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LEGACY AUDIO

SIGNATURE III LOUDSPEAKERS

Legacy Audio's speakers are built by a famous organ manufacturer, the Allen Organ Company of Pennsylvania. It wasn't always that way. Designer Bill Duddleston started out in 1983 with a Dutch cabinetmaker Jacob Albright and it was just the two of them who forged Legacy Audio into one of America's leading direct-sales loudspeaker organisations before merging with the Allen Organ Company in 1996. One reason you may not have heard of Legacy is that the company first started exporting from America only two years ago.

The Equipment

You only need to look at the Signature III to realise that Duddleston is no ordinary speaker designer: few modern speakers sport as many drivers on the front panel as the Signature III. And you're not seeing all of them either—there are two more bass drivers (one on the bottom of the cabinet facing downwards, so it's slot-loaded, and another on the rear panel. There's also a third

(dome) tweeter on the rear panel.

The reason for the number of drivers stems directly from Duddleston's speaker design strategies, which are to include room gain as a part of the transfer function, keep midrange reflections to a minimum and add diffuse high-frequency output without increasing on-axis brightness. (He has quite a few other strategies, but we just don't have the room to explain them all, about which more later.)

There's another reason for those three bass drivers, but it's not really to do with Duddleston's particular speaker philosophy, it's a straight-ahead law of physics, which says that if you want to deliver lots of bass, you need a very large driven area. To hang some figures on it, think of all those neat little three-driver, two-way, floor-standing speakers you see on dealers' showroom floors that use dual 150mm drivers. They'll have a maximum undistorted low-frequency response limit of 38Hz if you play back at an average

90dB SPL. By comparison, the three 300mm bass drivers used in the Signature III will still be delivering 90dB SPL down at 13Hz.

Some other things about bass you might not know. A loudspeaker's radiating area must increase in relation to the length of the wavelength reproduced if power distribution is to remain uniform and output is to stay linear. Also, efficiency, dynamic range and distortion will all improve as piston area and motor size are increased. Bass also improves with the size of the cabinet.

Low frequencies are delivered by a pair of 254mm diameter bass drivers mounted on the front and rear baffles, helped out by a single 254mm diameter 'passive' radiator that faces downwards. All three drivers are identical, with polypropylene cones, rubber roll surrounds and pressed steel baskets. The magnet structures are large, unshielded, and vented through the rear of the magnets. The Theile/Small diameter of each of

these drivers is 213mm, giving a cone area for the system of more than a square metre when all three are combined.

Although I have called the down-firing driver a 'passive radiator' it isn't really. It has an identical voice-coil and magnet system to the other two bass drivers. However, in a rather curious design arrangement, Dudleston uses the coil/magnet system in reverse, so that the motion of the cone that's induced by the air movement inside the cabinet caused by the other two drivers not only generates sound on the 'outside' of the cone but also energises the coil, generating back-emf. However, this back-emf is fed straight back into the driver (by means of being 'shorted' on the crossover PCB). This means that the faster the cone moves, the 'stiffer' the cone becomes, the end result being that it ends up dynamically limiting the cone excursion of the main two bass drivers by reducing the volume of air behind them. Dudleston calls this a dynamic braking system and claims it improves the transient response of the system by maintaining driver linearity at high power levels. In simple terms, what it means is that at low volume levels, the cabinet is a bass-reflex type, while at high volume levels, it becomes an infinite baffle. This idea was a new one on me, and no other loudspeaker designer I ran the concept past had ever heard of it, so it certainly appears to be unique to Legacy.

But if I thought this dynamic braking system was unusual, nothing prepared me for the Signature III's 'mid-bass' and 'midrange' drivers. These drivers are both 130mm in diameter, and both are made in Germany, but there the similarities end. The bottom-most (mid-bass) driver has a carbon-filled polypropylene cone supported by a rubber roll surround in a cast aluminium basket. The upper-most (midrange) driver has a Kevlar cone, an inverse rubber roll surround and a basket made from moulded plastic. I wondered (via email to Dudleston) about the interference effects that might arise from this unusual driver arrangement. He replied: 'The lone purpose of the carbon-filled polypropylene midbass is to 'fill' the dip

caused by floor bounce. Spreading the bass and midrange drivers minimises the dip somewhat. The fill driver's transfer function is derived by subtracting the averaged sum of midrange and bass driver's output from unity at an averaged distance of 2.75 metres (3.5, 3.0, 2.5, 2.0 metre measurements are taken). The resulting phase and amplitude characteristics fall out.'

What's floor bounce? Well, whenever you listen to a large floor-standing loudspeaker, you're

"This idea was a new one on me, and no other loudspeaker designer I ran the concept past had ever heard of it"

actually hearing two or more versions of the same sound. One signal (the loudest) travels in a direct line from the bass driver to your ears. The other signals bounce from the floor before reaching your ears. This almost always results in a narrow band of mid-bass frequencies becoming less audible because of wave cancellation. Although wall and ceiling reflections also cause cancellations, floor-bounce creates the worst cancellation effects, particularly if your floor is not carpeted. It's this effect that's being addressed by the Signature III's mid-bass driver.

The Signature III also addresses distortions in image depth. One way the human ear determines the proximity of a sound is by its volume. If a voice sounds loud, we assume that person is nearby, for example. Unfortunately, this means that when sound is reproduced by loudspeakers, sound sources can sometimes appear to move back and forth depending on how loud or soft they are. Dudleston says this effect can be countered by adding a rear-facing titanium dome tweeter to flatten the overall power response, which in turn has the effect of stabilising the location of images during changes in volume.

Take a look at the tweeter arrangement and you'll see this also is unconventional, because Dudleston uses two different tweeters to deliver the high frequencies. Sounds between 2.8kHz and 10kHz are reproduced by

a French-made Audax 34mm soft dome tweeter. This is a superb unit (TW034XO) with an enormous magnet assembly that can dissipate swathes of heat. Above 10kHz, the sound is delivered by a 52 x 10mm Japanese ribbon tweeter. In a ribbon design, a very thin strip of metal foil is stretched between two magnets. The electrical signal causes the foil to vibrate, generating sound waves. Because the foil has virtually no mass, the sound is more delicate and airy than any conventional dome tweeter.

LEGACY AUDIO

Brand: Legacy Audio
Model: Signature III
Category: Floorstanding Loudspeakers
Suggested Price: \$10,080.00
Warranty Period: Ten Years
Distributor: The Audio Video Supply
Address:
 69 Grandview Street
 Pymble
 NSW 2073
Tel: (02) 9983 9273
Fax: (02) 9983 0394
E-mail: sales@pymblehifi.com.au
Web: www.pymblehifi.com.au
 For additional information, turn to page 98 and circle 0241 on our Reader Information Service Card.

Test Results

Australian HI-FI Test Laboratories graphed the in-room frequency response of the Signature III loudspeakers, using a pink noise stimulus, as extending from 18Hz to 20kHz ± 3.5 dB: an excellent result, particularly at the bottom end, where few loudspeakers—even large floor-standing models—can reach so low. As is usual, the greatest variations in response were at the extreme bass frequencies and extreme treble, so that if these are trimmed slightly, the response extended from 35Hz to 10kHz ± 2.5 dB. Across the midrange, response tightened up even further, to be flat within ± 1.5 dB. Of interest in the response, despite the overall flatness of the curve, is the amount of bass energy across the band

20–100Hz, where the level is about 2dB above the average level across the rest of the band, and a very small suck-out at 200Hz, probably room related.

The roll-off above 10kHz is typical of what we see when a speaker is tested with a pink noise stimulus. You can see from the gated high-frequency response that when driven by a less complex and demanding test signal (a gated sine-wave), there's much more level available leading up to 10kHz and in the octave above.

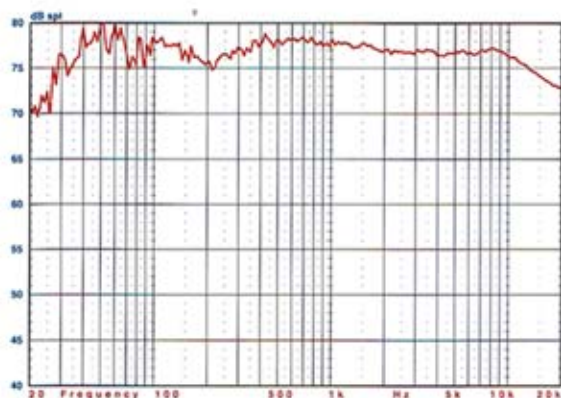
The graph showing the nearfield performance of the Signature III plots the output of the front-firing bass driver against the small polypropylene midbass driver. As you can see, the bass driver's output peaks at 55Hz. Below this frequency,

the response rolls off quite slowly and smoothly. (The contribution of the passive driver has not been factored in.) The smaller bass driver rolls off steeply below 100Hz, where its output peaks.

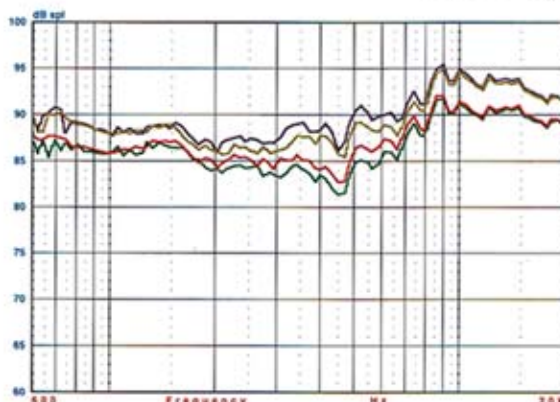
The Legacy's impedance graph shows that if you leave Switch 2 in the 'up' position, you'll be placing very heavy demands on the driving amplifier, because the impedance falls below 2.5-ohms across the region 60–70Hz and gets almost down to 1-ohm at 30Hz. With the switch in the 'down' position, the impedance dips down only as far as 3-ohms at 65Hz and is far more manageable.

Efficiency is high, with the Signature III returning 89.3dB SPL at one metre, with a 2.83V input, under Australian HI-FI Test Laboratories' standard test conditions. **AH**

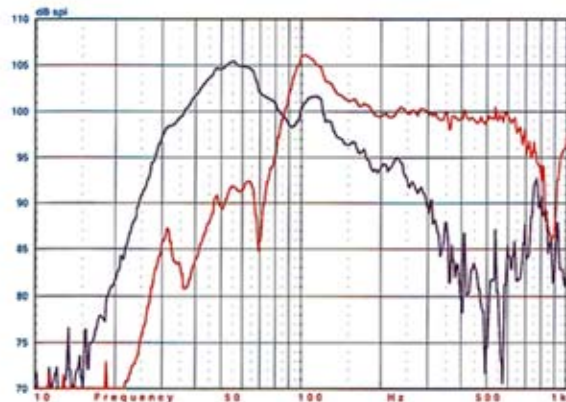
Steve Holding



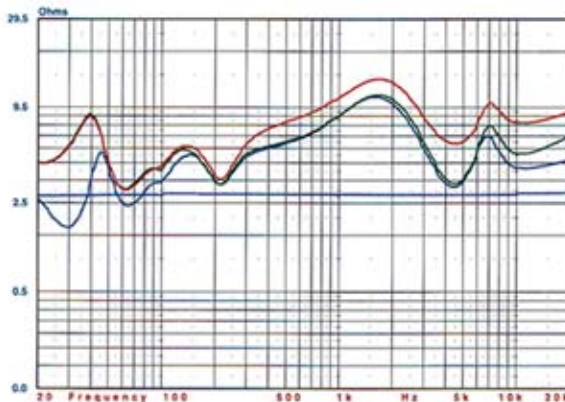
Pink noise frequency response at one watt at one metre, on axis with tweeter.



Gated sine frequency response at one watt, at one metre, on-axis, for different settings of controls.



Nearfield frequency responses, showing bass driver responses. (Note that data for smaller driver has not been re-scaled to compensate for difference in radiating area.)



Impedance vs Frequency for various settings of rear-panel switches. Flat trace shows precision 3-ohm resistor graphed for calibration purposes.

“it was perhaps just a shade *too* powerful around 50Hz, where there’s usually quite a lot going on”

Around the back of the Legacy Signature III I was surprised to find not just the dome tweeter I have already mentioned, but also a bi-wirable speaker terminal block fitted with four microswitches that can be used to tailor the sound of the system to suit your tastes in tonal quality and also to better match the speakers to your room. The ‘default’ setting is with all four switches in the up position. If you move SW1 down, this has the effect of reducing the level of frequencies above 400Hz by 2dB, which Legacy says ‘*can be helpful in restoring system balance with closely miked program material or nearfield listening positions.*’ Moving SW2 down ‘*reduces edginess in the lower treble region due to room flutter or bright program material.*’ Switch 3 is a low-frequency impedance contour that when in its down position will reduce upper bass heaviness caused by standing waves. The last switch (SW4) turns the rear-firing ‘ambience’ tweeter on and off.

Listening Sessions

Wow! The level of bass from the Signature IIIs was a real ear-opener. From the very first notes it was immediately obvious that these speakers are easily able to deliver the full dynamics and impact of recorded rock sessions and full-complement orchestral concerts without even a hint of distortion. The speakers had already been burned-in, and the bass they delivered was powerful and

extended. Indeed I thought it was perhaps just a shade *too* powerful around 50Hz, where there’s usually quite a lot going on with kick drum, electric bass and orchestral percussion, so I ended up flicking Switch 3 down, which balanced the sound beautifully. However, after more than a month with the speakers, I gradually became more accustomed to the power of the bass and found myself starting to sneak the switch back up with some CDs, since it became quite obvious that more than a few producers are artificially boosting the bass on their CDs to compensate for speakers that don’t have an adequate bass response. If you play such CDs through the Signature IIIs, you’ll definitely need to head for Switch 3. If you’re playing a CD that’s been naturalistically recorded, leave SW3 in its default (up) position.

I found the sound of the upper bass veered more to sounding warm and full than transparent, but the overall sonic character seemed so perfectly suited to the ‘big’ sound of the bass that the result was enormously satisfying from a musical standpoint. Listening to solo female vocalists, for example, the sound was ‘up-front’ and integrated, without the voices seeming to float in little spaces of their own. Instrumentalists were given a similar treatment, but the greater range resulted in a more natural effect.

Upper treble sound was ethereal—everything you could wish for really, with the large, front-firing dome able to give real bite and aggression to the upper harmonics of such instruments as trumpets, while the ribbon added air that enabled true atmospherics.

Perhaps the Signature IIIs’ most impressive attribute is the effortless way they go about the business of delivering music into your living room—particularly when you’re

listening at realistic volume levels. There’s no sense of them being ‘loud’, even when you turn the volume up. Whether this is because of the low intrinsic distortion levels, the excellent frequency balance or a combination of both, it’s a revelation. In fact I’m prepared to bet serious money you suddenly find yourself comfortably listening to your music at levels you previously never would have dreamed of—and enjoying the music all the more for the experience.

Conclusion

As you’ve probably gathered, designer William Dudleston is not your ‘average’ speaker designer, in that he’s prepared to build designs he believes in, even if they don’t fit well with mainstream speaker design concepts or what his marketing people would like him to build. It’s obviously a sore point, because he’s gone to the trouble of writing a 60-page book titled *The White Pages. Legacy Audio. Ideas and Opinions*’ that contains full, detailed (and largely non-technical) explanations of all the unusual features and circuits built into Legacy speakers, and the reasons they’re there. (Copies are available from the Australian distributor, Pymble HI-FI.)

The silly thing is that if you listen to the Signature IIIs, you won’t need to read the book, because their quality will tell you everything you need to know! **AHF**

greg borrowman

LAB REPORT

Readers interested in a full technical appraisal of the performance of the Legacy Audio Signature III 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.