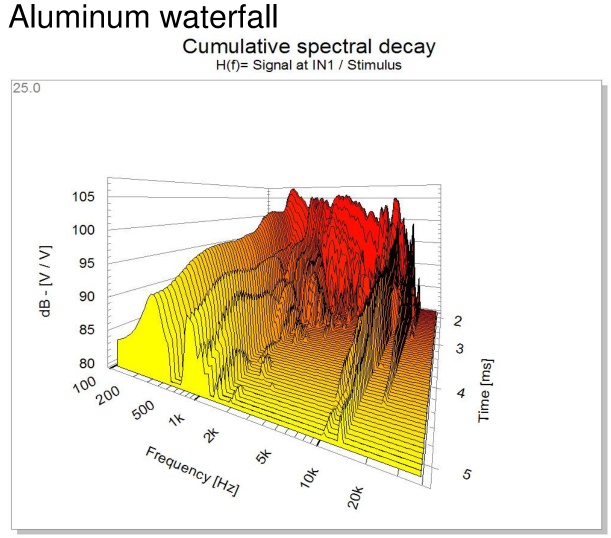


Putting it all together, we can view both time and frequency response on the same graph using 3-dimensional cumulative spectral decay (waterfall) plots. Here, we can clearly see the break-up of the aluminum diaphragm (right) above 10kHz, with resonances clearly ringing out past 5ms (>3ms after first arrival). The beryllium (left) remains very well-behaved throughout the top octave, and has no visible ringing after about 2.8ms (~1ms after first arrival).

Beryllium waterfall



Aluminum waterfall



In conclusion, the frequency response, especially if smoothed, does not tell the whole story about the sound one can expect from a speaker. But if we look closely at both the frequency- and time-domain responses, we begin to see why listening tests have evoked words like ‘transparent,’ ‘clarity,’ and ‘a veil is lifted’ when listening to the beryllium.