Usher Audio
Dancer Mini-X Diamond

LOUDSPEAKERS

Usher Audio's Dancer Mini-X Diamond is the third in this manufacturer's 'Mini' series, but it's actually the first 'Mini' that is *really* a 'Mini'. Members of the Usher Audio Owners' club might be smiling now, but other readers may well be confused by that statement. The club members are smiling because they know that the Usher Audio 'Mini-One' and 'Mini-Two' loudspeakers are both actually floor-standing speakers that stand more than a metre high, so they're hardly 'Mini' speakers. However, that term could well apply to the Dancer Mini-X, because it's just 435mm high. In fact it's closer in size to Usher Audio's award-winning Be-718, but it has, to my eyes, a much curvier and more attractive cabinet, obviously borrowed from the other 'Minis'. The Mini-X Diamond is also one of the smallest speakers in Usher Audio's range to sport its 'DMD' Diamond dome tweeter.

THE EQUIPMENT

Whereas most manufacturers buy 'off the shelf' drivers from specialist driver manufacturers, and others design their own drivers, but have them made by those self-same specialist driver manufacturers, Usher Audio is one of the very few speaker manufacturers that builds all the drivers it uses itself—bass drivers, midrange drivers and tweeters. All this driver manufacturing takes place in Usher Audio's home town of Taichung, Taiwan, in the same factory the speakers are assembled.

As you can see from the photograph, the Dancer Mini-X is a two-way bass-reflex design. The bass/midrange driver is an Usher Audio 8948A that is rated by Usher Audio as having a 7" diameter, and sure enough, the company's own data sheet shows that the

overall dimension of this driver is 177mm. However, the Thiele/Small diameter is 138mm, which puts the driver's effective cone area (Sd) at 150cm². Because this driver is available from Usher Audio for sale to other manufacturers, I can tell you that its Fo is 30.945Hz, its voice-coil is 42mm in diameter and it has a 1.055kg rear-vented magnet with a flux density of more than 11,000 gauss. [You can find a complete data sheet here: [**www.tinyurl.com/usher-8948A-datasheet**] The frame is completely cast from alloy, rather than being stamped from steel. And although Usher Audio makes a magnetically shielded version of the 8948A, the version inside the Mini-X is unshielded. The cone of the 8948 is made from that most traditional of materials: paper. Don't be put off by the fact that the cone on the Mini-X looks a little 'rough'. This is how it comes from the mould and means it's stronger and more rigid than if Usher Audio had mechanically smoothed it. (And if you thought it looks familiar, be reassured that it's identical in every way to the bass/midrange driver used in Usher Audio's famous Be-718 speakers).

The tweeter in the Dancer Mini-X Diamond is Usher Audio's own 'Diamond' tweeter, with a 32mm dome. Not surprisingly, Usher Audio does not make this tweeter available to other manufacturers (though you can buy them in pairs at retail level in order to upgrade earlier Usher Audio speakers fitted with Beryllium tweeters.) Usher Audio refers to the tweeter as a 'DMD' tweeter, which it says stands for 'Diamond Metal Diamond' and means that it's a 'hybrid' dome that has a central alloy membrane that's coated on both sides by ultra-thin layers of a diamond-like carbon coating. Or, in Usher Audio's own words, as extracted from its website: '*The DMD dome is effectively a diamond dome with a reduced mass and a well-controlled, appealing sound signature, resembling very closely a perfect piston in its behaviour. This is made possible by its laminated diamond-metal-diamond structure, which consists of a proprietary metal alloy base layer coated with an amorphous diamond-like carbon layer.*' (Unquote.)

In fact, the material Usher Audio is using is an amorphous carbon material that's more commonly known as 'DLC' or 'Diamond-Like-Carbon', of which there are seven different 'flavours' or formulations. All seven types contain significant numbers of sp3 hybridized carbon atoms, but the differences between them (and which are exploited for specific applications, hence the different 'flavours') are the way the carbon atoms are arranged, which can either be as a cubic lattice, or as a hexagonal lattice or as a combination of both types; and the ratio of sp2 to sp3 carbon atoms.

If you're after strength, for example, coating a stainless steel bearing with a DLC comprised exclusively of tetrahedral amorphous sp3 bonded carbon will increase its useful life from less than one year to an estimated 85 years. DLC coatings have dozens of uses including being used as protective coatings on optical discs such as DVD-Rs, on magnetic storage disks, for optical windows and on micro-electromechanical devices. Because it's possible (and, in fact, highly desirable) to manipulate the properties of DLC for specific applications, its properties can vary greatly from those of pure diamond, and also means that not all 'diamond' dome tweeters will have similar properties or sound quality.

As one example of the differences between true diamond and DLC, the Young's Modulus of pure diamond is 1,000 whereas the Young's Modulus of DLC can be designed to be anything from 200–800 depending on what it's going to be used for, and the hardness of diamond is 100GPa, whereas that of DLC may be anything from 20–80GPa, so you can see that for some physical properties, it's possible for DLC to be very close to diamond. However, if you were after thermal conductivity as a desirable property, the very best DLC tops out at 5Wm-1K-1, whereas pure diamond is 'way above 3000Wm-1K-1. (And for those of you who have forgotten their high-school chemistry classes, what we call a 'diamond' is made up of repeating units of carbon atoms joined to four other carbon atoms in a tetrahedral network where each is equidistant from its neighbouring carbon atoms.)

At the bottom of the Dancer Mini-X's cabinet is the bass-reflex port, which the company's founder and chief designer, Tsai Lien-Shui, has implemented as a slot (which is 15mm high, 150mm wide and 140mm deep) rather than the more usual tube (which would have to have been 53mm Ø.) This is actually a more expensive way to build a cabinet, and I can only assume that he's done it to move the port as far as possible from the bass/midrange driver, though I confess that considering the size of the cabinet, I cannot imagine this would make quite the difference it might on a larger cabinet. Speaking of cabinet build, I still haven't got over the weight of each Dancer Mini-X cabinet. Each one weighs 15.5kg. Some of this is the weight of the bass driver, which itself weighs an incredible 2.6kg, and some is down to the tweeter, which is one of the heaviest I've seen. However, a good deal is down to the construction of the cabinet, which has walls that are 25mm thick and a baffle that's fully 50mm thick. Usher Audio says that the material it uses to build the cabinet is: '*a new layered wood cabinet construction held together with a special penetrating glue, effectively creating multiple constrained layers for dramatically reduced cabinet resonances.*' I mentioned previously that the cabinet was 435mm high, so I should add that it's 260mm wide and 370mm deep before I go any further. Needless to say, it's designed for stand-mounting, though the front-firing reflex port means that you could, if you

USHER AUDIO DANCER MINI-X DIAMOND
LOUDSPEAKERS

Brand: Usher Audio
Model: Dancer Mini-X Diamond
Category: Standmount Loudspeakers
RRP: $3,500
Warranty: Five Years
Distributor: Westan Australia Pty Ltd
Address: 13 Bastow Place
Mulgrave VIC 3170
☎ **(03) 9541 8888**
✉ **salesvic@westan.com.au**
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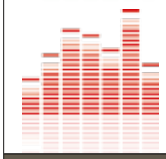
- Sweet balanced sound



- Difficult to hide wires
- Bit power-hungry
- Requires stands

LAB REPORT

Readers interested in a full technical appraisal of the performance of the Usher Audio Dancer Mini-X Loudspeakers should continue on and read the LABORATORY REPORT published on page 46. 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.

Lab Report on page 46

wished, wall-mount or shelf-mount them. However, when you see them in the flesh, you will see that they're 'way too beautiful to be put anywhere except on stands, where their curvaceous sides and multi-faceted baffle can be viewed to advantage from all angles.

The 'rear' of the cabinet (it's so rounded towards the back that it would be more appropriate to call it the 'spine' of the cabinet, rather than the 'rear') is where you'll find the speaker terminal plate, and what a terminal plate it is! It has four gold-plated terminals so you can bi-wire or bi-amplify the Mini-X, and really solid gold-plated jumper terminals you can use to bridge the terminals if you want to use only a single set of speaker wires. The terminal plate is made of solid metal that is 8mm thick, 54mm wide and 184mm high and is finished in a kind of 'burnished' gold that's very attractive. It's recessed into the cabinet. As you can see from the photographs, the side walls of the Dancer Mini-X speakers curve backwards from the front baffle to the narrow spine. This means you're not going to get standing waves inside the cabinet, which is good, and also improves the speakers' dispersion characteristics, which is also good, and also improves cabinet rigidity to reduce cabinet resonances which, yet again, is good. So while the cabinet design is best acoustic practise, it does mean that no matter how you position the speakers, it will be very difficult to hide the speaker wires from being obvious unless you're very creative indeed. Speaker wire visibility doesn't bother some owners at all… but it does others.

Inside the Usher Audio Dancer Mini-X Diamond I discovered that Usher Audio has taken the bi-wiring/bi-amping principle to the extreme, because the 'crossover' is spread across two completely separate printed circuit boards (PCBs), one for the high-pass filter section and the other for the low-pass filter section. According to Usher Audio, crossover takes place at 2.3kHz. Both PCBs are fixed to opposite walls of the cabinet, with an elastomeric substance between the PCB and the cabinet wall to avoid resonances. The totality of the crossover circuits' components is four 15-watt Usher Audio-branded resistors, three air-cored inductors and four 250V audiophile-grade capacitors. The wire linking the rear terminal plate to the PCBs—and the PCBs in turn to the drivers—is of very thick, very high-quality, 'Figure 8' construction, soldered at the PCB ends and spaded or bolted at the other. Overall, I think the crossover is one of the best-made I have ever seen: it's definitely the largest I've seen in any two-way design.

Usher Audio's Dancer Mini-X doesn't have a speaker grille as such, because that Diamond tweeter is well-protected by a wire mesh grille. The bass/midrange driver has a circular grille that covers it entirely. If you use this grille, be sure not to push it down too hard on its support pegs, because these 'pegs' are also used to fasten the bass/midrange driver to the cabinet (with the aid of captive nuts).

IN USE AND LISTENING SESSIONS

As I mentioned earlier in this review, the Usher Audio Dancer Mini-X Diamond speakers were designed to be stand-mounted, and if you can stretch to them, Usher Audio has designed a pair of stands specifically for the Mini-X that look absolutely superb, with a piece of timber curving gracefully around a solid black central post. Usher Audio refers to these stands as 'Waveguide' stands because it says the curved timber helps smooth and improve the monitor's low frequency response. When I say 'stretch' to them, I do so because production issues had apparently delayed these 'Waveguide' stands, so local distributor Westan could not only not provide the stands for the review, but it could also not provide a retail price at the time we went to press (June 2013), but I'd venture they'd be pretty pricey… probably because they'd be so difficult to manufacture. You can see a photograph of them here: [**tinyurl.com/usher-waveguide-stand**] (and that's designer Tsai Lien-Shui standing alongside.)

If you can't wait for the Waveguide stands, the stands that *are* available now are the Usher Audio RWS-728 stands, which are 700mm high and retail for $259 per pair. Although these will be available by the time you read this review, they weren't at the time of the review either, so I used a pair of ordinary (but perfectly serviceable!) Australian-made stands that put those Diamond tweeters at ear level and were solid enough that the motion of the Mini-X's bass/midrange driver could not cause any reactive forces. I should caution that when buying stands for the Mini-X, you should ensure the base of the stand is sufficiently large that the combination of stand and speaker is stable enough to withstand accidental knocks, because the not-inconsiderable weight of the Mini-X cabinet means that the centre of gravity is very high when it's on a stand, so stand stability will be crucial not just for performance, but also for the speakers' safety (and you wouldn't want to dent that Diamond DMD tweeter!).

The laws of physics dictate that no small, two-way stand-mount/bookshelf speaker with a moderately-small bass/midrange driver is going to be able to deliver deep bass at very high volume levels (which is, after all, why Usher Audio has larger floor-standing models in its range) but if a designer is careful and makes the right compromises, uses only the highest-quality components and, perhaps, sacrifices a little overall loudspeaker efficiency, it is certainly possible for a small two-way to deliver impressively realistic bass… and that's exactly what the Usher Audio Dancer Mini-X delivered in my listening environment.

I think the main thing a designer has to avoid when designing a small loudspeaker is bumping up the upper bass response in order to artificially extend the lower bass, and certainly Tsai Lien-Shui has avoided that temptation here, with the admirable result that the bass is very uniform, without any of that aforementioned 'bump' but also, with surprising extension down into the lowest frequencies, presumably because that slotted port is doing its stuff. In fact the very low frequencies were so powerful that I thought it might be possible to get the port to 'whistle' due to its narrowness, but no matter how much I wound up the volume level the port behaved itself. (If I put my ear close to it I could hear some higher-frequencies issuing from it, but back at the listening position, everything was perfect.) While I was pushing the Dancer Mini-Xs to see if I could get the port to whistle, I discovered that I was winding my amplifier's volume control 'way higher than usual, which indicated to

me that the Dancer Mini-X is not an overly efficient design… which would also explain the extended bass. Sure enough, when I played them with a much lower-powered amplifier (tested at 50-watts per channel), the speakers sounded a little power-starved, and the dynamics that were previously in abundance were now diminished. At the other end of the power spectrum, when I trialled them with a 200-watt per channel amplifier, I found I could now over-drive the Mini-X design and it was the tweeter that revealed that I was doing this: its sound hardened and became brassy. That said, this happened only at *very* high listening levels.

What was obvious at all the listening levels I used during the review process was the tiniest trace of midrange 'punch' which tended to push female vocals, especially, but also the instruments playing the melodies, to the fore of the mix. The effect is very subtle, and I have to say that I liked it a lot. It tended to be more revealing of the music being played. Importantly, even with the slight punch, the overall midrange sound was still very warm and totally engaging.

Having previously been very impressed with the sound quality of Usher Audio's Beryllium tweeter, I was looking forward to hearing the Diamond tweeter (though a bit disappointed that I didn't have a pair of Usher Audio Be-718s on hand to do a direct A–B comparison between the two tweeter types). As it happened, I need not have worried: I didn't need an A–B comparison to tell me that the new Diamond tweeter is audibly a cut above the Beryllium tweeter, with its most noticeable trait being that whereas I thought the Beryllium tweeter seemed to subdue the 'airiness' of the very highest frequencies, and also cut off some high-frequency decay, the new Diamond tweeter is super-airy, and there is absolutely no high-frequency cut-off at all. When a flute stops playing in a church, for example, you can hear the reverberations from the walls slowly dying away until they're lost in the blackness of the acoustic background. I was so impressed by this when listening to flute that I pulled out 'Hearing Solar Winds' with David Hykes and the Harmonic Choir, which also was recorded in a church in the middle of the night, to ensure a perfectly silent background for the recording, so you could hear the decay. The eerie sounds of the harmonic singing were realised to perfection by the Dancer Mini-X's Diamond tweeter. (In harmonic singing, a single singer creates two notes at the same time, and the differences in frequency between these notes creates 'overtones' that are far-higher in pitch than it's possible for even the highest-pitched soprano to sing. The 'quality' of the sound produced is a little like the sound you hear when rubbing the rim of a wine glass. And when you have a whole choir of harmonic singers, as on Hearing Solar Winds, the effect is amazing.)

I had been listening for several weeks to the Usher Audio Dancer Mini-X trying to put my finger on a particular sonic characteristic that was making them work so well, but it wasn't until I played 'In The Zone', (Andrew Rindfleisch and the Meridian Arts Ensemble) that I finally twigged what it was, which was that not only does the Diamond seem a better 'match' for the 8948A at the crossover point, but also that the whole presentation of the higher frequencies seemed more cohesive and somehow more 'together'. I guess it was the fact that the Meridian Arts Ensemble is an all-brass ensemble, and the acoustic of this recording is insanely good. What you hear is that despite all the brass, you can not only instantly hear the individual voices, but also the differences in tone between Jon Nelson's andTim Leopold's trumpets, even when the two are playing exactly the same note, and since the fundamental note is the same, it must be the harmonics that are being delivered with such precision because otherwise, to tell two trumpets apart would be all but impossible. Listen also to the way the Usher Audio Dancer Mini-Xs so accurately render the hand-stopping on *Abide with Me*, and to the 'singing' sound of the unison playing, which tells me that this is a truly musical design.

CONCLUSION

Usher Audio is going from strength to strength as a speaker manufacturer, and the new Usher Dancer Mini-X Diamond is a perfect example of all the company's strengths: gorgeous design, innovative driver technology, great build quality and outstanding sound quality. ***greg borrowman***

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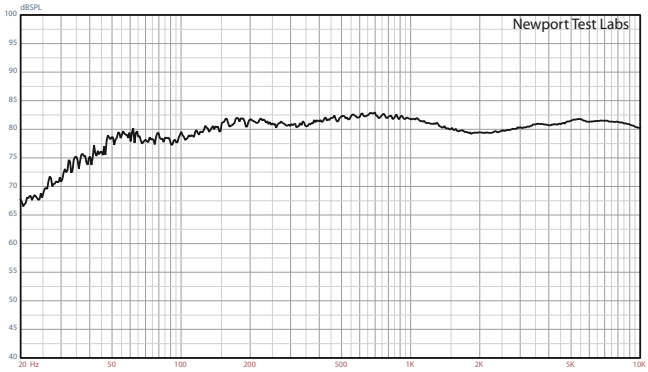
LABORATORY TEST RESULTS

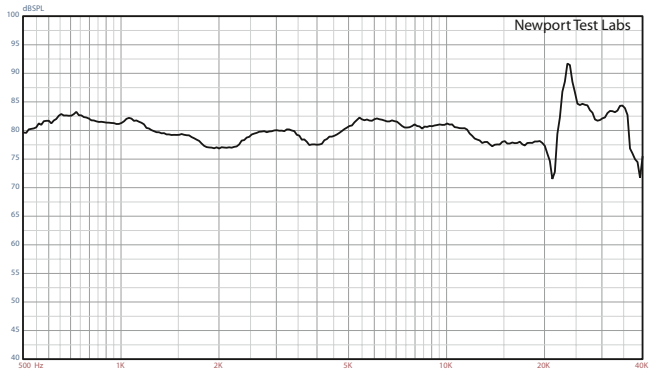
Newport Test Labs' 'in-room' frequency response, which averages nine points in front of the tweeter (at the centre, then either side left and right, then above and below, then above right, below right, then above left, below left) shows that the Usher Audio Dancer Mini-X Diamond's frequency response is very flat, varying no more than ±2.5dB from 46Hz right up to the graphing limit (in this case 10kHz: see Graphs 2, 5 and 6 for the frequency response above 10kHz). Although the low frequencies start a slow roll-off at about 150Hz, there's still plenty of bass down to below 50Hz. Above 150Hz, the response is almost within a ±1dB envelope, which is exceptionally good, considering that the shaping of the curve suggests to me that the crossover network has not been used to do any response corrections of any type.

The most obvious feature on Graph 2 is that very large tweeter resonance that peaks at 24kHz. It was not unexpected: when you're using one of the hardest materials in the world to create your dome, you'd have to expect a high-frequency resonance! However, it happens at a frequency much higher than the human ear is capable of hearing, and is beautifully-behaved within the audio band (below 20kHz). And you can see for yourself exactly how beautifully-behaved it is on the graph, which varies no more than ±2.5dB from the lower measurement limit of 500Hz right up to 20kHz. The resonant peak ensures that the octave between 10kHz and 20kHz, which with most soft-dome tweeters normally roll off, rolls off only 2.5dB. As far as extreme high-frequency extension is concerned, Usher Audio's Diamond tweeter is still powering away right up at 40kHz. (Although it rolls off a little above 35kHz, you can see that just before 40kHz the response is again heading upwards.)

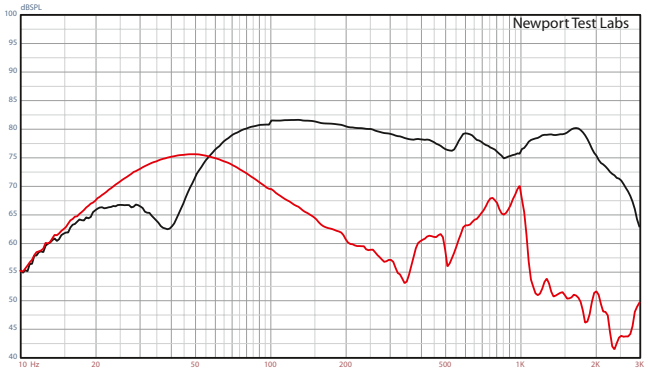
Newport Test Labs measured low-frequency response using its near-field technique, which simulates what you'd measure in an anechoic chamber, and you can see that the bass/midrange driver actually starts rolling off at around 100Hz, rather than the 150Hz noted on Graph 1. This difference would suggest that you'll be able to fine-tune the



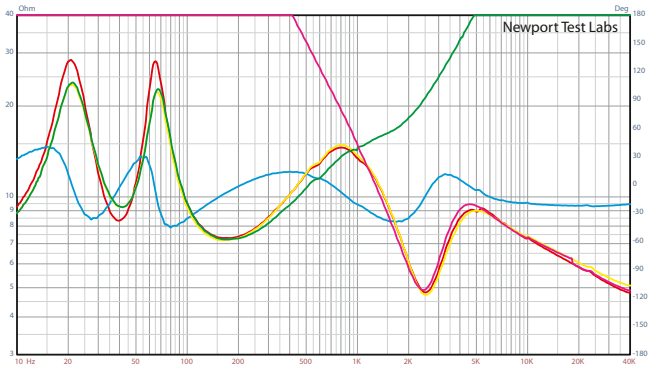
Graph 1. Averaged frequency response using pink noise test stimulus with capture unsmoothed. Trace is the averaged result of nine individual frequency sweeps measured at three metres, with the central grid point on-axis with the tweeter. [Usher Dancer Mini-X]



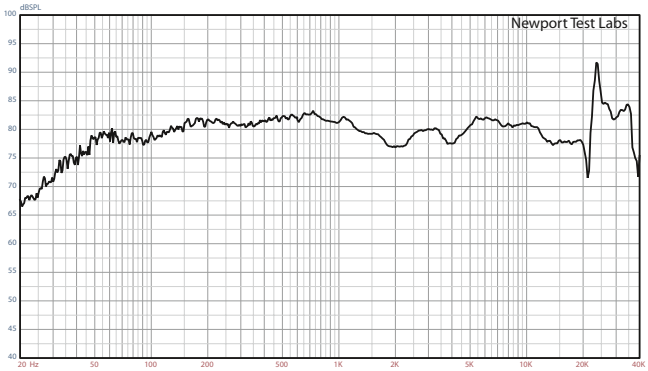
Graph 2. High-frequency response, expanded view. Test stimulus gated sine. Mic placed at three metres on-axis with dome tweeter. Lower measurement limit 500Hz. [Dancer Mini-X]



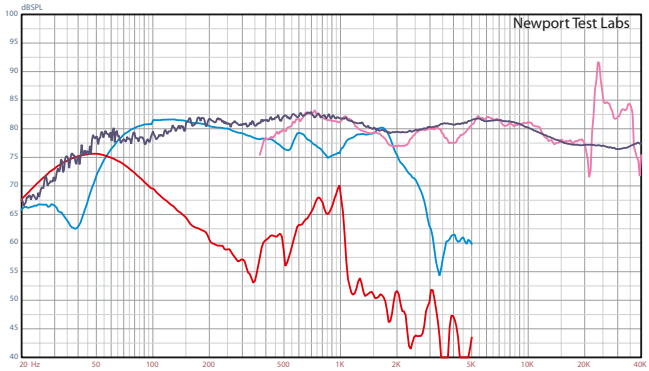
Graph 3. Low frequency response of front-firing bass reflex slot (red trace) and bass/midrange driver (black trace). Nearfield acquisition. Port/woofer levels not compensated for differences in radiating areas. [Usher Dancer Mini-X Loudspeaker]



Graph 4. Impedance modulus of left (red trace) and right (yellow trace) speakers plus phase (blue trace), high-pass section (pink track) and low-pass section (green trace).



Graph 5. 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 unsmoothed (from Graph 1). This has been manually spliced (at 600Hz) to the gated high-frequency response, an expanded view of which is shown in Graph 2. [Usher Dancer Mini-X Loudspeaker]



Graph 6. Composite response plot. Red trace is output of bass reflex port. Dark blue trace is anechoic response of bass driver. Pink trace is gated (simulated anechoic) response above 400Hz. Black trace is averaged in-room pink noise response. [Usher Dancer Mini-X]

Newport Test Labs' measurements prove the Usher Audio Dancer Mini-X Diamond to be a well-designed, stand-mount, bass-reflex speaker

level of bass with room positioning rather well. However, the 'null' in the bass drivers' response indicates that you really shouldn't expect much bass below 38Hz. (I note that Usher Audio's specifications put the Dancer Mini-X's response 3dB down at 41Hz.) The higher end of the response is not accurately portrayed on the graph because of the high-frequency limitations of the measurement technique itself, but you can see the crossover rolling the driver off quite sharply in order to make the 2.3kHz crossover point.

Graph 3 also shows the output of the front-firing port and you can see that it's fairly low-Q and although it delivers its maximum output at 50Hz, which doesn't quite 'fit' with the bass/midrange driver's minimum output, which occurs a little lower in frequency, the port still produces appreciable low frequency levels either side of 50Hz, being 3dB down at 23Hz and 110Hz. The port rolls off very smoothly (at 12dB/octave) above 50Hz up to 350Hz, but above this frequency it lets high frequencies from the rear of the bass/midrange driver's cone through… albeit at very low levels—low enough, in fact, that they'd be swamped by the output from the front of the cone at the same frequencies.

The impedance modulus (Graph 4) shows that the matching of the left and right speakers isn't perfect, but I am informed that the pair tested had been shipped right around Australia for various events and packed and unpacked multiple times. Knowing how Australia's courier companies treat heavy cardboard cartons, my guess is that the (very heavy) carton had been handled very badly during its various shipments and that the internal damping material had shifted, which would account for this discrepancy. I'd advise Usher Audio to ship its Dancer Mini-X design in two separate cartons: the increased weight of the cabinets has obviously outgrown the company's 'single-box' shipping strategy. You can see the impedance of the design is higher than usual, with a minimum impedance in the audio band at around 5Ω at 2.5kHz. From 10Hz up to 1.7kHz the impedance doesn't get much below 7Ω. The resonant peaks are at 20Hz and 65Hz, with the 'saddle' at 38Hz. The electrical crossover point (as distinct from the acoustic crossover point) appears to take place down at 1kHz, which would suggest that the tweeter is being worked quite hard. The impedance at high frequencies rolls off from around 9Ω at 4.5kHz to less than 5Ω at 40kHz and appears to be falling even lower at higher frequencies. It would be better to have the impedance rising at high frequencies: I can only assume this is an inherent trait of the Diamond tweeter.

In Graph 5, *Newport Test Labs* has 'spliced' the low-frequency in-room response to the gated high-frequency response to give an overall picture of the Usher Audio Dancer Mini-X's performance. As expected, the result is excellent. As measured and graphed by *Newport Test Labs*, the Usher Audio Dancer Mini-X Diamond's frequency response extends from 46Hz to 20kHz ±3dB. The design's efficiency was measured by the lab as being just 83dBSPL at one metre, for a 2.83Veq. input. Because of *Newport Test Labs'* stringent and unusual methodology for this test, which makes things very tough for small loudspeakers and even tougher for those with higher-than-average impedances, and knowing the Usher Audio Dancer Mini-X Diamond ticks both these boxes, I was not surprised by this result, even though it's 4dB lower than the sensitivity claimed by Usher Audio. Even if you split the difference it would mean that the Dancer Mini-X Diamond is of below-average efficiency, and will require a moderately high-powered amplifier to get the design sounding at its best.

In sum, *Newport Test Labs'* measurements prove the Usher Audio Dancer Mini-X Diamond to be a well-designed, stand-mount bass-reflex loudspeaker. Although it is relatively inefficient, it will be very easy to drive due to its overall high impedance. It also has an extremely flat frequency response that's beautifully balanced and well-extended at both ends of the audio spectrum. Overall, an excellent design. ***Steve Holding***

Usher Audio's new RWS-728 stands were designed for the Dancer Mini-X, are 700mm high and retail for $259 per pair.

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