B&W 606

LOUDSPEAKERS

It has been eight years since British manufacturer B&W first developed its 'Continuum' cone material for use in its flagship loudspeakers, the 800 Series Diamond models, and it's been six years since B&W released its first 'Six' series. Why mention both events? Because this year, for the first time, Continuum cones have been integrated into the sixth generation of the company's critically acclaimed 'Six Series'. The first Six Series speaker to arrive in Australia was the B&W 606 and, thanks to the help of Bowers & Wilkins Australia, a sample from the very first shipment was sent direct to Australian Hi-Fi Magazine for review.

THE EQUIPMENT

The new B&W 606 is a two driver, two-way, bass reflex stand-mount/bookshelf loudspeaker. As noted in the introduction, the 165mm diameter bass/midrange cone is made from a material that B&W calls 'Continuum' that's said to have a '*unique composite construction*' and first appeared on the 802 D3. Although B&W rates the overall width of the Continuum cone on the 606 at 165mm, the moving part of the cone (cone plus roll surround) is 145mm and the cone itself is only 120mm. The Thiele/Small diameter is 133mm, which gives a cone area (Sd) of around 140cm².

Continuum must be superior to Kevlar as a cone material, because B&W itself previously used Kevlar in this application… indeed B&W was the first company in the world to use Kevlar as a cone material—so successfully, in fact that it was copied by dozens of other speaker manufacturers around the world. Sometimes these copies were at least faithful to the original, and used woven Kevlar in their construction, but it must be said that sometimes the copies used material that merely 'looked' like woven Kevlar!

According to B&W the company has spent more than eight years developing Continuum, building more than 70 iterations before delivering the final production cones across a range of different diameters but despite this, technical details about the material are very thin on the ground. It has been suggested that one reason B&W is being so secretive is that it is trying to prevent other manufacturers from copying it, as they did with Kevlar. If this is true, it would suggest the reason that B&W has not filed any patents for Continuum, since doing so would immediately give the game away as to its composition.

What we do know is that Continuum is a coated woven material whose construction is based on the same controlled break-up theory that made Kevlar so appealing as a cone material. The problem with non-woven speaker cones, no matter what material they're made of—paper, plastic, metal etc—is that as the cone reaches the limits of its response the cone's forward and backwards motion will cease being pistonic (where all parts of the cone move forward and backward at the same velocity) and will quite suddenly go into the first 'break-up' mode, which is an uncontrolled action where some parts of the cone will move forward whilst others move backwards. This undesirable action is further complicated by the fact that this sudden break-up action will occur differently at different frequencies. Using a cone woven with Kevlar will ameliorate these affects, but according to Andy Kerr, Director of Product Communication at B&W, using a cone woven with Continuum ameliorates these effects even further. '*The Continuum Cone behaves quite differently*,' he said.

'*Its woven composite design is based on the concept of continuously varying degrees of flexibility that help it avoid the abrupt transitions that can drastically impair the openness and neutrality of a conventional drive unit. As a result its frequency response is remarkably predictable throughout its range*.' An on-line B&W video explaining the Continuum cone (tinyurl.com/continuum-clip) says it '*doesn't disrupt audible reflections but works as if the sound waves don't see the edge of the cone*.' Kerr provided two animated GIFs to illustrate the differences in performance at break-up between a Kevlar cone (tinyurl.com/kevlar-break-up) and a Continuum cone (tinyurl.com/continuum-break-up).

The tweeter upgrade has enabled B&W to shift the high-frequency resonance even higher in frequency...

The tweeter in the B&W 606 is also new for this series, though it is fitted to other models in B&W's range. It's an upgraded version of B&W's 25mm aluminium domed 'decoupled double dome' tweeter, the upgrade having enabled B&W to shift the inevitable high-frequency resonance even higher in frequency (to 38kHz) and thus even further away from the audio band. The construction of the 'double dome' differs from that of a normal dome tweeter because rather than attaching the dome directly to the voice-coil former, a section of dome with a large central cut-out is first attached to the voice-coil former, and then the full aluminium dome is attached to the dome section. Although an extra step is required, it results in a more rigid dome, simplifies the assembly process and decreases the chance of misalignment during manufacturing. Unlike many of B&W's earlier tweeters, the one used in the 606 has the rear of the dome loaded by a 'Nautilus'-like tapered tube so that the energy that comes from the rear of the dome surface is absorbed rather than being reflected (the tube is tapered to help ensure uniform absorption across a wider range of frequencies).

B&W has not just updated the drivers in the 606. For the previous five generations of the six series, B&W has been putting the bass reflex ports on the front baffle. For this sixth generation, the port is now on the rear, though it still uses B&W's 'Flowport' technology.

This 'Flowport' is designed to address a fundamental problem with bass reflex ports, which is that they can sometimes create unwanted noises when the bass driver is working hard, due to the considerable airflow through the port. Some of this noise is caused by turbulence as the air molecules interact with the surface of the port. Bowers & Wilkins' 'Flowport' solves this by 'dimpling' the surface of the port, which minimises turbulence in the same way that the dimples on a golf ball improve its flight through the air.

The 'Flowport' on the 606 is implemented rather differently to any that I can recall previously, because B&W has integrated the plastic 'Flowport' moulding with the rear terminals, so everything is supported on the same piece of black ABS plastic. There are two sets of terminals on the moulding so the 606 speakers can be bi-amped or bi-wired: If you choose to do neither, you'd leave them connected by the supplied and fitted buss-bars. The crossover network is mounted to the rear of this moulding.

In what is become almost *de rigueur* on modern bass-reflex designs, B&W supplies two-stage foam inserts that can be used to partially or completely block the ports on one or both loudspeakers.

B&W's Owner's Manual advises with regard to the use of these bungs: '*Moving the speakers further from the walls will generally reduce the volume of bass. Space behind the speakers will also help to create an aural impression of depth. Conversely, moving the speakers closer to the walls will increase the volume of bass. If you want to reduce the volume of bass without moving the speakers further from the wall, fit the foam plugs or, for less severe bass reduction, the foam rings in the port tubes*.' The port itself is 170mm long and 55mm wide so unlike some port/plug configurations, there's very little chance of accidentally pushing the plug though the port so far that it drops down inside the cabinet.

Another improvement on the 606 is that B&W is now also using magnets—rather than steel or plastic pegs—to hold the speaker grilles in position. B&W says this was to provide a 'cleaner look' but it also solves a problem many speaker owners will have experienced with plastic pegs which is that they're are very easy to accidentally snap while you are removing a grille (for the purpose of cleaning it, or for a 'grille-off' listening session). You won't have the same issue with a magnetically-attached grille.

The B&W 606 is available in only two colours—black and white—of which we were supplied the black finish for review. The black finish is a matte black and made by using a finely textured vinyl wrap. It's a very 'neat' finish that reflects light uniformly irrespective of viewing angle such that it

A gloriously rich and warm midrange complemented by a nicely balanced treble

looked to me to be a 'charcoal' colour, rather than a deep black. You get a black grille with the black speaker, but with a white speaker you're issued with a grey grille. Although it's certainly a very presentable cabinet finish, it didn't scream 'class' to me in the same way that gloss painted or veneered finishes do. And now that B&W has moved most—but not all—of its speaker production to China, a country that excels at delivering both finishes at very low cost, it rather surprised me that B&W has not taken advantage of this.

IN USE AND LISTENING SESSIONS

Since the B&W 606s seem to have been designed from the outset to be used *sans* grilles—at least from a visual standpoint—I thought one of the first things I should decide is whether I preferred the sound of the 606s with their grilles on or off. Since I also had to break in the speakers before starting any serious listening and only had a limited amount of time to do so, the process seemed like an excellent way to kill two birds with the same stone. Note that there are *two* grilles per speaker that can be removed: the main rectangular cloth grille that covers most of the baffle, and a smaller circular metal grille that covers just the tweeter.

Rather than attaching the dome directly to the voice-coil former, a section of dome with a large central cut-out is first attached to the voice-coil former, and then the full aluminium dome is attached to the dome section

After listening to a very wide range of music across all genres, I couldn't reliably hear any difference between listening with the grilles on or off, or in any combination. And when I say 'reliable' I mean that sometimes I fancied I heard a difference, but when I ran the same trial using the same music a day or two later, I couldn't hear the difference I'd heard before. So the result of my sessions is that I would strongly recommend you never—*ever*—remove the circular tweeter grilles, and that you listen to the speakers with the main grilles in place unless you prefer the 'look' of the speakers without the grilles, in which case I'd recommend storing the main

grilles somewhere they won't get dusty or exposed to light… such as in the plastic sleeves they are supplied in, and tucked away safely in a dark linen drawer somewhere.

As for positioning, I had no doubt the B&W 606s sounded their best and 'airiest' on stands, but the bass is better if you mount them on bookshelves, so it's definitely a case of swings and roundabouts. One workable compromise would be to use stands but to place those stands fairly close to the rear wall, which delivers a bit more 'air' than bookshelf mounting, but with a bit less bass. You can do further fine-tuning by experimenting with the port plugs, but I found that I definitely preferred the level and sound quality of the bass I heard without the plugs fitted, irrespective of musical genre.

Even with the ports open I found the bass to be a little on the 'light' side, but this is really only to be expected given the size of the bass/mid driver and the volume of the cabinet. What I did find, however, is that I could crank the volume up to surprisingly high levels yet still be hearing clean, accurate bass with no audible distortion. It was tight, punchy, dynamic bass too. For mine I thought that the bass was definitely better-sounding at higher listening levels than at low levels, but with a longer break-in time, these slight differences at the different listening levels may well have disappeared.

Listening to Zoe Knighton (cello) and Ian Munro (piano) play Grieg's *Cello Sonata in A Minor, Op.36* I was impressed by the way the B&W 606s were able to highlight the different touches Munro uses when playing repeated figures, so each is not just a straight repeat but a fresh imagining. The cello is the hero of this work, and Martin Wright (Move Records) has let his engineering reflect this, with the result that we hear clearly the gorgeous tonalities Knighton is able to extract from her cello, right across the entire range from the very lowest notes to the very highest—at least we hear them clearly if we're listening though B&W 606's.

The B&W 606's reproduction of Munro's piano was equally good. Listen to the sound of the piano introducing the sublime second movement—the aptly-named *Andante molto tranquillo*—and you'll be transfixed by the accuracy of the speakers' delivery.

But although the bass is exceptionally good for such a small loudspeaker, it's certainly outshone by the midrange delivery of the B&W 606. The clarity is immediately obvious and the articulation precise, yet there's no slurring over sibilants. The sound is beautifully transparent and segues into the treble seamlessly. I particularly liked that B&W apparently hasn't aimed at monitor-like accuracy, so the voices of female vocalists, in particular, had a slightly warmer sound, whilst baritones (but not basses) also sounded a little more wonderful through the B&W 606s than they might in real life. Along with that warmth is a slight upper-mid forwardness that helps with the feeling of presence and immediacy, so you get the best of both sonic worlds. For example Hayley Grace, singing her beautiful *Ghost of a Girl* (from her debut EP), was a truly sensational auditory experience, sounding superior to the many times I've heard it on many other loudspeaker systems.

The tweeter delivered the shimmering, extended upper registers that have impressed me with other B&W models featuring earlier versions of this aluminium-domed model, imparting an uncanny realism to the sound of cymbals, for example, and remaining totally dynamic when reproducing the sound of the xylophone and glockenspiel, both of which can be heard to marvellous effect by listening to Sergei Prokofiev's *Scythian Suite, Op. 20*, which also calls for two harps!

CONCLUSION

The B&W 606 costs a little more than the model it directly replaces, no doubt due to the added cost of the Continuum-coned low-frequency driver and the improved decoupled double dome tweeter—added costs that B&W seems to have tried to ameliorate by economising on the cabinet finish, which I am not convinced was a good economy, as I personally would have gladly paid extra for high-gloss painted finish.

But in the end, it's the sound that counts, and the B&W 606s certainly nail that, with bigger and better bass—especially at higher volume levels—than you'd expect from such small cabinets and a gloriously rich and warm midrange complemented by a nicely balanced treble. *Nicholas Bossi*

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Readers interested in a full technical appraisal of the performance of the B&W 606 Loudspeakers should continue on and read the LABORATORY REPORT published on the following pages. Readers should note that the results mentioned in the report, tabulated in performance charts and/or displayed using graphs and/or photographs should be construed as applying only to the specific sample tested.

CONTACT DETAILS

Brand: B&W
Model: 606
RRP: $1,149 per pair
Warranty: Five Years
Distributor: Bowers & Wilkins Australia
Address: Suite 303, 754 Pacific Highway Chatswood NSW 2067
T: (02) 9196 8990
W: www.bowers-wilkins.com

- Clean look
- Glorious midrange
- Goes loud!
- Finish choice

LABORATORY TEST REPORT

Graph 1 shows the frequency response of the B&W 606 as measured by *Newport Test Labs*. It's the combination of two different frequency response measurements, using two different measurement techniques. The section of the trace below 1kHz is the averaged result of nine individual frequency sweeps measured at three metres, with the central grid point on-axis with the tweeter using pink noise test stimulus with capture smoothed to 1/12th octave, with the bass reflex port completely open (no bungs). The section of the trace above 1kHz is the gated high-frequency response, an expanded view of which is shown in Graph 2.

You can see that apart from the small dip in the response between 4kHz and 7kHz the B&W 606's frequency response is remarkably flat, for the most part hovering just under the 85dBSPL graph horizontal from around 150Hz all the way up to 4kHz and overall, even including this dip, the section of the response that is visible on this graph extends from 68Hz to 20kHz ±4dB. However, the low-frequency section of the graph was measured with the port open. Using the half-bung extends the low-frequency response down to 55Hz. Presumably B&W's low-frequency specification of 52Hz was measured with the 606 in its 'sealed enclosure' mode when the port was fully blocked… a configuration that was not tested by *Newport Test Labs*.

The section of the B&W 606's frequency response above 20kHz (and down to 1kHz) is shown in Graph 2, and you can see that the tweeter's high-frequency response extends all the way up to 32kHz within the same ±4dB envelope. So overall, *Newport Test Labs* measured the B&W 606's frequency response as 55Hz to 32kHz ±4dB.

The high-frequency resonance peak on the review sample looks to be closer to 36kHz than the 38kHz specified by B&W, but even at this lower frequency it is high enough to be well out of the way of any audio frequencies. There are three traces on this graph and between them they show that you don't need to worry about removing the grilles to obtain the best performance, because B&W's engineers have made sure that the grilles are acoustically transparent and that you'll get pretty much the same response leaving the grilles on as you would leaving them off.

Low-frequency performance is shown in Graph 3, with the multiple traces this time showing the output of the rear-firing bass reflex port (red trace) and the output of the low-frequency driver with the port completely open (black trace), with the port half-blocked by a foam bung (green trace) and with the port completely blocked (blue trace). You can see that the sealed enclosure provides the smoothest, most extended roll-off, but at the expense of losing a little bass output. The bass reflex mode sees the output from the low frequency driver roll off the earliest, but in this case, there's quite a bit of low-frequency output from the port to compensate. The maximum output from the port doesn't quite coincide with the driver's minimum output, but since B&W is trying to extract three different alignments from the same cabinet/driver configuration, I think its engineers have done pretty well. As you can see, the half-blocked port extends low-frequency response about 10–12Hz lower than the bass reflex alignment.

B&W specifies the impedance of the B&W 606 as 8Ω with a minimum of 3.7Ω. It does not specify the frequency of the minima, but you can see from Graph 4 that it's up around 20kHz and that the impedance remains below 4Ω from about 12kHz to at least 40kHz and possibly a bit further (*Newport Test Labs* did not measure above 40kHz). This means that if you drive the B&W 606 with an older Class-D design you might experience some unpredictable results. However, any new Class-D design—or any Class AB design—will be able to handle the low impedance at these frequencies.

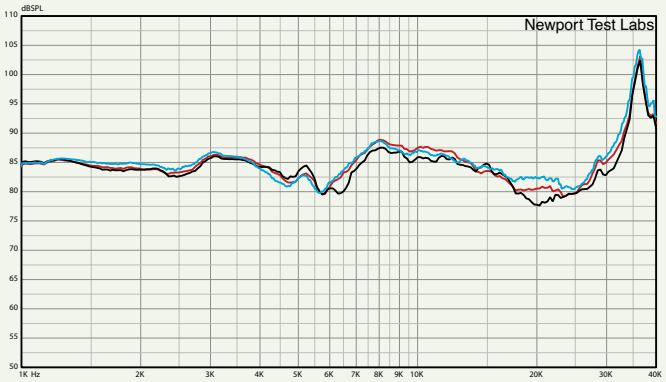
Elsewhere across the frequency band the impedance is mostly higher than 6Ω and never drops below 5Ω so the B&W 606 should be quite an easy load for any amplifier or AV receiver. The graph shows that the electrical crossover takes place at 1.9kHz and that the phase angle is benign.

Graph 5 shows the averaged in-room frequency response using a pink noise test stimulus with capture smoothed to one-twelfth octave showing response with the port open (black trace) and with the port blocked (dark blue trace). You can see that the dip in the response that was visible in Graphs 1 and 2 is not there, thanks to the averaging. You can also see that the bass-reflex alignment appears to give slightly improved bass response, though this would be dependent on speaker positioning in the room.

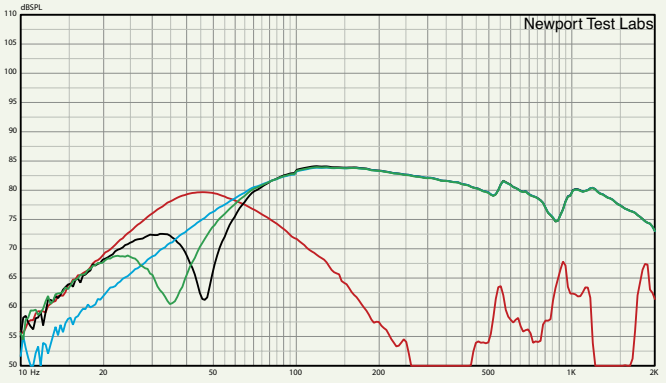
The final graph in the series is a composite of the graphs already presented. You can see that there are port resonances at 550Hz and 910Hz that have a tiny effect on the

B&W's many years of experience are plainly evidenced in the excellent measured performance of the B&W 606

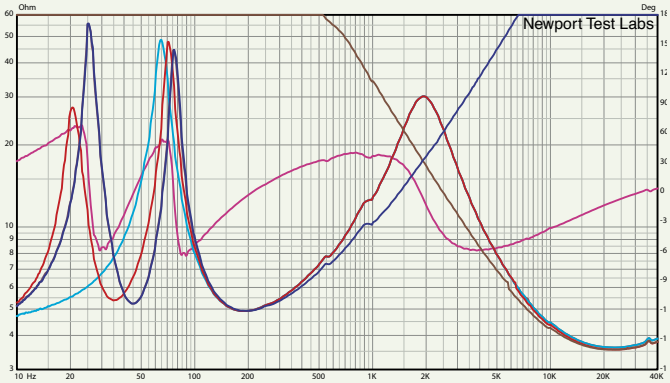
Graph 1. Frequency response. Trace below 1kHz is the averaged result of nine individual frequency sweeps measured at three metres, with the central grid point on-axis with the tweeter using pink noise test stimulus with capture smoothed to 1/12th octave. Port open - no bungs. This has been manually spliced (at 1kHz) to the gated high-frequency response, an expanded view of which is shown in Graph 2.



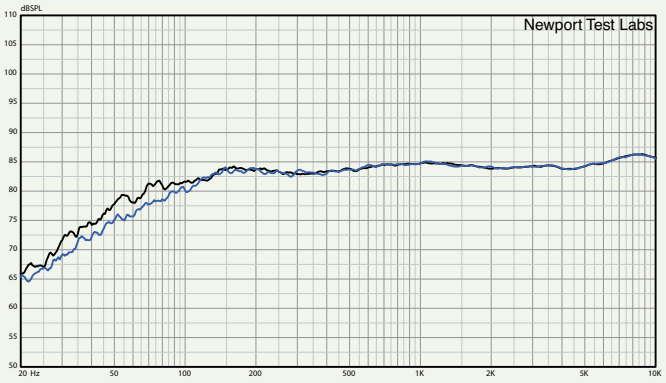
Graph 2. High-frequency response, expanded view. Test stimulus gated sine. Microphone placed at three metres on-axis with dome tweeter. Black trace is with tweeter grille and main grille fitted. Red trace is with tweeter grille but no main grille. Blue trace is without tweeter grille or main grille. Lower measurement limit 1kHz.



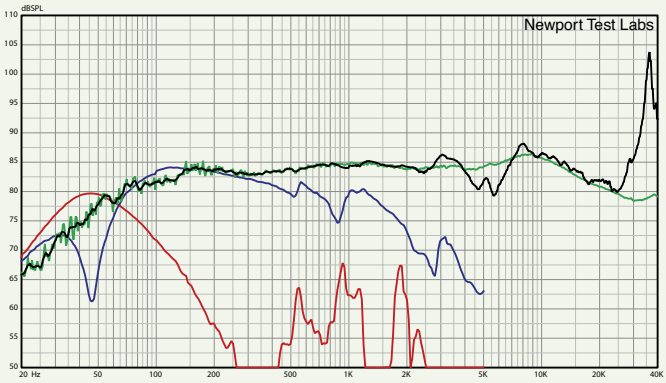
Graph 3. Low frequency response of rear-firing bass reflex port (red trace) and LF/MF driver without port blocked (black trace), with port half-blocked (green trace) and completely blocked (blue trace). Nearfield acquisition. Port/woofer levels not compensated for differences in radiating areas.



Graph 4. Impedance modulus without bungs (black trace), half-bunged (red trace) and fully bunged (light blue trace), plus high-pass (brown trace) and low-pass (dark blue) crossover sections, and phase (pink trace).



Graph 5. Averaged in-room frequency response using pink noise test stimulus with capture smoothed to one-twelfth octave showing port open mode(black trace) and port closed (dark blue trace). Both traces are the averaged results of nine individual frequency sweeps measured at three metres, with the central grid point on-axis with the tweeter.



Graph 6. Composite response plot. Red trace is output of bass reflex port. Dark blue trace is anechoic response of bass driver. Green trace is unsmoothed pink noise response, black trace is gated (simulated anechoic) response above 1kHz and smoothed pink noise response below 1kHz.

frequency response and above 1kHz you can see directly how the smoothed (green trace) response (which reflects how the human ear would perceive the B&W 606's frequency response) compares to the high-resolution high-frequency response (black trace) which contains details too fine to be resolved by the human ear.

Newport Test Labs measured the sensitivity of the B&W 606 at 85dBSPL at one metre under its normal test conditions. As I have noted many times previously, *Newport Test Labs*' methodology for this test is stricter than that most manufacturers use, and almost always results in 'lower' numbers than those claimed by manufacturers. The test also takes bandwidth into account, so smaller speakers are disadvantaged compared to larger ones. So I was not surprised at the test result of 85dBSPL: It's about exactly what I would have expected given the driver size and cabinet volume. I was, however, surprised at B&W's 88dBSPL specification, which seems a tad optimistic, but both figures suggest that an amplifier with a power output rating of at least 50–60-watts per channel in 8Ω will be required in order to extract the best from this particlar design.

B&W has been at the forefront of loudspeaker design for a good many years, and these many years of experience are plainly evidenced in the excellent measured performance of the B&W 606. *Steve Holding*