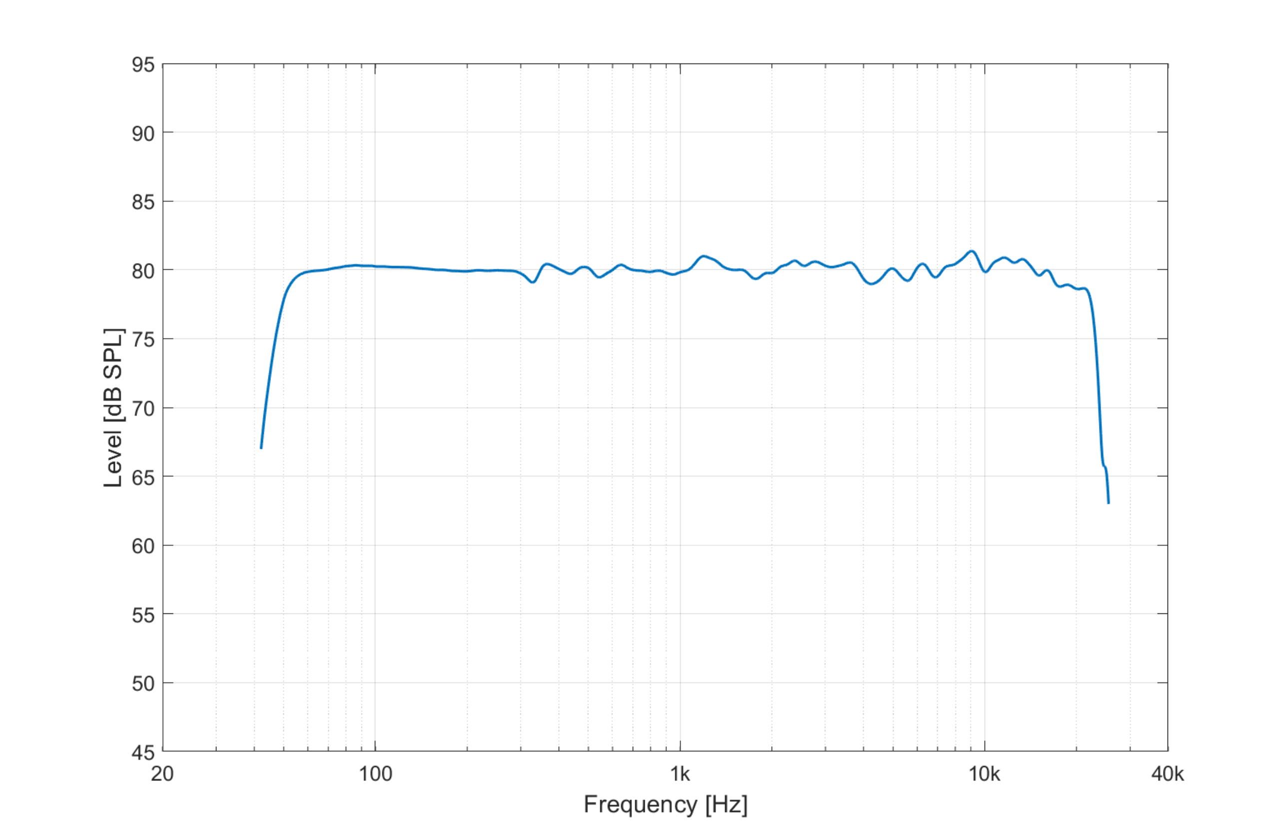
D3V

Active
Desktop
Monitoring
System

Measurement
Report
→ English

ADAM AUDIO



Frequency Response

The on-axis frequency response shows the sound radiating from the loudspeaker along the acoustical axis (a position on the front panel between the tweeter and woofer). Ideally it is a totally flat line from 0 to infinity Hz but in the real world this is not possible. All loudspeakers are band-limited devices so there is a low frequency roll-off and a high frequency roll-off. The low frequencies should extend as deep as possible for the size of loudspeaker. The high frequency response should extend beyond what one can hear. Between these two frequencies the line should be as flat as possible, but some of things that can stop this from happening are resonances, edge diffraction and system tuning.

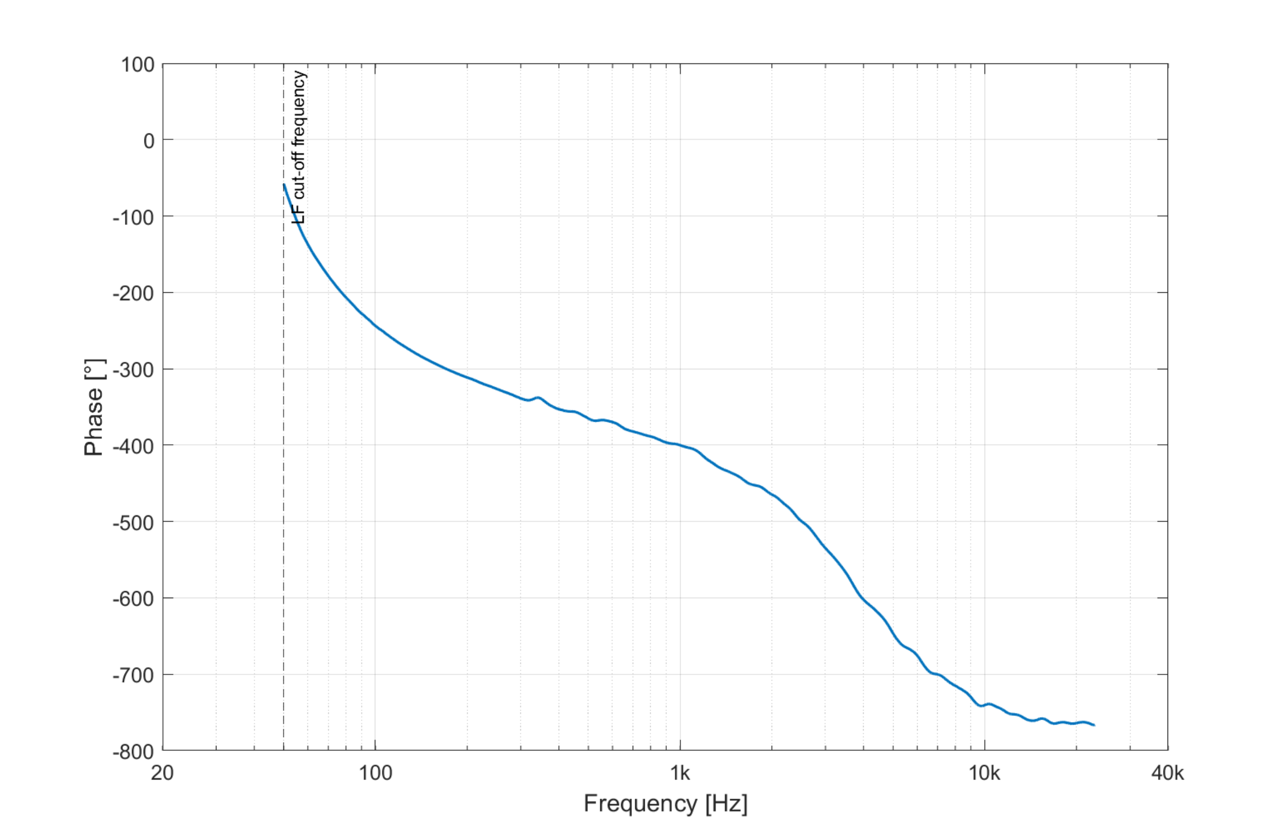
There are two features to note:

1. The D3V has a very flat response

2. The bass extension is exceptional deep for a product of this size due to dual side-firing passive radiators.

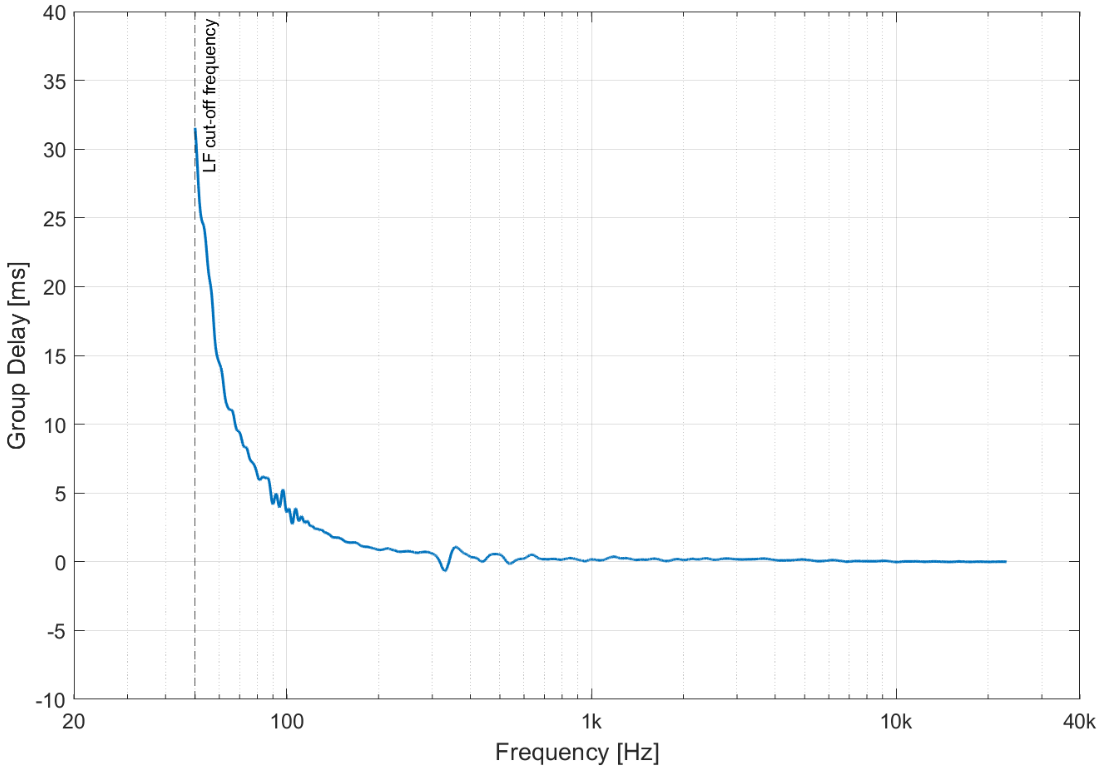
Position, Desk & Room Adaptation Filters

The same comments about the frequency response graph also apply here but this time superimposed on top of the on-axis frequency response are the various backplate control shapes for Position, Desk, and Room.



Phase Response

The phase response shows how the phase of the loudspeaker varies with frequency. Ideally it would be a flat line however that can only be achieved using a computationally expensive FIR filter to impose a frequency dependent delay on the phase response. The result of this would a high latency (20 ms for equalisation down to 50 Hz) which is not practical for this type of product. Therefore, to keep the latency to a minimum (4.0 ms), we have decided not to equalise the phase. However we do see that the ADAM AMT tweeter has a naturally flat phase response which leads to a very open and transparent sound because all the sound from it arrives to the listener at the same time.



Group Delay

Group delay is a measure of the time it takes for the sound to travel through the loudspeaker system: from input signal to sound out of the drivers. Mathematically it is the negative slope of the phase response. Mid and high frequencies can be seen to pass though the loudspeaker system very quickly whereas bass increasing takes longer as the frequency decreases. This is normal for a high pass filter, which is what a loudspeaker effectively is. If the roll-off slope is steeper (e.g. in a vented design vs. a sealed design) and/or at a lower frequency, the group delay peak will be higher. Ideally, group delay would be a flat line along the x-axis where the time taken is zero seconds. However that can only be achieved using a computationally expensive FIR filter to impose a frequency dependent delay on the phase response. The result of this would a high latency (20 ms for equalisation down to 50 Hz) which is not practical for this type of product. Therefore, to keep the latency to a minimum (4.0 ms), we have decided not to equalise the phase and thus flatten the group delay. What we have done though is to minimise any excess increase in the group delay to ensure the loudspeaker sounds „fast“ and „tight“, despite it being a passive radiator design.

Horizontal Isobars

The horizontal isobar plot shows how sound is dispersed into space from the loudspeaker in the horizontal plane. Even when moving around, the listening area in a studio is typical falls within 30 degrees of the on-axis direction, so this area should have the same colour (red) indicating the sound is evenly reproduced throughout the listening area. More extreme angles (represented by the area above +30 degrees and below -30 degrees on y-axis) are important for reflections. These reflections should have the same sound quality as the on-axis sound but at a lower level so they have reduced effect on the sound at the listening position thereby introducing minimal colouration. It is normal for the high frequencies to become quite narrowly dispersed (a function of the size of the driver relative to the wavelength and indicated by a reduced red area width) and for the bass frequencies to be very widely dispersed (red at all angles), with smaller loudspeakers being omnidirectional to higher frequencies than large loudspeakers.

In the D3V we see the red region is generally smooth and controlled, with the only some frequency regions where the dispersion widens slightly. This will not be audible because of the very short listening distance at which the D3V is typically used - one hears mostly the direct sound from the loudspeaker, not the sound from the room.

Vertical Isobars

The vertical isobar plot shows how sound is dispersed into space from the loudspeaker in the vertical plane. It is not so likely that one moves up and down when listening, so this direction is somewhat less important than the horizontal plane. However there can be strong reflections off the ceiling, floor or desktop placed in front of the loudspeaker, so the off-axis sound quality still has some influence on colouration at the listening position. Similar to the horizontal plane, the +/-20 degree region is important and should have the same colour (red) indicating the sound is evenly reproduced throughout the typical listening heights. More extreme angles (represented by the area above +20 degrees and below -20 degrees on y-axis) are important for reflections, with the desktop reflection being the strongest one. Normally one sees a significant narrowing of the directivity around the crossover in vertically placed drivers, in this case around 4 kHz. The dispersion from bass to treble will be similar to that seen in the horizontal plane (omnidirectional in the bass, tending towards a narrowing at high frequencies). It is quite typical that the vertical directivity is not as smooth as the horizontal directivity.

Waterfall Plot

The Cumulative Spectral Decay, more commonly known as a waterfall plot, shows a series of frequency responses of the loudspeaker that are taken later and later in time as one moves from the back of the plot to the front. It is used to visualise resonances. The response at the back is the frequency response shown in the first graph above. It is typical that bass takes longer to decay away hence the decaying ridge seen near the bottom end of the loudspeaker response. Ported and passive radiator loudspeakers have longer decays than sealed designs, and loudspeakers with a deeper bass response also have longer decays. Other resonances should be very short in comparison and ideally not present at all.

In the D3V we see no strong resonances.

Spectrogram

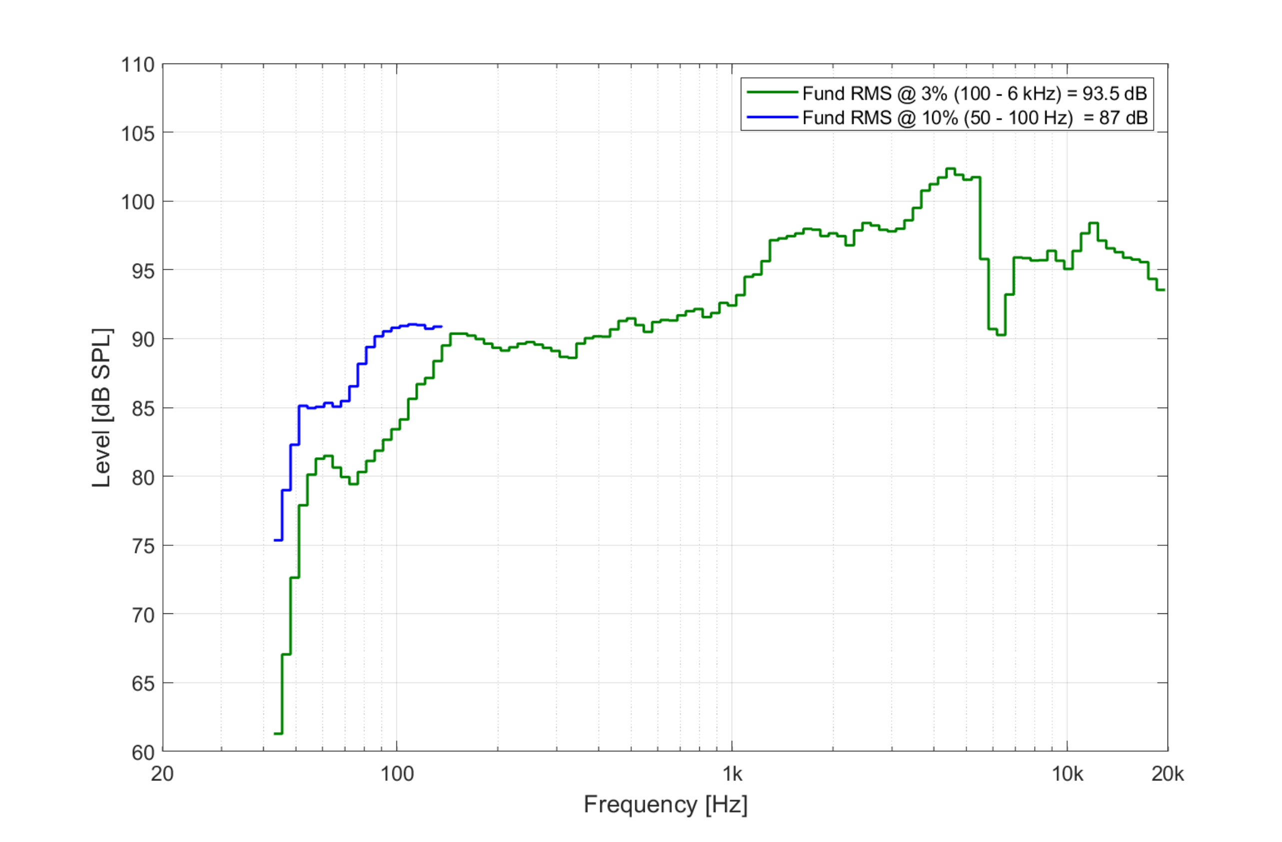
A spectrogram is a 2D version of the waterfall plot. Resonances can be seen as splashes of colour extending from the left to the right of the plot. Ideally there should be a red bar only at the left of the plot and blue everywhere else.

In the D3V we see the bass resonance, which is normal, and no other strong resonances.

Distortions

All loudspeakers distort but do it more than others. Distortion is sound output produced by the loudspeaker that is not present at the input. Harmonic distortion is distortion that is a multiple frequency of the original signal, for example if the input signal is 100 Hz, the second harmonic is at 200 Hz, the third harmonic is at 300 Hz, etc. Higher order harmonics are typically produced at a lower level, so if the 2nd and 3rd order harmonics are low, the higher order harmonics will be increasingly inaudible. If all the harmonics are added together we have the total harmonic distortion (THD) which is, by definition, the highest line on the graph. Second order harmonic distortion is caused by asymmetries in the system and can sound quite warm and pleasing. Vinyl records and valve amplifiers generate a lot of this. Third order harmonic distortion is caused by clipping in the system and never sounds good. Amplifiers played too loud or drivers reaching their maximum excursion suffer from this. Clearly all forms of distortion should be minimised in a studio monitor which has the task to accurately reproduce the input signal and add no extra content to that signal. It is possible to have a high THD and have a nice sounding product if the THD is dominated by second order harmonic distortion, therefore THD on its own is not a good indicator of audio quality. As the output level is increased the distortion also increases and eventually, if loud enough, all the audio from the loudspeaker can be distortion (0 dB = 100% on the graph) but the loudspeaker should already be strongly limited by the protection system well before this. Note that -20 dB = 10%, -30 dB = 3%, -40 dB = 1%, -50 dB = 0.3%, etc.

The D3V is a small loudspeaker so distortion at any specific level will be higher that in a larger loudspeaker, however it is remarkably low for such a small loudspeaker.



SPL

The max SPL curve shows how loud the loudspeaker can play at each frequency. The goal is to have the highest values possible, not to have a flat curve. Smaller loudspeakers will have lower max SPL at low frequencies. Loudspeakers with small amplifiers and/or drivers with a low sensitivity will also have a lower max SPL. The curve is measured using very short sine bursts that are increased in level until a defined THD (in this case 3% and 10%) is achieved.

The D3V is a small loudspeaker so max SPL below 120 Hz drops considerably. This can be solved in two ways: use a larger loudspeaker or add a subwoofer to take over low frequency reproduction.

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