B&W Bowers & Wilkins

Can you explain in more detail what your speaker specifications mean?

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Many of the items in our specifications are straightforward to understand. However, some require a little explanation.

Description

This tells you how many sections the frequency response is divided into (eg 2-way) and the type of bass loading. Note that the number of drive units may exceed the number of ways - you can have multiple units operating in parallel over the same frequency range. The term 2½-way requires some explanation. It is, as its name suggests a half-way house between a 2-way and a 3-way. Here two or more drive units operate in parallel at the lowest frequencies, but all but the top one have a large inductor in series, which progressively rolls off the output from a fairly low frequency (around 200Hz or so). The advantage over a 2-way is that you can have a large radiating area at low frequencies for greater output and lower distortion, but a smaller one at mid frequencies to preserve good dispersion. It's cheaper to make than a full 3-way. The crossover is simpler and, for a given bass performance, the cabinet is smaller, because you don't need a separate volume for the midrange unit.

You may come across different expressions for the same type of bass loading. We use the same naming convention as Richard Small in his classic papers, but here are some common alternatives:
Closed-box - *infinite baffle, sealed box*
Vented-box - *reflex, phase inverter*
Passive-radiator - *ABR, ADR, drone cone*

Frequency range

This defines the lower and upper frequency limits where the response is 6dB lower than the average flat level. There is no reference to how flat the response is between these frequencies. A drop of 6dB equates to half the sound pressure (that's not the same as half the perceived loudness though).

Frequency response

This describes how level the flat part of the speaker's response is. The usual limits are ±3dB. Even if they are tighter than this, we often quote the ±3dB as well so people can compare the -3dB bass extension. A loss of 3dB equates to half the power.
(Speaker responses are never as flat as amplifier responses, but the reasons why are too complex to go into here.)

Dispersion

There are several ways you can describe dispersion, but the way we do it is to compare the difference between the on-axis and off-axis responses. We quote a frequency range and angle that the off-axis response is within 2dB of the on-axis response in both the horizontal and vertical planes. You will notice that the dispersion in one plane (usually the vertical) is not as good as the other. In both directions you have the effect of each individual driver's response dropping off earlier with increasing frequency off-axis. However, in the direction of the line joining the drivers, you get extra narrowing of the dispersion at frequencies where more than one driver is operating. This effect is more noticable if the wavelength is comparable to or shorter than the distance between the drivers and usually only applies to the crossover region.

Sensitivity

This is a measure of how loud the speaker will sound for a given electrical input level. It quotes the sound pressure level (spl) in decibels (dB) at a distance of 1 metre for a given voltage input (2.83V). Now, 2.83V may seem an odd level, but it equates to 1 watt into a load of 8Ω. Be careful not to confuse sensitivity with efficiency, which for speakers is usually quoted in a similar fashion, except that reference is made to an input level of 1 watt, so the actual voltage depends on the speaker's impedance. For an 8Ω speaker, the sensitivity and efficiency figures are the same, but a 4Ω speaker with a sensitivity of 90dB would have an efficiency of only 87dB. Sensitivity rather than efficiency is quoted because amplifiers are voltage controlled devices and you will get an idea of the relative loudness as you A-B switch between speakers.

A higher sensitivity in the speaker means that the amplifier has to deliver less voltage to achieve any given level, so there is less chance of clipping. However, there is a mathematical relationship between efficiency/sensitivity, enclosure volume and bass cut-off frequency and the designer must trade these off one against the other. For a given enclosure size, a higher efficiency speaker will have a less extended bass response. As with most situations in life, you can’t have it all ways.

Harmonic distortion
We quote the frequency range over which the 2nd and 3rd harmonic components are below 1% (or -40dB) of the fundamental when the speaker is giving a level of 90dB spl at 1m, which is pretty loud. With our more expensive speakers, we sometimes quote a lower distortion limit too, but we always use the 1% figure across the board for comparison. Obviously, the lower the distortion the better.

You will notice that speaker total harmonic distortion figures tend to be worse than those of amplifiers and it is reasonable to ask why amplifier designers bother to get down to levels of say 0.01% or lower if the speaker is so much worse. The reason is that most of a speaker’s distortion is restricted to the lower-order harmonics, whereas amplifiers can readily generate higher-order harmonics that are much more objectionable.

Nominal impedance
The actual impedance of a loudspeaker varies significantly with frequency and the nominal value is only a rough guide to the load actually presented to the amplifier. Our method of averaging the figure does not follow the IEC standard, which states that the minimum at any frequency should not fall below 80% of the nominal value. For that reason we always quote the minimum value if it falls below the IEC allowed minimum.

Recommended amplifier power
We quote a range of amplifier powers. The larger figure is limited by the power handling capacity of the speaker. The lower value is the minimum we think you can get away with to generate reasonable (but not head-banging) levels in smaller rooms.

Note that we do not use the terms music power or RMS power. Music power is ill defined and, contrary to popular usage and in strict scientific terms, there is no such thing as RMS power (volts and amps yes, but not watts). Our power handling definition is based on the amplifier being used for music or speech signals and not being driven into clipping, but does refer to the constant power output capability of the amplifier. Please read the section on choosing amplifiers for a more detailed description on power handling.

Maximum recommended cable impedance
Any cable impedance wastes amplifier power, but because the speaker’s impedance is not constant with frequency, the voltage divider effect will also modify the frequency response. The lower the cable impedance, the less the change and the maximum we recommend will give less than 0.3dB change at any frequency.

At mid and high frequencies, one can get used to a certain level of response differences after a while. However, at bass frequencies things are more noticable as you are affecting the damping of the bass cut-off. Too much cable impedance and you begin to lose bass attack or “slam”.