

# Jamo

## R909 Loudspeakers



**First impressions are important.** My first impression of Jamo's R909 speakers was at their debut at the 2006 Las Vegas Consumer Electronics Show. After picking up my press badge, I decided to check out the main halls before heading off to visit the hundreds of hotel rooms containing the high-end audio exhibits. Wandering around the floor I regularly ran across new products, particularly loudspeakers, but all were static, non-functioning displays. Whenever I asked why the products weren't connected, I always received the same answer: 'You can't demonstrate speakers in here: it's too big and too noisy.' I wasn't surprised by this response because I entirely agreed on both counts. The halls at CES are (literally!) aeroplane-hanger sized, and the noise levels horrendous. You'd be mad to try and demonstrate a pair of home hi-fi speakers under such conditions, and insane to imagine that if you did, you could get them to sound good. Which is how I got to meet Henrik Mortensen.

Attracted to Jamo's stand by the exhibit of vibrantly-coloured Jamo R909s, which I'd never seen previously, I was taking the opportunity to examine them closely when Henrik introduced himself as their designer. After a brief discussion about

the various benefits of dipolar designs, and the difficulties of building open-baffle loudspeakers, Henrik suggested that the proof would be in the pudding, and would I care to have a listen. 'They're plugged in?' I asked incredulously. 'Sure!' he replied and headed off to an amplifier hidden beneath one of the display stands. A few seconds later I was stunned to hear sound thundering out from the R909s at a volume level that would put a professional sound re-inforcement system to shame, and with such powerful low frequencies that for a moment I thought Mortensen must have hidden a separate bass bin somewhere on the stand.

Mortensen came back and grinned when he saw the obvious look of surprise on my face. 'I bet you haven't ever heard bass like this from an open-baffle before,' he yelled. He was right: I hadn't.

### The Equipment

Speaker designers view speaker cabinets as a necessary evil. And for good reason. Suspend a single bass driver in mid-air and you'll find that when the cone moves forward, the air it pushes forward won't continue to move forward: it will instead race around the edge of the driver frame to fill the partial vacuum

at the back of the cone. It's to stop this transfer of air pressure that designers put drivers inside cabinets.

So why is the cabinet so evil? Firstly and most importantly, the large panels of the cabinet will vibrate, so the cabinet itself then produces sound waves that will adversely affect sound quality. More significantly, the vibrations in the cabinet will also interfere with the motion of the drive elements of the midrange and treble drivers, modifying the timbre of the music they reproduce in unpredictable ways. These vibrations can also affect the crossover. This is why so many designers use exotic materials, even concrete, to construct speaker enclosures.

The shape of the speaker cabinet also influences the way midrange and high frequencies are distributed around the room, so that different frequencies will be reproduced at different levels depending on where in the room you sit, which means that the speaker will sound different from different angles. As bad luck would have it, cabinets shaped to give the best bass response are the worst for dispersion, while those that deliver the best dispersion are unsuited for reproducing realistic bass. It's for these reasons that some designers put their bass, midrange and treble drivers in completely

**Brand:** Jamo  
**Model:** R909  
**Category:** Loudspeakers  
**RRP:** \$18,600  
**Warranty:** Seven Years  
**Distributor:** QualiFi Pty Ltd  
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separate and differently-sized enclosures.

Mortensen believes one of the cabinet's biggest problems is that the air inside the cabinet impedes the natural motion of the cone. In a completely sealed cabinet, for example, air is trapped inside the cabinet so that as the cone moves outwards, the air pressure inside the cabinet becomes lower than that of the outside air, so the air outside starts pushing against the cone, stopping it from going in the direction it's supposed to be heading. Even in a bass reflex cabinet the bass driver cannot move freely.

Still, for all the problems that directly result from using a cabinet, these problems pale by comparison with the difficulties confronting designers who don't want to use a cabinet. I had an inkling of exactly how problematical it was when Mortensen told me that the R909 was not actually the result of an 'authorised' design project at Jamo, but of a pet project he'd been working on for the past nine years.

The single seemingly most insurmountable problem when eliminating a cabinet is to stop sound cancellation at low frequencies: that is, stop the air travelling from the front of the driver to the back. One solution is to make the panel supporting the driver larger. For example, if you had an infinitely large baffle, no cancellation would take place. Although this is self-evidently impossible, it turned out that even an impractically large flat baffle would still be too small to allow satisfactory performance. It was then Mortensen had a brainwave. What if the bass drivers produced so much bass that you didn't care if most of it cancelled out, because there'd still be enough bass left over to deliver the level of bass you wanted? The concept is not dissimilar to how you'd solve the problem of filling a bucket with water if the bucket had a hole in it. If you pour the water in slowly, the bucket will always remain empty, because the water will leak out of the hole at the same rate you're pouring it in. However, if you pour enough

water in fast enough, you can easily fill the bucket to overflowing.

It turned out that in order to deliver the high levels of bass required it was necessary to use two 381mm (15-inch) diameter bass drivers. Unfortunately, it also transpired that Jamo needed these drivers to have a free-air resonance of 27Hz, and all the drivers available had free-air resonances of around 45Hz, because this is the approximate value that's best if the drivers are used inside standard sealed or bass-reflex enclosures. In the end, Jamo had to design its own driver. The result is a 381mm-diameter driver that uses a very lightweight, air-dried paper cone, a polyurethane roll surround and a 50mm-diameter, fully-ventilated, voice-coil. The frame that holds all this is cast from magnesium alloy to enable the use of very thin support struts to connect the magnet assembly to the periphery of the cone, so that air at the back of the cone can move as freely as the air at the front. Between them, these two drivers deliver more than 100dB SPL at 200Hz.

The midrange driver uses an ingenious magnet system that Jamo says has been patented by Swedish company SEAS. What happens is that six neodymium bar magnets are stacked around the voice-coil instead of it being contained within a conventional 'chimney-style' ferrite magnetic structure. This means the voice-coil is very exposed, and thus its heat is not constrained within the magnet structure, where it would quickly build up and reduce efficiency. So not only is there no heat build-up, but also no compression. The magnetic circuit includes a copper ring to short-circuit potential eddy currents, delivering a reduction in distortion. The voice-coil former is attached to a magnesium-coated cone. The driver frame is also made of magnesium. Regular readers will know that I am not a fan of drivers with exposed voice-coils, because this type of design increases the possibility of foreign particles (grit, dirt, etc) entering the magnetic gap and causing

damage or poor sound (or both!). However, in the case of the R909's midrange driver, the voice-coil is so exposed that particles are unlikely to be trapped in the first place, and would be extremely easy to remove if they did, since you have almost completely free access to the voice coil and gap. As always, however, I would recommend operating the speakers with their grilles attached (front and rear grilles, in the case of the R909) to minimise the possibility of this happening in the first place.

High frequencies are handled by a ScanSpeak 'Revelator' 25mm dome tweeter, but one with a much smaller faceplate, to allow it to be mounted close to the midrange driver. ScanSpeak's Revelator is used by many high-end speaker manufacturers who appreciate the use of 'Symmetric Drive Technology' and the damped rear chamber, with its anti-resonator plug. Unlike most tweeters, there is no ferrofluid in the gap, so the resonance peak is somewhat higher than is usual with oil-damped tweeters, and has a higher Q. The Revelator also has an unusual copper ring around the dome, which ScanSpeak claims eliminates electrical phase shift and also reduces distortion.

The R909's 'baffle' (I put in those inverted commas because it's really just a mounting plate, not a true baffle) is made from seven layers of medium density fibreboard (MDF) that is shaped into five distinctive curves. It's attached to a cast iron base that is home to the crossover network and binding posts. On its own this base weighs 26 kilograms. At the rear of the 'baffle', a stainless steel brace (actually, two 5mm-thick braces, with a damping membrane sandwiched between them) anchor the whole assembly together, providing a rock-solid connection between the 'baffle', the drivers and the base.

As you've probably guessed already, the R909 is no lightweight! Each speaker tips the scales at just over 63kg, stands 1.276 metres high, and is 440mm wide and 560mm deep. (Interestingly, these are the dimensions I measured on my review



speakers. Jamo's measurements are slightly different, so either I made a mistake or Jamo has changed the size of the speakers slightly. Unfortunately, I had returned the speakers before I discovered the discrepancy.)

I should like to emphasize that open-baffle speakers are not by any means a new idea, and B-D Design's Quasar MkII has some design attributes in common with the R909, except that it partners a single Fostex FE206E with its dual 381mm drivers. Famous US designer Siegfried Linkwitz (many designers use Linkwitz-Reilly filters in their crossovers) is a long-time open-baffle fan. His Orion model has a rear brace that vaguely resembles the one on the R909. Most of these open-baffle designs, however, have enclosures behind either the bass driver(s) or the midrange, or separate woofer enclosures entirely, or must be driven by a specially-designed amplifier with its own in-built equalisation. (Linkwitz is also responsible for a 'Transform' circuit that can be used to equalise the bottom end of a sealed loudspeaker enclosure so that the response flat is from below resonance to the upper limit of the selected driver.)

### Listening Sessions

The pair of speakers supplied to me for review had been used for several press and dealer releases and were fully 'run-in', so I was confident that I'd be hearing the speakers at their best from the moment I connected them to my system. This being the case, I decided to start at quite high listening levels, and cranked the volume control 'way more clockwise than usual. I was in for a surprise, because given their bipolar nature, I had not counted on the Jamos being as efficient as they actually are. The sound pressure level almost blasted me from the room—not helped by the fact that for some perverse reason, I'd selected Human Nature's *Dancing in the Street*, which starts with a crescendo.

Once I'd got over the shock of the volume level, I found the Jamos were delivering this live disco-level sound with absolutely no discomfort at all. The bass came through with an impact I could feel in my stomach, yet the 'ride' of the cymbals was not overly splashy, and all the vocals, from the male lead right through to the female backing, were crystal-clear

and completely undistorted. In hindsight, I should hardly have been surprised: any speaker that can impress with its volume in a CES hanger is easily going to be able to overpower any normal-sized (or even abnormally-sized!) room.

After turning down the volume (just a little) I continued listening and by the end of the third track (*ABC*) on the album (*Songs of Motown II*) I'd become captivated by the dynamism of the sound. It sounds like a cliché, but I really could hear that there's no 'box' in the way of the music. Everything I played sounded incredibly instantaneous and 'live'. The intro to the famous *Uptight (Everything's Alright)* should be compulsory listening via the R909s—even if Motown isn't your thing. The sheer visceral impact of the drum and bass is incredible. I ended up listening to the whole CD, which was just as well, because I may otherwise have missed the *a capella* finalé, *Just My Imagination*. The Jamo R909 delivered this track so smoothly, and with such a realistic sense of 'space' that if I closed my eyes, I really could believe that Human Nature had come around to sing in my listening room. Here it wasn't just the smoothness, or the clean tonality of the sound of the Jamo R909s, but the way the sound was delivered into the room. Dipoles are renowned for doing this, but the way the R909s do it is something else again. Inspired by this, I put on Tony Backhouse's 'Deluxe' with his *a capella* choir Café of the Gate of Salvation, which is pure gospel with a great choir sound. It was fabulous. Backhouse's voice was reproduced exactly as he sounds in real life, and the choral backing is exceptional. As with Human Nature, it was as if the performers were in the room.

Emboldened, I ambitiously tried a rather larger-scale choral work, Handel's *Messiah* (on Telarc) and the Jamo R909s just continued to impress with their performance. This time it wasn't as if the choir was in the room: the sound was too big for that. Instead, the sound simply filled the room, but with the staging intact across the plane of the speakers, so it was more like a perfectly recorded performance. At this point I tried altering the position of the speakers in my room. I had followed some of Jamo's recommendations, in that I'd positioned the speakers one metre from the rear wall, angled the speakers by exactly 10 degrees, and placed them exactly 1.2 metres from the side walls. Several hours of experimentation showed that Jamo has really done its homework. Moving the speakers back towards the rear wall definitely affected the spaciousness of the sound (for

the worse), but more importantly it also 'loosened' the admirable tightness of the bass somewhat. Moving the speakers further away from the wall created rather too much of a 'surround' effect and tended to muddy the central image. In the end, however, I found that in my room, a slightly greater toe-in (13 degrees) than recommended delivered a more focussed central image, and increased slightly the already impressive sense of the image's height and depth. This no doubt was the result of the fact that dipoles emit virtually no sound from their sides (walk to the side of an R909 while just one is playing and you'll immediately hear what I mean), which would alter the way the sound was reflected from my walls, but I think it was also because of the adjustment in the direct radiation.

Mahler is always a favourite when evaluating the performance of a pair of

speakers with orchestral works, and in this case, I don't think I've heard a better sound in his First Symphony. The sixty or so bars of strange unison that begin this work are rich with string harmonics and the resulting disembodied tonal quality is ethereally reproduced by the Jamos. In the second movement (*Kraeftig bewegt*) the octave leaps of the violins are simply deliciously emotionally satisfying, as is the horn-call that, over hushed murmuring strings, heralds the return of the boisterous dance that starts this movement. And the rhythmic intensity of the gathered orchestral forces is the perfect vehicle for demonstrating the majestic power of Jamo's twin bass drivers.

A particular benefit of this work from an auditioning point of view is that Mahler gives a great many orchestral instruments starring turns, which is crucial to proper evaluation of tone and pitch accuracy, while the subtly varying rhythms allow one to easily judge pace and timing. In every instance, the R909 delivered the goods.

As a complete change of pace, I then put on *Dark Side of the Moon* (Pink Floyd), partly inspired by this album coming in No 1 in the recent ABC-TV viewer poll to discover the best rock album of all time. Also, of course, there's the many artificial sounds on this album to contrast between the purely electronic sounds and the instrumental sounds. The antique clocks chiming simultaneously on *Money* are a treat for the ears and the clinking of coins, the ringing of cash registers, and the sounds of paper tearing are reproduced by the Jamo R909s with uncanny precision and realism. On *The Great Gig in the Sky*, the superb articulation of the Jamos allowed me to hear the spoken comments, such as 'I never said I was frightened of dying' with unprecedented clarity. (Incidentally, while I am not quite convinced the ABC-TV actually got this one right, it's an indisputable fact that DSOTM is not only the third best-selling album of all time but still ranks as the album with the longest stay in the US *Billboard* Top 200).

I could not finalise my review without one final listen to a choral work, so I spun up Delos' 'Mysteries Beyond' (*Songs and Chants in Praise of Mary*) with the Voices of Ascension conducted by Dennis Keene. I figured this would be perfect for the Jamos, since recording engineer John Eargle uses microphone techniques that randomise stereo pickup of ambient and reverberant cues, which creates an extraordinarily spacious sound, in this case enhanced by the fact it was recorded in

New York's Church of the Ascension, the choir's home base. The recording has no fewer than five *Ave Marias*, by Fauré, Holst, Bruckner, Schubert, Victoria, and of course, the famous Bach/Gounod version. Holst's *Ave Maria* is the most superb of these, and the sopranos excel themselves in this work in particular, which is essential, since the work is scored for two four-part female choruses and the vocal range is extreme, from low Fs (for the contraltos) to high B-flats (sops). I don't think I've ever heard better soprano sound than on this CD. Keene says in his notes for this track that he actually found the work more satisfying on CD than it sounded live, because the eight voice parts are clearly discernible, along with the dialogue between the voices of Choir I in the left channel and those of Choir II in the right. I had the additional benefit of listening via the R909s, and the clarity and purity of the midrange and tweeter, and the seamless transition between them, moved the sound on this CD—and this track in particular—to a level that few audiophiles (or conductors) are ever going to be lucky enough to experience.

## Conclusion

What really frightened me after listening to these speakers is the thought that were it not for Henrik Mortensen's dedication and persistence, Jamo's R909s may never have seen light of day, which would have meant that the world would have missed out on a truly great loudspeaker, one that I predict will achieve immortality in the same way as Quad's original electrostatic. 

greg borrowman



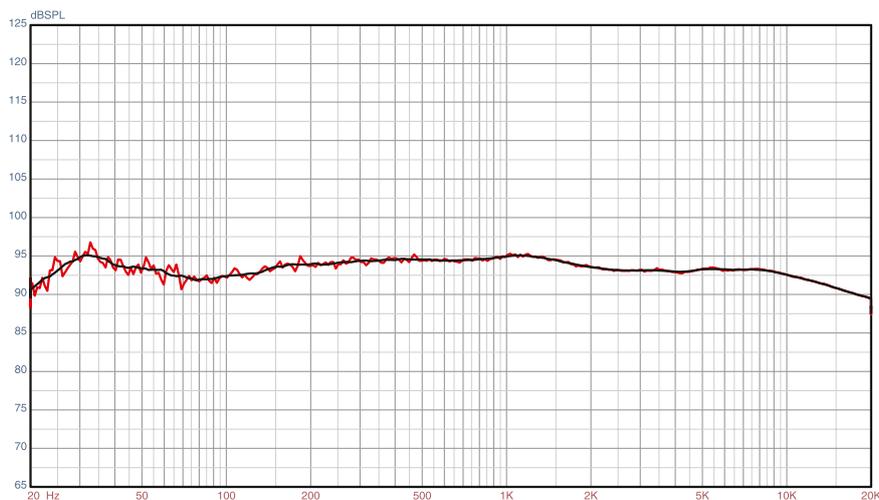
Readers interested in a full technical appraisal of the performance of the Jamo R909 Loudspeakers should continue on and read the LABORATORY REPORT published on the following pages. All readers should note that the results mentioned in the report, tabulated in performance charts and/or displayed using graphs and/or photographs should be construed as applying only to the specific sample tested.

LAB  
REPORT

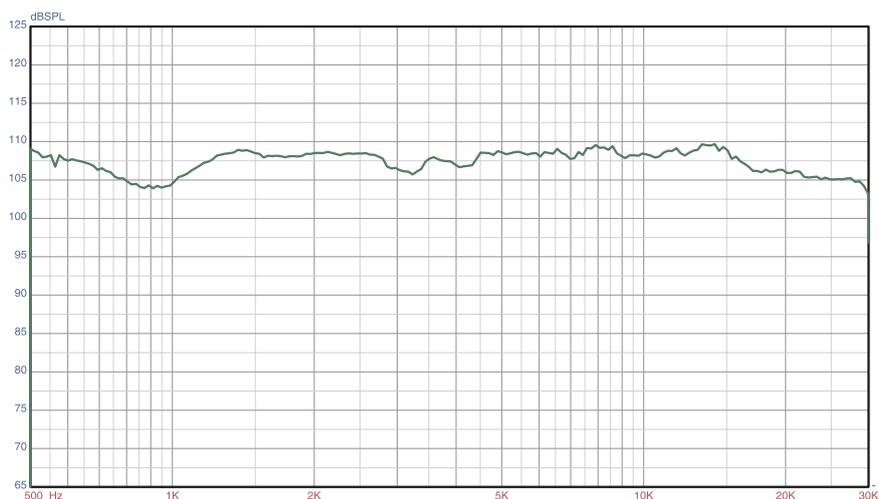
## Test Results

Newport Test Laboratories measured the frequency response of the Jamo R909 as extending from 20Hz to 20kHz  $\pm 3$ dB, using band-limited pink noise as the test stimulus. This result is shown in *Graph 1*. The slightly jagged trace is the original, unsmoothed trace, while the smoother trace underneath it is the same response, but with one-third octave smoothing applied. This response is extraordinary firstly for its extension: very, very few loudspeakers are capable of response down to 20Hz, and you can see output at 30Hz is at the upper (+3dB) limit of the envelope, rather than the lower limit you'd expect. It's also extraordinary for its incredible flatness over the most important musical frequencies. That is, if you disregard the frequency extremes (below 30Hz and above 10kHz), the response varies no more than 1.25dB! That is: 30Hz to 10kHz  $\pm 1.25$ dB. Finally, it's instructive to note how well the Revelator tweeter handles the extremely difficult pink noise test signal. Most tweeters quickly overheat when they have to reproduce a constant, high-volume pink noise signal, resulting in severe compression and considerable high-frequency roll-off. The Revelator tweeter rolls off a little, but only 1.25dB between 10kHz and 20kHz. Not to put too fine a point on it, this is an exceptional performance from Jamo's R909.

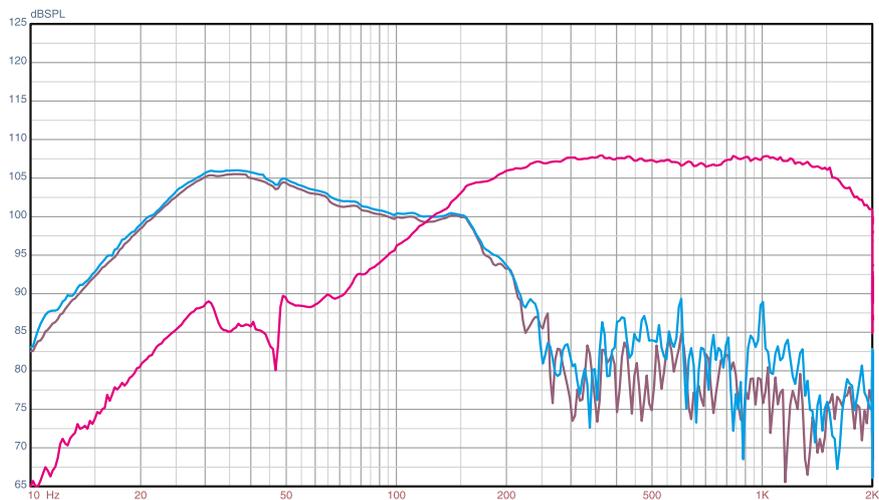
One reason for the Revelator tweeter's exemplary performance can be seen in *Graph 2*, which shows an expanded view of the high-frequency performance of the Jamo R909, measured using a gated sine technique that eliminates room reflections to simulate the performance in an anechoic chamber. Obviously, for a speaker that's designed for dipole operation—and thus depends on reflections from walls, floors and ceilings—this is not an ideal test environment, yet the Jamo R909 still returned a response that was easily contained within a  $\pm 3$ dB envelope, but this time extended right out to 30kHz. You can see that with the less demanding test signal, the response didn't start rolling off at 10kHz, but extended almost flat right out to 16kHz before rolling off a few dB then continuing flat out to 30kHz. Again, this is simply outstanding performance and I'd be quite confident in stating the overall frequency response as 20Hz to 30kHz  $\pm 3$ dB, by virtue of 'tacking' the sine response to the pink noise result. The slight dip centred around 900Hz is obviously a point where Jamo has intended that rear reflections should boost response at the listening position, but such reflections are filtered out in this measurement, hence the dip. You can see from the pink noise response that



**Graph 1:** Averaged pink noise frequency responses, smoothed and unsmoothed at 2.83v at 3.0 metres.

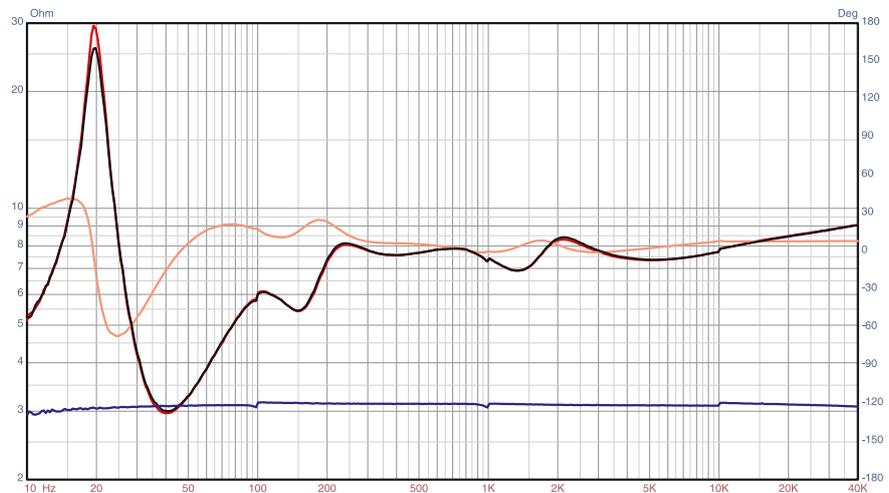


**Graph 2:** Gated sine frequency response (unsmoothed) at one watt, at 1.5 metres.



**Graph 3:** Nearfield frequency response of both bass drivers and midrange driver. (Note glitches at 50Hz are due to mains hum in test set-up.)

The superb results speak for themselves. This is a fantastic result for Jamo's design engineers.



**Graph 4:** Impedance vs frequency, with both left and right speakers graphed (see copy), plus phase response for left speaker only. Trace under is that of a reference 4Ω precision resistor, measured at the same time for calibration purposes. (Glitches at 100Hz, 1kHz and 10kHz caused by range-switching of test equipment.)

there is no dip at 900Hz, in fact quite the opposite: a slight peak.

*Graph 3* shows nearfield (pressure) traces for both bass drivers and the midrange driver. Note that the nearfield trace for one of the bass drivers has been manually shifted very slightly, otherwise the two traces would be so overlaid that it would be nigh-on impossible to distinguish the one from the other. Across their operating range, the traces are identical, it's only out-of-band that slight differences are apparent, probably the result of one driver being higher on the baffle than the other. (Note that the glitches on the trace at 50Hz are the result of mains hum in the measurement set-up, and nothing to do with the speaker being tested.) You can see that the bass driver's response starts rolling off at 30Hz quite steeply, so it's 6dB lower at 20Hz, but remember that this trace does not show the contribution from the rear of the driver, which would boost it. The same is true between 50 and 150Hz, where that falling response that's graphed would be boosted both by the output from the rear of the drivers and the addition of the output from the midrange driver, so they'd all sum to 'flat' as shown in *Graph 1*. The near-field response of the midrange driver is superbly flat, almost tracking perfectly along the grid-line of the graph between 290Hz and 1.3kHz.

*Graph 4* contains four traces: impedance curves for the left and right Jamo R909s, a measurement of the resistance of a precision 3Ω resistor (for graph calibration purposes:

it's easy to see this line, as it tracks almost along the 3Ω graph line at the bottom of the graph), and a phase measurement for the left speaker only. (To evaluate the phase measurement, use the degrees indicators at the right edge of the graph.) As you can see, the left and right channel impedance curves track each other exactly, except at one point: the resonant peak at 19Hz, where one speaker peaks 4Ω higher than the other. The fact that the impedance dips so low (below 3Ω) at 40Hz, where there will often be significant musical energy, means that you'll definitely require an amplifier than can deliver high-power output into 2Ω loads if you want best performance from the R909s. Fortunately, the phase angle at this frequency is only  $-15^\circ$ , so the load is not overly reactive. (Note that the small glitches in the response at 100Hz, 1kHz and 10kHz are because the test instrument range-switches at these frequencies, and nothing to do with either speaker's impedance.)

*Newport Test Laboratories* measured sensitivity at a distance of one metre, using a band-limited pink noise test stimulus, with an input voltage that would produce 2.83 volts across a perfect 8Ω non-inductive load, and averaged output over the entire 20Hz to 20kHz bandwidth. Under these conditions, the Jamo R909's sensitivity was measured at 87.3dB SPL.

The superb results speak for themselves. This is a fantastic result for Jamo's design engineers. 

Steve Holding