

SASHA MATSON

McIntosh Laboratory MC462

POWER AMPLIFIER



It hit me not long ago: I need more Mac in my life! I promptly purchased the current production version of McIntosh Laboratory's time-honored MC275 tubed preamplifier I already owned. The recently reinvigorated debate in these pages comparing solid-state and single-ended tube designs got me to thinking. One thing led to another, and

voilà! McIntosh's latest solid-state stereo amplifier, the MC462 Quad Balanced (\$9000), arrived, bolted to a shipping pallet and encased in two big, heavy, nested boxes. All that packaging weighs 33 lb—the amp inside weighs 115 lb. If you want to lift it onto a rack, you'll need two people, a serious handcart, and a strong, deep shelf.

Frank McIntosh and his company got off to a very strong

SPECIFICATIONS

Description Solid-state, class-AB stereo power amplifier. Inputs: 1 pair single-ended (RCA), 1 pair balanced. Outputs: 1 pair single-ended, 1 pair balanced; 6 pairs five-way binding posts (2, 4, 8 ohms). Power output: 450Wpc into 2, 4, or 8 ohms (26.5dBW). Frequency

response: 20Hz–20kHz, ± 0.25 dB; 20kHz–100kHz, ± 3 dB. Voltage gain: 29dB, 8 ohms. Input sensitivity: 4.2V balanced, 2.1V unbalanced. Damping factor: 40. THD: 0.005% maximum, 250mW-rated power. Signal/noise, A-weighted: 95dB balanced (122dB below rated

output). **Dimensions** 17.5" (445mm) W by 9.45" (240mm) H by 22.5" (572mm) D. Weight: 115.3 lb (52.3kg) net, 148.4 lb (67.3kg) shipping. **Serial number of unit reviewed** AGP1268. **Price** \$9000. Approximate number of dealers: over 200.

Warranty: 3 years, limited, non-transferable.

Manufacturer

McIntosh Laboratory, Inc., 2 Chambers Street, Binghamton, NY 13903. Tel: (607) 723-3512. Fax: (607) 724-0549. Web: www.mcintoshlabs.com.

start in 1949, in Silver Spring, Maryland, with their first product, the tubed Unity Coupled 50W1 Power Amplifier. A patent was granted that same year for the Unity Coupled circuit and transformer. In 1951, McIntosh Laboratory moved to Binghamton, New York, where they've been ever since.

A week after the MC462's arrival I saw for myself, on a guided tour of the plant, how it all comes together: I could feel McIntosh's conservative approach: doing the maximum, not the minimum, at all stages of design and manufacturing, to maintain a high level of quality.

What are you?

The solid-state MC462 power amplifier replaces the MC452 and is now the most powerful stereo amplifier McIntosh offers, with a specified continuous power output of 450Wpc into 2, 4, or 8 ohms, and peak output current of 75 amperes per channel. (McIntosh claims a 66% increase in dynamic headroom over the MC452, achieved by a big increase in power-supply filter capacitance.) The MC462's distortion is specified as not exceeding 0.005% at rated power output, and as no more than 0.002% in the mid-frequencies.

In the MC462, which operates in class-AB, the concept of complementary pairs is taken to an extreme. In most push-pull amps, the two phases of the signal waveform are amplified separately by two single-ended amplifiers, the outputs of which are then combined to recreate the waveform in full—and in the combining, some distortion products are cancelled out. What McIntosh has created is a push-pull amp in which each phase of the signal waveform is itself amplified by a push-pull output section: There are two complete push-pull amplifiers in each channel, their outputs combined in what McIntosh refers to as a Quad Balanced architecture.

The design element that allows McIntosh to do this has been a technical cornerstone of all their solid-state amps: a single-winding transformer called an autotransformer—or, in the trade lingo arguably coined by McIntosh, an Autoformer. Beginning in 1967 with their first transistor amp, the MC2505, McIntosh has used output-stage Autoformers to optimize impedance matching between output devices and loudspeaker loads, as well as to protect the latter from DC.

Fifty-two years later, an output-stage Autoformer allows the company to combine the outputs of multiple push-pull amps in a manner that, they say, has unprecedented distortion-cancelling capabilities. (This is also how the MC462 can deliver the same 450Wpc output to its pairs of 2, 4, or 8 ohm speaker taps.)

All of this firepower ran amazingly cool—when I laid a hand on the top panel, it was barely warm. This cool running is in part achieved through what McIntosh describes as their current-generation ThermalTrak Power Transistors; the MC462's power output circuit monitors their temperature and adjusts bias accordingly. Another reason is the extensive, heavy-duty heatsinking built into the rear half of the MC462. These include a nice touch: the initials MC are formed by the sinks' vertical fins and are visible from above—as if you're standing atop a subway grille on a Manhattan street. Also visible from that vantage is evidence of McIntosh's pride in the MC462's lineage: circuit block diagrams handsomely adorned the top plate.

At 17.5" wide by 9.45" high by 22.5" deep, the MC462 occupies an impressive amount of real estate, but finding room for it wasn't as hard as I at first thought—that 22.5"

1 When this review is reprinted on www.stereophile.com, it will be accompanied by an interview with McIntosh president Charlie Randall.—Ed.

MEASUREMENTS

I performed a full set of measurements on the McIntosh MC462, using my Audio Precision SYS2722 system (see the January 2008 "As We See It"). Before doing any testing, I preconditioned the MC462 by running its 8 ohm output at one-third power for 30 minutes into 8 ohms—thermally the warmest case for an amplifier with a class-AB or class-B output stage. At the end of that time

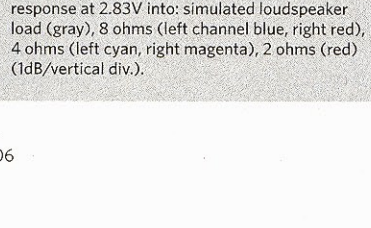


Fig.1 McIntosh MC462 (8 ohm output), frequency response at 2.83V into: simulated loudspeaker load (gray), 8 ohms (left channel blue, right red), 4 ohms (left cyan, right magenta), 2 ohms (red) (1dB/vertical div.).

the heatsinks were very hot, at 158.6°F (70.3°C). I usually precondition amplifiers for an hour, but I was concerned that the MC462 would get even hotter.

The McIntosh's voltage gain varied according to which output Autoformer tap was used and whether the balanced or unbalanced inputs were used. From the balanced inputs, the 8 ohm tap's gain into 8 ohms was a lower-than-usual 22.9dB, the 4 ohm

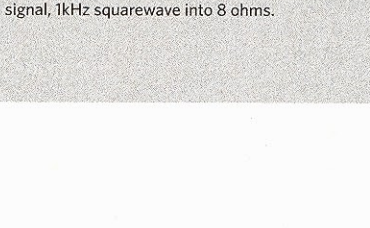


Fig.2 McIntosh MC462 (2 ohm output), small-signal, 1kHz squarewave into 8 ohms.

tap's gain lower at 20.4dB, and the 2 ohm's even lower, at 17.4dB. The gains using the unbalanced input were 6dB higher rather than 6dB lower; the latter is usually the case. All three sets of outputs preserved absolute polarity (ie, were non-inverting), the XLR jacks being wired with pin 2 hot, the modern standard.

I see www.stereophile.com/content/measurements-maps-precision.

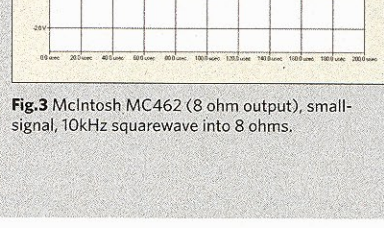


Fig.3 McIntosh MC462 (8 ohm output), small-signal, 10kHz squarewave into 8 ohms.

depth includes the two hefty handles on the faceplate and the rear deck on which the speaker terminals are vertically arrayed, and the amp's four rubber feet are sensibly separated by only 12.5" from front to back. The black glass faceplate proudly displays two large meters backlit in McIntosh blue, each about 5.5" wide by 2.5" high. The meters' upper scale is calibrated in watts, to indicate the MC462's output: the large numbers top out at 450, and after that, in smaller numbers, come "900" and "1.8k," referring to the amp's dynamic headroom: brief bursts of wattage beyond the MC462's rated continuous output. The MC462's specified dynamic headroom is 3dB—in the real world, that's a lot. The meters' lower row of figures calibrates the amp's output in decibels, from -50 to 0.

The rest of the front panel is minimalist. There are a green-lit "Olde English" McIntosh logo and three small red LEDs: one indicates Standby status, and the other two tell you when the Power Guard circuit kicks in. There are only two control knobs: the one at left, labeled Meter, turns the meters' Lights Off if desired; the Watts setting shows you real-time meter readings, while

Control of mechanical and circuit noise seems to be a real strength of McIntosh products.

Hold lets the needles linger on peak output levels before slowly resuming action. The other knob, Power, has positions for Off, On, and Remote, the last for connecting to a McIntosh preamp for power-up/down sequencing.

The rear end of the MC462 is straightforward. In addition to the six pairs of speaker output taps sticking straight up from the shallow rear deck are AC in, a fuse bay, and, jutting out horizontally from the rear panel, pairs of balanced and unbalanced inputs and outputs. One small switch lets you select between balanced and unbalanced operation, and with another you

measurements, continued

The MC462's unbalanced input impedance went very close to the specified 22k ohms from 20Hz to 20kHz. The balanced input impedance was twice the unbalanced, as expected. The output impedance was lowest from the 8 ohm Autoformer tap, at 0.09 ohm at 20Hz and 1kHz, rising to 0.13 ohm at 20kHz. The 4 ohm tap's output impedance was almost twice that of the 8 ohm tap—not what I was expecting—while the 2 ohm tap was 0.14 ohm at low and middle frequencies, rising to 0.185 ohm at the top of the au-



Fig.4 McIntosh MC462 (8 ohm output), spectrum of 1kHz sinewave, DC-1kHz, at 1W into 8 ohms (linear frequency scale).

dioband. As a result, the response with our standard simulated loudspeaker² varied by ± 0.2 dB (fig.1, gray trace). The channels' levels match to within 0.1dB, and the audioband response into 8 ohms (blue and red traces) and 4 ohms (cyan, magenta) is flat up to 20kHz. Into 2 ohms (green trace), a slight top-octave rolloff reaches -0.4dB at 20kHz. The MC462 reproduced a 1kHz squarewave with short risetimes and flat tops and bottoms (fig.2), suggesting that the amplifier's use of output transformers doesn't affect its

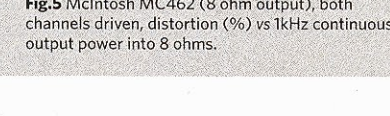


Fig.5 McIntosh MC462 (8 ohm output), both channels driven, distortion (%) vs 1kHz continuous output power into 8 ohms.

low-frequency reproduction. A 10kHz squarewave was reproduced without overshoot or ringing (fig.3).

The McIntosh MC462's channel separation (not shown) was superb, measuring close to 120dB in both directions below 1kHz, though it did decrease to 10dB at 20kHz, due to capacitive coupling between the channels at some point in the circuit. The wideband, unweighted signal/noise ratio, ref. 2.83V and measured



Fig.6 McIntosh MC462 (8 ohm output), both channels driven, distortion (%) vs 1kHz continuous output power into 4 ohms.

can enable or disable the Auto Off function, which shuts down the MC462 after it hasn't sensed an input signal for 30 minutes. I particularly liked McIntosh's patented gold-plated speaker binding posts. Each has two moving parts, which you first tighten with your fingers, then tighten a further quarter-turn with a small wrench (supplied), for a snug connection.

System and setup

Not wanting to face too many variables, and to give the MC462 enough time to break in, I spent my first days with my system unchanged, listening to my Harbeth 30.2 40th Anniversary Edition loudspeakers, which Herb Reichert reviewed in April 2018.³ Central upstate New York, where I live, benefits from ample clear power, but kicking that power's quality up a big notch is my AudioQuest Niagara 7000 power-line conditioner.

What first caught my ear when I cranked up the MC462 was nothing—no noise of any kind through the speakers or circuit noise from the amp itself. Control of mechanical and circuit noise seems to be a real strength of McIntosh products—I'd had a similar experience when introducing the McIntosh MC275 amp into my rig. The two amplifiers in my reference system that had preceded the MC275, a solid-state and a single-ended tube design, each produced some level of hum, as well as noise through my speakers, but I could never eliminate. But the MC462 provided those impressive backgrounds of "black" silence deeply desired by audiophiles—they really do play a role in the appreciation of microphonic and macroscopic differences in levels of detail and dynamics of recorded music.

The music goes 'round and 'round...

We all have our default settings. Each February, for *Stereophile's* annual "Records to Die For" feature, I could happily pick Shirley Horn's *Here's to Life* (CD, Verve 314 511 879-2). Every time, it's the first recording I reach for when I want to hear wussup in my system.

I cued up "Return to Paradise." Hearing music from the MC462 for the first time, I thought of visual metaphors. I thought of turning the contrast setting up or down on a television, or adjusting the amount of color saturation. Zooming in and out also has its audio analogs: the audio picture—the soundstage width and depth—enlarged in all parameters, and the colors seemed deeper. I heard a kind of fleshing out of Horn's voice, her deep mezzo sounding left and right. The other aspect that grabbed me was the percussion in this track, which is complex and subtle, capable of revealing a system's ability to resolve minute details. I heard intricate percussion sounds that I didn't recall having heard before, and the drum kit also had more impact, with more swing.

Knocking with my arsenal of par 22D4 picks, and because I knew it would make me smile, I put on Count Basie & His Atomic Band's recording "Roll 'Em Pete," from the rarities collection *Complete Live at the Crescendo 1958* (5 CDs, Phono 870245). Joe Williams nails it to the boards: "Well, you're so beautiful, but you've got to die someday. / All I want's a little loving, just before you pass away." Now *that* was something to die for—I had to laugh with pleasure. Via the MC462, Basie's piano was charging hard and taking no prisoners. The saxes and brass had that swell wallop I felt I was being

2 See www.stereophile.com/content/harbeth-monitor-302-40th-anniversary-edition-loudspeaker.

measurements, continued

at the highest gain output (8 ohms) and with the balanced input shorted to ground, was equally superb, at 87dB. This ratio improved to 96.2dB when the measurement bandwidth was restricted to the audioband, and to 99.6dB when A-weighted. Spectral analysis of the MC462's noise floor (fig.4) revealed spurs at 60Hz and its odd-order harmonics, these due to magnetic interference from the AC power transformer. All of these spuriae are very low in level, however, and will



Fig.7 McIntosh MC462 (2 ohm output), both channels driven, distortion (%) vs 1kHz continuous output power into 4 ohms.

not be audible. McIntosh specifies the MC462 as being able to deliver 450Wpc (26.5dBW) into a load matched to the nominal output Autoformer tap. With clipping defined as being when the THD+noise reaches 1%, fig.5 indicates that the MC462 exceeded its specification even with both channels driven, its 8 ohm output clipping at 516Wpc into 8 ohms (27.1dBW). The trace in this graph stops at 1%, as that is when the amplifier's protection was triggered.



Fig.8 McIntosh MC462 (2 ohm output), both channels driven, distortion (%) vs 1kHz continuous output power into 2 ohms.

Into 4 ohms (fig.6), the McIntosh's 8 ohm output clipped at 720Wpc (25.6dBW). It's fair to note that I don't hold the wall voltage constant for this test; with both channels clipping into 4 ohms, the wall voltage had dropped from 121 to 115.4V. The MC462's 2 ohm output delivered 190Wpc (22.8dBW) with both channels driven into 8 ohms at 1% THD+N, 298Wpc with both channels driven into 4 ohms (21.7dBW, fig.7), and 536W (21.3dBW) with one channel driven into 2 ohms (fig.8).

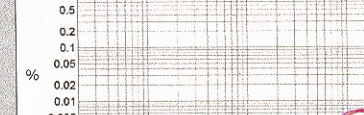


Fig.9 McIntosh MC462 (8 ohm output), THD+N (%) vs frequency at 28.3V into 8 ohms (left channel blue, right red), 4 ohms (left cyan, right magenta).

measurements, continued

Fig.5–8 indicate that distortion is extremely low, lying below the noise floor at powers below 30W or so. I therefore plotted how the THD+N changed with frequency from the 8 ohm output at a level of 28.3V, equivalent to 100W into 8 ohms and 200W into 4 ohms, where I could be sure I was looking at distortion rather than noise. The result (fig.9) reveals that the THD into 8 ohms (blue and red traces) and 4 ohms (cyan, magenta) rises above 1kHz, but still remains below 0.007%. I haven't shown the

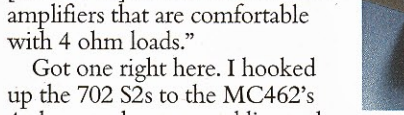


Fig.10 McIntosh MC462 (8 ohm output), 1kHz waveform at 50Wpc into 8 ohms, 0.00056% THD+N (top); distortion and noise waveform with fundamental notched out (bottom, not to scale).

THD+N trace into 2 ohms from this output, because it was >2% in the midrange and treble and >3% in the bass at 28.3V, which is equivalent to 400W into 2 ohms. The moral: Match the MC462's nominal output to the lowest impedance magnitude of the loudspeaker used.

The distortion signature is primarily of the second and third harmonics (fig.10); these components are very low in level, even at high powers (fig.11), though the right channel (red trace) had slightly more distortion



Fig.11 McIntosh MC462 (8 ohm output), spectrum of 50Hz sinewave, DC-1kHz, at 100Wpc into 8 ohms (linear frequency scale).

equal to the left (blue). Tested with an equal mix of 19 and 20kHz tones at high power into 8 ohms from the 8 ohm output, the levels of higher-order intermodulation products were extremely low (fig.12), and the second-order difference product at 1kHz lay at a "roots-of-the-universe" -114dB (0.0002%).

Summing up the McIntosh MC462's measured performance is easy: It is an extraordinarily well-engineered, exceptionally powerful amplifier.

—John Atkinson

measurements, continued

Fig.10–12 indicate that distortion is extremely low, lying below the noise floor at powers below 30W or so. I therefore plotted how the THD+N changed with frequency from the 8 ohm output at a level of 28.3V, equivalent to 100W into 8 ohms and 200W into 4 ohms, where I could be sure I was looking at distortion rather than noise. The result (fig.9) reveals that the THD into 8 ohms (blue and red traces) and 4 ohms (cyan, magenta) rises above 1kHz, but still remains below 0.007%. I haven't shown the

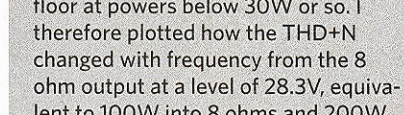


Fig.12 McIntosh MC462 (8 ohm output), HF intermodulation spectrum, DC-30kHz, 19+20kHz at 100Wpc peak into 8 ohms (linear frequency scale).

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MCINTOSH LABORATORY MC462

spanked—in a good way.

I needed to hear the MC462 with genuine three-way speakers, preferably a pair difficult to drive. Audio Classics Ltd. was kind enough to loan me a new pair of Bowers & Wilkins' floorstanding 702 S2s, reviewed in May 2018 by Kalman Rubinson.⁴ In his sidebar accompanying JA's review of the 702 S2s, JA measured an easygoing sensitivity of 90.2dB for the B&Ws. However, though this model's nominal impedance is specified as 8 ohms, JA found that it dipped down to 3 ohms in the bass, and concluded: "I think [the 702 S2] should be used with amplifiers that are comfortable with 4 ohm loads."

Got one right here. I hooked up the 702 S2s to the MC462's 4 ohm speaker taps and listened, knowing I was getting the same 450Wpc of power no matter which taps I used. And thanks to a heads-up from John Swenson's review in January 2019, I had on hand the perfect music—the Grateful Dead's *Pacific Northwest 73–74: Believe It If You Need It* (3 CDs, Dead.net/Rhino R2 572292). These live

recordings are from the period of the Dead's tours famous for the Wall of Sound, the massive PA system they briefly toured with in the 1970s. The Wall was powered by 48 McIntosh C2300 stereo amplifiers—a direct ancestor of the MC462—and put out a tidy 28,800W!

3 See www.stereophile.com/content/bowers-wilkins-702-s2-loudspeaker.

4 See www.stereophile.com/content/bowers-wilkins-702-s2-loudspeaker.

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