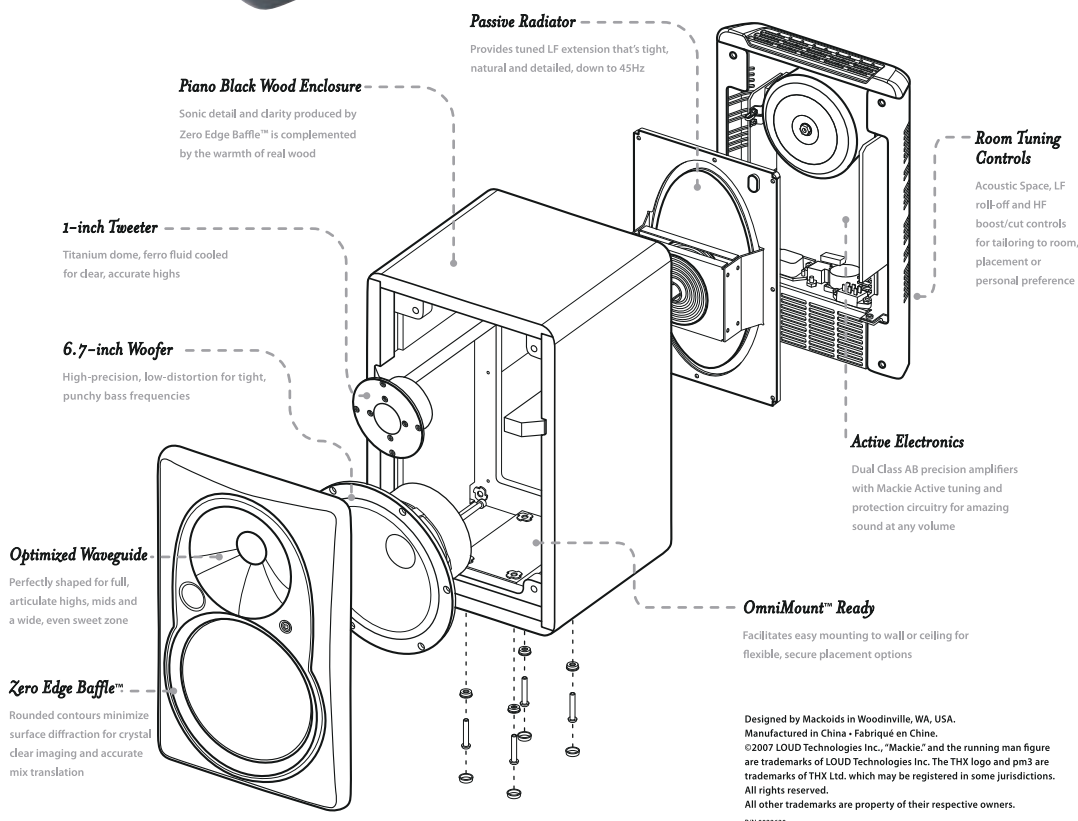


Re-inventing Mackie's HR monitors

Mackie has introduced its next-generation studio monitors with the HRmk2 models. Mackie's product manager **JAMES WOODBURN** explains the background to the new speakers and how they believe they have improved on a classic design.



MACKIE'S GOAL IN creating the original HR Series active studio monitors was to build a product that achieved sonic results found in high-end reference monitors, yet was also affordable. To determine optimal monitor design and which components to use — based not only on sound quality but also on cost-effectiveness — Greg Mackie recruited a team of seasoned acoustic and amplifier design veterans, including Terry Wetherbee and Cal Perkins, and invested in advanced analysis and measurement tools. Using computer-aided technologies including Finite Element Analysis (FEA), other computer modelling programs, as well as FFT real-time laser vibration analysis, Mackie and his team were able to select just the right parts. The HR824 was born, and the highly respected monitor is now a staple of high-end, project and home studios.

Since the release of the original HR Series, audio recording and the studio environment have changed by leaps and bounds. With greater bit depth and higher sampling rates, recorded audio now encompasses a fuller frequency and dynamic range. Along with the higher quality audio has come accessibility; more people can afford professional-level recording and audio equipment, and as a result, more studios have found their way into people's homes.

With all these changes come new demands and expectations for a studio monitor. Mackie revisited the original HR Series with the objective of equipping it to take on these demands, while at the same time maintaining its sonic character. Chosen for the mk2 makeover were the HR824 and HR624, the most popular monitors in the HR series. The engineering and design team set out to improve upon the characteristics that helped seal the classic HR monitor's reputation, such as its ability to handle low frequencies very well, its detailed high-frequency output and its broad stereo imaging, as well as develop higher performance standards for the new generation of monitors.

The design team tapped the expertise of Mackie and EAW engineers who spent hours listening to a variety of high-end monitors alongside the original HR Series, as well as prototypes of the HRmk2 Series. Notably, the team found that while the performance measurements of the more expensive monitors were favourable, the character of their sound was dramatically different from one speaker to the next. This emphasised to the team the importance of a monitor's unique sound qualities, and reinforced their desire to improve the HR in such a way as to not destroy the underlying sonic character that earned the classic its loyal following.

Being under the LOUD Technologies umbrella means Mackie product developers can draw on a variety of human resources and unique tools as well. Alongside traditional techniques used in the voicing process, one of the most valuable tools available to Mackie was FChart — sophisticated proprietary software created by EAW's research and development engineer David Gunness. FChart models all elements of a speaker, including 3D polars. By simulating placement of a microphone to obtain polar information, the team could see objective data

that verified or challenged their assessment of the monitor's performance on- and off-axis.

The HRmk2 team assessed that the original HR's baffle edges produced visible diffraction ripples, therefore significant benefits could be achieved from redesigning it. Engineers in Mackie's Industrial Design (ID) team developed a prototype for a new baffle with rounded contours replacing the edges. Over a course of listening and modification by ID, the design was finalised. Created from a single piece of cast aluminium, the HRmk2's Zero Edge Baffle produced dramatic results: edge diffraction was greatly reduced and time domain characteristics improved. The one-piece construction also reduces the possibility of vibration or resonance from the transducers.

The passive radiator design was a radical choice in the design of the original HR Series and it was one that paid off. It avoids the drawbacks of ducted ports or slots that can cause low frequency distortion and audible vent noise. In the HR Series monitor, the low frequency transducer is coupled to a composite honeycomb, mass-loaded, elliptical passive driver that 'fires' out the rear of the enclosure. This passive radiator produces most of the ultra-low frequency sound; there is very little distortion from the woofer because its cone movement is minimal at those frequencies. With a radiating area equivalent to a 12-inch woofer, it effectively doubles the low frequency transducer's ability to move air mass and, in the HR824, delivers flat response to 42Hz with a 37Hz 3dB-down point. In the HR624, it delivers flat response down to 42Hz with a 39Hz 3dB-down point. This design was carried into the new HRmk2 monitors, with other modifications made to improve bass frequency performance.

While the original HR monitors offered low-end extension, some people complained of a lack of detail at frequencies in the 180Hz–200Hz range. The new Zero Edge Baffle significantly improves articulation across the low end. In addition, the size of the cabinet has been increased to achieve the full frequency range without driving the amplifiers too hard, producing smoother low-frequency response and reducing the chance of distortion.

The HRmk2s retain the class A/B amplifiers used in the original HR monitors: the HR824mk2 boasts 150W low frequency and 100W high frequency amplifiers, while the HR624mk2 features 100W low frequency and 40W high frequency amplifiers. The team had weighed the option of a class D design but concluded that while there could be space- and weight-saving benefits, switching amplifier design would fundamentally change the sonic character of the HR speaker, which was something they were determined not to do. Using the same amplifier design also ensured the new monitors could carry

over the Acoustic Space circuitry of the original HRs, which allows users to tune the monitors to their room and compensate for placement in their listening environment. As in the original HRs, the amplifiers are voiced to match the entire monitor system, and are hand-trimmed to compensate for typical manufacturing tolerances between the drivers.

The selection of the new drivers in the HRmk2 Series was based on maintaining sonic quality at accessible price points. Each HRmk2 monitor features a high-precision, low-distortion woofer — 8.75-inch for the HR824mk2 and 6.7-inch for the HR624mk2 — and a 1-inch ferrofluid cooled titanium dome tweeter. The high-frequency driver is mounted on the die-cast aluminium exponential waveguide, which is now incorporated as part of the one-piece Zero Edge Baffle.

HRmk2 monitors retain the wood cabinet with internal bracing to increase strength and rigidity. To absorb internal reflections and dampen standing waves inside the cabinet, an open-cell adiabatic foam material is placed strategically inside the box. The design team chose wood for the cabinet based on opinion rather than scientific fact — they simply felt the inertness of an all-metal cabinet produced sound that was overly sterile. The team found that using wood in concert with an inert frontal surface adds that un-quantifiable 'bit of life'.

The design team chose to pursue THX pm3 approval to emphasise the versatility and reinforce the quality of the HRmk2 monitors. Like the original HRs, the HRmk2s are the only widely-available monitors with such a distinction. Also like their predecessors, they passed the specification tests in the first round, and in most areas, significantly surpassed the minimum requirements.

With the potential for the speakers to be used in settings from home theatres to gaming rooms to studios, even appearance became an important factor in the HRmk2 design process. The team opted for a high-gloss, piano black finish for the cabinet, a complementary shade against the deep charcoal grey of the Zero Edge Baffle.

At the end of the day, the process of designing the HRmk2s was about re-inventing a classic. The design and engineering team took great pains to retain the character and affordability of the original HR monitors, while at the same time preparing them to take on any challenge in today's

studio. Measurement specifications for the HRmk2s reveal they offer near-flat frequency response, as well as greater accuracy and depth of field than their predecessors, resulting in a wider, more even sweet spot. And while the charts and graphs confirm the team succeeded in achieving their goal, more importantly, their ears do too. ■

