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EQUIPMENT REPORT

Paradigm Reference Signature S2 LOUDSPEAKER

John Atkinson

DESCRIPTION Two-way, reflex-loaded, magnetically shielded, stand-mounted loudspeaker. Drive-units: 1" (25mm) G-PAL, gold-anodized aluminum dome tweeter; 7" (178mm) MLP, mica-loaded polymer-cone woofer. Crossover frequency: 1.8kHz. Crossover slopes: third-order, electro acoustic. Frequency response: 52Hz-22kHz, ± 2 dB on-axis; 52Hz-20kHz, ± 2 dB, 30° off-axis. Low-frequency extension: 38Hz DIN (-3dB in a typical listening room). Impedance: "compatible with 8 ohms" Sensitivity: 88dB/2.83V/m, anechoic. Recommended amplification power: 15-225W. Maximum input power: 140W with typical program source, provided the amplifier clips no more than 10% of the time.

DIMENSIONS 15" (381mm) H by 8.25" (210mm) W by 14" (316mm) D. Weight: 56 lbs (25.4kg). Internal volume: 13.7 liters (0.48ft³).

FINISHES Cherry, Natural Bird's-eye Maple, Rosewood, Piano Black Gloss; black or brown grille cloth.

SERIAL NUMBERS OF UNITS REVIEWED 10384, 10385.

PRICE \$1900-\$2200/pair, depending on finish. Matching Premier J-29 speaker stand sold separately. Approximate number of dealers: 350.

MANUFACTURER Paradigm Electronics Inc., 205 Annagem Blvd., Mississauga, Ontario L5T 2V1, Canada.
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Fax: (905) 632-0183.
Web: www.paradigm.com.



Canadian company Paradigm has made a name for itself over the past 20 years with affordably priced, high-performance loudspeakers. Its Reference Series designs have garnered much praise from this magazine—I was *well* impressed by the floorstanding Series 3 Reference Studio 100 (\$2300/pair) last January, my review following hard on the heels of Kalman Rubinson's enthusiastic recommendation of the smaller Studio 60 v.3 (\$1600/pair) in December 2004, while the bookshelf Reference Studio 20 (\$800/pair) has been a resident of *Stereophile's* "Recommended Components" listing ever since Bob Reina's original review in February 1998. (All three reviews can be found in the free online archives at www.stereophile.com.)

Paradigm has invested in research and development over the years, including the building of their own anechoic chamber, but missing from the Paradigm product lineup has been any "statement" product. Then, at the 2004 Consumer Electronics Show in Las Vegas, Paradigm's Rob Sample and Mark Aling showed me production prototypes of a small two-way design, the Reference Signature S2, which, with its high-tech drive-units and impeccable finish, was intended to spearhead the company's assault on the high end of loudspeaker design. "Sign me up for a review pair," I declared, "pronto!"

Signature

It took rather longer for the review speakers to arrive than I had anticipated, and the Reference Signature S2s had to take their place in the queue. However, when I unpacked the boxes I was impressed with what I found. The contrast between the gray, diecast front plates of the tweeter, woofer, and port, the polished gold-colored metal of the tweeter dome and the woofer's stationary phase plug, and the immaculate high-gloss finish of the bird's-eye maple veneer, was stunning. It's a shame that all this has to be hidden behind the grille, which consists of dark brown cloth stretched over

a plastic space frame. But as Paradigm's literature makes it clear, the grille fits flush with the drive-units to minimize edge diffraction. The enclosure itself is made from 3/4" MDF and has gently curved sidewalls and top panel, to increase rigidity. With its internal vertical H-brace behind the drive-units, it feels solid as a rock.

Paradigm makes its own drivers: the 1" tweeter in the S2 has an aluminum dome anodized a gold color, and neodymium magnets. This model has a very high dynamic range, and is said to be able to stand a peak transient of 60V! A heatsink attached to the rear of the tweeter helps dissipate heat

MEASUREMENTS

My estimate of the Reference Signature S2's voltage sensitivity agreed with the specification at 88.2dB(B)/2.83V/m, which is 1dB higher than the average of the speakers I have measured. Its impedance (fig.1) dips briefly below 4 ohms in the lower midrange, reaching a minimum of 3.6 ohms at 180Hz, but stays above 8 ohms for much of the audioband. Even with a combination of 5.2 ohms impedance and -40° capacitive phase angle in the upper bass at 112Hz, the Paradigm will not be too demanding a load for its partnering amplifier to drive. A slight wrinkle at 200Hz in the impedance traces is associated with a resonant mode detectable in the cabinet panels at the same frequency (fig.2), but its effect is low in level. The rigid, well-braced cabinet is otherwise acoustically inert.

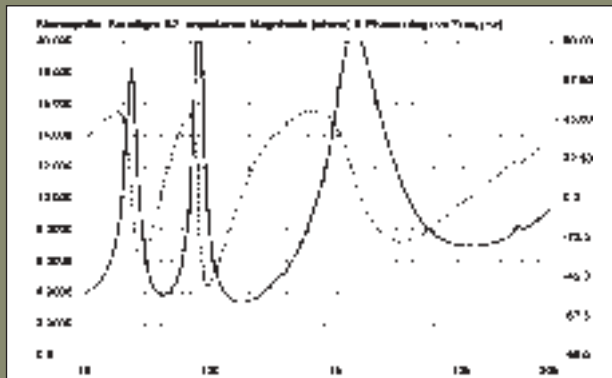


Fig. 1 Paradigm Reference Signature S2, electrical impedance (solid) and phase (dashed). (2 ohms/vertical div.)

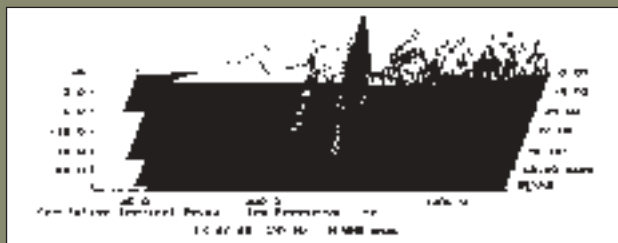


Fig. 2 Paradigm Reference Signature S2, cumulative spectral-decay plot calculated from the output of an accelerometer fastened to the cabinet's top panel (MLS driving voltage to speaker, 7.55V; measurement bandwidth, 2kHz).

The saddle in the impedance magnitude trace centered at 40Hz indicates the tuning frequency of the reflex port. The corresponding minimum-motion point at the same frequency can be seen in the nearfield woofer response in fig.3, with the port's output peaking in the same region. The port response rolls off smoothly above 50Hz, but I was alarmed to see a high-Q resonance present just above

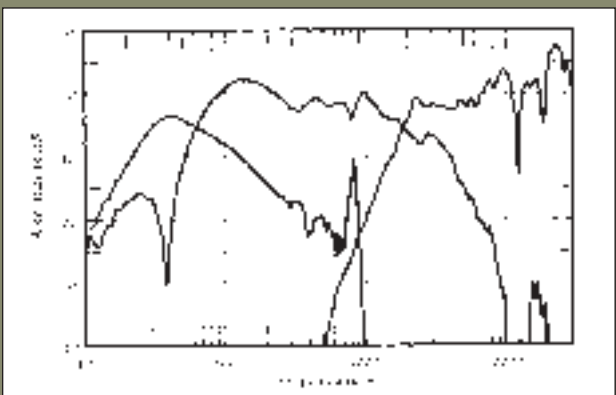


Fig. 3 Paradigm Reference Signature S2, acoustic crossover on tweeter axis at 50z, corrected for microphone response, with the nearfield woofer and port responses plotted below 300Hz and 1kHz, respectively.

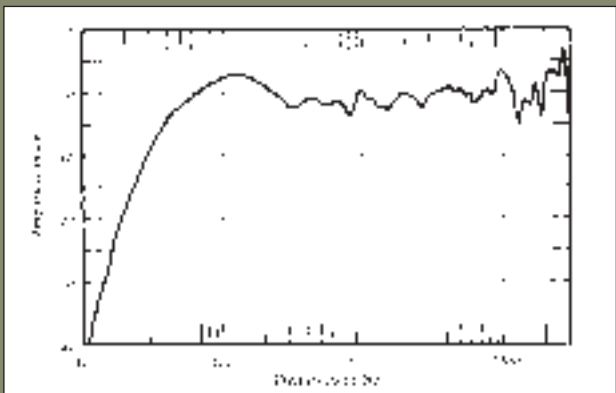


Fig. 4 Paradigm Reference Signature S2, anechoic response on tweeter axis at 50z, averaged across 30° horizontal window and corrected for microphone response, with the complex sum of the nearfield woofer and port responses, taking into account acoustic phase and distance from the nominal farfield point, plotted below 300Hz.

when the speaker is driven with sustained high-frequency signals. The woofer uses a 7" cone formed from mica-loaded polymer; it uses a 1.5" voice-coil and an inverted half-roll surround, and is mounted to the baffle with a compliant gasket.

The woofer is reflex-loaded with a fairly large-diameter port mounted beneath it on the baffle, this flared at both ends to minimize wind noise at high levels. Internal wiring is fairly heavy-gauge multistrand cable, with push-on clips used for the driver connections. Electrical connection is via two pairs of WBT binding posts set into the back panel, and the crossover is mounted behind these posts,

with separate boards used for each section. The filters appear to be second-order for the tweeter high-pass, using a single air-cored coil and a plastic-film capacitor; and third-order for the woofer low-pass, with two laminated iron-cored coils and a nonpolarized electrolytic capacitor.

Sound

I set up the Paradigms on 24" Celestion stands, the central pillars of which were filled with a mix of sand and lead shot, in the positions where the Dynaudio Special 25 that I reviewed in June had worked well. This is a little closer to the sidewalls than I use for full-range speakers,

which adds some needed boundary reinforcement to the midbass with minimonitors. Even then, the Reference Signature S2 sounded light in overall weight. However, its rich upper-bass register meant that only occasionally did I feel that I was being short-changed on low frequencies. The Fender bass on the channel-identification tracks on my *Editor's Choice* CD (Stereophile STPHO16-2) had a reasonably full-bodied tone, but with a slight accentuation of each note's leading edge.

Occasionally I thought I noticed a touch of "gruffness" in the S2's presentation of bass instruments, but provided the playback level was not extreme—this is a small speaker,

800Hz. This aberration is severe enough to create a suckout at the same frequency in the woofer's response.

The woofer's output shows slightly more of a boost in the upper bass in fig.3 than I expected from the nearfield measurement technique, implying a slightly underdamped bass alignment that, as I heard, will tend to compensate for the small speaker's lack of low bass. Higher in frequency, the woofer crosses over to the tweeter at 1.8kHz as specified, but with a shallower rollout for an octave or so above that frequency than expected from the specified third-order slope. The tweeter comes in with a third-order slope and is

flat for the first octave and a half in its passband, but has a shelved-up response in its top octave, broken up by some interference effects.

Fig.4 shows how these individual outputs sum on the tweeter axis in the farfield, averaged across a 30° horizontal angle. Again, the S2's upper bass is a little more exaggerated than is warranted for strictly neutral behavior, but the balance overall is impressively flat. However, a slight suckout can still be seen at 800Hz—the frequency of the resonant mode in the port's output—and the tweeter is slightly too high in level compared with the speaker's midrange level. The measurements that contributed to this graph were taken with the grille in place. The grille's frame helps create an obstruction-free acoustic environment, particularly for the tweeter. Removing the grille increases the HF driver's mid-treble output, to the detriment of overall high-frequency smoothness (fig.5).

The Signature S2's horizontal radiation pattern is shown in fig.6, with the tweeter-axis response subtracted from all the traces to reveal the speaker's true behavior. Other than a slight lack of off-axis energy between 1 and 2kHz, presumably due to the slightly oversized woofer, the contour lines below 8kHz in this graph are both even and evenly spaced, correlating with the stable, well-defined stereo imaging I noted in my auditioning. Above 10kHz, the off-axis ridge is actually due to the on-axis suckout centered on 12.8kHz in fig.4 filling in to the speaker's sides. In the vertical plane (fig.7), a lack of energy develops in the low treble

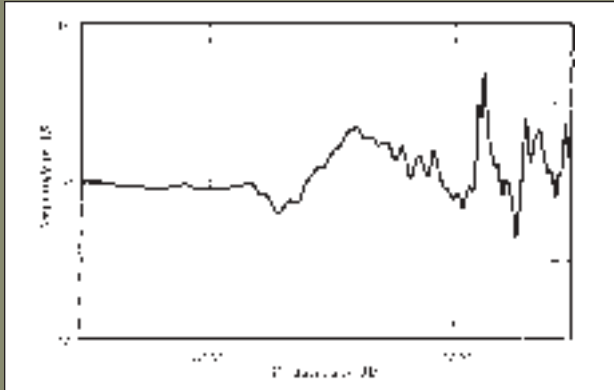


Fig. 5 Paradigm Reference Signature S2, effect on tweeter-axis response of removing the grille (5dB/vertical div.).

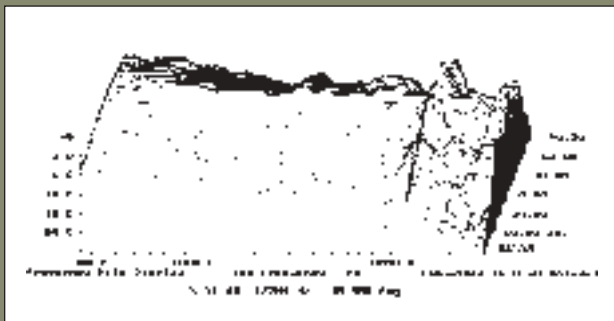


Fig. 6 Paradigm Reference Signature S2, lateral response family at 50z, normalized to response on tweeter axis, from back to front: differences in response 90–5° off-axis, reference response, differences in responses 5–90° off-axis.

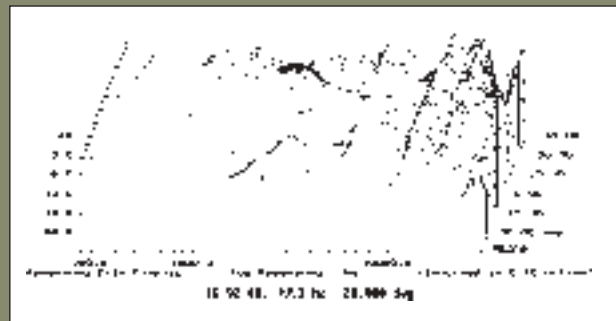


Fig. 7 Paradigm Reference Signature S2, vertical response family at 50z, normalized to response on tweeter axis, from back to front differences in response 45–5° above axis, reference response, differences in response 5–45° below axis.

after all—this was never a serious issue in my auditioning. But a 32Hz sinewave, even at modest volumes, produced some audible “doubling” (the addition of second-harmonic distortion). I never heard any wind noise emanating from the front-mounted port, by the way, but what I *did* hear from both speakers when I played the half-step-spaced toneburst track on *Editor's Choice* was some rattling of the grille between 90Hz and 160Hz. I fixed this with the strategic application of some Blu-Tack, but given that the grilles are so important to producing the correct treble balance, I was disappointed by this.

This track also revealed some slight problems with midrange clarity. I created

this test signal, which steps a sinewave burst from 32Hz to 4kHz and back again for each channel individually, because it quickly reveals when a speaker's drive-units have problems speaking with a single voice. As the toneburst went through the upper notes in the 512-1024Hz octave, each toneburst could be heard to acquire a very slight “shadow” at a different pitch. The same thing happened an octave lower; but with the shadow at the higher-pitched tone. I wasn't sure if I could consistently hear anything like this effect when listening to music; with spectrally pure sounds, however, such as the clarinet on my *Mosaic* CD (Stereophile STPH015-2), the instrument

occasionally sounded a little more sour in intonation than I was anticipating.

Once I had done the measurements I did wonder if the high-Q resonance present in the port's output just above 800Hz was responsible for this behavior. However, I could not hear anything untoward coming from the port itself. Other than that slight bit of “character” noticeable on specific recordings, the Paradigm's midrange was as pure and uncolored as I have heard. The voices on the new Hyperion CD of Morten Lauridsen's *Lux aeterna* (CDA67449), which John Marks has recently enthused over, were reproduced with a lack of unnatural color and a delightful delicacy. The individual

measurements, continued

more than 10° below the tweeter axis, with too much energy in the same region apparent at angles more than 5° above that axis, confirming the need to use stands with this speaker that place the listener's ears in the vicinity of the tweeter.

Fig.8 shows the response of the Signature S2s in my listening room, averaged for each speaker in a vertical

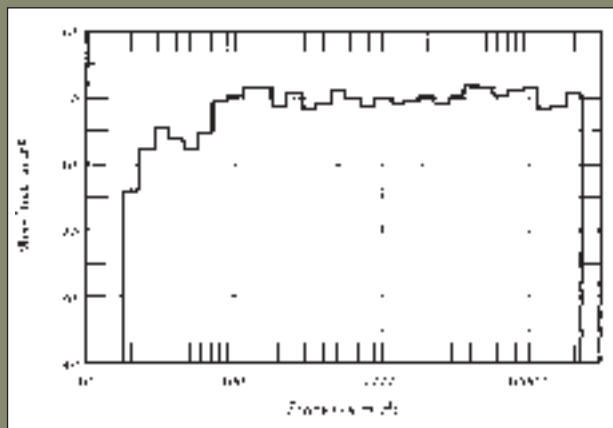


Fig. 8 Paradigm Reference Signature S2, 1/3-octave, spatially averaged response in JA's listening room.

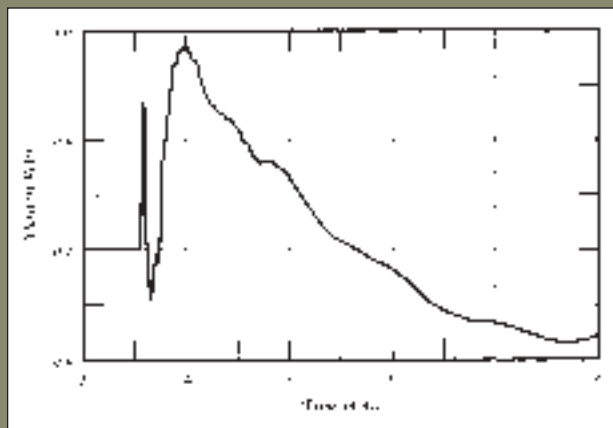


Fig. 9 Paradigm Reference Signature S2, step response on tweeter axis at 502 (5ms time window, 30kHz bandwidth).

window centered on the position of my ears. The graph is impressively flat from 80Hz to 20kHz, though with slight excesses of upper-bass and midtreble energy apparent. The former goes some way toward compensating for the S2's lack of mid- and low-bass output, while the latter is not unexpected, given my feelings about the speaker's slightly forward treble balance.

There are no surprises in the Paradigm's step response on the tweeter axis (fig.9), which reveals that both drive-units are connected with the same, positive, acoustic polarity. The slight discontinuity at the 3.7ms mark suggests that the best frequency-domain integration between the units actually occurs just below the tweeter axis, again confirming the need for high stands. The cumulative spectral-decay plot (fig.10) is generally clean in the treble, though with some low-level hash in the top octave, associated with the interference effects noted earlier. There is also a ridge of delayed low-level energy apparent at 2.3kHz, correlating with the small ripples seen in the step response. This may well be due to a residual mode in the woofer cone.

Overall, its measurements suggest that the Reference Signature S2 is another in the series of well-engineered loudspeakers emerging from the design studio led by Paradigm's co-owner Scott Bagby.

—John Atkinson

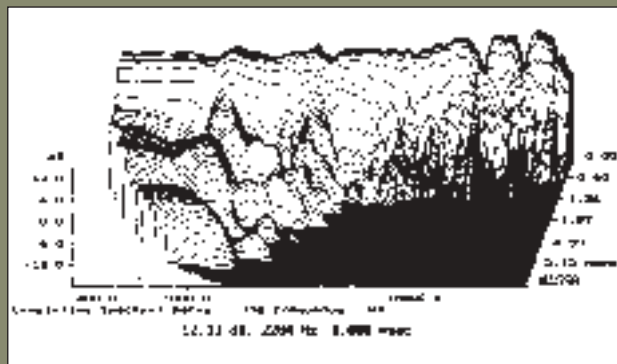


Fig. 10 Paradigm Reference Signature S2, cumulative spectral-decay plot at 502 (0.15ms risetime).

images of the singers were unambiguously positioned in the space between and behind the speakers, with almost no tendency for objects in the soundstage to “splash out” to the positions of the speakers.

DROP-DEAD GORGEOUS AT AN EQUALLY ATTRACTIVE PRICE, WITH FAULTS THAT ARE MINOR AND STRENGTHS THAT ARE MAJOR, THE S2 COMES HIGHLY RECOMMENDED.

Compared with the Dynaudio Special 25, the Signature S2's treble balance was a little on the forward side, though not quite to the same degree as the Danish speaker. The voices on Vaughan Williams' *Serenade to Music* (with the Corydon Singers and the ECO directed by Matthew Best, Hyperion CDA66420) were presented slightly in front of the speaker plane, and the work's climaxes sounded edgier than I was anticipating, even given this CD's fairly early digital provenance (it was recorded in 1990). In general, the Signature S2s were better suited to good modern classical CDs, such as Keith Johnson's recording of Rimsky-Korsakov's *Scheherazade* with the London Philharmonic under José Serebrier (Reference RR-89CD), than to aged ones suffering from analog tape distortion and noise modulation, such as the 1962 performance of Delius' *La Calinda* from the Philharmonia under George Weldon (EMI Studio 7 69534 2)—much as I love the latter on musical grounds.

On the other hand, this 43-year-old recording is nowhere near as sonically compromised as the CD side of Bruce Springsteen's new *Devils & Dust* Dual-Disc (Columbia CN 93900), which sounds overcompressed and plain distorted much of the time. (The DVD side sounds better in these respects; perhaps the mastering engineer—the A-list Bob Ludwig, according to the booklet—was not under as much pressure from the record-company suits to “make it louder.”) It is fair to point out that the cuts in which Springsteen accompanies himself on acoustic guitar (eg, the title track) are better in this respect than those with a full rock band—for example, “All the Way Home,” with its

Paradigm Signature S2

peak/mean ratio of just 4-5dB. As much as I wanted it to, the Signature S2 did nothing to smooth over the cracks in this piece of sonic dreck.

The S2's top octaves sounded *very* delicate, allowing subtle treble detail to be clearly resolved. At the start of Duke Ellington's “The Mooche,” from the Jerome Harris Quintet's *Rendezvous* (Stereophile STPHO13-2), drummer Billy Drummond gently and continually brushes his cymbals to provide a wash of HF that on speakers with poor tweeters resembles white noise. Played back on the Paradigms, the slight inflections in how Billy brushes the cymbals were clearly evident as changes in texture. Similarly, all the sonic subtleties in the two-channel remixes on Play, Peter Gabriel's

priority will be looking for a minimonitor as a first choice. In the tradition of the BBC LS3/5a, this Canadian speaker is not about loudness but about the ability to preserve subtleties and to maximize the purity of instrumental colors. Even so, I found a hardness that developed in the mid-treble to be the ultimate speed limit on loudness, rather than the fuzz and blurring that resulted from low-frequency overdrive.

To put this in perspective, the Paradigm played about as loud without strain as the MartinLogan Montage, which Kal Rubinson and I reviewed in the May and June 2005 issues. And on the superb Alison Krauss + Union Station *Live* DVD-V (Rounder 11661-0535-9; thanks for the PCM sound-track, Rounder), the music fit nicely within the Signature's dynamic limits.

ASSOCIATED EQUIPMENT

DIGITAL SOURCES Mark Levinson No.31.5 CD transport; Mark Levinson No.30.6, Benchmark DAC 1, Musical Fidelity XDAC^{v3} D/A processors; Technics DVD-A10 DVD-Audio player; Ayre C-5xe, Linn Unidisk SC universal players.

PREAMPLIFICATION Mark Levinson No.380S, No.3265 preamps.

POWER AMPLIFIERS Mark Levinson No.33 H monoblocks.

LOUDSPEAKERS Dynaudio Special 25, MartinLogan Montage.

CABLES Interconnect: AudioQuest Cheetah, Madrigal CZ Gel-1 balanced.

Speaker: AudioQuest Kilimanjaro.

Digital: Kimber Illuminations Orchid, DH Labs AES/EBU, AudioQuest

SVD-4, Stereovox hdxv S/PDIF. AC:

Synergistic Research Designers' Reference², PS Audio Lab.

ACCESSORIES Target TT-5 equipment racks; PS Audio Power Plant 300 at 90Hz (preamps, CD players only), Audio Power Industries 116 Mk.II & PE-1 AC line conditioners (not power amps); ASC Tube Traps, RPG Abffusors. AC power comes from two dedicated 20A circuits, each just 6' from the breaker box. A Mark Levinson No.33H was plugged into each.

—John Atkinson

collection of his sometimes disturbing videos on DVD-V (Warner R2 970396)—ranging, for example, from Kate Bush's delicately reassuring voicings and Tony Levin's bass chord foundation in “Don't Give Up” to the thunderous drums in “Biko”—emerged from the Paradigms unscathed.

Thunderous? Well, up to a point, given the Signature S2's relatively diminutive size. No one who rates dynamic range as a major

Summing up

If you value ultimate loudness and bass extension, then you should check out Paradigm's similarly priced, more utilitarian-styled Reference Studio 100 v.3. But if you're willing to sacrifice those attributes in favor of nuanced higher-frequency purity and the ability to develop a stable, detailed soundstage, Paradigm's Reference Signature S2 might well be for you, particularly if you have a smallish room. Drop-dead gorgeous at an equally attractive price, with faults that are minor and strengths that are major, the S2 comes highly recommended. ■