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Subwoofers

Earthquake SuperNova MKIV-15

By Steven Stone • September, 2002

Boom. Thud. Crash. What would a movie be without low-frequency effects? Even non-macho films like *Sense and Sensibility* have their share of carriage-wheel rumbings and horse-hoof thuds. Without a serious subwoofer that extends down to a solid 30Hz, and preferably even lower, a home-theater system can hardly be called "high-end."

Fortunately for aficionados of the subterranean, there exist companies like Earthquake Sound, which since 1986 has dedicated itself to the art of reproducing low frequencies. The SuperNova MKIV-15 represents Earthquake's latest thinking on what should go into a flagship subwoofer. After carefully checking my house's foundations for potential cracks and my walls for loose spots, I was fully prepared to find out if the MKIV was the best subwoofer in the known galaxy.



Earthborn Technology

Back in the early 1960s, Anthony Hoffman (the H in KLH) developed a mathematical formula that became known as Hoffman's Iron Law. Thiele and Small later refined the law's mathematics. The Iron Law states that the efficiency of a woofer system is directly proportional to its cabinet volume and the cube of its cutoff frequency (the lowest frequency it can usefully reproduce). To reduce the cutoff frequency from 40Hz to 20Hz you need to increase the enclosure volume by eight times. In other words, to produce half the frequency at the same output level you need a very big box. You can get around this by accepting a much lower efficiency, but this requires both a very large amplifier and a driver that can handle a lot of power, move a lot of air (requiring a long excursion), and do both while generating very little distortion.

A so-called reflex design provides a way around the Iron Law. A hole, or port, in the speaker enclosure loads the driver, reducing its excursion at the low end of its operating range. Below this range, the port itself contributes much of the system's output. One variation on this design uses a passive radiator in place of an open port or vent. A passive radiator is essentially a speaker without a drive mechanism (no magnet or voice-coil) that moves in sympathy with the vibrations and pressure created by the active speaker. By changing the size of the port—or the size and mass of the passive radiator—you can control the frequencies augmented by a reflex system.

Unfortunately, a reflex enclosure has its own set of compromises, including phase and group-delay anomalies and (in the case of a port) vent noise, which add to the woofer's total distortion. Ever since the introduction of the first ported enclosure in 1934, speaker designers have tried to come up with solutions to reduce these problems.

Earthquake has come up with a patented design that, according to the company, solves the problems and carries the technology to a higher level: a passive radiator tuned to a much lower frequency than other subwoofers. The Earthquake SuperNova subwoofer is said to combine the linearity of a sealed box with a ported design's advantages in dynamic ability and size.

The SuperNova MKIV-15 employs a 15-inch passive radiator capable of 4 inches of peak-to-peak movement. Because passive radiators are generally enclosed in a metal basket that limits their motion, they can't accomplish this feat. Also, conventional passive radiators do not move symmetrically in both directions; their outward motion differs from their inward motion. Earthquake's designer, Joseph Sahyoun, created an entirely new design, the Symmetrically Loaded Audio Passive System (SLAPS), that is said to solve both problems. The SLAPS passive radiator eliminates the need for a metal basket, and produces a device whose movements forward and back are symmetrical. It uses two flat diaphragms back-to-back, spaced by about an inch. Each diaphragm is composed of a special multi-layer polyether draw material that combines flexibility with strength, and uses a large-diameter (1.75 inches) roll in its surround material so that it can move the necessary 2 inches to produce a clean 15Hz.

The passive radiator is tuned to 17Hz, a full octave below the sealed cabinet's resonance point. This is said to eliminate most of the problems associated with a ported design. Group delay (in which some frequencies reach your ears before others) and phase-shift effects are moved to much lower frequencies, where their negative effects become inaudible. Because of the SLAPS design, the SuperNova's phase response and time alignment are said to match those of a sealed cabinet, but with the greater dynamic ability and smaller size of a ported design.

Equally innovative technology can be found in the SuperNova's 15-inch MAGMA active driver, an unconventional motor design featuring double-stacked, high-gauss, 1.5-inch-high magnets; a 7-inch-diameter, epoxy-coated, chill-plated super spider; copper-wound, high-temperature voice-coils 3 inches in diameter and 1.85 inches long; and a foam surround of 1-inch-thick single-layer, thermally pressed polyether. These make it possible for the driver to achieve extreme excursions of 19-21mm without physical deformation or losing reactive electromagnetic coupling. This heavy-duty driver looks as if it could be used for launching mortar shells.

The MKIV's 580W internal amplifier is a class-D, high-efficiency digital design. Not only is it much more efficient than a more conventional class-A/B amp, but it runs far cooler, eliminating the need for a large external heatsink. Optical Distortion Limiting (ODL) circuitry, another patented Earthquake process, converts the incoming analog signal to light, then optically couples it to the driver stage. The ODL circuit acts as an automatic and instantaneous input limiter, making it impossible for input signals of excessively high levels to clip the amplifier.

Earthquake offers three versions of the MKIV SuperNova. The standard model comes in black ash. Model P has a hard-shell finish of black polyurethane that resembles a flat black crinkle-coat. Finally, there's an "Uptown" version with a piano-gloss finish—and fabric grilles for those who feel it unseemly to look at a naked driver.

Earthquake has instituted some major topological changes since my review of their SuperNova Mk.II, which appeared in the February 1999 Guide. The passive driver is no longer on the side of the cabinet but on the rear, opposite the active driver. The Mk.II's controls and input-output connections were on its bottom; on the MKIV, they're on the side. These changes make the MKIV much easier to use—you don't have to turn it upside down to adjust or connect it.

The MKIV's control panel provides connections for line-level and high-level inputs. A pair of line-level RCA outputs permits daisy-chaining multiple MKIVs, if you wish. Controls include a volume-level knob, a 24dB/octave crossover knob for adjusting the low pass filter between 50 and 150Hz, a 0°/180° phase switch, and On/Off. In the On position, the SuperNova goes into standby mode when no signal has been detected for 30 minutes.

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Company Info

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Liftoff

The hardest part of setting up the Earthquake SuperNova was carrying it inside. Even getting it out of the box was relatively painless. The secret was to let gravity do the work: I opened the box's bottom flaps, then put the opened end down. Using my time-tested lazy-man methods, I had the SuperNova up and running 10 minutes after UPS had dropped it off.



And I do mean dropped. Although its shipping box had numerous scars, including two stove-in corners and several deep gashes, the MKIV itself was unscathed. Earthquake uses a thick, custom-fitted, sprayed-in cushion of packing foam to completely protect the SuperNova from the perils of travel. Even UPS couldn't trash it.

After sliding the unboxed SuperNova the last couple of feet to its final resting place, it took only a few minutes to hook it up and set the input levels. The Meridian 568 preamp-processor's built-in low-frequency test-tone generator made this a simple job. Unlike the SuperNova Mk.II, the MKIV doesn't have an Audio/Video switch. These pernicious controls are usually nothing more than glorified midbass boosts that change a subwoofer's relatively flat frequency response into an untidy hump. If you want more subwoofer volume for big-bang movies, Earthquake recommends that you turn up the MKIV's volume control.

Thanks to its remote control, you can adjust the MKIV's volume from the comfort of your listening chair. The only limitation is that you don't knob itself, and it's difficult to see the knob from a listening position. My advice: When you have the proper subwoofer level set, leave it alone. Volume twiddling is for only the terminally nervous or pyrotechnically inclined.

Walking on the Moon

There are four principal criteria for sound quality in a subwoofer: 1) It must produce very low frequencies. 2) It must produce all the frequencies within its operating range at high levels with low harmonic distortion. 3) Group delay should be minimal or nonexistent. 4) It must stop making sound when the signal stops. The Earthquake SuperNova scored high points in all four areas.

Driven by test signals in my large home-theater room, the SuperNova produced audible bass as low as 15Hz. More remarkably, there was no apparent 30Hz doubling. No other subwoofer I've used, including the earlier SuperNova MKII, could even begin to produce 15Hz tones cleanly. Of course, one doesn't hear 15Hz as much as feel it. My room sure felt it—hanging pictures and doors rattled and shook. The Earthquake MKIV-15 did 15Hz with panache and style. Only the passive woofer's extreme excursion hinted at how hard it had to work to put out this subterranean tone. From my listening seat, it just felt like magic.

At more common frequencies, between 20 and 40Hz, the SuperNova was as clean as a freshly washed white tablecloth, and as accurate as a newly graduated aerospace engineer. Whatever the material—full-scale orchestral recordings, small-ensemble jazz, blockbuster movie soundtracks—the MKIV performed with aplomb. To take full advantage of the sub's apparent speed and control, I changed my system's crossover point from 50Hz to 60Hz. Even though my Dunlavy SC-VIs have two 15-inch drivers apiece, the overall low-bass response in my room improved when more of the low-bass duties were shifted onto the SuperNova's shoulders. Bass transients became a bit cleaner and better defined, while the midbass lost some excess bloom and congestion.

Though a reviewer's job is to pick nits, I found precious few on the MKIV. Once I dialed in the setup, the sub did its job unobtrusively, supplying the last octave from 60Hz down while drawing little attention to itself. Only when I turned the SuperNova off was I fully aware of how much it had added to my system's overall sound and balance.

The only fault I found was ergonomic. Much more useful than a 0°/180° phase switch would be a dial by which installers could select the proper phase, which is determined by a subwoofer's location. With an infinitely adjustable dial you could tune in exactly the correct phase to achieve perfect alignment with your main speakers. Perhaps we'll see one on the SuperNova Mk.V.

A Final Swing around Jupiter's Rings

While few people want to experience a natural seismic event up close and personal, having the Earthquake SuperNova MKIV-15 subwoofer in my home theater was an exciting but safe way to make the earth move. Even in my large room, a single SuperNova was able to put out enough low-bass energy for the most bombastic scenes of mayhem and cosmic destruction. More austere films, too, benefited from the MKIV's nimbleness and finesse. Even music's harmonic foundation gained solidity and presence.

If you've priced the most expensive state-of-the-art subs, you could almost buy two MKIVs and still come out ahead. But you shouldn't need more than one. There might be better subwoofers on the planet, but I haven't heard them. I heartily recommend the Earthquake SuperNova MKIV-15 for any system requiring the ultimate sonic boon.

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Subwoofers

Earthquake SuperNova MKIV-15:

Specifications

Specifications

SuperNova MKIV-15 powered subwoofer in vented cabinet
Driver complement: 15" MAGMA-15 active driver and 15" SLAPS-15 passive radiator
Amplifier: 580W, class-D
Highpass filter: line-level, 70Hz @ 6dB/octave
Lowpass filter: 40-120Hz (variable), 24dB/octave
Dimensions: 20" x 17" x 18" (WxHxD)
Weight: 88 lbs (model P), 89 lbs in black ash
Finishes: polyurethane (model P), black ash; Piano gloss with grilles, add \$505
Price: \$2900
Manufacturer
Earthquake Sound Corporation
1215 O'Brien Drive
Menlo Park, CA 94025
tel. (650) 327-3003
fax (650) 327-0179
www.earthquakesound.com

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